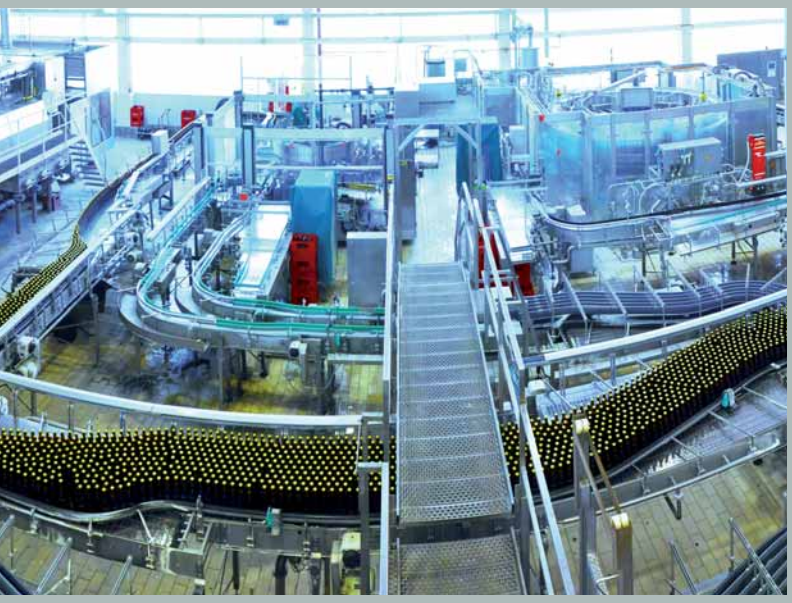
HELUKABEL®



Edition 11

# DATA, NETWORK & BUS TECHNOLOGY

HELUCOM®

HELUKAT®

helukabel-group.com

DNB Edition 11 (published 01.10.2015)

# INTRODUCTION

The market for automation is growing, and with it the networking of production structures. In the future, communication will not only take place from desk to machine; the increasingly digital networking will make possible the automated exchange of information from machine to machine. Networking production via the internet makes it possible to globalise value-added chains, with production that independently responds to unplanned events.

The challenge to transmit ever higher quantities of data faster and faster is also present in other areas of life. Municipalities face the challenge of expanding their broadband infrastructure and providing a reliable supply, even in rural areas. High-performance broadband networks are a prerequisite for economic growth and have now become relevant for many applications and areas of day-to-day life.

The challenges are quite diverse, but just as diverse are the solutions presented in this, Issue 11 of this catalogue. New additions to our range of products include microduct fibre optic cable, optical fibres for PROFInet and PROFIBUS systems, PROFInet A, B, C as FRNC versions, as well as drag chain capable ETHERNET category 6A and category 7 cables. Discover our wide range of products. We welcome your questions and feedback.

**Helmut Luksch,**
*Chief Executive Officer, HELUKABEL® GmbH*



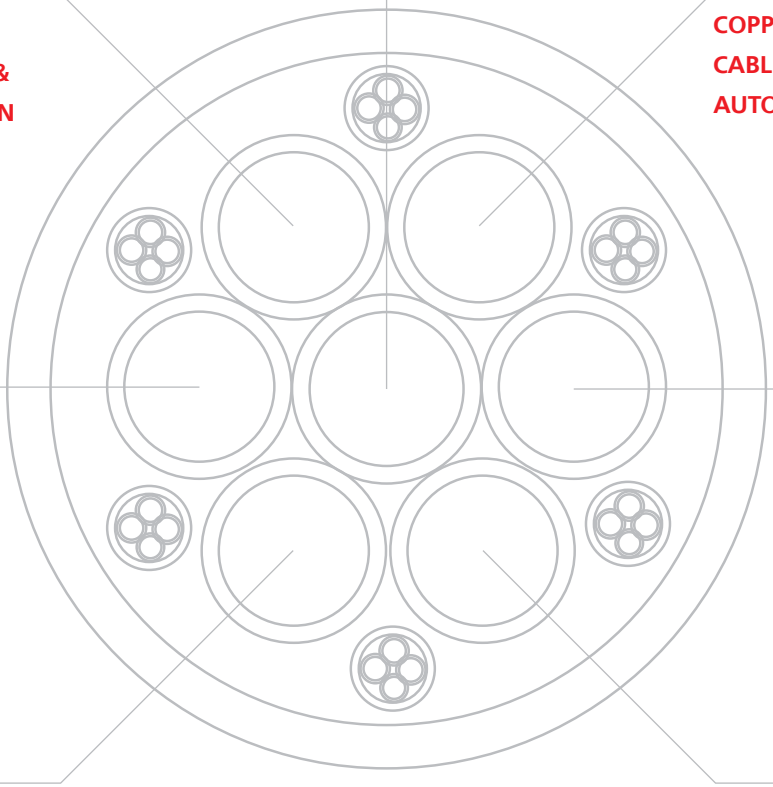
DNB Edition 11 (published 01.10.2015)

# HELUKABEL® DATA, NETWORK & BUS TECHNOLOGY

**COPPER LAN CABLES FOR BUILDING NETWORKING**

**GOF /HCS/ POF-CABLES BUILDING NETWORKING & INDUSTRIAL AUTOMATION**

**COPPER BUS/ETHERNET CABLES FOR INDUSTRIAL AUTOMATION**



**PASSIVE ACCESSORIES**

- Distribution panels
- UP/AP-Outlet
- Patch-cables
- Cabinets

**PLUG CONNECTOR COPPER + GOF/HCS/POF**

**MEASURING EQUIPMENT**

**PROCESSING TOOLS**

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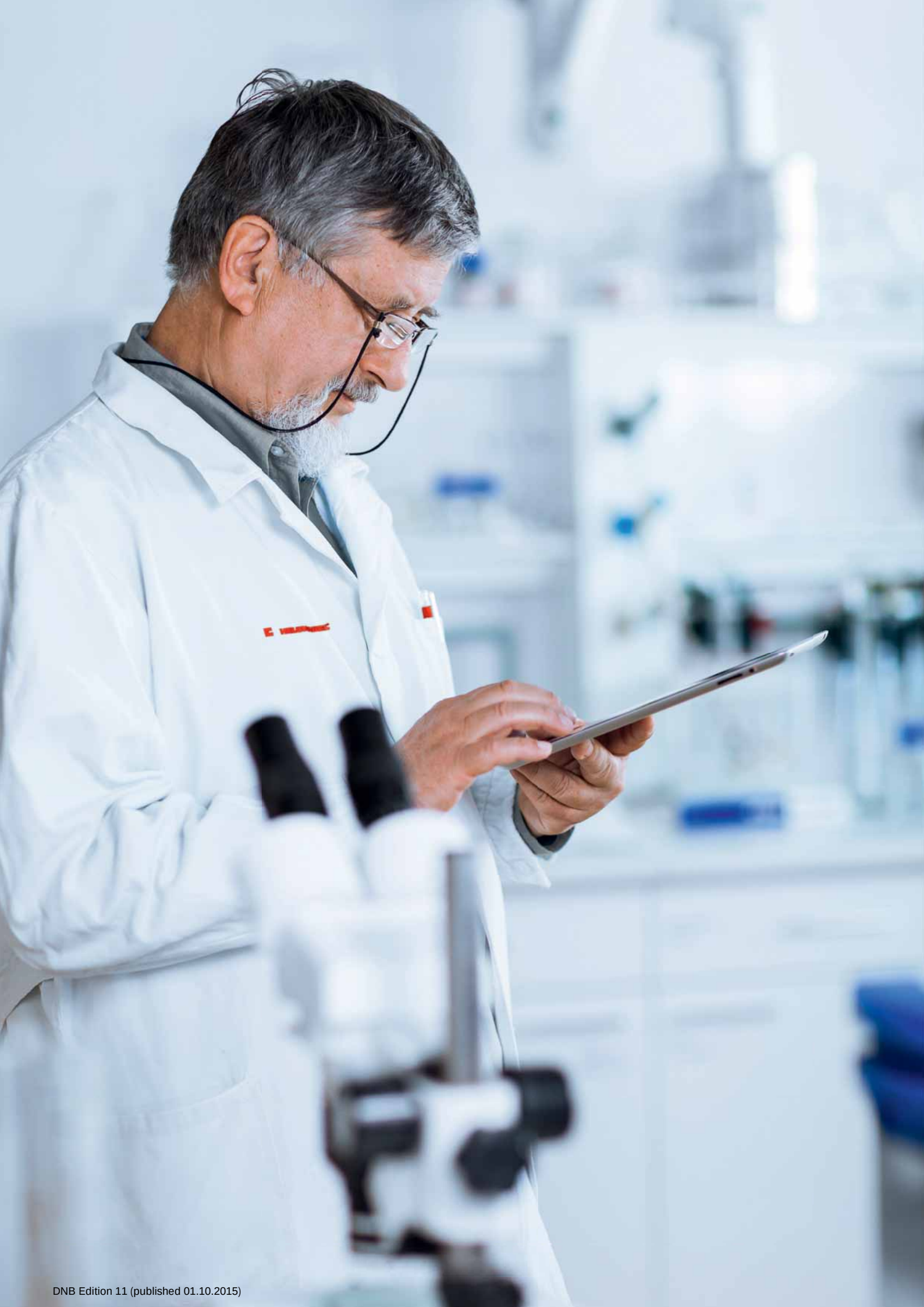


# RESEARCH & DEVELOPMENT

## We develop optimal, tailored cable solutions for our customers.

Torsion test apparatus

**Our test facilities:**

- Test systems for bending and torsion requirements
- Drag chain test systems with movement distances of 1 m, 3 m, 5 m, 6 m, 18 m, and 40 m
- Fire testing systems
- Abrasion testing systems
- Torsion test tower for wind turbine cables
- Aging ovens in accordance with UL, VDE, CSA, HAR, TÜV & CCC

Research and development are the foundation of our work and are an important engine for growth. In interdisciplinary teams we continuously push the boundaries to enhance our products and develop solutions to meet the latest technological demands. Moreover, we value our customer interactions and partnerships with regional colleges and research institutes to stay on top of emerging technologies.

The materials that we use are an important starting point of our work. In this regard, we place as much emphasis on searching for and utilizing new materials, as we do on manufacturing our plastic mixtures (granulates) ourselves, and influencing the improvement of technical characteristics, such as oil-resistance, temperature range or chemical compatibility. Moreover, we are capable of pulling a majority of the copper ourselves, thus ensuring a uniform, high-quality product relative to properties and workmanship.

With continuous optimization of our manufacturing processes and systems we take into consideration both efficient and economical production, and the complex requirements of various applications (such as cables for industrial robots or for applications under cleanroom conditions) into account.

A crucial stage in the development process of our products is the work done at our Test Center. For example, cables suitable for drag chain implementation, can be tested using equipment that accelerates cables up to 10 g.

Temperature ranges from -50° to +250° are simulated in a special climate-controlled environment so that drag chain cables can be tested for series production readiness in applications such as refrigerated warehouses or steel mills.

Drag chain test system

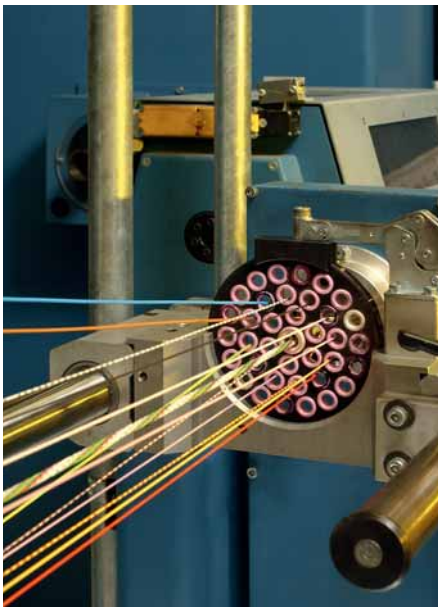
# PRODUCTION

## We specialize in the production of high-quality cables and wires.

Using the latest production methods, our two German plants manufacture approximately one million kilometers of conductors each year (= 77 times around the world). More than 300 qualified employees are specialized in the production of high-quality standard and custom cables. Through the use of the latest materials and collaboration with international test institutes, we drive innovation in the areas of automation, data technology, building system technology, and renewable energy.

Since 2014, in a 7,000 m² facility in the Chinese city of Taicang (approx. 50 km northwest of Shanghai) HELUKABEL® has been producing cable and wires, primarily for the Asian market. As is with our German plants, the focus is on high-quality, flexible and highly-flexible cables and wires that are manufactured in accordance with Chinese and international standards. The use of flexible manufacturing cells enable short delivery times.

Braiding machine



Stranding machine

Our production in numbers:

- 40,000 m² production area
- 23 extruder systems
- 19 stranding machines
- 50 braiding machines
- Cables & wires from 0.05 to 1,000 mm² (30 AWG to 2,000 kcmil)
- Manufacturing in accordance with: VDE, EAC (GOST-R), UL, CSA, HAR, CCC, Germanischer Lloyd, TÜV or customer specification



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# LOGISTICS

## Redefining logistics in the cable industry.

**INDUSTRIAL CABLE**
**Our logistics center – Hemmingen/Stuttgart**

- 40,500 Euro-pallet racks
  16 aisles with 16 storage and retrieval devices
- 35,900 bin locations in the automatic small parts warehouse with a capacity of 1,000 bins per hour
- 670 storage spaces in the heavy load warehouse with max. reels of 4,000 kg and 2.20 m diameter
- 2 km conveyor line for pallets
- Conveyer connects direct to the cable-cutting machines
- Manual processes reduced to merely packing

**INFRASTRUCTURE CABLES**
**Our logistics center – Neuenhagen/Berlin**

- 11,000 cable reels in stock
- Automatic processing of reels up to 2.80 m Ø and 10 t
- 10 rewinding machines
- Cut to length with state-of-the-art 1,200 mm² cutting tools
- 24-hr delivery is possible

At its corporate headquarters in the Swabian town of Hemmingen/Stuttgart, HELUKABEL® operates Europe's largest distribution center for cables and wires. Here a majority of the more than 33,000 products are located in a storage area of 160,000 m². Through the use of state-of-the-art conveyor and control technology, more than 1,000 orders can be picked and dispatched daily to destinations around the world.

Neuenhagen/Berlin is the central warehouse location for underground, medium-voltage, and other infrastructure cables. Storage capacities of more than 5,000 m² (indoor) and 50,000 m² (outdoor) enable fast delivery of cable, configured from 1 – 30 kV, to construction sites and major projects. The patented heavy-load cable-cutting machines with a load capacity of more than 10 tons are the largest of their kind in Germany.

The new logistics center at the Taicang (Shanghai, China) production facility serves as a product distribution hub for the Asian market, and offers incredible advantages, particularly for servicing time- and volume-critical customer projects.


Heavy-load, cable-cutting facility

Small parts warehouse



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HELUKAT® CONNECTING SYSTEMS

HELUCOM® CONNECTING SYSTEMS

HELUKAT® CONNECTING SYSTEMS INDUSTRY

HELUCOM® CONNECTING SYSTEMS INDUSTRY


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# CERTIFIED PRODUCTS ARE PRODUCTS YOU CAN TRUST

## Independently and continuously audited quality.

The certification of our products is proof of their superior quality. Product certificates for our products are issued by independent institutions on the basis of applicable performance tests. The certificates are required for use of the product in certain markets or areas of application.


CERTIFICATE

HELUKABEL

HELUKABEL GmbH
Neusaeser Weg 11
91575 Windsbach
Germany

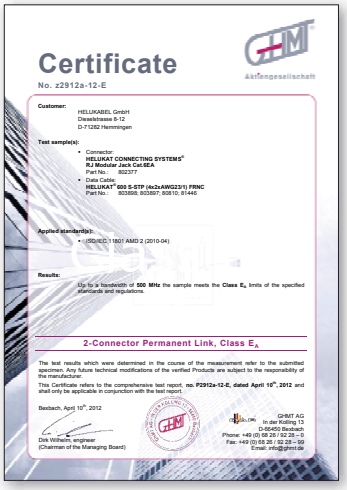
DIN EN ISO 9001:2008

Development, design and manufacture of cables and wires

VDE INSTITUT


Zertifikat

HELUKABEL GmbH
Dieselstr. 8-12
D-71282 Hemmingen


Certificate

No. z2912a-12-E

Customer:
HELUKABEL GmbH
Dieselstrasse 8-12
D-71282 Hemmingen

Test sample(s):
- Connector: HELUKAT CONNECTING SYSTEMS® RJ Modular Jack Cat.6EA Part No.: 802377
- Data Cable: HELUKAT® 600 S-STP (4x2xAWG23/1) FRNC Part No.: 803898; 803897; 80810; 81446

Applied standard(s):
- ISO/IEC 11801 AMD 2 (2010-04)

Results:
Up to a bandwidth of 500 MHz the sample meets the Class $E_A$ limits of the specified standards and regulations.

2-Connector Permanent Link, Class $E_A$

The test results which were determined in the course of the measurement refer to the submitted specimen. Any future technical modifications of the verified Products are subject to the responsibility of the manufacturer.
This Certificate refers to the comprehensive test report, no. P2912a-12-E, dated April 10th, 2012 and shall only be applicable in conjunction with the test report.

Bexbach, April 10th, 2012

Dirk Wilhelm, engineer
(Chairman of the Managing Board)

GHMT AG
In der Kolling 13
D-66450 Bexbach
Phone: +49 (0) 68 26 / 92 28 – 0
Fax: +49 (0) 68 26 / 92 28 – 99
Email: info@ghmt.de


CERTIFICATE

The Certification Body of TÜV SÜD Management Service GmbH certifies that

HELUKABEL

HELUKABEL GmbH
Dieselstr. 8-12
D-71282 Hemmingen

has established and applies a Quality and Environmental Management System for the following scope of application:

Distribution of Cables - Wires - Accessories.

Performance of audits (Report-No. 70023520) has furnished proof that the requirements under:

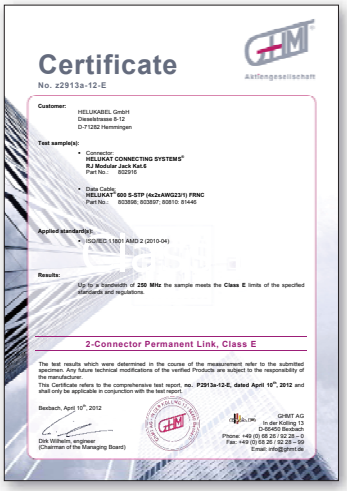
ISO 9001:2008
ISO 14001:2004

are fulfilled. This certificate is valid until 2016-01-25
Certificate Registration No. 12 100/104 20588 TMS

Munich, 2013-02-14


Zertifikat

HELUKABEL GmbH
Dieselstr. 8-12
D-71282 Hemmingen


Certificate

No. z2913a-12-E

Customer:
HELUKABEL GmbH
Dieselstrasse 8-12
D-71282 Hemmingen

Test sample(s):
- Connector: HELUKAT CONNECTING SYSTEMS® RJ Modular Jack Kat.6 Part No.: 802916
- Data Cable: HELUKAT® 600 S-STP (4x2xAWG23/1) FRNC Part No.: 803898; 803897; 80810; 81446

Applied standard(s):
- ISO/IEC 11801 AMD 2 (2010-04)

Results:
Up to a bandwidth of 250 MHz the sample meets the Class E limits of the specified standards and regulations.

2-Connector Permanent Link, Class E

The test results which were determined in the course of the measurement refer to the submitted specimen. Any future technical modifications of the verified Products are subject to the responsibility of the manufacturer.
This Certificate refers to the comprehensive test report, no. P2913a-12-E, dated April 10th, 2012 and shall only be applicable in conjunction with the test report.

Bexbach, April 10th, 2012

Dirk Wilhelm, engineer
(Chairman of the Managing Board)

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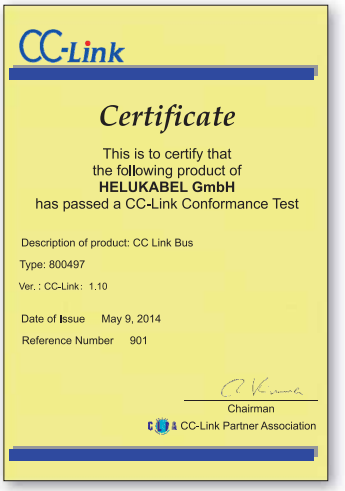
Fax: +49 (0) 68 26 / 92 28 – 99
Email: info@ghmt.de


CC-Link

Certificate

This is to certify that
the following product of
HELUKABEL GmbH
has passed a CC-Link Conformance Test

Description of product: CC Link Bus
Type: 800497
Ver. : CC-Link: 1.10

Date of Issue May 9, 2014
Reference Number 901

Chairman
CC-Link Partner Association


Manufacturers Declaration

HELUKABEL GmbH

Dieselstr. 8-12 71282 Hemmingen - Germany

PROFINET Cabling and Interconnection Technology
Version 1.1 March 2014


РОССИЙСКАЯ ФЕДЕРАЦИЯ
СЕРТИФИКАТ СООТВЕТСТВИЯ



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# Product finder HELUCOM® Fibre Optic systems

| Installation area | Application | Kind of processing | Fibre Type | Pulling type* | Tensile strength up to N* | Number of fibres |
|---|---|---|---|---|---|---|
| Inside | fixed | Splicing | G50/ G62,5/ E9 | Manual pulling | 1200 | 4 - 12 |
| | | | | | 3000 | 24 - 60 |
| | flexible | Direct pre-assembling | G50/ G62,5/ E9 | Manual pulling | 400 | 2 |
| | | | | | 400 | 1 - 2 |
| | | | | | 500 | 4 - 8 |
| | | | | | 800 | 10 - 12 |
| | | | | | 1200 | 4 |
| | | | | | 1200 | 4 |
| | | | | | 1500 | 2 - 8 |
| | | | | | 2400 | 12 - 24 |
| | | | G50/ G62,5/ E9/ K200/230 | | 600 | 2 |
| | | | K200/230 | | 800 | 4 |
| | | | | | 800 | 2 |
| | | | | | 800 | 2 |
| | | | P980/1000 | | 100 | 2 |
| | | | | | 100 | 2 |
| | | | | | 100 | 2 |
| | | | | | 140 | 1 - 2 |
| | high flexible | | G50/ G62,5/ E9 | Manual pulling | 650 | 2 - 8 |
| | | | | | 4800 | 4 - 12 |
| | | | | | 4800 | 4 - 12 |
| | | | P980/1000 | | 200 | 1 - 4 |
| | | | | | 400 | 1 - 4 |
| Inside/outside | fixed | Splicing | G50/ G62,5/ E9 | Manual pulling | 700 | 4 - 12 |
| | | | | | 1000 | 4 - 12 |
| | | | | | 1500 | 4 - 24 |
| | | | | Blowing in*/ Manual pulling | 2500 | 4 - 24 |
| | | | | | 2700 | 24 - 72 |
| | | | | | 3000 | 84 - 96 |
| | | Direct pre-assembling/Splicing | G50 | Manual pulling | 500 | 2 |
| | | | G50 OM4 | | 500 | 2 |
| | | | G50 | | 1000 | 2 |
| | | | E9 | | 1000 | 4 |
| | flexible | | G50/ G62,5/ E9 | | 3000 | 4 - 12 |
| | high flexible | | G50 | | 800 | 2 |
| Outside | fixed | Direct pre-assembling/Splicing | G50 | Manual pulling | 500 | 2 |
| | | | | | 800 | 2 |
| | | | G50/ G62,5/ E9 | | 1200 | 4 |
| | | | K200/230 | | 1500 | 2 |
| | | Splicing | E9 G652.D + G657.A1 | Blowing in*/ Manual pulling | 180 | 4 - 12 |
| | | | | | 700 | 4 - 72 |
| | | | | | 1500 | 84 - 288 |
| | | | E9 | | 2500 | 12 - 72 |
| | | | | | 2500 | 12 - 60 |
| | | | | | 2700 | 12 - 60 |
| | | | | Manual pulling | 3100 | 12 - 144 |
| | | | | | 4100 | 12 - 144 |
| | | | | | 9000 | 12 - 144 |
| | | | | | 11100 | 12 - 144 |
| | | | | | 16000 | 12 - 144 |
| | | | | | 35000 | 12 - 144 |
| | | | G50/ G62,5/ E9 | | 1500 | 4 - 24 |
| | | | | | 1500 | 2 - 24 |
| | | | | | 1500 | 2 - 24 |
| | | | | Blowing in*/ Manual pulling | 2500 | 24 - 72 |
| | | | | | 2700 | 2 - 24 |
| | | | | Manual pulling | 2600 | 2 - 4 |
| | | | | Blowing in*/ Manual pulling | 2700 | 2 - 72 |
| | | | | | 2700 | 2 - 72 |
| | | | | | 2700 | 2 - 72 |
| | | | | | 2700 | 84 - 144 |
| | | | | | 2700 | 24 - 72 |
| | | | | | 3000 | 84 - 144 |
| | | | | | 3000 | 84 - 144 |
| | | | | | 3000 | 84 - 144 |
| | | | | | 3000 | 84 - 144 |
| | | | | | 3500 | 84 - 144 |

* Note the information of the Blowing jet

* = Tensile strength up to N

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| | I-V2Y(ZN)11Y, rot | Industry wiring (Impuls and Control Level) | 81 |
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| | A-DF(ZN)B2Y | Campus wiring | 52 |
| | A-DQ(ZN)B2Y, verseilt | Campus wiring | 48 |
| | A-DSF(L)(ZN)2Y | Campus wiring (Signal wiring of roadways,...) | 60 |

Subject to technical alternations.

If you have technical questions, pleasen check the technical information at page 368 or contact our expert advisors from the Department data, network and bus technology.

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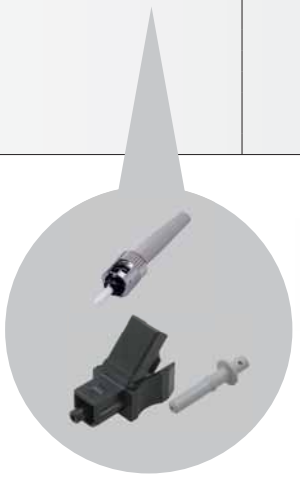
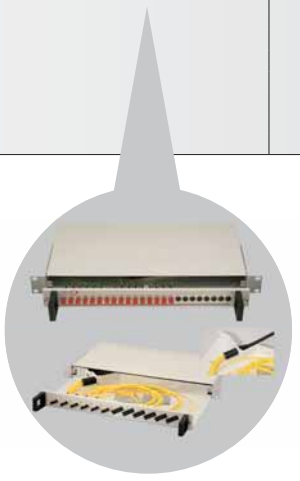
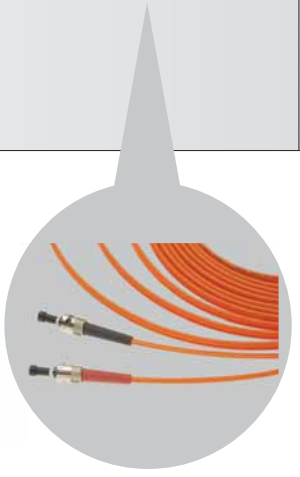
| 303<br>328 | 298 | 306/307<br>327 | |
| 303 | 298 | 306/307 | |



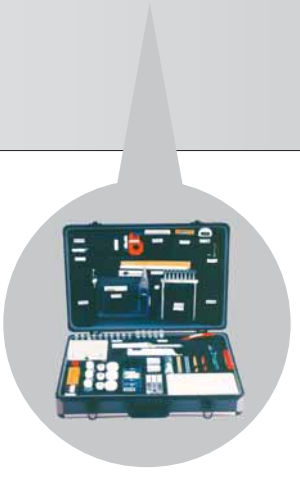
Plugs



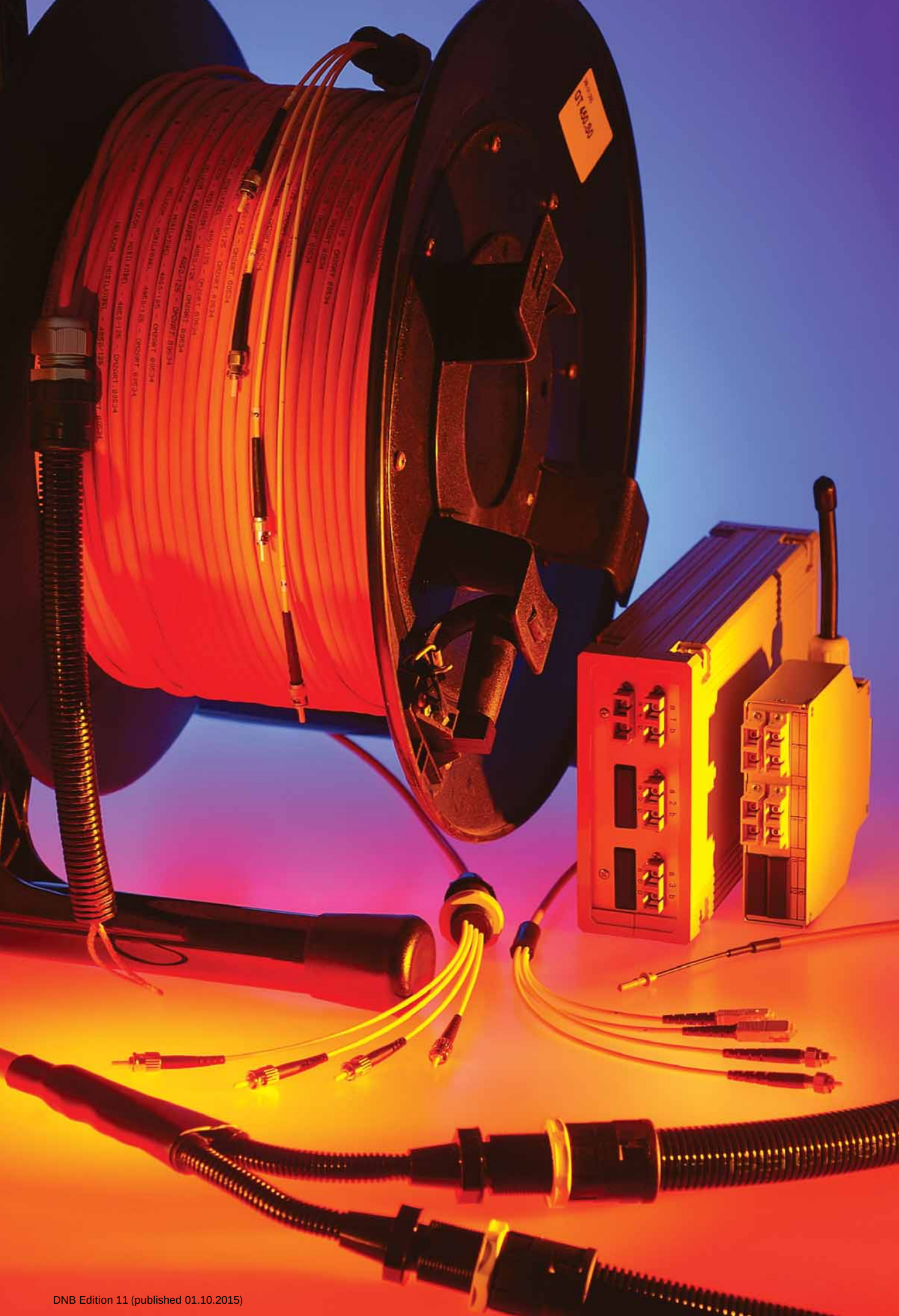
Splice Boxes



Jumper Cables



Processing Technic



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# Product finder HELUKAT® Copper Data Systems

| Installation area | Areal | Application | Category | Frequency range MHz | Application area | UL | CSA | Flame retaedance |
|---|---|---|---|---|---|---|---|---|
| Inside | Office | fixed | 5 | 100 | Floor-/Building wiring of security areas | – | – | IEC 60332-3 |
| | | | $5_e$ | 155 | Floor-/Building wiring | – | – | – |
| | | | $5_e$ | 155 | Floor-/Building wiring | – | – | – |
| | | | $5_e$ | 155 | Floor-/Building wiring | x | x | IEC 60332-1 |
| | | | $5_e$ | 200 | Floor-/Building wiring | – | – | IEC 60332-3 |
| | | | $5_e$ | 200 | Floor-/Building wiring | – | – | IEC 60332-3 |
| | | | 6 | 300 | Floor-/Building wiring | x | x | IEC 60332-1 |
| | | | 6 | 300 | Floor-/Building wiring | – | – | IEC 60332-1 |
| | | | 6 | 450 | Floor-/Building wiring | – | – | IEC 60332-3 |
| | | | 6 | 450 | Floor-/Building wiring | – | – | IEC 60332-3 |
| | | | $6_A$ | 500 | Floor-/Building wiring | – | – | IEC 60332-3 |
| | | | $6_A$ | 500 | Floor-/Building wiring | – | – | IEC 60332-3 |
| | | | 6 | 600 | Floor-/Building wiring | x | – | IEC 60332-1 |
| | | | $7_e$ | 1000 | Floor-/Building wiring | – | – | IEC 60332-3 |
| | | | $7_e$ | 1000 | Floor-/Building wiring | – | – | IEC 60332-3 |
| | | | $7_A$ | 1200 | Floor-/Building wiring | – | – | IEC 60332-3 |
| | | | $7_A$ | 1200 | Floor-/Building wiring | – | – | IEC 60332-3 |
| | | | 8(draft) | 1200 | Floor-/Building wiring | – | – | IEC 60332-3 |
| | | | 8(draft) | 1200 | Floor-/Building wiring | – | – | IEC 60332-3 |
| | | | 8(draft) | 1500 | Floor-/Building wiring, multimedia areas | – | – | IEC 60332-3 |
| | | | 8(draft) | 1500 | Floor-/Building wiring, multimedia areas | – | – | IEC 60332-3 |
| | | flexible | 5 | 100 | Workarea/Floor-wiring (Patchkabel) | – | – | – |
| | | | 5 | 100 | Workarea/Floor-wiring (Patchkabel) | – | – | IEC 60332-1 |
| | | | $5_e$ | 200 | Workarea/Floor-wiring (Patchkabel) | – | – | IEC 60332-1 |
| | | | $5_e$ | 200 | Workarea/Floor-wiring (Patchkabel) | x | x | IEC 60332-1 |
| | | | 6 | 300 | Workarea/Floor-wiring (Patchkabel) | – | – | IEC 60332-1 |
| | | | 6 | 300 | Workarea/Floor-wiring (Patchkabel) | x | x | IEC 60332-1 |
| | | | $6_A$ | 500 | Workarea/Floor-wiring (Patchkabel) | – | – | IEC 60332-1 |
| | | | 7 | 600 | Workarea/Floor-wiring (Patchkabel) | – | – | IEC 60332-1 |
| | Industry | fixed | 5 | 100 | Industry cabling Motion Controll | x | x | IEC 60332-1 |
| | | | $5_e$ | 100 | Industry cabling (Control- Automation- and Regulation Level) | – | – | IEC 60332-1 |
| | | | $5_e$ | 100 | Industry cabling (Control- Automation- and Regulation Level) | – | – | IEC 60332-1 |
| | | | $5_e$ | 100 | Industry cabling (Control- Automation- and Regulation Level) | x | x | IEC 60332-3 |
| | | | $5_e$ | 100 | Industry cabling (Control- Automation- and Regulation Level) | x | x | IEC 60332-3 |
| | | | $5_e$ | 100 | Industry cabling (Control- Automation- and Regulation Level) | – | – | IEC 60332-1 |
| | | | $5_e$ | 100 | Industry cabling, radiated areas (Control- Automation- and Regulation Level) | – | – | – |
| | | | $7_A$ | 1200 | Industry cabling, (Control- Automation- and Regulation Level) | – | – | IEC 60332-1 |
| | | | 6 | 250 | Industry cabling (Control- Automation- and Regulation Level) | x | x | IEC 60332-3 |
| | | | 6 | 250 | Industry cabling (Control- Automation- and Regulation Level) | x | x | IEC 60332-1 |
| | | | $6_A$ | 500 | Industry cabling, (Control- Automation- and Regulation Level) | x | x | IEC 60332-3 |
| | | | $7_e$ | 1200 | Industry cabling, (Control- Automation- and Regulation Level) | – | – | IEC 60332-1 |
| | | | 7 | 600 | Schiffsverkabelung (Control- Automation- and Regulation Level) | – | – | IEC 60332-3 |
| | | flexible | 5 | 100 | Industry cabling, flexible (Control- Automation- and Regulation Level) | x | x | IEC 60332-3 |
| | | | $5_e$ | 100 | Industry cabling (Control- Automation- and Regulation Level) | – | – | IEC 60332-1 |
| | | | $5_e$ | 100 | Industry cabling (Control- Automation- and Regulation Level) | – | – | IEC 60332-1 |
| | | | $5_e$ | 100 | Industry cabling, flexible (Control- Automation- and Regulation Level) | x | x | IEC 60332-1 |
| | | | $5_e$ | 100 | Industry cabling, flexible (Control- Automation- and Regulation Level) | x | x | IEC 60332-3 |
| | | | $5_e$ | 100 | Industry cabling, flexible (Control- Automation- and Regulation Level) | – | – | IEC 60332-1 |
| | | | $5_e$ | 100 | Schiffsverkabelung (Control- Automation- and Regulation Level) | x | x | IEC 60332-1 |
| | | | $5_e$ | 100 | Industry cabling, flexible (Control- Automation- and Regulation Level) | x | x | IEC 60332-1 |
| | | | $5_e$ | 100 | Industry cabling, flexible (Control- Automation- and Regulation Level) | x | – | IEC 60332-1 |
| | | | $5_e$ | 200 | Industry cabling, flexible (Control- Automation- and Regulation Level) | – | – | IEC 60332-1 |
| | | | 6 | 250 | Industry cabling, flexible (Control- Automation- and Regulation Level) | x | x | IEC 60332-3 |
| | | | 7 | 600 | Industry cabling, flexible (Control- Automation- and Regulation Level) | x | x | IEC 60332-1 |
| | | | $7_A$ | 1000 | Industry cabling, flexible (Control- Automation- and Regulation Level) | – | – | IEC 60332-1 |
| | | high flexible | 5 | 100 | Industry cabling, high flexible (Process- and Field Level) | – | – | IEC 60332-1 |
| | | | 5 | 100 | Industry cabling, high flexible (Process- and Field Level) | – | – | IEC 60332-1 |
| | | | 5 | 100 | Industry cabling, high flexible (Process- and Field Level) | x | x | IEC 60332-1 |
| | | | 5 | 100 | Industry cabling Motion Controll | x | x | IEC 60332-1 |
| | | | 5 | 100 | Industry cabling Motion Controll | x | x | IEC 60332-1 |
| | | | $5_e$ | 100 | Industry cabling, high flexible (Process- and Field Level) | x | x | IEC 60332-1 |
| | | | $5_e$ | 100 | Industry cabling, high flexible (Process- and Field Level) | x | x | IEC 60332-3 |
| | | | $5_e$ | 155 | Industry cabling, high flexible (Process- and Field Level) | x | – | IEC 60332-1 |
| | | | $5_e$ | 155 | Industry cabling, high flexible (Process- and Field Level) | x | x | IEC 60332-1 |
| | | | $5_e$ | 155 | Industry cabling, high flexible (Process- and Field Level) | x | x | IEC 60332-1 |
| | | | 6 | 250 | Industry cabling, high flexible (Process- and Field Level) | x | x | IEC 60332-1 |
| | | | $6_A$ | 500 | Industry cabling, high flexible (Process- and Field Level) | x | x | IEC 60332-3 |
| | | | $6_A$ | 500 | Industry cabling, high flexible (Process- and Field Level) | x | x | IEC 60332-1 |
| | | | $6_A$ | 500 | Industry cabling, high flexible (Control- Automation- and Regulation Level) | x | x | IEC 60332-1 |
| | | | 7 | 600 | Industry cabling, high flexible (Process- and Field Level) | x | x | IEC 60332-1 |
| Outside | Outdoor | fixed | $5_e$ | 100 | Industry cabling, rodent attacked areas (Campus- and Building wiring) | – | – | – |
| | | | $5_e$ | 200 | Campus backbone | – | – | – |
| | | | 6 | 300 | Campus backbone | – | – | – |
| | | | $7_e$ | 1000 | Campus backbone | – | – | IEC 60332-1 |
| | | | $7_e$ | 1000 | Campus backbone with rodent attacked | – | – | IEC 60332-1 (Inside cables) |
| | | | $7_e$ | 1000 | Campus backbone | x | x | IEC 60332-1 |

| halogen-free | Oil resistant | UV resistant | Construction | Core number | Core dimension | Description* | Part no. | Page |
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| x | – | – | F/UTP | 4 x 2 x | AWG23/1 | HELUKAT 100 F/UTP FE60 | 804045 | 100 |
| – | – | – | U/UTP | 4 x 2 x | AWG24/1 | HELUKAT 155 U/UTP | 80053 | 90 |
| – | – | – | F/UTP | 4 x 2 x | AWG24/1 | HELUKAT 155 F/UTP | 80043 | 98 |
| – | – | – | U/UTP | 4 x 2 x | AWG24/1 | HELUKAT 155 U/UTP UL | 802171 | 91 |
| x | – | – | SF/UTP | 4 x 2 x | AWG24/1 | HELUKAT 200 SF/UTP | 81609, 81610 | 103 |
| x | – | – | SF/UTP | 2 x 4 x 2 x | AWG24/1 | HELUKAT 200 SF/UTP duplex | 81123 | 104 |
| – | – | – | U/UTP | 4 x 2 x | AWG24/1 | HELUKAT 300 U/UTP UL | 802172 | 92 |
| x | – | – | U/UTP | 4 x 2 x | AWG24/1 | HELUKAT 300 U/UTP | 804766 | 93 |
| x | – | – | F/FTP | 4 x 2 x | AWG24/1 | HELUKAT 450 F/FTP | 82501 | 107 |
| x | – | – | F/FTP | 2 x 4 x 2 x | AWG24/1 | HELUKAT 450 F/FTP duplex | 82502 | 108 |
| x | – | – | F/FTP | 4 x 2 x | AWG23/1 | HELUKAT 500 F/FTP | 803378 | 109 |
| x | – | – | F/FTP | 2 x 4 x 2 x | AWG23/1 | HELUKAT 500 F/FTP duplex | 803379 | 110 |
| x | – | – | U/UTP | 4 x 2 x | AWG23/1 | HELUKAT 600 U/UTP | 805179 | 94 |
| x | – | – | S/FTP | 4 x 2 x | AWG23/1 | HELUKAT 600 S/FTP | 80810 | 112 |
| x | – | – | S/FTP | 2 x 4 x 2 x | AWG23/1 | HELUKAT 600 S/FTP duplex | 81446 | 113 |
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| x | – | – | S/FTP | 2 x 4 x 2 x | AWG23/1 | HELUKAT 1200 S/FTP duplex | 803381 | 119 |
| x | – | – | S/FTP | 4 x 2 x | AWG22/1 | HELUKAT 1200 S/FTP | 81699 | 120 |
| x | – | – | S/FTP | 2 x 4 x 2 x | AWG22/1 | HELUKAT 1200 S/FTP duplex | 800647 | 121 |
| x | – | – | S/FTP | 4 x 2 x | AWG22/1 | HELUKAT 1500 S/FTP | 802169 | 122 |
| x | – | – | S/FTP | 2 x 4 x 2 x | AWG22/1 | HELUKAT 1500 S/FTP duplex | 802170 | 123 |
| – | – | – | U/UTP | 4 x 2 x | AWG26/7 | HELUKAT 100 U/UTP flex | 80055 | 95 |
| x | – | – | F/UTP | 4 x 2 x | AWG26/7 | HELUKAT 100 F/UTP flex | 81278 | 99 |
| x | – | – | SF/UTP | 4 x 2 x | AWG26/7 | HELUKAT 200 SF/UTP flex | 81254 | 105 |
| – | – | – | F/UTP | 4 x 2 x | AWG26/7 | HELUKAT 200 F/UTP flex UL | 802173 | 101 |
| x | – | – | U/UTP | 4 x 2 x | AWG24/7 | HELUKAT 300 U/UTP flex | 804996 | 96 |
| – | – | – | U/FTP | 4 x 2 x | AWG26/7 | HELUKAT 300 U/FTP flex UL | 802174 | 106 |
| x | – | – | F/FTP | 4 x 2 x | AWG26/1 | HELUKAT 500 F/FTP flex | 804043 | 111 |
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| x | – | – | SF/UTP | 2 x 2 x | AWG24/1 | HELUKABEL 100IND Industrial Ethernet FRNC | 805699 | 142 |
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| x | x | – | S/FTP | 4 x 2 x | AWG24/7 | HELUKAT 600IND S/FTP, Shipline | 803382 | 133 |
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| – | x | x | SF/UTP | 2 x 2 x | AWG22/7 | HELUKAT 100IND PROFInet B, Festoon | 803295 | 157 |
| x | x | x | SF/UTP | 2 x 2 x + 4 x | AWG22/7 + 1,5mm² | HELUKAT 100IND PROFInet B, hybrid | 801651 | 156 |
| x | x | – | SF/UTP | 4 x 2 x | AWG26/7 | HELUKAT 200IND SF/UTP, Robustflex | 800068 | 144 |
| – | x | – | SF/UTP | 4 x 2 x | AWG24/7 | HELUKAT 250S SF/UTP, PVC CMG Drag chain | 805658 | 140 |
| x | x | x | S/FTP | 4 x 2 x | AWG26/7 | HELUKAT 600IND S/FTP, Robustflex | 802184 | 134 |
| x | x | x | S/FTP | 4 x 2 x | AWG26/7 | HELUKAT 1200IND S/FTP, Robustflex | 805684 | 131 |
| x | x | – | SF/UTP | 4 x 1 x | AWG24/19 | HELUKAT 200S SF/UTP, Drag chain | 800088 | 148 |
| x | x | – | SF/UTP | 4 x 2 x | AWG24/19 | HELUKAT 200S SF/UTP, Drag chain | 81155 | 149 |
| x | x | – | SF/UTP | 4 x 2 x | AWG26/19 | HELUKAT 100T SF/UTP, Tordierflex | 800067 | 150 |
| – | x | – | SF/UTP | 2 x 2 x + 1 x 2 x | AWG24/7 + AWG22/19 | HELUKABEL HMCB 500S, Drag chain | 803672 | 183 |
| x | x | – | SF/UTP | 2 x 2 x + 1 x 2 x | 2x2x0,20 + 1x2x0,38 | HELUKABEL HMCB 800W, Drag chain | 804767 | 184 |
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* Preparation of the jacket before connection necessary

*2 Reduced frequency to Cat.6

*3 Plugsystem- and ref. to the applications

*4 Reduced frequency to Cat. 6 bzw. Cat. 5e

*5 Reduced frequency to Cat. 5e

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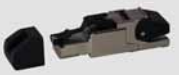
| B17 |  | 805044<br>Page 232 | RJ45 Jack Cat.6 |
| B18 |  | 804645<br>Page 232 | RJ45 Jack Cat.5e |
| B19 |  | 804544 | RH45 IE Kat6A, tool<br>free, 8-pole |

**Patch Cables**

**Splice Box, DIN rail**

**Splice Box**

**Outlet**

# Product finder HELUKABEL®

## Bus Systems

| Bus Systems | Areal | Installation area | Application | UL | CSA | Flame retardance | halogen-free | Oil resistant | UV resistant |
|---|---|---|---|---|---|---|---|---|---|
| **Profibus 150 Ohm** | Industry | Inside | fixed | – | – | IEC 60332-1 | x | x | – |
| | | | | – | – | – | – | x | x |
| | | | | – | – | IEC 60332-1 | x | – | – |
| | | | | – | – | IEC 60332-1, EN50289-4-16 | x | – | – |
| | | | | x | x | IEC 60332-1 | – | – | – |
| | | | | – | – | IEC 60332-1 | – | – | – |
| | | | | x | x | IEC 60332-3 | – | – | x |
| | | | | x | x | EN 50265-2-1 | x | – | x |
| | | | | x | x | IEC 60332-1 | x | x | x |
| | | | flexible/fixed | – | – | IEC 60332-1 | x | – | – |
| | | | | x | x | IEC 60332-3 | –/x | – | – |
| | | | | x | – | EN 50265-2-1 | – | – | – |
| | | | high flexible | – | – | IEC 60332-1 | x | x | – |
| | | | | x | – | – | x | x | x |
| | | | | x | – | IEC 60332-1 | x | x | – |
| | | | | x | x | IEC 60332-1 | x | x | – |
| | | | | x | x | EN 50265-2-1 | – | x | x |
| | | | | x | x | IEC 60332-1 | x | x | x |
| | | Outside | fixed | – | – | – | – | – | x |
| | | | | – | – | – | – | – | x |
| | | | | – | – | – | x | – | x |
| | | | | – | – | – | x | – | x |
| **Profibus PA 100 Ohm** | Industry | Inside | fixed | x | – | EN 50265-2-1 | – | – | – |
| | | | | x | | IEC 60332-1 | – | – | – |
| | | | | – | – | EN 50265-2-1 | – | – | x |
| | | Inside/Outside | | x | – | EN 50265-2-1 | – | – | x |
| | | | | – | – | EN 50265-2-1 | – | – | x |
| | | | | x | – | IEC 60332-1 | – | – | x |
| **CAN Bus 120 Ohm** | Industry | Inside | fixed | x | – | IEC 60332-1 | – | – | – |
| | | | | x | – | IEC 60332-1 | – | – | – |
| | | | | x | – | IEC 60332-1 | – | – | – |
| | | | | x | x | IEC 60332-1 | – | – | – |
| | | | | x | – | IEC 60332-1 | – | – | – |
| | | | | x | x | IEC 60332-1 | – | – | – |
| | | | | x | x | IEC 60332-1 | – | – | – |
| | | | flexible/fixed | x | x | IEC 60332-1 | x | x | X |
| | | | high flexible | – | – | – | x | x | – |
| | | | | x | – | IEC 60332-1 | x | x | – |
| | | | | x | – | IEC 60332-1 | x | x | – |
| | | | | x | – | IEC 60332-1 | x | x | – |
| | | Outside | fixed | – | – | – | – | – | x |
| **Foundation ™ Fieldbus 100 Ohm** | Industry | Inside/Outside | fixed | x | x | x | – | x | x |
| | | | flexible | x | x | x | – | x | x |
| | | | | x | x | x | – | x | x |
| | | | | x | x | x | – | x | x |
| **DeviceNet™ 120 Ohm** | Industry | Inside | fixed | x | x | IEC 60332-1 | – | x | x |
| | | | | x | x | IEC 60332-1 | x | – | x |
| | | | | x | x | IEC 60332-1 | – | – | x |
| | | | high flexible | x | x | VW 1 | x | x | x |
| **Interbus 100 Ohm** | Industry | Inside | fixed | x | – | IEC 60332-1 | – | – | – |
| | | | | x | – | IEC 60332-1 | – | – | – |
| | | | | – | – | IEC 60332-1 | x | – | – |
| | | | high flexible | – | – | IEC 60332-1 | x | x | – |
| | | | | – | – | IEC 60332-1 | x | x | – |
| **AS Interface** | Industry | Inside | flexible | – | – | – | x | x | x |
| | | | | – | – | – | x | x | –/x |
| | | | | – | – | IEC 60332-1 | – | x | –/x |
| | | | | x | x | IEC 60332-1 | – | x | –/x |
| | | | | x | – | IEC 60332-1 | x | x | – |
| | | | high flexible | x | x | IEC 60332-1 | x | x | –/x |
| | | | | x | x | IEC 60332-1 | x | x | –/x |
| **CC Link** | Industry | Inside | fixed | x | x | IEC 60332-1 | – | x | x |
| **Safety BUS 110 Ohm** | Industry | Inside | fixed | – | – | IEC 60332-1 | x | x | – |
| | | | high flexible | x | x | IEC 60332-1 | x | x | – |
| **Multibus** | Industry | Inside | high flexible | x | x | VW 1/ FT1 | x | x | – |
| | | | | x | x | VW 1/ FT1 | x | x | – |
| **USB 2.0 90 Ohm** | Industry | Inside | high flexible | x | x | IEC 60332-1 | – | x | – |
| | | | | x | x | IEC 60332-1 | – | x | – |
| **USB 3.0** | Industry | Inside | high flexible | x | x | IEC 60332-1 | x | x | – |
| **FireWire™ 800** | Industry | Inside | high flexible | x | x | IEC 60332-1 | x | x | – |
| **Coax 50 Ohm** | Industry | Inside | high flexible | – | – | IEC 60332-1 | x | x | x |
| **EIB Bus 100 Ohm** | Office | Inside | fixed | – | – | IEC 60332-1 | – | – | – |
| | | | | – | – | IEC 60332-1 | x | – | – |
| | | | | – | – | IEC 60332-1 | x | – | – |
| | | | | – | – | IEC 60332-1 | – | – | – |
| | | Outside | fixed | | | – | x | – | x |
| **MOD-Bus** | Office | Inside/Outside | fixed | – | – | IEC 60332-3 | – | x | x |
| | | | | – | – | IEC 60332-3 | – | x | x |
| **LON Bus 100/85 Ohm** | Office | Inside | fixed | – | – | IEC 60332-1 | x | – | – |
| | | | flexible | | | IEC 60332-1 | – | – | – |
| | | | flexible | | | IEC 60332-1 | x | – | – |
| | | | flexible | – | – | IEC 60332-1 | – | – | – |
| | | | flexible | – | – | IEC 60332-1 | x | – | – |
| **Hospital-System-Bus** | Office | Inside | fixed | – | – | IEC 60332-1 | –/x | – | – |

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| | Fast Connect (SK) | Profibus SK 7-wire 1x2xAWG23/7 PVC violett / 7FRNC violett | 805656 / 805657 | - |
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* Preparation of the jacket before connection necessary.

# Plug Matrix Bus Systems

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| C1 | 802401 | Profibus-90°-S |
| C2 | 802402 | Profibus-90°-PG-S |
| C3 | 802403 | Profibus-35°-S |
| C4 | 802404 | Profibus-35°-PG-S |
| C5 | 803356 | Profibus-45°-SK, solid |
| C6 | 803357 | Profibus-45°-PG-SK, solid |
| C7 | 803576 | Profibus-45°-SK, flex |
| C8 | 803577 | Profibus-45°-PG-SK, flex |
| C9 | 802405 | Profibus-axial-S |
| C10 | 802406 | Profibus-90°-SK, solid + flex |
| C11 | 802407 | Profibus-90°-PG-SK, solid + flex |
| C14 | 803194 | Profibus-90°-PG-SK Diagnose, solid |
| C15 | 803195 | Profibus-90°-SK Diagnose, solid |
| C18 | 803844 | Profibus-90°-PG-S Diagnose |
| C19 | 803845 | Profibus-90°-S Diagnose |
| C20 | 803208 | Profibus-axial-SK, solid |
| C22 | 803511 | Profibus-90°-PG-S Repeater |
| C23 | 803234 | CAN-axial-S |
| C24 | 802967 | CAN-90°-S |
| C25 | 803272 | CAN-90°-GA-S |


802401


802402


802403


802404


802405


802407


803194


803195


803844


803845

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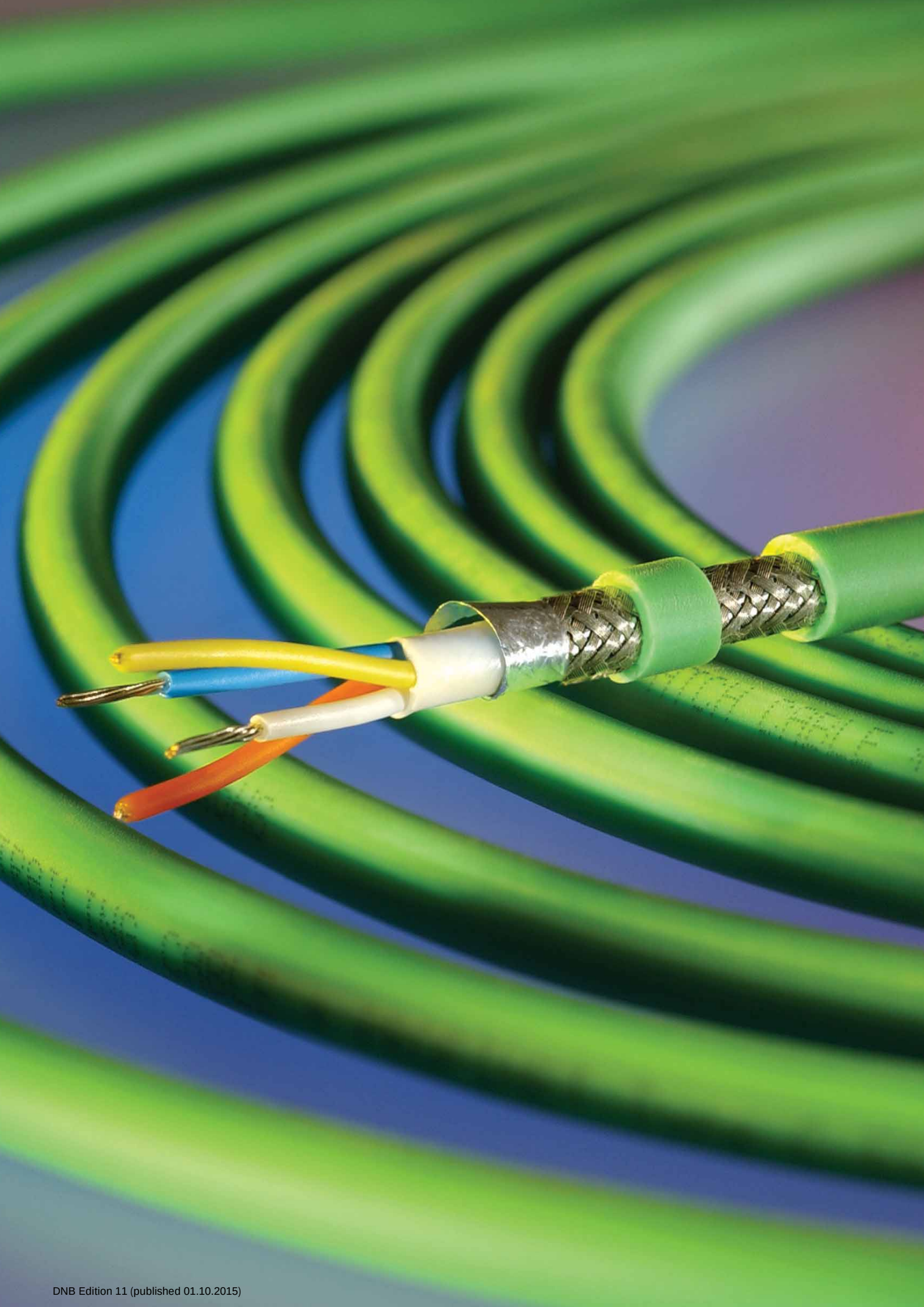


DNB Edition 11 (published 01.10.2015)

# CHAPTER OVERVIEW






DNB Edition 11 (published 01.10.2015)

# OVERVIEW OF THE DATA, NETWORK & BUS TECHNOLOGY

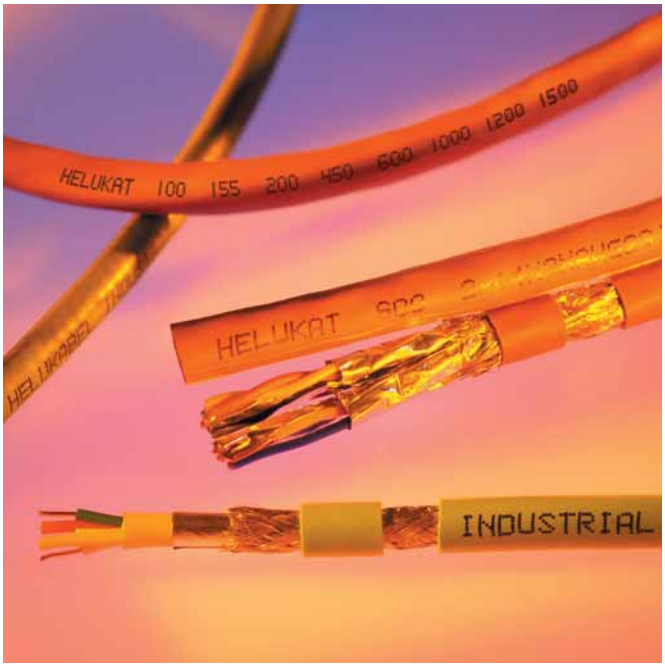
## Fibre Optic Cables


The future reliability of any installation depends on the correct choice of cable used in the network technique. It is only by careful selection of the components that compliance with the continually increasing requirements placed upon the quality of the network is possible. Infrastructures based on copper are continually nearing their physical limits because of the rapidly growing demands from multimedia developments, and hence an alternative to copper must be provided for installations in the future.

The benefits of optical fibre technology are obvious: High transmission rates, low attenuation, no electromagnetic problems, small dimensions and low weight. Modern designs for optical fibre cables of the HELUCOM® series exhibit the same robustness as a copper cable. The cable constructions are selected for optimum protection of the optical fibres in each application.

Within the HELUCOM® series, optical fibre cables are available with the common fibre types of 50/125 µm, 62,5/125 µm, 9/125 µm, 200/230 µm and 980/1000 µm. The HELUCOM® optical fibre cables are manufactured in accordance with the standards and regulations of DIN VDE 0888

## Copper Data Cables




All HELUKAT® data cables and wires comply with the latest standardisation recommendations and are designed for use in high-speed networks with transmission rates of 100 Mbit/s and higher (e.g. CCDI, TPDDI, ATM, SDH/SONET). All HELUKAT® types of cables and wires meet the requirements of category 5 according to EIA/TIA TSB-36 ISO/IEC DIS 11801, CENELEC pr EN 50173, as well as category 6/7 according to DIN 44312-5/ EN 50288. Cables for Ethernet applications, as well as coax/twinaxial cables cables for IBMs IVS system complete the product range from HELUKABEL®.

The excellent transmission characteristics of HELUKAT® data cables and wires constitute enormous challenges for production equipment and the measurement laboratories. HELUKAT® data cables and wires are manufactured using the latest machinery technologies. These have been designed for producing cables and wires of the categories 5/6/7/8 in accordance with the latest standardisation recommendations. A special laboratory for high-frequency testing such high transmission rates has been installed complete with network analyser and computer-controlled equipment for HF cables.

## Bus-Cables


Bus technology is being used in an increasing number of industrial applications. This technology can be applied in every branch in industry where process-control techniques are used. The enormous pressures of competitiveness and costs in all areas of process control emphasise the need for even more rationalisation and greater efficency. The traditional method of parallel wiring for the equipment and machines does not have the flexibility and thus constitutes a major factor in costs and time. The potential for saving costs from internetworking the machinery by bus systems is very high. So as to keep the amount of cabling low, the information from the master controller is sent over a bus network and is potentially available to all components in the system. Only those components specifically addressed by the information can respond and process these signals. All types of cables and wires used in all common bus systems are available from HELUKABEL®.

## Copper connection equipment

In addition to active components and cables, passive components such as 19" patch panel, patch cable and wiring boxes are necessary for installation and start-up of a data network. The wiring boxes are an important part of both the tertiary wiring and the structured wiring as a whole. These systems, which are also referred to as „IT connection units", can be installed in floors, walls or a channel system. No additional components are used in the wiring boxes. Also used in conjunction with the wiring boxes are sockets that fit the plug of the patch/connection cable. For operation of the data networks, HELUKABEL® provides complete CONNECTING SYSTEMS, which make it possible to ensure the full reliability and state-of-the-art functioning of the structured building wiring.

### Industrial copper connection components

The Ethernet technology has established itself at the automation and production levels as so-called INDUSTRIAL ETHERNET because it makes continuous communication at all levels of a business network possible. By using standardised interfaces for all communication equipment, the complexity of processes is reduced and the productivity is increased. With new industry-compatible network components based on IP20, IP 65 or IP67, or suitable for DIN rail mounting and standards such as ISO/IEC 24702, the prerequisites for a completely networked future have been created.

The HELUKAT CONNECTING SYSTEMS INDUSTRY series from HELUKABEL® provides passive copper connection components such as patch panels, sockets and patch cables for harsh industrial environments.



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# OVERVIEW OF THE DATA, NETWORK & BUS TECHNOLOGY

## Fibre optic connection

In addition to the fibre optic cable, the connection equipment plays an essential role in the construction of glass fibre networks. Optical transmission lines are only complete after installing pigtails, jumper cables, plugs, couplings, splice boxes and wiring boxes. Regardless of the application, HELUKABEL® has the cable solution that's right for you. This also includes the use of pre-assembled fibre optic cables. In only a short time, we can supply you with pre-assembled kits containing all the most frequently used plugs and cable types. As a result, it is possible to eliminate the high costs involved in obtaining the required tools. In addition, this "plug-and-play" solution helps you to reduce the time necessary for installation. These features are what make HELUCOM CONNECTING SYSTEMS® the ideal choice when it comes to providing our customers economical, high-quality solutions.

### Industrial Fibre optics connection components

Ethernet was initially used exclusively in the office environment. The Ethernet technology has now also established itself at the automation and production levels as so-called INDUSTRIAL ETHERNET because it makes continuous communication at all levels of a business network possible.

By using standardised interfaces for all communication equipment, the complexity of processes is reduced and the productivity is increased. With new industry-compatible network components based on IP20, IP 65 or IP67, or suitable for DIN rail mounting and standards such as ISO/IEC 24702, the prerequisites for a completely networked future have been created.

## Network system cabinets

Universal network system cabinets are the central point where all cable ends meet for the installation of local networks, in building and floor wiring as well as for the connection of terminal devices. The 19" network distributors are available in wall distributor or floor distributor versions.

The cabinets can be expanded to products in the area of data centres, servers and network technology. The design of the network cabinets allows the build-in of servers with special dimensions and standards. Active and passive components, a power supply and distribution system, an ingenious cable management system and a scalable thermal management system ensure high operational reliability. The thermal management system is an important component in effective heat dissipation for electronic assembles. The 19" ups-system (uninterruptible power supply) ensure reliable operation of systems.

In addition, we are also happy to provide tailor-made solutions to meet your individual needs. In this case, the cabinets are then equipped with the appropriate gear. In this way, you are provided with an individually configured product designed to meet your specific needs.

## Measurement & Processing Technics


In addition to the attenuation coefficients of the fibre optic cable, the attenuation values of the connection points must be carefully observed when planning a fibre optic network. In view of the high demands posed by present-day transmission processes, it is particularly important to work toward optimising connection points with regard to their attenuation values. To achieve this goal, a thermal splice process has been used. In this process, direct splicing is carried out using an arc lamp, which creates an adhesive bond between the fibres without any air gaps or inclusion of other materials. Afterwards, functionality, reliability and performance are tested using fibre optic measuring devices. The test procedures document the quality of the system, while locating sources of errors. The test protocol provides proof as to whether the cable system has been installed correctly. OTDR and performance measuring devices are used for testing. Tool cases for fibre optic cable installation and service cases for adhesives complete the professional assortment of products. For high-speed copper networks, we offer cable analysers for certification and troubleshooting.

## Active Components

For data transmission between computers, servers and PCs, both passive and active components are required. Passive elements such as wiring boxes, patch panels, cables and distributors are all permanent components of the building installation. Once they have been installed, they are no longer removed. Active components are electronic systems required for amplification, utilisation, control and transfer of data flow.

Active components make it possible for workplace computers to communicate with one another as well as send, receive and understand data. The network itself is comprised of computers that are interconnected, but independent of one another while accessing common resources. According to the requirements of the costumers HELUKABEL® is supplying switches, router and media converter from well-known manufactures for the configuration of high speed networks in office environment. For the use in industrial environment there are available devices from Moxa and Hirschmann. As supplement of the wired communication wireless products can be used for new installations and for expansions of existing LAN-networks.



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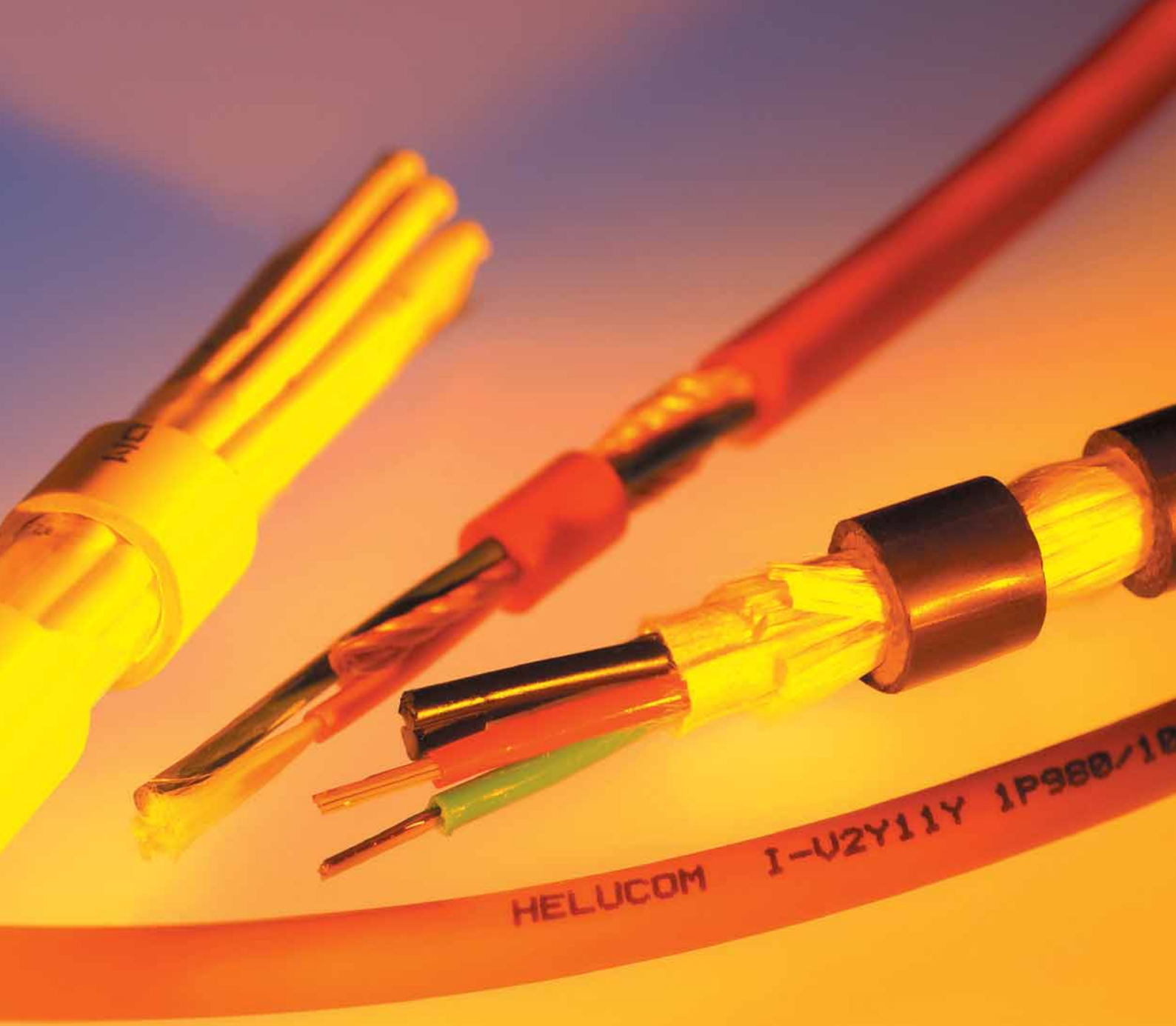



**HELUCOM pact fibre-optic universal cables A/I-DQ(ZN)BH**

Plastic-fibre cables industry I-V4Y(ZN)11Y

**Fibre-optic installation cables I-VH**

Fibre-optic cables with functional integrity A-DQ(ZN)BH E30

**Fibre-optic breakout cables I-V(ZN)HH**

Fibre-optic universal mini breakout cables A/I-VQ(ZN)BH

Fibre-optic aerial cables metal-free ADSS

**Fibre-optic outdoor cables A-DQ(ZN)2Y, stranded**

DNB Edition 11 (published 01.10.2015)

# FIBER OPTIC CABLES HELUCOM®





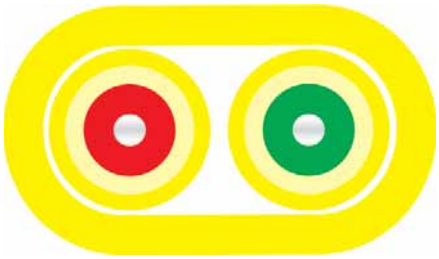

DNB Edition 11 (published 01.10.2015)

# Fibre Optic Indoor Cable

**acc. DIN VDE 0888**

HELUCOM®

I-VH, I-V11Y, I-VHH, I-V11Y11Y




## Cable structure

Core type: Composite buffered
Strain relief elements: Aramide
Outer sheath material: FRNC
Outer sheath colour: Yellow

## Temperature range

Laying, min.: 0°C
Laying, max.: +50°C
Operating, min.: 0°C
Operating, max.: +60°C

## Other data

Corrosiveness acc. to EN50267-2-3
Halogen-free acc. to 60754-2
Flame-resistance acc. to IEC 60332-1-2
Smoke density acc. to IEC 61034

| Designation | No. of fibres | Fibre type | Fibre category | Outer Ø app. mm | Max. tensile force N | Min. stat. bending radius mm | Caloric load app. MJ / m | Max. transverse pressure N / cm | Weight kg / km | **Part no.** |
|---|---|---|---|---|---|---|---|---|---|---|
| I-VH | 1 | Multimode G50/125 | OM2 | 2,6 | 300 | 40 | 0,17 | 10 | 8,7 | **80783** |
| I-VH | 1 | Multimode G62.5/125 | OM1 | 2,6 | 300 | 40 | 0,17 | 10 | 8,7 | **80782** |
| I-VH | 1 | Single-mode E9/125 | ITU-T G.652 | 2,6 | 300 | 40 | 0,17 | 10 | 8,7 | **80784** |
| I-VH | 2 | Multimode G50/125 | OM2 | 2,6 x 5,6 | 400 | 40 | 0,24 | 10 | 17,5 | **80316** |
| I-VH | 2 | Multimode G50/125 | OM3 | 2,6 x 5,6 | 400 | 40 | 0,24 | 10 | 17,5 | **804256** |
| I-VH | 2 | Multimode G62.5/125 | OM1 | 2,6 x 5,6 | 400 | 40 | 0,24 | 10 | 17,5 | **80699** |
| I-VH | 2 | Single-mode E9/125 | ITU-T G.652 | 2,6 x 5,6 | 400 | 40 | 0,24 | 10 | 17,5 | **80785** |
| I-V11Y | 2 | Multimode G50/125 | OM2 | 2,6 x 5,6 | 400 | 40 | 2,80 | 20 | 14,0 | **82408** |
| I-V11Y | 2 | Multimode G62.5/125 | OM1 | 2,6 x 5,6 | 400 | 40 | 2,80 | 20 | 14,0 | **82410** |
| I-V11Y | 2 | Single-mode E9/125 | ITU-T G.652 | 2,6 x 5,6 | 400 | 40 | 2,80 | 20 | 14,0 | **82411** |
| I-VHH | 2 | Multimode G50/125 | OM2 | 3,6 x 6,2 | 600 | 50 | 0,57 | 20 | 20,0 | **80789** |
| I-VHH | 2 | Multimode G50/125 | OM3 | 3,6 x 6,2 | 600 | 50 | 0,57 | 20 | 20,0 | **804254** |
| I-VHH | 2 | Multimode G62.5/125 | OM1 | 3,6 x 6,2 | 600 | 50 | 0,57 | 20 | 20,0 | **80790** |
| I-VHH | 2 | Single-mode E9/125 | ITU-T G.652 | 3,6 x 6,2 | 600 | 50 | 0,57 | 20 | 20,0 | **80791** |
| I-V11Y11Y | 2 | Multimode G50/125 | OM2 | 3,6 x 6,2 | 600 | 60 | 4,20 | 20 | 16,0 | **82409** |
| I-V11Y11Y | 2 | Multimode G62.5/125 | OM1 | 3,6 x 6,2 | 600 | 60 | 4,20 | 20 | 16,0 | **81900** |
| I-V11Y11Y | 2 | Single-mode E9/125 | ITU-T G.652 | 3,6 x 6,2 | 600 | 60 | 4,20 | 20 | 16,0 | **82412** |

Dimensions and specifications may be changed without prior notice.

## Application

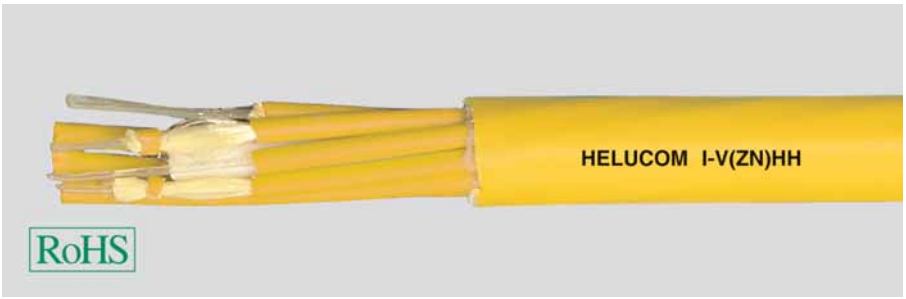
These HELUCOM® one-fibre and two-fibre (duplex) cables are used for fixed indoor installation, such as in cable ducts. These cables are also used as ready-made cables (pigtails) that are spliced to fixed cables or as connection cables (jumper cable) as well as for switch frames. The small diameter and the high flexibility make these cables ideal for the application in switch frames as well as for the connection of terminals.

# Fibre Optic Breakout-Cable

**acc. DIN VDE 0888**

HELUCOM®

I-V(ZN)HH




## Cable structure

Core type: Composite buffered
Strain relief elements: Aramide
Outer sheath material: FRNC
Outer sheath colour: Yellow

## Temperature range

Laying, min.: 0°C
Laying, max.: +50°C
Operating, min.: 0°C
Operating, max.: +60°C

## Other data

Corrosiveness acc. to EN50267-2-3
Halogen-free acc. to 60754-2
Flame-resistance acc. to IEC 60332-1 and IEC 60332-3
Smoke density acc. to IEC 61034

| Designation | No. of fibres | Fibre type | Fibre category | Number of fibres per core | Outer Ø app. mm | Max. tensile force N | Min. stat. bending radius mm | Caloric load app. MJ / m | Max. transverse pressure N / cm | Weight kg / km | **Part no.** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| I-V(ZN)HH | 2 | Multimode G50/125 | OM2 | 1 | 7,1 | 1000 | 270,0 | 1,00 | 150 | 40,0 | **80743** |
| I-V(ZN)HH | 2 | Multimode G62.5/125 | OM1 | 1 | 7,1 | 1000 | 270,0 | 1,00 | 150 | 40,0 | **80799** |
| I-V(ZN)HH | 2 | Single-mode E9/125 | ITU-T G.652 | 1 | 7,1 | 1000 | 270,0 | 1,00 | 150 | 40,0 | **80813** |
| I-V(ZN)HH | 4 | Multimode G50/125 | OM2 | 1 | 7,1 | 1000 | 270,0 | 1,00 | 150 | 45,0 | **80753** |
| I-V(ZN)HH | 4 | Multimode G62.5/125 | OM1 | 1 | 7,1 | 1000 | 270,0 | 1,00 | 150 | 45,0 | **80800** |
| I-V(ZN)HH | 4 | Single-mode E9/125 | ITU-T G.652 | 1 | 7,1 | 1000 | 270,0 | 1,00 | 150 | 45,0 | **80814** |
| I-V(ZN)HH | 6 | Multimode G50/125 | OM2 | 1 | 8,4 | 1350 | 270,0 | 1,25 | 150 | 70,0 | **80754** |
| I-V(ZN)HH | 6 | Multimode G62.5/125 | OM1 | 1 | 8,4 | 1350 | 270,0 | 1,25 | 150 | 70,0 | **80769** |
| I-V(ZN)HH | 6 | Single-mode E9/125 | ITU-T G.652 | 1 | 8,4 | 1350 | 270,0 | 1,25 | 150 | 70,0 | **80815** |
| I-V(ZN)HH | 8 | Multimode G50/125 | OM2 | 1 | 9,3 | 1500 | 270,0 | 1,50 | 150 | 100,0 | **80688** |
| I-V(ZN)HH | 8 | Multimode G62.5/125 | OM1 | 1 | 9,3 | 1500 | 270,0 | 1,50 | 150 | 100,0 | **80801** |
| I-V(ZN)HH | 8 | Single-mode E9/125 | ITU-T G.652 | 1 | 9,3 | 1500 | 270,0 | 1,50 | 150 | 100,0 | **80816** |
| I-V(ZN)HH | 12 | Multimode G50/125 | OM2 | 1 | 9,6 | 2350 | 270,0 | 1,85 | 150 | 165,0 | **80795** |
| I-V(ZN)HH | 12 | Multimode G62.5/125 | OM1 | 1 | 9,6 | 2350 | 270,0 | 1,85 | 150 | 165,0 | **80803** |
| I-V(ZN)HH | 12 | Single-mode E9/125 | ITU-T G.652 | 1 | 9,6 | 2350 | 270,0 | 1,85 | 150 | 165,0 | **80818** |
| I-V(ZN)HH | 16 | Multimode G50/125 | OM2 | 1 | 15,0 | 2400 | 270,0 | 2,40 | 150 | 170,0 | **80796** |
| I-V(ZN)HH | 16 | Multimode G62.5/125 | OM1 | 1 | 15,0 | 2400 | 270,0 | 2,40 | 150 | 170,0 | **80804** |
| I-V(ZN)HH | 16 | Single-mode E9/125 | ITU-T G.652 | 1 | 15,0 | 2400 | 270,0 | 2,40 | 150 | 170,0 | **80819** |
| I-V(ZN)HH | 24 | Multimode G50/125 | OM2 | 1 | 17,5 | 2400 | 330,0 | 3,20 | 150 | 220,0 | **80798** |
| I-V(ZN)HH | 24 | Multimode G62.5/125 | OM1 | 1 | 17,5 | 2400 | 330,0 | 3,20 | 150 | 220,0 | **80806** |
| I-V(ZN)HH | 24 | Single-mode E9/125 | ITU-T G.652 | 1 | 17,5 | 2400 | 320,0 | 3,20 | 150 | 220,0 | **80821** |

Dimensions and specifications may be changed without prior notice.

## Application

HELUCOM® breakout cables are designed to replace splicing on-site. They are mainly used in indoor applications for small and medium transmission lines. The fibre-optic connectors are be mounted directly to the individual cables. Therefore no splicing and no splice boxes are necessary. Pre-assembled cables only need to be laid on site and are immediately functional.

# Fibre Optic Minibreakout Cable

**acc. DIN VDE 0888**

HELUCOM®
I-V(ZN)H


## Cable structure

Core type: Tight buffer
Strain relief elements: Aramide
Outer sheath material: FRNC
Outer sheath colour: Orange

## Temperature range

Laying, min.: -5°C
Laying, max.: +50°C
Operating, min.: -10°C
Operating, max.: +60°C

## Other data

Corrosiveness acc. to EN50267-2-3
Halogen-free acc. to 60754-2
Flame-resistance acc. to IEC 60332-1-2
Smoke density acc. to IEC 61034

| Designation | No. of fibres | Fibre type | Fibre category | Number of fibres per core | Outer Ø app. mm | Max. tensile force N | Min. stat. bending radius mm | Caloric load app. MJ / m | Max. transverse pressure N / cm | Weight kg / km | **Part no.** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| I-V(ZN)H | 2 | Multimode G50/125 | OM2 | 1 | 4,0 | 400 | 60,0 | 0,24 | 40 | 15,0 | **80435** |
| I-V(ZN)H | 2 | Multimode G62.5/125 | OM1 | 1 | 4,0 | 400 | 60,0 | 0,24 | 40 | 15,0 | **80434** |
| I-V(ZN)H | 2 | Single-mode E9/125 | ITU-T G.652 | 1 | 4,0 | 400 | 60,0 | 0,24 | 40 | 15,0 | **80433** |
| I-V(ZN)H | 4 | Multimode G50/125 | OM2 | 1 | 4,8 | 400 | 70,0 | 0,31 | 40 | 19,0 | **80432** |
| I-V(ZN)H | 4 | Multimode G62.5/125 | OM1 | 1 | 4,8 | 400 | 70,0 | 0,31 | 40 | 19,0 | **80431** |
| I-V(ZN)H | 4 | Single-mode E9/125 | ITU-T G.652 | 1 | 4,8 | 400 | 70,0 | 0,31 | 40 | 19,0 | **80430** |
| I-V(ZN)H | 6 | Multimode G50/125 | OM2 | 1 | 5,3 | 400 | 80,0 | 0,35 | 40 | 23,0 | **80429** |
| I-V(ZN)H | 6 | Multimode G62.5/125 | OM1 | 1 | 5,3 | 400 | 80,0 | 0,35 | 40 | 23,0 | **80428** |
| I-V(ZN)H | 6 | Single-mode E9/125 | ITU-T G.652 | 1 | 5,3 | 400 | 80,0 | 0,35 | 40 | 23,0 | **80427** |
| I-V(ZN)H | 8 | Multimode G50/125 | OM2 | 1 | 5,3 | 500 | 80,0 | 0,40 | 40 | 25,0 | **80426** |
| I-V(ZN)H | 8 | Multimode G62.5/125 | OM1 | 1 | 5,3 | 500 | 80,0 | 0,40 | 40 | 25,0 | **80425** |
| I-V(ZN)H | 8 | Single-mode E9/125 | ITU-T G.652 | 1 | 5,3 | 500 | 80,0 | 0,40 | 40 | 25,0 | **80424** |
| I-V(ZN)H | 10 | Multimode G50/125 | OM2 | 1 | 6,0 | 600 | 90,0 | 0,53 | 40 | 32,0 | **80423** |
| I-V(ZN)H | 10 | Multimode G62.5/125 | OM1 | 1 | 6,0 | 600 | 90,0 | 0,53 | 40 | 32,0 | **80422** |
| I-V(ZN)H | 10 | Single-mode E9/125 | ITU-T G.652 | 1 | 6,0 | 600 | 90,0 | 0,53 | 40 | 32,0 | **80421** |
| I-V(ZN)H | 12 | Multimode G50/125 | OM2 | 1 | 7,0 | 800 | 110,0 | 0,61 | 40 | 40,0 | **80420** |
| I-V(ZN)H | 12 | Multimode G62.5/125 | OM1 | 1 | 7,0 | 800 | 110,0 | 0,61 | 40 | 40,0 | **80419** |
| I-V(ZN)H | 12 | Single-mode E9/125 | ITU-T G.652 | 1 | 7,0 | 800 | 110,0 | 0,61 | 40 | 40,0 | **80418** |

Dimensions and specifications may be changed without prior notice.

## Application

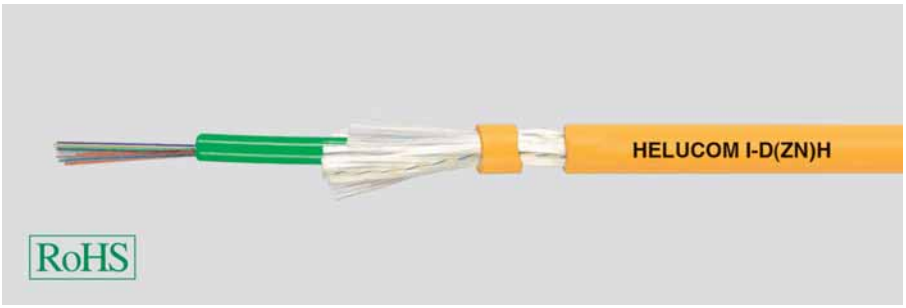
These HELUCOM® fibre-optic cables are used for the data network cabling in indoor applications. A big advantage of this cable type is its space-saving construction. Similar to the breakout cable, the connector is directly mounted at the tight buffer.

# Fibre Optic Indoor Cable

**acc. DIN VDE 0888**

HELUCOM®

I-D(ZN)H




## Cable structure

Core type: Loose tube
Strain relief elements: Aramide
Outer sheath material: FRNC
Outer sheath colour: Yellow

## Temperature range

Laying, min.: -5°C
Laying, max.: +50°C
Operating, min.: -20°C
Operating, max.: +60°C

## Other data

Corrosiveness acc. to EN50267-2-3
Halogen-free acc. to 60754-2
Flame-resistance acc. to IEC 60332-1-2
Smoke density acc. to IEC 61034

| Designation | No. of fibres | Fibre type | Fibre category | Number of fibres per core | Outer Ø app. mm | Max. tensile force N | Min. stat. bending radius mm | Caloric load app. MJ / m | Max. transverse pressure N / cm | Weight kg / km | **Part no.** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| I-D(ZN)H | 4 | Multimode G50/125 | OM2 | 4 | 8,0 | 1200 | 120,0 | 1,50 | 150 | 65,0 | **80631** |
| I-D(ZN)H | 4 | Multimode G62.5/125 | OM1 | 4 | 8,0 | 1200 | 120,0 | 1,50 | 150 | 65,0 | **80882** |
| I-D(ZN)H | 4 | Single-mode E9/125 | ITU-T G.652 | 4 | 8,0 | 1200 | 120,0 | 1,50 | 150 | 65,0 | **80896** |
| I-D(ZN)H | 6 | Multimode G50/125 | OM2 | 6 | 8,0 | 1200 | 120,0 | 1,50 | 150 | 65,0 | **80868** |
| I-D(ZN)H | 6 | Multimode G62.5/125 | OM1 | 6 | 8,0 | 1200 | 120,0 | 1,50 | 150 | 65,0 | **80883** |
| I-D(ZN)H | 6 | Single-mode E9/125 | ITU-T G.652 | 6 | 8,0 | 1200 | 120,0 | 1,50 | 150 | 65,0 | **80897** |
| I-D(ZN)H | 8 | Multimode G50/125 | OM2 | 8 | 8,0 | 1200 | 120,0 | 1,50 | 150 | 65,0 | **80869** |
| I-D(ZN)H | 8 | Multimode G62.5/125 | OM1 | 8 | 8,0 | 1200 | 120,0 | 1,50 | 150 | 65,0 | **80884** |
| I-D(ZN)H | 8 | Single-mode E9/125 | ITU-T G.652 | 8 | 8,0 | 1200 | 120,0 | 1,50 | 150 | 65,0 | **80898** |
| I-D(ZN)H | 10 | Multimode G50/125 | OM2 | 10 | 8,0 | 1200 | 120,0 | 1,50 | 150 | 65,0 | **80793** |
| I-D(ZN)H | 10 | Multimode G62.5/125 | OM1 | 10 | 8,0 | 1200 | 120,0 | 1,50 | 150 | 65,0 | **80885** |
| I-D(ZN)H | 10 | Single-mode E9/125 | ITU-T G.652 | 10 | 8,0 | 1200 | 120,0 | 1,50 | 150 | 65,0 | **80899** |
| I-D(ZN)H | 12 | Multimode G50/125 | OM2 | 12 | 8,0 | 1200 | 120,0 | 1,50 | 150 | 65,0 | **80045** |
| I-D(ZN)H | 12 | Multimode G62.5/125 | OM1 | 12 | 8,0 | 1200 | 120,0 | 1,50 | 150 | 65,0 | **80879** |
| I-D(ZN)H | 12 | Single-mode E9/125 | ITU-T G.652 | 12 | 8,0 | 1200 | 120,0 | 1,50 | 150 | 65,0 | **80880** |
| I-D(ZN)H | 16 | Multimode G50/125 | OM2 | 16 | 8,0 | 1200 | 120,0 | 1,50 | 150 | 135,0 | **80870** |
| I-D(ZN)H | 16 | Multimode G62.5/125 | OM1 | 16 | 8,0 | 1200 | 120,0 | 1,50 | 150 | 135,0 | **80886** |
| I-D(ZN)H | 16 | Single-mode E9/125 | ITU-T G.652 | 16 | 8,0 | 1200 | 120,0 | 1,50 | 150 | 135,0 | **80900** |
| I-D(ZN)H | 24 | Multimode G50/125 | OM2 | 12 | 12,5 | 3000 | 190,0 | 2,20 | 200 | 150,0 | **80872** |
| I-D(ZN)H | 24 | Multimode G50/125 | OM2 | 24 | 9,0 | 1600 | 140,0 | 1,50 | 150 | 135,0 | **80871** |
| I-D(ZN)H | 24 | Multimode G62.5/125 | OM1 | 12 | 12,5 | 3000 | 190,0 | 2,20 | 200 | 150,0 | **80888** |
| I-D(ZN)H | 24 | Multimode G62.5/125 | OM1 | 24 | 9,0 | 1600 | 140,0 | 1,50 | 150 | 135,0 | **81246** |
| I-D(ZN)H | 24 | Single-mode E9/125 | ITU-T G.652 | 12 | 12,5 | 3000 | 190,0 | 2,20 | 200 | 150,0 | **80902** |
| I-D(ZN)H | 24 | Single-mode E9/125 | ITU-T G.652 | 24 | 9,0 | 1600 | 140,0 | 1,50 | 150 | 135,0 | **80901** |
| I-D(ZN)H | 36 | Multimode G50/125 | OM2 | 12 | 13,5 | 3000 | 200,0 | 2,20 | 200 | 160,0 | **80875** |
| I-D(ZN)H | 36 | Multimode G62.5/125 | OM1 | 12 | 13,5 | 3000 | 200,0 | 2,20 | 200 | 160,0 | **80891** |
| I-D(ZN)H | 36 | Single-mode E9/125 | ITU-T G.652 | 12 | 13,5 | 3000 | 200,0 | 2,20 | 200 | 160,0 | **80905** |
| I-D(ZN)H | 48 | Multimode G50/125 | OM2 | 12 | 13,5 | 3000 | 200,0 | 2,20 | 200 | 160,0 | **80877** |
| I-D(ZN)H | 48 | Multimode G62.5/125 | OM1 | 12 | 13,5 | 3000 | 200,0 | 2,20 | 200 | 160,0 | **80893** |
| I-D(ZN)H | 48 | Single-mode E9/125 | ITU-T G.652 | 12 | 13,5 | 3000 | 200,0 | 2,20 | 200 | 160,0 | **80907** |
| I-D(ZN)H | 60 | Multimode G50/125 | OM2 | 12 | 13,5 | 3000 | 200,0 | 2,20 | 200 | 170,0 | **80878** |
| I-D(ZN)H | 60 | Multimode G62.5/125 | OM1 | 12 | 13,5 | 3000 | 200,0 | 2,20 | 200 | 170,0 | **80894** |
| I-D(ZN)H | 60 | Single-mode E9/125 | ITU-T G.652 | 12 | 13,5 | 3000 | 200,0 | 2,20 | 200 | 170,0 | **80908** |

Dimensions and specifications may be changed without prior notice.

## Application

These HELUCOM® fibre-optic cables are available either as central bundle core cable or as stranded versions. They are suitable for indoor cabling of buildings and facilities. The halogen-free version is especially suitable for the application in skyscrapers, hospitals and stores as well as in facilities with high concentration of capital goods, such as power plants, computing centers, and at locations with high security requirements, such as underground and control stations.

# Fibre Optic Indoor/Outdoor Minibreakout Cable

**acc. DIN VDE 0888**

HELUCOM®
A/I-VQ(ZN)BH


## Cable structure

Core type: Tight buffer
Strain relief elements: Aramide
Type of armouring: Glass yarns
Outer sheath material: FRNC
Outer sheath colour: Black

## Temperature range

Laying, min.: -5°C
Laying, max.: +50°C
Operating, min.: -20°C
Operating, max.: +55°C

## Other data

Corrosiveness acc. to EN50267-2-3
Halogen-free acc. to 60754-2
Flame-resistance acc. to IEC 60332-1-2
Smoke density acc. to IEC 61034
UV-resistant

| Designation | No. of fibres | Fibre type | Fibre category | Number of fibres per core | Outer Ø app. mm | Max. tensile force N | Min. stat. bending radius mm | Caloric load app. MJ / m | Max. transverse pressure N / cm | Weight kg / km | **Part no.** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A/I-VQ(ZN)BH | 4 | Multimode G50/125 | OM2 | 1 | 6,1 | 2000 | 90,0 | 0,35 | 40 | 40,0 | **82804** |
| A/I-VQ(ZN)BH | 4 | Multimode G62.5/125 | OM1 | 1 | 6,1 | 2000 | 90,0 | 0,35 | 40 | 40,0 | **82809** |
| A/I-VQ(ZN)BH | 4 | Single-mode E9/125 | ITU-T G.652 | 1 | 6,1 | 2000 | 90,0 | 0,35 | 40 | 40,0 | **82814** |
| A/I-VQ(ZN)BH | 6 | Multimode G50/125 | OM2 | 1 | 6,6 | 2000 | 100,0 | 0,41 | 40 | 47,0 | **82805** |
| A/I-VQ(ZN)BH | 6 | Multimode G62.5/125 | OM1 | 1 | 6,6 | 2000 | 100,0 | 0,41 | 40 | 47,0 | **82810** |
| A/I-VQ(ZN)BH | 6 | Single-mode E9/125 | ITU-T G.652 | 1 | 6,6 | 2000 | 100,0 | 0,41 | 40 | 47,0 | **82815** |
| A/I-VQ(ZN)BH | 8 | Multimode G50/125 | OM2 | 1 | 6,6 | 2000 | 100,0 | 0,43 | 40 | 51,0 | **82806** |
| A/I-VQ(ZN)BH | 8 | Multimode G62.5/125 | OM1 | 1 | 6,6 | 2000 | 100,0 | 0,43 | 40 | 51,0 | **82811** |
| A/I-VQ(ZN)BH | 8 | Single-mode E9/125 | ITU-T G.652 | 1 | 6,6 | 2000 | 100,0 | 0,43 | 40 | 51,0 | **82816** |
| A/I-VQ(ZN)BH | 10 | Multimode G50/125 | OM2 | 1 | 8,0 | 2000 | 120,0 | 0,61 | 40 | 65,0 | **82807** |
| A/I-VQ(ZN)BH | 10 | Multimode G62.5/125 | OM1 | 1 | 8,0 | 2000 | 120,0 | 0,61 | 40 | 65,0 | **82812** |
| A/I-VQ(ZN)BH | 10 | Single-mode E9/125 | ITU-T G.652 | 1 | 8,0 | 2000 | 120,0 | 0,61 | 40 | 65,0 | **82817** |
| A/I-VQ(ZN)BH | 12 | Multimode G50/125 | OM2 | 1 | 8,3 | 3000 | 125,0 | 0,71 | 40 | 70,0 | **82808** |
| A/I-VQ(ZN)BH | 12 | Multimode G62.5/125 | OM1 | 1 | 8,3 | 3000 | 125,0 | 0,71 | 40 | 70,0 | **82813** |
| A/I-VQ(ZN)BH | 12 | Single-mode E9/125 | ITU-T G.652 | 1 | 8,3 | 3000 | 125,0 | 0,71 | 40 | 70,0 | **82818** |

Dimensions and specifications may be changed without prior notice.

## Application

These HELUCOM® fibre-optic cables are used for the data network cabling in indoor and outdoor applications. With their black UV-resistant outer sheath and the non-metallic rodent protection, they are perfectly suited for outdoor use. A big advantage of this cable type is its space-saving construction. Similar to the breakout cable, the connector is directly mounted at the tight buffer.

# Fibre Optic Indoor/Outdoor Cable

**acc. DIN VDE 0888**

HELUCOM® pact

A/I-DQ(ZN)BH


## Cable structure

Core type: Loose tube
Strain relief elements: Glass yarns
Type of armouring: Glass yarns
Outer sheath material: FRNC
Outer sheath colour: Black

## Temperature range

Laying, min.: -5°C
Laying, max.: +50°C
Operating, min.: -20°C
Operating, max.: +60°C

## Other data

Corrosiveness acc. to EN50267-2-3
Halogen-free acc. to 60754-2
Flame-resistance acc. to IEC 60332-1-2
Smoke density acc. to IEC 61034
Longitudinally water-tight acc. to IEC 60794-1-2-F5
UV-resistant

| Designation | No. of fibres | Fibre type | Fibre category | Number of fibres per core | Outer Ø app. mm | Max. tensile force N | Min. stat. bending radius mm | Caloric load app. MJ / m | Max. transverse pressure N / cm | Weight kg / km | **Part no.** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A/I-DQ(ZN)BH | 4 | Multimode G50/125 | OM2 | 4 | 7,5 | 1500 | 150,0 | 1,10 | 200 | 55,0 | **82792** |
| A/I-DQ(ZN)BH | 4 | Multimode G50/125 | OM3 | 4 | 7,5 | 1500 | 150,0 | 1,10 | 200 | 55,0 | **802247** |
| A/I-DQ(ZN)BH | 4 | Multimode G62.5/125 | OM1 | 4 | 7,5 | 1500 | 150,0 | 1,10 | 200 | 55,0 | **82796** |
| A/I-DQ(ZN)BH | 4 | Single-mode E9/125 | ITU-T G.652 | 4 | 7,5 | 1500 | 150,0 | 1,10 | 200 | 55,0 | **82800** |
| A/I-DQ(ZN)BH | 6 | Multimode G50/125 | OM2 | 6 | 7,5 | 1500 | 150,0 | 1,10 | 200 | 55,0 | **82793** |
| A/I-DQ(ZN)BH | 6 | Multimode G50/125 | OM3 | 6 | 7,5 | 1500 | 150,0 | 1,10 | 200 | 55,0 | **802277** |
| A/I-DQ(ZN)BH | 6 | Multimode G62.5/125 | OM1 | 6 | 7,5 | 1500 | 150,0 | 1,10 | 200 | 55,0 | **82797** |
| A/I-DQ(ZN)BH | 6 | Single-mode E9/125 | ITU-T G.652 | 6 | 7,5 | 1500 | 150,0 | 1,10 | 200 | 55,0 | **82801** |
| A/I-DQ(ZN)BH | 8 | Multimode G50/125 | OM2 | 8 | 7,5 | 1500 | 150,0 | 1,10 | 200 | 55,0 | **82794** |
| A/I-DQ(ZN)BH | 8 | Multimode G50/125 | OM3 | 8 | 7,5 | 1500 | 150,0 | 1,10 | 200 | 55,0 | **802278** |
| A/I-DQ(ZN)BH | 8 | Multimode G62.5/125 | OM1 | 8 | 7,5 | 1500 | 150,0 | 1,10 | 200 | 55,0 | **82798** |
| A/I-DQ(ZN)BH | 8 | Single-mode E9/125 | ITU-T G.652 | 8 | 7,5 | 1500 | 150,0 | 1,10 | 200 | 55,0 | **82802** |
| A/I-DQ(ZN)BH | 12 | Multimode G50/125 | OM2 | 12 | 7,5 | 1500 | 150,0 | 1,10 | 200 | 55,0 | **82795** |
| A/I-DQ(ZN)BH | 12 | Multimode G50/125 | OM3 | 12 | 7,5 | 1500 | 150,0 | 1,10 | 200 | 55,0 | **802248** |
| A/I-DQ(ZN)BH | 12 | Multimode G50/125 | OM4 | 12 | 7,5 | 1500 | 150,0 | 1,10 | 200 | 55,0 | **804705** |
| A/I-DQ(ZN)BH | 12 | Multimode G62.5/125 | OM1 | 12 | 7,5 | 1500 | 150,0 | 1,10 | 200 | 55,0 | **82799** |
| A/I-DQ(ZN)BH | 12 | Single-mode E9/125 | ITU-T G.652 | 12 | 7,5 | 1500 | 150,0 | 1,10 | 200 | 55,0 | **82803** |
| A/I-DQ(ZN)BH | 24 | Multimode G50/125 | OM2 | 24 | 8,5 | 1500 | 170,0 | 1,40 | 200 | 75,0 | **802143** |
| A/I-DQ(ZN)BH | 24 | Multimode G50/125 | OM3 | 24 | 8,5 | 1500 | 170,0 | 1,40 | 200 | 75,0 | **802249** |
| A/I-DQ(ZN)BH | 24 | Multimode G50/125 | OM4 | 24 | 8,5 | 1500 | 170,0 | 1,40 | 200 | 75,0 | **804706** |
| A/I-DQ(ZN)BH | 24 | Multimode G62.5/125 | OM1 | 24 | 8,5 | 1500 | 170,0 | 1,40 | 200 | 75,0 | **802144** |
| A/I-DQ(ZN)BH | 24 | Single-mode E9/125 | ITU-T G.652 | 24 | 8,5 | 1500 | 170,0 | 1,40 | 200 | 75,0 | **802145** |

Dimensions and specifications may be changed without prior notice.

## Application

These HELUCOM® pact fibre-optic cables have a small but robust construction. They are suitable for indoor and outdoor cabling of buildings and facilities when space is an important argument. They are used in particular if the installation is to be done in one piece from the inside to the outside without additional use of couplings. With their black UV-resistant outer sheath and the non-metallic rodent protection, they are perfectly suited for outdoor use. The halogen-free outer sheath makes installation inhouse possible without any problems.



DNB Edition 11 (published 01.10.2015)

# Fibre Optic Indoor/Outdoor Cable

**acc. DIN VDE 0888**

HELUCOM®

A/I-DQ(ZN)BH, central


## Cable structure

Core type: Loose tube
Strain relief elements: Glass yarns
Type of armouring: Glass yarns
Outer sheath material: FRNC
Outer sheath colour: Black

## Temperature range

Laying, min.: -5°C
Laying, max.: +50°C
Operating, min.: -20°C
Operating, max.: +60°C

## Other data

Corrosiveness acc. to EN50267-2-3
Halogen-free acc. to 60754-2
Flame-resistance acc. to IEC 60332-1-2
Smoke density acc. to IEC 61034
Longitudinally water-tight acc. to IEC 60794-1-2-F5
UV-resistant

| Designation | No. of fibres | Fibre type | Fibre category | Number of fibres per core | Outer Ø app. mm | Max. tensile force N | Min. stat. bending radius mm | Caloric load app. MJ / m | Max. transverse pressure N / cm | Weight kg / km | **Part no.** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A/I-DQ(ZN)BH | 4 | Multimode G50/125 | OM2 | 4 | 10,0 | 2500 | 150,0 | 1,50 | 300 | 75,0 | **80270** |
| A/I-DQ(ZN)BH | 4 | Multimode G62.5/125 | OM1 | 4 | 10,0 | 2500 | 150,0 | 1,50 | 300 | 75,0 | **80276** |
| A/I-DQ(ZN)BH | 4 | Single-mode E9/125 | ITU-T G.652 | 4 | 10,0 | 2500 | 150,0 | 1,50 | 300 | 75,0 | **80264** |
| A/I-DQ(ZN)BH | 6 | Multimode G50/125 | OM2 | 6 | 10,0 | 2500 | 150,0 | 1,50 | 300 | 75,0 | **80271** |
| A/I-DQ(ZN)BH | 6 | Multimode G62.5/125 | OM1 | 6 | 10,0 | 2500 | 150,0 | 1,50 | 300 | 75,0 | **80265** |
| A/I-DQ(ZN)BH | 6 | Single-mode E9/125 | ITU-T G.652 | 6 | 10,0 | 2500 | 150,0 | 1,50 | 300 | 75,0 | **80272** |
| A/I-DQ(ZN)BH | 8 | Multimode G50/125 | OM2 | 8 | 10,0 | 2500 | 150,0 | 1,50 | 300 | 75,0 | **80273** |
| A/I-DQ(ZN)BH | 8 | Multimode G62.5/125 | OM1 | 8 | 10,0 | 2500 | 150,0 | 1,50 | 300 | 75,0 | **80274** |
| A/I-DQ(ZN)BH | 8 | Single-mode E9/125 | ITU-T G.652 | 8 | 10,0 | 2500 | 150,0 | 1,50 | 300 | 75,0 | **80275** |
| A/I-DQ(ZN)BH | 12 | Multimode G50/125 | OM2 | 12 | 10,0 | 2500 | 150,0 | 1,50 | 300 | 75,0 | **80681** |
| A/I-DQ(ZN)BH | 12 | Multimode G62.5/125 | OM1 | 12 | 10,0 | 2500 | 150,0 | 1,50 | 300 | 75,0 | **80278** |
| A/I-DQ(ZN)BH | 12 | Single-mode E9/125 | ITU-T G.652 | 12 | 10,0 | 2500 | 150,0 | 1,50 | 300 | 75,0 | **80279** |
| A/I-DQ(ZN)BH | 16 | Multimode G50/125 | OM2 | 16 | 10,0 | 2500 | 150,0 | 1,50 | 300 | 85,0 | **80280** |
| A/I-DQ(ZN)BH | 16 | Multimode G62.5/125 | OM1 | 16 | 10,0 | 2500 | 150,0 | 1,50 | 300 | 85,0 | **80281** |
| A/I-DQ(ZN)BH | 16 | Single-mode E9/125 | ITU-T G.652 | 16 | 10,0 | 2500 | 150,0 | 1,50 | 300 | 85,0 | **80851** |
| A/I-DQ(ZN)BH | 24 | Multimode G50/125 | OM2 | 24 | 10,0 | 2500 | 150,0 | 1,50 | 300 | 85,0 | **80725** |
| A/I-DQ(ZN)BH | 24 | Multimode G62.5/125 | OM1 | 24 | 10,0 | 2500 | 150,0 | 1,50 | 300 | 85,0 | **82431** |

Dimensions and specifications may be changed without prior notice.

## Application

These HELUCOM® fibre-optic cables are available either as central bundle core cable or as stranded versions. They are suitable for indoor and outdoor cabling of buildings and facilities. They are used in particular if the installation is to be done in one piece from the inside to the outside without additional use of couplings. With their black UV-resistant outer sheath and the non-metallic rodent protection, they are perfectly suited for outdoor use. The halogen-free outer sheath makes installation inhouse possible without any problems.

# Fibre Optic Indoor/Outdoor Cable

**acc. DIN VDE 0888**

HELUCOM®

A/I-DQ(ZN)BH, stranded


## Cable structure

Core type: Loose tube
GRP support element
Strain relief elements: Glass yarns
Type of armouring: Glass yarns
Outer sheath material: FRNC
Outer sheath colour: Black

## Temperature range

Laying, min.: -5°C
Laying, max.: +50°C
Operating, min.: -20°C
Operating, max.: +60°C

## Other data

Corrosiveness acc. to EN50267-2-3
Halogen-free acc. to 60754-2
Flame-resistance acc. to IEC 60332-1-2
Smoke density acc. to IEC 61034
Longitudinally water-tight acc. to IEC 60794-1-2-F5
UV-resistant

| Designation | No. of fibres | Fibre type | Fibre category | Number of fibres per core | Outer Ø app. mm | Max. tensile force N | Min. stat. bending radius mm | Caloric load app. MJ / m | Max. transverse pressure N / cm | Weight kg / km | **Part no.** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A/I-DQ(ZN)BH | 24 | Multimode G50/125 | OM2 | 12 | 11,0 | 2700 | 165,0 | 2,00 | 600 | 90,0 | **81495** |
| A/I-DQ(ZN)BH | 24 | Multimode G62.5/125 | OM1 | 12 | 11,0 | 2700 | 165,0 | 2,00 | 600 | 90,0 | **802263** |
| A/I-DQ(ZN)BH | 24 | Single-mode E9/125 | ITU-T G.652 | 12 | 11,0 | 2700 | 165,0 | 2,00 | 600 | 90,0 | **80846** |
| A/I-DQ(ZN)BH | 24 | Multimode G50/125 | OM3 | 12 | 11,0 | 2700 | 165,0 | 2,00 | 600 | 90,0 | **801616** |
| A/I-DQ(ZN)BH | 48 | Multimode G50/125 | OM2 | 12 | 11,0 | 2700 | 165,0 | 2,00 | 600 | 90,0 | **802261** |
| A/I-DQ(ZN)BH | 48 | Multimode G50/125 | OM3 | 12 | 11,0 | 2700 | 165,0 | 2,00 | 600 | 90,0 | **802280** |
| A/I-DQ(ZN)BH | 48 | Multimode G62.5/125 | OM1 | 12 | 11,0 | 2700 | 165,0 | 2,00 | 600 | 90,0 | **802264** |
| A/I-DQ(ZN)BH | 48 | Single-mode E9/125 | ITU-T G.652 | 12 | 11,0 | 2700 | 165,0 | 2,00 | 600 | 90,0 | **802266** |
| A/I-DQ(ZN)BH | 60 | Multimode G50/125 | OM2 | 12 | 11,0 | 2700 | 165,0 | 2,00 | 600 | 90,0 | **802262** |
| A/I-DQ(ZN)BH | 60 | Multimode G62.5/125 | OM1 | 12 | 11,0 | 2700 | 165,0 | 2,00 | 600 | 90,0 | **802265** |
| A/I-DQ(ZN)BH | 60 | Single-mode E9/125 | ITU-T G.652 | 12 | 11,0 | 2700 | 165,0 | 2,00 | 600 | 90,0 | **802267** |
| A/I-DQ(ZN)BH | 72 | Multimode G50/125 | OM2 | 12 | 11,5 | 2700 | 175,0 | 2,10 | 600 | 100,0 | **802268** |
| A/I-DQ(ZN)BH | 72 | Multimode G62.5/125 | OM1 | 12 | 11,5 | 2700 | 175,0 | 2,10 | 600 | 100,0 | **802271** |
| A/I-DQ(ZN)BH | 72 | Single-mode E9/125 | ITU-T G.652 | 12 | 11,5 | 2700 | 175,0 | 2,10 | 600 | 100,0 | **802274** |
| A/I-DQ(ZN)BH | 84 | Multimode G50/125 | OM2 | 12 | 12,5 | 3000 | 190,0 | 2,40 | 600 | 130,0 | **802269** |
| A/I-DQ(ZN)BH | 84 | Multimode G62.5/125 | OM1 | 12 | 12,5 | 3000 | 190,0 | 2,40 | 600 | 130,0 | **802272** |
| A/I-DQ(ZN)BH | 84 | Single-mode E9/125 | ITU-T G.652 | 12 | 12,5 | 3000 | 190,0 | 2,40 | 600 | 130,0 | **802275** |
| A/I-DQ(ZN)BH | 96 | Multimode G50/125 | OM2 | 12 | 12,5 | 3000 | 190,0 | 2,80 | 600 | 130,0 | **802270** |
| A/I-DQ(ZN)BH | 96 | Multimode G62.5/125 | OM1 | 12 | 12,5 | 3000 | 190,0 | 2,80 | 600 | 130,0 | **802273** |
| A/I-DQ(ZN)BH | 96 | Single-mode E9/125 | ITU-T G.652 | 12 | 12,5 | 3000 | 190,0 | 2,80 | 600 | 130,0 | **802276** |

Dimensions and specifications may be changed without prior notice.

## Application

These HELUCOM® fibre-optic cables are available either as central bundle core cable or as stranded versions. They are suitable for indoor and outdoor cabling of buildings and facilities. They are used in particular if the installation is to be done in one piece from the inside to the outside without additional use of couplings. With their black UV-resistant outer sheath and the non-metallic rodent protection, they are perfectly suited for outdoor use. The halogen-free outer sheath makes installation inhouse possible without any problems.

# Fibre Optic Cable with Functionality

**with reference to DIN 4102-12**

HELUCOM® FS30

A/I-DQ(ZN)BH


## Cable structure

Core type: Loose tube
Strain relief elements: Aramide
Type of armouring: Glass yarns
Outer sheath material: FR/LSOH
Outer sheath colour: Red

## Temperature range

Laying, min.: -10°C
Laying, max.: +50°C
Operating, min.: -25°C
Operating, max.: +60°C

## Other data

Corrosiveness acc. to EN50267-2-3
Halogen-free acc. to 60754-2
Flame-resistance acc. to IEC 60332-1-2
Smoke density acc. to IEC 61034
Longitudinally water-tight acc. to IEC 60794-1-2-F5
UV-resistant
Functional integrity: E30

| Designation | No. of fibres | Fibre type | Fibre category | Number of fibres per core | Outer Ø app. mm | Max. tensile force N | Min. stat. bending radius mm | Caloric load app. MJ / m | Max. transverse pressure N / cm | Weight kg / km | **Part no.** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A/I-DQ(ZN)BH | 4 | Multimode G50/125 | OM2 | 4 | 7,8 | 1000 | 80,0 | 1,08 | 200 | 102,0 | **801217** |
| A/I-DQ(ZN)BH | 4 | Multimode G62.5/125 | OM1 | 4 | 7,8 | 1000 | 80,0 | 1,08 | 200 | 102,0 | **801218** |
| A/I-DQ(ZN)BH | 4 | Single-mode E9/125 | ITU-T G.652 | 4 | 7,8 | 1000 | 80,0 | 1,08 | 200 | 102,0 | **801219** |
| A/I-DQ(ZN)BH | 12 | Multimode G50/125 | OM2 | 12 | 7,8 | 1000 | 80,0 | 1,08 | 200 | 102,0 | **801220** |
| A/I-DQ(ZN)BH | 12 | Multimode G62.5/125 | OM1 | 12 | 7,8 | 1000 | 80,0 | 1,08 | 200 | 102,0 | **801221** |
| A/I-DQ(ZN)BH | 12 | Single-mode E9/125 | ITU-T G.652 | 12 | 7,8 | 1000 | 80,0 | 1,08 | 200 | 102,0 | **801190** |

Dimensions and specifications may be changed without prior notice.

## Application

With the serie HELUCOM® E30 we have realized, based on a special construction and high quality raw materials, a functional integrity according to DIN 4102-12 E30 (30 minutes). Together with the planed accessories the cables realize the full function of the communication in areas like tunnels or buildings for the defined period of time. On request we also can deliver cables with more than 12 fibres as stranded construction.

# Fibre Optic Cable with Functionality

**with reference to IEC 60331-25**

HELUCOM® FS90

A/I-D(ZN)BH(SR)H


## Cable structure

Core type: Loose tube
Strain relief elements: Glass yarns
Inner sheath material: FRNC
Type of armouring: steel tape
Outer sheath material: FR/LSOH
Outer sheath colour: Black

## Temperature range

Laying, min.: -5°C
Laying, max.: +50°C
Operating, min.: -20°C
Operating, max.: +70°C

## Other data

Corrosiveness acc. to EN50267-2-3
Halogen-free acc. to 60754-2
Flame-resistance acc. to IEC 60332-1 and -3
Smoke density acc. to IEC 61034
Longitudinally water-tight acc. to IEC 60794-1-2-F5
Cable, laterally water-tight
UV-resistant
Functional integrity: IEC 60794/ IEC 60331-25

| Designation | No. of fibres | Fibre type | Fibre category | Number of fibres per core | Outer Ø app. mm | Max. tensile force N | Min. stat. bending radius mm | Caloric load app. MJ / m | Max. transverse pressure N / cm | Weight kg / km | **Part no.** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A/I-D(ZN)BH(SR)H | 4 | Multimode G50/125 | OM2 | 4 | 12,7 | 1500 | 180,0 | 6,20 | 300 | 216,0 | **803917** |
| A/I-D(ZN)BH(SR)H | 4 | Single-mode E9/125 | ITU-T G.652 | 4 | 12,7 | 1500 | 180,0 | 6,20 | 300 | 216,0 | **803919** |
| A/I-D(ZN)BH(SR)H | 12 | Multimode G50/125 | OM2 | 12 | 12,7 | 1500 | 180,0 | 6,20 | 300 | 216,0 | **803918** |
| A/I-D(ZN)BH(SR)H | 12 | Single-mode E9/125 | ITU-T G.652 | 12 | 12,7 | 1500 | 180,0 | 6,20 | 300 | 216,0 | **803920** |

Dimensions and specifications may be changed without prior notice.

## Application

With the serie HELUCOM® FS90 we have realized, based on a special construction and high quality raw materials, a functional integrity according to IEC 60331-25 within 90, minutes (up to 750°C). Together with the planed accessories the cables realize the full function of the communication in areas like tunnels or buildings for the defined period of time.

# Fibre Optic Outdoor Cable

**acc. DIN VDE 0888**

HELUCOM®

A-DQ(ZN)2Y, central


## Cable structure

Core type: Loose tube
Strain relief elements: Glass yarns
Outer sheath material: PE
Outer sheath colour: Black

## Temperature range

Laying, min.: -5°C
Laying, max.: +50°C
Operating, min.: -20°C
Operating, max.: +60°C

## Other data

Corrosiveness acc. to EN50267-2-3
Halogen-free acc. to 60754-2
Longitudinally water-tight acc. to IEC 60794-1-2-F5
UV-resistant

| Designation | No. of fibres | Fibre type | Fibre category | Number of fibres per core | Outer Ø app. mm | Max. tensile force N | Min. stat. bending radius mm | Caloric load app. MJ / m | Max. transverse pressure N / cm | Weight kg / km | **Part no.** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A-DQ(ZN)2Y | 2 | Multimode G50/125 | OM2 | 2 | 8,8 | 1500 | 130,0 | 1,60 | 250 | 40,0 | **80148** |
| A-DQ(ZN)2Y | 2 | Multimode G62.5/125 | OM1 | 2 | 8,8 | 1500 | 130,0 | 1,60 | 250 | 40,0 | **80164** |
| A-DQ(ZN)2Y | 2 | Single-mode E9/125 | ITU-T G.652 | 2 | 8,8 | 1500 | 130,0 | 1,60 | 250 | 40,0 | **80131** |
| A-DQ(ZN)2Y | 4 | Multimode G50/125 | OM2 | 4 | 8,8 | 1500 | 130,0 | 1,60 | 250 | 40,0 | **80149** |
| A-DQ(ZN)2Y | 4 | Multimode G62.5/125 | OM1 | 4 | 8,8 | 1500 | 130,0 | 1,60 | 250 | 40,0 | **80165** |
| A-DQ(ZN)2Y | 4 | Single-mode E9/125 | ITU-T G.652 | 4 | 8,8 | 1500 | 130,0 | 1,60 | 250 | 40,0 | **80132** |
| A-DQ(ZN)2Y | 6 | Multimode G50/125 | OM2 | 6 | 8,8 | 1500 | 130,0 | 1,60 | 250 | 40,0 | **80150** |
| A-DQ(ZN)2Y | 6 | Multimode G62.5/125 | OM1 | 6 | 8,8 | 1500 | 130,0 | 1,60 | 250 | 40,0 | **80166** |
| A-DQ(ZN)2Y | 6 | Single-mode E9/125 | ITU-T G.652 | 6 | 8,8 | 1500 | 130,0 | 1,60 | 250 | 40,0 | **80133** |
| A-DQ(ZN)2Y | 8 | Multimode G50/125 | OM2 | 8 | 8,8 | 1500 | 130,0 | 1,60 | 250 | 40,0 | **80151** |
| A-DQ(ZN)2Y | 8 | Multimode G62.5/125 | OM1 | 8 | 8,8 | 1500 | 130,0 | 1,60 | 250 | 40,0 | **80167** |
| A-DQ(ZN)2Y | 8 | Single-mode E9/125 | ITU-T G.652 | 8 | 8,8 | 1500 | 130,0 | 1,60 | 250 | 40,0 | **80134** |
| A-DQ(ZN)2Y | 12 | Multimode G50/125 | OM2 | 12 | 8,8 | 1500 | 130,0 | 1,60 | 250 | 40,0 | **80153** |
| A-DQ(ZN)2Y | 12 | Multimode G62.5/125 | OM1 | 12 | 8,8 | 1500 | 130,0 | 1,60 | 250 | 40,0 | **80169** |
| A-DQ(ZN)2Y | 12 | Single-mode E9/125 | ITU-T G.652 | 12 | 8,8 | 1500 | 130,0 | 1,60 | 250 | 40,0 | **80136** |
| A-DQ(ZN)2Y | 16 | Multimode G50/125 | OM2 | 16 | 8,8 | 1500 | 130,0 | 1,80 | 250 | 70,0 | **80154** |
| A-DQ(ZN)2Y | 16 | Multimode G62.5/125 | OM1 | 16 | 8,8 | 1500 | 130,0 | 1,80 | 250 | 70,0 | **80170** |
| A-DQ(ZN)2Y | 16 | Single-mode E9/125 | ITU-T G.652 | 16 | 8,8 | 1500 | 130,0 | 1,80 | 250 | 70,0 | **80137** |
| A-DQ(ZN)2Y | 24 | Multimode G50/125 | OM2 | 24 | 8,8 | 1500 | 130,0 | 1,80 | 250 | 70,0 | **80155** |
| A-DQ(ZN)2Y | 24 | Multimode G62.5/125 | OM1 | 24 | 8,8 | 1500 | 130,0 | 1,80 | 250 | 70,0 | **80171** |
| A-DQ(ZN)2Y | 24 | Single-mode E9/125 | ITU-T G.652 | 24 | 8,8 | 1500 | 130,0 | 1,80 | 250 | 70,0 | **80138** |

Dimensions and specifications may be changed without prior notice.

## Application

These HELUCOM® fibre-optic cables are characterized by a design that is particularly easy to mount. Around a central grooved cable, there is a composite of glass yarns and swelling fleece with characteristics that ensure the actual strain relief and waterproofing in longitudinal direction of the cable. In addition, these cables are designed grease-free. Wiping the jelly off is therefore unnecessary. This construction is particularly used in underground, tubes and channel areas, where rodent infestation is not to be expected.

# Fibre Optic Outdoor Cable

**acc. DIN VDE 0888**

HELUCOM®

A-DQ(ZN)2Y, stranded


## Cable structure

Core type: Loose tube
GRP support element
Strain relief elements: Glass yarns
Outer sheath material: PE
Outer sheath colour: Black

## Temperature range

Laying, min.: -5°C
Laying, max.: +50°C
Operating, min.: -20°C
Operating, max.: +60°C

## Other data

Corrosiveness acc. to EN50267-2-3
Halogen-free acc. to 60754-2
Longitudinally water-tight acc. to IEC 60794-1-2-F5
UV-resistant

| Designation | No. of fibres | Fibre type | Fibre category | Number of fibres per core | Outer Ø app. mm | Max. tensile force N | Min. stat. bending radius mm | Caloric load app. MJ / m | Max. transverse pressure N / cm | Weight kg / km | **Part no.** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A-DQ(ZN)2Y | 24 | Multimode G50/125 | OM2 | 12 | 10,0 | 2500 | 200,0 | 2,50 | 400 | 70,0 | **80156** |
| A-DQ(ZN)2Y | 24 | Multimode G62.5/125 | OM1 | 12 | 10,0 | 2500 | 200,0 | 2,50 | 400 | 70,0 | **80172** |
| A-DQ(ZN)2Y | 24 | Single-mode E9/125 | ITU-T G.652 | 12 | 10,0 | 2500 | 200,0 | 2,50 | 400 | 70,0 | **80139** |
| A-DQ(ZN)2Y | 36 | Multimode G50/125 | OM2 | 12 | 10,0 | 2500 | 200,0 | 2,50 | 400 | 70,0 | **80448** |
| A-DQ(ZN)2Y | 36 | Multimode G62.5/125 | OM1 | 12 | 10,0 | 2500 | 200,0 | 2,50 | 400 | 70,0 | **80449** |
| A-DQ(ZN)2Y | 36 | Single-mode E9/125 | ITU-T G.652 | 12 | 10,0 | 2500 | 200,0 | 2,50 | 400 | 70,0 | **80450** |
| A-DQ(ZN)2Y | 48 | Multimode G50/125 | OM2 | 12 | 10,0 | 2500 | 200,0 | 2,50 | 400 | 70,0 | **80447** |
| A-DQ(ZN)2Y | 48 | Multimode G62.5/125 | OM1 | 12 | 10,0 | 2500 | 200,0 | 2,50 | 400 | 70,0 | **80446** |
| A-DQ(ZN)2Y | 48 | Single-mode E9/125 | ITU-T G.652 | 12 | 10,0 | 2500 | 200,0 | 2,50 | 400 | 70,0 | **80445** |
| A-DQ(ZN)2Y | 60 | Multimode G50/125 | OM2 | 12 | 10,0 | 2500 | 200,0 | 2,50 | 400 | 70,0 | **80159** |
| A-DQ(ZN)2Y | 60 | Multimode G62.5/125 | OM1 | 12 | 10,0 | 2500 | 200,0 | 2,50 | 400 | 70,0 | **80175** |
| A-DQ(ZN)2Y | 60 | Single-mode E9/125 | ITU-T G.652 | 12 | 10,0 | 2500 | 200,0 | 2,50 | 400 | 70,0 | **80142** |
| A-DQ(ZN)2Y | 72 | Multimode G50/125 | OM2 | 12 | 10,5 | 2500 | 210,0 | 2,60 | 400 | 75,0 | **80444** |
| A-DQ(ZN)2Y | 72 | Multimode G62.5/125 | OM1 | 12 | 10,5 | 2500 | 210,0 | 2,60 | 400 | 75,0 | **80443** |
| A-DQ(ZN)2Y | 72 | Single-mode E9/125 | ITU-T G.652 | 12 | 10,5 | 2500 | 210,0 | 2,60 | 400 | 75,0 | **80442** |
| A-DQ(ZN)2Y | 84 | Multimode G50/125 | OM2 | 12 | 11,5 | 2700 | 230,0 | 3,30 | 400 | 110,0 | **80160** |
| A-DQ(ZN)2Y | 84 | Multimode G62.5/125 | OM1 | 12 | 11,5 | 2700 | 230,0 | 3,30 | 400 | 110,0 | **80176** |
| A-DQ(ZN)2Y | 84 | Single-mode E9/125 | ITU-T G.652 | 12 | 11,5 | 2700 | 230,0 | 3,30 | 400 | 110,0 | **80143** |
| A-DQ(ZN)2Y | 96 | Multimode G50/125 | OM2 | 12 | 11,5 | 2700 | 230,0 | 3,30 | 400 | 110,0 | **80441** |
| A-DQ(ZN)2Y | 96 | Multimode G62.5/125 | OM1 | 12 | 11,5 | 2700 | 230,0 | 3,30 | 400 | 110,0 | **80440** |
| A-DQ(ZN)2Y | 96 | Single-mode E9/125 | ITU-T G.652 | 12 | 11,5 | 2700 | 230,0 | 3,30 | 400 | 110,0 | **80439** |
| A-DQ(ZN)2Y | 108 | Multimode G50/125 | OM2 | 12 | 13,0 | 2700 | 260,0 | 4,00 | 400 | 130,0 | **80161** |
| A-DQ(ZN)2Y | 108 | Multimode G62.5/125 | OM1 | 12 | 13,0 | 2700 | 260,0 | 4,00 | 400 | 130,0 | **80177** |
| A-DQ(ZN)2Y | 108 | Single-mode E9/125 | ITU-T G.652 | 12 | 13,0 | 2700 | 260,0 | 4,00 | 400 | 130,0 | **80144** |
| A-DQ(ZN)2Y | 120 | Multimode G50/125 | OM2 | 12 | 13,0 | 2700 | 260,0 | 4,00 | 400 | 130,0 | **80162** |
| A-DQ(ZN)2Y | 120 | Multimode G62.5/125 | OM1 | 12 | 13,0 | 2700 | 260,0 | 4,00 | 400 | 130,0 | **80178** |
| A-DQ(ZN)2Y | 120 | Single-mode E9/125 | ITU-T G.652 | 12 | 13,0 | 2700 | 260,0 | 4,00 | 400 | 130,0 | **80146** |
| A-DQ(ZN)2Y | 144 | Multimode G50/125 | OM2 | 12 | 14,0 | 2700 | 280,0 | 5,00 | 400 | 150,0 | **80438** |
| A-DQ(ZN)2Y | 144 | Multimode G62.5/125 | OM1 | 12 | 14,0 | 2700 | 280,0 | 5,00 | 400 | 150,0 | **80437** |
| A-DQ(ZN)2Y | 144 | Single-mode E9/125 | ITU-T G.652 | 12 | 14,0 | 2700 | 280,0 | 5,00 | 400 | 150,0 | **80436** |

Dimensions and specifications may be changed without prior notice.

## Application

These HELUCOM® fibre-optic cables are characterized by a design that is particularly easy to mount and extremely tension-resistant. Around a stranded grooved cable and filler elements, there is a swelling fleece with characteristics that ensure strain relief and waterproofing in longitudinal direction of the cable. In addition, these cables are designed grease-free. Wiping the jelly off is therefore unnecessary. This construction is particularly used in underground, tubes and channel areas, where above-average tensile stresses and/or transverse compressions occur, but rodent infestation is not to be expected.



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# Fibre Optic Outdoor Cable

**acc. DIN VDE 0888**

HELUCOM® pact

A-DQ(ZN)B2Y, central


## Cable structure

Core type: Loose tube
Strain relief elements: Glass yarns
Type of armouring: Glass yarns
Outer sheath material: PE
Outer sheath colour: Black

## Temperature range

Laying, min.: -5°C
Laying, max.: +50°C
Operating, min.: -20°C
Operating, max.: +60°C

## Other data

Corrosiveness acc. to EN50267-2-3
Halogen-free acc. to 60754-2
Longitudinally water-tight acc. to IEC 60794-1-2-F5
UV-resistant

| Designation | No. of fibres | Fibre type | Fibre category | Number of fibres per core | Outer Ø app. mm | Max. tensile force N | Min. stat. bending radius mm | Caloric load app. MJ / m | Max. transverse pressure N / cm | Weight kg / km | **Part no.** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A-DQ(ZN)B2Y | 2 | Multimode G50/125 | OM2 | 2 | 7,5 | 1500 | 150,0 | 1,60 | 300 | 40,0 | **800754** |
| A-DQ(ZN)B2Y | 2 | Multimode G62.5/125 | OM1 | 2 | 7,5 | 1500 | 150,0 | 1,60 | 300 | 40,0 | **802131** |
| A-DQ(ZN)B2Y | 2 | Single-mode E9/125 | ITU-T G.652 | 2 | 7,5 | 1500 | 150,0 | 1,60 | 300 | 40,0 | **802137** |
| A-DQ(ZN)B2Y | 4 | Multimode G50/125 | OM2 | 4 | 7,5 | 1500 | 150,0 | 1,60 | 300 | 40,0 | **800755** |
| A-DQ(ZN)B2Y | 4 | Multimode G62.5/125 | OM1 | 4 | 7,5 | 1500 | 150,0 | 1,60 | 300 | 40,0 | **802132** |
| A-DQ(ZN)B2Y | 4 | Single-mode E9/125 | ITU-T G.652 | 4 | 7,5 | 1500 | 150,0 | 1,60 | 300 | 40,0 | **802138** |
| A-DQ(ZN)B2Y | 6 | Multimode G50/125 | OM2 | 6 | 7,5 | 1500 | 150,0 | 1,60 | 300 | 40,0 | **800756** |
| A-DQ(ZN)B2Y | 6 | Multimode G62.5/125 | OM1 | 6 | 7,5 | 1500 | 150,0 | 1,60 | 300 | 40,0 | **802133** |
| A-DQ(ZN)B2Y | 6 | Single-mode E9/125 | ITU-T G.652 | 6 | 7,5 | 1500 | 150,0 | 1,60 | 300 | 40,0 | **802139** |
| A-DQ(ZN)B2Y | 8 | Multimode G50/125 | OM2 | 8 | 7,5 | 1500 | 150,0 | 1,60 | 300 | 40,0 | **800757** |
| A-DQ(ZN)B2Y | 8 | Multimode G62.5/125 | OM1 | 8 | 7,5 | 1500 | 150,0 | 1,60 | 300 | 40,0 | **802134** |
| A-DQ(ZN)B2Y | 8 | Single-mode E9/125 | ITU-T G.652 | 8 | 7,5 | 1500 | 150,0 | 1,60 | 300 | 40,0 | **802140** |
| A-DQ(ZN)B2Y | 12 | Multimode G50/125 | OM2 | 12 | 7,5 | 1500 | 150,0 | 1,60 | 300 | 40,0 | **800759** |
| A-DQ(ZN)B2Y | 12 | Multimode G62.5/125 | OM1 | 12 | 7,5 | 1500 | 150,0 | 1,60 | 300 | 40,0 | **802135** |
| A-DQ(ZN)B2Y | 12 | Single-mode E9/125 | ITU-T G.652 | 12 | 7,5 | 1500 | 150,0 | 1,60 | 300 | 40,0 | **802141** |
| A-DQ(ZN)B2Y | 24 | Multimode G50/125 | OM2 | 24 | 8,5 | 1500 | 170,0 | 1,90 | 300 | 60,0 | **800762** |
| A-DQ(ZN)B2Y | 24 | Multimode G62.5/125 | OM1 | 24 | 8,5 | 1500 | 170,0 | 1,90 | 300 | 60,0 | **802136** |
| A-DQ(ZN)B2Y | 24 | Single-mode E9/125 | ITU-T G.652 | 24 | 8,5 | 1500 | 170,0 | 1,90 | 300 | 60,0 | **802142** |

Dimensions and specifications may be changed without prior notice.

## Application

These HELUCOM® pact fibre-optic cables are characterized by a design that is particularly easy to mount and is rodent-protected. Around a central grooved cable, there is a composite of glass yarns and swelling fleece with characteristics that ensure rodent protection, strain relief, and waterproofing in longitudinal direction of the cable. In addition, these cables are designed grease-free. Wiping the jelly off is therefore unnecessary. This construction is particularly used in underground, tubes and channel areas, where normal tensile stresses and/or transverse compressions occur and rodent infestation is to be expected.

# Fibre Optic Outdoor Cable

**acc. DIN VDE 0888**

HELUCOM®

A-DQ(ZN)B2Y, central


## Cable structure

Core type: Loose tube
Strain relief elements: Glass yarns
Type of armouring: Glass yarns
Outer sheath material: PE
Outer sheath colour: Black

## Temperature range

Laying, min.: -5°C
Laying, max.: +50°C
Operating, min.: -20°C
Operating, max.: +60°C

## Other data

Corrosiveness acc. to EN50267-2-3
Halogen-free acc. to 60754-2
Longitudinally water-tight acc. to IEC 60794-1-2-F5
UV-resistant

| Designation | No. of fibres | Fibre type | Fibre category | Number of fibres per core | Outer Ø app. mm | Max. tensile force N | Min. stat. bending radius mm | Caloric load app. MJ / m | Max. transverse pressure N / cm | Weight kg / km | **Part no.** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A-DQ(ZN)B2Y | 2 | Multimode G50/125 | OM2 | 2 | 10,0 | 2700 | 160,0 | 1,60 | 300 | 85,0 | **80196** |
| A-DQ(ZN)B2Y | 2 | Multimode G62.5/125 | OM1 | 2 | 10,0 | 2700 | 160,0 | 1,60 | 300 | 85,0 | **80212** |
| A-DQ(ZN)B2Y | 2 | Single-mode E9/125 | ITU-T G.652 | 2 | 10,0 | 2700 | 160,0 | 1,60 | 300 | 85,0 | **80180** |
| A-DQ(ZN)B2Y | 4 | Multimode G50/125 | OM2 | 4 | 10,0 | 2700 | 160,0 | 1,60 | 300 | 85,0 | **80197** |
| A-DQ(ZN)B2Y | 4 | Multimode G62.5/125 | OM1 | 4 | 10,0 | 2700 | 160,0 | 1,60 | 300 | 85,0 | **80213** |
| A-DQ(ZN)B2Y | 4 | Single-mode E9/125 | ITU-T G.652 | 4 | 10,0 | 2700 | 160,0 | 1,60 | 300 | 85,0 | **80181** |
| A-DQ(ZN)B2Y | 6 | Multimode G50/125 | OM2 | 6 | 10,0 | 2700 | 160,0 | 1,60 | 300 | 85,0 | **80198** |
| A-DQ(ZN)B2Y | 6 | Multimode G62.5/125 | OM1 | 6 | 10,0 | 2700 | 160,0 | 1,60 | 300 | 85,0 | **80214** |
| A-DQ(ZN)B2Y | 6 | Single-mode E9/125 | ITU-T G.652 | 6 | 10,0 | 2700 | 160,0 | 1,60 | 300 | 85,0 | **80182** |
| A-DQ(ZN)B2Y | 8 | Multimode G50/125 | OM2 | 8 | 10,0 | 2700 | 160,0 | 1,60 | 300 | 85,0 | **80199** |
| A-DQ(ZN)B2Y | 8 | Multimode G62.5/125 | OM1 | 8 | 10,0 | 2700 | 160,0 | 1,60 | 300 | 85,0 | **80215** |
| A-DQ(ZN)B2Y | 8 | Single-mode E9/125 | ITU-T G.652 | 8 | 10,0 | 2700 | 160,0 | 1,60 | 300 | 85,0 | **80183** |
| A-DQ(ZN)B2Y | 12 | Multimode G50/125 | OM2 | 12 | 10,0 | 2700 | 160,0 | 1,60 | 300 | 85,0 | **80201** |
| A-DQ(ZN)B2Y | 12 | Multimode G62.5/125 | OM1 | 12 | 10,0 | 2700 | 160,0 | 1,60 | 300 | 85,0 | **80217** |
| A-DQ(ZN)B2Y | 12 | Single-mode E9/125 | ITU-T G.652 | 12 | 10,0 | 2700 | 160,0 | 1,60 | 300 | 85,0 | **80185** |
| A-DQ(ZN)B2Y | 16 | Multimode G50/125 | OM2 | 16 | 10,0 | 2700 | 180,0 | 1,80 | 300 | 95,0 | **80202** |
| A-DQ(ZN)B2Y | 16 | Multimode G62.5/125 | OM1 | 16 | 10,0 | 2700 | 180,0 | 1,80 | 300 | 95,0 | **80218** |
| A-DQ(ZN)B2Y | 16 | Single-mode E9/125 | ITU-T G.652 | 16 | 10,0 | 2700 | 180,0 | 1,80 | 300 | 95,0 | **80186** |
| A-DQ(ZN)B2Y | 24 | Multimode G50/125 | OM2 | 24 | 10,0 | 2700 | 180,0 | 1,80 | 300 | 95,0 | **80204** |
| A-DQ(ZN)B2Y | 24 | Multimode G62.5/125 | OM1 | 24 | 10,0 | 2700 | 180,0 | 1,80 | 300 | 95,0 | **80220** |
| A-DQ(ZN)B2Y | 24 | Single-mode E9/125 | ITU-T G.652 | 24 | 10,0 | 2700 | 180,0 | 1,80 | 300 | 95,0 | **80187** |

Dimensions and specifications may be changed without prior notice.

## Application

These HELUCOM® fibre-optic cables are characterized by a design that is particularly easy to mount and is rodent-protected. Around a central grooved cable, there is a composite of glass yarns and swelling fleece with characteristics that ensure rodent protection, strain relief, and waterproofing in longitudinal direction of the cable. In addition, these cables are designed grease-free. Wiping the jelly off is therefore unnecessary. This construction is particularly used in underground, tubes and channel areas, where normal tensile stresses and/or transverse compressions occur and rodent infestation is to be expected.



DNB Edition 11 (published 01.10.2015)

# Fibre Optic Outdoor Cable

**acc. DIN VDE 0888**

HELUCOM®

A-DQ(ZN)B2Y, stranded


## Cable structure

Core type: Loose tube
GRP support element
Strain relief elements: Glass yarns
Type of armouring: Glass yarns
Outer sheath material: PE
Outer sheath colour: Black

## Temperature range

Laying, min.: -5°C
Laying, max.: +50°C
Operating, min.: -20°C
Operating, max.: +60°C

## Other data

Corrosiveness acc. to EN50267-2-3
Halogen-free acc. to 60754-2
Longitudinally water-tight acc. to IEC 60794-1-2-F5
UV-resistant

| Designation | No. of fibres | Fibre type | Fibre category | Number of fibres per core | Outer Ø app. mm | Max. tensile force N | Min. stat. bending radius mm | Caloric load app. MJ / m | Max. transverse pressure N / cm | Weight kg / km | **Part no.** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A-DQ(ZN)B2Y | 24 | Multimode G50/125 | OM2 | 12 | 10,5 | 2700 | 210,0 | 2,70 | 600 | 95,0 | **81382** |
| A-DQ(ZN)B2Y | 24 | Multimode G62.5/125 | OM1 | 12 | 10,5 | 2700 | 210,0 | 2,70 | 600 | 95,0 | **80219** |
| A-DQ(ZN)B2Y | 24 | Single-mode E9/125 | ITU-T G.652 | 12 | 10,5 | 2700 | 210,0 | 2,70 | 600 | 95,0 | **80188** |
| A-DQ(ZN)B2Y | 36 | Multimode G50/125 | OM2 | 12 | 10,5 | 2700 | 210,0 | 2,70 | 600 | 95,0 | **81108** |
| A-DQ(ZN)B2Y | 36 | Multimode G62.5/125 | OM1 | 12 | 10,5 | 2700 | 210,0 | 2,70 | 600 | 95,0 | **81109** |
| A-DQ(ZN)B2Y | 36 | Single-mode E9/125 | ITU-T G.652 | 12 | 10,5 | 2700 | 210,0 | 2,70 | 600 | 95,0 | **81110** |
| A-DQ(ZN)B2Y | 48 | Multimode G50/125 | OM2 | 12 | 10,5 | 2700 | 210,0 | 2,70 | 600 | 95,0 | **82648** |
| A-DQ(ZN)B2Y | 48 | Multimode G62.5/125 | OM1 | 12 | 10,5 | 2700 | 210,0 | 2,70 | 600 | 95,0 | **81112** |
| A-DQ(ZN)B2Y | 48 | Single-mode E9/125 | ITU-T G.652 | 12 | 10,5 | 2700 | 210,0 | 2,70 | 600 | 95,0 | **81113** |
| A-DQ(ZN)B2Y | 60 | Multimode G50/125 | OM2 | 12 | 10,5 | 2700 | 210,0 | 2,70 | 600 | 95,0 | **80207** |
| A-DQ(ZN)B2Y | 60 | Multimode G62.5/125 | OM1 | 12 | 10,5 | 2700 | 210,0 | 2,70 | 600 | 95,0 | **80223** |
| A-DQ(ZN)B2Y | 60 | Single-mode E9/125 | ITU-T G.652 | 12 | 10,5 | 2700 | 210,0 | 2,70 | 600 | 95,0 | **80191** |
| A-DQ(ZN)B2Y | 72 | Multimode G50/125 | OM2 | 12 | 11,0 | 2700 | 220,0 | 2,90 | 600 | 100,0 | **81133** |
| A-DQ(ZN)B2Y | 72 | Multimode G62.5/125 | OM1 | 12 | 11,0 | 2700 | 220,0 | 2,90 | 600 | 100,0 | **81134** |
| A-DQ(ZN)B2Y | 72 | Single-mode E9/125 | ITU-T G.652 | 12 | 11,0 | 2700 | 220,0 | 2,90 | 600 | 100,0 | **81120** |
| A-DQ(ZN)B2Y | 84 | Multimode G50/125 | OM2 | 12 | 12,0 | 3000 | 240,0 | 3,60 | 600 | 140,0 | **80208** |
| A-DQ(ZN)B2Y | 84 | Multimode G62.5/125 | OM1 | 12 | 12,0 | 3000 | 240,0 | 3,60 | 600 | 140,0 | **80224** |
| A-DQ(ZN)B2Y | 84 | Single-mode E9/125 | ITU-T G.652 | 12 | 12,0 | 3000 | 240,0 | 3,60 | 600 | 140,0 | **80192** |
| A-DQ(ZN)B2Y | 96 | Multimode G50/125 | OM2 | 12 | 12,0 | 3000 | 240,0 | 3,60 | 600 | 140,0 | **81135** |
| A-DQ(ZN)B2Y | 96 | Multimode G62.5/125 | OM1 | 12 | 12,0 | 3000 | 240,0 | 3,60 | 600 | 140,0 | **81136** |
| A-DQ(ZN)B2Y | 96 | Single-mode E9/125 | ITU-T G.652 | 12 | 12,0 | 3000 | 240,0 | 3,60 | 600 | 140,0 | **81121** |
| A-DQ(ZN)B2Y | 108 | Multimode G50/125 | OM2 | 12 | 13,5 | 3000 | 270,0 | 4,30 | 600 | 155,0 | **80209** |
| A-DQ(ZN)B2Y | 108 | Multimode G62.5/125 | OM1 | 12 | 13,5 | 3000 | 270,0 | 4,30 | 600 | 155,0 | **80225** |
| A-DQ(ZN)B2Y | 108 | Single-mode E9/125 | ITU-T G.652 | 12 | 13,5 | 3000 | 270,0 | 4,30 | 600 | 155,0 | **80193** |
| A-DQ(ZN)B2Y | 120 | Multimode G50/125 | OM2 | 12 | 13,5 | 3000 | 270,0 | 4,30 | 600 | 155,0 | **80210** |
| A-DQ(ZN)B2Y | 120 | Multimode G62.5/125 | OM1 | 12 | 13,5 | 3000 | 270,0 | 4,30 | 600 | 155,0 | **80226** |
| A-DQ(ZN)B2Y | 120 | Single-mode E9/125 | ITU-T G.652 | 12 | 13,5 | 3000 | 270,0 | 4,30 | 600 | 155,0 | **80194** |
| A-DQ(ZN)B2Y | 144 | Multimode G50/125 | OM2 | 12 | 14,5 | 3000 | 290,0 | 5,40 | 600 | 200,0 | **80211** |
| A-DQ(ZN)B2Y | 144 | Multimode G62.5/125 | OM1 | 12 | 14,5 | 3000 | 290,0 | 5,40 | 600 | 200,0 | **80227** |
| A-DQ(ZN)B2Y | 144 | Single-mode E9/125 | ITU-T G.652 | 12 | 14,5 | 3000 | 290,0 | 5,40 | 600 | 200,0 | **80195** |

Dimensions and specifications may be changed without prior notice.

## Application

These HELUCOM® fibre-optic cables are characterized by a design that is particularly easy to mount, extremely tension-resistant and rodent-proof. Around a stranded grooved cable and filler elements, there is a composite of glass yarns and swelling fleece with characteristics that ensure rodent protection, strain relief, and waterproofing in longitudinal direction of the cable. In addition, these cables are designed grease-free. Wiping the jelly off is therefore unnecessary. This construction is particularly used in underground, tubes and channel areas, where above-average tensile stresses and/or transverse compressions occur and rodent infestation is to be expected.

# Fibre Optic Outdoor Cable

**acc. DIN VDE 0888**

HELUCOM® pact

A-DQ(ZN)B2Y fibre combi, stranded


## Cable structure

Core type: Loose tube
GRP support element
Strain relief elements: Glass yarns
Type of armouring: Glass yarns
Outer sheath material: PE
Outer sheath colour: Black

## Temperature range

Laying, min.: -5°C
Laying, max.: +50°C
Operating, min.: -20°C
Operating, max.: +60°C

## Other data

Corrosiveness acc. to EN50267-2-3
Longitudinally water-tight acc. to IEC 60794-1-2-F5
UV-resistant

| Designation | No. of fibres | Fibre type | Fibre category | Number of fibres per core | Outer Ø app. mm | Max. tensile force N | Min. stat. bending radius mm | Caloric load app. MJ / m | Max. transverse pressure N / cm | Weight kg / km | **Part no.** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A-DQ(ZN)B2Y | 24 | Single- and multimode G50/125 | OM2 + ITU-T G.652 | 12 | 9,5 | 2500 | 200,0 | 2,50 | 400 | 90,0 | **803037** |
| A-DQ(ZN)B2Y | 24 | Single- und Multimode G50/125 OM3 | OM3 + ITU-T G.652 | 12 | 9,5 | 2500 | 200,0 | 2,50 | 400 | 90,0 | **803923** |
| A-DQ(ZN)B2Y | 48 | Single- and multimode G50/125 | OM2 + ITU-T G.652 | 12 | 9,5 | 2500 | 200,0 | 2,50 | 400 | 90,0 | **803038** |
| A-DQ(ZN)B2Y | 48 | Single- und Multimode G50/125 OM3 | OM3 + ITU-T G.652 | 12 | 9,5 | 2500 | 200,0 | 2,50 | 400 | 90,0 | **803924** |

Dimensions and specifications may be changed without prior notice.

## Application

These HELUCOM® pact fibre-optic cables are characterized by a design that is particularly easy to mount, tension-resistant and rodent-proof. Around a stranded grooved cable and filler elements, there is a composite of glass yarns and swelling fleece with characteristics that ensure rodent protection, strain relief and waterproofing in longitudinal direction of the cable. In addition, these cables are designed grease-free. Wiping the jelly off is therefore unnecessary. This construction is particularly used in underground, tubes and channel areas, where packing density also plays a role.



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# Fibre Optic Outdoor Cable

**acc. DIN VDE 0888**

HELUCOM®

A-DQ(ZN)B2Y fibre combi, stranded


## Cable structure

Core type: Loose tube
GRP support element
Strain relief elements: Glass yarns
Type of armouring: Glass yarns
Outer sheath material: PE
Outer sheath colour: Black

## Temperature range

Laying, min.: -5°C
Laying, max.: +50°C
Operating, min.: -20°C
Operating, max.: +60°C

## Other data

Corrosiveness acc. to EN50267-2-3
Halogen-free acc. to 60754-2
Longitudinally water-tight acc. to IEC 60794-1-2-F5
UV-resistant

| Designation | No. of fibres | Fibre type | Fibre category | Number of fibres per core | Outer Ø app. mm | Max. tensile force N | Min. stat. bending radius mm | Caloric load app. MJ / m | Max. transverse pressure N / cm | Weight kg / km | **Part no.** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A-DQ(ZN)B2Y | 24 | Single- and multimode G50/125 | OM2 + ITU-T G.652 | 12 | 10,5 | 2700 | 200,0 | 2,70 | 600 | 95,0 | **81478** |
| A-DQ(ZN)B2Y | 48 | Single- and multimode G50/125 | OM2 + ITU-T G.652 | 12 | 10,5 | 2700 | 200,0 | 2,70 | 600 | 95,0 | **801183** |

Dimensions and specifications may be changed without prior notice.

## Application

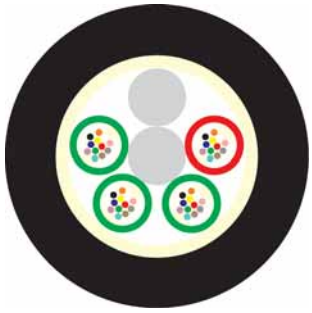
These HELUCOM® fibre-optic cables are characterized by a design that is particularly easy to mount, extremely tension-resistant and rodent-proof. Around a stranded grooved cable and filler elements, there is a composite of glass yarns and swelling fleece with characteristics that ensure rodent protection, strain relief and waterproofing in longitudinal direction of the cable. In addition, these cables are designed grease-free. Wiping the jelly off is therefore unnecessary. This construction is particularly used in underground, tubes and channel areas, where above-average tensile stresses and/or transverse compressions occur and rodent infestation is to be expected.

