

Cables for data transmission in industrial automation



The Quality Connection

LEONI

The LEONI Group

Cable expertise for the most various industrial markets.



LEONI is a leading supplier of cable systems and related services for the automotive industry and many other industrial sectors.

Our group of companies employs over 77,000 people in 32 countries. Entrepreneurial insight, first-class quality and the power to innovate have secured us our position as one of Europe's leading cable manufacturers. LEONI not only develops and manufactures a portfolio of technically sophisticated products that extends from wire and optical fiber to cables, cable systems and services, but also offers its customers a range of bespoke services.

Our full range of products and services also includes strands, standardised cables, hybrid/optical fiber and special cables, cable harnesses and wiring system components, as well as turnkey, assembled systems for applications in various industrial markets.

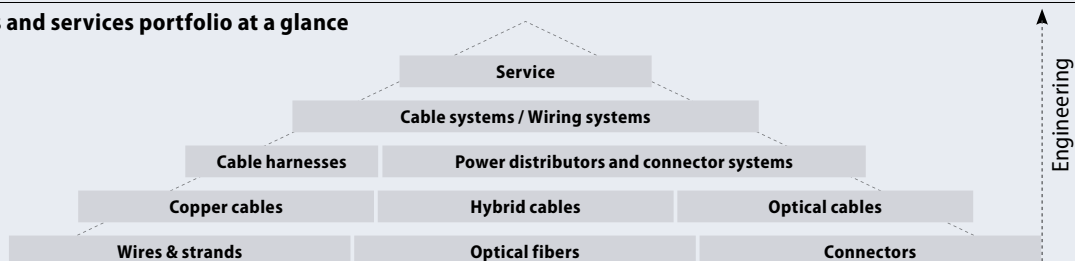
Your markets – our strength.

The breadth of LEONI's spectrum of products and services is matched by the markets and segments we supply. We focus our activities on customers in the sectors Automotive & Commercial Vehicles, Industrial Solutions, Electrical Appliances and Conductors & Copper Solutions.

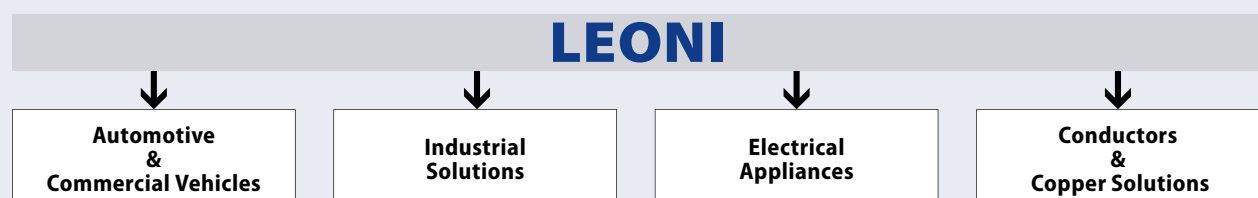
In the Industrial Solutions market, we are one of Europe's leading providers. Acting as both a cable manufacturer and a dedicated solution provider, we work in fields as diverse as telecommunications systems, fiber optic cable, data communications, manufacturing projects, solar and wind power, energy and infrastructure, building services, bespoke product and robotics solutions, healthcare, traffic systems and automation technologies. Customers worldwide benefit from our innovative, high-quality products that are both reliable and long-lasting. LEONI – we create the best connection for your future.

For further information, please visit www.leoni.com

Products and services portfolio at a glance



LEONI's core markets



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Application

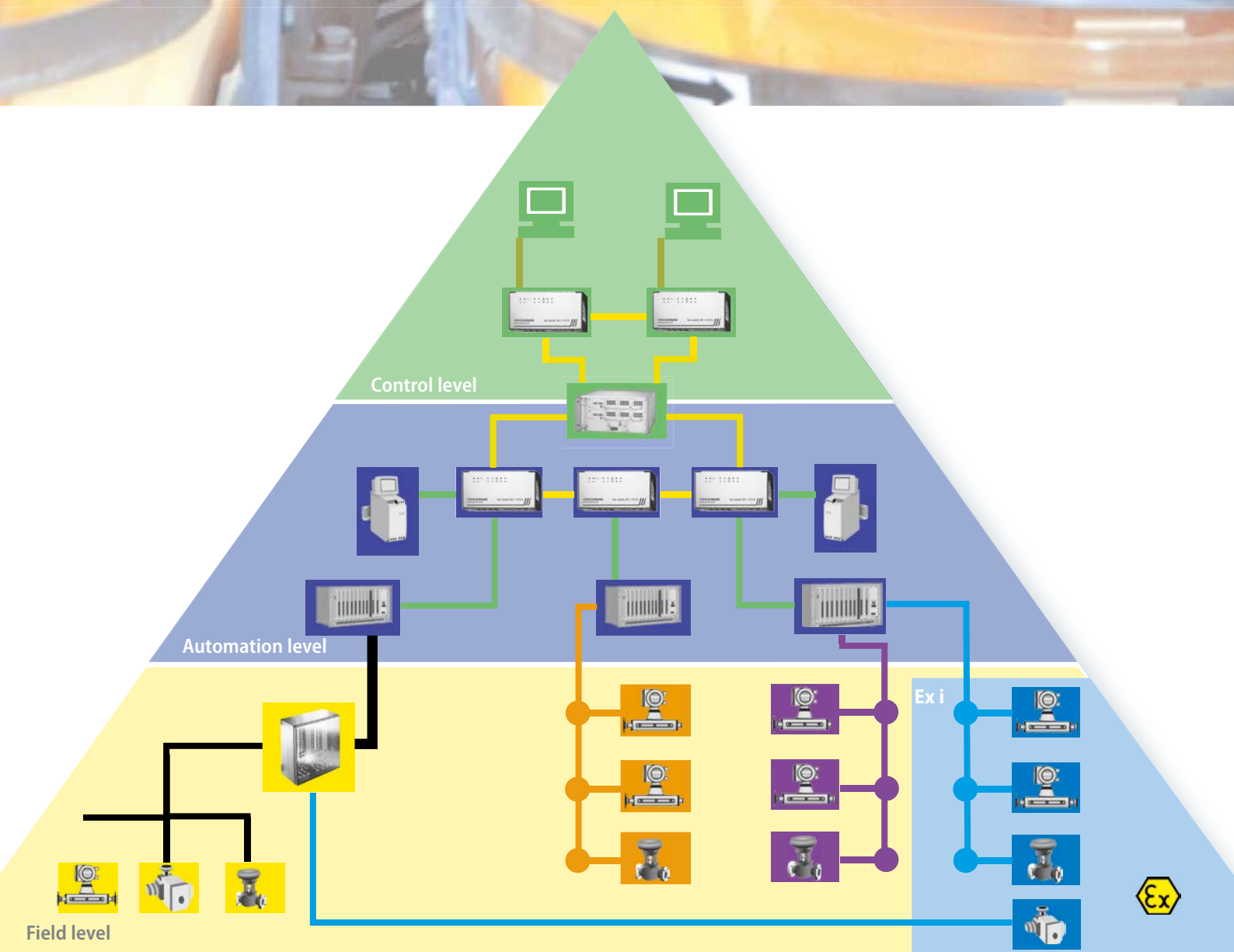
Fieldbus systems are used in digital networks which control machines and devices within a production plant with the help of actuators and sensors.

The IEC standard 61158-2 defines the profile of so-called H1 buses. The bus systems Profibus and FOUNDATION™ Fieldbus now predominant in process automation, follow this communication protocol.

Fieldbuses shall meet the following requirements:

- Use in hazardous and no-hazardous areas
- High transmission speeds
- Large amounts of data
- Real-time capabilities
- Deterministic
- Energy supply via bus

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Hierarchical Model with Industrial data transmission cable types

Fieldbus technology



Levels of the hierarchy

Digital communication and data transfer within a production structure takes place horizontally, i.e. between devices on one level, and vertically, to the systems on the other levels of the hierarchy.

The following levels are usually distinguished in automation systems:



Control level

This level controls and monitors higher functions with bus cycle times of <1000 ms.

Cables:  Ethernet TCP/IP copper cable
 Fiber optic cable





Automation level

This level controls the actual processes and control loops with bus cycle times of <100 ms.

Cables:  HSE-Industrial Ethernet cable
 Profibus FMS/DP cable

Field level

This level transfers data of the actuators and sensors; this requires a bus cycle time of <10 ms.

Cables:  4 ... 20 mA/Hart Instrumentation cable
 FOUNDATION™ Fieldbus cable
 Profibus PA cable
 Ex i

Demands made on Fieldbuses and Fieldbus systems

In the automation engineering, a wide range of factors determine which Fieldbus system to use, i.e. the technical characteristics of each bus system make it suitable for the sector and the application for which it is intended.

Process Automation

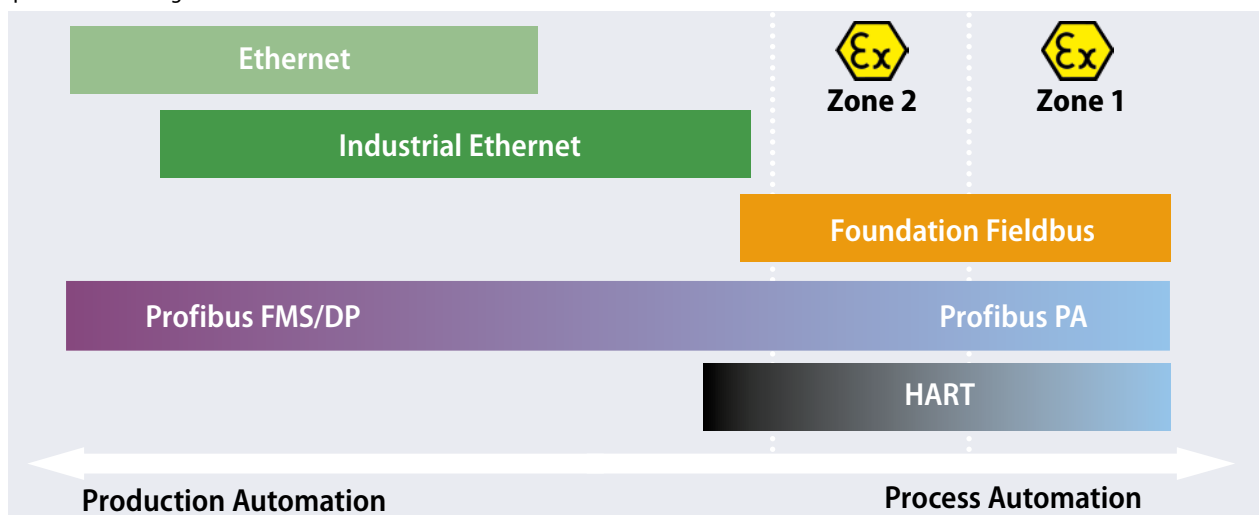
In process automation, we speak of the continuous or batch processing of goods in plants of the chemical, food or steel industries, power stations etc. Typically, the systems used for the process industry are strongly decentralized, complex plants which can be very extensive. The demands made on response times are usually less critical: these can be in the range of several seconds.

However, 'always up' systems are important for process automation as plants cannot be switched off due to the continuous processes running there.

Production Automation

Production automation mainly deals with the processing of goods in phases which are often independent of one another, e.g. in the automobile or electronic industry.

In these fields, high demands are made on the reaction times, i.e. hard real-time requirements in the millisecond range.





FISCO-Model

Especially in the use of bus systems in explosion-hazard areas, the so-called FISCO (Fieldbus Intrinsically Safe CONcept) facilitates the planning, installation and extension of networks.

The FISCO model was developed in Germany by the Physikalisch Technische Bundesanstalt (PTB) and has now been standardised according to the international standard IEC 60079-27.

The requirements for use of the FISCO model are as follows:

- All participants in the bus (devices) must be FISCO-approved
- Every field device takes up a constant basic current of at least 10 mA
- Only one supply source per Fieldbus segment
- With ignition protection type ia (Zone 0), the cable must not be longer than 1000 m and with ignition protection ib (Zone 1 and Zone 2) 1900 m
- Maximum length of each spur cable: 60 m for device group IIC and IIB
- Maximum length of each trunk cable, including all spur cables: 1000 m for device group IIC and 5000 m for device group IIB

According to IEC 60079-27, the parameters for the bus cables are as follows:

Loop resistance	$R = 15 \dots 150 \, \Omega/\text{km}$
Loop inductance	$L = 0.4 \dots 1 \, \text{mH}/\text{km}$
Mutual capacitance	$C = 45 \dots 200 \, \text{nF}/\text{km}$

When lines and cables matching the above requirements are used, it is no longer necessary to take other cable parameters into account.

F	Fieldbus
I	Intrinsically
S	Safe
CO	Concept

The Fieldbus Standard IEC 61158-2

Bus-types for 31.25 kbit/s – 100 Ω (e.g. PROFIBUS PA, FOUNDATIONTM Fieldbus).

IEC 61158-2 defines following categories for cable types for the data transfer range of 31.25 kbit/s.

Parameter	Type A	Type B	Type C	Type D
Impedance at $f = 31.25$ kHz	$100 \pm 20 \Omega$	$100 \pm 30 \Omega$	not specified	not specified
Max. conductor resistance	24 Ω /km	56 Ω /km	132 Ω /km	20 Ω /km
Max. attenuation at $f = 39$ kHz	3.0 dB/km	5.0 dB/km	8.0 dB/km	8.0 dB/km
Max. capacitance unbalance to shield	2 nF/km	not specified	not specified	not specified
Max. capacitance unbalance	not specified	6 nF/km length ≥ 30 m	not specified	not specified
Nom. conductor cross-section	0.8 mm ²	0.32 mm ²	0.13 mm ²	1.25 mm ²
Max. propagation delay change	1.7 μ s/km	not specified	not specified	not specified
Min. shield coverage	90 %	not specified	not specified	not specified
Max. usable length including all spur cables	1,900 m	1,200 m	400 m	200 m

Type A is the preferred bus type nowadays.

Type A is a single pair cable with an overall shield and is tailor-made to meet the high demand of automation engineering.

LEONI also offers multipair individually screened cables wherein each pair fulfils type A requirements acc. to IEC 61158-2.

Type B is an alternative type also used.

Type B is a version consisting of several pairs and an overall shield. Please note the restricted characteristics which can have a detrimental effect in case of future extensions of the plant.

Types C and D are of little importance and have been included here for the sake of completeness only.

Bus-types for the characteristic impedance range – 100 Ω up to 220 Ω (e.g. PROFIBUS DP).

For bus use in the characteristic impedance range between 100 Ω and 220 Ω , IEC 61158-2 defines cable types A and B with the following characteristics:

Parameter	Type A	Type B
Characteristic impedance	135 – 165 Ω at $f = 3$ up to 20 MHz	100 – 130 Ω at $f > 100$ kHz
Conductor resistance (loop)	110 Ω /km	not specified
Minimum conductor cross-section	0.34 mm ²	0.22 mm ²

The cable consists of one pair and an overall shield and the preferred type is type A.