# Fibre Optic Outdoor Cable

**acc. DIN VDE 0888**

HELUCOM®

A-DF(ZN)2Y




## Cable structure

Core type: Loose tube
GRP support element
Strain relief elements: Aramide
Outer sheath material: PE
Outer sheath colour: Black

## Temperature range

Laying, min.: -5°C
Laying, max.: +50°C
Operating, min.: -20°C
Operating, max.: +60°C

## Other data

Corrosiveness acc. to EN50267-2-3
Halogen-free acc. to 60754-2
Longitudinally water-tight acc. to IEC 60794-1-2-F5
UV-resistant

| Designation | No. of fibres | Fibre type | Fibre category | Number of fibres per core | Outer Ø app. mm | Max. tensile force N | Min. stat. bending radius mm | Caloric load app. MJ / m | Max. transverse pressure N / cm | Weight kg / km | **Part no.** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A-DF(ZN)2Y | 2 | Multimode G50/125 | OM2 | 2 | 9,5 | 2500 | 95,0 | 4,20 | 400 | 85,0 | **80016** |
| A-DF(ZN)2Y | 2 | Multimode G62.5/125 | OM1 | 2 | 9,5 | 2500 | 95,0 | 4,20 | 400 | 85,0 | **80033** |
| A-DF(ZN)2Y | 2 | Single-mode E9/125 | ITU-T G.652 | 2 | 9,5 | 2500 | 95,0 | 4,20 | 400 | 85,0 | **80000** |
| A-DF(ZN)2Y | 4 | Multimode G50/125 | OM2 | 4 | 9,5 | 2500 | 95,0 | 4,20 | 400 | 85,0 | **80017** |
| A-DF(ZN)2Y | 4 | Multimode G62.5/125 | OM1 | 4 | 9,5 | 2500 | 95,0 | 4,20 | 400 | 85,0 | **80034** |
| A-DF(ZN)2Y | 4 | Single-mode E9/125 | ITU-T G.652 | 4 | 9,5 | 2500 | 95,0 | 4,20 | 400 | 85,0 | **80001** |
| A-DF(ZN)2Y | 8 | Multimode G50/125 | OM2 | 8 | 9,5 | 2500 | 95,0 | 4,20 | 400 | 85,0 | **80019** |
| A-DF(ZN)2Y | 8 | Multimode G62.5/125 | OM1 | 8 | 9,5 | 2500 | 95,0 | 4,20 | 400 | 85,0 | **80036** |
| A-DF(ZN)2Y | 8 | Single-mode E9/125 | ITU-T G.652 | 8 | 9,5 | 2500 | 95,0 | 4,20 | 400 | 85,0 | **80003** |
| A-DF(ZN)2Y | 12 | Multimode G50/125 | OM2 | 12 | 9,5 | 2500 | 95,0 | 4,20 | 400 | 85,0 | **80021** |
| A-DF(ZN)2Y | 12 | Multimode G62.5/125 | OM1 | 12 | 9,5 | 2500 | 95,0 | 4,20 | 400 | 85,0 | **80038** |
| A-DF(ZN)2Y | 12 | Single-mode E9/125 | ITU-T G.652 | 12 | 9,5 | 2500 | 95,0 | 4,20 | 400 | 85,0 | **80005** |
| A-DF(ZN)2Y | 24 | Multimode G50/125 | OM2 | 12 | 9,5 | 2700 | 95,0 | 4,00 | 400 | 85,0 | **80024** |
| A-DF(ZN)2Y | 24 | Multimode G62.5/125 | OM1 | 12 | 9,5 | 2700 | 95,0 | 4,00 | 400 | 85,0 | **80041** |
| A-DF(ZN)2Y | 24 | Single-mode E9/125 | ITU-T G.652 | 12 | 9,5 | 2700 | 95,0 | 4,00 | 400 | 85,0 | **80008** |
| A-DF(ZN)2Y | 36 | Multimode G50/125 | OM2 | 12 | 9,5 | 2700 | 95,0 | 4,00 | 400 | 85,0 | **80912** |
| A-DF(ZN)2Y | 36 | Multimode G62.5/125 | OM1 | 12 | 9,5 | 2700 | 95,0 | 4,00 | 400 | 85,0 | **80913** |
| A-DF(ZN)2Y | 36 | Single-mode E9/125 | ITU-T G.652 | 12 | 9,5 | 2700 | 95,0 | 4,00 | 400 | 85,0 | **80914** |
| A-DF(ZN)2Y | 48 | Multimode G50/125 | OM2 | 12 | 9,5 | 2700 | 95,0 | 4,00 | 400 | 85,0 | **80026** |
| A-DF(ZN)2Y | 48 | Multimode G62.5/125 | OM1 | 12 | 9,5 | 2700 | 95,0 | 4,00 | 400 | 85,0 | **80046** |
| A-DF(ZN)2Y | 48 | Single-mode E9/125 | ITU-T G.652 | 12 | 9,5 | 2700 | 95,0 | 4,00 | 400 | 85,0 | **80010** |
| A-DF(ZN)2Y | 60 | Multimode G50/125 | OM2 | 12 | 9,5 | 2700 | 95,0 | 4,00 | 400 | 85,0 | **80027** |
| A-DF(ZN)2Y | 60 | Multimode G62.5/125 | OM1 | 12 | 9,5 | 2700 | 95,0 | 4,00 | 400 | 85,0 | **80047** |
| A-DF(ZN)2Y | 60 | Single-mode E9/125 | ITU-T G.652 | 12 | 9,5 | 2700 | 95,0 | 4,00 | 400 | 85,0 | **80011** |
| A-DF(ZN)2Y | 72 | Multimode G50/125 | OM2 | 12 | 10,0 | 2700 | 100,0 | 3,80 | 400 | 90,0 | **80473** |
| A-DF(ZN)2Y | 72 | Multimode G62.5/125 | OM1 | 12 | 10,0 | 2700 | 100,0 | 3,80 | 400 | 90,0 | **80474** |
| A-DF(ZN)2Y | 72 | Single-mode E9/125 | ITU-T G.652 | 12 | 10,0 | 2700 | 100,0 | 3,80 | 400 | 90,0 | **80475** |
| A-DF(ZN)2Y | 84 | Multimode G50/125 | OM2 | 12 | 10,7 | 3000 | 107,0 | 4,30 | 400 | 120,0 | **80028** |
| A-DF(ZN)2Y | 84 | Multimode G62.5/125 | OM1 | 12 | 10,7 | 3000 | 107,0 | 4,30 | 400 | 120,0 | **80048** |
| A-DF(ZN)2Y | 84 | Single-mode E9/125 | ITU-T G.652 | 12 | 10,7 | 3000 | 107,0 | 4,30 | 400 | 120,0 | **80012** |
| A-DF(ZN)2Y | 96 | Multimode G50/125 | OM2 | 12 | 11,5 | 3000 | 115,0 | 5,00 | 400 | 135,0 | **80777** |
| A-DF(ZN)2Y | 96 | Multimode G62.5/125 | OM1 | 12 | 11,5 | 3000 | 115,0 | 5,00 | 400 | 135,0 | **80774** |
| A-DF(ZN)2Y | 96 | Single-mode E9/125 | ITU-T G.652 | 12 | 11,5 | 3000 | 115,0 | 5,00 | 400 | 135,0 | **80764** |
| A-DF(ZN)2Y | 144 | Multimode G50/125 | OM2 | 12 | 14,5 | 3000 | 145,0 | 7,70 | 400 | 175,0 | **80032** |
| A-DF(ZN)2Y | 144 | Multimode G62.5/125 | OM1 | 12 | 14,5 | 3000 | 145,0 | 7,70 | 400 | 175,0 | **80051** |
| A-DF(ZN)2Y | 144 | Single-mode E9/125 | ITU-T G.652 | 12 | 14,5 | 3000 | 145,0 | 7,70 | 400 | 175,0 | **80015** |

Dimensions and specifications may be changed without prior notice.

## Application

These HELUCOM® fibre-optic cables are characterized by a stranded construction with jelly filling. They are made waterproof in longitudinal direction by filling a jelly mass into the stranding cavities. Non-metallic tension elements ensure above average strain relief. This construction is particularly used in the area of telecommunication and long distance, but also in regular channels and tubes.

# Fibre Optic Outdoor Cable

**acc. DIN VDE 0888**

HELUCOM®

A-DF(ZN)B2Y


## Cable structure

Core type: Loose tube
GRP support element
Strain relief elements: Aramide
Type of armouring: Glass yarns
Outer sheath material: PE
Outer sheath colour: Black

## Temperature range

Laying, min.: -5°C
Laying, max.: +50°C
Operating, min.: -20°C
Operating, max.: +60°C

## Other data

Corrosiveness acc. to EN50267-2-3
Halogen-free acc. to 60754-2
Longitudinally water-tight acc. to IEC 60794-1-2-F5
UV-resistant

| Designation | No. of fibres | Fibre type | Fibre category | Number of fibres per core | Outer Ø app. mm | Max. tensile force N | Min. stat. bending radius mm | Caloric load app. MJ / m | Max. transverse pressure N / cm | Weight kg / km | **Part no.** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A-DF(ZN)B2Y | 2 | Multimode G50/125 | OM2 | 2 | 10,5 | 2700 | 105,0 | 4,40 | 400 | 90,0 | **80100** |
| A-DF(ZN)B2Y | 2 | Multimode G62.5/125 | OM1 | 2 | 10,5 | 2700 | 105,0 | 4,40 | 400 | 90,0 | **80115** |
| A-DF(ZN)B2Y | 2 | Single-mode E9/125 | ITU-T G.652 | 2 | 10,5 | 2700 | 105,0 | 4,40 | 400 | 90,0 | **80084** |
| A-DF(ZN)B2Y | 4 | Multimode G50/125 | OM2 | 4 | 10,5 | 2700 | 105,0 | 4,40 | 400 | 90,0 | **80101** |
| A-DF(ZN)B2Y | 4 | Multimode G62.5/125 | OM1 | 4 | 10,5 | 2700 | 105,0 | 4,40 | 400 | 90,0 | **80116** |
| A-DF(ZN)B2Y | 4 | Single-mode E9/125 | ITU-T G.652 | 4 | 10,5 | 2700 | 105,0 | 4,40 | 400 | 90,0 | **80085** |
| A-DF(ZN)B2Y | 8 | Multimode G50/125 | OM2 | 8 | 10,5 | 2700 | 105,0 | 4,40 | 400 | 90,0 | **80031** |
| A-DF(ZN)B2Y | 8 | Multimode G62.5/125 | OM1 | 8 | 10,5 | 2700 | 105,0 | 4,40 | 400 | 90,0 | **80771** |
| A-DF(ZN)B2Y | 8 | Single-mode E9/125 | ITU-T G.652 | 8 | 10,5 | 2700 | 105,0 | 4,40 | 400 | 90,0 | **80087** |
| A-DF(ZN)B2Y | 12 | Multimode G50/125 | OM2 | 12 | 10,5 | 2700 | 105,0 | 4,40 | 400 | 90,0 | **80104** |
| A-DF(ZN)B2Y | 12 | Multimode G62.5/125 | OM1 | 12 | 10,5 | 2700 | 105,0 | 4,40 | 400 | 90,0 | **80120** |
| A-DF(ZN)B2Y | 12 | Single-mode E9/125 | ITU-T G.652 | 12 | 10,5 | 2700 | 105,0 | 4,40 | 400 | 90,0 | **80089** |
| A-DF(ZN)B2Y | 24 | Multimode G50/125 | OM2 | 12 | 10,5 | 2700 | 105,0 | 4,40 | 400 | 90,0 | **80759** |
| A-DF(ZN)B2Y | 24 | Multimode G62.5/125 | OM1 | 12 | 10,5 | 2700 | 105,0 | 4,40 | 400 | 90,0 | **80123** |
| A-DF(ZN)B2Y | 24 | Single-mode E9/125 | ITU-T G.652 | 12 | 10,5 | 2700 | 105,0 | 4,40 | 400 | 90,0 | **80092** |
| A-DF(ZN)B2Y | 36 | Multimode G50/125 | OM2 | 12 | 10,5 | 2700 | 105,0 | 4,30 | 400 | 90,0 | **81137** |
| A-DF(ZN)B2Y | 36 | Multimode G62.5/125 | OM1 | 12 | 10,5 | 2700 | 105,0 | 4,30 | 400 | 90,0 | **81138** |
| A-DF(ZN)B2Y | 36 | Single-mode E9/125 | ITU-T G.652 | 12 | 10,5 | 2700 | 105,0 | 4,30 | 400 | 90,0 | **81139** |
| A-DF(ZN)B2Y | 48 | Multimode G50/125 | OM2 | 12 | 10,5 | 2700 | 105,0 | 4,20 | 400 | 90,0 | **80109** |
| A-DF(ZN)B2Y | 48 | Multimode G62.5/125 | OM1 | 12 | 10,5 | 2700 | 105,0 | 4,20 | 400 | 90,0 | **80125** |
| A-DF(ZN)B2Y | 48 | Single-mode E9/125 | ITU-T G.652 | 12 | 10,5 | 2700 | 105,0 | 4,20 | 400 | 90,0 | **80094** |
| A-DF(ZN)B2Y | 60 | Multimode G50/125 | OM2 | 12 | 10,5 | 2700 | 105,0 | 4,20 | 400 | 90,0 | **80110** |
| A-DF(ZN)B2Y | 60 | Multimode G62.5/125 | OM1 | 12 | 10,5 | 2700 | 105,0 | 4,20 | 400 | 90,0 | **80126** |
| A-DF(ZN)B2Y | 60 | Single-mode E9/125 | ITU-T G.652 | 12 | 10,5 | 2700 | 105,0 | 4,20 | 400 | 90,0 | **80095** |
| A-DF(ZN)B2Y | 72 | Multimode G50/125 | OM2 | 12 | 11,0 | 2700 | 110,0 | 4,10 | 400 | 95,0 | **81143** |
| A-DF(ZN)B2Y | 72 | Multimode G62.5/125 | OM1 | 12 | 11,0 | 2700 | 110,0 | 4,10 | 400 | 95,0 | **81144** |
| A-DF(ZN)B2Y | 72 | Single-mode E9/125 | ITU-T G.652 | 12 | 11,0 | 2700 | 110,0 | 4,10 | 400 | 95,0 | **81145** |
| A-DF(ZN)B2Y | 84 | Multimode G50/125 | OM2 | 12 | 11,5 | 3000 | 115,0 | 4,60 | 400 | 136,0 | **80111** |
| A-DF(ZN)B2Y | 84 | Multimode G62.5/125 | OM1 | 12 | 11,5 | 3000 | 115,0 | 4,60 | 400 | 136,0 | **80127** |
| A-DF(ZN)B2Y | 84 | Single-mode E9/125 | ITU-T G.652 | 12 | 11,5 | 3000 | 115,0 | 4,60 | 400 | 136,0 | **80096** |
| A-DF(ZN)B2Y | 96 | Multimode G50/125 | OM2 | 12 | 12,0 | 3000 | 120,0 | 5,30 | 400 | 155,0 | **81147** |
| A-DF(ZN)B2Y | 96 | Multimode G62.5/125 | OM1 | 12 | 12,0 | 3000 | 120,0 | 5,30 | 400 | 155,0 | **81148** |
| A-DF(ZN)B2Y | 96 | Single-mode E9/125 | ITU-T G.652 | 12 | 12,0 | 3000 | 120,0 | 5,30 | 400 | 155,0 | **81149** |
| A-DF(ZN)B2Y | 144 | Multimode G50/125 | OM2 | 12 | 14,5 | 3000 | 145,0 | 8,00 | 400 | 228,0 | **80114** |
| A-DF(ZN)B2Y | 144 | Multimode G62.5/125 | OM1 | 12 | 14,5 | 3000 | 145,0 | 8,00 | 400 | 228,0 | **80130** |
| A-DF(ZN)B2Y | 144 | Single-mode E9/125 | ITU-T G.652 | 12 | 14,5 | 3000 | 145,0 | 8,00 | 400 | 228,0 | **80099** |

Dimensions and specifications may be changed without prior notice.

## Application

These HELUCOM® fibre-optic cables are characterized by a stranded construction with jelly filling. They are made waterproof in longitudinal direction by filling a jelly mass into the stranding cavities. Non-metallic tension elements and glass yarns ensure above average strain relief and rodent protection. This construction is particularly used in the area of telecommunication and long distance, but also in regular channels and tubes where rodent infestation is possible.

# Fibre Optic Outdoor Cable

**acc. DIN VDE 0888**

HELUCOM®

A-DF(ZN)2Y4Y


## Cable structure

Core type: Loose tube
GRP support element
Strain relief elements: Aramide
Inner sheath material: PE
Type of armouring: PA sheath
Outer sheath material: PA
Outer sheath colour: Black

## Temperature range

Laying, min.: -5°C
Laying, max.: +50°C
Operating, min.: -20°C
Operating, max.: +60°C

## Other data

Corrosiveness acc. to EN50267-2-3
Halogen-free acc. to 60754-2
Longitudinally water-tight acc. to IEC 60794-1-2-F5
Cable, laterally water-tight
UV-resistant

| Designation | No. of fibres | Fibre type | Fibre category | Number of fibres per core | Outer Ø app. mm | Max. tensile force N | Min. stat. bending radius mm | Caloric load app. MJ / m | Max. transverse pressure N / cm | Weight kg / km | **Part no.** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A-DF(ZN)2Y4Y | 2 | Multimode G50/125 | OM2 | 2 | 10,0 | 2700 | 100,0 | 6,10 | 400 | 90,0 | **80915** |
| A-DF(ZN)2Y4Y | 2 | Multimode G62.5/125 | OM1 | 2 | 10,0 | 2700 | 100,0 | 6,10 | 400 | 90,0 | **80927** |
| A-DF(ZN)2Y4Y | 2 | Single-mode E9/125 | ITU-T G.652 | 2 | 10,0 | 2700 | 100,0 | 6,10 | 400 | 90,0 | **80945** |
| A-DF(ZN)2Y4Y | 4 | Multimode G50/125 | OM2 | 4 | 10,0 | 2700 | 100,0 | 6,10 | 400 | 90,0 | **80735** |
| A-DF(ZN)2Y4Y | 4 | Multimode G62.5/125 | OM1 | 4 | 10,0 | 2700 | 100,0 | 6,10 | 400 | 90,0 | **80928** |
| A-DF(ZN)2Y4Y | 4 | Single-mode E9/125 | ITU-T G.652 | 4 | 10,0 | 2700 | 100,0 | 6,10 | 400 | 90,0 | **80895** |
| A-DF(ZN)2Y4Y | 8 | Multimode G50/125 | OM2 | 8 | 10,0 | 2700 | 100,0 | 6,10 | 400 | 90,0 | **80691** |
| A-DF(ZN)2Y4Y | 8 | Multimode G62.5/125 | OM1 | 8 | 10,0 | 2700 | 100,0 | 6,10 | 400 | 90,0 | **80809** |
| A-DF(ZN)2Y4Y | 8 | Single-mode E9/125 | ITU-T G.652 | 8 | 10,0 | 2700 | 100,0 | 6,10 | 400 | 90,0 | **80118** |
| A-DF(ZN)2Y4Y | 12 | Multimode G50/125 | OM2 | 12 | 10,0 | 2700 | 100,0 | 6,10 | 400 | 90,0 | **80627** |
| A-DF(ZN)2Y4Y | 12 | Multimode G62.5/125 | OM1 | 12 | 10,0 | 2700 | 100,0 | 6,10 | 400 | 90,0 | **80931** |
| A-DF(ZN)2Y4Y | 12 | Single-mode E9/125 | ITU-T G.652 | 12 | 10,0 | 2700 | 100,0 | 6,10 | 400 | 90,0 | **80947** |
| A-DF(ZN)2Y4Y | 24 | Multimode G50/125 | OM2 | 12 | 10,0 | 2700 | 100,0 | 6,10 | 400 | 90,0 | **80578** |
| A-DF(ZN)2Y4Y | 24 | Multimode G62.5/125 | OM1 | 12 | 10,0 | 2700 | 100,0 | 6,10 | 400 | 90,0 | **80576** |
| A-DF(ZN)2Y4Y | 24 | Single-mode E9/125 | ITU-T G.652 | 12 | 10,0 | 2700 | 100,0 | 6,10 | 400 | 90,0 | **80577** |
| A-DF(ZN)2Y4Y | 36 | Multimode G50/125 | OM2 | 12 | 10,0 | 2700 | 100,0 | 6,00 | 400 | 90,0 | **80672** |
| A-DF(ZN)2Y4Y | 36 | Multimode G62.5/125 | OM1 | 12 | 10,0 | 2700 | 100,0 | 6,00 | 400 | 90,0 | **80935** |
| A-DF(ZN)2Y4Y | 36 | Single-mode E9/125 | ITU-T G.652 | 12 | 10,0 | 2700 | 100,0 | 6,00 | 400 | 90,0 | **80950** |
| A-DF(ZN)2Y4Y | 48 | Multimode G50/125 | OM2 | 12 | 10,0 | 2700 | 100,0 | 6,00 | 400 | 90,0 | **80732** |
| A-DF(ZN)2Y4Y | 48 | Multimode G62.5/125 | OM1 | 12 | 10,0 | 2700 | 100,0 | 6,00 | 400 | 90,0 | **80936** |
| A-DF(ZN)2Y4Y | 48 | Single-mode E9/125 | ITU-T G.652 | 12 | 10,0 | 2700 | 100,0 | 6,00 | 400 | 90,0 | **80951** |
| A-DF(ZN)2Y4Y | 60 | Multimode G50/125 | OM2 | 12 | 10,0 | 2700 | 100,0 | 5,80 | 400 | 90,0 | **80920** |
| A-DF(ZN)2Y4Y | 60 | Multimode G62.5/125 | OM1 | 12 | 10,0 | 2700 | 100,0 | 5,80 | 400 | 90,0 | **80938** |
| A-DF(ZN)2Y4Y | 72 | Multimode G50/125 | OM2 | 12 | 10,5 | 2700 | 105,0 | 5,80 | 400 | 95,0 | **80921** |
| A-DF(ZN)2Y4Y | 72 | Multimode G62.5/125 | OM1 | 12 | 10,5 | 2700 | 105,0 | 5,80 | 400 | 95,0 | **80939** |
| A-DF(ZN)2Y4Y | 72 | Single-mode E9/125 | ITU-T G.652 | 12 | 10,5 | 2700 | 105,0 | 5,80 | 400 | 95,0 | **80954** |
| A-DF(ZN)2Y4Y | 84 | Multimode G50/125 | OM2 | 12 | 11,0 | 3000 | 110,0 | 8,40 | 400 | 110,0 | **80922** |
| A-DF(ZN)2Y4Y | 84 | Multimode G62.5/125 | OM1 | 12 | 11,0 | 3000 | 110,0 | 8,40 | 400 | 110,0 | **80940** |
| A-DF(ZN)2Y4Y | 84 | Single-mode E9/125 | ITU-T G.652 | 12 | 11,0 | 3000 | 110,0 | 8,40 | 400 | 110,0 | **80955** |
| A-DF(ZN)2Y4Y | 96 | Multimode G50/125 | OM2 | 12 | 11,5 | 3000 | 115,0 | 7,20 | 400 | 120,0 | **80923** |
| A-DF(ZN)2Y4Y | 96 | Multimode G62.5/125 | OM1 | 12 | 11,5 | 3000 | 115,0 | 7,20 | 400 | 120,0 | **80941** |
| A-DF(ZN)2Y4Y | 96 | Single-mode E9/125 | ITU-T G.652 | 12 | 11,5 | 3000 | 115,0 | 7,20 | 400 | 120,0 | **80956** |
| A-DF(ZN)2Y4Y | 144 | Multimode G50/125 | OM2 | 12 | 14,5 | 3000 | 145,0 | 10,40 | 400 | 180,0 | **80926** |
| A-DF(ZN)2Y4Y | 144 | Multimode G62.5/125 | OM1 | 12 | 14,5 | 3000 | 145,0 | 10,40 | 400 | 180,0 | **80944** |
| A-DF(ZN)2Y4Y | 144 | Single-mode E9/125 | ITU-T G.652 | 12 | 14,5 | 3000 | 145,0 | 10,40 | 400 | 180,0 | **80959** |

Dimensions and specifications may be changed without prior notice.

## Application

These HELUCOM® fibre-optic cables are characterized by a stranded construction with jelly filling. They are made waterproof in longitudinal direction by filling a jelly mass into the stranding cavities. Non-metallic tension elements and a second outer sheath made of polyamide (PA) ensure above average strain relief and rodent protection. This construction is particularly used in the area of telecommunication and long distance, but also in regular channels and tubes where rodent infestation is possible.



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# Fibre Optic Outdoor Cable

**Microduct**

HELUCOM®

A-DQ2Y, central


## Cable structure

Core type: Loose tube
Strain relief elements: Aramide
Outer sheath material: PE
Outer sheath colour: Black

## Temperature range

Laying, min.: -20°C
Laying, max.: +60°C
Operating, min.: -20°C
Operating, max.: +60°C

## Other data

Corrosiveness acc. to EN50267-2-3
Halogen-free acc. to 60754-2
Longitudinally water-tight acc. to IEC 60794-1-2-F5
UV-resistant

| Designation | No. of fibres | Fibre type | Fibre category | Number of fibres per core | Outer Ø app. mm | Max. tensile force N | Min. stat. bending radius mm | Caloric load app. MJ / m | Max. transverse pressure N / cm | Weight kg / km | **Part no.** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A-DQ2Y central | 4 | Single-mode E9/125 | ITU-T G.652 | 4 | 2,5 | 180 | 40,0 | 1,40 | 100 | 6,0 | **803664** |
| A-DQ2Y central | 4 | Single-mode E9/125 | ITU-T G.657 | 4 | 2,5 | 180 | 40,0 | 1,40 | 100 | 6,0 | **805672** |
| A-DQ2Y central | 12 | Single-mode E9/125 | ITU-T G.652 | 12 | 2,5 | 180 | 40,0 | 1,40 | 100 | 6,0 | **803929** |
| A-DQ2Y central | 12 | Single-mode E9/125 | ITU-T G.657 | 12 | 2,5 | 180 | 40,0 | 1,40 | 100 | 6,0 | **805673** |

Dimensions and specifications may be changed without prior notice.

## Application

These HELUCOM® micro fibre-optic cables are characterized by a design that is slim but robust. Around a central tube, there is a composite of swelling fleece with characteristics that ensure the strain relief, and waterproofing in longitudinal direction of the cable. Another feature is the low adhesion of the outer jacket. Therefore these cables can be blowing into microducts. A typical application is FTTH within communal building projects.

# Fibre Optic Outdoor Cable

**Microduct**

HELUCOM®

A-DQ2Y, stranded


## Cable structure

Core type: Loose tube
Strain relief elements: Aramide
Outer sheath material: PE
Outer sheath colour: Black

## Temperature range

Laying, min.: -5°C
Laying, max.: +50°C
Operating, min.: -30°C
Operating, max.: +70°C

## Other data

Corrosiveness acc. to EN50267-2-3
Halogen-free acc. to 60754-2
Longitudinally water-tight acc. to IEC 60794-1-2-F5
UV-resistant

| Designation | No. of fibres | Fibre type | Fibre category | Number of fibres per core | Outer Ø app. mm | Max. tensile force N | Min. stat. bending radius mm | Caloric load app. MJ / m | Max. transverse pressure N / cm | Weight kg / km | **Part no.** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A-DQ2Y stranded | 4 | Single-mode E9/125 | ITU-T G.652 | 4 | 5,8 | 850 | 90,0 | 0,87 | 150 | 27,0 | **803931** |
| A-DQ2Y stranded | 4 | Single-mode E9/125 | ITU-T G.657 | 4 | 5,8 | 850 | 90,0 | 0,87 | 150 | 27,0 | **805664** |
| A-DQ2Y stranded | 12 | Single-mode E9/125 | ITU-T G.652 | 12 | 5,8 | 850 | 90,0 | 0,87 | 150 | 27,0 | **803932** |
| A-DQ2Y stranded | 12 | Single-mode E9/125 | ITU-T G.657 | 12 | 5,8 | 850 | 90,0 | 0,87 | 150 | 27,0 | **805665** |
| A-DQ2Y stranded | 24 | Single-mode E9/125 | ITU-T G.652 | 12 | 5,8 | 850 | 90,0 | 0,87 | 150 | 27,0 | **803930** |
| A-DQ2Y stranded | 24 | Single-mode E9/125 | ITU-T G.657 | 12 | 5,8 | 850 | 90,0 | 0,87 | 150 | 27,0 | **805666** |
| A-DQ2Y stranded | 48 | Single-mode E9/125 | ITU-T G.652 | 12 | 5,8 | 850 | 90,0 | 0,87 | 150 | 27,0 | **803658** |
| A-DQ2Y stranded | 48 | Single-mode E9/125 | ITU-T G.657 | 12 | 5,8 | 850 | 90,0 | 0,87 | 150 | 27,0 | **805667** |
| A-DQ2Y stranded | 72 | Single-mode E9/125 | ITU-T G.652 | 12 | 5,8 | 850 | 90,0 | 0,87 | 150 | 27,0 | **803659** |
| A-DQ2Y stranded | 72 | Single-mode E9/125 | ITU-T G.657 | 12 | 5,8 | 850 | 90,0 | 0,87 | 150 | 27,0 | **805668** |
| A-DQ2Y stranded | 96 | Single-mode E9/125 | ITU-T G.652 | 12 | 6,8 | 1500 | 105,0 | 1,25 | 150 | 45,0 | **803660** |
| A-DQ2Y stranded | 96 | Single-mode E9/125 | ITU-T G.657 | 12 | 6,8 | 1500 | 105,0 | 1,25 | 150 | 45,0 | **805669** |
| A-DQ2Y stranded | 144 | Single-mode E9/125 | ITU-T G.652 | 12 | 9,4 | 1500 | 140,0 | 2,19 | 150 | 79,0 | **803661** |
| A-DQ2Y stranded | 144 | Single-mode E9/125 | ITU-T G.657 | 12 | 9,4 | 1500 | 140,0 | 2,19 | 150 | 79,0 | **805670** |
| A-DQ2Y stranded | 288 | Single-mode E9/125 | ITU-T G.652 | 12 | 10,2 | 3000 | 160,0 | 2,97 | 100 | 90,0 | **803668** |
| A-DQ2Y stranded | 288 | Single-mode E9/125 | ITU-T G.652 | 24 | 9,4 | 2500 | 150,0 | 2,97 | 150 | 77,0 | **805674** |
| A-DQ2Y stranded | 288 | Single-mode E9/125 | ITU-T G.657 | 12 | 10,2 | 3000 | 160,0 | 2,97 | 100 | 90,0 | **805671** |
| A-DQ2Y stranded | 288 | Single-mode E9/125 | ITU-T G.657 | 24 | 9,4 | 2500 | 150,0 | 2,97 | 150 | 77,0 | **805675** |

Dimensions and specifications may be changed without prior notice.

## Application

These HELUCOM® micro fibre-optic cables are characterized by a design that is slim but robust. Around stranded tubes, there is a composite of swelling material with characteristics that ensure the strain relief, and waterproofing in longitudinal direction of the cable. Another featrure of these cables is the low adhesion of the outer jacket. Therefore these cables can be blowing into microducts. A typical application is FTTx within communal infrastructure projects.



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# Fibre Optic Outdoor Cable

**steel armoured**

HELUCOM®

A-DQ(ZN)(SR)2Y


## Cable structure

Core type: Loose tube
Strain relief elements: Glass yarns
Type of armouring: Steel rib
Outer sheath material: PE
Outer sheath colour: Black

## Temperature range

Laying, min.: -5°C
Laying, max.: +50°C
Operating, min.: -20°C
Operating, max.: +70°C

## Other data

Corrosiveness acc. to EN50267-2-3
Halogen-free acc. to 60754-2
Longitudinally water-tight acc. to IEC 60794-1-2-F5
Cable, laterally water-tight
UV-resistant

| Designation | No. of fibres | Fibre type | Fibre category | Number of fibres per core | Outer Ø app. mm | Max. tensile force N | Min. stat. bending radius mm | Caloric load app. MJ / m | Max. transverse pressure N / cm | Weight kg / km | **Part no.** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A-DQ(ZN)(SR)2Y | 4 | Multimode G50/125 | OM2 | 4 | 9,5 | 1500 | 95,0 | 2,00 | 500 | 115,0 | **802917** |
| A-DQ(ZN)(SR)2Y | 4 | Multimode G62.5/125 | OM1 | 4 | 9,5 | 1500 | 95,0 | 2,00 | 500 | 115,0 | **803925** |
| A-DQ(ZN)(SR)2Y | 4 | Single-mode E9/125 | ITU-T G.652 | 4 | 9,5 | 1500 | 95,0 | 2,00 | 500 | 105,0 | **803927** |
| A-DQ(ZN)(SR)2Y | 12 | Multimode G50/125 | OM2 | 12 | 9,5 | 1500 | 95,0 | 2,00 | 500 | 115,0 | **802918** |
| A-DQ(ZN)(SR)2Y | 12 | Multimode G62.5/125 | OM1 | 12 | 9,5 | 1500 | 95,0 | 2,00 | 500 | 115,0 | **803926** |
| A-DQ(ZN)(SR)2Y | 12 | Single-mode E9/125 | ITU-T G.652 | 12 | 9,5 | 1500 | 95,0 | 2,00 | 500 | 115,0 | **803928** |
| A-DQ(ZN)(SR)2Y | 24 | Single-mode E9/125 | ITU-T G.652 | 24 | 9,5 | 1500 | 95,0 | 2,00 | 500 | 115,0 | **804797** |

Dimensions and specifications may be changed without prior notice.

## Application

These HELUCOM® fibre-optic cables are characterized by a compact construction with a swelling fleece. Above-average rodent protection is achieved with the metallic rodent protection (steel groove) and an outer sheath made of PE. This construction is particularly used in the area of telecommunication and long distance, but also in regular channels and tubes where rodent infestation is possible.

# Fibre Optic Outdoor Cable

**steel armoured**

HELUCOM®

A-DF(ZN)2Y(SR)2Y

NEW


## Cable structure

Core type: Loose tube
GRP support element
Strain relief elements: Aramide
Inner sheath material: PE
Type of armouring: Steel rib
Outer sheath material: PE
Outer sheath colour: Black

## Temperature range

Laying, min.: -20°C
Laying, max.: +50°C
Operating, min.: -30°C
Operating, max.: +70°C

## Other data

Corrosiveness acc. to EN50267-2-3
Halogen-free acc. to 60754-2
Longitudinally water-tight acc. to IEC 60794-1-2-F5
Cable, laterally water-tight
UV-resistant

| Designation | No. of fibres | Fibre type | Fibre category | Number of fibres per core | Outer Ø app. mm | Max. tensile force N | Min. stat. bending radius mm | Caloric load app. MJ / m | Max. transverse pressure N / cm | Weight kg / km | **Part no.** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A-DF(ZN)2Y(SR)2Y | 12 | Single-mode E9/125 | ITU-T G.652 | 2 | 13,0 | 2500 | 200,0 | 4,30 | 400 | 160,0 | **805244** |
| A-DF(ZN)2Y(SR)2Y | 24 | Single-mode E9/125 | ITU-T G.652 | 4 | 13,0 | 2500 | 200,0 | 4,30 | 400 | 160,0 | **805245** |
| A-DF(ZN)2Y(SR)2Y | 48 | Single-mode E9/125 | ITU-T G.652 | 12 | 13,5 | 2500 | 210,0 | 4,50 | 400 | 170,0 | **805246** |
| A-DF(ZN)2Y(SR)2Y | 60 | Single-mode E9/125 | ITU-T G.652 | 12 | 13,5 | 2500 | 210,0 | 4,50 | 400 | 170,0 | **805247** |

Dimensions and specifications may be changed without prior notice.

## Application

These HELUCOM® fibre-optic cables are characterized by a stranded construction with jelly filling. They are made waterproof in longitudinal direction by filling a jelly mass into the stranding cavities. Above-average rodent protection is achieved with the metallic rodent protection (corrugated steel) and the second outer sheath made of PE. This construction is particularly used in the area of telecommunication and long distance, but also in regular channels and tubes where rodent infestation is possible.

# Fibre Optic Outdoor Cable

**acc. ARCOR Standard**

HELUCOM®

A-DF(ZN)2Y(SR)2Y


## Cable structure

Core type: Loose tube
GRP support element
Strain relief elements: Aramide
Inner sheath material: PE
Type of armouring: Steel rib
Outer sheath material: PE
Outer sheath colour: Black

## Temperature range

Laying, min.: -20°C
Laying, max.: +50°C
Operating, min.: -30°C
Operating, max.: +70°C

## Other data

Corrosiveness acc. to EN50267-2-3
Halogen-free acc. to 60754-2
Longitudinally water-tight acc. to IEC 60794-1-2-F5
Cable, laterally water-tight
UV-resistant

| Designation | No. of fibres | Fibre type | Fibre category | Number of fibres per core | Outer Ø app. mm | Max. tensile force N | Min. stat. bending radius mm | Caloric load app. MJ / m | Max. transverse pressure N / cm | Weight kg / km | **Part no.** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A-DF(ZN)2Y(SR)2Y | 12 | Single-mode E9/125 | ITU-T G.652 | 2 | 15,0 | 2700 | 230,0 | 4,80 | 400 | 215,0 | **82190** |
| A-DF(ZN)2Y(SR)2Y | 24 | Single-mode E9/125 | ITU-T G.652 | 4 | 15,0 | 2700 | 230,0 | 4,80 | 400 | 215,0 | **800708** |
| A-DF(ZN)2Y(SR)2Y | 48 | Single-mode E9/125 | ITU-T G.652 | 12 | 17,0 | 2700 | 260,0 | 6,00 | 400 | 260,0 | **800709** |
| A-DF(ZN)2Y(SR)2Y | 60 | Single-mode E9/125 | ITU-T G.652 | 12 | 17,0 | 2700 | 260,0 | 6,00 | 400 | 260,0 | **800710** |
| A-DF(ZN)2Y(SR)2Y | 144 | Single-mode E9/125 | ITU-T G.652 | 12 | 23,0 | 3500 | 350,0 | 10,10 | 400 | 480,0 | **803284** |

Dimensions and specifications may be changed without prior notice.

## Application

These HELUCOM® fibre-optic cables are characterized by a stranded construction with jelly filling. They are made waterproof in longitudinal direction by filling a jelly mass into the stranding cavities. Above-average rodent protection is achieved with the metallic rodent protection (steel groove) and the second outer sheath made of PE. This construction is particularly used in the area of telecommunication and long distance where ARCOR standards must be followed, but also in regular channels and tubes where rodent infestation is possible.

# Fibre Optic Outdoor Cable Hybrid

**acc. DIN VDE 0888**

HELUCOM®

A-DSQ(ZN)B2Y


## Cable structure

Core type: Loose tube
GRP support element
Number of fibres per core: 4
Strain relief elements: Glass yarns
Type of armouring: Glass yarns
Outer sheath material: PE
Outer sheath colour: Black

## Temperature range

Laying, min.: -10°C
Laying, max.: +60°C
Operating, min.: -25°C
Operating, max.: +60°C

## Other data

Corrosiveness acc. to EN50267-2-3
Longitudinally water-tight acc. to IEC 60794-1-2-F5
UV-resistant

| Designation | No. of fibres | Fibre type | No. of copper cores | Dimensions of copper cores mm | Outer Ø app. mm | Max. tensile force N | Min. stat. bending radius mm | Caloric load app. MJ / m | Max. transverse pressure N / cm | Weight kg / km | **Part no.** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A-DSQ(ZN)B2Y | 4 | Multimode G50/125 | 2 | 1,2 | 12,0 | 2100 | 300 | 4,80 | 200 | 140,0 | **81209** |
| A-DSQ(ZN)B2Y | 4 | Multimode G62.5/125 | 2 | 1,2 | 12,0 | 2100 | 300 | 4,80 | 200 | 140,0 | **81255** |
| A-DSQ(ZN)B2Y | 4 | Single-mode E9/125 | 2 | 1,2 | 12,0 | 2100 | 300 | 4,80 | 200 | 140,0 | **81256** |
| A-DSQ(ZN)B2Y | 4 | Multimode G50/125 | 2 | 1,5 | 12,5 | 2300 | 320 | 4,80 | 200 | 160,0 | **82561** |
| A-DSQ(ZN)B2Y | 4 | Multimode G62.5/125 | 2 | 1,5 | 12,5 | 2300 | 320 | 4,80 | 200 | 160,0 | **81257** |
| A-DSQ(ZN)B2Y | 4 | Single-mode E9/125 | 2 | 1,5 | 12,5 | 2300 | 320 | 4,80 | 200 | 160,0 | **81258** |
| A-DSQ(ZN)B2Y | 4 | Multimode G50/125 | 4 | 1,5 | 17,0 | 2600 | 430 | 5,80 | 200 | 250,0 | **82786** |
| A-DSQ(ZN)B2Y | 4 | Multimode G62.5/125 | 4 | 1,5 | 17,0 | 2600 | 430 | 5,80 | 200 | 250,0 | **81259** |
| A-DSQ(ZN)B2Y | 4 | Single-mode E9/125 | 4 | 1,5 | 17,0 | 2600 | 430 | 5,80 | 200 | 250,0 | **81260** |

Dimensions and specifications may be changed without prior notice.

## Application

These HELUCOM® fibre-optic cables are designed especially for use in fibre-optical temperature measurements, such as monitoring of dams. The extreme mechanical requirements in these areas are fulfilled by the specially designed cable construction. These lines are hybrid glass fibre lines with copper cores and a special PE outer sheath.

Typical application within a coffer-dam




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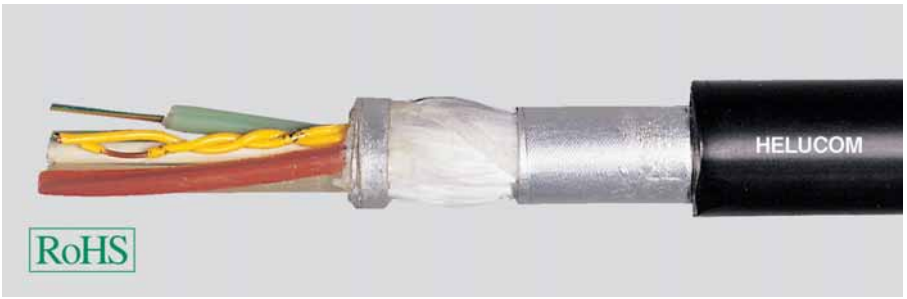
# Fibre Optic Outdoor Cable Hybrid

**acc. DIN VDE 0888**

HELUCOM®

A-DSF(L)(ZN)2Y




## Cable structure

Core type: Loose tube
GRP support element
Number of fibres per core: 12
Strain relief elements: Aramide
Aluminium laminated sheath
Outer sheath material: PE
Outer sheath colour: Black

## Temperature range

Laying, min.: -5°C
Laying, max.: +50°C
Operating, min.: -25°C
Operating, max.: +60°C

## Other data

Corrosiveness acc. to EN50267-2-3
Halogen-free acc. to 60754-2
Longitudinally water-tight acc. to IEC 60794-1-2-F5
Cable, laterally water-tight
UV-resistant

| Designation | No. of fibres | Fibre type | No. of copper cores | Dimensions of copper cores mm | Outer Ø app. mm | Max. tensile force N | Min. stat. bending radius mm | Caloric load app. MJ / m | Max. transverse pressure N / cm | Weight kg / km | **Part no.** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A-DSF(L)(ZN)2Y | 12 | Single-mode E9/125 | 2 | 0,6 | 12,0 | 2500 | 200 | 4,80 | 250 | 135,0 | **80495** |
| A-DSF(L)(ZN)2Y | 12 | Single-mode E9/125 | 4 | 0,6 | 12,0 | 2500 | 200 | 4,80 | 250 | 140,0 | **80497** |
| A-DSF(L)(ZN)2Y | 24 | Single-mode E9/125 | 2 | 0,6 | 13,1 | 2500 | 200 | 4,80 | 250 | 139,0 | **800753** |
| A-DSF(L)(ZN)2Y | 24 | Single-mode E9/125 | 4 | 0,6 | 13,1 | 2500 | 200 | 4,80 | 250 | 144,0 | **801182** |
| A-DSF(L)(ZN)2Y | 48 | Single-mode E9/125 | 2 | 0,6 | 13,1 | 2500 | 200 | 4,80 | 250 | 141,0 | **80501** |
| A-DSF(L)(ZN)2Y | 48 | Single-mode E9/125 | 4 | 0,6 | 13,1 | 2500 | 200 | 4,80 | 250 | 146,0 | **80503** |
| A-DSF(L)(ZN)2Y | 60 | Single-mode E9/125 | 2 | 0,6 | 14,1 | 2500 | 230 | 4,80 | 250 | 166,0 | **80504** |
| A-DSF(L)(ZN)2Y | 60 | Single-mode E9/125 | 4 | 0,6 | 14,1 | 2500 | 230 | 4,80 | 250 | 171,0 | **80506** |
| A-DSF(L)(ZN)2Y | 72 | Single-mode E9/125 | 2 | 0,6 | 14,8 | 2500 | 240 | 5,10 | 250 | 179,0 | **80507** |
| A-DSF(L)(ZN)2Y | 72 | Single-mode E9/125 | 4 | 0,6 | 14,8 | 2500 | 240 | 5,10 | 250 | 184,0 | **80509** |
| A-DSF(L)(ZN)2Y | 96 | Single-mode E9/125 | 2 | 0,6 | 16,6 | 3000 | 280 | 6,30 | 250 | 276,0 | **80510** |
| A-DSF(L)(ZN)2Y | 96 | Single-mode E9/125 | 4 | 0,6 | 16,6 | 3000 | 280 | 6,30 | 250 | 281,0 | **80512** |
| A-DSF(L)(ZN)2Y | 120 | Single-mode E9/125 | 2 | 0,6 | 18,4 | 3000 | 290 | 8,50 | 250 | 280,0 | **80513** |
| A-DSF(L)(ZN)2Y | 120 | Single-mode E9/125 | 4 | 0,6 | 18,4 | 3000 | 290 | 8,50 | 250 | 285,0 | **80515** |
| A-DSF(L)(ZN)2Y | 144 | Single-mode E9/125 | 2 | 0,6 | 20,3 | 3500 | 310 | 10,00 | 250 | 331,0 | **80516** |
| A-DSF(L)(ZN)2Y | 144 | Single-mode E9/125 | 4 | 0,6 | 20,3 | 3500 | 310 | 10,00 | 250 | 336,0 | **80518** |

Dimensions and specifications may be changed without prior notice.

## Application

These HELUCOM® outdoor cables are designed for use under extreme environmental conditions. With the double jelly filling and the Al/PE laminated sheath, they are waterproof in longitudinal and transverse direction. The welded Al tape acts as an additional vapour barrier. These cables can be layed directly in the ground, in tubes and in ducts. They are mainly used in local and long-distance networks.

# Aerial Fibre Optic Cable

**metall free**

HELUCOM®

ADSS L


## Cable structure

Core type: Loose tube
GRP support element
Strain relief elements: Aramide
Inner sheath material: PE
Outer sheath material: PE
Outer sheath colour: Black

## Temperature range

Laying, min.: -10°C
Laying, max.: +60°C
Operating, min.: -40°C
Operating, max.: +70°C

## Other data

Sag at 25°C ADSS 6L: 1,0m
Sag at 25°C ADSS 9L: 1,6m
Sag at 25°C ADSS 16L: 3,6m
Halogen-free acc. to 60754-2
Longitudinally water-tight acc. to IEC 60794-1-2-F5
Cable, laterally water-tight
UV-resistant

| Designation | Number of fibres | Fibre type | Number of fibres per core | Span width m | Max. tensile force kN | Additional load daN / m | Min. stat. bending radius mm | Outer Ø app. mm | Weight kg / km | **Part no.** |
|---|---|---|---|---|---|---|---|---|---|---|
| ADSS 6L | 12 | Single-mode E9/125 | 6 | 80 | 3 | 0,073 | 230 | 11,5 | 100 | **804733** |
| ADSS 6L | 24 | Single-mode E9/125 | 6 | 80 | 3 | 0,073 | 230 | 11,5 | 100 | **805160** |
| ADSS 6L | 48 | Single-mode E9/125 | 12 | 80 | 3 | 0,073 | 252 | 12,6 | 120 | **804735** |
| ADSS 6L | 144 | Single-mode E9/125 | 12 | 80 | 7 | 0,073 | 348 | 17,4 | 230 | **804736** |
| ADSS 9L | 12 | Single-mode E9/125 | 6 | 150 | 4 | 0,073 | 230 | 11,5 | 100 | **804737** |
| ADSS 9L | 24 | Single-mode E9/125 | 6 | 150 | 4 | 0,073 | 230 | 11,5 | 100 | **805161** |
| ADSS 9L | 48 | Single-mode E9/125 | 12 | 150 | 4 | 0,073 | 252 | 12,6 | 120 | **804739** |
| ADSS 9L | 144 | Single-mode E9/125 | 12 | 150 | 10 | 0,073 | 354 | 17,7 | 240 | **804740** |
| ADSS 16L | 12 | Single-mode E9/125 | 6 | 350 | 11 | 0,073 | 250 | 12,5 | 120 | **804741** |
| ADSS 16L | 24 | Single-mode E9/125 | 6 | 350 | 11 | 0,073 | 250 | 12,5 | 120 | **804742** |
| ADSS 16L | 48 | Single-mode E9/125 | 12 | 350 | 9 | 0,073 | 264 | 13,2 | 135 | **804743** |
| ADSS 16L | 144 | Single-mode E9/125 | 12 | 350 | 16 | 0,073 | 362 | 18,1 | 250 | **804744** |

Dimensions and specifications may be changed without prior notice.

## Application

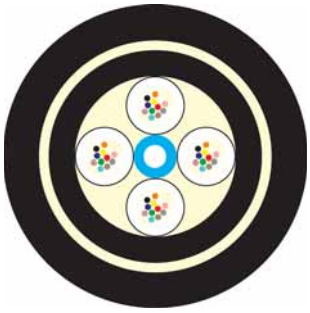
These HELUCOM® ADSS L cables designed as aerial cables for freely suspended installations on steel-bar-, wood-, concrete- or steel poles. The construction is waterproof in longitudinal direction thanks to the use of jelly-filled bundle cores and swelling tape. The outer jacket is UV-resistant and at the same time provides protection against light and normal environmental influences, such as sun insolation and wind. Installations on high voltage poles are possible up to a field-strength of 4 kV. There are constructions for span width of 80m, 150m or 350m under conditions according NESC® Light available. Corresponding accessories like suspension and tension fittings are in chapter 5.

# Aerial Fibre Optic Cable

**metall free**

HELUCOM®

ADSS




## Cable structure

Core type: Loose tube
GRP support element
Strain relief elements: Aramide
Inner sheath material: PE
Outer sheath material: PE
Outer sheath colour: Black

## Temperature range

Laying, min.: -10°C
Laying, max.: +60°C
Operating, min.: -25°C
Operating, max.: +70°C

## Other data

Sag at 25°C ADSS 9: 2,0m
Sag at 25°C ADSS 16: 4,5m
Sag at 25°C ADSS 35: 9,5m
Halogen-free acc. to 60754-2
Longitudinally water-tight acc. to IEC 60794-1-2-F5
Cable, laterally water-tight
UV-resistant

| Designation | Number of fibres | Fibre type | Number of fibres per core | Span width m | Max. tensile force kN | Additional load daN / m | Min. stat. bending radius mm | Outer Ø app. mm | Weight kg / km | **Part no.** |
|---|---|---|---|---|---|---|---|---|---|---|
| ADSS 9 | 12 | Single-mode E9/125 | 4 | 150 | 9 | 0,5 | 410 | 13,6 | 135 | **82390** |
| ADSS 9 | 24 | Single-mode E9/125 | 4 | 150 | 9 | 0,5 | 410 | 13,6 | 137 | **82391** |
| ADSS 9 | 36 | Single-mode E9/125 | 6 | 150 | 9 | 0,5 | 470 | 15,6 | 177 | **82392** |
| ADSS 9 | 48 | Single-mode E9/125 | 8 | 150 | 9 | 0,5 | 470 | 15,6 | 178 | **82393** |
| ADSS 9 | 60 | Single-mode E9/125 | 12 | 150 | 9 | 0,5 | 450 | 15,0 | 161 | **82394** |
| ADSS 9 | 96 | Single-mode E9/125 | 12 | 150 | 9 | 0,5 | 450 | 15,5 | 180 | **804275** |
| ADSS 9 | 144 | Single-mode E9/125 | 12 | 150 | 9 | 0,5 | 630 | 20,8 | 316 | **82395** |
| ADSS 16 | 12 | Single-mode E9/125 | 4 | 350 | 16 | 0,3 | 430 | 14,4 | 162 | **82396** |
| ADSS 16 | 24 | Single-mode E9/125 | 4 | 350 | 16 | 0,3 | 430 | 14,4 | 165 | **82397** |
| ADSS 16 | 36 | Single-mode E9/125 | 6 | 350 | 16 | 0,3 | 500 | 16,4 | 200 | **82398** |
| ADSS 16 | 48 | Single-mode E9/125 | 8 | 350 | 16 | 0,3 | 500 | 16,4 | 201 | **82399** |
| ADSS 16 | 60 | Single-mode E9/125 | 12 | 350 | 16 | 0,3 | 480 | 15,8 | 184 | **82400** |
| ADSS 16 | 96 | Single-mode E9/125 | 12 | 350 | 16 | 0,3 | 480 | 16,0 | 200 | **804276** |
| ADSS 16 | 144 | Single-mode E9/125 | 12 | 350 | 16 | 0,3 | 650 | 21,6 | 333 | **82401** |
| ADSS 35 | 12 | Single-mode E9/125 | 4 | 700 | 35 | 0,35 | 520 | 17,2 | 198 | **82402** |
| ADSS 35 | 24 | Single-mode E9/125 | 4 | 700 | 35 | 0,35 | 520 | 17,2 | 200 | **82403** |
| ADSS 35 | 36 | Single-mode E9/125 | 6 | 700 | 35 | 0,35 | 580 | 19,2 | 240 | **82404** |
| ADSS 35 | 48 | Single-mode E9/125 | 8 | 700 | 35 | 0,35 | 580 | 19,2 | 241 | **82405** |
| ADSS 35 | 60 | Single-mode E9/125 | 12 | 700 | 35 | 0,35 | 560 | 18,6 | 227 | **82406** |
| ADSS 35 | 144 | Single-mode E9/125 | 12 | 700 | 35 | 0,35 | 730 | 24,4 | 381 | **82407** |

Dimensions and specifications may be changed without prior notice.

## Application

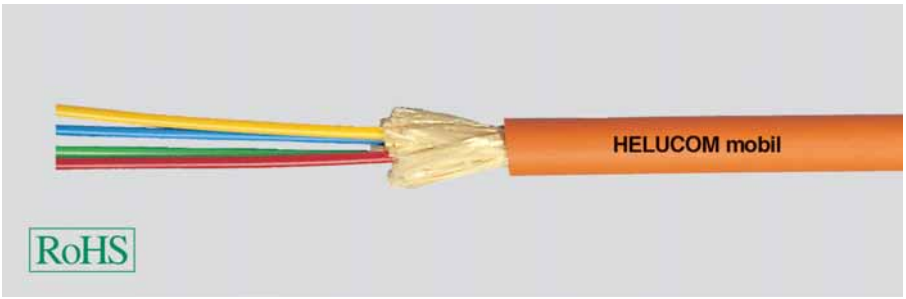
These HELUCOM® outdoor cables designed as aerial cables for freely suspended installations on posts and masts. The construction is waterproof in longitudinal direction thanks to the use of jelly-filled bundle cores and swelling tape. The outer jacket is UV-resistant and at the same time provides protection against environmental influences, such as snow, ice, sun insolation and wind. Corresponding accessories like suspension and tension fittings are in chapter 5.

# Fibre Optic Cable flexible

**WK - mobile**

HELUCOM® WK

A-V(ZN)11Y




## Cable structure

Core type: Tight buffer
Strain relief elements: Aramide
Outer sheath colour: Orange

## Temperature range

Laying, min.: +5°C
Laying, max.: +50°C
Operating, min.: -30°C
Operating, max.: +70°C

## Other data

Max. tensile force: 650 N
Max. transverse pressure: 40 N / cm
Longitudinally water-tight acc. to IEC 60794-1-2-F5
UV-resistant
Resistant to hammer impact acc. to IEC 60794-1-2-E4
Bending cycles acc. to IEC 60794-1-2-E6: 500.000
Oil-resistant

| Designation | Number of fibres | Fibre type | Fibre category | Outer Ø app. mm | Outer sheath material | Min. stat. bending radius mm | Flame proof | halogen-free | UL | Weight kg / km | **Part no.** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Fibre-optic cable | 2 | Multimode G50/125 | OM2 | 5,0 | PUR | 75 | yes | yes | no | 20 | **80382** |
| Fibre-optic cable | 2 | Multimode G62.5/125 | OM1 | 5,0 | PUR | 75 | yes | yes | no | 20 | **80363** |
| Fibre-optic cable | 4 | Multimode G50/125 | OM2 | 5,8 | PUR | 90 | yes | yes | no | 31 | **80534** |
| Fibre-optic cable | 4 | Multimode G62.5/125 | OM1 | 5,8 | PUR | 90 | yes | yes | no | 31 | **81036** |
| Fibre-optic cable | 4 | Single-mode E9/125 | ITU-T G.652 | 5,8 | PUR | 90 | yes | yes | no | 31 | **801727** |
| Fibre-optic cable | 8 | Multimode G50/125 | OM2 | 7,0 | PUR | 105 | yes | yes | no | 47 | **81037** |
| Fibre-optic cable | 8 | Multimode G62.5/125 | OM1 | 7,0 | PUR | 105 | yes | yes | no | 47 | **81038** |

Dimensions and specifications may be changed without prior notice.

## Application

These HELUCOM® cables were designed as mobile field cables. They are easily wound up on a drum and are very tension-proof. As the outer sheath is tightly anchored on the aramid braiding, it is especially suitable for mobile use. The advantage of these cables is evident especially where mobile fibre-optic lines are to be installed, such as for Drag Chains, TV transmission, supervision of protected areas, etc.



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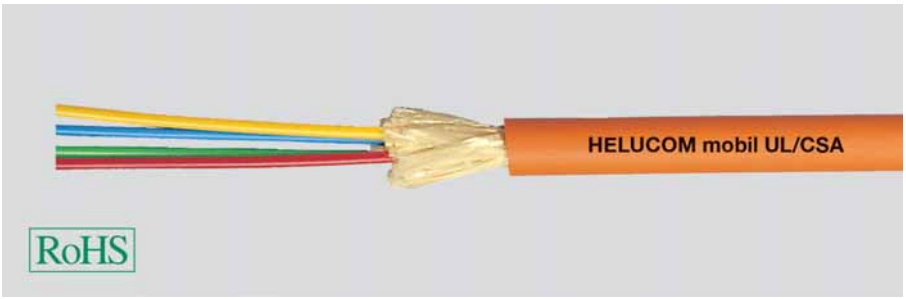
# Fibre Optic Cable flexible

**WK - UL/CSA**

HELUCOM® WK

A-V(ZN)YY




## Cable structure

Core type: Tight buffer
Strain relief elements: Aramide
Outer sheath colour: Orange

## Temperature range

Laying, min.: 0°C
Laying, max.: +50°C
Operating, min.: -30°C
Operating, max.: +80°C

## Other data

Max. tensile force: 1200 N
Max. transverse pressure: 44 N / cm
Longitudinally water-tight acc. to IEC 60794-1-2-F5
Applicable UL standards: OFNG UL 1685
Applicable CSA standards: FT4
UV-resistant
Bending cycles acc. to IEC 60794-1-2-E6: 9.000
Oil-resistant

| Designation | Number of fibres | Fibre type | Fibre category | Outer Ø app. mm | Outer sheath material | Inner sheath material | Min. stat. bending radius mm | Flame proof | halogen-free | UL | Weight kg / km | **Part no.** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fibre-optic cable | 4 | Multimode G50/125 | OM2 | 7,0 | PVC | PVC | 75 | yes | no | yes | 50 | **802792** |
| Fibre-optic cable | 4 | Multimode G62.5/125 | OM1 | 7,0 | PVC | PVC | 75 | yes | no | yes | 50 | **803934** |
| Fibre-optic cable | 4 | Single-mode E9/125 | ITU-T G.652 | 7,0 | PVC | PVC | 75 | yes | no | yes | 50 | **803935** |

Dimensions and specifications may be changed without prior notice.

## Application

These HELUCOM® cables were designed as mobile field cables. They are easily wound up on a drum and are very tension-proof. As the outer sheath is tightly anchored on the aramid braiding, it is especially suitable for mobile use. The advantage of these cables is obvious especially where mobile fibre-optic lines have to be installed, such as windturbine projects, TV transmission, supervision of protected areas, etc. This series with PVC jacket is certified according the **UL/CSA standard OFNG/ FT4**.

# Fibre Optic Cable flexible

**WK robust PUR + PVC (UL/CSA)**

HELUCOM® WK

AT-V(ZN)H(ZN)11Y, AT-V(ZN)Y(ZN)Y


## Cable structure

Core type: Composite buffered
Strain relief elements: Aramide
Outer sheath colour: Black

## Temperature range

Laying, min.: -10°C
Laying, max.: +50°C
Operating, min.: -40°C
Operating, max.: +90°C

## Other data

Max. tensile force: 4800 N
Max. transverse pressure: 200 N / cm
Longitudinally water-tight acc. to IEC 60794-1-2-F5
UV-resistant
Resistant to hammer impact acc. to IEC 60794-1-2-E4
Bending cycles acc. to IEC 60794-1-2-E6: 9.000
Oil-resistant

| Designation | Number of fibres | Fibre type | Fibre category | Outer Ø app. mm | Outer sheath material | Inner sheath material | Min. stat. bending radius mm | Flame proof | halogen-free | UL | Weight kg / km | **Part no.** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AT-V(ZN)H(ZN)11Y | 4 | Multimode G50/125 | OM2 | 8,5 | PUR | ULSZH | 100 | yes | yes | no | 125 | **803346** |
| AT-V(ZN)Y(ZN)Y | 4 | Multimode G50/125 | OM2 | 8,5 | PVC | PVC | 130 | yes | no | yes | 125 | **803348** |
| AT-V(ZN)H(ZN)11Y | 12 | Multimode G50/125 | OM2 | 12,4 | PUR | ULSZH | 190 | yes | yes | no | 320 | **803347** |
| AT-V(ZN)H(ZN)11Y | 12 | Single-mode E9/125 | ITU-T G.652 | 12,4 | PUR | ULSZH | 190 | yes | yes | no | 320 | **804700** |
| AT-V(ZN)Y(ZN)Y | 12 | Multimode G50/125 | OM2 | 12,4 | PVC | PVC | 190 | yes | no | yes | 320 | **803349** |

Dimensions and specifications may be changed without prior notice.

## Application

The HELUCOM ® WK range is set apart by its extreme rugged yet highly-flexible design. It is used wherever demanding environmental conditions and extreme movements occur. The tight buffer structure enables the cable to be pre-assembled on site with ease. Applications are for example Windturbines, TV transmissions, mobile field applications, etc.



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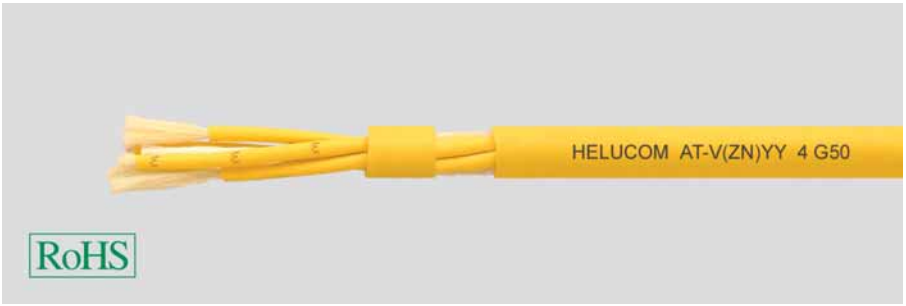
# Fibre Optic Cable flexible

HELUCOM® WK

AT-V(ZN)YY




## Cable structure

Core type: Composite buffered
Strain relief elements: Aramide
Outer sheath colour: Yellow

## Temperature range

Laying, min.: -10°C
Laying, max.: +50°C
Operating, min.: -40°C
Operating, max.: +90°C

## Other data

Max. tensile force: 1200 N
Max. transverse pressure: 100 N / cm
UV-resistant
Resistant to hammer impact acc. to IEC 60794-1-2-E4
Bending cycles acc. to IEC 60794-1-2-E6: 15
Oil-resistant

| Designation | Number of fibres | Fibre type | Fibre category | Outer Ø app. mm | Outer sheath material | Inner sheath material | Min. stat. bending radius mm | Flame proof | halogen-free | UL | Weight kg / km | **Part no.** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fibre-optic cable | 4 | Multimode G50/125 | OM2 | 7,4 | PVC | PVC | 90 | yes | no | no | 65 | **803364** |

Dimensions and specifications may be changed without prior notice.

## Application

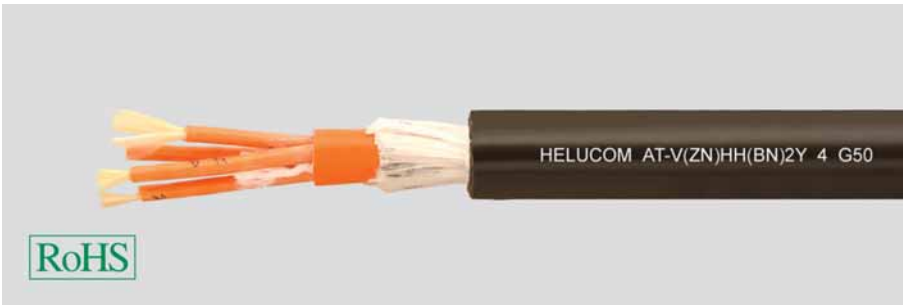
The HELUCOM ® range is set apart by its extreme rugged yet flexible design. It is used wherever demanding environmental conditions and movements occur. The tight buffer structure enables the cable to be pre-assembled on site with ease. Applications are for example industry applications, TV transmissions, etc.

# Fibre Optic Breakout Cable

**outdoor**

HELUCOM®

AT-V(ZN)HH(ZN)B2Y




## Cable structure

Core type: Composite buffered
GRP support element
Strain relief elements: Aramide
Inner sheath material: ULSZH
Type of armouring: Glass yarns
Outer sheath material: PE
Outer sheath colour: Black

## Temperature range

Laying, min.: -5°C
Laying, max.: +50°C
Operating, min.: -20°C
Operating, max.: +60°C

## Other data

Longitudinally water-tight acc. to IEC 60794-1-2-F5
UV-resistant
Oil-resistant

| Designation | Number of fibres | Fibre type | Fibre category | Outer Ø app. mm | Max. tensile force N | Min. stat. bending radius mm | Max. transverse pressure N / cm | Caloric load app. MJ / m | Weight kg / km | **Part no.** |
|---|---|---|---|---|---|---|---|---|---|---|
| AT-V(ZN)HH(ZN)B2Y | 4 | Multimode G50/125 | OM2 | 13,5 | 1200 | 340 | 300 | 2,95 | 140 | **801352** |

Dimensions and specifications may be changed without prior notice.

## Application

The HELUCOM ® range is set apart by its extreme rugged roden protected design. It is used wherever demanding environmental conditions while fixed installations occur. The tight buffer structure enables the cable to be pre-assembled on site with ease. Applications are for example industry applications, etc.

# Fibre Optic Breakout Cable PROFIBUS + PROFInet

**outdoor/ direct burial**

HELUCOM®

AT-V(ZN)H(ZN)BH

NEW


## Cable structure

Core type: Composite buffered
GRP support element
Strain relief elements: Aramide
Inner sheath material: ULSZH
Type of armouring: Glass yarns
Outer sheath material: FRNC
Outer sheath colour: Black

## Temperature range

Laying, min.: -20°C
Laying, max.: +60°C
Operating, min.: -40°C
Operating, max.: +70°C

## Other data

Corrosiveness acc. to EN50267-2-3
Halogen-free acc. to 60754-2
Flame-resistance acc. to IEC 60332-1 and IEC 60332-3
Smoke density acc. to IEC 61034
Longitudinally water-tight acc. to IEC 60794-1-2-F5
UV-resistant
Resistant to hammer impact acc. to IEC 60794-1-2-E4
Oil-resistant

| Designation | Number of fibres | Fibre type | Fibre category | Outer Ø app. mm | Max. tensile force N | Min. stat. bending radius mm | Max. transverse pressure N / cm | Weight kg / km | **Part no.** |
|---|---|---|---|---|---|---|---|---|---|
| AT-V(ZN)H(ZN)BH | 4 | Single-mode E9/125 | ITU-T G.652 | 9,0 | 1000 | 90 | 600 | 85 | **805687** |

Dimensions and specifications may be changed without prior notice.

## Application

The HELUCOM ® range is set apart by its rugged design. It is used wherever demanding environmental conditions while fixed installations occur. The tight buffer structure enables the cable to be pre-assembled on site with ease. Applications are for example tray installation or building installation within industry areas. This series can be used within PROFIBUS and PROFInet communications.

# Fibre Optic Breakout Cable PROFIBUS + PROFInet

**universal**

HELUCOM®

AT-W(ZN)YY

NEW


## Cable structure

Core type: Composite buffered
Strain relief elements: Aramide
Outer sheath material: PVC
Outer sheath colour: Green similar to RAL 6018

## Temperature range

Laying, min.: -5°C
Laying, max.: +50°C
Operating, min.: -25°C
Operating, max.: +80°C

## Other data

Flame-resistance acc. to IEC 60332-1 and IEC 60332-3
Applicable UL standards: OFN UL1651
Applicable CSA standards: FT4
UV-resistant
Oil-resistant

| Designation | Number of fibres | Fibre type | Fibre category | Outer Ø app. mm | Max. tensile force N | Min. stat. bending radius mm | Max. transverse pressure N / cm | Weight kg / km | **Part no.** |
|---|---|---|---|---|---|---|---|---|---|
| AT-W(ZN)YY | 2 | Multimode G50/125 | OM2 | 4,5 x 7,4 | 500 | 45 | 400 | 39 | **805688** |

Dimensions and specifications may be changed without prior notice.

## Application

The HELUCOM ® range is set apart by its rugged design. It is used wherever demanding environmental conditions while fixed installations occur. The tight buffer structure enables the cable to be pre-assembled on site with ease. Applications are for example tray installation or building installation within industry areas. This series can be used within PROFIBUS and PROFInet communications.

# Fibre Optic Breakout Cable PROFIBUS + PROFInet

**fixed installation**

HELUCOM®
AT-W(ZN)H(ZN)H

NEW


## Cable structure

Core type: Buffered-fibre
GRP support element
Strain relief elements: Aramide
Outer sheath material: FRNC
Outer sheath colour: Green similar to RAL 6018

## Temperature range

Laying, min.: -5°C
Laying, max.: +50°C
Operating, min.: -40°C
Operating, max.: +85°C

## Other data

Corrosiveness acc. to EN50267-2-3
Halogen-free acc. to 60754-2
Flame-resistance acc. to IEC 60332-1 and IEC 60332-3
Smoke density acc. to IEC 61034
Applicable UL standards: OFN UL1651
Applicable CSA standards: FT1
UV-resistant
Resistant to hammer impact acc. to IEC 60794-1-2-E4
Oil-resistant

| Designation | Number of fibres | Fibre type | Fibre category | Outer Ø app. mm | Max. tensile force N | Min. stat. bending radius mm | Max. transverse pressure N / cm | Weight kg / km | **Part no.** |
|---|---|---|---|---|---|---|---|---|---|
| AT-W(ZN)H(ZN)H | 2 | Multimode G50/125 | OM2 | 9,2 | 1200 | 90 | 500 | 80 | **805689** |
| AT-W(ZN)H(ZN)H | 2 | Multimode G50/125 | OM4 | 9,2 | 1200 | 90 | 500 | 80 | **805691** |

Dimensions and specifications may be changed without prior notice.

## Application

The HELUCOM ® range is set apart by its extreme rugged roden protected design. It is used wherever demanding environmental conditions while fixed installations occur. The tight buffer structure enables the cable to be pre-assembled on site with ease. Applications are for example Installation in backbones (805691) or in trays within industry areas (805689).

# Fibre Optic Breakout Cable PROFIBUS + PROFInet

**Drag Chain**

HELUCOM®
AT-W(ZN)Y(ZN)11Y

NEW


## Cable structure

Core type: Composite buffered
GRP support element
Strain relief elements: Aramide
Outer sheath material: PUR
Outer sheath colour: Green similar to RAL 6018

## Temperature range

Laying, min.: -5°C
Laying, max.: +50°C
Operating, min.: -40°C
Operating, max.: +80°C

## Other data

UV-resistant
Oil-resistant

| Designation | Number of fibres | Fibre type | Fibre category | Outer Ø app. mm | Max. tensile force N | Min. stat. bending radius mm | Max. transverse pressure N / cm | Weight kg / km | **Part no.** |
|---|---|---|---|---|---|---|---|---|---|
| AT-W(ZN)Y(ZN)11Y | 2 | Multimode G50/125 | OM2 | 10,5 | 1000 | 150 | 700 | 100 | **805690** |

Dimensions and specifications may be changed without prior notice.

## Application

The HELUCOM ® range is set apart by its rugged and high flexible design. It is used wherever demanding environmental conditions while moving applications occur. The tight buffer structure enables the cable to be pre-assembled on site with ease. Applications are for example Drag Chains. This serie can be used within PROFIBUS and PROFInet communications.

# Fibre Optic Breakout Cable PROFIBUS + PROFInet

HELUCOM®

AT-V(ZN)H(ZN)BH

NEW


## Cable structure

Core type: Composite buffered
GRP support element
Strain relief elements: Aramide
Type of armouring: Glass yarns
Outer sheath material: FRNC
Outer sheath colour: Black

## Temperature range

Laying, min.: -10°C
Laying, max.: +60°C
Operating, min.: -30°C
Operating, max.: +70°C

## Other data

Corrosiveness acc. to EN50267-2-3
Halogen-free acc. to 60754-2
Flame-resistance acc. to IEC 60332-1-2
Smoke density acc. to IEC 61034
Longitudinally water-tight acc. to IEC 60794-1-2-F5
UV-resistant
Oil-resistant

| Designation | Number of fibres | Fibre type | Fibre category | Outer Ø app. mm | Max. tensile force N | Min. stat. bending radius mm | Max. transverse pressure N / cm | Weight kg / km | **Part no.** |
|---|---|---|---|---|---|---|---|---|---|
| AT-V(ZN)H(ZN)BH | 2 | Multimode G50/125 | OM2 | 8,0 | 1000 | 140 | 300 | 70 | **805445** |

Dimensions and specifications may be changed without prior notice.

## Application

The HELUCOM ® range is set apart by its extreme rugged roden protected design. It is used wherever demanding environmental conditions while fixed installations occur. The tight buffer structure enables the cable to be pre-assembled on site with ease. Applications are for example direct burial or tray installation within industry areas.This series can be used within PROFIBUS and PROFInet communications.

# Fibre Optic Breakout Cable PROFIBUS + PROFInet

**direct burial**

HELUCOM®
AT-WQ(ZN)H(ZN)B2Y

NEW


## Cable structure

Core type: Buffered-fibre
GRP support element
Strain relief elements: Aramide
Type of armouring: Glass yarns
Outer sheath material: PE
Outer sheath colour: Black

## Temperature range

Laying, min.: -5°C
Laying, max.: +50°C
Operating, min.: -40°C
Operating, max.: +85°C

## Other data

Halogen-free acc. to 60754-2
Longitudinally water-tight acc. to IEC 60794-1-2-F5
UV-resistant
Resistant to hammer impact acc. to IEC 60794-1-2-E4
Oil-resistant

| Designation | Number of fibres | Fibre type | Fibre category | Outer Ø app. mm | Max. tensile force N | Min. stat. bending radius mm | Max. transverse pressure N / cm | Weight kg / km | **Part no.** |
|---|---|---|---|---|---|---|---|---|---|
| AT-WQ(ZN)H(ZN)B2Y | 2 | Multimode G50/125 | OM2 | 10,5 | 1200 | 105 | 500 | 90 | **805692** |

Dimensions and specifications may be changed without prior notice.

## Application

The HELUCOM ® range is set apart by its extreme rugged roden protected design. It is used wherever demanding environmental conditions while fixed installations occur. The tight buffer structure enables the cable to be pre-assembled on site with ease. Applications are for example direct burial or tray installation out of industry areas. This series can be used for PROFIBUS and PROFInet communications.



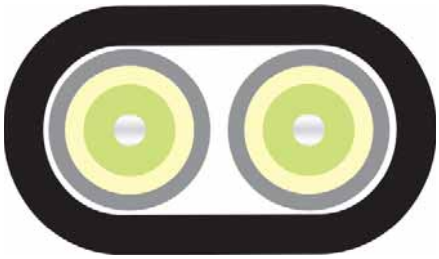
DNB Edition 11 (published 01.10.2015)

# Fibre Optic Cable robust

**multimode**

HELUCOM®

AT-VYY




## Cable structure

Core type: Tight buffer
Strain relief elements: Aramide
Outer sheath material: PVC
Outer sheath colour: Black

## Temperature range

Laying, min.: -5°C
Laying, max.: +50°C
Operating, min.: -20°C
Operating, max.: +60°C

## Other data

Flame-resistance acc. to IEC 60332-1-2
Longitudinally water-tight acc. to IEC 60794-1-2-F5
UV-resistant
Oil-resistant

| Designation | Number of fibres | Fibre type | Fibre category | Number of fibres per core | Outer Ø app. mm | Max. tensile force N | Min. stat. bending radius mm | Max. transverse pressure N / cm | Caloric load app. MJ / m | Weight kg / km | **Part no.** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| AT-VYY | 2 | Multimode G62.5/125 | OM1 | 1 | 6,8 x 10,2 | 400 | 110,0 | 300 | 1,10 | 76,0 | **800126** |

Dimensions and specifications may be changed without prior notice.

## Application

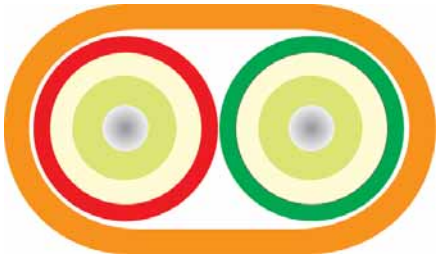
This HELUCOM® fibre-optic cable is suited for fixed installations in pits and channels, but also for flexible applications as jumper cable. Because of the robust construction with Single- and Overall-jacket you also can use it in industrial areas. With the core-construction, direct plug manufacturing, even on site, poses no problems.

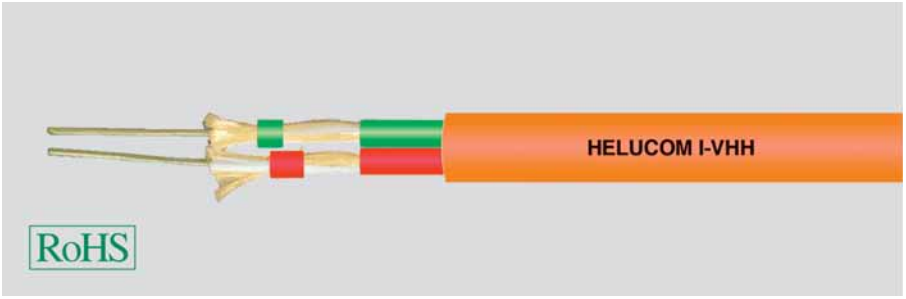
# Fibre Optic Cable flexible

**HCS**

HELUCOM®

I-VH, I-VHH






## Cable structure

Core type: Composite buffered
Strain relief elements: Aramide
Outer sheath material: FRNC
Outer sheath colour: Orange

## Temperature range

Laying, min.: -5°C
Laying, max.: +50°C
Operating, min.: -10°C
Operating, max.: +60°C

## Other data

Corrosiveness acc. to EN50267-2-3
Halogen-free acc. to 60754-2
Flame-resistance acc. to IEC 60332-1-2
Smoke density acc. to IEC 61034

| Designation | Number of fibres | Fibre type | Outer Ø app. mm | Max. tensile force N | Min. stat. bending radius mm | Max. transverse pressure N / cm | Caloric load app. MJ / m | Weight kg / km | **Part no.** |
|---|---|---|---|---|---|---|---|---|---|
| I-VH | 1 | HCS 200/230 | 2,8 | 300 | 40 | 10 | 0,26 | 2,8 | **800579** |
| I-VHH | 2 | HCS 200/230 | 3,8 x 6,6 | 600 | 50 | 10 | 0,52 | 30,0 | **81238** |

Dimensions and specifications may be changed without prior notice.

## Application

These HELUCOM® HCS fibre lines are suitable for stationary installation indoors. For heavy-duty mechanical requirements, such as application in industrial environments, a version with PUR outer sheath is available on request. With a HCS fibre transmission lengths of up to 300m can be achieved. With the tight buffer construction, direct plug manufacturing, even on site, poses no problems.

# Fibre Optic Breakout Cable robust, flexible

**HCS UL/CSA**

HELUCOM®

I-V(ZN)YY


## Cable structure

Core type: Composite buffered
Strain relief elements: Aramide
Outer sheath material: PVC
Outer sheath colour: Black

## Temperature range

Laying, min.: -20°C
Laying, max.: +75°C
Operating, min.: -30°C
Operating, max.: +85°C

## Other data

Flame-resistance acc. to IEC 60332-1 and IEC 60332-3
Applicable UL standards: OFNG UL 1685
Applicable CSA standards: FT4
UV-resistant
Oil-resistant

| Designation | Number of fibres | Fibre type | Fibre category | Number of fibres per core | Outer Ø app. mm | Max. tensile force N | Min. stat. bending radius mm | Max. transverse pressure N / cm | Caloric load app. MJ / m | Weight kg / km | **Part no.** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| I-V(ZN)YY | 2 | HCS 200/230 | Other | 1 | 7,5 | 800 | 100,0 | 300 | 1,40 | 68,0 | **801733** |

Dimensions and specifications may be changed without prior notice.

## Application

This HELUCOM® HCS fibre cable is suitable for fixed and normal flexible installations. Possible applications are normal and heavy-duty mechanical requirements for example in industrial environments. Because of a special PVC jacket this construction is certified by UL (FT1 and FT4). With the tight buffer construction, direct plug manufacturing, even on site, poses no problems. With a HCS fibre transmission lengths of up to 300m can be achieved.

# Fibre Optic Breakout Cable robust, flexible

**HCS**

HELUCOM®
I-V(ZN)Y11Y


## Cable structure

Core type: Composite buffered
Strain relief elements: Aramide
Outer sheath material: PUR
Outer sheath colour: Red

## Temperature range

Laying, min.: -5°C
Laying, max.: +50°C
Operating, min.: -20°C
Operating, max.: +70°C

## Other data

Oil-resistant

| Designation | Number of fibres | Fibre type | Fibre category | Number of fibres per core | Outer Ø app. mm | Max. tensile force N | Min. stat. bending radius mm | Max. transverse pressure N / cm | Caloric load app. MJ / m | Weight kg / km | **Part no.** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| I-V(ZN)Y11Y | 2 | HCS 200/230 | Other | 1 | 7,0 | 800 | 50,0 | 150 | 1,014 | 43,0 | **800980** |

Dimensions and specifications may be changed without prior notice.

## Application

This HELUCOM® HCS fibre cable is suitable for fixed installation. Possible applications are normal and heavy-duty mechanical requirements for example in industrial environments. With the tight buffer construction, direct plug manufacturing, even on site, poses no problems. With a HCS fibre transmission lengths of up to 300m can be achieved.

# Fibre Optic Breakout Cable flexible

**HCS**

HELUCOM®

AT-V(ZN)HH


## Cable structure

Core type: Composite buffered
GRP support element
Strain relief elements: Aramide
Outer sheath material: FRNC
Outer sheath colour: Black

## Temperature range

Laying, min.: -20°C
Laying, max.: +50°C
Operating, min.: -20°C
Operating, max.: +70°C

## Other data

Corrosiveness acc. to EN50267-2-3
Halogen-free acc. to 60754-2
Flame-resistance acc. to IEC 60332-1-2
Smoke density acc. to IEC 61034
UV-resistant
Oil-resistant

| Designation | Number of fibres | Fibre type | Fibre category | Number of fibres per core | Outer Ø app. mm | Max. tensile force N | Min. stat. bending radius mm | Max. transverse pressure N / cm | Caloric load app. MJ / m | Weight kg / km | **Part no.** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| AT-V(ZN)HH | 4 | HCS 200/230 | Other | 1 | 9,0 | 800 | 225,0 | 100 | 1,60 | 76,0 | **802260** |

Dimensions and specifications may be changed without prior notice.

## Application

This HELUCOM® HCS fibre cable is suitable for fixed and normal flexible installation. Possible applications are normal requirements and also limited industrial environments. The tight buffer structure enables the cable to be pre-assebmbled on site with ease. With a HCS fibre transmission lengths of up to 300m can be achieved.

# Fibre Optic Breakout Cable robust

**HCS**

HELUCOM®

AT-VQH(ZN)B2Y


## Cable structure

Core type: Composite buffered
GRP support element
Strain relief elements: Aramide
Type of armouring: Glass yarns
Outer sheath material: PE
Outer sheath colour: Black

## Temperature range

Laying, min.: -5°C
Laying, max.: +50°C
Operating, min.: -25°C
Operating, max.: +70°C

## Other data

Corrosiveness acc. to EN50267-2-3
Halogen-free acc. to 60754-2
Longitudinally water-tight acc. to IEC 60794-1-2-F5
UV-resistant
Oil-resistant

| Designation | Number of fibres | Fibre type | Fibre category | Number of fibres per core | Outer Ø app. mm | Max. tensile force N | Min. stat. bending radius mm | Max. transverse pressure N / cm | Caloric load app. MJ / m | Weight kg / km | **Part no.** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| AT-VQH(ZN)B2Y | 2 | HCS 200/230 | Other | 1 | 11,0 | 1500 | 200,0 | 500 | 2,10 | 90,0 | **801196** |

Dimensions and specifications may be changed without prior notice.

## Application

This HELUCOM® HCS fibre cable is suitable for fixed installation outdoors. Possible applications are normal and heavy-duty mechanical requirements for example in industrial environments. This is the reason we also equiped the cable with a non-metallic rodent-protection.With the tight buffer construction, direct plug manufacturing, even on site, poses no problems. With a HCS fibre transmission lengths of up to 300m can be achieved.

# Fibre Optic Universal Cable

**HCS**

HELUCOM®

A/I-DQ(ZN)BH


## Cable structure

Core type: Loose tube
Strain relief elements: Glass yarns
Type of armouring: Glass yarns
Outer sheath material: FR/LSOH
Outer sheath colour: Black

## Temperature range

Laying, min.: -5°C
Laying, max.: +50°C
Operating, min.: -20°C
Operating, max.: +70°C

## Other data

Corrosiveness acc. to EN50267-2-3
Halogen-free acc. to 60754-2
Flame-resistance acc. to IEC 60332-1-2
Smoke density acc. to IEC 61034
Longitudinally water-tight acc. to IEC 60794-1-2-F5
UV-resistant

| Designation | Number of fibres | Fibre type | Fibre category | Number of fibres per core | Outer Ø app. mm | Max. tensile force N | Min. stat. bending radius mm | Max. transverse pressure N / cm | Caloric load app. MJ / m | Weight kg / km | **Part no.** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| A/I-DQ(ZN)BH | 4 | HCS 200/230 | Other | 4 | 8,5 | 1500 | 130,0 | 150 | 2,00 | 76,0 | **801198** |
| A/I-DQ(ZN)BH | 8 | HCS 200/230 | Other | 8 | 8,5 | 1500 | 130,0 | 150 | 2,00 | 79,0 | **802001** |
| A/I-DQ(ZN)BH | 12 | HCS 200/230 | Other | 12 | 8,5 | 1500 | 130,0 | 150 | 2,00 | 82,0 | **802002** |
| A/I-DQ(ZN)BH | 24 | HCS 200/230 | Other | 8 | 17,7 | 6000 | 265,0 | 300 | 3,20 | 280,0 | **802003** |
| A/I-DQ(ZN)BH | 48 | HCS 200/230 | Other | 8 | 18,9 | 6000 | 285,0 | 300 | 3,20 | 355,0 | **802004** |

Dimensions and specifications may be changed without prior notice.

## Application

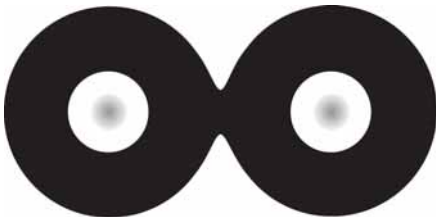
These HELUCOM® fibre-optic cables are available either as central bundle core cable or as stranded versions. They are suitable for fixed indoor and outdoor cabling of buildings and industry facilities. They are used in particular if the installation is to be done in one piece from the inside to the outside without additional use of couplings. With their black UV-resistant outer sheath and the non-metallic rodent protection, they are perfectly suited for outdoor use. The halogen-free outer sheath makes installation inhouse possible without any problems.

# Plastic Fibre cable industry

**POF/PE**

HELUCOM®

I-V2Y, I-V2Y(ZN)11Y




## Cable structure

Fibre type: POF 980/1000
Fibre cladding: PE

## Optical characteristic

Refractive index core: 1,492
Refractive index cladding: 1,419
Numerical aperture: 0,5
Attenuation see table

## Temperature range

Laying, min.: -20°C
Laying, max.: +80°C
Operating, min.: -20°C
Operating, max.: +80°C

| Designation | Outer sheath material | Sheath colour | Outer Ø app. mm | Max. tensile force N | Min. stat. bending radius mm | Fibre attenuation | Oil-resistant | Acc. to DESINA® | Weight kg / km | **Part no.** |
|---|---|---|---|---|---|---|---|---|---|---|
| I-V2Y 1P 980/1000 | PE | Black | 2,2 | 70 | 25,0 | 160A1 | no | no | 4,0 | **80532** |
| I-V2Y 2P 980/1000 | PE | Black | 2,2 x 4,4 | 140 | 25,0 | 160A1 | no | no | 8,0 | **80388** |
| I-V2Y(ZN)11Y 1P 980/1000, high flexible | PUR | Violet | 5,8 | 400 | 30,0 | 230A1 | yes | yes | 30,0 | **81611** |
| I-V2Y(ZN)11Y 2P 980/1000, high flexible | PUR | Violet | 6,0 | 400 | 31,0 | 230A1 | yes | yes | 36,0 | **80629** |
| I-V2Y(ZN)11Y 2P 980/1000, fixed installation | PUR | Violet | 6,0 | 400 | 31,0 | 230A1 | yes | yes | 36,0 | **81882** |
| I-V2Y(ZN)11Y 4P 980/1000, high flexible | PUR | Violet | 7,1 | 400 | 45,0 | 230A1 | yes | yes | 65,0 | **80630** |
| I-V2Y(ZN)11Y 2P 980/1000 + 2x1mm² Cu | PUR | Red | 7,8 | 200 | 70,0 | 230A1 | yes | no | 60,0 | **82032** |
| I-V2Y(ZN)11Y 2P 980/1000 + 3x1,5mm² Cu | PUR | Red | 11,0 | 200 | 70,0 | 230A1 | yes | no | 132,0 | **82033** |

Dimensions and specifications may be changed without prior notice.

## Application

HELUCOM® plastic-fibre cables are used in mechanical engineering, both in mobile and fixed applications. With different constructions, such as PUR outer sheaths, special strain relief components, hybrid construction with copper cores for power supply or only raw fibre cables, any possible fields of application are covered. Due to their solidity and their simple adjustability on site, the plastic-fibres (PMMA) are particularly suitable for applications where trouble-free data transmission in necessary under heavy-duty conditions.

# Plastic Fibre Cable PROFInet

**POF/PA**

HELUCOM®

I-V4Y(ZN)Y (type B), I-V4Y(ZN)11Y (type C)

NEW


## Cable structure

Fibre type: POF 980/1000
Fibre cladding: PA

## Optical characteristic

Refractive index core: 1,492
Refractive index cladding: 1,419
Numerical aperture: 0,5
Attenuation see table

## Temperature range

Laying, min.: -10°C
Laying, max.: +50°C
Operating, min.: -30°C
Operating, max.: +70°C

| Designation | Outer sheath material | Sheath colour | Outer Ø app. mm | Max. tensile force N | Min. stat. bending radius mm | Fibre attenuation | Oil-resistant | Acc. to DESINA® | Weight kg / km | **Part no.** |
|---|---|---|---|---|---|---|---|---|---|---|
| I-V4Y(ZN)Y 2P980/1000µm, fixed installation | PVC | Green | 7,8 | 100 | 100,0 | 160A1 | yes | no | 59,0 | **805686** |
| I-V4Y(ZN)11Y 2P980/1000 green, Drag Chain | PUR | Green | 8,0 | 200 | 120,0 | 180A1 | yes | no | 60,0 | **805838** |

Dimensions and specifications may be changed without prior notice.

## Application

Signal lines as plastic optical fibre. The use of these transmission systems significantly reduces the number of different cables in a planned bus installation in machine tools operations. Furthermore, possible EMC problems are prevented by the metal-free construction. The main fields of these cables are in machine construction and automobile industry. Installations for example in fixed installed rough areas (type B) or in Drag Chains (type C) are possible. The types on this page are especially constructed for communication within PROFInet systems.

# Plastic Fibre Cable PROFIBUS

**POF/PA**

HELUCOM®

I-V4Y(ZN)Y

NEW


## Cable structure

Fibre type: POF 980/1000
Fibre cladding: PA

## Optical characteristic

Refractive index core: 1,492
Refractive index cladding: 1,419
Numerical aperture: 0,5
Attenuation see table

## Temperature range

Laying, min.: -10°C
Laying, max.: +50°C
Operating, min.: -30°C
Operating, max.: +70°C

| Designation | Outer sheath material | Sheath colour | Outer Ø app. mm | Max. tensile force N | Min. stat. bending radius mm | Fibre attenuation | Oil-resistant | Acc. to DESINA® | Weight kg / km | **Part no.** |
|---|---|---|---|---|---|---|---|---|---|---|
| I-V4Y(ZN)Y 2P980/1000µm, fixed installation | PVC | Violet | 7,8 | 100 | 100,0 | 160A1 | yes | yes | 59,0 | **801280** |

Dimensions and specifications may be changed without prior notice.

## Application

Signal lines as plastic optical fibre. The use of these transmission systems significantly reduces the number of different cables in a planned bus installation in machine tools operations. Furthermore, possible EMC problems are prevented by the metal-free construction. The main application of these cables are in machine construction and automobile industry. The type on this page is especially constructed for communication within PROFIBUS systems.

# Plastic Fibre Cable Automotive

**POF/PA**

HELUCOM®

I-V4Y(ZN)11Y


## Cable structure

Fibre type: POF 980/1000
Fibre cladding: PA

## Optical characteristic

Refractive index core: 1,492
Refractive index cladding: 1,419
Numerical aperture: 0,5
Attenuation see table

## Temperature range

Laying, min.: -5°C
Laying, max.: +50°C
Operating, min.: -20°C
Operating, max.: +70°C

| Designation | Outer sheath material | Sheath colour | Outer Ø app. mm | Max. tensile force N | Min. stat. bending radius mm | Fibre attenuation | Oil-resistant | Acc. to DESINA® | Weight kg / km | **Part no.** |
|---|---|---|---|---|---|---|---|---|---|---|
| I-V4Y(ZN)11Y 2P980/1000 RUGGED | PUR | Red | 8,0 | 100 | 50,0 | 160A1 | yes | no | 42,0 | **801200** |
| I-V4Y(ZN)11Y 2P980/1000 FLEX RUGGED | PUR | Red | 8,0 | 100 | 50,0 | 250A1 | yes | no | 51,0 | **801201** |
| I-V4Y(ZN)11Y 2P980/1000 HEAVY | PUR | Red | 6,0 | 100 | 30,0 | 160A1 | yes | no | 28,0 | **801202** |

Dimensions and specifications may be changed without prior notice.

## Application

Signal lines as plastic optical fibre. The use of these transmission systems significantly reduces the number of different cables in a planned bus installation in machine tools operations. Furthermore, possible EMC problems are prevented by the metal-free construction. The main application of these cables are in machine construction and automobile industry (PA version).

# FIBRESPECIFICATIONS

| **Graded index fibres** | | | |
|---|---|---|---|
| **Specification** | | **Fibre type G 50/125** | **Fibre type G 62,5/125** |
| Fibre categorie | | OM2 Standard fibre | OM1 Standard fibre |
| Core diameter | | 50 ± 3 µm | 62,5 ± 3 µm |
| Numerical aperture | | 0,200 ± 0,015 | 0,275 ± 0,015 |
| Typ. attenuation | 850 nm | 2,5 dB/km | 3,0 dB/km |
| | 1300 nm | 0,7 dB/km | 1,0 dB/km |
| Min. bandwidth | 850 nm | 500 MHz x km | 200 MHz x km |
| | 1300 nm | 500 MHz x km | 500 MHz x km |
| Cladding diameter | | 125 ± 1 µm | |
| Primary coating diameter | | 245 ± 10 µm | |
| Core noncircularity | | < 5 % | |
| Cladding concentricity error | | < 3,0 µm | |
| Cladding nonconcentricity | | < 2,0 % | |
| | | | |
| **Specification** | | **Fibre type G 50/125** | |
| Fibre categorie | | OM3 Standard fibre | OM4 Standard fibre |
| Core diameter | | 50 ± 3 µm | 50 ± 3 µm |
| Numerical aperture | | 0,200 ± 0,015 | 0,200 ± 0,015 |
| Typ. attenuation | 850 nm | 2,5 dB/km | 3,0 dB/km |
| | 1300 nm | 0,5 dB/km | 1,0 dB/km |
| Min. bandwidth | 850 nm | 1500 MHz x km | 3500 MHz x km |
| | 1300 nm | 500 MHz x km | 500 MHz x km |
| Cladding diameter | | 125 ± 1 µm | 125 ± 1 µm |
| Primary coating diameter | | 245 ± 10 µm | 245 ± 10 µm |
| Core noncircularity | | < 5 % | < 5 % |
| Cladding concentricity error | | < 3,0 µm | < 6,0 µm |
| Cladding nonconcentricity | | < 2,0 % | < 2,0 % |

| **Single-Mode-Fibre** | | | |
|---|---|---|---|
| **Specification** | | **Fibre type E9...10/125 (single mode)** | |
| Fibre categorie | | ITU-T G. 652.d | ITU-T G 657.A1 |
| Attenuation | 1310 nm | 0,36 dB/km | 0,34 dB/km |
| | 1550 nm | 0,22 dB/km | 0,20 dB/km |
| Dispersion | 1285 - 1330 nm | < 3,5 ps/(nm x km) | |
| | 1550 nm | < 19 ps/(nm x km) | < 17,5 ps/(nm x km) |
| Wave length | | 1312 nm | |
| Mode field diameter at 1310 nm | | 9,3 ± 0,5 µm | 9,2 ± 0,3 µm |
| Cladding diameter | | 125 ± 1 µm | 125 ± 1 µm |
| Primary coating diameter | | 245 ± 10 µm | 245 ± 10 µm |
| Cut-off wavelength | | < 1250 nm | <126 mm |
| Cladding concentricity error | | ≤ 0,8 µm | ≤ 0,5 µm |
| Cladding nonconcentricity | | < 1,0 % | < 0,8 % |

| **POF and HCS-Fibre** | | | |
|---|---|---|---|
| **Specification** | | **Fibre type POF P980/1000** | **Fibre type HCS K200/230** |
| Core diameter | | 980 µm | 200 µm |
| Numerical aperture | | 0,5 | 0,37 |
| Typ. attenuation | 650nm | 160 dB/km | 10 db/km |
| | 850nm | - | 8 dB/km |
| Min. Bandwidth | 650nm | 10 MHz x 100m | 17 MHz x km |
| | 850nm | - | 20 MHz x km |
| Wallthickness | | 1000 µm | 230 µm |

Fibres with other parameteres on request

# FIBRE-OPTIC CABLES-CODE ACC. TO DIN VDE 0888

□ — □ □ □ □ □ □ □ □ □ □ □ □ □

1 2 3 4 5 6 7 8 9 10 11 12 13 14

14 Lg layerstranding

13 Bandwidth in MHz x km
(GF) dispersion parameter
in ps / nmxkm

12 Wavelength
B ≙ 850 nm
F ≙ 1300 nm
H ≙ 1550 nm

11 Attenuation coefficient in dB/km

10 Cladding diameter in µm

9 Core diameter in µm of graded index fibre
Field diameter in µm of single mode fibre

8 Design
E Single mode fibre
G Gradded index fibre

7 Number of fibres
Number of fibres per buffer
Number of multifibres per buffer

6
Y PVC-sheath
H Sheath with halogenfree material
B Armouring
BY Armouring with PVC-protective covering sheath
B2Y Armouring mit PE-protective covering sheath

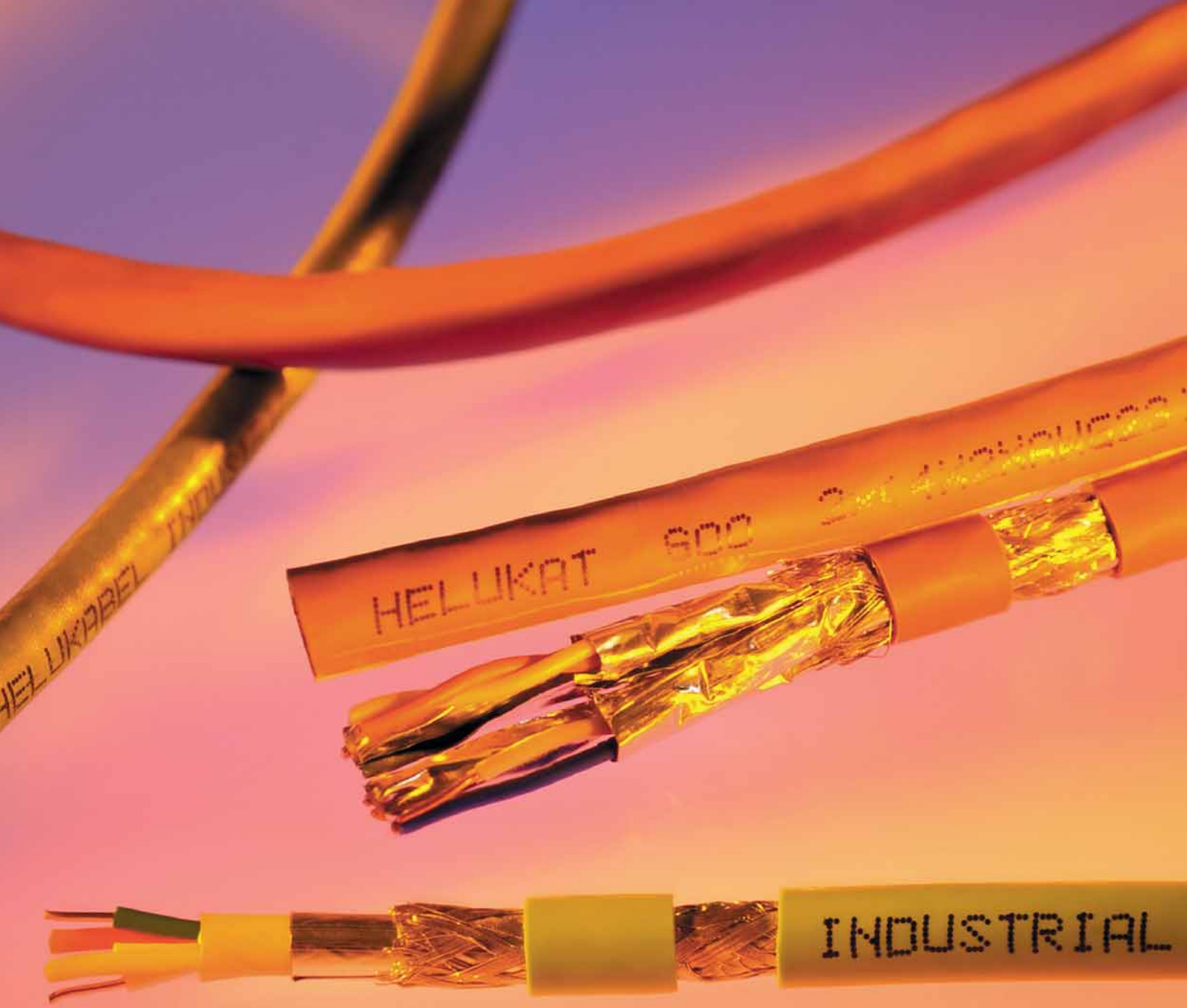
5
Y PVC-sheath
2Y PE-sheath
4Y PA-sheath
11Y PUR-sheath
(L)2Y PE-Laminated sheath
(ZN)2Y PE-sheath with nometallic strength menber
(L)(ZN)2Y PE-Laminated sheath with nometallic strength menber

4
F Filling of the cable core with petroleum jelly
Q Swellingmaterial

3 S Metallic element in the cable core

2
V Tight buffer
K Composite buffer fibre
H Loose buffer nonfilled
W Loose buffer, filled
B Multifibre buffer nonfilled
D Multifibre buffer filles

1
I Indoor cable
A Outdoor cable
AT Outdoor fan out cable




LAN Cable 300 U/UTP UL

**LAN Cable 155 U/UTP**

**LAN Cable 100 U/UTP flex**

**LAN Cable 450 F/FTP**

LAN Cable 1000 S/FTP duplex

**LAN Cable 200 SF/UTP flex**

Multimedia cable 1500 S/FTP

DNB Edition 11 (published 01.10.2015)

# COPPER DATA CABLES HELUKAT®





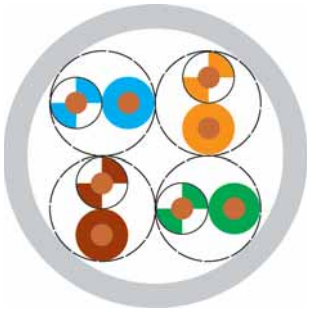

DNB Edition 11 (published 01.10.2015)

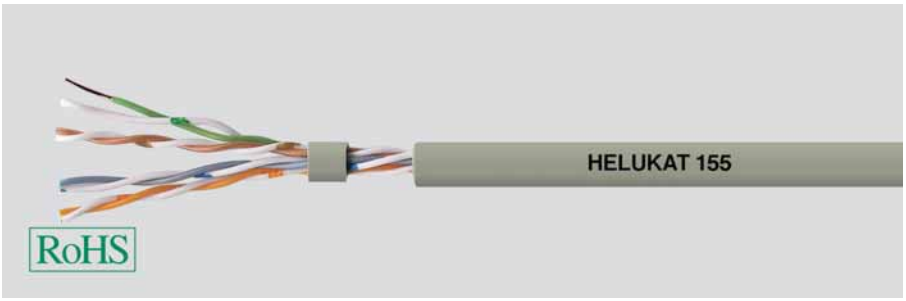
# LAN Cable

**Category 5e**

HELUKAT® 155

U/UTP

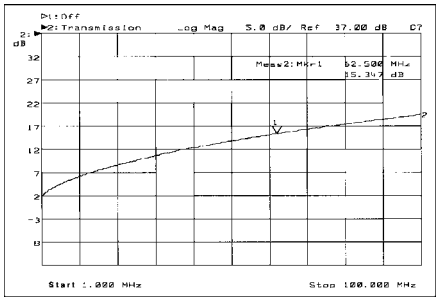





## Cable structure

## U/UTP 4x2xAWG 24/1 PVC

| | |
|---|---|
| Inner conductor Ø: | 0,51 mm |
| Conductor material: | Copper, bare |
| Core insulation: | PE |
| Core colours: | whbu/bu, whog/og, whgn/gn, whbn/bn |
| Separator: | - |
| Screen over stranding element: | - |
| Screen 1 over stranding: | - |
| Screen 2 over stranding: | - |
| Outer sheath material: | PVC |
| Outer diameter: | app. 4,9 mm |
| Outer sheath colour: | Grey |



## Electrical data

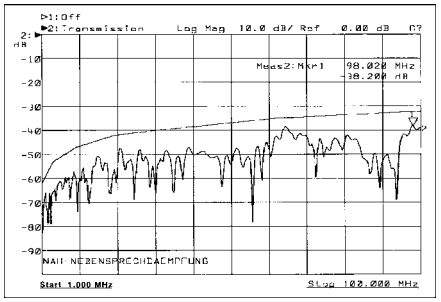
| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz<br>100 Ohm ± 20 Ohm at 101 to 155 MHz |
| Loop resistance: | 190 Ohm/km max. |
| Mutual capacitance: | 50 nF/km nom. |
| Rel. propagation velocity: | 66 % |

## Typical values

| | | | | | | |
|---|---|---|---|---|---|---|
| Frequency | (MHz) | 10 | 16 | 62,5 | 100 | 155 |
| Attenuation | (dB/100m) | 6,3 | 8,0 | 16,5 | 21,3 | 26,8 |
| Next | (dB) | 50,3 | 47,3 | 38,4 | 35,3 | 33,0 |
| ACR | (dB) | 44,0 | 39,3 | 21,9 | 14,0 | 6,2 |

## Technical data

| | |
|---|---|
| Weight: | app. 26 kg/km |
| bending radius, repeated: | 40 mm |
| Operating temperature range min.: | -20°C |
| Operating temperature range max.: | +60°C |
| Caloric load, approx. value: | 0,40 MJ/m |
| Copper weight: | 17,00 kg/km |



## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 5e

## Application

HELUKAT®155 data cables are used in the tertiary, but also in the secondary level of a network. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s, or ISDN absolutely trouble-free. Likewise, the mechanical characteristics are perfectly suited for the application in tight cable channels and platforms due to their optimized construction.

## Part no.

**80053,** U/UTP 4x2xAWG24/1 PVC (UTP)

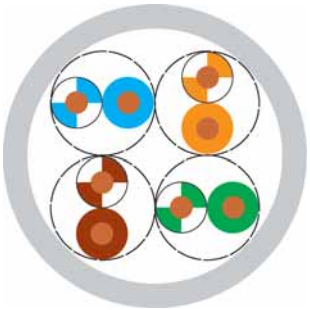
Dimensions and specifications may be changed without prior notice.

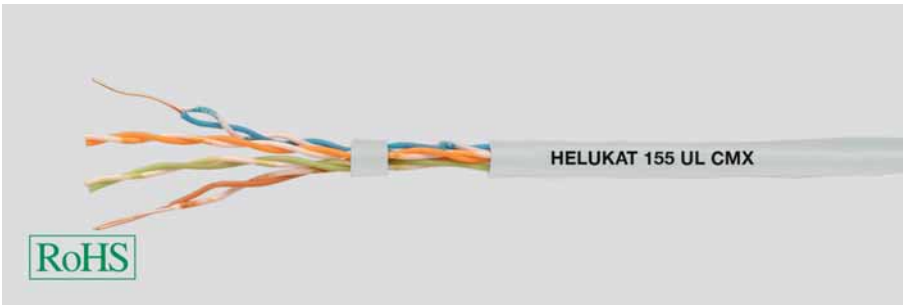
# LAN Cable

**Category 5e**

HELUKAT® 155

U/UTP UL

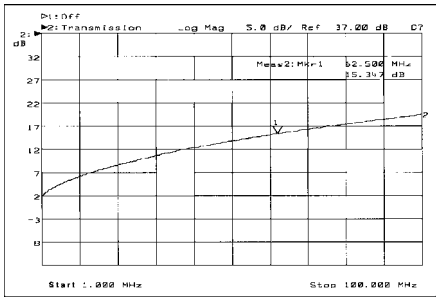





## Cable structure

## U/UTP 4x2xAWG 24/1 PVC, UL

| | |
|---|---|
| Inner conductor Ø: | 0,53 mm |
| Conductor material: | Copper, bare |
| Core insulation: | PE |
| Core colours: | whbu/bu, whog/og, whgn/gn, whbn/bn |
| Separator: | - |
| Screen over stranding element: | - |
| Screen 1 over stranding: | - |
| Screen 2 over stranding: | - |
| Outer sheath material: | PVC |
| Outer diameter: | app. 5,2 mm |
| Outer sheath colour: | Grey |



## Electrical data

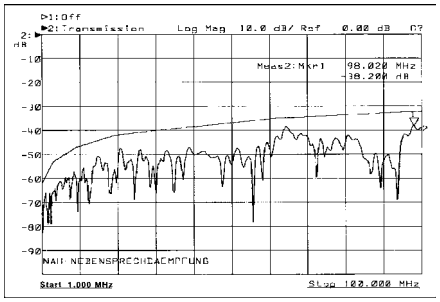
| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz<br>100 Ohm ± 20 Ohm at 101 to 155 MHz |
| Loop resistance: | 190 Ohm/km max. |
| Mutual capacitance: | 50 nF/km nom. |
| Rel. propagation velocity: | 66 % |

## Typical values

| Frequency | (MHz) | 10 | 16 | 62,5 | 100 | 155 |
|---|---|---|---|---|---|---|
| Attenuation | (dB/100m) | 6,1 | 7,7 | 15,2 | 19,9 | 22,7 |
| Next | (dB) | 65,0 | 63,0 | 53,0 | 40,0 | 37,0 |
| ACR | (dB) | 58,9 | 55,3 | 37,8 | 20,1 | 14,3 |

## Technical data

| | |
|---|---|
| Weight: | app. 35 kg/km |
| bending radius, repeated: | 42 mm |
| Operating temperature range min.: | -20°C |
| Operating temperature range max.: | +60°C |
| Caloric load, approx. value: | 0,43 MJ/m |
| Copper weight: | 17,00 kg/km |



## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 5e, Flame-retardant acc. to IEC 60332-1-2, Smoke density acc. to IEC 61034, CMX 444

## Application

HELUKAT®155 data cables are used in the tertiary, but also in the secondary level of a network. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as Gigabit Ethernet, Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s, or ISDN absolutely trouble-free. Likewise, the mechanical characteristics are perfectly suited for the application in tight cable channels and platforms due to their optimized construction. This type is certified according UL because of the special PVC jacket

## Part no.

**802171,** U/UTP 4x2xAWG24/1 PVC UL (UTP)

Dimensions and specifications may be changed without prior notice.



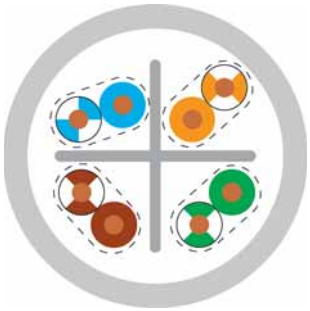
DNB Edition 11 (published 01.10.2015)

# LAN Cable

**Category 6**

HELUKAT® 300

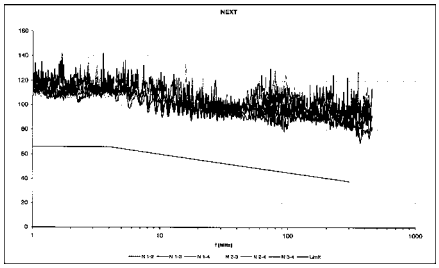
U/UTP UL




## Cable structure

## U/UTP 4x2xAWG 24/1 PVC, UL

| | |
|---|---|
| Inner conductor Ø: | 0,55 mm |
| Conductor material: | Copper, bare |
| Core insulation: | PE |
| Core colours: | whbu/bu, whog/og, whgn/gn, whbn/bn |
| Separator: | Polyester foil over stranded bundle |
| Screen over stranding element: | - |
| Screen 1 over stranding: | - |
| Screen 2 over stranding: | - |
| Outer sheath material: | PVC |
| Outer diameter: | app. 6,3 mm |
| Outer sheath colour: | Grey |




## Electrical data

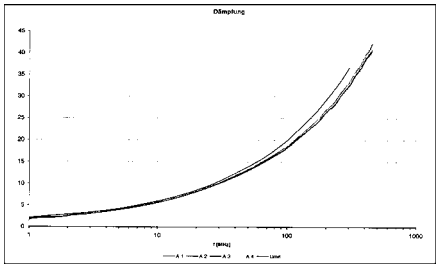
| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz<br>100 Ohm ± 20 Ohm at 101 to 300 MHz |
| Loop resistance: | 190 Ohm/km max. |
| Mutual capacitance: | 50 nF/km nom. |
| Rel. propagation velocity: | 67 % |

## Typical values

| Frequency | (MHz) | 10 | 16 | 62,5 | 100 | 155 | 200 | 300 |
|---|---|---|---|---|---|---|---|---|
| Attenuation | (dB/100m) | 5,6 | 7,0 | 14,3 | 18,2 | 22,9 | 26,0 | 32,5 |
| Next | (dB) | 72,0 | 70,0 | 65,0 | 63,0 | 60,0 | 57,0 | 55,0 |
| ACR | (dB) | 66,4 | 63,0 | 50,7 | 44,8 | 37,1 | 31,0 | 22,5 |

## Technical data

| | |
|---|---|
| Weight: | app. 46 kg/km |
| bending radius, repeated: | 55 mm |
| Operating temperature range min.: | -20°C |
| Operating temperature range max.: | +60°C |
| Caloric load, approx. value: | 0,68 MJ/m |
| Copper weight: | 20,00 kg/km |




## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 6, Flame-retardant acc. to IEC 60332-1-2, Smoke density acc. to IEC 61034, CMX 444

## Application

HELUKAT®300 data cables are used in the tertiary, but also in the secondary level of a network. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as Gigabit Ethernet, Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s, or ISDN absolutely trouble-free. Likewise, the mechanical characteristics are perfectly suited for the application in tight cable channels and platforms due to their optimized construction. This type is certified according UL because of the special PVC jacket

## Part no.

**802172,** U/UTP 4x2xAWG24/1 PVC UL (UTP)

Dimensions and specifications may be changed without prior notice.

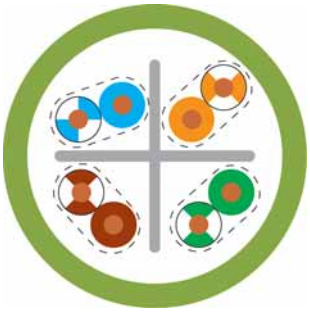
# LAN Cable

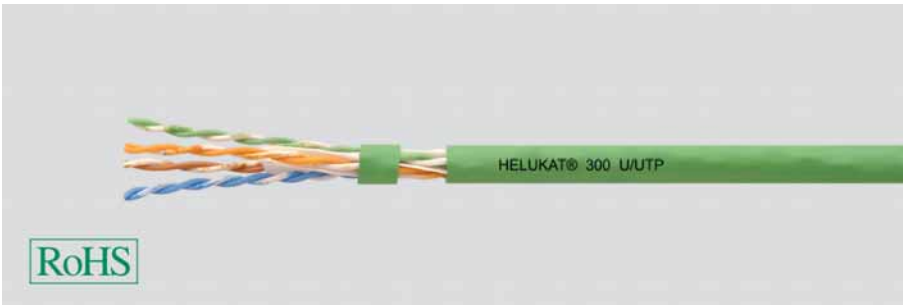
**Category 6**

## HELUKAT® 300

U/UTP FRNC

NEW

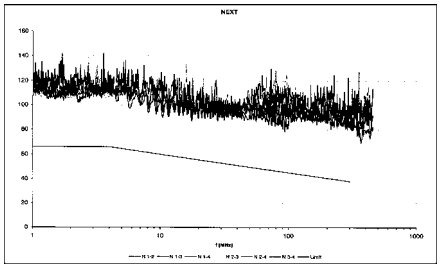





## Cable structure

## U/UTP 4x2xAWG 24/1 FRNC

| | |
|---|---|
| Inner conductor Ø: | 0,55 mm |
| Conductor material: | Copper, bare |
| Core insulation: | PE |
| Core colours: | whbu/bu, whog/og, whgn/gn, whbn/bn |
| Separator: | Polyester foil over stranded bundle |
| Screen over stranding element: | - |
| Screen 1 over stranding: | - |
| Screen 2 over stranding: | - |
| Outer sheath material: | FRNC |
| Outer diameter: | app. 6,8 mm |
| Outer sheath colour: | Green similar to RAL 6018 |



## Electrical data

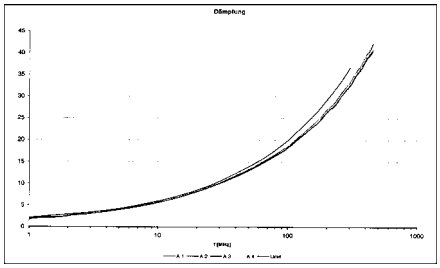
| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz<br>100 Ohm ± 20 Ohm at 101 to 300 MHz |
| Loop resistance: | 190 Ohm/km max. |
| Mutual capacitance: | 50 nF/km nom. |
| Rel. propagation velocity: | 67 % |

## Typical values

| Frequency | (MHz) | 10 | 16 | 62,5 | 100 | 155 | 200 | 300 |
|---|---|---|---|---|---|---|---|---|
| Attenuation | (dB/100m) | 5,6 | 7,0 | 14,3 | 18,2 | 22,9 | 26,0 | 32,5 |
| Next | (dB) | 72,0 | 70,0 | 65,0 | 63,0 | 60,0 | 57,0 | 55,0 |
| ACR | (dB) | 66,4 | 63,0 | 50,7 | 44,8 | 37,1 | 31,0 | 22,5 |

## Technical data

| | |
|---|---|
| Weight: | app. 46 kg/km |
| bending radius, repeated: | 55 mm |
| Operating temperature range min.: | -20°C |
| Operating temperature range max.: | +60°C |
| Caloric load, approx. value: | 0,125 MJ/m |
| Copper weight: | 20,00 kg/km |



## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 6, Flame-retardant acc. to IEC 60332-1-2, Smoke density acc. to IEC 61034, Halogen-free acc. to 60754-2, Corrosiveness acc. to EN50267-2-3

## Application

HELUKAT®300 data cables are used in the tertiary, but also in the secondary level of a network. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as Gigabit Ethernet, Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s, or ISDN absolutely trouble-free. Likewise, the mechanical characteristics are perfectly suited for the application in tight cable channels and platforms due to their optimized construction.

## Part no.

**804766,** U/UTP 4x2xAWG24/1 FRNC (UTP)

Dimensions and specifications may be changed without prior notice.



DNB Edition 11 (published 01.10.2015)

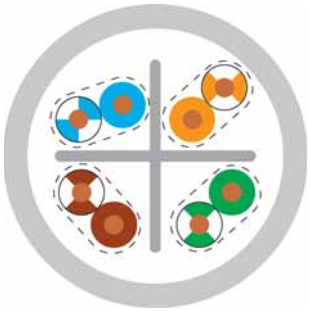
# LAN Cable

**Category 6**

## HELUKAT® 600

U/UTP FRNC

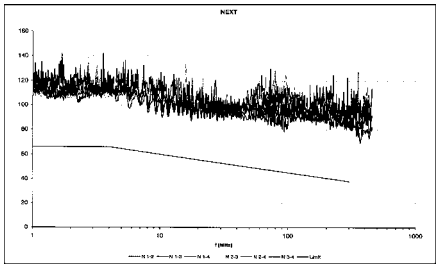
NEW




## Cable structure

## U/UTP 4x2xAWG 23/1 FRNC

| | |
|---|---|
| Inner conductor Ø: | 0,56 mm |
| Conductor material: | Copper, bare |
| Core insulation: | PE |
| Core colours: | whbu/bu, whog/og, whgn/gn, whbn/bn |
| Separator: | Polyester foil over stranded bundle |
| Screen over stranding element: | - |
| Screen 1 over stranding: | - |
| Screen 2 over stranding: | - |
| Outer sheath material: | FRNC |
| Outer diameter: | app. 6,5 mm |
| Outer sheath colour: | Grey similar to RAL 7035 |



## Electrical data

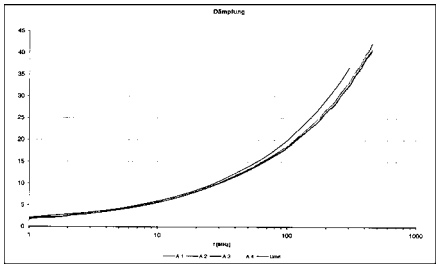
| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz<br>100 Ohm ± 20 Ohm at 101 to 600 MHz |
| Loop resistance: | 150 Ohm/km max. |
| Mutual capacitance: | 50 nF/km nom. |
| Rel. propagation velocity: | 67 % |

## Typical values

| Frequency | (MHz) | 10 | 16 | 62,5 | 100 | 155 | 200 | 300 | 500 | 600 |
|---|---|---|---|---|---|---|---|---|---|---|
| Attenuation | (dB/100m) | 5,5 | 6,9 | 14,3 | 18,0 | 22,1 | 25,3 | 31,8 | 39,8 | 44,1 |
| Next | (dB) | 72,0 | 70,0 | 65,0 | 63,0 | 60,0 | 57,0 | 55,0 | 53,0 | 49,0 |
| ACR | (dB) | 66,5 | 63,1 | 50,7 | 45,0 | 37,9 | 31,7 | 23,2 | 13,2 | 4,9 |

## Technical data

| | |
|---|---|
| Weight: | app. 52 kg/km |
| bending radius, repeated: | 55 mm |
| Operating temperature range min.: | -20°C |
| Operating temperature range max.: | +60°C |
| Caloric load, approx. value: | 0,135 MJ/m |
| Copper weight: | 20,00 kg/km |



## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category $6_A$, Flame-retardant acc. to IEC 60332-1-2, Smoke density acc. to IEC 61034, Halogen-free acc. to 60754-2, Corrosiveness acc. to EN50267-2-3, CMX 444

## Application

HELUKAT®600 data cables are used in the tertiary, but also in the secondary level of a network. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as Gigabit Ethernet, Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s, or ISDN absolutely trouble-free. Likewise, the mechanical characteristics are perfectly suited for the application in tight cable channels and platforms due to their optimized construction.

## Part no.

**805179,** U/UTP 4x2xAWG23/1 FRNC (UTP)

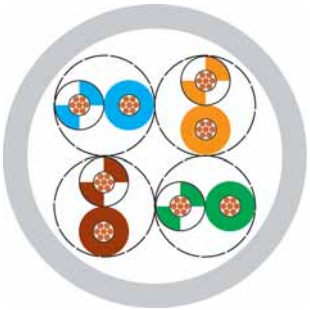
Dimensions and specifications may be changed without prior notice.

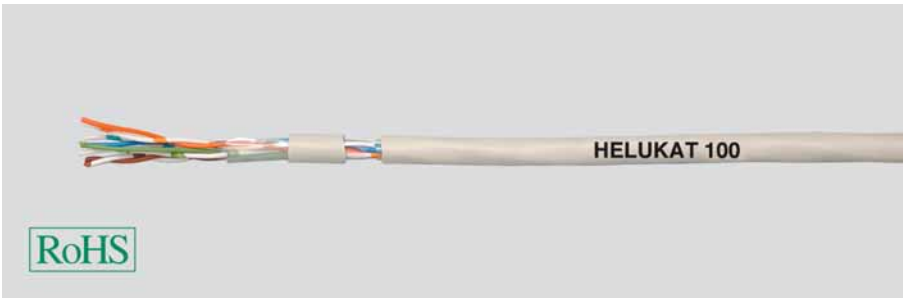
# LAN-Cable

**Category 5**

HELUKAT® 100

U/UTP flex

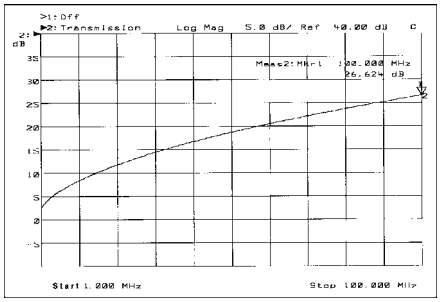





## Cable structure

## U/UTP 4x2xAWG 26/7 PVC

| | |
|---|---|
| Inner conductor Ø: | 0,48 mm |
| Conductor material: | Copper, bare |
| Core insulation: | PO |
| Core colours: | whbu/bu, whog/og, whgn/gn, whbn/bn |
| Separator: | - |
| Screen over stranding element: | - |
| Screen 1 over stranding: | - |
| Screen 2 over stranding: | - |
| Outer sheath material: | PVC |
| Outer diameter: | app. 4,5 mm |
| Outer sheath colour: | Grey similar to RAL 7035 |



## Electrical data

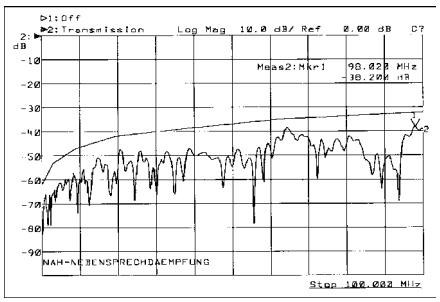
| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz |
| Loop resistance: | 290 Ohm/km max. |
| Mutual capacitance: | 50 nF/km nom. |
| Rel. propagation velocity: | 74 % |

## Typical values

| | | | | | |
|---|---|---|---|---|---|
| Frequency | (MHz) | 10 | 16 | 62,5 | 100 |
| Attenuation | (dB/10m) | 0,9 | 1,2 | 2,4 | 3,1 |
| Next | (dB) | 53,0 | 50,0 | 41,0 | 38,0 |
| ACR | (dB) | 52,1 | 48,8 | 38,6 | 34,9 |

## Technical data

| | |
|---|---|
| Weight: | app. 17 kg/km |
| bending radius, repeated: | 35 mm |
| Operating temperature range min.: | -20°C |
| Operating temperature range max.: | +60°C |
| Caloric load, approx. value: | 0,527 MJ/m |
| Copper weight: | 11,00 kg/km |



## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 5

## Application

HELUKAT®100 data cables are used in the tertiary level of a network as patch cables and connection cables. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s, or ISDN absolutely trouble-free. With its optimized construction, the HELUKAT®100 series can be manufactured quickly and easily with all common RJ45 plugs.

## Part no.

**80055,** U/UTP 4x2xAWG 26/7 PVC (UTP)

Dimensions and specifications may be changed without prior notice.



DNB Edition 11 (published 01.10.2015)

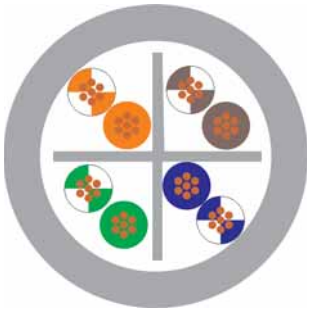
# LAN-Cable

**Category 6**

NEW

## HELUKAT® 300

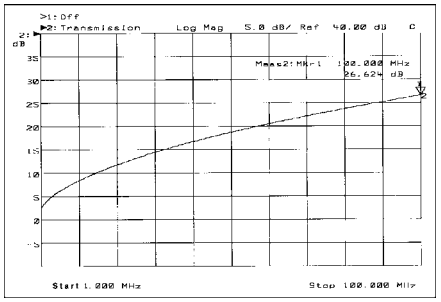
U/UTP flex




## Cable structure

## U/UTP 4x2xAWG 24/1 FRNC

| | |
|---|---|
| Inner conductor Ø: | 0,61 mm |
| Conductor material: | Copper, bare |
| Core insulation: | PE |
| Core colours: | whbu/bu, whog/og, whgn/gn, whbn/bn |
| Separator: | Polyester foil over stranded bundle |
| Screen over stranding element: | - |
| Screen 1 over stranding: | - |
| Screen 2 over stranding: | - |
| Outer sheath material: | FRNC |
| Outer diameter: | app. 6,0 mm |
| Outer sheath colour: | Grey similar to RAL 7035 |



## Electrical data

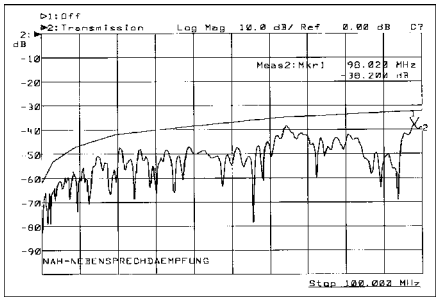
| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz<br>100 Ohm ± 20 Ohm at 101 to 300 MHz |
| Loop resistance: | 180 Ohm/km max. |
| Mutual capacitance: | 50 nF/km nom. |
| Rel. propagation velocity: | 67 % |

## Typical values

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Frequency | (MHz) | 10 | 16 | 62,5 | 100 | 155 | 200 | 300 |
| Attenuation | (dB/10m) | 0,8 | 1,0 | 2,0 | 2,6 | 3,3 | 3,7 | 4,7 |
| Next | (dB) | 75,0 | 71,0 | 65,0 | 63,0 | 60,0 | 57,0 | 56,0 |
| ACR | (dB) | 74,2 | 70,0 | 63,0 | 60,4 | 56,7 | 53,2 | 51,3 |

## Technical data

| | |
|---|---|
| Weight: | app. 38 kg/km |
| bending radius, repeated: | 50 mm |
| Operating temperature range min.: | -20°C |
| Operating temperature range max.: | +60°C |
| Caloric load, approx. value: | 0,11 MJ/m |
| Copper weight: | 19,00 kg/km |



## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 6, Flame-retardant acc. to IEC 60332-1-2, Smoke density acc. to IEC 61034, Halogen-free acc. to 60754-2, Corrosiveness acc. to EN50267-2-3

## Application

HELUKAT®300 unshielded data cables are used in the tertiary, but also in the secondary level of a network. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as Gigabit Ethernet, Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s, or ISDN absolutely trouble-free. With its optimized construction, the HELUKAT®300 series can be manufactured quickly and easily with many common RJ45 plugs.

## Part no.

**804996,** U/UTP 4x2xAWG 24/7 FRNC (UTP)

Dimensions and specifications may be changed without prior notice.

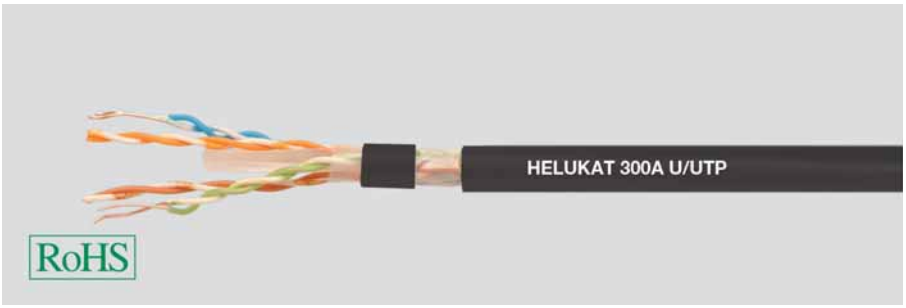
# LAN-Cable, Outdoor

**Category 6**

HELUKAT® 300A

U/UTP

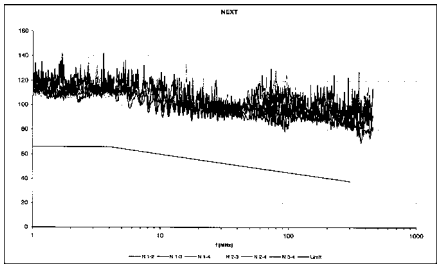
NEW




## Cable structure

## U/UTP 4x2xAWG 24/1 PE

| | |
|---|---|
| Inner conductor Ø: | 0,55 mm |
| Conductor material: | Copper, bare |
| Core insulation: | PE |
| Core colours: | whbu/bu, whog/og, whgn/gn, whbn/bn |
| Separator: | Polyester foil over stranded bundle |
| Screen over stranding element: | - |
| Screen 1 over stranding: | - |
| Screen 2 over stranding: | - |
| Outer sheath material: | PE |
| Outer diameter: | app. 6,4 mm |
| Outer sheath colour: | Black similar to RAL 9005 |



## Electrical data

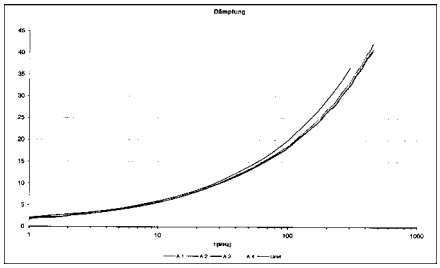
| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz<br>100 Ohm ± 20 Ohm at 101 to 300 MHz |
| Loop resistance: | 190 Ohm/km max. |
| Mutual capacitance: | 50 nF/km nom. |
| Rel. propagation velocity: | 67 % |

## Typical values

| Frequency | (MHz) | 10 | 16 | 62,5 | 100 | 155 | 200 | 300 |
|---|---|---|---|---|---|---|---|---|
| Attenuation | (dB/100m) | 5,6 | 7,0 | 14,3 | 18,2 | 22,9 | 26,0 | 32,5 |
| Next | (dB) | 72,0 | 70,0 | 65,0 | 63,0 | 60,0 | 57,0 | 55,0 |
| ACR | (dB) | 66,4 | 63,0 | 50,7 | 44,8 | 37,1 | 31,0 | 22,5 |

## Technical data

| | |
|---|---|
| Weight: | app. 47 kg/km |
| bending radius, repeated: | 52 mm |
| Operating temperature range min.: | -20°C |
| Operating temperature range max.: | +60°C |
| Caloric load, approx. value: | 0,30 MJ/m |
| Copper weight: | 19,00 kg/km |



## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 6, Halogen-free acc. to 60754-2

## Application

HELUKAT® 300A outdoor data cables are used in the tertiary level of a network. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as Gigabit Ethernet, Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s, or ISDN absolutely trouble-free. Likewise, the mechanical characteristics are perfectly suited for the application in ducts or along buildings due to their optimized construction.

## Part no.

**805683,** U/UTP 4x2xAWG24/1 PE (UTP)

Dimensions and specifications may be changed without prior notice.



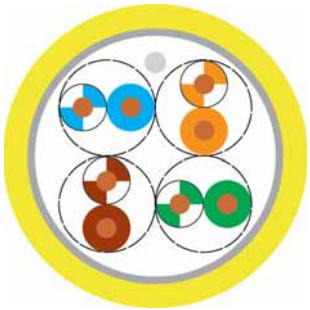
DNB Edition 11 (published 01.10.2015)

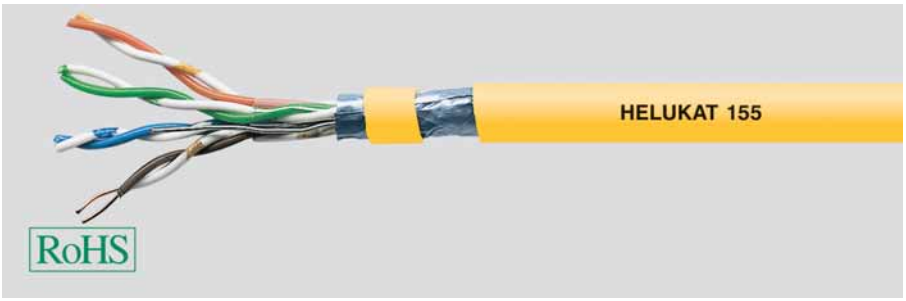
# LAN Cable

**Category 5e**

HELUKAT® 155

F/UTP

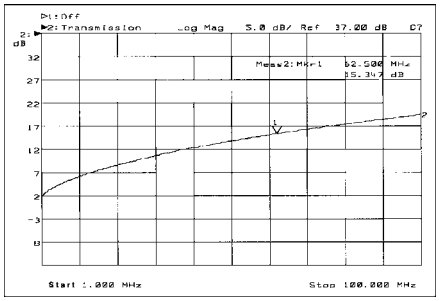





## Cable structure

## F/UTP 4x2xAWG 24/1 PVC

| | |
|---|---|
| Inner conductor Ø: | 0,51 mm |
| Conductor material: | Copper, bare |
| Core insulation: | PE |
| Core colours: | whbu/bu, whog/og, whgn/gn, whbn/bn |
| Separator: | Polyester foil over stranded bundle |
| Screen over stranding element: | - |
| Screen 1 over stranding: | Al-Foil |
| Screen 2 over stranding: | - |
| Drain wire: | yes |
| Outer sheath material: | PVC |
| Outer diameter: | app. 5,9 mm |
| Outer sheath colour: | Yellow similar to RAL 1021 |



## Electrical data

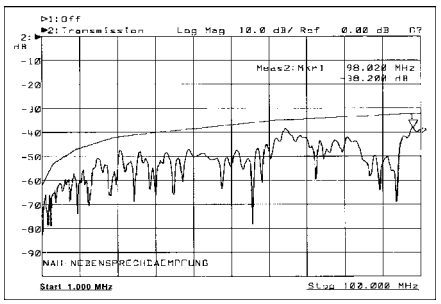
| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz<br>100 Ohm ± 20 Ohm at 101 to 155 MHz |
| Loop resistance: | 170 Ohm/km max. |
| Mutual capacitance: | 50 nF/km nom. |
| Rel. propagation velocity: | 69 % |

## Typical values

| | | | | | | |
|---|---|---|---|---|---|---|
| Frequency | (MHz) | 10 | 16 | 62,5 | 100 | 155 |
| Attenuation | (dB/100m) | 5,9 | 7,6 | 15,7 | 20,3 | 22,0 |
| Next | (dB) | 59,0 | 53,0 | 44,0 | 40,0 | 40,0 |
| ACR | (dB) | 53,1 | 45,4 | 28,3 | 19,7 | 18,0 |

## Technical data

| | |
|---|---|
| Weight: | app. 40 kg/km |
| bending radius, repeated: | 48 mm |
| Operating temperature range min.: | -20°C |
| Operating temperature range max.: | +60°C |
| Caloric load, approx. value: | 0,40 MJ/m |
| Copper weight: | 18,00 kg/km |



## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 5e

## Application

HELUKAT®155 data cables are used in the tertiary, but also in the secondary level of a network. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s, or ISDN absolutely trouble-free. Likewise, the mechanical characteristics are perfectly suited for the application in tight cable channels and platforms due to their optimized construction.

## Part no.

**80043,** F/UTP 4x2xAWG24/1 PVC (FTP)

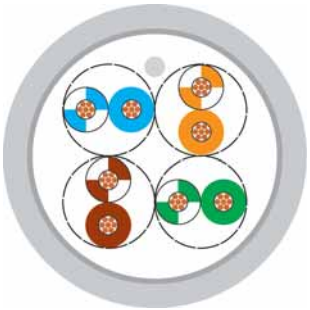
Dimensions and specifications may be changed without prior notice.

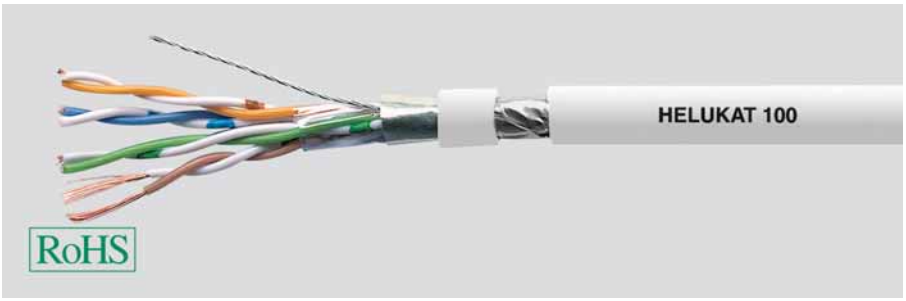
# LAN Cable

**Category 5**

HELUKAT® 100

F/UTP flex

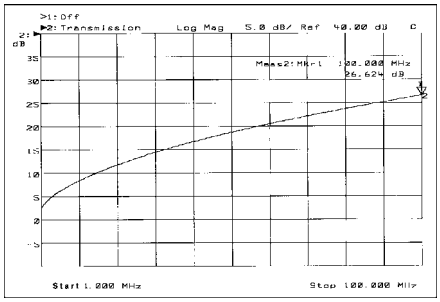





## Cable structure

## F/UTP 4x2xAWG 26/7 FRNC

| | |
|---|---|
| Inner conductor Ø: | 0,48 mm |
| Conductor material: | Copper, bare |
| Core insulation: | Foam-skin-PE |
| Core colours: | whbu/bu, whog/og, whgn/gn, whbn/bn |
| Separator: | - |
| Screen over stranding element: | - |
| Screen 1 over stranding: | Al-Foil |
| Screen 2 over stranding: | - |
| Drain wire: | yes |
| Outer sheath material: | FRNC |
| Outer diameter: | app. 5,3 mm |
| Outer sheath colour: | Grey similar to RAL 7035 |




## Electrical data

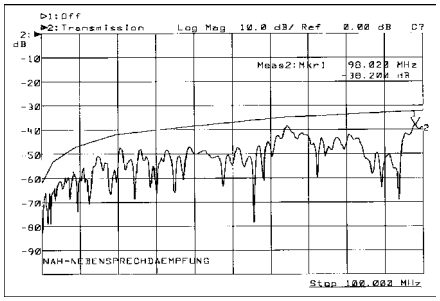
| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz |
| Loop resistance: | 290 Ohm/km max. |
| Mutual capacitance: | 50 nF/km nom. |
| Rel. propagation velocity: | 74 % |

## Typical values

| | | | | | |
|---|---|---|---|---|---|
| Frequency | (MHz) | 10 | 16 | 62,5 | 100 |
| Attenuation | (dB/10m) | 0,9 | 1,2 | 2,4 | 2,9 |
| Next | (dB) | 58,0 | 56,0 | 45,0 | 43,0 |
| ACR | (dB) | 57,1 | 54,8 | 42,6 | 40,1 |

## Technical data

| | |
|---|---|
| Weight: | app. 31 kg/km |
| bending radius, repeated: | 40 mm |
| Operating temperature range min.: | -20°C |
| Operating temperature range max.: | +60°C |
| Caloric load, approx. value: | 0,45 MJ/m |
| Copper weight: | 14,00 kg/km |




## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 5, Flame-retardant acc. to IEC 60332-1-2, Smoke density acc. to IEC 61034, Halogen-free acc. to 60754-2, Corrosiveness acc. to EN50267-2-3

## Application

HELUKAT®100 data cables are used in the tertiary level of a network as patch cables and connection cables. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s, or ISDN absolutely trouble-free. With its optimized construction, the HELUKAT®100 series can be manufactured quickly and easily with all common RJ45 plugs.

## Part no.

**81278,** F/UTP 4x2xAWG 26/7 FRNC (FTP)

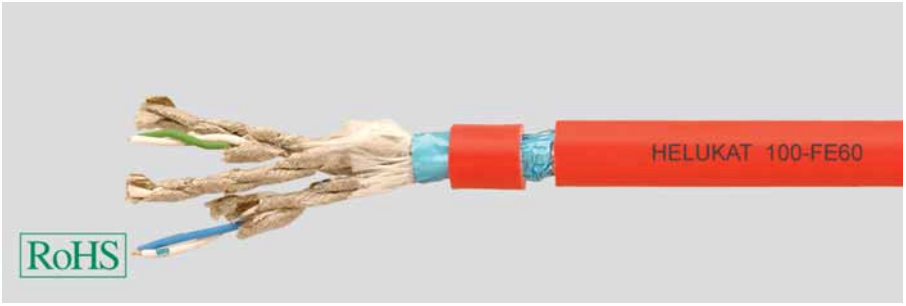
Dimensions and specifications may be changed without prior notice.

# LAN Cable

**Category 5**

HELUKAT® 100

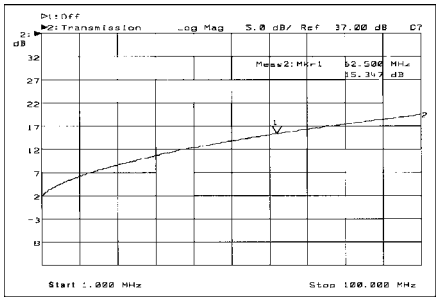
F/UTP FE60




## Cable structure

**F/UTP 4x2xAWG 23/1 FR-0H**

| | |
|---|---|
| Inner conductor Ø: | 0,57 mm |
| Conductor material: | Copper, bare |
| Core insulation: | PO + flame resistant tape |
| Core colours: | whbu/bu, whog/og, whgn/gn, whbn/bn |
| Separator: | - |
| Screen over stranding element: | PO tape |
| Screen 1 over stranding: | Helical glasfibre tape |
| Screen 2 over stranding: | Al-Foil |
| Drain wire: | yes |
| Outer sheath material: | LSZH |
| Outer diameter: | app. 8,3 mm |
| Outer sheath colour: | Red |



## Electrical data

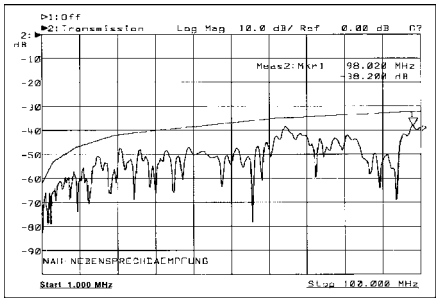
| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz |
| Loop resistance: | 188 Ohm/km max. |
| Mutual capacitance: | 65 nF/km nom. |
| Rel. propagation velocity: | 67 % |

## Typical values

| | | | | | |
|---|---|---|---|---|---|
| Frequency | (MHz) | 10 | 16 | 62,5 | 100 |
| Attenuation | (dB/100m) | 5,9 | 7,9 | 16,3 | 21,1 |
| Next | (dB) | 58,0 | 51,0 | 41,0 | 38,0 |
| ACR | (dB) | 52,1 | 43,1 | 24,7 | 16,9 |

## Technical data

| | |
|---|---|
| Weight: | app. 75 kg/km |
| bending radius, repeated: | 130 mm |
| Operating temperature range min.: | -20°C |
| Operating temperature range max.: | +70°C |
| Caloric load, approx. value: | 0,72 MJ/m |
| Copper weight: | 24,00 kg/km |



## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 5, Flame-retardant acc. to IEC 60332-3, Smoke density acc. to IEC 61034, Halogen-free acc. to 60754-2, Corrosiveness acc. to EN50267-2-3

## Application

HELUKAT®100-FE60 data cables are used in the tertiary, but also in the secondary level of a network. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s, or ISDN absolutely trouble-free. Likewise, the thermal characteristics are perfectly suited to realize an isolation integrity according EN50200-FE60 due to their optimized construction.

## Part no.

**804045,** F/UTP 4x2xAWG23/1 FRNC

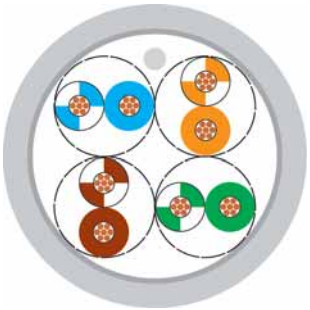
Dimensions and specifications may be changed without prior notice.

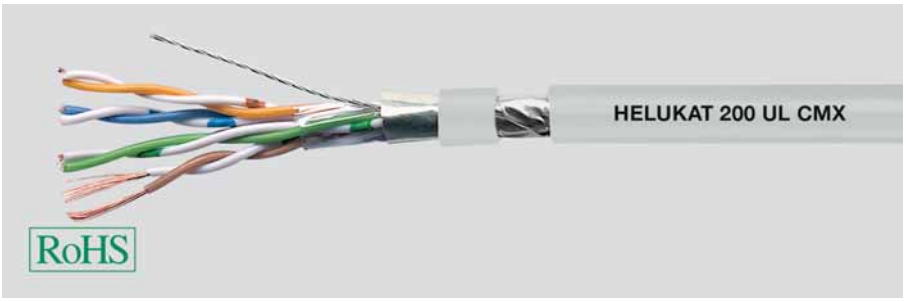
# LAN Cable

**Category 5e**

## HELUKAT® 200

F/UTP Flex, UL

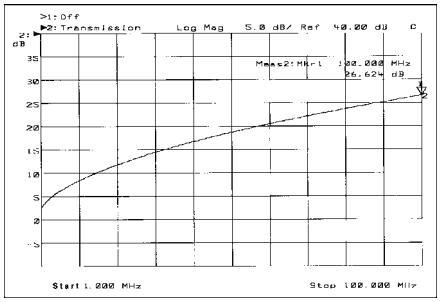





## Cable structure

## F/UTP 4x2xAWG 26/7 PVC, UL

| | |
|---|---|
| Inner conductor Ø: | 0,48 mm |
| Conductor material: | Copper, bare |
| Core insulation: | PE |
| Core colours: | whbu/bu, whog/og, whgn/gn, whbn/bn |
| Separator: | - |
| Screen over stranding element: | - |
| Screen 1 over stranding: | Al-Foil |
| Screen 2 over stranding: | - |
| Drain wire: | yes |
| Outer sheath material: | PVC |
| Outer diameter: | app. 5,4 mm |
| Outer sheath colour: | Grey similar to RAL 7035 |




## Electrical data

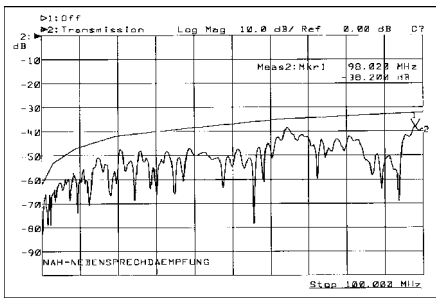
| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz<br>100 Ohm ± 20 Ohm at 101 to 200 MHz |
| Loop resistance: | 290 Ohm/km max. |
| Mutual capacitance: | 50 nF/km nom. |
| Rel. propagation velocity: | 67 % |

## Typical values

| Frequency | (MHz) | 10 | 16 | 62,5 | 100 | 200 |
|---|---|---|---|---|---|---|
| Attenuation | (dB/10m) | 0,9 | 1,2 | 2,4 | 3,1 | 3,9 |
| Next | (dB) | 62,0 | 60,0 | 50,0 | 48,0 | 45,0 |
| ACR | (dB) | 61,1 | 58,8 | 47,6 | 44,9 | 41,1 |

## Technical data

| | |
|---|---|
| Weight: | app. 30 kg/km |
| bending radius, repeated: | 44 mm |
| Operating temperature range min.: | -20°C |
| Operating temperature range max.: | +60°C |
| Caloric load, approx. value: | 0,40 MJ/m |
| Copper weight: | 15,00 kg/km |




## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 5e, Flame-retardant acc. to IEC 60332-1-2, Smoke density acc. to IEC 61034, CMX 444

## Application

HELUKAT®200 data cables are used in the tertiary level of a network as patch cables and connection cables. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as Gigabit Ethernet, Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s, or ISDN absolutely trouble-free. With its optimized construction, the HELUKAT®200 series can be manufactured quickly and easily with all common RJ45 plugs. This type is certified according UL because of the special PVC jacket.

## Part no.

**802173,** F/UTP 4x2xAWG26/7 PVC UL (FTP)

Dimensions and specifications may be changed without prior notice.



DNB Edition 11 (published 01.10.2015)

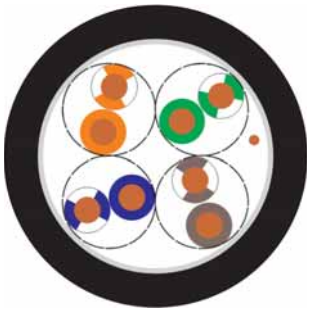
# LAN-Cable, Outdoor

**Category 5e**

HELUKAT® 200A

F/UTP

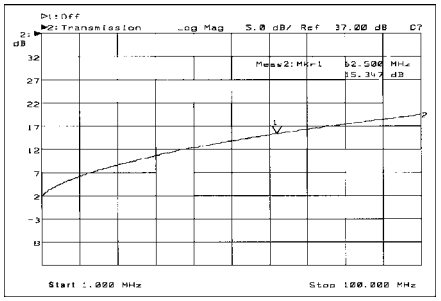
NEW




## Cable structure

**F/UTP 4x2xAWG 24/1 PE**

| | |
|---|---|
| Inner conductor Ø: | 0,55 mm |
| Conductor material: | Copper, bare |
| Core insulation: | PE |
| Core colours: | whbu/bu, whog/og, whgn/gn, whbn/bn |
| Separator: | - |
| Screen over stranding element: | Al-Foil |
| Screen 1 over stranding: | - |
| Screen 2 over stranding: | - |
| Drain wire: | yes |
| Outer sheath material: | PE |
| Outer diameter: | app. 8,0 mm |
| Outer sheath colour: | Black similar to RAL 9005 |



## Electrical data

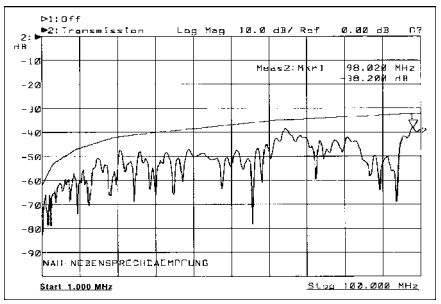
| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz<br>100 Ohm ± 20 Ohm at 101 to 200 MHz |
| Loop resistance: | 190 Ohm/km max. |
| Mutual capacitance: | 45 nF/km nom. |
| Rel. propagation velocity: | 67 % |

## Typical values

| Frequency | (MHz) | 10 | 16 | 62,5 | 100 | 155 | 200 |
|---|---|---|---|---|---|---|---|
| Attenuation | (dB/100m) | 5,6 | 7,2 | 14,4 | 18,2 | 22,9 | 24,2 |
| Next | (dB) | 70,0 | 68,0 | 56,0 | 50,0 | 45,0 | 42,0 |
| ACR | (dB) | 64,4 | 60,8 | 41,6 | 31,8 | 22,1 | 17,8 |

## Technical data

| | |
|---|---|
| Weight: | app. 100 kg/km |
| bending radius, repeated: | 65 mm |
| Operating temperature range min.: | -30°C |
| Operating temperature range max.: | +70°C |
| Copper weight: | 18,00 kg/km |



## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 5e, Halogen-free acc. to 60754-2

## Application

HELUKAT® 200A outdoor data cables are used in the tertiary level of a network. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as Gigabit Ethernet, Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s, or ISDN absolutely trouble-free. Likewise, the mechanical characteristics are perfectly suited for the application in ducts or along buildings due to their optimized construction.

## Part no.

**805572,** F/UTP 4x2xAWG 24/1 PE (FTP)

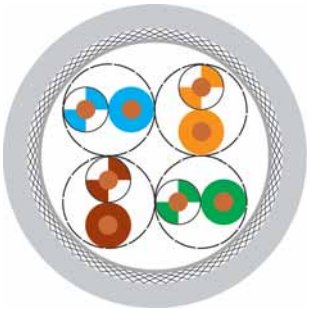
Dimensions and specifications may be changed without prior notice.