Fiber optic cables

In addition to copper cables, fiber optic cables consisting of the following fiber types defined according to IEC 61158-2 are used:

Multi mode fiber	62.5/125 μ m
Single mode fiber	9...10/125 μ m as well as
Plastic fiber	980/1000 μ m

Transmission systems

Profibus (Process Fieldbus)

PROFIBUS DP (Decentralized Periphery)

PROFIBUS DP was specially designed for rapid cyclical data transmission. PROFIBUS DP uses RS-485 as a transmission technology for high data rates.

Depending on the data rate, the maximum segment lengths for cable type A are as follows:

Data rate kbit/s								
9.6	19.2	93.75	187.5	500	1500	3000	6000	12000
Segment length (m)								
1200	1200	1200	1000	400	200	100	100	100

PROFIBUS PA (Process Automation)

The PROFIBUS PA is used in the field of process automation and its special characteristics are power supply over bus and intrinsic safety.

The transmission technology used MBP (Manchester Coded Bus Powered). MBP is synchronous transmission with a fixed transmission rate of 31.25 kbit/s and Manchester-II coding. The intrinsically safe PROFIBUS PA is connected to the PROFIBUS DP via segments couplers or links.

Synopsis of Transmission Media PROFIBUS

	MBP	RS485	RS485-IS	Optical fiber
Data transmission	digital, Manchester Coding	digital, NRZ* coding, RS485	digital, NRZ* coding, RS485	optical, NRZ* coding
Transmission rate	31.25 kbit/s	9.6 – 12000 kbit/s	9.6 – 1500 kbit/s	9.6 – 12000 kbit/s
Cable	1-pair cable, twisted and shielded Type A	1-pair cable, twisted and shielded Type A	1-pair cable, twisted and shielded Type A	multi- and singlemode- fiber with glass, plastic fiber (POF)
Power supply	via bus line	optionally via additional cores	optionally via additional cores	optionally via additional cores
Ignition protection type	EEx ia/ib	no	EEx ia/ib	no
Network topology	Line and tree structure	Line structure	Line structure	Line-, star- and ring structure
Number of participants	max. 32 per segment, max. 126 per network	max. 32 per segment, max. 126 per network	max. 32 per segment, max. 126 per network	max. 126 per network
Repeater	max. 32 per segment, max. 126 per network	max. 9 with signal refresh	max. 9 with signal refresh	unlimited with signal re- fresh (depending on the time delay of signal)

* Non-Return-to-Zero

Transmission systems

FOUNDATION™ Fieldbus



Like the PROFIBUS PA, the FOUNDATION™ Fieldbus is standardised via IEC 61158-2 and works with the same transmission media (see page 9).

The difference to PROFIBUS PA is that the FOUNDATION™ Fieldbus does not require Fieldbus masters and the field devices can correspond with each other.

With the FOUNDATION™ Fieldbus, the “host device” only monitors the procedures. Within process automation, the FF forms a so-called LAN (Local Area Network) and the FF devices are connected to H1 links. Several H1 links are connected to the high-performance network HSE High-Speed-Ethernet via linking devices. Individual devices can also be directly connected to the HSE network.

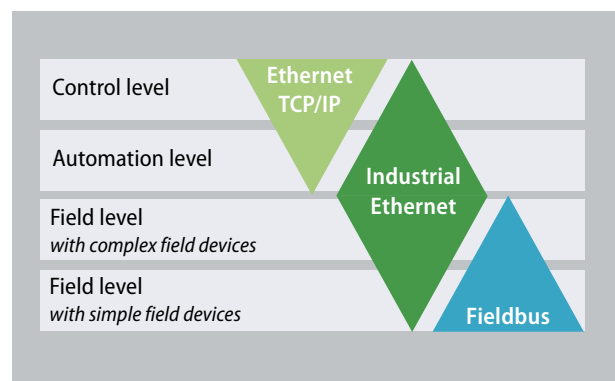
As with the PROFIBUS PA, the FISCO model applies for the FOUNDATION™ Fieldbus, thus allowing intrinsically safe use of the FF in explosion-hazard areas of the plant.

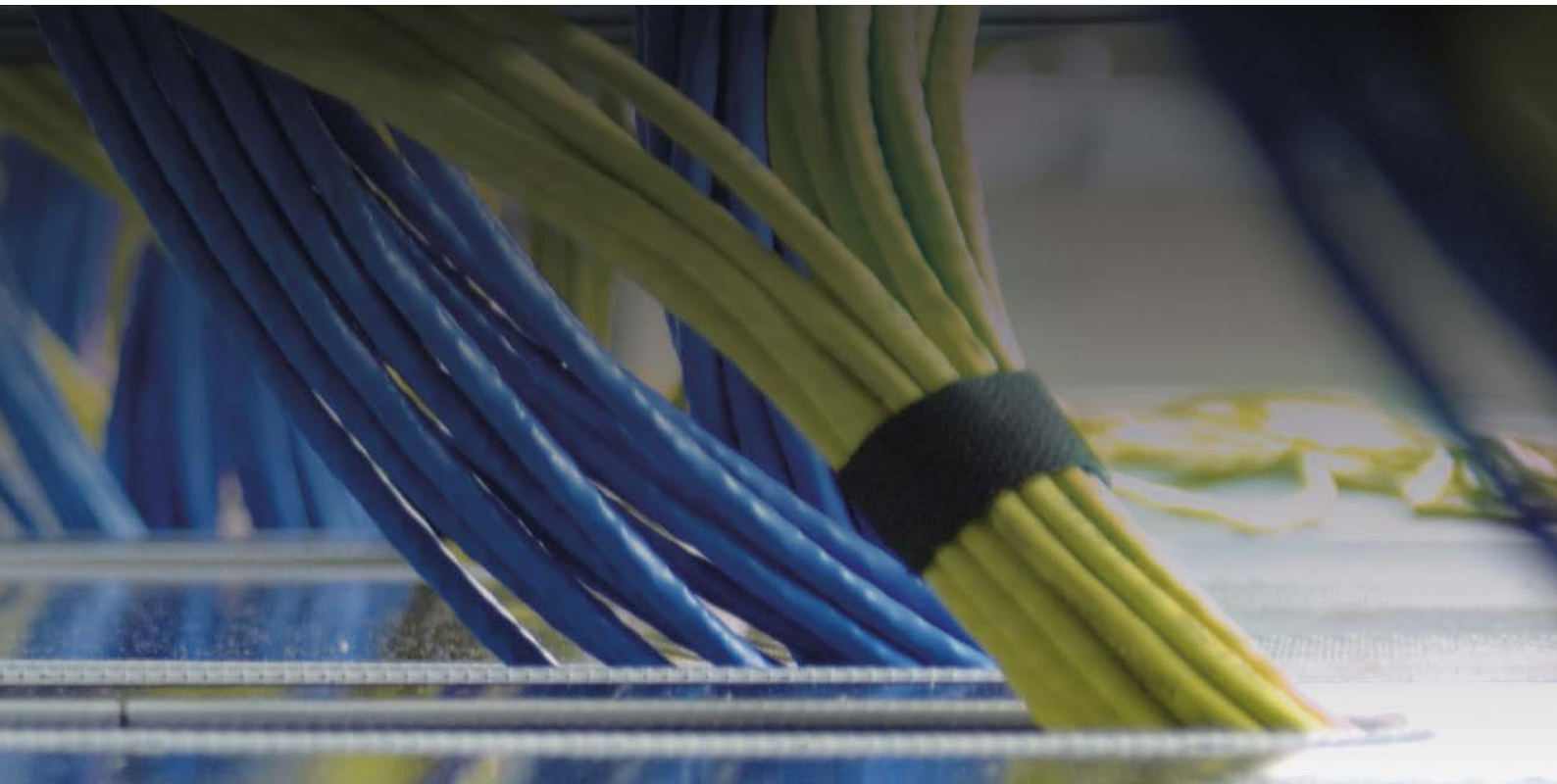
Industrial Ethernet

As a result of the increased demands made on transmission speeds and data rates, the Ethernet Protocol is also found besides bus technology in the world of automation, including field device controls.

New technologies (such as switching etc.) also make Ethernet suitable for real-time applications, allowing it to be used in the field of automation parallel to the Fieldbus.

The level structure is then as follows:





The M I C E concept

The wide range of environmental conditions prevailing with industrial applications mean that the demands made on lines and systems can vary. The draft standard ISO/IEC 24702 / EN 50173-3 classifies environmental conditions via the so-called MICE matrix.

This distinguishes between the following

M	...mechanical environmental influences This category defines shock, impact and vibratory stress
I	...housing protection This category defines the particle size and quantity of liquid, etc.
C	...climatic and chemical environmental influence This category defines environmental temperature, humidity and concentration of various gases, etc.
E	...electromagnetic stress This category defines electrostatic discharges and magnetic field strengths, etc.

A wide range of environmental profiles can be defined according to the MICE table. Examples:

$M_1 I_1 C_1 E_1$	Office area (worst case)
$M_2 I_2 C_2 E_2$	Factory buildings (worst case, light duty)
$M_3 I_3 C_3 E_3$	Field area (worst case, heavy duty)
$M_3 I_1 C_2 E_2$	Combination

Mechanical	M_1	M_2	M_3
IP-Rating	I_1	I_2	I_3
Climatic	C_1	C_2	C_3
Electromagnetic	E_1	E_2	E_3

Increasing stress



As a result of the increased demands made on transmission speeds and data rates, the Ethernet Protocol is also found besides bus technology in the world of automation, including field device controls.

New technologies (such as switching etc.) also make Ethernet suitable for real-time applications, allowing it to be used in the field of automation parallel to the Fieldbus.

The standard in office communication



Cable programme

Industrial Ethernet

In contrast to the office environment, the industrial environment is quite different and often presents harsh conditions, such as:

- High dust load
- High humidity
- Mechanical stress due to vibrations or impact
- High temperatures and temperature fluctuations

Corrosive or contaminating media such as acids, alkalis and oils

Characteristics

- Flame retardant
- Zero halogen
- Oil resistant
- Radiation-proof
- Perspiration-proof
- Abrasion-proof
- Suitable for drag chains
- Heat resistant

For cables in "harsh environments", IEC 62012 offers design elements and materials adapted to industrial environmental conditions.

For example:

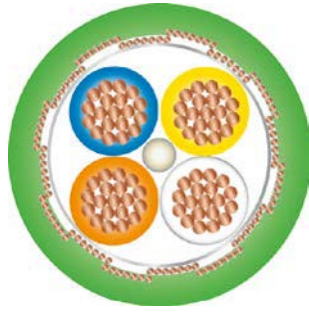
- 2-pair designs support Ethernet (10 Mbit/s) and Fast Ethernet (100 Mbit/s).
- 4-pair designs support all current and future protocols, i.e.: Ethernet (10 Mbit/s), Fast Ethernet (100 Mbit/s) and GigaBit Ethernet (1000 Mbit/s)
- S/FTP cables have one dual screen consisting of an individual and an overall screen. They have excellent EMC characteristics and superior electrical performance and are designed for industrial use.

They also support the transmission of several services under one sheath (cable sharing).


MegaLine®
Industrial Ethernet

PROFINET Type A CAT 5	PROFINET Type B CAT 5	
Industrial secondary and tertiary cabling acc. to EN 50173-3 and ISO/IEC 24702 for indoor application. (fixed installation)	Industrial secondary and tertiary cabling acc. to EN 50173-3 and ISO/IEC 24702 for indoor application. (flexible installation)	Application
2 x 2 x AWG 22/1 (quad)	2 x 2 x AWG 22/7 (quad)	Design Design
KS-2YY(St+C)Y	KS-2YY(St+C)Y	Dimension
green	green	Type
7KS01674	7KS01675	Outer sheath colour
		Part No.
		Construction
plain annealed copper, AWG 22/1	plain annealed copper, max. AWG 22/7	Conductor
polyethylene PE	polyethylene PE	Insulation
pair 1: blue/white – pair 2: orange/yellow	pair 1: blue/white – pair 2: orange/yellow	Colour code
cores twisted to quad	cores twisted to quad	Laying up
extruded thermoplastic material	extruded thermoplastic material	Inner sheath
plastic coated aluminium tape in contact with tinned copper wire braid, optical coverage approx. 85 %	plastic coated aluminium tape in contact with tinned copper wire braid, optical coverage approx. 85 %	Screen
polyvinyl chloride PVC	polyvinyl chloride PVC	Outer sheath
diameter 6.6 mm	diameter 6.7 mm	approx.
60 kg/km	60 kg/km	Weight approx.
8 x cable diameter	8 x cable diameter	Minimum bending radius
		Temperature range
-20 °C up to + 70 °C	-20 °C up to + 70 °C	-during operation
-5 °C up to + 50 °C	0 °C up to + 50 °C	-during installation
		Electrical properties
max. 57.1 Ω/km	max. 57.6 Ω/km	Conductor resistance
100 Ω ± 5 Ω	100 Ω ± 5 Ω	Impedance (f = 100 MHz)
200 MHz	200 MHz	Bandwidth
nominal 33 dB	nominal 33 dB	Next at
		Bandwidth frequency
nominal 24 dB/100 m	nominal 24 dB/100 m	Attenuation at
		Bandwidth frequency
nominal 90 dB	nominal 90 dB	Interference power suppression
		up to f = 1 GHz
		Other Properties
acc. to IEC 60332-3-24 (cat. C)	acc. to IEC 60332-3-24 (cat. C)	Flame retardant
please see our catalogue datacom-cable and cabling systems or visit our homepage www.leoni-datacom.com		Connectors/Glands

Further cable variations and part numbers on page 19.



MegaLine®

Industrial Ethernet

PROFINET TYPE C CAT 5

Application Industrial secondary and tertiary cabling acc. to EN 50173-3 and ISO/IEC 24702 for indoor application. (for drag chains)

Design

Dimension 2 x 2 x AWG 22/19 (Quad)

Type KS-2YH(St+C)11Y

Outer sheath colour green

Part No. 7KS01676

Construction

Conductor plain annealed copper, AWG 22/19

Insulation polyethylene PE

Colour code pair 1: blue/white – pair 2: orange/yellow

Laying up cores twisted to quad

Inner sheath extruded thermoplastic material

Screen plastic coated aluminium tape in contact with tinned copper wire braid, optical coverage approx. 85 %

Outer sheath polyurethane PUR,
approx. diameter 6.8 mm

Weight approx. 60 kg/km

Minimum bending radius 8 x cable diameter

Temperature range

-during operation -20 °C up to + 70 °C

-during installation -5 °C up to + 50 °C

Electrical properties

Conductor resistance max. 57.8 Ω/km

Impedance (f = 100 MHz) 100 Ω ± 5 Ω

Bandwidth 200 MHz

NEXT at nominal 33 dB

Bandwidth frequency

Attenuation at nominal 24 dB/100 m

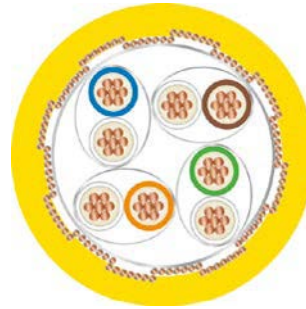
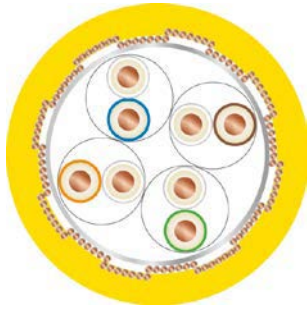
Bandwidth frequency

Interference power suppression nominal 90 dB
up to f = 1 GHz

Other Properties

Flame retardant acc. to IEC 60332-1-2

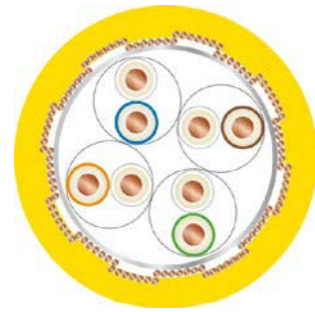
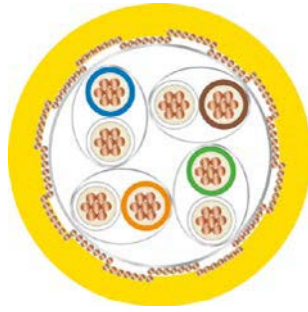
Connectors/Glands please see our catalogue datacom-cable and cabling systems or visit our homepage www.leoni-datacom.com
Further cable variations and part numbers on page 19.