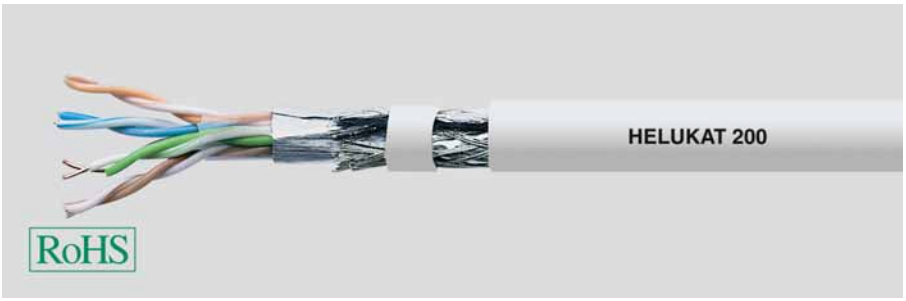
# LAN Cable

**Category 5e**

HELUKAT® 200

SF/UTP

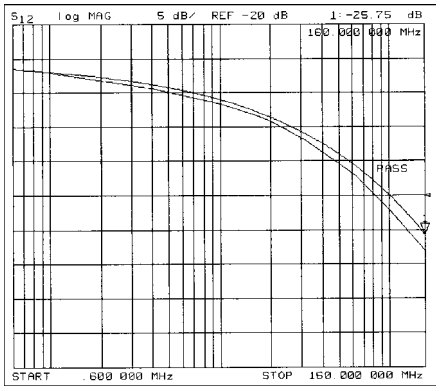





## Cable structure

## SF/UTP 4x2xAWG 24/1 PVC

| | |
|---|---|
| Inner conductor Ø: | 0,51 mm |
| Conductor material: | Copper, bare |
| Core insulation: | Foam-skin-PE |
| Core colours: | whbu/bu, whog/og, whgn/gn, whbn/bn |
| Separator: | - |
| Screen over stranding element: | - |
| Screen 1 over stranding: | Al-Foil |
| Screen 2 over stranding: | Cu braid |
| Outer sheath material: | PVC / FRNC |
| Outer diameter: | app. 6,0 mm / app. 6,0 mm |
| Outer sheath colour: | Grey similar to RAL 7035 |




## Electrical data

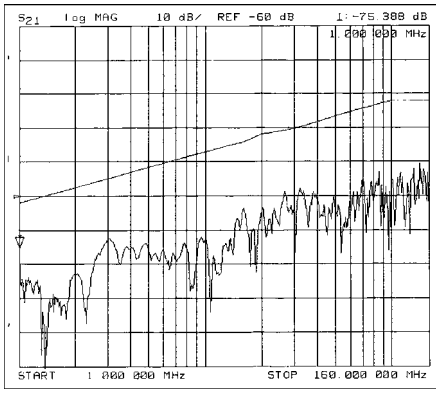
| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz<br>100 Ohm ± 20 Ohm at 101 to 200 MHz |
| Loop resistance: | 185 Ohm/km max. |
| Mutual capacitance: | 48 nF/km nom. |
| Rel. propagation velocity: | 74 % |

## Typical values

| Frequency | (MHz) | 10 | 16 | 62,5 | 100 | 200 |
|---|---|---|---|---|---|---|
| Attenuation | (dB/100m) | 5,6 | 7,2 | 14,4 | 18,2 | 25,9 |
| Next | (dB) | 62,0 | 59,0 | 50,0 | 46,0 | 40,0 |
| ACR | (dB) | 56,4 | 51,8 | 35,6 | 27,8 | 14,6 |

## Technical data

| | |
|---|---|
| Weight: | app. 50 kg/km |
| bending radius, repeated: | 52 mm |
| Operating temperature range min.: | -20°C |
| Operating temperature range max.: | +60°C |
| Caloric load, approx. value: | 0,60 MJ/m / 0,48 MJ/m |
| Copper weight: | 28,00 kg/km |




## Norms

81610:
Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 5e
81609:
Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 5e, Flame-retardant: acc. to IEC 60332-3, Smoke density acc. to IEC 61034, Halogen-free acc. to 60754-2, Corrosiveness acc. to EN50267-2-3

## Application

HELUKAT®200 data cables are used in the tertiary, but also in the secondary level of a network. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as Gigabit Ethernet, Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s, or ISDN absolutely trouble-free. Likewise, the mechanical characteristics are perfectly suited for the application in tight cable channels and platforms due to their optimized construction.

## Part no.

**81610,** SF/UTP 4x2xAWG 24/1 PVC (S-FTP) **81609,** SF/UTP 4x2xAWG 24/1 FRNC (S-FTP)

Dimensions and specifications may be changed without prior notice.



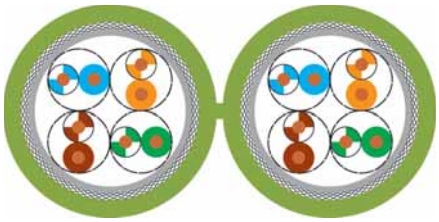
DNB Edition 11 (published 01.10.2015)

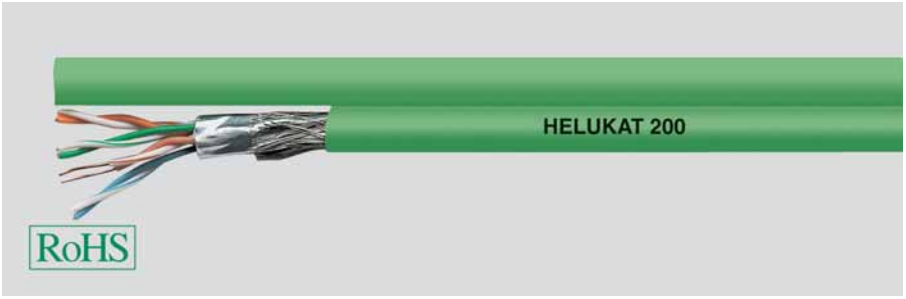
# LAN Cable

**Category 5e**

## HELUKAT® 200

SF/UTP duplex

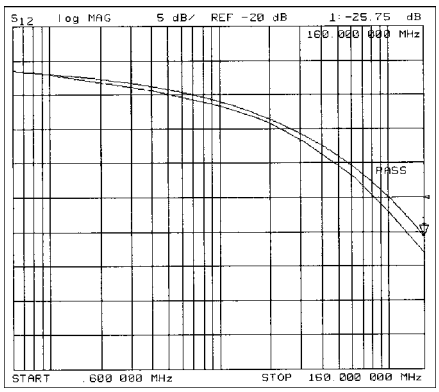





## Cable structure

## SF/UTP 2x(4x2xAWG 24/1) FRNC

| | |
|---|---|
| Inner conductor Ø: | 0,51 mm |
| Conductor material: | Copper, bare |
| Core insulation: | Foam-skin-PE |
| Core colours: | whbu/bu, whog/og, whgn/gn, whbn/bn |
| Separator: | - |
| Screen over stranding element: | - |
| Screen 1 over stranding: | Al-Foil |
| Screen 2 over stranding: | Cu braid |
| Outer sheath material: | FRNC |
| Cable dimensions: | app. 6,0 mm x 12,5 mm |
| Outer sheath colour: | Green similar to RAL 6018 |




## Electrical data

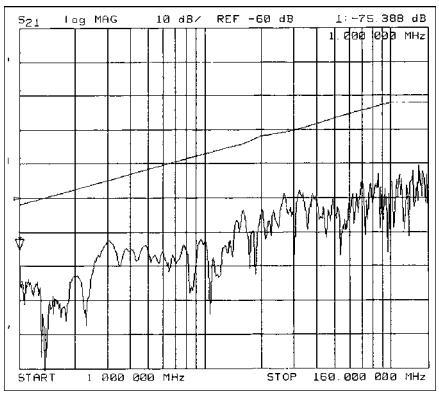
| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz<br>100 Ohm ± 20 Ohm at 101 to 200 MHz |
| Loop resistance: | 185 Ohm/km max. |
| Mutual capacitance: | 48 nF/km nom. |
| Rel. propagation velocity: | 74 % |

## Typical values

| | | | | | | |
|---|---|---|---|---|---|---|
| Frequency | (MHz) | 10 | 16 | 62,5 | 100 | 200 |
| Attenuation | (dB/100m) | 5,6 | 7,2 | 14,4 | 18,2 | 25,9 |
| Next | (dB) | 62,0 | 59,0 | 50,0 | 46,0 | 40,0 |
| ACR | (dB) | 56,4 | 51,8 | 35,6 | 27,8 | 14,6 |

## Technical data

| | |
|---|---|
| Weight: | app. 100 kg/km |
| bending radius, repeated: | 52 mm |
| Operating temperature range min.: | -20°C |
| Operating temperature range max.: | +60°C |
| Caloric load, approx. value: | 0,96 MJ/m |
| Copper weight: | 56,00 kg/km |




## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 5e, Flame-retardant acc. to IEC 60332-3, Smoke density acc. to IEC 61034, Halogen-free acc. to 60754-2, Corrosiveness acc. to EN50267-2-3

## Application

HELUKAT®200 data cables are used in the tertiary, but also in the secondary level of a network. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as Gigabit Ethernet, Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s, or ISDN absolutely trouble-free. Likewise, the mechanical characteristics are perfectly suited for the application in tight cable channels and platforms due to their optimized construction.

## Part no.

**81123,** SF/UTP 2x(4x2xAWG 24/1) FRNC (S-FTP)

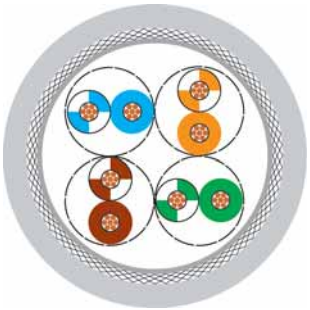
Dimensions and specifications may be changed without prior notice.

# LAN Cable

**Category 5e**

## HELUKAT® 200

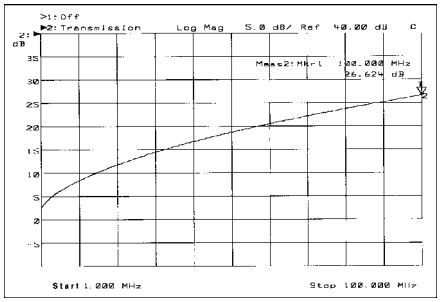
SF/UTP flex




## Cable structure

**SF/UTP 4x2xAWG 26/7 FRNC**

| | |
|---|---|
| Inner conductor Ø: | 0,48 mm |
| Conductor material: | Copper, bare |
| Core insulation: | Foam-skin-PE |
| Core colours: | whbu/bu, whog/og, whgn/gn, whbn/bn |
| Separator: | - |
| Screen over stranding element: | - |
| Screen 1 over stranding: | Al-Foil |
| Screen 2 over stranding: | Cu braid |
| Outer sheath material: | FRNC |
| Outer diameter: | app. 5,4 mm |
| Outer sheath colour: | Grey similar to RAL 7035 |




## Electrical data

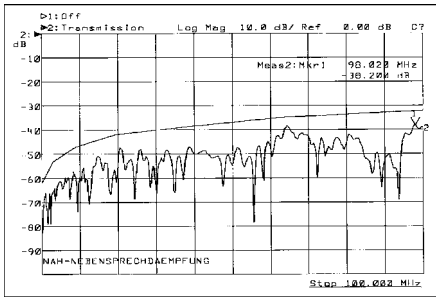
| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz<br>100 Ohm ± 20 Ohm at 101 to 200 MHz |
| Loop resistance: | 300 Ohm/km max. |
| Mutual capacitance: | 47 nF/km nom. |
| Rel. propagation velocity: | 69 % |

## Typical values

| Frequency | (MHz) | 10 | 16 | 62,5 | 100 | 200 |
|---|---|---|---|---|---|---|
| Attenuation | (dB/10m) | 0,8 | 1,1 | 2,4 | 2,9 | 4,3 |
| Next | (dB) | 58,0 | 56,0 | 45,0 | 43,0 | 37,0 |
| ACR | (dB) | 57,2 | 54,9 | 42,6 | 40,1 | 32,7 |

## Technical data

| | |
|---|---|
| Weight: | app. 40 kg/km |
| bending radius, repeated: | 46 mm |
| Operating temperature range min.: | -20°C |
| Operating temperature range max.: | +60°C |
| Caloric load, approx. value: | 0,543 MJ/m |
| Copper weight: | 24,00 kg/km |




## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 5e, Flame-retardant acc. to IEC 60332-1-2, Smoke density acc. to IEC 61034, Halogen-free acc. to 60754-2, Corrosiveness acc. to EN50267-2-3

## Application

HELUKAT®200 data cables are used in the tertiary level of a network as patch cables and connection cables. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as Gigabit Ethernet, Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s, or ISDN absolutely trouble-free. With its optimized construction, the HELUKAT®200 series can be manufactured quickly and easily with all common RJ45 plugs.

## Part no.

**81254,** SF/UTP 4x2xAWG 26/7 FRNC (S-FTP)

Dimensions and specifications may be changed without prior notice.



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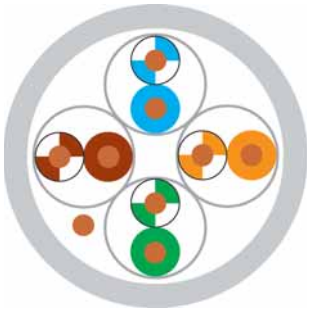
# LAN Cable

**Category 6**

## HELUKAT® 300

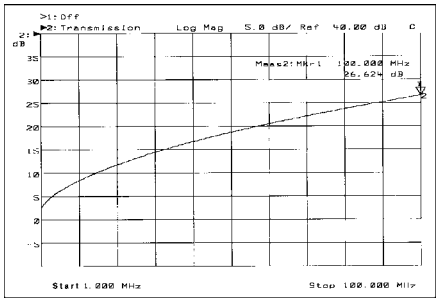
U/FTP, UL




## Cable structure

## U/FTP 4x2xAWG 26/7 PVC, UL

| | |
|---|---|
| Inner conductor Ø: | 0,48 mm |
| Conductor material: | Copper, bare |
| Core insulation: | Foam-skin-PE |
| Core colours: | whbu/bu, whog/og, whgn/gn, whbn/bn |
| Separator: | Polyester foil over stranded bundle |
| Screen over stranding element: | Al-Foil |
| Screen 1 over stranding: | - |
| Screen 2 over stranding: | - |
| Drain wire: | yes |
| Outer sheath material: | PVC |
| Outer diameter: | app. 5,9 mm |
| Outer sheath colour: | Grey similar to RAL 7035 |



## Electrical data

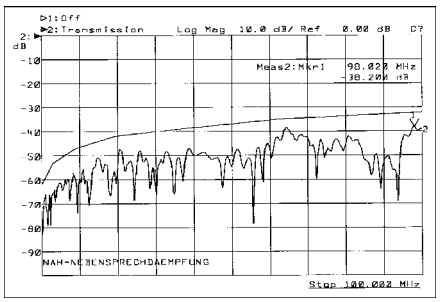
| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz<br>100 Ohm ± 20 Ohm at 101 to 300 MHz |
| Loop resistance: | 290 Ohm/km max. |
| Mutual capacitance: | 45 nF/km nom. |
| Rel. propagation velocity: | 77 % |

## Typical values

| Frequency | (MHz) | 10 | 16 | 62,5 | 100 | 200 | 300 |
|---|---|---|---|---|---|---|---|
| Attenuation | (dB/10m) | 0,9 | 1,1 | 2,2 | 2,7 | 3,9 | 4,7 |
| Next | (dB) | 90,0 | 88,0 | 83,0 | 80,0 | 76,0 | 73,0 |
| ACR | (dB) | 89,1 | 86,9 | 80,8 | 77,3 | 72,1 | 68,3 |

## Technical data

| | |
|---|---|
| Weight: | app. 37 kg/km |
| bending radius, repeated: | 48 mm |
| Operating temperature range min.: | -20°C |
| Operating temperature range max.: | +60°C |
| Caloric load, approx. value: | 0,41 MJ/m |
| Copper weight: | 20,00 kg/km |



## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 6, Flame-retardant acc. to IEC 60332-1-2, Smoke density acc. to IEC 61034, CMX 444

## Application

HELUKAT®300 data cables are used in the tertiary level of a network as patch cables and connection cables. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as Gigabit Ethernet, Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s, or ISDN absolutely trouble-free. With its optimized construction, the HELUKAT®300 series can be manufactured quickly and easily with all common RJ45 plugs. This type is certified according UL because of the special PVC jacket.

## Part no.

**802174,** U/FTP 4x2xAWG 26/7 PVC

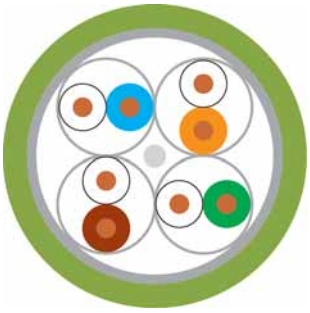
Dimensions and specifications may be changed without prior notice.

# LAN Cable

**Category 6**

HELUKAT® 450

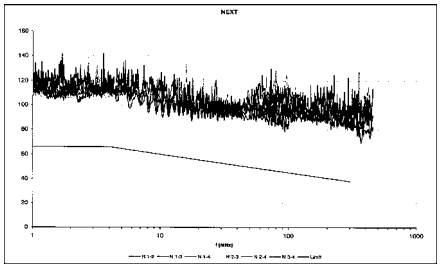
F/FTP




## Cable structure

## F/FTP 4x2xAWG 24/1 FRNC

| | |
|---|---|
| Inner conductor Ø: | 0,52 mm |
| Conductor material: | Copper, bare |
| Core insulation: | Foam-skin-PE |
| Core colours: | wh/bu, wh/og, wh/gn, wh/bn |
| Separator: | - |
| Screen over stranding element: | Al-Foil |
| Screen 1 over stranding: | Al-Foil |
| Screen 2 over stranding: | - |
| Drain wire: | yes |
| Outer sheath material: | FRNC |
| Outer diameter: | app. 7,4 mm |
| Outer sheath colour: | Green similar to RAL 6018 |




## Electrical data

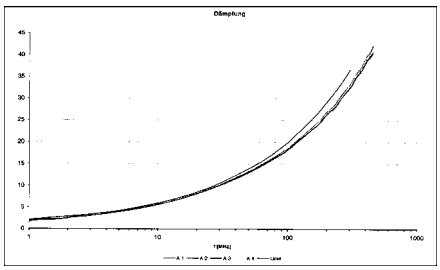
| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz<br>100 Ohm ± 20 Ohm at 101 to 450 MHz |
| Loop resistance: | 165 Ohm/km max. |
| Mutual capacitance: | 43 nF/km nom. |
| Rel. propagation velocity: | 79 % |

## Typical values

| Frequency | (MHz) | 10 | 16 | 62,5 | 100 | 200 | 300 | 450 |
|---|---|---|---|---|---|---|---|---|
| Attenuation | (dB/100m) | 5,4 | 7,0 | 13,8 | 17,6 | 26,0 | 34,0 | 38,5 |
| Next | (dB) | 100,0 | 100,0 | 95,8 | 94,5 | 91,0 | 87,0 | 84,3 |
| ACR | (dB) | 94,6 | 93,0 | 82,0 | 76,9 | 65,0 | 53,0 | 45,8 |

## Technical data

| | |
|---|---|
| Weight: | app. 50 kg/km |
| bending radius, repeated: | 59 mm |
| Operating temperature range min.: | -20°C |
| Operating temperature range max.: | +60°C |
| Caloric load, approx. value: | 0,57 MJ/m |
| Copper weight: | 24,00 kg/km |




## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 6, Flame-retardant acc. to IEC 60332-3, Smoke density acc. to IEC 61034, Halogen-free acc. to 60754-2, Corrosiveness acc. to EN50267-2-3

## Application

HELUKAT®450 data cables are used in the tertiary, but also in the secondary level of a network. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as Gigabit Ethernet, Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s or ISDN absolutely trouble-free. Likewise, the mechanical characteristics are perfectly suited for the application in tight cable channels and platforms due to their optimized construction.

## Part no.

**82501,** F/FTP 4x2xAWG 24/1 FRNC (S-STP)

Dimensions and specifications may be changed without prior notice.



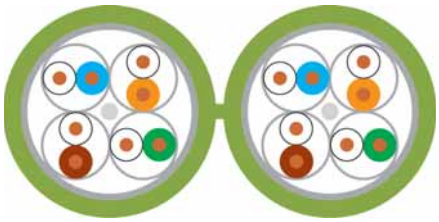
DNB Edition 11 (published 01.10.2015)

# LAN Cable

**Category 6**

## HELUKAT® 450

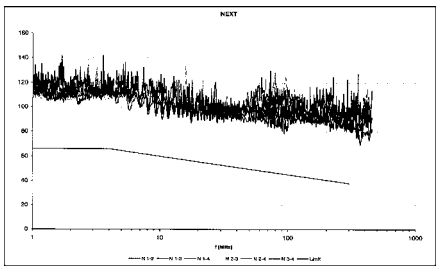
F/FTP duplex




## Cable structure

## F/FTP 2x(4x2xAWG 24/1) FRNC

| | |
|---|---|
| Inner conductor Ø: | 0,52 mm |
| Conductor material: | Copper, bare |
| Core insulation: | Foam-skin-PE |
| Core colours: | wh/bu, wh/og, wh/gn, wh/bn |
| Separator: | - |
| Screen over stranding element: | Al-Foil |
| Screen 1 over stranding: | Al-Foil |
| Screen 2 over stranding: | - |
| Drain wire: | yes |
| Outer sheath material: | FRNC |
| Cable dimensions: | app. 7,4 mm x 15,0 mm |
| Outer sheath colour: | Green similar to RAL 6018 |



## Electrical data

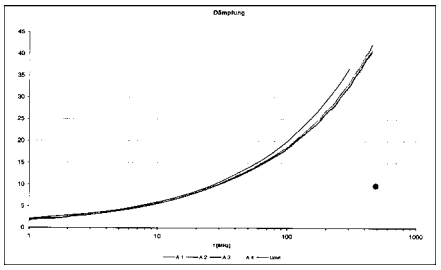
| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz<br>100 Ohm ± 20 Ohm at 101 to 450 MHz |
| Loop resistance: | 165 Ohm/km max. |
| Mutual capacitance: | 43 nF/km nom. |
| Rel. propagation velocity: | 79 % |

## Typical values

| Frequency | (MHz) | 10 | 16 | 62,5 | 100 | 200 | 300 | 450 |
|---|---|---|---|---|---|---|---|---|
| Attenuation | (dB/100m) | 5,4 | 7,0 | 13,8 | 17,6 | 26,0 | 34,0 | 38,5 |
| Next | (dB) | 100,0 | 100,0 | 95,8 | 94,5 | 91,0 | 87,0 | 84,3 |
| ACR | (dB) | 94,6 | 93,0 | 82,0 | 76,9 | 65,0 | 53,0 | 45,8 |

## Technical data

| | |
|---|---|
| Weight: | app. 100 kg/km |
| bending radius, repeated: | 59 mm |
| Operating temperature range min.: | -20°C |
| Operating temperature range max.: | +60°C |
| Caloric load, approx. value: | 1,14 MJ/m |
| Copper weight: | 48,00 kg/km |



## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 6, Flame-retardant acc. to IEC 60332-3, Smoke density acc. to IEC 61034, Halogen-free acc. to 60754-2, Corrosiveness acc. to EN50267-2-3

## Application

HELUKAT®450 data cables are used in the tertiary, but also in the secondary level of a network. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as Gigabit Ethernet, Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s or ISDN absolutely trouble-free. Likewise, the mechanical characteristics are perfectly suited for the application in tight cable channels and platforms due to their optimized construction.

## Part no.

**82502,** F/FTP 2x4x2xAWG 24/1 FRNC (S-STP)

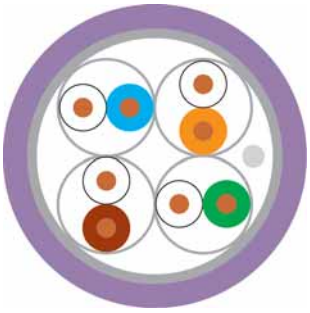
Dimensions and specifications may be changed without prior notice.

# LAN Cable

**Category $6_A$**

HELUKAT® 500

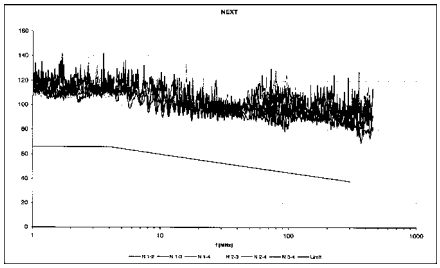
F/FTP




## Cable structure

## F/FTP 4x2xAWG 23/1 LSZH

| | |
|---|---|
| Inner conductor Ø: | 0,57 mm |
| Conductor material: | Copper, bare |
| Core insulation: | Foam-skin-PE |
| Core colours: | wh/bu, wh/og, wh/gn, wh/bn |
| Separator: | - |
| Screen over stranding element: | Al-Foil |
| Screen 1 over stranding: | Al-Foil |
| Screen 2 over stranding: | - |
| Drain wire: | yes |
| Outer sheath material: | LSZH |
| Outer diameter: | app. 7,5 mm |
| Outer sheath colour: | Blue Lilac similar to RAL 4005 |




## Electrical data

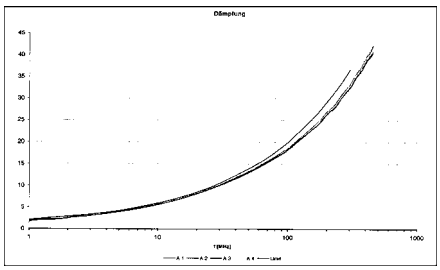
| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz<br>100 Ohm ± 20 Ohm at 101 to 500 MHz |
| Loop resistance: | 160 Ohm/km max. |
| Mutual capacitance: | 45 nF/km nom. |
| Rel. propagation velocity: | 80 % |

## Typical values

| Frequency | (MHz) | 10 | 16 | 62,5 | 100 | 200 | 250 | 300 | 500 |
|---|---|---|---|---|---|---|---|---|---|
| Attenuation | (dB/100m) | 5,7 | 7,2 | 14,2 | 18,1 | 25,8 | 29,0 | 31,9 | 41,8 |
| Next | (dB) | 100,0 | 100,0 | 100,0 | 97,4 | 92,9 | 91,4 | 90,2 | 86,9 |
| ACR | (dB) | 94,3 | 92,8 | 85,8 | 79,3 | 67,1 | 62,4 | 58,3 | 45,1 |

## Technical data

| | |
|---|---|
| Weight: | app. 50 kg/km |
| bending radius, repeated: | 100 mm |
| Operating temperature range min.: | -20°C |
| Operating temperature range max.: | +60°C |
| Caloric load, approx. value: | 0,55 MJ/m |
| Copper weight: | 26,00 kg/km |




## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category $6_A$, Flame-retardant acc. to IEC 60332-3, Smoke density acc. to IEC 61034, Halogen-free acc. to 60754-2, Corrosiveness acc. to EN50267-2-3

## Application

HELUKAT® 500 data cables are used in the tertiary, but also in the secondary level of a network. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as 10Gigabit Ethernet, Gigabit Ethernet, Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s or ISDN absolutely trouble-free. Likewise, the mechanical characteristics are perfectly suited for the application in tight cable channels and platforms due to their optimized construction.

## Part no.

**803378,** F/FTP 4x2xAWG 23/1 LSZH (S-STP)

Dimensions and specifications may be changed without prior notice.



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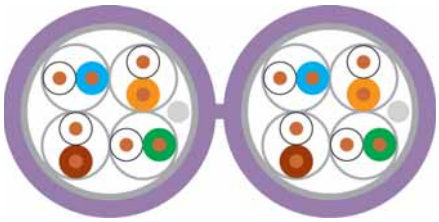
# LAN Cable

**Category $6_A$**

HELUKAT® 500

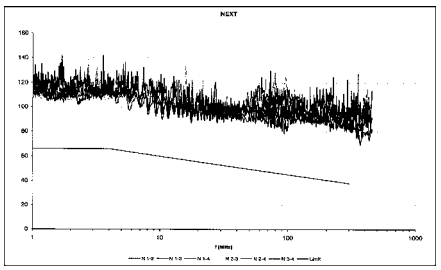
F/FTP duplex




## Cable structure

## F/FTP 2x(4x2xAWG 23/1) LSZH (S-STP)

| | |
|---|---|
| Inner conductor Ø: | 0,57 mm |
| Conductor material: | Copper, bare |
| Core insulation: | Foam-skin-PE |
| Core colours: | wh/bu, wh/og, wh/gn, wh/bn |
| Separator: | - |
| Screen over stranding element: | Al-Foil |
| Screen 1 over stranding: | Al-Foil |
| Screen 2 over stranding: | - |
| Drain wire: | yes |
| Outer sheath material: | LSZH |
| Cable dimensions: | app. 7,8 mm x 15,9 mm |
| Outer sheath colour: | Blue Lilac similar to RAL 4005 |




## Electrical data

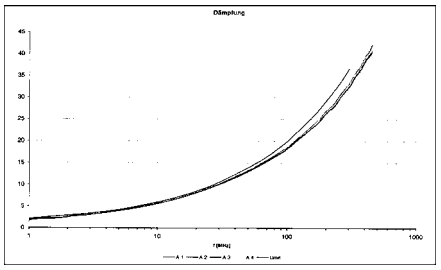
| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz<br>100 Ohm ± 20 Ohm at 101 to 500 MHz |
| Loop resistance: | 160 Ohm/km max. |
| Mutual capacitance: | 45 nF/km nom. |
| Rel. propagation velocity: | 80 % |

## Typical values

| Frequency | (MHz) | 10 | 16 | 62,5 | 100 | 200 | 250 | 300 | 500 |
|---|---|---|---|---|---|---|---|---|---|
| Attenuation | (dB/100m) | 5,7 | 7,2 | 14,2 | 18,1 | 25,8 | 29,0 | 31,9 | 41,8 |
| Next | (dB) | 100,0 | 100,0 | 100,0 | 97,4 | 92,9 | 91,4 | 90,2 | 86,9 |
| ACR | (dB) | 94,3 | 92,8 | 85,8 | 79,3 | 67,1 | 62,4 | 58,3 | 45,1 |

## Technical data

| | |
|---|---|
| Weight: | app. 100 kg/km |
| bending radius, repeated: | 100 mm |
| Operating temperature range min.: | -20°C |
| Operating temperature range max.: | +60°C |
| Caloric load, approx. value: | 1,13 MJ/m |
| Copper weight: | 52,00 kg/km |




## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category $6_A$, Flame-retardant acc. to IEC 60332-3, Smoke density acc. to IEC 61034, Halogen-free acc. to 60754-2, Corrosiveness acc. to EN50267-2-3

## Application

HELUKAT® 500 data cables are used in the tertiary, but also in the secondary level of a network. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as 10Gigabit Ethernet, Gigabit Ethernet, Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s or ISDN absolutely trouble-free. Likewise, the mechanical characteristics are perfectly suited for the application in tight cable channels and platforms due to their optimized construction.

## Part no.

**803379,** F/FTP 2x4x2xAWG 23/1 LSZH (S-STP)

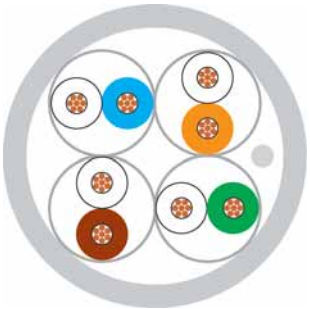
Dimensions and specifications may be changed without prior notice.

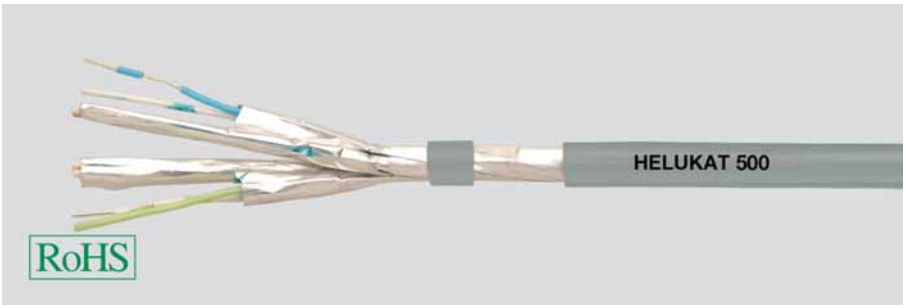
# LAN Cable

**Category $6_A$**

## HELUKAT® 500

U/FTP, flex

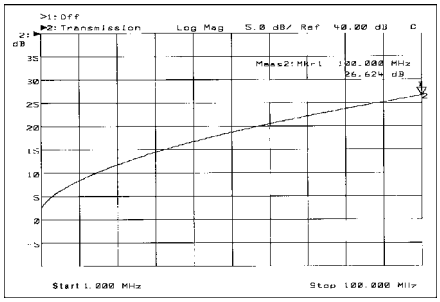





## Cable structure

## U/FTP 4x2xAWG 26/7 (stranded) LSZH

| | |
|---|---|
| Inner conductor Ø: | 0,48 mm |
| Conductor material: | Copper, bare |
| Core insulation: | Foam-skin-PE |
| Core colours: | wh/bu, wh/og, wh/gn, wh/bn |
| Separator: | - |
| Screen over stranding element: | Al-Foil |
| Screen 1 over stranding: | - |
| Screen 2 over stranding: | - |
| Drain wire: | yes |
| Outer sheath material: | LSZH |
| Outer diameter: | app. 5,8 mm |
| Outer sheath colour: | Grey similar to RAL 7035 |




## Electrical data

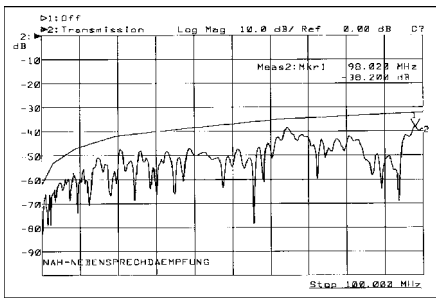
| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz<br>100 Ohm ± 20 Ohm at 101 to 500 MHz |
| Loop resistance: | 330 Ohm/km max. |
| Mutual capacitance: | 54 nF/km nom. |
| Rel. propagation velocity: | 78 % |

## Typical values

| Frequency | (MHz) | 10 | 16 | 62,5 | 100 | 200 | 250 | 500 |
|---|---|---|---|---|---|---|---|---|
| Attenuation | (dB/10m) | 0,8 | 1,1 | 2,1 | 2,7 | 3,9 | 4,4 | 6,3 |
| Next | (dB) | 100,0 | 100,0 | 100,0 | 97,0 | 92,0 | 91,0 | 86,0 |
| ACR | (dB) | 99,2 | 98,9 | 97,9 | 94,3 | 88,1 | 86,6 | 79,7 |

## Technical data

| | |
|---|---|
| Weight: | app. 35 kg/km |
| bending radius, repeated: | 49 mm |
| Operating temperature range min.: | -20°C |
| Operating temperature range max.: | +60°C |
| Caloric load, approx. value: | 0,39 MJ/m |
| Copper weight: | 15,00 kg/km |




## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category $6_A$, Flame-retardant acc. to IEC 60332-1-2, Smoke density acc. to IEC 61034, Halogen-free acc. to 60754-2, Corrosiveness acc. to EN50267-2-3

## Application

HELUKAT® 500 data cables are used in the tertiary level of a network as patch cables and connection cables. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as 10Gigabit Ethernet, Gigabit Ethernet, Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s or ISDN absolutely trouble-free. With its optimized construction, the HELUKAT®500 series can be manufactured quickly and easily with many common RJ45 plugs.

## Part no.

**804043,** U/FTP 4x2xAWG 26/7 LSZH

Dimensions and specifications may be changed without prior notice.



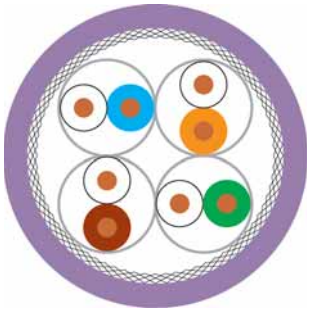
DNB Edition 11 (published 01.10.2015)

# LAN Cable

**Category 7e**

HELUKAT® 600

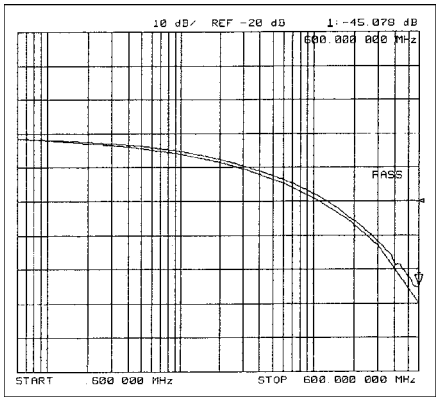
S/FTP




## Cable structure

## S/FTP 4x2xAWG 23/1 FRNC

| | |
|---|---|
| Inner conductor Ø: | 0,57 mm |
| Conductor material: | Copper, bare |
| Core insulation: | Foam-skin-PE |
| Core colours: | wh/bu, wh/og, wh/gn, wh/bn |
| Separator: | - |
| Screen over stranding element: | Al-Foil |
| Screen 1 over stranding: | Cu braid |
| Screen 2 over stranding: | - |
| Outer sheath material: | FRNC |
| Outer diameter: | app. 7,5 mm |
| Outer sheath colour: | Blue Lilac similar to RAL 4005 |




## Electrical data

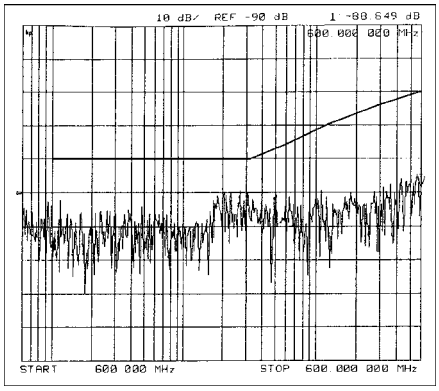
| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz<br>100 Ohm ± 20 Ohm at 101 to 1000 MHz |
| Loop resistance: | 169 Ohm/km max. |
| Mutual capacitance: | 43 nF/km nom. |
| Rel. propagation velocity: | 79 % |

## Typical values

| Frequency | (MHz) | 10 | 16 | 62,5 | 100 | 200 | 300 | 600 | 900 | 1000 |
|---|---|---|---|---|---|---|---|---|---|---|
| Attenuation | (dB/100m) | 5,6 | 7,1 | 13,9 | 17,5 | 25,2 | 32,1 | 44,9 | 55,0 | 58,0 |
| Next | (dB) | 100,0 | 100,0 | 96,0 | 94,0 | 88,0 | 84,0 | 73,0 | 71,0 | 69,0 |
| ACR | (dB) | 94,4 | 92,9 | 82,1 | 76,5 | 62,8 | 51,9 | 28,1 | 16,0 | 9,0 |

## Technical data

| | |
|---|---|
| Weight: | app. 60 kg/km |
| bending radius, repeated: | 60 mm |
| Operating temperature range min.: | -20°C |
| Operating temperature range max.: | +60°C |
| Caloric load, approx. value: | 0,60 MJ/m |
| Copper weight: | 28,00 kg/km |




## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 7e, Flame-retardant acc. to IEC 60332-3, Smoke density acc. to IEC 61034, Halogen-free acc. to 60754-2, Corrosiveness acc. to EN50267-2-3

## Application

HELUKAT®600 data cables are used in the tertiary, but also in the secondary level of a network. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as Gigabit Ethernet, Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s or ISDN absolutely trouble-free. Likewise, the mechanical characteristics are perfectly suited for the application in tight cable channels and platforms due to their optimized construction.

## Part no.

**80810,** S/FTP 4x2xAWG 23/1 FRNC (S-STP)

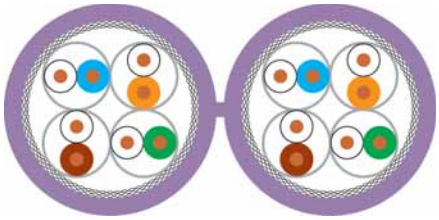
Dimensions and specifications may be changed without prior notice.

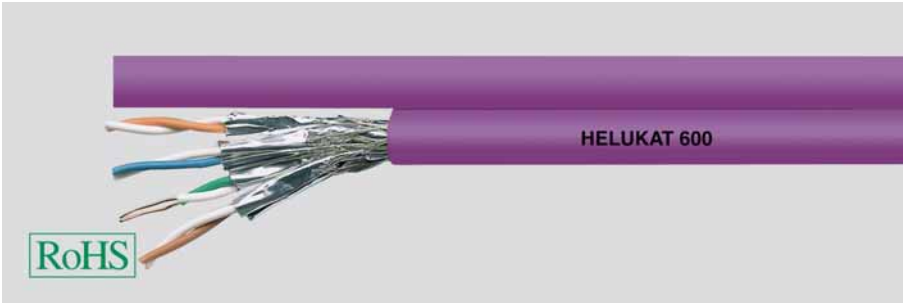
# LAN Cable

**Category 7e**

## HELUKAT® 600

S/FTP duplex

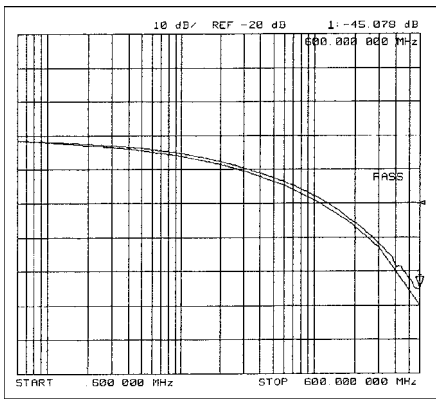





## Cable structure

**S/FTP 2x(4x2xAWG 23/1) FRNC**

| | |
|---|---|
| Inner conductor Ø: | 0,57 mm |
| Conductor material: | Copper, bare |
| Core insulation: | Foam-skin-PE |
| Core colours: | wh/bu, wh/og, wh/gn, wh/bn |
| Separator: | - |
| Screen over stranding element: | Al-Foil |
| Screen 1 over stranding: | Cu braid |
| Screen 2 over stranding: | - |
| Outer sheath material: | FRNC |
| Cable dimensions: | app. 7,5 mm x 16,0 mm |
| Outer sheath colour: | Blue Lilac similar to RAL 4005 |




## Electrical data

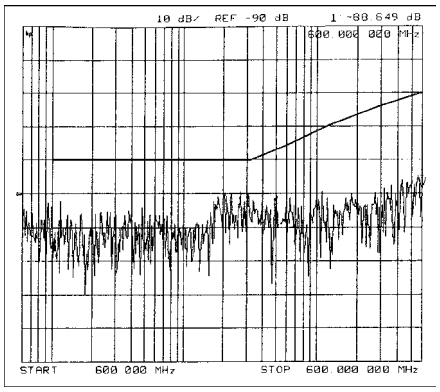
| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz<br>100 Ohm ± 20 Ohm at 101 to 1000 MHz |
| Loop resistance: | 169 Ohm/km max. |
| Mutual capacitance: | 43 nF/km nom. |
| Rel. propagation velocity: | 79 % |

## Typical values

| Frequency | (MHz) | 10 | 16 | 62,5 | 100 | 200 | 300 | 600 | 900 | 1000 |
|---|---|---|---|---|---|---|---|---|---|---|
| Attenuation | (dB/100m) | 5,6 | 7,1 | 13,9 | 17,5 | 25,2 | 32,1 | 44,9 | 55,0 | 58,0 |
| Next | (dB) | 100,0 | 100,0 | 96,0 | 94,0 | 88,0 | 84,0 | 73,0 | 71,0 | 69,0 |
| ACR | (dB) | 94,4 | 92,9 | 82,1 | 76,5 | 62,8 | 51,9 | 28,1 | 16,0 | 9,0 |

## Technical data

| | |
|---|---|
| Weight: | app. 120 kg/km |
| bending radius, repeated: | 60 mm |
| Operating temperature range min.: | -20°C |
| Operating temperature range max.: | +60°C |
| Caloric load, approx. value: | 1,20 MJ/m |
| Copper weight: | 56,00 kg/km |




## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 7e, Flame-retardant acc. to IEC 60332-3, Smoke density acc. to IEC 61034, Halogen-free acc. to 60754-2, Corrosiveness acc. to EN50267-2-3

## Application

HELUKAT®600 data cables are used in the tertiary, but also in the secondary level of a network. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as Gigabit Ethernet, Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s or ISDN absolutely trouble-free. Likewise, the mechanical characteristics are perfectly suited for the application in tight cable channels and platforms due to their optimized construction.

## Part no.

**81446,** S/FTP 2x(4x2xAWG 23/1) FRNC (S-STP)

Dimensions and specifications may be changed without prior notice.



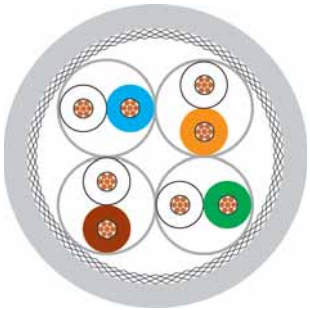
DNB Edition 11 (published 01.10.2015)

# LAN Cable

**Category 7**

## HELUKAT® 600

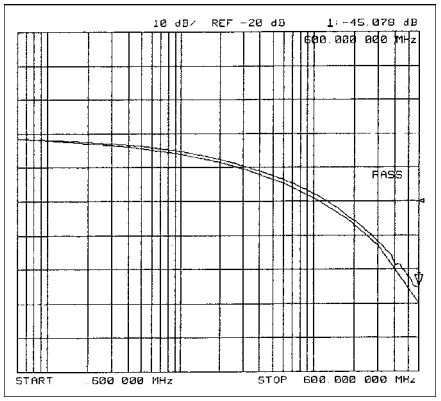
S/FTP flex




## Cable structure

## S/FTP 4x2xAWG 26/7 FRNC

| | |
|---|---|
| Inner conductor Ø: | 0,48 mm |
| Conductor material: | Copper, bare |
| Core insulation: | Foam-skin-PE |
| Core colours: | wh/bu, wh/og, wh/gn, wh/bn |
| Separator: | - |
| Screen over stranding element: | Al-Foil |
| Screen 1 over stranding: | Cu braid |
| Screen 2 over stranding: | - |
| Outer sheath material: | FRNC |
| Outer diameter: | app. 5,9 mm |
| Outer sheath colour: | Grey similar to RAL 7035 |




## Electrical data

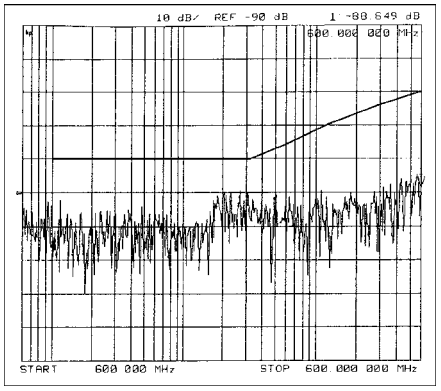
| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz<br>100 Ohm ± 20 Ohm at 101 to 600 MHz |
| Loop resistance: | 290 Ohm/km max. |
| Mutual capacitance: | 45 nF/km nom. |
| Rel. propagation velocity: | 77 % |

## Typical values

| Frequency | (MHz) | 10 | 16 | 62,5 | 100 | 200 | 300 | 600 |
|---|---|---|---|---|---|---|---|---|
| Attenuation | (dB/10m) | 0,8 | 1,0 | 2,0 | 2,6 | 4,0 | 4,9 | 6,3 |
| Next | (dB) | 96,0 | 96,0 | 95,0 | 94,0 | 88,0 | 86,0 | 80,0 |
| ACR | (dB) | 95,2 | 95,0 | 93,0 | 91,4 | 84,0 | 81,1 | 73,7 |

## Technical data

| | |
|---|---|
| Weight: | app. 42 kg/km |
| bending radius, repeated: | 55 mm |
| Operating temperature range min.: | -20°C |
| Operating temperature range max.: | +60°C |
| Caloric load, approx. value: | 0,47 MJ/m |
| Copper weight: | 22,00 kg/km |




## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 7, Flame-retardant acc. to IEC 60332-1-2, Smoke density acc. to IEC 61034, Halogen-free acc. to 60754-2, Corrosiveness acc. to EN50267-2-3

## Application

HELUKAT®600 data cables are used in the tertiary level of a network as patch cables and connection cables. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as Gigabit Ethernet, Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s or ISDN absolutely trouble-free. With its optimized construction, the HELUKAT®600 series can be manufactured quickly and easily with all common RJ45 plugs.

## Part no.

**80294,** S/FTP 4x2xAWG 26/7 FRNC (S-STP)

Dimensions and specifications may be changed without prior notice.

# LAN Cable Outdoor

**Category 7e**

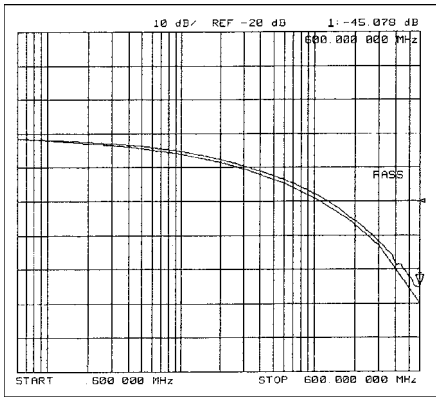
HELUKAT® 600A

S/FTP PVC/PVC


## Cable structure

## S/FTP 4x2xAWG 23/1 PVC/PVC

| | |
|---|---|
| Inner conductor Ø: | 0,58 mm |
| Conductor material: | Copper, bare |
| Core insulation: | Foam-skin-PE |
| Core colours: | wh/bu, wh/og, wh/gn, wh/bn |
| Separator: | - |
| Inner sheath material: | PVC |
| Screen over stranding element: | Al-Foil |
| Screen 1 over stranding: | Cu braid |
| Screen 2 over stranding: | - |
| Outer sheath material: | PVC |
| Outer diameter: | app. 11,6 mm |
| Outer sheath colour: | Black similar to RAL 9005 |




## Electrical data

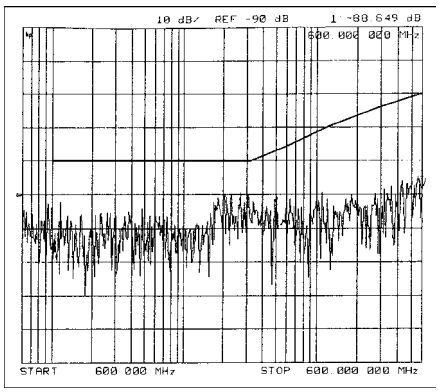
| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz<br>100 Ohm ± 20 Ohm at 101 to 1000 MHz |
| Loop resistance: | 160 Ohm/km max. |
| Mutual capacitance: | 43 nF/km nom. |
| Rel. propagation velocity: | 79 % |

## Typical values

| Frequency | (MHz) | 10 | 16 | 62,5 | 100 | 200 | 300 | 600 | 900 | 1000 |
|---|---|---|---|---|---|---|---|---|---|---|
| Attenuation | (dB/100m) | 5,6 | 7,1 | 13,9 | 17,5 | 25,2 | 32,1 | 44,9 | 55,0 | 58,0 |
| Next | (dB) | 100,0 | 100,0 | 96,0 | 94,0 | 88,0 | 84,0 | 73,0 | 71,0 | 69,0 |
| ACR | (dB) | 94,4 | 92,9 | 82,1 | 76,5 | 62,8 | 51,9 | 28,1 | 16,0 | 9,0 |

## Technical data

| | |
|---|---|
| Weight: | app. 153 kg/km |
| bending radius, repeated: | 95 mm |
| Operating temperature range min.: | -30°C |
| Operating temperature range max.: | +70°C |
| Caloric load, approx. value: | 2,62 MJ/m |
| Copper weight: | 32,00 kg/km |




## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 7e, Flame-retardant acc. to IEC 60332-1-2

## Application

HELUKAT® 600A data cables are used in the tertiary, but also in the secondary level of a network. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as Gigabit Ethernet, Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s or ISDN absolutely trouble-free. The series of HELUKAT® 600A with a double PVC jacket is constructed especially for outdoor applications like laying at house walls or in cable lines.

## Part no.

**801147,** S/FTP 4x2xAWG 23/1 PVC/PVC (S-STP)

Dimensions and specifications may be changed without prior notice.



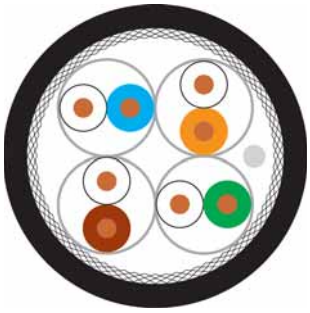
DNB Edition 11 (published 01.10.2015)

# LAN Cable direct Burial

**Category 7e**

HELUKAT® 600E

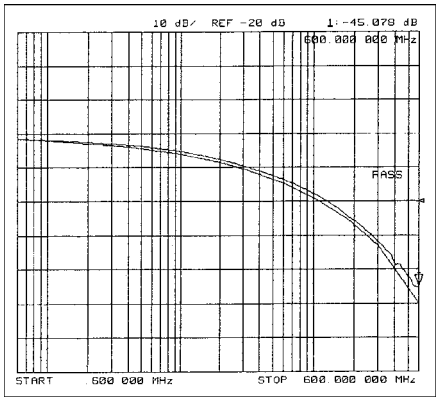
S/FTP PVC




## Cable structure

## S/FTP 4x2xAWG 23/1 direct burial

| | |
|---|---|
| Inner conductor Ø: | 0,58 mm |
| Conductor material: | Copper, bare |
| Core insulation: | Foam-skin-PE |
| Core colours: | wh/bu, wh/og, wh/gn, wh/bn |
| Separator: | - |
| Screen over stranding element: | Al-Foil |
| Screen 1 over stranding: | Cu braid |
| Screen 2 over stranding: | - |
| Outer sheath material: | PVC |
| Outer diameter: | app. 9,8 mm |
| Outer sheath colour: | Black |




## Electrical data

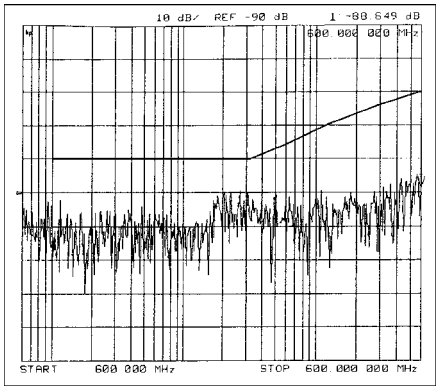
| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz<br>100 Ohm ± 20 Ohm at 101 to 1000 MHz |
| Loop resistance: | 150 Ohm/km max. |
| Mutual capacitance: | 42 nF/km nom. |
| Rel. propagation velocity: | 79 % |

## Typical values

| Frequency | (MHz) | 10 | 16 | 62,5 | 100 | 200 | 300 | 600 | 900 | 1000 |
|---|---|---|---|---|---|---|---|---|---|---|
| Attenuation | (dB/100m) | 5,6 | 7,1 | 13,9 | 17,5 | 25,2 | 32,1 | 44,9 | 55,0 | 58,0 |
| Next | (dB) | 100,0 | 100,0 | 96,0 | 94,0 | 88,0 | 84,0 | 73,0 | 71,0 | 69,0 |
| ACR | (dB) | 94,4 | 92,9 | 82,1 | 76,5 | 62,8 | 51,9 | 28,1 | 16,0 | 9,0 |

## Technical data

| | |
|---|---|
| Weight: | app. 102 kg/km |
| bending radius, repeated: | 100 mm |
| Operating temperature range min.: | -45°C |
| Operating temperature range max.: | +65°C |
| Caloric load, approx. value: | 1,40 MJ/m |
| Copper weight: | 32,00 kg/km |




## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 7e, Flame-retardant acc. to IEC 60332-1-2, Smoke density acc. to IEC 61034

## Application

HELUKAT® 600E data cables are used in the tertiary, but also in the secondary level of a network. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as Gigabit Ethernet, Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s or ISDN absolutely trouble-free. The series of HELUKAT® 600E with a cold resistant PVC jacket is constructed especially for outdoor applications like laying at house walls or direct burial.

## Part no.

**802167,** S/FTP 4x2xAWG23/1 PVC (S-STP)

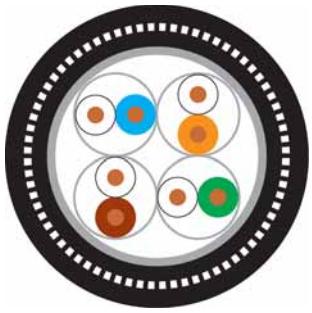
Dimensions and specifications may be changed without prior notice.

# LAN Cable direct Burial / armoured

**Category 7e**

HELUKAT® 600AE

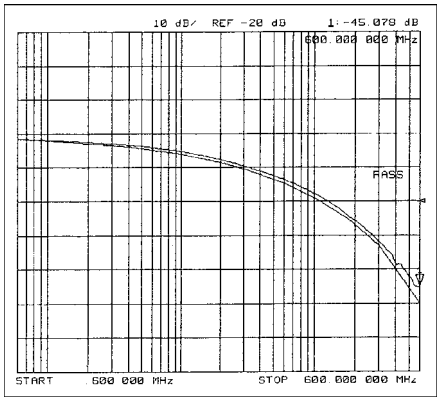
S/FTP FRNC/PE




## Cable structure

## S/FTP 4x2xAWG 23/1 FRNC/PE

| | |
|---|---|
| Inner conductor Ø: | 0,58 mm |
| Conductor material: | Copper, bare |
| Core insulation: | Foam-skin-PE |
| Core colours: | wh/bu, wh/og, wh/gn, wh/bn |
| Separator: | - |
| Inner sheath material: | FRNC |
| Screen over stranding element: | Al-Foil |
| Screen 1 over stranding: | Cu braid |
| Screen 2 over stranding: | - |
| : | Steel shaft |
| Outer sheath material: | PE |
| Outer diameter: | app. 12,2 mm |
| Outer sheath colour: | Black |




## Electrical data

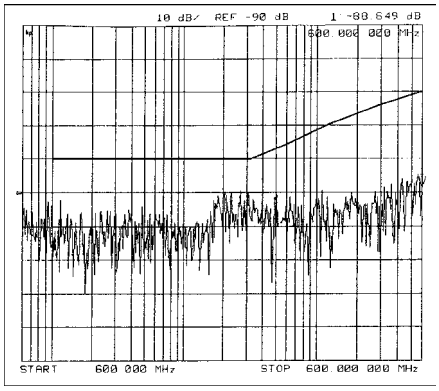
| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz<br>100 Ohm ± 20 Ohm at 101 to 1000 MHz |
| Loop resistance: | 150 Ohm/km max. |
| Mutual capacitance: | 43 nF/km nom. |
| Rel. propagation velocity: | 79 % |

## Typical values

| Frequency | (MHz) | 10 | 16 | 62,5 | 100 | 200 | 300 | 600 | 900 | 1000 |
|---|---|---|---|---|---|---|---|---|---|---|
| Attenuation | (dB/100m) | 5,6 | 7,1 | 13,9 | 17,5 | 25,2 | 32,1 | 44,9 | 55,0 | 58,0 |
| Next | (dB) | 100,0 | 100,0 | 96,0 | 94,0 | 88,0 | 84,0 | 73,0 | 71,0 | 69,0 |
| ACR | (dB) | 94,4 | 92,9 | 82,1 | 76,5 | 62,8 | 51,9 | 28,1 | 16,0 | 9,0 |

## Technical data

| | |
|---|---|
| Weight: | app. 155 kg/km |
| bending radius, repeated: | 330 mm |
| Operating temperature range min.: | -45°C |
| Operating temperature range max.: | +70°C |
| Caloric load, approx. value: | 2,30 MJ/m |
| Copper weight: | 32,00 kg/km |




## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 7e

## Application

HELUKAT® 600AE data cables are used in the tertiary, but also in the secondary level of a network. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as Gigabit Ethernet, Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s or ISDN absolutely trouble-free. The series of HELUKAT® 600AE with a FRNC/PE double jacket and the rodent protection is constructed especially for outdoor and direct burial applications.

## Part no.

**802168,** S/FTP 4x2xAWG 23/1 FRNC/PE (S-STP)

Dimensions and specifications may be changed without prior notice.



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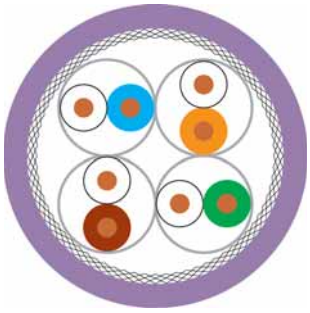
# LAN Cable

**Category 7A**

HELUKAT® 1200

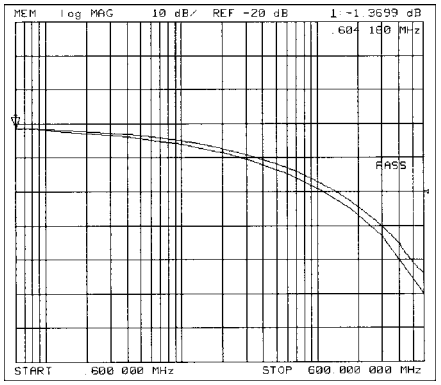
S/FTP




## Cable structure

**S/FTP 4x2xAWG 23/1 LSZH**

| | |
|---|---|
| Inner conductor Ø: | 0,57 mm |
| Conductor material: | Copper, bare |
| Core insulation: | Foam-skin-PE |
| Core colours: | wh/bu, wh/og, wh/gn, wh/bn |
| Separator: | - |
| Screen over stranding element: | Al-Foil |
| Screen 1 over stranding: | Cu braid |
| Screen 2 over stranding: | - |
| Outer sheath material: | LSZH |
| Outer diameter: | app. 7,5 mm |
| Outer sheath colour: | Blue Lilac similar to RAL 4005 |




## Electrical data

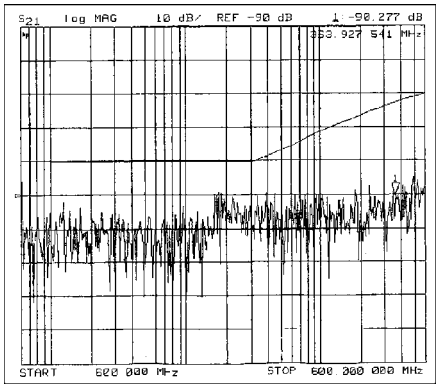
| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz<br>100 Ohm ± 20 Ohm at 101 to 1200 MHz |
| Loop resistance: | 160 Ohm/km max. |
| Mutual capacitance: | 43 nF/km nom. |
| Rel. propagation velocity: | 77 % |

## Typical values

| Frequency | (MHz) | 10 | 16 | 62,5 | 100 | 200 | 300 | 600 | 900 | 1000 | 1200 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Attenuation | (dB/100m) | 5,2 | 6,8 | 13,3 | 17,3 | 24,2 | 30,2 | 43,5 | 54,3 | 56,9 | 62,9 |
| Next | (dB) | 105,0 | 105,0 | 105,0 | 100,0 | 95,0 | 93,0 | 88,0 | 85,0 | 84,0 | 82,0 |
| ACR | (dB) | 99,8 | 98,2 | 91,7 | 82,7 | 70,8 | 62,8 | 44,5 | 30,7 | 27,1 | 19,1 |

## Technical data

| | |
|---|---|
| Weight: | app. 60 kg/km |
| bending radius, repeated: | 65 mm |
| Operating temperature range min.: | -20°C |
| Operating temperature range max.: | +60°C |
| Caloric load, approx. value: | 0,57 MJ/m |
| Copper weight: | 30,00 kg/km |




## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 7A, Flame-retardant acc. to IEC 60332-3, Smoke density acc. to IEC 61034, Halogen-free acc. to 60754-2, Corrosiveness acc. to EN50267-2-3

## Application

HELUKAT®1200-7A data cables are used in the tertiary, but also in the secondary level of a network. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as 10Gigabit Ethernet, Gigabit Ethernet, Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s or ISDN absolutely trouble-free. Likewise, the mechanical characteristics are perfectly suited for the application in tight cable channels and platforms due to their optimized construction.

## Part no.

**803380,** S/FTP 4x2xAWG 23/1 FRNC (S-STP)

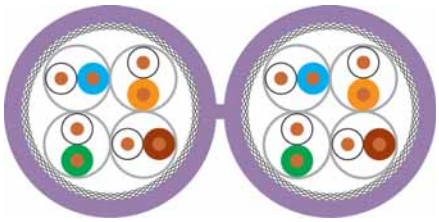
Dimensions and specifications may be changed without prior notice.

# LAN Cable

**Category $7_A$**

HELUKAT® 1200

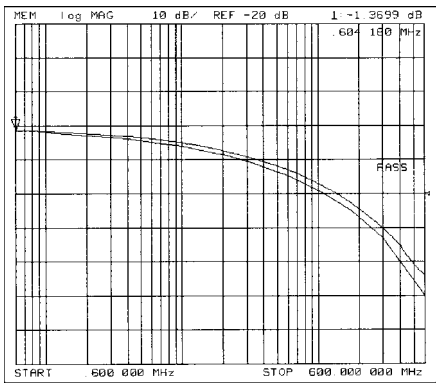
S/FTP duplex




## Cable structure

## S/FTP 2x(4x2xAWG 23/1) LSZH

| | |
|---|---|
| Inner conductor Ø: | 0,57 mm |
| Conductor material: | Copper, bare |
| Core insulation: | Foam-skin-PE |
| Core colours: | wh/bu, wh/og, wh/gn, wh/bn |
| Separator: | - |
| Screen over stranding element: | Al-Foil |
| Screen 1 over stranding: | Cu braid |
| Screen 2 over stranding: | - |
| Outer sheath material: | LSZH |
| Cable dimensions: | app. 16,0 mm x 7,5 mm |
| Outer sheath colour: | Blue Lilac similar to RAL 4005 |




## Electrical data

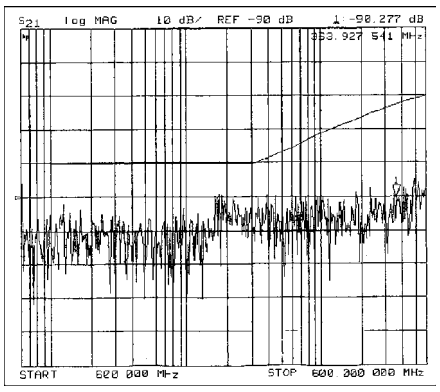
| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz<br>100 Ohm ± 20 Ohm at 101 to 1200 MHz |
| Loop resistance: | 160 Ohm/km max. |
| Mutual capacitance: | 43 nF/km nom. |
| Rel. propagation velocity: | 77 % |

## Typical values

| Frequency | (MHz) | 10 | 16 | 62,5 | 100 | 200 | 300 | 600 | 900 | 1000 | 1200 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Attenuation | (dB/100m) | 5,2 | 6,8 | 13,3 | 17,3 | 24,2 | 30,2 | 43,5 | 54,3 | 56,9 | 62,9 |
| Next | (dB) | 105,0 | 105,0 | 105,0 | 100,0 | 95,0 | 93,0 | 88,0 | 85,0 | 84,0 | 82,0 |
| ACR | (dB) | 99,8 | 98,2 | 91,7 | 82,7 | 70,8 | 62,8 | 44,5 | 30,7 | 27,1 | 19,1 |

## Technical data

| | |
|---|---|
| Weight: | app. 120 kg/km |
| bending radius, repeated: | 65 mm |
| Operating temperature range min.: | -20°C |
| Operating temperature range max.: | +60°C |
| Caloric load, approx. value: | 1,16 MJ/m |
| Copper weight: | 60,00 kg/km |




## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category $7_A$, Flame-retardant acc. to IEC 60332-3, Smoke density acc. to IEC 61034, Halogen-free acc. to 60754-2, Corrosiveness acc. to EN50267-2-3

## Application

HELUKAT®1200-7A data cables are used in the tertiary, but also in the secondary level of a network. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as 10Gigabit Ethernet, Gigabit Ethernet, Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s or ISDN absolutely trouble-free. Likewise, the mechanical characteristics are perfectly suited for the application in tight cable channels and platforms due to their optimized construction.

## Part no.

**803381,** S/FTP 2x(4x2xAWG 23/1) FRNC (S-STP)

Dimensions and specifications may be changed without prior notice.



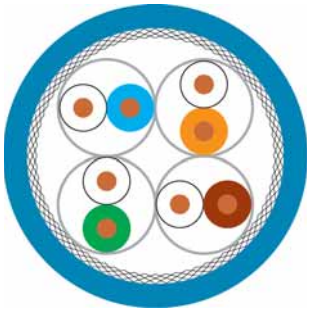
DNB Edition 11 (published 01.10.2015)

# LAN Cable

**Category 8**

## HELUKAT® 1200

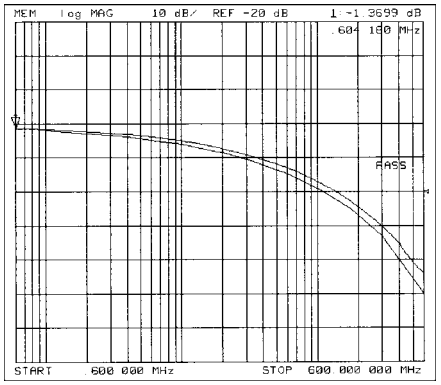
S/FTP




## Cable structure

## S/FTP 4x2xAWG 22/1 FRNC

| | |
|---|---|
| Inner conductor Ø: | 0,64 mm |
| Conductor material: | Copper, bare |
| Core insulation: | Foam-skin-PE |
| Core colours: | wh/bu, wh/og, wh/gn, wh/bn |
| Separator: | - |
| Screen over stranding element: | Al-Foil |
| Screen 1 over stranding: | Cu braid |
| Screen 2 over stranding: | - |
| Outer sheath material: | FRNC |
| Outer diameter: | app. 7,7 mm |
| Outer sheath colour: | Blue similar to RAL 5015 |




## Electrical data

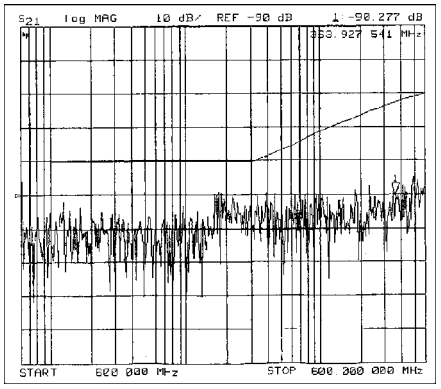
| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz<br>100 Ohm ± 20 Ohm at 101 to 1200 MHz |
| Loop resistance: | 120 Ohm/km max. |
| Mutual capacitance: | 43 nF/km nom. |
| Rel. propagation velocity: | 79 % |

## Typical values

| Frequency | (MHz) | 10 | 16 | 62,5 | 100 | 200 | 300 | 600 | 1000 | 1200 |
|---|---|---|---|---|---|---|---|---|---|---|
| Attenuation | (dB/100m) | 4,9 | 6,3 | 12,7 | 16,3 | 23,5 | 29,4 | 42,8 | 53,0 | 59,0 |
| Next | (dB) | 100,0 | 100,0 | 95,0 | 93,0 | 90,0 | 87,0 | 81,0 | 78,0 | 77,0 |
| ACR | (dB) | 95,1 | 93,7 | 82,3 | 76,7 | 66,5 | 57,6 | 38,2 | 25,0 | 18,0 |

## Technical data

| | |
|---|---|
| Weight: | app. 66 kg/km |
| bending radius, repeated: | 72 mm |
| Operating temperature range min.: | -20°C |
| Operating temperature range max.: | +60°C |
| Caloric load, approx. value: | 0,70 MJ/m |
| Copper weight: | 40,00 kg/km |




## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 8 (draft), Flame-retardant acc. to IEC 60332-3, Smoke density acc. to IEC 61034, Halogen-free acc. to 60754-2, Corrosiveness acc. to EN50267-2-3

## Application

HELUKAT®1200 data cables are used in the tertiary, but also in the secondary level of a network. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as Gigabit Ethernet, Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s or ISDN absolutely trouble-free. Likewise, the mechanical characteristics are perfectly suited for the application in tight cable channels and platforms due to their optimized construction.

## Part no.

**81699,** S/FTP 4x2xAWG 22/1 FRNC (S-FTP)

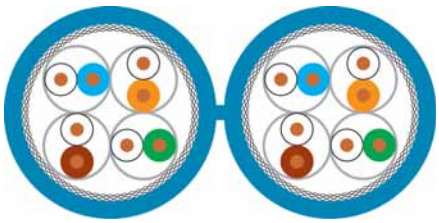
Dimensions and specifications may be changed without prior notice.

# LAN Cable

**Category 8**

## HELUKAT® 1200

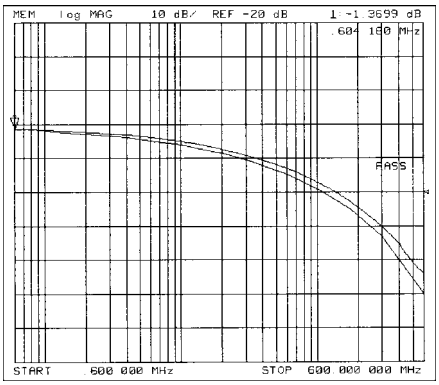
S/FTP duplex




## Cable structure

## S/FTP 2x(4x2xAWG 22/1) FRNC

| | |
|---|---|
| Inner conductor Ø: | 0,64 mm |
| Conductor material: | Copper, bare |
| Core insulation: | Foam-skin-PE |
| Core colours: | wh/bu, wh/og, wh/gn, wh/bn |
| Separator: | - |
| Screen over stranding element: | Al-Foil |
| Screen 1 over stranding: | Cu braid |
| Screen 2 over stranding: | - |
| Outer sheath material: | FRNC |
| Cable dimensions: | app. 7,7 mm x 16,5 mm |
| Outer sheath colour: | Blue similar to RAL 5015 |




## Electrical data

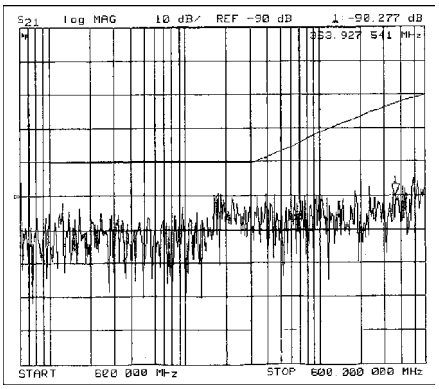
| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz<br>100 Ohm ± 20 Ohm at 101 to 1200 MHz |
| Loop resistance: | 120 Ohm/km max. |
| Mutual capacitance: | 43 nF/km nom. |
| Rel. propagation velocity: | 79 % |

## Typical values

| Frequency | (MHz) | 10 | 16 | 62,5 | 100 | 200 | 300 | 600 | 1000 | 1200 |
|---|---|---|---|---|---|---|---|---|---|---|
| Attenuation | (dB/100m) | 4,9 | 6,3 | 12,7 | 16,3 | 23,5 | 29,4 | 42,8 | 53,0 | 59,0 |
| Next | (dB) | 100,0 | 100,0 | 95,0 | 93,0 | 90,0 | 87,0 | 81,0 | 78,0 | 77,0 |
| ACR | (dB) | 95,1 | 93,7 | 82,3 | 76,7 | 66,5 | 57,6 | 38,2 | 25,0 | 18,0 |

## Technical data

| | |
|---|---|
| Weight: | app. 133 kg/km |
| bending radius, repeated: | 72 mm |
| Operating temperature range min.: | -20°C |
| Operating temperature range max.: | +60°C |
| Caloric load, approx. value: | 1,50 MJ/m |
| Copper weight: | 80,00 kg/km |




## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 8 (draft), Flame-retardant acc. to IEC 60332-3, Smoke density acc. to IEC 61034, Halogen-free acc. to 60754-2, Corrosiveness acc. to EN50267-2-3

## Application

HELUKAT®1200 data cables are used in the tertiary, but also in the secondary level of a network. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as Gigabit Ethernet, Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s or ISDN absolutely trouble-free. Likewise, the mechanical characteristics are perfectly suited for the application in tight cable channels and platforms due to their optimized construction.

## Part no.

**800647,** S/FTP 2x(4x2xAWG 22/1) FRNC (S-STP)

Dimensions and specifications may be changed without prior notice.



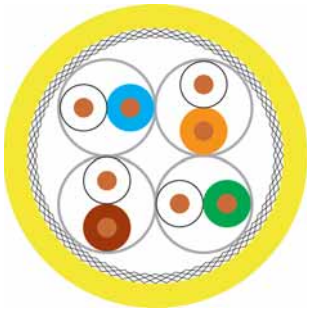
DNB Edition 11 (published 01.10.2015)

# Multimedia Cable

**Category 8**

HELUKAT® 1500

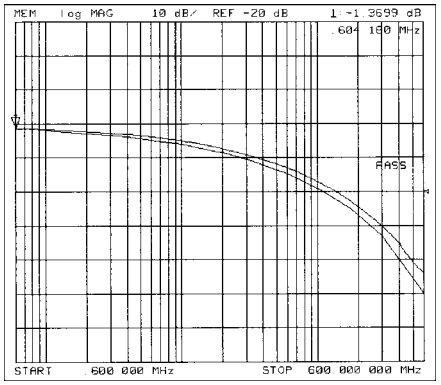
S/FTP




## Cable structure

**S/FTP 4x2xAWG 22/1 FRNC**

| | |
|---|---|
| Inner conductor Ø: | 0,64 mm |
| Conductor material: | Copper, bare |
| Core insulation: | Foam-skin-PE |
| Core colours: | wh/bu, wh/og, wh/gn, wh/bn |
| Separator: | - |
| Screen over stranding element: | Al-Foil |
| Screen 1 over stranding: | Cu braid |
| Screen 2 over stranding: | - |
| Outer sheath material: | FRNC |
| Outer diameter: | app. 7,7 mm |
| Outer sheath colour: | Yellow |




## Electrical data

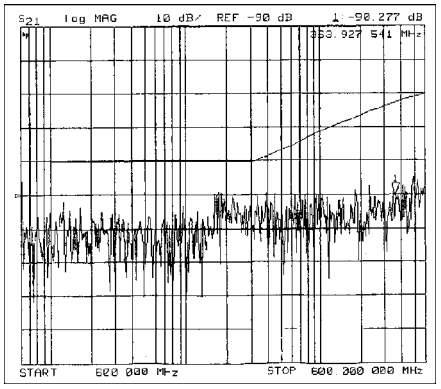
| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz<br>100 Ohm ± 20 Ohm at 101 to 1200 MHz |
| Loop resistance: | 120 Ohm/km max. |
| Mutual capacitance: | 42 nF/km nom. |
| Rel. propagation velocity: | 77 % |

## Typical values

| Frequency | (MHz) | 10 | 16 | 62,5 | 100 | 200 | 300 | 600 | 1000 | 1200 | 1500 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Attenuation | (dB/100m) | 4,2 | 6,3 | 12,7 | 16,5 | 21,5 | 27,5 | 41,7 | 54,4 | 59,8 | 66,2 |
| Next | (dB) | 110,0 | 110,0 | 110,0 | 110,0 | 110,0 | 105,0 | 95,0 | 85,0 | 80,0 | 74,0 |
| ACR | (dB) | 105,8 | 103,7 | 97,3 | 93,5 | 88,5 | 77,5 | 53,3 | 30,6 | 22,2 | 7,8 |

## Technical data

| | |
|---|---|
| Weight: | app. 66 kg/km |
| bending radius, repeated: | 68 mm |
| Operating temperature range min.: | -20°C |
| Operating temperature range max.: | +60°C |
| Caloric load, approx. value: | 0,74 MJ/m |
| Copper weight: | 41,00 kg/km |




## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 8 (draft), Flame-retardant acc. to IEC 60332-3, Smoke density acc. to IEC 61034, Halogen-free acc. to 60754-2, Corrosiveness acc. to EN50267-2-3

## Application

HELUKAT® 1500 data cables are used in the tertiary, but also in the secondary level of a network. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as 10Gigabit Ethernet, Gigabit Ethernet, Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s or ISDN absolutely trouble-free. That means applications such as multimedia (TV, Video, Data, Speach) are no problem for this series.Likewise, the mechanical characteristics are perfectly suited for the application in tight cable channels and platforms due to their optimized construction.

## Part no.

**802169,** S/FTP 4x2xAWG 22/1 FRNC (S-STP)

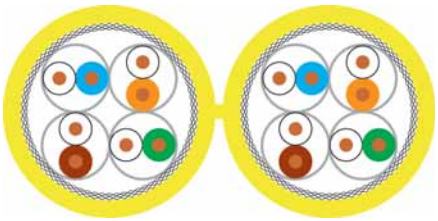
Dimensions and specifications may be changed without prior notice.

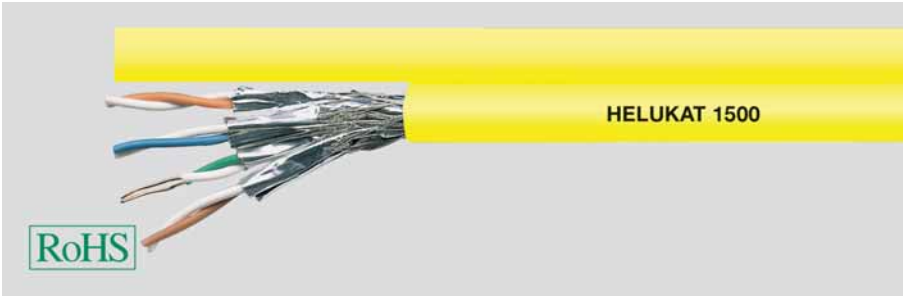
# Multimedia Cable

**Category 8**

HELUKAT® 1500

S/FTP duplex

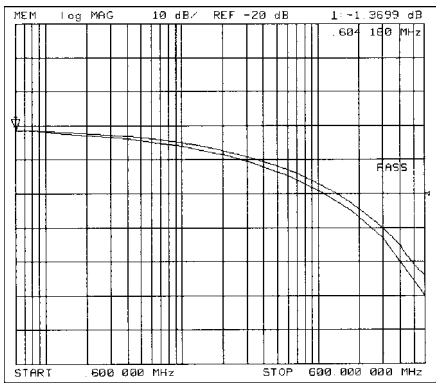





## Cable structure

## S/FTP 2x(4x2xAWG 22/1) FRNC

| | |
|---|---|
| Inner conductor Ø: | 0,64 mm |
| Conductor material: | Copper, bare |
| Core insulation: | Foam-skin-PE |
| Core colours: | wh/bu, wh/og, wh/gn, wh/bn |
| Separator: | - |
| Screen over stranding element: | Al-Foil |
| Screen 1 over stranding: | Cu braid |
| Screen 2 over stranding: | - |
| Outer sheath material: | FRNC |
| Cable dimensions: | app. 7,7 mm x 16,2 mm |
| Outer sheath colour: | Yellow |




## Electrical data

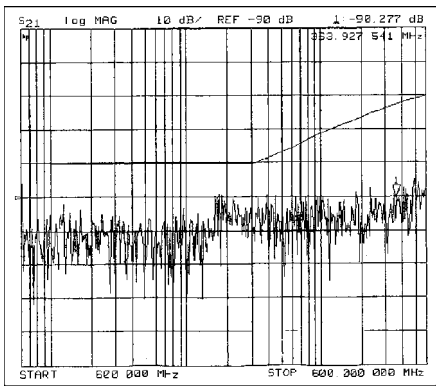
| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz<br>100 Ohm ± 20 Ohm at 101 to 1200 MHz |
| Loop resistance: | 120 Ohm/km max. |
| Mutual capacitance: | 42 nF/km nom. |
| Rel. propagation velocity: | 77 % |

## Typical values

| Frequency | (MHz) | 10 | 16 | 62,5 | 100 | 200 | 300 | 600 | 1000 | 1200 | 1500 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Attenuation | (dB/100m) | 4,2 | 6,3 | 12,7 | 16,5 | 21,5 | 27,5 | 41,7 | 54,4 | 59,8 | 66,2 |
| Next | (dB) | 110,0 | 110,0 | 110,0 | 110,0 | 110,0 | 105,0 | 95,0 | 85,0 | 80,0 | 74,0 |
| ACR | (dB) | 105,8 | 103,7 | 97,3 | 93,5 | 88,5 | 77,5 | 53,3 | 30,6 | 22,2 | 7,8 |

## Technical data

| | |
|---|---|
| Weight: | app. 135 kg/km |
| bending radius, repeated: | 68 mm |
| Operating temperature range min.: | -20°C |
| Operating temperature range max.: | +60°C |
| Caloric load, approx. value: | 1,50 MJ/m |
| Copper weight: | 82,00 kg/km |




## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 8 (draft), Flame-retardant acc. to IEC 60332-3, Smoke density acc. to IEC 61034, Halogen-free acc. to 60754-2, Corrosiveness acc. to EN50267-2-3

## Application

HELUKAT®1500 data cables are used in the tertiary, but also in the secondary level of a network. They are characterized by large performance reserves and outstanding performance. They can be used to implement services such as 10Gigabit Ethernet, Gigabit Ethernet, Fast Ethernet, Ethernet, ATM155, FDDI, token ring 4/16 Mbit/s or ISDN absolutely trouble-free. That means applications such as multimedia (TV, Video, Data, Speach) are no problem for this series.Likewise, the mechanical characteristics are perfectly suited for the application in tight cable channels and platforms due to their optimized construction.

## Part no.

**802170,** S/FTP 2x(4x2xAWG 22/1) FRNC (S-STP)

Dimensions and specifications may be changed without prior notice.



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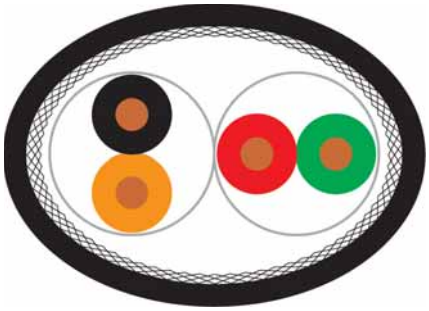
# LAN Cable

HELUKABEL® IVS

IBM P/N 33G2772




## Cable structure

| | IBM P/N 33G2772 type 1A | IBM P/N 33G2775 type 6A | IBM P/N 33G8224 type 1A mini |
|---|---|---|---|
| Inner conductor Ø: | 0,64 mm | 0,48 mm | 0,4 mm |
| Conductor material: | Copper, bare | Copper, bare | Copper, bare |
| Core insulation: | Foam-skin-PE | Foam-skin-PE | Foam-skin-PE |
| Number of cores: | 4 | 4 | 4 |
| Core colours: | bk/og, rd/gn | bk/og, rd/gn | bk/og, rd/gn |
| Screen over stranding element: | Al-Foil | Al-Foil | Al-Foil |
| Screen over stranding 1: | Cu braid, tinned | Cu braid, tinned | Cu braid, tinned |
| Screen over stranding 2: | - | - | - |
| Outer sheath material: | PVC | PVC | PVC |
| Cable dimensions: | app. 7,6 mm x 11,9 mm | app. 7,8 mm | app. 5,5 mm x 8,9 mm |
| Outer sheath colour: | Black | Black | Black |

## Electrical data

| | | | |
|---|---|---|---|
| Characteristic impedance: | 150 Ohm<br>± 15 Ohm at 3 to 20 MHz<br>185 Ohm<br>± 18.5 Ohm at 38.4 kHz<br>270 Ohm<br>± 27 Ohm at 9.6 kHz | 150 Ohm<br>± 15 Ohm at 3 to 20 MHz<br>235 Ohm<br>± 35.25 Ohm at 38.4 kHz<br>390 Ohm<br>± 58.5 Ohm at 9.6 kHz | 150 Ohm<br>± 15 Ohm at 3 to 20 MHz<br>235 Ohm<br>± 23.5 Ohm at 38.4 kHz<br>390 Ohm<br>± 39 Ohm at 9.6 kHz |
| Direct current resistance: | 57,1 Ohm/km | 151 Ohm/km | 151 Ohm/km |
| Rel. propagation velocity: | 78 % | - | 78 % |

## Typical values

| Frequency | (MHz) | 20 | 100 | 20 | 100 | 20 | 100 |
|---|---|---|---|---|---|---|---|
| Attenuation | (dB/100m) | 7,4 | 18,7 | 4,9 | 12,3 | 7,4 | 18,7 |
| Next | (dB) | 80,0 | 60,0 | 50,0 | 39,0 | 60,0 | 49,0 |

## Technical data

| | | | |
|---|---|---|---|
| Weight: | app. 85 kg/km | app. 70 kg/km | app. 60 kg/km |
| bending radius, repeated: | 110 mm | 117 mm | 84 mm |
| Operating temperature range min.: | -10°C | -10°C | -10°C |
| Operating temperature range max.: | +70°C | +70°C | +70°C |
| Caloric load, approx. value: | 1,70 MJ/m | 0,78 MJ/m | 0,68 MJ/m |
| Copper weight: | 38,00 kg/km | 25,00 kg/km | 21,00 kg/km |

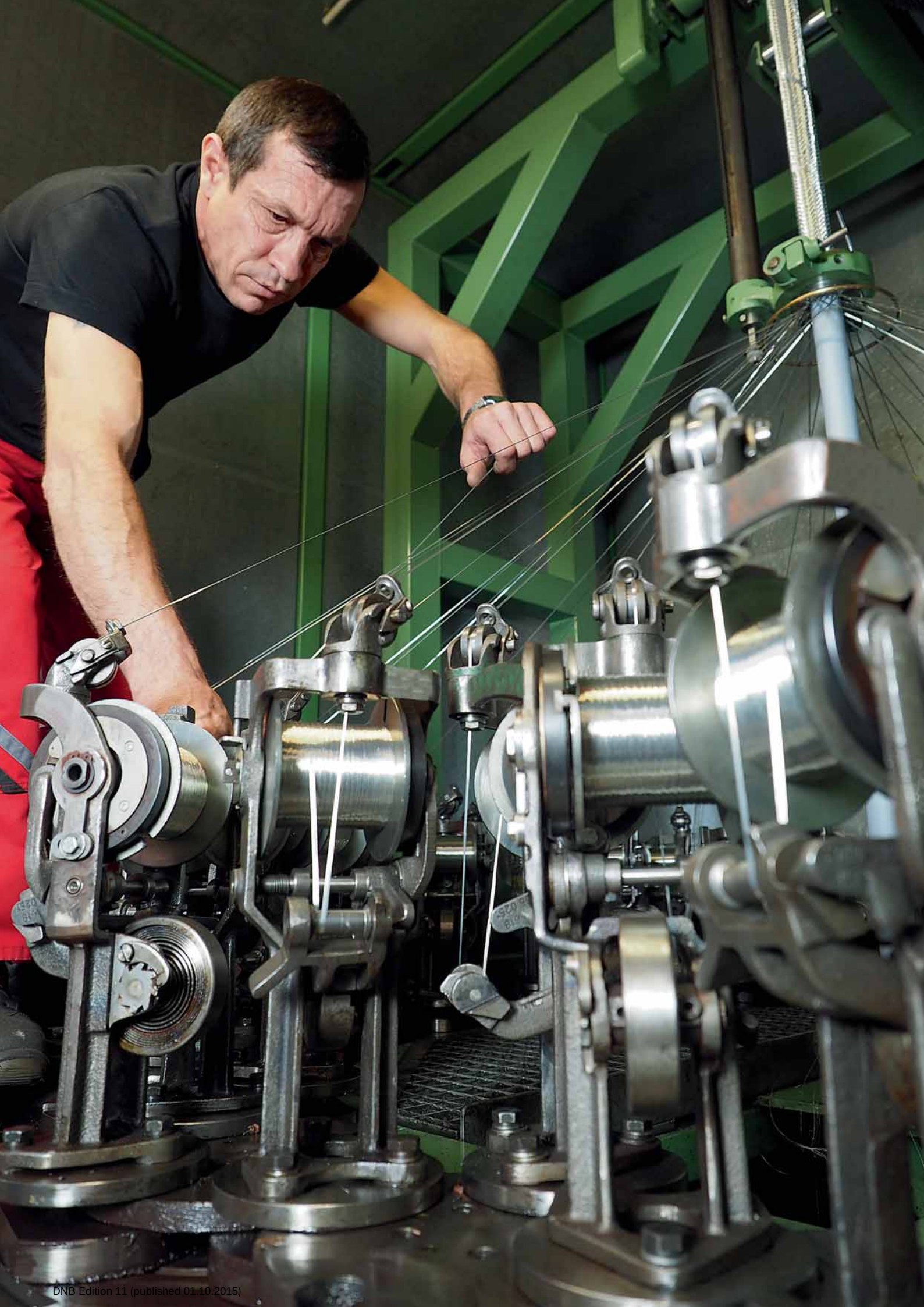
## Application

HELUKABEL® IVS types are used in the area of the IVS system, developed by IBM. They correspond to the wiring guidelines set by IBM.

## Part no.

| | | |
|---|---|---|
| **80068,** IBM P/N 33G2772 type 1A | **80071,** IBM P/N 33G2775 type 6A | **80070,** IBM P/N 33G8224 type 1A mini |

Dimensions and specifications may be changed without prior notice.



**BUS-Cables USB 3.0 Bus**

BUS-Cables Profibus SHIPLINE

BUS-Cables E-Bus

# BUS-Cables CAN Bus

**Industrial Ethernet PROFInet type A**

Industrial Ethernet 200IND SF/UTP ROBUSTFLEX

**Industrial Ethernet PROFInet C Torsion**


DNB Edition 11 (published 01.10.2015)

# BUS-CABLES





DNB Edition 11 (published 01.10.2015)

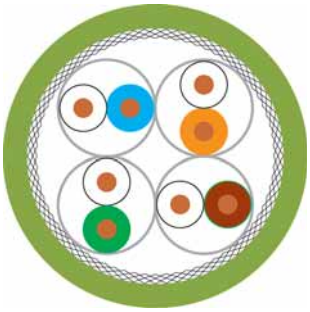
# BUS-CABLES

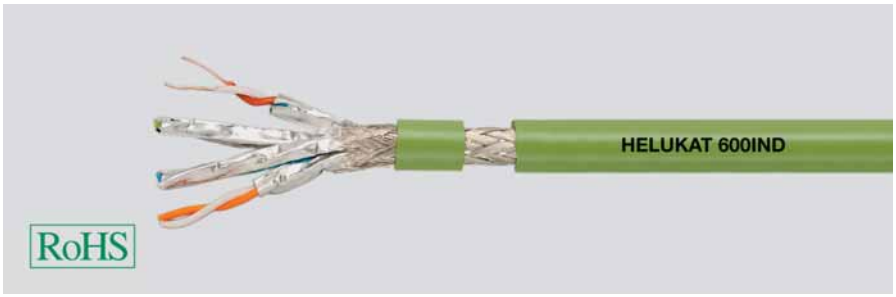
# Industrial Ethernet

**ROBUST**

## HELUKAT® 600IND

S/FTP, Category 7e






## Type
## Industrial Area
## Cable structure
## S/FTP 4x2xAWG 23/1 PUR

| | |
|---|---|
| Inner conductor diameter: | Copper, bare (AWG 23/1) |
| Core insulation: | Foam-skin-PE |
| Core colours: | wh/bu, wh/og, wh/gn, wh/bn |
| Stranding element: | Double core |
| Separator: | - |
| Shielding 1: | Al-Foil |
| Screen 1 over stranding: | Cu braid |
| Screen 2 over stranding: | - |
| Outer sheath material: | PUR |
| Cable external diameter: | app. 7,8 mm |
| Outer sheath colour: | Green similar to RAL 6018 |

## Electrical data

| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz<br>100 Ohm ± 20 Ohm at 101 to 1200 MHz |
| Loop resistance: | 149 Ohm/km max. |
| Mutual capacitance: | 43 nF/km nom. |
| Relative propagation velocity: | 77 % |

## Typical values

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| frequency | (MHz) | 10 | 16 | 62,5 | 100 | 250 | 350 | 600 | 900 | 1000 | 1200 |
| attenuation | (db/100m) | 5,6 | 7,0 | 13,8 | 17,6 | 28,3 | 34,0 | 45,2 | 57,1 | 60,8 | 66,0 |
| next | (db) | 95,0 | 95,0 | 89,0 | 87,0 | 82,0 | 79,0 | 74,0 | 70,0 | 66,0 | 63,0 |
| ACR | (db) | 89,4 | 88,0 | 75,2 | 69,4 | 53,7 | 43,0 | 27,8 | 13,9 | 5,2 | -3,0 |

## Technical data

| | |
|---|---|
| Weight: | app. 68 kg/km |
| bending radius, repeated: | 78 mm |
| Operating temperature range min.: | -40°C |
| Operating temperature range max.: | +80°C |
| Caloric load, approx. value: | 0,74 MJ/m |
| Copper weight: | 34,00 kg/km |

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 7e, Flame-retardant acc. to IEC 60332-1-2, Halogen-free acc. to 60754-2, Oil-resistant

## Application

HELUKAT® 600IND Category 7e Robust is used for harsh industrial environments. Mechanically, this product exhibits excellent resistance to mineral oils, greases and cooling lubricants and has good microbe and hydrolysis resistance. Electrically, this cable is characterized by high reserve capacity and outstanding performance. This allows you to create services such as Gigabit Ethernet, Fast Ethernet, Ethernet, ATM155, FDDI, Token Ring 4/16 Mbit/s or ISDN without difficulty. These cables considerably exceed the requirement for compliance with Class B interference emission to EN55022, as well as interference immunity to EN55024. This gives the series outstanding EMC characteristics.

## Part no.

**801197,** S/FTP 4x2xAWG 23/1 PUR (S-STP)

Dimensions and specifications may be changed without prior notice.



DNB Edition 11 (published 01.10.2015)

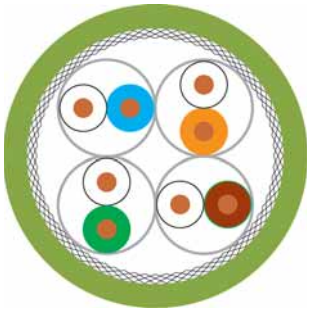
# Industrial Ethernet

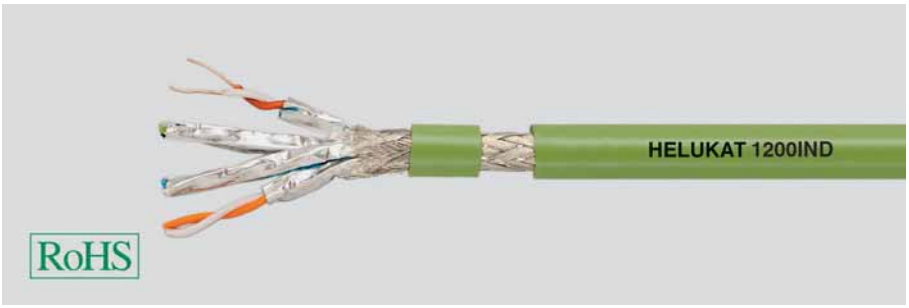
**ROBUST**

## HELUKAT® 1200IND

S/FTP, Category $7_A$

NEW






## Cable structure

## S/FTP 4x2xAWG 23/1 PUR

| | |
|---|---|
| Inner conductor Ø: | 0,57 mm |
| Conductor material: | Copper, bare |
| Core insulation: | Foam-skin-PE |
| Core colours: | wh/bu, wh/og, wh/gn, wh/bn |
| Separator: | - |
| Screen over stranding element: | Al-Foil |
| Screen 1 over stranding: | Cu braid |
| Screen 2 over stranding: | - |
| Outer sheath material: | PUR |
| Outer diameter: | app. 7,8 mm |
| Outer sheath colour: | Green similar to RAL 6018 |

## Electrical data

| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz<br>100 Ohm ± 20 Ohm at 101 to 1200 MHz |
| Loop resistance: | 149 Ohm/km max. |
| Mutual capacitance: | 43 nF/km nom. |

## Typical values

| frequency | (MHz) | 10 | 16 | 62,5 | 100 | 250 | 350 | 600 | 900 | 1200 |
|---|---|---|---|---|---|---|---|---|---|---|
| attenuation | (dB/100m) | 5,6 | 7,0 | 13,8 | 17,6 | 28,3 | 34,0 | 45,2 | 57,1 | 66 |
| Next | (dB) | 95,0 | 95,0 | 89,0 | 87,0 | 82,0 | 89,0 | 74,0 | 70,0 | 63,0 |
| PS-ACR | (dB) | 89,4 | 86,0 | 73,2 | 67,4 | 51,7 | 43,0 | 27,8 | 13,9 | 1,0 |

## Technical data

| | |
|---|---|
| Weight: | app. 68 kg/km |
| Operating temperature range min.: | -40°C |
| Operating temperature range max.: | +80°C |
| Caloric load, approx. value: | 0,76 MJ/m |
| Copper weight: | 37,00 kg/km |

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category $7_A$, Flame-retardant acc. to IEC 60332-1-2, Halogen-free acc. to 60754-2, Oil-resistant

## Application

HELUKAT® 1200IND Category 7A Robust is used for harsh industrial environments. Mechanically, this product exhibits excellent resistance to mineral oils, greases and cooling lubricants and has good microbe and hydrolysis resistance. Electrically, this cable is characterized by high reserve capacity and outstanding performance.

## Part no.

**805680,** S/FTP 4x2xAWG 23/1 PUR (S-STP)

Dimensions and specifications may be changed without prior notice.

# Industrial Ethernet

**ROBUSTFLEX**

## HELUKAT® 1000IND

S/FTP, Category $7_A$

NEW


## Cable structure

**S/FTP 4x2xAWG 26/7 PUR**

| | |
|---|---|
| Inner conductor Ø: | 0,48 mm |
| Conductor material: | Copper, bare |
| Core insulation: | Foam-skin-PE |
| Core colours: | wh/bu, wh/og, wh/gn, wh/bn |
| Separator: | - |
| Screen over stranding element: | Al-Foil |
| Screen 1 over stranding: | Cu braid |
| Screen 2 over stranding: | - |
| Outer sheath material: | PUR |
| Outer diameter: | app. 6,2 mm |
| Outer sheath colour: | Green similar to RAL 6018 |

## Electrical data

| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz<br>100 Ohm ± 20 Ohm at 101 to 1000 MHz |
| Loop resistance: | 290 Ohm/km max. |
| Mutual capacitance: | 44 nF/km nom. |
| Rel. propagation velocity: | 64 % |

## Typical values

| Frequenz | (MHz) | 10 | 100 | 250 | 800 | 900 | 1000 |
|---|---|---|---|---|---|---|---|
| Dämpfung | (dB/10m) | 0,9 | 2,8 | 4,5 | 8,2 | 8,8 | 9,3 |
| Next | (dB) | 78,0 | 78,0 | 72,4 | 64,9 | 64,1 | 63,4 |
| ACR | (dB) | 25,0 | 19,0 | 15,6 | 15,6 | 15,6 | 15,6 |

## Technical data

| | |
|---|---|
| Weight: | app. 40 kg/km |
| bending radius, repeated: | 50 mm |
| Operating temperature range min.: | -25°C |
| Operating temperature range max.: | +80°C |
| Caloric load, approx. value: | 0,45 MJ/m |
| Copper weight: | 23,00 kg/km |

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category $7_A$, Flame-retardant acc. to IEC 60332-1-2, Halogen-free acc. to 60754-2, Oil-resistant, AWM 20963 (80°C/30V)

## Application

HELUKAT®1000IND Category $7_A$ Robustflex is an Ethernet cable that, thanks to use of a halogen-free PU outer sheath, is ideal for harsh industrial surroundings. This cable is configurable with common RJ45 plugs (industrial and office version), as well as with some Sub-D and M12 plugs.

## Part no.

**805684,** S/FTP 4x2xAWG 26/7 PUR (S-STP)

Dimensions and specifications may be changed without prior notice.

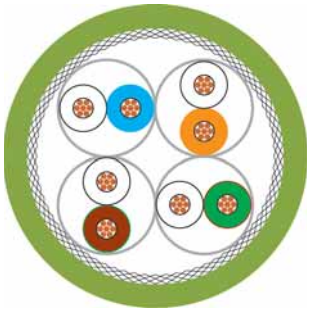
# Industrial Ethernet

**Drag Chain**

## HELUKAT® 600S

SF/FTP, Category 7

NEW




## Cable structure

**SF/FTP 4x2xAWG 24/7 (stranded) PUR**

| | |
|---|---|
| Inner conductor Ø: | 0,6 mm |
| Conductor material: | Copper, bare |
| Core insulation: | Foam-skin-PE |
| Core colours: | wh/bu, wh/og, wh/gn, wh/bn |
| Separator: | - |
| Screen over stranding element: | Al-Foil |
| Screen 1 over stranding: | Al-Foil |
| Screen 2 over stranding: | Cu braid |
| Outer sheath material: | PUR |
| Outer diameter: | app. 8,7 mm |
| Outer sheath colour: | Green similar to RAL 6018 |

## Electrical data

| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz<br>100 Ohm ± 20 Ohm at 101 to 600 MHz |
| Loop resistance: | 175 Ohm/km max. |

## Typical values

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| frequency | (MHz) | 10 | 16 | 62,5 | 100 | 200 | 300 | 600 |
| attenuation | (db/100m) | 6,7 | 8,5 | 17,4 | 22,1 | 31,6 | 39,2 | 57,4 |
| next | (db) | 78 | 78 | 75,5 | 72,4 | 67,9 | 65,2 | 60,7 |
| ACR | (db) | 71,3 | 69,5 | 58,1 | 50,3 | 36,3 | 26 | 3,3 |

## Technical data

| | |
|---|---|
| Weight: | app. 95 kg/km |
| bending radius, repeated: | 131 mm |
| Operating temperature range min.: | -30°C |
| Operating temperature range max.: | +70°C |
| Copper weight: | 46,00 kg/km |

## Norms

Acc. to ISO/IEC 11801, Acc. to EIA/TIA 568-A, Category 7, Flame-retardant acc. to IEC 60332-1-2, Halogen-free acc. to 60754-2, Oil-resistant, CMX 75°C (shielded)

## Application

HELUKAT® 600S Category 7 Trailing Cable is designed for use in cable carriers and the recurring loads caused by moving machine components. It provides excellent transmission characteristics under extremely difficult conditions.

## Part no.

**805614,** SF/FTP 4x2xAWG 24/7 PUR

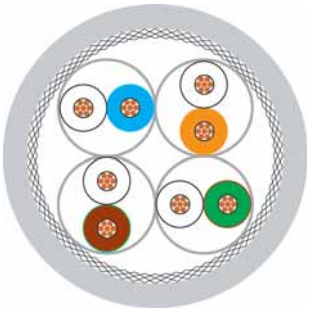
Dimensions and specifications may be changed without prior notice.

# Industrial Ethernet

**SHIPLINE**

## HELUKAT® 600IND

S/FTP, Category 7




## Type

## Marine and Offshore

## Cable structure

## S/FTP 4x2xAWG 24/7 (stranded) FRNC

| | |
|---|---|
| Inner conductor diameter: | Copper, bare (AWG 24/7) |
| Core insulation: | Foam-skin-PE |
| Core colours: | wh/bu, wh/og, wh/gn, wh/bn |
| Stranding element: | Double core |
| Separator: | - |
| Shielding 1: | Al-Foil |
| Screen 1 over stranding: | Cu braid |
| Screen 2 over stranding: | - |
| Outer sheath material: | FRNC |
| Cable external diameter: | app. 9,1 mm ± 0,3 mm |
| Outer sheath colour: | Grey similar to RAL 7035 |

## Electrical data

| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz<br>100 Ohm ± 20 Ohm at 101 to 600 MHz |
| Loop resistance: | 168 Ohm/km max. |
| Mutual capacitance: | 43 nF/km nom. |
| Relative propagation velocity: | 72 % |

## Typical values

| Frequency | (MHz) | 10 | 16 | 62,5 | 100 | 200 | 600 |
|---|---|---|---|---|---|---|---|
| Attenuation | (dB/10m) | 0,7 | 0,8 | 1,6 | 2,1 | 3,1 | 5,2 |
| Next | (dB) | 90,0 | 90,0 | 85,0 | 81,0 | 76,0 | 68,0 |
| ACR | (dB) | 89,3 | 89,2 | 83,4 | 78,9 | 72,9 | 62,8 |

## Technical data

| | |
|---|---|
| Weight: | app. 85 kg/km |
| bending radius, repeated: | 85 mm |
| Operating temperature range min.: | -20°C |
| Operating temperature range max.: | +75°C |
| Caloric load, approx. value: | 0,80 MJ/m |
| Copper weight: | 36,00 kg/km |

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 7, Flame-retardant acc. to IEC 60332-3, Smoke density acc. to IEC 61034, Halogen-free acc. to 60754-2, Corrosiveness acc. to EN50267-2-3, Oil-resistant

## Application

HELUKAT® 600IND Category 7 Shipline is designed specially for use in shipbuilding and exceptionally well-suited for Ethernet applications. It guarantees excellent transmission characteristics and may be used even under the harshest conditions.The cable listed here is certified by **German Lloyd**; this means it is designed for flexible marine and offshore applications.

## Part no.

**803382,** S/FTP 4x2xAWG 24/7 stranded FRNC (S-STP)

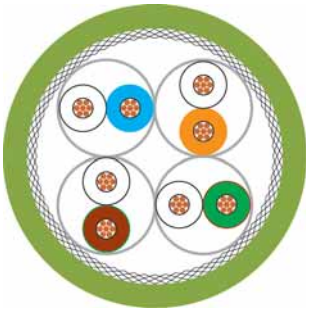
Dimensions and specifications may be changed without prior notice.

# Industrial Ethernet

**ROBUSTFLEX**

## HELUKAT® 600IND

S/FTP, Category 7




## Type
## Industrial Patch Cables
## Cable structure
## S/FTP 4x2xAWG 26/7 PUR

| | |
|---|---|
| Inner conductor diameter: | Copper, bare (AWG 26/7) |
| Core insulation: | Foam-skin-PE |
| Core colours: | wh/bu, wh/og, wh/gn, wh/bn |
| Stranding element: | Double core |
| Separator: | - |
| Shielding 1: | Al-Foil |
| Screen 1 over stranding: | Cu braid |
| Screen 2 over stranding: | - |
| Outer sheath material: | PUR |
| Cable external diameter: | app. 6,4 mm ± 0,3 mm |
| Outer sheath colour: | Green similar to RAL 6018 |

## Electrical data

| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz<br>100 Ohm ± 20 Ohm at 101 to 600 MHz |
| Loop resistance: | 290 Ohm/km max. |
| Mutual capacitance: | 42 nF/km nom. |
| Relative propagation velocity: | 64 % |

## Typical values

| Frequenz | (MHz) | 10 | 16 | 62,5 | 100 | 200 | 600 |
|---|---|---|---|---|---|---|---|
| Dämpfung | (dB/100m) | 8,4 | 10,4 | 20,5 | 26,2 | 38 | 67,8 |
| PS Next | (dB) | 95 | 95 | 90 | 90 | 85 | 73 |
| PS ACR | (dB) | 86,6 | 84,6 | 69,5 | 63,8 | 47,0 | 5,2 |

## Technical data

| | |
|---|---|
| Weight: | app. 48 kg/km |
| bending radius, repeated: | 64 mm |
| Operating temperature range min.: | -40°C |
| Operating temperature range max.: | +80°C |
| Caloric load, approx. value: | 0,45 MJ/m |
| Copper weight: | 28,00 kg/km |

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 7, Flame-retardant acc. to IEC 60332-1-2, Halogen-free acc. to 60754-2, Oil-resistant, AWM 20963 (80°C/30V)

## Application

HELUKAT®600IND Category 7 Robustflex is an Ethernet cable that is ideal for harsh industrial surroundings thanks to use of a halogen-free PU outer sheath. This cable is configurable with common RJ45 plugs (industrial and office version), as well as with some Sub-D and M12 plugs.

## Part no.

**802184,** S/FTP 4x2xAWG 26/7 PUR (S-STP)

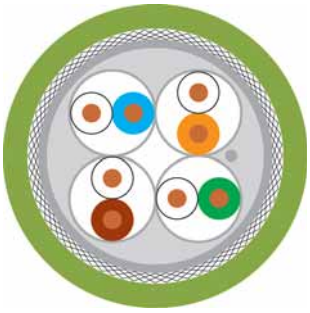
Dimensions and specifications may be changed without prior notice.

# Industrial Ethernet

**10GIG**

## HELUKAT® 500IND

S/FTP, Category $6_A$




## Type
## Cable structure

## Industrial Area
## S/FTP 4x2xAWG 22/1

| | |
|---|---|
| Inner conductor diameter: | Copper, bare (AWG 22/1) |
| Core insulation: | Foam-skin-PE |
| Core colours: | wh/bu, wh/og, wh/gn, wh/bn |
| Stranding element: | Double core |
| Separator: | - |
| Inner sheath material: | FRNC |
| Shielding 1: | Al-Foil |
| Total shielding: | AL-Foil + braid |
| Drain wire: | yes |
| Outer sheath material: | PVC |
| Cable external diameter: | app. 9,6 mm ± 0,3 mm |
| Outer sheath colour: | Green similar to RAL 6018 |

## Electrical data

| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz<br>100 Ohm ± 20 Ohm at 101 to 500 MHz |
| Conductor resistance, max.: | 59 Ohm/km |
| Insulation resistance, min.: | 0,5 GOhm x km |
| Loop resistance: | 118 Ohm/km max. |
| Mutual capacitance: | 72 nF/km nom. |
| Test voltage: | 0,7 kV |
| Relative propagation velocity: | 62 % |

## Typical values

| Frequency | (MHz) | 10 | 16 | 62,5 | 100 | 250 | 500 |
|---|---|---|---|---|---|---|---|
| Attenuation | (dB/100m) | 5,9 | 7,5 | 15,0 | 19,1 | 31,1 | 45,3 |
| Next | (dB) | 60,3 | 57,2 | 48,4 | 45,3 | 39,3 | 34,8 |
| PSNext | (dB) | 57,3 | 54,2 | 45,4 | 42,3 | 36,3 | 31,8 |

## Technical data

| | |
|---|---|
| Weight: | app. 115 kg/km |
| bending radius, repeated: | 80 mm |
| Operating temperature range min.: | -20°C |
| Operating temperature range max.: | +60°C |
| Caloric load, approx. value: | 1,63 MJ/m |
| Copper weight: | 44,00 kg/km |

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category $6_A$, CMG FT4

## Application

HELUKAT® 500IND was designed specially for extreme industrial applications for fixed installation. The copper data cable is especially well-suited for **Category $6_A$10 Gigabit/500MHz (IEC 61156-5)** Ethernet applications. It guarantees excellent transmission characteristics and may be used even under the harshest conditions.

## Part no.

**803693,** INDUSTRIAL ETHERNET KAT.6A 10GIG PVC

Dimensions and specifications may be changed without prior notice.



DNB Edition 11 (published 01.10.2015)

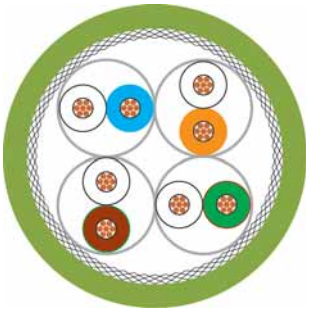
# Industrial Ethernet

**Drag Chain PVC + PUR**

## HELUKAT® 500S

S/FTP, Category 6A

NEW




| Type<br>Cable structure | Drag Chain applications<br>S/FTP 4x2xAWG 24/7 | Drag Chain applications<br>S/FTP 4x2xAWG 24/7 |
|---|---|---|
| Inner conductor diameter: | Copper, bare (AWG 24/7) | Copper, bare (AWG 24/7) |
| Core insulation: | PE | PE |
| Core colours: | wh/bu, wh/og, wh/gn, wh/bn | wh/bu, wh/og, wh/gn, wh/bn |
| Stranding element: | Double core | Double core |
| Separator: | Polyester foil over stranded bundle | Polyester foil over stranded bundle |
| Shielding 1: | Al-Foil | Al-Foil |
| Total shielding: | Cu braid, tinned | Cu braid, tinned |
| Outer sheath material: | PVC | PUR |
| Cable external diameter: | app. 8,9 mm ± 0,2 mm | app. 8,9 mm ± 0,2 mm |
| Outer sheath colour: | Green similar to RAL 6018 | Green similar to RAL 6018 |

## Electrical data

| | | |
|---|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz<br>100 Ohm ± 20 Ohm at 101 to 500 MHz | 100 Ohm ± 15 Ohm at 1 to 100 MHz<br>100 Ohm ± 20 Ohm at 101 to 500 MHz |
| Insulation resistance, min.: | 0,5 GOhm x km | 0,5 GOhm x km |
| Mutual capacitance: | 50 nF/km nom. | 50 nF/km nom. |
| Test voltage: | 0,7 kV | 0,7 kV |
| Relative propagation velocity: | 67 % | 67 % |

## Typical values

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| frequency | (MHz) | 10 | 16 | 62,5 | 100 | 200 | 300 | 500 |
| attenuation | (db/100m) | 8,9 | 11,2 | 22,5 | 28,7 | 41,4 | 51,4 | 67,9 |
| next | (dB) | 60,3 | 57,2 | 48,4 | 45,3 | 40,8 | 38,1 | 34,8 |

## Technical data

| | | |
|---|---|---|
| Weight: | app. 76 kg/km | app. 76 kg/km |
| bending radius, repeated: | 135 mm | 135 mm |
| Operating temperature range min.: | -10°C | -40°C |
| Operating temperature range max.: | +80°C | +80°C |
| Caloric load, approx. value: | 1,69 MJ/m | 1,69 MJ/m |
| Copper weight: | 44,00 kg/km | 44,00 kg/km |

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 6A, CM 75°C or PLTC

## Application

HELUKAT® 500S was designed specially for flexible applications in Drag Chains in extreme industrial environments. The copper data cable is especially well-suited for Category 6A Ethernet applications. It guarantees excellent transmission characteristics and may be used even under the harshest conditions.
The PVC version has UL CM + PLTC listing; the PUR version UL recognized and additional halogen free

## Part no.

| | |
|---|---|
| **805704,** INDUSTRIAL ETHERNET KAT.6A 10GIG PVC | **805703,** INDUSTRIAL ETHERNET KAT.6A 10GIG PUR |

Dimensions and specifications may be changed without prior notice.

# Industrial Ethernet

**Drag Chain**

## HELUKAT® 500S

S/FTP, Category $6_A$

NEW


## Cable structure

**SF/FTP 4x2xAWG26/7 PUR**

| | |
|---|---|
| Inner conductor Ø: | 0,55 mm |
| Conductor material: | Copper, tinned |
| Core insulation: | Foam-skin-PE |
| Core colours: | wh/bu, wh/og, wh/gn, wh/bn |
| Separator: | - |
| Screen over stranding element: | Al-Foil |
| Total shielding: | AL-Foil + braid |
| Outer sheath material: | PUR |
| Outer diameter: | app. 7,8 mm |
| Outer sheath colour: | Green similar to RAL 6018 |

## Electrical data

| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz<br>100 Ohm ± 20 Ohm at 101 to 500 MHz |
| Conductor resistance, max.: | 55,4 Ohm/km |
| Insulation resistance, min.: | 5 GOhm x km |
| Loop resistance: | 110 Ohm/km max. |
| Mutual capacitance: | 50 nF/km nom. |
| Test voltage: | 0,7 kV |

## Typical values

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Frequency | (MHz) | 10 | 16 | 62,5 | 100 | 300 | 500 |
| Attentuation | (dB/10m) | 0,9 | 1,1 | 2,3 | 2,9 | 5,1 | 6,8 |
| Next | (dB) | 60,3 | 57,2 | 48,4 | 45,3 | 38,1 | 34,8 |

## Technical data

| | |
|---|---|
| Weight: | app. 64 kg/km |
| bending radius, repeated: | 117 mm |
| Operating temperature range min.: | -10°C |
| Operating temperature range max.: | +70°C |
| Caloric load, approx. value: | 1,35 MJ/m |
| Copper weight: | 34,00 kg/km |

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category $6_A$, Flame-retardant acc. to IEC 60332-1-2, Halogen-free acc. to 60754-2, CMX 75°C (shielded)

## Application

HELUKAT® 500S trailing cable Category $6_A$ is designed for use in cable carriers and the recurring loads caused by moving machine components. It provides excellent transmission characteristics under extremely difficult conditions.

## Part no.

**805548,** INDUSTRIAL ETHERNET CAT.6A 10GIG PUR

Dimensions and specifications may be changed without prior notice.



DNB Edition 11 (published 01.10.2015)

# Industrial Ethernet

**PVC CMG**

## HELUKAT® 250IND

SF / UTP, Category 6

NEW


## Cable structure

**SF/UTP 4x2xAWG 24/1**

| | |
|---|---|
| Inner conductor Ø: | 0,51 mm |
| Conductor material: | Copper, bare |
| Core insulation: | Foam-skin-PE |
| Core colours: | wh/bu, wh/og, wh/gn, wh/bn |
| Separator: | Polyester foil over stranded bundle |
| Inner sheath material: | FRNC |
| Screen over stranding element: | - |
| Total shielding: | AL-Foil + braid |
| Outer sheath material: | PVC |
| Outer diameter: | app. 8,0 mm |
| Outer sheath colour: | Green similar to RAL 6018 |

## Electrical data

| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz<br>100 Ohm ± 20 Ohm bei 101 bis 250 MHz |
| Conductor resistance, max.: | 85 Ohm/km |
| Insulation resistance, min.: | 0,5 GOhm x km |
| Loop resistance: | 190 Ohm/km max. |
| Mutual capacitance: | 72 nF/km nom. |
| Test voltage: | 0,7 kV |
| Rel. propagation velocity: | 62 % |

## Typical values

| Frequenz | (MHz) | 10 | 16 | 62,5 | 100 | 250 |
|---|---|---|---|---|---|---|
| attenuation | (dB/100m) | 6,3 | 7,9 | 16,0 | 20,7 | 35,0 |
| Next | (dB) | 59,3 | 56,2 | 47,4 | 44,3 | 38,3 |
| PSNext | (dB) | 57,3 | 54,2 | 45,4 | 42,3 | 36,3 |

## Technical data

| | |
|---|---|
| Weight: | app. 76 kg/km |
| bending radius, repeated: | 40 mm |
| Operating temperature range min.: | -40°C |
| Operating temperature range max.: | +80°C |
| Caloric load, approx. value: | 1,69 MJ/m |
| Copper weight: | 37,00 kg/km |

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 6, Flame-retardant acc. to IEC 60332-3, CMG FT4

## Application

HELUKAT® 250IND was designed specially for extreme industrial applications. The copper data cable is especially well-suited for Ethernet applications Category 6. It guarantees excellent transmission characteristics and may be used even under the harshest conditions.

## Part no.

**805655,** INDUSTRIAL ETHERNET CAT.6

Dimensions and specifications may be changed without prior notice.

# Industrial Ethernet

**PVC AWM**

## HELUKAT® 250IND

SF / UTP, Category 6

NEW


## Cable structure

**SF/UTP 4x2xAWG 24/1**

| | |
|---|---|
| Inner conductor Ø: | 0,52 mm |
| Conductor material: | Copper, bare |
| Core insulation: | PE |
| Core colours: | wh/bu, wh/og, wh/gn, wh/bn |
| Separator: | - |
| Inner sheath material: | FRNC |
| Screen over stranding element: | - |
| Total shielding: | AL-Foil + braid |
| Outer sheath material: | PVC |
| Outer diameter: | app. 8,0 mm |
| Outer sheath colour: | Green similar to RAL 6018 |

## Electrical data

| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz<br>100 Ohm ± 20 Ohm bei 101 bis 250 MHz |
| Insulation resistance, min.: | 0,5 GOhm x km |
| Mutual capacitance: | 72 nF/km nom. |
| Test voltage: | 0,7 kV |
| Rel. propagation velocity: | 62 % |

## Typical values

| | | | | | | |
|---|---|---|---|---|---|---|
| Frequency | (MHz) | 10 | 16 | 62,5 | 100 | 250 |
| Attenuation | (dB/100m) | 5,9 | 7,5 | 15,0 | 19,1 | 31,1 |
| Next | (dB) | 60,3 | 57,2 | 48,4 | 45,3 | 39,3 |
| PSNext | (dB) | 57,3 | 54,2 | 45,4 | 42,3 | 36,3 |

## Technical data

| | |
|---|---|
| Weight: | app. 78 kg/km |
| bending radius, repeated: | 40 mm |
| Operating temperature range min.: | -40°C |
| Operating temperature range max.: | +80°C |
| Caloric load, approx. value: | 1,69 MJ/m |
| Copper weight: | 40,00 kg/km |

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 6, Flame-retardant acc. to IEC 60332-3, UL Style 2571

## Application

HELUKAT® 250IND was designed specially for extreme industrial applications. The copper data cable is especially well-suited for Category 6 Ethernet applications. It guarantees excellent transmission characteristics and may be used even under the harshest conditions. This version with PVC jacket is designed specifically for fixed installation under difficult industrial conditions.

## Part no.

**805681,** INDUSTRIAL ETHERNET CAT.6

Dimensions and specifications may be changed without prior notice.



DNB Edition 11 (published 01.10.2015)

# Industrial Ethernet

**Drag Chain PVC**

## HELUKAT® 250S

SF / UTP, Category 6

NEW


## Cable structure

**SF/UTP 4x2xAWG 24/7**

| | |
|---|---|
| Inner conductor Ø: | 0,6 mm |
| Conductor material: | Copper, bare |
| Core insulation: | Foam-skin-PE |
| Core colours: | whbu/bu, whog/og, whgn/gn, whbn/bn |
| Separator: | Polyester foil over stranded bundle |
| Inner sheath material: | FRNC |
| Screen over stranding element: | - |
| Total shielding: | AL-Foil + braid |
| Outer sheath material: | PVC |
| Outer diameter: | app. 8,0 mm |
| Outer sheath colour: | Green similar to RAL 6018 |

## Electrical data

| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz<br>100 Ohm ± 20 Ohm bei 101 bis 250 MHz |
| Conductor resistance, max.: | 90 Ohm/km |
| Insulation resistance, min.: | 0,5 GOhm x km |
| Loop resistance: | 180 Ohm/km max. |
| Mutual capacitance: | 50 nF/km nom. |
| Test voltage: | 0,7 kV |
| Rel. propagation velocity: | 67 % |

## Typical values

| Frequency | (MHz) | 10 | 16 | 62,5 | 100 | 200 | 250 |
|---|---|---|---|---|---|---|---|
| Attenuation | (db/100m) | 5,8 | 11,4 | 23,2 | 29,9 | 43,7 | 49,5 |
| Next | (dB) | 59,3 | 56,2 | 47,4 | 44,3 | 39,8 | 38,3 |
| PSNext | (dB) | 57,3 | 54,2 | 45,4 | 42,3 | 37,8 | 36,3 |

## Technical data

| | |
|---|---|
| Weight: | app. 72 kg/km |
| bending radius, repeated: | 160 mm |
| Operating temperature range min.: | -5°C |
| Operating temperature range max.: | +50°C |
| Caloric load, approx. value: | 1,69 MJ/m |
| Copper weight: | 39,00 kg/km |

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 6, Flame-retardant acc. to IEC 60332-3, CMG FT4

## Application

HELUKAT® 250S was designed specially for extreme industrial applications. The copper data cable is especially well-suited for Category 6 Ethernet applications. It guarantees excellent transmission characteristics and may be used even under the harshest conditions. This version with PVC jacket and stranded conductor is designed specifically for trailing use under difficult industrial conditions.

## Part no.

**805658,** INDUSTRIAL ETHERNET CAT.6

Dimensions and specifications may be changed without prior notice.

# Industrial Ethernet

**Drag Chain PUR**

## HELUKAT® 250S

SF/UTP, Category 6


## Type
## Drag Chain applications
## Cable structure
## SF/UTP 4x2x0.15 mm² (stranded) PUR

| | |
|---|---|
| Inner conductor diameter: | Copper, tinned (AWG 26/19) |
| Core insulation: | PP |
| Core colours: | whbu/bu, whog/og, whgn/gn, whbn/bn |
| Stranding element: | Double core |
| Separator: | - |
| Inner sheath material: | FRNC |
| Shielding 1: | - |
| Total shielding: | AL-Foil + braid |
| Outer sheath material: | PUR |
| Cable external diameter: | app. 7,8 mm ± 0,2 mm |
| Outer sheath colour: | Green similar to RAL 6018 |

## Electrical data

| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz<br>100 Ohm ± 20 Ohm bei 101 bis 250 MHz |
| Conductor resistance, max.: | 140 Ohm/km |
| Insulation resistance, min.: | 5 GOhm x km |
| Loop resistance: | 280 Ohm/km max. |
| Mutual capacitance: | 50 nF/km nom. |
| Test voltage: | 0,7 kV |
| Relative propagation velocity: | 67 % |

## Typical values

| Frequency | (MHz) | 10 | 16 | 62,5 | 100 | 250 |
|---|---|---|---|---|---|---|
| Attentuation | (dB/10m) | 0,9 | 1,2 | 2,4 | 2,9 | 4,9 |
| Next | (dB) | 60,3 | 57,2 | 48,4 | 45,3 | 39,3 |
| ACR | (dB) | 59,4 | 56,0 | 46,0 | 42,4 | 34,4 |

## Technical data

| | |
|---|---|
| Weight: | app. 63 kg/km |
| bending radius, repeated: | 60 mm |
| Operating temperature range min.: | -30°C |
| Operating temperature range max.: | +70°C |
| Caloric load, approx. value: | 1,35 MJ/m |
| Copper weight: | 34,00 kg/km |

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 6, Flame-retardant acc. to IEC 60332-1-2, Halogen-free acc. to 60754-2, CMX 75°C (shielded)

## Application

HELUKAT® 250S trailing cable Category 6 is designed for use in cable carriers and the recurring loads caused by moving machine components. It provides excellent transmission characteristics under extremely difficult conditions.

## Part no.

**803387,** INDUSTRIAL ETHERNET CAT.6

Dimensions and specifications may be changed without prior notice.

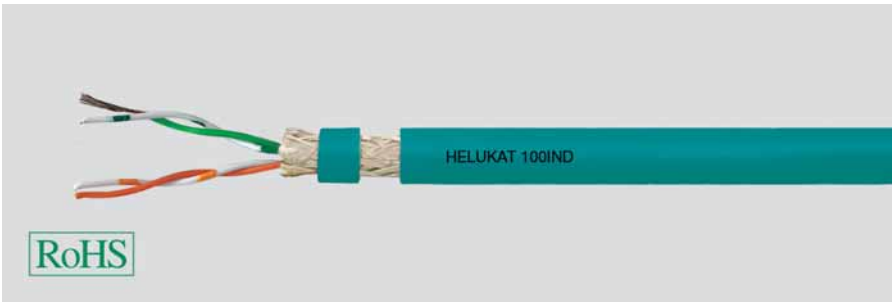
# Industrial Ethernet

**FRNC + PUR**

## HELUKAT® 100IND

SF/UTP, Category 5e

NEW




| | | |
|---|---|---|
| **Type** | **Fixed installation, indoor** | **Fixed installation, indoor** |
| **Cable structure** | **SF/UTP 2x2xAWG24/1** | **SF/UTP 2x2xAWG24/1** |
| Inner conductor diameter: | Copper, bare (AWG 24/1) | Copper, bare (AWG 24/1) |
| Core insulation: | Foam-skin-PE | Foam-skin-PE |
| Core colours: | wsor/or, wsgn/gn | wsor/or, wsgn/gn |
| Stranding element: | Double core | Double core |
| Separator: | Polyester foil over stranded bundle | - |
| Shielding 1: | Al-Foil | - |
| Total shielding: | AL-Foil + braid | AL-Foil + braid |
| Outer sheath material: | FRNC | PUR |
| Cable external diameter: | app. 5,6 mm ± 0,2 mm | app. 5,6 mm ± 0,2 mm |
| Outer sheath colour: | blau similar to RAL 5021 | blau similar to RAL 5021 |

## Electrical data

| | | |
|---|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz | 100 Ohm ± 15 Ohm at 1 to 100 MHz |
| Conductor resistance, max.: | 86 Ohm/km | 86 Ohm/km |
| Insulation resistance, min.: | 0,5 GOhm x km | 0,5 GOhm x km |
| Loop resistance: | 192 Ohm/km max. | 192 Ohm/km max. |
| Mutual capacitance: | 48 nF/km nom. | 48 nF/km nom. |
| Nominal voltage: | 125 V | 125 V |
| Test voltage: | 1 kV | 1 kV |

## Typical values

| | | | | | |
|---|---|---|---|---|---|
| frequency | (MHz) | 10 | 16 | 62,5 | 100 |
| attenuation | (dB/100m) | 6,3 | 8,1 | 16,5 | 21,4 |
| next | (dB) | 50,3 | 47,4 | 38,4 | 35,3 |

## Technical data

| | | |
|---|---|---|
| Weight: | app. 45 kg/km | app. 53 kg/km |
| bending radius, repeated: | 45 mm | 45 mm |
| Operating temperature range min.: | -30°C | -30°C |
| Operating temperature range max.: | +80°C | +80°C |
| Copper weight: | 22,00 kg/km | 22,00 kg/km |

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Category 5, Flame-retardant acc. to IEC 60332-3, Halogen-free acc. to 60754-2, Corrosiveness acc. to EN50267-2-3

## Application

HELUKAT® 100IND Category 5e FRNC for fixed installation indoor in halogen free and flame retardent edition.
The PUR version is excellent oil resistant, halogen free and abrasion resistant.

## Part no.

**805699,** INDUSTRIAL ETHERNET CAT.5e

**805700,** INDUSTRIAL ETHERNET CAT.5e

Dimensions and specifications may be changed without prior notice.

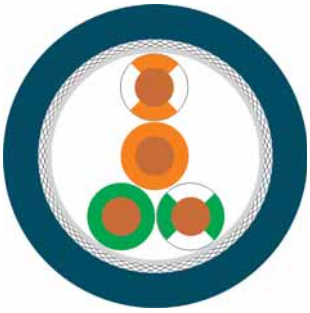
# Industrial Ethernet

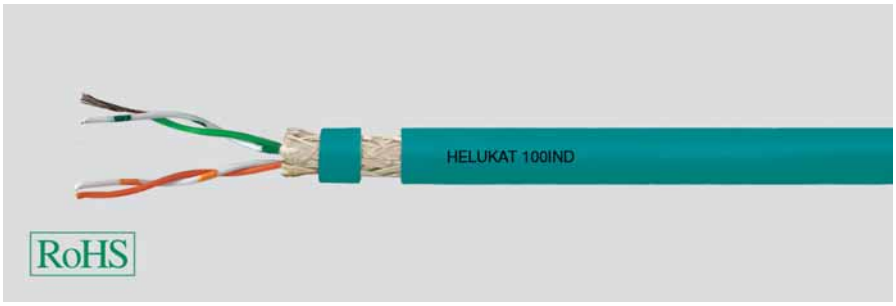
**FLEX FRNC + PUR**

## HELUKAT® 100IND

SF/UTP, Category 5e

NEW






| Type<br>Cable structure | Mobile use<br>SF/UTP 2x2xAWG26/7 (stranded) | Mobile use<br>SF/UTP 2x2xAWG26/7 (stranded) |
|---|---|---|
| Inner conductor diameter: | Copper, bare (AWG 26/7) | Copper, bare (AWG 26/7) |
| Core insulation: | PE | PE |
| Core colours: | wsor/or, wsgn/gn | wsor/or, wsgn/gn |
| Stranding element: | Double core | Double core |
| Separator: | - | - |
| Shielding 1: | - | PETP fleece |
| Total shielding: | AL-Foil + braid | AL-Foil + braid |
| Outer sheath material: | FRNC | PUR |
| Cable external diameter: | app. 5,6 mm ± 0,2 mm | app. 5,7 mm ± 0,2 mm |
| Outer sheath colour: | blau similar to RAL 5021 | blau similar to RAL 5021 |

## Electrical data

| | | |
|---|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz | 100 Ohm ± 15 Ohm at 1 to 100 MHz |
| Conductor resistance, max.: | 142 Ohm/km | - |
| Insulation resistance, min.: | 0,5 GOhm x km | - |
| Loop resistance: | 284 Ohm/km max. | - |
| Mutual capacitance: | 48 nF/km nom. | 50 nF/km nom. |
| Nominal voltage: | 125 V | - |
| Test voltage: | 1 kV | 0,5 kV |
| Relative propagation velocity: | 77 % | 67 % |

## Typical values

| | | | | | |
|---|---|---|---|---|---|
| Frequency | (MHz) | 10 | 16 | 62,5 | 100 |
| Attentuation | (dB/100m) | 9,6 | 12,1 | 24,9 | 32,0 |
| Next | (dB) | 50,3 | 47,2 | 38,4 | 35,3 |

## Technical data

| | | |
|---|---|---|
| Weight: | app. 43 kg/km | app. 45 kg/km |
| bending radius, repeated: | 84 mm | 89 mm |
| Operating temperature range min.: | -5°C | -5°C |
| Operating temperature range max.: | +60°C | +60°C |
| Caloric load, approx. value: | 0,64 MJ/m | 0,64 MJ/m |
| Copper weight: | 19,00 kg/km | 19,00 kg/km |

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 5e, Flame-retardant acc. to IEC 60332-1-2, Halogen-free acc. to 60754-2, Corrosiveness acc. to EN50267-2-3

## Application

HELUKAT® 100IND Category 5e FRNC flex is designed for flexible use. Thanks to the FRNC sheath, it also offers halogen free and flame retardent parameters.
The PUR version is excellent oil resistant, halogen free and abrasion resistant.

## Part no.

**805701,** INDUSTRIAL ETHERNET CAT.5e

**805702,** INDUSTRIAL ETHERNET CAT.5e

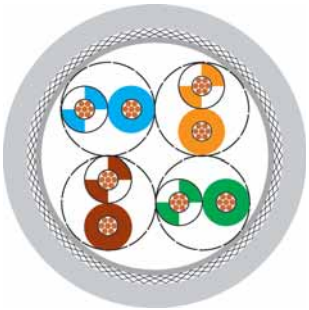
Dimensions and specifications may be changed without prior notice.

# Industrial Ethernet

**ROBUSTFLEX**

## HELUKAT® 200IND

SF/UTP, Category 5e




## Type
## Industrial Patch Cables
## Cable structure
## SF/UTP 4x2xAWG 26/7 PUR

| | |
|---|---|
| Inner conductor diameter: | Copper, bare (AWG 26/7) |
| Core insulation: | PO |
| Core colours: | whbu/bu, whog/og, whgn/gn, whbn/bn |
| Stranding element: | Double core |
| Separator: | Polyester foil over stranded bundle |
| Shielding 1: | - |
| Screen 1 over stranding: | Al-Foil |
| Screen 2 over stranding: | Cu braid |
| Outer sheath material: | PUR |
| Cable external diameter: | app. 5,8 mm |
| Outer sheath colour: | Grey similar to RAL 7035 |

## Electrical data

| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz<br>100 Ohm ± 20 Ohm at 101 to 200 MHz |
| Loop resistance: | 260 Ohm/km max. |
| Mutual capacitance: | 47 nF/km nom. |
| Relative propagation velocity: | 74 % |

## Typical values

| | | | | | | |
|---|---|---|---|---|---|---|
| Frequency | (MHz) | 10 | 16 | 62,5 | 100 | 200 |
| Attenuation | (dB/10m) | 0,8 | 1,1 | 2,4 | 2,9 | 4,3 |
| Next | (dB) | 58,0 | 56,0 | 45,0 | 43,0 | 37,0 |
| ACR | (dB) | 57,2 | 54,9 | 42,6 | 40,1 | 32,7 |

## Technical data

| | |
|---|---|
| Weight: | app. 44 kg/km |
| bending radius, repeated: | 46 mm |
| Operating temperature range min.: | -40°C |
| Operating temperature range max.: | +80°C |
| Caloric load, approx. value: | 0,54 MJ/m |
| Copper weight: | 24,00 kg/km |

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 5e, Flame-retardant acc. to IEC 60332-1-2, Halogen-free acc. to 60754-2, Oil-resistant

## Application

HELUKAT® 200IND Category 5e Robustflex is used in harsh industrial surroundings and characterized by high reserve capacity and outstanding performance. Mechanically, the halogen-free PU outer sheath makes it ideal for harsh industrial surroundings. This cable is configurable with common RJ45 plugs (industrial and office version), as well as with various Sub-D and M12 plugs.

## Part no.

**800068,** SF/UTP 4x2xAWG 26/7 PUR (S-FTP)

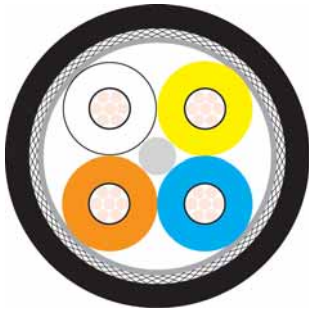
Dimensions and specifications may be changed without prior notice.

# Industrial Ethernet

**WK Industrial 105°C**

HELUKAT® 100IND

SF/UTP, Category 5e




## Type
## Cable structure

**Windenergy**
**SF/UTP 2x2x0,75 mm (stranded)**

| | |
|---|---|
| Inner conductor diameter: | Copper, tinned (AWG 22/7) |
| Core insulation: | XLPE ray cross-linking |
| Core colours: | wh, ye, bu, og |
| Stranding element: | Star quad |
| Separator: | Polyester foil over stranded bundle |
| Shielding 1: | Al-Foil |
| Total shielding: | Cu braid, tinned |
| Outer sheath material: | X-FRNC |
| Cable external diameter: | app. 6,5 mm ± 0,2 mm |
| Outer sheath colour: | Black similar to RAL 9005 |

## Electrical data

| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz |
| Conductor resistance, max.: | 60 Ohm/km |
| Insulation resistance, min.: | 0,5 GOhm x km |
| Loop resistance: | 120 Ohm/km max. |
| Mutual capacitance: | 57 nF/km nom. |
| Test voltage: | 2 kV |
| Relative propagation velocity: | 69 % |

## Typical values

| | | | | | |
|---|---|---|---|---|---|
| Frequency | (MHz) | 10 | 16 | 62,5 | 100 |
| Attenuation | (dB/100m) | 6,3 | 8,0 | 16,5 | 21,3 |
| Next | (dB) | 70,0 | 65,0 | 55,0 | 50,0 |
| ACR | (dB) | 63,7 | 57,0 | 38,5 | 28,7 |

## Technical data

| | |
|---|---|
| Weight: | app. 64 kg/km |
| bending radius, repeated: | 52 mm |
| Operating temperature range min.: | -40°C |
| Operating temperature range max.: | +105°C * |
| Caloric load, approx. value: | 0,89 MJ/m |
| Copper weight: | 34,00 kg/km |

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Category 5, Flame-retardant acc. to IEC 60332-3, Halogen-free acc. to 60754-2, Corrosiveness acc. to EN50267-2-3, UL-Syle 21281 80°C/300V

## Application

HELUKAT® 100IND Category 5e WK Industrial 105°C is designed specially for demanding temperature requirements such as those encountered in wind turbines. Radiation cross-linking provides improved thermal stability as well as good oil resitance.

## Part no.

**802293,** INDUSTRIAL ETHERNET CAT.5

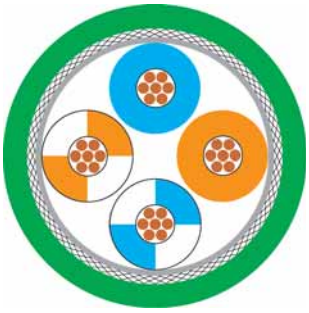
Dimensions and specifications may be changed without prior notice.

# Industrial Ethernet

**Drag Chain ECO**

## HELUKAT® 100S

SF/UTP 4 core, Category 5e




## Type
## Cable structure

## Drag Chain applications
## SF/UTP 4x1x0.15 mm² (stranded)

| | |
|---|---|
| Inner conductor diameter: | Copper, bare (AWG 26/19) |
| Core insulation: | PO |
| Core colours: | bl, or, whbl, whor |
| Stranding element: | Star quad |
| Separator: | - |
| Shielding 1: | PETP fleece |
| Total shielding: | AL-Foil + braid |
| Outer sheath material: | PUR |
| Cable external diameter: | app. 4,8 mm ± 0,2 mm |
| Outer sheath colour: | Green similar to RAL 6018 |

## Electrical data

| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz |
| Conductor resistance, max.: | 125 Ohm/km |
| Insulation resistance, min.: | 5 GOhm x km |
| Loop resistance: | 250 Ohm/km max. |
| Mutual capacitance: | 50 nF/km nom. |
| Test voltage: | 0,5 kV |
| Relative propagation velocity: | 67 % |

## Typical values

| | | | | | | |
|---|---|---|---|---|---|---|
| Frequency | (MHz) | 10 | 16 | 62,5 | 100 | 155 |
| Attentuation | (dB/100m) | 9,5 | 12,1 | 24,8 | 32,0 | 41,0 |
| Next | (dB) | 50,0 | 48,0 | 38,5 | 35,3 | 30,0 |

## Technical data

| | |
|---|---|
| Weight: | app. 30 kg/km |
| bending radius, repeated: | 70 mm |
| Operating temperature range min.: | -40°C |
| Operating temperature range max.: | +80°C |
| Caloric load, approx. value: | 0,37 MJ/m |
| Copper weight: | 17,00 kg/km |

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 5e, Flame-retardant acc. to IEC 60332-1-2, Halogen-free acc. to 60754-2, AWM 20963 (80°C/30V)

## Application

HELUKAT® 100S Category 5e Drag Chain Eco is designed in use in cable carriers and the recurring loads cause by moving machine components. Thanks to the PU sheath, it also offers excellent resistance to common mineral oils, greases and cooling lubricants.

## Part no.

**82838,** INDUSTRIAL ETHERNET CAT.5e

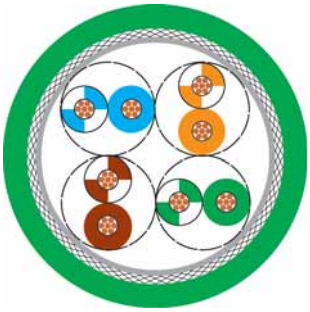
Dimensions and specifications may be changed without prior notice.

# Industrial Ethernet

**Drag Chain ECO**

## HELUKAT® 100S

SF/UTP 4-pair, Category 5e




## Type

## Drag Chain applications

## Cable structure

## SF/UTP 4x2x0.15 mm² (stranded)

| | |
|---|---|
| Inner conductor diameter: | Copper, bare (AWG 26/19) |
| Core insulation: | PO |
| Core colours: | whbu/bu, whog/og, whgn/gn, whbn/bn |
| Stranding element: | Double core |
| Separator: | - |
| Shielding 1: | PETP fleece |
| Total shielding: | AL-Foil + braid |
| Outer sheath material: | PUR |
| Cable external diameter: | app. 6,6 mm ± 0,2 mm |
| Outer sheath colour: | Green similar to RAL 6018 |

## Electrical data

| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz |
| Conductor resistance, max.: | 125 Ohm/km |
| Insulation resistance, min.: | 5 GOhm x km |
| Loop resistance: | 250 Ohm/km max. |
| Mutual capacitance: | 50 nF/km nom. |
| Test voltage: | 0,5 kV |
| Relative propagation velocity: | 67 % |

## Typical values

| | | | | | | |
|---|---|---|---|---|---|---|
| Frequency | (MHz) | 10 | 16 | 62,5 | 100 | 155 |
| Attentuation | (dB/100m) | 9,5 | 12,1 | 24,8 | 32,0 | 41,0 |
| Next | (dB) | 50,3 | 47,2 | 38,4 | 35,3 | 30,0 |

## Technical data

| | |
|---|---|
| Weight: | app. 56 kg/km |
| bending radius, repeated: | 102 mm |
| Operating temperature range min.: | -40°C |
| Operating temperature range max.: | +80°C |
| Caloric load, approx. value: | 0,64 MJ/m |
| Copper weight: | 31,00 kg/km |

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 5e, Flame-retardant acc. to IEC 60332-1-2, Halogen-free acc. to 60754-2, AWM 20963 (80°C/30V)

## Application

HELUKAT® 100S Category 5e Drag Chain Eco is designed for use in cable carriers and the recurring loads caused by moving machine components. Thanks to the PUR sheath, it also offers excellent resistance to common mineral oils, greases and cooling lubricants.

## Part no.

**82839,** INDUSTRIAL ETHERNET CAT.5e

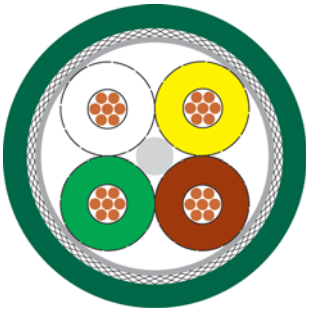
Dimensions and specifications may be changed without prior notice.

# Industrial Ethernet

**Drag Chain**

## HELUKAT® 200S

SF/UTP 4 core, Category 5




## Type
## Cable structure

**Drag Chain Patch Cables**
**SF/UTP 4x1xAWG 24/19 (stranded) PUR**

| | |
|---|---|
| Inner conductor diameter: | Copper, bare (AWG 24/19) |
| Core insulation: | PP |
| Core colours: | wh, ye, br, gn |
| Stranding element: | Quad |
| Separator: | Polyester foil over stranded bundle |
| Shielding 1: | - |
| Screen 1 over stranding: | Al-Foil |
| Screen 2 over stranding: | Cu braid |
| Outer sheath material: | PUR |
| Cable external diameter: | app. 6,2 mm ± 0,2 mm |
| Outer sheath colour: | Green similar to RAL 6026 |

## Electrical data

| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz |
| Loop resistance: | 156 Ohm/km max. |
| Mutual capacitance: | 51 nF/km nom. |
| Relative propagation velocity: | 67 % |

## Typical values

| | | | | | |
|---|---|---|---|---|---|
| Frequency | (MHz) | 10 | 16 | 62,5 | 100 |
| Attenuation | (dB/10m) | 0,6 | 0,8 | 1,6 | 2,2 |
| Next | (dB) | 59,0 | 55,0 | 43,0 | 38,0 |
| ACR | (dB) | 58,4 | 54,2 | 41,4 | 35,8 |

## Technical data

| | |
|---|---|
| Weight: | app. 54 kg/km |
| bending radius, repeated: | 75 mm |
| Operating temperature range min.: | -20°C |
| Operating temperature range max.: | +70°C |
| Caloric load, approx. value: | 0,944 MJ/m |
| Copper weight: | 30,00 kg/km |

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 5e, Flame-retardant acc. to IEC 60332-1-2, Halogen-free acc. to 60754-2, Oil-resistant

## Application

HELUKAT® 200S Category 5e Drag Chain is designed for use in cable carriers and the extreme loads caused by moving machine components and provides excellent transmission characteristics under the most difficult and extreme conditions. Thanks to the clever structure, it is also suitable mechanically for use even in cable carriers with a high packing density.

## Part no.

**800088,** SF/UTP 4x1xAWG 24/19 PUR (S-FTP)

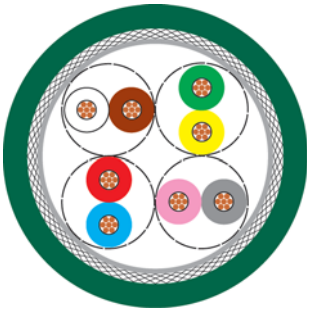
Dimensions and specifications may be changed without prior notice.

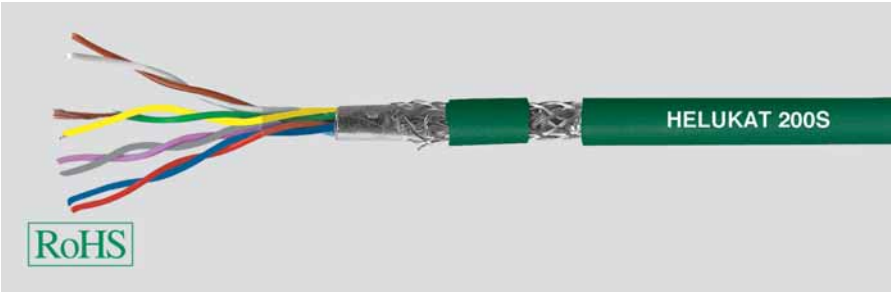
# Industrial Ethernet

**Drag Chain**

## HELUKAT® 200S

SF/UTP 4 pair, Category 5






## Type
## Cable structure

**Drag Chain Patch Cables**
**SF/UTP 4x2xAWG 24/19 PUR (stranded)**

| | |
|---|---|
| Inner conductor diameter: | Copper, bare (AWG 24/19) |
| Core insulation: | PE |
| Core colours: | wh/bn, gn/ye, gy/pk, bu/rd |
| Stranding element: | Double core |
| Separator: | Polyester foil over stranded bundle |
| Shielding 1: | - |
| Screen 1 over stranding: | Al-Foil |
| Screen 2 over stranding: | Cu braid |
| Outer sheath material: | PUR |
| Cable external diameter: | app. 9,5 mm ± 0,2 mm |
| Outer sheath colour: | Green similar to RAL 6026 |

## Electrical data

| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz |
| Loop resistance: | 156 Ohm/km max. |
| Mutual capacitance: | 51 nF/km nom. |
| Relative propagation velocity: | 67 % |

## Typical values

| | | | | | |
|---|---|---|---|---|---|
| Frequency | (MHz) | 10 | 16 | 62,5 | 100 |
| Attenuation | (dB/10m) | 0,7 | 0,9 | 1,9 | 2,5 |
| Next | (dB) | 57,0 | 54,0 | 45,0 | 43,0 |
| ACR | (dB) | 56,3 | 53,1 | 43,0 | 40,5 |

## Technical data

| | |
|---|---|
| Weight: | app. 110 kg/km |
| bending radius, repeated: | 115 mm |
| Operating temperature range min.: | -25°C |
| Operating temperature range max.: | +70°C |
| Caloric load, approx. value: | 2,08 MJ/m |
| Copper weight: | 54,30 kg/km |

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 5, Flame-retardant acc. to IEC 60332-1-2, Halogen-free acc. to 60754-2, Oil-resistant

## Application

HELUKAT® 200S Category 5e Drag Chain is designed for use in cable carriers and the extreme loads caused by moving machine components and provides excellent transmission characteristics under the most difficult and extreme conditions. Thanks to the clever structure, it is also suitable mechanically for use even in cable carriers with a high packing density.

## Part no.

**81155,** SF/UTP 4x2xAWG 24/19 PUR (S-FTP)

Dimensions and specifications may be changed without prior notice.



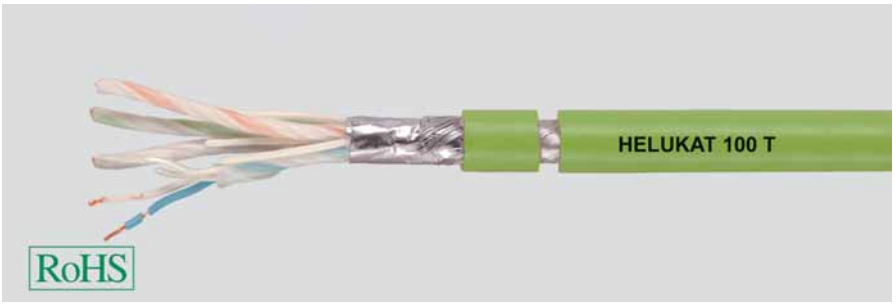
DNB Edition 11 (published 01.10.2015)

# Industrial Ethernet

**TORDIERFLEX**

## HELUKAT® 100T

SF/UTP, Category 5




## Type
## Cable structure

**Torsion Patch Cables**
**SF/UTP 4x2xAWG 26/19 (stranded) PUR**

| | |
|---|---|
| Inner conductor diameter: | Copper, bare (AWG 26/19) |
| Core insulation: | PP |
| Core colours: | wh/bu, wh/og, wh/gn, wh/bn |
| Stranding element: | Double core |
| Separator: | Polyester foil over stranded bundle |
| Shielding 1: | - |
| Screen 1 over stranding: | Polyester foil copper, bare |
| Screen 2 over stranding: | Cu braid |
| Outer sheath material: | PUR |
| Cable external diameter: | app. 7,5 mm |
| Outer sheath colour: | Green similar to RAL 6018 |

## Electrical data

| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz |
| Loop resistance: | 260 Ohm/km max. |
| Mutual capacitance: | 50 nF/km nom. |
| Relative propagation velocity: | 68 % |

## Typical values

| | | | | | |
|---|---|---|---|---|---|
| Frequency | (MHz) | 10 | 16 | 62,5 | 100 |
| Attenuation | (dB/10m) | 0,9 | 1,2 | 2,4 | 3,1 |
| Next | (dB) | 56,0 | 53,0 | 43,0 | 40,0 |
| ACR | (dB) | 55,1 | 51,8 | 40,6 | 36,9 |

## Technical data

| | |
|---|---|
| Weight: | app. 74 kg/km |
| bending radius, repeated: | 56 mm |
| Operating temperature range min.: | -20°C |
| Operating temperature range max.: | +60°C |
| Caloric load, approx. value: | 1,234 MJ/m |
| Copper weight: | 29,50 kg/km |

## Norms

Acc. to ISO/IEC 11801, Acc. to EN 50173, Acc. to EIA/TIA 568-A, Category 5, Flame-retardant acc. to IEC 60332-1-2, Halogen-free acc. to 60754-2, Oil-resistant, AWEM Style 20236 80°C/30V

## Application

HELUKAT® 100T Category 5 Torsionflex is designed for applications with torsion loads, e.g. in robots, and characterized by high reserve capacity and outstanding performance, even after exposure to extreme conditions. Thanks to the clever structure, it is also possible to achieve a long service life mechanically.

## Part no.

**800067,** SF/UTP 4x2xAWG 26/19 PUR (S-FTP)

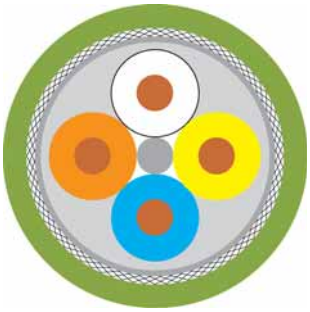
Dimensions and specifications may be changed without prior notice.

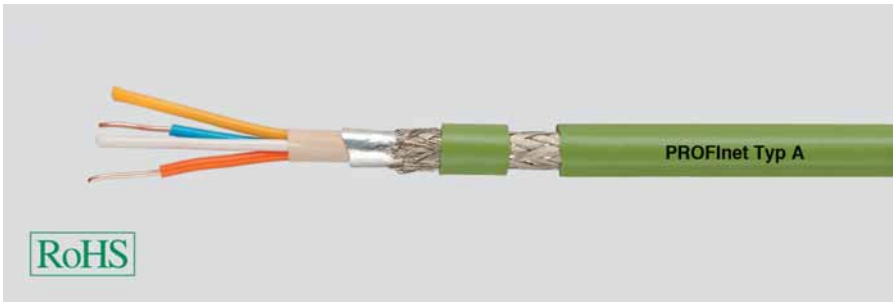
# Industrial Ethernet

**PROFInet Type A fixed installed + robust**

HELUKAT®

PVC + PUR






| Type | Fixed installation, indoor | Industrial Area |
|---|---|---|
| **Cable structure** | **2x2x0.64 mm** | **2x2x0.64 mm** |
| Inner conductor diameter: | Copper, bare (AWG 22/1) | Copper, bare (AWG 22/1) |
| Core insulation: | PE | PE |
| Core colours: | wh, ye, bu, og | wh, ye, bu, og |
| Stranding element: | Star quad | Star quad |
| Separator: | Polyester foil over stranded bundle | Polyester foil over stranded bundle |
| Inner sheath material: | PVC | PVC |
| Shielding 1: | Al-Foil | Al-Foil |
| Total shielding: | Cu braid, tinned | Cu braid, tinned |
| Outer sheath material: | PVC | PUR |
| Cable external diameter: | app. 6,5 mm ± 0,2 mm | app. 6,5 mm ± 0,2 mm |
| Outer sheath colour: | Green similar to RAL 6018 | Green similar to RAL 6018 |

## Electrical data

| | | |
|---|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz | 100 Ohm ± 15 Ohm at 1 to 100 MHz |
| Conductor resistance, max.: | 57,5 Ohm/km | 62,5 Ohm/km |
| Insulation resistance, min.: | 5 GOhm x km | 0,5 GOhm x km |
| Loop resistance: | 115 Ohm/km max. | 115 Ohm/km max. |
| Mutual capacitance: | 48 nF/km nom. | 50 nF/km nom. |
| Test voltage: | 2 kV | 2 kV |

## Typical values

| | | | | | |
|---|---|---|---|---|---|
| Frequency | (MHz) | 10 | 16 | 62,5 | 100 |
| Attenuation | (dB/100m) | 5,2 | 6,9 | 15,0 | 19,5 |
| Next | (dB) | 70,0 | 65,0 | 55,0 | 50,0 |
| ACR | (dB) | 64,8 | 58,1 | 40,0 | 30,5 |

## Technical data

| | | |
|---|---|---|
| Weight: | app. 67 kg/km | app. 64 kg/km |
| bending radius, repeated: | 65 mm | 65 mm |
| Operating temperature range min.: | -40°C | -40°C |
| Operating temperature range max.: | +80°C | +70°C |
| Caloric load, approx. value: | 0,34 MJ/m | 0,91 MJ/m |
| Copper weight: | 32,00 kg/km | 32,00 kg/km |

## Norms

| | | |
|---|---|---|
| Applicable standards: | PROFInet Guideline + IEC 61158-2 | PROFInet Guideline + IEC 61158-2 |
| | Acc. to ISO/IEC 11801 | Acc. to ISO/IEC 11801 |
| | Acc. to EN 50173 | Acc. to EN 50173 |
| | Category 5e | Category 5e |
| | Flame-retardant acc. to IEC 60332-1-2 | Flame-retardant acc. to IEC 60332-1-2 |
| UL Style: | CMG 75°C or PLTC or AWM 21694 600V | - |
| CSA standard: | CSA FT 4 | - |

## Application

HELUKAT® PROFInet Type A Category 5e for fixed installation in industrial networks, rugged. It guarantees excellent transmission characteristics and may be used even under the harshest conditions. The cable listed here corresponds to PROFInet Type A; this means the version with PVC sheath is designed for normal fixed installations and the version with PUR sheath is for difficult fixed installations in harsh industrial environments.

## Part no.

**800653,** PROFInet type A (SK)

**801194,** PROFInet type A (SK)

Dimensions and specifications may be changed without prior notice.



DNB Edition 11 (published 01.10.2015)

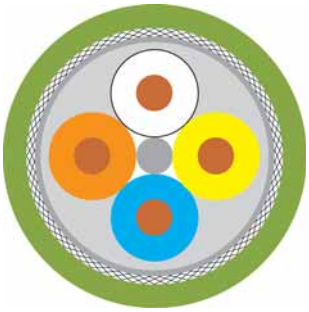
# Industrial Ethernet

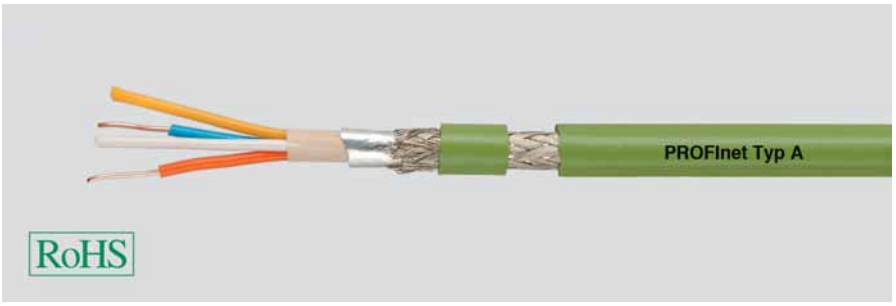
**PROFInet Type A fixed installed FRNC**

HELUKAT®

FRNC

NEW






## Type
## Cable structure

**Fixed installation, indoor**
**2x2x0.64 mm**

| | |
|---|---|
| Inner conductor diameter: | Copper, bare (AWG 22/1) |
| Core insulation: | PE |
| Core colours: | wh, ye, bu, og |
| Stranding element: | Star quad |
| Separator: | Polyester foil over stranded bundle |
| Inner sheath material: | FRNC |
| Shielding 1: | Al-Foil |
| Total shielding: | Cu braid, tinned |
| Outer sheath material: | FRNC |
| Cable external diameter: | app. 6,5 mm ± 0,2 mm |
| Outer sheath colour: | Green similar to RAL 6018 |

## Electrical data

| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz |
| Conductor resistance, max.: | 57,5 Ohm/km |
| Insulation resistance, min.: | 5 GOhm x km |
| Loop resistance: | 115 Ohm/km max. |
| Mutual capacitance: | 48 nF/km nom. |
| Test voltage: | 2 kV |

## Typical values

| | | | | | |
|---|---|---|---|---|---|
| Frequency | (MHz) | 10 | 16 | 62,5 | 100 |
| Attenuation | (dB/100m) | 5,2 | 6,9 | 15,0 | 19,5 |
| Next | (dB) | 70,0 | 65,0 | 55,0 | 50,0 |
| ACR | (dB) | 64,8 | 58,1 | 40,0 | 30,5 |

## Technical data

| | |
|---|---|
| Weight: | app. 65 kg/km |
| bending radius, repeated: | 65 mm |
| Operating temperature range min.: | -25°C |
| Operating temperature range max.: | +75°C |
| Caloric load, approx. value: | 0,34 MJ/m |
| Copper weight: | 32,00 kg/km |

## Norms

| | |
|---|---|
| Applicable standards: | PROFInet Guideline + IEC 61158-2<br>Acc. to ISO/IEC 11801<br>Acc. to EN 50173<br>Category 5e<br>Halogen-free acc. to 60754-2<br>Flame-retardant acc. to IEC 60332-1-2<br>Corrosiveness acc. to EN50267-2-3<br>Low-smoke acc. to EN50268-2 |
| UL Style: | CMG 75°C PLTC FT4 |
| CSA standard: | CSA FT 4 |

## Application

HELUKAT® PROFInet Type A FRNC Category 5e for fixed installation in industrial networks, rugged. It guarantees excellent transmission characteristics and may be used even under the harshest conditions. The cable listed here corresponds to PROFInet Type A in halogen free and flame retardent design.

## Part no.

**805653,** PROFInet type A (SK)

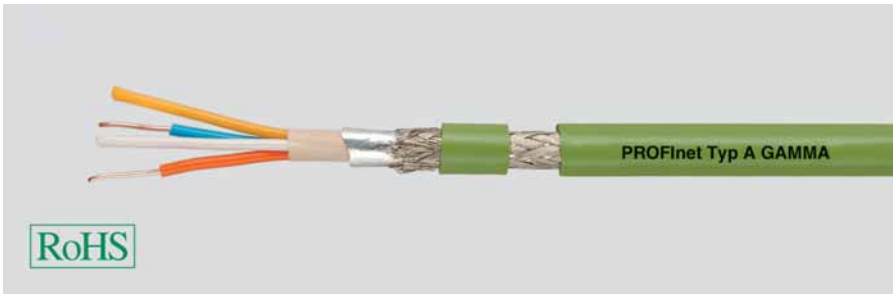
Dimensions and specifications may be changed without prior notice.

# Industrial Ethernet

**PROFInet Type A radiation resistant + armoured**

HELUKAT®

PUR + PE




| Type | ray loaded areas | Fixed installation, outdoor |
|---|---|---|
| **Cable structure** | **2x2x0.64 mm** | **2x2x0.64 mm** |
| Inner conductor diameter: | Copper, bare (AWG 22/1) | Copper, bare (AWG 22/1) |
| Core insulation: | XLPE ray cross-linking | PE |
| Core colours: | wh, ye, bu, og | wh, ye, bu, og |
| Stranding element: | Star quad | Star quad |
| Separator: | Polyester foil over stranded bundle | Polyester foil over stranded bundle |
| Inner sheath material: | TPR ray cross-linking | PVC |
| Shielding 1: | Al-Foil | Al-Foil |
| Total shielding: | Cu braid, tinned | Cu braid, tinned |
| Armouring: | - | Steel band |
| Outer sheath material: | PUR | PE |
| Cable external diameter: | app. 6,5 mm ± 0,2 mm | app. 9,3 mm ± 0,5 mm |
| Outer sheath colour: | Green similar to RAL 6018 | Black |

## Electrical data

| | | |
|---|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz | 100 Ohm ± 15 Ohm at 1 to 100 MHz |
| Conductor resistance, max.: | 62 Ohm/km | 57,5 Ohm/km |
| Insulation resistance, min.: | 0,5 GOhm x km | 0,5 GOhm x km |
| Loop resistance: | 124 Ohm/km max. | 115 Ohm/km max. |
| Mutual capacitance: | 50 nF/km nom. | 50 nF/km nom. |
| Test voltage: | 2 kV | 2 kV |

## Typical values

| Frequency | (MHz) | 10 | 16 | 62,5 | 100 |
|---|---|---|---|---|---|
| Attenuation | (dB/100m) | 5,2 | 6,9 | 15,0 | 19,5 |
| Next | (dB) | 70,0 | 65,0 | 55,0 | 50,0 |
| ACR | (dB) | 64,8 | 58,1 | 40,0 | 30,5 |

## Technical data

| | | |
|---|---|---|
| Weight: | app. 63 kg/km | app. 124 kg/km |
| bending radius, repeated: | 100 mm | 100 mm |
| Operating temperature range min.: | -40°C | -40°C |
| Operating temperature range max.: | +80°C | +70°C |
| Caloric load, approx. value: | 0,29 MJ/m | 2,14 MJ/m |
| Copper weight: | 32,00 kg/km | 31,00 kg/km |

## Norms

| | | |
|---|---|---|
| Applicable standards: | PROFInet Guideline + IEC 61158-2<br>Acc. to ISO/IEC 11801<br>Acc. to EN 50173<br>Category 5e | PROFInet Guideline + IEC 61158-2<br>Acc. to ISO/IEC 11801<br>Acc. to EN 50173<br>Category 5e |

## Application

HELUKAT® PROFInet Type A Cat 5e is radiation-resistant + armoured for fixed installation in industrial networks. It guarantees excellent transmission characteristics and may be used even under the harshest conditions. The cables listed here correspond to PROFInet Type A and thanks to their special construction with cross-linked PVC-inner sheath/PUR outer sheath are well-suited for fixed applications inside irradiated areas, while the armoured type with PVC inner sheath/PE outer sheath is ideal for areas with rodent problems.

## Part no.

**801195,** PROFInet type A (SK)

**801650,** PROFInet type A (SK)

Dimensions and specifications may be changed without prior notice.



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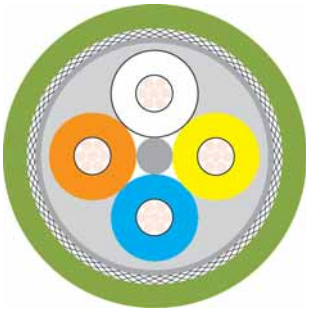
# Industrial Ethernet

**PROFInet Type B flexible**

HELUKAT®

PVC




## Type
## Cable structure

## Mobile use
## 2x2x0,75 mm (stranded)

| | |
|---|---|
| Inner conductor diameter: | Copper, tinned (AWG 22/7) |
| Core insulation: | PE |
| Core colours: | wh, ye, bu, og |
| Stranding element: | Star quad |
| Separator: | Polyester foil over stranded bundle |
| Inner sheath material: | PVC |
| Shielding 1: | Al-Foil |
| Total shielding: | Cu braid, tinned |
| Outer sheath material: | PVC |
| Cable external diameter: | app. 6,5 mm ± 0,2 mm |
| Outer sheath colour: | Green similar to RAL 6018 |

## Electrical data

| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz |
| Conductor resistance, max.: | 60 Ohm/km |
| Insulation resistance, min.: | 0,5 GOhm x km |
| Loop resistance: | 120 Ohm/km max. |
| Mutual capacitance: | 52 nF/km nom. |
| Test voltage: | 2 kV |

## Typical values

| | | | | | |
|---|---|---|---|---|---|
| Frequency | (MHz) | 10 | 16 | 62,5 | 100 |
| Attenuation | (dB/100m) | 6,3 | 8,0 | 16,5 | 21,3 |
| Next | (dB) | 70,0 | 65,0 | 55,0 | 50,0 |
| ACR | (dB) | 64,0 | 57,4 | 39,0 | 29,0 |

## Technical data

| | |
|---|---|
| Weight: | app. 67 kg/km |
| bending radius, repeated: | 100 mm |
| Operating temperature range min.: | -40°C |
| Operating temperature range max.: | +70°C |
| Caloric load, approx. value: | 0,32 MJ/m |
| Copper weight: | 32,00 kg/km |

## Norms

| | |
|---|---|
| Applicable standards: | PROFInet Guideline + IEC 61158-2<br>Acc. to ISO/IEC 11801<br>Acc. to EN 50173<br>Category 5e<br>Flame-retardant acc. to IEC 60332-3 |
| UL Style: | CMG 75°C PLTC FT4 |
| CSA standard: | CSA FT 4 |

## Application

HELUKAT® PROFInet Type B (flexible) Cat.5e for use on moving parts. The cables listed here correspond to the PROFInet classifications Type B for moving cables and are designed to withstand mechanical loads. The version PVC is the standard cable; the FRNC version is used for halogen free requirements.

## Part no.

**800654,** PROFInet type B (SK)

Dimensions and specifications may be changed without prior notice.

# Industrial Ethernet

**PROFInet Type B flexible**

HELUKAT®

FRNC

NEW


## Type
## Cable structure

## Mobile use
## 2x2x0,75 mm (stranded)

| | |
|---|---|
| Inner conductor diameter: | Copper, tinned (AWG 22/7) |
| Core insulation: | PE |
| Core colours: | wh, ye, bu, og |
| Stranding element: | Star quad |
| Separator: | Polyester foil over stranded bundle |
| Inner sheath material: | FRNC |
| Shielding 1: | Al-Foil |
| Total shielding: | Cu braid, tinned |
| Outer sheath material: | FRNC |
| Cable external diameter: | app. 6,5 mm ± 0,2 mm |
| Outer sheath colour: | Green similar to RAL 6018 |

## Electrical data

| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz |
| Conductor resistance, max.: | 60 Ohm/km |
| Insulation resistance, min.: | 0,5 GOhm x km |
| Loop resistance: | 120 Ohm/km max. |
| Mutual capacitance: | 52 nF/km nom. |
| Test voltage: | 2 kV |

## Typical values

| | | | | | |
|---|---|---|---|---|---|
| Frequency | (MHz) | 10 | 16 | 62,5 | 100 |
| Attenuation | (dB/100m) | 6,3 | 8,0 | 16,5 | 21,3 |
| Next | (dB) | 70,0 | 65,0 | 55,0 | 50,0 |
| ACR | (dB) | 64,0 | 57,4 | 39,0 | 29,0 |

## Technical data

| | |
|---|---|
| Weight: | app. 65 kg/km |
| bending radius, repeated: | 100 mm |
| Operating temperature range min.: | -25°C |
| Operating temperature range max.: | +75°C |
| Caloric load, approx. value: | 0,32 MJ/m |
| Copper weight: | 32,00 kg/km |

## Norms

| | |
|---|---|
| Applicable standards: | PROFInet Guideline + IEC 61158-2<br>Acc. to ISO/IEC 11801<br>Acc. to EN 50173<br>Category 5e<br>Halogen-free acc. to 60754-2<br>Flame-retardant acc. to IEC 60332-3<br>Corrosiveness acc. to EN50267-2-3<br>Low-smoke acc. to EN50268-2 |
| UL Style: | CMG 75°C PLTC FT4 |
| CSA standard: | CSA FT 4 |

## Application

HELUKAT® PROFInet Type B (flexible) Category 5e for flexible use. The cable listed here correspond to the PROFInet classification Type B.

## Part no.

**805654,** PROFInet type B (SK)

Dimensions and specifications may be changed without prior notice.



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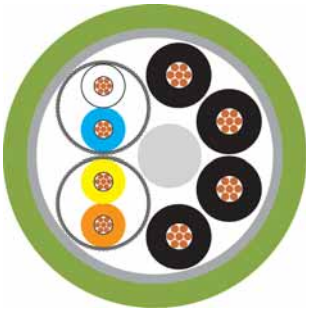
# Industrial Ethernet

**PROFInet Type B flexible hybrid**

HELUKAT®

FRNC




## Type
## Mobile use
## Cable structure
## 2x2x0,75 mm (stranded)+ 4x1,5qmm

| | |
|---|---|
| Inner conductor diameter 1: | Copper, bare (AWG 22/7) |
| Inner conductor diameter 2: | Copper, bare (AWG 16/84) |
| Core insulation 1: | Foam-skin-PE |
| Core insulation 2: | PO |
| Core colours 1: | wh, ye, bu, og |
| Core colours 2: | Black |
| Stranding element 1: | Double core |
| Separator: | Polyester foil over stranded bundle |
| Shielding 1: | AL-Foil + braid |
| Total shielding: | Polyester foil |
| Outer sheath material: | FRNC |
| Cable external diameter: | app. 10,3 mm ± 0,3 mm |
| Outer sheath colour: | Green similar to RAL 6018 |

## Electrical data

| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz |
| Conductor resistance, max.: | 60 Ohm/km |
| Insulation resistance, min.: | 0,5 GOhm x km |
| Loop resistance: | 120 Ohm/km max. |
| Mutual capacitance: | 52 nF/km nom. |
| Test voltage: | 2 kV |

## Typical values

| Frequency | (MHz) | 10 | 16 | 62,5 | 100 |
|---|---|---|---|---|---|
| Attenuation | (dB/100m) | 6,3 | 8,0 | 16,5 | 21,3 |
| Next | (dB) | 50,3 | 47,2 | 38,4 | 35,3 |
| ACR | (dB) | 43,7 | 39,0 | 21,5 | 13,7 |

## Technical data

| | |
|---|---|
| Weight: | app. 153 kg/km |
| bending radius, repeated: | 103 mm |
| Operating temperature range min.: | -40°C |
| Operating temperature range max.: | +70°C |
| Caloric load, approx. value: | 1,50 MJ/m |
| Copper weight: | 94,00 kg/km |

## Norms

| | |
|---|---|
| Applicable standards: | PROFInet Guideline + IEC 61158-2<br>Acc. to ISO/IEC 11801<br>Acc. to EN 50173<br>Category 5e<br>Halogen-free acc. to 60754-2<br>Flame-retardant acc. to IEC 60332-1-2<br>Corrosiveness acc. to EN50267-2-3<br>Low-smoke acc. to EN50268-2 |
| UL Style: | UL Style 21282 |

## Application

HELUKAT® PROFInet Type B Category 5e hybrid for flexible applications. The cable listed here corresponds to PROFInet Type B with integrated power supply in a cable with halogen-free and flame-retardent construction.

## Part no.

**801651,** PROFInet type B (SK)

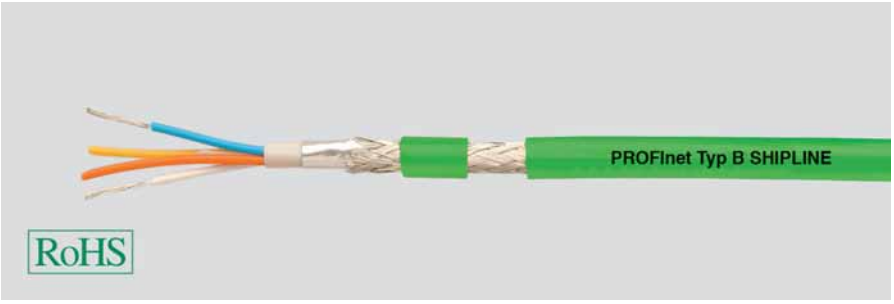
Dimensions and specifications may be changed without prior notice.

# Industrial Ethernet

**PROFInet Typ B SHIPLINE * FESTOON**

HELUKAT®

FRNC + PVC




| Type | Marine and Offshore | FESTOON |
|---|---|---|
| **Cable structure** | **2x2x0,75 mm (stranded)** | **2x2x0.75 mm (stranded)** |
| Inner conductor diameter: | Copper, tinned (AWG 22/7) | Copper, tinned (AWG 22/7) |
| Core insulation: | PP | PE |
| Core colours: | wh, ye, bu, og | wh, ye, bu, og |
| Stranding element: | Star quad | Star quad |
| Separator: | Polyester foil over stranded bundle | Polyester foil over stranded bundle |
| Inner sheath material: | FRNC | PVC |
| Shielding 1: | Al-Foil | Al-Foil |
| Total shielding: | Cu braid, tinned | Cu braid, tinned |
| Outer sheath material: | FRNC | PVC |
| Cable external diameter: | app. 6,5 mm ± 0,4 mm | app. 6,5 mm ± 0,2 mm |
| Outer sheath colour: | Green similar to RAL 6018 | Green similar to RAL 6018 |

## Electrical data

| | | |
|---|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz | 100 Ohm ± 15 % |
| Conductor resistance, max.: | 60 Ohm/km | 60 Ohm/km |
| Insulation resistance, min.: | 0,5 GOhm x km | 0,5 GOhm x km |
| Loop resistance: | 120 Ohm/km max. | 120 Ohm/km max. |
| Mutual capacitance: | 52 nF/km nom. | 52 nF/km nom. |
| Test voltage: | 0,7 kV | 2 kV |

## Typical values

| | | | | | |
|---|---|---|---|---|---|
| Frequency | (MHz) | 10 | 16 | 62,5 | 100 |
| Attenuation | (dB/100m) | 6,0 | 7,6 | 16,0 | 21,0 |
| Next | (dB) | 70,0 | 65,0 | 55,0 | 50,0 |
| ACR | (dB) | 64,0 | 57,4 | 39,0 | 29,0 |

## Technical data

| | | |
|---|---|---|
| Weight: | app. 64 kg/km | app. 68 kg/km |
| bending radius, repeated: | 50 mm | 70 mm |
| Operating temperature range min.: | -40°C | -10°C |
| Operating temperature range max.: | +75°C | +80°C |
| Caloric load, approx. value: | 0,45 MJ/m | 1,20 MJ/m |
| Copper weight: | 32,00 kg/km | 32,00 kg/km |

## Norms

| | | |
|---|---|---|
| Applicable standards: | PROFInet Guideline + IEC 61158-2<br>Acc. to ISO/IEC 11801<br>Acc. to EN 50173<br>Category 5e<br>Halogen-free acc. to 60754-2<br>Flame-retardant acc. to IEC 60332-3<br>Corrosiveness acc. to EN50267-2-3<br>Low-smoke acc. to EN50268-2 | PROFInet Guideline + IEC 61158-2<br>Acc. to ISO/IEC 11801<br>Acc. to EN 50173<br>Category 5e<br>Flame-retardant acc. to IEC 60332-3 |
| UL Style: | CMG 75°C PLTC FT4 | CMG 75°C or PLTC or AWM 21694 600V |
| CSA standard: | CSA FT 4 | CSA FT 4 |

## Application

HELUKAT® PROFInet Type B Category 5e SHIPLINE + FESTOON designed specially for marine/offshore applications as well as FESTOON applications. The SHIPLINE version is certified by the **Germanische Lloyd** and suitable for flexible **marine and offshore applications**.

## Part no.

**802185,** PROFInet type B (SK)

**803295,** PROFInet type B (SK)

Dimensions and specifications may be changed without prior notice.



DNB Edition 11 (published 01.10.2015)

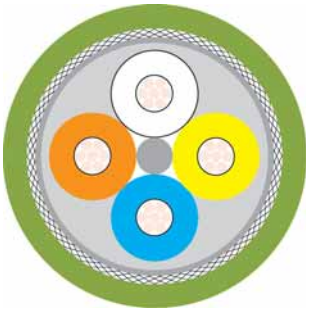
# Industrial Ethernet

**PROFInet Type C high flexible**

HELUKAT®

PVC + PUR

NEW




| Type | Drag Chain applications 2x2x0.75 mm (stranded) | Drag Chain applications 2x2x0.75 mm (stranded) |
|---|---|---|
| **Cable structure** | | |
| Inner conductor diameter: | Copper, tinned (AWG 22/7) | Copper, tinned (AWG 22/7) |
| Core insulation: | PE | PE |
| Core colours: | wh, ye, bu, og | wh, ye, bu, og |
| Stranding element: | Star quad | Star quad |
| Separator: | Polyester foil over stranded bundle | Polyester foil over stranded bundle |
| Inner sheath material: | PVC | FRNC |
| Shielding 1: | Al-Foil | Al-Foil |
| Total shielding: | Cu braid, tinned | Cu braid, tinned |
| Outer sheath material: | PVC | PUR |
| Cable external diameter: | app. 6,5 mm ± 0,2 mm | app. 6,5 mm ± 0,2 mm |
| Outer sheath colour: | Green similar to RAL 6018 | Green similar to RAL 6018 |
| **Electrical data** | | |
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz | 100 Ohm ± 15 Ohm at 1 to 100 MHz |
| Conductor resistance, max.: | 60 Ohm/km | 60 Ohm/km |
| Insulation resistance, min.: | 0,5 GOhm x km | 0,5 GOhm x km |
| Loop resistance: | 120 Ohm/km max. | 120 Ohm/km max. |
| Mutual capacitance: | 52 nF/km nom. | 52 nF/km nom. |
| Test voltage: | 1,5 kV | 1,5 kV |

## Typical values

| | | | | | |
|---|---|---|---|---|---|
| Frequency | (MHz) | 10 | 16 | 62,5 | 100 |
| Attenuation | (dB/100m) | 6,3 | 8,0 | 16,5 | 21,3 |
| Next | (dB) | 70,0 | 65,0 | 55,0 | 50,0 |
| ACR | (dB) | 64,0 | 57,4 | 39,0 | 29,0 |

| | | |
|---|---|---|
| **Technical data** | | |
| Weight: | app. 68 kg/km | app. 61 kg/km |
| bending radius, repeated: | 55 mm | 55 mm |
| Operating temperature range min.: | -20°C | -20°C |
| Operating temperature range max.: | +70°C | +60°C |
| Caloric load, approx. value: | 0,85 MJ/m | 0,85 MJ/m |
| Copper weight: | 32,00 kg/km | 32,00 kg/km |
| **Norms** | | |
| Applicable standards: | PROFInet Guideline + IEC 61158-2<br>Acc. to ISO/IEC 11801<br>Acc. to EN 50173<br>Category 5e<br>Flame-retardant CSA FT4 | PROFInet Guideline + IEC 61158-2<br>Acc. to ISO/IEC 11801<br>Acc. to EN 50173<br>Category 5e<br>Halogen-free acc. to 60754-2<br>Flame-retardant acc. to IEC 60332-1-2 |
| UL Style: | CMG FT4 | CMX 75°C (shielded) |

## Application

HELUKAT® PROFInet Type C PVC (highly flexible) Category 5e for use on moving parts and in cable carriers. The cable listed here correspond to the PROFInet classifications Type C for moving cables and are designed to withstand mechanical loads. Thanks to the flame retardent jacket the PVC cable has UL CMG PLTC FT4 approval. The PUR version has UL CMX listing and offers higher values in chain and chemical resistance.

| Part no. | | |
|---|---|---|
| | **802914,** PROFInet type C (SK) | **800655,** PROFInet type C (SK) |

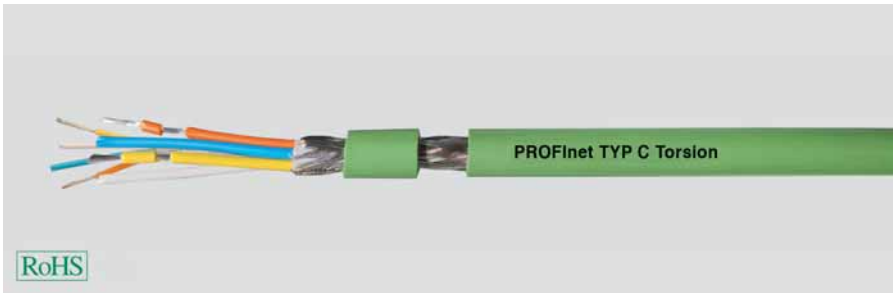
Dimensions and specifications may be changed without prior notice.

# Industrial Ethernet

**PROFInet Type C Torsion**

HELUKAT®

PUR




## Type
## Cable structure

## Torsional applications
## 2x2x0,75 mm (stranded)

| | |
|---|---|
| Inner conductor diameter: | Copper, tinned (AWG 22/19) |
| Core insulation: | Foam-skin-PE |
| Core colours: | wh, ye, bu, og |
| Stranding element: | Star quad |
| Separator: | Polyester foil over stranded bundle |
| Shielding 1: | Cu braid, tinned |
| Total shielding: | Cu braid, tinned |
| Outer sheath material: | PUR |
| Cable external diameter: | app. 6,5 mm ± 0,2 mm |
| Outer sheath colour: | Green similar to RAL 6018 |

## Electrical data

| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz |
| Conductor resistance, max.: | 60 Ohm/km |
| Insulation resistance, min.: | 0,5 GOhm x km |
| Loop resistance: | 120 Ohm/km max. |
| Mutual capacitance: | 52 nF/km nom. |
| Test voltage: | 0,7 kV |

## Typical values

| | | | | | |
|---|---|---|---|---|---|
| Frequency | (MHz) | 10 | 16 | 62,5 | 100 |
| Attenuation | (dB/100m) | 7,6 | 10,0 | 26,5 | 41,0 |
| ELFEXT | (dB) | 43,8 | 39,7 | 24,0 | 20,0 |

## Technical data

| | |
|---|---|
| Weight: | app. 54 kg/km |
| bending radius, repeated: | 70 mm |
| Operating temperature range min.: | -40°C |
| Operating temperature range max.: | +80°C |
| Caloric load, approx. value: | 0,45 MJ/m |
| Copper weight: | 32,00 kg/km |

## Norms

| | |
|---|---|
| Applicable standards: | PROFInet Guideline + IEC 61158-2<br>Category 5e<br>Halogen-free acc. to 60754-2<br>Flame-retardant acc. to IEC 60332-1-2 |
| UL Style: | AWM Style 21161 80°C |

## Application

HELUKAT® PROFInet Type C Category 5e TORSION offers excellent transmission characteristics and is designed for applications with torsion loads, e.g. in robots. The cable listed here corresponds to the PROFInet Type C classification for continous movement.

## Part no.

**802186,** PROFInet type C (SK)

Dimensions and specifications may be changed without prior notice.



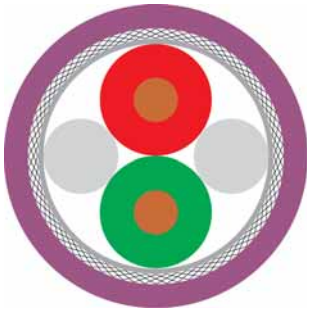
DNB Edition 11 (published 01.10.2015)

# BUS Cables

**Profibus L2 indoor**

HELUKABEL®

PVC




| Type<br>Cable structure | Fixed installation, indoor<br>1x2x0.64 mm | Fixed installation, indoor<br>1x2x0.64 mm |
|---|---|---|
| Inner conductor diameter: | Copper, bare (AWG 22/1) | Copper, bare (AWG 22/1) |
| Core insulation: | Foam-skin-PE | Foam-skin-PE |
| Core colours: | rd, gn | rd, gn |
| Stranding element: | 2 cores + 2 fillers stranded together | 2 cores + 2 fillers stranded together |
| Separator: | Polyester foil over stranded bundle | Polyester foil over stranded bundle |
| Shielding 1: | Al-Foil | Al-Foil |
| Total shielding: | Cu braid, tinned | Cu braid, tinned |
| Outer sheath material: | PVC | PVC |
| Cable external diameter: | app. 7,8 mm ± 0,2 mm | app. 7,8 mm ± 0,2 mm |
| Outer sheath colour: | Grey similar to RAL 7001 | Violet similar to RAL 4001 |

## Electrical data

| | | |
|---|---|---|
| Characteristic impedance: | 150 Ohm ± 10 % | 150 Ohm ± 10 % |
| Conductor resistance, max.: | 55 Ohm/km | 55 Ohm/km |
| Insulation resistance, min.: | 1 GOhm x km | 1 GOhm x km |
| Loop resistance: | 110 Ohm/km max. | 110 Ohm/km max. |
| Mutual capacitance: | 30 nF/km nom. | 30 nF/km nom. |
| Test voltage: | 1,5 kV | 1,5 kV |
| Attenuation: | 9,6 kHz < 2,5 dB/km<br>38,4 kHz < 4,0 dB/km<br>4 MHz < 22,0 dB/km<br>16 MHz < 42,0 dB/km | 9,6 kHz < 2,5 dB/km<br>38,4 kHz < 4,0 dB/km<br>4 MHz < 22,0 dB/km<br>16 MHz < 42,0 dB/km |

## Technical data

| | | |
|---|---|---|
| Weight: | app. 69 kg/km | app. 69 kg/km |
| bending radius, repeated: | 120 mm | 120 mm |
| Operating temperature range min.: | -40°C | -40°C |
| Operating temperature range max.: | +70°C | +70°C |
| Caloric load, approx. value: | 0,99 MJ/m | 0,99 MJ/m |
| Copper weight: | 24,00 kg/km | 24,00 kg/km |

## Norms

| | | |
|---|---|---|
| Applicable standards: | Profibus acc. to DIN 19245 T3 and EN50170<br>Flame-retardant acc. to IEC 60332-1-2 | Profibus acc. to DIN 19245 T3 and EN50170<br>Flame-retardant acc. to IEC 60332-1-2 |
| UL Style: | CMX 75°C (shielded) | CMX 75°C (shielded) |
| CSA standard: | CSA FT1 | CSA FT1 |

## Application

HELUKABEL® Profibus L2 Indoor is designed for fixed indoor installation in Profibus industrial networks. Depending on the application, the colour grey (special colour) or violet (standard colour) is availiable. Otherwise, the technical characteristics of the two products are identical.

## Part no.

| | |
|---|---|
| **80384,** Profibus L2 | **81448,** Profibus L2 |

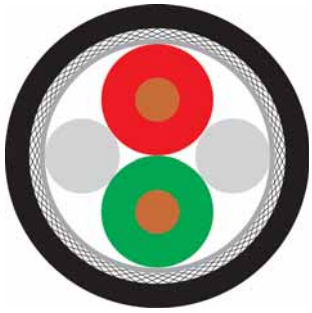
Dimensions and specifications may be changed without prior notice.

# BUS Cables

**PROFIBUS L2 Outdoor + Industry**

HELUKABEL®

PE + PUR




| Type | Fixed installation, outdoor | Industrial Area |
|---|---|---|
| **Cable structure** | **1x2x0.64 mm** | **1x2x0.64 mm** |
| Inner conductor diameter: | Copper, bare (AWG 22/1) | Copper, bare (AWG 22/1) |
| Core insulation: | Foam-skin-PE | Foam-skin-PE |
| Core colours: | rd, gn | rd, gn |
| Stranding element: | 2 cores + 2 fillers stranded together | 2 cores + 2 fillers stranded together |
| Separator: | Polyester foil over stranded bundle | Polyester foil over stranded bundle |
| Shielding 1: | Al-Foil | Al-Foil |
| Total shielding: | Cu braid, tinned | Cu braid, tinned |
| Outer sheath material: | PE | PUR |
| Cable external diameter: | app. 8,0 mm ± 0,4 mm | app. 8,0 mm ± 0,4 mm |
| Outer sheath colour: | Black similar to RAL 9005 | Petrol similar to RAL 5018 |
| **Electrical data** | | |
| Characteristic impedance: | 150 Ohm ± 10 % | 150 Ohm ± 10 % |
| Conductor resistance, max.: | 55 Ohm/km | 55 Ohm/km |
| Insulation resistance, min.: | 1 GOhm x km | 1 GOhm x km |
| Loop resistance: | 110 Ohm/km max. | 110 Ohm/km max. |
| Mutual capacitance: | 30 nF/km nom. | 30 nF/km nom. |
| Test voltage: | 1,5 kV | 1,5 kV |
| Attenuation: | 9,6 kHz < 2,5 dB/km<br>38,4 kHz < 4,0 dB/km<br>4 MHz < 22,0 dB/km<br>16 MHz < 42,0 dB/km | 9,6 kHz < 2,5 dB/km<br>38,4 kHz < 4,0 dB/km<br>4 MHz < 22,0 dB/km<br>16 MHz < 42,0 dB/km |
| **Technical data** | | |
| Weight: | app. 64 kg/km | app. 67 kg/km |
| bending radius, repeated: | 120 mm | 120 mm |
| Operating temperature range min.: | -40°C | -40°C |
| Operating temperature range max.: | +70°C | +70°C |
| Caloric load, approx. value: | 2,26 MJ/m | 1,52 MJ/m |
| Copper weight: | 24,00 kg/km | 24,00 kg/km |
| **Norms** | | |
| Applicable standards: | Profibus acc. to DIN 19245 T3 and EN50170<br>Halogen-free acc. to 60754-2 | Profibus acc. to DIN 19245 T3 and EN50170<br>Halogen-free acc. to 60754-2<br>Flame-retardant acc. to IEC 60332-1-2 |

## Application

HELUKABEL® Profibus L2 Outdoor + Industry are special cables for use in Profibus industrial networks. The Outdoor version is designed for use in open-air environments, i.e. can withstand wind, weather and sun (not for burial direcly in the ground). The Industry version is used in fixed installation applications in harsh industrial environment. Mechanically, this product exhibits excellent resistance to mineral oils, greases and cooling lubricants and has good microbe and hydrolysis resistance.

| Part no. | | |
|---|---|---|
| | **80792,** Profibus L2 | **81186,** Profibus L2 |

Dimensions and specifications may be changed without prior notice.



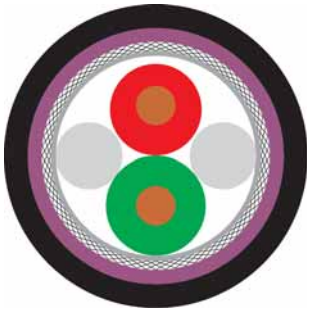
DNB Edition 11 (published 01.10.2015)

# BUS Cables

**Profibus L2 direct Burial without + with Armouring**

HELUKABEL®

PE




| Type<br>Cable structure | Direct burial<br>1x2x0.64 mm | Direct burial<br>1x2x0.64 mm |
|---|---|---|
| Inner conductor diameter: | Copper, bare (AWG 22/1) | Copper, bare (AWG 22/1) |
| Core insulation: | Foam-skin-PE | Cell PE |
| Core colours: | rd, gn | rd, gn |
| Stranding element: | 2 cores + 2 fillers stranded together | 2 cores + 2 fillers stranded together |
| Separator: | Polyester foil over stranded bundle | - |
| Inner sheath material: | PVC | PVC |
| Shielding 1: | Al-Foil | Al-Foil |
| Total shielding: | Cu braid, tinned | Cu braid, tinned |
| Armouring: | - | Steel band |
| Outer sheath material: | PE | PE |
| Cable external diameter: | app. 10,0 mm ± 0,2 mm | app. 10,6 mm ± 0,5 mm |
| Outer sheath colour: | Black similar to RAL 9005 | Black similar to RAL 9005 |
| **Electrical data** | | |
| Characteristic impedance: | 150 Ohm ± 10 % | 150 Ohm ± 10 % |
| Conductor resistance, max.: | 55 Ohm/km | 55 Ohm/km |
| Insulation resistance, min.: | 1 GOhm x km | 5 GOhm x km |
| Loop resistance: | 110 Ohm/km max. | 110 Ohm/km max. |
| Mutual capacitance: | 30 nF/km nom. | 30 nF/km nom. |
| Nominal voltage: | - | 250 V |
| Test voltage: | 1,5 kV | 1,5 kV |
| Attenuation: | 9,6 kHz < 2,5 dB/km<br>38,4 kHz < 4,0 dB/km<br>3 MHz < 22,0 dB/km<br>20 MHz < 42,0 dB/km | 9,6 kHz < 2,5 dB/km<br>38,4 kHz < 4,0 dB/km<br>4 MHz < 22,0 dB/km<br>16 MHz < 42,0 dB/km |
| **Technical data** | | |
| Weight: | app. 92 kg/km | app. 132 kg/km |
| bending radius, repeated: | 150 mm | 165 mm |
| Operating temperature range min.: | -40°C | -40°C |
| Operating temperature range max.: | +80°C | +80°C |
| Caloric load, approx. value: | 2,657 MJ/m | 2,40 MJ/m |
| Copper weight: | 24,00 kg/km | 24,00 kg/km |
| **Norms** | | |
| Applicable standards: | Profibus acc. to DIN 19245 T3 and EN50170 | Profibus acc. to DIN 19245 T3 and EN50170 |

## Application

HELUKABEL® Profibus L2 Direct Burial cables without + with armouring are special cables in the Profibus industrial networks. The version without armouring is for normal and direct cable burial in the ground. The version with steel tape armouring offers additional protection against rodents and is the right choice for regions with such animals.

## Part no.

**82824,** Profibus ERD

**802177,** Profibus L2

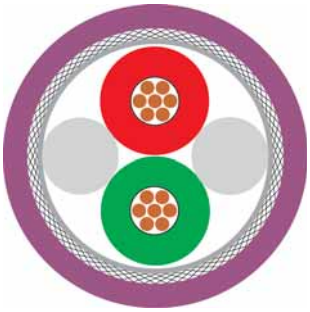
Dimensions and specifications may be changed without prior notice.

# BUS Cables

**Profibus L2 7-wire**

HELUKABEL®

PVC




## Type
## Cable structure

Mobile use

**1x2x0.64 mm (stranded)**

| | |
|---|---|
| Inner conductor diameter: | Copper, bare (AWG 24/7) |
| Core insulation: | Foam-skin-PE |
| Core colours: | rd, gn |
| Stranding element: | 2 cores + 2 fillers stranded together |
| Separator: | Polyester foil over stranded bundle |
| Shielding 1: | Al-Foil |
| Total shielding: | Cu braid, tinned |
| Outer sheath material: | PVC |
| Cable external diameter: | app. 7,8 mm ± 0,3 mm |
| Outer sheath colour: | Violet similar to RAL 4001 |

## Electrical data

| | |
|---|---|
| Characteristic impedance: | 150 Ohm ± 10 % |
| Conductor resistance, max.: | 80 Ohm/km |
| Insulation resistance, min.: | 2 GOhm x km |
| Loop resistance: | 160 Ohm/km max. |
| Mutual capacitance: | 30 nF/km nom. |
| Test voltage: | 1,5 kV |
| Attenuation: | 9,6 kHz < 2,9 dB/km<br>38,4 kHz < 4,6 dB/km<br>4 MHz < 25,0 dB/km<br>16 MHz < 49,0 dB/km |

## Technical data

| | |
|---|---|
| Weight: | app. 70 kg/km |
| bending radius, repeated: | 94 mm |
| Operating temperature range min.: | -30°C |
| Operating temperature range max.: | +80°C |
| Caloric load, approx. value: | 1,20 MJ/m |
| Copper weight: | 24,00 kg/km |

## Norms

| | |
|---|---|
| Applicable standards: | Profibus acc. to DIN 19245 T3 and EN50170<br>Flame-retardant acc. to EN 50265-2-1 |
| UL Style: | UL Style 2571 |

## Application

HELUKABEL® Profibus L2 7-wire for mobile applications in Profibus industrial networks. With its core design and the special PVC sheath, the type described here is suitable for normal mobile applications.

## Part no.

**800648,** Profibus L2

Dimensions and specifications may be changed without prior notice.

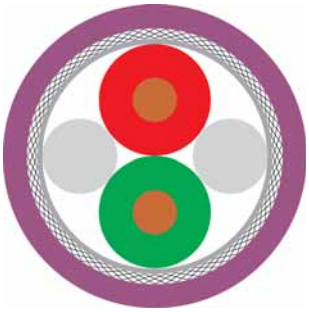
# BUS Cables

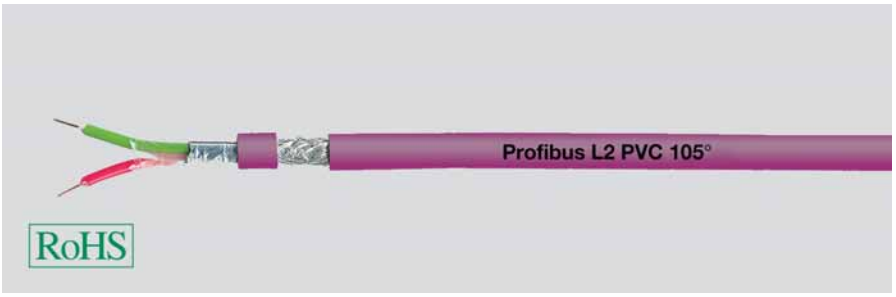
**Profibus fixed installed High Temperature +105°C or + 200°C**

HELUKABEL®

PVC + FRNC PH120

NEW






| Type<br>Cable structure | Fixed installation, indoor<br>1x2x0.64 mm | High temperature areas<br>1x2xAWG23/1 |
|---|---|---|
| Inner conductor diameter: | Copper, bare (AWG 22/1) | Copper, bare (AWG 23/1) |
| Core insulation: | Foam-skin-PE | Rubber compound |
| Core colours: | rd, gn | rd, gn |
| Stranding element: | 2 cores + 2 fillers stranded together | 2 cores + 2 fillers stranded together |
| Separator: | Polyester foil over stranded bundle | - |
| Shielding 1: | Al-Foil | - |
| Total shielding: | Cu braid, tinned | AL-Foil + braid |
| Outer sheath material: | PVC | FRNC |
| Cable external diameter: | app. 7,8 mm ± 0,2 mm | app. 8,3 mm ± 0,3 mm |
| Outer sheath colour: | Violet similar to RAL 4001 | Black similar to RAL 9005 |

## Electrical data

| | | |
|---|---|---|
| Characteristic impedance: | 150 Ohm ± 10 % | 150 Ohm ± 10 % |
| Conductor resistance, max.: | 55 Ohm/km | 74,5 Ohm/km |
| Insulation resistance, min.: | 1 GOhm x km | 2 GOhm x km |
| Loop resistance: | 110 Ohm/km max. | 149 Ohm/km max. |
| Mutual capacitance: | 30 nF/km nom. | 36 nF/km nom. |
| Test voltage: | 1,5 kV | 1,5 kV |
| Attenuation: | Frequency at +20°C | Frequency at +20°C at +200°C |
| | 9,6 kHz < 3,0 dB/km | 9,6 kHz < 3,0 dB/km < 8,0 dB/km |
| | 38,4 kHz < 5,0 dB/km | 38,4 kHz < 5,0 dB/km < 12,0 dB/km |
| | 4 MHz < 22,0 dB/km | 4 MHz < 22,0 dB/km < 41,0 dB/km |
| | 16 MHz < 42,0 dB/km | 16 MHz < 42,0 dB/km < 90,0 dB/km |

## Technical data

| | | |
|---|---|---|
| Weight: | app. 69 kg/km | app. 88 kg/km |
| bending radius, repeated: | 120 mm | 130 mm |
| Operating temperature range min.: | -40°C | -50°C |
| Operating temperature range max.: | +105°C | +200°C |
| Caloric load, approx. value: | 0,99 MJ/m | 1,46 MJ/m |
| Copper weight: | 24,00 kg/km | 28,00 kg/km |

## Norms

| | | |
|---|---|---|
| Applicable standards: | Profibus acc. to DIN 19245 T3 and EN50170<br>Flame-retardant acc. to IEC 60332-1-2 | Profibus acc. to DIN 19245 T3 and EN50170<br>Halogen-free acc. to 60754-2<br>Flame-retardant acc. to IEC 60332-1-2 |

## Application

HELUKABEL® Profibus L2 105°C is for fixed installation indoor and enhanced temperature resistance.
The version Profibus L2 SR 200°C Fire Resistant has additional circuit integrity for 120 minutes (EN50200 PH120) and the temperature range up to +200°C for fix indoor installation.

## Part no.

| | |
|---|---|
| **805705,** Profibus high temperature | **805706,** Profibus high temperature with circuit integrity |

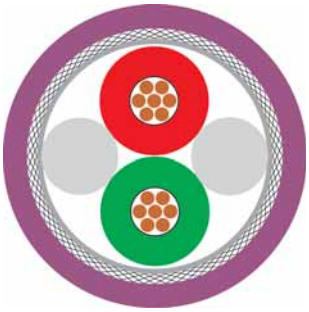
Dimensions and specifications may be changed without prior notice.

# BUS Cables

**Profibus L2 Drag Chain**

HELUKABEL®

PUR




| Type | Drag Chain applications 1x2x0.64 mm (stranded) | Drag Chain applications 1x2x0.64 mm (stranded) |
|---|---|---|
| **Cable structure** | | |
| Inner conductor diameter: | Copper, bare (AWG 24/19) | Copper, bare (AWG 24/19) |
| Core insulation: | Foam-skin-PE | Foam-skin-PE |
| Core colours: | rd, gn | rd, gn |
| Stranding element: | 2 cores + 2 fillers stranded together | 2 cores + 2 fillers stranded together |
| Separator: | Polyester foil over stranded bundle | Polyester foil over stranded bundle |
| Shielding 1: | Al-Foil | Al-Foil |
| Total shielding: | Cu braid, tinned | Cu braid, tinned |
| Outer sheath material: | PUR | PUR |
| Cable external diameter: | app. 8,0 mm ± 0,4 mm | app. 8,0 mm ± 0,4 mm |
| Outer sheath colour: | Violet similar to RAL 4001 | Petrol similar to RAL 5018 |
| **Electrical data** | | |
| Characteristic impedance: | 150 Ohm ± 10 % | 150 Ohm ± 10 % |
| Conductor resistance, max.: | 80 Ohm/km | 80 Ohm/km |
| Insulation resistance, min.: | 5 GOhm x km | 5 GOhm x km |
| Loop resistance: | 160 Ohm/km max. | 160 Ohm/km max. |
| Mutual capacitance: | 30 nF/km nom. | 30 nF/km nom. |
| Test voltage: | 1,5 kV | 1,5 kV |
| Attenuation: | 9,6 kHz < 3,0 dB/km<br>38,4 kHz < 5,0 dB/km<br>4 MHz < 25,0 dB/km<br>16 MHz < 52,0 dB/km | 9,6 kHz < 3,0 dB/km<br>38,4 kHz < 5,0 dB/km<br>4 MHz < 25,0 dB/km<br>16 MHz < 52,0 dB/km |
| **Technical data** | | |
| Weight: | app. 70 kg/km | app. 70 kg/km |
| bending radius, repeated: | 80 mm | 80 mm |
| Operating temperature range min.: | -30°C | -30°C |
| Operating temperature range max.: | +70°C | +70°C |
| Caloric load, approx. value: | 1,24 MJ/m | 1,24 MJ/m |
| Copper weight: | 25,00 kg/km | 25,00 kg/km |
| **Norms** | | |
| Applicable standards: | Profibus acc. to DIN 19245 T3 and EN50170<br>Halogen-free acc. to 60754-2 | Profibus acc. to DIN 19245 T3 and EN50170<br>Halogen-free acc. to 60754-2 |

## Application

HELUKABEL® Profibus L2 Trailing cable for permanant moving in Drag Chain. Two jacket colours availiable - petrol or violet. All other technical parameters are the same.

## Part no.

**80267,** Profibus L2

**81003,** Profibus L2

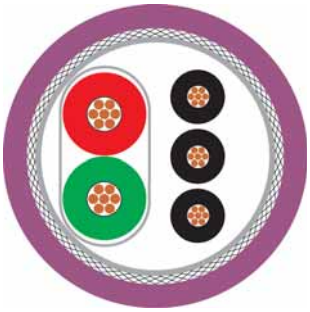
Dimensions and specifications may be changed without prior notice.

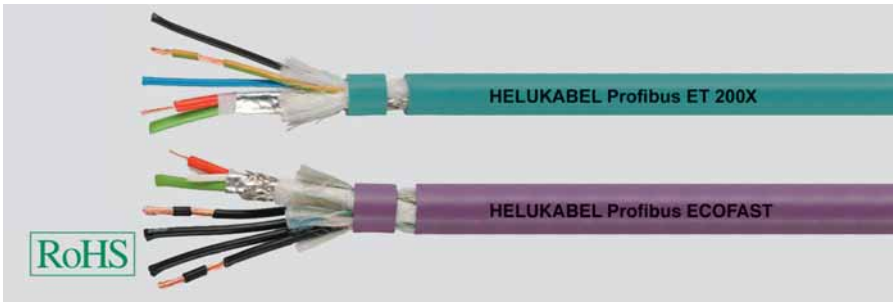
# BUS Cables

**Profibus Drag Chain ET200X + ECOFAST**

HELUKABEL®

PUR






| Type<br>Cable structure | Drag Chain applications<br>1x2x0.65 mm +<br>3x1x0.75 mm² (stranded) | Drag Chain applications<br>1x2x0.65 mm +<br>4x1x1.5 mm² (stranded) |
|---|---|---|
| Inner conductor diameter 1: | Copper, bare (AWG 24/19) | Copper, bare (AWG 24/19) |
| Inner conductor diameter 2: | Copper, bare (AWG 18/42) | Copper, bare (AWG 18/85) |
| Core insulation 1: | Foam-skin-PE | Foam-skin-PE |
| Core insulation 2: | PE | PE |
| Core colours 1: | rd, gn | rd, gn |
| Core colours 2: | bk, bu, gnye | bk, bk, bk, bk |
| Stranding element 1: | Double core | 2 cores + 2 fillers stranded together |
| Separator: | Polyester foil over stranded bundle | Polyester foil over stranded bundle |
| Shielding 1: | AL-Foil + braid | AL-Foil + braid |
| Total shielding: | Polyester foil | - |
| Outer sheath material: | PUR | PUR |
| Cable external diameter: | app. 9,7 mm ± 0,3 mm | app. 11,5 mm ± 0,3 mm |
| Outer sheath colour: | Petrol similar to RAL 5018 | Violet similar to RAL 4001 |

## Electrical data

| | | |
|---|---|---|
| Characteristic impedance: | 150 Ohm ± 10 % | 150 Ohm ± 15 % |
| Conductor resistance, max.: | 73 Ohm/km | 73 Ohm/km |
| Insulation resistance, min.: | 5 GOhm x km | 1 GOhm x km |
| Loop resistance: | 145 Ohm/km max. | 145 Ohm/km max. |
| Mutual capacitance: | 30 nF/km nom. | 30 nF/km nom. |
| Test voltage: | 1,5 kV | 1,5 kV |
| Relative propagation velocity: | - | 81 % |
| Attenuation: | 9,6 kHz < 3,0 dB/km<br>38,4 kHz < 5,0 dB/km<br>4 MHz < 25,0 dB/km<br>16 MHz < 52,0 dB/km | 9,6 kHz ⩽ 3,0 dB/km<br>38,4 kHz ⩽ 5,0 dB/km<br>4 MHz ⩽ 25,0 dB/km<br>16 MHz ⩽ 52,0 dB/km |

## Technical data

| | | |
|---|---|---|
| Weight: | app. 106 kg/km | app. 160 kg/km |
| bending radius, repeated: | 145 mm | 173 mm |
| Operating temperature range min.: | -15°C | -15°C |
| Operating temperature range max.: | +60°C | +60°C |
| Caloric load, approx. value: | 1,953 MJ/m | 2,835 MJ/m |
| Copper weight: | 46,00 kg/km | 90,00 kg/km |

## Norms

| | | |
|---|---|---|
| Applicable standards: | Profibus acc. to DIN 19245 T3 and EN50170<br>Halogen-free acc. to 60754-2<br>Flame-retardant acc. to IEC 60332-1-2 | Profibus acc. to DIN 19245 T3 and EN50170<br>Halogen-free acc. to 60754-2<br>Flame-retardant acc. to IEC 60332-1-2 |
| UL Style: | AWM Style 20236 AWM I/II A/B 80°C 30V FT1 | UL Style 20233 |

## Application

HELUKABEL® Profibus ET200X + Ecofast Hybrid cables are designed for continuous motion in cable carriers. The hybrid construction integrates the power supply next to the Profibus in one cable. The type ET200X offers three 0,75mm² power conductors, while the type Ecofast 4 has 1,5mm² power conductors and greater current-carrying capacity.

## Part no.

**82913,** Profibus L2

**800044,** Profibus L2

Dimensions and specifications may be changed without prior notice.



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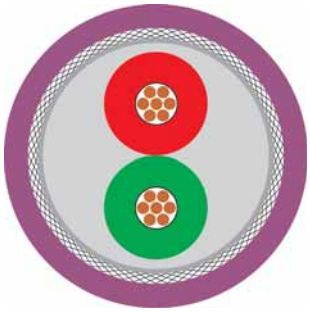
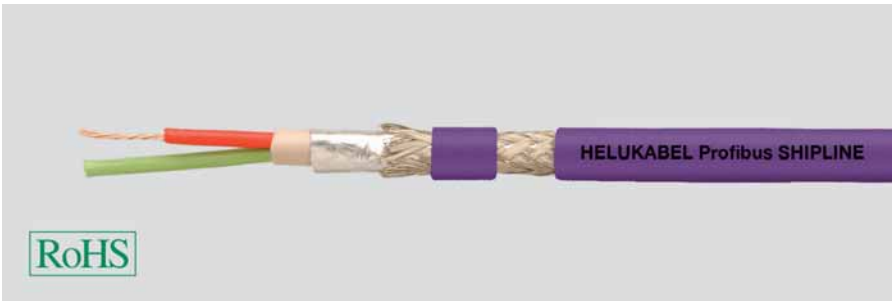
# BUS Cables

**Profibus fixed installed SHIPLINE + High Temperature 180°C**

HELUKABEL®

X-FRNC + FEP






| Type | Marine and Offshore | High temperature areas |
|---|---|---|
| **Cable structure** | **1x2x0.75 mm (stranded)** | **1x2x0.64 mm** |
| Inner conductor diameter: | Copper, bare (AWG 22/7) | Copper, bare (AWG 22/1) |
| Core insulation: | Foam-skin-PE | FEP |
| Core colours: | rd, gn | rd, gn |
| Stranding element: | Double core | 2 cores + 2 fillers stranded together |
| Separator: | Polyester foil over stranded bundle | - |
| Inner sheath material: | FRNC | - |
| Shielding 1: | Al-Foil | Al-Foil |
| Total shielding: | Cu braid, tinned | Cu braid, tinned |
| Outer sheath material: | X-FRNC | FEP |
| Cable external diameter: | app. 8,0 mm ± 0,4 mm | app. 7,2 mm ± 0,3 mm |
| Outer sheath colour: | Violet similar to RAL 4001 | Violet similar to RAL 4001 |
| **Electrical data** | | |
| Characteristic impedance: | 150 Ohm ± 10 % | 150 Ohm ± 10 % |
| Conductor resistance, max.: | 55 Ohm/km | 55 Ohm/km |
| Insulation resistance, min.: | 1,6 GOhm x km | 1,6 GOhm x km |
| Loop resistance: | 110 Ohm/km max. | 110 Ohm/km max. |
| Mutual capacitance: | 29 nF/km nom. | 28 nF/km nom. |
| Nominal voltage: | 60 V | 250 V |
| Test voltage: | 1 kV | 3,6 kV |
| Attenuation: | 9,6 kHz < 2,5 dB/km<br>38,4 kHz < 4,0 dB/km<br>4 MHz < 22,0 dB/km<br>16 MHz < 42,0 dB/km | 9,6 kHz < 2,5 dB/km<br>38,4 kHz < 4,0 dB/km<br>4 MHz < 22,0 dB/km<br>16 MHz < 42,0 dB/km |
| **Technical data** | | |
| Weight: | app. 84 kg/km | app. 64 kg/km |
| bending radius, repeated: | 80 mm | 52 mm |
| Operating temperature range min.: | -25°C | -50°C |
| Operating temperature range max.: | +80°C | +180°C |
| Caloric load, approx. value: | 1,26 MJ/m | 0,30 MJ/m |
| Copper weight: | 35,00 kg/km | 24,00 kg/km |
| **Norms** | | |
| Applicable standards: | Profibus acc. to DIN 19245 T3 and EN50170<br>Halogen-free acc. to 60754-2<br>Flame-retardant acc. to IEC 60332-1-2 | Profibus acc. to DIN 19245 T3 and EN50170<br>Flame-retardant acc. to IEC 60332-3 |

## Application

HELUKABEL® Profibus Shipline is designed for marine/offshore applications and **certified by German Lloyd**. Thanks to use of stranded conductors, this cable can be moved occasionally. The High-Temperature version is used in fixed installations with demanding temperature requirements, e.g. in the vicinity of a hot furnace or near welding activities.

## Part no.

**802178,** Profibus SHIPLINE

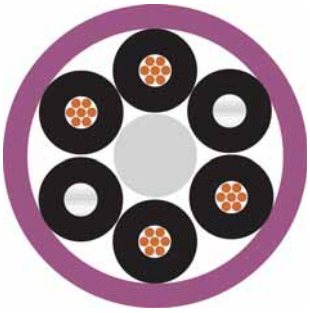
**802179,** Profibus high temperature

Dimensions and specifications may be changed without prior notice.

# BUS Cables

**DESINA®-HYBRID-BUS Drag Chain hybrid**

PUR




## Type
## Cable structure

**Hybrid Bus Cable**
**4x1.5 mm² + 2xPOF**

| | |
|---|---|
| Conductor material | Copper, bare, KL.6 = extra fine wire |
| Core insulation: | TPM |
| Polymer optical fibre: | 4x POF 980/1000 |
| Core colours: | Black |
| Core identification: | Numbers |
| Total shielding: | PETP fleece |
| Outer sheath material: | TPU |
| Cable external diameter: | app. 8,8 mm ± 0,3 mm |
| Outer sheath colour: | Violet similar to RAL 4001 |

## Electrical data

| | |
|---|---|
| Conductor resistance, max.: | 13,7 Ohm/km |
| Insulation resistance, min.: | 0,5 GOhm x km |
| Test voltage: | 3 kV |

## Optical characteristic

| | |
|---|---|
| Fibre attenuation: | 230 dB/km max. at 650 nm |

## Technical data

| | |
|---|---|
| Weight: | app. 120 kg/km |
| bending radius, repeated: | 130 mm |
| Operating temperature range min.: | -20°C |
| Operating temperature range max.: | +80°C |
| Copper weight: | 60,00 kg/km |

## Norms

| | |
|---|---|
| Applicable standards: | Detail specification for DESINA |

## Application

HELUKABEL® DESINA®-Hybrid-Bus is used for mobile applications in machinery. Use of a TPU sheath provides excellent resistance to common mineral oils, greases and cooling lubricants in industrial automation.

## Part no.

**81713,** DESINA HYBRID BUS

Dimensions and specifications may be changed without prior notice.



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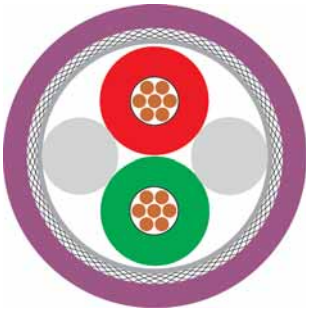
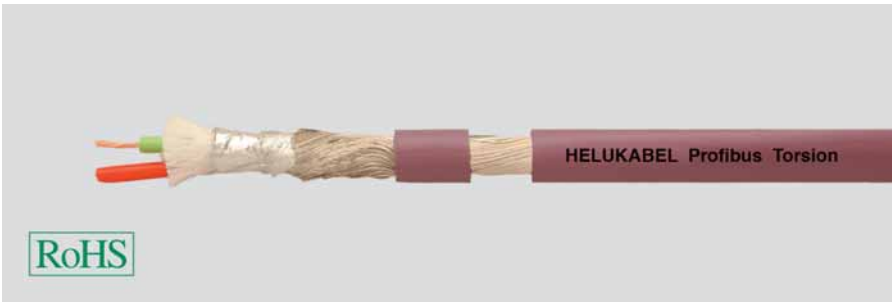
# BUS Cables

**Profibus L2 high flexible TORSION + FESTOON**

HELUKABEL®

PUR + PVC






| Type<br>Cable structure | Torsional applications<br>1x2x0.80 mm (stranded) | Mobile use<br>1x2x0.65 mm (stranded) |
|---|---|---|
| Inner conductor diameter: | Copper, bare (AWG 22/19) | Copper, bare (AWG 23/19) |
| Core insulation: | Foam-skin-PE | Cell PE |
| Core colours: | rd, gn | rd, gn |
| Stranding element: | 2 cores + filler | 2 cores + 2 fillers stranded together |
| Separator: | Polyester foil over stranded bundle | Polyester foil over stranded bundle |
| Shielding 1: | Al-Foil | Al-Foil |
| Total shielding: | Cu braid, tinned | Cu braid, tinned |
| Outer sheath material: | PUR | PVC |
| Cable external diameter: | app. 8,0 mm ± 0,4 mm | app. 8,0 mm ± 0,3 mm |
| Outer sheath colour: | Violet similar to RAL 4001 | Petrol similar to RAL 5018 |

## Electrical data

| | | |
|---|---|---|
| Characteristic impedance: | 150 Ohm ± 10 % | 150 Ohm ± 10 % |
| Conductor resistance, max.: | 49 Ohm/km | 66,5 Ohm/km |
| Insulation resistance, min.: | 1,6 GOhm x km | 1,6 GOhm x km |
| Loop resistance: | 98 Ohm/km max. | 133 Ohm/km max. |
| Mutual capacitance: | 29 nF/km nom. | 28 nF/km nom. |
| Test voltage: | 3,6 kV | 2 kV |
| Relative propagation velocity: | - | 81 % |
| Attenuation: | 9,6 kHz < 2,5 dB/km | 9,6 kHz ⩽ 3,0 dB/km |
| | 38,4 kHz < 3,0 dB/km | 38,4 kHz ⩽ 4,0 dB/km |
| | 4 MHz < 25,0 dB/km | 4 MHz ⩽ 25,0 dB/km |
| | 16 MHz < 49,0 dB/km | 16 MHz ⩽ 49,0 dB/km |

## Technical data

| | | |
|---|---|---|
| Weight: | app. 66 kg/km | app. 64 kg/km |
| bending radius, repeated: | 32 mm | 70 mm |
| Operating temperature range min.: | -25°C | -40°C |
| Operating temperature range max.: | +75°C | +60°C |
| Caloric load, approx. value: | 0,89 MJ/m | 1,09 MJ/m |
| Copper weight: | 32,00 kg/km | 23,00 kg/km |

## Norms

| | | |
|---|---|---|
| Applicable standards: | Profibus acc. to DIN 19245 T3 and EN50170<br>Halogen-free acc. to 60754-2<br>Flame-retardant acc. to IEC 60332-1-2 | Profibus acc. to DIN 19245 T3 and EN50170<br>Flame-retardant acc. to EN 50265-2-1 |
| UL Style: | CMX 75°C (shielded) | CMG 75°C or CL2 or AWM 20201 600V |
| CSA standard: | - | CSA FT 4 |

## Application

HELUKABEL® Profibus Torsion is used in mobile applications in robots. The special torsion construction allows this cable to be twisted (torsioned) and is halogen-free thanks to use PU sheath. The Festoon version is used for hanging/moving loads in garland applications.

## Part no.

| | |
|---|---|
| **800109,** Profibus L2 | **800649,** Profibus L2 |

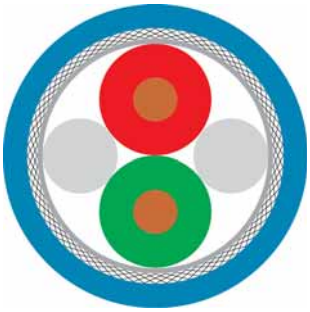
Dimensions and specifications may be changed without prior notice.

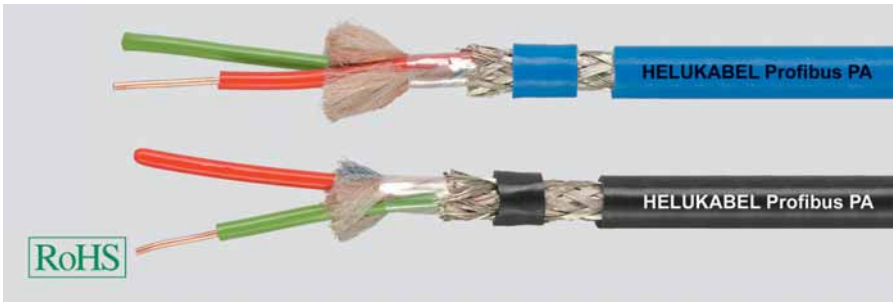
# BUS Cables

**Profibus PA fixed installed**

HELUKABEL®

PVC






| Type<br>Cable structure | Hazardous areas<br>1x2x1.0/2.55 mm | Non-hazardous areas<br>1x2x1.0/2.55 mm |
|---|---|---|
| Inner conductor diameter: | Copper, bare (AWG 18/1) | Copper, bare (AWG 18/1) |
| Core insulation: | PE | PE |
| Core colours: | rd, gn | rd, gn |
| Stranding element: | 2 cores + 2 fillers stranded together | 2 cores + 2 fillers stranded together |
| Separator: | Polyester foil over stranded bundle | Polyester foil over stranded bundle |
| Shielding 1: | Al-Foil | Al-Foil |
| Total shielding: | Cu braid, tinned | Cu braid, tinned |
| Outer sheath material: | PVC | PVC |
| Cable external diameter: | app. 7,6 mm ± 0,2 mm | app. 7,6 mm ± 0,2 mm |
| Outer sheath colour: | Blue | Black |

## Electrical data

| | | |
|---|---|---|
| Characteristic impedance: | 100 Ohm ± 20 % | 100 Ohm ± 20 % |
| Conductor resistance, max.: | 22 Ohm/km | 22 Ohm/km |
| Insulation resistance, min.: | 1 GOhm x km | 1 GOhm x km |
| Loop resistance: | 44 Ohm/km max. | 44 Ohm/km max. |
| Mutual capacitance: | 60 nF/km nom. | 60 nF/km nom. |
| Nominal voltage: | 300 V | 300 V |
| Test voltage: | 2,5 kV | 2,5 kV |
| Attenuation: | 39 kHz ⩽ 3,0 dB/km | 39 kHz ⩽ 3,0 dB/km |

## Technical data

| | | |
|---|---|---|
| Weight: | app. 76 kg/km | app. 76 kg/km |
| bending radius, repeated: | 140 mm | 140 mm |
| Operating temperature range min.: | -30°C | -30°C |
| Operating temperature range max.: | +80°C | +80°C |
| Caloric load, approx. value: | 0,95 MJ/m | 0,95 MJ/m |
| Copper weight: | 44,00 kg/km | 44,00 kg/km |

## Norms

| | | |
|---|---|---|
| Applicable standards: | Profibus acc. to DIN 19245 T3 and EN50170<br>Flame-retardant acc. to EN 50265-2-1 | Profibus acc. to DIN 19245 T3 and EN50170<br>Flame-retardant acc. to EN 50265-2-1 |
| UL Style: | UL Style 2571 | UL Style 2571 |

## Application

HELUKABEL® Profibus PA is used for normal requirements in the process automation field (chemical industry). The colour blue identifies it as suitable for use in potentially explosive areas (and ATEX/ Class II, EX-i/ EN 60079-14). For other applications, the colour black is usually selected.

## Part no.

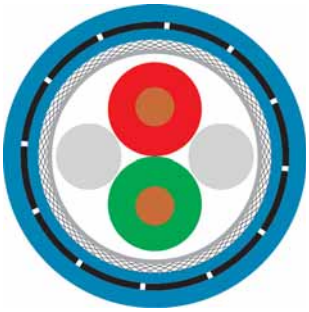
| | |
|---|---|
| **82835,** Profibus PA | **82836,** Profibus PA |

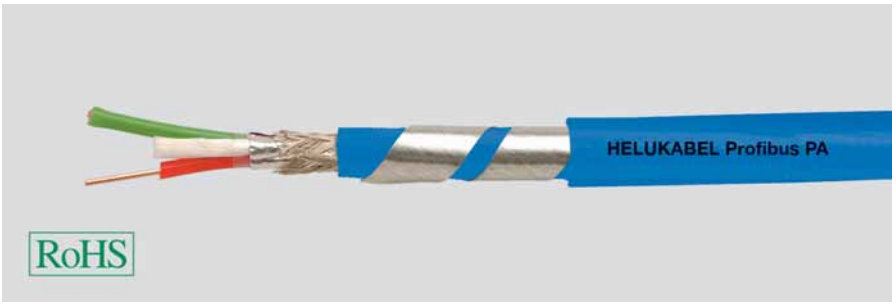
Dimensions and specifications may be changed without prior notice.

# BUS Cables

**Profibus PA fixed installed armoured**

PVC / PVC






| Type<br>Cable structure | Hazardous areas<br>1x2x1.0/2.55 mm | Non-hazardous areas<br>1x2x1.0/2.55 mm |
|---|---|---|
| Inner conductor diameter: | Copper, bare (AWG 18/1) | Copper, bare (AWG 18/1) |
| Core insulation: | PE | PE |
| Core colours: | rd, gn | rd, gn |
| Stranding element: | 2 cores + 2 fillers stranded together | 2 cores + 2 fillers stranded together |
| Separator: | Polyester foil over stranded bundle | Polyester foil over stranded bundle |
| Inner sheath material: | PVC | PVC |
| Shielding 1: | Al-Foil | Al-Foil |
| Total shielding: | Cu braid, tinned | Cu braid, tinned |
| Armouring: | Steel band | Steel band |
| Outer sheath material: | PVC | PVC |
| Cable external diameter: | app. 10,2 mm ± 0,2 mm | app. 10,2 mm ± 0,2 mm |
| Outer sheath colour: | Blue | Black |

## Electrical data

| | | |
|---|---|---|
| Characteristic impedance: | 100 Ohm ± 15 % | 100 Ohm ± 15 % |
| Conductor resistance, max.: | 22 Ohm/km | 22 Ohm/km |
| Insulation resistance, min.: | 1 GOhm x km | 1 GOhm x km |
| Loop resistance: | 44 Ohm/km max. | 44 Ohm/km max. |
| Mutual capacitance: | 55 nF/km nom. | 55 nF/km nom. |
| Nominal voltage: | 300 V | 300 V |
| Test voltage: | 2,5 kV | 2,5 kV |
| Attenuation: | 39 kHz ⩽ 3,0 dB/km | 39 kHz ⩽ 3,0 dB/km |

## Technical data

| | | |
|---|---|---|
| Weight: | app. 170 kg/km | app. 170 kg/km |
| bending radius, repeated: | 140 mm | 200 mm |
| Operating temperature range min.: | -20°C | -20°C |
| Operating temperature range max.: | +70°C | +70°C |
| Caloric load, approx. value: | 1,95 MJ/m | 1,95 MJ/m |
| Copper weight: | 45,00 kg/km | 45,00 kg/km |

## Norms

| | | |
|---|---|---|
| Applicable standards: | Profibus acc. to DIN 19245 T3 and EN50170<br>Flame-retardant acc. to EN 50265-2-1 | Profibus acc. to DIN 19245 T3 and EN50170<br>Flame-retardant acc. to EN 50265-2-1 |

## Application

HELUKABEL® Profibus PA Armoured is used in areas with rodent such as rats, nutria etc. but also offers additional protection against all other outside mechanical influences thanks to its steel tape armouring. The colour blue identifies it as suitable for use in potentially explosive areas (and ATEX/ Class II, EX-i/EN 60079-14). For other applications, the colour black is usually used.

## Part no.

| | |
|---|---|
| **802180,** Profibus PA | **802181,** Profibus PA |

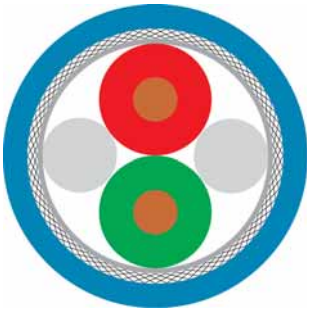
Dimensions and specifications may be changed without prior notice.

# BUS Cables

**Profibus PA LD fixed installed**

HELUKABEL®

PVC




| Type<br>Cable structure | Hazardous areas<br>1x2x1.6/3.2 mm | Non-hazardous areas<br>1x2x1.6/3.2 mm |
|---|---|---|
| Inner conductor diameter: | Copper, bare (AWG 16/7) | Copper, bare (AWG 16/7) |
| Core insulation: | Foam-skin-PE | Foam-skin-PE |
| Core colours: | rd, gn | rd, gn |
| Stranding element: | 2 cores + 2 fillers stranded together | 2 cores + 2 fillers stranded together |
| Separator: | Polyester foil over stranded bundle | Polyester foil over stranded bundle |
| Shielding 1: | Al-Foil | Al-Foil |
| Total shielding: | Cu braid, tinned | Cu braid, tinned |
| Outer sheath material: | PVC | PVC |
| Cable external diameter: | app. 9,5 mm ± 0,3 mm | app. 9,5 mm ± 0,3 mm |
| Outer sheath colour: | Blue | Black |

## Electrical data

| | | |
|---|---|---|
| Characteristic impedance: | 100 Ohm ± 20 % | 100 Ohm ± 20 % |
| Conductor resistance, max.: | 24 Ohm/km | 24 Ohm/km |
| Insulation resistance, min.: | 1 GOhm x km | 1 GOhm x km |
| Loop resistance: | 48 Ohm/km max. | 48 Ohm/km max. |
| Mutual capacitance: | 60 nF/km nom. | 60 nF/km nom. |
| Nominal voltage: | 300 V | 300 V |
| Test voltage: | 1 kV | 1 kV |
| Attenuation: | 39 kHz ⩽ 2,7 dB/km | 39 kHz ⩽ 2,7 dB/km |

## Technical data

| | | |
|---|---|---|
| Weight: | app. 131 kg/km | app. 131 kg/km |
| bending radius, repeated: | 100 mm | 100 mm |
| Operating temperature range min.: | -40°C | -40°C |
| Operating temperature range max.: | +70°C | +70°C |
| Caloric load, approx. value: | 1,57 MJ/m | 1,57 MJ/m |
| Copper weight: | 62,00 kg/km | 62,00 kg/km |

## Norms

| | | |
|---|---|---|
| Applicable standards: | Profibus acc. to DIN 19245 T3 and EN50170<br>Flame-retardant acc. to IEC 60332-1-2 | Profibus acc. to DIN 19245 T3 and EN50170<br>Flame-retardant acc. to IEC 60332-1-2 |
| UL Style: | UL Style 2571 | UL Style 2571 |

## Application

HELUKABEL® Profibus PA Long Distance is used for especially long transmission distances in process networks. It uses a larger conductor cross-section to satisfy the attenuation requirements. The colour blue identifies it as suitable for use in potentially explosive areas (and ATEX/Class II, EX-i/EN 60079-14). For other applications, the colour black is usually selected.

| Part no. | | |
|---|---|---|
| | **800650,** Profibus PA | **800715,** Profibus PA |

Dimensions and specifications may be changed without prior notice.



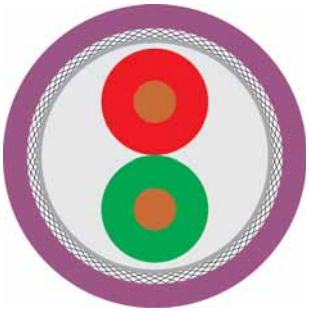
DNB Edition 11 (published 01.10.2015)

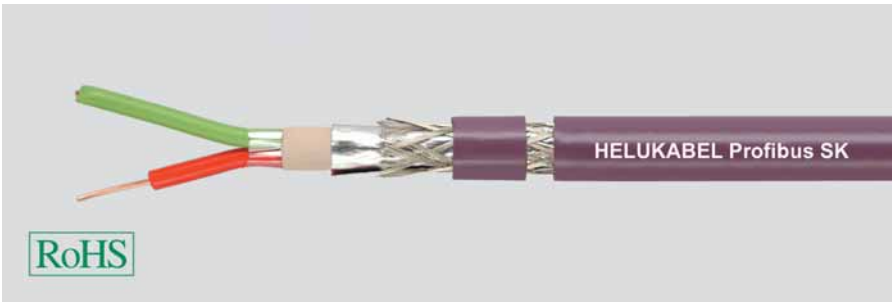
# BUS Cables

**Profibus SK fixed installed Indoor + Outdoor**

HELUKABEL®

PVC + PE






| Type<br>Cable structure | Fixed installation, indoor<br>1x2x0.64 mm | Fixed installation, outdoor<br>1x2x0.64 mm |
|---|---|---|
| Inner conductor diameter: | Copper, bare (AWG 22/1) | Copper, bare (AWG 22/1) |
| Core insulation: | Foam-skin-PE | Foam-skin-PE |
| Core colours: | rd, gn | rd, gn |
| Stranding element: | Double core | Double core |
| Separator: | Polyester foil over stranded bundle | Polyester foil over stranded bundle |
| Inner sheath material: | PVC | PVC |
| Shielding 1: | Al-Foil | Al-Foil |
| Total shielding: | Cu braid, tinned | Cu braid, tinned |
| Outer sheath material: | PVC | PE |
| Cable external diameter: | app. 8,0 mm ± 0,4 mm | app. 8,0 mm ± 0,4 mm |
| Outer sheath colour: | Violet similar to RAL 4001 | Black similar to RAL 9005 |

## Electrical data

| | | |
|---|---|---|
| Characteristic impedance: | 150 Ohm ± 10 % | 150 Ohm ± 10 % |
| Conductor resistance, max.: | 55 Ohm/km | 55 Ohm/km |
| Insulation resistance, min.: | 1 GOhm x km | 1 GOhm x km |
| Loop resistance: | 110 Ohm/km max. | 110 Ohm/km max. |
| Mutual capacitance: | 35 nF/km nom. | 35 nF/km nom. |
| Test voltage: | 1,5 kV | 1,5 kV |
| Attenuation: | 9,6 kHz < 2,5 dB/km<br>38,4 kHz < 4,0 dB/km<br>4,0 MHz < 22,0 dB/km<br>16,0 MHz < 42,0 dB/km | 9,6 kHz < 2,5 dB/km<br>38,4 kHz < 4,0 dB/km<br>4 MHz < 22,0 dB/km<br>16 MHz < 42,0 dB/km |

## Technical data

| | | |
|---|---|---|
| Weight: | app. 79 kg/km | app. 65 kg/km |
| bending radius, repeated: | 120 mm | 120 mm |
| Operating temperature range min.: | -40°C | -20°C |
| Operating temperature range max.: | +80°C | +70°C |
| Caloric load, approx. value: | 1,068 MJ/m | 1,451 MJ/m |
| Copper weight: | 24,00 kg/km | 24,00 kg/km |

## Norms

| | | |
|---|---|---|
| Applicable standards: | Profibus acc. to DIN 19245 T3 and EN50170<br>Flame-retardant acc. to IEC 60332-3 | Profibus acc. to DIN 19245 T3 and EN50170<br>Halogen-free acc. to 60754-2 |
| UL Style: | CMG 75°C or CL3 or AWM 21694 600V | - |
| CSA standard: | CSA FT 4 | - |

## Application

HELUKABEL® Profibus SK Indoor + Outdoor have a special structure for processing with the Fast Connect Stripping Tool from Siemens. The indoor version is used for normal requirements in fixed installation applications in equipment; the Outdoor version is used in open-air applications, i.e. can withstand wind, weather and sun (not for burial directly in the ground).

## Part no.

| | |
|---|---|
| **81903,** Profibus SK | **81904,** Profibus SK |

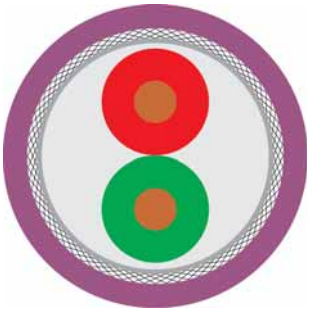
Dimensions and specifications may be changed without prior notice.

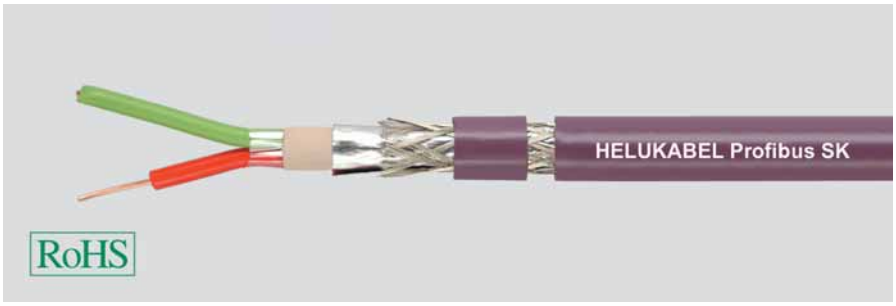
# BUS Cables

**Profibus SK fixed installed FRNC + Robust**

HELUKABEL®

FRNC + PUR






| Type | Fixed installation, indoor | Industrial Area |
|---|---|---|
| **Cable structure** | **1x2x0.64 mm** | **1x2x0.64 mm** |
| Inner conductor diameter: | Copper, bare (AWG 22/1) | Copper, bare (AWG 22/1) |
| Core insulation: | Foam-skin-PE | Foam-skin-PE |
| Core colours: | rd, gn | rd, gn |
| Stranding element: | Double core | Double core |
| Separator: | Polyester foil over stranded bundle | Polyester foil over stranded bundle |
| Inner sheath material: | FRNC | FRNC |
| Shielding 1: | Al-Foil | Al-Foil |
| Total shielding: | Cu braid, tinned | Cu braid, tinned |
| Outer sheath material: | FRNC | PUR |
| Cable external diameter: | app. 8,0 mm ± 0,4 mm | app. 8,0 mm ± 0,4 mm |
| Outer sheath colour: | Violet similar to RAL 4001 | Violet similar to RAL 4001 |
| **Electrical data** | | |
| Characteristic impedance: | 150 Ohm ± 10 % | 150 Ohm ± 10 % |
| Conductor resistance, max.: | 55 Ohm/km | 55 Ohm/km |
| Insulation resistance, min.: | 1 GOhm x km | 1 GOhm x km |
| Loop resistance: | 110 Ohm/km max. | 110 Ohm/km max. |
| Mutual capacitance: | 35 nF/km nom. | 35 nF/km nom. |
| Test voltage: | 1,5 kV | 1,5 kV |
| Attenuation: | 9,6 kHz < 2,5 dB/km | 9,6 kHz < 2,5 dB/km |
| | 38,4 kHz < 4,0 dB/km | 38,4 kHz < 4,0 dB/km |
| | 4 MHz < 22,0 dB/km | 4 MHz < 22,0 dB/km |
| | 16 MHz < 42,0 dB/km | 16 MHz < 42,0 dB/km |
| **Technical data** | | |
| Weight: | app. 73 kg/km | app. 71 kg/km |
| bending radius, repeated: | 160 mm | 120 mm |
| Operating temperature range min.: | -25°C | -40°C |
| Operating temperature range max.: | +70°C | +70°C |
| Caloric load, approx. value: | 1,203 MJ/m | 1,574 MJ/m |
| Copper weight: | 24,00 kg/km | 24,00 kg/km |
| **Norms** | | |
| Applicable standards: | Profibus acc. to DIN 19245 T3 and EN50170 | Profibus acc. to DIN 19245 T3 and EN50170 |
| | Halogen-free acc. to 60754-2 | Halogen-free acc. to 60754-2 |
| | Flame-retardant acc. to EN 50265-2-1 | Flame-retardant acc. to IEC 60332-1-2 |
| UL Style: | CM 750C (shielded) | AWM Style 20236 AWM I/II A/B 80°C 30V FT1 |
| CSA standard: | - | CSA FT1 |

## Application

HELUKABEL® Profibus SK FRNC + Robust has a special structure for processing with the Fast Connect Stripping Tool from Siemens. The FRNC version is used to satisfy halogen-free and flame-retardent requirements in buildings. The Robust version is used in harsh industrial environments and offers excellent resistance to mineral oils, greases and cooling lubricants.

| Part no. | | |
|---|---|---|
| | **81501,** Profibus SK | **81905,** Profibus SK |

Dimensions and specifications may be changed without prior notice.



DNB Edition 11 (published 01.10.2015)

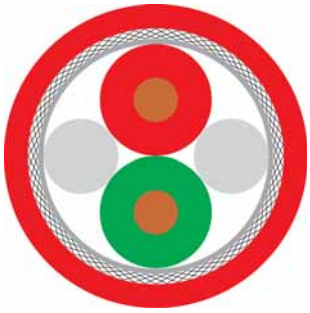
# BUS Cables

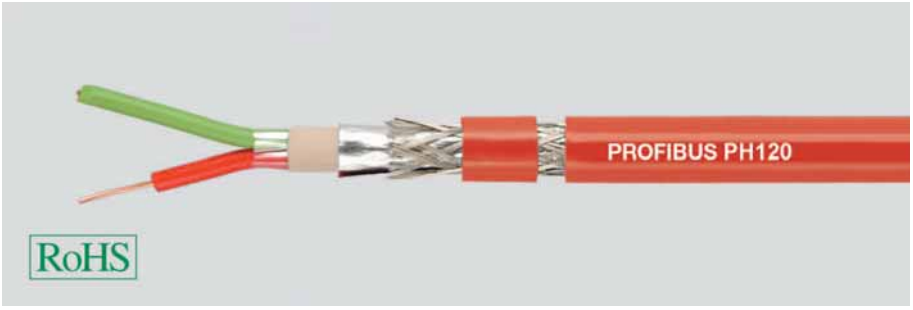
**Profibus fixed installed FRNC**

HELUKABEL®

PH 120

NEW






## Type
## Fixed installation, indoor

## Cable structure
## 1x2x0.64 mm

| | |
|---|---|
| Inner conductor diameter: | Copper, bare (AWG 22/1) |
| Core insulation: | Foam-skin-PE |
| Core colours: | rd, gn |
| Stranding element: | Double core |
| Separator: | - |
| Shielding 1: | - |
| Total shielding: | AL-Foil + braid |
| Outer sheath material: | FRNC |
| Cable external diameter: | app. 8,4 mm ± 0,3 mm |
| Outer sheath colour: | Red |

## Electrical data

| | |
|---|---|
| Characteristic impedance: | 150 Ohm ± 10 % |
| Conductor resistance, max.: | 59,1 Ohm/km |
| Insulation resistance, min.: | 1 GOhm x km |
| Loop resistance: | 118 Ohm/km max. |
| Mutual capacitance: | 30 nF/km nom. |
| Test voltage: | 0,7 kV |

Attenuation:

| Frequency | before EN50200 | after EN50200 PH120 |
|---|---|---|
| 9,6 kHz | 2,1 dB/km | 2,3 dB/km |
| 38,4 kHz | 3,0 dB/km | 3,3 dB/km |
| 4 MHz | 18,5 dB/km | 20,4 dB/km |
| 16 MHz | 34,5 dB/km | 38,0 dB/km |

## Technical data

| | |
|---|---|
| Weight: | app. 93 kg/km |
| bending radius, repeated: | 130 mm |
| Operating temperature range min.: | -20°C |
| Operating temperature range max.: | +70°C |
| Caloric load, approx. value: | 1,46 MJ/m |
| Copper weight: | 33,00 kg/km |

## Norms

Applicable standards:

Profibus acc. to DIN 19245 T3 and EN50170
Halogen-free acc. to 60754-2
Flame-retardant acc. to EN 50265-2-1

## Application

HELUKABEL® Profibus FRNC PH120 has a special structure for circuit integrity for 120 minutes and is used for fix installation in buildings.

## Part no.

**805695,** Profibus Circuit Integrity

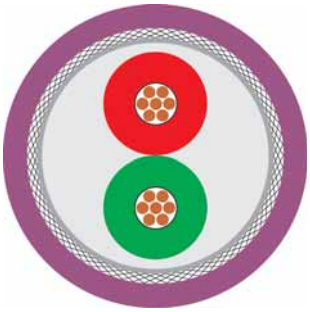
Dimensions and specifications may be changed without prior notice.

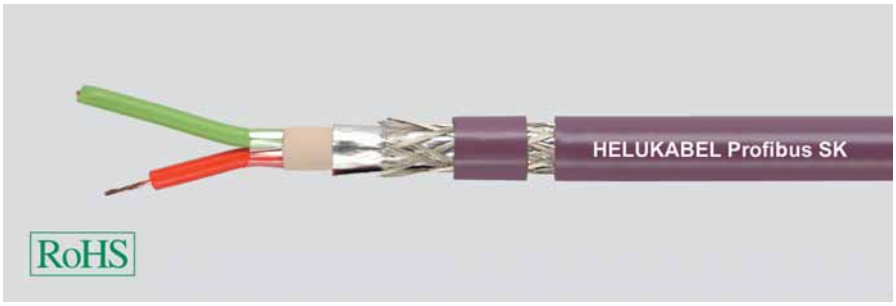
# BUS Cables

**Profibus SK Drag Chain**

HELUKABEL®

PUR






| Type<br>Cable structure | Drag Chain applications<br>1x2x0.65 mm (stranded) | Drag Chain applications<br>1x2x0.65 mm (stranded) |
|---|---|---|
| Inner conductor diameter: | Copper, bare (AWG 24/19) | Copper, bare (AWG 24/19) |
| Core insulation: | Foam-skin-PE | Foam-skin-PE |
| Core colours: | rd, gn | rd, gn |
| Stranding element: | Double core | Double core |
| Separator: | Polyester foil over stranded bundle | Polyester foil over stranded bundle |
| Inner sheath material: | PVC | PVC |
| Shielding 1: | Al-Foil | Al-Foil |
| Total shielding: | Cu braid, tinned | Cu braid, tinned |
| Outer sheath material: | PUR | PUR |
| Cable external diameter: | app. 8,0 mm ± 0,4 mm | app. 8,0 mm ± 0,4 mm |
| Outer sheath colour: | Violet similar to RAL 4001 | Petrol similar to RAL 5018 |
| **Electrical data** | | |
| Characteristic impedance: | 150 Ohm ± 10 % | 150 Ohm ± 10 % |
| Conductor resistance, max.: | 67 Ohm/km | 67 Ohm/km |
| Insulation resistance, min.: | 1 GOhm x km | 1 GOhm x km |
| Loop resistance: | 134 Ohm/km max. | 134 Ohm/km max. |
| Mutual capacitance: | 35 nF/km nom. | 35 nF/km nom. |
| Test voltage: | 1,5 kV | 1,5 kV |
| Attenuation: | 9,6 kHz < 3,0 dB/km<br>38,4 kHz < 5,0 dB/km<br>4 MHz < 25,0 dB/km<br>16 MHz < 52,0 dB/km | 9,6 kHz < 3,0 dB/km<br>38,4 kHz < 5,0 dB/km<br>4 MHz < 25,0 dB/km<br>16 MHz < 52,0 dB/km |
| **Technical data** | | |
| Weight: | app. 70 kg/km | app. 70 kg/km |
| bending radius, repeated: | 100 mm | 100 mm |
| Operating temperature range min.: | -40°C | -40°C |
| Operating temperature range max.: | +70°C | +70°C |
| Caloric load, approx. value: | 1,53 MJ/m | 1,53 MJ/m |
| Copper weight: | 25,00 kg/km | 25,00 kg/km |
| **Norms** | | |
| Applicable standards: | Profibus acc. to DIN 19245 T3 and EN50170<br>Flame-retardant acc. to IEC 60332-1-2 | Profibus acc. to DIN 19245 T3 and EN50170<br>Flame-retardant acc. to IEC 60332-1-2 |
| UL Style: | CMX 75°C (shielded) | CMX 75°C (shielded) |
| CSA standard: | CSA FT1 | CSA FT1 |

## Application

HELUKABEL® Profibus SK Drag Chain is designed for continous motion in cable carriers and has a special structure for processing with the Fast Connect Stripping Tool from Siemens. Thanks to the PU sheath, it also offers excellent resistance to common mineral oils, greases and cooling lubricants. Depending on the application, the colour petrol or violet is availiable.

| Part no. | | |
|---|---|---|
| | **801659,** Profibus SK | **81906,** Profibus SK |

Dimensions and specifications may be changed without prior notice.



DNB Edition 11 (published 01.10.2015)

# BUS Cables

**FOUNDATION™ Fieldbus flexible Basic**

PVC


## Type
## Cable structure

**process automation**
**1x2x1.1/2,55-100 LI**

| | |
|---|---|
| Inner conductor diameter: | Copper, bare (AWG 18/7) |
| Core insulation: | PO |
| Core colours: | or, bl |
| Stranding element: | 2 cores + 2 fillers stranded together |
| Separator: | Polyester foil over stranded bundle |
| Shielding 1: | Al-Foil |
| Total shielding: | Cu braid, tinned |
| Drain wire: | yes |
| Outer sheath material: | PVC |
| Cable external diameter: | app. 8,0 mm ± 0,3 mm |
| Outer sheath colour: | Orange |

## Electrical data

| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 20 Ohm |
| Conductor resistance, max.: | 22 Ohm/km |
| Insulation resistance, min.: | 5 GOhm x km |
| Loop resistance: | 44 Ohm/km max. |
| Mutual capacitance: | 60 nF/km nom. |
| Nominal voltage: | 300 V |
| Test voltage: | 1,5 kV |
| Attenuation: | 39 kHz ⩽ 3,4 dB/km |

## Technical data

| | |
|---|---|
| Weight: | app. 85 kg/km |
| bending radius, repeated: | 80 mm |
| Operating temperature range min.: | -40°C |
| Operating temperature range max.: | +80°C |
| Caloric load, approx. value: | 1,22 MJ/m |
| Copper weight: | 45,00 kg/km |

## Norms

| | |
|---|---|
| Applicable standards: | Foundation Fieldbus Spec. FF-816-1.4<br>Flame-retardant acc. to IEC 60332-3 |
| UL Style: | CMG 75°C PLTC FT4 |
| CSA standard: | CSA FT 4 |

## Application

HELUKABEL® FOUNDATION™ Fieldbus Basic for normal requirements in this industrial networks. Thanks to use of stranded conductors, this cable can be moved occasionally and satisfies the usual American requirements for such networks.

## Part no.

**803354,** Foundation™ Fieldbus Basic

Dimensions and specifications may be changed without prior notice.

# BUS Cables

**FOUNDATION™ Fieldbus flexible Type A + gnye**

HELUKABEL®

PVC


## Type
## process automation
## Cable structure
## 1x2x1.1/2,85-100 LI + 1x0,8 gnye

| | |
|---|---|
| Inner conductor diameter 1: | Copper, bare (AWG 18/41) |
| Inner conductor diameter 2: | Copper, bare (AWG 18/41) |
| Core insulation 1: | XLPE ray cross-linking |
| Core insulation 2: | PVC |
| Core colours 1: | bu, bn |
| Core colours 2: | gn/ye |
| Stranding element 1: | Double core |
| Separator: | - |
| Shielding 1: | Al-Foil |
| Total shielding: | Cu braid, tinned |
| Drain wire: | yes |
| Outer sheath material: | PVC |
| Cable external diameter: | app. 7,9 mm ± 0,3 mm |
| Outer sheath colour: | Yellow |

## Electrical data

| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 20 Ohm |
| Conductor resistance, max.: | 24 Ohm/km |
| Insulation resistance, min.: | 2 GOhm x km |
| Loop resistance: | 48 Ohm/km max. |
| Mutual capacitance: | 65 nF/km nom. |
| Nominal voltage: | 300 V |
| Test voltage: | 1,5 kV |
| Attenuation: | 39 kHz ⩽ 3,4 dB/km |

## Technical data

| | |
|---|---|
| Weight: | app. 84 kg/km |
| bending radius, repeated: | 80 mm |
| Operating temperature range min.: | -25°C |
| Operating temperature range max.: | +105°C |
| Caloric load, approx. value: | 1,00 MJ/m |
| Copper weight: | 49,00 kg/km |

## Norms

| | |
|---|---|
| Applicable standards: | Foundation Fieldbus Spec. FF-816-1.4<br>Flame-retardant acc. to IEC 60332-3 |
| UL Style: | CMG 105° or CL3 FT4 |
| CSA standard: | CSA FT 4 |

## Application

HELUKABEL® FOUNDATION™ Fieldbus Type A + gnye offers an additional conductor in the structure in compliance with the FF specification. Thanks to use of stranded conductors, this cable can be moved occasionally and satisfies the usual American requirements for such networks.

## Part no.

**801191,** Foundation Fieldbus FF A

Dimensions and specifications may be changed without prior notice.

# BUS Cables

**FOUNDATION™ Fieldbus flexible Type A armoured**

HELUKABEL®

PVC


## Type
## process automation
## Cable structure
## 1x2x1.1/2,85-100 LI + 1x0,8 gnye, armoured

| | |
|---|---|
| Inner conductor diameter 1: | Copper, bare (AWG 18/41) |
| Inner conductor diameter 2: | Copper, bare (AWG 18/37) |
| Core insulation 1: | XLPE ray cross-linking |
| Core insulation 2: | PVC |
| Core colours 1: | bu, bn |
| Core colours 2: | gn/ye |
| Stranding element 1: | Double core |
| Separator: | - |
| Shielding 1: | Al-Foil |
| Total shielding: | Al-Foil |
| Drain wire: | yes |
| Armouring: | Corrugated copper tube |
| Outer sheath material: | PVC |
| Cable external diameter: | app. 12,3 mm ± 0,3 mm |
| Outer sheath colour: | Yellow |

## Electrical data

| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 20 Ohm |
| Conductor resistance, max.: | 24 Ohm/km |
| Insulation resistance, min.: | 2 GOhm x km |
| Loop resistance: | 48 Ohm/km max. |
| Mutual capacitance: | 65 nF/km nom. |
| Nominal voltage: | 300 V |
| Test voltage: | 1,5 kV |
| Attenuation: | 39 kHz ⩽ 3,4 dB/km |

## Technical data

| | |
|---|---|
| Weight: | app. 187 kg/km |
| bending radius, repeated: | 130 mm |
| Operating temperature range min.: | -25°C |
| Operating temperature range max.: | +105°C |
| Caloric load, approx. value: | 1,65 MJ/m |
| Copper weight: | 125,00 kg/km |

## Norms

| | |
|---|---|
| Applicable standards: | Foundation Fieldbus Spec. FF-816-1.4<br>Flame-retardant acc. to IEC 60332-3 |
| UL Style: | CMG 105°C or PLTC FT4 Sun Res |
| CSA standard: | CSA FT 4 |

## Application

HELUKABEL® FOUNDATION™ Type A Armoured finds use in areas with rodents such as rats, nutria etc. but also offers additional protection against all other outside mechanical influences thanks to its corrugated tape armouring. Thanks to use of stranded conductors, this cable can be moved occasionally and satisfies the usual American requirements for such networks.

## Part no.

**801192,** Foundation Fieldbus FF A

Dimensions and specifications may be changed without prior notice.

# BUS Cables

**FOUNDATION™ Fieldbus flexible Type A**

HELUKABEL®

PVC


## Type
## process automation
## Cable structure
## 1x2x1.1/2,85-100 LI

| | |
|---|---|
| Inner conductor diameter: | Copper, bare (AWG 18/37) |
| Core insulation: | XLPE ray cross-linking |
| Core colours: | bu, bn |
| Stranding element: | Double core |
| Separator: | - |
| Shielding 1: | Al-Foil |
| Total shielding: | Cu braid, tinned |
| Drain wire: | yes |
| Outer sheath material: | PVC |
| Cable external diameter: | app. 7,9 mm ± 0,3 mm |
| Outer sheath colour: | Yellow |

## Electrical data

| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 20 Ohm |
| Conductor resistance, max.: | 24 Ohm/km |
| Insulation resistance, min.: | 2 GOhm x km |
| Loop resistance: | 48 Ohm/km max. |
| Mutual capacitance: | 65 nF/km nom. |
| Nominal voltage: | 300 V |
| Test voltage: | 1,5 kV |
| Attenuation: | 39 kHz ⩽ 3,4 dB/km |

## Technical data

| | |
|---|---|
| Weight: | app. 89 kg/km |
| bending radius, repeated: | 80 mm |
| Operating temperature range min.: | -40°C |
| Operating temperature range max.: | +105°C |
| Caloric load, approx. value: | 1,05 MJ/m |
| Copper weight: | 42,00 kg/km |

## Norms

| | |
|---|---|
| Applicable standards: | Foundation Fieldbus Spec. FF-816-1.4<br>Flame-retardant acc. to IEC 60332-3 |
| UL Style: | CMG 105° or CL3 FT4 |
| CSA standard: | CSA FT 4 |

## Application

HELUKABEL® FOUNDATION™ Fieldbus Type A for normal requirements in this industrial network. Thanks to use of stranded conductors, this cable can be moved occasionally and satisfies the usual American requirements for such networks.

## Part no.

**801193,** Foundation Fieldbus FF A

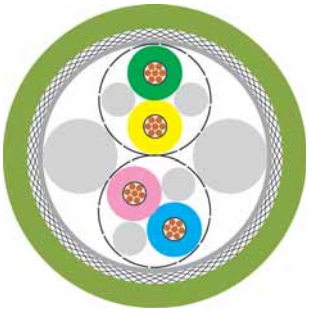
Dimensions and specifications may be changed without prior notice.

# BUS Cables

**HMCB200 fixed installed**

HELUKABEL®

PVC




## Type
## Fixed installation, indoor

## Cable structure
## 2x2x0,22qmm

| | |
|---|---|
| Inner conductor diameter: | Copper, bare (AWG 22/7) |
| Core insulation: | Foam-skin-PE |
| Core colours: | gn, ye, pk, bu |
| Stranding element: | Double core |
| Separator: | Polyester foil over stranded bundle |
| Shielding 1: | Al-Foil |
| Total shielding: | Cu braid, tinned |
| Outer sheath material: | PVC |
| Cable external diameter: | app. 6,8 mm ± 0,15 mm |
| Outer sheath colour: | Green similar to RAL 6018 |

## Electrical data

| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz |
| Conductor resistance, max.: | 94,2 Ohm/km |
| Insulation resistance, min.: | 1 GOhm x km |
| Loop resistance: | 188 Ohm/km max. |
| Mutual capacitance: | 50 nF/km nom. |
| Test voltage: | 0,5 kV |

## Typical values

| | | | | | |
|---|---|---|---|---|---|
| Frequency | (MHz) | 10 | 16 | 62,5 | 100 |
| Attenuation | (dB/100m) | 8,0 | 10,0 | 20,0 | 27,0 |
| Next | (dB) | 56,0 | 53,0 | 43,0 | 40,0 |
| ACR | (dB) | 48,0 | 43,0 | 23,0 | 13,0 |

## Technical data

| | |
|---|---|
| Weight: | app. 63 kg/km |
| bending radius, repeated: | 70 mm |
| Operating temperature range min.: | -20°C |
| Operating temperature range max.: | +80°C |
| Caloric load, approx. value: | 0,92 MJ/m |
| Copper weight: | 35,00 kg/km |

## Norms

| | |
|---|---|
| Applicable standards: | Flame-retardant acc. to IEC 60332-1-2 |
| UL Style: | AWM Style 2502 AWM I/II A/B 80°C 30V FT1 |

## Application

HELUKABEL® HMCB200 for fixed installation and slight occasional movement, range up to 100m. This cable is used in Siemens Systems. Typical plugs are RJ45 Industrial IP20 Siemens or Y-Con RJ45 Yamaichi or round M-Connectors from Molex.

## Part no.

**802471,** HMCB200

Dimensions and specifications may be changed without prior notice.

* Drive Cliq is registered trademark from Siemens AG.

# BUS Cables

**HMCB500S Drag Chain**




## Type
## Cable structure
## Drag Chain applications
## 2x2xAWG24 + 1x2xAWG22

| | |
|---|---|
| Inner conductor diameter 1: | Copper, bare (AWG 24/7) |
| Inner conductor diameter 2: | Copper, tinned (AWG 22/19) |
| Core insulation 1: | Foam-skin-PE |
| Core insulation 2: | PE |
| Core colours 1: | gn, ye, pk, bu |
| Core colours 2: | rd, bk |
| Stranding element 1: | Double core |
| Separator: | - |
| Shielding 1: | - |
| Total shielding: | AL-Foil + braid |
| Outer sheath material: | PVC |
| Cable external diameter: | app. 6,95 mm ± 0,15 mm |
| Outer sheath colour: | Green similar to RAL 6018 |

## Electrical data

| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz |
| Conductor resistance, max.: | 90 Ohm/km |
| Insulation resistance, min.: | 1 GOhm x km |
| Loop resistance: | 180 Ohm/km max. |
| Mutual capacitance: | 50 nF/km nom. |
| Test voltage: | 0,5 kV |

## Typical values

| | | | | | |
|---|---|---|---|---|---|
| Frequency | (MHz) | 10 | 16 | 62,5 | 100 |
| Attenuation | (dB/100m) | 10,0 | 12,0 | 23,0 | 30,0 |
| Next | (dB) | 47,0 | 44,0 | 35,0 | 32,0 |
| ACR | (dB) | 37,0 | 36,0 | 12,0 | 2,0 |

## Technical data

| | |
|---|---|
| Weight: | app. 66 kg/km |
| bending radius, repeated: | 125 mm |
| Operating temperature range min.: | 0°C |
| Operating temperature range max.: | +60°C |
| Caloric load, approx. value: | 0,00 MJ/m |
| Copper weight: | 38,00 kg/km |

## Norms

| | |
|---|---|
| Applicable standards: | Flame-retardant acc. to IEC 60332-1-2 |
| UL Style: | AWM Style 2502 AWM I/II A/B 80°C 30V FT1 |
| CSA standard: | CSA FT1 |

## Application

HELUKABEL® HMCB500S is designed for occasional moving in cable carriers and ranges up to 100m without repeater. This cable is used in Siemens Systems.
Typical plugs are RJ45 Industrial IP20 Siemens or Y-Con RJ45 Yamaichi or round M-Connectors from Molex.

## Part no.

**803672,** HMCB500S

Dimensions and specifications may be changed without prior notice.
* Drive Cliq is registered trademark from Siemens AG.



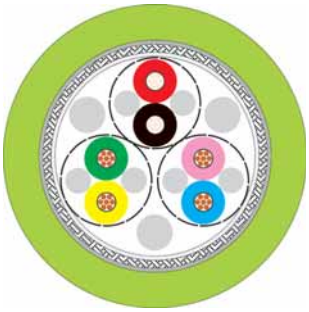
DNB Edition 11 (published 01.10.2015)

# BUS Cables

**HMCB800 Drag Chain**

HELUKABEL®

PUR




## Type
## Cable structure

## Drag Chain applications
## 2x2x0,20qmm + 1x2x0,38qmm

| | |
|---|---|
| Inner conductor diameter 1: | Copper, bare (AWG 25/19) |
| Inner conductor diameter 2: | Copper, tinned (AWG 22/19) |
| Core insulation 1: | PE |
| Core insulation 2: | PE |
| Core colours 1: | gn, ye, pk, bu |
| Core colours 2: | rd, bk |
| Stranding element 1: | Double core |
| Separator: | - |
| Shielding 1: | - |
| Total shielding: | AL-Foil + braid |
| Outer sheath material: | PUR |
| Cable external diameter: | app. 6,95 mm ± 0,15 mm |
| Outer sheath colour: | Green similar to RAL 6018 |

## Electrical data

| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm at 1 to 100 MHz |
| Conductor resistance, max.: | 100 Ohm/km |
| Insulation resistance, min.: | 1 GOhm x km |
| Loop resistance: | 270 Ohm/km max. |
| Mutual capacitance: | 50 nF/km nom. |
| Test voltage: | 0,5 kV |

## Typical values

| | | | | | |
|---|---|---|---|---|---|
| Frequency | (MHz) | 10 | 16 | 62,5 | 100 |
| Attenuation | (dB/100m) | 8,0 | 10,0 | 20,0 | 27,0 |
| Next | (dB) | 47,0 | 44,0 | 35,0 | 32,0 |
| ACR | (dB) | 39,0 | 34,0 | 15,0 | 5,0 |

## Technical data

| | |
|---|---|
| Weight: | app. 61 kg/km |
| bending radius, repeated: | 75 mm |
| Operating temperature range min.: | -20°C |
| Operating temperature range max.: | +60°C |
| Caloric load, approx. value: | 0,90 MJ/m |
| Copper weight: | 40,00 kg/km |

## Norms

| | |
|---|---|
| Applicable standards: | Halogen-free acc. to 60754-2<br>Flame-retardant acc. to IEC 60332-1-2 |
| UL Style: | AWM Style 20236 AWM I/II A/B 80°C 30V FT1 |
| CSA standard: | CSA FT1 |

## Application

HELUKABEL® HMCB800W is designed for the most demanding continous moving requirements in cable carriers and ranges up to 70 m without repeater. This cable is ideal solution in Siemens systems.
Typical plugs are RJ45 Industrial IP20 Siemens or Y-Con RJ45 Yamaichi or round M-Connectors from Molex.

## Part no.

**804767,** HMCB800

Dimensions and specifications may be changed without prior notice.

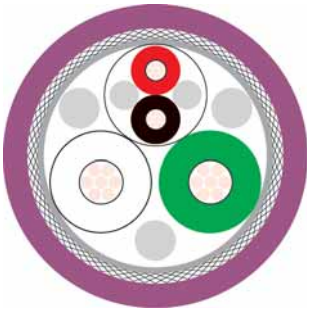
* Drive Cliq is registered trademark from Siemens AG.

# BUS Cables

**USB Bus S 2.0 Drag Chain**

HELUKABEL®

PUR




## Type
## Cable structure

## Drag Chain applications
## 1x2xAWG28 + 1x2xAWG20

| | |
|---|---|
| Inner conductor diameter 1: | Copper, tinned (AWG 28/19) |
| Inner conductor diameter 2: | Copper, tinned (AWG 20/64) |
| Core insulation 1: | PP |
| Core insulation 2: | PP |
| Core colours 1: | wh, gn |
| Core colours 2: | rd, bk |
| Stranding element 1: | 2 cores + 2 fillers stranded together |
| Separator: | Polyester foil over stranded bundle |
| Shielding 1: | - |
| Total shielding: | AL-Foil + braid |
| Outer sheath material: | PUR |
| Cable external diameter: | app. 5,0 mm ± 0,2 mm |
| Outer sheath colour: | Violet similar to RAL 4001 |

## Electrical data

| | |
|---|---|
| Characteristic impedance: | 90 Ohm ± 15 % |
| Conductor resistance, max.: | 230 Ohm/km |
| Insulation resistance, min.: | 0,1 GOhm x km |
| Loop resistance: | 460 Ohm/km max. |
| Mutual capacitance: | 60 nF/km nom. |
| Test voltage: | 0,5 kV |

## Typical values

| Frequency | (MHz) | 1 | 10 | 16 | 62,5 | 100 | 200 | 300 | 400 |
|---|---|---|---|---|---|---|---|---|---|
| Attenuation | (dB/100m) | 4,5 | 12,0 | 15,4 | 31,0 | 39,0 | 60,0 | 76,2 | 99,0 |

## Technical data

| | |
|---|---|
| Weight: | app. 45 kg/km |
| bending radius, repeated: | 50 mm |
| Operating temperature range min.: | -30°C |
| Operating temperature range max.: | +60°C |
| Caloric load, approx. value: | 0,55 MJ/m |
| Copper weight: | 30,00 kg/km |

## Norms

| | |
|---|---|
| Applicable standards: | USB-Standard 2.0<br>Halogen-free acc. to 60754-2<br>Flame-retardant CSA FT1 |
| UL Style: | AWM 20963 (80°C/30V) |
| CSA standard: | CSA FT1 |

## Application

HELUKABEL® USB BUS S is designed for continous moving in cable carriers and lengths up to max. 5m. Conventional USB cables fail within a short period of time, which is why HELUKABEL developed this special cable. Thanks to the PUR sheath, it also offers excellent resistance to common mineral oils, greases and cooling lubricants.

## Part no.

**802469,** USB S

Dimensions and specifications may be changed without prior notice.



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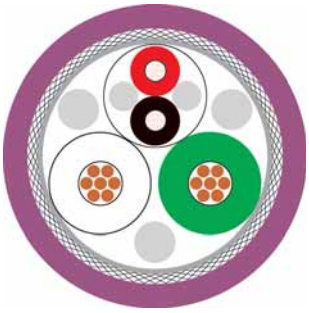
# BUS Cables

## USB Bus L 2.0 Drag Chain

HELUKABEL®

PUR




## Type
## Cable structure

## Drag Chain applications
## 1x2xAWG24 + 1x2xAWG20

| | |
|---|---|
| Inner conductor diameter 1: | Copper, tinned (AWG 24/19) |
| Inner conductor diameter 2: | Copper, tinned (AWG 20/19) |
| Core insulation 1: | PO |
| Core insulation 2: | PVC |
| Core colours 1: | wh, gn |
| Core colours 2: | rd, bk |
| Stranding element 1: | Double core |
| Separator: | - |
| Shielding 1: | - |
| Total shielding: | AL-Foil + braid |
| Drain wire: | yes |
| Outer sheath material: | PUR |
| Cable external diameter: | app. 6,3 mm ± 0,2 mm |
| Outer sheath colour: | Violet similar to RAL 4001 |

## Electrical data

| | |
|---|---|
| Characteristic impedance: | 90 Ohm ± 15 % |
| Conductor resistance, max.: | 36 Ohm/km |
| Insulation resistance, min.: | 0,2 GOhm x km |
| Loop resistance: | 71 Ohm/km max. |
| Mutual capacitance: | 50 nF/km nom. |
| Nominal voltage: | 300 V |
| Test voltage: | 2 kV |

## Typical values

| Frequency | (MHz) | 1 | 24 | 48 | 96 | 200 | 400 |
|---|---|---|---|---|---|---|---|
| Attenuation | (dB/100m) | 4,0 | 19,0 | 27,0 | 38,0 | 64,0 | 116,0 |

## Technical data

| | |
|---|---|
| Weight: | app. 56 kg/km |
| bending radius, repeated: | 95 mm |
| Operating temperature range min.: | -30°C |
| Operating temperature range max.: | +70°C |
| Caloric load, approx. value: | 0,57 MJ/m |
| Copper weight: | 40,00 kg/km |

## Norms

| | |
|---|---|
| Applicable standards: | USB-Standard 2.0<br>Flame-retardant acc. to IEC 60332-1-2 |
| UL Style: | AWM 21198 (80°C/ 300V) |

## Application

HELUKABEL® USB BUS L is designed for continous motion in cable carriers and lengths up to max. 10m without a repeater. Conventional USB cables fail within a short period of time and need a repeater after a cable length of 5m, which is why HELUKABEL developed this special cable with a larger cross-section. Thanks to the PUR sheath, it also offers excellent resistance to common mineral oils, greases and cooling lubricants.

## Part no.

**802470,** USB L

Dimensions and specifications may be changed without prior notice.

# BUS Cables

**USB Bus 3.0 Drag Chain**

HELUKABEL®

PUR


## Type
## Cable structure

## Drag Chain applications
## 2x2xAWG28 + 2x(1x2xAWG28)

| | |
|---|---|
| Inner conductor diameter 1: | Copper, tinned (AWG 28/19) |
| Inner conductor diameter 2: | Copper, tinned (AWG 28/19) |
| Core insulation 1: | Foam-skin-PE |
| Core insulation 2: | PE |
| Core colours 1: | bu/ye, or/vio |
| Core colours 2: | rd/bk, gn/gnwh |
| Stranding element 1: | Double core |
| Separator: | Polyester foil over stranded bundle |
| Shielding 1: | AL-Foil + braid |
| Total shielding: | Cu braid, tinned |
| Outer sheath material: | PUR |
| Cable external diameter: | app. 6,5 mm ± 0,3 mm |
| Outer sheath colour: | Violet similar to RAL 4001 |

## Electrical data

| | |
|---|---|
| Characteristic impedance: | 90 Ohm ± 20 %<br>105 Ohm ± 15% at 1 MHz |
| Conductor resistance, max.: | 205 Ohm/km |
| Insulation resistance, min.: | 2 GOhm x km |
| Loop resistance: | 410 Ohm/km max. |
| Mutual capacitance: | 60 nF/km nom. |
| Test voltage: | 0,7 kV |
| Relative propagation velocity: | 75 % |

## Typical values

| | | | | |
|---|---|---|---|---|
| Frequency | (MHz) | 1 | 625 | 1200 |
| Attenuation UTP pair | (dB/100m) | 4,0 | - | - |
| Attenuation S/FTP pair | (dB/100m) | 4,0 | 115,0 | 180,0 |

## Technical data

| | |
|---|---|
| Weight: | app. 62 kg/km |
| bending radius, repeated: | 55 mm |
| Operating temperature range min.: | -30°C |
| Operating temperature range max.: | +70°C |
| Caloric load, approx. value: | 0,69 MJ/m |
| Copper weight: | 42,00 kg/km |

## Norms

| | |
|---|---|
| Applicable standards: | USB-Standard 3.0<br>Halogen-free acc. to 60754-2<br>Flame-retardant acc. to IEC 60332-1-2 |
| UL Style: | AWM Style 20236 AWM I/II A/B 80°C 30V FT1 |
| CSA standard: | CSA FT1 |

## Application

HELUKABEL® USB S 3.0, designed specifically for use in heavy-duty industries, are the ideal solution for highly-flexible applications such as Drag Chains and camera technology. They guarantee superior transmission properties. The transmission distance is connected with the transmission rate.

## Part no.

**805287,** USB S

Dimensions and specifications may be changed without prior notice.



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# BUS Cables

**FIREWIRE Drag Chain**

HELUKABEL®

PUR

NEW


## Type
## Cable structure

## Drag Chain applications
## 2x2xAWG26/19 + 2xAWG22/19

| | |
|---|---|
| Inner conductor diameter 1: | Copper, tinned (AWG 22/19) |
| Inner conductor diameter 2: | Copper, tinned (AWG 26/19) |
| Core insulation 1: | PP |
| Core insulation 2: | Foam-skin-PE |
| Total shielding: | Cu braid, tinned |
| Outer sheath material: | PUR |
| Cable external diameter: | app. 8,2 mm |
| Outer sheath colour: | Violet similar to RAL 4001 |

## Electrical data

| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 % |
| Conductor resistance, max.: | 59,4 Ohm/km |
| Insulation resistance, min.: | 2 GOhm x km |
| Loop resistance: | 120 Ohm/km max. |
| Mutual capacitance: | 45 nF/km nom. |
| Nominal voltage: | 30 V |
| Test voltage: | 0,7 kV |

## Typical values

| Frequency | (MHz) | 250 | 400 | 500 | 800 | 1000 |
|---|---|---|---|---|---|---|
| attenuation | (dB/5m) | 2,5 | 3,0 | 3,6 | 4,7 | 5,6 |

## Technical data

| | |
|---|---|
| Weight: | app. 88 kg/km |
| bending radius, repeated: | 98 mm |
| Operating temperature range min.: | -30°C |
| Operating temperature range max.: | +70°C |
| Caloric load, approx. value: | 0,986 MJ/m |
| Copper weight: | 58,00 kg/km |

## Norms

| | |
|---|---|
| Applicable standards: | Halogen-free acc. to 60754-2<br>Flame-retardant CSA FT1 |
| UL Style: | AWM Style 20236 AWM I/II A/B 80°C 30V FT1 |

## Application

HELUKABEL® FireWire™ Trailing will be used for permanent moving processes.

## Part no.

**805057,** FireWire™

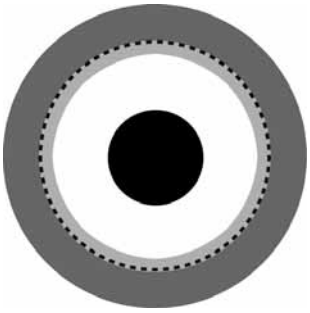
Dimensions and specifications may be changed without prior notice.

# BUS Cables

**Coax 50 Ohm, Drag Chain**

HELUKABEL®

PUR




## Cable structure

**19x0,18/ 2,95mm 50 Ohm**

| | |
|---|---|
| Inner conductor material: | copper, bare |
| Inner conductor diameter: | 0,9 mm |
| Outer conductor material: | copper, tinned |
| Outer conductor form: | Braiding |
| Dielectric: | PP |
| Total shielding: | Cu braid, tinned |
| Sheath material: | PUR (Polyurethan) |
| External diameter: | app. 5,4 mm ± 0,2 mm |
| Sheath colour: | black |

## Electrical data

| | |
|---|---|
| Characteristic impedance: | 50 Ohm ± 2 Ohm |
| Conductor resistance, max.: | 38 Ohm/km |
| Insulation resistance, min.: | 1 GOhm x km |
| Test voltage: | 2 kV |
| Relative propagation velocity: | 67 % |

## Typical values

| Frequency | (MHz) | 50 | 100 | 200 | 300 | 500 | 800 | 900 | 1000 | 1800 | 2000 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Attenuation | (dB/100m) | 11,5 | 16,5 | 24,0 | 30,0 | 40,0 | 52,0 | 59,0 | 65,0 | 105,0 | 112,0 |

## Technical data

| | |
|---|---|
| Weight: | app. 45 kg/km |
| bending radius, repeated: | 54 mm |
| Operating temperature range max.: | +50°C |
| Laying temperature range min.: | -20°C |
| Laying temperature range max.: | +50°C |
| Copper weight: | 23,00 kg/km |

## Norms

Applicable standards: Halogen-free acc. to 60754-2

## Application

This Coax cable, designed specifically for use in heavy-duty industries, is the ideal solution for highly-flexible applications such as Drag Chains.

## Part no.

**804299,** Coax Drag Chain

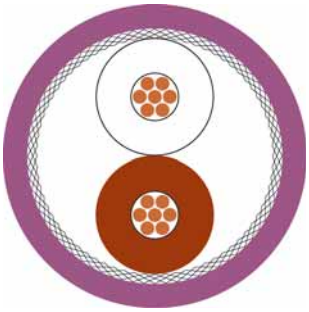
Dimensions and specifications may be changed without prior notice.

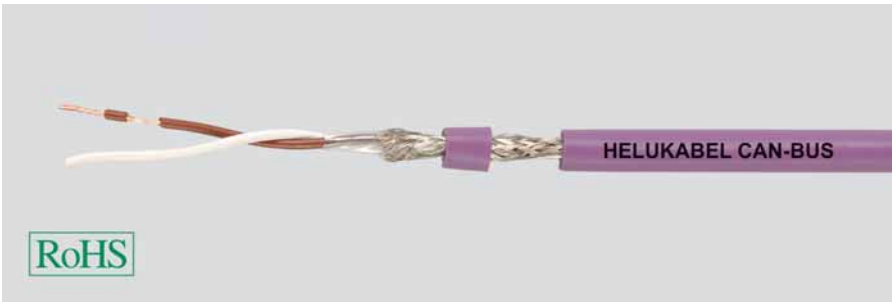
# BUS Cables

**CAN Bus fixed installed**

HELUKABEL®

PVC






| Type | Fixed installation, indoor | Fixed installation, indoor |
|---|---|---|
| **Cable structure** | **1x2x0.22 mm² (stranded)** | **4x1x0.22 mm² (stranded)** |
| Inner conductor diameter: | Copper, bare (AWG 24/7) | Copper, bare (AWG 24/7) |
| Core insulation: | Cell PE | Cell PE |
| Core colours: | wh/bn | wh, bn, gn, ye |
| Stranding element: | Double core | Star quad |
| Separator: | Polyester foil over stranded bundle | Polyester foil over stranded bundle |
| Shielding 1: | - | - |
| Total shielding: | Cu braid, tinned | Cu braid, tinned |
| Outer sheath material: | PVC | PVC |
| Cable external diameter: | app. 5,4 mm ± 0,2 mm | app. 6,9 mm ± 0,2 mm |
| Outer sheath colour: | Violet similar to RAL 4001 | Violet similar to RAL 4001 |
| **Electrical data** | | |
| Characteristic impedance: | 120 Ohm ± 10 % | 120 Ohm ± 10 % |
| Conductor resistance, max.: | 88 Ohm/km | 88 Ohm/km |
| Insulation resistance, min.: | 1 GOhm x km | 1 GOhm x km |
| Loop resistance: | 175 Ohm/km max. | 175 Ohm/km max. |
| Mutual capacitance: | 58 nF/km nom. | 58 nF/km nom. |
| Nominal voltage: | 30 V | 30 V |
| Test voltage: | 1,5 kV | 1,5 kV |
| **Technical data** | | |
| Weight: | app. 41 kg/km | app. 60 kg/km |
| bending radius, repeated: | 81 mm | 107 mm |
| Operating temperature range min.: | -40°C | -40°C |
| Operating temperature range max.: | +70°C | +70°C |
| Caloric load, approx. value: | 0,574 MJ/m | 1,234 MJ/m |
| Copper weight: | 17,00 kg/km | 21,00 kg/km |
| **Norms** | | |
| Applicable standards: | CAN Bus acc. to ISO 11898-2<br>Flame-retardant acc. to EN 50265-2-1 | CAN Bus acc. to ISO 11898-2<br>Flame-retardant acc. to EN 50265-2-1 |
| UL Style: | UL Style 2571 | UL Style 2571 |

## Application

HELUKABEL® CAN Bus for fixed installation and occasional motion, for normal requirements. The 2-pair version is designed with star-quad twisting, i.e. diagonal conductors form an electrial pair and meets the requirements of the CAN Standard. For cable lengths up to max. 40m (observe CAN specifications).

| Part no. | | |
|---|---|---|
| | **81286,** CAN BUS | **81287,** CAN BUS |

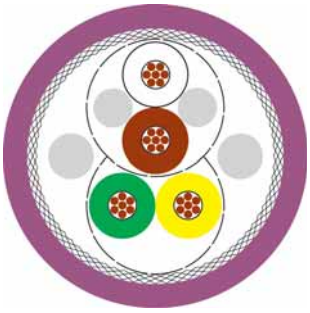
Dimensions and specifications may be changed without prior notice.

# BUS Cables

**CAN Bus fixed installed**

HELUKABEL®

PVC




## Type
## Cable structure

**Fixed installation, indoor**
**2x2x0.22 mm² (stranded)**

| | |
|---|---|
| Inner conductor diameter: | Copper, bare (AWG 24/7) |
| Core insulation: | Cell PE |
| Core colours: | wh/bn, gn/ye |
| Stranding element: | 2 cores + 2 fillers stranded together |
| Separator: | Polyester foil over stranded bundle |
| Shielding 1: | - |
| Total shielding: | Cu braid, tinned |
| Outer sheath material: | PVC |
| Cable external diameter: | app. 7,5 mm ± 0,3 mm |
| Outer sheath colour: | Violet similar to RAL 4001 |

## Electrical data

| | |
|---|---|
| Characteristic impedance: | 120 Ohm ± 10 % |
| Conductor resistance, max.: | 87,6 Ohm/km |
| Insulation resistance, min.: | 5 GOhm x km |
| Loop resistance: | 175 Ohm/km max. |
| Mutual capacitance: | 40 nF/km nom. |
| Nominal voltage: | 30 V |
| Test voltage: | 1,5 kV |

## Technical data

| | |
|---|---|
| Weight: | app. 60 kg/km |
| bending radius, repeated: | 113 mm |
| Operating temperature range min.: | -25°C |
| Operating temperature range max.: | +70°C |
| Caloric load, approx. value: | 1,13 MJ/m |
| Copper weight: | 32,00 kg/km |

## Norms

| | |
|---|---|
| Applicable standards: | CAN Bus acc. to ISO 11898-2<br>Flame-retardant acc. to IEC 60332-1-2 |
| UL Style: | UL Style 2571 |
| CSA standard: | CSA FT1 |

## Application

HELUKABEL® CAN BUS for fixed installation and occasion motion, for normal requirements. The two signal pairs are provided in the form twisted pais. As a result, the diameter is somewhat larger than that of 81287. In the event of diameter problems, please have a look at this type. For cable lengths up to max. 40m ( observe CAN specifications).

## Part no.

**82509,** CAN BUS

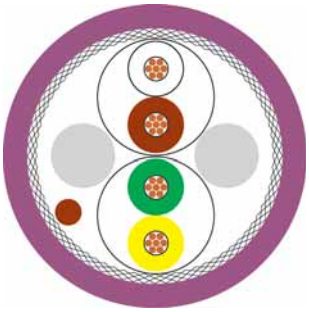
Dimensions and specifications may be changed without prior notice.

# BUS Cables

**CAN Bus fixed installed 105°C**

HELUKABEL®

PVC




## Type
## Cable structure

## Industrial Area
## 2x2xAWG 24/19 mm² (stranded)

| | |
|---|---|
| Inner conductor diameter: | Copper, bare (AWG 24/19) |
| Core insulation: | XLPE ray cross-linking |
| Core colours: | wh/bn, gn/ye |
| Stranding element: | Double core |
| Separator: | Polyester foil over stranded bundle |
| Shielding 1: | - |
| Total shielding: | Cu braid, tinned |
| Outer sheath material: | PUR |
| Cable external diameter: | app. 8,4 mm ± 0,3 mm |
| Outer sheath colour: | Violet similar to RAL 4001 |

## Electrical data

| | |
|---|---|
| Characteristic impedance: | 120 Ohm ± 10 % |
| Conductor resistance, max.: | 87,2 Ohm/km |
| Insulation resistance, min.: | 1 GOhm x km |
| Loop resistance: | 174 Ohm/km max. |
| Mutual capacitance: | 42 nF/km nom. |
| Nominal voltage: | 600 V |
| Test voltage: | 2,5 kV |

## Technical data

| | |
|---|---|
| Weight: | app. 80 kg/km |
| bending radius, repeated: | 126 mm |
| Operating temperature range min.: | -40°C |
| Operating temperature range max.: | +105°C * |
| Caloric load, approx. value: | 1,31 MJ/m |
| Copper weight: | 40,00 kg/km |

## Norms

| | |
|---|---|
| Applicable standards: | CAN Bus acc. to ISO 11898-2<br>Halogen-free acc. to 60754-2<br>Flame-retardant acc. to IEC 60332-1-2 |
| UL Style: | UL/CSA 21223 80°C, 600V |

## Application

HELUKABEL® CAN Bus for fixed installation up to 105°C in difficult industrial environments with demanding temperature requirements thanks to cross-linking of the conductor insulation. Thanks to use a PUR sheath, this version is also halogen-free. For cable lengths up to max. 40m (observe CAN specifications).

## Part no.

**801982,** CAN BUS

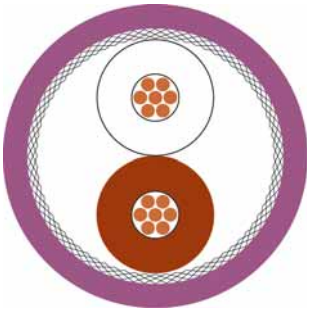
Dimensions and specifications may be changed without prior notice.

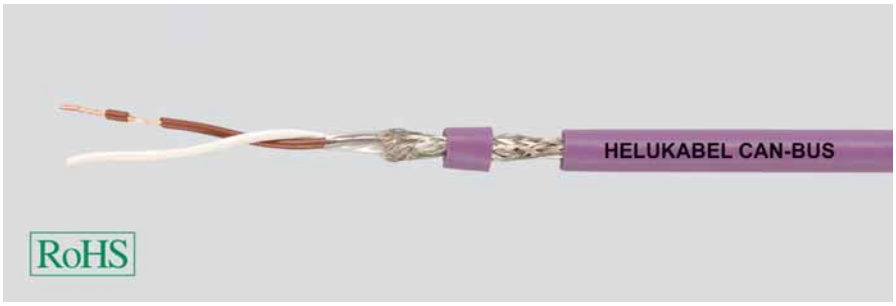
# BUS Cables

**CAN Bus fixed installed**

HELUKABEL®

PVC






| Type | Fixed installation, indoor | Fixed installation, indoor |
|---|---|---|
| **Cable structure** | **1x2x0.34 mm² (stranded)** | **4x1x0.34 mm² (stranded)** |
| Inner conductor diameter: | Copper, bare (AWG 22/7) | Copper, bare (AWG 22/7) |
| Core insulation: | Cell PE | Cell PE |
| Core colours: | wh/bn | wh/bn, gn/ye |
| Stranding element: | Double core | Star quad |
| Separator: | Polyester foil over stranded bundle | Polyester foil over stranded bundle |
| Shielding 1: | - | - |
| Total shielding: | Cu braid, tinned | Cu braid, tinned |
| Outer sheath material: | PVC | PVC |
| Cable external diameter: | app. 6,5 mm ± 0,2 mm | app. 8,0 mm ± 0,2 mm |
| Outer sheath colour: | Violet similar to RAL 4001 | Violet similar to RAL 4001 |
| **Electrical data** | | |
| Characteristic impedance: | 120 Ohm ± 10 % | 120 Ohm ± 10 % |
| Conductor resistance, max.: | 57 Ohm/km | 57 Ohm/km |
| Insulation resistance, min.: | 5 GOhm x km | 5 GOhm x km |
| Loop resistance: | 114 Ohm/km max. | 114 Ohm/km max. |
| Mutual capacitance: | 58 nF/km nom. | 40 nF/km nom. |
| Nominal voltage: | 30 V | 30 V |
| Test voltage: | 2 kV | 2 kV |
| **Technical data** | | |
| Weight: | app. 65 kg/km | app. 77 kg/km |
| bending radius, repeated: | 98 mm | 120 mm |
| Operating temperature range min.: | -30°C | -30°C |
| Operating temperature range max.: | +70°C | +70°C |
| Caloric load, approx. value: | 1,109 MJ/m | 1,179 MJ/m |
| Copper weight: | 23,00 kg/km | 30,00 kg/km |
| **Norms** | | |
| Applicable standards: | CAN Bus acc. to ISO 11898-2<br>Flame-retardant acc. to EN 50265-2-1 | CAN Bus acc. to ISO 11898-2<br>Flame-retardant acc. to EN 50265-2-1 |
| UL Style: | UL Style 2571 | UL Style 2571 |

## Application

HELUKABEL® CAN Bus for fixed installation and occasional motion, for normal requirements. The 2-pair version is designed with a star-quad twisting, i.e. diagonal conductors form an electrical pair and meets the requirements of the CAN standard. For cable lenghts up to max. 40m (observe CAN specifications).

| Part no. | **801572,** CAN BUS | **801573,** CAN BUS |
|---|---|---|

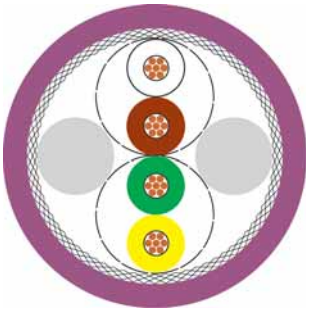
Dimensions and specifications may be changed without prior notice.

# BUS Cables

**CAN Bus fixed installed**

HELUKABEL®

PVC




## Type
## Cable structure

**Fixed installation, indoor**
**2x2x0.34 mm² (stranded)**

| | |
|---|---|
| Inner conductor Ø: | Copper, bare (AWG 22/7) |
| Core insulation: | Foam-skin-PE |
| Core colours: | wh/bn, gn/ye |
| Stranding element: | Double core |
| Separator: | Polyester foil over stranded bundle |
| Shielding 1: | - |
| Total shielding: | Cu braid, tinned |
| Outer sheath material: | PVC |
| Cable external diameter: | app. 8,5 mm ± 0,3 mm |
| Outer sheath colour: | Violet similar to RAL 4001 |

## Electrical data

| | |
|---|---|
| Characteristic impedance: | 120 Ohm ± 10 % |
| Conductor resistance, max.: | 55,4 Ohm/km |
| Insulation resistance, min.: | 5 GOhm x km |
| Loop resistance: | 110 Ohm/km max. |
| Mutual capacitance: | 40 nF/km nom. |
| Nominal voltage: | 250 V |
| Test voltage: | 1,5 kV |

## Technical data

| | |
|---|---|
| Weight: | app. 85 kg/km |
| bending radius, repeated: | 130 mm |
| Operating temperature range min.: | -40°C |
| Operating temperature range max.: | +70°C |
| Caloric load, approx. value: | 1,32 MJ/m |
| Copper weight: | 46,00 kg/km |

## Norms

| | |
|---|---|
| Applicable standards: | CAN Bus acc. to ISO 11898-2<br>Flame-retardant acc. to IEC 60332-1-2 |
| UL Style: | CMX 75°C (shielded) |
| CSA standard: | CSA FT1 |

## Application

HELUKABEL® CAN Bus fixed installations and occasionally motion, for normal requirements. The two signal pairs are provided in the form twisted pairs. As a result, the diameter is somewhat larger than that of 801573. In the event of diameter problems, please have a look at this type. For cable lengths up to max. 40m (observe CAN specifications).

## Part no.

**803344,** CAN BUS

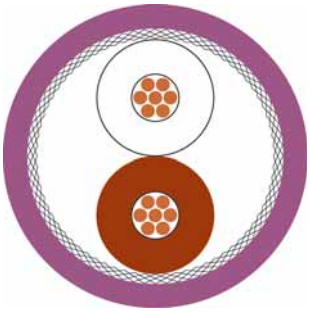
Dimensions and specifications may be changed without prior notice.

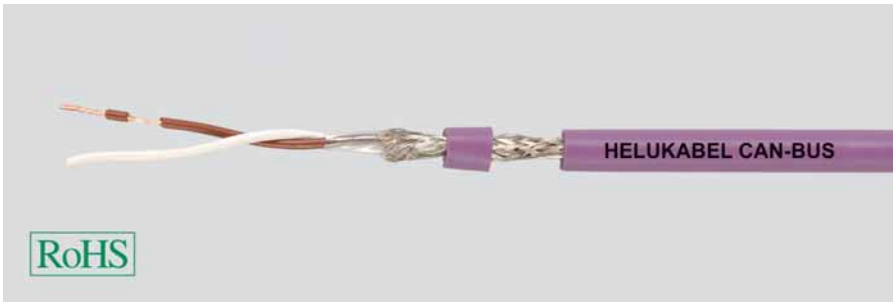
# BUS Cables

**CAN Bus fixed installed**

HELUKABEL®

PVC






| Type<br>Cable structure | Fixed installation, indoor<br>1x2x0.50 mm² (stranded) | Fixed installation, indoor<br>4x1x0.50 mm² (stranded) |
|---|---|---|
| Inner conductor diameter: | Copper, bare (AWG 20/7) | Copper, bare (AWG 20/7) |
| Core insulation: | Foam-skin-PE | Foam-skin-PE |
| Core colours: | wh/bn | wh, bn, gn, ye |
| Stranding element: | Double core | Star quad |
| Separator: | Polyester foil over stranded bundle | Polyester foil over stranded bundle |
| Shielding 1: | - | - |
| Total shielding: | Cu braid, tinned | Cu braid, tinned |
| Outer sheath material: | PVC | PVC |
| Cable external diameter: | app. 7,0 mm ± 0,2 mm | app. 8,5 mm ± 0,2 mm |
| Outer sheath colour: | Violet similar to RAL 4001 | Violet similar to RAL 4001 |
| **Electrical data** | | |
| Characteristic impedance: | 120 Ohm ± 10 % | 120 Ohm ± 10 % |
| Conductor resistance, max.: | 36,4 Ohm/km | 37 Ohm/km |
| Insulation resistance, min.: | 1 GOhm x km | 1 GOhm x km |
| Loop resistance: | 72 Ohm/km max. | 74 Ohm/km max. |
| Mutual capacitance: | 40 nF/km nom. | 44 nF/km nom. |
| Test voltage: | 1,5 kV | 1,5 kV |
| **Technical data** | | |
| Weight: | app. 69 kg/km | app. 100 kg/km |
| bending radius, repeated: | 100 mm | 130 mm |
| Operating temperature range min.: | -40°C | -40°C |
| Operating temperature range max.: | +70°C | +70°C |
| Caloric load, approx. value: | 1,09 MJ/m | 1,64 MJ/m |
| Copper weight: | 30,00 kg/km | 45,00 kg/km |
| **Norms** | | |
| Applicable standards: | CAN Bus acc. to ISO 11898-2<br>Flame-retardant acc. to EN 50265-2-1 | CAN Bus acc. to ISO 11898-2<br>Flame-retardant acc. to EN 50265-2-1 |
| UL Style: | UL Style 2571 | UL Style 2571 |

## Application

HELUKABEL® CAN Bus for fixed installation and occasion motion, for normal requirements. The 2-pair version is designed with star-quad twisting, i.e. diagonal conductors form an electrical pair and meets the requirements of the CAN standard. For cable lengths up to 600m (observe CAN specifications).

## Part no.

**800571,** CAN BUS

**800685,** CAN BUS

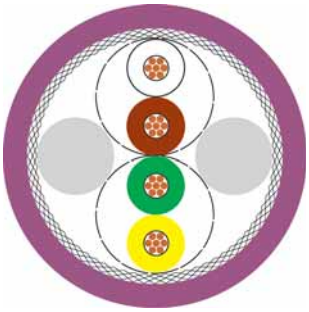
Dimensions and specifications may be changed without prior notice.

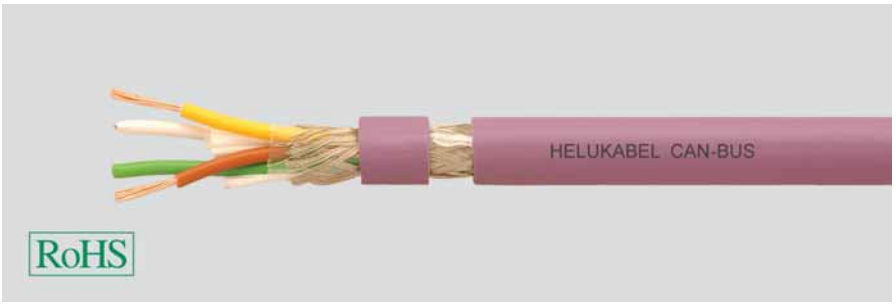
# BUS Cables

**CAN Bus fixed installed**

HELUKABEL®

PVC






## Type
## Cable structure

**Fixed installation, indoor**
**2x2x0.50 mm² (stranded)**

| | |
|---|---|
| Inner conductor diameter: | Copper, bare (AWG 20/7) |
| Core insulation: | Foam-skin-PE |
| Core colours: | wh/bn, gn/ye |
| Stranding element: | Double core |
| Separator: | Polyester foil over stranded bundle |
| Shielding 1: | - |
| Total shielding: | Cu braid, tinned |
| Outer sheath material: | PVC |
| Cable external diameter: | app. 9,6 mm ± 0,3 mm |
| Outer sheath colour: | Violet similar to RAL 4001 |

## Electrical data

| | |
|---|---|
| Characteristic impedance: | 120 Ohm ± 10 % |
| Conductor resistance, max.: | 34,4 Ohm/km |
| Insulation resistance, min.: | 5 GOhm x km |
| Loop resistance: | 68 Ohm/km max. |
| Mutual capacitance: | 40 nF/km nom. |
| Nominal voltage: | 250 V |
| Test voltage: | 1,5 kV |

## Technical data

| | |
|---|---|
| Weight: | app. 116 kg/km |
| bending radius, repeated: | 150 mm |
| Operating temperature range min.: | -40°C |
| Operating temperature range max.: | +70°C |
| Caloric load, approx. value: | 1,62 MJ/m |
| Copper weight: | 60,00 kg/km |

## Norms

| | |
|---|---|
| Applicable standards: | CAN Bus acc. to ISO 11898-2<br>Flame-retardant acc. to IEC 60332-1-2 |
| UL Style: | CMX 75°C (shielded) |
| CSA standard: | CSA FT1 |

## Application

HELUKABEL® CAN Bus for fixed installation and occasion motion, for normal requirements. The two signal pairs are provided in the form twisted pairs. As a result, the diameter is somewhat larger than that of 800685. In the event of diameter problems, please have a look at this type. For cable lengths up to 600m (observe CAN specifications).

## Part no.

**803722,** CAN BUS

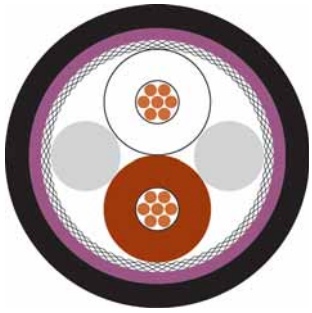
Dimensions and specifications may be changed without prior notice.

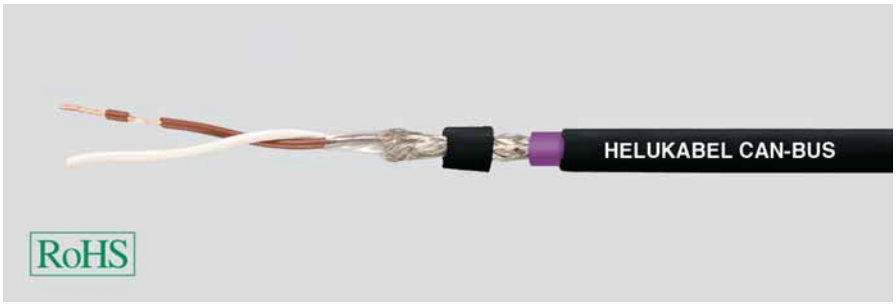
# BUS Cables

**CAN Bus direct Burial**

HELUKABEL®

PE






| Type<br>Cable structure | Direct burial<br>1x2x0.50 mm² (stranded) | Direct burial<br>4x1x0.50 mm² (stranded) |
|---|---|---|
| Inner conductor diameter: | Copper, bare (AWG 20/7) | Copper, bare (AWG 20/7) |
| Core insulation: | Foam-skin-PE | Foam-skin-PE |
| Core colours: | wh/bn | wh, bn, gn, ye |
| Stranding element: | 2 cores + 2 fillers stranded together | Star quad |
| Separator: | Polyester foil over stranded bundle | Polyester foil over stranded bundle |
| Inner sheath material: | PVC | PVC |
| Shielding 1: | - | - |
| Total shielding: | Cu braid, tinned | Cu braid, tinned |
| Armouring: | PET/PA tape | PET/PA tape |
| Outer sheath material: | PE | PE |
| Cable external diameter: | app. 9,2 mm ± 0,4 mm | app. 9,7 mm ± 0,4 mm |
| Outer sheath colour: | Black similar to RAL 9005 | Black similar to RAL 9005 |
| **Electrical data** | | |
| Characteristic impedance: | 120 Ohm ± 10 % | 120 Ohm ± 10 % |
| Conductor resistance, max.: | 37 Ohm/km | 36,4 Ohm/km |
| Insulation resistance, min.: | 1 GOhm x km | 1 GOhm x km |
| Loop resistance: | 74 Ohm/km max. | 72 Ohm/km max. |
| Mutual capacitance: | 40 nF/km nom. | 44 nF/km nom. |
| Test voltage: | 1,5 kV | 1,5 kV |
| **Technical data** | | |
| Weight: | app. 105 kg/km | app. 115 kg/km |
| bending radius, repeated: | 150 mm | 160 mm |
| Operating temperature range min.: | -40°C | -40°C |
| Operating temperature range max.: | +70°C | +70°C |
| Caloric load, approx. value: | 2,05 MJ/m | 2,18 MJ/m |
| Copper weight: | 33,00 kg/km | 45,00 kg/km |
| **Norms** | | |
| Applicable standards: | CAN Bus acc. to ISO 11898-2 | CAN Bus acc. to ISO 11898-2 |

## Application

HELUKABEL® CAN Bus Direct Burial is suitable for fixed outdoor installation or direct burial applications. The 2-pair version is designed with star-quad twisting, i.e. diagonal conductors form an electrical pair and meets the requirements of the CAN standard. For cable lengths up to 600m (observe CAN specifications).

| Part no. | | |
|---|---|---|
| | **804268,** CAN BUS | **804269,** CAN BUS |

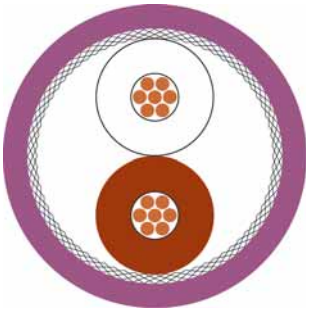
Dimensions and specifications may be changed without prior notice.