MegaLine®

Industrial Ethernet

MegaLine® D1-20 SF/U HV CAT 5, heavy duty	MegaLine® F6-70 S/F HV flex CAT 7, heavy duty	
Industrial secondary and tertiary cabling acc. to EN 50173-3 and ISO/IEC 24702 for indoor application. (fixed installation)	Industrial secondary and tertiary cabling acc. to EN 50173-3 and ISO/IEC 24702 for indoor application. (fixed installation)	Application
4 x 2 x AWG 24/1	4 x 2 x AWG 24/7 PiMF	Design Dimension
KS-02YS(St+C)HV	KS-02YSC11Y	Type
yellow	yellow	Outer sheath colour
7KS50053	7KS70139	Part No.
plain annealed copper, AWG 24/1	plain annealed copper, AWG 24/7	Construction Conductor
foamed polyethylene with skin layer	foamed polyethylene with skin layer	Insulation
white/blue, white/orange, white/green, white/brown	white/blue, white/orange, white/green, white/brown	Colour code
cores to pairs, pairs to cable core	cores to pairs, pairs to cable core	Individual screen
plastic coated aluminium tape in contact with tinned copper wire braid, optical coverage approx. 40 %	plastic coated aluminium tape in contact with tinned copper wire braid, optical coverage approx. 65 %	Laying up
low smoke zero halogen compound LSZH	polyurethane PUR	Screen
diameter 6.6 mm	diameter 8.8 mm	Outer sheath
51 kg/km	78 kg/km	approx.
8 x cable diameter	5 x cable diameter	Weight approx.
-20 °C up to + 60 °C	-20 °C up to + 60 °C	Minimum bending radius
0 °C up to + 50 °C	-5 °C up to + 50 °C	Temperature range -during operation -during installation
max. 95 Ω/km	max. 84 Ω/km	Electrical properties Conductor resistance
100 Ω ± 5 Ω	100 Ω ± 5 Ω	Impedance (f = 100 MHz)
200 MHz	700 MHz	Bandwidth
nominal 40 dB	nominal 68 dB	NEXT at
nominal 26.5 dB/100 m	nominal 5.23 dB/100 m	Bandwidth frequency Attenuation at
nominal 90 dB	nominal 90 dB	Bandwidth frequency Interference power suppression up to f = 1 GHz
acc. to IEC 60332-3-24 (cat. C)	acc. to IEC 60332-1-2	Other Properties Flame retardant
please see our catalogue datacom-cable and cabling systems or visit our homepage www.leoni-datacom.com		Connectors/Glands
Further cable variations and part numbers on page 19.		



MegaLine®

Industrial Ethernet

MegaLine® E5-70 S/F 11Y flex CAT 6A, heavy duty

MegaLine® D1-20 SF/U 11Y flex CAT 5, heavy duty

Application	Industrial secondary and tertiary cabling acc. to EN 50173-3 and ISO/IEC 24702 for indoor application. (fixed installation)	Industrial workplace, work area and patch panel acc. to EN 50173-3 and ISO/IEC 24702 for indoor application (flexible installation)
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Design

Dimension 4 x 2 x AWG 27/7 PiMF

Type KS-02YSC11Y

Outer sheath colour yellow

Part no. 7KS60048

4 x 2 x AWG 26/7

KS-02YS(St+C)11Y

yellow

7KS50046

Construction

Conductor plain annealed copper, AWG 27/7

Insulation foamed polyethylene with skin layer

Colour code white/blue, white/orange, white/green, white/brown

Individual screen plastic coated aluminium tape

Laying up cores to pairs, pairs to cable core

plain annealed copper, AWG 26/7

foamed polyethylene with skin layer

white/blue, white/orange, white/green, white/brown

cores to pairs, pairs to cable core

Screen plastic coated aluminium tape in contact with tinned copper wire braid, optical coverage approx. 65 %

Outer sheath polyurethane PUR
diameter approx. 5.9 mm

Weight approx. 34 kg/km

plastic coated aluminium tape in contact with tinned copper wire braid, optical coverage, approx. 40 %

polyurethane PUR
diameter approx. 6 mm

approx. 37 kg/km

Minimum bending radius 5 x cable diameter

8 x cable diameter

Temperature range

-during operation -40 °C up to + 70 °C

-during installation 0 °C up to + 50 °C

-40 °C up to +70 °C

-10 °C up to +50 °C

Electrical properties

Conductor resistance max. 170 Ω/km

max. 145 Ω/km

Impedance (f = 100 MHz) 100 Ω ± 5 Ω

100 Ω ± 5 Ω

Bandwidth 700 MHz

200 MHz

NEXT at bandwidth frequency nominal 65 dB

nominal 42 dB

Attenuation at bandwidth frequency nominal 8.15 dB/100 m

nominal 3.86 dB/10 m

Interference power suppression up to f = 1 GHz nominal 90 dB

nominal 55 dB

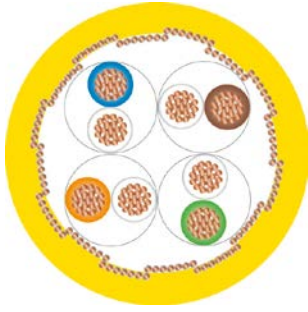
Other properties

Flame retardant acc. to IEC 60332-2-2

acc. to IEC 60332-1-2

Connectors/Glands please see our catalogue datacom-cable and cabling systems or visit our homepage www.leoni-datacom.com

Further cable variations and part numbers on page 19.



MegaLine®

Industrial Ethernet

MegaLine® D1-20 S/U 11Y superflex CAT 5, heavy duty	MegaLine® F10-130 S/F (L)2Y CAT 7A, heavy duty	
Industrial cabling acc. to EN 50173-3 and ISO/IEC 24702 for indoor application (for drag chains)	Industrial cabling acc. to EN 50173-3 and ISO/IEC 24702 for outdoor application. (fixed installation)	Application
4 x 2 x AWG 26/19	4 x 2 x AWG 22/1 PiMF	Design
KS-6Y3GC11Y	KS-02YSCH(L)2Y	Dimension
yellow	black	Type
7KS50051	7KS7002U	Outer sheath colour
		Part no.
		Construction
plain annealed copper, AWG 26/19	plain annealed copper, AWG 22/1	Conductor
plain annealed copper, AWG 24/19		
FEP	foamed polyethylene with skin layer	Insulation
white/blue, white/orange, white/green, white/brown	white/blue, white/orange, white/green, white/brown	Colour code
	plastic coated aluminium tape	Individual screen
cores to pairs, pairs to cable core	cores to pairs, pairs to cable core	Laying up
	zero halogen compound	Inner sheath
tinned copper wire braid, optical coverage, approx. 85 %	plastic coated aluminium tape in contact with tinned copper wire braid, optical coverage approx. 65 %	Screen
polyurethane PUR	aluminium tape laminated to polyethylene PE	Outer sheath
diameter approx. 6.8 mm – AWG 26/19	diameter approx. 12 mm	
diameter approx. 8.3 mm – AWG 24/19		
approx. 58 kg/km (AWG 26/19)	approx. 150 kg/km	Weight
approx. 84 kg/km (AWG 24/19)		
5 x cable diameter	8 x cable diameter	Minimum bending radius
		Temperature Range
–40 °C up to +85 °C	–25 °C up to +70 °C	-during operation
–0 °C up to +50 °C	–10 °C up to +50 °C	-during installation
		Electrical Properties
max. 130 Ω/km (AWG 26)	max. 57.1 Ω/km	Conductor resistance
max. 95 Ω/km (AWG 24)		
100 Ω ± 5 Ω	100 Ω ± 5 Ω	Impedance (f = 100 MHz)
100 MHz	1300 MHz	Bandwidth
nominal 45 dB	nominal 80 dB	NEXT at bandwidth frequency
nominal 3.95 dB/10 m (AWG 26)	61.4 dB/100 m	Attenuation at bandwidth frequency
nominal 3.15 dB/10 m (AWG 24)		
nominal 55 dB	nominal 70 dB	Interference power suppression up to f = 1 GHz
		Other properties
acc. to IEC 60332-1-2	acc. to IEC 60332-2-2	Flame retardant
please see our catalogue datacom-cable and cabling systems or visit our homepage www.leoni-datacom.com		Connectors/Glands

Further cable variations and part numbers on page 19.

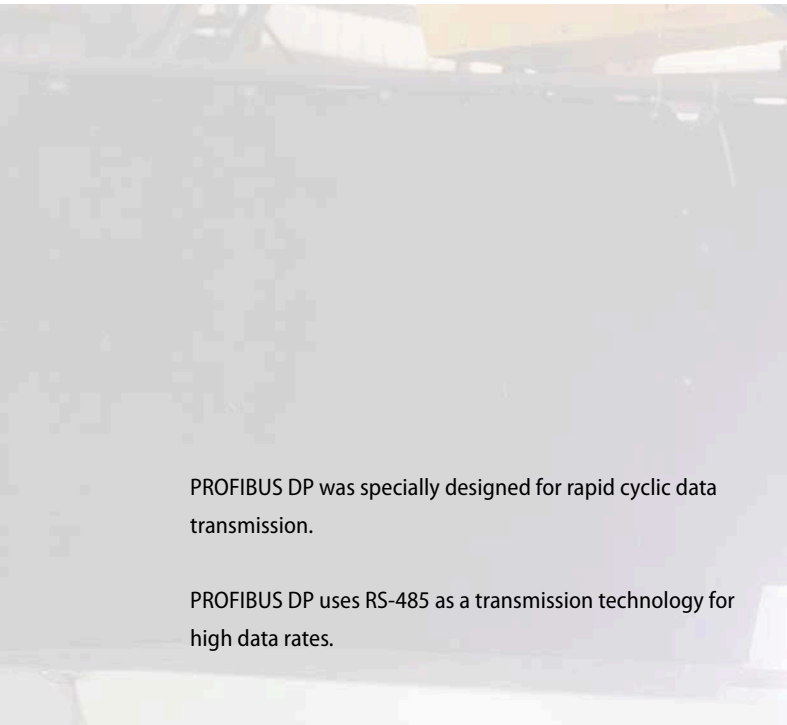
Notes:

MegaLine®

Overview of part numbers and cable variations

Industrial Ethernet

Cable		Type description	Size	Colour	Part number
ML 522MSC	with PVC PROFINET Type A, better than CAT 5	KS-2YY(St+C)Y	2 x 2 x AWG 22/1 (Quad)	green	7KS01674
ML 522MSC	with PVC PROFINET Type B, better than CAT 5	KS-2YY(St+C)Y	2 x 2 x AWG 22/7 (Quad)	green	7KS01675
ML 522MSC	with PUR PROFINET Type C, better than CAT 5	KS-2YH(St+C)11Y	2 x 2 x AWG 22/19 (Quad)	green	7KS01676
ML D1-20 SF/U HV	in LSZH zero halogen, flame retardant; better than CAT 5	KS-02YS(St+C)HV	4 x 2 x AWG 24/1	yellow	7KS50053
ML D1-20 SF/U 11V	with PUR flexible; better than CAT 5	KS-02YS(St+C)11Y	4 x 2 x AWG 24/1	yellow	7KS50046
ML F6-70 S/F HV	flex in LSZH zero halogen, flame retardant; better than CAT 7	KS-02YSCHV	4 x 2 x AWG 24/7 PiMF	yellow	7KS70139
ML F6-70 S/F flex	with PUR flexible; better than CAT 7	KS-02YSC11Y	4 x 2 x AWG 24/7 PiMF	yellow	7KS70139
ML E5-70 S/F flex	with PUR flexible; better than CAT 6A	KS-02YSC11Y	4 x 2 x AWG 27/7 PiMF	yellow	7KS60048
ML D1-20 S/U superflex	with PUR for drag chains; better than cat 5	KS-6Y3GC11Y	4 x 2 x AWG 26/19	yellow	7KS50051
ML D1-20 S/U superflex	with PUR for drag chains; better than cat 5	KS-6Y3GC11Y	4 x 2 x AWG 24/19	yellow	7KS50052
ML F10-130 S/F	with PE outer sheath for outdoor applications; better than Cat. 7	KS-02YSCH(L)2Y	4 x 2 x AWG 22/1 PiMF	black	7KS7002U



PROFIBUS DP was specially designed for rapid cyclic data transmission.

PROFIBUS DP uses RS-485 as a transmission technology for high data rates.

DP – Decentralized Periphery



Cable programme

PROFIBUS DP 150 Ω

The Business Unit Industrial Projects offers products for PROFIBUS DP which are optimised for the miscellaneous applications in automation technology.

The LEONI cable versions fulfil type A according to IEC 61158-2, i.e. the laying-up of cables are pairs with screen. Following cable versions are available:

Characteristics

- **Flame retardant**
- **Permanent installation**
- **Zero halogen**
- **Silicon free**
- **Oil resistant**
- **RoHS compliant**

Following cable versions are available:

Basic

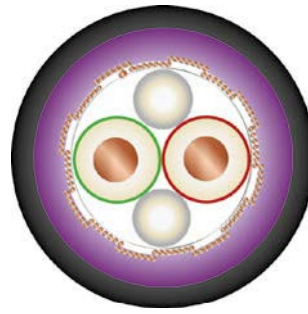
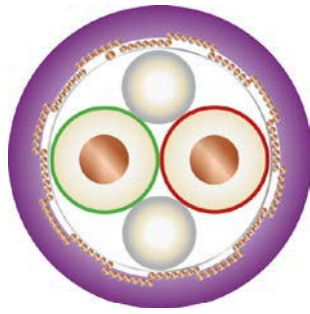
- Standard version for fixed installation.

Fast Assembly FA

- Such as standard version Basic, but suitable for fast assembly with special tool (see chapter “assembly” on page 52).

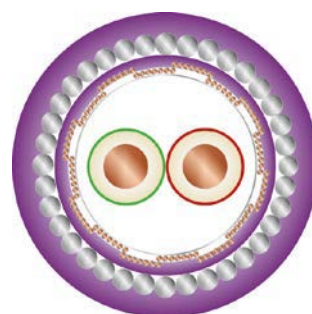
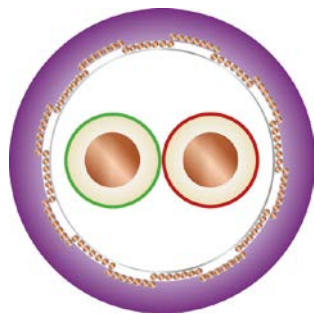
Flex

- Such as standard version Basic, but with 19-strands conductor for flexible installation.


ICON® Bus
**Profibus FMS/DP
150 Ω**

Basic 70 °C	Basic with PE sheath 70 °C	
Spur and trunk cable for fixed installation indoor and outdoor, on racks, in conduits.	Spur and trunk cable for fixed installation indoor and outdoor, on racks, trays, in conduits, in dry and wet locations. Suitable for direct burial.	Application
76770501	7677501V	Design
FB-02YS(St+Ce)Y-fl	FB-02YS(St+Ce)Y2Y	Part. No.
1 x 2 x AWG 22/1	1 x 2 x AWG 22/1	Type description
violet	violet	Product size
		Colour
		Construction
plain annealed copper wire, solid, size: AWG 22	plain annealed copper wire, solid, size: AWG 22	Conductor
foamed polyethylene with skin layer	foamed polyethylene with skin layer	Insulation
(+)-core: red, (-)-core: green	(+)-core: red, (-)-core: green	Colour code
plastic coated aluminium tape, metallic surface outside, in contact with tinned copper drain wire and tinned copper wire braid	plastic coated aluminium tape, metallic surface outside, in contact with tinned copper drain wire and tinned copper wire braid	Collective screen
polyvinyl chloride PVC	polyvinyl chloride PVC	Outer sheath
	polyethylene PE	Outer cover
7.5 x cable diameter	7.5 x cable diameter	Min. bending radius
75 kg/km	100 kg/km	Cable weight
		Temperature Range
-30°C up to +70°C	-30°C up to +70°C	- during operation
-5°C up to +50°C	-5°C up to +50°C	- during installation
		Electrical Properties at 20 °C
110 Ω/km	110 Ω/km	Conductor resistance (loop) max.
12 Ω/km	12 Ω/km	Screen resistance nom.
0.9 mH/km	0.9 mH/km	Inductance nom.
1.5 nF/km	1.5 nF/km	Capacit. unbalance to earth max.
150 Ω ± 15 Ω	150 Ω ± 15 Ω	Impedance at f ≥ 3 MHz
nom. 6 / 9 / 12 / 18 / 40 dB/km	nom. 6 / 9 / 12 / 18 / 40 dB/km	Attenuation at f = 0.25 / 0.625 / 1.25 / 3.125 / 16 MHz
		Other properties
UL 13 (vertical tray)	UL 13 (vertical tray) (without additional PE sheath)	Flame retardant
IEC 60332-3-24 (Cat. c)	IEC 60332-3-24 (Cat. c) (without PE)	- Test on single cable
ICEA S-73-532	ICEA S-73-532	- Test on bunched cables
UL 1581 section 1200	UL 1581 section 1200	Oil resistance
M 16	M 16 / M 12; 9-pin D-sub	Sunlight resistance
		Connectors/Glands

Further cable variations, part numbers and UL listed types on page 25.


ICON® Bus
**Profibus FMS/DP
150 Ω**
Fast Assembly 70 °C
Fast Assembly with steel wire armour 70 °C
Application

Spur and trunk cable for fixed installation indoor and outdoor, on racks, trays, in conduits, in dry and wet locations. Suitable for fast assembly tool.

Spur and trunk cable for fixed installation indoor and outdoor, on racks, trays, in conduits, in dry and wet locations. Recommended for increased mechanical stresses. Suitable for fast assembly tool.

Design
Part. No.

74220501

7422501U

Type description

FB-02YS(St+C)Y-fl

FB-02YS(St+C)YSWAY-fl

Product size

1 x 2 x AWG 22/1

1 x 2 x AWG 22/1

Colour

violet

violet

Construction
Conductor

plain annealed copper wire, solid, size: AWG 22

plain annealed copper wire, size: AWG 22

Insulation

foamed polyethylene with skin layer

foamed polyethylene with skin layer

Colour code

(+) -core: red, (-) -core: green

(+) -core: red, (-) -core: green

Collective screen

plastic coated aluminium tape in contact with tinned copper wire braid

plastic coated aluminium tape in contact with tinned copper wire braid

Filling material

extruded copolymer

extruded copolymer

Inner sheath 1 material

polyvinyl chloride PVC

Armour

galvanised round steel wires

Outer sheath material

polyvinyl chloride PVC

polyvinyl chloride PVC

Min. bending radius

7.5 x cable diameter

10 x cable diameter

Outer dia approx.

8.0 ± 0.4 mm

11.7 mm

Cable weight

78 kg/km

275 kg/km

Temperature Range

- during operation

-30°C up to +70°C

-30°C up to +70°C

- during installation

-5°C up to +50°C

-5°C up to +50°C

Electrical Properties at 20 °C
Conductor resistance (loop) max.

110 Ω/km

110 Ω/km

Screen resistance nom.

12 Ω/km

12 Ω/km

nom. Inductance

0.9 mH/km

0.9 mH/km

Capacit. unbalance to earth max.

1.5 nF/km

1.5 nF/km

Impedance at f ≥ 3 MHz

150 Ω ± 15 Ω

150 Ω ± 15 Ω

Attenuation at f = 0.25 / 0.625 / 1.25 / 3.125 / 16 MHz

nom. 6 / 9 / 12 / 18 / 40 dB/km

nom. 6 / 9 / 12 / 18 / 40 dB/km

Other properties
Flame retardant

- Test on single cable

UL 13 (vertical tray)

UL 13 (vertical tray)

- Test on bunched cables

IEC 60332-3-24 (Cat. c)

IEC 60332-3-24 (Cat. c)

Oil resistance

ICEA S-73-532

ICEA S-73-532

Sunlight resistance

UL 1581 section 1200

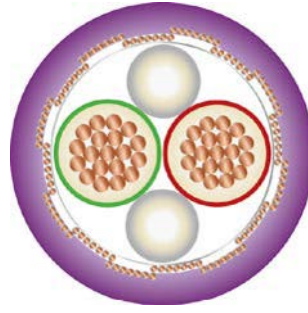
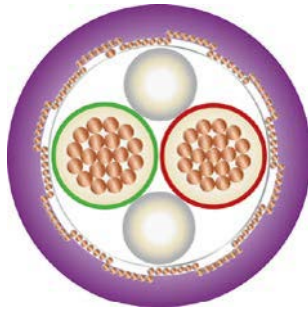
UL 1581 section 1200

Connectors/Glands

M 16 / M 12; 9-pin D-sub

M 16 / M 12; 9-pin D-sub

Further cable variations, part numbers and UL listed types on page 25.


ICON® Bus
**Profibus FMS/DP
150 Ω**

Flex 70 °C	Flex 70 °C	
Spur and trunk cable for flexible installation indoor and outdoor, on racks, trays, in conduits, in dry and wet locations.	Spur and trunk cable for flexible installation indoor and outdoor, on racks, trays, in conduits, in dry and wet locations.	Application
76770503	82050000	Design
FB-02YS(St+Ce)Y-fl	FB-02YS(St+C)11Y	Part. No.
1 x 2 x AWG 22/19	1 x 2 x AWG 22/19	Type description
violet	violet	Product size
		Colour
		Construction
plain annealed copper wire, multi stranded, size: AWG 22	plain annealed copper wire, multi stranded, size: AWG 22	Conductor
foamed polyethylene with skin layer	foamed polyethylene with skin layer	Insulation
(+)-core: red, (-)-core: green	(+)-core: red, (-)-core: green	Colour code
plastic coated aluminium tape, metallic surface outside, in contact with tinned copper drain wire and tinned copper wire braid	plastic coated aluminium tape in contact with tinned copper wire braid	Collective screen
polyvinyl chloride PVC	polyurethane PUR	Outer sheath material
10 x cable diameter	10 x cable diameter	Min. bending radius - repeated bending
7.5 x cable diameter	7.5 x cable diameter	- single bending
8.9 mm	7.8 mm	Outer dia approx.
80 kg/km	60 kg/km	Cable weight
		Temperature Range
-30°C up to +70°C	-30°C up to +70°C	- during operation
-5°C up to +50°C	-5°C up to +50°C	- during installation
		Electrical Properties at 20 °C
110 Ω/km	110 Ω/km	Conductor resistance (loop) max.
12 Ω/km	12 Ω/km	Screen resistance nom.
0.9 mH/km	0.9 mH/km	Inductance nom.
1.5 nF/km	1.5 nF/km	Capacit. unbalance to earth max.
150 Ω ± 15 Ω	150 Ω ± 15 Ω	Impedance at f ≥ 3 MHz
nom. 6 / 9 / 12 / 18 / 40 dB/km	nom. 6 / 9 / 12 / 18 / 40 dB/km	Attenuation at f = 0.25 / 0.625 / 1.25 / 3.125 / 16 MHz
		Other properties
		Flame retardant
UL 13 (vertical tray)		- Test on single cable
IEC 60332-3-24 (Cat. c)		- Test on bunched cables
ICEA S-73-532	ICEA S-73-532	Oil resistance
UL 1581 section 1200		Sunlight resistance
M 16	M 16 / M 12; 9-pin D-sub	Connectors/Glands

Further cable variations, part num-bers and UL listed types on page 25.

Notes:



Overview of part numbers and cable variations

Profibus FMS/DP
150 Ω

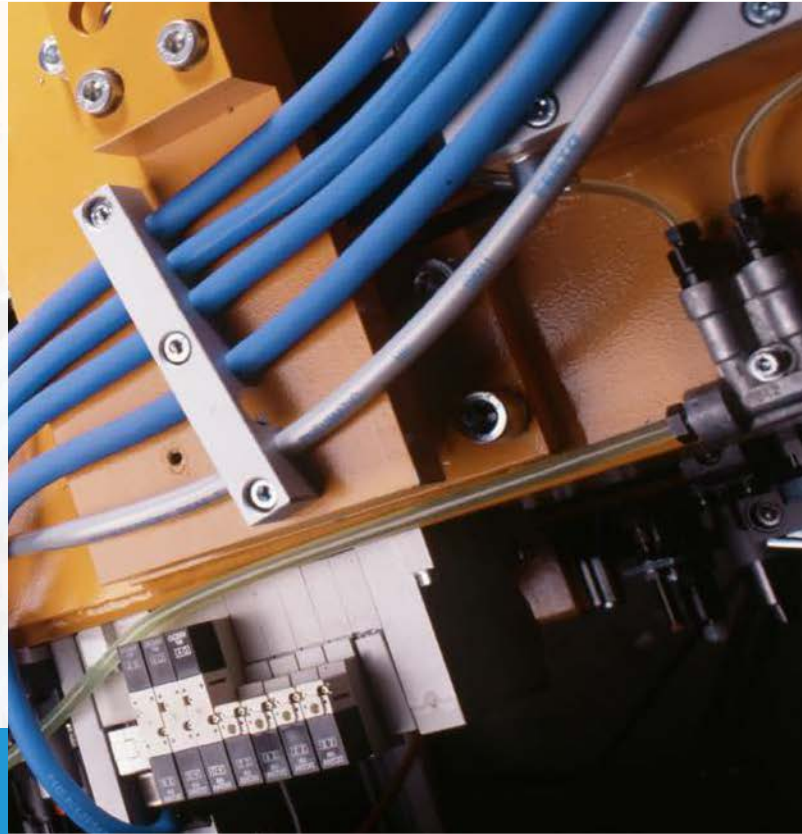
Cable	Type description	Size	Part number			
			UL approval (75 °C)*		EN 50288-7 (70 °C)	
			blue	violet	blue	violet
70 °C / 75 °C						
Basic	FB-02YS(St+Ce)Y-fl	1 x 2 x AWG 22/1	76770302	76770301	76770502	76770501
Basic with Padditional PE sheath	FB-02YS(St+Ce)Y2Y	1 x 2 x AWG 22/1	---	---	7677502V	7677501V
Basic, zero halogen	FB-02YS(St+Ce)H	1 x 2 x AWG 22/1	79260302	79260301	79260502	79260501
Basic with steel wire armour	FB-02YS(St+Ce)YSWAY-fl	1 x 2 x AWG 22/1	7677302U	7677301U	7677502U	7677501U
Basic with steel wire armour, zero halogen	FB-02YS(St+Ce)HSAWAH	1 x 2 x AWG 22/1	7926302U	7926301U	7926502U	7926501U
Flex	FB-02YS(St+Ce)Y-fl	1 x 2 x AWG 22/19	76770304	76770303	76770504	76770503
Flex with PUR	FB-02YS(St+C)11Y	1 x 2 x AWG 22/19	---	---	82050001	82050000
Flex, zero halogen	FB-02YS(St+Ce)H	1 x 2 x AWG 22/19	79260304	79260303	79260504	79260503
Fast Assembly	FB-02YS(St+C)Y-fl	1 x 2 x AWG 22/1	74220301	74220302	74220502	74220501
Fast Assembly with additional PE sheath	FB-02YS(St+C)Y2Y	1 x 2 x AWG 22/1	---	---	7422502V	7422501V
Fast Assembly, zero halogen	FB-02YS(St+C)H	1 x 2 x AWG 22/1	74360301	74360302	74360502	74360501
Fast Assembly, steel wire armour	FB-02YS(St+C)YSWAY-fl	1 x 2 x AWG 22/1	7422301U	7422302U	7422502U	7422501U
Fast Assembly, steel wire armour, zero halogen	FB-02YS(St+C)HSAWAH	1 x 2 x AWG 22/1	7436301U	7436302W	---	---
Fast Assembly, steel wire braid, zero halogen	FB-02YS(St+C)HQH	1 x 2 x AWG 22/1	---	---	7436301V	7436302X

* UL file E107687

The PROFIBUS PA is used in the field of process automation and its special characteristics are power supply over bus and intrinsic safety.

The transmission technology used MBP (Manchester Coded Bus Powered). MBP is synchronous transmission with a fixed transmission rate of 31.25 kbit/s and Manchester-II coding.

The intrinsically safe PROFIBUS PA is connected to the PROFIBUS DP via segments couplers or links.



PA – Process Automation

Cable programme

PROFIBUS PA 100 Ω

The Business Unit Industrial Projects offers products for PROFIBUS PA which are optimised for the miscellaneous applications in automation technology.

The LEONI cable versions fulfil type A according to IEC 61158-2, i.e. the laying-up of cables are pairs with screen.

Characteristics

- **Flame retardant**
- **Permanent installation**
- **Zero halogen**
- **Silicon free**
- **Oil resistant**
- **RoHS compliant**

Following cable versions are available:

Basic

- Standard version for fixed installation.

Fast Assembly FA

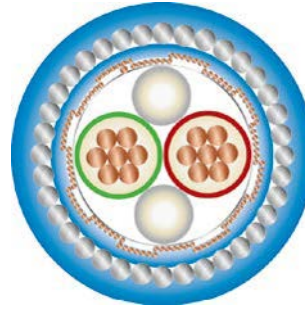
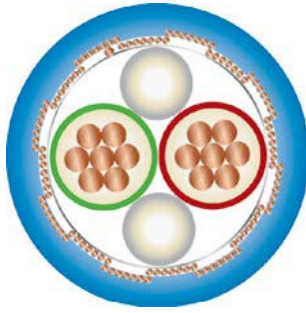
- Such as standard version Basic, but suitable for fast assembly with special tool (see chapter “assembly” on page 66).