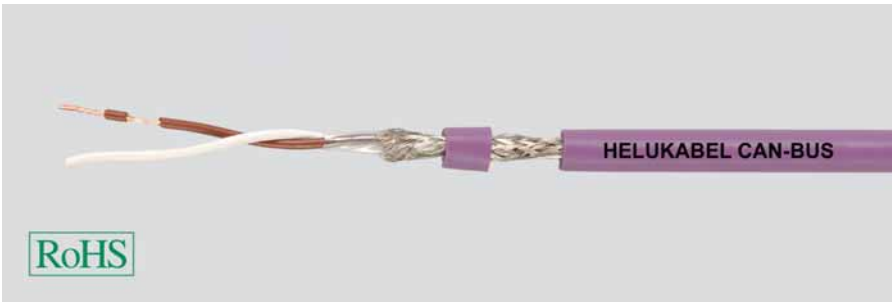
# BUS Cables

**CAN Bus fixed installed**

HELUKABEL®

PVC






| Type | Fixed installation, indoor | Fixed installation, indoor |
|---|---|---|
| **Cable structure** | **1x2x0.75 mm² (stranded)** | **4x1x0.75 mm² (stranded)** |
| Inner conductor diameter: | Copper, bare (AWG 18/24) | Copper, bare (AWG 18/24) |
| Core insulation: | Foam-skin-PE | Foam-skin-PE |
| Core colours: | wh/bn | wh, bn, gn, ye |
| Stranding element: | Double core | Star quad |
| Separator: | Polyester foil over stranded bundle | Polyester foil over stranded bundle |
| Shielding 1: | - | - |
| Total shielding: | Cu braid, tinned | Cu braid, tinned |
| Outer sheath material: | PVC | PVC |
| Cable external diameter: | app. 8,3 mm ± 0,3 mm | app. 8,8 mm ± 0,3 mm |
| Outer sheath colour: | Violet similar to RAL 4001 | Violet similar to RAL 4001 |
| **Electrical data** | | |
| Characteristic impedance: | 120 Ohm ± 15 % | 120 Ohm ± 15 % |
| Conductor resistance, max.: | 27,5 Ohm/km | 27,5 Ohm/km |
| Insulation resistance, min.: | 1 GOhm x km | 1 GOhm x km |
| Loop resistance: | 55 Ohm/km max. | 55 Ohm/km max. |
| Mutual capacitance: | 42 nF/km nom. | 42 nF/km nom. |
| Nominal voltage: | 300 V | 300 V |
| Test voltage: | 1,5 kV | 1,5 kV |
| **Technical data** | | |
| Weight: | app. 101 kg/km | app. 112 kg/km |
| bending radius, repeated: | 110 mm | 110 mm |
| Operating temperature range min.: | -40°C | -40°C |
| Operating temperature range max.: | +70°C | +70°C |
| Caloric load, approx. value: | 1,67 MJ/m | 1,76 MJ/m |
| Copper weight: | 40,00 kg/km | 58,00 kg/km |
| **Norms** | | |
| Applicable standards: | CAN Bus acc. to ISO 11898-2<br>Flame-retardant acc. to IEC 60332-1-2 | CAN Bus acc. to ISO 11898-2<br>Flame-retardant acc. to IEC 60332-1-2 |
| UL Style: | UL Style 2571 | UL Style 2571 |
| CSA standard: | CSA FT1 | CSA FT1 |

## Application

HELUKABEL® CAN Bus for fixed installation and occasion motion, for normal requirements. The 2-pair version is designed with star-quad twisting, i.e. diagonal conductors form an electrical pair and satisfy the requirements of the CAN standard. For cable lengths over 600m (observe CAN specifications).

| Part no. | | |
|---|---|---|
| | **803383,** CAN BUS | **803384,** CAN BUS |

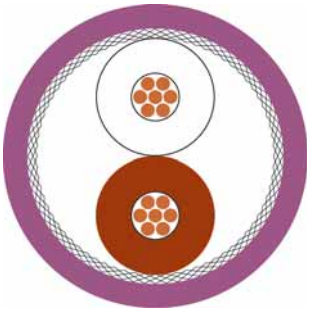
Dimensions and specifications may be changed without prior notice.

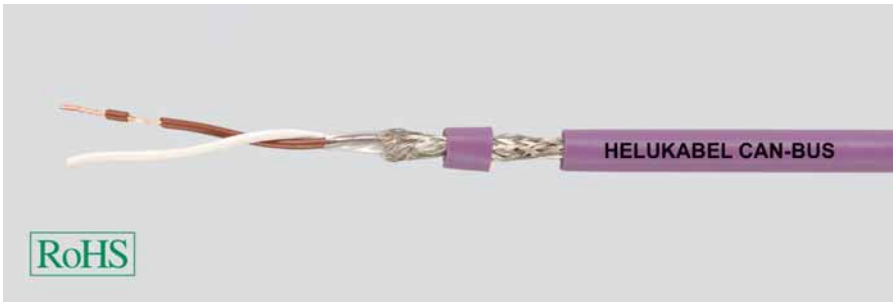
# BUS Cables

## CAN Bus Drag Chain

HELUKABEL®

PUR






| Type<br>Cable structure | Drag Chain applications<br>1x2x0.25 mm² (stranded) | Drag Chain applications<br>4x1x0.25 mm² (stranded) |
|---|---|---|
| Inner conductor diameter: | Copper, bare (AWG 24/19) | Copper, bare (AWG 24/19) |
| Core insulation: | PE | PE |
| Core colours: | wh/bn | wh, bn, gn, ye |
| Stranding element: | Double core | Star quad |
| Separator: | Polyester foil over stranded bundle | Polyester foil over stranded bundle |
| Shielding 1: | - | - |
| Total shielding: | Cu braid, tinned | Cu braid, tinned |
| Outer sheath material: | PUR | PUR |
| Cable external diameter: | app. 6,1 mm ± 0,3 mm | app. 6,5 mm ± 0,3 mm |
| Outer sheath colour: | Violet similar to RAL 4001 | Violet similar to RAL 4001 |

## Electrical data

| | | |
|---|---|---|
| Characteristic impedance: | 120 Ohm ± 10 % | 120 Ohm ± 10 % |
| Conductor resistance, max.: | 87,6 Ohm/km | 85 Ohm/km |
| Insulation resistance, min.: | 1 GOhm x km | 1 GOhm x km |
| Loop resistance: | 175 Ohm/km max. | 170 Ohm/km max. |
| Mutual capacitance: | 50 nF/km nom. | 50 nF/km nom. |
| Test voltage: | 1,5 kV | 1,5 kV |

## Technical data

| | | |
|---|---|---|
| Weight: | app. 40 kg/km | app. 45 kg/km |
| bending radius, repeated: | 90 mm | 95 mm |
| Operating temperature range min.: | -40°C | -30°C |
| Operating temperature range max.: | +70°C | +70°C |
| Caloric load, approx. value: | 0,798 MJ/m | 0,943 MJ/m |
| Copper weight: | 18,00 kg/km | 25,00 kg/km |

## Norms

| | | |
|---|---|---|
| Applicable standards: | CAN Bus acc. to ISO 11898-2<br>Halogen-free acc. to 60754-2 | CAN Bus acc. to ISO 11898-2<br>Halogen-free acc. to 60754-2 |

## Application

HELUKABEL® CAN Bus is designed for guided continous motion in cable carriers. The 2-pair version is designed with a star-quad twisting, i.e. diagonal conductors form an electrical pair and satisfy the requirements of the CAN standard. For cable lengths up to max. 40m (observe CAN specifications).

| Part no. | | |
|---|---|---|
| | **81911,** CAN BUS, highly flexible | **81912,** CAN BUS, highly flexible |

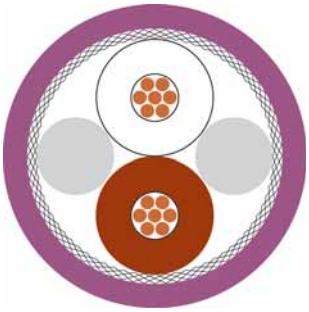
Dimensions and specifications may be changed without prior notice.

# BUS Cables

**CAN Bus Drag Chain, UL**

HELUKABEL®

PUR




| Type<br>Cable structure | Drag Chain applications<br>1x2x0.34 mm² (stranded) | Drag Chain applications<br>4x1x0.34 mm² (stranded) |
|---|---|---|
| Inner conductor diameter: | Copper, bare (AWG 22) | Copper, bare (AWG 22/43) |
| Core insulation: | Foam-skin-PE | Foam-skin-PE |
| Core colours: | wh/bn | wh/bn, gn/ye |
| Stranding element: | 2 cores + 2 fillers stranded together | Star quad |
| Separator: | - | - |
| Shielding 1: | - | - |
| Total shielding: | Cu braid, tinned | Cu braid, tinned |
| Outer sheath material: | PUR | PUR |
| Cable external diameter: | app. 6,9 mm ± 0,3 mm | app. 7,5 mm ± 0,3 mm |
| Outer sheath colour: | Violet similar to RAL 4001 | Violet similar to RAL 4001 |
| **Electrical data** | | |
| Characteristic impedance: | 120 Ohm ± 15 % | 120 Ohm ± 15 % |
| Conductor resistance, max.: | 56 Ohm/km | 56 Ohm/km |
| Insulation resistance, min.: | 5 GOhm x km | 5 GOhm x km |
| Loop resistance: | 170 Ohm/km max. | 170 Ohm/km max. |
| Mutual capacitance: | 40 nF/km nom. | 40 nF/km nom. |
| Nominal voltage: | 250 V | 250 V |
| Test voltage: | 1,5 kV | 1,5 kV |
| **Technical data** | | |
| Weight: | app. 54 kg/km | app. 64 kg/km |
| bending radius, repeated: | 105 mm | 130 mm |
| Operating temperature range min.: | -30°C | -30°C |
| Operating temperature range max.: | +70°C | +70°C |
| Caloric load, approx. value: | 1,20 MJ/m | 1,20 MJ/m |
| Copper weight: | 30,00 kg/km | 42,00 kg/km |
| **Norms** | | |
| Applicable standards: | CAN Bus acc. to ISO 11898-2<br>Halogen-free acc. to 60754-2<br>Flame-retardant acc. to IEC 60332-1-2 | CAN Bus acc. to ISO 11898-2<br>Halogen-free acc. to 60754-2<br>Flame-retardant acc. to IEC 60332-1-2 |
| UL Style: | CMX 444 | CMX 444 |

## Application

HELUKABEL® CAN Bus is designed for guided continous motion in cable carriers. The 2-pair version is designed with star-quad twisting, i.e. diagonal conductors form an electrical pair and meets the requirements of the CAN standard. For cable lengths up to max. 40m (observe CAN specifications).

| Part no. | | |
|---|---|---|
| | **802182,** CAN BUS, highly flexible | **802339,** CAN BUS, highly flexible |

Dimensions and specifications may be changed without prior notice.

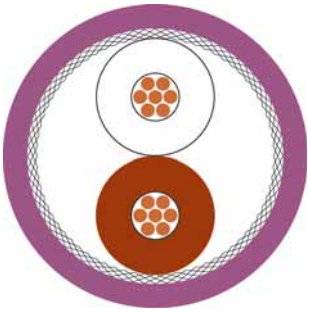
# BUS Cables

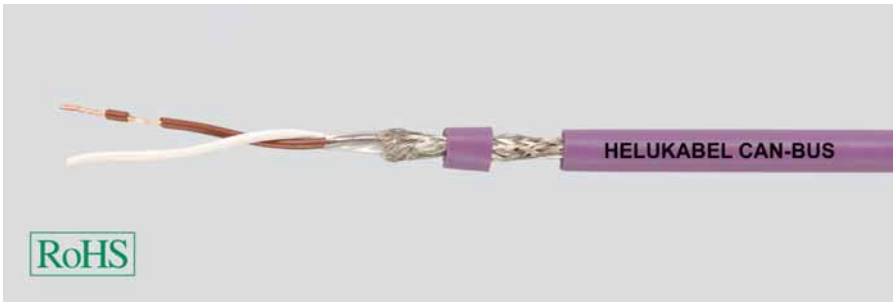
**CAN Bus Drag Chain, UL**

HELUKABEL®

PUR

NEW






| Type<br>Cable structure | Drag Chain applications<br>1x2x0.5 mm² (stranded) | Drag Chain applications<br>4x1x0.5 mm² (stranded) |
|---|---|---|
| Inner conductor diameter: | Copper, bare (AWG 20/19) | Copper, bare (AWG 20/19) |
| Core insulation: | Foam-skin-PE | Foam-skin-PE |
| Core colours: | wh/bn | wh, bn, gn, ye |
| Stranding element: | Double core | Star quad |
| Separator: | Polyester foil over stranded bundle | Polyester foil over stranded bundle |
| Shielding 1: | - | - |
| Total shielding: | Cu braid, tinned | Cu braid, tinned |
| Outer sheath material: | PUR | PUR |
| Cable external diameter: | app. 8,0 mm ± 0,3 mm | app. 8,2 mm ± 0,3 mm |
| Outer sheath colour: | Violet similar to RAL 4001 | Violet similar to RAL 4001 |
| **Electrical data** | | |
| Characteristic impedance: | 120 Ohm ± 10 % | 120 Ohm ± 10 % |
| Conductor resistance, max.: | 34,4 Ohm/km | 39 Ohm/km |
| Insulation resistance, min.: | 5 GOhm x km | 5 GOhm x km |
| Loop resistance: | 68 Ohm/km max. | 78 Ohm/km max. |
| Mutual capacitance: | 40 nF/km nom. | 42 nF/km nom. |
| Test voltage: | 1,5 kV | 1,5 kV |
| **Technical data** | | |
| Weight: | app. 77 kg/km | app. 88 kg/km |
| bending radius, repeated: | 120 mm | 120 mm |
| Operating temperature range min.: | -30°C | -30°C |
| Operating temperature range max.: | +70°C | +70°C |
| Caloric load, approx. value: | - | 1,44 MJ/m |
| Copper weight: | 43,00 kg/km | - |
| **Norms** | | |
| Applicable standards: | CAN Bus acc. to ISO 11898-2<br>Acc. to ISO/IEC 11801<br>Halogen-free acc. to 60754-2<br>Flame-retardant acc. to IEC 60332-1-2 | CAN Bus acc. to ISO 11898-2<br>Acc. to ISO/IEC 11801<br>Halogen-free acc. to 60754-2<br>Flame-retardant acc. to IEC 60332-1-2 |
| UL Style: | CMX 75°C (shielded) | CMX 75°C (shielded) |
| CSA standard: | CSA FT1 | CSA FT1 |

## Application

HELUKABEL® CAN Bus is designed for guided continous motion in cable carriers. For long cable lengths acc. ISO 11898 (observe CAN specifications). As 1- or 2-pair (starquad) version availiable

## Part no.

**805685,** CAN BUS, highly flexible

**805696,** CAN BUS, highly flexible

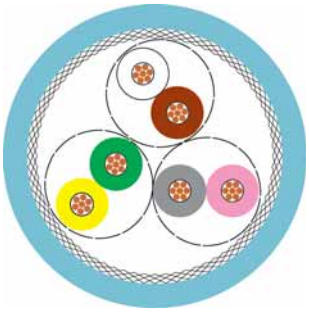
Dimensions and specifications may be changed without prior notice.

# BUS Cables

**I-BUS fixed installed**

HELUKABEL®

PVC




| Type<br>Cable structure | Fixed installation, indoor<br>3x2x0.22 mm² | Fixed installation, indoor<br>3x2x0.22 mm² +<br>3x1.0 mm² |
|---|---|---|
| Inner conductor diameter: | Copper, bare (AWG 24/7) | Copper, bare (AWG 24/7) |
| Inner conductor diameter 2: | - | Copper, bare (AWG 17/56) |
| Core insulation: | PE | PE |
| Core insulation 2: | - | PE |
| Core colours: | wh/bn, gn/rd, ye/gn | wh/bn, gn/rd, ye/gn |
| Core colours 2: | - | bu, rd, gnye |
| Stranding element: | Double core | Double core |
| Separator: | Polyester foil over stranded bundle | Polyester foil over stranded bundle |
| Shielding 1: | - | - |
| Total shielding: | Cu braid, bare | Cu braid, bare |
| Outer sheath material: | PVC | PVC |
| Cable external diameter: | app. 7,0 mm ± 0,3 mm | app. 8,0 mm ± 0,3 mm |
| Outer sheath colour: | Pastel turquoise similar to RAL 6034 | Pastel turquoise similar to RAL 6034 |

## Electrical data

| | | |
|---|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm | 100 Ohm ± 15 Ohm |
| Conductor resistance, max.: | 96 Ohm/km | 96 Ohm/km |
| Insulation resistance, min.: | 1 GOhm x km | 1 GOhm x km |
| Loop resistance: | 192 Ohm/km max. | 192 Ohm/km max. |
| Mutual capacitance: | 60 nF/km nom. | 60 nF/km nom. |
| Test voltage: | 1 kV | 1 kV |
| Attenuation: | 256 kHz < 15,0 dB/km<br>772 kHz < 24,0 dB/km<br>1 MHz < 27,0 dB/km<br>4 MHz < 52,0 dB/km<br>10 MHz < 84,0 dB/km<br>16 MHz < 112,0 dB/km<br>20 MHz < 119,0 dB/km | 256 kHz < 15,0 dB/km<br>772 kHz < 24,0 dB/km<br>1 MHz < 27,0 dB/km<br>4 MHz < 52,0 dB/km<br>10 MHz < 84,0 dB/km<br>16 MHz < 112,0 dB/km<br>20 MHz < 119,0 dB/km |

## Technical data

| | | |
|---|---|---|
| Weight: | app. 70 kg/km | app. 96 kg/km |
| bending radius, repeated: | 110 mm | 120 mm |
| Operating temperature range min.: | -40°C | -40°C |
| Operating temperature range max.: | +70°C | +70°C |
| Caloric load, approx. value: | 1,20 MJ/m | 1,31 MJ/m |
| Copper weight: | 35,00 kg/km | 68,00 kg/km |

## Norms

| | | |
|---|---|---|
| Applicable standards: | interbus specification 2.0, IEC61158<br>Flame-retardant acc. to EN 50265-2-1 | interbus specification 2.0, IEC61158<br>Flame-retardant acc. to EN 50265-2-1 |
| UL Style: | UL Style 2571 | UL Style 2571 |

## Application

HELUKABEL® I-Bus is designed for fixed installation and occasional motion, for normal Interbus installation and as a hybrid cable with integrated power supply.

## Part no.

**80778,** I-BUS

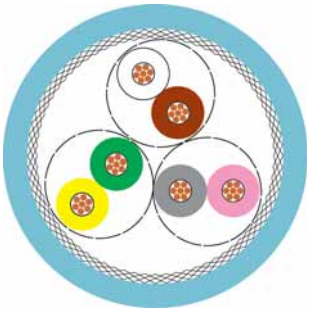
**81202,** I-BUS

Dimensions and specifications may be changed without prior notice.

# BUS Cables

**I-BUS fixed installed, halogenfree**

PE




## Type
## Fixed installation, indoor

## Cable structure
## 3x2x0.22 mm²

| | |
|---|---|
| Inner conductor diameter: | Copper, bare (AWG 24/7) |
| Core insulation: | PE |
| Core colours: | wh/bn, gn/rd, ye/gn |
| Stranding element: | Double core |
| Separator: | Polyester foil over stranded bundle |
| Shielding 1: | Al-Foil |
| Total shielding: | Cu braid, bare |
| Outer sheath material: | PE |
| Cable external diameter: | app. 7,0 mm ± 0,3 mm |
| Outer sheath colour: | Pastel turquoise similar to RAL 6034 |

## Electrical data

| | |
|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm |
| Conductor resistance, max.: | 96 Ohm/km |
| Insulation resistance, min.: | 1 GOhm x km |
| Loop resistance: | 192 Ohm/km max. |
| Mutual capacitance: | 50 nF/km nom. |
| Test voltage: | 1 kV |
| Attenuation: | 256 kHz < 15,0 dB/km |
| | 772 kHz < 24,0 dB/km |
| | 1 MHz < 27,0 dB/km |
| | 4 MHz < 52,0 dB/km |
| | 10 MHz < 84,0 dB/km |
| | 16 MHz < 112,0 dB/km |
| | 20 MHz < 119,0 dB/km |

## Technical data

| | |
|---|---|
| Weight: | app. 67 kg/km |
| bending radius, repeated: | 110 mm |
| Operating temperature range min.: | -25°C |
| Operating temperature range max.: | +60°C |
| Caloric load, approx. value: | 1,10 MJ/m |
| Copper weight: | 35,00 kg/km |

## Norms

| | |
|---|---|
| Applicable standards: | interbus specification 2.0, IEC61158 |
| | Halogen-free acc. to 60754-2 |

## Application

HELUKABEL® I-Bus is halogen-free and designed for fixed installation in buildings in an Interbus network. The cable is used in dry areas where its halogen-free construction is a major aspect.

## Part no.

**81557,** I-BUS

Dimensions and specifications may be changed without prior notice.

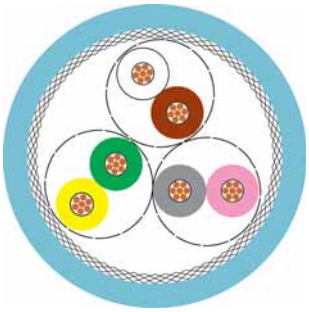


DNB Edition 11 (published 01.10.2015)

# BUS Cables

**I-BUS Drag Chain**

PUR




| Type<br>Cable structure | Drag Chain applications<br>3x2x0.25 mm² | Drag Chain applications<br>3x2x0.25 mm² +<br>3x1.0 mm² |
|---|---|---|
| Inner conductor diameter: | Copper, bare (AWG 24/19) | Copper, bare (AWG 24/19) |
| Inner conductor diameter 2: | - | Copper, bare (AWG 17/56) |
| Core insulation: | PE | PE |
| Core insulation 2: | - | PE |
| Core colours: | wh/bn, gn/rd, ye/gn | wh/bn, gn/rd, ye/gn |
| Core colours 2: | - | bu, rd, gnye |
| Stranding element: | Double core | Double core |
| Separator: | Polyester foil over stranded bundle | Polyester foil over stranded bundle |
| Shielding 1: | - | - |
| Total shielding: | Cu braid, bare | Cu braid, bare |
| Outer sheath material: | PUR | PUR |
| Cable external diameter: | app. 7,6 mm ± 0,3 mm | app. 8,6 mm ± 0,3 mm |
| Outer sheath colour: | Pastel turquoise similar to RAL 6034 | Violet similar to RAL 4001 |

## Electrical data

| | | |
|---|---|---|
| Characteristic impedance: | 100 Ohm ± 15 Ohm | 100 Ohm ± 15 Ohm |
| Conductor resistance, max.: | 96 Ohm/km | 96 Ohm/km |
| Insulation resistance, min.: | 1 GOhm x km | 1 GOhm x km |
| Loop resistance: | 192 Ohm/km max. | 192 Ohm/km max. |
| Mutual capacitance: | 60 nF/km nom. | 60 nF/km nom. |
| Test voltage: | 1 kV | 1 kV |
| Attenuation: | 256 kHz < 15,0 dB/km<br>772 kHz < 24,0 dB/km<br>1 MHz < 27,0 dB/km<br>4 MHz < 52,0 dB/km<br>10 MHz < 84,0 dB/km<br>16 MHz < 112,0 dB/km<br>20 MHz < 119,0 dB/km | 256 kHz < 15,0 dB/km<br>772 kHz < 24,0 dB/km<br>1 MHz < 27,0 dB/km<br>4 MHz < 52,0 dB/km<br>10 MHz < 84,0 dB/km<br>16 MHz < 112,0 dB/km<br>20 MHz < 119,0 dB/km |

## Technical data

| | | |
|---|---|---|
| Weight: | app. 63 kg/km | app. 92 kg/km |
| bending radius, repeated: | 120 mm | 130 mm |
| Operating temperature range min.: | -20°C | -20°C |
| Operating temperature range max.: | +70°C | +70°C |
| Caloric load, approx. value: | 0,937 MJ/m | 1,227 MJ/m |
| Copper weight: | 36,00 kg/km | 70,00 kg/km |

## Norms

| | | |
|---|---|---|
| Applicable standards: | interbus specification 2.0, IEC61158<br>Halogen-free acc. to 60754-2<br>Flame-retardant acc. to EN 50265-2-1 | interbus specification 2.0, IEC61158<br>Halogen-free acc. to 60754-2 |

## Application

HELUKABEL® I-Bus is designed for guided continuous motion in cable carriers and as strictly a bus cable or a hybrid version (with integrated power supply). Both versions feature a halogen-free PUR jacket.

## Part no.

| | |
|---|---|
| **81203,** I-BUS | **82696,** I-BUS |

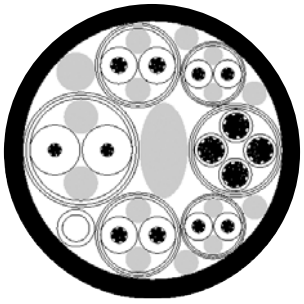
Dimensions and specifications may be changed without prior notice.

# BUS-Cables

**Multibus I, high flexible**

HELUKABEL®

PUR




## Type

## Multibus I, 15 cores high flexible

## Cable structure

| | |
|---|---|
| Profibus: | 1 x 2 x AWG 22 mm² (Foam-Skin PO/rd/gn) |
| DeviceNet™: | 2 x 2 x AWG 22 mm² (Foam-Skin PO/wh/bn, ye/gn) |
| Interbus: | 2 x 2 x 0,25 (Foam-Skin PO/ gn/pk, ye/gn) |
| Power cores: | 4 x 1 x 1,0 mm² (PO/rd, bl, bu, bn) |
| Protective earth core: | 1,0 mm² (PO/gnye) |
| Stranding: | Single cores totaly stranded together and filled with plastic elements |
| Total shielding: | PP vlies |
| Outer sheath material: | PUR, halogenfree |
| Cable external diameter: | app. 14,7 mm |
| Outer sheath colour: | violet similar to RAL 4001 |

## Electrical data

| | |
|---|---|
| Characteristic impedance: | 150 + -15 Ohm (Profibus)<br>120 + -12 Ohm (DeviceNet™)<br>100 + -15 Ohm (Interbus) |
| Conductor resistance: | <= 20 Ohm/km (power cores + protection core)<br><= 70 Ohm/km (Profibus)<br><= 70 Ohm/km (DeviceNet™)<br><= 80 Ohm/km (Interbus) |
| Insulation resistance: | >= 500 Mohm x km (at 20° C) |
| Mutual capacitance: | 30 pF/m nominal (Profibus)<br>40 pF/m nominal (DeviceNet™)<br>50 pF/m nominal (Interbus) |
| Testvoltage: | 2500 V (core/ core)<br>1500 V (core/ screen) |

## Mechanical data

| | |
|---|---|
| Bending radius single: | <= 70 mm |
| Bending radius repeated: | <= 110 mm |
| Tensile strength static: | 300 N |
| Tensile strength dynamic: | 140 N |
| Oil resistance: | Diesel, IRM 902, Biohydran TM68, Ecocut HFN 10LE |
| Flame resistance: | IEC 60332-1, VW1/ FT1 acc. C-UL |
| FCKW free: | yes |
| Self extinguishable: | yes |
| Other attributes: | PVC free, free of lacquer wetting disturbing substances, siliconfree, resistant against PVC flexibiliser and cable fat RB1 |

## Thermal attributes

| | |
|---|---|
| Operating temperature range: | - 40° C to + 80° C |
| Laying temperature range: | - 30° C to + 80° C |

## Norms

Profibus standard, DeviceNet™ standard, Interbus standard

## UL-Style

VW1/ FT1 acc. C-UL, AWM style 20236

## Application

HELUKABEL® Multibus I is highly flexible with a special structure for use in cable carrier applications and robotics (use in acc. with HELU specification) in a PVC-free design. The Multibus I combines the Profibus / DeviceNet™ / Interbus bus systems as well as the power supply in a single hybrid cable.

## Part no.

**801652,** Multibus I, 15 cores



DNB Edition 11 (published 01.10.2015)

# BUS-Cables

**Multibus II, high flexible**

HELUKABEL®

PUR


## Type

**Multibus II, 15 cores high flexible**

## Cable structure

| | |
|---|---|
| Profibus: | 1 x 2 x 0,34 mm² (Foam-Skin PO/rd/gn) |
| DeviceNet™: | 4 x 2 x 0,34 mm² (Foam-Skin PE/ye, or, wh, bu-ye, or, wh, bu) |
| Power cores 1: | 2 x 1,0 mm² (PO/rd, bl) |
| Power cores 2: | 2 x 1,5 mm² (PO/bu, bn) |
| Protective earth core: | 1,5 mm² (PO/gnye) |
| Stranding: | Single cores totaly stranded together and filled with plastic elements |
| Total shielding: | PP vlies |
| Outer sheath material: | PUR, halogenfree |
| Cable external diameter: | app. 15,0 mm |
| Outer sheath colour: | violet similar to RAL 4001 |

## Electrical data

| | |
|---|---|
| Characteristic impedance: | 150 + -15 Ohm (Profibus)<br>100 + -15 Ohm (PROFInet) |
| Conductor resistance: | <= 20 Ohm/km (power cores + protection core)<br><= 70 Ohm/km (Profibus)<br><= 62 Ohm/km (PROFInet) |
| Insulation resistance: | >= 500 Mohm x km (at 20° C) |
| Mutual capacitance: | 30 pF/m nominal (Profibus)<br>40 pF/m nominal (PROFInet) |
| Testvoltage: | 2500 V (core/ core)<br>1500 V (core/ screen) |

## Mechanical data

| | |
|---|---|
| Bending radius single: | <= 70 mm |
| Bending radius repeated: | <= 110 mm |
| Tensile strength static: | 300 N |
| Tensile strength dynamic: | 140 N |
| Oil resistance: | Diesel, IRM 902, Biohydran TM68, Ecocut HFN 10LE |
| Flame resistance: | IEC 60332-1, VW1/ FT1 acc. C-UL |
| FCKW free: | yes |
| Self extinguishable: | yes |
| Other attributes: | PVC free, free of lacquer wetting disturbing substances, siliconfree, resistant against PVC flexibiliser and cable fat RB1 |

## Thermal attributes

| | |
|---|---|
| Operating temperature range: | - 40° C to + 80° C |
| Laying temperature range: | - 20° C to + 80° C |

## Norms

Profibus standard, PROFInet standard

## UL-Style

VW1/ FT1 acc. C-UL, AWM style 20236

## Application

HELUKABEL® Multibus II is highly flexible with a special structure for use in cable carrier applications and robotics (use in acc. with HELU specification) in a PVC-free design. The Multibus II (further development of Multibus I) combines the Profibus /Profinet bus systems as well as the power supply in a single hybrid cable.

## Part no.

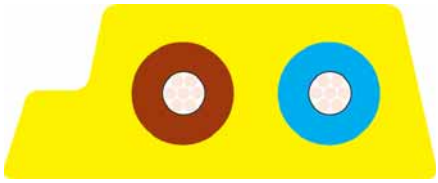
**804115,** Multibus II, 15 cores

# BUS Cables

**A-BUS EPDM**

HELUKABEL®

EPDM




| Type<br>Cable structure | Actuator Sensor Interface<br>2x1.5 mm² | Actuator Sensor Interface<br>2x1.5 mm² |
|---|---|---|
| Inner conductor: | Copper, tinned | Copper, tinned |
| Core insulation: | Rubber compound | Rubber compound |
| Core colours: | bu, bn | bu, bn |
| Separator: | - | - |
| Shielding 1: | - | - |
| Total shielding: | - | - |
| Outer sheath material: | EPDM | EPDM |
| Outer sheath colour: | Yellow similar to RAL 1023 | Black similar to RAL 9005 |

## Electrical data

| | | |
|---|---|---|
| Conductor resistance, max.: | 13,7 Ohm/km | 13,7 Ohm/km |
| Insulation resistance, min.: | 1 GOhm x km | 1 GOhm x km |
| Loop resistance: | 27 Ohm/km max. | 27 Ohm/km max. |
| Nominal voltage: | 32 V | 48 V |
| Test voltage: | 1 kV at 15 min. | 1 kV at 15 min. |

## Technical data

| | | |
|---|---|---|
| Weight: | app. 70 kg/km | app. 70 kg/km |
| bending radius, repeated: | 30 mm | 30 mm |
| Operating temperature range min.: | -40°C | -40°C |
| Operating temperature range max.: | +85°C | +85°C |
| Caloric load, approx. value: | 0,975 MJ/m | 0,975 MJ/m |
| Copper weight: | 31,00 kg/km | 31,00 kg/km |

## Norms

| | | |
|---|---|---|
| Applicable standards: | ASI standard<br>Halogen-free acc. to 60754-2 | ASI standard<br>Halogen-free acc. to 60754-2 |

## Application

HELUKABEL® A-Bus EPDM Rubber for normal use in an AS-I system. Applications include wet/dry areas where the properties of a rubber jacket are desired. In addition, this material offers benefits such as low compression forces needed when contacting and the best sealing against the AS-I module.

| Part no. | | |
|---|---|---|
| | **80824,** A-BUS EPDM | **80825,** A-BUS EPDM |

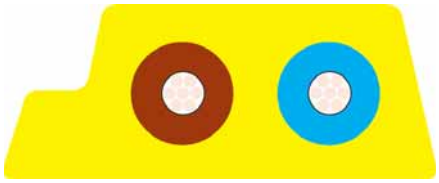
Dimensions and specifications may be changed without prior notice.

# BUS Cables

## A-BUS EPDM, Long Distance

HELUKABEL®

EPDM




| Type | Industrial Area | Industrial Area |
|---|---|---|
| **Cable structure** | **2x2.5 mm²** | **2x2.5 mm²** |
| Inner conductor: | Copper, tinned | Copper, tinned |
| Core insulation: | Rubber compound | Rubber compound |
| Core colours: | bu, bn | bu, bn |
| Separator: | - | - |
| Shielding 1: | - | - |
| Total shielding: | - | - |
| Outer sheath material: | EPDM | EPDM |
| Outer sheath colour: | Yellow similar to RAL 1023 | Black similar to RAL 9005 |

## Electrical data

## Technical data

| | | |
|---|---|---|
| Weight: | app. 130 kg/km | app. 130 kg/km |
| bending radius, repeated: | 35 mm | 30 mm |
| Operating temperature range min.: | -40°C | -40°C |
| Operating temperature range max.: | +85°C | +85°C |
| Caloric load, approx. value: | 0,70 MJ/m | 0,70 MJ/m |
| Copper weight: | 49,00 kg/km | 49,00 kg/km |

## Norms

| | | |
|---|---|---|
| Applicable standards: | ASI standard<br>Halogen-free acc. to 60754-2 | ASI standard<br>Halogen-free acc. to 60754-2 |

## Application

HELUKABEL® A-Bus Long Distance EPDM Rubber 2,5mm² for normal use in an AS-I system. The enlarged cross-section allows bigger transmission distances, higher ampacity and this results in savings of supplementary power packs. Applications include wet/dry areas where the properties of a rubber jacket are desired. In addition, this material offers benefits such as low compression forces needed when contacting and the best sealing against the AS-I module.

| Part no. | | |
|---|---|---|
| | **804408,** A-BUS EPDM | **804409,** A-BUS EPDM |

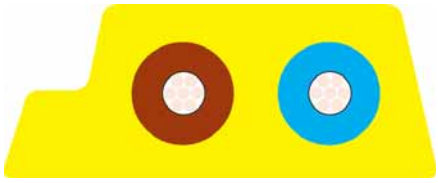
Dimensions and specifications may be changed without prior notice.

# BUS Cables

**A-BUS PUR, UL/CSA**

HELUKABEL®

PUR




| | | |
|---|---|---|
| **Type** | **Actuator Sensor Interface 2x1.5 mm²** | **Actuator Sensor Interface 2x1.5 mm²** |
| **Cable structure** | | |
| Inner conductor: | Copper, tinned | Copper, tinned |
| Core insulation: | PO | PO |
| Core colours: | bu, bn | bu, bn |
| Separator: | - | - |
| Shielding 1: | - | - |
| Total shielding: | - | - |
| Outer sheath material: | PUR | PUR |
| Outer sheath colour: | Yellow similar to RAL 1023 | Black similar to RAL 9005 |
| **Electrical data** | | |
| Conductor resistance, max.: | 13,7 Ohm/km | 13,7 Ohm/km |
| Insulation resistance, min.: | 1 GOhm x km | 1 GOhm x km |
| Loop resistance: | 27 Ohm/km max. | 27 Ohm/km max. |
| Nominal voltage: | 32 V | 48 V |
| Test voltage: | 1 kV at 15 min. | 1 kV at 15 min. |
| **Technical data** | | |
| Weight: | app. 64 kg/km | app. 64 kg/km |
| bending radius, repeated: | 30 mm | 30 mm |
| Operating temperature range min.: | -40°C | -40°C |
| Operating temperature range max.: | +80°C | +80°C |
| Caloric load, approx. value: | 0,965 MJ/m | 0,965 MJ/m |
| Copper weight: | 31,00 kg/km | 31,00 kg/km |
| **Norms** | | |
| Applicable standards: | ASI standard<br>Halogen-free acc. to 60754-2<br>Flame-retardant acc. to IEC 60332-1-2 | ASI standard<br>Halogen-free acc. to 60754-2<br>Flame-retardant acc. to IEC 60332-1-2 |
| UL Style: | AWM Style 20549 | AWM Style 20549 |
| CSA standard: | CSA FT2 | CSA FT2 |

## Application

HELUKABEL® A-Bus PUR is ideal for use in wet/dry areas thanks to its outstanding characteristics when exposed to common coolants/lubricants. This version can also be used in cable carriers (special installation conditions must be observed: place wide cable side on inside radius, use partitions and install flat/round cables separately). These types are approved for use in the American market (UL 1581, FT2) thanks to use of special materials.

| | | |
|---|---|---|
| **Part no.** | **82434,** A-BUS PUR | **82822,** A-BUS PUR |

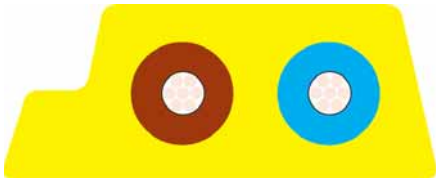
Dimensions and specifications may be changed without prior notice.

# BUS Cables

## A-BUS PUR 2X2.5 PUR, Long Distance, UL/CSA

HELUKABEL®

PUR




| Type | Drag Chain applications 2x2.5 mm² | Drag Chain applications 2x2.5 mm² |
|---|---|---|
| **Cable structure** | | |
| Inner conductor: | Copper, tinned | Copper, tinned |
| Core insulation: | PO | PO |
| Core colours: | bu, bn | bu, bn |
| Separator: | - | - |
| Shielding 1: | - | - |
| Total shielding: | - | - |
| Outer sheath material: | PUR | PUR |
| Outer sheath colour: | Yellow similar to RAL 1023 | Black similar to RAL 9005 |
| **Electrical data** | | |
| Conductor resistance, max.: | 8,21 Ohm/km | 8,21 Ohm/km |
| Loop resistance: | 16 Ohm/km max. | 16 Ohm/km max. |
| Nominal voltage: | 32 V | 48 V |
| **Technical data** | | |
| Weight: | app. 140 kg/km | app. 140 kg/km |
| bending radius, repeated: | 30 mm | 30 mm |
| Operating temperature range min.: | -40°C | -40°C |
| Operating temperature range max.: | +80°C | +80°C |
| Caloric load, approx. value: | 0,90 MJ/m | 0,90 MJ/m |
| Copper weight: | 49,00 kg/km | 49,00 kg/km |
| **Norms** | | |
| Applicable standards: | ASI standard<br>Halogen-free acc. to 60754-2<br>Flame-retardant CSA FT2 | ASI standard<br>Halogen-free acc. to 60754-2<br>Flame-retardant CSA FT2 |
| UL Style: | AWM Style 20549 | AWM Style 20549 |
| CSA standard: | CSA FT2 | CSA FT2 |

## Application

AS components are interconnected with this special system cable. With the AS interface, the cable assembly from the control system to the sensor/actuator is not needed. The AS interface is the field bus system that transmitts both data and power in one single cable. With fast contacting in penetration technique, the possibility of errors in cabling is largely reduced. The special outer jacket provides protection against oil, grease, and refrigerant lubricants, and the cable is therefore even suitable for applications in wet surroundings, in machinery and plant construction, as well as in the machine tool and automotive industry. The PUR variant is suitable for heavy-duty industrial environments.
Because of the cross section 2,5qmm it is possible to realize longer distances.
These types are certified for the American market (UL 1581, FT2) through the use of special materials.

| Part no. | | |
|---|---|---|
| | **804410,** A-BUS PUR | **804411,** A-BUS PUR |

Dimensions and specifications may be changed without prior notice.

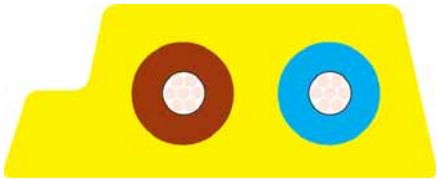
# BUS Cables

**A-BUS TPE, UL CMG**

HELUKABEL®

TPE 105°

NEW




| Type<br>Cable structure | Mobile use<br>2x1.5 mm² | Mobile use<br>2x1.5 mm² |
|---|---|---|
| Inner conductor: | Copper, tinned | Copper, tinned |
| Core insulation: | TPE | TPE |
| Core colours: | bu, bn | bu, bn |
| Separator: | - | - |
| Shielding 1: | - | - |
| Total shielding: | - | - |
| Outer sheath material: | TPE | TPE |
| Outer sheath colour: | Yellow | Black |

## Electrical data

| | | |
|---|---|---|
| Conductor resistance, max.: | 13,7 Ohm/km | 13,7 Ohm/km |
| Insulation resistance, min.: | 1 GOhm x km | 1 GOhm x km |
| Loop resistance: | 27 Ohm/km max. | 27 Ohm/km max. |
| Nominal voltage: | 32 V | 48 V |
| Test voltage: | 1,5 kV at 15 min. | 1,5 kV at 15 min. |

## Technical data

| | | |
|---|---|---|
| Weight: | app. 71 kg/km | app. 70 kg/km |
| bending radius, repeated: | 24 mm | 24 mm |
| Operating temperature range min.: | -40°C | -40°C |
| Operating temperature range max.: | +105°C | +105°C |
| Caloric load, approx. value: | 1,10 MJ/m | 1,10 MJ/m |
| Copper weight: | 31,00 kg/km | 31,00 kg/km |

## Norms

| | | |
|---|---|---|
| Applicable standards: | ASI standard<br>Flame-retardant acc. to IEC 60332-1-2 | ASI standard<br>Flame-retardant acc. to IEC 60332-1-2 |
| UL Style: | CL2 CMG | CL2 CMG |
| CSA standard: | CSA FT 4 | CSA FT 4 |

## Application

HELUKABEL® A-Bus TPE UL/CSA for demanding temperature requirements up to 105 °C and with improved flame retardance specifically for the American market. The special outer sheath makes the cable resistant to many oils, greases and cooling lubricants and thus suitable for applications in wet surroundings, in machinery and plant construction as well as in the machine tool and automotive industries.

| Part no. | | |
|---|---|---|
| | **805693,** A-BUS UL | **805694,** A-BUS UL |

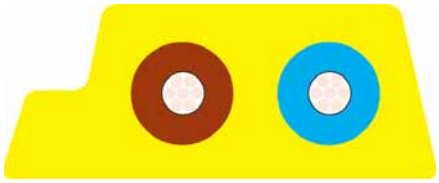
Dimensions and specifications may be changed without prior notice.

# BUS Cables

## A-BUS TPE

HELUKABEL®

TPE




| Type | Actuator Sensor Interface 2x1.5 mm² | Actuator Sensor Interface 2x1.5 mm² |
|---|---|---|
| **Cable structure** | | |
| Inner conductor: | Copper, tinned | Copper, tinned |
| Core insulation: | TPE | TPE |
| Core colours: | bu, bn | bu, bn |
| Separator: | - | - |
| Shielding 1: | - | - |
| Total shielding: | - | - |
| Outer sheath material: | TPE | TPE |
| Outer sheath colour: | Yellow | Black |
| **Electrical data** | | |
| Conductor resistance, max.: | 13,7 Ohm/km | 13,7 Ohm/km |
| Insulation resistance, min.: | 1 GOhm x km | 1 GOhm x km |
| Loop resistance: | 27 Ohm/km max. | 27 Ohm/km max. |
| Nominal voltage: | 32 V | 48 V |
| Test voltage: | 1,5 kV at 15 min. | 1,5 kV at 15 min. |
| **Technical data** | | |
| Weight: | app. 70 kg/km | app. 70 kg/km |
| bending radius, repeated: | 24 mm | 24 mm |
| Operating temperature range min.: | -40°C | -40°C |
| Operating temperature range max.: | +105°C | +105°C |
| Caloric load, approx. value: | 1,10 MJ/m | 1,10 MJ/m |
| Copper weight: | 31,00 kg/km | 31,00 kg/km |
| **Norms** | | |
| Applicable standards: | ASI standard<br>Flame-retardant acc. to IEC 60332-1-2 | ASI standard<br>Flame-retardant acc. to IEC 60332-1-2 |

## Application

HELUKABEL® A-Bus TPE for demanding temperature requirements up to 105 °C and flame retardance. The special outer sheath makes the cable resistant to many oils, greases and cooling lubricants and thus suitable for applications in wet surroundings, in machinery and plant construction as well as in the machine tool and automotive industries.

| Part no. | | |
|---|---|---|
| | **801846,** A-BUS TPE | **801847,** A-BUS TPE |

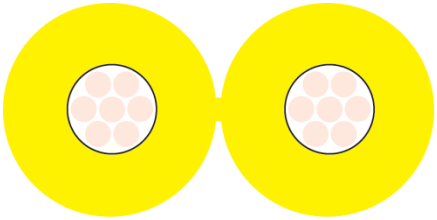
Dimensions and specifications may be changed without prior notice.

# BUS Cables

## AS-Interface Electrical Cabinet FLIH

HELUKABEL®

FRNC




## Type
**Fixed installation, indoor**

## Cable structure
**2x0,86/ 2,5**

| | |
|---|---|
| Inner conductor: | Copper, tinned |
| Separator: | - |
| Shielding 1: | - |
| Total shielding: | - |
| Outer sheath material: | FRNC |
| Outer sheath colour: | Yellow |

## Electrical data

| | |
|---|---|
| Characteristic impedance: | 105 Ohm ± 35 Ohm |
| Conductor resistance, max.: | 23 Ohm/km |
| Insulation resistance, min.: | 0,01 GOhm x km |
| Loop resistance: | 46 Ohm/km max. |
| Nominal voltage: | 300 V |
| Test voltage: | 2 kV at 15 min. |

## Technical data

| | |
|---|---|
| Weight: | app. 24 kg/km |
| bending radius, repeated: | 30 mm |
| Operating temperature range min.: | -25°C |
| Operating temperature range max.: | +70°C |
| Caloric load, approx. value: | 0,30 MJ/m |
| Copper weight: | 20,00 kg/km |

## Norms

| | |
|---|---|
| Applicable standards: | ASI standard<br>Halogen-free acc. to 60754-2<br>Flame-retardant acc. to IEC 60332-1-2 |
| UL Style: | UL Style 2444 |

## Application

HELUKABEL® AS-Interface FLIH for electrical cabinet applications, especially for wiring inside electrical cabinets. Compared to "normal" AS-I wire, less space is needed and routing is improved. This cable is also designed for appropriate fast contacting through use of the penetration technique. Special modules for electrical cabinets that are compatible with this wire are available on the market.

## Part no.

**802183,** AS-Interface FLIH

Dimensions and specifications may be changed without prior notice.



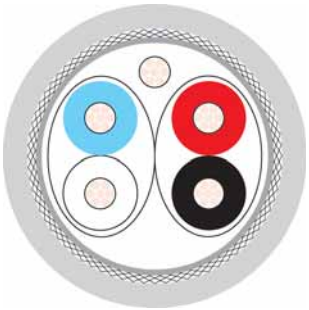
DNB Edition 11 (published 01.10.2015)

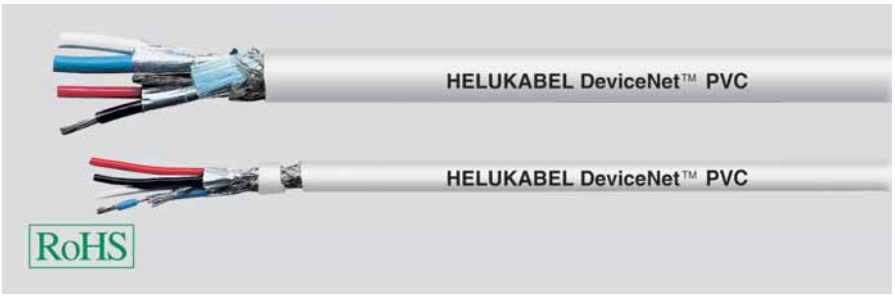
# BUS Cables

**DeviceNet™ fixed installed thick + thin**

HELUKABEL®

PVC






| Type<br>Cable structure | Fixed installation, indoor<br>1x2xAWG18 +<br>1x2xAWG15 | Fixed installation, indoor<br>1x2xAWG24 +<br>1x2xAWG22 |
|---|---|---|
| Inner conductor diameter 1: | Copper, tinned (AWG 18/19) | Copper, tinned (AWG 24/19) |
| Inner conductor diameter 2: | Copper, tinned (AWG 15/19) | Copper, tinned (AWG 22/19) |
| Core insulation 1: | Foam-skin-PE | Foam-skin-PE |
| Core insulation 2: | PVC | PVC |
| Core colours 1: | light bu, wh | light bu, wh |
| Core colours 2: | rd, bk | rd, bk |
| Stranding element 1: | Double core | Double core |
| Separator: | - | - |
| Shielding 1: | Al-Foil | Al-Foil |
| Total shielding: | Cu braid, tinned | Copper shifting, tinned |
| Drain wire: | yes | yes |
| Outer sheath material: | PVC | PVC |
| Cable external diameter: | app. 12,2 mm ± 0,3 mm | app. 6,9 mm ± 0,3 mm |
| Outer sheath colour: | Grey similar to RAL 7001 | Grey similar to RAL 7001 |
| **Electrical data** | | |
| Characteristic impedance: | 120 Ohm ± 10 % | 120 Ohm ± 10 % |
| Conductor resistance, max.: | 22,6 Ohm/km | 90 Ohm/km |
| Insulation resistance, min.: | 0,2 GOhm x km | 0,2 GOhm x km |
| Loop resistance: | 45 Ohm/km max. | 180 Ohm/km max. |
| Mutual capacitance: | 39,8 nF/km nom. | 39,8 nF/km nom. |
| Test voltage: | 2 kV | 2 kV |
| Attenuation: | 125 kHz < 4,2 dB/km<br>500 kHz < 8,1 dB/km | 125 kHz < 9.5 dB/km<br>500 kHz < 16.4 dB/km |
| **Technical data** | | |
| Weight: | app. 192 kg/km | app. 67 kg/km |
| bending radius, repeated: | 190 mm | 110 mm |
| Operating temperature range min.: | -20°C | -20°C |
| Operating temperature range max.: | +80°C | +80°C |
| Caloric load, approx. value: | 2,92 MJ/m | 0,91 MJ/m |
| Copper weight: | 88,00 kg/km | 35,00 kg/km |
| **Norms** | | |
| Applicable standards: | ODVA DeviceNet<br>Flame-retardant acc. to IEC 60332-3 | ODVA DeviceNet<br>Flame-retardant acc. to IEC 60332-3 |
| UL Style: | CMG 75°C PLTC FT4 | CMG 75°C PLTC FT4 |
| CSA standard: | CEC: CMG FT4 | CSA FT 4 |

## Application

HELUKABEL® DeviceNet™ PVC for fixed installation. The special aspect of this bus system is that a data pair and a power supply pair are **always** integrated in one cable. The small cross-section is used for short distances or as a point-to-point connection; the large cross-section as main conductor for long distances and frequently in combination with the thin conductor as drain wire.

## Part no.

**800683,** DeviceNet PVC

**800684,** DeviceNet PVC

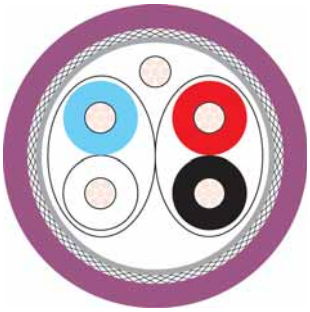
Dimensions and specifications may be changed without prior notice.

# BUS Cables

**DeviceNet™ fixed installed thick + thin**

HELUKABEL®

FRNC




| Type<br>Cable structure | Fixed installation, indoor<br>1x2xAWG18 +<br>1x2xAWG15 | Fixed installation, indoor<br>1x2xAWG24 +<br>1x2xAWG22 |
|---|---|---|
| Inner conductor diameter 1: | Copper, tinned (AWG 18/19) | Copper, tinned (AWG 24/19) |
| Inner conductor diameter 2: | Copper, tinned (AWG 15/19) | Copper, tinned (AWG 22/19) |
| Core insulation 1: | Cell PE | Cell PE |
| Core insulation 2: | PE | PE |
| Core colours 1: | light bu, wh | light bu, wh |
| Core colours 2: | rd, bk | rd, bk |
| Stranding element 1: | Double core | Double core |
| Separator: | - | - |
| Shielding 1: | Al-Foil | Al-Foil |
| Total shielding: | Cu braid, tinned | Cu braid, tinned |
| Drain wire: | yes | yes |
| Outer sheath material: | FRNC | FRNC |
| Cable external diameter: | app. 12,2 mm ± 0,3 mm | app. 6,9 mm ± 0,3 mm |
| Outer sheath colour: | Violet similar to RAL 4001 | Violet similar to RAL 4001 |
| **Electrical data** | | |
| Characteristic impedance: | 120 Ohm ± 10 % | 120 Ohm ± 10 % |
| Conductor resistance, max.: | 22,6 Ohm/km | 90 Ohm/km |
| Insulation resistance, min.: | 0,2 GOhm x km | 0,2 GOhm x km |
| Loop resistance: | 45 Ohm/km max. | 180 Ohm/km max. |
| Mutual capacitance: | 39 nF/km nom. | 39,8 nF/km nom. |
| Test voltage: | 2 kV | 2 kV |
| Attenuation: | 125 kHz < 4.2 dB/km<br>500 kHz < 8.1 dB/km | 125 kHz < 9.5 dB/km<br>500 kHz < 16.4 dB/km |
| **Technical data** | | |
| Weight: | app. 195 kg/km | app. 70 kg/km |
| bending radius, repeated: | 190 mm | 110 mm |
| Operating temperature range min.: | -25°C | -25°C |
| Operating temperature range max.: | +80°C | +80°C |
| Caloric load, approx. value: | 2,73 MJ/m | 0,82 MJ/m |
| Copper weight: | 88,00 kg/km | 34,00 kg/km |
| **Norms** | | |
| Applicable standards: | ODVA DeviceNet<br>Halogen-free acc. to 60754-2<br>Flame-retardant acc. to EN 50265-2-1 | ODVA DeviceNet<br>Halogen-free acc. to 60754-2<br>Flame-retardant acc. to EN 50265-2-1 |
| UL Style: | CL2 CMG | CL2 CMG |
| CSA standard: | CEC: CMG FT4 | CEC: CMG FT4 |

## Application

HELUKABEL® DeviceNet™ FRNC for fixed installation in areas where high flame retardance and a halogen-free design are needed. The special aspect of this bus system is that a data pair and a power supply pair are **always** integrated in one cable. The small cross-section is used for short distances or as a point-to-point connection; the large cross-section as main conductor for long distances and frequently in combination with the thin conductor as drain wire.

| Part no. | | |
|---|---|---|
| | **800681,** DeviceNet FRNC | **800682,** DeviceNet FRNC |

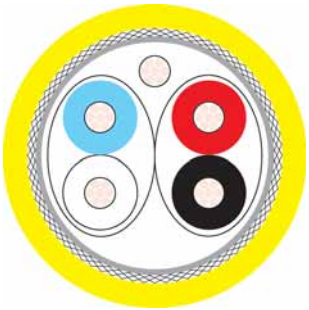
Dimensions and specifications may be changed without prior notice.

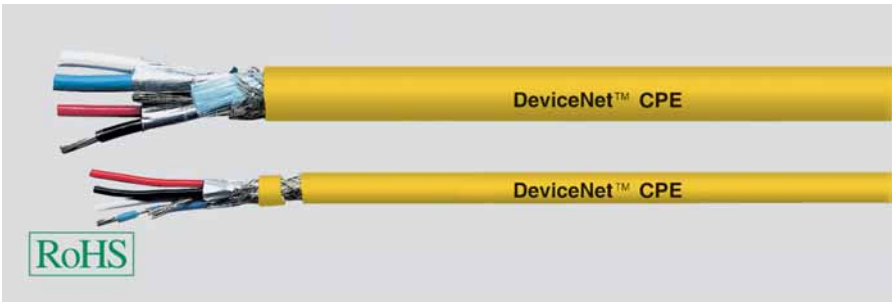
# BUS Cables

**DeviceNet™ fixed installed thick + thin**

HELUKABEL®

CPE






| Type<br>Cable structure | Fixed installation, indoor<br>1x2xAWG18 +<br>1x2xAWG15 | Fixed installation, indoor<br>1x2xAWG24 +<br>1x2xAWG22 |
|---|---|---|
| Inner conductor diameter 1: | Copper, tinned (AWG 18/19) | Copper, tinned (AWG 24/19) |
| Inner conductor diameter 2: | Copper, tinned (AWG 15/19) | Copper, tinned (AWG 22/19) |
| Core insulation 1: | Cell PE | PE |
| Core insulation 2: | PE | PVC |
| Core colours 1: | light bu, wh | light bu, wh |
| Core colours 2: | rd, bk | rd, bk |
| Stranding element 1: | Double core | Double core |
| Separator: | - | - |
| Shielding 1: | Al-Foil | Al-Foil |
| Total shielding: | Cu braid, tinned | Cu braid, tinned |
| Drain wire: | yes | yes |
| Outer sheath material: | CPE | CPE |
| Cable external diameter: | app. 12,0 mm ± 0,3 mm | app. 7,0 mm ± 0,3 mm |
| Outer sheath colour: | Yellow | Yellow |

## Electrical data

| | | |
|---|---|---|
| Characteristic impedance: | 120 Ohm ± 10 % | 120 Ohm ± 10 % |
| Conductor resistance, max.: | 22,6 Ohm/km | 90 Ohm/km |
| Insulation resistance, min.: | 0,2 GOhm x km | 0,2 GOhm x km |
| Loop resistance: | 45 Ohm/km max. | 180 Ohm/km max. |
| Mutual capacitance: | 39 nF/km nom. | 39 nF/km nom. |
| Test voltage: | 2 kV | 2 kV |
| Attenuation: | 125 kHz < 4.3 dB/km<br>500 kHz < 8.2 dB/km | 125 kHz < 9.5 dB/km<br>500 kHz < 16.4 dB/km |

## Technical data

| | | |
|---|---|---|
| Weight: | app. 195 kg/km | app. 70 kg/km |
| bending radius, repeated: | 190 mm | 110 mm |
| Operating temperature range min.: | -20°C | -20°C |
| Operating temperature range max.: | +60°C | +60°C |
| Caloric load, approx. value: | 2,73 MJ/m | 0,82 MJ/m |
| Copper weight: | 71,20 kg/km | 28,10 kg/km |

## Norms

| | | |
|---|---|---|
| Applicable standards: | ODVA DeviceNet<br>Flame-retardant acc. to EN 50265-2-1 | ODVA DeviceNet<br>Flame-retardant acc. to EN 50265-2-1 |
| UL Style: | CMG PLTC | CL2 CMG |
| CSA standard: | CEC: CMG FT4 | CEC: CMG FT4 |

## Application

HELUKABEL® DeviceNet™ CPE for fixed installation with very high flame-retardance requirements. The special aspect of this bus system is that a data pair and a power supply pair are **always** integrated in one cable. The small cross-section is used for short distances or as a point-to-point connection; the large cross-section as main conductor for long distances and frequently in combination with the thin conductor as drain wire.

## Part no.

| | |
|---|---|
| **81907,** DeviceNet CPE | **81908,** DeviceNet CPE |

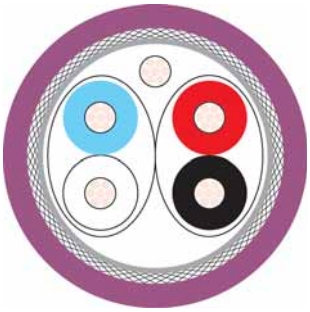
Dimensions and specifications may be changed without prior notice.

# BUS Cables

**DeviceNet™ high flexible thick + thin**

HELUKABEL®

PUR, high flexible




| Type<br>Cable structure | Drag Chain applications<br>1x2xAWG18 +<br>1x2xAWG15 | Drag Chain applications<br>1x2xAWG24 +<br>1x2xAWG22 |
|---|---|---|
| Inner conductor diameter 1: | Copper, tinned (AWG 18/40) | Copper, tinned (AWG 24/19) |
| Inner conductor diameter 2: | Copper, tinned (AWG 15/84) | Copper, tinned (AWG 22/19) |
| Core insulation 1: | Cell PE | Cell PE |
| Core insulation 2: | PE | PE |
| Core colours 1: | light bu, wh | light bu, wh |
| Core colours 2: | rd, bk | rd, bk |
| Stranding element 1: | Double core | Double core |
| Separator: | - | - |
| Shielding 1: | Al-Foil | Al-Foil |
| Total shielding: | Cu braid, tinned | Cu braid, tinned |
| Drain wire: | yes | yes |
| Outer sheath material: | PUR | PUR |
| Cable external diameter: | app. 12,2 mm ± 0,3 mm | app. 6,9 mm ± 0,3 mm |
| Outer sheath colour: | Violet similar to RAL 4001 | Violet similar to RAL 4001 |
| **Electrical data** | | |
| Characteristic impedance: | 120 Ohm ± 10 % | 120 Ohm ± 10 % |
| Conductor resistance, max.: | 22,6 Ohm/km | 90 Ohm/km |
| Insulation resistance, min.: | 0,2 GOhm x km | 0,2 GOhm x km |
| Loop resistance: | 45 Ohm/km max. | 45 Ohm/km max. |
| Mutual capacitance: | 39,8 nF/km nom. | 39,8 nF/km nom. |
| Test voltage: | 2 kV | 2 kV |
| Attenuation: | 125 kHz < 4.1 dB/km<br>500 kHz < 8.2 dB/km | 125 kHz < 9.5 dB/km<br>500 kHz < 16.4 dB/km |
| **Technical data** | | |
| Weight: | app. 185 kg/km | app. 68 kg/km |
| bending radius, repeated: | 61 mm | 70 mm |
| Operating temperature range min.: | -40°C | -40°C |
| Operating temperature range max.: | +80°C | +80°C |
| Caloric load, approx. value: | 2,54 MJ/m | 0,76 MJ/m |
| Copper weight: | 90,00 kg/km | 35,00 kg/km |
| **Norms** | | |
| Applicable standards: | ODVA DeviceNet<br>Halogen-free acc. to 60754-2<br>Flame-retardant acc. to EN 50265-2-1 | ODVA DeviceNet<br>Halogen-free acc. to 60754-2<br>Flame-retardant acc. to EN 50265-2-1 |
| UL Style: | CMX 75°C CL2X | CMX 75°C CL2X |

## Application

HELUKABEL® DeviceNet™ PUR highly flexible for use in cable carriers with outstanding resistance to common coolants/lubricants. The special aspect of this bus system is that a data pair and a power supply pair are **always** integrated in one cable. The small cross-section is used for short distances or as a point-to- point connection; the large cross-section as main conductor for long distances and frequently in combination with the thin conductor as drain wire.

## Part no.

**81909,** DeviceNet PUR

**81910,** DeviceNet PUR

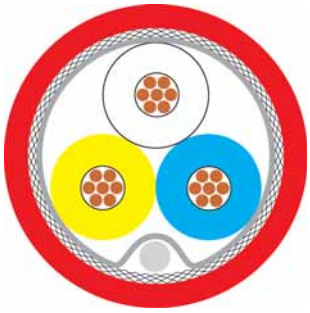
Dimensions and specifications may be changed without prior notice.

# BUS Cables

**CC-Link BUS fixed installed**

HELUKABEL®

PVC




## Type
## Fixed installation, indoor

## Cable structure
## 3x0.5 mm²

| | |
|---|---|
| Inner conductor diameter: | Copper, bare (AWG 20/7) |
| Core insulation: | Foam-skin-PE |
| Core colours: | wh, bu, ye |
| Stranding element: | Triple core |
| Separator: | Polyester foil over stranded bundle |
| Shielding 1: | Al-Foil |
| Total shielding: | Cu braid, tinned |
| Drain wire: | yes |
| Outer sheath material: | PVC |
| Cable external diameter: | app. 7,7 mm ± 0,3 mm |
| Outer sheath colour: | Red |

## Electrical data

| | |
|---|---|
| Characteristic impedance: | 110 Ohm ± 15 Ohm |
| Conductor resistance, max.: | 37,8 Ohm/km |
| Insulation resistance, min.: | 10 GOhm x km |
| Loop resistance: | 75 Ohm/km max. |
| Mutual capacitance: | 60 nF/km nom. |
| Test voltage: | 2 kV |
| Attenuation: | 1 MHz < 16,0 dB/100m<br>5 MHz < 35,0 dB/100m |

## Technical data

| | |
|---|---|
| Weight: | app. 77 kg/km |
| bending radius, repeated: | 120 mm |
| Operating temperature range min.: | -40°C |
| Operating temperature range max.: | +75°C |
| Caloric load, approx. value: | 1,10 MJ/m |
| Copper weight: | 40,00 kg/km |

## Norms

| | |
|---|---|
| Applicable standards: | CC-Link Specification 1.10<br>Flame-retardant acc. to EN 50265-2-1 |
| UL Style: | CM 75°C or PLTC |
| CSA standard: | CSA FT 4 |

## Application

HELUKABEL® CC-Link Bus PVC for fixed installation. The primary market is Asia, but the USA and the United Kingdom are using CC-Link increasingly. The cable has the appropriate approvals for these markets. A version with power supply conductors is optionally available. It is used particularly in channels.

## Part no.

**800497,** CC-Link communications cable

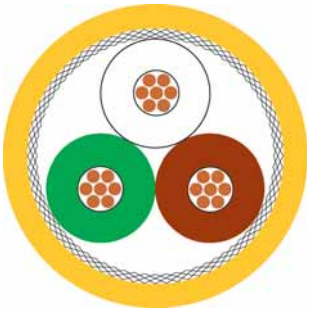
Dimensions and specifications may be changed without prior notice.

# BUS Cables

**SafetyBUS fixed installed + high flexible**

HELUKABEL®

FRNC + PUR




| Type<br>Cable structure | Fixed installation, indoor<br>3x0,75 mm² (stranded) | Drag Chain applications<br>3x0,75 mm² (stranded) |
|---|---|---|
| Inner conductor diameter: | Copper, bare (AWG 18/24) | Copper, bare (AWG 18) |
| Core insulation: | Foam-skin-PE | Foam-skin-PE |
| Core colours: | wh, bn, gn | wh, bn, gn |
| Stranding element: | Triple core | Triple core |
| Separator: | Polyester foil over stranded bundle | Polyester foil over stranded bundle |
| Shielding 1: | - | - |
| Total shielding: | Cu braid, tinned | Cu braid, tinned |
| Outer sheath material: | FRNC | PUR |
| Cable external diameter: | app. 7,5 mm ± 0,3 mm | app. 7,8 mm ± 0,2 mm |
| Outer sheath colour: | Yellow similar to RAL 1003 | Yellow similar to RAL 1003 |

## Electrical data

| | | |
|---|---|---|
| Characteristic impedance: | 110 Ohm ± 10 Ohm | 110 Ohm ± 10 Ohm |
| Conductor resistance, max.: | 27,7 Ohm/km | 26 Ohm/km |
| Insulation resistance, min.: | 5 GOhm x km | 5 GOhm x km |
| Loop resistance: | 52 Ohm/km max. | 52 Ohm/km max. |
| Mutual capacitance: | 45 nF/km nom. | 45 nF/km nom. |
| Nominal voltage: | 250 V | 250 V |
| Test voltage: | 3 kV | 3 kV |
| Attenuation: | 1 MHz < 1,6 dB/km<br>5 MHz < 3,4 dB/km<br>10 MHz < 5,6 dB/km<br>16 MHz < 7,5 dB/km | 1 MHz < 1,6 dB/km<br>5 MHz < 3,4 dB/km<br>10 MHz < 5,6 dB/km<br>16 MHz < 7,5 dB/km |

## Technical data

| | | |
|---|---|---|
| Weight: | app. 68 kg/km | app. 65 kg/km |
| bending radius, repeated: | 75 mm | 80 mm |
| Operating temperature range min.: | -25°C | -30°C |
| Operating temperature range max.: | +80°C | +80°C |
| Caloric load, approx. value: | 0,72 MJ/m | 0,76 MJ/m |
| Copper weight: | 50,00 kg/km | 50,00 kg/km |

## Norms

| | | |
|---|---|---|
| Applicable standards: | abutted at SafetyBUS p technical guidelines<br>copper wires 1.0<br>Halogen-free acc. to 60754-2<br>Flame-retardant acc. to IEC 60332-3 | abutted at SafetyBUS p technical guidelines<br>copper wires 1.0<br>Halogen-free acc. to 60754-2<br>Flame-retardant acc. to IEC 60332-1-2 |
| UL Style: | - | CMX 75°C (shielded) |

## Application

HELUKABEL® SafetyBUS FRNC for fixed installation; the PUR version is intended for use in cable carriers. Both versions are halogen-free.

## Part no.

**800651,** SafetyBus p

**800652,** SafetyBus p

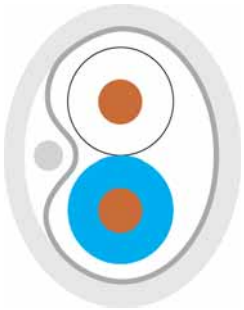
Dimensions and specifications may be changed without prior notice.

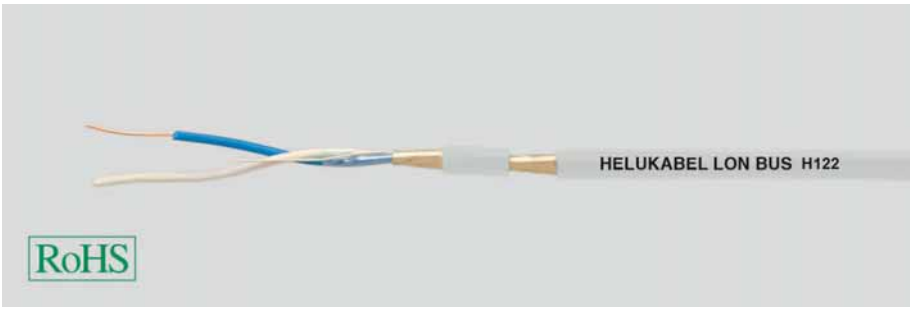
# BUS Cables

**LON BUS H122 + Y116**

HELUKABEL®

FRNC + PVC






| Type | Fixed installation, indoor | Mobile use |
|---|---|---|
| **Cable structure** | **1x2xAWG 22/1** | **1x2xAWG 16/19** |
| Inner conductor diameter: | Copper, tinned (AWG 22/1) | Copper, tinned (AWG 16/19) |
| Core insulation: | PE | PVC |
| Core colours: | wh, bu | wh, bk |
| Stranding element: | Double core | Double core |
| Separator: | Polyester foil over stranded bundle | Polyester foil over stranded bundle |
| Shielding 1: | - | - |
| Total shielding: | Al-Foil | - |
| Drain wire: | yes | - |
| Outer sheath material: | FRNC | PVC |
| Cable external diameter: | app. 4,4 mm ± 0,3 mm | app. 7,0 mm ± 0,4 mm |
| Outer sheath colour: | White | Grey |
| **Electrical data** | | |
| Characteristic impedance: | 100 Ohm ± 10 % | 85 Ohm ± 15 % |
| Conductor resistance, max.: | 57 Ohm/km | 15,8 Ohm/km |
| Insulation resistance, min.: | 5 GOhm x km | 0,02 GOhm x km |
| Loop resistance: | 114 Ohm/km max. | 31 Ohm/km max. |
| Mutual capacitance: | 45 nF/km nom. | 10 nF/km nom. |
| Nominal voltage: | 125 V | 300 V |
| Test voltage: | 0,7 kV | 2 kV |
| **Technical data** | | |
| Weight: | app. 25 kg/km | app. 65 kg/km |
| bending radius, repeated: | 70 mm | 85 mm |
| Operating temperature range min.: | -20°C | -20°C |
| Operating temperature range max.: | +75°C | +80°C |
| Caloric load, approx. value: | 0,337 MJ/m | 1,25 MJ/m |
| Copper weight: | 11,00 kg/km | 30,00 kg/km |
| Applicable standards: | Halogen-free acc. to 60754-2<br>Flame-retardant acc. to IEC 60332-1-2 | Flame-retardant acc. to IEC 60332-1-2 |

## Application

HELUKABEL® LON BUS H122 FRNC for fixed installation; version Y116 for mobile applications. For both versions: Use indoors is in fixed installations (H122) and as a patch cable (Y116) and must comply with DIN EN 50090-2-2 (VDE 0892 Part 2-2:1997-06).

## Part no.

**802187,** LON H122

**802188,** LON Y116

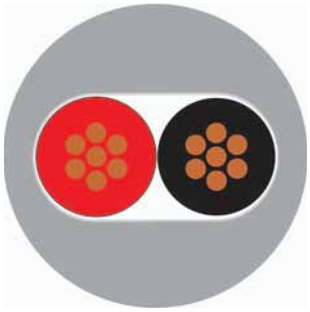
Dimensions and specifications may be changed without prior notice.

# BUS Cables

## LON BUS Y118 + H118

HELUKABEL®

PVC + FRNC




NEW

| Type<br>Cable structure | Mobile use<br>1x2xAWG 18/16 | Fixed installation, indoor<br>1x2xAWG 18/16 |
|---|---|---|
| Inner conductor diameter: | Copper, tinned (AWG 18/16) | Copper, tinned (AWG 18/16) |
| Core insulation: | PVC | PE |
| Core colours: | rd, bk | rd, bk |
| Stranding element: | Double core | Double core |
| Separator: | Polyester foil over stranded bundle | Polyester foil over stranded bundle |
| Shielding 1: | - | - |
| Total shielding: | - | - |
| Outer sheath material: | PVC | FRNC |
| Cable external diameter: | app. 5,4 mm ± 0,3 mm | app. 5,4 mm ± 0,3 mm |
| Outer sheath colour: | Grey similar to RAL 7001 | Grey similar to RAL 7001 |
| **Electrical data** | | |
| Characteristic impedance: | 85 Ohm ± 15 % | 85 Ohm ± 15 % |
| Conductor resistance, max.: | 14 Ohm/km | 14 Ohm/km |
| Insulation resistance, min.: | 0,02 GOhm x km | 0,02 GOhm x km |
| Loop resistance: | 28 Ohm/km max. | 28 Ohm/km max. |
| Mutual capacitance: | 10 nF/km nom. | 10 nF/km nom. |
| Nominal voltage: | 300 V | 300 V |
| Test voltage: | 1,5 kV | 1,5 kV |
| **Technical data** | | |
| Weight: | app. 40 kg/km | app. 40 kg/km |
| bending radius, repeated: | 85 mm | 85 mm |
| Operating temperature range min.: | -20°C | -20°C |
| Operating temperature range max.: | +80°C | +70°C |
| Caloric load, approx. value: | 1,25 MJ/m | 1,25 MJ/m |
| Copper weight: | 20,00 kg/km | 20,00 kg/km |
| Applicable standards: | Flame-retardant acc. to IEC 60332-1-2 | Halogen-free acc. to 60754-2<br>Flame-retardant acc. to IEC 60332-1-2 |

## Application

HELUKABEL® LON BUS Y118 PVC for mobile applications; version H118 FRNC for fixed installation. For both versions: use indoors acc. DIN EN 50090-2-2 (VDE 0892 Teil 2-2:1997-06).

## Part no.

**805660,** LON Y118

**805662,** LON H118

Dimensions and specifications may be changed without prior notice.



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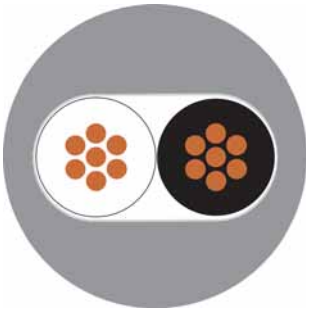
# BUS Cables

**LON BUS H116**

HELUKABEL®

FRNC

NEW




## Type
## Cable structure

**Fixed installation, indoor**
**1x2xAWG 16/19**

| | |
|---|---|
| Inner conductor diameter: | Copper, tinned (AWG 16/19) |
| Core insulation: | PE |
| Core colours: | wh, bk |
| Stranding element: | Double core |
| Separator: | Polyester foil over stranded bundle |
| Shielding 1: | - |
| Total shielding: | - |
| Outer sheath material: | FRNC |
| Cable external diameter: | app. 7,0 mm ± 0,4 mm |
| Outer sheath colour: | Grey similar to RAL 7001 |

## Electrical data

| | |
|---|---|
| Characteristic impedance: | 85 Ohm ± 15 % |
| Conductor resistance, max.: | 14 Ohm/km |
| Insulation resistance, min.: | 0,02 GOhm x km |
| Loop resistance: | 28 Ohm/km max. |
| Mutual capacitance: | 10 nF/km nom. |
| Nominal voltage: | 300 V |
| Test voltage: | 2 kV |

## Technical data

| | |
|---|---|
| Weight: | app. 65 kg/km |
| bending radius, repeated: | 85 mm |
| Operating temperature range min.: | -20°C |
| Operating temperature range max.: | +70°C |
| Caloric load, approx. value: | 1,25 MJ/m |
| Copper weight: | 30,00 kg/km |
| Applicable standards: | Halogen-free acc. to 60754-2<br>Flame-retardant acc. to IEC 60332-1-2 |

## Application

HELUKABEL® LON BUS H116 FRNC fored fix installation indoor acc. DIN EN 50090-2-2 (VDE 0892 Teil 2-2:1997-06).

## Part no.

**805661,** LON H116

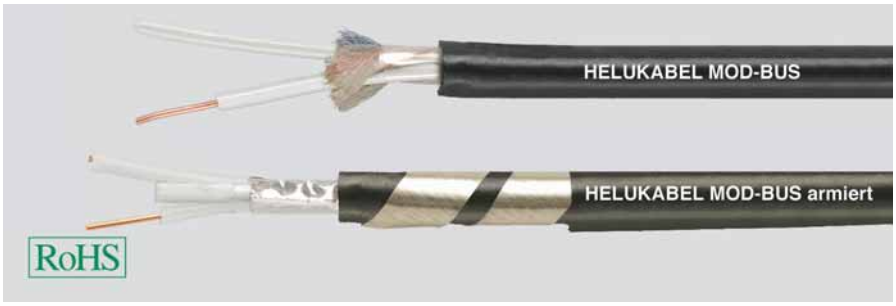
Dimensions and specifications may be changed without prior notice.

# BUS Cables

**MOD-BUS fixed installed**

HELUKABEL®

PVC + armoured




NEW

| Type<br>Cable structure | Fixed installation, indoor<br>1x2x0,75-105 LI | Fixed installation, indoor<br>1x2x0,75-105 LI armoured |
|---|---|---|
| Core insulation: | PE | PE |
| Core colours: | wh, bu | wh, bu |
| Stranding element: | 2 cores + 2 fillers stranded together | 2 cores + 2 fillers stranded together |
| Separator: | Polyester foil over stranded bundle | Polyester foil over stranded bundle |
| Shielding 1: | Al-Foil | Al-Foil |
| Total shielding: | - | - |
| Drain wire: | yes | yes |
| Armouring: | - | other |
| Outer sheath material: | PVC | PVC |
| Cable external diameter: | app. 7,5 mm ± 0,3 mm | app. 12,1 mm ± 0,5 mm |
| Outer sheath colour: | Black similar to RAL 9005 | Black similar to RAL 9005 |
| **Electrical data** | | |
| Characteristic impedance: | 105 Ohm ± 20 Ohm | 105 Ohm ± 20 Ohm |
| Conductor resistance, max.: | 25 Ohm/km | 25 Ohm/km |
| Insulation resistance, min.: | 1 GOhm x km | 1 GOhm x km |
| Loop resistance: | 50 Ohm/km max. | 50 Ohm/km max. |
| Nominal voltage: | 300 V | 300 V |
| **Technical data** | | |
| Weight: | app. 70 kg/km | app. 263 kg/km |
| bending radius, repeated: | 80 mm | 182 mm |
| Operating temperature range min.: | -30°C | -30°C |
| Operating temperature range max.: | +70°C | +70°C |
| Copper weight: | 45,00 kg/km | 45,00 kg/km |
| Applicable standards: | Flame-retardant acc. to IEC 60332-3 | Flame-retardant acc. to IEC 60332-3 |

## Application

HELUKABEL® MOD-Bus PVC for standard application in this industry network.

## Part no.

**805698,** MOD-Bus Single Pair

**805697,** MOD-Bus Single Pair armoured

Dimensions and specifications may be changed without prior notice.



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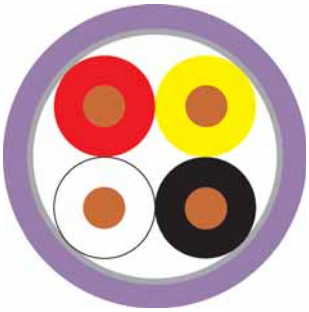
# BUS Cables

**E-BUS / KNX fixed installed**

HELUKABEL®

PVC




| Type | 2-pairs | 2-pairs |
|---|---|---|
| **Cable structure** | **2x2x0.8 mm** | **2x2x0.8 mm** |
| Inner conductor: | Copper, bare | Copper, bare |
| Core insulation: | PVC | PVC |
| Core colours: | wh, ye, rd, bk | wh, ye, rd, bk |
| Stranding element: | Star quad | Star quad |
| Separator: | Polyester foil over stranded bundle | Polyester foil over stranded bundle |
| Shielding 1: | - | - |
| Total shielding: | Al-Foil | Al-Foil |
| Drain wire: | yes | yes |
| Outer sheath material: | PVC | PVC |
| Cable external diameter: | app. 6,6 mm ± 0,3 mm | app. 6,6 mm ± 0,3 mm |
| Outer sheath colour: | Blue Lilac similar to RAL 4005 | Green similar to RAL 6010 |

## Electrical data

| | | |
|---|---|---|
| Characteristic impedance: | 100 Ohm | 100 Ohm |
| Conductor resistance, max.: | 73,2 Ohm/km | 73,2 Ohm/km |
| Insulation resistance, min.: | 0,1 GOhm x km | 0,1 GOhm x km |
| Loop resistance: | 146 Ohm/km max. | 146 Ohm/km max. |
| Mutual capacitance: | 100 nF/km nom. | 100 nF/km nom. |
| Test voltage: | 4 kV | 4 kV |

## Technical data

| | | |
|---|---|---|
| Weight: | app. 64 kg/km | app. 64 kg/km |
| bending radius, repeated: | 95 mm | 95 mm |
| Operating temperature range min.: | -30°C | -30°C |
| Operating temperature range max.: | +70°C | +70°C |
| Caloric load, approx. value: | 0,90 MJ/m | 0,90 MJ/m |
| Copper weight: | 25,00 kg/km | 25,00 kg/km |

## Norms

| | | |
|---|---|---|
| Applicable standards: | EIB/KNX standard<br>Flame-retardant acc. to EN 50265-2-1 | EIB/KNX standard<br>Flame-retardant acc. to EN 50265-2-1 |

## Application

HELUKABEL® E-BUS EIB/KNX PVC for fixed installation. The E-Bus cable is intended for transmission of bus signals in intelligent building systems. The cables ensure perfect communication in compliance with EIB regulations. They can be installed over, in and under plaster, in conduits and cable channels, in dry, damp and wet rooms as well as outdoors - if protected from direct sunlight. Wiring together with high-power cables is possible without limitation. The EIB/KNX bus can be used to control lighting, blinds, heating, ventilation, indicator boards etc.

## Part no.

**81081,** E-BUS / KNX

**81663,** E-BUS / KNX

Dimensions and specifications may be changed without prior notice.

# BUS Cables

**E-BUS / KNX fixed installed**

HELUKABEL®

FRNC + PVC


| Type<br>Cable structure | 2-pairs<br>2x2x0.8 mm | 4-pairs<br>4x2x0.8 mm |
|---|---|---|
| Inner conductor: | Copper, bare | Copper, bare |
| Core insulation: | PE | PVC |
| Core colours: | wh, ye, rd, bk | wh, ye, rd, gn, bu, bn, wh, wh |
| Stranding element: | Star quad | Double core |
| Separator: | Polyester foil over stranded bundle | Polyester foil over stranded bundle |
| Shielding 1: | - | - |
| Total shielding: | Al-Foil | Al-Foil |
| Drain wire: | yes | yes |
| Outer sheath material: | FRNC | PVC |
| Cable external diameter: | app. 6,6 mm ± 0,3 mm | app. 8,2 mm ± 0,4 mm |
| Outer sheath colour: | Blue Lilac similar to RAL 4005 | Blue Lilac similar to RAL 4005 |
| **Electrical data** | | |
| Characteristic impedance: | 100 Ohm | 100 Ohm |
| Conductor resistance, max.: | 73,2 Ohm/km | 73,2 Ohm/km |
| Insulation resistance, min.: | 0,1 GOhm x km | 0,1 GOhm x km |
| Loop resistance: | 146 Ohm/km max. | 146 Ohm/km max. |
| Mutual capacitance: | 100 nF/km nom. | 100 nF/km nom. |
| Test voltage: | 4 kV | 4 kV |
| **Technical data** | | |
| Weight: | app. 54 kg/km | app. 92 kg/km |
| bending radius, repeated: | 95 mm | 120 mm |
| Operating temperature range min.: | -30°C | -30°C |
| Operating temperature range max.: | +70°C | +70°C |
| Caloric load, approx. value: | 0,58 MJ/m | 1,37 MJ/m |
| Copper weight: | 25,00 kg/km | 41,00 kg/km |
| **Norms** | | |
| Applicable standards: | EIB/KNX standard<br>Halogen-free acc. to 60754-2<br>Flame-retardant acc. to EN 50265-2-1 | EIB/KNX standard<br>Flame-retardant acc. to EN 50265-2-1 |

## Application

HELUKABEL® E-BUS / KNX FRNC + PVC for fixed installation. If the application requires a halogen-free installation, the FRNC version is the right choice. The E-Bus cable is intended for transmission of bus signals in intelligent building systems. The cables ensure perfect communication in compliance with EIB/KNX regulations. They can be installed over, in and under plaster, in conduits and cable channels, in dry, damp and wet rooms as well as outdoors - if protected from direct sunlight. Wiring together with high-power cables is possible without limitation. The EIB/KNX bus can be used to control lighting, blinds, heating, ventilation, indicator boards etc.

| Part no. | | |
|---|---|---|
| | **80826,** E-BUS / KNX | **81077,** E-BUS / KNX |

Dimensions and specifications may be changed without prior notice.



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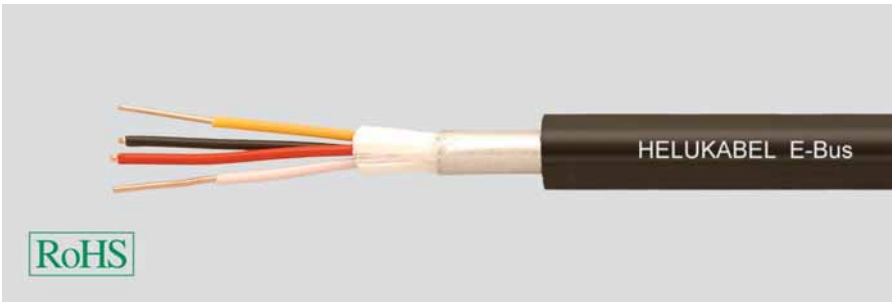
# BUS Cables

**E-BUS / KNX BURIAL fixed installed**

HELUKABEL®

PE, BURIAL




## Type
## Direct burial
## Cable structure
## 2x2x0.8 mm

| | |
|---|---|
| Inner conductor: | Copper, bare |
| Core insulation: | PE |
| Core colours: | wh, ye, rd, bk |
| Stranding element: | Star quad |
| Separator: | Polyester foil over stranded bundle |
| Shielding 1: | - |
| Total shielding: | Al-Foil |
| Outer sheath material: | PE |
| Cable external diameter: | app. 8,8 mm ± 0,3 mm |
| Outer sheath colour: | Black similar to RAL 9005 |

## Electrical data

| | |
|---|---|
| Characteristic impedance: | 100 Ohm |
| Conductor resistance, max.: | 73,2 Ohm/km |
| Insulation resistance, min.: | 5 GOhm x km |
| Loop resistance: | 146 Ohm/km max. |
| Mutual capacitance: | 55 nF/km nom. |
| Test voltage: | 0,8 kV |

## Technical data

| | |
|---|---|
| Weight: | app. 75 kg/km |
| bending radius, repeated: | 130 mm |
| Operating temperature range min.: | -20°C |
| Operating temperature range max.: | +70°C |
| Caloric load, approx. value: | 2,00 MJ/m |
| Copper weight: | 25,00 kg/km |

## Norms

| | |
|---|---|
| Applicable standards: | EIB/KNX standard<br>Halogen-free acc. to 60754-2 |

## Application

HELUKABEL® E-BUS / KNX ERD with PE jacket for fixed installation in the ground or outdoors and as a connection between buildings or to EIB/KNX components on the building. They can be installed over, in and under plaster, in conduits and cable channels, in dry, damp and wet rooms as well as outdoors - if protected from direct sunlight. Wiring together with high-power cables is possible without limitation. The EIB/KNX bus can be used to control lighting, blinds, heating, ventilation, indicator boards etc.

## Part no.

**802800,** E-BUS / KNX BURIAL

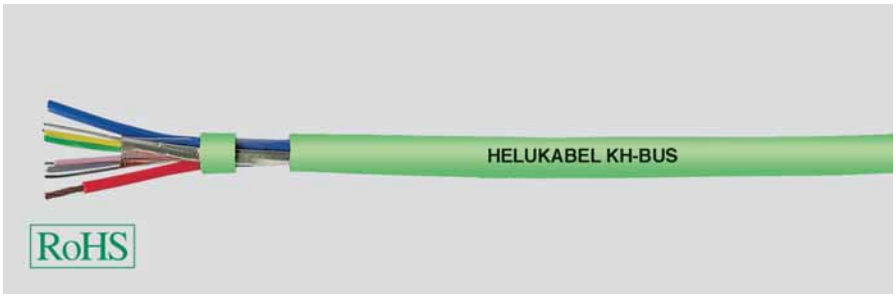
Dimensions and specifications may be changed without prior notice.

# BUS Cables

**KH-BUS fixed installed**

HELUKABEL®

PVC + FRNC



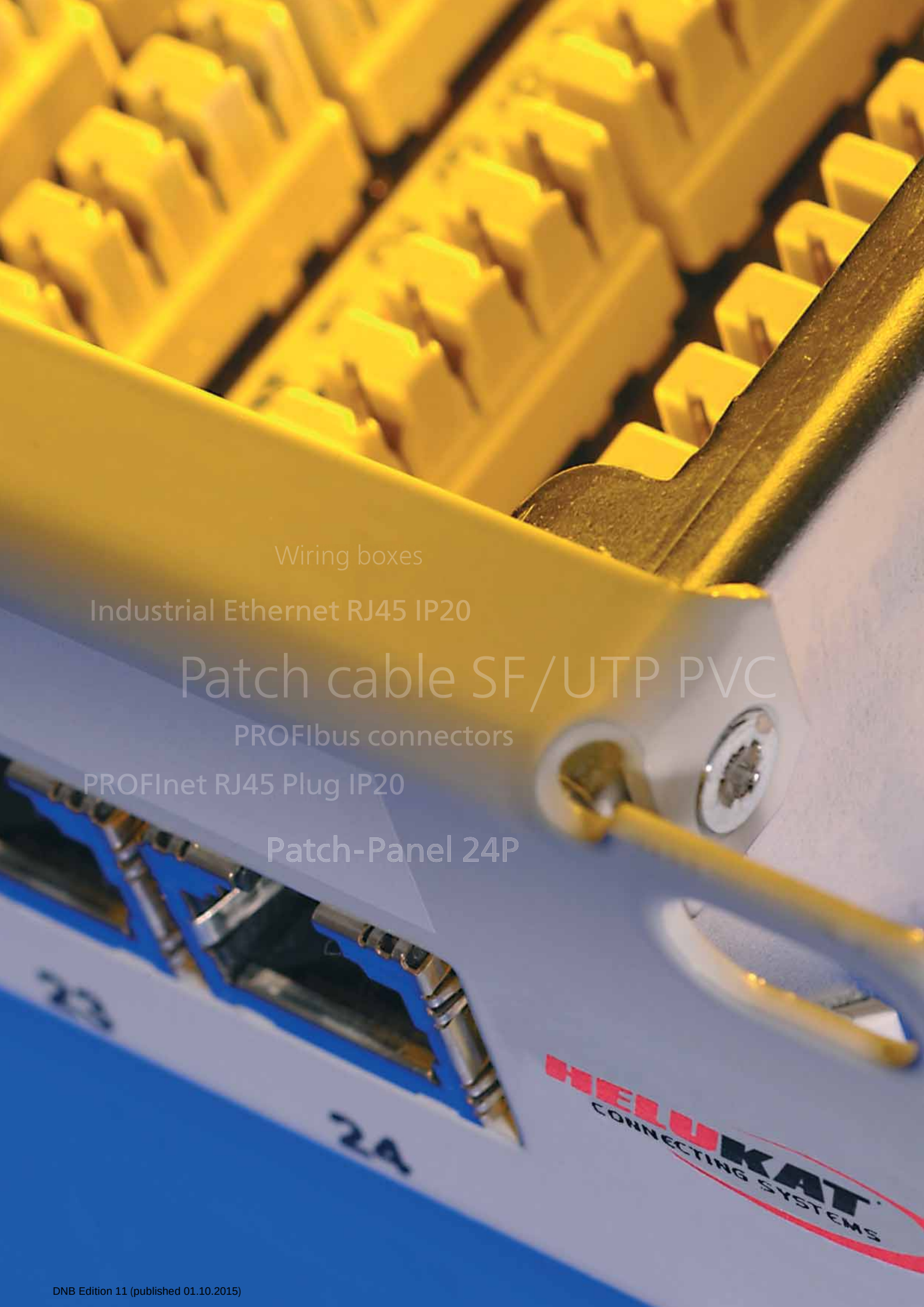

| Type<br>Cable structure | Hospital-Bus<br>2x1.5mm² (stranded) +<br>2x2x0.60 mm (solid) | Hospital-Bus<br>2x1.5mm² (stranded) +<br>2x2x0.60 mm (solid) |
|---|---|---|
| Inner conductor, power core: | Copper, bare | Copper, bare |
| Inner conductor, data core: | Copper, tinned | Copper, tinned |
| Core insulation, power core: | PVC | PE |
| Core insulation, data core: | PE | PE |
| Core colours, power core: | rd, bu | rd, bu |
| Core colours, data core: | gn/ye, gy/pk | gn/ye, gy/pk |
| Stranding element, data core: | Double core | Double core |
| Shielding, data pair: | PP foil + aluminium-lined foil + PP foil | PP foil + aluminium-lined foil + PP foil |
| Drain wire: | yes | yes |
| Outer sheath material: | PVC | FRNC |
| Cable external diameter: | app. 8,0 mm ± 0,3 mm | app. 8,0 mm ± 0,3 mm |
| Outer sheath colour: | Green similar to RAL 6001 | Green similar to RAL 6001 |
| **Electrical data** | | |
| Insulation resistance, min.: | 0,02 GOhm x km | 0,02 GOhm x km |
| Mutual capacitance: | 70 nF/km nom. | 70 nF/km nom. |
| Test voltage: | 2 kV | 2 kV |
| **Technical data** | | |
| Weight: | app. 90 kg/km | app. 93 kg/km |
| bending radius, repeated: | 120 mm | 120 mm |
| Operating temperature range min.: | -40°C | -25°C |
| Operating temperature range max.: | +80°C | +80°C |
| Caloric load, approx. value: | 1,01 MJ/m | 0,86 MJ/m |
| Copper weight: | 53,00 kg/km | 53,00 kg/km |

## Application

HELUKABEL® KH-BUS PVC + FRNC for fixed installation of patient calling systems. Simple and fast installation is an important factor there. For this reason, a 6-conductor hybrid cable is used to connect the individual components of the calling system. This cable is used for the power supply, speech and data transmission. The FRNC version is the right choice when a halogen-free installation is required.

| Part no. | **81085,** KH-BUS | **81447,** KH-BUS |
|---|---|---|

Dimensions and specifications may be changed without prior notice.




DNB Edition 11 (published 01.10.2015)

# COPPER DATA CONNECTION TECHNICS





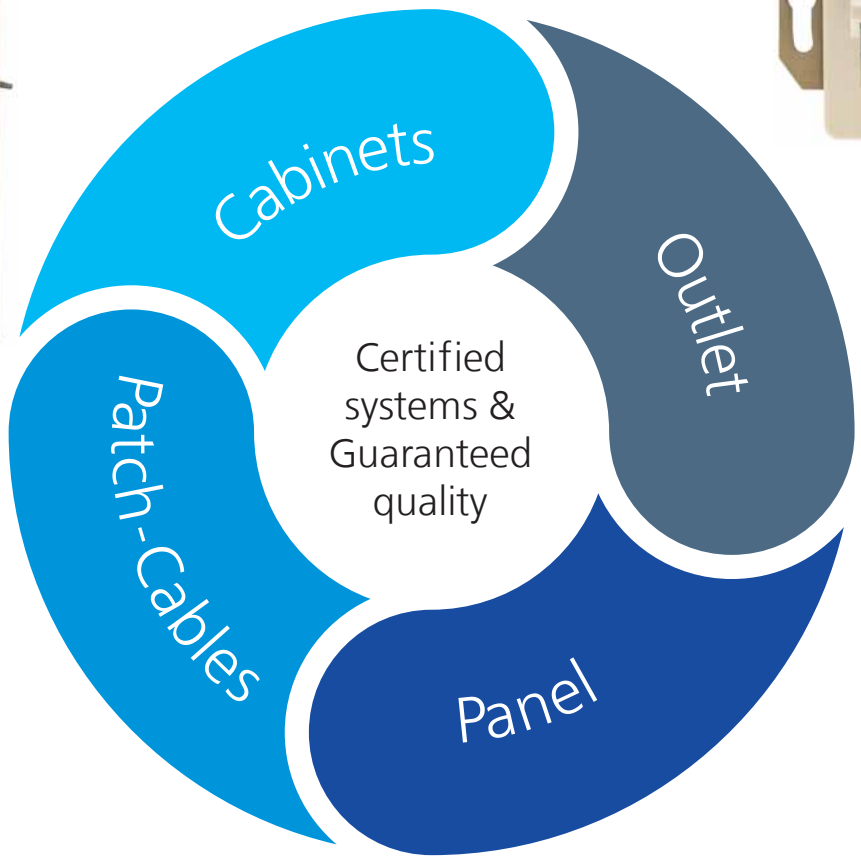
DNB Edition 11 (published 01.10.2015)

# COMPLETE SYSTEM SOLUTIONS

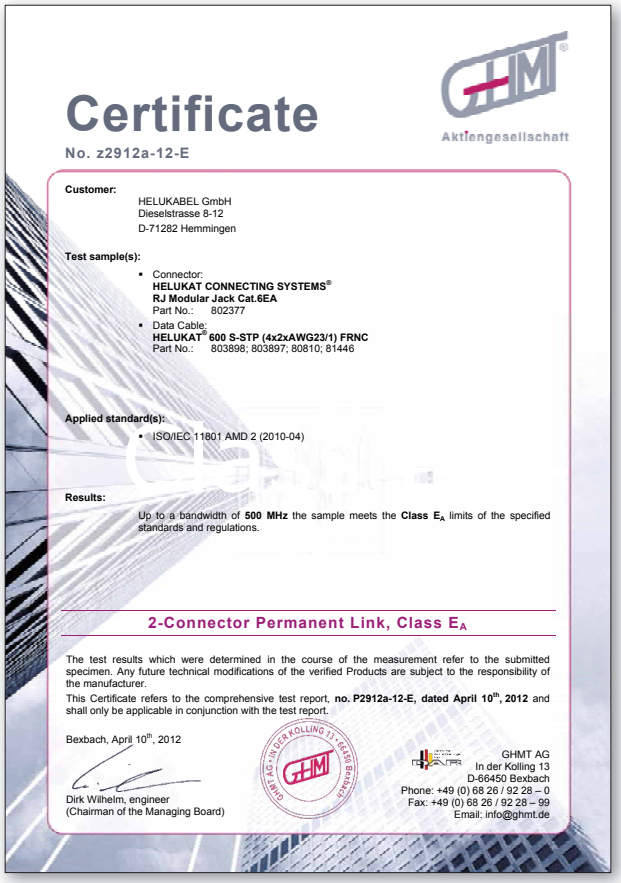
As a result of the drastic growth of the volume of data handled by data and network systems together with subsequently lower tolerance deviations allowed in relation to standard specifications, ensuring the optimum level of component integration and efficiency is sure to be a vital factor in the creation of successful systems in the future.

In recent years, **HELUKAT®** has earned an excellent reputation in the area of structured copper data wiring. Superior quality combined with expert technical assistance and prompt delivery to customers is what makes HELUKABEL® the brand of choice. With **HELUKAT CONNECTING SYSTEMS®,** we have come full circle to provide you with a complete wiring system comprising everything from the installation cable, patch panels and RJ45 sockets all the way to patch cables and data cabinets. To provide customers and users with a sufficient level of transparency, components have been subjected to a non-based examination carried out according to the channel link. The GHMT company has certified our products for category 6 and classes D, E and Ea.

Simply specify the network structures you need, and let the superior quality and reliability of HELUKAT CONNECTING SYSTEMS® do the rest.







# Certificate

Aktiengesellschaft

No. z2912a-12-E

**Customer:**

HELUKABEL GmbH
Dieselstrasse 8-12
D-71282 Hemmingen

**Test sample(s):**

- Connector:
  **HELUKAT CONNECTING SYSTEMS®**
  **RJ Modular Jack Cat.6EA**
  Part No.: 802377
- Data Cable:
  **HELUKAT® 600 S-STP (4x2xAWG23/1) FRNC**
  Part No.: 803898; 803897; 80810; 81446

**Applied standard(s):**

- ISO/IEC 11801 AMD 2 (2010-04)

**Results:**

Up to a bandwidth of **500 MHz** the sample meets the **Class $E_A$** limits of the specified standards and regulations.

## 2-Connector Permanent Link, Class $E_A$

The test results which were determined in the course of the measurement refer to the submitted specimen. Any future technical modifications of the verified Products are subject to the responsibility of the manufacturer.

This Certificate refers to the comprehensive test report, **no. P2912a-12-E, dated April 10th, 2012** and shall only be applicable in conjunction with the test report.

Bexbach, April 10th, 2012

Dirk Wilhelm, engineer
(Chairman of the Managing Board)

GHMT AG
In der Kolling 13
D-66450 Bexbach
Phone: +49 (0) 68 26 / 92 28 – 0
Fax: +49 (0) 68 26 / 92 28 – 99
Email: info@ghmt.de

# Zertifikat

**Auftraggeber:** **HELUKABEL GmbH**
**Dieselstraße 8-12**
**D-71282 Hemmingen**

**Prüfling:**

Installationskabel: 90m — **Helukat 600 4x2xAWG23 S-STP**
Art.-Nr.: 80810

Anschlussdose: **Helukat Connecting Systems Datendose UP**
Art.-Nr.: 82851

Verteilerfeld: **Helukat Connecting Systems Patch Panel 24 Port**
Art.-Nr.: 82848

**Bewertungsstandards:** ISO/IEC 11801: 2002
Information technology – Cabling for customer premises.

EN 50173-1: 2002
Information technology – Generic cabling systems –
Part 1: General requirements and office areas

**Resultat:** Der Prüfling hält bei den im Prüfbericht genannten Prüfparametern die Grenzwerte der besagten Vorgabedokumente **nach Klasse E im Permanent-Link von 90m ein.**

Die bei der Prüfung ermittelten Ergebnisse beziehen sich auf den beschriebenen und vom Auftraggeber vorgelegten Prüfling. Zukünftige technische Änderungen der Datenkabel und Steckverbinder unterliegen dem Verantwortungsbereich der Hersteller.

Dieses Zertifikat verweist auf den ausführlichen Prüfbericht **PB-Nr. P1444b-05-D vom 14. Juli 2005** und ist nur in Verbindung mit diesem gültig.

Bexbach, 14. Juli 2005

Dipl.-Ing. Dirk Wilhelm
(Vorstandsvorsitzender)

GHMT AG
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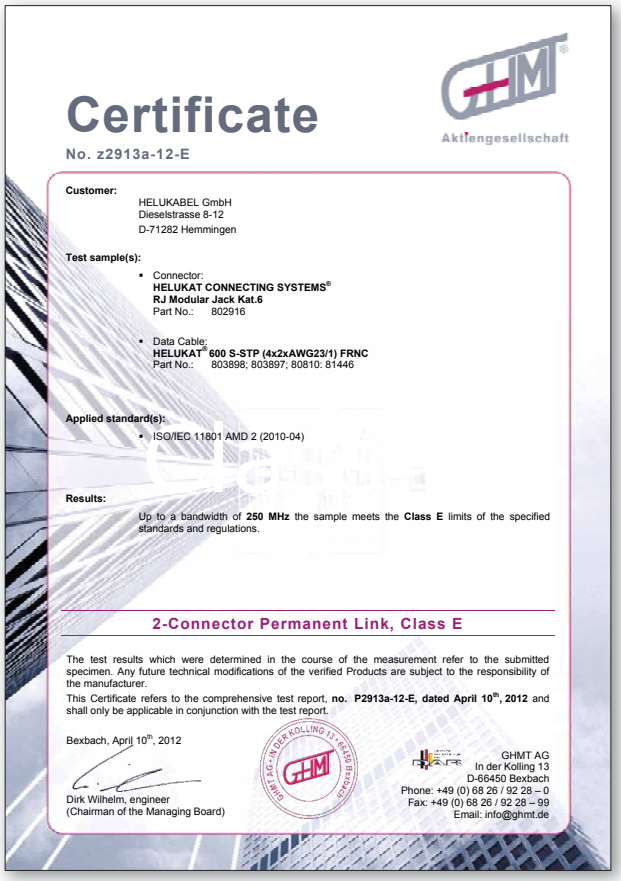
D-66450 Bexbach
Tel.: +49 (0) 68 26 / 92 28 – 0
Fax: +49 (0) 68 26 / 92 28 – 99
E-Mail: info@ghmt.de
http://www.ghmt.de

GHMT Aktiengesellschaft



# Certificate

Aktiengesellschaft

No. z2913a-12-E

**Customer:**

HELUKABEL GmbH
Dieselstrasse 8-12
D-71282 Hemmingen

**Test sample(s):**

- Connector:
  **HELUKAT CONNECTING SYSTEMS®**
  **RJ Modular Jack Kat.6**
  Part No.: 802916
- Data Cable:
  **HELUKAT® 600 S-STP (4x2xAWG23/1) FRNC**
  Part No.: 803898; 803897; 80810: 81446

**Applied standard(s):**

- ISO/IEC 11801 AMD 2 (2010-04)

**Results:**

Up to a bandwidth of **250 MHz** the sample meets the **Class E** limits of the specified standards and regulations.

## 2-Connector Permanent Link, Class E

The test results which were determined in the course of the measurement refer to the submitted specimen. Any future technical modifications of the verified Products are subject to the responsibility of the manufacturer.

This Certificate refers to the comprehensive test report, **no. P2913a-12-E, dated April 10th, 2012** and shall only be applicable in conjunction with the test report.

Bexbach, April 10th, 2012

Dirk Wilhelm, engineer
(Chairman of the Managing Board)

GHMT AG
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D-66450 Bexbach
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Fax: +49 (0) 68 26 / 92 28 – 99
Email: info@ghmt.de

# Certificate

**Customer:** **HELUKABEL® GmbH**
Dieselstr. 8-12
D-71282 Hemmingen

**Description:**

Modul — **HELUKAT CONNECTING SYSTEMS®**
Modularsystem Keystone Cat. 6EA 500 MHz
Part-No.: 802377

Connector — **HELUKAT CONNECTING SYSTEMS®**
Connector Cat. 7 to connect Data Cables

Data Cable
1 x 84m
2 x 3m
**HELUKAT® 600MHz**
Data Cable S-STP 4x2xAWG23/1 FRNC 600MHz
Part-No.: 80810

Patchcord
2 x 5m
**HELUKAT CONNECTING SYSTEMS®**
S-STP 4x2xAWG26/7 FRNC 600MHz
RJ45 Category 6 (Siewart 39), Length 5,0m

**Applied standards:**

ISO/IEC 11801 Amendment 1: 2008-04
Information technology – Generic cabling for customer premises

ISO/IEC TR-24750 Assessment and mitigation of installed balanced cabling channels in order to support 10GBASE-T

TIA/EIA-568-B.2-10
Transmission performance specifications for 4-pair 100 Ω augmented category 6 cabling

ANSI/TIA-TSB-155
Additional guidelines for 4-pair 100 Ω category 6 cabling for 10GBase-T

IEEE 802.3an TM-2006
Local and Metropolitan Area Networks (10 GBASE-T)

**Results:** Up to a bandwidth of **Augmented Class E (500MHz)** the sample, a **4-Connector-Channel**, meet the limits of the specified standards and regulations.

The test results which were determined in the course of the measurement refer to the submitted specimen. Any future technical modifications of the data cables or connectors are subject to the responsibility of the manufacturer.

This Certificate refers to the comprehensive test report, **no. P1918b-08-E, from July 31st 2008** and shall only be applicable in conjunction with the test report.

Bexbach, July 31st 2008

Dirk Wilhelm, engineer
(Chairman of the Managing Board)

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E-Mail: info@ghmt.de
http://www.ghmt.de

GHMT Aktiengesellschaft

# MODULAR-SYSTEM RJ45

## Jack/Keystone

| | | | | | | |
|---|---|---|---|---|---|---|
| Category: | $7_A$ | $6_A$ | 6 | 6 | 6 | 5e |
| Plug type: | AMP-Twist | RJ45 8(8) | | | | |
| Screening: | yes | | | no | | |
| Colour: | metallic | | | black | white | |
| Part no: | **805586** | **802377** | **802916** | **804691** | **805044** | **804645** |
| Packing unit: | 10 | 12 | | | | |
| Dust Protection: | yes | yes | no | yes | yes | no |

## Panel

| | | | |
|---|---|---|---|
| Version: | Modular Panel | | |
| Module type: | AMP-Twist | RJ45 | |
| Colour: | black | grey | black |
| Max. number of modules: | 24 | | |
| Part no: | **805587** | **802376** | **805429** |
| Packing unit: | 1 | | |
| Dust Protection: | from Keystone | optional see Accessories | |

## Outlet

| | | | | |
|---|---|---|---|---|
| Version: | Support for module | | | |
| Module type: | RJ45 | | | |
| Colour: | white | | | Metall |
| Max. number of modules: | 3 | 2 | 1 | 2 |
| Part no: | **802986** | **802378** | **802985** | **804763** |
| Packing unit: | 4 | | | 1 |
| Dust Protection: | optional see Accessories | | | no |



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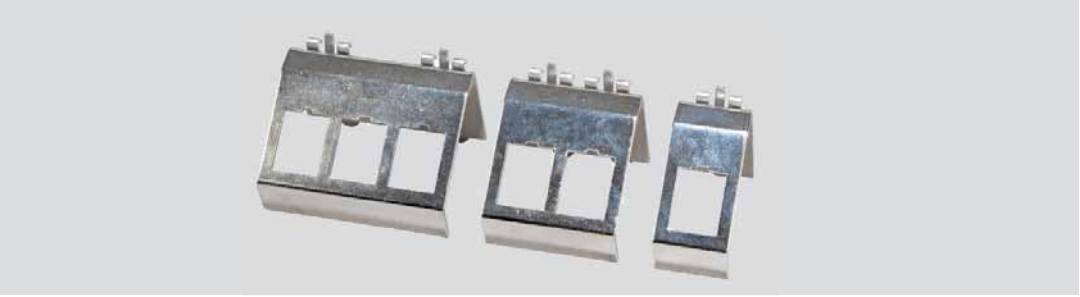
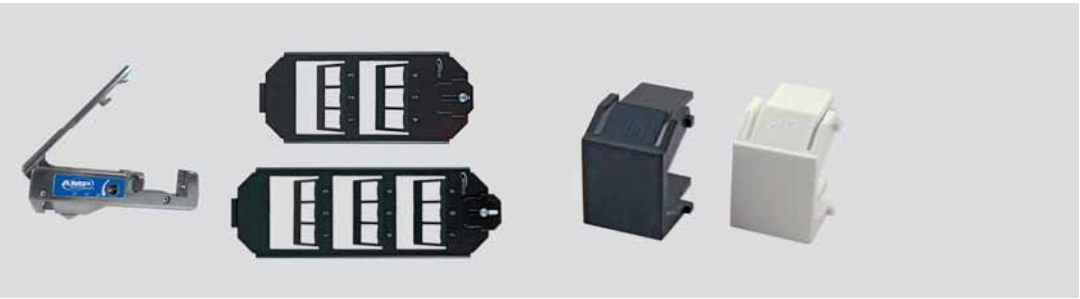
## Plug

| | | |
|---|---|---|
| Category: | $7_A$ | |
| Version: | AMP-Twist Plu | |
| Type of conductor: | Stranded conductor | Solid conductor |
| Part no: | **805588** | **805589** |
| Packing unit: | 10 | |



## DIN rail module

| | | | |
|---|---|---|---|
| Version: | DIN rail module for Jack/Keystone | | |
| Max. number of modules: | 1 | 2 | 3 |
| Colour: | metallic | | |
| Part no: | **805403** | **805404** | **805405** |
| Packing unit: | 1 | | |



## Accessories

| | | | | | |
|---|---|---|---|---|---|
| Part no: | 805381 | 802988 | 802987 | 802990 | 804286 |
| Description: | Tools for AMP-Twist Jack | Floor tank frame set 3x3 Port empty | Floor tank frame set 2x3 Port empty | Dust Protection forKeystone-system Outlet and Panels | |
| Colour: | metallic | black | | white | black |

**Norms and standards**
Kat. 5, Kat. 5e, Kat. 6, Kat. $6_A$, Kat. $7_A$ according to the specifications of each product. More informations can be found at our data sheets.
**Application**
As floor distributor in applications of digital and analog image, data and voice transmission.



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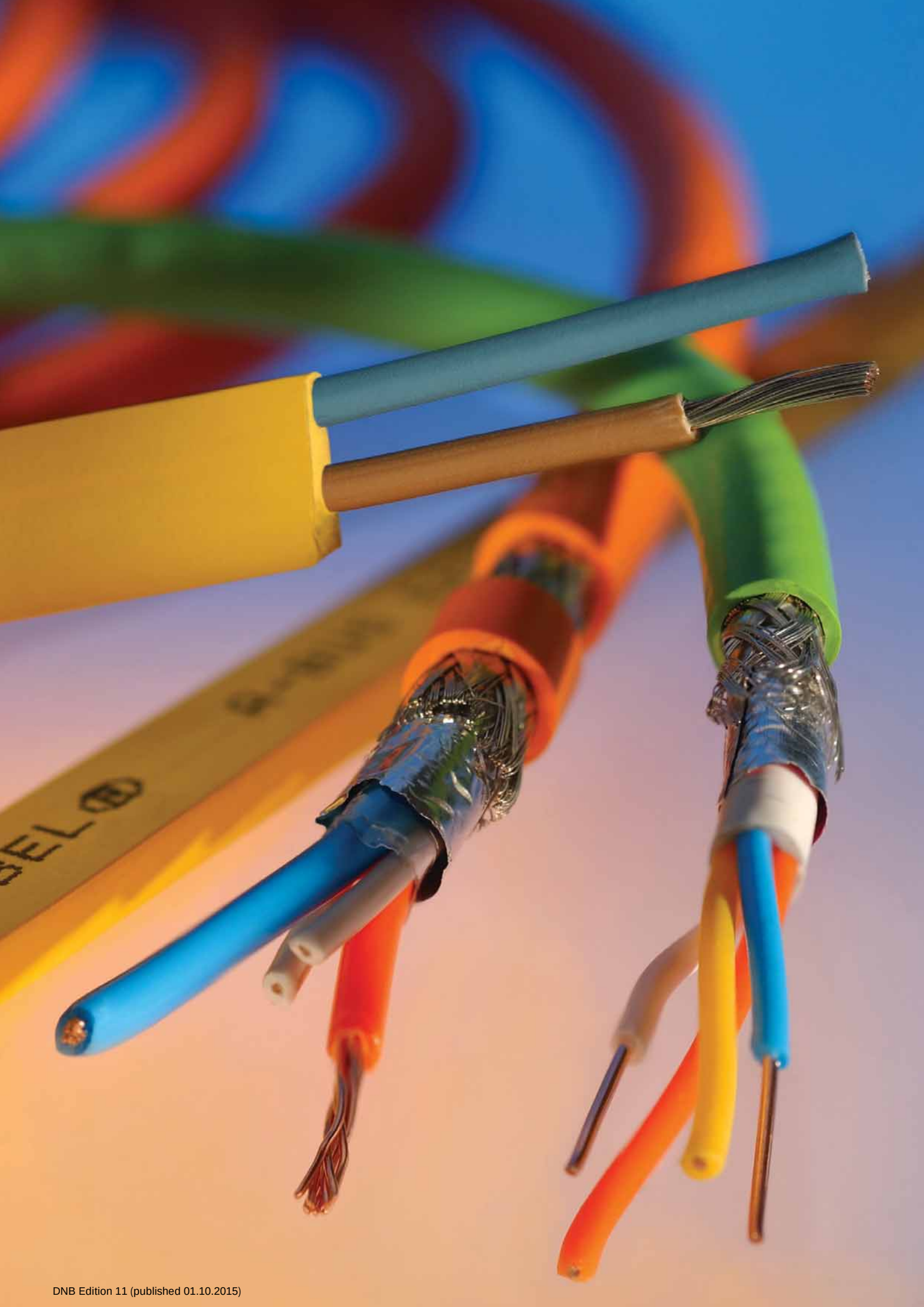

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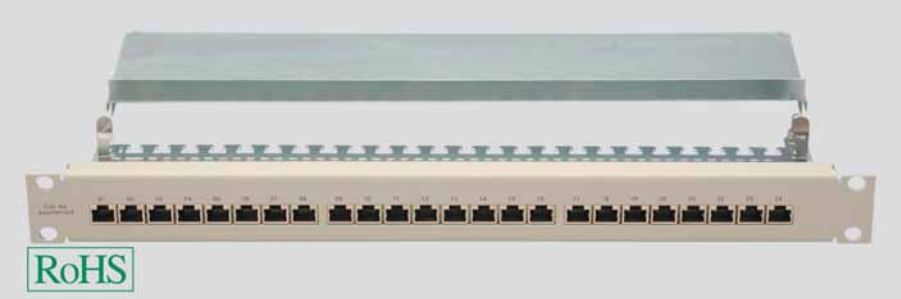
# Patch-Panels RJ45

Category 6E$_A$




## Type

**Patch panel category 24P 6EA 500MHz**

## Configuration

| | |
|---|---|
| Housing material: | Steel plate, solid |
| Colour: | Grey similar to RAL 7035 |
| Board: | 3x8 mother board, number-coded |
| Push-on connector type: | RJ45(8/8) |
| Number of bushes: | 24 |
| Type of screen: | Overall screen |
| Screen removal: | metalized cable straps |
| Strain relief: | by means of cable straps |
| Cover lock: | Quick-action snap cover |

## Connecting system

| | |
|---|---|
| Connection type: | LSA plus - insulation piercing connections |
| Suitable for cable diameter: | 0.4 - 0.64mm (AWG 26 - 22) |
| Insulation diameter, min.: | 0,7 - 1,6 mm (PE) |

## Assignment type

EIA/TIA 568 A + EIA/TIA 568 B

## Dimension

| | |
|---|---|
| Width: | 483 mm |
| Depth: | 125 mm |
| Number of height modules (HM): | 1 |
| Fastening dimensions: | 19" |

## Norms and standards

HELUKAT® CONNECTING SYSTEMS® system component up to 500 MHz (10 GBit Ethernet) in accordance with category 6a EIA/TIA 568-B.2-10, IEEE 802.3an TM-2006, ISO/IEC 11801 (Amendment 1 JTC 1/SC N1255), ISO/IEC TR-24750 and EN 55022 (EMV).

## Application

As floor distributor in applications of digital and analog image, data and voice transmission.

## Part no.

**802024**

Dimensions and specifications may be changed without prior notice.

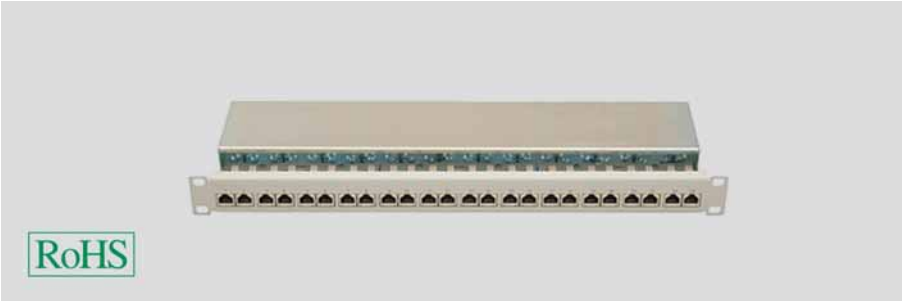
## Packing unit

**1**

# Patch-Panels RJ45

HELUKAT® CONNECTING SYSTEMS

Category 6 / Class E




## Type

**Patch panel class E 24P**

## Configuration

| | |
|---|---|
| Housing material: | Steel plate, solid |
| Colour: | Grey similar to RAL 7035 |
| Board: | 3x8 mother board, colour and number-coded |
| Push-on connector type: | RJ45(8/8) |
| Number of bushes: | 24 |
| Type of screen: | Overall screen |
| Screen removal: | via continuous screening tape |
| Strain relief: | via pre-installed cable clips |
| Cover lock: | Quick-action snap cover |

## Connecting system

| | |
|---|---|
| Connection type: | LSA plus - insulation piercing connections |
| Suitable for cable diameter: | 0.4 - 0.64mm (AWG 26 - 22) |
| Insulation diameter, min.: | 0,7 - 1,7 mm (PE) |

## Assignment type

EIA/TIA 568 A + EIA/TIA 568 B

## Dimension

| | |
|---|---|
| Width: | 483 mm |
| Depth: | 148 mm |
| Number of height modules (HM): | 1 |
| Fastening dimensions: | 19" |

## Norms and standards

HELUKAT® CONNECTING SYSTEMS® system component up to 250 MHz in the parmanent link of category 6 / Class E in accordance with ISO 11801, 2nd edition, EN 50173, 2nd edition, EIA/TIA 568 B, and EN 55022 (EMC).

## Application

As floor distributor in applications of digital and analog image, data and voice transmission.

## Part no.

**82848**

Dimensions and specifications may be changed without prior notice.

## Packing unit

**1**

# Patch-Panels RJ45 unscreened

Category 6/ Class E


## Type

**Patch-Panel unscreened class E 24P**

## Configuration

| | |
|---|---|
| Housing material: | Steel plate, solid |
| Colour: | Black similar to RAL 9005 |
| Board: | 3x8 mother board, colour and number-coded |
| Push-on connector type: | RJ45(8/8) |
| Number of bushes: | 24 |
| Type of screen: | no |
| Strain relief: | by means of cable straps |

## Connecting system

| | |
|---|---|
| Connection type: | LSA plus - insulation piercing connections |
| Suitable for cable diameter: | 0.4 - 0.64mm (AWG 26 - 22) |
| Insulation diameter, min.: | 0,7 - 1,7 mm (PE) |

## Assignment type

EIA/TIA 568 A + EIA/TIA 568 B

## Dimension

| | |
|---|---|
| Width: | 440 mm |
| Depth: | 110 mm |
| Number of height modules (HM): | 1 |
| Fastening dimensions: | 19" |

## Norms and standards

HELUKAT® CONNECTING SYSTEMS® unscreened system component up to 250 MHz of category 6 / Class E in accordance with ISO 11801, EN 50173.

## Application

As floor distributor in applications of digital and analog image, data and voice transmission.

## Part no.

**802908**

Dimensions and specifications may be changed without prior notice.

## Packing unit

**1**



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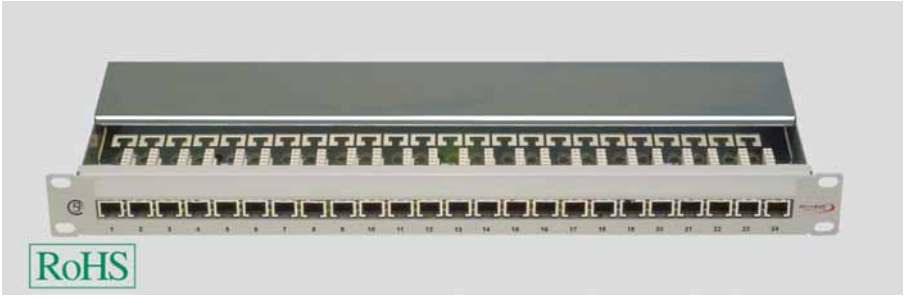
# Patch-Panels RJ45

Kategorie 5e / Klasse D




## Type

**Patch panel cat. 5e / class D 24P**

## Configuration

| | |
|---|---|
| Housing material: | Steel plate, solid |
| Colour: | Grey similar to RAL 7035 |
| Board: | 3x8 mother board, colour and number-coded |
| Push-on connector type: | RJ45(8/8) |
| Number of bushes: | 24 |
| Type of screen: | Overall screen |
| Screen removal: | via continuous screening tape |
| Strain relief: | via pre-installed cable clips |
| Cover lock: | Quick-action twist lock |

## Connecting system

| | |
|---|---|
| Connection type: | LSA plus - insulation piercing connections |
| Suitable for cable diameter: | 0.4 - 0.64mm (AWG 26 - 22) |
| Insulation diameter, min.: | 0,7 - 1,7 mm (PE) |

## Assignment type

EIA/TIA 568 A + EIA/TIA 568 B

## Dimension

| | |
|---|---|
| Width: | 483 mm |
| Depth: | 148 mm |
| Number of height modules (HM): | 1 |
| Fastening dimensions: | 19" |

## Norms and standards

HELUKAT® CONNECTING SYSTEMS® system component up to 100 MHz in category 5(e) / Class D in accordance with ISO 11801, 2nd edition, EN 50173, 2nd edition, EIA/TIA 568 B, and EN 55022 (EMC)

## Application

As floor distributor in applications of digital and analog image, data and voice transmission.

## Part no.

**82010**

Dimensions and specifications may be changed without prior notice.

## Packing unit

**1**

# Patch-Panels RJ45 unscreened

Category 3


## Type

**Patch panel 25-port cat.3**

## Configuration

| | |
|---|---|
| Housing material: | Steel plate, solid |
| Colour: | Grey similar to RAL 7035 |
| Board: | 5x 5 mother board, number-coded |
| Push-on connector type: | RJ45(8/4) |
| Number of bushes: | 25 |
| Type of screen: | no |
| Screen removal: | no |
| Strain relief: | by means of cable straps |

## Connecting system

| | |
|---|---|
| Connection type: | LSA plus - insulation piercing connections |
| Suitable for cable diameter: | 0.4 - 0.64mm (AWG 26 - 22) |

## Assignment type

acc. ISO/IEC 11801 and EN 50173

## Dimension

| | |
|---|---|
| Width: | 483 mm |
| Depth: | 118 mm |
| Number of height modules (HM): | 1 |
| Fastening dimensions: | 19" |

## Norms and standards

HELUKAT® CONNECTING SYSTEMS® category 3 system component according ISO/IEC 11801 and EN 50173.

## Application

As floor distributor in applications of voice transmission (ISDN). Deliverable as 25-port or 50-port version.

## Part no.

**81302**

Dimensions and specifications may be changed without prior notice.

## Packing unit

**1**

# Patch-Panels RJ45 unscreened

Category 3


## Type

**Patch panel 50-port cat.3**

## Configuration

| | |
|---|---|
| Housing material: | Steel plate, solid |
| Colour: | Grey similar to RAL 7035 |
| Board: | 1x 25 mother board (double), number-coded |
| Push-on connector type: | RJ45(8/4) |
| Number of bushes: | 50 |
| Type of screen: | no |
| Screen removal: | no |
| Strain relief: | by means of cable straps |

## Connecting system

| | |
|---|---|
| Connection type: | LSA plus - insulation piercing connections |
| Suitable for cable diameter: | 0.4 - 0.64mm (AWG 26 - 22) |

## Assignment type

acc. ISO/IEC 11801 and EN 50173

## Dimension

| | |
|---|---|
| Width: | 483 mm |
| Depth: | 118 mm |
| Number of height modules (HM): | 1 |
| Fastening dimensions: | 19" |

## Norms and standards

HELUKAT® CONNECTING SYSTEMS® category 3 system component according ISO/IEC 11801 and EN 50173.

## Application

As floor distributor in applications of voice transmission (ISDN). Deliverable as 25-port or 50-port version.

## Part no.

**801159**

Dimensions and specifications may be changed without prior notice.

## Packing unit

**1**

# Outlets RJ45

HELUKAT® CONNECTING SYSTEMS

Category $6E_A$


| | | |
|---|---|---|
| **Type** | **RJ-45 UP socket 2P cat. 6EA 500MHz vertical** | **RJ-45 UP socket 2P cat. 6a 500MHz horizontal** |
| **Configuration** | | |
| Housing material: | Die-cast, shielded | Die-cast, shielded |
| Colour: | Pure White similar to RAL 9010 | Pure White similar to RAL 9010 |
| Board: | 1x2 | 1x2 |
| Push-on connector type: | RJ45(8/8) | RJ45(8/8) |
| Outlet direction: | 45 degrees | 45 degrees |
| Number of bushes: | 2 | 2 |
| Type of screen: | Overall screen | Overall screen |
| Strain relief: | via pre-installed cable clips | via pre-installed cable clips |
| Cable inlet: | vertical | horizontal |
| **Connecting system** | | |
| Connection type: | LSA plus - insulation piercing connections | LSA plus - insulation piercing connections |
| Suitable for cable diameter: | 0,4 - 0,64mm (AWG 26 - 22) | 0,4 - 0,64mm (AWG 26 - 22) |
| Insulation diameter, min.: | 0,7 - 1,6 mm (PE) | 0,7 - 1,6 mm (PE) |
| **Assignment type** | EIA/TIA 568 A + EIA/TIA 568 B | EIA/TIA 568 A + EIA/TIA 568 B |
| **Dimension** | | |
| Dimensions of central plate: | 50 x 50mm | 50 x 50mm |
| Installation dimensions: | 50 x 50 x 32mm | 50 x 50 x 32mm |
| **Norms and standards** | HELUKAT® CONNECTING SYSTEMS® system component up to 500 MHz (10 GBit Ethernet) in accordance with category 6a EIA/TIA 568-B.2-10, IEEE 802.3an TM-2006, ISO/IEC 11801 (Amendment 1 JTC 1/SC N1255), ISO/IEC TR-24750 and EN 55022 (EMV). | |
| **Application** | As workstation interface in applications of digital and analog image, data and voice transmission. Available as in-wall version (channel) and top-mount version (wall). | |
| **Part no.** | **802025** | **802034** |
| | Dimensions and specifications may be changed without prior notice. | |
| **Packing unit** | **10** | **10** |

# Outlets RJ45

HELUKAT® CONNECTING SYSTEMS

Category 6 / Class E


| Type | RJ-45 UP socket class E 2P horizontal | RJ-45 UP socket class E 2P vertical |
|---|---|---|
| **Configuration** | | |
| Housing material: | Die-cast, shielded | Plastic, shielded |
| Colour: | Pure White similar to RAL 9010 | Pure White similar to RAL 9010 |
| Board: | 1x2 | 1x2 |
| Push-on connector type: | RJ45(8/8) | RJ45(8/8) |
| Outlet direction: | 45 degrees | 45 degrees |
| Number of bushes: | 2 | 2 |
| Type of screen: | Overall screen | Overall screen |
| Strain relief: | via pre-installed cable clips | via pre-installed cable clips |
| Cable inlet: | horizontal | vertical |
| **Connecting system** | | |
| Connection type: | LSA plus - insulation piercing connections | LSA plus - insulation piercing connections |
| Suitable for cable diameter: | 0,4 - 0,64mm (AWG 26 - 22) | 0,4 - 0,64mm (AWG 26 - 22) |
| Insulation diameter, min.: | 0,7 - 1,6 mm (PE) | 0,7 - 1,6 mm (PE) |
| **Assignment type** | EIA/TIA 568 A + EIA/TIA 568 B | EIA/TIA 568 A + EIA/TIA 568 B |
| **Dimension** | | |
| Dimensions of central plate: | 50 x 50mm | 50 x 50mm |
| Installation dimensions: | 51 x 51 x 29mm | 51 x 51 x 29mm |
| **Norms and standards** | HELUKAT® system component up to 250 MHz in the parmanent link of category 6 / Class E in accordance with ISO 11801, 2nd edition, EN 50173, 2nd edition, EIA/TIA 568 B, and EN 55022 (EMC). | |
| **Application** | As workstation interface in applications of digital and analog image, data and voice transmission. Available as in-wall version (channel) and top-mount version (possible with an extra frame). | |
| **Part no.** | **82847** | **82851** |
| | Dimensions and specifications may be changed without prior notice. | |
| **Packing unit** | **10** | **10** |

# Outlets RJ45 unscreened

Category 6/ Class E


| | | |
|---|---|---|
| **Type** | **RJ-45 UP socket unscreened class E 2P vertical** | **RJ-45 UP socket unscreened class E 2P horizontal** |
| **Configuration** | | |
| Housing material: | Plastic | Plastic |
| Colour: | Pure White similar to RAL 9010 | Pure White similar to RAL 9010 |
| Board: | 1x2 | 1x2 |
| Push-on connector type: | RJ45(8/8) | RJ45(8/8) |
| Outlet direction: | 45 degrees | 45 degrees |
| Number of bushes: | 2 | 2 |
| Type of screen: | no | no |
| Strain relief: | via pre-installed cable clips | via pre-installed cable clips |
| Cable inlet: | vertical | horizontal |
| **Connecting system** | | |
| Connection type: | LSA plus - insulation piercing connections | LSA plus - insulation piercing connections |
| Suitable for cable diameter: | 0,4 - 0,64mm (AWG 26 - 22) | 0,4 - 0,64mm (AWG 26 - 22) |
| Insulation diameter, min.: | 0,7 - 1,6 mm (PE) | 0,7 - 1,6 mm (PE) |
| **Assignment type** | EIA/TIA 568 A + EIA/TIA 568 B | EIA/TIA 568 A + EIA/TIA 568 B |
| **Dimension** | | |
| **Norms and standards** | HELUKAT® system component unscreened up to 250 MHz of category 6 or Class E in accordance with ISO 11801, EN 50173, ANSI/TIA/EIA 568 B2-1. | |
| **Application** | As workstation interface in applications of digital and analog image, data and voice transmission. Available as in-wall version (channel) and top-mount version (possible with an extra frame). | |
| **Part no.** | **802909** | **803033** |
| | Dimensions and specifications may be changed without prior notice. | |
| **Packing unit** | **10** | **10** |

# Outlets RJ45

Category 5e / Class D


| Type | RJ-45 UP socket cat. 5e 2P horizontal | RJ-45 UP socket cat. 5e 2P vertical |
|---|---|---|
| **Configuration** | | |
| Housing material: | Die-cast, shielded | Die-cast, shielded |
| Colour: | Pure White similar to RAL 9010 | Pure White similar to RAL 9010 |
| Board: | 1x2 | 1x2 |
| Push-on connector type: | RJ45(8/8) | RJ45(8/8) |
| Outlet direction: | 45 degrees | 45 degrees |
| Number of bushes: | 2 | 2 |
| Type of screen: | Overall screen | Overall screen |
| Strain relief: | via pre-installed cable clips | via pre-installed cable clips |
| Cable inlet: | horizontal | vertical |
| **Connecting system** | | |
| Connection type: | LSA plus - insulation piercing connections | LSA plus - insulation piercing connections |
| Suitable for cable diameter: | 0,4 - 0,64mm (AWG 26 - 22) | 0,4 - 0,64mm (AWG 26 - 22) |
| Insulation diameter, min.: | 0,7 - 1,1mm (PE) | 0,7 - 1,1mm (PE) |
| **Assignment type** | EIA/TIA 568 A + EIA/TIA 568 B | EIA/TIA 568 A + EIA/TIA 568 B |
| **Dimension** | | |
| Dimensions of central plate: | 50 x 50mm | 50 x 50mm |
| Installation dimensions: | 51 x 51 x 29mm | 51 x 51 x 29mm |
| **Norms and standards** | HELUKAT® CONNECTING SYSTEMS® system component up to 100 MHz in category 5(e) / Class D in accordance with ISO 11801, 2nd edition, EN 50173, 2nd edition, EIA/TIA 568 B, and EN 55022 (EMC) | |
| **Application** | As workstation interface in applications of digital and analog image, data and voice transmission. Available as in-wall version (channel) and top-mount version (wall). | |
| **Part no.** | **82008** | **82853** |
| | Dimensions and specifications may be changed without prior notice. | |
| **Packing unit** | **10** | **10** |

# Patch Cables RJ45

Category 6E$_A$


## Type

**Patch cable S/FTP halogenfree, Cat.6a 500 MHz (10GBit)**

## Cable

Designation: S/FTP 4x2xAWG 26/7 LSZH
Sheath material: LSZH
Frequency: up to 500 MHz

## Plug

Push-on connector type 1: RJ45 8(8)
Push-on connector type 2: RJ45 8(8)
Pin assignment: 1:1 acc. to TIA/EIA 568 B

## Flame proof

acc. to IEC 60332-1-2

## Norms and standards

HELUKAT® CONNECTING SYSTEMS® system components up to 500 MHz (10GBit) of category 6a / Class E in accordance with ISO 11801, 2nd edition, EN 50173, 2nd edition, and EIA/TIA 568 C-2.

## Preferred types

| Part no. | Sheath colour | Length in metres | Unit |
|---|---|---|---|
| **802380** | grey | 1,0 | 10 |
| **802381** | grey | 2,0 | 10 |
| **802382** | grey | 3,0 | 10 |
| **802383** | grey | 5,0 | 10 |
| **802384** | grey | 7,5 | 10 |
| **802385** | grey | 10,0 | 10 |
| **804287** | grey | 15,0 | 10 |

Dimensions and specifications may be changed without prior notice.

## Options

Naturally, we also offer other lengths and colors on request.

# Patch Cables RJ45

Category 6A


## Type

**Patch cable U/UTP halogenfree, Cat.6a 500 MHz (10GBit)**

## Cable

Designation: U/UTP 4x2xAWG26/7 LSZH
Sheath material: LSZH
Frequency: up to 500 MHz

## Plug

Push-on connector type 1: RJ45 8(8)
Push-on connector type 2: RJ45 8(8)
Pin assignment: 1:1 acc. to TIA/EIA 568 B

## Flame proof

acc. to IEC 60332-1-2

## Norms and standards

HELUKAT® CONNECTING SYSTEMS® system components up to 500 MHz (10GBit) of category 6a / Class E in accordance with ISO 11801, 2nd edition, EN 50173, 2nd edition, and EIA/TIA 568 C-2.

## Preferred types

| Part no. | Sheath colour | Length in metres | Unit |
|---|---|---|---|
| **804972** | grey | 1,0 | 10 |
| **804973** | grey | 2,0 | 10 |
| **804974** | grey | 3,0 | 10 |
| **804975** | grey | 5,0 | 10 |
| **804976** | grey | 7,5 | 10 |
| **804977** | grey | 10,0 | 10 |
| **805055** | grey | 15,0 | 10 |

Dimensions and specifications may be changed without prior notice.

## Options

Naturally, we also offer other lengths and colors on request.

# Patch Cables RJ45

HELUKAT® CONNECTING SYSTEMS

Category 6 / Class E


## Type

**Patch cable S/FTP halogenfree, Cat.6**

## Cable

Designation: S/FTP 4x2xAWG 27/7 halogenfree
Sheath material: LSZH
Frequency: up to 250 MHz

## Plug

Push-on connector type 1: RJ45 8(8)
Push-on connector type 2: RJ45 8(8)
Pin assignment: 1:1 acc. to TIA/EIA 568 B

## Flame proof

acc. to IEC 60332-1-2

## Norms and standards

HELUKAT® CONNECTING SYSTEMS® system components up to 250 MHz of category 6 / Class E in accordance with ISO 11801, 2nd edition, EN 50173, 2nd edition, and EIA/TIA 568 B.

## Preferred types

| Part no. | Sheath colour | Length in metres | Unit |
|---|---|---|---|
| **82857** | grey | 0,5 | 10 |
| **82858** | grey | 1,0 | 10 |
| **82859** | grey | 2,0 | 10 |
| **82860** | grey | 3,0 | 10 |
| **82861** | grey | 5,0 | 10 |
| **82862** | grey | 7,5 | 5 |
| **82863** | grey | 10,0 | 5 |
| **82864** | grey | 15,0 | 5 |

| Part no. | Sheath colour | Length in metres | Unit |
|---|---|---|---|
| **802999** | blue | 0,5 | 10 |
| **803000** | blue | 1,0 | 10 |
| **803001** | blue | 2,0 | 10 |
| **803002** | blue | 3,0 | 10 |
| **803003** | blue | 5,0 | 10 |
| **803004** | blue | 7,5 | 5 |
| **803005** | blue | 10,0 | 5 |
| **803006** | blue | 15,0 | 5 |

| Part no. | Sheath colour | Length in metres | Unit |
|---|---|---|---|
| **803007** | green | 0,5 | 10 |
| **803008** | green | 1,0 | 10 |
| **803009** | green | 2,0 | 10 |
| **803010** | green | 3,0 | 10 |
| **803011** | green | 5,0 | 10 |
| **803012** | green | 7,5 | 5 |
| **803013** | green | 10,0 | 5 |
| **803014** | green | 15,0 | 5 |

Continuation ▸

# Patch Cables RJ45

HELUKAT CONNECTING SYSTEMS

Category 6 / Class E

| Part no. | Sheath colour | Length in metres | Unit |
|---|---|---|---|
| **802991** | red | 0,5 | 10 |
| **802992** | red | 1,0 | 10 |
| **802993** | red | 2,0 | 10 |
| **802994** | red | 3,0 | 10 |
| **802995** | red | 5,0 | 10 |
| **802996** | red | 7,5 | 5 |
| **802997** | red | 10,0 | 5 |
| **802998** | red | 15,0 | 5 |

| Part no. | Sheath colour | Length in metres | Unit |
|---|---|---|---|
| **803015** | yellow | 0,5 | 10 |
| **803016** | yellow | 1,0 | 10 |
| **803017** | yellow | 2,0 | 10 |
| **803018** | yellow | 3,0 | 10 |
| **803019** | yellow | 5,0 | 10 |
| **803020** | yellow | 7,5 | 5 |
| **803021** | yellow | 10,0 | 5 |
| **803022** | yellow | 15,0 | 5 |

| Part no. | Sheath colour | Length in metres | Unit |
|---|---|---|---|
| **803023** | black | 0,5 | 10 |
| **803024** | black | 1,0 | 10 |
| **803025** | black | 2,0 | 10 |
| **803026** | black | 3,0 | 10 |
| **803027** | black | 5,0 | 10 |
| **803028** | black | 7,5 | 5 |
| **803029** | black | 10,0 | 5 |
| **803030** | black | 15,0 | 5 |

Dimensions and specifications may be changed without prior notice.

## Options

Naturally, we also offer other lengths, colors and crossover cables on request.

# Patch Cables RJ45 unscreened

HELUKAT® CONNECTING SYSTEMS

Category 6 / Class E


## Type

**Patch cable unscreened U/UTP PVC, Cat.6**

## Cable

Designation: U/UTP 4x2xAWG 24/7 PVC
Sheath material: PVC
Frequency: up to 250 MHz

## Plug

Push-on connector type 1: RJ45 8(8)
Push-on connector type 2: RJ45 8(8)
Pin assignment: 1:1 acc. to TIA/EIA 568 B

## Flame proof

acc. to IEC 60332-1-2

## Norms and standards

HELUKAT® CONNECTING SYSTEMS® system components up to 250 MHz in the of category 6 or EIA/TIA 568 B.

## Preferred types

| Part no. | Sheath colour | Length in metres | Unit |
|---|---|---|---|
| **803097** | grey | 0,5 | 10 |
| **803098** | grey | 1,0 | 10 |
| **803099** | grey | 2,0 | 10 |
| **803100** | grey | 3,0 | 10 |
| **803101** | grey | 5,0 | 10 |
| **803102** | grey | 7,5 | 10 |
| **803103** | grey | 10,0 | 10 |
| **803104** | grey | 15,0 | 10 |

| Part no. | Sheath colour | Length in metres | Unit |
|---|---|---|---|
| **803113** | blue | 0,5 | 10 |
| **803114** | blue | 1,0 | 10 |
| **803115** | blue | 2,0 | 10 |
| **803116** | blue | 3,0 | 10 |
| **803117** | blue | 5,0 | 10 |
| **803118** | blue | 7,5 | 10 |
| **803119** | blue | 10,0 | 10 |
| **803120** | blue | 15,0 | 10 |

| Part no. | Sheath colour | Length in metres | Unit |
|---|---|---|---|
| **803121** | green | 0,5 | 10 |
| **803122** | green | 1,0 | 10 |
| **803123** | green | 2,0 | 10 |
| **803124** | green | 3,0 | 10 |
| **803125** | green | 5,0 | 10 |
| **803126** | green | 7,5 | 10 |
| **803127** | green | 10,0 | 10 |
| **803128** | green | 15,0 | 10 |

Continuation ▸

# Patch Cables RJ45 unscreened

HELUKAT CONNECTING SYSTEMS

Category 6 / Class E

| Part no. | Sheath colour | Length in metres | Unit |
|---|---|---|---|
| **803105** | red | 0,5 | 10 |
| **803106** | red | 1,0 | 10 |
| **803107** | red | 2,0 | 10 |
| **803108** | red | 3,0 | 10 |
| **803109** | red | 5,0 | 10 |
| **803110** | red | 7,5 | 10 |
| **803111** | red | 10,0 | 10 |
| **803112** | red | 15,0 | 10 |

| Part no. | Sheath colour | Length in metres | Unit |
|---|---|---|---|
| **803129** | yellow | 0,5 | 10 |
| **803130** | yellow | 1,0 | 10 |
| **803131** | yellow | 2,0 | 10 |
| **803132** | yellow | 3,0 | 10 |
| **803133** | yellow | 5,0 | 10 |
| **803134** | yellow | 7,5 | 10 |
| **803135** | yellow | 10,0 | 10 |
| **803136** | yellow | 15,0 | 10 |

| Part no. | Sheath colour | Length in metres | Unit |
|---|---|---|---|
| **803137** | black | 0,5 | 10 |
| **803138** | black | 1,0 | 10 |
| **803139** | black | 2,0 | 10 |
| **803140** | black | 3,0 | 10 |
| **803141** | black | 5,0 | 10 |
| **803142** | black | 7,5 | 10 |
| **803143** | black | 10,0 | 10 |
| **803144** | black | 15,0 | 10 |

Dimensions and specifications may be changed without prior notice.

## Options

Naturally, we also offer other lengths, colors and crossover cables on request.

# Patch Cables RJ45

HELUKAT® CONNECTING SYSTEMS

Category 5e / Class D


## Type

**Patch cable SF/UTP PVC Cat.5e**

## Cable

Designation: SF/UTP 4x2xAWG 26/7 PVC
Sheath material: PVC
Frequency: up to 100 MHz

## Plug

Push-on connector type 1: RJ45 8(8)
Push-on connector type 2: RJ45 8(8)
Pin assignment: 1:1 acc. to TIA/EIA 568 B

## Flame proof

acc. to IEC 60332-1-2

## Norms and standards

HELUKAT® CONNECTING SYSTEMS® system components up to 100 MHz of category 5(e) / Class D in accordance with ISO 11801, 2nd edition, EN 50173, 2nd edition, and EIA/TIA 568 B.

## Preferred types

| Part no. | Sheath colour | Length in metres | Unit |
|---|---|---|---|
| **803049** | grey | 0,5 | 10 |
| **803050** | grey | 1,0 | 10 |
| **803051** | grey | 2,0 | 10 |
| **803052** | grey | 3,0 | 10 |
| **803053** | grey | 5,0 | 10 |
| **803054** | grey | 7,5 | 10 |
| **803055** | grey | 10,0 | 10 |
| **803056** | grey | 15,0 | 10 |

| Part no. | Sheath colour | Length in metres | Unit |
|---|---|---|---|
| **803065** | blue | 0,5 | 10 |
| **803066** | blue | 1,0 | 10 |
| **803067** | blue | 2,0 | 10 |
| **803068** | blue | 3,0 | 10 |
| **803069** | blue | 5,0 | 10 |
| **803070** | blue | 7,5 | 10 |
| **803071** | blue | 10,0 | 10 |
| **803072** | blue | 15,0 | 10 |

| Part no. | Sheath colour | Length in metres | Unit |
|---|---|---|---|
| **803073** | green | 0,5 | 10 |
| **803074** | green | 1,0 | 10 |
| **803075** | green | 2,0 | 10 |
| **803076** | green | 3,0 | 10 |
| **803077** | green | 5,0 | 10 |
| **803078** | green | 7,5 | 10 |
| **803079** | green | 10,0 | 10 |
| **803080** | green | 15,0 | 10 |

Continuation ▸



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# Patch Cables RJ45

HELUKAT CONNECTING SYSTEMS

Category 5e / Class D

| Part no. | Sheath colour | Length in metres | Unit |
|---|---|---|---|
| **803057** | red | 0,5 | 10 |
| **803058** | red | 1,0 | 10 |
| **803059** | red | 2,0 | 10 |
| **803060** | red | 3,0 | 10 |
| **803061** | red | 5,0 | 10 |
| **803062** | red | 7,5 | 10 |
| **803063** | red | 10,0 | 10 |
| **803064** | red | 15,0 | 10 |

| Part no. | Sheath colour | Length in metres | Unit |
|---|---|---|---|
| **803081** | yellow | 0,5 | 10 |
| **803082** | yellow | 1,0 | 10 |
| **803083** | yellow | 2,0 | 10 |
| **803084** | yellow | 3,0 | 10 |
| **803085** | yellow | 5,0 | 10 |
| **803086** | yellow | 7,5 | 10 |
| **803087** | yellow | 10,0 | 10 |
| **803088** | yellow | 15,0 | 10 |

| Part no. | Sheath colour | Length in metres | Unit |
|---|---|---|---|
| **803089** | black | 0,5 | 10 |
| **803090** | black | 1,0 | 10 |
| **803091** | black | 2,0 | 10 |
| **803092** | black | 3,0 | 10 |
| **803093** | black | 5,0 | 10 |
| **803094** | black | 7,5 | 10 |
| **803095** | black | 10,0 | 10 |
| **803096** | black | 15,0 | 10 |

Dimensions and specifications may be changed without prior notice.

## Options

Naturally, we also offer other lengths, colors and crossover cables on request.

# Patch Cables RJ45

HELUKAT® CONNECTING SYSTEMS

Category 5e / Class D


## Type

**Patch cable U/UTP PVC Cat.5e**

## Cable

Designation: U/UTP 4x2xAWG 24/7 PVC
Sheath material: PVC
Frequency: up to 155 MHz

## Plug

Push-on connector type 1: RJ45 8(8)
Push-on connector type 2: RJ45 8(8)
Pin assignment: 1:1 acc. to TIA/EIA 568 B

## Flame proof

acc. to IEC 60332-1-2

## Norms and standards

HELUKAT® CONNECTING SYSTEMS® system components up to 155 MHz of category 5e in accordance with ISO 11801, EIA/TIA 568 B.

## Preferred types

| Part no. | Sheath colour | Length in metres | Unit |
|---|---|---|---|
| **804646** | grey | 0,5 | 10 |
| **804647** | grey | 1,0 | 10 |
| **805738** | grey | 5,0 | 10 |
| **805739** | grey | 7,5 | 10 |
| **804648** | grey | 3,0 | 10 |
| **805737** | grey | 2,0 | 10 |
| **805740** | grey | 10,0 | 10 |
| **805741** | grey | 15,0 | 10 |

Dimensions and specifications may be changed without prior notice.

## Options

Naturally, we also offer other lengths, colors and crossover cables on request.

# General Accessories


## Preferred types

| Part no. | Description | Colour | Unit |
|---|---|---|---|
| **801686** | RJ45 plug 8 pole Category 5, TM11 grey | grey | 10 |
| **801772** | RJ45 plug 8 pole Category 6, TM21 black | black | 10 |
| **82852** | RJ-45 AP-frame | Pure White similar to RAL 9010 | 5 |
| **82695** | RJ-45 AP-frame cat.5 socket | Pearl White similar to RAL 1013 | 5 |
| **800260** | Central plate 80x80 UP-socket | Pure White similar to RAL 9010 | 10 |

Dimensions and specifications may be changed without prior notice.

# Rubber Cable Reels

**HELUKAT® Datacables**

## Type

**Rubber cable reel with HELUKAT® copper data cable**

## Drum

**Rubber**

Equipment: with supporting frame

## Plug

Push-On connector type 1: RJ45 8/8 - jack
Push-On connector type 2: RJ45 8/8 - jack
System type: office connector
Pin assignment: 1:1 acc. to TIA/EIA 568 B

## Norms and standards

Components of HELUKAT® CONNECTING SYSTEMS® to 155 MHz acc. Categorie 5E and to 600MHz acc. Categorie 6 (Link), ISO 11801 1st Edition, EN 50173-3 and EIA/TIA 568 B. Be in accordance with the Cat.5E respectively the Cat. 6 structured cabling.

## Preferred types

| Part no. | Designation | Sheath colour | Frequency MHz | Cable length m | Flame proof | Oil-resistant |
|---|---|---|---|---|---|---|
| **802073** | FTP 4x2xAWG24/1 PVC | Yellow similar to RAL 1021 | 155 | 50,0 | - | - |
| **802074** | FTP 4x2xAWG24/1 PVC | Yellow similar to RAL 1021 | 155 | 90,0 | - | - |
| **802075** | S-STP 4x2xAWG 23/1 FRNC | Blue Lilac similar to RAL 4005 | 600 | 50,0 | acc. to IEC 60332-3 | - |
| **802076** | S-STP 4x2xAWG 23/1 FRNC | Blue Lilac similar to RAL 4005 | 600 | 90,0 | acc. to IEC 60332-3 | - |
| **802207** | S-STP 4x2xAWG 23/1 PUR | Green similar to RAL 6018 | 600 | 50,0 | acc. to IEC 60332-1-2 | EN60811-2-1 |
| **802208** | S-STP 4x2xAWG 23/1 PUR | Green similar to RAL 6018 | 600 | 90,0 | acc. to IEC 60332-1-2 | EN60811-2-1 |

Dimensions and specifications may be changed without prior notice.

## Characteristics

Rubber cable reel with RJ45 jacks and dust protection. Suitable for mobile use on site, for example for meetings, TV-Transmissions, Fairs, etc.. Everywhere when there is a need for a removable cable connection. Usable for fixed installation cabling.

## Options

We also can deliver other cable length, cross-over cables or other types of plugs.