Flex

- Such as standard version Basic, but with 19-strands conductor for flexible installation.

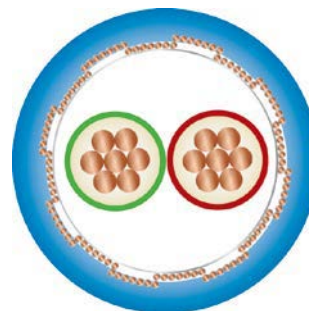
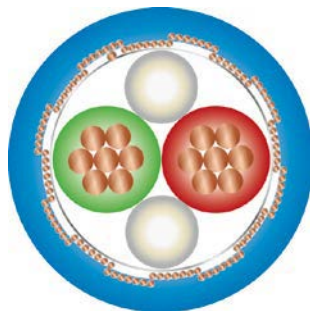
Long Distance

- Version with PE-insulation and sizes AWG 16/7 or AWG 14/7 as trunk cable with reduced voltage drop.


ICON® Bus

Basic 70 °C	Basic with steel wire armour 70 °C	Profibus PA 100 Ω
Spur and trunk cable for fixed installation indoor and outdoor, on racks, trays, in conduits, in dry and wet locations.	Spur and trunk cable for fixed installation indoor and outdoor, on racks, trays, in conduits, in dry and wet locations. Suitable for direct burial and increased mechanical stresses.	Application
76770601	7677601U	Design
FB-02YS(St+Ce)Y-fl	FB-02YS(St+Ce)YSWAY-fl	Part. No.
1 x 2 x AWG 18/7	1 x 2 x AWG 18/7	Type description
blue	blue	Product size
		Colour
		Construction
plain annealed copper wire, stranded, size: AWG 18	plain annealed copper wire, stranded, size: AWG 18	Conductor
foamed polyethylene with skin layer	foamed polyethylene with skin layer	Insulation
(+)-core: red, (-)-core: green	(+)-core: red, (-)-core: green	Colour code
plastic coated aluminium tape, metallic surface outside, in contact with tinned copper drain wire and tinned copper wire braid	plastic coated aluminium tape, metallic surface outside, in contact with tinned copper drain wire and tinned copper wire braid	Collective screen
--	polyvinyl chloride PVC	Inner sheath
--	galvanised round steel wires	Armour
polyvinyl chloride PVC	polyvinyl chloride PVC	Outer sheath material
7.5 x cable diameter	10 x cable diameter	Min. bending radius - repeated bending
7.9 mm	12.0 mm	Outer dia approx.
75 kg/km	275 kg/km	Cable weight
		Temperature Range
-30°C up to +70°C	-30°C up to +70°C	- during operation
-5°C up to +50°C	-5°C up to +50°C	- during installation
		Electrical Properties at 20 °C
43.6 Ω/km	43.6 Ω/km	Conductor resistance (loop) max.
12 Ω/km	12 Ω/km	Screen resistance nom..
60 nF/km	60 nF/km	Mutual capacitance nom.
0.7 mH/km	0.7 mH/km	Inductance nom.
2 nF/km	2 nF/km	Capacit. unbalance to earth max.
100 Ω ± 20 Ω	100 Ω ± 20 Ω	Impedance at f = 31.25 kHz
3.0 dB/km	3.0 dB/km	Attenuation at f = 39 kHz max.
1.7 μs/km	1.7 μs/km	Propagation delay change max. (f = 7.9 kHz - 39 kHz)
		Other properties
		Flame retardant
UL 13 (vertical tray)	UL 13 (vertical tray)	- Test on single cabl
IEC 60332-3-24 (Cat. c)	IEC 60332-3-24 (Cat. c)	- Test on bunched cables
ICEA S-73-532	ICEA S-73-532	Oil resistance
UL 1581 section 1200	UL 1581 section 1200	Sunlight resistance
M 16 / M 12	M 16 / M 12	Connectors/Glands

Further cable variations, part numbers and UL listed types on page 31.



ICON® Bus

Profibus PA 100 Ω

Basic 90 °C

Fast Assembly 70 °C

Application

Spur and trunk cable for fixed installation indoor and outdoor, on racks, trays, in conduits, in dry and wet locations.

Spur and trunk cable for fixed installation indoor and outdoor, on racks, trays, in conduits, in dry and wet locations. Suitable for fast assembly tool.

Design

Part. No.

76990601

74220601

Type description

FB-2X(St+Ce)Y-fl

FB-02YS(St+C)Y-fl

Product size

1 x 2 x AWG 18/7

1 x 2 x AWG 18/7

Colour

blue

blue

Construction

Conductor

plain annealed copper wire, stranded, size: AWG 18

plain annealed copper wire, stranded, size: AWG 18

Insulation

cross-linked polyethylene XLPE

foamed polyethylene with skin layer

Colour code

(+)-core: red, (-)-core: green

(+)-core: red, (-)-core: green

Collective screen

plastic coated aluminium tape, metallic surface outside, in contact with tinned copper drain wire and tinned copper wire braid

plastic coated aluminium tape in contact with tinned copper wire braid

Filling material

extruded copolymer

Outer sheath material

polyvinyl chloride PVC

polyvinyl chloride PVC

Min. bending radius

7.5 x cable diameter

7.5 x cable diameter

- repeated bending

Outer dia approx.

8.1 mm

8.1 mm

Cable weight

85 kg/km

90 kg/km

Temperature Range

- during operation

-30°C up to +90°C

-30°C up to +70°C

- during installation

-5°C up to +50°C

-5°C up to +50°C

Electrical Properties at 20 °C

Conductor resistance (loop) max.

43.6 Ω/km

43.6 Ω/km

Screen resistance nom.

12 Ω/km

12 Ω/km

Mutual capacitance nom.

60 nF/km

60 nF/km

nom. Inductance

0.7 mH/km

0.7 mH/km

Capacit. unbalance to earth max.

2 nF/km

2 nF/km

Impedance at f = 31.25 kHz

100 Ω ± 20 Ω

100 Ω ± 20 Ω

Attenuation at f = 39 kHz max.

3.0 dB/km

3.0 dB/km

Propagation delay change

1.7 µs/km

1.7 µs/km

max. (f = 7.9 kHz - 39 kHz)

Other properties

Flame retardant

- Test on single cable

UL 13 (vertical tray)

UL 13 (vertical tray)

- Test on bunched cables

IEC 60332-3-24 (Cat. c)

IEC 60332-3-24 (Cat. c)

Oil resistance

ICEA S-73-532

ICEA S-73-532

Sunlight resistance

UL 1581 section 1200

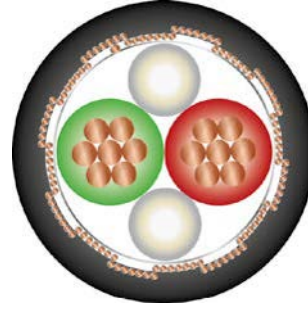
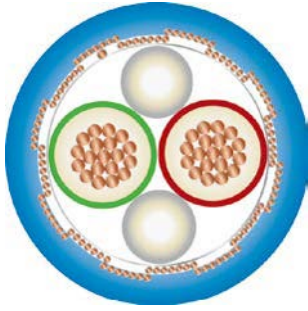
UL 1581 section 1200

Connectors/Glands

M 16 / M12

M 16 / M12

Further cable variations, part numbers and UL listed types on page 31.


ICON® Bus
Profibus PA 100 Ω

Flex 70 °C	Long Distance 70 °C	
Spur and trunk cable for flexible installation indoor and outdoor, on racks, trays, in conduits, in dry and wet locations.	Trunk cable for fixed installation indoor and outdoor, on racks, trays, in conduits, in dry and wet locations. Between Segment-Coupler and "Field-Barrier-Device".	Application
76770603	79290604	Design
FB-02YS(St+Ce)Y-fl	FB-2Y(St+Ce)Y-fl	Part. No.
1 x 2 x AWG 18/19	1 x 2 x AWG 14/7	Type description
blue	black	Product size
		Colour
		Construction
plain annealed copper wire, multi stranded, size: AWG 18	plain annealed copper wire, stranded, size: AWG 14	Conductor
foamed polyethylene with skin layer	polyethylene PE	Insulation
(+)-core: red, (-)-core: green	(+)-core: red, (-)-core: green	Colour code
plastic coated aluminium tape, metallic surface outside, in contact with tinned copper drain wire and tinned copper wire braid	plastic coated aluminium tape, metallic surface outside, in contact with tinned copper drain wire and tinned copper wire braid	Collective screen
polyvinyl chloride PVC	polyvinyl chloride PVC	Outer sheath material
10 x cable diameter	10 x cable diameter	Min. bending radius - repeated bending
7.5 x cable diameter	7.5 x cable diameter	- single bending
90 kg/km	160 kg/km	Cable weight
		Temperature Range
-30°C up to +70°C	-30°C up to +70°C	- during operation
-5°C up to +50°C	-5°C up to +50°C	- during installation
		Electrical Properties at 20 °C
43.6 Ω/km	17.9 Ω/km	Conductor resistance (loop) max.
12 Ω/km	12 Ω/km	Screen resistance nom.
60 nF/km	60 nF/km	Mutual capacitance nom.
0.7 mH/km	0.7 mH/km	Inductance nom.
2 nF/km	2 nF/km	Capacit. unbalance to earth max.
100 Ω ± 20 Ω	100 Ω ± 20 Ω	Impedance at f = 31.25 kHz
3.0 dB/km	3.0 dB/km	Attenuation at f = 39 kHz max.
1.7 μs/km	1.7 μs/km	Propagation delay change max. (f = 7.9 kHz - 39 kHz)
		Other properties
		Flame retardant
UL 13 (vertical tray)	UL 13 (vertical tray)	- Test on single cable
IEC 60332-3-24 (Cat. c)	IEC 60332-3-24 (Cat. c)	- Test on bunched cables
ICEA S-73-532	ICEA S-73-532	Oil resistance
UL 1581 section 1200	UL 1581 section 1200	Sunlight resistance
M 16 / M 12	M 16 / M 12	Connectors/Glands

Further cable variations, part numbers and UL listed types on page 31.

Notes:



Overview of part numbers and cable variations

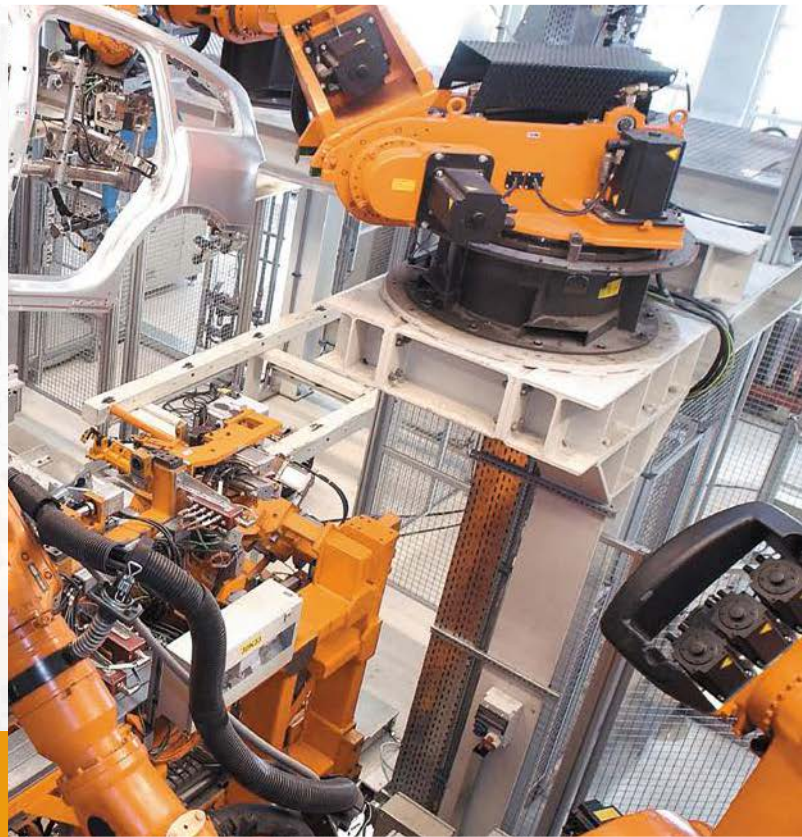
Profibus PA 100 Ω

Cable		Type description	Size	Part number			
				UL-approved (75 °C)		EN 50288-7 (70 °C)	
				black	blue	black	blue
70 °C / 75 °C							
Basic		FB-02YS(St+Ce)Y-fl	1 x 2 x AWG 18/7	76770101	76770100	76770602	76770601
Basic, zero halogen		FB-02YS(St+Ce)H	1 x 2 x AWG 18/7	79260101	79260100	79260602	79260601
Basic with steel wire armour		FB-02YS(St+Ce)YSWAY-fl	1 x 2 x AWG 18/7	7677101V	7677100V	7677602U	7677601U
Basic with steel wire armour, zero halogen		FB-02YS(St+Ce)HSAWH	1 x 2 x AWG 18/7	7926101U	7926100U	7926602U	7926601U
Fast Assembly		FB-02YS(St+C)Y-fl	1 x 2 x AWG 18/7	74220101	74220100	74220602	74220601
Fast Assembly, zero halogen		FB-02YS(St+C)H	1 x 2 x AWG 18/7	74360101	74360100	74360602	74360601
Flex		FB-02YS(St+Ce)Y-fl	1 x 2 x AWG 18/19	76770201	76770200	76770604	76770603
Flex, zero halogen		FB-02YS(St+Ce)H	1 x 2 x AWG 18/19	79260201	79260202	79260604	79260603
Long Distance		FB-2Y(St+Ce)Y-fl	1 x 2 x AWG 14/7	79290103	79290102	79290604	79290603
Long Distance, zero halogen		FB-2Y(St+Ce)H	1 x 2 x AWG 14/7	79300103	79300102	79300604	79300603
				UL-approved (90 °C)		EN 50288-7 (90 °C)	
				black	blue	black	blue
90 °C							
Basic with XLPE Insulation		FB-2X(St+Ce)Y-fl	1 x 2 x AWG 18/7	76990101	76990100	76990602	76990601

* UL file E107687

With the FOUNDATION™ Fieldbus, the “host device” only monitors the procedures. Within process automation, the FF forms a so-called LAN (Local Area Network) and the FF devices are connected to H1 links. Several H1 links are connected to the high-performance network HSE High-Speed-Ethernet via linking devices. Individual devices can also be directly connected to the HSE network.

Bus system for process automation



Cable programme

FOUNDATION™ Fieldbus 100 Ω

The Business Unit Industrial Projects offers products for the FOUNDATION™ Fieldbus which are optimised for the miscellaneous applications in automation technology.

The LEONI cable versions fulfil type A according to IEC 61158-2, i.e. the laying-up of cables are pairs with screen.

Characteristics

- Flame retardant
- Permanent installation
- Zero halogen
- Silicon free
- Oil resistant
- RoHS compliant

Following cable versions are available:

Basic

- Standard version for fixed installation.

Fast Assembly FA

- Such as standard version Basic, but suitable for fast assembly with special tool (see chapter “assembly” on page 66).

Flex

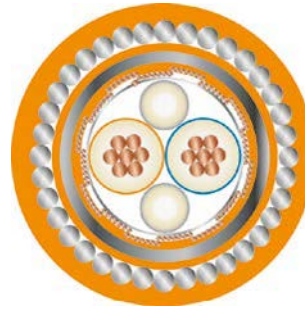
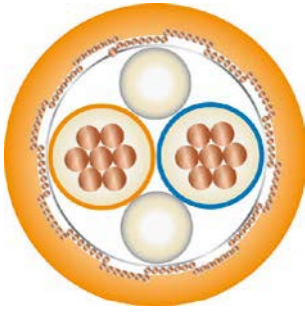
- Such as standard version Basic, but with 19-strands conductor for flexible installation.

Eco

- Such as standard Basic, but without braided screen.

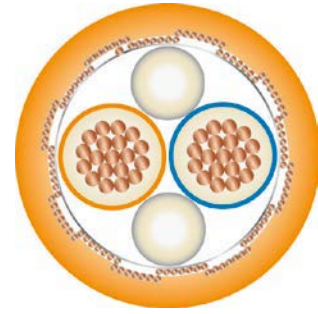
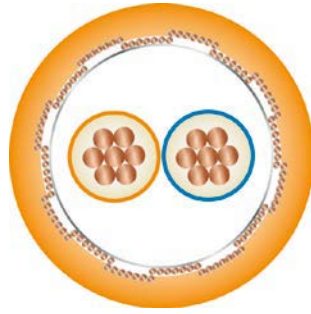
Long Distance

- Version with PE-Insulation and sizes AWG 16/7 or AWG 14/7 as trunk cable with reduced voltage drop.


ICON® Bus

Basic 70 °C	Basic 70 °C, lead sheath with steel wire armour	FOUNDATION Fieldbus H1 100 Ω
Spur and trunk cable for fixed installation indoor and outdoor, on racks, trays, in conduits, in dry and wet locations.	Spur and trunk cable for fixed installation indoor and outdoor, on racks, trays, in conduits, in dry and wet locations. Recommended for direct burial, especially in presence of oil and aggressive chemical substances.	Application
76770605	82380002	Design
FB-02YS(St+Ce)Y-fl	FB-02YS(St+Ce)YMYSWAY-fl	Part. No.
1 x 2 x AWG 18/7	1 x 2 x AWG 18/7	Type description
orange	orange	Product size
		Colour
		Construction
plain annealed copper wire, stranded, size: AWG 18	plain annealed copper wire, stranded, size: AWG 18	Conductor
foamed polyethylene with skin layer	foamed polyethylene with skin layer	Insulation
(+)-core: orange, (-)-core: blue	(+)-core: orange, (-)-core: blue	Colour code
plastic coated aluminium tape, metallic surface outside, in contact with tinned copper drain wire and tinned copper wire braid	plastic coated aluminium tape, metallic surface outside, in contact with tinned copper drain wire and tinned copper wire braid	Collective screen
	polyvinyl chloride PVC, orange	Inner sheath 1
	lead sheath	Metallic sheath
	polyvinyl chloride PVC, orange	Inner sheath 2
	galvanised round steel wires	Armour
polyvinyl chloride PVC	polyvinyl chloride PVC	Outer sheath material
7.5 x cable diameter	15 x cable diameter	Min. bending radius
7.9 mm	16.3 mm	Outer dia approx.
75 kg/km	710 kg/km	Cable weight
		Temperature Range
-30°C up to +70°C	-30°C up to +70°C	- during operation
-5°C up to +50°C	-5°C up to +50°C	- during installation
		Electrical Properties at 20 °C
43.6 Ω/km	43.6 Ω/km	Conductor resistance (loop) max.
12 Ω/km	12 Ω/km	Screen resistance nom.
60 nF/km	60 nF/km	Mutual capacitance nom.
0.7 mH/km	0.7 mH/km	Inductance nom.
2 nF/km	2 nF/km	Capacit. unbalance to earth max.
100 Ω ± 20 Ω	100 Ω ± 20 Ω	Impedance at f = 31.25 kHz
3.0 dB/km	3.0 dB/km	Attenuation at f = 39 kHz max.
1.7 μs/km	1.7 μs/km	Propagation delay change max. (f = 7.9 kHz - 39 kHz)
		Other properties
		Flame retardant
UL 13 (vertical tray)	UL 13 (vertical tray)	- Test on single cable
EC 60332-3-24 (Cat. c)	IEC 60332-3-24 (Cat. c)	- Test on bunched cables
ICEA S-73-532	ICEA S-73-532	Oil resistance
UL 1581 section 1200	UL 1581 section 1200	Sunlight resistance
M 16 / M 12	M 16 / M 12	Connectors/Glands

Further cable variations, part numbers and UL listed types on page 46.


ICON® Bus
**FOUNDATION™ Fieldbus
H1 100 Ω**
Fast Assembly 70 °C
Flex 70 °C
Application

Spur and trunk cable for fixed installation indoor and outdoor, on racks, trays, in conduits, in dry and wet locations. Suitable for fast assembly tool.

Spur and trunk cable for flexible installation indoor and outdoor, on racks, trays, in conduits, in dry and wet locations.

Design
Part. No.

74220603

76770607

Type description

FB-02YS(St+C)Y-fl

FB-02YS(St+Ce)Y-fl

Product size

1 x 2 x AWG 18/7

1 x 2 x AWG 18/19

Colour

orange

orange

Construction
Conductor

plain annealed copper wire, stranded, size: AWG 18

plain annealed copper wire, multi stranded, size: AWG 18

Insulation

foamed polyethylene with skin layer

foamed polyethylene with skin layer

Colour code

(+) -core: orange, (-) -core: blue

(+) -core: orange, (-) -core: blue

Collective screen

plastic coated aluminium tape in contact with tinned copper wire braid

plastic coated aluminium tape, metallic surface outside, in contact with tinned copper drain wire and tinned copper wire braid

Filling material

extruded copolymer

Inner sheath 1 material
Outer sheath material

polyvinyl chloride PVC

polyvinyl chloride PVC

Min. bending radius

7.5 x cable diameter

7.5 x cable diameter

Cable weight

95 kg/km

90 kg/km

Temperature Range

- during operation

-30°C up to +70°C

-30°C up to +70°C

- during installation

-5°C up to +50°C

-5°C up to +50°C

Electrical Properties at 20 °C
Conductor resistance (loop) max.

43.6 Ω/km

43.6 Ω/km

Screen resistance nom.

12 Ω/km

12 Ω/km

Mutual capacitance nom.

60 nF/km

60 nF/km

Inductance nom

0.7 mH/km

0.7 mH/km

Capacit. unbalance to earth max.

2 nF/km

2 nF/km

Impedance at f = 31.25 kHz

100 Ω ± 20 Ω

100 Ω ± 20 Ω

Attenuation at f = 39 kHz max.

3.0 dB/km

3.0 dB/km

Propagation delay change max. (f = 7.9 kHz - 39 kHz)

1.7 µs/km

1.7 µs/km

Other properties

- Test on single cable

UL 13 (vertical tray)

UL 13 (vertical tray)

- Test on bunched cables

IEC 60332-3-24 (Cat. c)

IEC 60332-3-24 (Cat. c)

Oil resistance

ICEA S-73-532

ICEA S-73-532

Sunlight resistance

UL 1581 section 1200

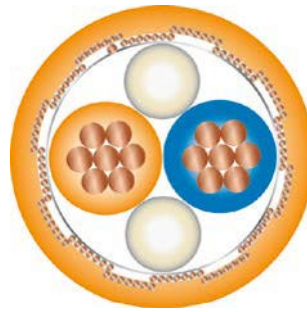
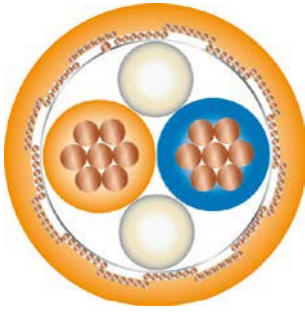
UL 1581 section 1200

Connectors/glands

M 16 / M12

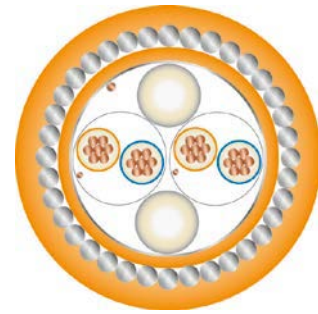
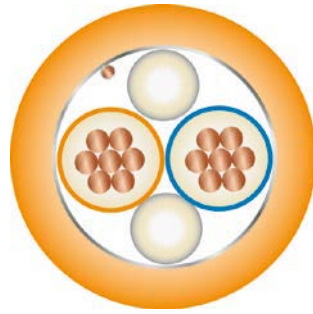
M 16 / M12

Further cable variations, part numbers and UL listed types on page 46.


ICON® Bus

Long Distance 70 °C AWG 16	Long Distance 70 °C AWG 14	FOUNDATION Fieldbus H1 100 Ω
Trunk cable for fixed installation indoor and outdoor, on racks, trays, in conduits, in dry and wet locations. Between Segment-Coupler and "Field-Barrier-Device". Recommended for use as fire protection measure for people and important material assets.	Trunk cable for fixed installation indoor and outdoor, on racks, trays, in conduits, in dry and wet locations. Between Segment-Coupler and "Field-Barrier-Device". Recommended for use as fire protection measure for people and important material assets.	Application
79300605	79300607	Design
FB-2Y(St+Ce)H	FB-2Y(St+Ce)H	Part. No.
1 x 2 x AWG 16/7	1 x 2 x AWG 14/7	Type description
orange	orange	Product size
		Colour
		Construction
plain annealed copper wire, stranded, size: AWG 16	plain annealed copper wire, stranded, size: AWG 14	Conductor
polyethylene PE	polyethylene PE	Insulation
(+)-core: orange, (-)-core: blue	(+)-core: orange, (-)-core: blue	Colour code
plastic coated aluminium tape, metallic surface outside, in contact with tinned copper drain wire and tinned copper wire braid	plastic coated aluminium tape, metallic surface outside, in contact with tinned copper drain wire and tinned copper wire braid	Collective screen
low smoke zero halogen flame retardant compound LSZH	low smoke zero halogen flame retardant compound LSZH	Outer sheath material
7.5 x cable diameter	7.5 x cable diameter	Min. bending radius - repeated bending
115 kg/km	160 kg/km	Cable weight
		Temperature Range
-30°C up to +70°C	-30°C up to +70°C	- during operation
-5°C up to +50°C	-5°C up to +50°C	- during installation
		Electrical Properties at 20 °C
28.5 Ω/km	17.9 Ω/km	Conductor resistance (loop) max.
12 Ω/km	12 Ω/km	Screen resistance nom.
60 nF/km	60 nF/km	Mutual capacitance nom.
0.7 mH/km	0.7 mH/km	Inductance nom
2 nF/km	2 nF/km	Capacit. unbalance to earth max.
100 Ω ± 20 Ω	100 Ω ± 20 Ω	Impedance at f = 31.25 kHz
3.0 dB/km	3.0 dB/km	Attenuation at f = 39 kHz max.
1.7 µs/km	1.7 µs/km	Propagation delay change max. (f = 7.9 kHz - 39 kHz)
		Other properties
		Flame retardant
UL 13 (vertical tray)	UL 13 (vertical tray)	- Test on single cable
IEC 60332-3-24 (Cat. c)	IEC 60332-3-24 (Cat. c)	- Test on bunched cables
ICEA S-73-532 (*)	ICEA S-73-532 (*)	Oil resistance
UL 1581 section 1200	UL 1581 section 1200	Sunlight resistance
M 16	M 16	Connectors / glands

Further cable variations, part numbers and UL listed types on page 46.



ICON® Bus

FOUNDATION™ Fieldbus H1 100 Ω

Eco 70 °C

Eco 70 °C with steel wire armour

Application

Spur and trunk cable for fixed installation indoor and outdoor, on racks, trays, in conduits, in dry and wet locations.

Spur and trunk cable for fixed installation indoor and outdoor, on racks, trays, in conduits, in dry and wet locations. Suitable for direct burial and increased mechanical stresses.

Design

Part. No. 74250601

7425601U

Type description FB-02YS(St)Y-fl

FB-02YS(St)YSWAY-fl

Product size 1 x 2 x AWG 18/7

1 x 2 x AWG 18/7

Colour orange

orange

Construction

Conductor plain annealed copper wire, stranded, size: AWG 18

plain annealed copper wire, stranded, size: AWG 18

Insulation foamed polyethylene with skin layer

foamed polyethylene with skin layer

Colour code (+)-core: orange, (-)-core: blue

(+)-core: orange, (-)-core: blue

Collective screen plastic coated aluminium tape in contact with tinned copper drain wire

plastic coated aluminium tape in contact with tinned copper drain wire

Inner sheath 1 material

polyvinyl chloride PVC, orange

Armour

galvanised round steel wires

Outer sheath material polyvinyl chloride PVC

polyvinyl chloride PVC

Min. bending radius - repeated bending 7.5 x cable diameter

10 x cable diameter

Outer dia. 8.2 mm

11.8 mm

Cable weight 85 kg/km

260 kg/km

Temperature Range

- during operation -30°C up to +70°C

-30°C up to +70°C

- during installation -5°C up to +50°C

-5°C up to +50°C

Electrical Properties at 20 °C

Conductor resistance (loop) max. 43.6 Ω/km

43.6 Ω/km

Screen resistance nom. 30 Ω/km

30 Ω/km

Mutual capacitance nom. 60 nF/km

60 nF/km

Inductance nom. 0.7 mH/km

0.7 mH/km

Capacit. unbalance to earth max. 2 nF/km

2 nF/km

Impedance at f = 31.25 kHz 100 Ω ± 20 Ω

100 Ω ± 20 Ω

Attenuation at f = 39 kHz max. 3.0 dB/km

3.0 dB/km

Propagation delay change max. (f = 7.9 kHz - 39 kHz) 1.7 μs/km

1.7 μs/km

Other properties

Flame retardant

- Test on single cable UL 13 (vertical tray)

UL 13 (vertical tray)

- Test on bunched cables IEC 60332-3-24 (Cat. c)

IEC 60332-3-24 (Cat. c)

Oil resistance ICEA S-73-532

ICEA S-73-532

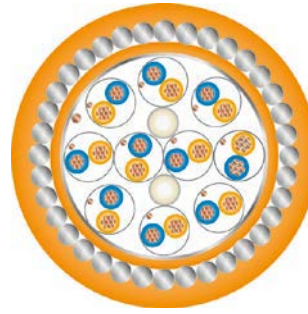
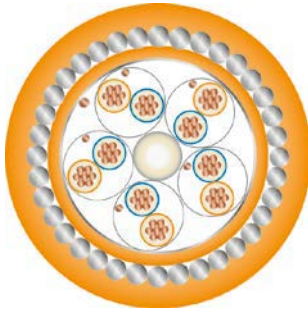
Sunlight resistance UL 1581 section 1200

UL 1581 section 1200

Connectors/glands M 16 / M 12

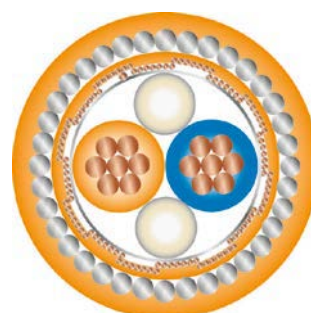
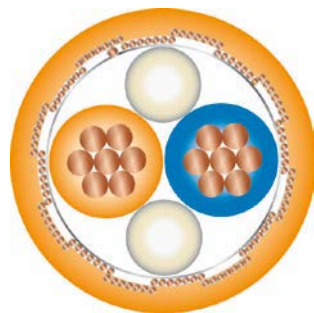
M 16 / M 12

Further cable variations, part numbers and UL listed types on page 46.