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# COPPER CONNECTING EQUIPMENT





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# COPPER CONNECTORS OVERVIEW

### Plug RJ45 Industrial

- plastic housing
- IP20, light duty
- Category 5
- IEC 60603-7
- Field-processable

### Plug RJ45 Industrial

- plastic housing
- IP20, light duty
- Category 5
- IEC 60603-7
- Field-processable

### Plug RJ45 PROFInet IE

- Central construction
- plastic housing
- IP20, light duty
- Category 5e
- Field-processable

### Plug RJ45 Industrial

- plastic housing
- IP20
- Category 5
- IEC 60603-7
- Field-processable

### Plug RJ45 PROFInet IE


- Central construction
- metal housing
- IP20, light duty
- Category 5e
- Field-processable

### Plug RJ45 PROFInet IE


- Angled construction
- metal housing
- IP20, light duty
- Category 5e
- Field-processable

## Plug RJ45 PROFInet IE

- Angled construction
- plastic housing
- IP20, light duty
- Category 5e
- Field-processable

## Plug RJ45 Snap-In IE

- Central construction
- plastic housing
- IP67, heavy duty
- Category 5

## Plug RJ45 10GIG IE

- Central + Angled construction
- plastic housing
- IP20, light duty
- Category 6/ Classe EA
- Field-processable

## Plug RJ45 10GIG IE

- Central construction
- metal housing
- IP20, light duty
- Category 6A
- Field-processable

## Plug M12 D- /B-codet

- metal housing / plastic housing
- IP67, heavy duty
- Category 5 (IEC 61076-2-101)
- Profibus

## Plug SUB-D for PROFIBUS and CAN

- 180°, 90°, 45°, 35° execution
- metal housing
- IP20, light duty
- With and Without PG
- With and Without Diagnose function
- Field-processable



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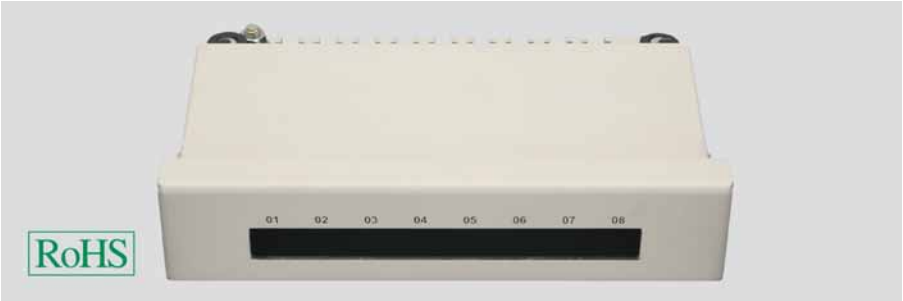
# Patch-Panels

**INDUSTRIAL ETHERNET**

Top hat rail modular, horizontal




## Type

**Basic Panel**

## Cable structure

| | |
|---|---|
| Housing material: | Steel plate, solid |
| Colour: | Grey similar to RAL 7035 |
| Max. number of modules: | 8 |
| Screen removal: | via continuous screening tape |
| Strain relief: | by means of cable straps |
| Cover lock: | Quick-action twist lock |

## Dimension

| | |
|---|---|
| Width: | 195 mm |
| Depth: | 150 mm |
| Number of height modules (HM): | 1 |

| | |
|---|---|
| **Part no.**: | **801311** |
| Packing unit: | 5 |

## Type

**Modul for top-hat rail installation patch panel, 2xST MM**

| | |
|---|---|
| Plug type A: | - |
| Pin Code A: | - |
| Plug type B: | - |
| Pin Code B: | - |
| Shielding: | |
| **Part no.**: | **801314** |
| Packing unit: | 10 |

## Type

**Modul for top-hat rail installation patch panel, 2xSC MM**

| | |
|---|---|
| Plug type A: | - |
| Pin Code A: | - |
| Plug type B: | - |
| Pin Code B: | - |
| Shielding: | |
| **Part no.**: | **801315** |
| Packing unit: | 1 |

## Norms and standards

HELUKAT® CONNECTING SYSTEMS® INDUSTRY individual system components, category 6 de-embedded (IEC 60603-7-5), ISO 11801 2nd Edition, EN 50173-1 2nd Edition, EIA/TIA 568-B.2-1 and EN 55022 (EMV).

## Application

As connection distribution unit for DIN rail installation e.g. in the switch cabinet, for applications involving digital and analog image, data and voice transmission. Can be combined (also with fibre optic components) thanks to the modular structure. Tool-free turn latches enable simple closing and opening of the housing.

Dimensions and specifications may be changed without prior notice.

# Top hat rail modules

**INDUSTRIAL ETHERNET**

Duplex modul cat.6 de-embedded


## Type

**Top-hat rail installation modul 2xRJ45/LSA, Cat.6**

## Configuration

| | |
|---|---|
| Housing material: | Steel plate, solid |
| Board: | Individual - modular |
| Push-on connector type: | RJ45(8/8) |
| Number of bushes: | 2 |
| Type of screen: | Overall screen |
| Screen removal: | via clips |
| Strain relief: | via pre-installed cable clips |
| Cover lock: | Fastening by means of screws |

## Connecting system

| | |
|---|---|
| Connection type: | LSA plus - insulation piercing connections |
| Suitable for cable diameter: | 0.4 - 0.64mm (AWG 26 - 22) |

## Assignment type

EIA/TIA 568 A + EIA/TIA 568 B

## Dimension

| | |
|---|---|
| Width: | 36 mm |
| Depth: | 110 mm |

## Norms and standards

HELUKAT® CONNECTING SYSTEMS® INDUSTRY individual system components, category 6, ISO 11801 2nd Edition, EN 50173-1 2nd Edition, EIA/TIA 568-B.2-1 and EN 55022 (EMV)

## Application

As connection distribution unit for DIN rail installation e.g. in the switch cabinet, for applications involving digital and analog image, data and voice transmission.

## Part no.

**801310**

Dimensions and specifications may be changed without prior notice.

## Packing unit

**10**

# Machine outlet IP67

**INDUSTRIAL ETHERNET**

VARIOSUB, HAN® 3A


| | | |
|---|---|---|
| **Type** | **Ind.Outlet Metal, Cat.6 RJ45-IP67-VARIOSUB PHOENIX** | **Ind.Outlet Metal, Cat.5 RJ45-IP67 HAN 3A HARTING** |
| **Configuration** | | |
| Housing material: | Aluminium die-cast, shielded | Aluminium die-cast, shielded |
| Colour: | Grey | Grey |
| Board: | 1x2 | 1x2 |
| Push-on connector type: | RJ45(8/8) | RJ45(8/8) |
| Outlet direction: | Straight | Straight |
| Number of bushes: | 2 | 2 |
| Type of screen: | Overall screen | Overall screen |
| Strain relief: | via pre-installed cable clips | via pre-installed cable clips |
| Cable inlet: | horizontal<br>vertical | horizontal<br>vertical |
| Protection classification (IP): | 67 | 67 |
| **Connecting system** | | |
| Connection type: | LSA plus - insulation piercing connections | LSA plus - insulation piercing connections |
| Suitable for cable diameter: | 0,4 - 0,64mm (AWG 26 - 22) | 0,4 - 0,64mm (AWG 26 - 22) |
| Insulation diameter, min.: | 0,7 - 1,7 mm (PE) | 0,7 - 1,7 mm (PE) |
| **Assignment type** | EIA/TIA 568 A + EIA/TIA 568 B | EIA/TIA 568 A + EIA/TIA 568 B |
| **Dimension** | | |
| Installation dimensions: | 175 x 110 x 45mm | 175 x 110 x 45mm |
| **Norms and standards** | HELUKAT® CONNECTING SYSTEMS INDUSTRY® components up to 100 MHz category 5 in accordance with ISO/IEC 11801 2nd Edition, EN50173 2nd Edition. Moreover it satisfies the MICE specifications (class 3), EMC requirements in accordance with DIN EN 6100, and the requirements of the IP 67 housing protection class. | |
| **Application** | Robust data connection socket (shielded) for the extreme implementation. Robust aluminum die-cast housing, meets all mechanical requirements like vibration, shock, and transverse forces. The socket is used either on the machine distributor (MD) or wall mounted directly on the machine (MC) as connection unit. | |
| **Part no.** | **801278** | **801306** |
| | Dimensions and specifications may be changed without prior notice. | |
| **Packing unit** | **5** | **5** |

# Machine outlet IP67

**INDUSTRIAL ETHERNET**

M12 D-coded, B-coded


| | | |
|---|---|---|
| **Type** | **Ind.Outlet Metal, Cat.5, 2 x M12 D-coded, IP67** | **Ind.Outlet Metal, 2 x M12 B-coded, IP67** |
| **Configuration** | | |
| Housing material: | Aluminium die-cast, shielded | Aluminium die-cast, shielded |
| Colour: | Grey | Grey |
| Board: | 1x2 | 1x2 |
| Push-on connector type: | plug M12 | plug M12 |
| Outlet direction: | Straight | Straight |
| Number of bushes: | 2 | 2 |
| Type of screen: | Overall screen | Overall screen |
| Strain relief: | via pre-installed cable clips | via pre-installed cable clips |
| Cable inlet: | horizontal<br>vertical | horizontal<br>vertical |
| Protection classification (IP): | 67 | 67 |
| **Connecting system** | | |
| Connection type: | LSA plus - insulation piercing connections | LSA plus - insulation piercing connections |
| Suitable for cable diameter: | 0,4 - 0,64mm (AWG 26 - 22) | 0,4 - 0,64mm (AWG 26 - 22) |
| Insulation diameter, min.: | 0,7 - 1,7 mm (PE) | 0,7 - 1,7 mm (PE) |
| **Assignment type** | D-coded acc. DKE/IEC 61076-2-101 | B-coded acc. DKE/IEC 61076-2-101 |
| **Dimension** | | |
| Installation dimensions: | 175 x 110 x 45mm | 175 x 110 x 45mm |
| **Norms and standards** | HELUKAT® CONNECTING SYSTEMS® INDUSTRY components up to 100 MHz category 5 in accordance with ISO/IEC 11801 2nd Edition, EN50173 2nd Edition. Couplings in accordance with IEC 61076.2191-A1 Moreover it satisfies the MICE specifications (class 3), EMC requirements in accordance with DIN EN 6100, and the requirements of the IP 67 housing protection class. | |
| **Application** | Robust data connection socket (shielded) for the extreme implementation. Robust aluminum die-cast housing; meets all mechanical requirements like vibration, shock, and transverse forces. The socket is used either on the machine distributor (MD) or wall mounted directly on the machine (MC) as connection unit. | |
| **Part no.** | **801305** | **801312** |
| | Dimensions and specifications may be changed without prior notice. | |
| **Packing unit** | **5** | **5** |



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# Outlet top hat rail

**INDUSTRIAL ETHERNET**

RJ45, horizontal/vertical


| | Top-hat rail outlet 2xRJ-45 cat.6/Class E 2P horizontal | Top-hat rail outlet 2xRJ-45 cat.6/Class E 2P verical |
|---|---|---|
| **Type** | | |
| **Configuration** | | |
| Housing material: | Plastic, shielded | Plastic, shielded |
| Colour: | Pure White similar to RAL 9010 | Pure White similar to RAL 9010 |
| Board: | 1x2 | 1x2 |
| Push-on connector type: | RJ45(8/8) | RJ45(8/8) |
| Outlet direction: | 45 degrees | 45 degrees |
| Number of bushes: | 2 | 2 |
| Type of screen: | Overall screen | Overall screen |
| Strain relief: | via pre-installed cable clips | via pre-installed cable clips |
| Cable inlet: | horizontal | vertical |
| **Connecting system** | | |
| Connection type: | LSA plus - insulation piercing connections | LSA plus - insulation piercing connections |
| Suitable for cable diameter: | 0,4 - 0,64mm (AWG 26 - 22) | 0,4 - 0,64mm (AWG 26 - 22) |
| Insulation diameter, min.: | 0,7 - 1,7 mm (PE) | 0,7 - 1,7 mm (PE) |
| **Assignment type** | EIA/TIA 568 A + EIA/TIA 568 B | EIA/TIA 568 A + EIA/TIA 568 B |
| **Dimension** | | |
| Dimensions of central plate: | 50 x 50mm | 50 x 50mm |
| Installation dimensions: | 80 x 80 x 46mm | 80 x 80 x 46mm |
| **Norms and standards** | HELUKAT® CONNECTING SYSTEMS® INDUSTRY system component up to 250 MHz in the parmanent link of category 6 or Class E in accordance with ISO 11801, 2nd edition, EN 50173, 2nd edition, EIA/TIA 568 B, and EN 55022 (EMC) | |
| **Application** | As connection unit for DIN rail installation e.g. in the switch cabinet, for applications involving digital and analog image, data and voice transmission. | |
| **Part no.** | **801308** | **801309** |
| | Dimensions and specifications may be changed without prior notice. | |
| **Packing unit** | **10** | **10** |

# Patch Cables PROFInet A

RJ45-HAN® 3A, IP67


## Type

**Patch Cable RJ45 HARTING HAN® 3A IP67, PROFInet A fixed installation**

## Cable

Designation: PROFInet type A (SK)
Sheath material: PVC
Frequency: up to 100 MHz

## Plug

Push-on connector type 1: RJ45-connector IP67
Push-on connector type 2: RJ45-connector IP67
System type: Harting IP67 HAN® 3A metal
Pin assignment: 1:1 acc. to TIA/EIA 568 B

## Flame proof

acc. to IEC 60332-1-2

## Oil-resistant

Acc. to EN60811-2-1

## Norms and standards

Components of HELUKAT® CONNECTING SYSTEMS® to 100 MHz acc. Categorie 5, ISO 11801 1st Edition, EN 50173-3, EIA/TIA 568 B and IEC 61918. Support the PROFInet guideline V 1.8.

## Preferred types

| Part no. | Sheath colour | Length in metres | Unit |
|---|---|---|---|
| **801342** | green | 0,5 | 10 |
| **801343** | green | 1,0 | 10 |
| **801344** | green | 2,0 | 10 |
| **801345** | green | 3,0 | 10 |
| **801346** | green | 5,0 | 10 |
| **801347** | green | 10,0 | 10 |
| **801365** | green | 15,0 | 10 |
| **801366** | green | 50,0 | 5 |
| **801367** | green | 100,0 | 1 |

Dimensions and specifications may be changed without prior notice.

## Characteristics

Jumper cable for the connection between IP67 protected ethernet applications according ISO/IEC 11801 with RJ45 plugs. Usable for fixed installation cabling.

## Options

We also can deliver other cable length, cross-over cables or other types of plugs.



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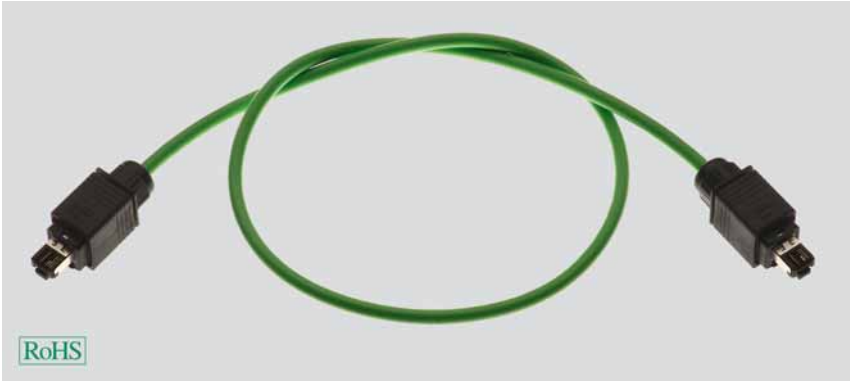
# Patch Cables PROFInet A

RJ45-HAN® PushPull, IP65/67




## Type

**Patch Cable RJ45 HARTING Push-Pull plastic IP65/67, PROFInet A fixed installation**

## Cable

Designation: PROFInet type A (SK)
Sheath material: PVC
Frequency: up to 100 MHz

## Plug

Push-on connector type 1: RJ45-connector IP67
Push-on connector type 2: RJ45-connector IP67
System type: Harting IP65/67 HAN® PushPull 4P plastic
Pin assignment: 1:1 acc. to TIA/EIA 568 B

## Flame proof

acc. to IEC 60332-1-2

## Oil-resistant

Acc. to EN60811-2-1

## Norms and standards

Components of HELUKAT® CONNECTING SYSTEMS® to 100 MHz acc. Categorie 5, ISO 11801 1st Edition, EN 50173-3, EIA/TIA 568 B and ISO/IEC 24702 variant 14 (AIDA conform). Support the PROFInet guideline V 1.8.

## Preferred types

| Part no. | Sheath colour | Length in metres | Unit |
|---|---|---|---|
| **802423** | green | 1,5 | 10 |
| **802424** | green | 3,0 | 10 |
| **802425** | green | 5,0 | 10 |
| **802426** | green | 10,0 | 10 |
| **802427** | green | 20,0 | 10 |
| **802428** | green | 50,0 | 5 |
| **802429** | green | 100,0 | 1 |

Dimensions and specifications may be changed without prior notice.

## Characteristics

Jumper cable for the connection between IP67 protected ethernet applications according ISO/IEC 11801 with RJ45 plugs. Usable for fixed installation cabling.

## Options

We also can deliver other cable length, cross-over cables or other types of plugs.

# Patch Cables PROFInet C

RJ45-HAN® 3A, IP67


## Type

**Patch Cable RJ45 HARTING HAN® 3A IP67, PROFInet C Drag Chain**

## Cable

Designation: PROFInet type C (SK)
Sheath material: PUR
Frequency: up to 100 MHz

## Plug

Push-on connector type 1: RJ45-connector IP67
Push-on connector type 2: RJ45-connector IP67
System type: Harting IP67 HAN® 3A metal
Pin assignment: 1:1 acc. to TIA/EIA 568 B

## Flame proof

acc. to IEC 60332-1-2

## Oil-resistant

Acc. to EN60811-2-1

## Norms and standards

Components of HELUKAT® CONNECTING SYSTEMS® to 100 MHz acc. Categorie 5, ISO 11801 1st Edition, EN 50173-3, EIA/TIA 568 B and IEC 61918. Support the PROFInet guideline V 1.8.

## Preferred types

| Part no. | Sheath colour | Length in metres | Unit |
|---|---|---|---|
| **801332** | green | 0,5 | 10 |
| **801333** | green | 1,0 | 10 |
| **801334** | green | 2,0 | 10 |
| **801335** | green | 3,0 | 10 |
| **801336** | green | 5,0 | 10 |
| **801337** | green | 10,0 | 10 |

Dimensions and specifications may be changed without prior notice.

## Characteristics

- Drag Chain suitable
- Bending radius 7,5 x cable outerdiameter maximum
- Moving speed 240 m/min maximum
- Movement distance 10 m maximum
- Accelaration 4 m/s² maximum
- Cycles maximum 5 Mio.
- Temperature range from -40°C to +80°C
- Transmission rate maximum 100 Mbit/s
- Transmission distance maximum 100 m from the Hub to the receiver
- Suitable for the „Heavy-Duty" range.

## Options

We also can deliver other cable length, cross-over cables or other types of plugs.



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# Patch Cables PROFInet C

RJ45-HAN® PushPull, IP65/67


## Type

**Patch Cable RJ45 HARTING Push-Pull IP67, PROFInet C Drag Chain**

## Cable

Designation: PROFInet type C (SK)
Sheath material: PUR
Frequency: up to 100 MHz

## Plug

Push-on connector type 1: RJ45-connector IP67
Push-on connector type 2: RJ45-connector IP67
System type: Harting IP65/67 HAN® PushPull 4P plastic
Pin assignment: 1:1 acc. to TIA/EIA 568 B

## Flame proof

acc. to IEC 60332-1-2

## Oil-resistant

Acc. to EN60811-2-1

## Norms and standards

Components of HELUKAT® CONNECTING SYSTEMS® to 100 MHz acc. Categorie 5, ISO 11801 1st Edition, EN 50173-1, EIA/TIA 568 B and ISO/IEC 24702 - variant 14 (AIDA konform). Support the PROFInet guideline V 1.8.

## Preferred types

| Part no. | Sheath colour | Length in metres | Unit |
|---|---|---|---|
| **802395** | green | 0,5 | 10 |
| **802396** | green | 1,0 | 10 |
| **802397** | green | 2,0 | 10 |
| **802398** | green | 3,0 | 10 |
| **802399** | green | 5,0 | 10 |
| **802400** | green | 10,0 | 10 |

Dimensions and specifications may be changed without prior notice.

## Characteristics

- Drag Chain suitable
- Bending radius 7,5 x cable outerdiameter maximum
- Moving speed 240 m/min maximum
- Movement distance 10 m maximum
- Accelaration 4 m/s² maximum
- Cycles maximum 5 Mio.
- Temperature range from -40°C to +80°C
- Transmission rate maximum 100 Mbit/s
- Transmission distance maximum 100 m from the Hub to the receiver
- Suitable for the „Heavy-Duty" range.

## Options

We also can deliver other cable length, cross-over cables or other types of plugs.

# Patch Cables LAN-Industry

RJ45-VARIOSUB, IP67


## Type

**Patch Cable RJ45 PHOENIX Variosub IP67, LAN-Industry Drag Chain**

## Cable

Designation: LAN industry 4x2x0,15
Sheath material: PUR
Frequency: up to 100 MHz

## Plug

Push-on connector type 1: RJ45-connector IP67
Push-on connector type 2: RJ45-connector IP67
System type: Phoenix Variosub IP67
Pin assignment: 1:1 acc. to TIA/EIA 568 B

## Flame proof

acc. to IEC 60332-1-2

## Oil-resistant

Acc. to EN60811-2-1

## Norms and standards

Components of HELUKAT® CONNECTING SYSTEMS® to 100 MHz acc. Categorie 5, ISO 11801 1st Edition, EN 50173-3 and EIA/TIA 568 B.

## Preferred types

| Part no. | Sheath colour | Length in metres | Unit |
|---|---|---|---|
| **800827** | green | 0,5 | 10 |
| **800828** | green | 1,0 | 10 |
| **800829** | green | 2,0 | 10 |
| **800830** | green | 3,0 | 10 |
| **800831** | green | 5,0 | 10 |
| **800832** | green | 10,0 | 10 |

Dimensions and specifications may be changed without prior notice.

## Characteristics

- Drag Chain suitable
- Bending radius 7,5 x cable outerdiameter maximum
- Moving speed 180 m/min maximum
- Movement distance 6 m maximum
- Accelaration 5 m/s² maximum
- Cycles maximum 10 Mio.
- Temperature range from -40°C to +80°C
- Transmission rate maximum 100 Mbit/s
- Transmission distance maximum 50 m from the Hub to the receiver
- Suitable for the „Heavy-Duty" range.

## Options

We also can deliver other cable length, cross-over cables or other types of plugs.



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# Adapter Cables PROFInet A

RJ45, RJ-INDUSTRIAL IP20 to HAN® 3A IP67


## Type

**Adapter cable RJ45 HARTING IP20 to HAN® 3A IP67, PROFInet A fixed installation**

## Cable

Designation: PROFInet type A (SK)
Sheath material: PVC
Frequency: up to 100 MHz

## Plug

Push-on connector type 1: RJ45-connector IP20
Push-on connector type 2: RJ45-connector IP67
System type: Harting IP67 to IP20
Pin assignment: 1:1 acc. to TIA/EIA 568 B

## Flame proof

acc. to IEC 60332-1-2

## Oil-resistant

Acc. to EN60811-2-1

## Norms and standards

Components of HELUKAT® CONNECTING SYSTEMS® to 100 MHz acc. Categorie 5, ISO 11801 1st Edition, EN 50173-3, EIA/TIA 568 B and IEC 61918. Support the PROFInet guideline V 1.8.

## Preferred types

| Part no. | Sheath colour | Length in metres | Unit |
|---|---|---|---|
| **801338** | green | 10,0 | 10 |
| **801339** | green | 15,0 | 10 |
| **801340** | green | 50,0 | 5 |
| **801341** | green | 100,0 | 1 |

Dimensions and specifications may be changed without prior notice.

## Characteristics

Adapter cable for the connection between IP20 protected and IP67 protected ethernet applications according ISO/IEC 11801 with RJ45 plugs. Usable for fixed installation cabling.

## Options

We also can deliver other cable length, cross-over cables or other types of plugs.

# Patch Cables PROFInet A

RJ45 4P INDUSTRIAL IP20


## Type

**Patch Cable RJ45 HARTING Industrial IP20, PROFInet A fixed installation**

## Cable

Designation: PROFInet type A (SK)
Sheath material: PVC
Frequency: up to 100 MHz

## Plug

Push-on connector type 1: RJ45-connector IP20
Push-on connector type 2: RJ45-connector IP20
System type: Harting IP20 Industrial 4P
Pin assignment: 1:1 acc. to TIA/EIA 568 B

## Flame proof

acc. to IEC 60332-1-2

## Oil-resistant

Acc. to EN60811-2-1

## Norms and standards

Components of HELUKAT® CONNECTING SYSTEMS® to 100 MHz acc. Categorie 5, ISO 11801 1st Edition, EN 50173-3, EIA/TIA 568 B and IEC 60603-7. Support the PROFInet guideline V 1.8.

## Preferred types

| Part no. | Sheath colour | Length in metres | Unit |
|---|---|---|---|
| **802416** | green | 1,5 | 10 |
| **802417** | green | 3,0 | 10 |
| **802418** | green | 5,0 | 10 |
| **802419** | green | 10,0 | 10 |
| **802420** | green | 20,0 | 5 |
| **802421** | green | 50,0 | 5 |
| **802422** | green | 100,0 | 1 |

Dimensions and specifications may be changed without prior notice.

## Characteristics

Jumper cable for the connection between IP20 protected ethernet applications according ISO/IEC 11801 with RJ45 plugs. Usable for fixed installation cabling.

## Options

We also can deliver other cable length, cross-over cables or other types of plugs.



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# Patch Cables PROFInet A

RJ45 angled left, INDUSTRIAL IP20


## Type

**Patch Cable RJ45 HARTING Industrial IP20 angled left, PROFInet A fixed installation**

## Cable

Designation: PROFInet type A (SK)
Sheath material: PVC
Frequency: up to 100 MHz

## Plug

Push-on connector type 1: RJ45-connector IP20
Push-on connector type 2: open
System type: Harting RJ Robust IP20 angeled left
Pin assignment: 1:1 acc. to TIA/EIA 568 B

## Flame proof

acc. to IEC 60332-1-2

## Oil-resistant

Acc. to EN60811-2-1

## Norms and standards

Components of HELUKAT® CONNECTING SYSTEMS® to 100 MHz acc. Categorie 5, ISO 11801 1st Edition, EN 50173-3, EIA/TIA 568 B and IEC 60603-7. Support the PROFInet guideline V 1.8.

## Preferred types

| Part no. | Sheath colour | Length in metres | Unit |
|---|---|---|---|
| **802410** | green | 0,5 | 10 |
| **802411** | green | 1,0 | 10 |
| **802412** | green | 2,0 | 10 |
| **802413** | green | 3,0 | 10 |
| **802414** | green | 5,0 | 10 |
| **802415** | green | 10,0 | 10 |

Dimensions and specifications may be changed without prior notice.

## Characteristics

Jumper cable for the connection between IP20 protected ethernet applications according ISO/IEC 11801 with RJ45 plug, second side without plug. Usable for fixed installation cabling within cabinets or controllers.

## Options

We also can deliver other cable length, cross-over cables or other types of plugs.

# Patch Cables LAN-Industry

RJ45 4P INDUSTRIAL IP20


## Type

**Patch Cable RJ45 HARTING Industrial IP20, LAN-Industry flexible**

## Cable

Designation: SF/UTP 4x2xAWG 26/7 PUR
Sheath material: PUR
Frequency: up to 100 MHz

## Plug

Push-on connector type 1: RJ45-connector IP20
Push-on connector type 2: RJ45-connector IP20
System type: Harting IP20 Industrial 4P
Pin assignment: 1:1 acc. to TIA/EIA 568 B

## Flame proof

acc. to IEC 60332-1-2

## Oil-resistant

Acc. to EN60811-2-1

## Norms and standards

Components of HELUKAT® CONNECTING SYSTEMS® to 100 MHz acc. Categorie 5, ISO 11801 1st Edition, EN 50173-3, EIA/TIA 568 B and IEC 60603-7.

## Preferred types

| Part no. | Sheath colour | Length in metres | Unit |
|---|---|---|---|
| **800839** | grey | 0,5 | 10 |
| **800840** | grey | 1,0 | 10 |
| **800841** | grey | 2,0 | 10 |
| **800842** | grey | 3,0 | 10 |
| **800843** | grey | 5,0 | 10 |
| **800844** | grey | 10,0 | 10 |

Dimensions and specifications may be changed without prior notice.

## Characteristics

- Suitable for using in rough environs
- Suitable for normal movements
- Temperature range from -20°C to +60°C
- Transmission rate maximum 100 Mbit/s
- Transmission distance maximum 30m from the Hub to the receiver
- Suitable for the „Light-Duty" range

## Options

We also can deliver other cable length, cross-over cables or other types of plugs.



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# Patch Cables LAN-Industry

RJ45 8P INDUSTRIAL IP20, Cat.6


## Type

**Patch Cable RJ45 8P HARTING INDUSTRIAL IP20, LAN-Industry**

## Cable

Designation: S/FTP 4x2xAWG 26/7 PUR, UL
Sheath material: PUR
Frequency: up to 600 MHz

## Plug

Push-on connector type 1: RJ45-connector IP20
Push-on connector type 2: RJ45-connector IP20
System type: Harting IP20 RJ Industrial 8P
Pin assignment: 1:1 acc. to TIA/EIA 568 B

## Flame proof

acc. to IEC 60332-1-2

## Oil-resistant

Acc. to EN60811-2-1

## Norms and standards

Components of HELUKAT® CONNECTING SYSTEMS® to 250 MHz acc. Categorie 6/ Class E, ISO 11801 1st Edition, EN 50173-1 and EIA/TIA 568 B. Plug according IEC 60603-7 and Category 6.

## Preferred types

| Part no. | Sheath colour | Length in metres | Unit |
|---|---|---|---|
| **802389** | green | 0,5 | 10 |
| **802390** | green | 1,0 | 10 |
| **802391** | green | 2,0 | 10 |
| **802392** | green | 3,0 | 10 |
| **802393** | green | 5,0 | 10 |
| **802394** | green | 10,0 | 10 |

Dimensions and specifications may be changed without prior notice.

## Characteristics

- Suitable for using in rough environs
- Suitable for normal movements
- Temperature range from -40°C to +80°C
- Transmission rate maximum 100 Mbit/s
- Transmission distance maximum 30m from the Hub to the receiver
- Suitable for the „Light-Duty" range

## Options

We also can deliver other cable length, cross-over cables or other types of plugs.

# Rangierkabel PROFInet C

RJ45 4P INDUSTRIAL IP20


## Type

**Patch Cable RJ45 HARTING Industrial IP20, PROFInet C Drag Chain**

## Cable

Designation: PROFInet type C (SK)
Sheath material: PUR
Frequency: up to 100 MHz

## Plug

Push-on connector type 1: RJ45-connector IP20
Push-on connector type 2: RJ45-connector IP20
System type: Harting IP20 Industrial 4P
Pin assignment: 1:1 acc. to TIA/EIA 568 B

## Flame proof

acc. to IEC 60332-1-2

## Oil-resistant

Acc. to EN60811-2-1

## Norms and standards

Components of HELUKAT® CONNECTING SYSTEMS® to 100 MHz acc. Categorie 5, ISO 11801 1st Edition, EN 50173-1, EIA/TIA 568 B and EN 60603-7. Support the PROFInet guideline V 1.8.

## Preferred types

| Part no. | Sheath colour | Length in metres | Unit |
|---|---|---|---|
| **802432** | green | 0,5 | 10 |
| **802433** | green | 1,0 | 10 |
| **802434** | green | 2,0 | 10 |
| **802435** | green | 3,0 | 10 |
| **802436** | green | 5,0 | 10 |
| **802437** | green | 10,0 | 10 |

Dimensions and specifications may be changed without prior notice.

## Characteristics

- Drag Chain suitable
- Bending radius 7,5 x cable outerdiameter maximum
- Moving speed 240 m/min maximum
- Movement distance 10 m maximum
- Accelaration 4 m/s² maximum
- Cycles maximum 5 Mio.
- Temperature range from -40°C to +80°C
- Transmission rate maximum 100 Mbit/s
- Transmission distance maximum 100 m from the Hub to the receiver
- Suitable for the „Light-Duty" range.

## Options

We also can deliver other cable length, cross-over cables or other types of plugs.



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# Patch Cables LAN-Industry

RJ45 4P INDUSTRIAL IP20


## Type

**Patch Cable RJ45 HARTING IP20, LAN-Industry Drag Chain**

## Cable

Designation: SF/UTP 4x1xAWG 24/19 PUR
Sheath material: PUR
Frequency: up to 100 MHz

## Plug

Push-on connector type 1: RJ45-connector IP20
Push-on connector type 2: RJ45-connector IP20
System type: Harting IP20 Industrial 4P
Pin assignment: 1:1 acc. to TIA/EIA 568 B

## Flame proof

acc. to IEC 60332-1-2

## Oil-resistant

Acc. to EN60811-2-1

## Norms and standards

Components of HELUKAT® CONNECTING SYSTEMS® to 100 MHz acc. Categorie 5, ISO 11801 1st Edition, EN 50173-3 and EIA/TIA 568 B. Support the ISO/IEC 24702 and IEC 61076-3-106.

## Preferred types

| Part no. | Sheath colour | Length in metres | Unit |
|---|---|---|---|
| **800833** | green | 0,5 | 10 |
| **800834** | green | 1,0 | 10 |
| **800835** | green | 2,0 | 10 |
| **800836** | green | 3,0 | 10 |
| **800837** | green | 5,0 | 10 |
| **800838** | green | 10,0 | 10 |

Dimensions and specifications may be changed without prior notice.

## Characteristics

- Drag Chain suitable
- Bending radius 7,5 x cable outerdiameter maximum
- Moving speed 180 m/min maximum
- Movement distance 6 m maximum
- Accelaration 5 m/s² maximum
- Cycles maximum 10 Mio.
- Temperature range from -40°C to +80°C
- Transmission rate maximum 100 Mbit/s
- Transmission distance maximum 50 m from the Hub to the receiver
- Suitable for the „Light-Duty" range

## Options

We also can deliver other cable length, cross-over cables or other types of plugs.

# Patch Cables LAN-Industry

RJ45-VARIOSUB, IP20


## Type

**Patch Cable RJ45 LAN-Industry PHOENIX Variosub IP20, Drag Chain**

## Cable

| | |
|---|---|
| Designation: | LAN industry 4x1x0,15 |
| Sheath material: | PUR |
| Frequency: | up to 100 MHz |

## Plug

| | |
|---|---|
| Push-on connector type 1: | RJ45-connector IP20 |
| Push-on connector type 2: | RJ45-connector IP20 |
| System type: | Phoenix Variosub IP20 |
| Pin assignment: | 1:1 acc. to TIA/EIA 568 B |

## Flame proof

acc. to IEC 60332-1-2

## Oil-resistant

Acc. to EN60811-2-1

## Norms and standards

Components of HELUKAT® CONNECTING SYSTEMS® to 100 MHz acc. Categorie 5, ISO 11801 1st Edition, EN 50173-3 and EIA/TIA 568 B. Support the "IAONA Industrial Ethernet Guide" Release 4.0.

## Preferred types

| Part no. | Sheath colour | Length in metres | Unit |
|---|---|---|---|
| **801326** | green | 0,5 | 10 |
| **801327** | green | 1,0 | 10 |
| **801328** | green | 2,0 | 10 |
| **801329** | green | 3,0 | 10 |
| **801330** | green | 5,0 | 10 |
| **801331** | green | 10,0 | 10 |

Dimensions and specifications may be changed without prior notice.

## Characteristics

- Drag Chain suitable
- Bending radius 7,5 x cable outerdiameter maximum
- Moving speed 180 m/min maximum
- Movement distance 6 m maximum
- Accelaration 5 m/s² maximum
- Cycles maximum 10 Mio.
- Temperature range from -40°C to +80°C
- Transmission rate maximum 100 Mbit/s
- Transmission distance maximum 30 m from the Hub to the receiver
- Suitable for the „Light-Duty" range.

## Options

We also can deliver other cable length, cross-over cables or other types of plugs.



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# Patch Cables USB Industry

USB 2.0 A


## Type

**USB 2.0 A patch cable, industrial USB – Drag Chain application.**

## Cable

Designation: USB 2.0 shielded cable PUR, up to 5,0m
Sheath material: PUR
Frequency: up to 400 MHz

## Plug

Push-on connection 1: USB A
Push-on connection 2: USB A

## Flame proof

Acc. to IEC 60332-1-2

## Norms and standards

HELUKABEL® CONNECTING SYSTEMS® system components to 400 MHz in compliance with USB 2.0 Standard. Suitable for applications such as image processing (e.g. surveillance cameras), metrology and control technology.

## Preferred types

| Part no. | Sheath colour | Length in metres | Unit |
|---|---|---|---|
| **802464** | violet | 0,5 | 10 |
| **802465** | violet | 1,0 | 10 |
| **802466** | violet | 2,0 | 10 |
| **802467** | violet | 3,0 | 10 |
| **802468** | violet | 5,0 | 10 |

Dimensions and specifications may be changed without prior notice.

## Characteristics

- Suitable for use as a patch cable in harsh environments
- Suitable for Drag Chain and other constantly moving applications
- Application temperature from -20°C to +60°C
- High-speed data transmission rate to max. 480 Mbit/s
- 5.0m maximum transmission distance to terminal device.
- Suitable for light duty applications.

## Options

Naturally, we also offer other lengths and connector types for IP applications on request.

# Patch Cables LAN-Industry

M12/4-pole central IP67


## Type

**Patch Cable M12 LAN-Industry IP67, Drag Chain**

## Cable

Designation: LAN industry 4x2x0,15
Sheath material: PUR
Frequency: up to 100 MHz

## Plug

Push-on connector type 1: M12-Connector bush shielded
Push-on connector type 2: M12-Buchse bush shielded
Pin assignment: D-coded according to DKE/IEC 61076-2-101

## Flame proof

acc. to IEC 60332-1-2

## Oil-resistant

Acc. to EN60811-2-1

## Norms and standards

Components of HELUKAT® CONNECTING SYSTEMS® to 100 MHz acc. Categorie 5, ISO 11801 1st Edition. Plug according IEC 61076-2-101-A1. Support the "IAONA Industrial Ethernet Guide" Release 4.0.

## Preferred types

| Part no. | Sheath colour | Length in metres | Unit |
|---|---|---|---|
| **800800** | green | 0,3 | 10 |
| **800801** | green | 1,0 | 10 |
| **800802** | green | 2,0 | 10 |
| **800803** | green | 3,0 | 10 |
| **800804** | green | 5,0 | 10 |
| **800805** | green | 10,0 | 10 |

Dimensions and specifications may be changed without prior notice.

## Characteristics

- Drag Chain suitable
- Bending radius 7,5 x cable outerdiameter maximum
- Moving speed 180 m/min maximum
- Movement distance 6 m maximum
- Accelaration 5 m/s² maximum
- Cycles maximum 10 Mio.
- Temperature range from -40°C to +80°C
- Transmission rate maximum 100 Mbit/s
- Transmission distance maximum 50 m from the Hub to the receiver
- PIN 1 = whog, PIN 3 = og, PIN 2 = whgn, PIN 4 = gn
- Suitable for the „Heavy-Duty" range

## Options

We also can deliver other cable length, other pin codes or other types of plugs.



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# Patch Cables LAN-Industry

M12/4-pole angled IP67


## Type

**Patch Cable M12W LAN-Industry IP67, Drag Chain**

## Cable

Designation: LAN industry 4x2x0,15
Sheath material: PUR
Frequency: up to 100 MHz

## Plug

Push-on connector type 1: M12-Connector bend shielded
Push-on connector type 2: M12-Buchse bend shielded
Pin assignment: D-coded according to DKE/IEC 61076-2-101

## Flame proof

acc. to IEC 60332-1-2

## Oil-resistant

Acc. to EN60811-2-1

## Norms and standards

Components of HELUKAT® CONNECTING SYSTEMS® to 100 MHz acc. Categorie 5, ISO 11801 1st Edition. Plug according IEC 61076-2-101-A1. Support the "IAONA Industrial Ethernet Guide" Release 4.0.

## Preferred types

| Part no. | Sheath colour | Length in metres | Unit |
|---|---|---|---|
| **800806** | green | 0,3 | 10 |
| **800807** | green | 1,0 | 10 |
| **800808** | green | 2,0 | 10 |
| **800809** | green | 3,0 | 10 |
| **800810** | green | 5,0 | 10 |
| **800811** | green | 10,0 | 10 |

Dimensions and specifications may be changed without prior notice.

## Characteristics

- Drag Chain suitable
- Bending radius 7,5 x cable outerdiameter maximum
- Moving speed 180 m/min maximum
- Movement distance 6 m maximum
- Accelaration 5 m/s² maximum
- Cycles maximum 10 Mio.
- Temperature range from -40°C to +80°C
- Transmission rate maximum 100 Mbit/s
- Transmission distance maximum 50 m from the Hub to the receiver
- PIN 1 = whog, PIN 3 = og, PIN 2 = whgn, PIN 4 = gn
- Suitable for the „Heavy-Duty" range

## Options

We also can deliver other cable length, other pin codes or other types of plugs.

# Patch Cables Profibus RS 485

M12/4-pole central IP67


## Type

**Patch Cable M12 for Profibus RS 485, Drag Chain**

## Cable

Designation: Profibus 1x2x0,64 (strand) Drag Chain
Sheath material: PUR
Frequency: up to 16 MHz

## Plug

Push-on connector type 1: M12-Connector bush shielded
Push-on connector type 2: M12-Buchse bush shielded
Pin assignment: B-coded according to DKE/IEC 61076-2-101

## Oil-resistant

Acc. to EN60811-2-1

## Norms and standards

Components of HELUKABEL® CONNECTING SYSTEMS® for applications of Profibus RS 485. Plug according IEC 61076-2-101-A1. Support the EN50170.

## Preferred types

| Part no. | Sheath colour | Length in metres | Unit |
|---|---|---|---|
| **800812** | violett similar RAL 4001 | 0,3 | 10 |
| **800813** | violett similar RAL 4001 | 1,0 | 10 |
| **800814** | violett similar RAL 4001 | 2,0 | 10 |
| **800815** | violett similar RAL 4001 | 3,0 | 10 |
| **800816** | violett similar RAL 4001 | 5,0 | 10 |
| **800817** | violett similar RAL 4001 | 10,0 | 10 |

Dimensions and specifications may be changed without prior notice.

## Characteristics

- Drag Chain suitable
- Bending radius 10 x cable outerdiameter maximum
- Moving speed 200 m/min maximum
- Movement distance 5 m maximum
- Accelaration 5 m/s² maximum
- Cycles maximum 5 Mio.
- Temperature range from -25°C to +70°C
- Transmission rate maximum 3,6 re. 12 Mbit/s
- Segment distance maximum 100 m
- PIN 2 (A) = green, PIN 4 (B) = red, screen terminated on the nut and on PIN 5
- Suitable for the „Heavy-Duty" range

## Options

We also can deliver other cable length, other pin codes or other types of plugs like SUB-D.



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# Patch Cables Profibus RS 485

M12/4-pole angled IP67


## Type

**Patch Cable M12W for Profibus RS 485, Drag Chain**

## Cable

Designation: Profibus 1x2x0,64 (strand) Drag Chain
Sheath material: PUR
Frequency: up to 16 MHz

## Plug

Push-on connector type 1: M12-Connector bend shielded
Push-on connector type 2: M12-Buchse bend shielded
Pin assignment: B-coded according to DKE/IEC 61076-2-101

## Oil-resistant

Acc. to EN60811-2-1

## Norms and standards

Components of HELUKABEL® CONNECTING SYSTEMS® for applications of Profibus RS 485. Plug according IEC 61076-2-101-A1. Support the EN50170.

## Preferred types

| Part no. | Sheath colour | Length in metres | Unit |
|---|---|---|---|
| **800818** | violett similar RAL 4001 | 0,3 | 10 |
| **800819** | violett similar RAL 4001 | 1,0 | 10 |
| **800820** | violett similar RAL 4001 | 2,0 | 10 |
| **800821** | violett similar RAL 4001 | 3,0 | 10 |
| **800822** | violett similar RAL 4001 | 5,0 | 10 |
| **800823** | violett similar RAL 4001 | 10,0 | 10 |

Dimensions and specifications may be changed without prior notice.

## Characteristics

- Drag Chain suitable
- Bending radius 10 x cable outerdiameter maximum
- Moving speed 200 m/min maximum
- Movement distance 5 m maximum
- Accelaration 5 m/s² maximum
- Cycles maximum 5 Mio.
- Temperature range from -25°C to +70°C
- Transmission rate maximum 3,6 re. 12 Mbit/s
- Segment distance maximum 100 m
- PIN 2 (A) = green, PIN 4 (B) = red, screen terminated on the nut and on PIN 5
- Suitable for the „Heavy-Duty“ range

## Options

We also can deliver other cable length, other pin codes or other types of plugs like SUB-D.

# Copper Connection Technics

Industry plugs RJ45


## Type

| | | | | |
|---|---|---|---|---|
| Protection classification (IP): | 20 | 20 | 67 | 20 |
| System type: | Harting IP20 Industrial 4P | standard central | Phoenix Variosub IP67 | standard angled |
| Category: | 5 | 5 | 5 | 5 |

## Technical details

| | | | | |
|---|---|---|---|---|
| Connection type: | Crimp | Crimp | Crimp | Crimp |
| core diameter: | AWG 22-24 (stranded) and AWG 22-23 (massive) | AWG 22 - 26 (stranded + massive) | AWG 24-26 (stranded) | AWG 22 - 26 (stranded + massive) |
| cable diameter min.: | 6,4 | 4,5 | 5,0 | 4,5 |
| cable diameter max.: | 6,9 | 8,1 | 8,5 | 8,1 |
| Suitable for circular cable: | yes | yes | yes | yes |
| Suitable for flat cable: | no | no | no | no |
| Suitable for stranded conductor: | yes | yes | yes | yes |
| Suitable for solid conductor: | yes | yes | yes | yes |
| Operating temperature range min.: | -40°C | -20°C | 0°C | -20°C |
| Operating temperature range max.: | +70°C | +70°C | +70°C | +70°C |
| Part no.: | **800986** | **802920** | **801318** | **804234** |
| Packing unit: | **10** | **10** | **10** | **10** |

Dimensions and specifications may be changed without prior notice.

## Application

RJ45 plug connectors in accordance with EN50173-1 suitable for industrial Ethernet implementation. Available as IP20 or IP67/50 version. Technical details:

- Plug geometry: in accordance with IEC 60603-7 (RJ45).
- Suitable for light-duty or heavy-duty applications (depending on the plug type).

## Included in delivery

RJ45-plug/ M12-plug, housing and assembly instructions.

## Options

We also deliver other brandes or connector systems as M12 for industrial applications, on request.

# Copper Connection Technics

HELUKAT CONNECTING SYSTEMS INDUSTRY

Industry plugs RJ45

NEW


## Type

| | | | | | | |
|---|---|---|---|---|---|---|
| Protection classification (IP): | 20 | 20 | 20 | 20 | 20 | 20 |
| System type: | standard central | standard angled | standard central | standard angled | standard angled | standard central |
| Category: | 5 | 5 | 5 | 6 | 5 | 6 |

## Technical details

| | | | | | | |
|---|---|---|---|---|---|---|
| Connection type: | insulation displacement connector (IDC) | insulation displacement connector (IDC) | insulation displacement connector (IDC) | insulation displacement connector (IDC) | insulation displacement connector (IDC) | insulation displacement connector (IDC) |
| core diameter: | AWG 22-24 (stranded) | AWG 22-24 (stranded + solid) | AWG 22-27 (stranded + solid) | AWG 22-27 (stranded + solid) | AWG 22-27 (stranded + solid) | AWG 22-27 (stranded + solid) |
| cable diameter min.: | 6,3 | 6,3 | 4,5 | 4,5 | 4,5 | 4,5 |
| cable diameter max.: | 6,7 | 6,7 | 9,0 | 8,0 | 8,0 | 9,5 |
| Suitable for circular cable: | yes | yes | yes | yes | yes | yes |
| Suitable for flat cable: | no | no | no | no | no | no |
| Suitable for stranded conductor: | yes | yes | yes | yes | yes | yes |
| Suitable for solid conductor: | yes | yes | yes | yes | yes | yes |
| Operating temperature range min.: | -20°C | -20°C | -40°C | -40°C | -40°C | -40°C |
| Operating temperature range max.: | +70°C | +70°C | +70°C | +70°C | +70°C | +70°C |
| Part no.: | **805401** | **805402** | **805781** | **805784** | **805782** | **805783** |
| Packing unit: | **1** | **1** | **1** | **1** | **1** | **1** |

Dimensions and specifications may be changed without prior notice.

## Application

RJ45 IP and plug connectors in accordance with PROFInet suitable for industrial Ethernet implementation. Available as 90° or 180° version.

## Included in delivery

RJ45-plug and assembly instructions.

## Options

We also deliver other brandes or connector systems for industrial applications, on request.


## Type

**PROFIBUS connectors**

## Cage

| | |
|---|---|
| Model: | Plug |
| Number of poles: | 9 |
| Contact design: | male |
| Housing material: | metalized plastic |

## Technical details

| | |
|---|---|
| Protection classification (IP): | 20 |
| Suitable for core diameter: | 0,64 mm |
| max. transmission rate: | 12 |
| max. current drain: | 0,0125 A |
| terminating impedance: | yes |
| Operating temperature range min.: | 0°C |
| Operating temperature range max.: | +60°C |

## Plug types

| Part no. | Out-going cable | Pro-gramming inter-face | Dia-gnos-tics mode | Connection type | Suitable for cable structure | Suitable for core type | Dimensions in mm | Unit |
|---|---|---|---|---|---|---|---|---|
| **802401** | 90° | - | - | Screwing terminal | - | solid and flexible | 64 x 40 x 17 | 10 |
| **803845** | 90° | - | yes | Screwing terminal | - | solid and flexible | 64 x 40 x 17 | 10 |
| **802402** | 90° | yes | - | Screwing terminal | - | solid and flexible | 64 x 40 x 17 | 10 |
| **803844** | 90° | yes | yes | Screwing terminal | - | solid and flexible | 64 x 40 x 17 | 10 |
| **802406** | 90° | - | - | Crimp | SK/FC | solid and flexible | 72 x 40 x 17 | 10 |
| **803195** | 90° | - | yes | Crimp | SK/FC | solid and flexible | 64 x 40 x 17 | 10 |
| **802407** | 90° | yes | - | Crimp | SK/FC | solid and flexible | 72 x 40 x 17 | 10 |
| **803194** | 90° | yes | yes | Crimp | SK/FC | solid and flexible | 64 x 40 x 17 | 10 |
| **803356** | 45° | - | - | Crimp | SK/FC | solid | 95 x 70 x 17 | 10 |
| **803576** | 45° | - | - | Crimp | SK/FC | flexible | 72 x 40 x 17 | 10 |
| **803357** | 45° | yes | - | Crimp | SK/FC | solid | 72 x 40 x 17 | 10 |
| **803577** | 45° | yes | - | Crimp | SK/FC | flexible | 72 x 40 x 17 | 10 |
| **802403** | 35° | - | - | Screwing terminal | - | solid and flexible | 54 x 40 x 17 | 10 |
| **802404** | 35° | yes | - | Screwing terminal | - | solid and flexible | 54 x 40 x 17 | 10 |
| **802405** | axial | - | - | Screwing terminal | - | solid and flexible | 68 x 39,5 x 17 | 10 |
| **803208** | axial | - | - | Crimp | SK/FC | solid and flexible | 70 x 35 x 17 | 10 |

Dimensions and specifications may be changed without prior notice.

## Application

The compact design of the bus connectors from the series HELUKABEL® CONNECTING SYSTEMS makes them suitable for use in nearly all Siemens CPU types. A slide switch sets whether the connector will be used as a node or end of segment. The switch can also be operated when the connector is plugged. The switch setting is clearly visible.

## Included in delivery

SUB-D plug 9 poles, housing and assembly instructions.

PROFIBUS adapter


## Type

**Adaptor Profibus Sub-D/M12 with and without PG**

## Cage

Model: Adaptor
Contact design: Sub-D / M12
Housing material: metalized plastic

## Technical details

Protection classification (IP): 20

max. transmission rate: 12
max. current drain: 0,0125 A
terminating impedance: yes

Operating temperature range min.: -25°C
Operating temperature range max.: +85°C

## Plug types

| Part no. | Out-going cable | PG-Connection Jack | Dia-gnos-tics mode | Connection type | Dimensions in mm | Unit |
|---|---|---|---|---|---|---|
| **805194** | 90° | - | - | M12 | 70 x 41 x 17 | 10 |
| **805195** | 90° | yes | - | M12 + Sub-D | 70 x 41 x 17 | 10 |
| **805709** | 90° | yes | yes | M12 + Sub-D | 70 x 41 x 17 | 10 |

Dimensions and specifications may be changed without prior notice.

## Application

PROFIBUS adaptor Sub-D / M12 will be used for interconnection with harnessed M12 cables. This will avoid interconnection failures and the time for installation is reduced to a minimum.
This adaptor has two M12 interfaces and integrated termination resitors which can be selected under installed condition.
The housing is metallized for an improved EMV resistance.
Availiable with and without PG connector (Sub-D interface on the backside) and status LED´s.
orange = status of termination resistor
green = activity of bus
blue = participation on bus traffic
The PROFIBUS adaptor has an enhanced temperature range of -25°C till +85°C (acc. UL test parameter +60°C)

## Included in delivery

Sub-D / M12 Adaptor

## Options

We also deliver connectors for other systems like CAN-Bus, DeviceNet or Interbus on request.

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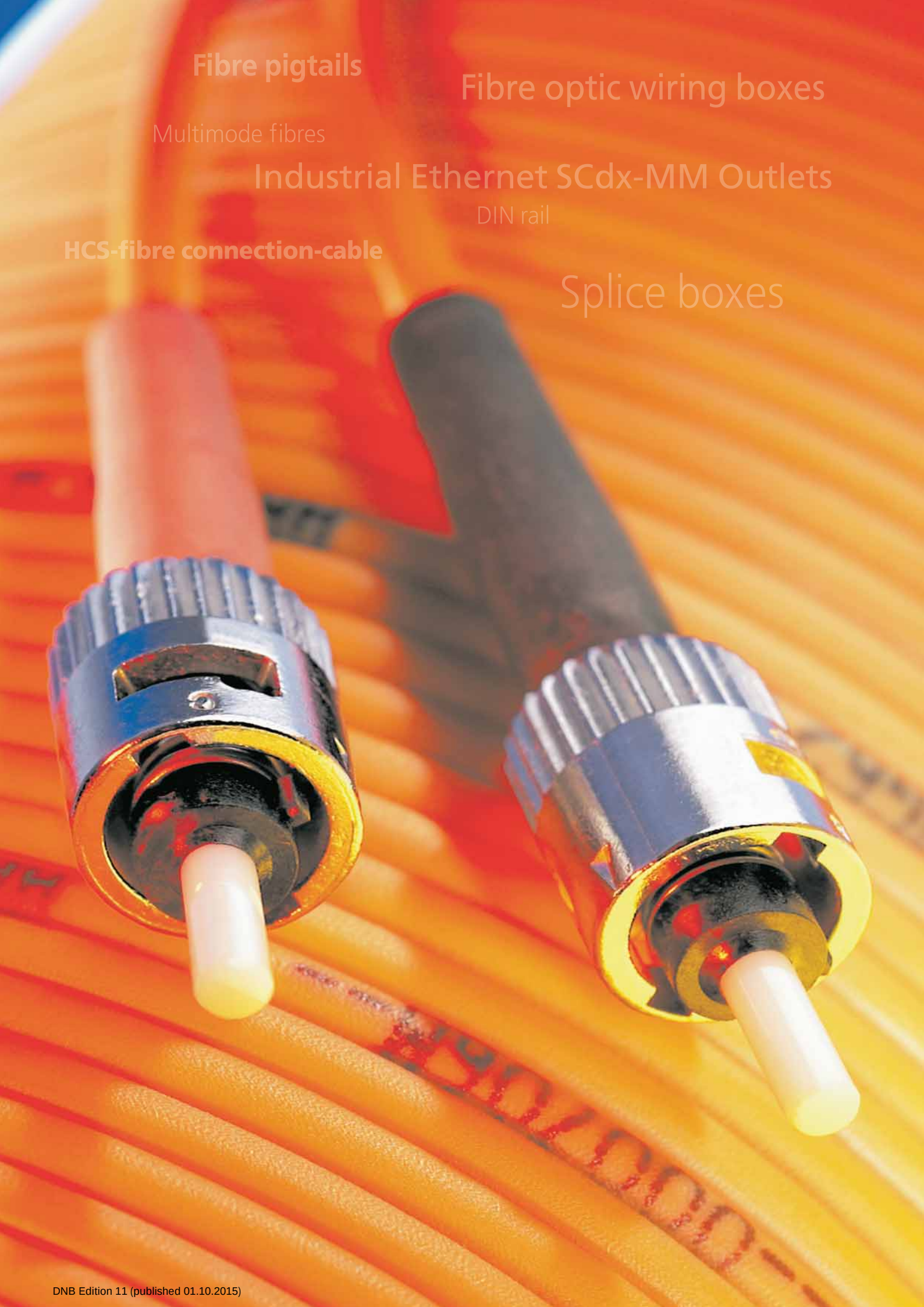


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# FIBER OPTIC CONNECTION TECHNICS






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# FIBRE OPTIC PLUG & ADAPTER OVERVIEW

## ST plug


- Ceramic ferrule
- Available for single mode or multi-mode

## ST adapter


- Ceramic ferrule
- Available for single mode or multi-mode

## SC/SCdx plug


- Ceramic ferrule
- Normal cross section or 8° diagonal cross section (single mode only)
- Available for single mode or multi-mode

## SC/SCdx adapter


- Ceramic ferrule
- Normal cross section or 8° diagonal cross section (single mode only)
- Available for single mode or multi-mode

## LC plug


- Ceramic ferrule
- Available for single mode or multi-mode

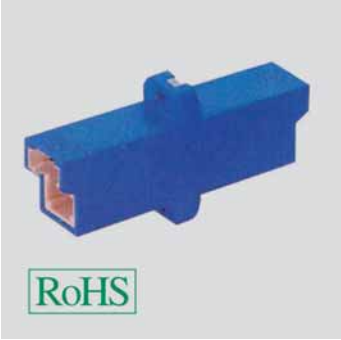
## LC adapter


- Ceramic ferrule
- Available for single mode or multi-mode

## E-2000 plug


- Ceramic ferrule
- Normal cross section or 8° diagonal cross section (single mode only)
- Available for single mode or multi-mode

## E-2000 adapter




- Ceramic ferrule
- Normal cross section or 8° diagonal cross section (single mode only)
- Available for single mode or multi-mode

## DIN plug


- Ceramic ferrule
- Available for single mode or multi-mode

## DIN adapter


- Ceramic ferrule
- Available for single mode or multi-mode

## MTRJ Plug


- Ceramic ferrule
- Available for single mode or multi-mode

## MTRJ adapter


- Ceramic ferrule
- Available for single mode or multi-mode

## FC PC plug


- Ceramic ferrule
- Normal cross section or 8° diagonal cross section (single mode only)
- Available for single mode or multi-mode

## FC PC adapter


- Ceramic ferrule
- Normal cross section or 8° diagonal cross section (single mode only)
- Available for single mode or multi-mode

## F-SMA plug


- Ceramic ferrule
- Available for single mode or multi-mode

## F-SMA adapter


- Ceramic ferrule
- Available for single mode or multi-mode



DNB Edition 11 (published 01.10.2015)

# PRE-ASSEMBLED FIBRE OPTIC CABLES

No special knowledge or tools are needed to install HELUCOM® pre-assembled fibre optic cables. The cable is pre-assembled and can be connected immediately after it has been laid. As a result, the installation process actually comprises nothing more than laying the cable itself. In the distributor bodies, the fibres from the loose-tube cable are conducted through the individual simplex cables without splicing. The simplex cables are terminated using pre-assembled plugs. Included in delivery is a plug shield that protects the plugs, simplex cables and distributor body while the cable is being laid. The pulling aid is connected to the pull cable. As a result, it is possible to lay the cable together with the pre-assembled distributor just as you would lay a standard cable. The benefits of pre-assembled and pre-assembled cables are easy to see: The fibre optic cables are cut to the desired length, and the fibres are glued to different plug models in a clean and dust-free environment.

## Features:

**Applicatlons:**
1. Outdoor wiring
2. Indoor wiring

**Cable types:**
- Zipcords with halogen-free outer jacket
- Breakout cables with halogen-free outer jacket
- Mini breakout cables with halogen-free outer jacket
- Fibre optic cables with central / stranded loose-tube cable
- Plastic fibre cables (POF)

**Fibre types:**
- E9/125 µm
- G50/125 µm
- G62,5/125 µm
- 200/230 µm
- 980/1000 µm

**Plug systems:**
- ST, SC, SCdx, LC, MTRJ, E-2000, DIN, FDDI, FC-PC and F-SMA

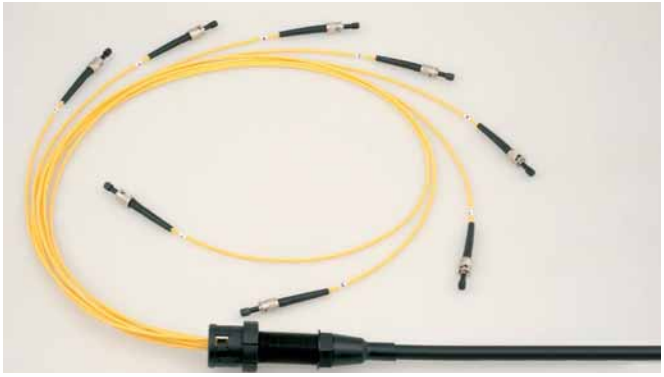
**Additional pre-assembled klts:**
- Pulling aid
- Pulling tube
- Core coding

### Pre–assembled fibre optic cables

**01** The pre-assembled loose-tube cable together with distributor body and pulling protection as it appears just before shipment. Depending on the length of the cable, the cable can be shipped as a ring or on a disposable shipping reel.

**02** Detailed view form the end of the cable with pulling aid.

**03** Detailed view of the robust cast distributor body. The distributor body is equipped with a compatible plastic gland for installation in splice boxes. In addition, the system can be reused in a new installation.



**04** Mini loose-tube cables designed to allow easy insertion into prepared splice boxes. In addition, the mini loose-tube cables are number-coded.

**05** Glass fibre splice box used as cable end enclosure for multi-core fibreoptic cables in 19" cabinets. The splice box is particularly suitable as a connecting unit for our pre-fabricated fibre-optic grooved cables.



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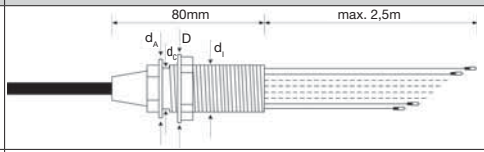
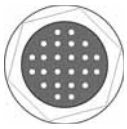
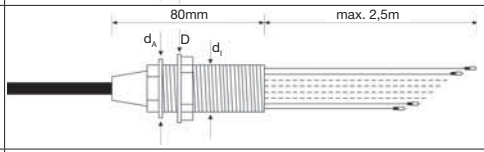
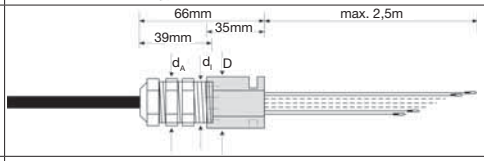
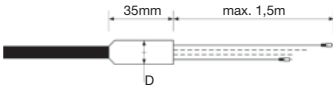
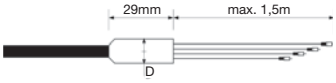
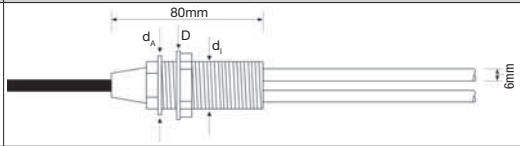
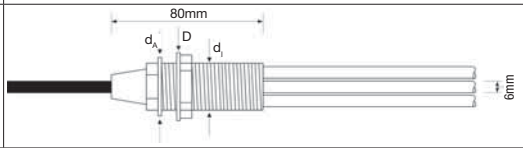
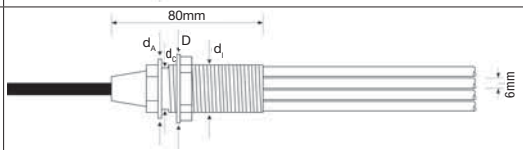
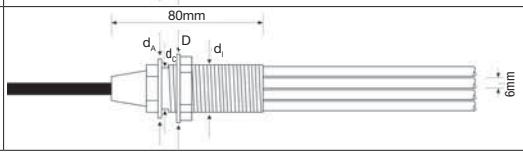
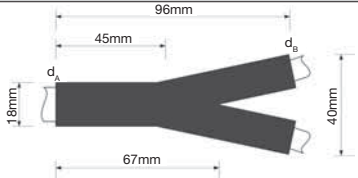
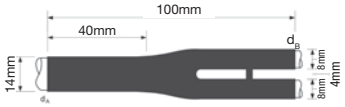
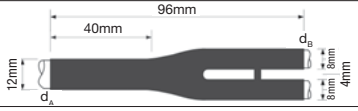
# PRE-ASSEMBLED FIBRE OPTIC CABLES

**Matrix Distributor bodies**

| Designation | Figure | Top view | |
|---|---|---|---|
| | | compact fibre | empty fibre |
| **WKOM-01** |  |  | |
| **WKOM-02** |  |  | |
| **WKOM-03** |  |  |  |
| **WKOM-04** |  |  |  |
| **WKOM-05** |  |  |  |

| Designation | Figure | Top view |
|---|---|---|
| | | |
| **WKOM-100** |  |  |
| **WKOM-101** |  |  |
| **WKOM-102-4** |  |  |
| **WKOM-102-5** |  |  |

**Cable allocation**

| Designation | Figure | Top view |
|---|---|---|
| | | |
| **WKOM-105** |  | |
| **WKOM-106** |  | |
| **WKOM-107** |  | |

| | Compact fibre | Empty fibre | Thread | Fibre optic cable | Allocation table | | | |
|---|---|---|---|---|---|---|---|---|
| | max. number | max. number | type | max ø [mm] | length [mm] | D [mm] | $d_A$ [mm] | $d_I$ [mm] |
| | 24 | - | PG21 | 12 | 80 | 39 | 34 | 28 |
| | 12 | - | PG16 | 12 | 80 | 34 | 28 | 23 |
| | 4 | 12 | PG11 | 10 | 66 | 29 | 26 | 18,5 |
| | 4 | 12 | - | 10 | 35 | 17 | - | - |
| | 4 | 4 | - | 5 | 29 | 12 | - | - |

| | Thread | Cable A | Cable B | Cable B | Allocation table | | | |
|---|---|---|---|---|---|---|---|---|
| | type | max ø [mm] | number | ø [mm] | Length [mm] | D [mm] | $d_A$ [mm] | $d_I$ [mm] |
| | PG16 | 12 | 2 | 6 | 80 | 34 | 28 | 23 |
| | PG16 | 12 | 3 | 6 | 80 | 34 | 28 | 23 |
| | PG21 | 12 | 4 | 8 | 80 | 39 | 34 | 28 |
| | PG21 | 12 | 5 | 6 | 80 | 39 | 34 | 28 |

| | Thread | Cable A | Cable B | Cable B | Allocation table | | | |
|---|---|---|---|---|---|---|---|---|
| | type | max ø [mm] | number | ø [mm] | Length [mm] | D [mm] | $d_A$ [mm] | $d_I$ [mm] |
| | - | 14 | 2 | 12 | 110 | - | 18 | 14 |
| | - | 10 | 2 | 8 | 100 | - | 14 | 10 |
| | - | 8 | 2 | 6 | 100 | - | 12 | 8 |

# MTP® / MPO – PLUG AND PLAY IN THE DATA PROCESSING CENTRE OF THE FUTURE

In data processing centres, height units in the rack as well as space along the cable routes are highly valuable. For fibre optic connections, the MTP® system (see IEC61754-7 and TIA/EIA 604-5) is an attractive option. With trunk cables, which bundle 12 to 24 fibres in a single connector, it is possible to implement a cabling structure that is flexible and future-proof.
(Refer to standard ISO11801 as well as EN50173-5). The trunk cable, which has a nominal diameter of 3.5 mm (4.5 mm in the case of 24 fibres), connects two modular inserts stowed in a 1 HE carrier frame. With push-pull technology, the plug of the trunk cable is quickly and reliably connected with the module. The MTP® system from HELUKABEL® can be used to implement up to 96 fibres in a single height unit. In theory, this means that with 48 height units available, it is possible to manage up to 4608 fibres. With LC, SC, and ST connectivity, almost every connector preference can be met. MTP® products are factory pre-assembled and can be manufactured to order in any length. The fibre types OS1, OS2, and OM1 through 4 can be used for this system. Time-consuming, costly splicing work is a thing of the past with this plug and play system.

**MPO/MTP® module patch panel**

- Carrier completely extractable
- 3 or 4 module slots
- up to 96 fibres per 1 HU possible
- 19" design, 1HU, 255 mm depth
- Colour RAL 9005


**MPO/MTP® cassette**

- Available in 1HU or ½ HU.
- Lightweight aluminium housing
- with 12/24 LC, 12 SC, or 6 MTP® connections
- High packing density up to 12 LC duplex (24 fibres)
- Fibre types OS1(+APC), OM2, OM3, OM4


**Front panel 6x MPO/MTP®**

- Lightweight aluminium front
- Painted in RAL 9005
- Push-Pull locking
- Fitted with 6 MTP® pass-thru connectors

**MPO/MTP® blanking plates**

- for covering module slots not in use
- in 1 or ½ HU
- Fast push-pull locking

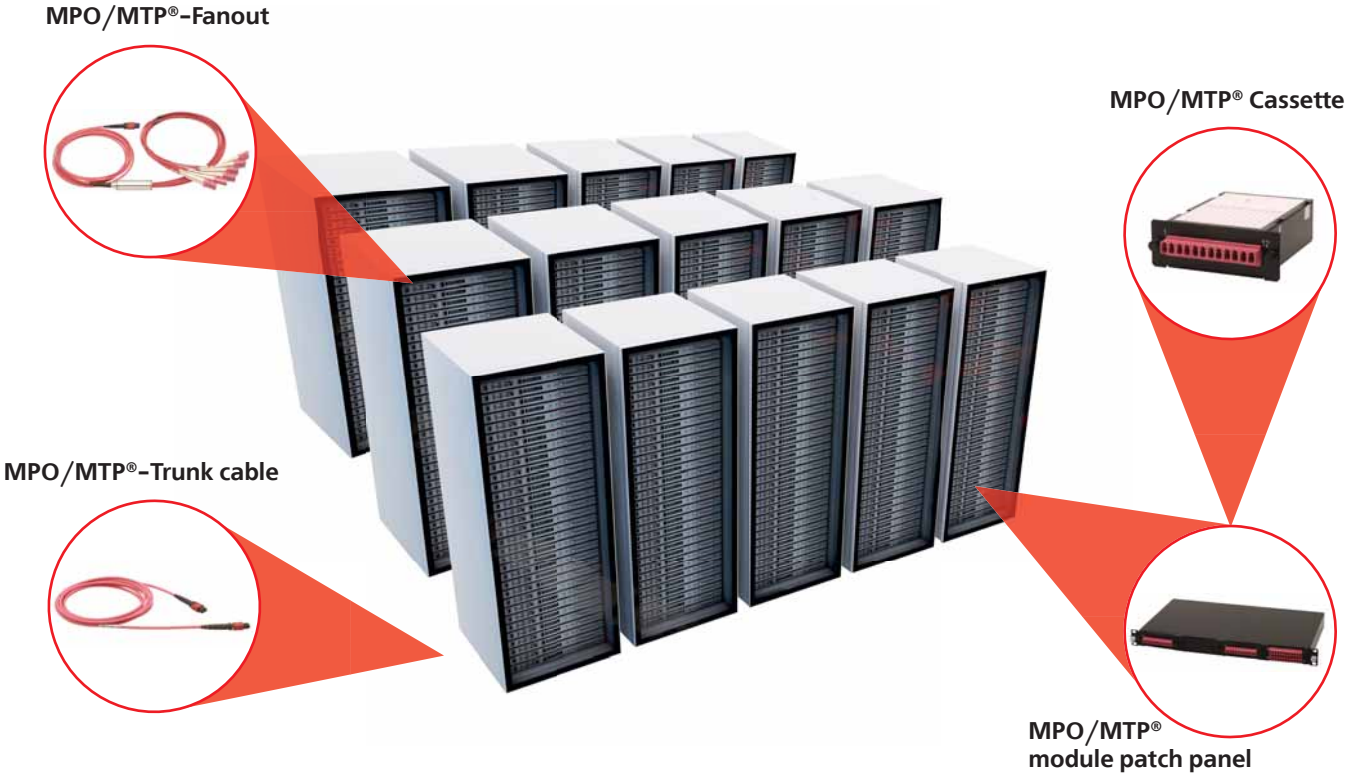
# PRE-ASSEMBLED FIBRE OPTIC CABLES

**MPO/MTP®-trunk cables**

- 12 or 24 fibres•Length to order
- Maximum performance due to factory quality assurance
- Diameter approx. 4.5mm (reinforced) or approx. 3.5mm
- Halogen-free
- Available as SM and OM3/4
- Fast, reliable push-pull locking
- MTP® male/female connectors possible

**MPO/MTP®-Fanout**

- MTP® to LC/SC trunk cable
- 12 or 24 fibres•Pigtails and total lengths to order
- Pigtail available as wire (0.9mm) or cable (2.0mm)
- Duplex clip possible
- Diameter 4.5 mm (reinforced) or 3.0 mm
- Halogen-free
- MTP® male/female connectors possible
- Fibre types OS1(+APC), OM2, OM3, OM4




This is only a small excerpt from our product range in order to serve as a basis for planning. We will be happy to work with you to put together an offer based on your requirements.



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## Type

**19" splice boxes, telescope**

## Cage

| | |
|---|---|
| Housing material: | Steel sheet |
| Cover lock: | Fastening by means of screws |
| Colour: | Grey similar to RAL 7035 |

## Equipment

Full
Couplers
Pigtails

## Dimensions

| | |
|---|---|
| Number of height modules (HM): | 1 |
| Fastening dimensions: | 19" |
| Width: | 225 mm |

## Preferred types

| Part no. | Number of couplers | Type of coupler | Fibre type | Unit |
|---|---|---|---|---|
| **801164** | 4 | ST | Multimode G50/125 | 1 |
| **802453** | 4 | ST | Multimode G50/125 OM3 | 1 |
| **801165** | 8 | ST | Multimode G50/125 | 1 |
| **802454** | 8 | ST | Multimode G50/125 OM3 | 1 |
| **81354** | 12 | ST | Multimode G50/125 | 1 |
| **802455** | 12 | ST | Multimode G50/125 OM3 | 1 |
| **81355** | 12 | ST | Multimode G62.5/125 | 1 |
| **82869** | 12 | ST | Single-mode E9/125 | 1 |
| **81356** | 24 | ST | Multimode G50/125 | 1 |
| **802456** | 24 | ST | Multimode G50/125 OM3 | 1 |
| **81357** | 24 | ST | Multimode G62.5/125 | 1 |
| **82870** | 24 | ST | Single-mode E9/125 | 1 |
| **801166** | 2 | SC duplex | Multimode G50/125 | 1 |
| **802457** | 2 | SC duplex | Multimode G50/125 OM3 | 1 |
| **801167** | 4 | SC duplex | Multimode G50/125 | 1 |
| **802458** | 4 | SC duplex | Multimode G50/125 OM3 | 1 |
| **81358** | 6 | SC duplex | Multimode G50/125 | 1 |
| **802459** | 6 | SC duplex | Multimode G50/125 OM3 | 1 |
| **81359** | 6 | SC duplex | Multimode G62.5/125 | 1 |
| **82871** | 6 | SC duplex | Single-mode E9/125 | 1 |
| **81675** | 12 | SC duplex | Multimode G50/125 | 1 |
| **802460** | 12 | SC duplex | Multimode G50/125 OM3 | 1 |
| **81676** | 12 | SC duplex | Multimode G62.5/125 | 1 |
| **82872** | 12 | SC duplex | Single-mode E9/125 | 1 |
| **803145** | 2 | LCdx | Multimode G50/125 | 1 |
| **803146** | 2 | LCdx | Multimode G50/125 OM3 | 1 |
| **803147** | 4 | LCdx | Multimode G50/125 | 1 |
| **803148** | 4 | LCdx | Multimode G50/125 OM3 | 1 |
| **803149** | 6 | LCdx | Multimode G50/125 | 1 |
| **803150** | 6 | LCdx | Multimode G50/125 OM3 | 1 |
| **803151** | 6 | LCdx | Multimode G62.5/125 | 1 |
| **803152** | 6 | LCdx | Single-mode E9/125 | 1 |
| **803153** | 12 | LCdx | Multimode G50/125 | 1 |
| **803154** | 12 | LCdx | Multimode G50/125 OM3 | 1 |
| **803155** | 12 | LCdx | Multimode G62.5/125 | 1 |
| **803156** | 12 | LCdx | Single-mode E9/125 | 1 |
| **82873** | 12 | E2000 | Multimode G50/125 | 1 |
| **82874** | 12 | E2000 | Multimode G62.5/125 | 1 |
| **82875** | 12 | E2000 | Single-mode E9/125 | 1 |

Dimensions and specifications may be changed without prior notice.

## Application

Glass fibre splice boxes are used as cable end enclosures for multi-core fibre-optic cables in 19" cabinets.

# Fibre Optic Connection Technics

Splice-Boxes partly equiped, Telescope


## Type

**19" splice boxes, telescope partially configured with couplings MM**

## Cage

Housing material: Steel sheet
Cover lock: Fastening by means of screws
Colour: Grey similar to RAL 7035

## Equipment

Partially-configured
Couplers

## Dimensions

Number of height modules (HM): 1
Fastening dimensions: 19"
Width: 225 mm

## Preferred types

| Part no. | Number of couplers | Type of coupler | Unit |
|---|---|---|---|
| **801171** | 4 | ST | 1 |
| **801172** | 8 | ST | 1 |
| **801173** | 12 | ST | 1 |
| **801174** | 24 | ST | 1 |
| **801168** | 2 | SC duplex | 1 |
| **801169** | 4 | SC duplex | 1 |
| **801170** | 6 | SC duplex | 1 |
| **80996** | 12 | SC duplex | 1 |
| **803157** | 2 | LCdx | 1 |
| **803158** | 4 | LCdx | 1 |
| **803159** | 6 | LCdx | 1 |
| **803160** | 12 | LCdx | 1 |

Dimensions and specifications may be changed without prior notice.

## Options

On request, different assembly variations, such as F-SMA, FC/PC, and DIN and/or diagonal cross section designs, are also available.

## Application

Glass fibre splice boxes are used as cable end enclosures for multi-core fibreoptic cables in 19" cabinets. The splice boxes described here are particularly suitable as a connecting unit for our pre-fabricated fibre-optic grooved cables.



DNB Edition 11 (published 01.10.2015)

# Fibre Optic Connecting Technics

Mini Wallcabinet splicing


## Type

**Mini-Wallmount Cabinet**

## Cage

| | |
|---|---|
| Housing material: | Steel sheet |
| Colour: | Grey similar to RAL 7035 |

## Equipment

With front plate

| | |
|---|---|
| Maximum number of couplings/adapters: | 8 |
| Number of couplings/adapters: | 8 |
| With coupling/adapter: | Empty |

## Dimensions

| | |
|---|---|
| Width: | 54 mm |

## Included in delivery

Housing with cover, lockable, 2 keys, 2 plastic expanding rivets, 4 openings with sealing strips for incoming and outgoing cables.

## Application

A maximum of 8 splice boxes or 4 splice boxes and one distributor plate can be installed. The distributor plate can be fastened using 2 plastic expanding rivets. Dimensions: W=320xH=280xD=54mm.

## Part no.

**802461**

Dimensions and specifications may be changed without prior notice.

Mini Wallcabinet splicing


## Type

**Mini-Wallmount Cabinet**

## Cage

| | |
|---|---|
| Housing material: | Steel sheet |
| Colour: | Grey similar to RAL 7035 |

## Equipment

With front plate

| | |
|---|---|
| Maximum number of couplings/adapters: | 4 |
| Number of couplings/adapters: | 4 |
| With coupling/adapter: | Empty |

## Dimensions

| | |
|---|---|
| Width: | 55 mm |

## Included in delivery

1 x distribution plate for 8 x ST or 8 x FC (D-hole) connecters and 1 x distribution plate for 4 x SC Duplex or 4 x LC 4-Way connectors

## Application

Cabinet with hinged cover, lockable, 2 keys, 2 dust-proof openings for incoming and outgoing cables that are fixed in place with cable ties. Space for a maximum of 4 splice trays or 1 splice tray and a distribution plate.
Dimensions: Width = 265 x Height = 150 x Depth = 55mm.
Included in delivery: 1 x distribution plate for 8 x ST or 8 x FC (D-hole) connecters and 1 x distribution plate for 4 x SC Duplex or 4 x LC 4-Way connectors.

## Part no.

**802462**

Dimensions and specifications may be changed without prior notice.


## Type

**Fibre-optic wiring boxes, in-wall installation**

## Cage

| | |
|---|---|
| Housing material: | Plastic |
| Colour: | Pure White similar to RAL 9010 |
| Outlet direction: | Angled |
| Type of fastening: | Snap-in |

## Equipment

Coupler
Central plate
Text box

## Dimension

50 x 50mm

## Preferred types

| Part no. | Number of couplers | Type of coupler | Suitable for fibre type | Unit |
|---|---|---|---|---|
| **81072** | 2 | ST | Multi-mode | 10 |
| **81073** | 4 | ST | Multi-mode | 10 |
| **81074** | 2 | SC | Multi-mode | 10 |
| **81075** | 4 | SC | Multi-mode | 10 |

Dimensions and specifications may be changed without prior notice.

## Options

On request, we also supply sockets in other configurations, such as three-way, to four-way, or six-way sockets. In addition, different codings can be supplied by means of colored identification buttons.

## Application

The fibre-optic wiring box forms the end element of the fibre-optic network at the workstation. From the wiring box, computers and peripheral devices are connected with cable connections (jumper cables). Depending on the version, the wiring box can be used in-wall mounting or top-mounting.



**Type** **Fibre Optic connector**

**Preferred types**

| Part no. | Type | Suitable for fibre type | Unit |
|---|---|---|---|
| **80396** | ST | Multi-mode | 50 |
| **81062** | SC | Multi-mode | 50 |
| **81063** | SC duplex | Multi-mode | 50 |
| **800728** | SC duplex | Single-mode | 50 |
| **800725** | F-SMA | Multi-mode | 50 |
| **800727** | F-SMA | Single-mode | 50 |
| **800723** | LC | Multi-mode | 50 |
| **800726** | LC | Single-mode | 50 |
| **82025** | MT-RJ | Multi-mode | 50 |
| **800724** | FC | Multi-mode | 50 |
| **800720** | E2000 | Single-mode | 50 |
| **800721** | DIN | Multi-mode | 50 |

Dimensions and specifications may be changed without prior notice.

**Included in delivery**

Fibre-optic plug

**Application**

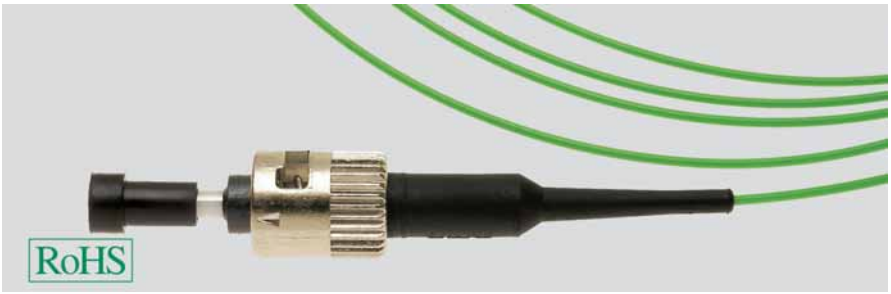
Fibre-optic plugs and couplings serve as links or removable connections for equipment outputs or distribution centers.

**Type** **LWL-coupler**

**Preferred types**

| Part no. | Type | Suitable for fibre type | Unit |
|---|---|---|---|
| **800729** | SC / ST | Single-mode | 50 |
| **802252** | ST / ST | Multi-mode | 50 |
| **80605** | ST / ST | Single-mode | 50 |
| **81069** | SC / ST | Multi-mode | 50 |
| **805112** | SC / SC | Multi-mode | 50 |
| **81065** | SC / SC | Multi-mode | 50 |
| **800731** | SC / SC | Single-mode | 50 |
| **805111** | SC / SC | Single-mode | 50 |
| **81070** | SC duplex / ST | Multi-mode | 50 |
| **800730** | SC duplex / ST | Single-mode | 50 |
| **81066** | SC duplex / SC duplex | Multi-mode | 50 |
| **800732** | SC duplex / SC duplex | Single-mode | 50 |
| **82026** | MT-RJ / MT-RJ | Multi-mode | 50 |
| **800735** | LC / LC | Multi-mode | 50 |
| **800736** | LC / LC | Single-mode | 50 |
| **800733** | E2000 / E2000 | Single-mode | 50 |
| **800737** | FC/PC / FC/PC | Multi-mode | 50 |
| **800738** | F-SMA / F-SMA | Multi-mode | 50 |
| **800734** | DIN / DIN | Multi-mode | 50 |

Dimensions and specifications may be changed without prior notice.




## Type
## Standard length
## Fibre pigtails
## 2,0m

### Preferred types

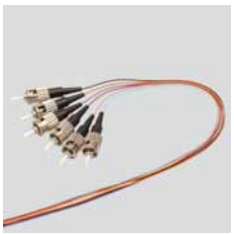
Plug type: ST

| Part no. | Fibre type | Sheath colour | Unit |
|---|---|---|---|
| **80457** | Multimode G50/125 OM2 | Green | 12 |
| **80606** | Multimode G62.5/125 | Blue | 12 |
| **81041** | Single-mode E9/125 | Yellow | 12 |

Plug type: SC

| Part no. | Fibre type | Sheath colour | Unit |
|---|---|---|---|
| **81044** | Multimode G50/125 OM2 | Green | 12 |
| **81045** | Multimode G62.5/125 | Blue | 12 |
| **81046** | Single-mode E9/125 | Yellow | 12 |

Plug type: ST



| Part no. | Fibre type | Sheath colour | Unit |
|---|---|---|---|
| **805718** | Multimode G50/125 OM2 | color coded | 12 |
| **805719** | Multimode G50/125 OM3 | color coded | 12 |
| **805720** | Multimode G50/125 OM4 | color coded | 12 |
| **805722** | Multimode G62.5/125 | color coded | 12 |
| **805721** | Single-mode E9/125 | color coded | 12 |

Plug type: SC

| Part no. | Fibre type | Sheath colour | Unit |
|---|---|---|---|
| **805723** | Multimode G50/125 OM2 | color coded | 12 |
| **805080** | Multimode G50/125 OM3 | color coded | 12 |
| **805724** | Multimode G50/125 OM4 | color coded | 12 |
| **805725** | Multimode G62.5/125 | color coded | 12 |
| **805110** | Single-mode E9/125 | color coded | 12 |

Continuation▸

Plug type: LC

| Part no. | Fibre type | Sheath colour | Unit |
|---|---|---|---|
| **805726** | Multimode G50/125 OM2 | color coded | 12 |
| **805727** | Multimode G50/125 OM3 | color coded | 12 |
| **805728** | Multimode G50/125 OM4 | color coded | 12 |
| **805730** | Multimode G62.5/125 | color coded | 12 |
| **805729** | Single-mode E9/125 | color coded | 12 |

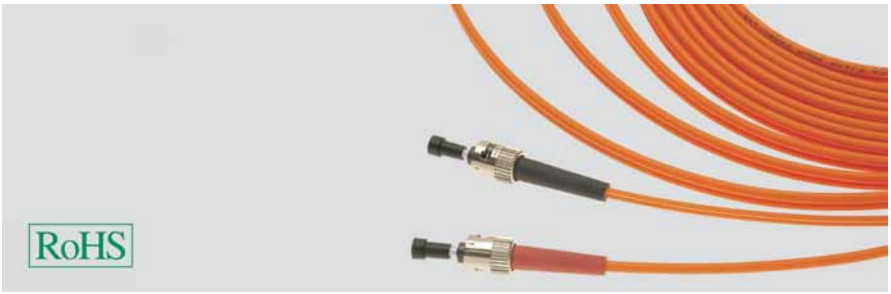
Dimensions and specifications may be changed without prior notice.

## Application

Pigtails are used in glass fibre sets, such as splice boxes. 12 pigtails with fibrecoatings 900µ in a packing unit. Every packing unit contains an individual measurement protocol.

## Options

On request, different assembly variations, such as E2000, FC/PC, F-SMA or DIN, are also available. 8° or 9° diagonal cross sections are also manufactured with the corresponding plug types.




## Type

## Jumper cable I-VH 2x1 (glas fibre)

## Preferred types

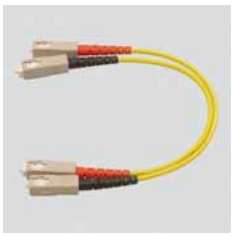
Plug type: ST / ST

| Part no. | Fibre type | Length in metres | Sheath colour | Unit |
|---|---|---|---|---|
| **803161** | Multimode G50/125 OM2 | 1 | Orange | 10 |
| **80983** | Multimode G50/125 OM2 | 2 | Orange | 10 |
| **801175** | Multimode G50/125 OM2 | 3 | Orange | 10 |
| **801176** | Multimode G50/125 OM2 | 5 | Orange | 10 |
| **805796** | Multimode G50/125 OM3 | 1 | turquoise | 10 |
| **802442** | Multimode G50/125 OM3 | 2 | turquoise | 10 |
| **805797** | Multimode G50/125 OM3 | 3 | turquoise | 10 |
| **805798** | Multimode G50/125 OM3 | 5 | turquoise | 10 |
| **80636** | Multimode G62.5/125 | 2 | Orange | 10 |
| **805799** | Single-mode E9/125 | 1 | Yellow | 10 |
| **81043** | Single-mode E9/125 | 2 | Yellow | 10 |
| **805800** | Single-mode E9/125 | 3 | Yellow | 10 |
| **805801** | Single-mode E9/125 | 5 | Yellow | 10 |

Plug type: SC duplex / ST

| Part no. | Fibre type | Length in metres | Sheath colour | Unit |
|---|---|---|---|---|
| **803163** | Multimode G50/125 OM2 | 1 | Orange | 10 |
| **81053** | Multimode G50/125 OM2 | 2 | Orange | 10 |
| **803164** | Multimode G50/125 OM2 | 3 | Orange | 10 |
| **803165** | Multimode G50/125 OM2 | 5 | Orange | 10 |
| **805790** | Multimode G50/125 OM3 | 1 | turquoise | 10 |
| **802444** | Multimode G50/125 OM3 | 2 | turquoise | 10 |
| **805791** | Multimode G50/125 OM3 | 3 | turquoise | 10 |
| **805792** | Multimode G50/125 OM3 | 5 | turquoise | 10 |
| **81054** | Multimode G62.5/125 | 2 | Orange | 10 |
| **805793** | Single-mode E9/125 | 1 | Yellow | 10 |
| **81055** | Single-mode E9/125 | 2 | Yellow | 10 |
| **805794** | Single-mode E9/125 | 3 | Yellow | 10 |
| **805795** | Single-mode E9/125 | 5 | Yellow | 10 |

Plug type: SC duplex / SC duplex



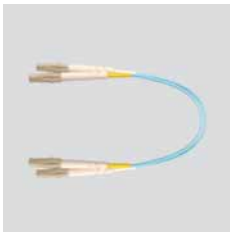
| Part no. | Fibre type | Length in metres | Sheath colour | Unit |
|---|---|---|---|---|
| **803162** | Multimode G50/125 OM2 | 1 | Orange | 10 |
| **81050** | Multimode G50/125 OM2 | 2 | Orange | 10 |
| **801177** | Multimode G50/125 OM2 | 3 | Orange | 10 |
| **801178** | Multimode G50/125 OM2 | 5 | Orange | 10 |
| **805078** | Multimode G50/125 OM3 | 1 | turquoise | 10 |
| **802443** | Multimode G50/125 OM3 | 2 | turquoise | 10 |
| **805079** | Multimode G50/125 OM3 | 3 | turquoise | 10 |
| **805712** | Multimode G50/125 OM3 | 5 | turquoise | 10 |
| **81051** | Multimode G62.5/125 | 2 | Orange | 10 |
| **800423** | Single-mode E9/125 | 1 | Yellow | 10 |
| **81052** | Single-mode E9/125 | 2 | Yellow | 10 |
| **800424** | Single-mode E9/125 | 3 | Yellow | 10 |
| **805715** | Single-mode E9/125 | 5 | Yellow | 10 |

Continuation ▸

# Fibre Optic Connecting Technics



Plug type: LC duplex / LC duplex

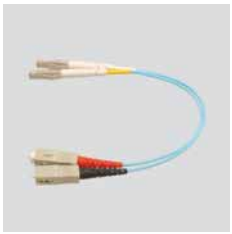


| Part no. | Fibre type | Length in metres | Sheath colour | Unit |
|---|---|---|---|---|
| **803166** | Multimode G50/125 OM2 | 1 | Orange | 10 |
| **802447** | Multimode G50/125 OM2 | 2 | Orange | 10 |
| **803167** | Multimode G50/125 OM2 | 3 | Orange | 10 |
| **803168** | Multimode G50/125 OM2 | 5 | Orange | 10 |
| **805076** | Multimode G50/125 OM3 | 1 | turquoise | 10 |
| **802445** | Multimode G50/125 OM3 | 2 | turquoise | 10 |
| **805077** | Multimode G50/125 OM3 | 3 | turquoise | 10 |
| **805714** | Multimode G50/125 OM3 | 5 | turquoise | 10 |
| **802449** | Multimode G62.5/125 | 2 | Orange | 10 |
| **805045** | Single-mode E9/125 | 1 | Yellow | 10 |
| **802451** | Single-mode E9/125 | 2 | Yellow | 10 |
| **805046** | Single-mode E9/125 | 3 | Yellow | 10 |
| **805717** | Single-mode E9/125 | 5 | Yellow | 10 |

Plug type: LC duplex / ST

| Part no. | Fibre type | Length in metres | Sheath colour | Unit |
|---|---|---|---|---|
| **803171** | Multimode G50/125 OM2 | 1 | Orange | 10 |
| **802543** | Multimode G50/125 OM2 | 2 | Orange | 10 |
| **803172** | Multimode G50/125 OM2 | 3 | Orange | 10 |
| **803173** | Multimode G50/125 OM2 | 5 | Orange | 10 |
| **805802** | Multimode G50/125 OM3 | 1 | turquoise | 10 |
| **803174** | Multimode G50/125 OM3 | 2 | turquoise | 10 |
| **805804** | Multimode G50/125 OM3 | 3 | turquoise | 10 |
| **805803** | Multimode G50/125 OM3 | 5 | turquoise | 10 |
| **803175** | Multimode G62.5/125 | 2 | Orange | 10 |
| **805805** | Single-mode E9/125 | 1 | Yellow | 10 |
| **803176** | Single-mode E9/125 | 2 | Yellow | 10 |
| **805807** | Single-mode E9/125 | 3 | Yellow | 10 |
| **805806** | Single-mode E9/125 | 5 | Yellow | 10 |

Plug type: LC duplex / SC duplex



| Part no. | Fibre type | Length in metres | Sheath colour | Unit |
|---|---|---|---|---|
| **803169** | Multimode G50/125 OM2 | 1 | Orange | 10 |
| **802448** | Multimode G50/125 OM2 | 2 | Orange | 10 |
| **802545** | Multimode G50/125 OM2 | 3 | Orange | 10 |
| **803170** | Multimode G50/125 OM2 | 5 | Orange | 10 |
| **805074** | Multimode G50/125 OM3 | 1 | turquoise | 10 |
| **802446** | Multimode G50/125 OM3 | 2 | turquoise | 10 |
| **805075** | Multimode G50/125 OM3 | 3 | turquoise | 10 |
| **805713** | Multimode G50/125 OM3 | 5 | turquoise | 10 |
| **802450** | Multimode G62.5/125 | 2 | Orange | 10 |
| **802482** | Single-mode E9/125 | 1 | Yellow | 10 |
| **802452** | Single-mode E9/125 | 2 | Yellow | 10 |
| **801836** | Single-mode E9/125 | 3 | Yellow | 10 |
| **805716** | Single-mode E9/125 | 5 | Yellow | 10 |

Dimensions and specifications may be changed without prior notice.

## Application

Cable connections by HELUCOM® are used for wiring terminals.

## Options

On request, different assembly variations, such as E2000, FC/PC, F-SMA or DIN, are also available. 8° or 9° diagonal cross sections are also manufactured with the corresponding plug types.


## Preferred types

| Part no. | Type | Unit |
|---|---|---|
| **80307** | SPLICING CASSETTE | 10 |
| **81365** | SPLICE HOLDER "SHRINK" | 100 |
| **81364** | SPLICE HOLDER "CRIMP" | 100 |
| **81363** | CASSETTE COVER | 10 |
| **81362** | SHRINK-ON SPLICE PROTECTOR | 100 |
| **80309** | CRIMP SPLICE PROTECTOR | 100 |

Dimensions and specifications may be changed without prior notice.

## Options

On request, we also supply special consumables that are not covered by our high-quality types.

# Rubber Cable Reels

HELUCOM® Mobile Cable


## Type

**Rubber cable reel with HELUCOM® fibre optic mobile cable**

## Drum

**Rubber**

Equipment: with supporting frame

## Cable

Description: Fibre-optic cable, mobile, trailing
sheath colour: Orange

Flame proof: VDE 0482-332-1-2

## Plug

System type: office connector
Protective grommet: Plugged
APC version: no

## Norms and standards

Components of HELUCOM CONNECTING SYSTEMS® according actual standards. Meet the standard IEC 60794-1-2 F5 and E6. Also they realize the optical data acc. OM1, OM2 and ITU-T G.652.

## Preferred types

| Part no. | Fibre category | Fibre count | Plug 1 | Plug 2 | Cable length m |
|---|---|---|---|---|---|
| **802223** | Multimode G50/125 | 4 | ST | ST | 500,0 |
| **802226** | Multimode G62,5/125 | 4 | ST | ST | 500,0 |
| **802229** | Single-Mode E9/125 | 4 | ST | ST | 500,0 |
| **802224** | Multimode G50/125 | 4 | SC duplex | SC duplex | 500,0 |
| **802227** | Multimode G62,5/125 | 4 | SC duplex | SC duplex | 500,0 |
| **802230** | Single-Mode E9/125 | 4 | SC duplex | SC duplex | 500,0 |
| **802225** | Multimode G50/125 | 4 | LC duplex | LC duplex | 500,0 |
| **802228** | Multimode G62,5/125 | 4 | LC duplex | LC duplex | 500,0 |
| **802231** | Single-Mode E9/125 | 4 | LC duplex | LC duplex | 500,0 |

Dimensions and specifications may be changed without prior notice.

## Characteristics

Rubber cable reel with 4 fibre optic jacks and fibre optic plugs. Suitable for mobile use on site, for example for meetings, TV-Transmissions, Fairs, etc.. Everywhere when there is a need for a removable cable connection. Usable for flexible and fixed installation cabling.

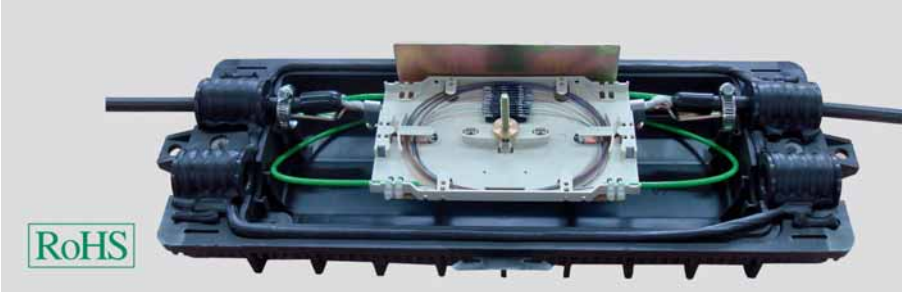
## Options

We also can deliver other cable length, other fibre types or other types of plugs.



DNB Edition 11 (published 01.10.2015)

# Fibre Optic enclosures




## Preferred types

| Part no. | Type | Unit |
|---|---|---|
| **802936** | Fibre Optic Burial Sleeve 24 Fibre capacity | 1 |
| **804300** | Fibre Optic Burial Sleeve 48 Fibre capacity | 1 |

Dimensions and specifications may be changed without prior notice.

## Application

This fiber optic sleeve is suitable for use with up to 48 fibers and is therefore suitable for most applications in optical distribution networks. The fiber optic sleeve is to chemical and mechanical influences in all fields of optical crosslinked, resistant. In the sleeve set are all included for the complete assembly of the sleeve parts required. The type and number of splice trays are selected according to the particular application. The joint consists of two plastic parts and mastic sealants. The wedge slide closure enables easy and fast closing the outdoor sleeve. Through the closure mechanism short installation times and simple open and closed again be made possible.

# Fibre Optic enclosures


## Preferred types

| Part no. | Type | Unit |
|---|---|---|
| **804301** | Mast- Hood-Sleeves 48 Fibre capacity | 1 |
| **804302** | Mast- Hood-Sleeves 144 Fibre capacity | 1 |

Dimensions and specifications may be changed without prior notice.

## Application

Mast-, tower or hood sleeves are designed for underground laying and mounting in stacks and on masts. These types of sleeves are used in a vertical position – all ingoing and outgoing cables are feeded at the bottom. The special construction ensures a maximal protection against environmental conditions. The family of hood sleeves contains 24 to 144 shrinking splices in which max. 12 fiber optic splices lead to a hinged splice cassette. These sleeves are used in long distance data transmission and in the backbone-area of big companies. Access to single fibers is possible trough operation by the hinged splice cassettes, which ensures an undisturbed function of the cables.

# FITTINGS FOR METAL-FREE AERIAL CABLE

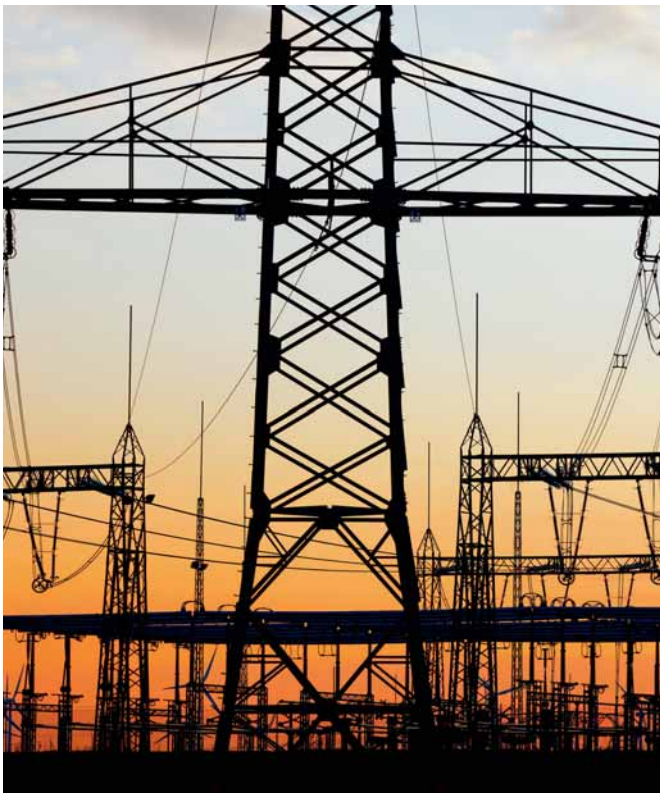
HELUCOM® ADSS fittings are designed to meet the special requirements of optical fibre aerial cable. Our customers, such as electricity supply companies, erection firms, railway and telecommunication companies, receive with the beginning of the planning technical solutions with optimized fittings and the best technical solutions from the planning stage through to optimized fittings and state-of-the-art damping concepts for durable and reliable operation of their transmission lines.

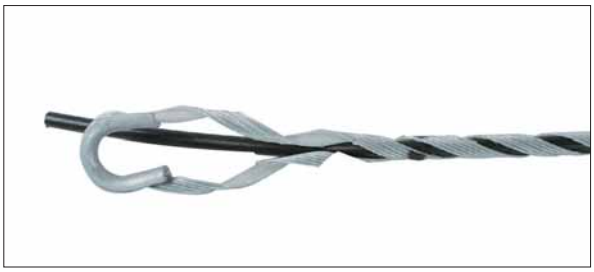
HELUCOM® ADSS fittings are designed to meet the increased demands on optical fibre aerial cables. Especially the helical fittings even exceed the necessary mechanical requirements. The range of HELUCOM® ADSS helical fittings includes a suitable solution for every application.

The method of operation of helical fittings has been adapted from nature and is based on the principle of a cable puller. The inside diameter of the unloaded helical rods is slightly smaller than the outside diameter of the optical fibre aerial cable.

Installing these preformed helical rods creates a spring tension and sets up the mechanical preloaded contact. A special feature of this design is that the helical fitting distributes the forces acting on the cable uniformly over a large area of the cable, which avoids mechanical loads on the optical fibres.

The advantages of HELUCOM® ADSS helical fittings include easy installation and low load on the cable. The helical rods can be installed without tools and installation faults are impossible. The installation can be inspected visually from the ground level.





# Fittings for metal-free optival fibre aerial cables (ADSS)

**Span length < 80 m**

## Suspension Fittings

### Suspension rods

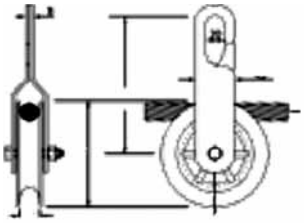
**Application**

HELUCOM® ADSS Suspension rods consisting of thimble, LG- and TG-helical rods are designed for vertical loads up to 1kN. They are used for span lengths up to 80 m approximately. The TG-suspension rods with the preformed loop is the supporting accessory. The shorter and straight LG-supporting rods are only used for stiffening the area round the suspension point. The loop of the fitting is stabilized and protected against abrasion with a ring type thimble.

**Details**

| Designation | Material | Part no. | Unit |
|---|---|---|---|
| Suspension rod (TG) 80m/ ADSS 6L | Steel | **805731** | 1 |
| Supporting rod (LG) 80m/ ADSS 6L | Steel | **805732** | 1 |
| Thimble 80m/ ADSS 6L | Steel | **805733** | 1 |

Dimensions and specifications may be changed without prior notice.



### Suspension pulleys with/ without protection rods

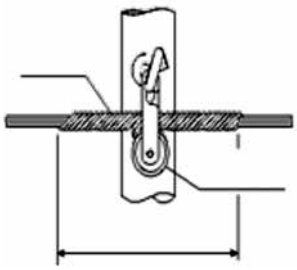
**Application**

HELUCOM® ADSS Suspension pulleys are used for suspension of ADSS cables. The suspension pulleys benefit from the fact that in case of a tree falling in the span length the ADSS cable is not destroyed. This has no influence on the communication line. To avoid high compression forces at the point of contact between cable and suspension pulleys the use of protection rods is recommended.

**Details**

| Designation | Material | Part no. | Unit |
|---|---|---|---|
| Suspension pulley ADSS 6L/ 9L | Steel | **805747** | 1 |
| Protection rod ADSS 6L/ 9L | Steel | **805748** | 1 |

Dimensions and specifications may be changed without prior notice.



### Suspension pulley with helical rod

**Application**

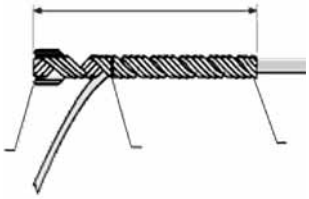
HELUCOM® ADSS Suspension pulleys with helical rods are used for suspension of ADSS cables. They are designed for span lengths up to 150 m approximately and tensile forces up to 2,5 kN.

**Details**

| Designation | Material | Part no. | Unit |
|---|---|---|---|
| Suspension pulley with helical rod ADSS 6L/9L | Steel | **805749** | 1 |

Dimensions and specifications may be changed without prior notice.

## Tension Fittings



### Helical Dead Ends

**Application**

HELUCOM® ADSS Helical dead ends are designed for the full tensioning of ADSS cables in short span lengths up to 80 m/ 150m. The loop of the dead end can be protected against abrasion by a thimble.
For short spans (up to approx. 80m) and small forces: The dead end is mounted on the cable starting at the black crossing mark. This leads to a long cable loop and a large bending radius of the cable. A thimble can be used in the loop of the dead end.

**Details**

| Designation | Material | Part no. | Unit |
|---|---|---|---|
| Helical dead end (AG) ADSS 6L/9L | Steel | **805751** | 1 |
| Thimble ADSS 6L/9L | Steel | **805752** | 1 |

Dimensions and specifications may be changed without prior notice.



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# Fittings for metal-free optival fibre aerial cables (ADSS)

**Span length 80 - 150 m**

## Suspension Fittings

### Suspension rods

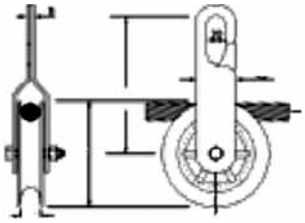
**Application**

HELUCOM® ADSS Suspension rods consisting of thimble, TG- and UTA-helical rods are designed for vertical loads up to 5kN. They are used for span lengths from 80m up to 150 m. The loop of the TG-suspension rods is stabilized and protected against abrasion by a ring type thimble. Protection rods are mounted under the suspension rods to protect the ADSS cable. They reduce radial forces in the cable and increase - due to the increased bending stiffness - the bending radius of the ADSS cable.

**Details**

| Designation | Material | **Part no.** | Unit |
|---|---|---|---|
| Suspension rod (TG) 150m/ ADSS 9L | Steel | **805734** | 1 |
| Supporting rod (UTA) 150m/ ADSS 9L | Steel | **805735** | 1 |
| Thimble 150m/ ADSS 9L | Steel | **805736** | 1 |

Dimensions and specifications may be changed without prior notice.



### Suspension pulleys with/ without protection rods

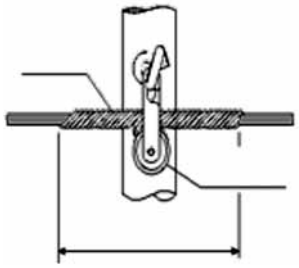
**Application**

HELUCOM® ADSS Suspension pulleys are used for suspension of ADSS cables. The suspension pulleys benefit from the fact that in case of a tree falling in the span length the ADSS cable is not destroyed. This has no influence on the communication line. To avoid high compression forces at the point of contact between cable and suspension pulleys the use of protection rods is recommended.

**Details**

| Designation | Material | **Part no.** | Unit |
|---|---|---|---|
| Suspension pulley ADSS 6L/ 9L | Steel | **805747** | 1 |
| Protection rod ADSS 6L/ 9L | Steel | **805748** | 1 |

Dimensions and specifications may be changed without prior notice.



### Suspension pulley with helical rod

**Application**

HELUCOM® ADSS Suspension pulleys with helical rods are used for suspension of ADSS cables. They are designed for span lengths up to 150 m approximately and tensile forces up to 2,5 kN.

**Details**

| Designation | Material | **Part no.** | Unit |
|---|---|---|---|
| Suspension pulley with helical rod ADSS 6L/9L | Steel | **805749** | 1 |

Dimensions and specifications may be changed without prior notice.

### Vibration damper (AVIBRA)

**Application**

The purpose of HELUCOM® ADSS Avibra vibration dampers is to dissipate partly the wind power input on the ADDS cable to prevent critical cable stresses. The Avibra vibration damper is composed of a helically formed plastic rod. About one fifth of the overall length of the helix is of smaller diameter. This section is used to attach the damper and provides a completely reliable grip on the ADSS cable so that the damper will not slip even on slopes. The remaining length of the helix has no close contact to the cable. Due to differential motions between ADSS cable and Avibra damper, the ADSS cable vibrations are eliminated.

**Details**

| Designation | Material | **Part no.** | Unit |
|---|---|---|---|
| Vibration damper (AVIBRA) 150m/ ADSS 9L | Plastic | **805753** | 1 |

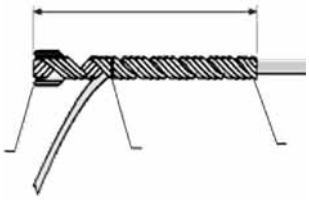
Dimensions and specifications may be changed without prior notice.

Continuation▸

# Fittings for metal-free optival fibre aerial cables (ADSS)

**Span length 80 - 150 m**

## Tension Fittings



## Helical Dead Ends

### Application

HELUCOM® ADSS Helical dead ends are designed for the full tensioning of ADSS cables in short span lengths up to 80 m/ 150m. The loop of the dead end can be protected against abrasion by a thimble.
For short spans (up to approx. 80m) and small forces: The dead end is mounted on the cable starting at the black crossing mark. This leads to a long cable loop and a large bending radius of the cable. A thimble can be used in the loop of the dead end.

### Details

| Designation | Material | **Part no.** | Unit |
|---|---|---|---|
| Helical dead end (AG) ADSS 6L/9L | Steel | **805751** | 1 |
| Thimble ADSS 6L/9L | Steel | **805752** | 1 |

Dimensions and specifications may be changed without prior notice.



DNB Edition 11 (published 01.10.2015)

# Fittings for metal-free optival fibre aerial cables (ADSS)

**Span length > 150 m**

## Suspension Fittings

### LTA - Armour grip suspensions

**Application**

HELUCOM® ADSS armour grip suspension is used for the movable suspension of conductors and optical fibre aerial cables on suspension towers. The armour grip suspension is composed of a certain number of helically formed rods, a concave Neoprene insert consisting of two halfs and a clamp body. The helical rods are placed on the Neoprene insert at the suspension point. This centre assembly is fixed by the clamp body which due to positive locking prevents axial displacement of the conductor.

**Details**

| Designation | Material | Part no. | Unit |
|---|---|---|---|
| Armour grip suspension (LTA) 350m/ ADSS 16L | Aluminum alloy | **805756** | 1 |
| Shakle (for LTA) 350m/ ADSS 16L | Steel | **805757** | 1 |

Dimensions and specifications may be changed without prior notice.

**Characteristics**

Other Materials:
Straps: Steel, h.d.g.
Bolt: Steel, h.d.g.
Insert: Neoprene

### Vibration damper (AVIBRA)

**Application**

The purpose of HELUCOM® ADSS Avibra vibration dampers is to dissipate partly the wind power input on the ADDS cable to prevent critical cable stresses. The Avibra vibration damper is composed of a helically formed plastic rod. About one fifth of the overall length of the helix is of smaller diameter. This section is used to attach the damper and provides a completely reliable grip on the ADSS cable so that the damper will not slip even on slopes. The remaining length of the helix has no close contact to the cable. Due to differential motions between ADSS cable and Avibra damper, the ADSS cable vibrations are eliminated.

**Details**

| Designation | Material | Part no. | Unit |
|---|---|---|---|
| Vibration damper (AVIBRA) 350m/ ADSS 16L | Plastic | **805758** | 1 |

Dimensions and specifications may be changed without prior notice.

## Tension Fittings

### Helical dead ends

**Application**

HELUCOM® ADSS helical dead ends are particulary designed for the full tensioning of metal-free optical fibre aerial cable in medium and long spans.
For long spans and high forces: The dead end is mounted on the cable starting at the red crossing mark. This leads to a short cable loop. Additional intermediate fittings for installation at the tower and a thimble are necessary. The use of protection rods is recommended. When selecting the helical dead ends the total diameter resulting out of the cable diameter plus two times the rod diameter of protection rods has to be taken into account.

**Details**

| Designation | Material | Part no. | Unit |
|---|---|---|---|
| Helical dead end (AG) 350m/ ADSS 16L | Steel | **805775** | 1 |
| Thimble for helical dead end ADSS 16L | other | **805776** | 1 |
| Shakle (for AG) 350m/ ADSS 16L | Steel | **805777** | 1 |

Dimensions and specifications may be changed without prior notice.

Continuation▸

# Fittings for metal-free optival fibre aerial cables (ADSS)

**Span length > 150 m**



## Protection rods

### Application

HELUCOM® ADSS URG-Protection rods are preferably made of steel, h.d.g. and shall protect the self supporting fibre optical aerial cables at tension sets. They are mounted beneath the helical dead end and spread the radial forces on the cable uniformly along the zone of contact. Especially on the cable at the loop-side of the helical dead end radial forces (depending on the tension force) can stress the optical part of the cable inadmissibly. This will cause high damping which results in a reduced data transmission or in the worst case an interruption.

### Details

| Designation | Material | **Part no.** | Unit |
|---|---|---|---|
| Protection rod (URG) 350m/ ADSS 16L | Steel | **805778** | 1 |

Dimensions and specifications may be changed without prior notice.



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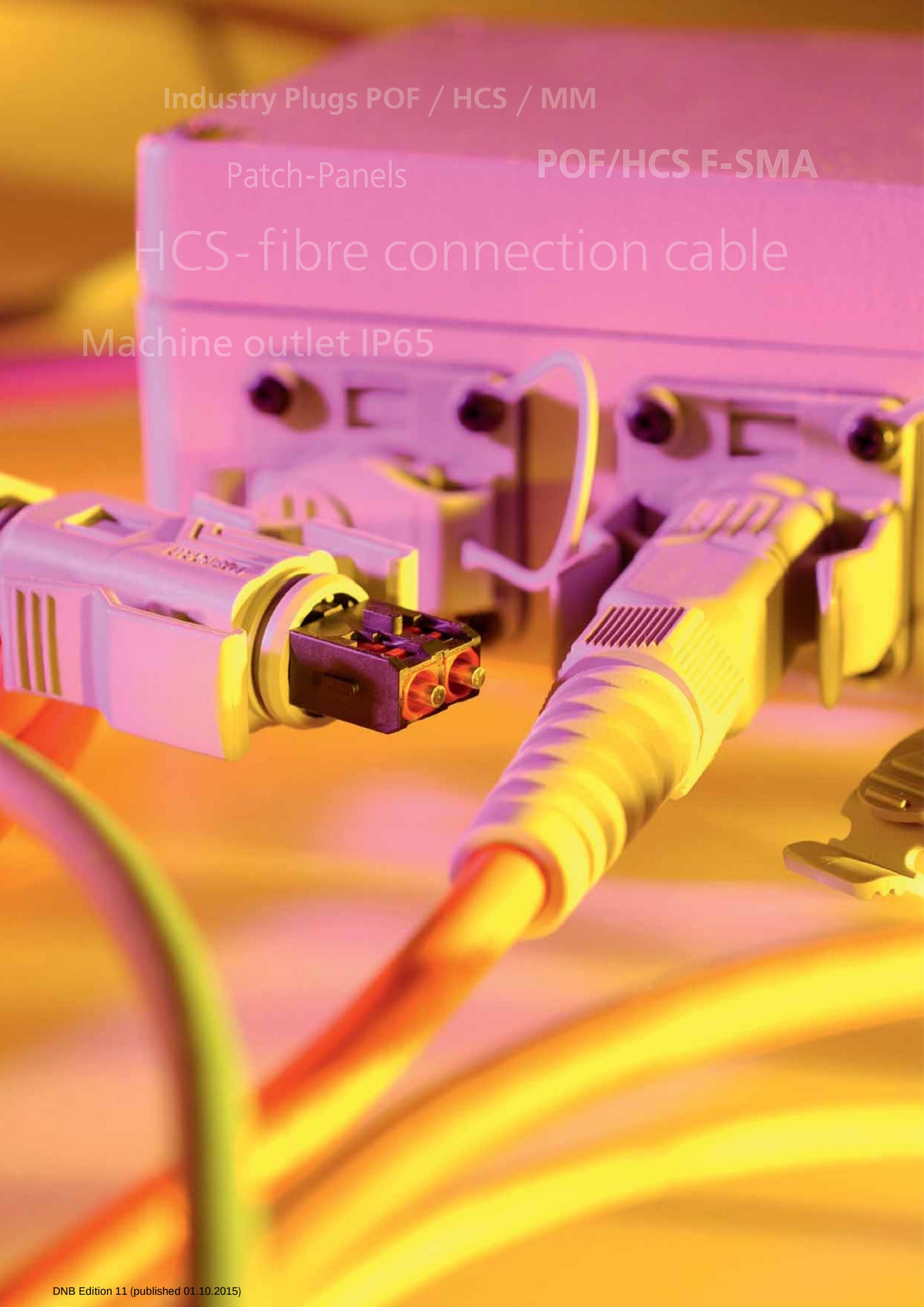


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# FIBRE OPTICS CONNECTION COMPONENTS - INDUSTRY

# POF/HCS CONNECTION TECHNOLOGY

## POF-HFBR 4501/4511
## HCS-HFBR 4521

- Simplex connector
- Plastic enclosure
- For POF and HCS
- Processing: crimping, grinding, polishing

## POF-TOCP 155/F05
## HCS-TOCP/F05

- Simplex connector
- Plastic enclosure
- For POF and HCS
- Processing: crimping, grinding, polishing or hotplate

## POF-HFBR 4503/4513

- Simplex connector
- Plastic enclosure
- For POF
- Processing: crimp /latch

## POF-TOCP 255/F07
## HCS-TOCP 255/F07

- Duplex connector
- Plastic enclosure
- For POF and HCS
- Processing: crimping, grinding, polishing or hotplate

## POF-HFBR 4533/4531

- Simplex connector
- Plastic enclosure
- For POF
- Processing: crimping, grinding, polishing

## POF/HCS F-SMA

- Simplex connector
- Metal enclosure
- For POF and HCS (2.2/3.6/6.0 mm)
- Processing: crimping, grinding, polishing

## POF-HFBR 4506

- Duplex connector
- Plastic enclosure
- For POF
- Processing: crimping, grinding, polishing

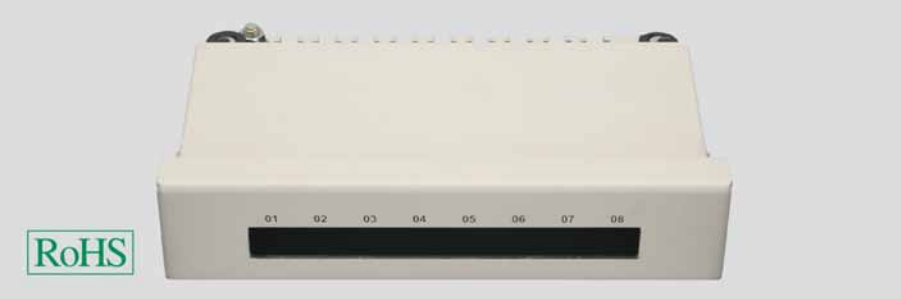
## POF/HCS ST

- Simplex connector
- Metal / plastic enclosure
- For POF and HCS (2.2/3.6 mm)
- Processing: crimping, grinding, polishing

# Patch-Panels

**INDUSTRIAL ETHERNET**

Top hat rail modular, horizontal




## Type

**Basic Panel**

## Configuration

| | | |
|---|---|---|
| Housing material: | Steel plate, solid | Steel plate, solid |
| Colour: | Grey similar to RAL 7035 | Grey similar to RAL 7035 |
| Max. number of modules: | 8 | 16 |
| Screen removal: | via continuous screening tape | via continuous screening tape |
| Strain relief: | by means of cable straps | by means of cable straps |
| Cover lock: | Quick-action twist lock | Quick-action twist lock |

## Dimension

| | | |
|---|---|---|
| Width: | 195 mm | 195 mm |
| Depth: | 150 mm | 150 mm |
| Number of height modules (HM): | 1 | 2 |

## Part no.:

| | | |
|---|---|---|
| | **801311** | **801304** |

## Packing unit:

| | | |
|---|---|---|
| | 5 | 5 |

## Module

| | | | |
|---|---|---|---|
| With coupling/adapter | yes | yes | |
| Connection type, exterior | ST | SC-Duplex | |
| Connection type, internal | ST | SC-Duplex | |
| Number of couplers | 1 | 1 | |
| Fibre type | Multimode | Multimode | |
| APC version | N | N | |
| Type: | Modul for top-hat rail installation patch panel, 2xST MM | Modul for top-hat rail installation patch panel, 2xSC MM | Modul for top-hat rail installation patch panel, blind 2ME |

## Part no.:

| | | | |
|---|---|---|---|
| | **801314** | **801315** | **801316** |

## Packing unit:

| | | | |
|---|---|---|---|
| | 10 | 1 | 10 |

## Norms and standards

HELUKAT® CONNECTING SYSTEMS® INDUSTRY individual system components, category 6 de-embedded (IEC 60603-7-5), ISO 11801 2nd Edition, EN 50173-1 2nd Edition, EIA/TIA 568-B.2-1 and EN 55022 (EMV).

## Application

As connection distribution unit for DIN rail installation e.g. in the switch cabinet, for applications involving digital and analog image, data and voice transmission. Can be combined (also with fibre optic components) thanks to the modular structure. Tool-free turn latches enable simple closing and opening of the housing.

Dimensions and specifications may be changed without prior notice.


## Type

**Fibre Optic DIN RAIL splicebox vertical, telescope partially configured with couplings MM**

## Cage

Housing material: Steel sheet
Cover lock: Fastening by means of screws
Colour: Grey

## Equipment

Partially-configured
Couplers

## Dimensions

Number of height modules (HM): 3
Width: 133 mm

## Preferred types

| Part no. | Number of couplers | Type of coupler | Unit |
|---|---|---|---|
| **804303** | 2 | SC duplex | 1 |
| **804305** | 4 | ST | 1 |
| **804307** | 2 | LCdx | 1 |

Dimensions and specifications may be changed without prior notice.

## Options

On request, different assembly variations, such as F-SMA, FC/PC, and DIN and/or diagonal cross section designs, are also available.

## Application

The Fibre Optic DIN rails are used for installing preassembled Breakout cables with cable splitter WKOM-03. The compact and robust construction and handsome design make them suitable for applications in the industry. The panels consist of a metal housing with integrated coupling heads are built in at the front. Breakout cables are inserted up and down. Modern components provide for excellent attenuation and low reflection losses.

# Machine outlet IP67

**INDUSTRIAL ETHERNET**

SC MM, IP67


## Type

**Industrial Ethernet, SCdx multimode outlets IP67**

## Configuration

| | |
|---|---|
| Housing material: | Aluminium die-cast |
| Colour: | Grey |
| Outlet direction: | Straight |
| Type of fastening: | Screw |
| Dust protection: | Hinged cover |
| Protection classification (IP): | 67 |

## Equipment

| | |
|---|---|
| | Coupler |
| Type: | SC |
| Number of couplings: | 2 |
| Suitable for fibre type: | Multi-mode |

## Dimension

175 x 110 x 45mm

## Area of application

Industrial environment

## Part no.

**801354**

Dimensions and specifications may be changed without prior notice.

## Packing unit

**5**

## Norms and standards

HELUCOM CONNECTING SYSTEMS® INDUSTRY component suitable for multimode fibre applications (G50/125µm and G62.5/125µm). Moreover it satisfies the MICE specifications (class 3), EMC requirements in accordance with DIN EN 6100, and the requirements of the IP 67 housing protection class.

## Application

Robust data connection socket (shielded) for the extreme implementation. Robust aluminum die-cast housing; meets all mechanical requirements like vibration, shock, and transverse forces. The socket is used either on the machine distributor (MD) or wall mounted directly on the machine (MC) as connection unit.

# Machine outlet IP65

**INDUSTRIAL ETHERNET**

SC MM, IP65


## Type

**Industrial Ethernet outlet plastic IP 65, SCdx POF/HCS/MM**

## Configuration

| | |
|---|---|
| Housing material: | Aluminium die-cast |
| Colour: | Grey similar to RAL 7032 |
| Outlet direction: | Straight |
| Type of fastening: | Screw |
| Dust protection: | Hinged cover |
| Protection classification (IP): | 65 |

## Equipment

| | |
|---|---|
| | Coupler |
| Type: | SC |
| Number of couplings: | 2 |
| Suitable for fibre type: | POF/HCS/MM |

## Dimension

125 x 80 x 57mm

## Area of application

Industrial environment

## Part no.

**801421**

Dimensions and specifications may be changed without prior notice.

## Packing unit

**5**

## Norms and standards

HELUCOM CONNECTING SYSTEMS® INDUSTRY component suitable for POF, HCS and multimode fibre applications (980/1000µm, 200/230µm, 50/125µm and 62.5/125µm). More they satisfy the MICE specifications, EMC requirements in accordance with DIN EN 61000, and the IP65 housing protection class requirements. The socket can be used in a temperature range of 0°C to +70°C.

## Application

Robust data connection socket (shielded) for extreme implementation. Robust plastic housing, and satisfies all mechanical requirements like vibration, shock, and transverse forces. The socket is used either on the machine distributor (MD) or wall mounted directly on the machine (MC) as connection unit.

# Machine outlet top-hat rail

**INDUSTRIAL ETHERNET**

ST, SC, LCdx


## Type

**Fibre optic top-hat rail installation data outlets**

## Configuration

| | | | |
|---|---|---|---|
| Housing material: | Plastic | Plastic | Plastic |
| Colour: | Pure White similar to RAL 9010 | Pure White similar to RAL 9010 | Pure White similar to RAL 9010 |
| Outlet direction: | Angled | Angled | Angled |
| Type of fastening: | Snap-in | Snap-in | Snap-in |
| Dust protection: | Hinged cover | Hinged cover | Hinged cover |

## Equipment

| | | | |
|---|---|---|---|
| | Coupler | Coupler | Coupler |
| Type: | ST | LC | SC |
| Number of couplings: | 2 | 4 | 2 |
| Suitable for fibre type: | Multi-mode | Multi-mode | Multi-mode |

## Dimension

80 x 80 x 46mm | 80 x 80 x 46mm | 80 x 80 x 46mm

## Area of application

Industrial environment | Industrial environment | Industrial environment

## Part no.

**801355** | **801357** | **801356**

Dimensions and specifications may be changed without prior notice.

## Packing unit

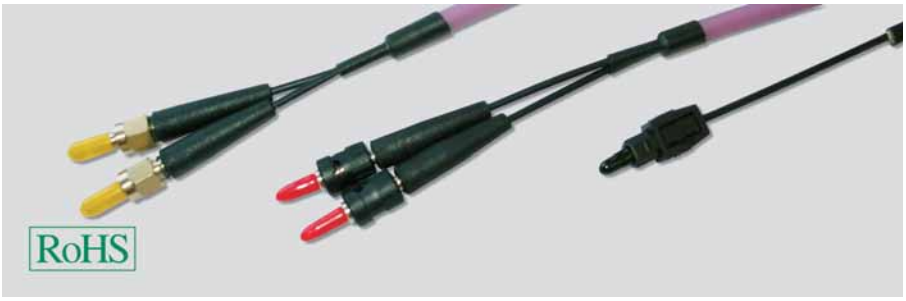
**10** | **10** | **10**

## Norms and standards

HELUCOM CONNECTING SYSTEM INDUSTRY® system component suitable for multimode fibre applications (G50/125µm and G62.5/125µm).

## Application

As connection unit for DIN rail installation e.g. in the switch cabinet, for applications involving digital and analog image, data and voice transmission.




## Type

## Jumper cable I-V2Y 1P 980/1000µm (POF)

## Version

Simplex

## Preferred types

| Part no. | End 1 | End 2 | Fibre type | Length m | Unit |
|---|---|---|---|---|---|
| **801411** | ST | ST | POF 980/1000 | 2 | 10 |
| **801413** | HFBR 4533 blau, simplex | HFBR 4533 blau, simplex | POF 980/1000 | 2 | 10 |
| **801410** | F-SMA | F-SMA | POF 980/1000 | 2 | 10 |
| **801472** | HFBR 4511 blue, simplex | HFBR 4511 blue, simplex | POF 980/1000 | 2 | 10 |
| **801473** | HFBR 4503 grey, simplex | HFBR 4503 grey, simplex | POF 980/1000 | 2 | 10 |
| **801474** | HFBR 4513 blue, simplex | HFBR 4513 blue, simplex | POF 980/1000 | 2 | 10 |
| **801412** | HFBR 4531 black, simplex | HFBR 4531 black, simplex | POF 980/1000 | 2 | 10 |
| **801471** | HFBR 4531 black, simplex | HFBR 4531 black, simplex | POF 980/1000 | 2 | 10 |
| **801475** | F05 simplex | F05 simplex | POF 980/1000 | 2 | 10 |

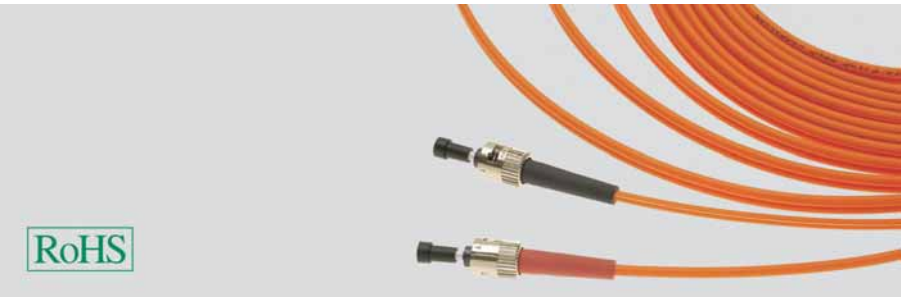
Dimensions and specifications may be changed without prior notice.

## Options

These connecting cables are also available in other lengths and with other plug types, on request. We also supply jumper cable with PUR sheath reinforcement for implementation in extreme industrial environments.

## Application

POF (Polymer Optical Fibre) connection cable from HELUCOM® are particularly used in applications involving machine tools and industrial equipment, e.g. for connecting controller and drive. Systems such as SERCOS rely on POF fibre. POF jumper cables are characterized by a significantly more robust structure compared to traditional glass fibre lines. The version with PE coating is designed for normal implementation.




## Type

## Jumper cable I-V(ZN)HH 2K 200/230µm (HCS)

## Version

Duplex

## Preferred types

| Part no. | End 1 | End 2 | Fibre type | Length m | Unit |
|---|---|---|---|---|---|
| **801415** | ST | ST | HCS 200/230 | 2 | 10 |
| **801416** | HFBR 4521 simplex | HFBR 4521 simplex | HCS 200/230 | 2 | 10 |
| **801414** | F-SMA | F-SMA | HCS 200/230 | 2 | 10 |
| **801476** | F07 duplex | F07 duplex | HCS 200/230 | 2 | 10 |

Dimensions and specifications may be changed without prior notice.

## Options

These connecting cables are also available in other lengths and with other plug types, on request. We also supply jumper cable with PUR or PE sheath reinforcement for implementation in extreme industrial environments.

## Application

HCS (Hard Clad Silica) connection cables from HELUCOM® are particularly used in applications involving machine tools and industrial equipment, e.g. for connecting controller and drive. Systems such as LIGHTBUS rely on HCS fibre. HCS jumper cables are characterized by a significantly more robust structure compared to traditional glass fibre lines. The version with FRNC sheathing is designed for normal mobile implementation.


## Type

## Fibre Optic connector

## Preferred types

| Part no. | Type | Suitable for fibre type | Unit |
|---|---|---|---|
| **801378** | HFBR 4501grey, simplex | POF 980/1000 | 50 |
| **801379** | HFBR 4511 blue, simplex | POF 980/1000 | 50 |
| **801380** | HFBR 4503 grey, simplex | POF 980/1000 | 50 |
| **801381** | HFBR 4513 blue, simplex | POF 980/1000 | 50 |
| **801382** | HFBR 4516 latch, duplex | POF 980/1000 | 50 |
| **800713** | HFBR 4533 blue, simplex | POF 980/1000 | 50 |
| **800714** | HFBR 4531 black, simplex | POF 980/1000 | 50 |
| **801387** | HFBR 4506 grey, duplex | POF 980/1000 | 50 |
| **801388** | HFBR 4516 latch, duplex | POF 980/1000 | 50 |
| **801383** | F05 simplex, grind and polish | POF 980/1000 | 50 |
| **801384** | F05 simplex, hotplate | POF 980/1000 | 50 |
| **801386** | TOCP 255 duplex | POF 980/1000 | 50 |
| **801385** | F07 duplex, hotplate | POF 980/1000 | 50 |
| **801390** | ST | POF 980/1000 | 50 |
| **801420** | SC duplex | POF 980/1000 | 50 |
| **82821** | F-SMA 2,2mm | POF 980/1000 | 50 |
| **801389** | F-SMA 6,0mm | POF 980/1000 | 50 |
| **801832** | HFBR 4521 blue simplex, for 2,2mm | HCS 200/230 | 50 |
| **801392** | HFBR 4521 black simplex, for 2,2mm | HCS 200/230 | 50 |
| **801393** | F05 simplex, für 2,2mm | HCS 200/230 | 50 |
| **801394** | F07 duplex, für 2,2mm | HCS 200/230 | 50 |
| **801396** | ST | HCS 200/230 | 50 |
| **801419** | SC duplex | HCS 200/230 | 50 |
| **801395** | F-SMA 2,2mm | HCS 200/230 | 50 |
| **801418** | SC duplex | Multi-mode | 50 |

Dimensions and specifications may be changed without prior notice.

## Options

On request, we also supply other plug connector types.

## Included in delivery

Fibre-optic plug (partly with housing, crimpring)

## Application

Fibre optic plugs and couplings serve as links or removable connections for equipment outputs or distribution centers. The types designed have been especially designed for industrial use (light-duty or heavy-duty). They can be assembled in the field and, depending on the type, they are available in a clamp, crimp, adhesive, or hot plate version. According to IAONA the ST or the F-SMA plug is specified as standard.

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# Server

## Fan Unit data cabinet

## Distribution cabinets

# NETWORK SYSTEM CABINETS





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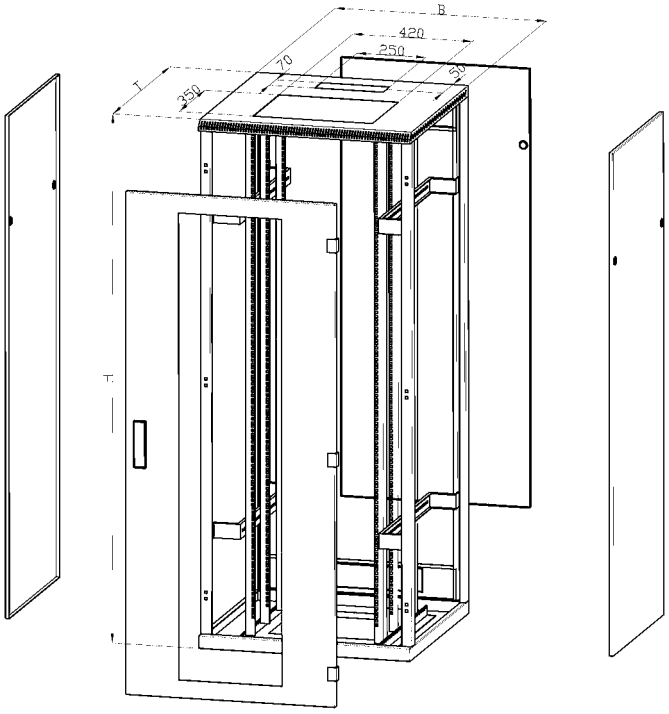
# Network Distribution Rack

## Network Cabinet


## Details

- sheet steel case pre -assembled,self ventilated
- Light gray RAL 7035
- Cable feeding possible from the ground or top
- Earthing set pre -installed
- Protection class IP20
- Accessories: 1x strip, 1x cage nut set (20 pieces), 4 levelling feet M10, 2x keys

## Heat dissipation

- Energy dissipation via cabinet surface up to 450 W (at a temperature differential of 15°C)

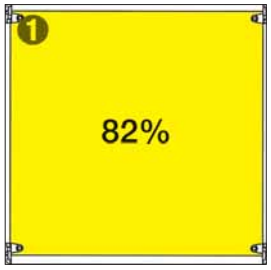
## Preferred types

| Width mm | Height mm | Depth mm | Number of height modules (HM) | Design | Unit | **Part no.** |
|---|---|---|---|---|---|---|
| 800 | 1980 | 800 | 42 | Steel door, rear, Glass door, front | 1 | **801425** |
| 600 | 1980 | 600 | 42 | Steel door, rear, Glass door, front | 1 | **804051** |
| 600 | 1980 | 800 | 42 | Steel door, rear, Glass door, front | 1 | **803480** |

Dimensions and specifications may be changed without prior notice.

# FEATURES

Vario distributor cabinet




**01** Space-saving construction makes is possible to utilise 82% of the area occupied by the product for installation of component parts and/ or cable.

**02** Cable in/ out using tailor-made cover plates / panels that can be removed on all sides at the base.

**03** Use of the Miracel multi-function brace makes it much easier to save space and maintain order when installing cables. Even cabinets with a width of 600 mm are designed with lateral compartment space for continuous cable or ventilation installation.

**04** Raster rails utilising the proven T-slot and spring-nut construction make it easy to install component parts with continuous adjustment or with a 19" or 25-mm raster.

**05** Front and rear doors open at an angle of 180 degrees, increasing the accessibility of components for installation and repair, especially on cabinets arranged in rows.

**06** If desired, doors and side compartments can be equipped with locks to prevent unauthorised access.

**07** After disengaging the quick-release connectors, it is possible to remove side and rear parts in only seconds to permit rapid installation of components.

**08** Decorative profiles on the door / cabinet allow you to choose the colours that suit you best.

**09** A wide adjustable base foot reduces floor load and makes it possible to compensate for uneven surfaces.



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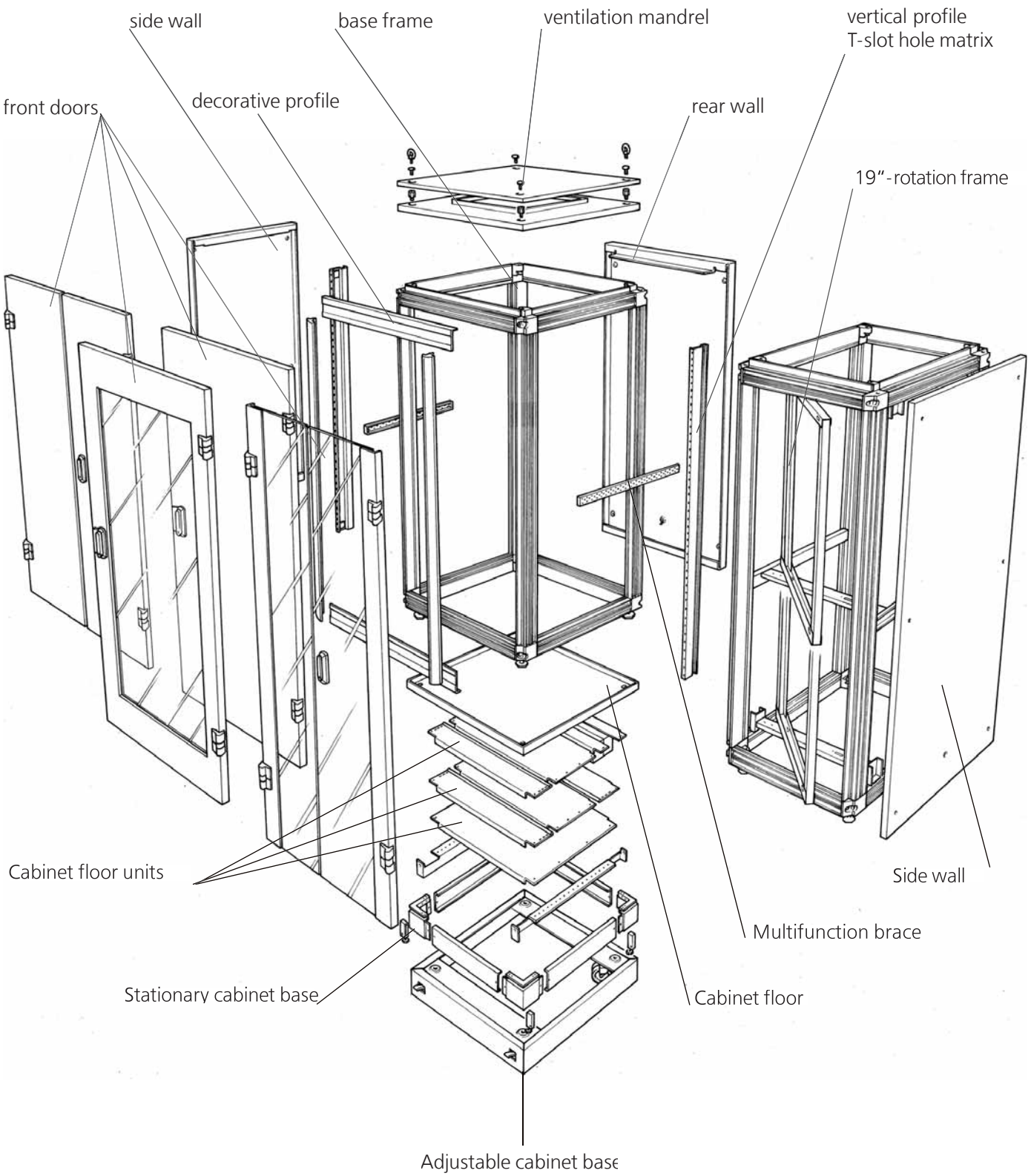
# CONSTRUCTION

Vario distributor cabinet



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# Network Distribution Rack

**Wall mounting Rack**


## Details:

- Steel sheet housing
- preassembled, self ventilated
- Door with security glass
- Cabling from top or button
- Protection class IP20
- Wall fastening
- Color:light grey RAL7035
- housing totaly grounded
- Accessories inclusive: 2xkeys, 1x set cage nut and screws ,1x cable strip

## Preferred types

| Width mm | Height mm | Depth mm | Number of height modules (HM) | Design | Unit | **Part no.** |
|---|---|---|---|---|---|---|
| 600 | 330 | 500 | 6 | Glass door, front | 1 | **801687** |
| 600 | 330 | 400 | 6 | Glass door, front | 1 | **804055** |
| 600 | 465 | 400 | 9 | Glass door, front | 1 | **804056** |
| 600 | 465 | 500 | 9 | Glass door, front | 1 | **801688** |
| 600 | 600 | 500 | 12 | Glass door, front | 1 | **801689** |
| 600 | 600 | 400 | 12 | Glass door, front | 1 | **804057** |
| 600 | 730 | 500 | 15 | Glass door, front | 1 | **801690** |
| 600 | 730 | 400 | 15 | Glass door, front | 1 | **804058** |
| 600 | 860 | 500 | 18 | Glass door, front | 1 | **801691** |
| 600 | 860 | 400 | 18 | Glass door, front | 1 | **804059** |

Dimensions and specifications may be changed without prior notice.



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# FEATURES

Wall housing

**01** Up to 50% of the transport volume is reduced using „flat-pack" packaging. Spacesaving packaging facilitates transport until installation.

**04** Large switch area on side and cable clamping rails (available as accessories) enable well ordered cable installation.

**02** Easy installation thanks to: Pre-fabricated keyholes on the back side Quick-insert support rails and cover pieces Symmetrical housing construction

**05** 19" or metric installation possible, Sliding bolt construction makes it easy to replace door stops. Ventilation design can be expanded at a later date using the optional active ventilation unit.

**03**Accessibility from all sides makes installation of component parts easier.
Open-planconstruction facilitates on-site connection of already existent cable strands.

**06** Pre-drilled holes on the vertical profile and back side make it easy to attach accessories such as socket strips.

# Network Distribution Rack

## Socket Strips


## Characteristics

Housing made of sturdy aluminium U housing, socket inserts made of PA, modular design and rotated 450. Mounting angle rotatable in 900 steps. Inlet HO5VV-F 3G1.5 mm² (250 V/16 A), length: 2.0m: Manufactured according to DIN VDE 0620/05.92-DIN 49440 (sockets), E DIN VDE 0675 part 6 (overvoltage protection) and EN 133200:1994 (filter). Color of the plastic components grey similar to RAL 7035.

## Preferred types

### Series HELU Line

| Socket type | Part no. | Unit |
|---|---|---|
| HELU Line 19" 8x without switch | **82904** | 1 |
| HELU Line 19" 7x with switch | **82905** | 1 |
| HELU Line 19" 5x without switch, thermistor-type equipment protection | **82906** | 1 |
| HELU Line 19" 5x residual-current personnel protection system, 2-pin, 30 mA/30mS | **82908** | 1 |
| HELU Line 19" 5x circuit-breaker, 2-pin, 16A/B | **82909** | 1 |

Dimensions and specifications may be changed without prior notice.



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# Network Distribution Rack

## Socket DV


## Characteristics

Socket for network cabinets inclusive mounting screws M6x8mm
Material: Steel plate
Paint Finish: RAL 7035, light grey
Enlargement for network rack to install cales from socket easier

## Preferred types

| Description | Suitable for ventilation/venting | Material | Height mm | For cabinet width mm | For cabinet depth mm | **Part no.** | Unit |
|---|---|---|---|---|---|---|---|
| Rack Socket | yes | Steel plate, light grey, Ral 7035 | 100 | 600 | 600 | **801876** | 1 |
| Rack Socket | yes | Steel plate, light grey, Ral 7035 | 100 | 600 | 800 | **801881** | 1 |
| Rack Socket | yes | Steel plate, light grey, Ral 7035 | 100 | 800 | 800 | **801674** | 1 |

Dimensions and specifications may be changed without prior notice.

# Network Distribution Rack

**Accessories**

## Characteristics

**19-inch hole matrix**

Elements to reinforce or to enlarge the network rack. Help to mount aktive components or heavy duty lower shelf in existing cabinets. 19-inch hole matrix included.Rack mount nuts mounting possible.

## Preferred types

### 19" profiles

| Description | Material | Surface | Number of height modules (HM) | Suitable for | **Part no.** | Unit |
|---|---|---|---|---|---|---|
| 19-inch hole matrix | Stainless steel | Galvanised | 12 | Wall box | **82052** | 1 |
| 19-inch hole matrix | Stainless steel | Galvanised | 15 | Floor box | **82097** | 1 |
| 19-inch hole matrix | Stainless steel | Galvanised | 21 | Floor box | **82040** | 1 |
| 19-inch hole matrix | Stainless steel | Galvanised | 41 | Floor cabinet | **82047** | 1 |

Dimensions and specifications may be changed without prior notice.



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# Network Distribution Rack

## Accessoires


## Characteristics

Shelf, adjustable
For installation in all networking and
server cabinets and rack frames, mouting with screws and cage nut
Material: steel sheet
Finish: RAL7035, light grey

## Preferred types

### Shelf

| Description | Width mm | Depth mm | Extractable | Load rating N | Suitable for | **Part no.** | Unit |
|---|---|---|---|---|---|---|---|
| Shelf 1U | 432 | 380 | no | 100 | Floor cabinet | **801754** | 1 |
| Pullout shelf 1U | 432 | 380 | yes | 150 | Floor cabinet | **801697** | 1 |
| Pullout shelf 1U | 440 | 350 | yes | 10 | Floor cabinet | **801849** | 1 |
| Pullout shelf 1U | 440 | 500 | yes | 50 | Floor cabinet | **801878** | 1 |
| Pullout shelf 1U | 440 | 500 | yes | 50 | Floor cabinet | **801805** | 1 |
| Shelf 2U | 432 | 380 | no | 20 | Floor cabinet | **82043** | 1 |
| Pullout shelf 2U | 445 | 300 | no | 15 | Floor cabinet | **801701** | 1 |
| Shelf 2U | 445 | 400 | no | 25 | Floor cabinet | **802716** | 1 |

Dimensions and specifications may be changed without prior notice.

# Network Distribution Rack

## Fan units


## Characteristics

**Fan unit**
Roof fan, 1U, Weight 3.9 kg
Fan, capacity 160 cbm/h
For installation in all networking and server cab.
Control via connected thermostat
Thermostat and mounting material included
Rear sided mains connection via
non-heating appliance socket
(connection cable not included)
Rated voltage 230 V, 50 Hz
Illuminated switch ON/OFF
Material: steel sheet
Finish: RAL7035, light grey
Fan features:
Rated voltage 230 V, Frequency 50 Hz, Rated power 22 W, Speed 2700 r/min, Noise level 44 dB(A), Air capacity 160 m³/h, Temperature range -10 to +70 °C, Dimensions 119 x 199 x 38 mm

**Other Accessories**
Mounting equippment and other passiv elements for data racks for orderly and clearly cable routing pease find on page number 89.

## Preferred types

### Fan units

| Description | Number of fans | With thermostat | Installation location | Suitable for | Part no. | Unit |
|---|---|---|---|---|---|---|
| Fan Unit data cabinet, 2-fan | 2 | yes | top area | Floor box | **82055** | 1 |
| Fan plate, 4-fan | 4 | yes | top area | Floor cabinet | **82039** | 1 |

Dimensions and specifications may be changed without prior notice.

# Network Distribution Rack

## Mounting materials


## Preferred types

## Mounting materials

| Description | Number of elements which can be installed | For fastening of | Suitable for | **Part no.** | Unit |
|---|---|---|---|---|---|
| Set of cative nuts | 20 | 19-inch components | Floor cabinet | **82058** | 1 |
| Cable Routing Bracket | 20 | 19-inch components | Floor cabinet | **801699** | 1 |
| Fastening set screen-profile | 50 | Louvered profile | Wall box | **82053** | 1 |
| Cable routing panel 19" | 42 | Cables | Floor cabinet | **802764** | 1 |
| Cable tidy rail 19" | 2 | Cables | Floor cabinet | **804244** | 1 |

Dimensions and specifications may be changed without prior notice.

# Network Distribution Rack

## Lighting


## Preferred types

## Lighting

| Description | Material | Length mm | Suitable for | **Part no.** | Unit |
|---|---|---|---|---|---|
| Cabinet light, Luminestra | Plastic | 365 | Floor cabinet | **800455** | 1 |
| Cabinet light, compact | Plastic | 365 | Universal | **80305** | 1 |

Dimensions and specifications may be changed without prior notice.


# Measuring instrument toolbox

## ASSEMBLY CASE

HELUCUT

## Crimping tool

DNB Edition 11 (published 01.10.2015)

# MEASUREMENT & PROCESSING TECHNICS






DNB Edition 11 (published 01.10.2015)

# Technic of Measurement

## Characteristics

Roof fan, 1U, Weight 7 kg
4 Fans, capacity 640 cbm/h
For installation in all networking and server cab.
Control via connected thermostat
Thermostat and mounting material included
Rear sided mains connection via
non-heating appliance socket
(connection cable not included)
Rated voltage 230 V, 50 Hz
Illuminated switch ON/OFF
Material: steel sheet
Finish: RAL7035, light grey
Fan features:
Rated voltage 230 V, Frequency 50 Hz, Rated
power 22 W, Speed 2700 r/min, Noise level
44 dB(A), Air capacity 160 m³/h, Temperature
range -10 to +70 °C, Dimensions 119 x 199 x 38 mm

## Application

- Test and collect data up to four wavelengths by pressing only one button
- Very fast acquisition time
- Fast ready-to-measure boot-up time of 4 seconds

## Details

- Simultaneous use of touch screen, short-cut keys and tracking knob for high user convenience
- Maximum 256,000 data points for highest resolution
- Loss resolution of 0.001 dB
- 6.4" full VGA touch screen
- Three test modes (auto, advanced and template) fit best to user skills and applications for maximum measurement convenience
- Possible configurations cover all typical fiber applications from long-haul and WDM to metro networks, FTTx as well as LAN
- Easy-to-use post-processing software OSTSView with professional report generation function including bidirectional analysis and quick print function
- Powerful Li-Ion battery provide mains independent operation time of 8 hours (Bellcore TR-NWT-001138)
- Diverse storage options (in addition to 80 MB builtin flash memory, two USB ports2) and a CF card slot
- Internal memory sufficient for up to 1,500 typical traces
- Numerous connection ports for easy connectivity for convenient download and upgrade
- 10/100 Mb/s Ethernet RJ-45 network interface
- Rugged and waterproof housing for long life time

## Designation

OTDR OV 1000 QUAD MDSD-SC

## Part no.

**802495**

Dimensions and specifications may be changed without prior notice.