ICON® Bus

Multipair 70 °C with steel wire armour		FOUNDATION Fieldbus H1 100 Ω
Trunk cable for fixed installation indoor and outdoor, on racks, in conduits. Suitable for direct burial and increased mechanical stresses.	Trunk cable for fixed installation indoor and outdoor, on racks, in conduits. Suitable for direct burial and increased mechanical stresses.	Application
74790009	74790010	Design
FB-02YS(St)YSWAY-fl PiMF	FB-02YS(St)YSWAY-fl PiMF	Part. No.
5 x 2 x AWG 18/7 PiMF	10 x 2 x AWG 18/7 PiMF	Type description
orange	orange	Product size
		Colour
		Construction
plain annealed copper wire, stranded, size: AWG 18	plain annealed copper wire, stranded, size: AWG 18	Conductor
foamed polyethylene with skin layer	foamed polyethylene with skin layer	Insulation
(+)-core: orange, (-)-core: blue, element identification with numbered tapes	(+)-core: orange, (-)-core: blue, element identification with numbered tapes	Colour code
plastic coated aluminium tape in contact with tinned copper drain wire	plastic coated aluminium tape in contact with tinned copper drain wire	Individual and collective screen
polyvinyl chloride PVC, orange	polyvinyl chloride PVC, orange	Inner sheath 1 material
galvanised round steel wires	galvanised round steel wires	Armour
polyvinyl chloride PVC	polyvinyl chloride PVC	Outer sheath material
10 x cable diameter	10 x cable diameter	Min. bending radius - repeated bending
19.9 mm	25.9 mm	Outer dia. nom
770 kg/km	1140 kg/km	Cable weight
		Temperature Range
-30°C up to +70°C	-30°C up to +70°C	- during operation
-5°C up to +50°C	-5°C up to +50°C	- during installation
		Electrical Properties at 20 °C
43.6 Ω/km	43.6 Ω/km	Conductor resistance (loop) max.
30 Ω/km	30 Ω/km	Screen resistance nom.
60 nF/km	60 nF/km	Mutual capacitance nom.
0.7 mH/km	0.7 mH/km	Inductance nom
2 nF/km	2 nF/km	Capacit. unbalance to earth max.
100 Ω ± 20 Ω	100 Ω ± 20 Ω	Impedance at f = 31.25 kHz
3.0 dB/km	3.0 dB/km	Attenuation at f = 39 kHz
1.7 µs/km	1.7 µs/km	Propagation delay change max. (f = 7.9 kHz - 39 kHz)
		Other properties
		Flame retardant
UL 13 (vertical tray)	UL 13 (vertical tray)	- Test on single cable
IEC 60332-3-24 (Cat. c)	IEC 60332-3-24 (Cat. c)	- Test on bunched cables
ICEA S-73-532	ICEA S-73-532	Oil resistance
UL 1581 section 1200	UL 1581 section 1200	Sunlight resistance

Further cable variations, part numbers and UL listed types on page 46.


ICON® Bus
**FOUNDATION™ Fieldbus
H1 100 Ω**
Basic 90 °C
Basic 90 °C with steel wire armour
Application

Spur and trunk cable for fixed installation indoor and outdoor, on racks, trays, in conduits, in dry and wet locations.

Spur and trunk cable for fixed installation indoor and outdoor, on racks, trays, in conduits, in dry and wet locations. Suitable for direct burial and increased mechanical stresses.

Design
Part. No.

76990000

77580003

Type description

FB-2X(St+Ce)Y-fl

FB-2X(St+Ce)YSWAY-fl

Product size

1 x 2 x AWG 18/7

1 x 2 x AWG 18/7

Colour

orange

orange

Construction
Conductor

plain annealed copper wire, stranded, size: AWG 18

plain annealed copper wire, stranded, size: AWG 18

Insulation

cross-linked polyethylene XLPE

cross-linked polyethylene XLPE

Colour code

(+)-core: orange, (-)-core: blue

(+)-core: orange, (-)-core: blue

Collective screen

plastic coated aluminium tape, metallic surface outside, in contact with tinned copper drain wire and tinned copper wire braid

plastic coated aluminium tape, metallic surface outside, in contact with tinned copper drain wire and tinned copper wire braid

Inner sheath 1 material

polyvinyl chloride PVC, orange

Armour

galvanised round steel wires

Outer sheath material

polyvinyl chloride PVC

polyvinyl chloride PVC

Min. bending radius

7.5 x cable diameter

10 x cable diameter

Outer dia approx.

8.1 mm

12.7 mm

Cable weight

90 kg/km

300 kg/km

Temperature Range

- during operation

-30°C up to +90°C

-30°C up to +90°C

- during installation

-5°C up to +50°C

-5°C up to +50°C

Electrical Properties at 20 °C
Conductor resistance (loop) max.

43.6 Ω/km

43.6 Ω/km

Screen resistance nom.

12 Ω/km

12 Ω/km

Mutual capacitance nom.

60 nF/km

60 nF/km

Inductance nom.

0.7 mH/km

0.7 mH/km

Capacit. unbalance to earth max.

2 nF/km

2 nF/km

Impedance at f = 31.25 kHz

100 Ω ± 20 Ω

100 Ω ± 20 Ω

Attenuation at f = 39 kHz max.

3.0 dB/km

3.0 dB/km

Propagation delay change max. (f = 7.9 kHz - 39 kHz)

1.7 µs/km

1.7 µs/km

Other properties
Flame retardant

- Test on single cable

UL 13 (vertical tray)

UL 13 (vertical tray)

- Test on bunched cables

IEC 60332-3-24 (Cat. c)

IEC 60332-3-24 (Cat. c)

Oil resistance

ICEA S-73-532

ICEA S-73-532

Sunlight resistance

UL 1581 section 1200

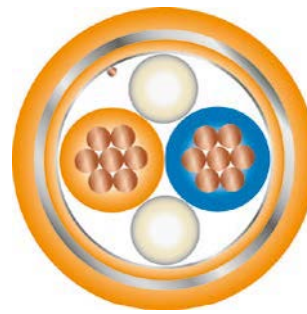
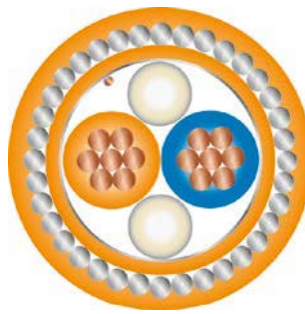
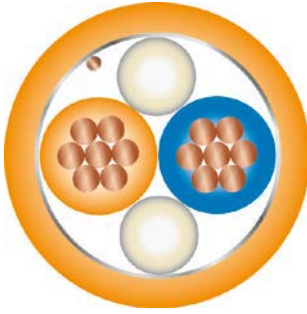
UL 1581 section 1200

Connectors/glands

M 16 / M 12

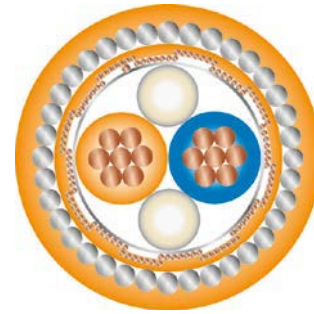
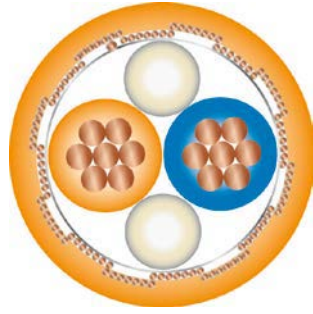
M 16 / M 12

Further cable variations, part numbers and UL listed types on page 46.


ICON® Bus
**FOUNDATION™ Fieldbus
H1 100 Ω**

Eco 90 °C	Eco 90 °C with steel wire armour	Eco 90 °C with corrugated steel tape	
Spur and trunk cable for fixed installation indoor and outdoor, on racks, trays, in conduits, in dry and wet locations.	Spur and trunk cable for fixed installation indoor and outdoor, on racks, trays, in conduits, in dry and wet locations. Suitable for direct burial and increased mechanical stresses.	Spur and trunk cable for fixed installation indoor and outdoor, on racks, trays, in conduits, in dry and wet locations. Suitable for direct burial and increased mechanical stresses.	Application
80830005	80830006	82560001	Design
FB-2X(St)Y-fl	FB-2X(St)YSWAY-fl	FB-2X(St)Y(SR)Y-fl	Part. No.
1 x 2 x AWG 18/7	1 x 2 x AWG 18/7	1 x 2 x AWG 18/7	Type description
orange	orange	orange	Product size
			Colour
plain annealed copper wire, stranded, size: AWG 18	plain annealed copper wire, stranded, size: AWG 18	plain annealed copper wire, stranded, size: AWG 18	Conductor
cross-linked polyethylene XLPE	cross-linked polyethylene XLPE	cross-linked polyethylene XLPE	Insulation
(+)-core: orange, (-)-core: blue	(+)-core: orange, (-)-core: blue	(+)-core: orange, (-)-core: blue	Colour code
plastic coated aluminium tape in contact with tinned copper drain wire	plastic coated aluminium tape in contact with tinned copper drain wire	plastic coated aluminium tape in contact with tinned copper drain wire	Collective screen
	polyvinyl chloride PVC, orange	polyvinyl chloride PVC, orange	Inner sheath 1 material
	galvanised round steel wires	corrugated steel tape	Armour
polyvinyl chloride PVC	polyvinyl chloride PVC	polyvinyl chloride PVC	Outer sheath material
7.5 x cable diameter	10 x cable diameter	10 x cable diameter	Min. bending radius
			Temperature Range
-30°C up to +90°C	-30°C up to +90°C	-30°C up to +90°C	- during operation
-5°C up to +50°C	-5°C up to +50°C	-5°C up to +50°C	- during installation
43.6 Ω/km	43.6 Ω/km	43.6 Ω/km	Electrical Properties at 20 °C
30 Ω/km	30 Ω/km	30 Ω/km	Conductor resistance (loop) max.
60 nF/km	60 nF/km	60 nF/km	Screen resistance nom.
0.7 mH/km	0.7 mH/km	0.7 mH/km	Mutual capacitance nom.
2 nF/km	2 nF/km	2 nF/km	Inductance nom.
100 Ω ± 20 Ω	100 Ω ± 20 Ω	100 Ω ± 20 Ω	Capacit. unbalance to earth max.
3.0 dB/km	3.0 dB/km	3.0 dB/km	Impedance at f = 31.25 kHz
1.7 μs/km	1.7 μs/km	1.7 μs/km	Attenuation at f = 39 kHz max.
			Propagation delay change max. (f = 7.9 kHz - 39 kHz)
			Other properties
UL 13 (vertical tray)	UL 13 (vertical tray)	UL 13 (vertical tray)	Flame retardant
IEC 60332-3-24 (Cat. c)	IEC 60332-3-24 (Cat. c)	IEC 60332-3-24 (Cat. c)	- Test on single cable
ICEA S-73-532	ICEA S-73-532	ICEA S-73-532	- Test on bunched cables
UL 1581 section 1200	UL 1581 section 1200	UL 1581 section 1200	Oil resistance
M 16 / M 12	M 16 / M 12	M 16 / M 12	Sunlight resistance
			Connectors/Glands

Further cable variations, part numbers and UL listed types on page 46.


ICON® Bus
**FOUNDATION™ Fieldbus
H1 100 Ω**
Long Distance 90 °C
Long Distance 90 °C with steel wire armour
Application

Trunk cable for fixed installation indoor and outdoor, on racks, trays, in conduits, in dry and wet locations. Between Segment-Coupler and "Field-Barrier-Device".

Trunk cable for fixed installation indoor and outdoor, on racks, trays, in conduits, in dry and wet locations. Between Segment-Coupler and "Field-Barrier-Device". Suitable for direct burial and increased mechanical stresses.

Design
Part. No.

76990001

77580022

Type description

FB-2X(St+Ce)Y-fl

FB-2X(St+Ce)YSWAY-fl

Product size

1 x 2 x AWG 16/7

1 x 2 x AWG 14/7

Colour

orange

orange

Construction
Conductor

plain annealed copper wire, stranded, size: AWG 16

plain annealed copper wire, stranded, size: AWG 14

Insulation

cross-linked polyethylene XLPE

cross-linked polyethylene XLPE

Colour code

(+) -core: orange, (-) -core: blue

(+) -core: orange, (-) -core: blue

Collective screen

plastic coated aluminium tape, metallic surface outside, in contact with tinned copper drain wire and tinned copper wire braid

plastic coated aluminium tape, metallic surface outside, in contact with tinned copper drain wire and tinned copper wire braid

Inner sheath 1 material

polyvinyl chloride PVC, orange

Armour

galvanised round steel wires

Outer sheath material

polyvinyl chloride PVC

polyvinyl chloride PVC

Min. bending radius

7.5 x cable diameter

10 x cable diameter

Outer dia.

9.4 mm

16 mm

Cable weight

115 kg/km

450 kg/km

Temperature Range

- during operation

-30°C up to +90°C

-30°C up to +90°C

- during installation

-5°C up to +50°C

-5°C up to +50°C

Electrical Properties at 20 °C
Conductor resistance (loop) max.

28.5 Ω/km

17.9 Ω/km

Screen resistance nom.

12 Ω/km

12 Ω/km

Mutual capacitance nom.

60 nF/km

60 nF/km

Inductance nom

0.7 mH/km

0.7 mH/km

Capacit. unbalance to earth max.

2 nF/km

2 nF/km

Impedance at f = 31.25 kHz

100 Ω ± 20 Ω

100 Ω ± 20 Ω

Attenuation at f = 39 kHz max.