## Characteristics

The DTX Compact OTDR is a revolutionary enhancement to the DTX CableAnalyzer.The DTX Compact OTDR is a full featured Optical Time Domain Reflectometer (OTDR) module that snaps onto a DTX CableAnalyzer. In additon to copper testing, it makes this powerful certification tool a complete, easy-to-use OTDR that shoots and analyzes traces on singlemode and multimode fiber. With the DTX Compact OTDR, the DTX CableAnalyzer becomes the only cable tester that can completely certify copper and fiber cabling according to all industry standards. The DTX Compact OTDR makes every technician a fiber expert with unparalleled ease of use, automatic OTDR settings, loss limits for events and fiber links, launch fiber compensation, automatic event analysis, and results management, all with the familiar user interface of the DTX CableAnalyzer.

## Application

- Acceptance and test measurements of all common single- and multi-mode fibre optics (1310/1550nm and 850/1300nm)
- With its compact design, the DTX Compact-OTDR is outstanding for field applications

## Details

- Expanding installation revenue without expanding staff
- Shortening technicians learning curve for fiber testing
- Performing Basic (Tier 1) and Extended (Tier 2) fiber certification with a single tool
- Accelerating troubleshooting with a powerful, single-ended OTDR for fiber and extensive DTX diagnostics for copper
- Delivering integrated copper and fiber reports using LinkWare™ Results Management Software

## Designation

DTX Compact OTDR QUAD

## Part no.

**802496**

Dimensions and specifications may be changed without prior notice.



DNB Edition 11 (published 01.10.2015)

# Technic of Measurement

## Characteristics

The output of the signal generator is a modulatable power source, which creates a stabilized optical power output by means of an LED adapter. With the micro process technology used, the measuring instrument permits the measurement of two wavelengths as well as the display of the absolute power in 5W or dBm. For relative power measurements, the measured value is dispalyed in dB. A change adapter system permits connecting all common fibre-optic cable plug connectors. Systems like TCOP 155, F-SMA, ST, HFBR, F05/ F07 or SC are available.

## Application

The good characteristics and the precise coupling to ready-made fibre-optic cables with the exchangeable adapter system allow using the signal generators and receiver in a variety of applications, such as installation control, quality control, attenuation measurements of fibre-optic cables, laboratory tests, or testing visual transmitters and receivers.

## Details

Measuring instrument OPM1:
- Optical power measuring instrument
- 660nm and 850nm calibrated wavelengths
- M12 change adapter connector
- 25mm x 50mm LC display
- Plastic housing
- sturdy plastic sleeve
- simple operation

Signal generator MS100HU:
- Stabilized power source
- 1, 10, 20 kHz modulating frequency
- BNC female connector
- 9V battery operation or ext. power pack
- 25mm x 50mm LC display
- Plastic housing
- sturdy plastic sleeve
- simple operation

## Designation

Measuring instrument case POF/ TOCP 255/F07

## Part no.

**800597**

Dimensions and specifications may be changed without prior notice.

# Technic of Measurement

## Characteristics

The output of the signal generator is a modulatable power source, which creates a stabilized optical power output by means of an LED adapter. With the micro process technology used, the measuring instrument permits the measurement of two wavelengths as well as the display of the absolute power in 5W or dBm. For relative power measurements, the measured value is dispalyed in dB. A change adapter system permits connecting all common fibre-optic cable plug connectors. Following systems are available:
SC Adapter
FST Adapter
HFBR Adapter
TOPCP Adapter

## Application

The good characteristics and the precise coupling to ready-made fibre-optic cables with the exchangeable adapter system allow using the signal generators and receiver in a variety of applications, such as installation control, quality control, attenuation measurements of fibre-optic cables, laboratory tests, or testing visual transmitters and receivers.

## Details

Measuring instrument OPM1:
- Optical power measuring instrument
- 660nm and 850nm calibrated wavelengths
- M12 change adapter connector
- 25mm x 50mm LC display
- Plastic housing
- sturdy plastic sleeve
- simple operation

Signal generator MS100HU:
- Stabilized power source
- 1, 10, 20 kHz modulating frequency
- BNC female connector
- 9V battery operation or ext. power pack
- 25mm x 50mm LC display
- Plastic housing
- sturdy plastic sleeve
- simple operation

| | |
|---|---|
| **Designation** | Measuring instrument toolbox HCS |
| **Part no.** | **801465** |

Dimensions and specifications may be changed without prior notice.



DNB Edition 11 (published 01.10.2015)

# Processing Technic

## Application

When assembling fibre-optic cables and cores, special tools are required. The high-qualitaty tools are put together in the fibre-optic toolbox.

## Details

Generally, the toolbox is equipped with two removable, double-sided tool plates, a covering tool plate, and a document compartment. The essential components are a hot air blower, cross head screw drivers, Miller stand-off pliers, Clauss stand-off, tube socket wrench, bolt cutter as well as consumption materials.

## Designation

Fibre-optic tool case

## Part no.

**800378**

Dimensions and specifications may be changed without prior notice.

## Equipment of fibre optical tool case


## Application
Tool for damage-free stripping of fibre optics, cut or uncut mini grooved cable. Also for suitable for rough grooved cables as well as inside of stranding.

## Details
- Multifibre buffer tube diameters to 1.8mm to 4.2mm can be cut by means of replaceable multifibre buffer tube guides
- Tool made of burnished special tool steel with plastic handle
- Simple time and cost-saving operation

## Included in delivery
Cut start tool, core guide set, spatula, hexagon key, and spare knife, supplied in a plastic case

## Designation
HELUCUT I 0.9-4.2

## Part no.
**800380**

Dimensions and specifications may be changed without prior notice.


## Application
Tool for damage-free stripping of fibre optics, cut or uncut maxi grooved cable. This avoids fibre separation when creating of branches.

## Details
- The application area is grooved cables with a diameter of 4.0 - 10,0 mm (expandable to 14.0mm)
- Interchangable grooved cable guide (5.0/6.0/7.0/8.0/9.0/10.0)
- Diametric cutting technique (with cable supply)
- High continuous cutting performance
- Simple time and cost-saving operation

## Included in delivery
Cut start tool, cutting set, cable shears, toggle and hexagon key, supplied in a plastic case

## Designation
HELUCUT II 4.2-10.5

## Part no.
**800381**

Dimensions and specifications may be changed without prior notice.



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## Application
This box can be used for both, mobile applications on site and stationary applications.
**Type for ST (BFOC) connector**

## Details
The assembly toolbox contains all necessary processing tools for professional POF 980/1000µm plug assembly for ST plugs. Essential components are: Crimping pliers 4-notch, positioning sleeve, crimping pliers 5-edge, sheath stripping tool, fibre stripper, Kevlar scissors, cutter, buffing wheels, polishing paper (grain 1000) and aluminum case.

## Options
Naturally, we can also supply toolboxes for processing HP and Toshiba plug systems.

## Designation
POF Connector Assembly Case ST

## Part no.
**801186**

Dimensions and specifications may be changed without prior notice.

## Application
This box can be used for both, mobile applications on site and stationary applications.
**Type for F-SMA connector**

## Details
The assembly toolbox contains all necessary processing tools for professional POF 980/1000µm plug assembly for F-SMA plugs. Essential components are: Crimping pliers 4-notch, positioning sleeve, crimping pliers 5-edge, sheath stripping tool, fibre stripper, Kevlar scissors, cutter, buffing wheels, polishing paper (grain 1000) and aluminum case.

## Options
Naturally, we can also supply toolboxes for processing HP and Toshiba plug systems.

## Designation
POF Connector Assembly Case F-SMA

## Part no.
**801400**

Dimensions and specifications may be changed without prior notice.


## Application
Tool for damage-free cutting and crimping of 2.2 mm synthetic fibres (POF). Repolishing is no longer necessary.

## Details
- The application area is POF fibres with 2.2 mm diameter
- Interchangeable cutting device
- Stripping length of 4.0 - 20.0 mm
- Tool made of burnished special tool steel with plastic handle
- Simple time and cost-saving operation

## Included in delivery
Pliers made from special tool steel with cutting device and stripping knife

## Designation
HELUCUT`n STRIPP

## Part no.
**800382**

Dimensions and specifications may be changed without prior notice.


## Application
Tool for damage-free cutting, stripping and crimping of 2.2 mm synthetic fibres (POF). Repolishing is no longer necessary.

## Details
- The application area is POF fibres with 2.2 mm diameter
- Adaptable to different contacts
- Optimal crimping quality due to safety interlock
- Tool made of burnished special tool steel with plastic handle
- Simple time and cost-saving operation

## Included in delivery
Pliers made from special tool steel with cutting device

## Designation
HELUCUT`n STRIPP Multi

## Part no.
**800383**

Dimensions and specifications may be changed without prior notice.



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## Application
Tool for damage-free cutting and stripping of synthetic fibre lines (POF).

## Details
- Field of application are POF fibres with 2.2 mm in diameter and PUR-encased POF fibres (simplex, duplex, quattro), Make: HELUKABEL® art. no. 81611, 81882, 80629, 80630
- Interchangeable cutting device
- Stripping length of 4.0 - 20.0 mm
- Tool made of burnished special tool steel with plastic handle
- Simple time and cost-saving operation

## Included in delivery
Pliers made from special tool steel with cutting device and stripping knife set.

## Designation
POF MULTI STRIPPER TOOL

## Part no.
**81320**

Dimensions and specifications may be changed without prior notice.


## Application
Tool for trouble-free crimping of 2.2 mm synthetic fibres (POF).

## Details
- The application area is POF fibres with 2.2 mm diameter
- Suitable for different contacts (4.85mm diameter + 3.15mm key width)
- Optimal crimping quality due to safety interlock
- Unblocking possibilities in case of possible faulty operation
- Tool made from durable special tool steel with plastic handle
- Very simple operation

## Included in delivery
Tool made from special tool steel

## Designation
HELUcrimp

## Part no.
**800385**

Dimensions and specifications may be changed without prior notice.

## Application
This box can be used for both, mobile applications on site and stationary applications.

## Details
The assembly toolbox contains all necessary processing tools for professional HCS 200/230µm plug assembly "adhesive technique" for ST plugs. Essential components are: Crimping pliers, 3 x fibre strippers (0,6, 0,3, 0,18mm), scoring pin, hardening oven, manual microscope (100x), change adapter ST, polishing paper (grain 0.3µm, 5µm), polishing plate, cutter, polishing disk, epoxy adhesive, syringe and aluminum case.

## Options
Naturally, we can also supply toolboxes for processing HP and Toshiba plug systems.

## Designation
HCS Connector Assembly Case for ST

## Part no.
**801403**

Dimensions and specifications may be changed without prior notice.

## Application
This box can be used for both, mobile applications on site and stationary applications.

## Details
The assembly toolbox contains all necessary processing tools for professional HCS 200/230µm plug assembly "adhesive technique" for F-SMA plugs. Essential components are: Crimping pliers, 3 x fibre strippers (0,6, 0,3, 0,18mm), scoring pin, hardening oven, manual microscope (100x), change adapter ST, polishing paper (grain 0.3µm, 5µm), polishing plate, cutter, polishing disk, epoxy adhesive, syringe and aluminum case.

## Options
Naturally, we can also supply toolboxes for processing HP and Toshiba plug systems.

## Designation
HCS CONNECTOR ASSEMBLY CASE FOR F-SMA PLUG

## Part no.
**801404**

Dimensions and specifications may be changed without prior notice.



DNB Edition 11 (published 01.10.2015)


## Application

The test equipment is suitable for the error analysis of PROFIBUS DP segments. With its possibility to test these segments systematically without large effort, time-consuming individual tests are unnecessary.

## Details

- Connector PROFESSIONAL BUS RS485 (DB9 socket strip) and RS232 (DB9 socket strip)
- Power supply with rechargeable battery pack 4.8V/1.500 mAh NIMH
- Error detection in 3 steps: without closure, with one closure and with two closure
- Short-circuit display A-B core with distance reading in meters
- Short-circuit display A-B shield with distance reading in meters
- Line and shield break display with distance reading in meters
- Display for interchanged signal lines A-B
- Display for incorrect or missing bus closures
- Display for incorrect position of the bus connectors
- Error due to inadmissible line length
- Error in characteristic impedance
- Incorrectly used cable type
- Reflections
- Error in sending and reception levels
- Error due to use of inadmissible branch lines

## Included in delivery

Basic equipment in the sturdy service toolbox: 2 rechargeable batteries, international charging station, RS232 cable, PROFIBUS branch line, PROFIBUS T line, bus cutter, gender changer (3), documentation

## Designation

Measuring instrument for PROFIBUS NetTEST II

## Part no.

**800657**

Dimensions and specifications may be changed without prior notice.


## Application
Pliers for crimping of shielded modular RJ45 plug connectors.

## Details
- Crimping pliers for shielded RJ45 TYPE Hirose TM11, TM21, TM31
- Crimps the strain relief in the same work step
- particulaly suited for manufacturing "on site"

## Included in delivery
RJ45 pliers

## Designation
HELUCRIMP45

## Part no.
**82493**

Dimensions and specifications may be changed without prior notice.


## Application
Tool for crimping Harting Industrial IP20 RJ45 8 - poles (HELUKABEL® type 802258 and 802259).

## Details
- Straight action principle with ratchel release
- Contact positioning with locator
- Ergonomic soft grips

## Included in delivery
Crimping tool made of special steel.

## Designation
Crimping tool for Harting Industrial RJ45 8 - poles

## Part no.
**802375**

Dimensions and specifications may be changed without prior notice.



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## Application
Dismantling and stripping the special Profibus SK types.

## Details
- Triple-stage stand-off of sheath, screen, and filler
- Knife block can be inserted on both sides
- Standard port for SK bus lines with outside diameter of 8.0 mm
- Variable tool use thanks to adjustable screw holders or replacement of the knife block for other line types as well, e.g. coaxial cables

## Included in delivery
Stripping tools with brown knife block and adjustment block. As an option, other knife blocks for other diameters are available.

## Options
Knife cartridges for other cable types or constructions

## Designation
Stripper for SK bus cables

## Part no.
**81233**

Dimensions and specifications may be changed without prior notice.


## Application
Dismantling tool for unshielded and shielded data cables.

## Details
- Can cut UTP and STP data cables and other cables of up to 4 mm²
- Dismantling of the outer insulation of UTP and STP data cables, as well as other round cables from 0.5 - 12.5 mm
- No damage to shielding or conductor due to stripping knife adjustable to different insulation thicknesses
- Length stop for repeatable cutting and stripping lengths

## Included in delivery
Dismantling tool with length stop

## Designation
HELU-LAN 12

## Part no.
**82902**

Dimensions and specifications may be changed without prior notice.

# Processing Technic


## Application
Dismantling and stripping the special PROFInet™ types A, B, C.

## Details
- Triple-stage stand-off of sheath, screen, and filler
- Knife block can be inserted on both sides
- Standard port for PROFInet™ lines with outside diameter of 6.5 mm
- Variable tool use thanks to adjustable screw holders or replacement of the knife block for other line types as well, e.g. coaxial cables

## Included in delivery
Stripping tools with green knife block and adjustment block. As an option, other knife blocks for other diameters are available.

## Options
Knife cartridges for other cable types or constructions

## Designation
Stripper for PROFInet cables

## Part no.
**801497**

Dimensions and specifications may be changed without prior notice.



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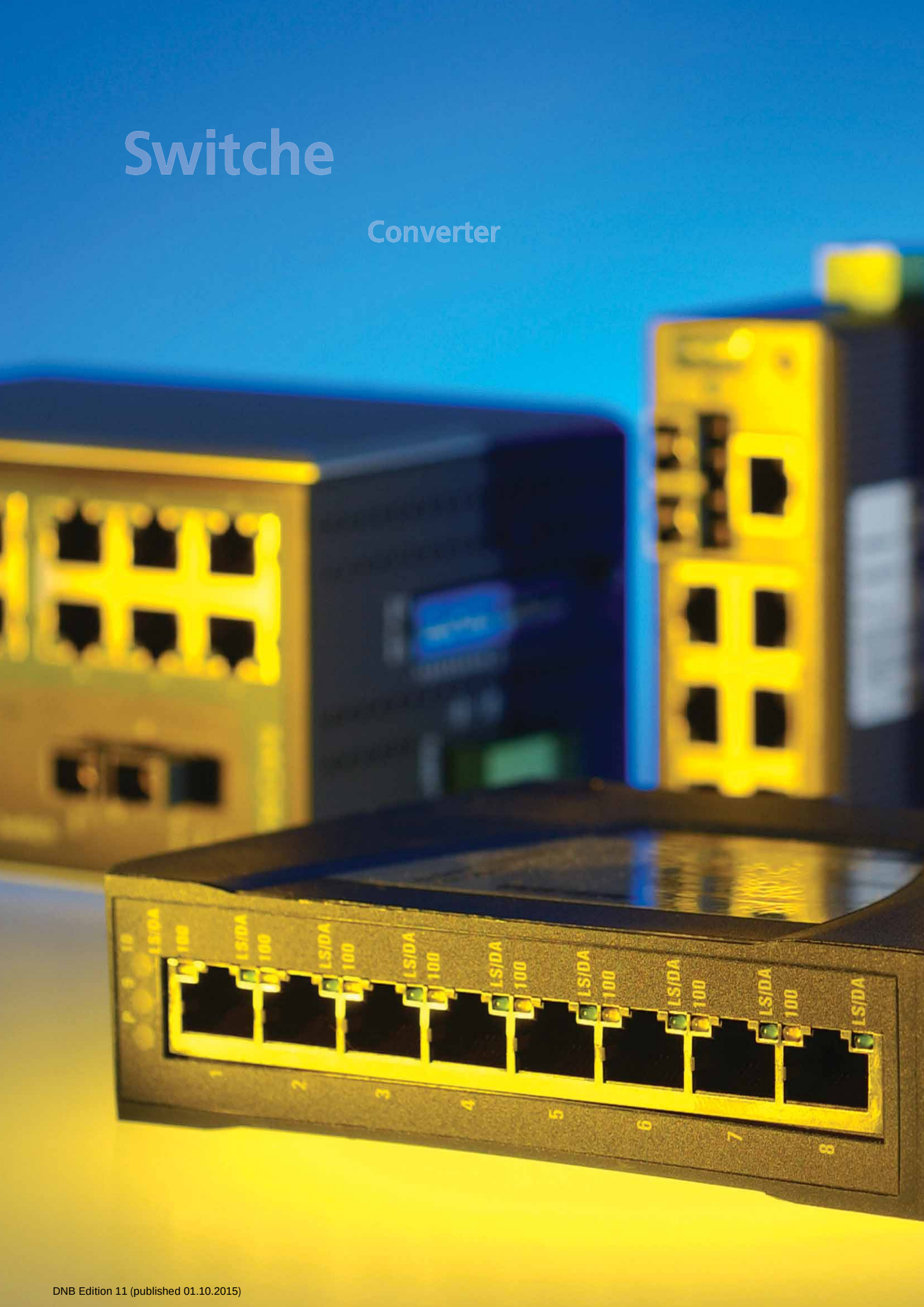
# Switche

## Converter




DNB Edition 11 (published 01.10.2015)

# ACTIVE COMPONENTS





DNB Edition 11 (published 01.10.2015)

# Active Components

## Switches for top DIN Rails


## Switches for top DIN Rails

## Description

Entry level Industrial ETHERNET rail switch with store and forward switching mode and speeds of 10/100 and 1000Mbit/s. All devices are maintenance-free and automatically adapt to your requirements. Switch with copper RJ45 and fibre optic port. Ideal for using as media converters. Plug and play.

All devices have the following features:
- Autocrossing (crossover adaption, straight or crossed)
- Autonegotiation (speed adaption 10/100/1000)
- Autopolarity (pin correction on RJ 45 connector)
- Redundant power supply (2x DC In: 9.6 V to 32 V)
- Proliferation of options for all applications (e.g. ship building, vehicle construction, automation)

Compact design and low weight

## Technical Data

- Voltage: 9,6 V DC-32 V DC
- Max. power consumption: 130 mA
- Humidity: 10-95%
- Protection class: IP30
- cUL 508
- Accessories: Exclusive 19" mounting frame 802793 and power unit (e.g. RPS15 Part No. 803178) available to order.

| Type | Description | Operating temperature | Speed | Ports | Part No. |
|---|---|---|---|---|---|
| Spider 1Tx/1Fx | 1x TP RJ45, 1x Fx SC duplex | 0°C bis +60°C | 10/100 Mbit/s | 2 | 802851 |
| Spider 4Tx/1Fx | 4x TP RJ45, 1x Fx SC duplex | 0°C bis +60°C | 10/100 Mbit/s | 5 | 803177 |
| Spider 5 Tx | 5x TP RJ45 | 0°C bis +60°C | 10/100 Mbit/s | 5 | 803323 |
| Spider 8TX | 8x TP RJ45 | 0°C bis +60°C | 10/100 Mbit/s | 8 | 803324 |
| Spider II Giga 5T/2S EEC | 5x TP RJ45, 2x GE-SFP slots | -40°C bis +70°C | 10/100/1000 Mbit/s | 7 | 803326 |
| Spider II Giga 5T EEC | 5x TP RJ45 | -40°C bis +70°C | 10/100/1000 Mbit/s | 5 | 803325 |

Other versions on request.

Dimensions and specifications may be changed without prior notice.

# Active Components

## Power supply for DIN Rails

## Description

For quick and safe installation just use our power supplies or the 19" mounting frame for data rack integration. 24 V DC power supply for the redundant power to DIN Rail components with one terminal block 3-pin 230 V (100 V - 240 V AC In) and one terminal block 5-pin, 2x24 V DC Out. Output current up to 5 A. With LED diagnostic: green Power and DC ON. Power untis can be switched parallel!

## Technical Data

- Diagnostic: LED (Power, DC ON)
- Redundancy function: Power supply can be switched parallel
- Humidity (non-condensing): Max. 95%
- Weight: 130 - 500 g
- Protection class: IP 20
- EMC, interference immunity: EN 50082-1: EN 61000-6-2 (encompasses EN 55024)
- EN 50082-2: EN 61000-6-2 (encompasses EN 55024)
- EMC, emitted interference: EN 50081-1
- EN 50081-2
- Safety of industrial control equipment: cUL 508
- Safety of information technology equipment: cUL 60950 (E 137006)
- Hazardous locations cUL 1604 class 1 Div. 2
- Scope of delivery: Rail power supply, description and operating manual

| Type | Description | Operating temperature | Out | In | Part No. |
|---|---|---|---|---|---|
| RPS 15 | DIN Rail power pack | -10°C bis 70°C | 24, 5 V DC/30W max. 1,3 A | 100 V - 240 AC max. 0,6 A | 803178 |
| RPS 80 EEC | DIN Rail power pack | -25°C bis 70°C | 24, 5 V DC/80W max. 3,3 A | 100 V - 240 V AC max. 1,6 A | 803331 |

Dimensions and specifications may be changed without prior notice.

Other versions on request.

# 19" mounting frame for top hat rail components

## Description

Frame for mounting DIN Rail components for fixed installation in data and network cabinets with 19" frames. Mounting to 19" rail using cage nuts.

| Type | Description | Dimensions | Assembly | Weight | Part No. |
|---|---|---|---|---|---|
| DIN rail rdapter | Mounting frame for 19"cabinets | BxHxT 481 mm (435mm usable) x177mmx275mm | 19" rack or switch cabinet | 1 kg | 802793 |



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1250
900
250
50

# SERVICES





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## Expert planning and project development

For each and every network, the right planning is crucial, regardless of whether you´re considering installation of a new network, inter-networking between existing islands or expansion and optimisation of an already present network. When investing in a network, it is essential to choose your products carefully to ensure the quality and security of your investment well into the future.
Here, HELUKABEL® provides you with a proven and well-structured concept that maintains an optimum infrastructure during all stages of planning while focusing on finding the best possible technical solutions.
Taken into account are not only the company´s development and its communication targets, but also the need to protect investments made for existing solutions.
Other important factors that must be considered when planning are the investment security and reliability of the network infrastructure of the future. The reliability and efficiency of a network in the future all depends on how well the network was initially planned. At HELUKABEL®, planning is carried out by experts in the field, so you can be sure that your investment is secure.

## Working to meet all your business needs

HELUKABEL® offers a wide array of network solutions to meet your every need. Regardless of your network structure or technology, we can provide you with a turnkey system that meets your individual requirements – from delivery of the cable and on-site installation all the way to final transfer of the system.
Careful and correct installation is essential for reliable and efficient operation of the network. This is especially important in an age of high-speed networks, which place great demands on the quality of the traffic networks that carry the data. To achieve these goals, you need the help of highly qualified experts who are there for you on a daily basis. After installation is complete, the entire network together with all installed components is checked carefully from top to bottom. The result of the measurements and checks are recorded in protocol form. This information is just as important for your documentation as the network-specific plans and component lists.
HELUKABEL® is certified to ISO 9000. For you, this means you can rely on a well-structured work method that guides the project through every stage to completion.

## Providing you with high-quality services

In addition to supplying network components, HELUKABEL® offers a complete line of services, making us your one stop provider complete, turnkey network solutions and comprehensive service. Our employees have extensive experience working with network components. They are constantly being trained to ensure that they are always informed of the latest developments in this innovative field.
We use high-quality equipment ranging from fibre optic splicing devices to LAN analysers to ensure the best possible performance of your network.
We only use the best components available today. Our collaboration with numerous well-known manufactures of IT components makes it possible for us to provide you with the right selection of components for proper installation of your network.
After installation is complete, the entire network together with all installed components is checked with care. The result of the measurements and checks are recorded in protocol form. This information is just as important for your documentation as the network-specific plans and adresses and component lists.

## Practical training

We provide continuing education and training specially designed to meet the growing demands of the market. Our seminars and workshops provide you with the latest information in the field, giving you the edge you need to succeed in your daily works.
As cable specialist, we are interested in sharing with you the extensive knowledge and expertise we have gained in the field. We offer seminars covering all theoretical and practical questions concerning copper and fibre optic cables. In the courses, we familiarise you with the installation and correct application of our products to ensure reliable and lasting operation.
In addition, the course provide useful background information for customer-specific solutions as well as practical exercises.
We offer the following standard training courses: Category 5 / 6 / 7 measuring techniques, The basic of fibre optics, Arc lamp splicing devices, OTDR measuring techniques

If you do not find the course you need, we are happy to provide you with a tailored solution to meet your requirements.



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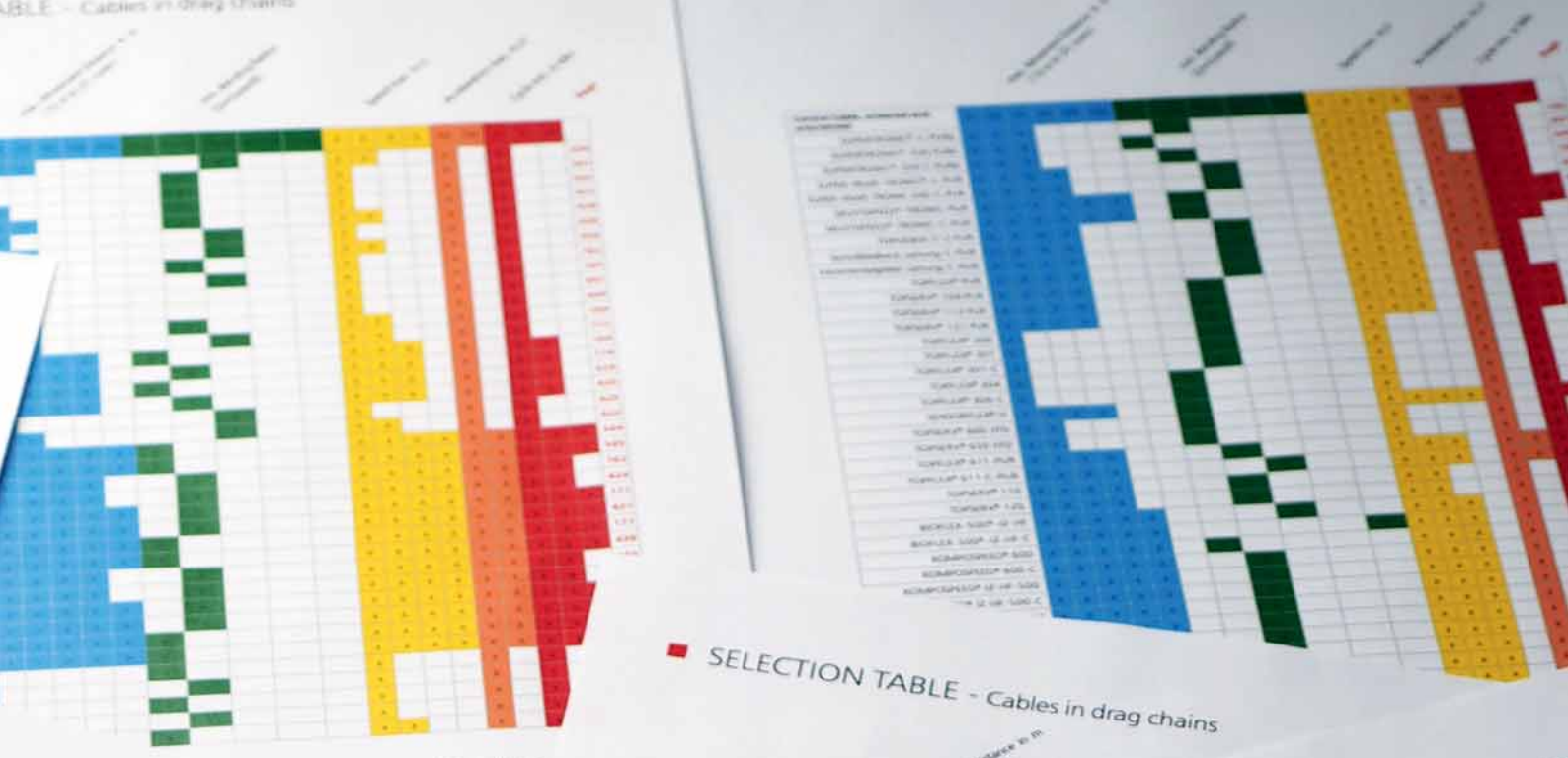
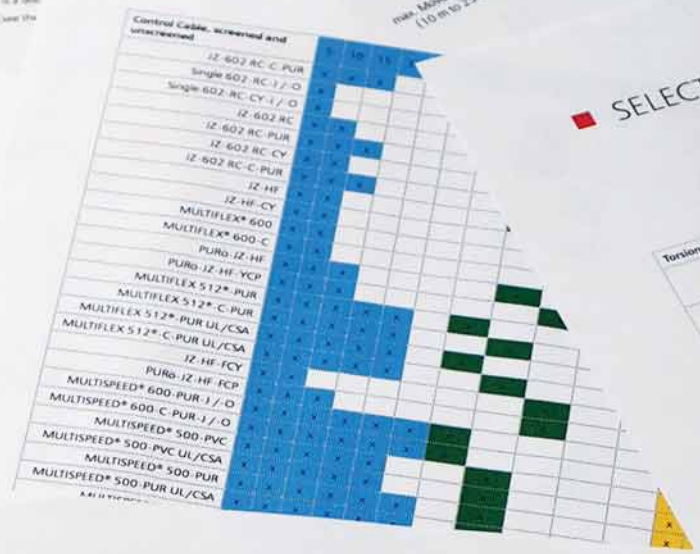


SELECTION TABLE - Cables in drag chains



SELECTION TABLE - CABLES & WIR

HELUKABEL®

## Questionnaire for energy drag chains

Company

First name, Name

Street, No.

Postal Code, Place

Phone / Fax

E-Mail

Installation site

Kind of machine

In operation since

Sender

### 1. Drag Chain-Parameter

1. Chain length/chain width m/mm
2. Chain pitch mm
3. Bending radius mm
4. Guide stays existing [ ] yes [ ] no
5. Frame stays existing [ ] yes [ ] no
6. Layout/Installation [ ] horizontal [ ] vertical

### 2. Installation and Movement-Parameter

1. Movement distance (max.) m
2. Speeds m/s
3. Acceleration m/s²
4. Frequency per time unit x/h
5. Average movement distance/cycle m
6. Daily working duration h
7. Feeding at mid of moving distance [ ] yes [ ] no
8. Additional weight/chain kg

### 3. Cable-Parameter

1. Cable length (total)

## Enquiry Special Cable

Phone +49 7150 9209-0
Fax +49 7150 81786
E-Mail: anfrage-spezialkabel@helukabel.de

**Enquiry**

yearly requirement approx. ____ m
Delivery required
Size
Make-up
Type of Cable

**Application**

a) [ ] indoor [ ] outdoor
b) [ ] stationary [ ] for flexing
c) [ ] Drag chain speed ____ m/s
load
ambient ____ °C
[ ] with reversed bending
Acceleration ____ m/s²
[ ] cyclic [ ] non-cyclic
continuous ____ °C

**Temperatures**

**Construction**

# TECHNICAL INFORMATION





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# OSI REFERENCE MODEL

The communication between systems (devices, computers) in an open network architecture is specified schematically and standardised by the OSI reference model. The individual functions for communication between an application process in one system and any other application in another system are classified in seven functional layers. The complex communication process is simplified by this abstraction and divided into logical units.
A further benefit of this modularisation of the individual function tasks is also the possibility of being able to simply replace the technical implementation of one layer independently from the other layers. For example, it is possible to easily change the transmission medium. The functionality of the other layers is maintained without modification.

**Layer 7 Application layer**
(also called: processing layer, application level). The application layer is at the top of the seven hierarchical layers. It provides the applications with a multitude of functionalities (for example, data transmission, email, Virtual Terminal or Remote Login etc.).

**Layer 6 Presentation layer**
(also called: data presentation layer, data provision level). The presentation layer converts the system-dependent presentation of the data (for example, ASCII, EBCDIC) to an independent form and thus enables syntactically correct data exchange between different systems. Tasks such as data compression and encryption also belong to Layer 6.

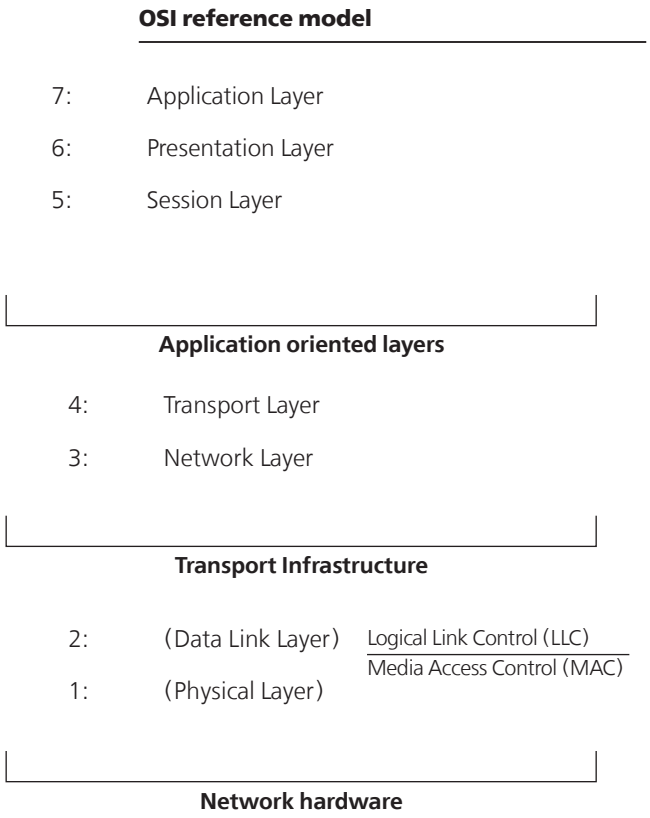
**Layer 5 Session layer**
(control of logical connections, session level). The session layer provides services for an organised and synchronised data exchange in order to resolve session crashes and similar problems. For this purpose, restart points, so-called tokens, are implemented, using which the session can be resynchronised after a transport connection failure without having to restart the transmission from the beginning.

**Layer 4 Transport layer**
(also called: end-to-end control, transport control). The tasks of the transport layer include the segmentation of data packets and congestion control. The transport layer is the bottom layer which provides a complete end-to-end communication between sender and recipient. It provides standard access to the application-oriented layers 5 - 7 so that these do not need to take account of the characteristics of the communication network. Five differentiated service classes of different quality are defined in Layer 4 and can be used by the upper layers, from the simplest to the most convenient service with multiplexing mechanisms, error protection and error correction methods.

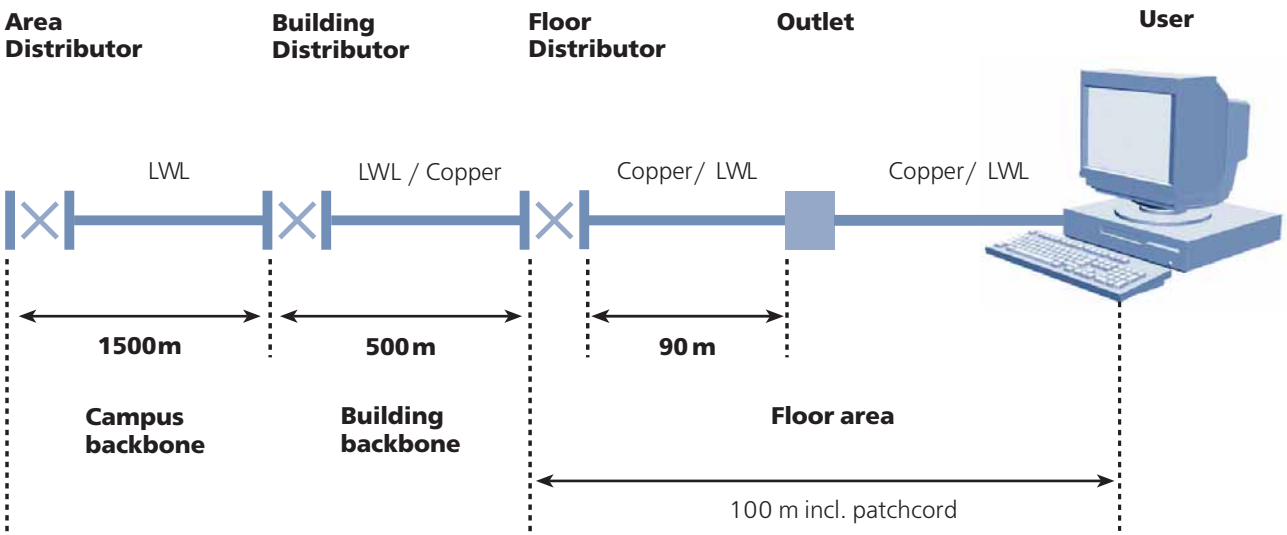
**Layer 3 Network layer**
(also called: packet level:). The network layer ensures control of connections for connection-oriented services and the forwarding of data packets for packet-oriented services. In both cases, the data transmission passes over the complete communication network and includes the routing between the network nodes. As a direct connection between the sender and destination is not always possible, packets must be forwarded from nodes which are on the path.

**Layer 2 Data link layer**
(also called: connection link layer, connection level, procedure level). The role of the data link layer is to ensure a safe, i.e. transmission as error-free as possible and to control the access to the transmission medium. Splitting the bit data stream into blocks and the insertion of sequence numbers and check numbers are provided for this. Incorrect or lost blocks caused by errors can be requested again by the recipient using acknowledgement and repetition mechanisms. The blocks are also called frames. A so-called flow control makes it possible for a recipient to dynamically control the speed at which the other side is allowed to send blocks.

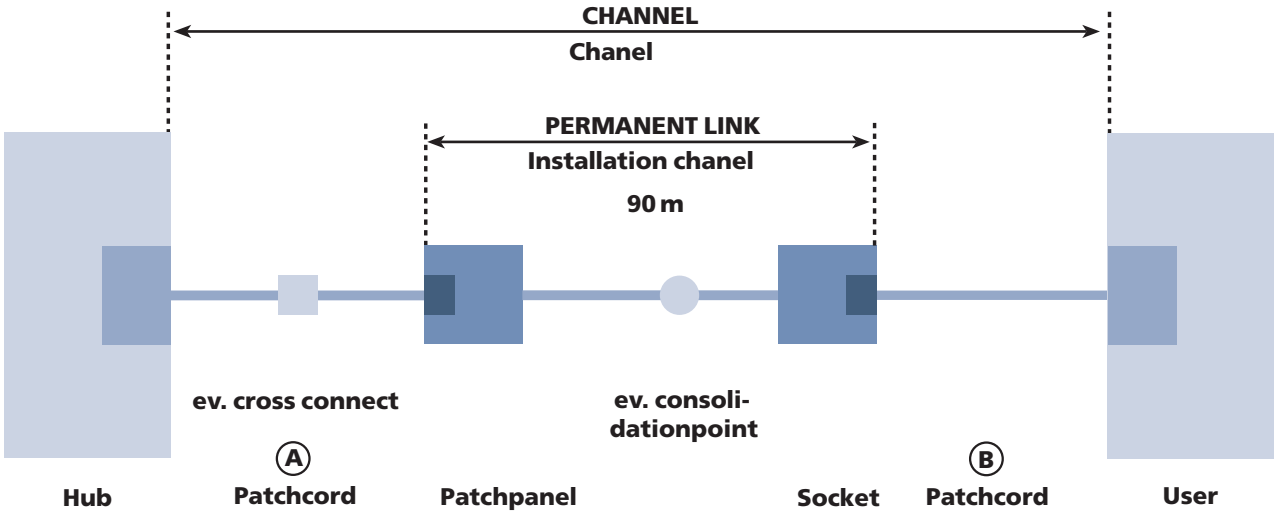
**Layer 1 Physical layer**
(also called: bit transmission layer, physical level). The physical layer is the bottom layer. The specifications for Layer 1 mainly include the mechanical (plug connectors, etc.), electrical (level, type of pulse, etc.) and optical (wavelength) characteristics of the transmission medium (cable, fibre optics, wireless technology etc.).



# BASICS OF STRUCTURED CABLING (EN 50173)

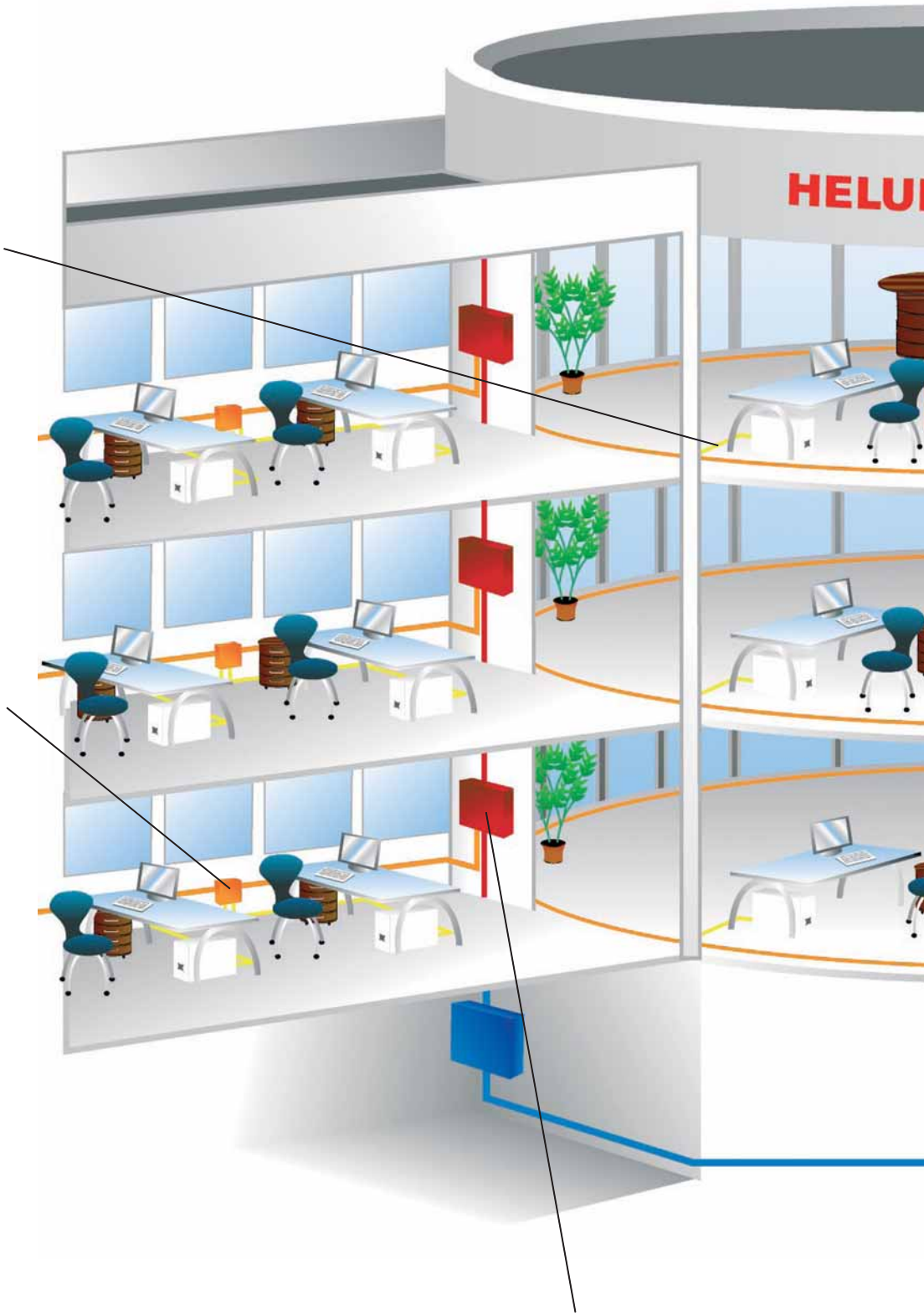



**The permanent link and the transmission path (channel) are defined as follows in the ISO/IEC 11801 and EN 50173 standards:**




**A + B ca. 10 m**

# STRUCTURED WIRING



## Device wiring / Work Area

- **Copper data cables (Chapter 2 HELUKAT®)**
  1. U/UTP (UTP*)
  2. F/UTP (FTP*)
  3. SF/UTP (S-FTP*)
  4. S/FTP (S-STP*)

- **Glas fibre cables (Chapter 1 HELUCOM®)**
  1. Installation cables/Zipcord (I-VH)

## Floor Wiring/ Horizontal Cables

- **Copper data cables (Chapter 2 HELUKAT®)**
  1. U/UTP (UTP*)
  2. F/UTP (FTP*)
  3. SF/UTP (S-FTP*)
  4. S/FTP (S-STP*)

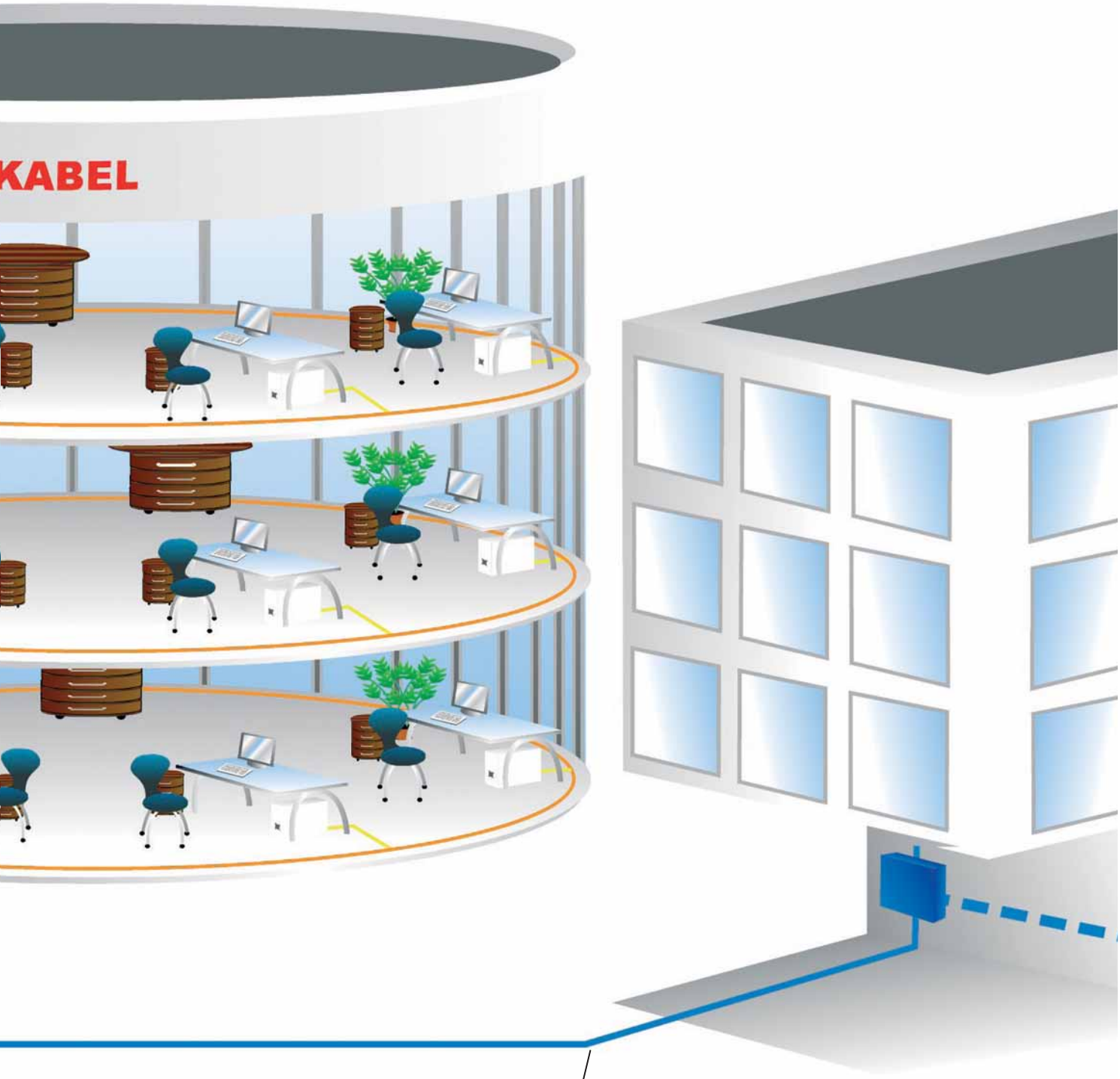
- **Glass fibre cables (Chapter 1 HELUCOM®)**
  1. Breakout-Kabel (z.B. I-V(ZN)HH)
  2. Minibreakout-Kabel (z.B. A/I-VQ(ZN)BH)

## Building backbone/Vertical Cables

- **Copper data cables (Chapter 2 HELUKAT®)**
  1. U/UTP (UTP*)
  2. F/UTP (FTP*)
  3. SF/UTP (S-FTP*)
  4. S/FTP (S-STP*)

- **Glass fibre cables (Chapter 1 HELUCOM®)**
  1. Breakout-Cable (z.B. I-V(ZN)HH)
  2. Minibreakout-Cable (z.B. A/I-VQ(ZN)BH)
  3. Loose-tube cable with or without rodent protection (z.B. A/I-DQ(ZN)BH)

* old description




## Campus Cables

- **Glass fibre cables**
  (Chapter 1 HELUCOM®)
  1. Breakout with rodent protection (z.B. AT-V(ZN)HH(BN)2Y)
  2. Loose-tube cable with rodent protection (z.B. A-DQ(ZN)B2Y)

## Application:

**These cables are suitable for use with the following LAN standards:**

| | |
|---|---|
| Ethernet | 10 Mb/s |
| Token Ring | 10 Mb/s |
| Fast Ethernet | 100 Mb/s |
| FDDI-CDDI | 100 Mb/s |
| ATM | 155 Mb/s |
| ATM | 622 Mb/s |
| Gigabit Ethernet | 1 Gb/s |
| 10 Gigabit Ethernet | 10 Gb/s |



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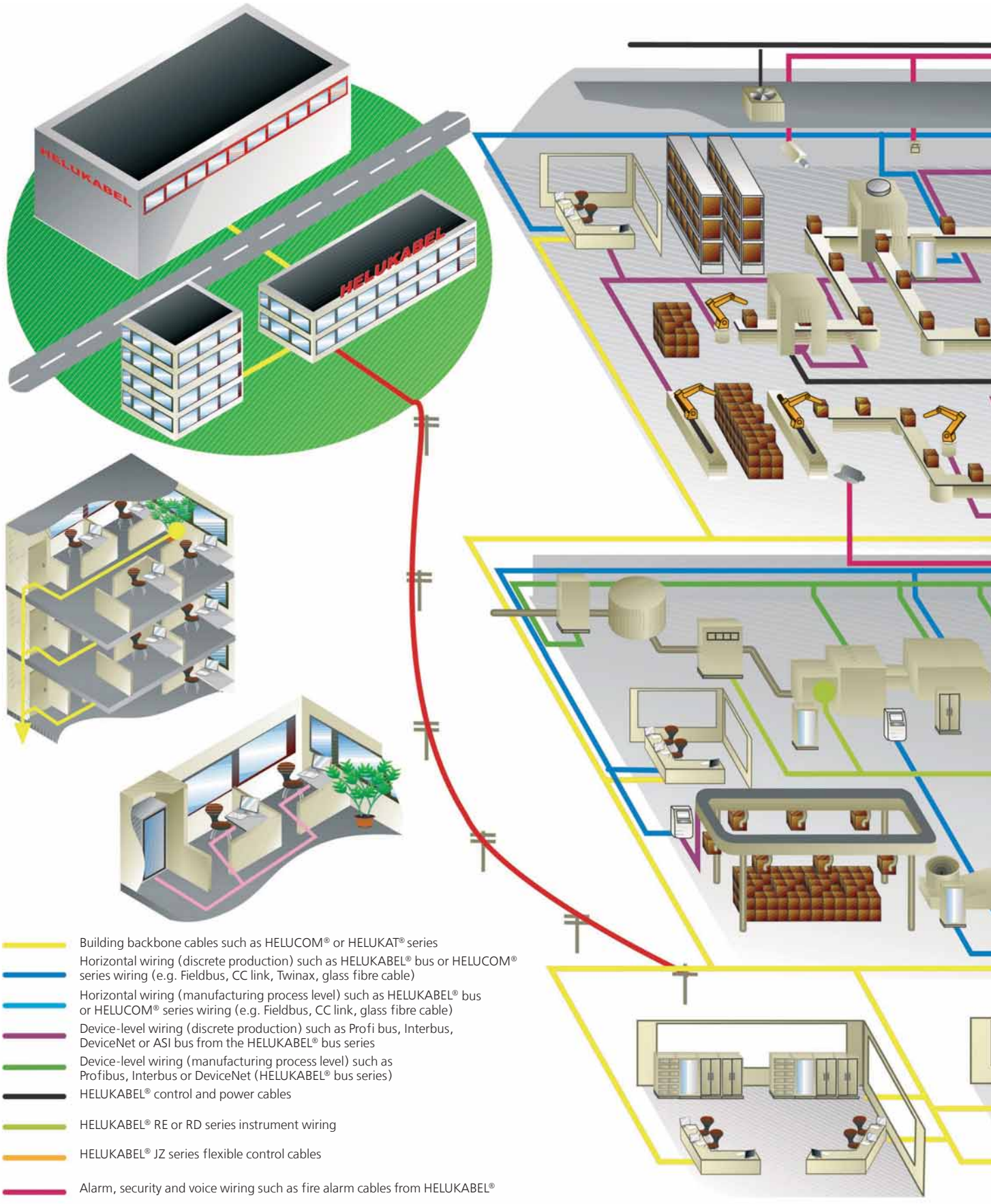
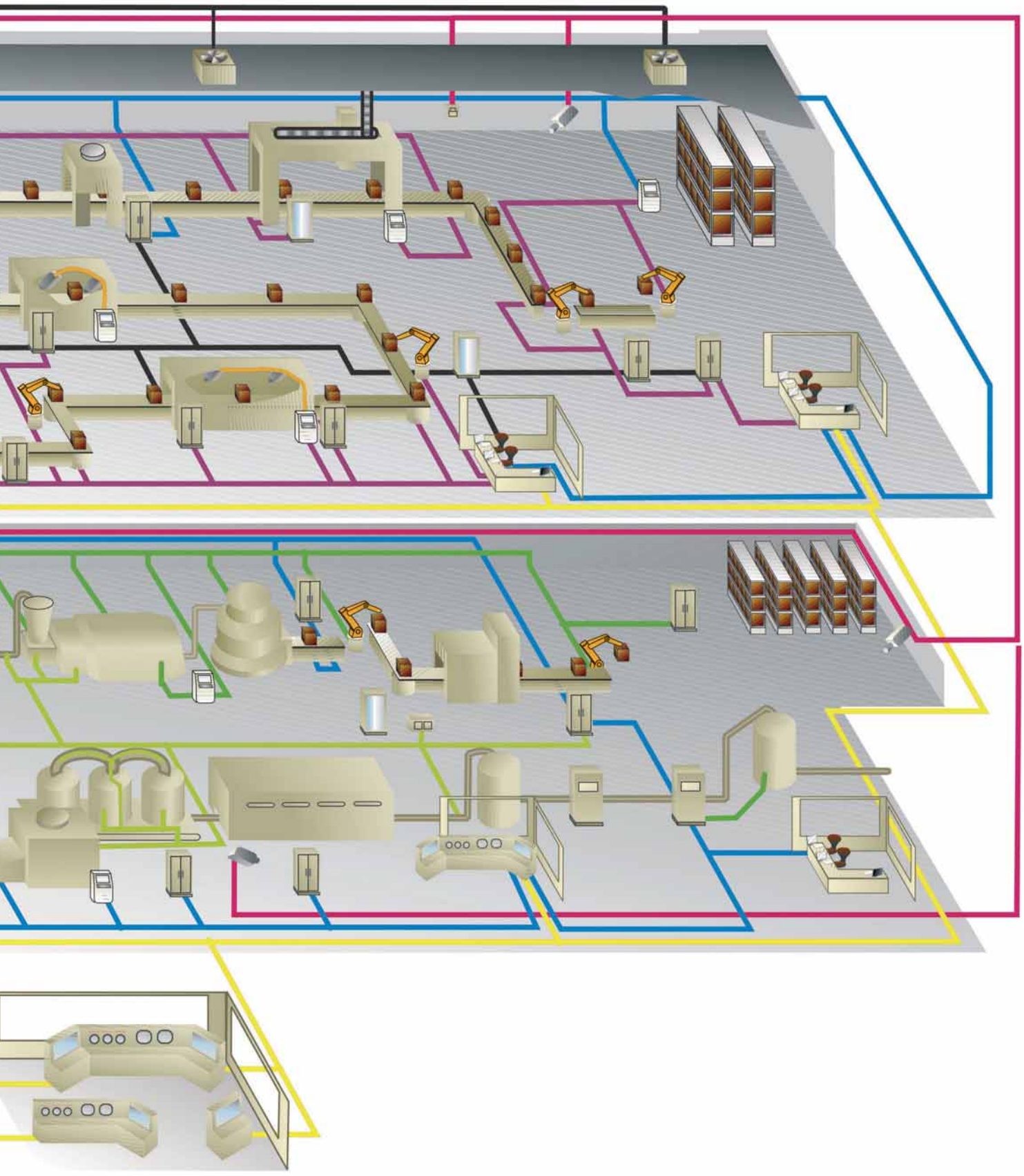
# WIRING TOPOLOGY OF INDUSTRIAL APPLICATION




- Building backbone cables such as HELUCOM® or HELUKAT® series
- Horizontal wiring (discrete production) such as HELUKABEL® bus or HELUCOM® series wiring (e.g. Fieldbus, CC link, Twinax, glass fibre cable)
- Horizontal wiring (manufacturing process level) such as HELUKABEL® bus or HELUCOM® series wiring (e.g. Fieldbus, CC link, glass fibre cable)
- Device-level wiring (discrete production) such as Profi bus, Interbus, DeviceNet or ASI bus from the HELUKABEL® bus series
- Device-level wiring (manufacturing process level) such as Profibus, Interbus or DeviceNet (HELUKABEL® bus series)
- HELUKABEL® control and power cables
- HELUKABEL® RE or RD series instrument wiring
- HELUKABEL® JZ series flexible control cables
- Alarm, security and voice wiring such as fire alarm cables from HELUKABEL®
- HELUCOM® or HELUKAT® series floor wiring
- HELUCOM® series area backbone cables



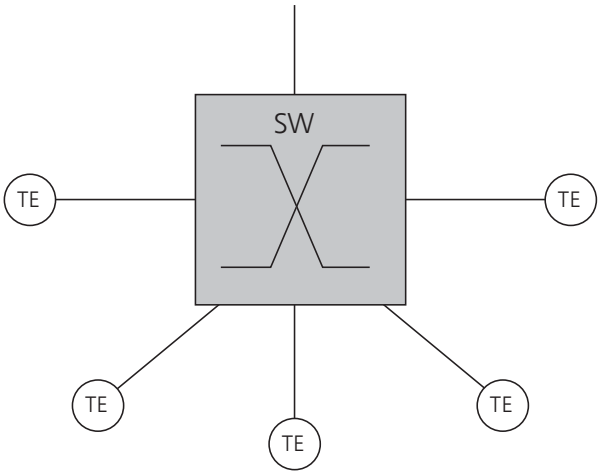
# NETWORK TOPOLOGIES IN THE INDUSTRIAL ENVIRONMENT

The network topologies for Ethernet networks are oriented towards the requirements of the equipment to be networked. The most frequently used are star, point-to-point, tree and ring structures. In practice, a real system often consists of a mixture of the structures considered below.

**Star**

The characteristic of the star structure is a central switch with individual connects to all nodes of the network. Applications for star network structures are areas with high node density and low thermal expansion, e.g. small production cells or a single production machine.

SW = Switch
TE = Terminal Equipment
(data terminal)

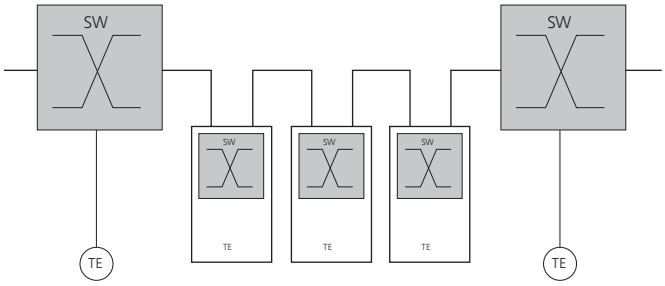



**Tree**

The tree topology results from the connection of several stars to a network. It is used for dividing complex systems into subsystems.

**Point-to-point**

The point-to-point structure can be realised by a switch in the vicinity of the integrated switch in the node to be connected. The point-to-point structure is preferred for use in systems with remote structure, e.g. conveyor systems and for connecting production cells.

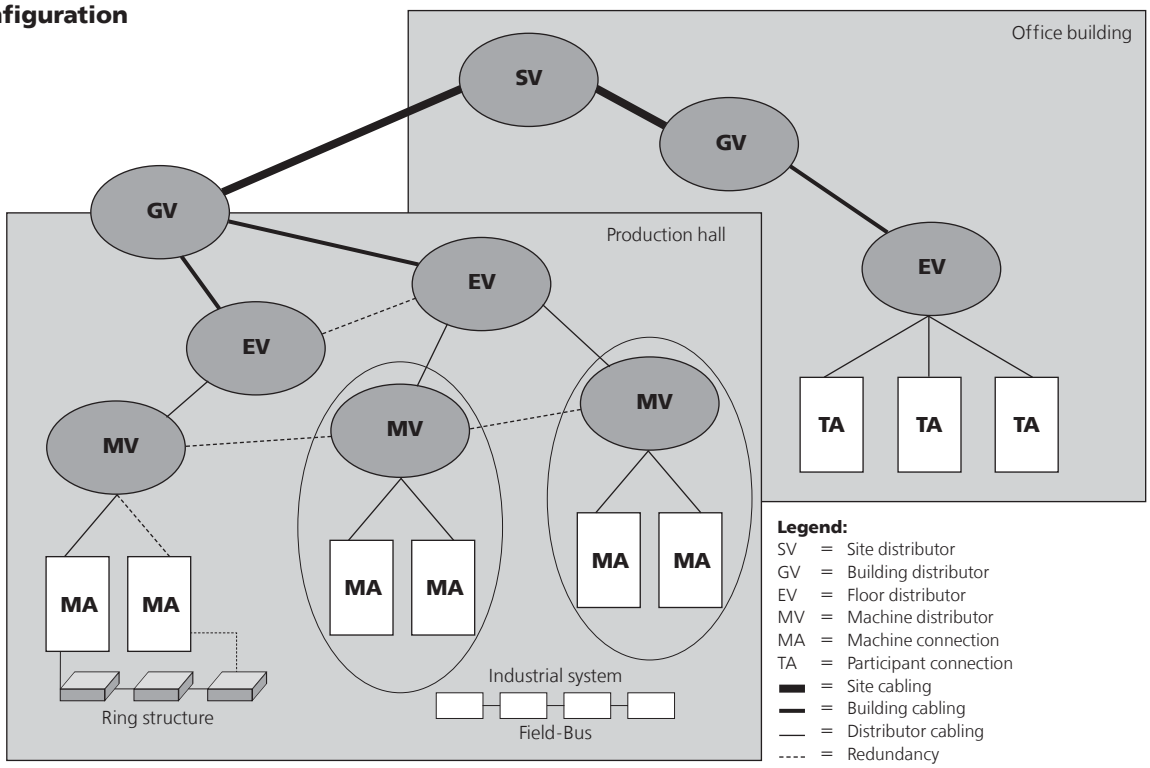



Point-to-point structure
SW = Switch
TE = Terminal Equipment

**Ring (redundancy)**

A ring structure is produced if the ends of a line are closed with an additional connection. Ring topologies are used in systems with increased availability requirements for protection against cable breaks or failure of network components.

**Example configuration**



# PLANNING AND INSTALLATION INSTRUCTIONS COPPER DATA CABLES

Fibre optic cable is recommended for execution of the PRIMARY area, whereby the site distributor is usually connected to the individual building distributors in a star configuration.
The SECONDARY area can be laid out with fibre optic, as well as with copper cable, (fibre optic is recommended and the structure can be either a star configuration or a ring configuration.
The TERTIARY area is executed in a star configuration with copper cable.
The minimum cable structure recommendation is 4 pair with a conductor cross-section of 0.51 mm that is covered with foil shielding. However cable with foil shielding for each pair, and overall braid screening is preferred in order to also handle future applications and requirements. (Higher near-end crosstalk attenuation and better EMC behaviour).
Halogen-free cable is recommended for buildings with higher concentration of material assets or personnel. The system reserves in the type selection should be specified for a service life of 10-15 years. Ensure that all components contained are either screened or non-screened. Existing standards facilitate execution and increase security, and they should be strictly complied with.
Due to the high cable density in the tertiary area, sufficiently dimensioned cable routes must be planned.

## Installation instructions

Note that in the tertiary area, the max. cable length between floor distributors and the workstation wiring box is 90 m. (Ethernet according to 802.3, Copper).
Ensure that earthing is carefully equalised. The earth potential difference between any earthing points should not exceed 1 volt.
Ensure that power cables and data cables are separated by a metallic centre web if laid in shared cable routes.
Ensure that the cables are used in enclosed and dry areas and that the cable routes are protected from aggressive chemicals and rodents.
An adjacent fire barrier is required for floor penetrations for the riser line.

## Cable installation guidelines

Never take cable and lines from a reel against their original run direction (Fig. 1); turn around (Fig. 2) is also not permitted. When installing cable, the reel should always be horizontal (Fig. 3), preferably it should be placed on a roll dispenser. This is the only way to ensure that the cable is laid on the ground without incurring damage due to mechanical stress.

In order to avoid a crossover effect with cable rings, they should always be positioned vertically (Fig. 4) and unrolled onto the ground. If cable cannot be unrolled in the required length due to a lack of space, then you must maintain a bend of sufficient dimensions when running back. If, for example, multiple cables are routed parallel in the same channel, then we recommend bundling them using cable ties or insulation tape. The bundle should always be laid out straight to avoid possible jamming when installing.

## Tensile stress during and after the installation

Data lines should only be exposed to low level mechanical stress. In the relevant guidelines, 5daN/qmm Cu-conductor is specified as maximum permissible tensile force. This results in the following permissible tensile stress values depending on number of pairs and execution of the overall screen:

| Conductor | ø | without screened braiding | | with screened braiding | |
|---|---|---|---|---|---|
| Dimension | NW (mm) | 2 pair | 4 pair | 2 pair | 4 pair |
| AWG26/7 | 7 x 0.16 | 3 daN | 6 daN | 7 daN | 10 daN |
| AWG24 | 0.51 | 5 daN | 9 daN | 9 daN | 15 daN |
| AWG23 | 0.55 | - | - | 13 daN | 19 daN |
| Ø 0.6 | 0.60 | 7 daN | 12 daN | 16 daN | 24 daN |
| AWG22 | 0.64 | 8 daN | 15 daN | 17 daN | 25 daN |

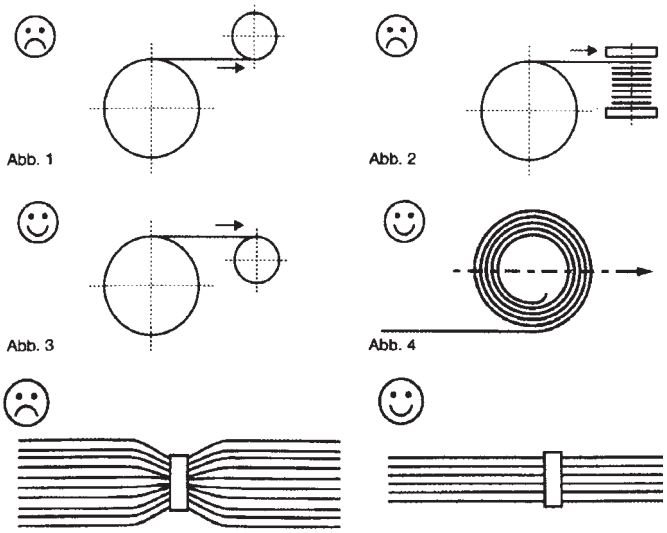
**(1daN corresponds to approximately 1kg)**

Ensure that the cable is not pulled too forcefully when bending around sharp corners or edges. Excessive mechanical stress can influence the transmissions properties. The **bend radius** must not exceed **8 times** the cable diameter while subject to tensile stress. In installed condition this value can be reduced to **4 times** the cable diameter.

In the design as well as in the production of HELUKAT® lines, care has been taken to achieve cable structure that is as solid and compact as possible, so that no essential losses occur in the transmission parameters if these installation guidelines cannot be complied with due to local conditions.

## Patch cable

The calculation of the maximum. Patch Cable Length = flexible printed circuit, calculated using the formula below. It follows with optimal conditions, a max. 80 m flexible Section (AWG 22, 7-wiry, FM45 industrial connectors, Profinet-B). This patch cable is a channel for a complete route. After installation, it is absolutely necessary to carry out a measurement.



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# OPTICAL TRANSMISSION CHARACTERISTICS

## Optical transmission characteristics

**There are two main factors which determine the optical quality of the fibre optic cable: attenuation and bandwidth**

These transmission parameters are always specified for two operating wave lengths (optical windows):

| | |
|---|---|
| Multimode G50 and G62.5/125 µm -> | 850 and 1300 nm |
| Singlemode E9/125 µm -> | 1310 and 1550 nm |

The attenuation characteristic describes the loss in intensity of the light signal sent via the fibre and is specified as fibre attenuation in dB/km. The bandwidth is a unit of measurement for the dispersion characteristic of the fibre optic cable and is expressed in MHz*km; for singlemode fibres it is the dispersion coefficient in ps/nm*km.

A fibre optic cable with a bandwidth-length product of 1200 MHz*km features an impressive usable bandwidth of 2.4 GHz over 500 m. Unlike transmission via copper, transmission via glass does not involve any compromising of the digital signals. As a result, bandwidth and transmission speed are the same: Hz = bit/s.
In addition to the bandwidth-length product, the beginning of the Gigabit age has also made an additional characteristic of multimode fibres important. The guaranteed Gigabit length in m is measured using a special method defined in the standard FOTP 204.

When planning the lengths of fibre optic cables, it is important to consider these three important transmission parameters for the calculations. Of course, it's not always necessary for the fibres to meet the highest standards in terms of optical transmission parameters. In secondary and tertiary cabling, in particular, it is uncommon to exceed lengths of 400 m. In these cases, it is often possible to settle for a lower specification without sacrificing performance or investment security. When it comes to pigtails or patch cables, the bandwidth and attenuation no longer play a role for the optical quality. At lengths of up to 10 m, these cables have almost unlimited bandwidth, and the attenuation is limited by the connectors – not the fibre between them.

With the incredible rate of progress in IT, the question of "which fibre type?" and, by extension, "what transmission capacities?" has grown in importance. In the multimode range, the answer is clear. The 50 µm fibre is technically far superior to the 62.5 µm in every respect. In the smaller optical core, far fewer discrete modes propagate, with the result of less attenuation, higher bandwidths, and higher Gigabit distances. When it comes to costs, the meter price of 50 µm cable is actually lower. With the latest development, transmission of up to 10 Gbit/s by means of wavelength multiplexing, singlemode fibre is becoming increasingly important. With just a single mode, great distances and almost unlimited bandwidths are possible. The manufacture of the E9/125 is less complex, and as a result more affordable than that of a multimode fibre.

## Jacket materials

There are two materials that are in widespread use for jacketing fibre optic cables: polyethylene PE and halogen-free, flame resistant material (Flame Retardant Non Corrosive).
The only real difference between universal cables and outdoor cables is the halogen-free, flame resistant jacket of the universal cables. The great advantage with universal cables is that there is no need for an interface between outdoor cables and indoor cables where the cables enter the building. This eliminates the need for time consuming, costly splicing work. However, when laying universal cables it should be kept in mind that these must be pulled into HDPE conduits which have been sealed against moisture ingress on both sides of the building. This is because there is one clear difference between the FRNC jacket and the PE jacket. The halogen-free, flame-resistant jacket does not come close to providing the level of protection offered by PE against lateral diffusion of water.

## Armouring

Rodents can pose a hazard in easily accessed conduits or shafts. In these environments, the cables must be provided with armour, to protect them against the rodents' natural gnawing instinct. If the cables happen to block the path of the rodent, the rodents will attempt to gnaw through the problem cable. In general, there are two options: a metallic or non-metallic armour against rodents. The first is a corrugated steel jacket, and the second is a glass roving wrap.
Tests on the rodent-resistance of fibre optic cables have shown that the two types of armour are not equally effective. Cables with a glass roving armour had clear signs of damage after some time, indicating that there would be a negative effect on the transmission performance in the long term. The corrugated steel jacket, on the other hand, was unaffected by the rats. Based on these test results from an independent institute, it is essential to inspect the cable routes when planning the installation of fibre optic cable systems.
An additional important criterion when selecting fibre optic cables is the whether the cable is free of metal. If there is metal in a dielectric cable, it must be completely electrically insulated: i.e. in accordance with DIN VDE 0800, one end of the metal armouring, always in the direction of the main distributor, must be laid on the earthing bar in the distribution cabinet. This additional work can be eliminated if the metal layer is sealed off at the mouth of the cable, for instance with a shrink sleeve. This ensures that in the case of contact, electrostatic discharge would not pose any health hazard for humans.

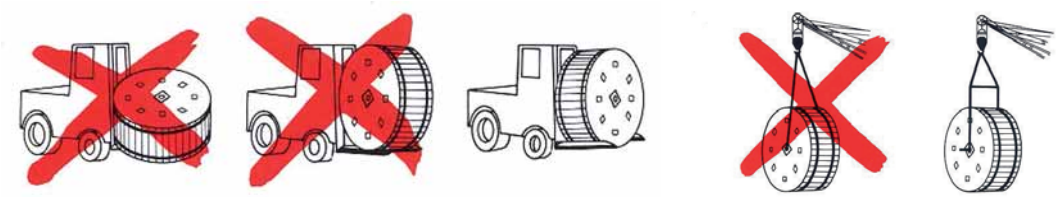
# RECOMMENDATIONS FOR INSTALLING AND WORKING WITH FIBRE OPTIC CABLES

**Introduction**
Cable configuration has the purpose of protecting the fibre optic cable during transport, storage, installation and operation. During each of these stages, the cable is exposed to different influences, such as mechanical stress, different temperatures, humidity, and sunlight.

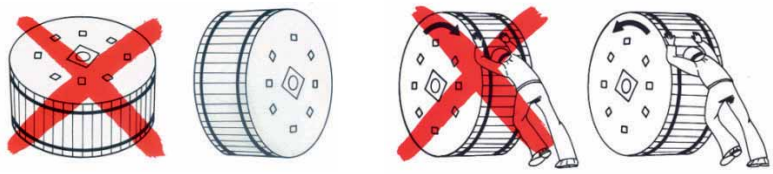
The cable will function reliably in the environment for which it was designed. For example, a cable for underground installation is not suitable for use as an aerial cable. The cable configuration and the materials have been specially selected to ensure that the specified transmission characteristics continue to be fulfilled throughout the service life of the cable. In addition to the cable configuration, the quality of the professional installation or assembly of the cables also is an important factor for ensuring the transmission characteristics over the long term.

**General information**
Cables which are stored in unsupervised areas should be protected against vandalism and other potential sources of damage. If there is an interruption during installation, e.g. a break is taken overnight, be sure to protect the cable ends against moisture ingress. Corresponding warning tape should be integrated as part of the installation work. Comply with local ordinances and customer specifications.

**Transport and storage**
Cable drums should be handled with care during loading and unloading. Always use a suitable forklift or crane to load the drums. Check the drums for any damage (e.g. broken flange, protruding nails, etc.) to prevent later cable damage during the installation.



Drums of fibre optic cable must always be kept upright during transport. Check that the roll direction is correct (arrow on the drum) to prevent the reel of cable from loosening. Secure the cables during transport. (loading safety)



If the cable will be stored for a longer period, we recommend protecting the cable against continuous sun exposure.
Use suitable caps to protect the cable ends from moisture ingress.

**Installation instructions**
Observe the cable specification sheets. These contain all of the important information for the installation:
- Minimum bending radius with and without tensile load
- Maximum tensile force
- Minimum and maximum installation temperature
- Maximum transverse pressure

The permissible bending radius depends on the cable configuration. Compliance with the minimum bending radii protects the cable configuration against damage from excessively tight bends during installation and during later operation, ensuring long-term operating reliability.

**Important,** when using wheels to redirect the cable, each individual wheel must meet the specified minimum bending radius.

Indication of source: KABELWERK RHENANIA GmbH



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# RECOMMENDATIONS FOR INSTALLING AND WORKING WITH FIBRE OPTIC CABLES

The maximum permissible tensile force is defined by the strain relief elements in the cable, and is specified so that below this maximum force, the fibres are not subjected to any continuous elongation, which could damage the fibres.

The specifications for the minimum and maximum installation temperature refer to the temperature of the cable and not to the ambient temperature. This means that at low ambient temperatures, the cable can be heated in advance, or in the case of excessive ambient temperatures, be cooled in advance. The heating or cooling phase can range from a few hours up to 24 hours, depending on the cable type, cable length, and the size of the drum. Excessive transverse pressure can damage the cable core and negatively affect the service life of the fibres.

**Laying the cable directly in the ground**
When laying cable directly in the ground, without a conduit, make sure that the cables are lying in sand bed, free of stones. Make sure that the cable is at the correct distance from other supply lines and cables.

**Ploughing**
Fibre optic cables that are ploughed in must be suitable for this installation method.

**Drawing cable into conduits**
If the cable will be drawn in, make sure that all strain relief elements are equally subjected to the tensile load. The pulling grips must be designed for the respective cable type (tensile force, diameter). For stranded cables without glass or Aramid fibre roving over the cable core, it is important that the central strength member takes part in the pulling. We offer high tensile strength capping as an option.

**Important**, the pulling equipment must be equipped with a tensile force limiter, which stops the pulling process if the maximum tensile force is exceeded. The tensile forces must be documented over the entire pulling process. To avoid torsion, use anti-twist ropes and swivel shackles.

If the cables will not be directly pulled from the cable, the cable must be laid out in a figure-eight configuration. Take care to comply with the permissible bending radii.

Wrong

Correct

When using lubricants, make sure that these have been approved by Deutsche Telekom (ZTV-TKNetz, Part 40) or are of equal or higher quality. The use of mechanical "figure eight machines" is often problematic, as many of these machines do not monitor the bending radius.

Indication of source: KABELWERK RHENANIA GmbH

# RECOMMENDATIONS FOR INSTALLING AND WORKING WITH FIBRE OPTIC CABLES

**Blowing**
The alternative to the pulling method is to install the cable using the air blown method. Keep in mind that not every duct is suitable for every cable type. The tube and cable diameters must be designed for each other.
Due to their design, microduct cables are only suitable for use in microduct tubes.

With the blowing method, it is possible to blow a second or even a third cable into standard ducts that already contain a cable. However, for the second and third cable, the blowing distance will be shorter. With modern blowing equipment, depending on the routing, it is possible to blow in cable of up to several kilometres in length. The blowing result depends on correctly matching all elements of the blowing equipment (blowing jets, post-cooler, compressor) to the cable to be installed, and is also highly dependent on the qualifications of the operating personnel. For this reason, we recommend having the personnel trained by the respective device manufacturer.

Before starting the blowing process:
- Check the conduit system with a gauge
- Blow a foam carrier through the conduit to clean and pre-lubricate it. Make sure that the lubricant is dosed correctly (see manufacturer specifications)
- Perform the crash test The crash test determines the maximum contact pressure of the blowing machine.

**Important**: The simultaneous introduction of lubricant during the process should only take place downstream from the drive (worm gear, drive wheel) of the blowing machine.

For each cable diameter, there are blowing caps for rounding off the cable end. The use of these caps is obligatory.

Blowing central loose tube cables into conduits is a special case. For the wide conduit diameter, these cables are not really stiff enough to achieve acceptable blowing lengths. To improve the blowing performance, it is necessary to use aids. End caps are available in various sizes for the different tube diameters. With the use of end caps, blowing lengths of 2 km can be achieved, even with central loose tube cables.

**Aerial cables**
Aerial cables are specially designed to be suspended from poles. The design takes into account the increased tensile forces as well as additional loads such as those from wind and ice. Aerial cables are always specially designed for the given project, as conditions will vary depending on the site of operation. For aerial cables, the strain relief elements must be made of Aramid yarns. Glass rovings should not be used. When laying the aerial cables, take care to comply with the maximum tensile forces as well as the specified minimum bending radii. This is especially important for multiple rolls. Each individual roll must meet the specified minimum bending radius.
Furthermore, the fixtures in use must be designed for the cable. Fixtures that are not seated correctly can reduce the service life of the cable and also result in hazards due to excessive sagging or even falling cable. Preformed spiral fixtures are recommended, as these provide a secure hold with only minimal load on the cable.

**Tools ideal for processing cables and fibre optics**
When further processing the cables, be sure to use suitable tools, such as: Bevel type cable cutter, fibre optic cleaver, coating stripper, tube splitter





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# INSTALLATION GUIDLINES FOR HCS + POF CABLES

## Installation Guidelines for Polymer Fiber Cables (980/1000µm)

**Do Not Exceed Maximum Cable Lengths**
- When installing polymer fiber cables, the maximum cable length of 50 or 70 m (depending on the fiber optic system used) between two devices must not be exceeded. The cable length can be further reduced using special cables or joints.

**Do Not Use Cables Shorter Than the Permitted Minimum Lengths**
- Fiber optic cables that are shorter than 1 m can result in the receiver being overcontrolled. Only use cables longer than 1 m.

**The Bending Radius Must Be Maintained**
- Please ensure that the minimum bending radius is no smaller than the given data/ standard. This is particularly important if fiber optic cables are led through housing or installed in right angle cable ducts.

**Do Not Exceed Tensile Load and Lateral Strength**
- The permanent tensile load of a polymer fiber cable must not exceed the maximum standard.
- Squeezing the cable, for a period longer than just stepping on it, must be avoided (attend to the maximum lateral strength).

## Installation Guidelines for HCS Cables (200/230 µm)

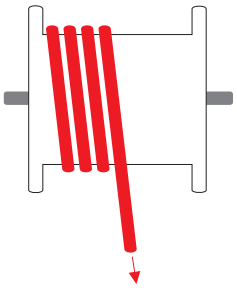
**Do Not Exceed Maximum Cable Lengths**
- When installing HCS cables, the maximum cable length of 300 or 400 m between two devices must not be exceeded.

**The Bending Radius Must Be Maintained**
- Please note that the bending radius must not fall below the minimum value. This is particularly important if fiber optic cables are led through housing or installed in right angle cable ducts.

**Do Not Exceed Tensile Load and Lateral Strength**
- The permanent tensile load of an HCS cable must not exceed maximum standard.
- Squeezing the cable, for a period longer than just stepping on it, must be avoided (attend to the maximum lateral strength).

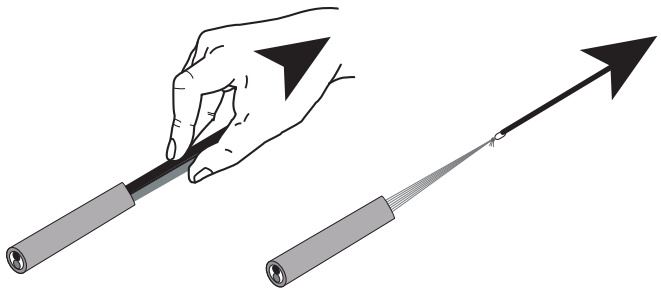
## Installing HCS– + POF–Cables

**Use an Uncoiling Device to Uncoil the Fiber Optic Cable**
- The fiber optic cable must only be uncoiled from the cable drum using an uncoiling device.

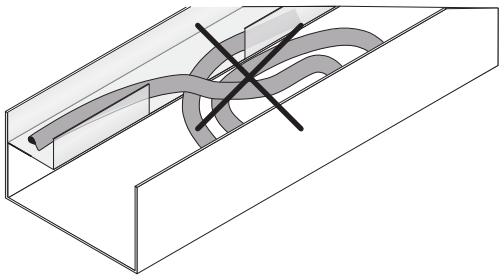


**Do Not Twist the Cable**
- With short cable runs, avoid twisting the cable (torsion).

**Insert the Fiber Optic Cable Correctly**
- Do not pull the cable by the individual fibers. Do not pull the cable forcefully if the cable becomes caught. If you install the fiber optic cable using a cable-pulling device you must secure the device to the strain relief (e.g., aramide yarn).



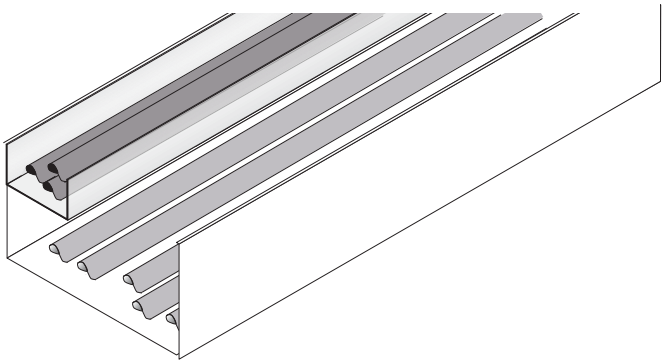
**Install Cables in Cable Ducts**
- Install the cables in cable ducts without loops.



# INSTALLATION GUIDLINES FOR HCS + POF CABLES

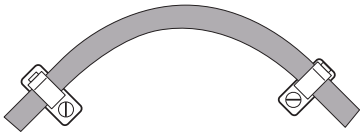
**Install Fiber Optic Cables Separately**

- Fiber optic cables are installed in cable ducts or cable conduits. If theses cables are installed in ducts together with heavy power cables, the fiber optic cables should be installed in a separated area of the duct or as the uppermost cable. This is to protect fiber optic cables against increased bending and tensile loads.



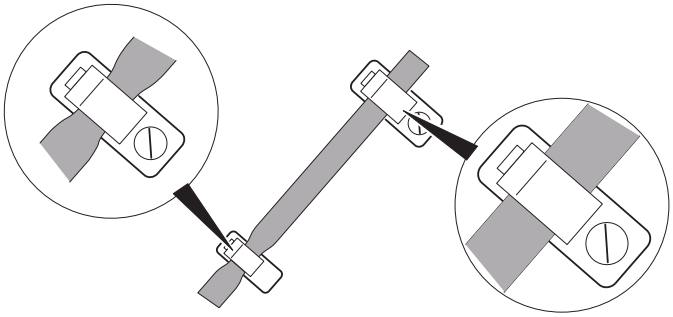
**Secure the Bending Radius: Cable**

- If the fiber optic cable has to be installed at a right angle, secure it with cable binders. This prevents the bending radius falling below its a permissible range.



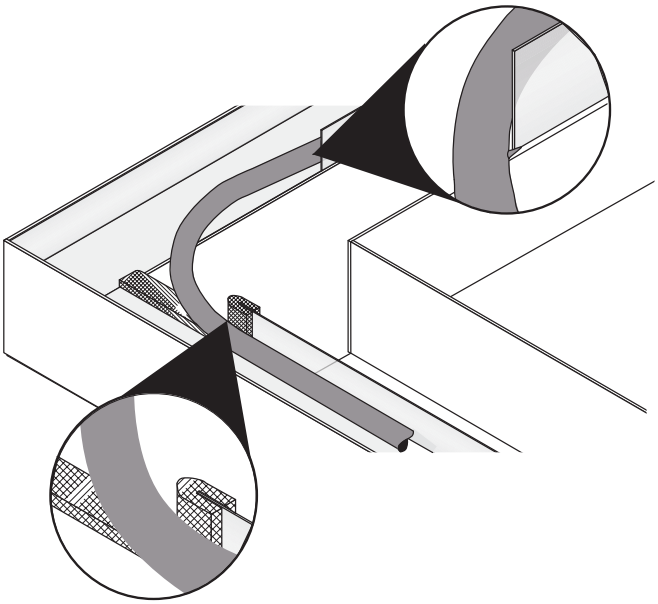
**Do Not Squeeze Fiber Optic Cables When Securing**

- When securing cable binders, clamps, and control cabinet inlets, ensure the cable is not squeezed.
- Preferably use plastic fastening elements with a large surface to avoid squeezing.
- The fastening elements must have a width of at least 5 mm and should be carefully tightened manually.



**Protect Fiber Optic Cables from Sharp Edges**

- Protect the fiber optic cables from sharp edges. Insert an edge protector. Smooth or remove any sharp edges.





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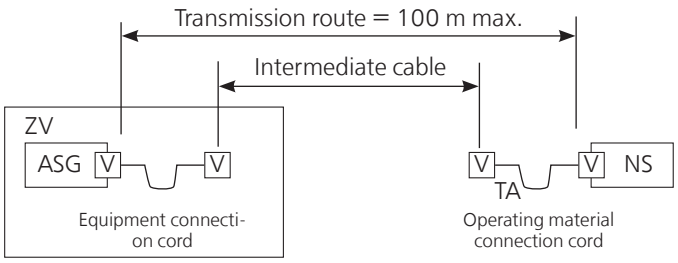
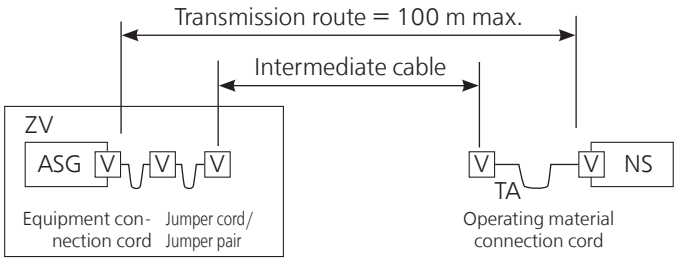
**EN 50173-3:2007**

a) Model trough connection – TA




b) Model jumper – TA




**Model for intermediate cabling**

## Equations for the transmission routes of intermediate cabling

| Model | Image | Model equation | | |
|---|---|---|---|---|
| | | Class D | Class E | Class F |
| Through connection – TA | a) | $H = 109 - F \times X$ | $H = 107 - 3^a - F \times X$ | $H = 107 - 2^a - F \times X$ |
| Jumper ring – TA | b) | $H = 107 - F \times X$ | $H = 106 - 3^a - F \times X$ | $H = 106 - 3^a - F \times X$ |

*H* largest length of the intermediate cable (m).
*F* total length of the jumper cable, jumper pairs, operating material connection and equipment connection cords (m).
*X* Ratio of damping of flexible cables (dB/m) to the damping of permanently installed intermediate cables (dB/m) – see section 9 (> 1)

[a] The length reduction represents an allocated reserve to consider the insertion damping variations.

For operating temperatures above 20 °C, *H* must be reduced by 0.2% for shielded cables and by 0.4% for unshielded cables for each °C (20 °C to 40 °C) and by 0.6% for each °C (> 40 °C to 60 °C). The documents of the manufacturer or the supplier must be consulted if the intended operating temperature exceeds 60 °C.

The following general restrictions apply:

- The physical length of the transmission distance must not exceed 100 m;
- the physical length of the intermediate cable must not exceed 90 m and – depending on the cord used and the number of plug connection – it can be less;
- the individual length of the jumper cords or jumper pairs must not exceed 5 m.

The largest length of the intermediate cable depends on the total length of the cord, which must be supported on a transmission route.
An administration system must be installed during the operation of the installed cabling to ensure that the cords used for the generation of the transmission route are in accordance with the draft rules for the floor, the building or the installation.

# REQUIREMENTS FOR OFFICE AND INDUSTRIAL NETWORKS

The international standard ISO/IEC 11801 and its European equivalent EN 50173 define an application-neutral, standard IT networking for a building complex. Their contents are largely identical. Both standards assume an office environment usage of the building and require application neutrality. The specific requirements for Ethernet networks in industrial environments such as:

- system specific cable layout
- individual connectivity for each machine / system
- point-to-point network structures
- robust industry-compatible cables and plug connectors with particular requirements for EMC, temperature, moisture, dust and vibration are not considered in both these standards. The comparison is below:

| | **Office area** | **Production and field area** |
|---|---|---|
| **Installation conditions** | • fixed basic installation in the building<br>• laying in false floors<br>• variable equipment connection at the work place<br>• prefabricated equipment connection cables<br>• mainly standard work places (desk with PC, ...)<br>• tree-shaped network structures | • strongly system-dependent cabling<br>• system specific cable layout<br>• connection points are seldom changed<br>• equipment connections can be assembled in the field<br>• each machine / system requires individual connectivity<br>• frequent point-to-point network structures and (redundant) ring structures |
| **Transmission performance** | • big data packets (for ex. pictures)<br>• medium network availability<br>• transmission time in seconds range<br>• high proportion of not cyclic transmission<br>• no isochronity | • small data packets (measured values)<br>• very high network availability<br>• transmission time in microseconds range<br>• high proportion of cyclic transmission<br>• isochronity |
| **Environmental requirements** | • moderate temperatures<br>• low dust contamination<br>• no moisture<br>• hardly any vibration<br>• low EMC load<br>• low mechanical hazard<br>• low UV radiation<br>• hardly any chemical hazard | • extreme temperatures<br>• high dust contamination<br>• possible moisture<br>• vibrating machines<br>• high EMC load<br>• risk of mechanical damage<br>• UV exposure outdoors<br>• chemical contamination by oily or aggressive atmospheres |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# THE MICE CONCEPT

## The MICE concept – explanation using cabling solutions as an example

**M** echanical — Mechanical properties
**I** ngress — Leak tightness properties
**C** limatic — Climatic properties
**E** lectromagnetic — Electromagnetic properties

In contrast to the cables used in the office environment, the selection of the correct insulation material for communication cables used in the industrial environment is crucially important for a fault-free and above all, reliable operation of communication and data networks.

First drafts of the future cabling standard show an interesting approach which could help the user with the selection of the correct cable.

| | → low requirements office application | → medium requirements industrial application | → high requirements rough industrial application |
|---|---|---|---|
| **Mechanical properties** | **$M_1$** | **$M_2$** | **$M_3$** |
| Impacts (maximum acceleration) | 40 $ms^2$ | 100 $ms^2$ | 250 $ms^2$ |
| Vibrations (oscillation amplitude 2-9 Hz) | 1,5 mm | 7,0 mm | 15,0 mm |
| Vibrations (acceleration amplitude 9-500 Hz) | 5 $ms^2$ | 20 $ms^2$ | 50 $ms^2$ |
| Tensile force | see note* | see note* | see note* |
| Pressure | 45 N over 25 mm (linear) min. | 1.100 N over 150 mm (linear) min. | 2.200 N over150 mm (linear) min. |
| Impact | 1 J | 10 J | 30 J |
| Torsion | see note* | see note* | see note* |
| **Leak tightness properties** | **$I_1$** | **$I_2$** | **$I_3$** |
| Particle entry (max. diameter) | 12,5 mm | 50 µm | 50 µm |
| Immersion | none | Liquid spray interval ⩽12-5 l/min/⩾6,3 mm spray/>2-5 m distance | Liquid spray interval ⩽12-5 l/min/⩾6,3 mm spray/>2-5 m distance and immersion (⩽1m for⩽30 minutes) |
| **Climatic properties** | **$C_1$** | **$C_2$** | **$C_3$** |
| Ambient temperature | -10°C to +60°C | -25°C to +70°C | -40°C to +70°C |
| Rate of temperature range | 0,1°C per Minute | 1,0°C per Minute | 3°C per Minute |
| Humidity | 5% - 85% (non-condensing) | 5% - 95% (non-condensing) | 5% - 95% (non-condensing) |
| Solar irradiation | 700 $Wm^2$ | 1120 $Wm^2$ | 1120 $Wm^2$ |
| **Contamination by liquids foreign substances** | Max. | Max. | Max. |
| Sodium chlorid (Saltwater/seawater) (ppm) | 0 | 0,3 | 0,3 |
| Oil (ppm) | 0 | 5,0 | 500 |
| Sodium stearate (soap) | none | 5% aqueous, not gelatinous | 5% aqueous, not gelatinous |
| Cleaning agents | none | ffs | ffs |
| Dissolved carriers | none | temporary (condensation) | current |
| **Contamination by gases foreign substances ($cm^3$/ $m^3$=ppm)** | Average value/maximum value | Average value/maximum value | Average value/maximum value |
| Hydrogen sulphide | <0,003/<0,01 | <0,05/<0,5 | <10/<50 |
| Sulphur dioxide | <0,01/<0,03 | <0,1/<0,3 | <5/<15 |
| Sulphur trioxide | <0,01/<0,03 | <0,1/0,3 | <5/<15 |
| Wet chlorine (<50% humidity) | <0,0005/<0,001 | <0,005/<0,03 | <0,05/<0,3 |
| Dry chlorine (<50% humidity) | <0,002/<0,01 | <0,02/<0,1 | <0,2/<1,0 |
| Hydrogen chloride | -/<0,06 | <0,06/<0,3 | <0,6/3,0 |
| Hydrogen fluoride | <0,001/<0,005 | <0,01/<0,05 | <0,1/<1,0 |
| Ammonia | <1/<5 | <10/<50 | <50/<250 |
| Nitrogen oxide | <0,05/<0,1 | <0,57/<1 | <5/<10 |
| Ozone | <0,002/<0,005 | <0,025/<0,05 | <0,1/<1 |
| **Electromagnetc properties** | **E1** | **E2** | **E3** |
| Electromagnetic discharge Contact (0,667µC) | 4 kV | 4 kV | 4 kV |
| Electromagnetic discharge - Air (0,132µC) | 8 kV | 8 kV | 8 kV |
| Solar irradiation | 700 $Wm^2$ | 1.120 $Wm^2$ | 1.120 $Wm^2$ |
| EMC-Emission HF-AM | 3 V/m at 80-2.000 MHz 1V/m at 2.000-2.700 MHz | 3 V/m at 80-2.000 MHz 1V/m at 2.000-2.700 MHz | 10 V/m at 80-1.000 MHz 3V/m at 1.400-2.000 MHz |
| Conducted HF | 3 V at 150 kHz - 80 MHz | 3 V at 150 kHz - 80 MHz | 10 V at 150 kHz - 80 MHz |
| EFT/B | | | |
| Alternating current | 500 V | 1.000 V | 2.000 V |
| Volatage surge (earth potential difference) | | | |
| Signal, earthing line | 500 V | 1.000 V | 2.000 V |
| Magnetic field (50/60 Hz) | 1 $Am^{-1}$ | 3 $AM^{-1}$ | 30 $Am^{-1}$ |
| Magnetic field (60-20.000 Hz) | ffs | ffs | ffs |
| | Surge: Long term effect of repeated surges on the channel must be taken into account | | |

* Installation-specific according to IEC 61918 / Draft standard CD ISO/IEC 24702

# THE MICE CONCEPT

## Application Examples

| Area of application | properties | | | | | | | | environement class |
|---|---|---|---|---|---|---|---|---|---|
| | Humidity | Vibration | Irradiation | Electrical | UV light | Aggressiv Fields | Oil | $H^2O$ | Solution proposals |
| Chemical industry | x | x | | x | | x | x | x | $M_2I_3C_2E_2$ |
| Car manufacturing | | x | | x | | x | x | | $M_3I_3C_2E_3$ |
| Airport | x | | | | x | | x | | $M_2I_2C_1E_1$ |
| Transmission line | x | | | | x | | x | x | $M_2I_2C_1E_1$ |
| Oil production facility | x | x | | | x | | x | x | $M_3I_3C_2E_1$ |
| Mining | x | x | | | | | | | $M_3I_3C_1E_1$ |
| Power station | x | x | x | x | | | | | $M_3I_3C_2E_3$ |
| Nuclear power station | x | x | x | x | | x | x | | $M_3I_3C_3E_3$ |
| Steelworks | x | x | | x | | | | | $M_3I_3C_2E_3$ |

Possible classification criteria of environemental requirements

# IAONA-CLASSIFICATION

General requirements for cabling components in the industrial environment according to IAONA recommendations

| Parameter | Value | Notes |
|---|---|---|
| Operating temperature | 0°C ... +55°C | Installation >5°C |
| Storage temperature | -25°C ... +70°C | IEC 61131-2 |
| Storage temperature | 5°C ... +55°C, 3°C/min. Test N b | IEC 6068-2-14 |
| Humidity | 10% ... 95% non-condensing | IEC 60068-2-14 |
| Shock test | 15 G, 11 ms<br>according to EN 60068-2-27 or IEC 60068-2-27<br>Criterion: no mechanical or functional damage | |
| Vibration | 5 G at 10 Hz ... 150 Hz<br>according to EN 60068-2-6 or IEC 60068-2-6, Kriterium A | |
| Earthing | | |
| Cabling class<br>(min. requirements) | EN 50173; 2002 or ISO/IEC 11801, Klasse D | |

**There are also two protection classes defined as in addition to these general requirements which, on closer examination, are aimed at the protection of the connection components:**

**Light Duty (IP20)**
This class contains components which are installed in a protected distribution cabinet. These requirements must be limited by those for the office environment as these cabinets are also installed in the vicinity of moving system parts. The protection class IP20 according to EN 60529 is defined for this class which states that the components are protected against penetration by solid foreign substances no larger than 12.5 mm. Protection against penetration by moisture is not included.

**Heavy Duty (IP67)**
The components in this protection class are completely exposed to the aggressive industrial environment. According to the IP67 protection class, the components are constructed absolutely dustproof and protected against damage by temporary immersion in water.

| | Light Duty | Heavy Duty |
|---|---|---|
| Protection class Degree of contamination | IP 20 + IP 30<br>according to IEC 60529, EN 60529 | IP 67 + IP 69<br>according to IEC 60529, EN 60529 |
| Relative humidity | 95% non-condensing | Temperature cycles (25°C-50°C-25°C)<br>at 80% to 95% Relative humidity condensing according to IEC 60068-2-30 |
| Operating temperature | 0°C at +55°C | -20°C at +65°C |
| Shock test | 15 G, 11 ms<br>according to EN 60068-2-27 and IEC 60068-2-27<br>no mechanical and functional damage | 15 G, 11 ms<br>according to EN 60068-2-27 and IEC 60068-2-27<br>no mechanical and functional damage |
| Vibration | 5 G at 10 Hz ... 150 Hz<br>according to EN 60068-2-6 and IEC 60068-2-6, Krit. A | 5 G at 10 Hz ... 150 Hz<br>according to EN 60068-2-6 and IEC 60068-2-6, Krit. A |


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# CHARACTERISTICS* OF INSULATING AND SHEATH MATERIALS

| Designation | | | | Electrical | | | | | Thermic | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | VDE Initial Code | Abbre-viations | Materials | Density g/m³ | Break-down-voltage KV/mm (20°C) | Spezific volu-me resistivty Ohm•cm 20°C | Dielectric constant 50 Hz/ 20°C | Dielectric lossfactor tan б | Working tempe-rature perma-nent °C | Working tempe-rature short time °C | Melttem-perature +°C | Flame resistance |
| Thermoplastic | Y | PVC | Polyvinylchloride comounds | 1,35-1,5 | 25 | $10^{13}$-$10^{15}$ | 3,6-6 | $4x10^{-2}$ - $1x10^{-1}$ | -30 +70 | +100 | >140 | self-extinguishing |
| | Yw | PVC | Heat resistant 90°C | 1,3-1,5 | 25 | $10^{12}$-$10^{15}$ | 4-6,5 | | -20 +90 | +120 | >140 | |
| | Yw | PVC | Heat resistant 105°C | 1,3-1,5 | 25 | $10^{12}$-$10^{15}$ | 4,5-6,5 | | -20 +105 | +120 | >140 | |
| | Yk | PVC | Cold resistant | 1,2-1,4 | 25 | $10^{12}$-$10^{15}$ | 4,5-6,5 | | -40 +70 | +100 | >140 | |
| | 2Y | LDPE | low density Polyethylene | 0,92-0,94 | 70 | $10^{17}$ | 2,3 | $2x10^{-4}$ | -50 +70 | +100 | 105-110 | flammable |
| | 2Y | HDPE | high density Polyethylene | 0,94-0,98 | 85 | $10^{17}$ | 2,3 | $3x10^{-4}$ | -50 +100 | +120 | 130 | |
| | 2X | VPE | crossed-linked Polyethylene | 0,92 | 50 | $10^{12}$-$10^{16}$ | 4-6 | $2x10^{-3}$ | 35 +90 | +100 | - | |
| | O2Y | | foamed Polyethylene | ~0,65 | 30 | $10^{17}$ | ~1,55 | $5x10^{-4}$ | -40 +70 | +100 | 105 | |
| | 3Y | PS | Polystrole | 1,05 | 30 | $10^{16}$ | 2,5 | $1x10^{-4}$ | -50 +80 | +100 | >120 | |
| | 4Y | PA | Polyamide | 1,02-1,1 | 30 | $10^{15}$ | 4 | $2x10^{-2}$ - $1x10^{-3}$ | -60 +105 | +125 | 210 | |
| | 9Y | PP | Polypropylene | 0,91 | 75 | $10^{16}$ | 2,3-2,4 | $4x10^{-4}$ | -10 +140 | +140 | 160 | |
| | 11Y | PUR | Polyurethane | 1,15-1,2 | 20 | $10^{10}$-$10^{12}$ | 4-7 | $2,3x10^{-2}$ | -55 +80 | +100 | 150 | |
| | TPE-E (12Y) | | Polyester; Elastomer | 1,2-1,4 | 40 | $>10^{10}$ | 3,7-5,1 | $1,8x10^{-2}$ | -50 +100 | +140 | 190 | |
| | TPE-O | | Polyolefine; Elastomer | 0,89-1,0 | 30 | $>10^{14}$ | 2,7-3,6 | | | +130 | 150 | |
| Elastomere | G | NR/ SBR | Natural rubber Styrol-Butadiene-rubber-compunds | 1,5-1,7 | 20 | $10^{12}$-$10^{15}$ | 3-5 | $1,9x10^{-2}$ | -65 +60 | +120 | - | flammable |
| | 2G | SiR | Silicon rubber | 1,2-1,3 | 20 | $10^{15}$ | 3-4 | $6x10^{-3}$ | -60 +180 | +260 | - | high flammable |
| | 3G | EPR | Ethylen-Propylene rubber compunds | 1,3-1,55 | 20 | $10^{14}$ | 3-3,8 | $3,4x10^{-3}$ | -30 +90 | +160 | - | flammable |
| | 4G | EVA | Ethylen-Vinylacetat Copolymer-compounds | 1,3-1,5 | 30 | $10^{12}$ | 5-6,5 | $2x10^{-2}$ | -30 +125 | +200 | - | |
| | 5G | CR | Polychloropren compounds | 1,4-1,65 | 20 | $10^{10}$ | 6-8,5 | $5x10^{-2}$ | -40 +100 | +140 | - | self-extinguishing |
| | 6G | CSM | Chlorsulfonated Polyethylene compounds | 1,3-1,6 | 25 | $10^{12}$ | 6-9 | $2,8x10^{-2}$ | -30 +80 | +140 | +160 | |
| High temp.materials | 10Y | PVDF | Polyvinylidene fluoride Kynar/ Dyflor | 1,7-1,9 | 25 | $10^{14}$ | 9-7 | $1,4x10^{-2}$ | -40 +135 | +160 | >170 | self-extinguishing |
| | 7Y | ETFE | Ethylene-tetrafluor ethylene | 1,6-1,8 | 36 | $10^{16}$ | 2,6 | $8x10^{-4}$ | -100 +150 | +180 | >265 | |
| | 6Y | FEP | Fluorine ethylene propylene | 2,0-2,3 | 25 | $10^{18}$ | 2,1 | $3x10^{-4}$ | -100 +205 | +230 | >225 | |
| | 5YX | PFA | Perfluoralkoxypolimeric | 2,0-2,3 | 25 | $10^{18}$ | 2,1 | $3x10^{-4}$ | -190 +260 | +280 | >290 | |
| | 5Y | PTFE | Polytetrafluorethylene | 2,0-2,3 | 20 | $10^{18}$ | 2,1 | $3x10^{-4}$ | -190 +260 | +300 | >325 | |
| halogen-free compouns | H | uncross-linked | halogen-free Polymer-compounds | 1,4-1,6 | 25 | $10^{12}$-$10^{14}$ | 3,4-5 | $\sim 10^{-1}$ | -30 +70 | +100 | >130 | self-extinguishing |
| | HX | cross-linked | halogen-free Polymer-compounds | 1,4-1,6 | 25 | $10^{13}$-$10^{14}$ | 3,4-5 | $10^{-2}$ - $10^{-1}$ | -30 +90 | +150 | - | |

* The characteristics valid for unprocessed materials

| Thermic | | | | | | Mechanical | | | | | Halogen-free | Weather | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Oxygen index LOI (% $O_2$) | Heating value $H_0$ MU $kg^{-1}$ | Thermal-conducti-vity W $K^{-1}$ $m^{-1}$ | Corrosive gases in case of fire | Radiatinre-sistance max. Mrad | tensile stregth N/$mm^2$ | Elongation at break % | Shorehard-ness | Abra-sion resistan-ce | Abrasion resistance | halogenfree | Weather resistance | Cold resistance |
| 23-42 | 17-25 | 0,17 | Hydrogen chlorid | 80 | 10-25 | 130-350 | 70-95 (A) | medium | 0,4 | no | medium in black | moderate good |
| | 16-22 | | | | | | | | | | | |
| 24-42 | 16-20 | | | | | | | | | | | |
| | 17-24 | | | | | | | | | | | |
| ⩽22 | 42-44 | 0,3 | no | 100 | 10-20 | 400-600 | 43-50 (D) | | 0,1 | yes | | very good |
| | | 0,4 | | | 20-30 | 500-1000 | 60-63 (D) | good | | | | good |
| | | 0,3 | | | 12,5-20 | 300-400 | 40-45 (D) | medium good | | | | |
| 18-30 | | 0,25 | | | 8-12 | 350-450 | - | - | - | conditional[1)] | good | |
| ⩽22 | 40-43 | 0,25 | | 80 | 55-65 | 300-400 | 35-50 (D) | good | 0,4 | yes | - | |
| | 27-31 | 0,23 | | 10 | 50-60 | 50-170 | - | very good | 1,0-1,5 | | moderate good | moderate good |
| | 42-44 | 0,19 | | | 20-35 | 300 | 55-60 (D) | medium good | 0,1 | | good | good |
| 20-26 | 20-26 | 0,25 | | 100 (500) | 30-45 | 500-700 | 70-100(A) | very good | 1,5 | yes[2)] | medium | |
| ⩽29 | 20-25 | 0,5 | | 10 | 30 | >300 | 85 (A) 70 (D) | good | | yes | very good | very good |
| ⩽25 | 23-28 | 1,5 | | | 20 | | 55 (A) 70 (D) | | | | | |
| ⩽22 | 21-25 | - | no | 100 | 5-10 | 300-600 | 60-70 (A) | mode-rate | 1,0 | no | medium | very good |
| 25-35 | 17-19 | 0,22 | | 50 | | | 40-80 (A) | | | yes | good | |
| ⩽22 | 21-25 | - | | 200 | | 200-400 | 65-85 (A) | | | | very good | good |
| | 19-23 | - | | 100 | 8-12 | 25-350 | 70-80 (A) | | | | gut | |
| 30-35 | 14-19 | - | Hydrogen chlorid | 50 | 10-20 | 400-700 | 55-70 (A) | mode-rate | | no | very good | moderate good |
| | 19-23 | - | | | | 35-600 | 60-70 (A) | | 1,5 | | | medium |
| 40-45 | 15 | 0,17 | Hydrofluoric | 10 | 50-80 | 150 | 75-80 (D) | very good | 0,01 | no | very good | very good |
| 30-35 | 14 | 0,24 | yes | | 40-50 | 150 | 70-75 (D) | | 0,02 | | | |
| >95 | 5 | 0,26 | | 1 | 15-25 | 250 | 55-60 (D) | | 0,01 | | | |
| | | 0,21 | | 0,1 | 25-30 | | | | 0,01 | | | |
| | | 0,26 | | | 80 | 50 | | | 0,01 | | | |
| ⩽40 | 17-22 | 0,17 | no | 100 | 8-13 | 150-250 | 65-95 (A) | mode-rate | 0,2-1,5 | yes | medium in black: good | medium |
| | 16-25 | 0,20 | | 200 | 8-13 | 150-250 | | | | | | |



DNB Edition 11 (published 01.10.2015)

# ESSENTIAL CABLE PARAMETERS

**Wave impedance**

Characteristic impedance is the terminating resistance of a cable at which no line reflections occur, i.e. the total power fed into the cable by a signal source is transmitted at the characteristic impedance on the output, except for the losses caused by cable attenuation. A data cable's task is transmitting electrical pulse groups. The higher the desired data bit rate, the greater the frequency bandwidth that must be selected for the transmission channel (e.g. cable). Output impedance and input impedance of the devices connected to the cable must match (or must be adapted) to the characteristic impedance of the data cable. If this is not the case, then pulse distortions occur, which means defective transmission. The characteristic impedances of symmetric cables for telecommunications engineering are standardised in EN 50173 or ISO/IEC 11801: 100, 120 and 150.

**Wave attenuation a [dB]**

Cable attenuation reduces the signal amplitude arriving at the output, and thus limits the free cable lengths that can be implemented. Ohmic loss resistance in the longitudinal direction occurs due to the conductor material and the conductor cross section. In addition the skin effect (current displacement) reduces the effective conductor cross section as frequency increases. The frequency dependence of the selected core insulation material also determines additional capacitive loss resistances between the conductors. Cable attenuation, which is usually specified at a reference length of 100 m, defines the ratio of transmission level to reception level.

**Near-end crosstalk NEXT, aNN [dB]**

Cross-talk describes the undesired passover of signal energy into a neighbouring line channel. In this process, the electromagnetic field of the wanted signal of a conductor pair generates an interference signal on the same cable side
(NEAR-END) in a neighbouring core pair. Near-end crosstalk (NEXT) results from the power ratio "Input power on the interfering pair to output power on the disturbed pair", but at the same end of the cable.

**Far-end crosstalk FEXT, aFN [dB]**

The electromagnetic field of the wanted signal at the
input of the pair generates an interference signal at the output side (FAR-END) of a neighbouring pair. Far end crosstalk (FEXT) results from the power ratio "Input power on the interfering core pair to output power on the disturbed pair", but at the opposite end of the cable.

**ELFEXT**

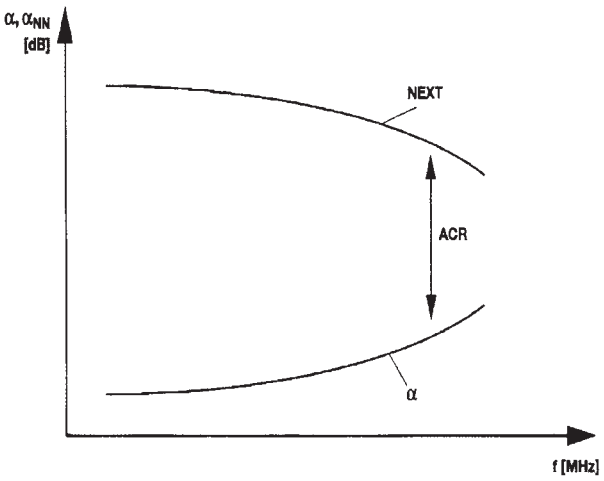
ELFEXT is a relative value that defines the ratio of the crosstalk output level to the actual output level. The interference level interspersed on the second pair is placed in the ratio to the output level. The ELFEXT value has the advantage relative to the FEXT value that it is not dependent on channel length, because the interference signal as well as the output signal depend on the channel length, and are determined on the same remote point.

**Attenuation to Crosstalk Ratio - ACR [dB]**

The ACR value is determined by the difference of near-end crosstalk and line attenuation, measured at the same frequency.

**ACR(f) NEXT(f) - a (f)**

Thus, in order to ensure problem-free transmission, the ACR must be as high as possible (high NEXT and low wave attenuation). The ACR value is a characteristic value used for simple evaluation of a cable's transmission quality. For cables, the ACR should be at least 10dB at the highest signal transmission frequency.




**Power Sum NEXT [dB]**

Crosstalk is the signal portion induced in one line channel from a neighbouring line channel. The power sum is calculated from the addition of the crosstalk values of all elements contained in the cable.

# ESSENTIAL CABLE PARAMETERS

**PSACR**

Power Sum ACR defines the sum of all ACRs detected for the individual pairs (difference NEXT to attenuation).

**PSELFEXT**

The power sum FEXT comprises the powersum of the far-end crosstalk. This is the sum of all interference signals that are coupled in a pair. For 2 pair cable the PSFEXT corresponds to the FEXT; if the number of conductor pairs is higher, then the differences become ever greater because the interference signals from all pairs are interspersed in one pair.

**Return loss attenuation [dB]**

If there are different wave resistances (e.g. between cable and a component), then a portion of the supplied signal energy is reflected at this interference point. Such reflections must be kept to a minimum to ensure problem-free transmission.

**Delay Skew**

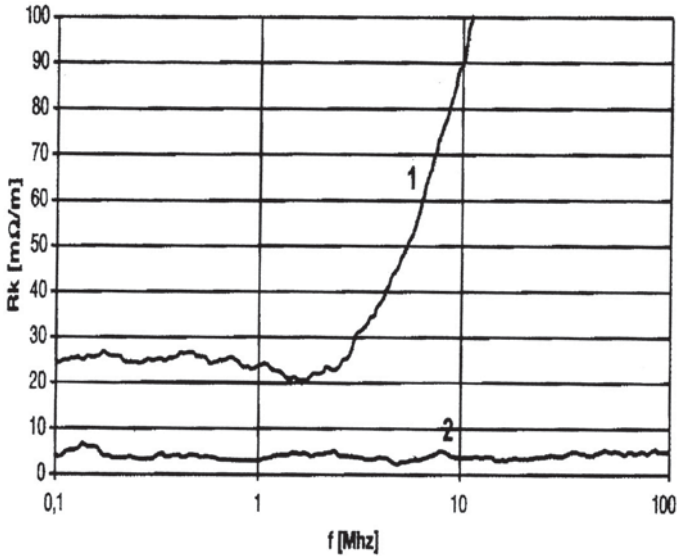
This refers to the runtime differences of the individual pairs.

**Transfer impedance Rk [Ω/m]**

As the transmission frequency for data lines increases, electromagnetic compatibility (EMC) becomes increasingly more important. To protect the cables from the effects of unwanted interference or to protect any surrounding electrical systems from disruptive emanations from the cable, more attention is being paid to adequate shielding for data transmission lines.

The magnetic field of a pair of conductors can largely be compensated for by twisting the wires, but the electrical field has to be countered by attaching sheet shielding and/or braided shielding. The transfer impedance (coupling resistance) is frequency-dependent and increases with the length of the cable (linear). The coupling resistance is therefore specified in

Ω/m and should be as low as possible. The lower the coupling resistance, the more efficient the shielding effect and the more significantly it contributes toward optimizing the EMC values of the entire system. Another important factor for the shielding effect is the choice and quality of the grounding point, which should have as low a resistance value as possible over the entire frequency range. By using double shielding (sheet and braided shielding), a vastly improved shielding effect can be obtained, particularly in the higher frequency range.




1 ... Sheet shielding
2 ... FSheet and braided shielding



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# EN (EUROPEAN) STANDARDS

**EN 50173 Channel Class C / Cat. 3, low-frequency (phone, DSL)**

| Wire Map | Resolution Ω | Length Max. | Prop. Delay nS | Delay Skew nS | Freq. MHz | Insertion Loss dB | NEXT dB | RL dB | ACR-N dB | ACR-F dB | PS NEXT dB | PS ACR-N dB | PS ACR-F dB |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 12345678 | 40 | i | 555 | 50 | 1 | 4,2 | 39,1 | 15,0 | 34,9 | | | | |
| 12345678 | | | | | 4 | 7,6 | 29,2 | 15,0 | 21,6 | | | | |
| | | | | | 8 | 10,4 | 24,3 | 15,0 | 13,9 | | | | |
| 12345678S | | | | | 10 | 11,5 | 22,7 | 15,0 | 11,2 | | | | |
| 12345678S | | | | | 16 | 14,4 | 19,4 | 15,0 | 5,0 | | | | |

**EN 50173 Channel Class D / Cat. 5, Ethernet to 100 MBit/s (4-pairs)**

| Wire Map | Resolution Ω | Length Max. | Prop. Delay nS | Delay Skew nS | Freq. MHz | Insertion Loss dB | NEXT dB | RL dB | ACR-N dB | ACR-F dB | PS NEXT dB | PS ACR-N dB | PS ACR-F dB |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 12345678 | 25 | i | 555 | 50 | 1 | 4,2 | 60,0 | 17,0 | 56,0 | 57,4 | 57,0 | 53,0 | 54,4 |
| 12345678 | | | | | 4 | 4,5 | 53,5 | 17,0 | 49,0 | 45,4 | 50,5 | 46,0 | 42,4 |
| | | | | | 8 | 6,4 | 48,6 | 17,0 | 42,2 | 39,3 | 45,6 | 39,2 | 36,3 |
| 12345678S | | | | | 10 | 7,2 | 47,0 | 17,0 | 39,8 | 37,4 | 44,0 | 36,8 | 34,4 |
| 12345678S | | | | | 16 | 9,1 | 43,6 | 17,0 | 34,5 | 33,3 | 40,6 | 31,5 | 30,3 |
| | | | | | 20 | 10,2 | 42,0 | 17,0 | 31,8 | 31,4 | 39,0 | 28,8 | 28,4 |
| | | | | | 25 | 11,5 | 40,3 | 16,0 | 28,9 | 29,4 | 37,3 | 25,9 | 26,4 |
| | | | | | 31,25 | 12,9 | 38,7 | 15,1 | 25,8 | 27,5 | 35,7 | 22,8 | 24,5 |
| | | | | | 62,5 | 18,6 | 33,6 | 12,0 | 15,0 | 21,5 | 30,6 | 12,0 | 18,5 |
| | | | | | 100 | 24,0 | 30,1 | 10,0 | 6,1 | 17,4 | 27,1 | 3,1 | 14,4 |

**EN 50173 Channel Class E / Cat. 6, Ethernet 200 MBit/s (4-pair), up to 1000 MBit/s**

| Wire Map | Resolution Ω | Length Max. | Prop. Delay nS | Delay Skew nS | Freq. MHz | Insertion Loss dB | NEXT dB | RL dB | ACR-N dB | ACR-F dB | PS NEXT dB | PS ACR-N dB | PS ACR-F dB |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 12345678 | 25 | i | 555 | 50 | 1 | 4,0 | 65,0 | 19,0 | 61,0 | 63,3 | 62,0 | 58,0 | 60,3 |
| 12345678 | | | | | 4 | 4,2 | 63,0 | 19,0 | 58,9 | 51,2 | 60,5 | 56,4 | 48,2 |
| | | | | | 8 | 5,9 | 58,2 | 19,0 | 52,3 | 45,2 | 55,6 | 49,7 | 42,2 |
| 12345678S | | | | | 10 | 6,6 | 56,6 | 19,0 | 50,0 | 43,3 | 54,0 | 47,4 | 40,3 |
| 12345678S | | | | | 16 | 8,3 | 53,2 | 18,0 | 44,9 | 39,2 | 50,6 | 42,3 | 36,2 |
| | | | | | 20 | 9,3 | 51,6 | 17,5 | 42,3 | 37,2 | 49,0 | 39,7 | 34,2 |
| | | | | | 25 | 10,5 | 50,0 | 17,0 | 39,6 | 35,3 | 47,3 | 36,9 | 32,3 |
| | | | | | 31,25 | 11,7 | 48,4 | 16,5 | 36,7 | 33,4 | 45,7 | 34,0 | 30,4 |
| | | | | | 62,5 | 16,9 | 43,4 | 14,0 | 26,5 | 27,3 | 40,6 | 23,7 | 24,3 |
| | | | | | 100 | 21,7 | 39,9 | 12,0 | 18,2 | 23,3 | 37,1 | 15,4 | 20,3 |
| | | | | | 200 | 31,7 | 34,8 | 9,0 | 3,1 | 17,2 | 31,9 | 0,1 | 14,2 |
| | | | | | 250 | 35,9 | 33,1 | 8,0 | -2,8 | 15,3 | 30,2 | -5,8 | 12,3 |

**EN 50173 Channel Class EA / Cat. 6A, Ethernet up to 10 Gbit/s, short-length**

| Wire Map | Resolution Ω | Length Max. | Prop. Delay nS | Delay Skew nS | Freq. MHz | Insertion Loss dB | NEXT dB | RL dB | ACR-N dB | ACR-F dB | PS NEXT dB | PS ACR-N dB | PS ACR-F dB |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 12345678 | 25 | i | 555 | 50 | 1 | 4,0 | 65,0 | 19,0 | 61,0 | 63,3 | 62,0 | 58,0 | 60,3 |
| 12345678 | | | | | 4 | 4,2 | 63,0 | 19,0 | 58,9 | 51,2 | 60,5 | 56,4 | 48,2 |
| | | | | | 8 | 5,8 | 58,2 | 19,0 | 52,4 | 45,2 | 55,6 | 49,8 | 42,2 |
| 12345678S | | | | | 10 | 6,5 | 56,6 | 19,0 | 50,1 | 43,3 | 54,0 | 47,5 | 40,3 |
| 12345678S | | | | | 16 | 8,2 | 53,2 | 18,0 | 45,0 | 39,2 | 50,6 | 42,4 | 36,2 |
| | | | | | 20 | 9,2 | 51,6 | 17,5 | 42,5 | 37,2 | 49,0 | 39,8 | 34,2 |
| | | | | | 25 | 10,2 | 50,0 | 17,0 | 39,8 | 35,3 | 47,3 | 37,1 | 32,3 |
| | | | | | 31,25 | 11,5 | 48,4 | 16,5 | 36,9 | 33,4 | 45,7 | 34,2 | 30,4 |
| | | | | | 62,5 | 16,4 | 43,4 | 14,0 | 27,0 | 27,3 | 40,6 | 24,2 | 24,3 |
| | | | | | 100 | 20,9 | 39,9 | 12,0 | 19,0 | 23,3 | 37,1 | 16,2 | 20,3 |
| | | | | | 200 | 30,1 | 34,8 | 9,0 | 4,7 | 17,2 | 31,9 | 1,8 | 14,2 |
| | | | | | 250 | 33,9 | 33,1 | 8,0 | -0,8 | 15,3 | 30,2 | -3,7 | 12,3 |
| | | | | | 350 | 40,6 | 30,6 | 6,6 | -10,0 | 12,4 | 27,6 | -13,0 | 9,4 |
| | | | | | 500 | 49,3 | 27,9 | 6,0 | -21,4 | 9,3 | 24,8 | -24,5 | 6,3 |

# EN (EUROPEAN) STANDARDS

| EN 50173 Channel Class F / Cat. 7, Ethernet up to 1000 Mbit/s, Ethernet up to 10 Gbit/s, short length | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wire Map | Resolution Ω | Length Max. | Prop. Delay nS | Delay Skew nS | Freq. MHz | Insertion Loss dB | NEXT dB | RL dB | ACR-N dB | ACR-F dB | PS NEXT dB | PS ACR-N dB | PS ACR-F dB |
| 12345678 | 25 | i | 555 | 30 | 1 | 4,0 | 65,0 | 19,0 | 61,0 | 65,0 | 62,0 | 58,0 | 62,0 |
| 12345678 | | | | | 4 | 4,1 | 65,0 | 19,0 | 60,9 | 65,0 | 62,0 | 57,9 | 62,0 |
| | | | | | 8 | 5,7 | 65,0 | 19,0 | 59,3 | 62,4 | 62,0 | 56,3 | 59,4 |
| 12345678S | | | | | 10 | 6,4 | 65,0 | 19,0 | 58,6 | 60,8 | 62,0 | 55,6 | 57,8 |
| 12345678S | | | | | 16 | 8,1 | 65,0 | 18,0 | 56,9 | 57,5 | 62,0 | 53,9 | 54,5 |
| | | | | | 20 | 9,1 | 65,0 | 17,5 | 55,9 | 55,9 | 62,0 | 52,9 | 52,9 |
| | | | | | 25 | 10,2 | 65,0 | 17,0 | 54,8 | 54,4 | 62,0 | 51,8 | 51,4 |
| | | | | | 31,25 | 11,4 | 65,0 | 16,5 | 53,6 | 52,8 | 62,0 | 50,6 | 49,8 |
| | | | | | 62,5 | 16,3 | 65,0 | 14,0 | 48,7 | 47,8 | 62,0 | 45,7 | 44,8 |
| | | | | | 100 | 20,8 | 62,9 | 12,0 | 42,1 | 44,4 | 59,9 | 39,1 | 41,4 |
| | | | | | 200 | 30,0 | 58,3 | 9,0 | 28,4 | 39,4 | 55,3 | 25,4 | 36,4 |
| | | | | | 250 | 33,8 | 56,9 | 8,0 | 23,1 | 37,8 | 53,9 | 20,1 | 34,8 |
| | | | | | 600 | 54,6 | 51,2 | 8,0 | -3,4 | 31,3 | 48,2 | -6,4 | 28,3 |

**EN 50173 Channel Class FA / Cat. 7A, Ethernet up tos 10 Gbit/s (IEEE 802.3an)**

| Wire Map | Resolution Ω | Length Max. | Prop. Delay nS | Delay Skew nS | Freq. MHz | Insertion Loss dB | NEXT dB | RL dB | ACR-N dB | ACR-F dB | PS NEXT dB | PS ACR-N dB | PS ACR-F dB |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 12345678 | 25 | i | 555 | 30 | 1 | 4,0 | 65,0 | 19,0 | 61,0 | 65,0 | 62,0 | 58,0 | 62,0 |
| 12345678 | | | | | 4 | 4,1 | 65,0 | 19,0 | 60,9 | 65,0 | 62,0 | 57,9 | 62,0 |
| | | | | | 8 | 5,7 | 65,0 | 19,0 | 59,3 | 65,0 | 62,0 | 56,3 | 62,0 |
| 12345678S | | | | | 10 | 6,4 | 65,0 | 19,0 | 58,6 | 65,0 | 62,0 | 55,6 | 62,0 |
| 12345678S | | | | | 16 | 8 | 65,0 | 18,0 | 57,0 | 63,3 | 62,0 | 54,0 | 60,3 |
| | | | | | 20 | 9 | 65,0 | 17,5 | 56,0 | 61,4 | 62,0 | 53,0 | 58,4 |
| | | | | | 25 | 10 | 65,0 | 17,0 | 55,0 | 59,4 | 62,0 | 52,0 | 56,4 |
| | | | | | 31,25 | 11,2 | 65,0 | 16,5 | 53,8 | 57,5 | 62,0 | 50,8 | 54,5 |
| | | | | | 62,5 | 15,9 | 65,0 | 14,0 | 49,1 | 51,5 | 62,0 | 46,1 | 48,5 |
| | | | | | 100 | 20,3 | 65,0 | 12,0 | 44,7 | 47,4 | 62,0 | 41,7 | 44,4 |
| | | | | | 200 | 28,9 | 60,9 | 9,0 | 32,0 | 41,4 | 57,9 | 29,0 | 38,4 |
| | | | | | 250 | 32,5 | 59,1 | 8,0 | 26,7 | 39,4 | 56,1 | 23,7 | 36,4 |
| | | | | | 600 | 51,4 | 51,2 | 8,0 | 0,7 | 31,8 | 49,1 | -2,3 | 28,8 |

(STAND 07/2010)



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# CLASSIFICATION OF FIBRE OPTIC CABLES / TRANSMISSION RANGES

Transmission distance according to ISO/IEC 11801 (2nd Edition) bzw. EN 50173

**Attenuation of the transmission distance**

| | Attenuation [dB] | | | |
|---|---|---|---|---|
| | Multimode LWL ; 50 µm und 62,5 µm | | Singlemode LWL | |
| **Class** | 850 nm | 1300 nm | 1310 nm | 1550 nm |
| OF 300 | 2,55 | 1,95 | 1,80 | 1,80 |
| OF 500 | 3,25 | 2,25 | 2,00 | 2,00 |
| OF 2000 | 8,50 | 4,50 | 3,50 | 3,50 |

OF ... = Optical Fiber mit Übertragungsstrecke in m.

**Specification for 10 Mbit/s bis 1 Gbit/s**

| | Fibre type | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | OM 1 | | OM 2 | | OM 3 | | OS 1 | |
| **Application** | 850 nm | 1300 nm | 850 nm | 11300 nm | 850 nm | 1300 nm | 1310 nm | 1550 nm |
| FOIRL | OF 2000 | | OF 2000 | | OF 2000 | | | |
| 10 BASE-FL, FP und -FB | OF 2000 | | OF 2000 | | OF 2000 | | | |
| 100 BASE-FX | | OF 2000 | | OF 2000 | | OF 2000 | | |
| 1000 BASE-SX | OF 300 | | OF 500 | | OF 500 | | | |
| 1000 BASE-LX | | OF 500 | | OF 500 | | OF 500 | OF 2000 | |

**Specification for 10 Gbit/s**

| | Fibre type | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | OM 1 | | OM 2 | | OM 3 | | OS 1 | |
| **Application** | 850 nm | 1300 nm | 850 nm | 11300 nm | 850 nm | 1300 nm | 1310 nm | 1550 nm |
| 10 BASE-LX4 | | OF 300 | | OF 300 | | | | |
| 10 BASE-ER/EW | | | | | | | | OF 2000 |
| 10 BASE-SR/SW | | | | | OF 300 | | | |
| 10 BASE-LR/LW | | | | | | | OF 2000 | |

**Ranges for 10/100/1000/10000 Mbit/s-Ethernet**

| | Medium | Cable | Range [1)] |
|---|---|---|---|
| **Ethernet** | AUI | | 50 m |
| | 10BASE2 | Thin Ethernet | 185 m |
| | 10BASE5 | Thin Ethernet | 500 m |
| | 10BASE-T | Twisted Pair | 100 m |
| | 10BASE-FL | 62,5 µm, 50µm Multimode-LWL | 2.000 m |
| **Fast Ethernet** | 100BASE-TX | Twisted Pair | 100 m |
| | 100BASE-FX | 62,5 µm, 50µm Multimode-LWL HDX | 412 m |
| | | 62,5 µm, 50µm Multimode-LWL FDX | 2.000 m |
| **Gigabit Ethernet** | 1000BASE-CX | Koax | 25 m |
| | 1000BASE-T | Twisted Pair, Cat. 5 | 100 m |
| | 1000BASE-SX | 62,5 µm Multimode LWL | 275 m |
| | | 50 µm Multimode LWL | 550 m |
| | 1000BASE-LX | 62,5 µm Multimode LWL | 550 m |
| | | 50 µm Multimode LWL | 550 m |
| | | 9 µm Singlemode LWL | 5.000 m |
| **10 Gigabit** | 10GBASE-LX4 | Multimode LWL | 300 m |
| **Ethernet** | 10GBASE-SR/SW | Multimode LWL | 66 m |
| | 10GBASE-LR/LW | Singlemode LWL | 10.000 m |
| | 10GBASE-ER/EW | Singlemode LWL | 40. 000 m |

[1)] minimum supported value

# FIBRESPECIFICATIONS

| Graded index fibres (multimode) | | | |
|---|---|---|---|
| **Specification** | | **Fibre type G 50/125** | **Fibre type G 62,5/125** |
| Fibre categorie | | OM2 Standardfibre | OM1 Standardfibre |
| Core diameter | | 50 ± 3 µm | 62,5 ± 3 µm |
| Numerical aperture | | 0,200 ± 0,015 | 0,275 ± 0,015 |
| Typ. attenuation | 850 nm | 2,5 dB/km | 3,0 dB/km |
| | 1300 nm | 0,7 dB/km | 1,0 dB/km |
| Min. bandwidth | 850 nm | 500 MHz x km | 200 MHz x km |
| | 1300 nm | 500 MHz x km | 500 MHz x km |
| Cladding diameter | | 125 ± 1 µm | |
| Primary coating diameter | | 245 ± 10 µm | |
| Core noncircularity | | < 5 % | |
| Cladding concentricity error | | < 3,0 µm | |
| Cladding nonconcentricity | | < 2,0 % | |

| **Specification** | | **Fibre type G 50/125** | |
|---|---|---|---|
| Fibre categorie | | OM3 Standardfibre | OM4 Standardfibre |
| Core diameter | | 50 ± 3 µm | 50 ± 3 µm |
| Numerical aperture | | 0,200 ± 0,015 | 0,200 ± 0,015 |
| Typ. attenuation | 850 nm | 2,5 dB/km | 3,0 dB/km |
| | 1300 nm | 0,5 dB/km | 1,0 dB/km |
| Min. bandwidth | 850 nm | 1500 MHz x km | 3500 MHz x km |
| | 1300 nm | 500 MHz x km | 500 MHz x km |
| Cladding diameter | | 125 ± 1 µm | 125 ± 1 µm |
| Primary coating diameter | | 245 ± 10 µm | 245 ± 10 µm |
| Core noncircularity | | < 5 % | < 5 % |
| Cladding concentricity error | | < 3,0 µm | < 6,0 µm |
| Cladding nonconcentricity | | < 2,0 % | < 2,0 % |

| Single-mode-fibres | | | |
|---|---|---|---|
| **Specification** | | **Fibre type E9...10/125 (single mode)** | |
| Fibre categorie | | ITU-T G. 652.d | ITU-T G 657.A1 |
| Core diameter | 1310 nm | 0,36 dB/km | 0,34 dB/km |
| Numerical aperture | 1550 nm | 0,22 dB/km | 0,20 dB/km |
| Typ. attenuation | 1285 - 1330 nm | < 3,5 ps/(nm x km) | |
| | 1550 nm | < 19 ps/(nm x km) | < 17,5 ps/(nm x km) |
| Min. bandwidth | | 1312 nm | |
| | | 9,3 ± 0,5 µm | 9,2 ± 0,3 µm |
| Cladding diameter | | 125 ± 1 µm | 125 ± 1 µm |
| Primary coating diameter | | 245 ± 10 µm | 245 ± 10 µm |
| Core noncircularity | | < 1250 nm | <126 mm |
| Cladding concentricity error | | ≤ 0,8 µm | ≤ 0,5 µm |
| Cladding nonconcentricity | | < 1,0 % | < 0,8 % |

| POF and HCS Fibre | | | |
|---|---|---|---|
| **Specification** | | **Fibre type POF P980/1000** | **Fibre type HCS K200/230** |
| Core diameter | | 980 µm | 200 µm |
| Numerical aperture | | 0,5 | 0,37 |
| Typ. attenuation | 650nm | 160 dB/km | 10 db/km |
| | 850nm | - | 8 dB/km |
| Min. bandwidth | 650nm | 10 MHz x 100m | 17 MHz x km |
| | 850nm | - | 20 MHz x km |
| Wallthickness | | 1000 µm | 230 µm |

Fibres with other parameters on request



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# NETWORKS AND FIELD BUSES

| | Ethernet | Profibus |
|---|---|---|
| **Topology** | Star topology where star points are made via active equipment (hub or switch) | Profibus-DP is designed as point-to-point topology. The bus is terminated at both ends with a resistance network connected to the power supply. |
| **Electrical interface, Data transmission** | Symmetrical interface, full duplex. Galvanic Decoupling via carier. | based on symmertical interface RS 485 |
| **Data transfer rate** | 10/100/1000/10.000 Mbit/s | 9,6 Kbit/s - 12 Mbit/s |
| **Electrical interface, Energy transfer** | RJ 45, 8-pin<br>PoE+, 8023at, 802.3af | RS 485 |
| **Signal designation, Core assignment** | Transmit + orange<br>Transmit - white/orange<br>Receive + green<br>Receive - green/white | A-line green<br>B-line red |
| **Plug connector for IP20 or higher** | RJ 45 for Light-Duty | D-SUB 9, M12 |
| **Plug connector for IP67 or higher** | RJ 45 for Heavy-Duty M12, 4-pole, D-coded | D-SUB 9, M12, 5-pole, B-coded |

**Pin assignment**

| Signal designation (Plug connector) | RJ 45 | M12 |
|---|---|---|
| Transmit + | 2 | 1 |
| Transmit – | 1 | 3 |
| Receive + | 6 | 2 |
| Receive – | 3 | 4 |

| Signal designation (Plug connector) | D-SUB 9 | M12 |
|---|---|---|
| A-line | 8 | 2 |
| B-line | 3 | 4 |
| shield | 1 | 5 |

| | | |
|---|---|---|
| **Bus length** | up to 100m from the Hub/switch to the terminal device | up to 1200m per Segment |
| **Number of participants** | unlimited | up to 126, bis 32 per Bus segment |
| **Directive** | Industrial Ethernet Planning, EN 50173 and Installation Guide, PNO (Profinet) | Guideline 2.142, PNO |
| **Standardisation** | IEE 802.3 | EN 50170 |

| CAN | Interbus | Device Net |
|---|---|---|
| CAN is designed as point-to-point topology. The bus is terminated at both ends with a terminating resistor | The Interbus is designed as an active ring. In order to overcome the disadvantage of doubled cable layout, the outgoing and return signals are included in one cable so that the user has the impression of a point-to-point topology. | Like CAN, another power supply is also transmitted. The series line is called the "trunk line" and the stubs are called "drop lines". The "thick cable" is used for the trunk line and "thin cable" is used for the drop or trunk line. |
| Symmetrical interface, with special definition using CAN transceiver chips | based on symmetrical S 485 interface | Symmetrical interface with special definition using CAN transceiver chips |
| up to 1Mbit/s | 500 kBit/s or 2 Mbit/s | up to 500 KBits/s |
| not in the standard configuration | not in the standard configuration | 24 V DC<br>8 A for thick cable<br>3 A for thin cable |
| CAN_L green<br>CAN_H yellow<br>CAN_GND brown | DO yellow<br>DO green<br>DI grey<br>DI pink<br>COM brown | CAN_L blue<br>CAN_H white<br>V- red<br>V+ black<br>Drain colourless |
| COMBICON<br>D-SUB 9<br>RJ 45 | D-SUB 9 | COMBICON |
| M12, 5-pole, A-coded<br>7/8", 5-pole | D-SUB 9<br>M12, 5-pole, B-coded | M12, 5-pole, A-coded<br>7/8", 5-pole |

| Plug connector / Signal designation | COMBICON | D-SUB 9 | M12 | RJ 45 | 7/8" |
|---|---|---|---|---|---|
| CAN_L | 2 | 2 | 5 | 2 | 5 |
| CAN_H | 4 | 7 | 4 | 1 | 4 |
| CAN_GND | 1 | 3 | 3 | 3 | 3 |

| Plug connector / Signal designation | D-SUB 9 | M12 |
|---|---|---|
| DO | 1 | 1 |
| DO | 6 | 2 |
| DI | 2 | 3 |
| DI | 7 | 4 |
| COM | 3 | 5 |

| Plug connector / Signal designation | COMBICOM | M12 | 7/8" |
|---|---|---|---|
| CAN_L | 2 | 5 | 5 |
| CAN_H | 4 | 4 | 4 |
| V+ | 5 | 2 | 2 |
| V- | 1 | 3 | 3 |
| Drain | 3 | 1 | 1 |

| | | |
|---|---|---|
| up to 1000m | up to 400m between two participants, up to 13 km total length | up to 500m |
| up to 640 | up to 4096 | up to 2048 |
| CiA DR-303-1 | INTERBUS-conformity test | DeviceNet Connector Profiles |
| not specified | IEC 61158 | not specified |



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# FIBRE-OPTIC CABLES-CODE ACC. TO DIN VDE 0888

□ — □ □ □ □ □ □ □ □ □ □ □ □ □ □

1 2 3 4 5 6 7 8 9 10 11 12 13 14

14 Lg layerstranding

13 Bandwidth in MHz x km
(GF) dispersion parameter
in $\frac{ps}{nm \times km}$

12 Wavelength
B ≙ 850 nm
F ≙ 1300 nm
H ≙ 1550 nm

11 Attenuation coefficient in dB/km

10 Cladding diameter in µm

9 Core diameter in µm of graded index fibre
Field diameter in µm of single mode fibre

8 Design
E Single mode fibre
G Gradded index fibre

7 Number of fibres
Number of fibres per buffer
Number of multifibres buffer

6
Y PVC-sheath
H Sheath with halogenfree material
B Armouring
BY Armouring with PVC-protective covering sheath
B2Y Armouring mit PE-protective covering sheath

5
Y PVC-sheath
2Y PE-sheath
4Y PA-sheath
11Y PUR-sheath
(L)2Y PE-Laminated sheath
(ZN)2Y PE-sheath with nometallic strength menber
(L)(ZN)2Y PE-Laminated sheath with nometallic strength menber

4
F Filling of the cable core with petroleum jelly
Q Swellingmaterial

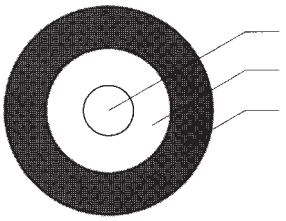
3 S Metallic element in the cable core

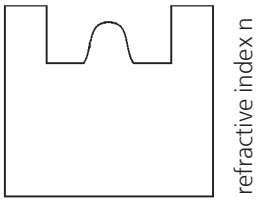
2
V Tight buffer
K Composite buffer fibre
H Loose buffer nonfilled
W Loose buffer, filled
B Multifibre buffer nonfilled
D Multifibre buffer filles

1
I Indoor cable
A Outdoor cable
AT Outdoor fan out cable

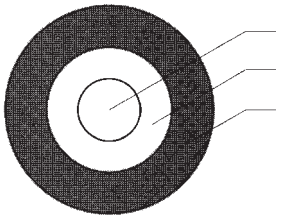
# CROSS-SECTIONS OF FIBRE OPTICS AND CORES

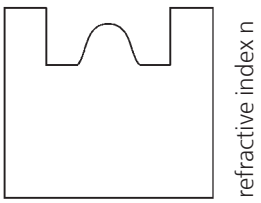
## Graded index fibre G 50/125



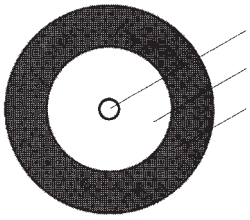



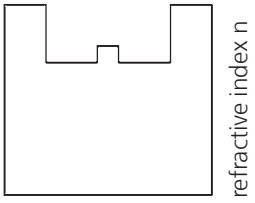

## Graded index fibre G 62,5/125

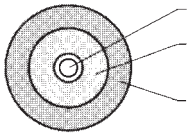


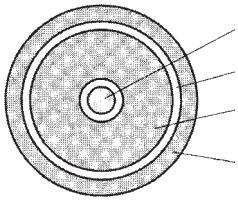

## Single-mode fibre E . . 10/125



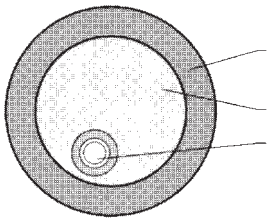



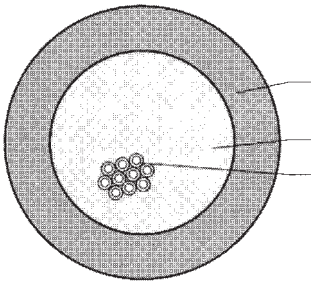

Tight buffer




Semi-tight-fibre




Loose buffer filled




Multifibre buffer filled



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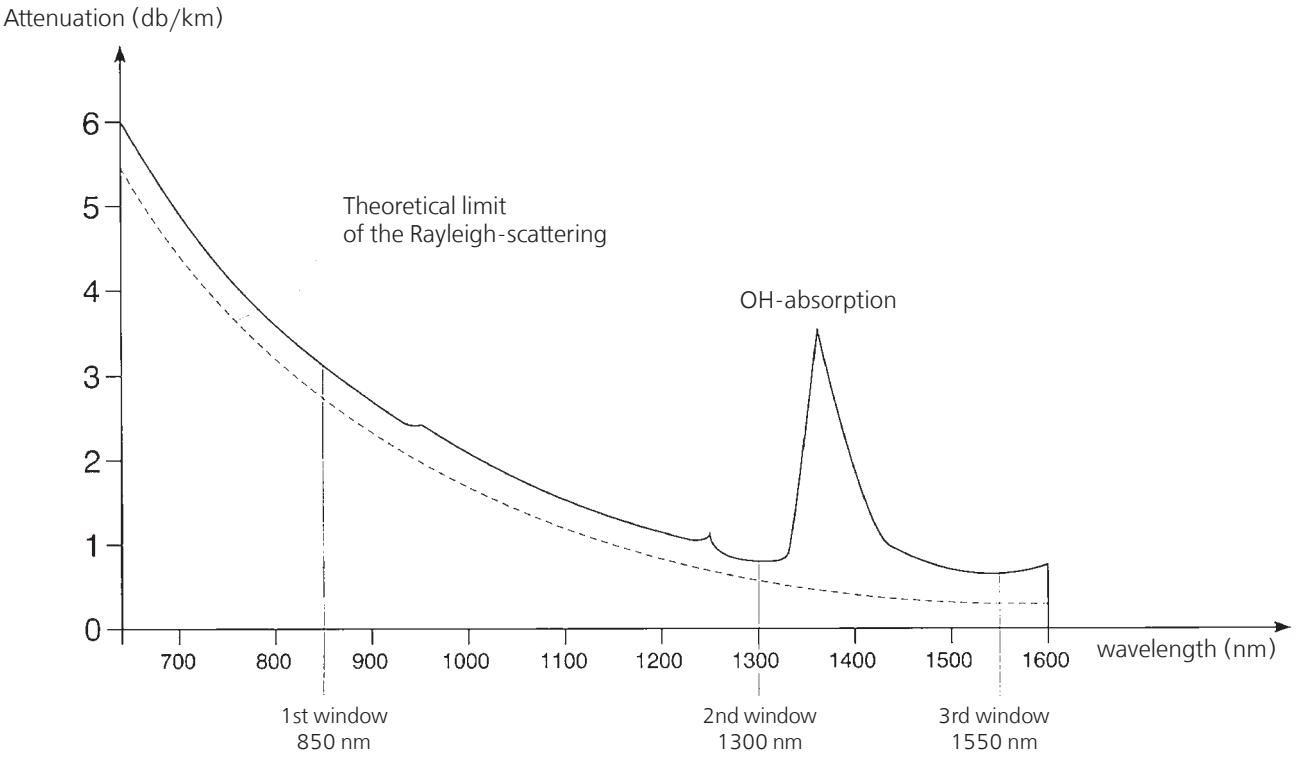
# SPECTRAL ATTENUATION CHARACTERISTIC OF GLASS

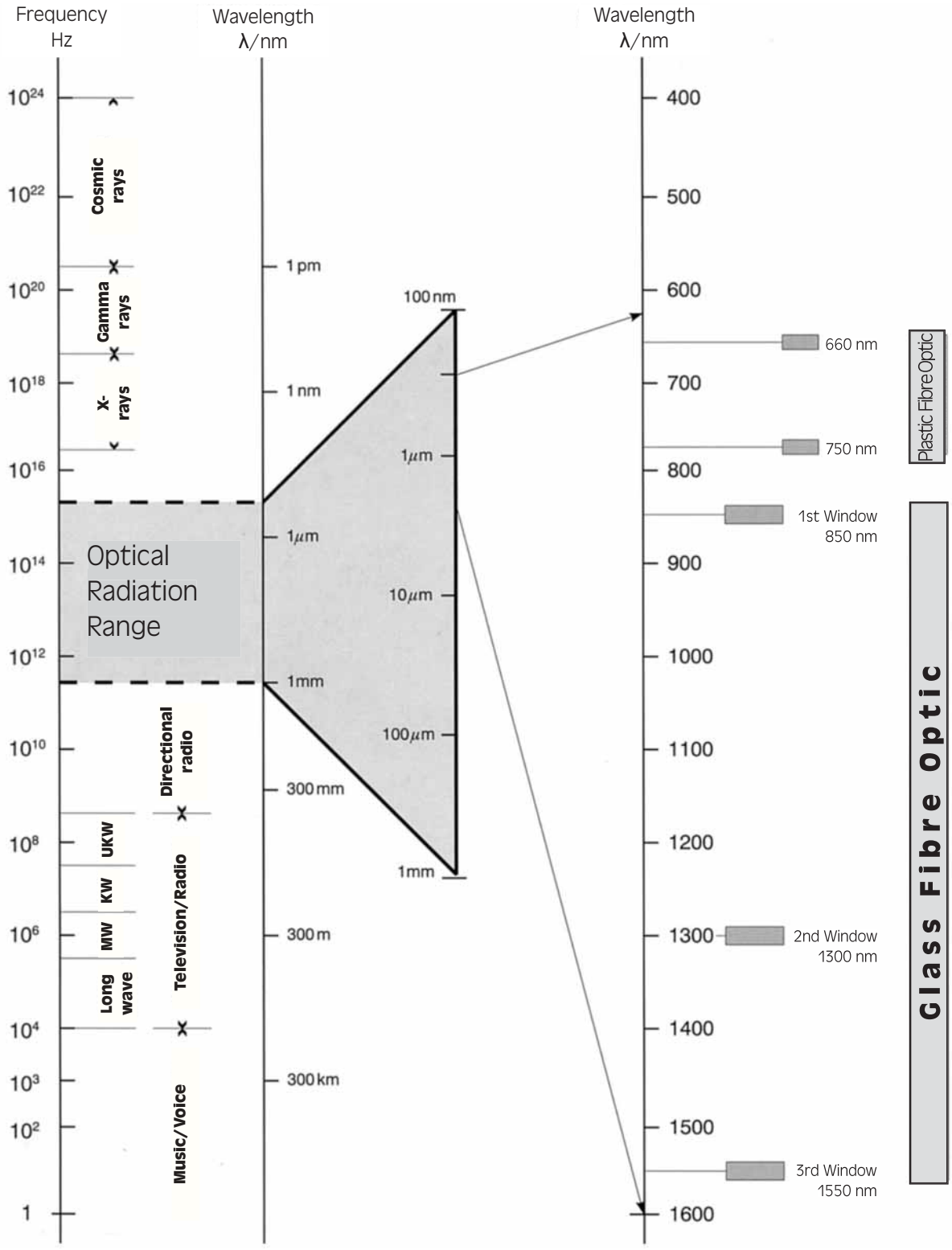



Rayleigh-scattering means the losses that result from the continuous dispersion of light. This continuous dispersion originates in a local change of the refractive index. The refractive index is changed by irregularities of the density of fused silica glass. The Rayleigh-scattering decreases with the increasing of wavelength. Entering of moisture produces OH-ions which cause limited but very high peaks of attenuation at ca. 950, 1200 and 1400 nm.

## Indexprofiles and characteristics

| Fibre-cross-section | Profile of refractive index | Wave propagation (modes) and change of pulse | Characteristics |
|---|---|---|---|
| Step index | Multimode fibre | Input pulse / Sheath $n_2$ / Core $n_2$ / Output pulse | • Bandwidth <100 MHz / km<br>• Dispersion 10...150 ns / km<br>• Long impulse spreading for short distances < 500 m<br>• Attenuation: middle-high |
| Graded index | Multimode fibre | Sheath $n_2$ / Core $n_2$ | • Bandwidth <1 GHz /km<br>• Dispersion 1...5 ns /km<br>• Short impulse spreading for middle distances > 500 m<br>• Attenuation: low |
| Step index | Single mode fibre | Sheath $n_2$ / Core $n_2$ | • Bandwidth <10 GHz / km<br>• Dispersion 4...150 ns / km<br>• No impulse spreading for long distances > 500 m<br>• Attenuation: very low |

# THE ELECTROMAGNETIC SPECTRUM




**Visible rays, light**

- violett 380 - 420 nm
- blue 420 - 490 nm
- green 530 - 650 nm
- red 650 - 780 nm

**Infra-red ray**

780 nm - 1 mm



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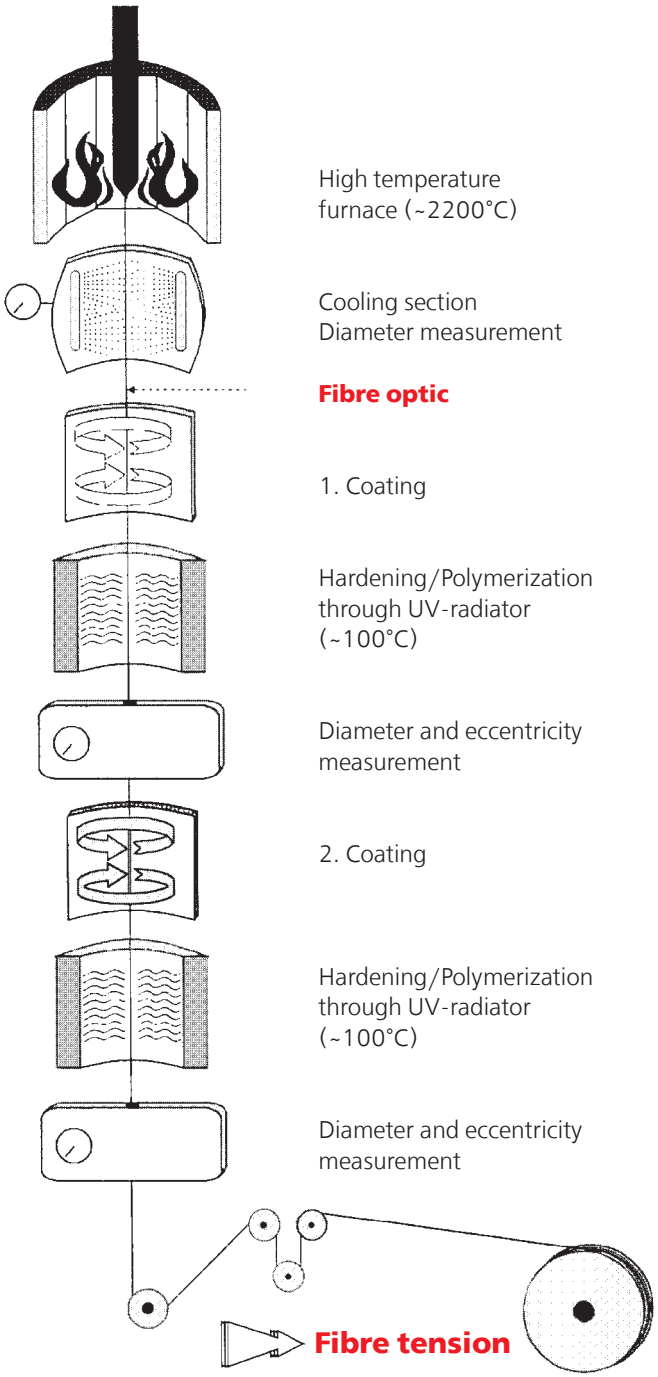
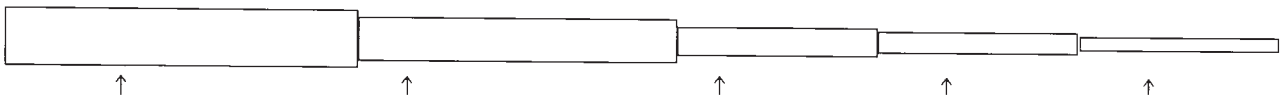
# FIBRE OPTIC DRAWING TOWER-DESIGN




## Faser mit Kunststoffbeschichtung



| Secondary coating (main coating) hard material of plastic | Primary coating (pre-coating) soft material of plastic | Coat of lacquer UV-Epoxy | glass cladding ($n_2$) | glass core ($n_1$) |
|---|---|---|---|---|

**Diameter range and coating thickness:**

| | | |
|---|---|---|
| • glass core diameter | - | 10 to 100 µm |
| • glass cladding diameter | - | 125 to 150 µm |
| • thickness of lacquer coating | - | 2 to 5 µm |
| • primary coating diameter | - | 150 to 500 µm |
| • secondary coating diameter | - | 250 or 900 µm |

# CODE-DESIGNATION-EXPLANATIONS FOR CABLES AND INSULATED WIRE

| | |
|---|---|
| A- | Outdoor cable |
| A | approved national design |
| AB | Outdoor cable with lighting protection |
| AD | Outdoor cable with differential protection |
| AJ- | Outdoor cable with induction protection |
| ASLH | self-supporting communication cables for high voltage overhead lines |
| B | armouring |
| B | spinning of textile yarn |
| b | armouring |
| (1B...) | one layer of steel tape... thickness of the steel tape in mm |
| (2B...) | two layers of steel tape... thickness of the steel tape in mm |
| BD | unit-type stranding |
| BLK | bare copper-conductor without insulation |
| BZ | bronze conductor |
| C | screen of copper wire braiding |
| C | screen of copper wire spinning |
| C | outer protection of jute and viscous compound |
| Cu | copper wire |
| (-Cu) | total cross-section of copper screens (mm2) |
| D | screen of copper wires |
| (D) | screen of helically applied copper wires |
| DM | Dieselhorst-Martin quad |
| Dreier | three cores in triple stranded |
| E | copper drain wire |
| E(e) | protective covering of viscous compound with embedded layer of plastic tape |
| e | single wire, solid |
| F | cable cores assembly with petrol-jelly |
| F | foil wrapping |
| F | flat cable |
| F | star quad for railway cable |
| F | star quad for phantom circuits |
| (F...) | flat wire armouring... thickness in mm |
| OF | jelly filled cable core, filling compound of hard substances |
| FR | flame retardant |
| f | flexible, fine wire stranding |
| ff | extra fine wire stranding |
| G | insulation or sheath material of rubber (NR) or (SBR) |
| G- | Mining cable |
| GJ | Mining cable with induction protection |
| GS | glass fibre whipping or braiding |
| 2G | insulation or jacket of silicone rubber, (SIR) |
| 3G | insulation or jacket of ethylene propylene rubber, (EPR) |
| 4G | insulation or jacket of ethylene vinylacetate rubber (EVA) |
| 5G | insulation or jacket of chloroprene rubber (CR) |
| 6G | insulation or jacket of chlorosulphonated polyethylene (CSM), Hypalon |
| 7G | insulation or jacket of Flouroelastomer (FKM) |
| 8G | insulation or jacket of Nitrile rubber (NBR) |
| 9G | PE-C rubber (CM) |
| 53G | CM, chlorinated Polyethylene |
| H | insulation or jacket of halogen-free compound |
| H | Harmonized Documents |
| (H...) | maximal value of mutual capacitance (nF / km) |
| (HS) | semi-conducting tape of layer |
| HX | cross-linked, halogen-free polymer compound |
| ...IMF | individual stranding element (pairs or single cores etc.) in metal foil and drain wire |
| IMF | several stranding elements in metalfoil and drain wire |
| -J | cable with green-yellow earth core |
| -JZ | cable with green-yellow earth core and cores with inprinted numbers |
| K | copper-tape |
| (K) | inner sheath and longitudinally folded copper tape |
| LA | tinsel conductor (flat copper wire stranded over the thread of synthetic fibres) |
| LD | corrugated aluminium sheath |
| Lg | in layers stranding |
| Li | stranded wires conductor |
| (L)Y | laminated sheath Al-tape and PVC-jacket |
| (L)2Y | laminated sheath Al-tape and PE-jacketl |
| 2L | double enamel coating as insulation |
| M | plastic-sheath cable |
| M | lead sheath |
| Mz | alloyed lead sheath |
| (mS) | magnetic shield |
| N | VDE standard |
| (N) | in adapted to VDE standard |
| NC | non-corrosiv, smoke-gase |
| NF | natural colour |
| -O | cable without green-yellow earth core |
| -OZ | cable without green-yellow earth core and cores with imprinted numbers |
| ö | oil-resistant |
| 02Y | Foam-PE, insulation (cellular PE) |
| Q | Steel wire braiding |
| (R...) | round wire, diameter in mm |
| RAGL- | Compensating cable for thermocoupling |
| RD- | Rhenomatic cable |
| RE | Computer cable |
| RG- | Coaxial cable according MIL specification |
| re | round, single wire |
| rm | round, multiwire |
| RS- | computer switchboard cable |
| S | silk whipping |
| S | signal cables for railways |
| (S...) | nominal value of mutual capacitance (nF /km) |
| -S | signal cable for German Railway |
| S- | Switchboard cable |
| SL | flexible sheathed cable |
| 2S | two layers of silk whipping |
| St | star quad for phantom circuits |
| St I | star quad in telephone cables for lager distance |
| St III | star quad in local cables |
| (St) | static screen |
| Staku | copper clad steel wire |
| Staku-Li | copper clad steel stranded wires |
| ...t | termite protection |
| T | supporting element for overhead cable |
| T- | fan out cable |
| TF | carrier frequency of pairs or quads triple |
| TiC | triple in copper wire braid |
| TiMF | triple in metal foil |
| U | braiding of textile fibres |
| VGD | gold-plated |
| VN | ickel-plated; VS silver-plated |
| VZK | galvanized; VZN tinned |
| W | corrugated steel sheath |
| W | high heat resistant |
| W | corrugated steel sheath |
| X | cross-linked polyvinylchlorid (X-PVC) or other materials |
| XPE | cross-linked polyethylene (X-PE) |
| 2X | cross-linked polyethylene |
| 7X | cross-linked Ethylentetrafluorethylen (X-ETFE) |
| 10X | cross-linked Polyvinylidenfluorid (X-PVDF) |
| Y | PVC, polyvinylchloride |
| Yu | PVC, polyvinylchloride, non-flammable, flame-retardant |
| Yv | PVC, polyvinylchloride, with reinforced sheath |
| YV | Equipment wires with tinned conductor |
| Yw | PVC, polyvinylchlorid, heat resistant up to 90°C |
| 2Y | Polyethylene (PE) |
| 2Yv | Polyethylene, reinforced sheath |
| 02Y | Cellular polyethylene |
| 02YS | insulation of cellular polyethylene with outer PE-skin |
| 2YHO | insulation of air-spaced polyethylene |
| 3Y | insulation polystyrene (PS), Styroflex |
| 4Y | insulation or jacket of polyamide (PA) |
| 5Y | insulation or jacket of polytetrafluorethylene (PTFE), HELUFLON® |
| 5YX | Perfluoralkoxy (PFA) |
| 6Y | Perfluoroethylene-propylene (FEP), HELUFLON® |
| 7Y | insulation or jacket of ethylentetrafluore-thylen (ETFE) |
| 8Y | insulation of polyimid (PI), Kapton® |
| 9Y | polypropylen (PP) |
| 10Y | PVDF, Polyvinylidene fluoride |
| 11Y | polyurethan (PUR) |
| 12Y | TPE-E, TPE |
| 13Y | TPE-EE, TPE on base of Polyester-Ester |
| 31Y | TPE-S, TPE on base of Polystyrol |
| 41Y | TPE-A, TPE on base of Polyamide |
| 51Y | PFA, Perfluor-Alkoxylalkane |
| 71Y | ECTFE, Monochlortrifluorethylene |
| 91Y | TPE-O, TPE on base of Polyester-Ester |
| -Z | core imprinted with numbers |
| Z | twin cable |
| (Z) | high-tensile braid of steel wires |
| (ZG) | high-tensile element of glass fibre yarn |
| (ZN) | high-tensile of non-metallic elements |



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# AWG-WIRES AND AWG-STRANDED CONDUCTORS

## CONDUCTOR MAKE-UP, CROSS-SECTION, RESISTANCE AND WEIGHT

| AWG No. | AWG-make-up n x AWG | conductor make-up mm | crosssection mm² | conductor outer-Ø mm | conductor resistance Ohm/km | conductor weight kg/km |
|---|---|---|---|---|---|---|
| 36 | solid | solid | 0,013 | 0,127 | 1460,0 | 0,116 |
| 36 | 7/44 | 7 x 0,05 | 0,014 | 0,152 | 1271,0 | 0,125 |
| 34 | solid | solid | 0,020 | 0,160 | 918,0 | 0,178 |
| 34 | 7/42 | 7 x 0,064 | 0,022 | 0,192 | 777,0 | 0,196 |
| 32 | solid | solid | 0,032 | 0,203 | 571,0 | 0,284 |
| 32 | 7/40 | 7 x 0,078 | 0,034 | 0,203 | 538,0 | 0,302 |
| 32 | 19/44 | 19 x 0,05 | 0,037 | 0,229 | 448,0 | 0,329 |
| 30 | solid | solid | 0,051 | 0,254 | 365,0 | 0,45 |
| 30 | 7/38 | 7 x 0,102 | 0,057 | 0,305 | 339,0 | 0,507 |
| 30 | 19/42 | 19 x 0,064 | 0,061 | 0,305 | 286,7 | 0,543 |
| 28 | solid | solid | 0,080 | 0,330 | 232,0 | 0,71 |
| 28 | 7/36 | 7 x 0,127 | 0,087 | 0,381 | 213,0 | 0,774 |
| 28 | 19/40 | 19 x 0,078 | 0,091 | 0,406 | 186,0 | 0,81 |
| 27 | 7/35 | 7 x 0,142 | 0,111 | 0,457 | 179,0 | 0,988 |
| 26 | solid | solid | 0,128 | 0,409 | 143,0 | 1,14 |
| 26 | 10/36 | 10 x 0,127 | 0,127 | 0,533 | 137,0 | 1,13 |
| 26 | 19/38 | 19 x 0,102 | 0,155 | 0,508 | 113,0 | 1,38 |
| 26 | 7/34 | 7 x 0,160 | 0,141 | 0,483 | 122,0 | 1,25 |
| 24 | solid | solid | 0,205 | 0,511 | 89,4 | 1,82 |
| 24 | 7/32 | 7 x 0,203 | 0,227 | 0,610 | 76,4 | 2,02 |
| 24 | 10/34 | 10 x 0,160 | 0,201 | 0,582 | 85,6 | 1,79 |
| 24 | 19/36 | 19 x 0,127 | 0,241 | 0,610 | 69,2 | 2,14 |
| 24 | 41/40 | 41 x 0,078 | 0,196 | 0,582 | 84,0 | 1,74 |
| 22 | solid | solid | 0,324 | 0,643 | 55,3 | 2,88 |
| 22 | 7/30 | 7 x 0,254 | 0,355 | 0,762 | 48,4 | 3,16 |
| 22 | 19/34 | 19 x 0,160 | 0,382 | 0,787 | 45,1 | 3,4 |
| 22 | 26/36 | 26 x 0,127 | 0,330 | 0,762 | 52,3 | 2,94 |
| 20 | solid | solid | 0,519 | 0,813 | 34,6 | 4,61 |
| 20 | 7/28 | 7 x 0,320 | 0,562 | 0,965 | 33,8 | 5,0 |
| 20 | 10/30 | 10 x 0,254 | 0,507 | 0,889 | 33,9 | 4,51 |
| 20 | 19/32 | 19 x 0,203 | 0,615 | 0,940 | 28,3 | 5,47 |
| 20 | 26/34 | 26 x 0,160 | 0,523 | 0,914 | 33,0 | 4,65 |
| 20 | 41/36 | 41 x 0,127 | 0,520 | 0,914 | 32,9 | 4,63 |
| 18 | solid | solid | 0,823 | 1,020 | 21,8 | 7,32 |
| 18 | 7/26 | 7 x 0,404 | 0,897 | 1,219 | 19,2 | 7,98 |
| 18 | 16/30 | 16 x 0,254 | 0,811 | 1,194 | 21,3 | 7,22 |
| 18 | 19/30 | 19 x 0,254 | 0,963 | 1,245 | 17,9 | 8,57 |
| 18 | 41/34 | 41 x 0,160 | 0,824 | 1,194 | 20,9 | 7,33 |
| 18 | 65/36 | 65 x 0,127 | 0,823 | 1,194 | 21,0 | 7,32 |
| 16 | solid | solid | 1,310 | 1,290 | 13,7 | 11,66 |
| 16 | 7/24 | 7 x 0,511 | 1,440 | 1,524 | 12,0 | 12,81 |
| 16 | 65/34 | 65 x 0,160 | 1,310 | 1,499 | 13,2 | 11,65 |
| 16 | 26/30 | 26 x 0,254 | 1,317 | 1,499 | 13,1 | 11,72 |
| 16 | 19/29 | 19 x 0,287 | 1,229 | 1,473 | 14,0 | 10,94 |
| 16 | 105/36 | 105 x 0,127 | 1,330 | 1,499 | 13,1 | 11,84 |
| 14 | solid | solid | 2,080 | 1,630 | 8,6 | 18,51 |
| 14 | 7/22 | 7 x 0,643 | 2,238 | 1,854 | 7,6 | 19,92 |
| 14 | 19/27 | 19 x 0,361 | 1,945 | 1,854 | 8,9 | 17,31 |
| 14 | 41/30 | 41 x 0,254 | 2,078 | 1,854 | 8,3 | 18,49 |
| 14 | 105/34 | 105 x 0,160 | 2,111 | 1,854 | 8,2 | 18,79 |

| AWG No. | AWG-make-up n x AWG | conductor make-up mm | crosssection mm² | conductor outer-Ø mm | conductor resistance Ohm/km | conductor weight kg/km |
|---|---|---|---|---|---|---|
| 12 | solid | Solid | 3,31 | 2,05 | 5,4 | 29,46 |
| 12 | 7/20 | 7 x 0,813 | 3,63 | 2,438 | 4,8 | 32,30 |
| 12 | 19/25 | 19 x 0,455 | 3,09 | 2,369 | 5,6 | 27,50 |
| 12 | 65/30 | 65 x 0,254 | 3,292 | 2,413 | 5,7 | 29,29 |
| 12 | 165/34 | 165 x 0,160 | 3,316 | 2,413 | 5,2 | 29,51 |
| 10 | solid | solid | 5,26 | 2,59 | 3,4 | 46,81 |
| 10 | 37/26 | 37 x 0,404 | 4,74 | 2,921 | 3,6 | 42,18 |
| 10 | 49/27 | 49 x 0,363 | 5,068 | 2,946 | 3,6 | 45,10 |
| 10 | 105/30 | 105 x 0,254 | 5,317 | 2,946 | 3,2 | 47,32 |
| 8 | 49/25 | 49 x 0,455 | 7,963 | 3,734 | 2,2 | 70,87 |
| 8 | 133/29 | 133 x 0,287 | 8,604 | 3,734 | 2,0 | 76,57 |
| 8 | 655/36 | 655 x 0,127 | 8,297 | 3,734 | 2,0 | 73,84 |
| 6 | 133/27 | 133 x 0,363 | 13,764 | 4,676 | 1,5 | 122,49 |
| 6 | 259/30 | 259 x 0,254 | 13,123 | 4,674 | 1,3 | 116,79 |
| 6 | 1050/36 | 1050 x 0,127 | 13,316 | 4,674 | 1,3 | 118,51 |
| 4 | 133/25 | 133 x 0,455 | 21,625 | 5,898 | 0,80 | 192,46 |
| 4 | 259/27 | 259 x 0,363 | 26,804 | 5,898 | 0,66 | 238,55 |
| 4 | 1666/36 | 1666 x 0,127 | 21,104 | 5,898 | 0,82 | 187,82 |
| 2 | 133/23 | 133 x 0,574 | 34,416 | 7,417 | 0,50 | 306,30 |
| 2 | 259/26 | 259 x 0,404 | 33,201 | 7,417 | 0,52 | 295,49 |
| 2 | 665/30 | 665 x 0,254 | 33,696 | 7,417 | 0,52 | 299,89 |
| 2 | 2646/36 | 2646 x 0,127 | 33,518 | 7,417 | 0,52 | 298,31 |
| 1 | 133/22 | 133 x 0,643 | 43,187 | 8,331 | 0,40 | 384,37 |
| 1 | 259/25 | 259 x 0,455 | 42,112 | 8,331 | 0,41 | 374,80 |
| 1 | 817/30 | 817 x 0,254 | 41,397 | 8,331 | 0,42 | 368,43 |
| 1 | 2109/34 | 2109 x 0,160 | 42,403 | 8,331 | 0,41 | 377,39 |
| 1/0 | 133/21 | 133 x 0,724 | 54,75 | 9,347 | 0,31 | 487,28 |
| 1/0 | 259/24 | 259 x 0,511 | 53,116 | 9,347 | 0,32 | 472,73 |
| 2/0 | 133/20 | 133 x 0,813 | 69,043 | 10,516 | 0,25 | 614,48 |
| 2/0 | 259/23 | 259 x 0,574 | 67,021 | 10,516 | 0,25 | 596,49 |
| 3/0 | 259/22 | 259 x 0,643 | 84,102 | 11,786 | 0,20 | 748,51 |
| 3/0 | 427/24 | 427 x 0,511 | 87,570 | 11,786 | 0,19 | 779,37 |
| 4/0 | 259/21 | 259 x 0,724 | 106,626 | 13,259 | 0,16 | 948,97 |
| 4/0 | 427/23 | 427 x 0,574 | 110,494 | 13,259 | 0,15 | 983,39 |

# AWG-WIRES (SOLID-CONDUCTOR)

| AWG No. | Wire-Ø mm |
|---|---|
| 44 | 0,050 |
| 41 | 0,070 |
| 40 | 0,079 |
| 39 | 0,089 |
| 38 | 0,102 |
| 37 | 0,114 |
| 36 | 0,127 |
| 35 | 0,142 |
| 34 | 0,160 |
| 33 | 0,180 |
| 32 | 0,203 |
| 31 | 0,226 |

| AWG No. | Wire-Ø mm |
|---|---|
| 30 | 0,254 |
| 29 | 0,287 |
| 28 | 0,320 |
| 27 | 0,363 |
| 26 | 0,404 |
| 25 | 0,455 |
| 24 | 0,511 |
| 23 | 0,574 |
| 22 | 0,643 |
| 21 | 0,724 |
| 20 | 0,813 |
| 19 | 0,912 |

| AWG No. | Wire-Ø mm |
|---|---|
| 18 | 1,024 |
| 17 | 1,151 |
| 16 | 1,290 |
| 15 | 1,450 |
| 14 | 1,628 |
| 13 | 1,829 |
| 12 | 2,052 |
| 11 | 2,304 |
| 10 | 2,588 |
| 9 | 2,906 |
| 8 | 3,268 |
| 7 | 3,665 |

| AWG No. | Wire-Ø mm |
|---|---|
| 6 | 4,115 |
| 5 | 4,620 |
| 4 | 5,189 |
| 3 | 5,827 |
| 2 | 6,543 |
| 1 | 7,348 |
| 1/0 | 8,252 |
| 2/0 | 9,266 |
| 3/0 | 10,404 |
| 4/0 | 11,684 |

# STRANDED MAKE-UP (DIN VDE 0295, IEC 60228 bzw. HD 383)

| crosssection | stranded wires | | multistranded wires | | fine wires | | extra-fine wires | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class 2 DIN VDE 0295 | | | | Class 5 DIN VDE 0295 | | Class 6 DIN VDE 0295 | | | | | | | |
| | column1 | | column 2 | | column 3 | | column 4 | | column 5 | | column 6 | | column 7 | |
| | wire number x | singe of wire-Ø | wire number x | singe of wire-Ø | wire number x | singe of wire-Ø | wire number x | singe of wire-Ø | wire number x | singe of wire-Ø | wire number x | singe of wire-Ø | wire number x | singe of wire-Ø |
| | mm | | mm | | mm | | mm | | mm | | mm | | mm | |
| 0,14 | | | | | 18x0,1 | | 18x0,1 | | 18x0,1 | | 36x0,07 | | 72x0,5 | |
| 0,25 | | | | | 14x0,15 | | 32x0,1 | | 32x0,1 | | 65x0,07 | | 128x0,5 | |
| 0,34 | | | 7x0,25 | | 19x0,15 | | 42x01 | | 42x0,1 | | 88x0,07 | | 174x0,5 | |
| 0,38 | | | 7x0,27 | | 12x0,2 | | 21x0,15 | | 48x0,1 | | 100x0,07 | | 194x0,5 | |
| 0,5 | 7x0,30 | | 7x0,30 | | 16x0,2 | | 28x0,15 | | 64x0,1 | | 131x0,07 | | 256x0,5 | |
| 0,75 | 7x0,37 | | 7x0,37 | | 24x0,2 | | 42x0,15 | | 96x0,1 | | 195x0,07 | | 384x0,5 | |
| 1,0 | 7x0,43 | | 7x0,30 | | 32x0,2 | | 56x0,15 | | 128x0,1 | | 260x0,07 | | 512x0,5 | |
| 1,5 | 7x0,52 | | 7x0,37 | | 30x0,25 | | 84x0,15 | | 192x0,1 | | 392x0,07 | | 768x0,5 | |
| 2,5 | 7x0,67 | | 7x0,43 | | 50x0,25 | | 140x0,15 | | 320x0,1 | | 651x0,07 | | 1280x0,5 | |
| 4 | 7x0,85 | | 7x0,52 | | 56x0,3 | | 224x0,15 | | 512x0,1 | | 1040x0,07 | | | |
| 6 | 7x1,05 | | 19x0,41 | | 84x0,3 | | 192x0,2 | | 768x0,1 | | 1560x0,07 | | | |
| 10 | 7x1,35 | | 19x0,52 | | 80x0,4 | | 320x0,2 | | 1280x0,1 | | 2600x0,07 | | | |
| 16 | 7x1,70 | | 19x0,64 | | 128x0,4 | | 512x0,2 | | 2048x0,1 | | | | | |
| 25 | 7x2,13 | | 49x0,65 | | 200x0,4 | | 800x0,2 | | 3200x0,1 | | | | | |
| 35 | 7x2,52 | | 84x0,62 | | 280x0,4 | | 1120x0,2 | | | | | | | |
| 50 | 19x1,83 | | 133x0,58 | | 400x0,4 | | 705x0,3 | | | | | | | |
| 70 | 19x2,17 | | 133x0,69 | | 356x0,5 | | 990x0,3 | | | | | | | |
| 95 | 19x2,52 | | 189x0,69 | | 485x0,5 | | 1340x0,3 | | | | | | | |
| 120 | 37x2,03 | | 259x0,69 | | 614x0,5 | | 1690x0,3 | | | | | | | |
| 150 | 37x2,27 | | 336x0,67 | | 765x0,5 | | 2123x0,3 | | | | | | | |
| 185 | 37x2,52 | | 392x0,69 | | 944x0,5 | | 1470x0,4 | | | | | | | |
| 240 | 61x2,24 | | 494x0,69 | | 1255x0,5 | | 1905x0,4 | | | | | | | |
| 300 | 61x2,50 | | 627x0,70 | | 1530x0,5 | | 2385x0,4 | | | | | | | |
| 400 | 61x2,89 | | 790x0,70 | | 2035x0,5 | | | | | | | | | |
| 500 | 61x3,23 | | | | 1768x0,6 | | | | | | | | | |

[1] The number of individual wires are without obligation.

[2] The diameters of the single wires for each conductor are not allowed to exceed the values stated to DIN VDE 0295. The single wires of a stranded conductor must have all the same nominal diameters.

[3] Minimum-number of single wires of stranded conductor (up to 35 mm²). The single wires of a stranded conductor must have all the same nominal diameters.

[2] **Note:** permissible maximal diameter of single wires:

| nominal value | maximal value |
|---|---|
| mm | mm |
| 0,2 | 0,21 |
| 0,25 | 0,26 |
| 0,3 | 0,31 |
| 0,4 | 0,41 |
| 0,5 | 0,51 |
| 0,6 | 0,61 |

Comparsion AWG-measurements to metrical cross-sections (mm²)

| AWG | mm² | AWG | mm² | AWG | mm² | AWG | mm² |
|---|---|---|---|---|---|---|---|
| 30 | 0,05 | 18 | 0,75 | 6 | 16 | 300 MCM | 150 |
| 28 | 0,08 | 17 | 1,00 | 4 | 25 | 350 MCM | 185 |
| 26 | 0,14 | 16 | 1,50 | 2 | 35 | 500 MCM | 240 |
| 24 | 0,25 | 14 | 2,50 | 1 | 50 | 600 MCM | 300 |
| 22 | 0,34 | 12 | 4 | 2/0 | 70 | 750 MCM | 400 |
| 21 | 0,38 | 10 | 6 | 3/0 | 95 | 1000 MCM | 500 |
| 20 | 0,50 | 8 | 10 | 4/0 | 120 | | |

This cross reference list shows equivalent nominal values. Actual cross sections may vary. The AWG values are approximate, if the cables are made to European Standards (mm²) and vice versa. In critical applications, where the current reaches upper limits. The deviating operation conditions for installation and laying according to standards are to be taken into consideration.

# US-AMERICAN AND BRITISH UNITS

## Conversion of usual measuring units

In the USA the measurements are mainly used in AWG-numbers (AWG = American Wire Gauge). The AWG-numbers conform the british B&S-numbers (BS = Brown & Sharp) überein.

| AWG No. | Crosssection mm² | Diameter mm² | Conductor resistance Ohm/km |
|---|---|---|---|
| 1000 MCM* | 507 | 25,4 | 0,035 |
| 750 | 380 | 22,0 | 0,047 |
| 600 | 304 | 19,7 | 0,059 |
| 500 | 254 | 20,7 | 0,07 |
| 400 | 203 | 18,9 | 0,09 |
| 350 | 178 | 17,3 | 0,10 |
| 300 | 152 | 16,0 | 0,12 |
| 250 | 127 | 14,6 | 0,14 |
| 4/0 | 107,20 | 11,68 | 0,18 |
| 3/0 | 85,00 | 10,40 | 0,23 |
| 2/0 | 67,50 | 9,27 | 0,29 |
| 0 | 53,40 | 8,25 | 0,37 |
| 1 | 42,40 | 7,35 | 0,47 |
| 2 | 33,60 | 6,54 | 0,57 |
| 3 | 26,70 | 5,83 | 0,71 |
| 4 | 21,20 | 5,19 | 0,91 |
| 5 | 16,80 | 4,62 | 1,12 |
| 6 | 13,30 | 4,11 | 1,44 |
| 7 | 10,60 | 3,67 | 1,78 |
| 8 | 8,366 | 3,26 | 2,36 |
| 9 | 6,63 | 2,91 | 2,77 |
| 10 | 5,26 | 2,59 | 3,64 |
| 11 | 4,15 | 2,30 | 4,44 |
| 12 | 3,30 | 2,05 | 5,41 |
| 13 | 2,62 | 1,83 | 7,02 |
| 4/0 wird auch geschrieben: 0000; 1 mil = 0,001 inch = 0,0254 mm<br>* bei größerem Querschnitt Maßangaben in MCM (circular mils) | | | |

| AWG No. | Crosssection mm² | Diameter mm² | Conductor resistance Ohm/km |
|---|---|---|---|
| 14 | 2,08 | 1,63 | 8,79 |
| 15 | 1,65 | 1,45 | 11,20 |
| 16 | 1,31 | 1,29 | 14,70 |
| 17 | 1,04 | 1,15 | 17,80 |
| 18 | 0,8230 | 1,0240 | 23,0 |
| 19 | 0,6530 | 0,9120 | 28,3 |
| 20 | 0,5190 | 0,8120 | 34,5 |
| 21 | 0,4120 | 0,7230 | 44,0 |
| 22 | 0,3250 | 0,6440 | 54,8 |
| 23 | 0,2590 | 0,5730 | 70,1 |
| 24 | 0,2050 | 0,5110 | 89,2 |
| 25 | 0,1630 | 0,4550 | 111,0 |
| 26 | 0,1280 | 0,4050 | 146,0 |
| 27 | 0,1020 | 0,3610 | 176,0 |
| 28 | 0,0804 | 0,3210 | 232,0 |
| 29 | 0,0646 | 0,2860 | 282,0 |
| 30 | 0,0503 | 0,2550 | 350,0 |
| 31 | 0,0400 | 0,2270 | 446,0 |
| 32 | 0,0320 | 0,2020 | 578,0 |
| 33 | 0,0252 | 0,1800 | 710,0 |
| 34 | 0,0200 | 0,1600 | 899,0 |
| 35 | 0,0161 | 0,1430 | 1125,0 |
| 36 | 0,0123 | 0,1270 | 1426,0 |
| 37 | 0,0100 | 0,1130 | 1800,0 |
| 38 | 0,00795 | 0,1010 | 2255,0 |
| 39 | 0,00632 | 0,0897 | 2860,0 |
| 1 CM = 1 Circ. mi. = 0,0005067 mm²<br>1 MCM = 1000 Circ. mils = 0,5067 mm² | | | |

## General measuring units

| **Length** | |
|---|---|
| 1 mil | = 0,0254 mm |
| 1 in (Inch) | =25,4 mm |
| 1 ft (foot) | = 0,3048 m |
| 1 yd (yard) | = 0,9144 m |
| 1 ch (chain) | = 20,1 m |
| 1 mile (land mile) | = 1,609 km/ 1760 yards |
| 1 mile (nautic mile) | = 1,852 km |
| 1 mm | = 0,039370 inches |
| 1 m | = 39,370079 inches |
| **Area** | |
| 1 CM (circ. mil) | = 0,507 • $10^{-3}$ mm² |
| 1 MCM | = 0,5067 mm² |
| 1 sq. inch | =645,16 mm² |
| 1 sq. foot | = 0,0929 m² |
| 1 square yard | = 0,836 m² |
| 1 acre | = 4047 m² |
| 1 square mile | = 2,59 km² |
| **Density** | |
| 1 cu. in. (cubic inch) | = 16,39 cm³ |
| 1 cu. ft. (cubic foot) | = 0,0283 m³ |
| 1 cu. yd. (cubic yard) | = 0,7646 m³ |
| 1 gal. (US gallon) | = 3,785 l |
| 1 gal. brit gallon | = 4,546 l |
| 1 US pint | = 0,473 l |
| 1 US quart | = 0,946 l |
| 1 US barrel | = 158,8 l |
| **Temperature** | |
| F (Fahrenheit) | = (1,8 • C) +3° |
| C (Celsius) | = 0,5556 • (F-32°) |

| **Weight** | |
|---|---|
| 1 grain | = 64,8 mg |
| 1 dram | = 1,77 g |
| 1 oz (ounce) | = 28,35 g |
| 1 lb (pound) | = 0,4536 Kp |
| 1 stone | = 6,35 Kp |
| 1 qu (quarter) | = 12,7 Kp |
| 1 US-cwt (hundred-weight) | = 45,36 Kp |
| 1 US ton (short ton) | = 0,907 t |
| 1 brit. ton (long ton) | = 1,016 t |
| **Force** | |
| 1 lb | = 4,448 N |
| 1 brit. ton | = 9954 N |
| 1pdl (Poundal) | = 0,1383 N |
| 1 kp | = 9,81 N |
| 1 N | = 1,02 kp |
| **Velocity** | |
| 1 mile/h | =1,609 km/h |
| 1 Knoten | = 1,852 km/h |
| 1 ft/s | = 0,305 m/s |
| 1 ft/min | = 5,08 • $10^{-3}$ m/s |
| **Energy** | |
| 1 lb/mile | = 0,282 kg/m |
| 1 lb/yard | = 0,496 kg/m |
| 1 lb/foot | = 1,488 kg/m |
| **Radiation absorbed dose** | |
| 1 Gray | = 1J/kg |
| 1 rad | = $10^{-2}$J/kg = 1 Centi Gy |
| 1 Centi | = 100 Joule |
| 1 rad | = cJ/kg = 0,01 Gy |
| 1 Mrad | = 1 • $10^{6}$ cJ/kg |

| **Pressure** | |
|---|---|
| 1 psi (lb/sq.) | = 68,95 mbar<br>= 6,895 • $10^{-3}$Nmm² |
| 1 lb/sq. ft | = 0,478 mbar |
| 1 pdl/sq. ft. | = 1,489 N/m² |
| 1 in Hg | = 33,86 mbar |
| 1 ft $H_20$ | = 29,89 mbar |
| 1 in $H_20$ | = 2,491 mbar |
| 1 N/mm² | = 145 psi / 10 bar |
| 1 kp/mm² | = 1422 psi |
| 1 at | = 736 Torr / 1 kp/cm² |
| 1 Torr | = 1 mm Hg |
| 1 bar | = 0,1 H Pa |
| 1 Pa | = 1 N/m² |
| **Density** | |
| 1 lb/cu. ft | = 16,02 kg/m³ |
| 1 lb/cu. in. | 27,68 t/m³ |
| **Horse power** | |
| 1 hp • h | = 1,0139 PS • h |
| | = 2,684 • $10^{6}$ Joule |
| | = 746 W • h |
| 1 BTU (brit. therm. unit) | = 1055 Joule |
| **Electrical units** | |
| 1 ohm/1000 yd | = 1,0936 Ω/km |
| 1 ohm/1000ft | = 3,28 Ω/km |
| 1µF/mile | = 0,62 µF/km |
| 1 megohm/mile | = 1,61 MΩ/km |
| 1 µµf/foot | = 3,28 pF/m |
| 1 decible/mile | = 71,5 mN/m |
| **Power rate** | |
| 1 PS | =0,736 kW |
| 1 kW | = 1,36 PS |
| 1 hp | = 0,7457 kW |
| 1 kW | = 1,31 hp |



DNB Edition 11 (published 01.10.2015)

# COPPER AND ALU-PRICE CALCULATION

Calculation examples:

Assumption:
- DEL-Quotation 194,29 EUR/100 kg for copper
- Daily rate 173,84 EUR/100 kg for aluminium
- Individual discount, e. g. 20%

**1. Profibus 1 x 2 x 0,64 mm, PVC, Part no. 81448**

Quantity ordered 1000 m

| | |
|---|---|
| Price brutto (Copper base)= 150 EUR | 1400,00 EUR/km |
| minus 20% (discount) | 280,00 EUR/km |
| | 1120,00 EUR/km |

+ Copper surcharge:

$$\frac{(194{,}29 + 1{,}9429) - 150}{100} \text{ x Copper value}$$

| | |
|---|---|
| equal, 0,4623 EUR/kg x 22 kg/km = | 10,17 EUR/km |
| | 1130,17 EUR/km |

**2. NYCWY 3 x 70/35 sm, 0,6/1 kV, Part No. 32268**

Quantity ordered 1000 m

| | |
|---|---|
| Copper base = 0 | 14780,00 EUR/km |
| minus 20% (discount) | 2956,00 EUR/km |
| | 11824,00 EUR/km |

+ Copper surcharge (Conductor + screen):

$$\frac{(194{,}29 + 1{,}9429) - 0}{100} \text{ x Copper value}$$

| | |
|---|---|
| equal, 1,962 EUR/kg x 2410 kg/km = | 4728,42 EUR/km |
| | 16552,42 EUR/km |

**3. NA2XSY 1 x 70 sm/16, 12/20 kV, Part No. 32454**

Quantity ordered 1000 m

− Aluminium conductor
− Copper screen

| | |
|---|---|
| Copper base = 0 | 9500,00 EUR/km |
| minus 20% (discount) | 1900,00 EUR/km |
| | 7600,00 EUR/km |

+ Copper surcharge (screen):

$$\frac{(194{,}29 + 1{,}9429) - 0}{100} \text{ x Copper value}$$

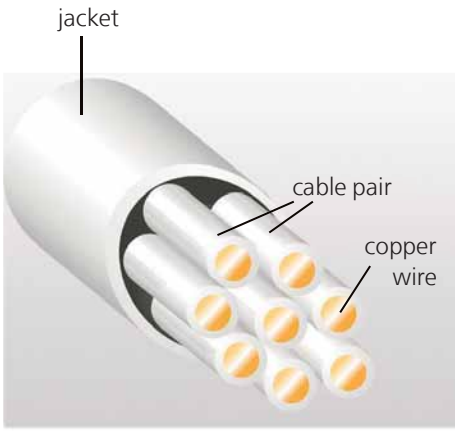
| | |
|---|---|
| equal, 1,962 EUR/kg x 182 kg/km = | 357,08 EUR/km |

+ Aluminium (Conductor):
Aluminium value x daily rate

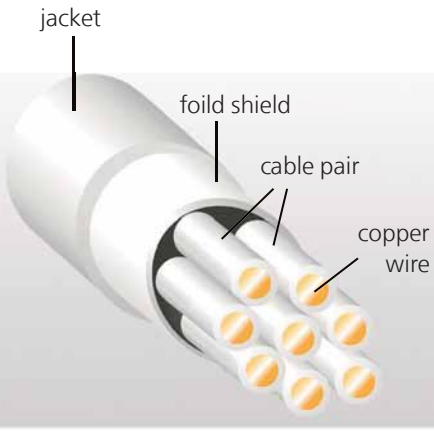
| | |
|---|---|
| 203 kg/km x 1,74 EUR/kg | 353,22 EUR/km |
| | 8310,30 EUR/km |

# LAN-CABLE DESIGNATION

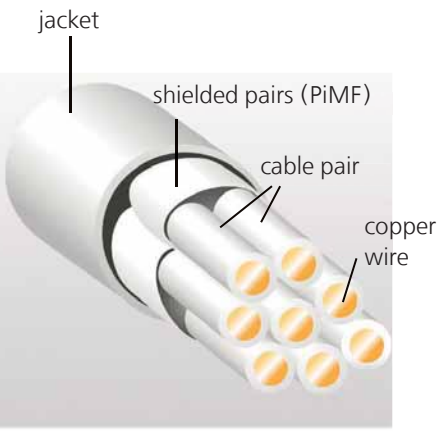
**U/UTP (UTP*)**



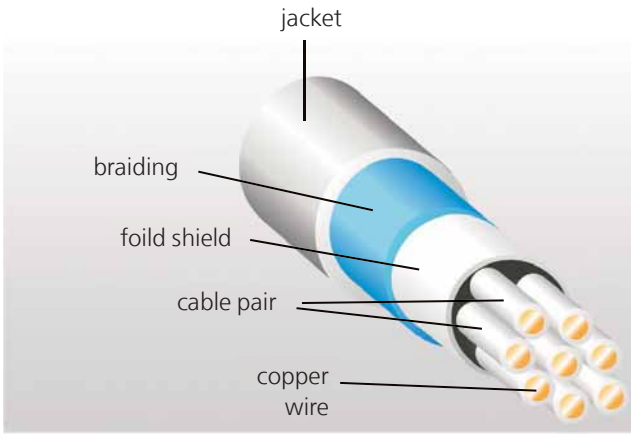

**F/UTP (FTP*)**



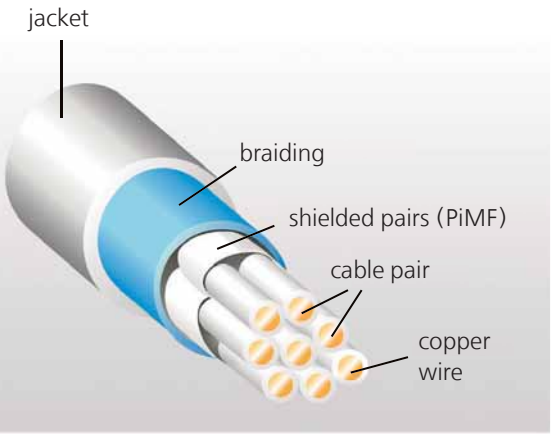

**U/FTP (STP*)**



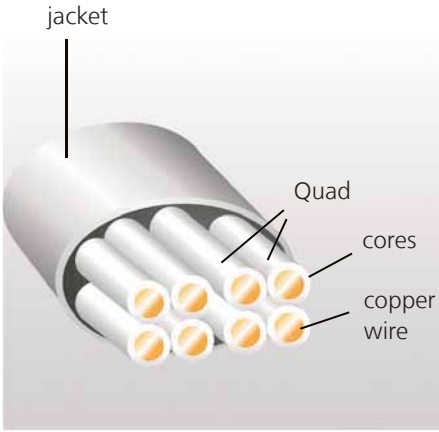

**SF/UTP (S-FTP*)**



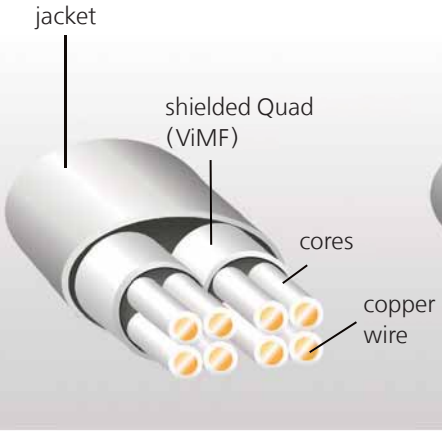

**S/FTP (S-STP*)**



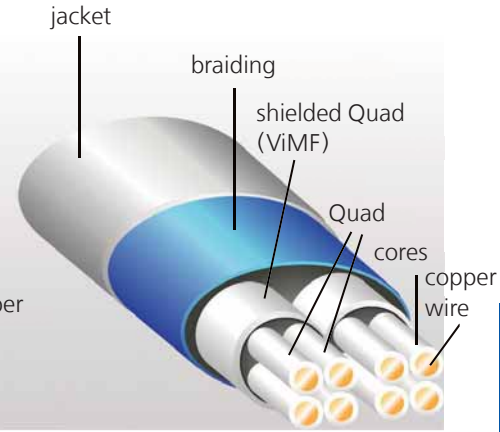

**U/UTP (UTQ*)**




**U/FTP (S-STQ*)**




**S/FTP (S-STQ*)**




***Old term**



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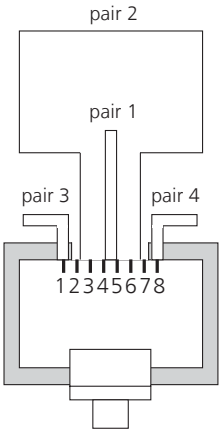
# RJ45 CONNECTOR PIN ASSIGNMENT FOR ETHERNET APPLIKATIONS

## Ethernet RJ45

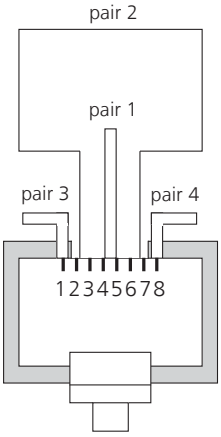
The 8-pole RJ45 is available with the connection diagram according to EIA/TIA T568A and EIA/TIA T568B has the 8-pole RJ45 plug connector. The twisted pair cable must be connected to 8-pole RJ45 sockets and comply with one of the two standards. The standard mainly used is EIA/TIA T568B while EIA/TIA T568A (AT&T) is less common.

## MDI (EIA/TIA T568A)



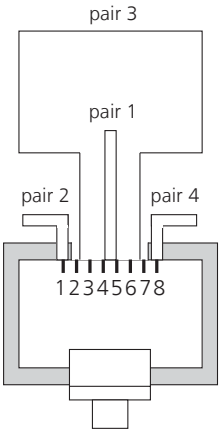

| Pin | Colour code Wire | Asignment 10BASE-T, 100BASE-TX | Asignment 1000BASE-TX |
|---|---|---|---|
| 1 | WHT/GRN | Tx+ | BI_DA+ |
| 2 | GRN | Tx- | BI_DA- |
| 3 | WHT/ORG | Rx+ | BI_DB+ |
| 4 | BLU | | BI_DC+ |
| 5 | WHT/BLU | | BI_DC- |
| 6 | ORG | Rx- | BU_DB+ |
| 7 | WHT/BRN | | BI_DD+ |
| 8 | BRN | | BI_DD- |

## MDI-X




| Pin | Colour code Wire | Asignment 10BASE-T, 100BASE-TX | Asignment 1000BASE-TX |
|---|---|---|---|
| 1 | WHT/ORG | Rx+ | BI_DB+ |
| 2 | ORG | Rx- | BI_DB- |
| 3 | WHT/GRN | Tx+ | BI_DA+ |
| 4 | BLU | | BI_DD+ |
| 5 | WHT/BLU | | BI_DD- |
| 6 | GRN | Tx- | BU_DA- |
| 7 | WHT/BRN | | BI_DC+ |
| 8 | BRN | | BI_DC- |

## MDI (EIA/TIA T568B)



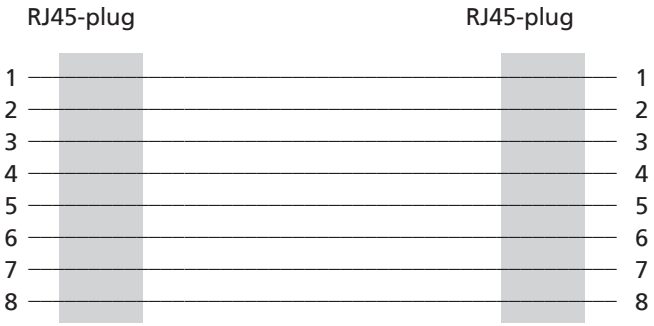

| Pin | Colour code Wire | Asignment 10BASE-T, 100BASE-TX | Asignment 1000BASE-TX |
|---|---|---|---|
| 1 | WHT/ORG | Tx+ | BI_DA+ |
| 2 | ORG | Tx- | BI_DA- |
| 3 | WHT/GRN | Rx+ | BI_DB+ |
| 4 | BLU | | BI_DC+ |
| 5 | WHT/BLU | | BI_DC- |
| 6 | GRN | Rx- | BU_DB- |
| 7 | WHT/BRN | | BI_DD+ |
| 8 | BRN | | BI_DD- |

**Note:** Other technologies such as Token Ring, FDDI etc. use different pin assignments

# RJ45 WIRING OPTIONS

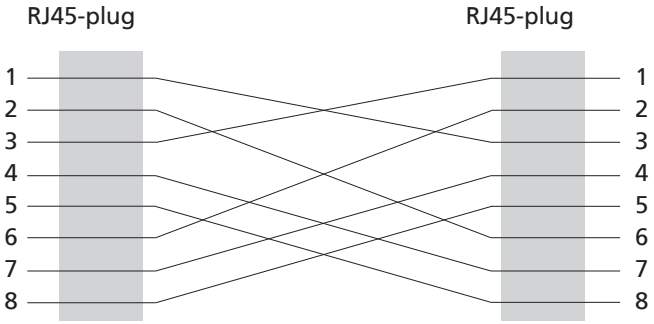
Two different patch cables are used in Ethernet networks - the straight-through and the crossover cable.

### Straight-through patch cable




A straight-through cable is used if an Ethernet switch should be connected to the network connection of a computer.

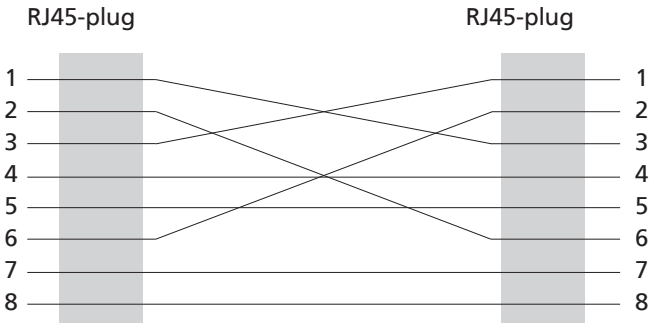
### Crossover cable




A crossover cable is used if two Ethernet switches or two computers should be connected with each other via their network connections.

**Note:** Suitable for all Ethernet technologies

### Semi crossover




A crossover cable is used if two Ethernet switches or two computers should be connected with each other via their network connections.

**Note:** Not suitable for Gigabit Ethernet because this technology uses all pins.



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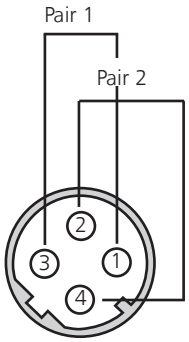
# M12 CONNECTOR PIN ASSIGNMENT

## Ethernet M12 connection diagram 4-poled

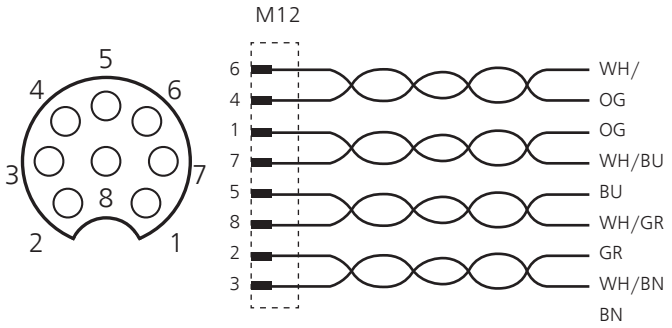
(IEC 61076-2-101)



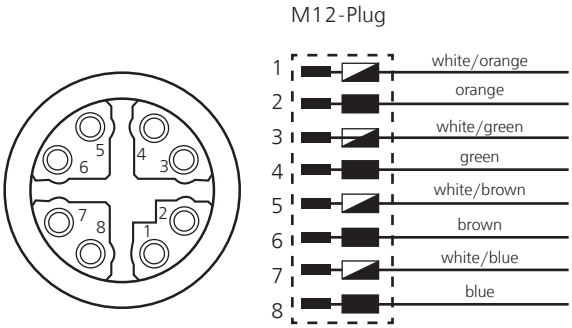

| Pin | Colour Code | Assignment 10BASE-T 100BASE-TX |
|---|---|---|
| **1** | BLU/YEL | Tx+ |
| **2** | YEL/WHT | Rx+ |
| **3** | WHT/ORG | Tx- |
| **4** | ORG/BLU | Rx- |

D-Coding for Industrial Ethernet

## Ethernet M12 connection diagram 8-poled



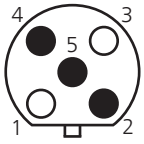

A-Coded Kat.5



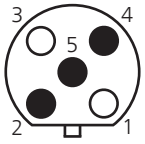

X-Coding Kat.5 / 6 bzw. $6_A$

## Profibus M12 connection diagram

5-poled Plug




5-poled Adapter




| | |
|---|---|
| PIN 2: | A-Line (grün) |
| PIN 4: | A-Line (rot) |
| PIN 5: | Shield |
| Thread connection: | Shield |

B-Coding for Profibus

## DeviceNet™ M12 connection diagram

5-poled Plug

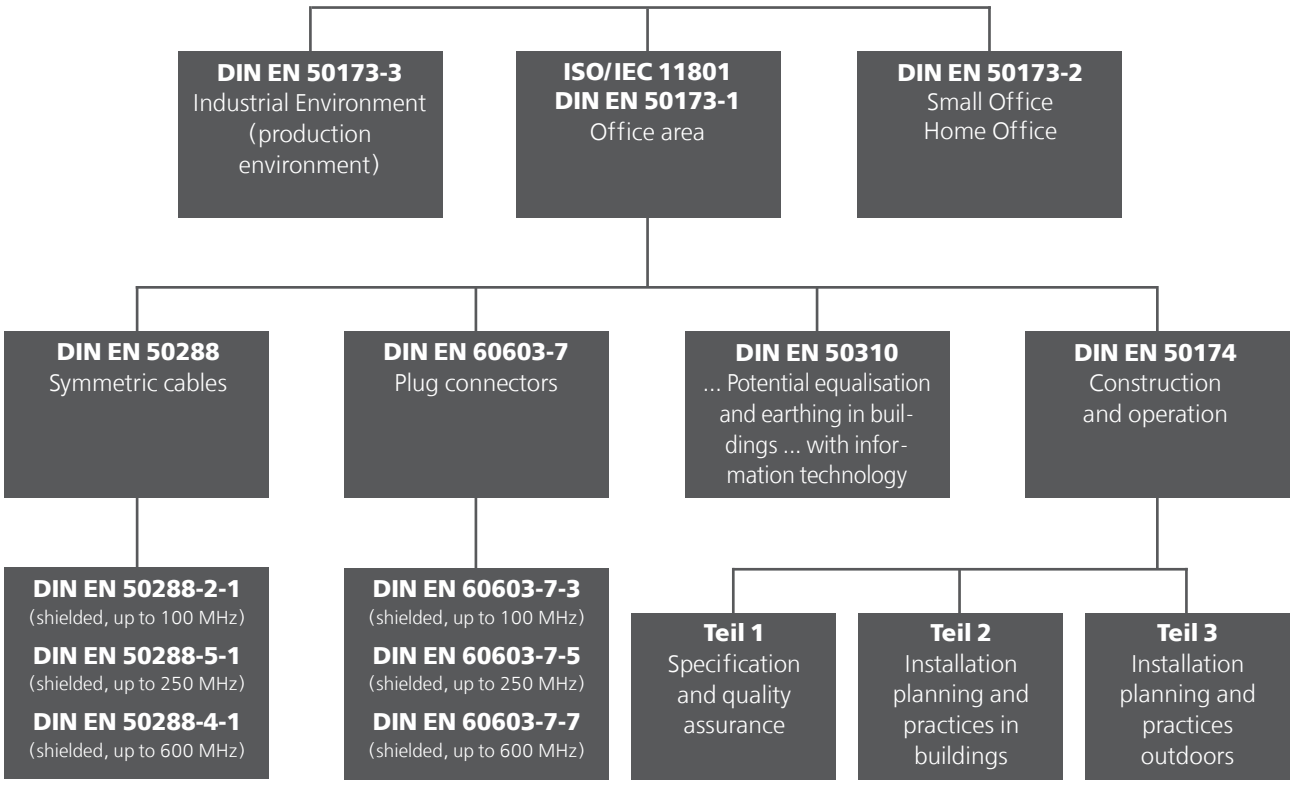

5-poled Adapter


| | |
|---|---|
| PIN 1: | Shield |
| PIN 2: | V+ |
| PIN 3: | V- |
| PIN 4: | CAN_H |
| PIN 5: | CAN_L |
| Threaded connection: | shield |

A-Coding for DeviceNet™

# STANDARDS OVERVIEW

## Standards overview: application-neutral cabling systems




The EN 50173 and ISO/IEC 11801 standards today are largely identical and contain the same requirements for cables and components.
Both standards are currently being revised and a complete harmonisation is being striven for.

The requirements for components (categories) are also specified in the following standards:
- Cables EN 50288
- Mating faces EN 60603-7 and IEC 61076-3-104
- Measuring equipment EN 651935

The EN standards also include the European EMC regulations:
- Radiation Class A/B EN 55022
- Interference resistance EM 50082-1

Building cabling in EN 50173 just like in ISO/IEC 11801 is divided into three areas:
- Primary or campus area for connecting the buildings of one site with each other
- Secondary or vertical area for connecting the separate floors of a building
- Tertiary or horizontal area for connecting the connection units (e.g. wall sockets) with the floor distributor

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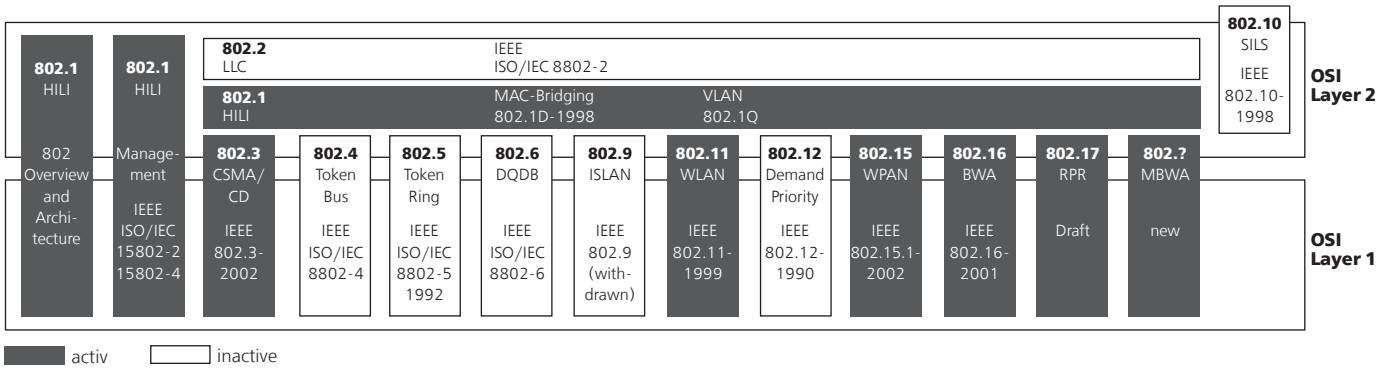
The IEEE Standards Association (IEEE-SA) is an organisation where all activities and programmes concerning IEEE standards are carried out under one roof.
The IEEE 802 LAN/MAN Standards Committee develops standards for local area networks and metropolitan area networks.



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# IP-CODE (PROTECTION CLASSES)

**Definition of protection classifications according to EN 60529**

The IEC 60529 standard „Protection classifications using enclosure (IP Code)" provides a system for classifying the protection ratings of electrical operating materials by enclosure. This standard defines terms for the protection classifications by enclosure concerning:

- Protection of persons against access to dangerous parts inside the enclosure
- Protection of operating material inside the enclosure against ingress by solid foreign substances
- Protection of operating material inside the enclosure against damage by the ingress of water

| Protection level against solid foreign bodies | | | Protection level against water | | |
|---|---|---|---|---|---|
| First number | Short description | Definition | Second number | Short description | Definition |
| 0 | Not protected | The object sensor, a 50 mm ball, must not fully penetrate. | 0 | Not protected | Vertically falling droplets must not have a damaging effect. |
| 1 | Protected against solid foreign bodies of 50 mm diameter and larger | The object sensor, a 12.5 mm ball, must not fully penetrate. | 1 | Protected against dripping water | Vertically falling droplets must not have a damaging effect if the enclosure is tilted by an angle of up to 15° on both sides of the perpendiculars. |
| 2 | Protected against solid foreign bodies of 12.5 mm diameter and larger | The object sensor, a 2.5 mm diameter ball, must not penetrate at all. | 2 | Protection against dripping water if the enclosure is tilted by up to 15°. | Water sprayed at both sides of the perpendiculars at an angle of up to 60° must not have a damaging effect. |
| 3 | Protected against solid foreign bodies of 2.5 mm diameter and larger | The object sensor, a 2.5 mm diameter ball, must not penetrate at all. | 3 | Protected against spray water | Water sprayed against the enclosure from one direction must not have a damaging effect. |
| 4 | Protected against solid foreign bodies of 1.0 mm diameter and larger | The object sensor, a 1.0 mm diameter ball, must not penetrate at all. | 4 | Protected against spray water | Water sprayed against the enclosure in a jet from every direction must not have a damaging effect. Protected against spray water at increased pressure |
| | | | 4K | Protected against water with high preassure | Water sprayed against the enclosure from any direc-tion at increased pressure must not have any dama-ging effects. (Only applies to road vehicles according to DIN 40 050 Part 9) |
| | | | 5 | Protected against | Water sprayed against the enclosure in a strong jet from every direction must not have a damaging effect. |
| | | | 6 | Protected against strong hose water | Water sprayed against the enclosure in a strong jet from every direction must not have a damaging effect. |
| | | | 6K | Protected against hose wa-ter at increased pressure | Water sprayed against the enclosure in a jet at increased pressure from every direction must not have any damaging effects. (Only applies to road vehicles according to DIN 40050 Part 9) |
| | | | 7 | Protected against the effect when temporarily submerged in water | Water may not enter in harmful quantities when the enclosure is held submerged. |
| | | | 8 | Protected against the effect when permanently submerged in water | The volume of penetrating water must not have a damaging effect when the enclosure is temporarily submerged in water at a certain pressure. |
| **Example: Letters IP 65** First index: Protection against contact and ingress by foreign bodies; Second index: Protection against liquid | | | 9K | Protected against the effect when permanently submerged in water | The volume of penetrating water must not have a damaging effect when the enclosure is permanently submerged in water. |

# FIRE PERFORMANCE AND FIRE PROPAGATION IN ACCORDANCE WITH NACH EN 60332-X

European standards EN 50167, EN 50168, and EN 50169, require not only data lines with shielding, they also require data lines with halogen-free sheathing. Consideration and compliance with these standards is particularly recommended for public facilities such as hospitals, schools, and airports. We also recommend the use of halogen-free cable for buildings with high concentration of personnel or material assets.

Cable with PVC sheath

If there is a fire, standard PVC materials can propagate fires and form hydrochloric acid through the liberation of hydrogen chloride gas (HCl) in combination with moisture (e.g. water for fire fighting). In addition, burning PVC (polyvinyl chloride) produces high smoke density and the corrosive damage to buildings and equipment can often assume devastating proportions that far exceed the actual fire damage. HELUKAT® data lines are manufactured in accordance with IEC 60332-1-2 relative to fire propagation behaviour.

Cable with halogen-free sheath

Here materials are used that do not contain halogens (such as chloride) and that do not release corrosive gases in the event of fire. The portion of toxic gases is also reduced to a minimum, and smoke density and fire propagation are hardly present or possible. Markings on the cable include the abbreviations FRNC or LSOH. These markings specifically refer to the following:

| | |
|---|---|
| FR | flame retardant (inhibits fire propagation) |
| NC | non-corrosive (no corrosive components) |
| LS | low smoke (low smoke density) |
| OH | zero halogen (halogen-free) |

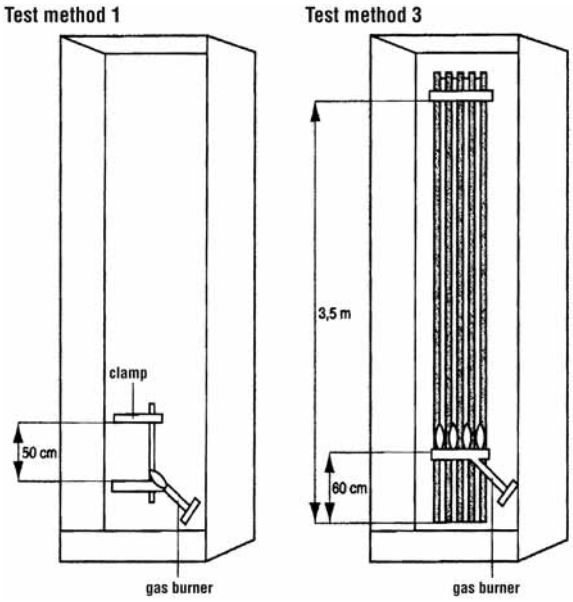
For safety, when using such materials, it is essential that the view of passageways and emergency exits remains unobstructed. For this, however, it is necessary to also consider the use of such materials for other products such as power cables or cable guide channels. In terms of fire propagation behaviour, HELUKAT® data lines are manufactured in accordance with IEC 60332-1-2 or in accordance with the more rigorous IEC 60332-3-24.

Caloric load [kWh/m] [MJ/m]

There is a wide variety of different combustible fixtures or products in every building. These include (even if concealed in suspended ceilings or channels) cables and lines that can represent a significant part of the facility, particularly in commercial premises. These cables have different energies (heating values) and they can significantly increase the total caloric value of a building. Consequently, in the planning stage ensure that caloric value quantities are kept as low as possible.

Test methods for fire propagation

The verification or definition of how effectively or how well cable must counter fire propagation and thus the spread of the fire is specified in the standards IEC 60332-1-2,
IEC 60332-2 and IEC 60332-3-24. For test method 1, a 50 cm long cable is exposed to flame from a gas burner for 1 minute, and must then extinguish any flame on its own, and it may be burned up to a maximum of 5 cm under the upper clamp. For test method 3, an entire bundle of cable, 3.5 m long is mounted vertically on a ladder in a cabinet and exposed to flame for 20 minutes. After turning off the gas burner, the flame must extinguish on its own within 1 hour and the distance between burner and the fire damage on the cables furthest removed from the burner must not exceed 2.5 m.




**This test is a very realistic representation of a possible fire in a cabling chute.**



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# CAPACITY OF KTG-POOL DRUMS

## Wooden drums (standard)

| Drumcode-numbers | Drumsize | Flange Ø Fd | Drum-Barrel Ø Kd | Bore Ø Bd | Widthover all I1 | Width for windings I2 | Load bearing capacity max. | Drumweight |
|---|---|---|---|---|---|---|---|---|
| | | mm | mm | mm | mm | mm | kg | kg |
| 051 | 05 | 500 | 150 | 56 | 470 | 410 | 100 | 8 |
| 061 | 06 | 630 | 315 | 56 | 415 | 315 | 250 | 17 |
| 071 | 07 | 710 | 355 | 80 | 520 | 400 | 250 | 25 |
| 081 | 08 | 800 | 400 | 80 | 520 | 400 | 400 | 31 |
| 091 | 09 | 900 | 450 | 80 | 690 | 560 | 750 | 47 |
| 101 | 10 | 1000 | 500 | 80 | 710 | 560 | 900 | 71 |
| 121 | 12 | 1250 | 630 | 80 | 890 | 670 | 1700 | 144 |
| 141 | 14 | 1400 | 710 | 80 | 890 | 670 | 2000 | 175 |
| 161 | 16/8 | 1600 | 800 | 80 | 1100 | 850 | 3000 | 280 |
| 181 | 18/10 | 1800 | 1000 | 100 | 1100 | 840 | 4000 | 380 |
| 201 | 20/12 | 2000 | 1250 | 100 | 1350 | 1045 | 5000 | 550 |
| 221 | 22/12 | 2240 | 1400 | 125 | 1450 | 1140 | 6000 | 710 |
| 250 | 25/14 | 2500 | 1400 | 125 | 1450 | 1140 | 7500 | 875 |
| 251 | 25/16 | 2500 | 1600 | 125 | 1450 | 1130 | 7500 | 900 |
| 281 | 28/18 | 2800 | 1800 | 140 | 1635 | 1280 | 10000 | 1175 |

## Plastic drums

| Drumcode-numbers | Flange Ø Fd | Bore Ø Bd | Widthover all I1 | Width for windings I2 | Load bearing capacity max. | Drumweight |
|---|---|---|---|---|---|---|
| | mm | mm | mm | mm | kg | kg |
| 050 | 500 | 150 | 456 | 404 | 100 | 4 |
| 070 | 710 | 355 | 510 | 400 | 250 | 15 |
| 080 | 800 | 400 | 510 | 400 | 350 | 16 |
| 090 | 900 | 450 | 680 | 560 | 400 | 23 |
| 100 | 1000 | 500 | 704 | 560 | 500 | 32 |

## One-way wooden drums

| Drumcode-numbers | Flange Ø Fd | Bore Ø Bd | Widthover all I1 | Width for windings I2 | Load bearing capacity max. | Drumweight |
|---|---|---|---|---|---|---|
| | mm | mm | mm | mm | mm | kg |
| HE 350 | 350 | 150 | 320 | 300 | 56 | 1,8 |
| HE 400 | 400 | 150 | 320 | 300 | 56 | 2,1 |
| HE 401 | 400 | 150 | 425 | 405 | 56 | 2,3 |
| HE 501 | 500 | 150 | 320 | 300 | 56 | 3,0 |
| HE 500 | 500 | 150 | 425 | 405 | 56 | 3,3 |
| HE 600 | 600 | 150 | 425 | 405 | 56 | 4,5 |
| HE 760 | 760 | 300 | 425 | 400 | 80 | 8,0 |

# UL-LISTED OR UL-RECOGNIZED FOR DATA CABLES?

North America is an important market for German machinery and plant manufacturers. Customers often demand "UL approval" without, however, being acquainted with the possibilities, advantages and disadvantages of the range of approval types.
As a rule, a UL Mark tends to open up doors in this market. However, there is no approval type that applies across the board for all applications. Sometimes an approved cable will nevertheless fail to be accepted by the customer at the site. The rude awakening often comes too late, after the product has already been installed in the plant and the local inspector refuses the acceptance. In such a case, the installed cable must be removed, either completely or in part.
For example: A drag chain cable 800655 with PUR jacket has UL-Recognized AWM Style or UL-Listed CMX approval. PUR is an excellent material for cables that are in continuous motion, but is not highly flame resistant. If this cable is used not just in the chain or on the plant, but is also used in the cable trays as a connection between the machines, it is very likely that the inspector will refuse the acceptance. This is because in the USA there are different flammability requirements for stationary cable installations. For this application, the version 800653 with PVC jacket and UL-Listed CMG should be used to prevent problems with the acceptance.

**UL Recognized**

UL's Recognized Components are AWM Styles that can be listed on what is known as a "Yellow Card". This approval type is similar to the VDE registration number: A product for the wiring of machinery/equipment is submitted to the UL with set application specifications for the voltage level, flame resistance, temperature range, etc. UL tests whether the product complies with the specified requirements and then issues either an existing AWM Style or, if the parameters do not match an existing Style, issues a new UL AWM Style. AWM (Appliance Wiring Material) components are used in UL-Listed or UL-Classified end products. The final acceptance depends on the installation and use of the complete plant.

**UL–Listed**

UL-Listed, on the other hand, is an actual standard, and applies for cabling in buildings, in cabled factory equipment, as well as for field cable installations for machinery and plants. Data cables are described in the standard UL444. Depending on the application and flame resistance, the applicable standard is listed in the individual chapters, according to the respective criteria for data cables (CM, CMG, CMX...). The great advantage is that the standard is universally recognized and has a higher status / level of acceptance in the field. The inspector normally will know most of the commonly found standards without having to look them up, allowing the inspector to make a quicker decision. This approval simplifies and accelerates the acceptance in plants in these markets, and for machinery and plant manufacturers, it also significantly cuts the time and costs involved in the inspection and acceptance.

| Listing Type | Typical application | Flammability test | relevant for industrial automation |
|---|---|---|---|
| **CMP** (Plenum) | highest safety requirement in respect to flame resistance (Steiner tunnel) Installation without additional protection | FT6 | no |
| **CMR** (Riser) | Cabling in multi-storey buildings as riser, minimum 2 stories (vertical duct) | UL 1666 | no |
| **CM, CMG** (General Purpose) | Cabling for buildings, with general use (no risers / plenum) optional PLTC approval (vertical duct) | CSA FT4 | yes, Cabling in factor halls, cable trays, and in the field and machinery |
| **CMX** (Dwellings) | Limited use within buildings | UL 2556 VW-1 CSA FT 1 | yes Field and machinery cabling |



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# NORM-GLOSSARY

| | |
|---|---|
| **IEEE 802** | Overview and Architecture |
| **IEEE 802** | LMSC; LAN MAN Standard Committee |
| **IEEE 802.1** | Higher Layer Interface Standards |
| **IEEE 802.1B-1995** | LAN/MAN Management (ISO/IEC 15802-2:1995)I |
| **IEEE 802.1D-1998** | Media access control (MAC) bridges (includes IEEE 802.1p Priority and Dynamic Multicast Filtering, GARP, GMRP) |
| **IEEE 802.1 E-1994** | System load protocol (ISO/IEC 15802-4 : 1994) |
| **IEEE 802.1F-1993** | Common Definitions and Procedures for IEEE 802 Management Information |
| **IEEE 802.1G-1998** | Remote Media Access Control (MAC) bridging (ISO/IEC 15802-5 : 1998) |
| **IEEE 802.1H-1997** | Media Access Control (MAC) Bridging of Ethernet V2.0 in Local Area Networks (ISO/IEC TR 11802-5 : 1997) |
| **IEEE 802.1Q-1998** | IEEE Standard for Virtual Bridged Local Area Networks (VLAN Tagging, GVRP) |
| **IEEE 802.1W-2001** | IEEE Standard for Rapid Reconfiguration |
| **IEEE 802.1X-2001** | IEEE Standard for Port-Base Network Access Control |
| **IEEE 802.2** | LLC; Logical Link Control |
| **IEEE 802.3** | CSMA/CD; Carrier Sense Multiple Access with Collision Detection (Ethernet) |
| **IEEE 802.3a-1988 (Clause 10)** | 10 Mb/s MAU 10BASE2 |
| **IEEE 802.3b-1985 (Clause 11)** | 10 Mb/s Broadband MAU, 10BROAD36 |
| **IEEE 802.3c-1985 (9.1-9.8)** | 10 Mb/s Baseband Repeater |
| **IEEE 802.3d-1987 (9.9)** | 10 Mb/s Fibre MAU, FOIRL |
| **IEEE 802.3e-1987 (Clause 12)** | 1 Mb/s MAU and Hub 1BASE5 |
| **IEEE 802.3h-1990 (Clause 5)** | 10 Mb/s Layer Management, DTEs |
| **IEEE 802.3i-1990 (Clauses 13 and 14)** | 10 Mb/s UTP MAU, 10 BASE-TP |
| **IEEE 802.3j-1993 (Clauses 15-18)** | 10 Mb/s Fibre MAUs 10BASE-FP, FB and FL |
| **IEEE 802.3k-1993 (Clause 19)** | 10 Mb/s Layer Management, Repeaters |
| **IEEE 802.3l-1992 (14.10)** | 10 Mb/s PICS proforma 10BASE-T MAU |
| **IEEE 802.3m-1995** | Maintenance 2 |
| **IEEE 802.3n-1995** | Maintenance 3 |
| **IEEE 802.3p-1993 (Clause20)** | Management, 10 Mb/s Integrated MAUs |
| **IEEE 802.3q-1993 (Clause 5)** | 10 Mb/s Layer Management, GDMO Format |
| **IEEE 802.3r-1996 (8.8)** | Type 10BASE5 Medium Attachment Unit PICS proforma |
| **IEEE 802.3s-1995** | Maintenance 4 |
| **IEEE 802.3t-1995** | 120 Ohm informative annex to 10BASE-T |
| **IEEE 802.3u-1995 (Clauses 21-30)** | Type 100BASE-T MAC parameters, Physical Layer, MAUs and Repeater for 100 Mb/s |
| **IEEE 802.3v-1995** | 150 Ohm informative annex to 10BASE-T |
| **IEEE 802.3x-1997 and 802.3y-1997** | (Revisions to 802.3, Clauses 31 and 32), Full Duplex Operation and Type 100BASE-T2 |
| **IEEE 802.3z-1998 (Clauses 34-39,41-42)** | Type 1000BASE-X MAC Parameters, Physical Layer, Repeater and Management Parameters for 1000 Mb/s Operation |
| **IEEE 802.3aa-1998** | Maintenance 5 |
| **IEEE 802.9ac-1998** | Frame Extensions for Virtual Bridged Local Area Network (VLAN) Tagging on 802.3 Networks |
| **IEEE 802.3ab-1999 (Clause 40)** | Physical Layer Parameters and Specifications for 1000 Mb/s Operation Over 4 Pair of Category 5 Balanced Copper Cabling, Type 1000BASE-T |
| **IEEE 802.3ad-2000 (Clause 43)** | Aggregation of Multiple Link Segments |
| **An additional standard, 1802.3** | provides conformance test information for 10BASE-T |
| **IEEE 802.3ae-2002** | Media Access Control (MAC) Parameters, Physical Layer, and Management Parameters for 10 Gb/s Operation |
| **IEEE 802.af** | in work DTE Power via MDI |
| **IEEE 802.3ah** | in work Ethernet in the First Mile |
| **IEEE 802.4** | TBUS; Token bus |
| **IEEE 802.5** | TRING; Token Ring |
| **IEEE 802.6** | DQDB; Distributed Queue Dual Bus |
| **IEEE 802.7** | BBTAG; Broadband Technical Advisory Group |
| **IEEE 802.8** | FOTAG; Fibre Optic Technical Advisory Group |
| **IEEE 802.9** | ISLAN; Integrated Services LAN |
| **IEEE 802.10** | SILS; Standard for Interoperable LAN Security |
| **IEEE 802.11** | WLAN; Wireless LANs |
| **IEEE 802.12** | DPAP; Demand Priority Access Protocol |
| **IEEE 802.14** | CATV; LANs in Cable Television Networks |
| **IEEE 802.15** | WPAN; Wireless Personal Area Networks |
| **IEEE 802.16** | BWA; Broadband Wireless Access |
| **IEEE 802.17** | RPR; Resilient Packet Ring |
| **IEEE 802.18** | RRTAG; Radion Regulatory Technical Advisory Group |

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|---|---|
| **IEEE 802.19** | CTAG; Coexistence Technical Advisory Group |
| **IEEE 802.20** | MBWA; Mobile Broadband Wireless Access |

**Important standards for network components and network environments DIN EN**

| | |
|---|---|
| **DIN EN 50081-1** | Electromagnetic compatibility (EMC) Generic standards: emission standard; Part 1: residential, commercial and light industrial environments |
| **DIN EN 50082-1** | Electromagnetic compatibility (EMC) Generic standards: emission standard; Part 1: residential, commercial and light industrial environments |
| **DIN EN 50098-1** | Information technology cabling of building complexes - Part 1: ISDN basic connection |
| **DIN EN 50173-1** | Information technology - application-neutral communication cable systems, general requirements and office environments (cf ISO/IEC 11801) |
| **DIN EN 50173-2** | Information technology - application-neutral communication systems, residential (cf ISO/IEC 11801) (SOHO area) |
| **DIN EN 50173-3** | Information technology - application-neutral communication systems, industrial (cf ISO/IEC 11801) |
| **DIN EN 50174-1** | Information technology - installation of communication cabling - Part 1: Specification and quality assurance |
| **DIN EN 50174-2** | Information technology - installation of communication cabling - Part 2: Installation planning and practices in buildings |
| **DIN EN 50174-3** | Information technology - installation of communication cabling - Part 3: Installation planning and practices outdoors |
| **DIN EN 50288-4-1** | Multicore metallic data and control cables for analogue and digital transmission - Part 2-1: Generic specification for shielded cable up to 600 MHz; cables for the horizontal and vertical area |
| **DIN EN 50288-4-2** | Multicore metallic data and control cables for analogue and digital transmission - Part 2-2: Generic specification for shielded cable up to 600 MHz; device connection cables and switchboard cables |
| **DIN EN 50288-2-1** | Symmetric cable, shielded up to 100 MHz |
| **DIN EN 50288-5-1** | Symmetric cable, shielded up to 250 MHz |
| **DIN EN 50288-4-1** | Symmetric cable, shielded up to 600 MHz |
| **DIN EN 50310** | Application of measures for potential equalisation and earthing in buildings with information technology equipment |
| **DIN EN 55022** | Information technology equipment - radio interference properties . thresholds and measuring methods (IEC/CISPR 22:1997, modified + A1:2000) |
| **DIN EN 55024** | Information technology equipment - interference resistance characteristics - thresholds and test methods (IEC/CISPR 24:1997, modified) |
| **DIN EN 60068-1** | Environmental tests - Part 1: General and guideline (IEC 60068-1:1988 + Corrigendum 1988 + A1: 1992) |
| **DIN EN 60068-2-2** | Environmental tests - Part 2: Tests; Test group B: Dry heat (ICE 60068-2-2:1974 + IEC 68-2-2A:1976 +A1:1993) |
| **DIN EN 60068-2-6** | Environmental tests - Part 2: Tests; Test Fc: vibrations, sinusoidal (IEC 60068-2-6:1995 + Corrigendum 1995) |
| **DIN EN 60068-2-14** | Environmental tests - Part 2: Tests; Test N; temperature change (IEC 60068-2-14:1984 + A1:1986) |
| **DIN EN 60068-2-27** | Environmental tests - Part 2: Tests; Test Ea and guideline: Shocks (IEC 60068-2-27:1987) |
| **DIN EN 60068-2-30** | Environmental tests - Part 2: Tests Db and guideline: moist heat, cyclic (12+12 hours cycle) (IEC 60068-2-30:1980+A1:1985) |
| **DIN EN 60068-2-32** | Environmental tests - Part 2: Tests: Test Ed: free falling (IEC 60068-2-32:1975+A1:1982 +A2:1990) |
| **DIN EN 60603-7-3** | Connectors, shielded up to 100 MHz |
| **DIN EN 60603-7-5** | Connectors, shielded up to 250 MHz |
| **DIN EN 60603-7-7** | Connectors, shielded up to 600 MHz |
| **DIN EN 60794-3** | Fibre optic cables - Part 3: pipeline, underground and aerial cables: generic specification (IEC 60794-3:1998) |
| **DIN EN 60811-1-1** | Insulation and sheathing materials for cables and insulated conductors - General test method - Part 1-1: General application; measuring the wall thickness and the external dimensions; method for determining the mechanical properties (IEC 60811-1-1:1993 + A1:2001) |
| **DIN EN 60825-2** | Safety of laser equipment - Part 2: safety of fibre optic cable communication systems (IEC 60825-2:2000) |
| **DIN EN 60950** | Safety of information technology equipment |
| **DIN V ENV 61000-2-2** | Electromagnetic compatibility (EMC) Part 2-2: Environmental conditions; main section 2: Compatibility level for low frequency cable propagated interference factors and signal transmission in public low voltage networks (IEC 61000-2-2:1990, modified) |
| **DIN EN 61000-3-2** | Electromagnetic compatibility (EMC) Part 3-2: Limits; Limits for harmonic current emissions (equipment Input current up to and Including 16 A per conductor) (IEC 6100-3-2:2000, modified) |
| **DIN EN 61000-4-1** | Electromagnetic compatibility (EMC) Part 4-1: Test and measuring methods; Overview of the series IEC 61000-4(IEC 61000-4-1:2000) |
| **DIN EN 61000-4-2** | Electromagnetic compatibility (EMC) - Part 4: Test and measuring methods - Main section 2: Interference resistance to static electricity discharge - EMC Basic standard (IEC 61000-4-2:1995) |
| **DIN EN 61000-4-3** | Electromagnetic compatibility (EMC) Part 4-3: Test and measuring methods; Testing the interference resistance against high frequency magnetic fields (IEC 61000-4-3:2002) |



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| **DIN EN 61000-4-4** | Electromagnetic compatibility (EMC) - Part 4: Test and measuring methods - Main section 4: Testing the Interference resistance against fast transient electrical interference factors/Burst-EMC Basic standard (IEC 61000-4-4:1995) |
| **DIN EN 61000-4-5** | Electromagnetic compatibility (EMC) - Part 4: Test and measuring methods - Main section 5: Testing the interference resistance against surge voltages (IEC 61000-4-5:1995) |
| **DIN EN 61000-4-6** | Electromagnetic compatibility (EMC) - Part 4: Test and measuring methods - Main section 6: Cable-propagated interference factors, induced by high frequency fields (IEC 61000-4-6:1996) |
| **DIN EN 61000-6-1** | Electromagnetic compatibility (EMC) Part 6-1: Generic standards - immunity for residential, commercial and light industrial environments (IEC 61000-6-1:1997, modified) |
| **DIN EN 61000-6-2** | Electromagnetic compatibility (EMC) Part 6-2: Generic standards; interference resistance for industrial environment (IEC 61000-6-2:1999, modified) |
| **DIN EN 61000-6-3** | Electromagnetic compatibility (EMC) Part 6-3: Generic standards; Generic standard Interference emission for residential, commercial and light industrial environments (IEC 61000-6-3:1996, modified) |
| **DIN EN 61000-6-4** | Electromagnetic compatibility (EMC) Part 6-4: Generic standards; Generic standard interference emission for industrial environment (IEC 61000-6-4:1997, modified) |
| **DIN EN 61131-2** | Programmable Logic Controllers - Part 2: Equipment requirements and testing (IEC 61131-2:1992) |
| **DIN EN 187000** | Generic standard specification; Fibre optic cable |
| **DIN EN 187101** | Family specification: Fibre optic telephone, underground and pipeline cables |
| **DIN EN 188000** | Generic specification: Fibre optics |
| **DIN EN 188100** | Generic specification: Single mode fibre optics |
| **DIN EN 188101** | Family specification: Non-dispersion-shifted single mode fibre optic cables (Type B1:1) |
| **DIN EN 188201** | Family specification: Multimode fibre optic cables - Category Ala |
| **DIN EN 188202** | Family specification: Multimode fibre optic cables - Category Alb |
| **IEC** | IEC 60096-1<br>High frequency cables; Part 1: General requirements and measurement methods<br>IEC 60793-2 |
| **IEC 60793-2** | Fibre optics - Part 2: Product specification |
| **IEC 60794-2** | Fibre optic cables; Part 2: Indoor cables - product specification |
| **IEC 60874-10** | Connectors for fibre optics; Part 10: Generic specification; Fibre optics connector Type BFOC/2,5 (ST) |
| **IEC 1156-1** | Generic specification of the symmetric data cable for message transmission |
| **IEC 1156-2** | Generic specification for floor cables |
| **IEC 1156-3** | Generic specification for patch and device connection cables |
| **IEC 1156-4** | Generic specification for building connection and vertical cables |
| **EN ISO/IEC** | DIN EN ISO/IEC 9314-3<br>Information processing systems - distributed data interface with fibre optics<br>(FDDI) - Part 3: Medium-specific specifications for the bit transmission layer<br>(PMD) (ISO/IEC 9314-3:1990) |
| **ISO/IEC** | ISO/IEC 11801<br>Information technology - application-neutral site cabling (cf EN 50173) 2nd edition 2003<br>ISO/IEC 24702 |
| **DIN VDE** | DIN VDE 0100-540<br>Erection of power installations with rated voltages up to 1000 V; selection and setting up electrical equipment; earthing, earth conductor, potential equalisation conductor |
| **UL** | UL 508<br>Industrial Control Equipment; Standard for Safety<br>UL 1604<br>Industrial Control Equipment for Use in Hazardous Locations |
| **UL 60950** | Safety of Information Technology Equipment |
| **Germanischer Lloyd** | Germanischer Lloyd; Classification and construction regulations, VI-7-3-Part 1 |
| **CENELEC-Normen** | European guidelines, in Europe "normative" (CENELEC is the European committee for electronic standardisation) |
| **EN 50173** | describes the performance requirements for the application-neutral cabling system |
| **HD 608** | Generic specification of the symmetric data cable for message transmission |
| **EN 50167** | Generic specification for shielded floor cables |
| **EN 50168** | Generic specification for shielded patch and device connection cables |
| **EN 50169** | Generic specification for shielded building connection and vertical cables |
| **EN 55022** | (concerning EMC). Contains limits and methods for measuring radio interference for information technology equipment. |
| **Note** | In the standards EN 50167 EN 50168 and EN 50169 data cables with shielding<br>and halogen-free outside covering are specified |

# GLOSSARY

**10 Base FX** Standard for 10 Mbit/s Ethernet data transfer on fibre optic cables. Every connection is made using two fibres, one fibre for "send data" and another one for "receive data".

**10 Base T** Standard for 10 Mbit/s Ethernet data transfer on twisted pair cables. Every connection is made using two pairs of cores, one pair for "send data" and another one for "receive data".

**100 Base FX** Standard for 100 Mbit/s Ethernet data transfer on fibre optic cables. Every connection is made using two fibres, one fibre for "send data" and another one for "receive data".

**100 Base TX** Standard for 100 Mbit/s Ethernet data transfer on twisted pair cables. Every connection is made using two pairs of cores, one pair for "send data" and another one for "receive data".

**1000 Base FX** Standard for 1000 Mbit/s Ethernet data transfer on fibre optic cables. Every connection is made using two fibres, one fibre for "send data" and another one for "receive data".

**1000 Base TX** Standard for 1000 Mbit/s Ethernet data transfer on twisted pair cables. Every connection is made using two pairs of cores, one pair for "send data" and another one for "receive data".

**Absorption** The weakening (loss) of radiation when passing through material. A part of the radiant energy of light is converted, for example, to heat.

**Access protocol** Access method. Regulates access to the medium. Ethernet: CSMA/CD ; Token-Ring: Token; FDDI: Append Token; WLAN: CSMA/CA

**Account** Account

**ACL** Agent Communication Language - communication language for information exchange between agents.

**ACR (attenuation to crosstalk ratio):** The ACR value shows the difference between near-end crosstalk and wave attenuation. The value should be as large as possible.

**Active components** In electrical engineering: Conductors and conductive parts of operating materials which are usually earthed when live.

**Active redundancy** Action for increasing system availability. During fault-free operation, all of several available system components are involved in performing the function. In the case of failure, the intact components take over the task of the defective components.

**Actuator, actor** Control components, e.g. adjustment motor, switch coupling, power switch for accessing the process, i.e. for using information for influencing material or energy flows in a well-controlled object.

**ADM** User Association DIN-Messbus.

**ADSL** Asymmetric Digital Subscriber Line - digital subscriber connection line with asymmetrically distributed bandwidth from and to the subscriber.

**AFNOR** Association Française de NORmalisation (France)

**Aging** Process for updating data, special address storage. After expiry of a time period, an address is flagged as "old" and is deleted on the next cycle if it has not been detected at a port by then.

**Alignment** Optimal positioning of the ends of the optical fibre for splice connections (splicing). When connecting single-mode fibre optics, the alignment of the fibres is made with the LID system.

**Analogue signal** Signal whose information parameter can take any of many values within technically specified limits. Theoretically an infinite resolving capacity, however limited practically.

**Analogue signal** A physically measurable value (such as a voltage for example), modifiable in frequency and amplitude for information transfer.

**ANSI** American National Standards Institute promotes and manages industry standards

**APC** Advanced Process Control - advanced methods of process control. They imply model predictive control (MPC) rules, fuzzy control, KNN and softsensors. APC methods are used particularly in the process industry. In chemical mass production for example, they are used for controlling reactors, distillation columns, centrifuges and coupled systems and for the optimal control of starting, loading and product change procedures. Critical process factor fluctuations can be reduced, faults can be rectified more quickly and thus raw material and energy consumption can be minimised and output and product quality can be increased.

**API** Application Programming Interface - interface which the applications use for communication.

**Appartus** Equipment, device, machine, tool, mechanism. For the purpose of the EMC law, an apparatus is an end product with an independent function, its own enclosure and if needed interfaces and connections for the functional and proper power supply integration in its usage environment.

**Application Layer** Application Layer - layer 7 of the OSI reference model. Applications access network services. Services are provided which support the applications, e.g. software for data transfer.

**Arcnet** Real-time capable field bus for industrial high-speed applications, especially for networking intelligent units, e.g. for communication between controllers or PLC systems with PC applications.

**ARP** Address Resolution Protocol requests the associated MAC address via the IP address.

**AS** Active star coupler

**AS** Australian Standard

**ASI** Actuator Sensor Interface - bus systems for the lowest automation level. Enables the simple connection of sensors, actuators and integrated systems to the first control level.

**ASIC** Application Specific Integrated Circuit

**ASN.1** Abstract Syntax Notation One. Programming language of the MIB

**ASRS** Automatic Storage and Retrieval System - automatic high bay warehouse

**ASTM** American Standard of Testing Materials (USA)



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# GLOSSARY

**ATM** Asynchronous Transfer Mode. Based on cells of 53 bytes. Suitable for telephone, video and other data transfer. Mainly used in WAN applications.

**Attenuation** Reduction of the signal output between two cross section areas of a fibre. It is dependent on the wavelength: Main causes: Dispersion, absorption. Its unit of measure is "dB", specified as 10log P(L1)/P(L2).

**Attenuation coefficient** This is the attenuation of the cable in relation to the length in stationary condition (unit: dB/km or dB/100 m)

**Attenuation** Damping

**AUI** Attachment Unit Interface. Interface for physical separation of transceivers from Ethernet controllers.

**Auto negotiation** A process defined in Fast Ethernet using which the participants agree a common transfer mode before the actual data transfer (100 Mbit/s or 10 Mbit/s, Full Duplex or Half Duplex)

**Auto negotiation** Detects the transfer parameters such as speed, duplex mode, flow control at the port of the connected device and sets the optimal values accordingly.

**Autocrossing** Automatic crossover of the send and receive lines at twisted pair interfaces is possible with this function. Participants, e.g. switches, which support this function can be connected with each other using a straight through cable instead of a crossover cable.

**Automatic macine** An automatic machine, derived from the Greek "automatos" = self-moving, from the technical realisation perspective is every piece of equipment which automatically runs an intended process after fulfilling specified start conditions after the granting of the start command.

**Automation** Application of technology, using which operating equipment completely or partially performs specified operations according to preset programs without human intervention.

**Automation pyramid** Classically consists of five levels: field level (sensor / actuator), control level (process control, forming production cells), HMI level, MES level, ERP level

**AWG** American Wire Gauge, a unit for wire diameter. Back scattering technique a method for measuring length, reflection and attenuation curve in a data cable. A small proportion of the signal is reflected to the sender and evaluated.

**Backbone (-network)** Connects several LAN or WAN networks to a large network.

**Backpressure** Simulates a collision in HDX mode by generating a jam signal.

**Balun** Device for joining balanced (the currents are equal in magnitude and opposite in phase such as twisted pair) and unbalanced (one side is connected to earth and the other carries the signal such as coax) lines, but also for resistance transformation (wave resistance adaptation).

**Bandwidth** As well as the attenuation, the bandwidth is the second parameter for designating the properties of a fibre optic cable. The bandwidth represents a measure of the dispersion behaviour of a fibre optic cable.

**Bandwidth** Amount of data which can be transported within one second. For an individual connection, this is analogous to speed, e.g. 10 Mbit/s, 100 Gbit/s.

**Batch-Processing** Batch-Processing - processing a quantity of objects in a defined sequence, e.g. a list of requests, instructions or other data to be transmitted.

**Baud rate** Measure for the number of symbols transferred per second. Also called symbol rate, symbol speed or step speed. Unit = baud. If a symbol is only represented by one bit [0 or 1], the baud rate corresponds to the bit rate. If a symbol has several bits, the bit rate is larger than the baud rate.

**BDM** Basic Drive Module: includes the converter part and the drive specific controller and regulation.

**Bending radius** Smallest radius which the conductor can be bent without additional attenuation.

**BFOC** Bayonet Fibre Optical Connector. Also known as ST connector. Fibre optic connector with bayonet connection. Standardised as the only connector for 10 Mbit/s Ethernet. Also available for multimode and single mode glass fibres and for POF.

**BGP** Border Gateway Protocol Routing Protocol in the WAN.

**Binary signal** Signal whose information parameter can only take two values.

**Bit** Binary Digit - binary position, binary character, binary number. Basic unit for information in digital transfer systems (0/1, On/Off).

**Bit rate** Number of bits which are transferred within a time unit. Measure for the transfer speed of binary data.

**bit serial** The individual bits of a character are transferred one after the other in time on a single line.

**BITBUS** Field bus based on standard technologies such as RS485 and SDLC. Easy to use communication system.

**BLP** Bandwidth length product

**BOOTP** Bootstrap Protocol. Provides the statically assigned IP address to a given MAC address.

**BPDU** Bridge Protocol Data Unit. Signalisation packet between switches, used for spanning tree.

**bps** Bits per second: Measure for data transfer speed.

**Bridge** A device which connects two LANs with each other.

**Broadcast telegram** Broadcast to all network participants.

**BS** British Standard (UK)

**BSI** British Standards Institute (UK)

# GLOSSARY

**BT** Bit time. Duration of a bit.

**Buffered fibre cable** Consists of several loose fibres in a common sleeve.

**Building automation** Computer based control, observation and monitoring of all relevant functions for the operation or use of one or several buildings, e.g. heating, ventilation, air conditioning, lighting, ...

**Bundles** The fibres are arranged parallel to each other and joined flat with each other at equal spacing (e.g. directly glued or between two adhesive films). Several bundles can be grouped in stacks in one cable.

**Bus, Bus system** Basically, a distinction between serial and parallel buses must be made. Serial bus systems (cable bus systems) transfer data bit serial between widely distributed components of a system using a common medium (two-wire or four-wire, coaxial cable, fibre optic cable or radio waves) and in this way drastically reduce the wiring complexity as compared with a conventional star configuration.

**BV** Bureau Veritas (France)

**Byte** Data format or unit for characterising information quantities and storage capacities. 1 byte = 8 bits. Common multiples: kB, MB, GB

**Cable** Means for transferring signals. It consists of one or several electric conductors insulated from each other in a common sleeve installed in the cable covering.

**Cable core** The whole of the stranded elements present in the cable and the wrapping over all these elements.

**Cable covering** Sheath, generally made of polyethylene (PE), polyvinyl chloride (PVC) or halogen-free material (H) which protects the cable core from environmental influences.

**Cable screen** Conductive sleeve of a cable or a conductor for protecting individual cores or the complete stranded elements against electromagnetic influences from the outside.

**CAE** Computer Aided Engineering - computer supported planning, design, development and project planning. (computer supported engineering work in the broadest sense)

**Caloric load** Total of the caloric load values of all combustible materials in a room (unit for cable: MJ/m or in kWh/m)

**CAM** Computer Aided Manufacturing - computer supported production (production in computer automated manufacturing systems).

**CAN** Controller Area Network: Serial bus system, car manufacturing, industrial control equipment, design according to ISO 11898 bus medium twisted pair conductor.

**CAP** Computer Aided Planning - computer supported planning (e.g. of processes, work operations, work sequences, operating material usage etc.).

**CAQA** Computer Aided Quality Assurance - computer supported quality assurance (planning and realisation of the operational quality assurance tasks).

**CATV** Community Antenna Television (International)

**CC–Link** Control & Communication Link - field bus system which makes high- speed communication up to 10 Mbps possible between the field equipment.

**CDM** Complete Drive Module - it consists of a so-called Basic Drive Module (BDM) and possible accessories such as power supply equipment for example.

**CEBEC** Comite Electrotechnique Belge (Belgium)

**CEE** International Commission on Rules for the Approval of Electrical Equipment (international commission)

**CEI** Commission Electrotechnique Internationale (International)

**CEMP** Centre d'Etude des Matières Plastiques (France)

**CEN** Comité Européen de Normalisation (European Committee for Standardisation)

**CENELEC** Comité Européen de Normalisation Electrotechnique (European Committee for Electrical Engineering Standardisation) Responsible for the harmonisation of electrical engineering standards in the European Union.

**Channel** Connection path between two operating points from and including distribution equipment (e.g. hub) up to and including work place connection cable.

**Central drive technology** Design technique for drive concepts with several motors where the central power supply, the converter, the motor controller, possibly required motor regulators and diverse switching equipment are combined in one switch cabinet.

**CiA** CAN in Automation e.V.: International user and manufacturer association founded in 1992. This provides technical, product-specific and general information with the aim of disseminating knowledge about CAN.

**CIP** Control & Information Protocol.

**Client** A workstation connected to a network, e.g. a PC, which uses the services of a server. The client sends user requests in a special protocol to the server, receives its responses and displays these in legible form on the user's screen.

**Client Server Network** Tasks are clearly divided. The server provides services and the clients use these services.

**CLPA** CC-Link Partner Association

**CNC** Computerised Numerical Control.

**CNET** Centre National d'Etude de Télécommunication (France)

**CNOMO** Comité de Normalisation des Moyens de Production (France) - commission for standardisation of tools and machine tools in the French automobile industry

**Coating** A plastic coating applied to the fibre covering surface as mechanical protection.



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# GLOSSARY

**Coaxial cable** Concentric conductor pair consisting of an inside and an outside conductor which completely encloses the inside conductor. Inside conductor and outside conductor are insulated from each other with a homogenous material or a combination of fixed supporting shells and a gas.

**Collision domain** For the CSMA/CD access method, the runtime of a data packet from one participant to the other is limited. Dependent on the data rate, this produces a spatially limited network, the so-called collision domain. The maximum expansion of a collision domain is 4250 m for 10 Mbit/s (Ethernet) and 412 m for 100 Mbit/s (Fast Ethernet). Full duplex operation of a connection makes expansion beyond these limits possible as it rules out collisions. The precondition for this is the use of bridges or switches.

**Compact fibre** A combination of single fibre loose buffer and tight buffered cable. The small hollow space between fibre and sheathing is filled with a non-stick coating.

**Component based automation** New concept at TIA for applications with distributed intelligence. It is based on the new PROFInet standard of the PROFIBUS user organisation (PNO) and supports consequent modularisation using the component technology in machine construction and engineering.

**Conductor** The conductor is used for forwarding the electrical carriers and thus consists of an electrically conductive material (metal). The conductor is usually round.

**Conductor resistance** The conductor resistance is determined by the quality of the copper used and the conductor cross section. It increases linearly with the length of the cable and is decisive for the attenuation.

**Core** The core is a conductor enclosed in an insulation sleeve. The insulation sleeve can be air or any other non-conductive material (usually plastic).

**Corrosivity** Produced by corrosive gases and acids when burning cables and wires. Non-corrosive cables should be used for laying in buildings. Halogen-free cables are generally non-corrosive.

**Coupler** Passive component for transferring / branching light to one or several fibres. The arriving optical light power is divided or combined from another view direction.

**Coupling mechanism** Physical mechanism over which electromagnetic interferences, assuming sources affect sinks and based on the electromagnetic interference energy process from source to sink are transferred.

**Coupling resistance** Measurement for the quality of the screening. It is defined as the ratio of the voltage along the screen of the disturbed system to the current of the interfering system.

**CP** Communication Processor - controls the process of the communication protocol between the components of a system

**CPU** Central Processing Unit

**Crimping** A mechanical protection is made by pressing a sleeve around the fibres.

**Crosstalk** Interference produced in a neighbouring pair from the usage signal in a wire pair.

**Crosstalk** Undesired transfer of energy, e.g. between two neighbouring fibres of a cable.

**CSA** Canadian Standards Association (Canada)

**CSMA/CD method** Carrier Sense Multiple Access/Collision Detection - access method for Ethernet according to IEEE 802.3. Each participant checks whether the transfer medium is free before sending a message. (Carrier Sense). Afterwards, it begins to send and simultaneously checks whether other participants (Multiple Access) have also started to transmit data. A collision occurs if two or more participants send at the same time. The participants end their data transmission (Collision Detection). The next attempt for a free line is started after a random time. For the CSMA/CD method, the network expansion is determined by a maximum permissible running time of the data signals on the network which is dependent on the data rate.

**CSTB** Centre Scientifique et Technique du Bâtiment (France)

**Cut-Through** Switching process where a packet is already forwarded after recognition of the destination address. In this way, the latency time is low; however defective packets are also forwarded. Also known as "on the fly packet switching".

**CVI** Complete Vertical Integration: This means the continuous information flow in automated production from the sensors and actuators via the control level to the management level. Its efficient realisation requires that office and factory automation are based on the same information technology platform and that the interfaces between the individual levels are standardised across all manufacturers.

**Data** Characters or continuous functions which represent information based on known or implied arrangements for processing purposes.

**Data Link Layer** Layer 2 in the OSI reference model: the data packets to be sent are converted unto so-called frames and sent, whereby the receiving side acknowledgement of the frames transmitted is waited for.

**dB** Decibel: Unit which has been used to express the level for logarithmic relationship factors such as transfer factor, amplification factor, attenuation factor as the logarithm of the decimal logarithm. 1 dB 0.115 Np

**DCOM** Decentralised Control Systems

**DCS** Digital Communications System

**DCS** Distance Control System

**DDL** Device Description Language

**DDR-SDRAM** Double Data Rate SDRAM: new type of memory which uses the rising and the falling edge of the clock signal for data transfer. Read/write speed increases.

# GLOSSARY

**Decentralised drive technology** In contrast to centralised drive technology, here only the power supply and parts, if needed, of a central controller are installed in a switch cabinet for drive systems with several motors while all other functional parts such as converters and regulators are installed directly at the location for the individual motors.

**Decibel (dB)** Unit for transmission strength, attenuation and output level.

**DEMKO** Danmarks Elekriske Materielkontrol (Denmark)

**DES** Data Encryption Standard

**DESINA** Decentralised and standardised installation technology for machine tools and production systems (comprehensive overall concept for the standardisation and decentralisation of the fluid technical and electrical Installation of machines and systems).

**Destination address** Destination address for Ethernet.

**Device Description** DD - Device Description: it provides an expanded text description of every individual device in the virtual field device.

**DeviceNet** Simple CAN-based communication system for networking industrial automation equipment with superordinate controllers. Two twisted pair shielded pairs within a cable are used for transmission. One is used for communication and the other for supplying power to the connected equipment.

**DFÜ** Dial-up connection

**DHCP** Dynamic Host Configuration Protocol. On request, communicates its IP address to a device which is permanently allocated via the associated MACaddress or is dynamically granted.

**Dielectric** An electrically non-conductive substance which an electrical field goes through. Increases the capacity of a plate condenser.

**Dielectric constant** Dielectric value. Substance-specific constant for the polarisability factor of the substance. The higher the dielectric constant of a dielectric the higher the capacity of the corresponding condenser.

**Digital signal** A digital signal has several information parameters, e.g. 8, 16, 32 or 64, which are provided one after the other chronologically for serial signals and in parallel chronologically for parallel signals. The 1/0 coded representation of information such as digits and letters or the bit patterns from analogue signals (sounds, images, videos, measurement values etc) produced by scanning and quantisation.

**Digital/Analogue converter** Functional unit which converts a digital signal to an analogue signal.

**DIN** Deutsches Institut für Normung

**DIN rail** Support rail, construction element for simple mounting of modules. As well as the mechanical support function, support rails are very often used as PE collecting bars.

**DIN Messbus** Bus system designed for the reliable and cost-effective communication of equipment for measuring, monitoring and recording process and operation data. Practically any bus and branching cables, transfer rates 110 bps to 1 Mbps, full duplex operation. Areas of application: production measuring technology, quality assurance, statistical process control, operating and machine data recording and also in conjunction with programmable logic controllers.

**DIS** Draft International Standard

**Dispersion** Light impulses in a fibre have time diversification due to the dispersion. Distinctions are made between mode, material and wave dispersion.

**DKE** Deutsche Kommission Elektrotechnik Elektronik Informationstechnik im DIN und VDE. As national organisation for developing standards in electrical engineering and information technology, the DKE ensures important cross section concerns such as safety, EMC, components and performance of classic electricity grids through mobile radio communication up to software and Internet protocols.

**DMA** Digital Motion Access

**DMC** Digital Motion Control

**DNS** Domain Name System. Translates host names to IP addresses via DNS server or statically with the "hosts" file.

**Domains** Broadcast domain - network segment only limited by routers where a broadcast spreads freely. Collision domain: Network segment limited by switches or routers where collisions spread freely.

**DP** Decentralised Periphery (Profibus application layer, layer 7 in the OSI reference model)

**DPI** Dots Per Inch

**DTE** Data Terminal Equipment

**Duplex connector** Two fibre optic connectors combined with a clip or their design which are usually used as send and receive line.

**DVMRP** Distance Vector Multicast Routing Protocol. Internetwork Gateway Protocol, largely based on RIP. DVMRP uses IGMP to exchange routing datagrams with its neighbours.

**DWDM** Dense Wavelength Division Multiplex

**EANTC** European Advanced Networking Test Centre.

**Earth** In the context of electrotechnical matters, this means the more or less good electrically conductive earth which shows no potential differences outside the influence range of earth connections or other electrical phenomena.

**Earth conductor** Conductor which connects the body of an apparatus to be earthed with an earth connector or several earth connectors provided this conductor is insulated in the earth or laid outside it.

**EC Motors** Electronically Commutated Motors - electronic motors



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# GLOSSARY

**EFAC** European Factory Automation Committee

**EIA** Electronic Industries Alliance (USA)

**EIA** Electronic Industries Association

**EIB** European Installation Bus

**EIBA** EIB Association

**Elastomer** Materials which can be reversibly expanded to at least double their starting length and have a low elasticity modulus and high recoil elasticity.

**Electric motors** are electromechanical energy converters which can operate as motor and generator I.e. driving and braking.

**Electromagnetic interference** Irradiation of interference during signal transmission caused by electromagnetic fields.

**ELM** Electrical Link Module

**EMC** Electromagnetic compatibility is the capability of an electric apparatus to operate satisfactorily in its electromagnetic environment without abnormally influencing this environment (which also includes other equipment) or itselfbeing influenced by it.

**EMC** Electromagnetic compatibility RFI immunity and emissions behaviour, Class A/B.

**EMC Directive Cable** European Commission Electromagnetic Compatibility Directive 89/336/EC. Plays a role in passive cabling in conjunction with the active components. Therefore, shielded systems should be used exclusively for information technology cabling.

**EMC Directive, general** Basic requirements for electromagnetic compatibility are specified in this new EMC Directive which equipment must comply with so that it can be placed on the market and put into service. "Equipment" is the higherlevel concept for the objects included in the Directive, which on the one hand are "apparatus" and on the other hand "stationary systems". For the purposes of the Directive, equipment also means components and assemblies installed in a device by the end user and mobile systems, which are defined as a combination of devices and other components which can be operated at various locations. Stationary systems in the new EMC Directive also includes large machines, high-voltage systems, electricity grids and telecommunication networks. These must be designed according to the recognised technology regulations, however do not require a conformity assessment before being put into service.

**EN** European Norm

**Encoder** Coder, encrypter - in information technology, an encoder is a hardware or software based system for converting data in order to convey a certain amount of information faster over a slow transport path for example, or to require less storage space for archiving. In both cases, the information content remains the same, but the amount of data is reduced. Afterwards, at the other end of the line or after reading the stored data, the reverse procedure is required in order to restore the original data format. This is done using a decoder. An encoder is called a rotary encoder in industrial automation. This is an electromechanical precision device which converts analogue angle values at the input side on its shaft as compared with a reference point into electric digital output signals. Encoding A mechanical device on a connection system which ensures a non-reversed connection or prevents the insertion of a plug into a socket of the same connector type, i.e.. switched to a different use.

**EPC** Electronic Product Code - electronic numbering system for physical objects such as, e.g. products, pallets, packets, individually packaged goods and also livestock.

**EPDM** Ethylene Propylene Diene Monomer - synthetic rubber Produced by polymerisation.

**EPSG** Ethernet Powerlink Standardisation Group

**ESD** Electrostatic Discharge

**ETG** EtherCAD Technology Group

**EtherCAT** Ethernet for Control and Automation Technology. Ethernet solution for industrial automation. Thanks to the optimal usage of the Ethernet bandwidth, small quantities of data can also be transferred efficiently with Ether CAT.
Extremely short cycle times and high transfer performance are the result. For example, any 1,000 distributed digital I/Os can be queried with EtherCAT in 30 µs with reading and writing in full duplex. 50 µs are needed for 200 analogue values and 100 axes are checked in 100 µs. EtherCAT is particularly suitable for fast PCbased control technology. The master does not need any special plug-in card and can be implemented with a very simple interface on any available Ethernet controllers. EtherCAT is also well suited for small and medium control technology and will also open up completely new application areas for distributed I/Os there.

**Ethernet** Based on the CSMA/CD access method. Coaxial cable or twisted pair wires are used as transfer medium. Widely used technology for networking computers in a LAN. Ethernet technology has generally established itself in the office environment.

**Ethernet-Powerlink** is an expansion of the standard Ethernet. It enables data exchange under hard real-time conditions with cycle times down to 200 µs and jitter of less than 1 µs. Thus, Ethernet can be used in automation technology on all communication levels from the control level to the I/Os.

**Ethernet/IP** Ethernet Industrial Protocol

# GLOSSARY

**EtheNet/IP** Protocol stack for Ethernet which has been developed for industrial applications. It is based on the standard TCP/IP protocol and uses a common application layer with DeviceNet. It this makes information exchange between device level networks and information systems at the operating level easier.

**ETSI** European Telecommunication Standards Institute

**Factory automation** Factory Automation

**Failure rate** Measure for the failure behaviour of system units (e.g. components). The proportion of failures per time period with respect to the total number of a system quantity is designated as the failure rate.

**FAN** Field Area Network - field bus system: Network for real-time capable exchange of data and information between automation components, equipment and power units inside the technology area of systems.

**FAR** Federal Air Regulation

**Fast Ethernet** 100 Mbps transfer rate

**FCS** Frame Check Sequence. Checksum at the end of the Ethernet packet; calculated and recorded by the sender. The recipient calculates the checksum based on the packet received and compares this with the value entered.

**FDDI (Fiber Distributed Data Interface)** FDDI (Fibre Distributed Data Interface) Fibre optic network with dual opposite ring topology and 100 Mbit/s transfer rate. The FDDI is fault tolerant to cable or node failure.

**FDIS** Final Draft International Standard

**FDMA** Frequency Division Multiple Access - multiple access in the frequency multiplex

**FDT** Field Device Tool: industry standard created by ZVEI and PNO, which makes the integration of measuring and automation equipment in the process and system control systems easier.

**FDX** Full duplex - transfer mode of a component: sending and receiving is possible simultaneously. No access method is necessary.

**FEXT** A form of crosstalk where signals from participants on the opposite side of a twisted pair line overlap.

**FF** Field bus Foundation

**Fibre core** Core of a glass fibre with a higher refractive index than the cladding glass.

**Fibre multiplex** Transmission method where one fibre is assigned to each transmission channel.

**Fibre optics** Transparent dielectric waveguide for transferring electromagnetic waves in the visible light range. Conductor based on glass fibre or plastic fibre; not sensitive to electromagnetic interference.

**Field bus** Bus system near the process for direct connection of sensors and actuators with their own intelligence. Small quantities of data are transferred in digital form between sensors, actuators and controller on a field bus.

**Field bus barrier** Device for increasing the number of field bus participants in the Ex-area.

**FIP** Factory Implementation Protocol or Flux Information Process

**FITL (Fiber In The Loop)** FITL (Fibre In The Loop) Fibre in the local connection network. The following are distinguished depending on the end point of the fibre path: FTTB Fibre to the building; FTTC Fibre to the curb / kerb: FTTH Fibre to the home; FTTD Fibre to the desk

**Flame resistance** Description of the behaviour of products against fire propagation

**Flame retardant** Flame retardant, i.e. fire propagation in the case of fire is delayed (FR)

**Frequency** Number of complete oscillations per second (in Hz)

**Frequency converters** are devices based on power electronic semiconductor components which operate in switched mode, i.e. only in the on-state or in the off-state. Especially in variable speed alternating current drive systems, they have the task of producing a usually three-phase modifiable frequency and voltage amplitude for feeding the rotary motor from a single or three phase mains alternating current constant frequency and amplitude.

**FRNC** Flame retardant and non corrosive

**FTP** File Transfer Protocol: Rules for transferring data from one computer via a network to another computer. The protocol is based on TCP/IP which has established itself as quasi standard for data transfer via Ethernet networks. FTP is one of the most used protocols on the Internet. It is defined in RFC 959 in the official regulations for Internet communication.

**FTP** 1. File Transfer Protocol. Protocol on Layer 5, uses TCP for transport, therefore usage in WAN 2. Foiled Twisted-Pair.

**FTTD** Fibre To The Desk

**FTZ** Fernmeldetechnisches Zentralamt

**Full duplex** Data transfer process in which information is transmitted simultaneously in both directions.

**Full duplex operation (two-way transfer)** Information transfer in both directions on one fibre.

**GARP** Generic Attribute Registration Protocol. Protocol family for exchanging parameters between switches on Layer 2 gateway device for connecting two networks which have different protocols.

**Gbit** GigaBit, 109 Bit

**Gbps** Gigabits per second

**Gigabit Ethernet** Fast data network specified in 1999 in IEEE 802.3

**Glass cladding** The glass enclosing the core of a glass fibre; the cladding glass has a lower refractive index than the core glass.

**GMA** VDE/VDI-Gesellschaft Mess- und Automatisierungstechnik

**GOST** USSR-Standards



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# GLOSSARY

**Graded index fibre** The graded index fibre is a fibre optic cable with a graded index profile

**Graded index profile** Fibre whose refraction index profile decreases parabolically from the inside to the outside across the cross section of the core surface.

**GRP Element Gradientenfaser** Antibuckling and strength, ember made of glass filaments (GRP: Glass Reinforced Plastic).

**Half duplex** Operating mode, where a device can either send or receive data. Ethernet collision detection is active for half duplex. The network expansion is limited by the runtime delays of the equipment and transmission media.

**Half-life** (A radionuclid) is the time in which the activity is reduced by half.

**Halogen-free** No halides (e.g. chlorine) in use. Halogen-free cables are used for increased fire protection requirements with respect to protection of persons or on account of high material concentration. In the case of fire they release noncorrosive gases and the released quantity of toxic gases is significantly lower than for PVC materials.

**HCS** Half duplex - transfer mode of a component: either sending or receiving is possible.

**HD** Harmonisation Document (international)

**HID** Human Interface Devices - user interfaces: any device for interaction between human and computer.

**HMI** Human Machine Interface

**HN** Harmonisation des Normes (France)

**Hollow core** Consists of a fibre and a loose sleeve enclosing it.

**Horizontal Integration** Connects the MES solutions with each other in an enterprise pyramid. In this way, all information is available online and multiple data entries and doubled data retention are avoided.

**HRTS** Hard Real-Time System - system that is able to meet hard real-timerequirements.

**HSE** High Speed Ethernet Industrial Ethernet solution of the Fieldbus Foundation FF

**HSLAN** High Speed LAN: local network with transfer rates around 100 Mbps and higher.

**HTML** Hyper Text Markup Language - programming language with hypertext links.
Language used for most Websites.

**HTTP** Hyper Text Transfer Protocol - data transfer protocol for the transfer of HTML pages and the files of all kinds linked to them. It is the protocol on which the whole World Wide Web is based; this means it regulates the interaction between Web browser and Web server. It is active for every mouse click on a hyperlink and ensures that the browser is provided with the respective next piece of desired information.

**Hub** Central connecting device in a network with star topology which distributes arriving data packets to all connected end devices.

**Hybrid cable** Consists of at least two different types of cable (e.g. fibre optic and copper cables) in a common sleeve.

**IAONA** Industrial Automation Open Networking Alliance: Alliance of leading international automation equipment manufacturers for dissemination of open network standards such as Ethernet as world wide standard for industrial communication.

**ICMP** Internet Control Message Protocol.
Most well-known command: Ping.

**ID** Identifier

**IDA** Interface for Distributed Automation. Open interface on top of the TCP/IP stack for automation applications.

**IEA** International Ethernet Association - association for promoting the use of industrial Ethernet

**IEC** International Electrotechnical Commission

**IEE** Institution of Electrical Engineers (Great Britain)

**IEEE** Institute of Electrical and Electronics Engineers

**IETF** Internet Engineering Task Force.

**IFG** Inter Frame Gap. minimum gap between two packets.

**IGMP** Internet Group Management Protocol. Layer 3 protocol for multicast transport.

**IGP** Interior Gateway Protocol.

**IGRP** Interior Gateway Routing Protocol.

**Impedance** Impedance of the electrical quadripole; it is composed of the ohmic resistance and the reactance, the frequency-dependent resistances and capacitances. The impedance is constructively specified by the dimensions of the internal conductor, dielectric and shielding.

**Indoor cable** Cable for applications inside buildings. They are not suitable for laying outdoors.

**Industrial Ethernet** Designation for Ethernet in automation technology. Due to the industrial usage environments, the network components must comply with expanded temperature ranges and increased requirements with respect to the reliability and safety of the network.

**Insertion loss** For assessment of the transfer quality of a plug connector, its insertion loss is taken into account, i.e. it is determined what amount the attenuation of an optical transmission path increases when a plug connection is inserted into this transmission path.

**Insulation resistance** It is determined by the insulation material whereby the material properties are more significant than the insulation thickness. The insulation resistance is dependent on the length. The higher the specific resistance of a material, the more suitable the material is for insulation; the unit is [m]; for cables and wires, the derived units [Mkm] or [Gkm] are common.

# GLOSSARY

**INTERBUS** Bus system which is designed from its technical characteristics specially for use with industrial sensors/actuators and continuous networking from the controller level right up to the last limit switch.

**Interface** Intersection point at which two different systems are connected for the purpose of data transfer.

**Interface** From the hardware standpoint, an interface identifies the connection point between two assemblies/devices/systems.

**Inteference** Fault, adverse effect, reduction of functionality

**Interference resistance** Ability of a device, of a unit or of a system to operate without reduction of functionality in the presence of electromagnetic interference.

**Intrinsic safety** Protection class of explosion proof electrical equipment. This is achieved in the course of designing this equipment by limiting the energy in the intrinsic electrical circuits.

**IP** Internet Protocol : protocol according to which the data within a network, e.g. in the Internet or intranet reach one computer from another. Every computer present in the network is uniquely identified by its IP address.

**IP Adress** Internet Protocol address: numeric address which is assigned to a computer in the Internet and which makes it uniquely identifiable. It consists of a sequence of four groups of numbers, each with maximum three digits, separated by periods.

**IP protection classes** They characterise the protection of electrical equipment by enclosure, cover or casing and in fact the protection of persons against access to dangerous parts inside the cover and protection against the ingress of foreign bodies and water.

**IPC** Industrial PC

**ISDN** Integrated Services Digital Network. A digital network in which all types of data such as, e.g. voice, text or images are transmitted to and from the participant via a single line.

**ISDN** Integrated Services Digital Network. WAN transfer protocol.

**ISO** International Standards Organisation: world wide federation of national standards institutions from more than 130 countries.

**ISO/OSI** OSI reference model

**ITU-T** International Telecommunication Union, Telecommunication Standardisation Sector Standardisation Committee

**Jabber** Defective frames for Ethernet with more than 1518 bytes.

**Jitter** Term for time fluctuations of cyclic events.

**KB** Kilobyte -> 1 KB = 210 or 1024 bytes

**kbps** Kilobits per second

**KEMA** Keuring van Elektrotechnische Materialen (Netherlands)

**L-PAS** The video image evaluation L-PAS (Lens Profile Alignment System) is a system for splice process control. The ends of the fibres to be spliced are constructed with one or several CCD cameras. The video signal is used on the one hand for displaying the fibres on the monitor and for controlling the fibre positioning and on the other hand for the splice attenuation assessment.

**LACP** Link Aggregation Control Protocol.

**LAN** Local Area Network: spatially limited system for high speed information transfer between a limited number of independent terminals with equal rights.

**LAN** Local Area Network e.g. Ethernet, FDDI and Token Ring

**LAP** Link Access Protocol.

**LASER** Light Amplification by Stimulated Emission of Radiation: Amplifier for electromagnetic waves in the visible light spectrum.

**Latency** Delay time

**Latency time** Period of time needed by a device to react to an input event at the output or also the time which, e.g. a data packet needs to traverse a network from sender to recipient or how long it remains in a network device before it is forwarded.

**Launch angle** Angle between the propagation direction of the light occurring and the optical axis of a fibre optic cable. In order for the light occurring to be couples, this angle must be between zero and a maximum value which depends on the location on the front surface of the thread or on its local refraction difference as compared with the switching.

**Lay-length** The axial length along the centre axis of a cable according to which a stranding element is wrapped completely (360°) once around the axis.

**LCIE** Laboratoire Central des Industries Electriques (France)

**LED** Light Emitting Diode

**LID-System (Local Injection and Detection System)** The LID system provides highly precise positioning of the fibres in the x/y and z directions. It consists of two bending couplers (sender and receiver). The light is coupled into the fibres on the sending side. The transmitted light power is measured at the receiving side. Criterion for the optimal alignment of the fibres is the maximum of the light power transmitted over the splice.

**Light speed** v0 2, 998 x 108 m/sec

**Light waves** Electromagnetic waves in the optical frequencies range. The term "light" originally referred to the visible radiation with the human eye with a wavelength between 400 and 800 nm. However, it is also common to describe radiation in the adjacent spectral ranges (e.g. infrared) as light.

**Link** Connection path between two nodes from and including the distribution patch panel up to and including the work place connection socket.



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**Link Aggregation** Combination of several ports (max, 4) into one virtual port. Parallel connection transfer with redundancy if a port fails. Standard IEEE 802.3. Commonly called "Trunking".

**LON** Local Operating Network: open bus system which makes possible the interaction of components from different manufacturers.

**Loop resistance** Ohmic complete resistance from transmit and return conductors (unit: W/km)

**Low Voltage Directive** The aim of the directive is to ensure the safety of the consumers. It concerns all electrical equipment for generating, transmitting, distributing, storing electrical energy, e.g. generators, cables, switches, sockets and many others, for use with a rated voltage between 50 and 1,000 Volts for alternating current and between 75 and 1,500 Volts for direct current. Exceptions are regulated in Appendix II of the Directive. Such equipment, according to the Directive, is only allowed to be brought into circulation if it is manufactured according to the state of safety technology specified in the European Union, it does not endanger people, productive livestock and property during proper installation and maintenance and during proper use, it has been subjected to a conformity assessment procedure by the manufacturer, there is a corresponding declaration of conformity and it is marked with the CE marking.

**LSOH** Low smoke and halogen-free (LS = low smoke) (OH = zero halogen)

**LWL** Fibre optics

**MAC** Medium Access Control

**Machine** According to the Machines Directive, a machine means a totality of parts, at least one of which is moveable, connected with each other. As well as the mechanical components, operating, control and energy components also belong to the machine.

**MAN** Metropolitan Area Network (large area network, e.g. connection of several LANs within a city).

**MAP** Manufacturing Automation Protocol - data transfer protocol for automated manufacturing.

**Master** Central bus participant which regulates the bus access. All other participants operate as slaves.

**Master/Slave Concept** Master element determines, slave element follows the instructions of the master. For example, an automation device as master element grants the access rights for the other components for the decentralised bus controller.

**MC** Motion Control

**MDI** Medium Dependent Interface

**MDI-X** MDI-Crossover

**Meshed structure** Every participant is connected with several others. Several independent transmission paths can exist between two stations. This redundancy can be used for assurance of the data transport if there is an interruption of one transmission path.

**MIB** Management Information Base. Contains the description of the connected objects and functions in a network.

**Microbending** Bending of a fibre which produces light losses and thus attenuation increases.

**Migration** Process of porting data or software to a different technical platform

**MII** Media Independent Interface

**MIL** Military Specification (USA)

**MLPPP** Multi Link PPP. See also PPP.

**MMI** Man Machine Interface

**MMS** Man Machine Interface (MMI)

**MODbus** Master / Slave network which makes it possible, for example, for a master computer to communicate with one or several PLCs or Remote I/Os, to perform program processes, data transfers or other operations.

**Modem** Device which converts the signals from one form into another in order to make the compatibility with another system.

**Modes** All waveguides capable of propagation in a fibre optic cable

**Motion Control** Motion control

**MPLS** Multiprotocol Label Switching. Layer 3-Protocol.

**MSB** Most Significant Bit.

**MTBF** Mean Time Between Failure.

**Muti-vendor system** in such a system, the problem-free collaboration of automation components from different manufacturers is made possible based on manufacturerneutral communication media and transfer protocols.

**Multicast** Data packet which is destined for a group of devices, e.g. to all Hirschmann equipment.

**Multicast telegramm** is sent to a group of defined recipients. This group can be reached using one address.

**Multimode fibre** Fibre optic cable whose core diameter is large in comparison with the wavelength of the light so that two or more modes are capable of propagation.

**Multiplexing** Combination of two or several information channels on a common transfer medium.

**Multistage profile** Fibre with a sharp drop of the refraction index between core and cladding, whereby the refraction indexes of core and cladding in themselves remain constant. Transmitting width: The frequency at which the amount of the transfer function of a fibre optic cable has dropped to a specified value. The transmitting width of a fibre optic cable is approximately reciprocal to its length.

**NAT** Network Address Translation

**NC** Numerical Control

# GLOSSARY

**NEC** National Electrical Code (USA)

**NEMA** National Electrical Manufactures Association (USA)

**NEMKO** Norges Elektriske Materiellkontroll (Norway)

**NEN** Nederlands Normalisatie Instituut (Netherlands)

**NetBEUI** NetBIOS Extend User Interface. Extended version of the NetBIOS protocol which is used by network software such as LAN Manager, LAN Server, Windows for Workgroups and Windows NT.

**Network** Connection structure made up of individual elements which are connected with each other and/or which have a defined interaction with each other (road networks, electricity supply grids, communication networks)

**Network** System with the associated transfer method that is supported by message coding cabling.

**Network Layer** Layer 3 in the OSI reference model: The data packets are addressed here and logical names and addresses are converted into physical ones and the transmission paths are determined.

**NEXT** Near End Crosstalk, in dB, calculated from the power ratio of the wanted signal power to the interference signal power at the same end of the cable.

**NF** Normes Françaises (France)

**NFC** Normes Françaises Class C (France)

**NIC** Network Interface Card. network interface in the computer.

**NMS** Network Management System

**Node** Branching point in a network.

**Node** Participant in the data network, e.g. computer, printer, hub, switch, ...

**NRZ** Non Return to Zero. Signal code.

**NVP** Nominal Velocity of Propagation - reduction factor of a data cable in [%] as compared to a line with a dielectric constant of 1 of the insulating material (air). Among other things, it is used for calculating the runtime (e.g. NVP 77 % produces a runtime of approx. 0.33 / NVP 4.2 ns/m).

**ODVA** Open DeviceNet Vendor Association: independent organisation which supports the further development, use and dissemination of DeviceNet world wide.

**ODVA** Open Device Vendor Association - is an organisation which promotes the world wide dissemination of DeviceNet and EtherNet/IP network technologies and standards in industrial automation.

**OLE** Object Linking and Embedding - is a technology for transferring various data between devices.

**OLM** Optical Link Module: Bus component for the construction of fibre optics networks and the transition from copper conductors to fibre optic cable.

**OLP** Optical Link Plug: Bus component, slave connection, industrial communication.

**OPC** OLE for Process Control. Protocol in process automation for the standardised data exchange between Windows applications.

**Open Systems** An Open System is not sectioned off, but has active connections to its environment, i.e. it can exchange material, energy and information flows with its environment. According to IEEE, an open technical system provides the precondition for the portability of applications to many platforms from different manufacturers, the ability for the collaboration of different applications and for a consistent appearance to the user. This requires the manufacturer-neutral free choice of software and hardware components based on uniform and standardised interfaces and the simple configurability of application-specific system options according to the plug and play principle.

**Operating capacity** Effective line capacity

**Operation contol level** Level at which the relevant decisions for operation management are made. The occurrence of technical and organisation data from various areas is characteristic. The required communication system can range over several enterprise components or premises.

**OSI** Open Systems Interconnection. International standardisation programme, established by ISO and ITU-T in order to created standards for data networks which ensure the compatibility of equipment from different manufacturers.

**OSI reference model** Has been presented by the ISO with the objective of making it possible to connect networks from different manufacturers with different topologies. The OSI reference model thereby describes a standard which classifies and specifies according to which principles the communication, using various protocols, between the components to a network takes place. Altogether, it consists of seven Layers: Physical Layer; Data Link Layer; Network Layer; Transport Layer; Session Layer; Presentation Layer and Application Layer.

**OTDR** Optical Time Domain Reflectometer. Measuring apparatus.

**OUI** Organisationally Unique Identifier. The first three bytes of the MAC address identify the manufacturer of the component.

**Outdoor cable** Cables which are constructed so that they are sufficient for all requirements such as those which occur for underground and pipeline cable systems.

**ÖVE** Austrian Association of Electrotechnique

**P-NET** Field bus for process automation. The electrical specification of P-Net is based on the RS-485 standard and uses a shielded two-wire cable. This allows cable lengths up to 1,200 m without repeaters.

**Packet size** Frame size



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# GLOSSARY

**Parallel Detection** Partial function of auto negotiation in order to adjust to a partner which does not support auto negotiation. A port detects the speed due to FLP or NLP and adjusts accordingly to 100 Mbit/s or 10 Mbit/s. HDX is always used as duplex mode.

**PAS** Process Automation System

**Patch cable** Flexible connection cable for connecting two components e.g. in a distribution cabinet.

**PB** Petabyte -> 1PB = 250

**PD** Powered Device - describes the end device in the draft of the IEEE P802.3af standard. IEEE 3af defines how a power supply can be done using an Ethernet twisted pair cable.

**PDU** Protocol Data Unit

**PFM** Plant Floor Machinery - production system

**PHY** Physical sublayer. Physical layer / component.

**Physical Layer** Layer 1 in the OSI reference model: Bit transfer layer, lowest level, electrical and mechanical specifications for cables and network adapters are defined and also the mode for how the bits are sent via the cable.

**Pigtail** Short piece of fibre optic cable for coupling components where one end has a connector and the other end is spliced.

**PIMF** Pair in metal foil.

**PLC** Programmable Logic Controller - calculation based control device whose functionality is specified by a so-called application program.

**PLS** Process control system

**PLT** Process control technology

**Plug connection** Easily removable connection with plugs. The insertion loss of a plug connection is usually higher than the transfer loss of a splice connection.

**PMD** PROFInet Machine Distributor: central signal distributor with individual connections to all terminal equipment of the network.

**PMD** Physical Medium Dependent. Physical Layer / Component on Level 1a.

**PNO** Profibus Nutzerorganisation (Profibus User Organisation)

**POF** Polymer Optical Fibre - designation for a fibre optic cable whose optical core and sheath are made using plastic. POF fibres have a typical core diameter of 0.98 mm.

**Point-to-point structure** All participants are on a common transmission path. Only one message can be transported from one station to another at a time.

**Polling** Method for synchronisation during the data transfer. During polling one partner queries the master and the other slaves cyclically whether they want to send something or can receive something.

**Port-Mirroring** The data traffic of one port is mirrored at a different port in order to, for example, examine this with an analyser.

**Potential equalisation** Electrical connection which brings the bodies of electrical equipment and external conductive parts to approximately the same potential.

**Power switch** Circuit breaker, mechanical switch hat can switch on the current under proper operating conditions, carry this without time limit and switch off, which can also under defined extraordinary conditions, e.g. short-circuit currents, switch on, carry for a specified time and switch off.

**Presentation Layer** Presentation layer: Layer 6 in the OSI reference model: This layer determines the text formatting and display. Furthermore, it is responsible for data security. It also makes data compression possible.

**Pressure sensor** Measuring element which converts the physical pressure factor into an output factor proportional to the pressure.

**Primary cabling** A connection of the individual building distributors on the works premises.

**Priorisierung** Prioritisation
Data packets are processed in priority order according to defined criteria.

**Process** Process, procedure or sequence in which time continuous or discontinuous quantitative or qualitative modification of the parameters and/or the status of a real or virtual observation object or medium are ensured.

**Process automation** In the context of the given explanations of process and automation, this generally means the use of technical equipment resources for the automatic execution of any processes.

**Process industry** Designation for industrial sectors in whose systems there are technical processes running, i.e. those in which the material, bulk goods or energy flows Involved In the main process are treated or processed continuously or discontinuously such as, for example, in chemical large systems, in pharmaceutical industry systems, steel production and cement manufacturing, foodstuffs, semi-luxury food and drinks industry, and in waste incineration plants, foundries and others.

**Process optimisation** The processes running in technical systems are always operated with the objective, taking account of certain given conditions, of achieving the best possible process result.

**Product bandwidth length** This describes the effect that the bandwidth of a given product is inversely proportional to its length. The product bandwidth length is usually stated in Mhz x km or GHz x km.

**Product bandwidth length** Used for estimating the distance supported by a multimode fibre for a specified data rate (speed). Thereby, the gross rate must be used, e.g. 125 Mbit/s for Fast Ethernet.

**Production automation** Automation market segment for the industrial areas of circuit, assembly, component, device and power unit production.

**PROFIBUS** Process Field Bus

# GLOSSARY

**PROFIBUS-DP** Profibus for the area of "decentralised peripherals". Simple digital and analogue input / output components and intelligent signal and process data processing units can be relocated locally and thus, among other things, significantly reduce costs for the cabling complexity. Mainly for time-critical applications in production automation.

**PROFIBUS-FMS** Profibus Fieldbus Message Specification: Field bus for use at the system level with relatively low real-time requirements, industry standard.

**PROFIBUS-PA** Process Field Bus for Process Automation

**PROFInet** Open component-based industrial communication system based on Ethernet for distributed automation systems. Load-bearing components are the object-oriented modelling of systems and their functional parts based on COM, runtime communication based on TCP/IP and DCOM and manufacturer-independent engineering concept for the system project planning of a PROFInet system with a graphical circuit diagram editor. Technology promoted and supported by PNO.

**Profinet CbA** Solution for distributed decentralised intelligence. Standardised module specification. Open communication between modules. Engineering with drag and drop.

**Profinet IO** Direct connection of decentralised field equipment to Ethernet is possible.

**Profinet IRT** Isochronous Real Time: is hardware supported real-time communication with isochronous data transfer.

**ProfiSafe** Safety profile: allows the transfer of safety-integrated and standard data on one bus line.

**Proprietary** Property rights assigned

**Protocol** Series of procedures for making and controlling a communication.

**PSE** Power Sourcing Equipment - describes the power providing device in the draft of the IEEE P802.3af standard. IEEE 3af defines how a power supply can be done using an Ethernet twisted pair cable.

**PVV** Path Variability Value. Expressed in bit times.

**QoS** Quality of Service. Quality of the transfer, e.g. speed, bandwidth, latency, safety or priority. Only realised for priority on Layer 2 in IEEE 802.1D.

**Quadro Star** Strand element which consists of four wires twisted with each other whereby the respectively opposite wires form a transmission path (trunk). Front surface coupling (star surface coupling) Signal transfer via fibre ends connected at the front.

**Queue/Queuing** Generally describes the queue of elements or tasks. A queue in a data transfer system is a queue of messages or data packets which are waiting for further processing or forwarding. They are sorted temporarily and processed one after the other using a corresponding queuing method.

**RAM** Random Access Memory. Volatile memory.

**RARP** Remote Access System.

**RAS** Remote Access System.

**Real-time** A system operates in real-time or is capable of real-time operation if it accepts input factors in a defined time period, processes these and provides the results in good time for a partner system or the system environment.

**Real-time classes** The real-time requirements for calculation, control, regulation and communication systems are determined by the partner systems they interact with.

**Real-time requirements** Real-time systems have the characteristic of reliably reacting to an external stimulation within a defined time period. As regards compliance with the time limitation, a distinction must be made between hard and soft real-time requirements. Hard real-time requirement: if all required system responses to an external stimulation must be made absolutely reliably within a fixed, specified time period. Soft real-time requirement: if exceeding a specified time limit can be tolerated to a certain extent.

**Real-time system** System which responds to an external event within a specified time period. The focus here is not absolutely on speed. Rather, the necessary reaction speed depends on the environment or partner object which the system is co-operating with in a concrete application. For example, fast digital regulations require real-time systems whose reaction times are in microseconds; on the other hand, automation solutions with programmable logic controllers have reaction times in milliseconds, and for slower systems in the process industry, e.g. temperature regulations, reaction times in seconds or even minutes are sufficient. As regards compliance with the time limit, a distinction must be made between hard and soft real-time requirements. There is a hard real-time requirement if all required system responses to an external stimulation must absolutely be made reliably under all possible conditions within a fixed, specified time period, otherwise there is a risk of serious damage. On the other hand, there is a soft real-time requirement if exceeding a specified time limit can be tolerated to a certain extent as no serious consequences are to be expected. The real-time capability of a system is itself dependent on many influencing factors. Especially for automation technology, ignal running times, cycle times, latency times, jitter, synchronity requirements and the data throughput play a significant role.

**Receiver** Assembly for converting optical signals to electrical signals. It consists of a photo diode which converts the incoming optical signal into photocurrent which is amplified afterwards in a (low-noise) amplifier; if needed there are other downstream electronic circuits, e.g. decoder, for the signal preparation.

**Redundancy** Abundance, excess, surplus

**Reflection** Reflection of rays (waves) at border surfaces between two different substances.



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**Refraction** Direction change made by an electromagnetic wave (e.g. light) when it passes from one material into another and there is a large difference in the refraction index for both materials.

**Refraction index** The factor at which the light speed in an optical medium (e.g. glass) is smaller than in a vacuum.

**Reinforcement** Protection element (usually made of steel wires or belts) used for cables with special usage conditions such as for use at sea and in mines.

**Repeater** Repeater, amplifier - apparatus for amplifying and regenerating signals and a network. It can cover larger distances. Simple, economic means of extending a LAN.

**Repeater** Component for signal regeneration on level 1. Regenerates amplitude, signal edge and clock signal. Repeaters with more than two ports are called hubs.

**Resistance difference** Difference of the ohmic resistance between two cores of a cable (unit W)

**Return loss** Measure for matching systems; when the correct termination resistance of a cable (wave resistance) is selected, the reflection factor is 0 and thus also the return loss.

**RG58** Coaxial cable with 50 Ohm wave resistance. Also called Thin Wire or 10BASE2.

**Ring structure** All participants are connected with each other in a ring. There is no centre.
All participants have equal rights.

**RIP** Routing Information Protocol - for exchanging routing information between routers in the LAN. There are two versions: RIP V1 and RIP V2.

**RJ45** Connector for twisted pair.

**RMON** Remote Monitoring.

**Rotary encoders** Are small electromechanical precision devices which convert the angle positions of a mechanical shaft which they are connected to into coded data which can be evaluated electrically. They are also called angle sensors, angle encoders and angle coders. Basically, a distinction between incremental and absolute systems must be made.

**Rotary field magnets** are alternating current asynchronous motors with squirrel cage rotor which are designed for permanent standstill operation. This means they are thermally dimensioned so that they can remain switched on at the rated voltage with a fully braked shaft and thereby develop their greatest torque.

**Rotary magnets** are electromagnetic actuators with and without return springs activated by direct or alternating current which enable limited angle movements. They are used for demanding applications in automation technology.

**Router** Component on Layer 3 of the ISO/OSI reference model. Connects networks on Layer 3. Using additional routes to the destination, it provides a choice of routes depending on definable criteria such as route costs.

**RS232** Recommended Standard Number 232, the oldest and most widely used interface standard, also called V.24 Interface; all signals are related to earth so that it is an unbalanced to ground interface.

**RS422** Recommended Standard Number 422; balanced to ground operation, thus higher interference resistance. High Level: 2 -6 V: Low Level: +2...+6 V; four-wire connection

**RS485** Recommended Standard Number 485; expanded interface standard as compared with RS422; High Level: 1.5 -6 V: Low Level: +1,5....+6 V; two-wire connection -> half duplex operation or four-wire connection -> full duplex operation.

**RSVP** Resource Reservation Protocol. reserved bandwidths in the WAN.

**RTCP** Real-time Transport Control Protocol.

**Rx** Receive

**SA** Source Address

**SAE** Society of Automotive Engineers

**SafetyBUS** Field bus system for serial transfer of safety-related information. Safety systems and products such as light barriers, safety door and emergency stop circuits can thus be safely and decentralised connected with each other.

**SAN** Storage Area Network - network for connecting servers and storage subsystems such as discs, RAID and tape systems. Usually based on Fibre Channel.

**SC** Straight Connector. Connector.

**Screen** Cable structural element for shielding. The design of the screen depends on whether protection against electrical fields (capacitive coupling) or against magnetic fields (inductive coupling) or both is aimed for. The screen material against magnetic fields should always have high electrical conductivity and low inductivity which is why copper is usually used for the conductor.

**SDLC** Synchronous Data Link Control - synchronous data transfer procedure

**Secondary cabling** Internal building connection of the building distributor with the individual floor distributors. (Backbone).

**Segmentation/ Network segmentation** Provides the limit of collision domains and enables a performance improvement of Ethernet networks. The network segmentation is achieved using, e.g. switches.

**SEK** Svenska Elekriska Kommissionen (Sweden)

**Selfcentering effect** The selfcentering effect is the striving caused by the surface tension of the melted glass by the glass fibre to form an homogenous, preferably not offset connection.

**SEMKO** Svenska Elekriska Materielkontrollandstalten (Sweden)

# GLOSSARY

**Sensor** Apparatus which converts a physical factor based on a physical effect into an electric, pneumatic or hydraulic signal for further processing. These sensors are used in automation technology to obtain necessary information for process execution. For example, the recording of power unit and machine statuses or for recording process data such as temperature, pressure, speed, filling level, flow rate, paths, angles etc.

**SERCOS Interface** Serial Real-time Communications Standard Interface - digital drive position. Communications standard for precise Motion Control applications, e.g. for information exchange between a CNC controller and digital servo drives and decentralised I/Os. Enables very fast and precise real-time communication between a master and several slaves using a fibre optic cable.

**Servomotors** Electric motors for activating mechanical components, for example valves or for position-controlled return or positioning of mechanical axes in machine tools, robots and in many other applications.

**Session Layer** Session layer / communication control layer in the OSI reference model, Layer 5: This allows using two applications on different computers and ending them again. It realises the dialogue management, regulates the length of the data transfer and takes care of which participant sends or receives when, and the session synchronisation and the recreation of sessions after a failure

**SETI** Sähkötarkastuslatios (Finland)

**SEV** Schweizerischer Elektrotechnischer Verein (Switzerland)

**Shield** Screening which should prevent the transfer of interference signals, e.g. those from electrical fields for data cables, usually braided with aluminium or copper.

**Signal** Time-modifiable physical factor, e.g. a voltage or a current, which has a parameter that gives concrete information about further processing of a different physical factor.

**Shielding attenuation** Measure of the reduction or attenuation of the electromagnetic field strength at a point in the room, caused by inserting an electromagnetic shield between the field source and this point; usually expressed in dB.

**Single mode fibre** Fibre optic cable whose core diameter is so small in comparison with the wavelength of the light that only one mode is capable of propagation.

**Skin Effekt** The tendency of alternating current to flow on the surface of a conductor as the frequency increases (reduction of the effective conductor cross section and thus increase of the electrical resistance).

**Slave** Participant in a network which can only participate in data transfer after being approached by the master.

**SLIP** Serial Line Internet Protocol. Standard protocol for serial point-to-point connections, uses serial interface for IP traffic.

**Slotted core cable** Cable where the fibres are in grooves made in the surface of the central element.

**Smoke density** Measure for smoke development when burning a cable. Attention should be paid to a low smoke density for laying in buildings (typical value: 50%).

**SMTP** Simple Mail Transfer Protocol. Internet protocol which provides email services.

**SNAP** Subnetwork Access Protocol.

**SNMP** Simple Network Management Protocol

**SNV** Schweizerischer Normenverband

**SOHO** Small Office Home Office. Networks for small offices / branches and teleworkers

**Spanning Tree** Protocol which automatically resolves network loops. When switches are installed, effects redundant paths for additional security in the case of a connection failure. Changeover time 30s to 60s.

**Splice** A permanent cable connection, e.g. a splicing of two fibres for fibre optic cables.

**Splitter** Optical component for dividing the light output from one onto several fibres.

**SQE** Signal Quality Error. Signal returned to the LAN controller from a transceiver to communicate whether the packet has been sent correctly. Also called heartbeat.

**SRS** Safety Requirements Specification: it forms the starting point for the development of safe systems.

**SRTS** Soft Real-Time System - real-time system which can only meet soft real-time requirements.

**Star coupler** Active or passive component which ensures a uniform light output distribution for an equally large number of incoming and outgoing fibres.

**Star topology** All participants are connected to a central node. Every communication runs via this node. Direct communication between the participants is not possible.

**Store & Forward** Switching process where a packet is first completely stored and then forwarded.

**STP** Shielded Twisted Pair.

**STQ** Shielded Twisted Quad.

**Switch** Device, similar to a hub, which forwards received data packets in a network in contrast to a hub not to all network nodes but only to the respective addresses. This means, that in contrast to a hub, a switch looks after targeted communication within a network which only plays back a message between sender and receiver. Network nodes not involved are not affected.

**Switched Network** Designation for an Ethernet network which is constructed with switches.

**System** Interconnection of apparatus, systems or electrical or electronic components at a given location. These components perform a specific task with each other.

**System part (unit)** Consists of various devices. Each device usually contains one or more instrument loops which operate in parallel with each other. Examples: pump, compressor, pipeline, ...



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**System safety** Avoidance of dangerous operating conditions in process systems or their environment. This often concerns avoidance of the risk of explosion.

**System types** Subdivision in single-purpose systems or single-product systems which are designed for precise manufacture of one product and into multipurpose systems and multiple product systems.

**Tag field** Optional field inserted in Ethernet packets after the source data.

**TCO** Total Cost of Ownership.

**TCP** Transmission Control Protocol: Protocol which is used together with the Internet Protocol (IP) to transfer data from one computer to another in the Internet.

**Tertiary cabling** Horizontal connection of the floor distributor with the connection units at the work place.

**TGL** DDR-Standards: Technical standards, "Product regulations and delivery conditions" (former German Democratic Republic)

**TIA** Telecommunication Industry Association. Standardisation Committee

**Time multiplex** Transfer process where several pieces of information are transferred simultaneously with different wavelengths on one fibre.

**Token** Mark, character, sign: Transmission authorisation token in networks with collision-free access

**Token–Process** Bus access process: during this process, the token is forwarded from one participant to the next. The participant in possession of the token has permission to send and can access the common transfer medium.

**Topology** The physical or logical structure of network connections and nodes (star ring and bus configuration).

**TOS** Type of Service. Field in the IP packet for prioritisation.

**TP** Twisted-Pair. Data cable.

**TPDDI** Twisted Pair Distributed Data Interface.

**Traceability** Traceability

**Transceiver** Transmitter/Receiver - data transmitter/receiver combined in one unit.

**Transfer rate** Speed of the transfer, also bandwidth. Ethernet: 10,100,1000,10000 Mbit/s ; Token-Ring: 4 Mbit/s, 16 Mbit/s ; FDDI: 100 Mbit/s

**Transponder** In measuring and monitoring technology, this means a microchip with a sending and receiving antenna, a control logic and data and energy storage which enables contactless communication with a corresponding reading system.

**Transport Layer** Layer 4 in the OSI reference model: is responsible for the correct provision of data. For this, it converts the flow of transmission data into small data packets for the transfer or when receiving converts the data packets back into a data stream. This layer is also responsible for sending acknowledgements. The main tasks are thus the creation and dismantling of participant connections and the safe transfer of the data.

**Tree structure** Combination of star structure, point-to-point structure, ring structure and meshed structure

**Tx** Transmit

**UDP** User Datagram Protocol - network protocol

**UL** Underwriters Laboratories. Independent authority in the USA, which carries out product safety examinations.

**UL** Unterwriters Laboratories Inc. (USA)

**UNI** Unificazione nationale Italiana (Italy)

**Unicast** Data packet which is only addressed to one recipient, in contrast to multicast and broadcast.

**Unsymmetrical to ground/earth** Often also called e-coupling - is the difference between the earthing capacities of both conductors.

**UPS** Uninterruptible Power Supply

**UTE** Union Technique de l´ Electricité

**Utility Automation** Automation market segment for the public supply areas of electricity, water/sewerage, pipelines etc.

**UTP** Unshielded Twisted Pair.

**UTQ** Unshielded Twisted Quad.

**Validation of Profibus Systems** Guideline which specifies the validation supporting functions in conjunction with the use of Profibus in foodstuffs or pharmaceutical systems.

**VDE** Verband der Elektrotechnik Elektronik Informationstechnik e.V.

**VDEW** Vereinigung Deutscher Elektrizitätswerke e.V.

**VDI** Verein Deutscher Ingenieure

**VDMA** Verband Deutscher Maschinen- und Anlagenbau e.V.

**VDSI** Verband Deutscher Sicherheitsingenieure e.V.

**VLAN** Virtual LAN, constructed with switches. Goal: broadcast limitation to the network area where the broadcast is useful. Is also used for segmenting networks for security reasons.

**VPN** Virtual Private Network. The complete data traffic is encrypted in a VPN for secure transfer via public TCP/IP networks. A VPN uses "tunnelling" in order to encrypt all information at the IP level.

**VRRP** Virtual Redundant Router Protocol. Protocol for controlling redundant routers.

# GLOSSARY

**WAN** Wide Area Network Network which includes the connection between elements over a large geographic distance.

**Wave resistance** Complex specification factor of the relationship of the wave voltages to the wave currents at every point of the conductor.

**Wave length** Length of a complete oscillation (period) of a wave. Three wavelength ranges are usually used in optical message technology. These are 850 nm, 1310 nm and 1550 nm.

**Wavelength multiplex** Transfer process where several parallel incoming data signals are transferred on a fibre in one serial data stream.

**WDM** Wavelength Division Multplex.

**WFQ** Weighted Fair Queuing. Method for elaborating the priority queues in a switch. The highest priority queue, for example, receives 50% of the bandwidth, the next receives 25%, etc. .

**WLAN** Wireless LAN

**Work Area cabling** Connection of the connection unit at the work place with the data terminal equipment.

**WWDM** The transfer capacity of the optical fibres in fibre optic networks can be increased with the WWDM system. The system multiplexes several optical single mode signals to an optical composite signal. Thus several applications can be transferred simultaneously using one fibre optic cable pair. This makes the installation of additional fibre optic cables unnecessary and this significantly reduces costs.

**XML** Extended Markup Language.

**ZVEH** Zentralverband der Deutschen Elektrohandwerke e.V.

**ZVEI** Zentralverband Elektrotechnik- und Elektronikindustrie e.V.



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## NOTES

**Technical modifications**



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