3.0 dB/km

3.0 dB/km

**Propagation delay change
max (f = 7.9 kHz - 39 kHz)**

1.7 µs/km

1.7 µs/km

Other properties
Flame retardant

- Test on single cable

UL 13 (vertical tray)

UL 13 (vertical tray)

- Test on bunched cables

IEC 60332-3-24 (Cat. c)

IEC 60332-3-24 (Cat. c)

Oil resistance

ICEA S-73-532

ICEA S-73-532

Sunlight resistance

UL 1581 section 1200

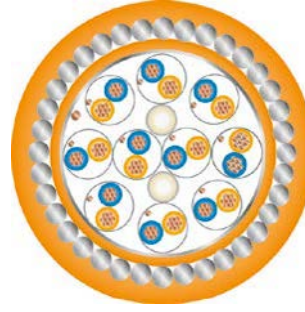
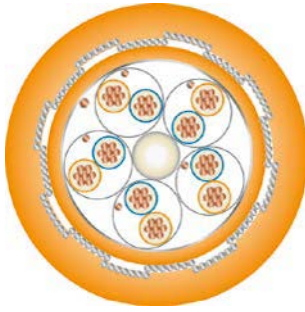
UL 1581 section 1200

Connectors/glands

M 16 / M 12

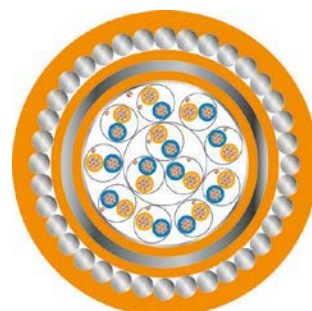
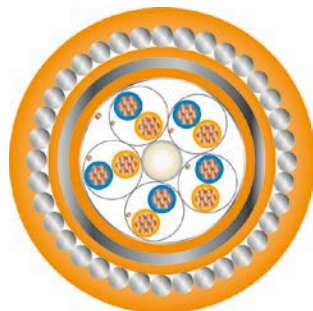
M 16 / M 12

Further cable variations, part numbers and UL listed types on page 46.


ICON® Bus

Multipair 90 °C with steel wire armour		FOUNDATION™ Fieldbus H1 100 Ω
Trunk cable for fixed installation indoor and outdoor, on racks, trays, in conduits, in dry and wet locations. Suitable for direct burial and increased mechanical stresses.		Application
75370025	75370026	Design
FB-2X(St)YSWAY-fl PiMF	FB-2X(St)YSWAY-fl PiMF	Part. No.
5 x 2 x AWG 18/7 PiMF	10 x 2 x AWG 18/7 PiMF	Type description
orange	orange	Product size
		Colour
		Construction
plain annealed copper wire, stranded, size: AWG 18	plain annealed copper wire, stranded, size: AWG 18	Conductor
cross-linked polyethylene XLPE	cross-linked polyethylene XLPE	Insulation
(+)-core: orange, (-)-core: blue, element identification with numbered tapes	(+)-core: orange, (-)-core: blue, element identification with numbered tapes	Colour code
plastic coated aluminium tape in contact with tinned copper drain wire	plastic coated aluminium tape in contact with tinned copper drain wire	Individual and collective screen
polyvinyl chloride PVC, orange	polyvinyl chloride PVC, orange	Inner sheath 1 material
galvanised round steel wires	galvanised round steel wires	Armour
polyvinyl chloride PVC	polyvinyl chloride PVC	Outer sheath material
10 x cable diameter	10 x cable diameter	Min. bending radius
19.9 mm	25.9 mm	Outer dia approx.
770 kg/km	1140 kg/km	Cable weight
		Temperature Range
-30°C up to +90°C	-30°C up to +90°C	- during operation
-5°C up to +50°C	-5°C up to +50°C	- during installation
		Electrical Properties at 20 °C
43.6 Ω/km	43.6 Ω/km	Conductor resistance (loop) max.
30 Ω/km	30 Ω/km	Screen resistance nom.
60 nF/km	60 nF/km	Mutual capacitance nom.
0.7 mH/km	0.7 mH/km	Inductance nom.
2 nF/km	2 nF/km	Capacit. unbalance to earth max.
100 Ω ± 20 Ω	100 Ω ± 20 Ω	Impedance at f = 31.25 kHz
3.0 dB/km	3.0 dB/km	Attenuation at f = 39 kHz max
1.7 μs/km	1.7 μs/km	Propagation delay change max (f = 7.9 kHz - 39 kHz)
		Other properties
		Flame retardant
UL 13 (vertical tray)	UL 13 (vertical tray)	- Test on single cable
IEC 60332-3-24 (Cat. c)	IEC 60332-3-24 (Cat. c)	- Test on bunched cables
ICEA S-73-532	ICEA S-73-532	Oil resistance
UL 1581 section 1200	UL 1581 section 1200	Sunlight resistance
M 16 / M 12	M 16 / M 12	Connectors/Glands

Further cable variations, part numbers and UL listed types on page 46.



ICON® Bus

FOUNDATION™ Fieldbus H1 100 Ω

Multipair 90 °C, lead sheath with steel wire armour

Multipair 90 °C with steel wire armour, lead sheath

Application

Trunk cable for fixed installation indoor and outdoor, on racks, trays, in conduits, in dry and wet locations. Recommended for direct burial, especially in presence of oil and aggressive chemical substances.

Trunk cable for fixed installation indoor and outdoor, on racks, trays, in conduits, in dry and wet locations. Recommended for direct burial, especially in presence of oil and aggressive chemical substances.

Design

Part. No.

82310004

82310005

Type description

FB-2X(St)YMYSWAY-fl PiMF

FB-2X(St)YMYSWAY-fl PiMF

Product size

5 x 2 x AWG 18/7 PiMF

10 x 2 x AWG 18/7 PiMF

Colour

orange

orange

Construction

Conductor

plain annealed copper wire, stranded, size: AWG 18

plain annealed copper wire, stranded, size: AWG 18

Insulation

cross-linked polyethylene XLPE

cross-linked polyethylene XLPE

Colour code

(+)-core: orange, (-)-core: blue, element identification with numbered tapes

(+)-core: orange, (-)-core: blue, element identification with numbered tapes

Individual screen

plastic coated aluminium tape in contact with tinned copper drain wire

plastic coated aluminium tape in contact with tinned copper drain wire

Inner sheath 1 material

polyvinyl chloride PVC, orange

polyvinyl chloride PVC, orange

Metallic sheath

lead sheath

lead sheath

Inner sheath 2

polyvinyl chloride PVC

polyvinyl chloride PVC

Armour

galvanised round steel wires

galvanised round steel wires

Outer sheath material

polyvinyl chloride PVC

polyvinyl chloride PVC

Min. bending radius

15 x cable diameter

15 x cable diameter

Outer dia approx.

26.9 mm

33.0 mm

Cable weight

1820 kg/km

2700 kg/km

Temperature Range

- during operation

-30°C up to +90°C

-30°C up to +90°C

- during installation

-5°C up to +50°C

-5°C up to +50°C

Electrical Properties at 20 °C

Conductor resistance (loop) max.

43.6 Ω/km

43.6 Ω/km

Screen resistance nom.

30 Ω/km

30 Ω/km

Mutual capacitance nom.

60 nF/km

60 nF/km

Inductance nom.

0.7 mH/km

0.7 mH/km

Capacit. unbalance to earth max.

2 nF/km

2 nF/km

Impedance at f = 31.25 kHz

100 Ω ± 20 Ω

100 Ω ± 20 Ω

Attenuation at f = 39 kHz max.

3.0 dB/km

3.0 dB/km

Propagation delay change max. (f = 7.9 kHz - 39 kHz)

1.7 µs/km

1.7 µs/km

Other properties

Flame retardant

- Test on single cable

UL 13 (vertical tray)

UL 13 (vertical tray)

- Test on bunched cables

IEC 60332-3-24 (Cat. c)

IEC 60332-3-24 (Cat. c)

Oil resistance

ICEA S-73-532

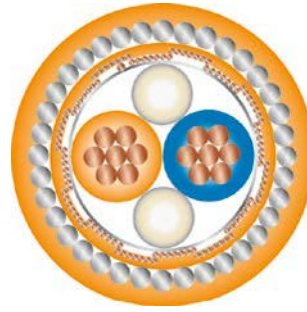
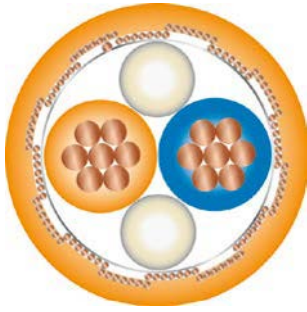
ICEA S-73-532

Sunlight resistance

UL 1581 section 1200

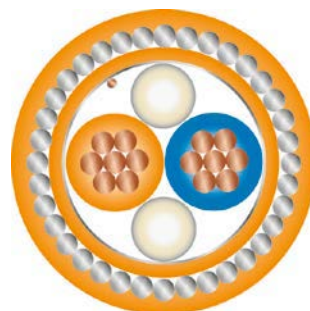
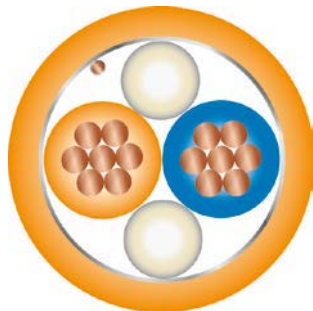
UL 1581 section 1200

Further cable variations, part numbers and UL listed types on page 46.


ICON® Bus

Basic 105 °C		FOUNDATION™ Fieldbus H1 100 Ω
Spur and trunk cable for fixed installation indoor and outdoor, on racks, trays, in conduits, in dry and wet locations.		Application
82460002		Design
FB-9Y(St+Ce)Yw-fl		Part. No.
1 x 2 x AWG 18/7		Type description
orange		Product size
plain annealed copper wire, stranded, size: AWG 18		Colour
thermoplastic polyolefin compound		Construction
(+) -core: orange, (-) -core: blue		Conductor
plastic coated aluminium tape, metallic surface outside, in contact with tinned copper drain wire and tinned copper wire braid		Insulation
polyvinyl chloride PVC		Colour code
7.5 x cable diameter		Collective screen
7.7 mm		Inner sheath 1 material
80 kg/km		Armour
-30°C up to +105°C		Outer sheath material
-5°C up to +50°C		Min. bending radius
43.6 Ω/km		Outer dia approx.
12 Ω/km		Cable weight
60 nF/km		Temperature Range
0.7 mH/km		- during operation
2 nF/km		- during installation
100 Ω ± 20 Ω		Electrical Properties at 20 °C
3.0 dB/km		Conductor resistance (loop) max.
1.7 μs/km		Screen resistance nom.
		Mutual capacitance nom.
		Inductance nom.
		Capacit. unbalance to earth max.
		Impedance at f = 31.25 kHz
		Attenuation at f = 39 kHz max.
		Propagation delay change max (f = 7.9 kHz - 39 kHz)
		Other properties
		Flame retardant
UL 13 (vertical tray)		- Test on single cable
IEC 60332-3-24 (Cat. c)		- Test on bunched cables
ICEA S-73-532		Oil resistance
UL 1581 section 1200		Sunlight resistance
M 16 / M 12		Connectors/Glands

Further cable variations, part numbers and UL listed types on page 46.



ICON® Bus

FOUNDATION™ Fieldbus H1 100 Ω

Eco 105 °C

Multipair 105 °C with steel wire armour

Application

Spur and trunk cable for fixed installation indoor and outdoor, on racks, trays, in conduits, in dry and wet locations.

Spur and trunk cable for fixed installation indoor and outdoor, on racks, trays, in conduits, in dry and wet locations. Suitable for direct burial and increased mechanical stresses.

Design

Part. No.

83170000

89880000

Type description

FB-9Y(St)Yw-fl

FB-9Y(St)YwSWAYw-fl

Product size

1 x 2 x AWG 18/7

1 x 2 x AWG 18/7

Colour

orange

orange

Construction

Conductor

plain annealed copper wire, stranded, size: AWG 18

plain annealed copper wire, stranded, size: AWG 18

Insulation

thermoplastic polyolefin compound

thermoplastic polyolefin compound

Colour code

(+)-core: orange, (-)-core: blue

(+)-core: orange, (-)-core: blue

Collective screen

plastic coated aluminium tape in contact with tinned copper drain wire

plastic coated aluminium tape in contact with tinned copper drain wire

Inner sheath 1 material

polyvinyl chloride PVC, orange

Armour

galvanised round steel wires

Outer sheath material

polyvinyl chloride PVC

polyvinyl chloride PVC

Min. bending radius

7.5 x cable diameter

10 x cable diameter

Outer dia approx.

8.1 mm

12.7 mm

Cable weight

75 kg/km

290 kg/km

Temperature Range

- during operation

-30°C up to +105°C

-30°C up to +105°C

- during installation

-5°C up to +50°C

-5°C up to +50°C

Electrical Properties at 20 °C

Conductor resistance (loop) max.

43.6 Ω/km

43.6 Ω/km

Screen resistance nom.

30 Ω/km

30 Ω/km

Mutual capacitance nom.

60 nF/km

60 nF/km

Inductance nom.

0.7 mH/km

0.7 mH/km

Capacit. unbalance to earth max.

2 nF/km

2 nF/km

Impedance at f = 31.25 kHz

100 Ω ± 20 Ω

100 Ω ± 20 Ω

Attenuation at f = 39 kHz max.

3.0 dB/km

3.0 dB/km

Propagation delay change max. (f = 7.9 kHz - 39 kHz)

1.7 μs/km

1.7 μs/km

Other properties

Flame retardant

- Test on single cable

UL 13 (vertical tray)

UL 13 (vertical tray)

- Test on bunched cables

IEC 60332-3-24 (Cat. c)

IEC 60332-3-24 (Cat. c)

Oil resistance

ICEA S-73-532

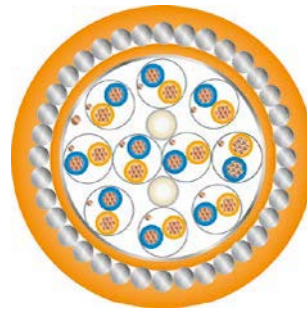
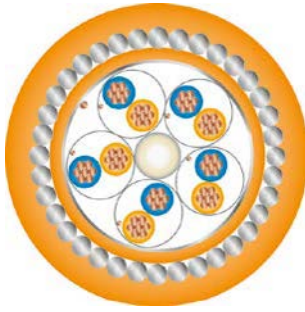
ICEA S-73-532

Sunlight resistance

UL 1581 section 1200

UL 1581 section 1200

Further cable variations, part numbers and UL listed types on page 46.


ICON® Bus

Multipair 105 °C with steel wire armour		FOUNDATION™ Fieldbus H1 100 Ω
Trunk cable for fixed installation indoor and outdoor, on racks, trays, in conduits, in dry and wet locations. Suitable for direct burial and increased mechanical stresses.		Application
89880002	89880003	Design
FB-9Y(St)YwSWAYw-fl PiMF	FB-9Y(St)YwSWAYw-fl PiMF	Part. No.
5 x 2 x AWG 18/7 PiMF	10 x 2 x AWG 18/7 PiMF	Type description
orange	orange	Product size
		Colour
		Construction
plain annealed copper wire, stranded, size: AWG 18	plain annealed copper wire, stranded, size: AWG 18	Conductor
thermoplastic polyolefin compound	thermoplastic polyolefin compound	Insulation
(+)-core: orange, (-)-core: blue, element identification with numbered tapes	(+)-core: orange, (-)-core: blue, element identification with numbered tapes	Colour code
plastic coated aluminium tape in contact with tinned copper drain wire	plastic coated aluminium tape in contact with tinned copper drain wire	Individual and collective screen
polyvinyl chloride PVC, orange	polyvinyl chloride PVC, orange	Inner sheath 1 material
galvanised round steel wires	galvanised round steel wires	Armour
polyvinyl chloride PVC	polyvinyl chloride PVC	Outer sheath material
10 x cable diameter	10 x cable diameter	Min. bending radius
19.9 mm	25.9 mm	Outer dia approx.
770 kg/km	1140 kg/km	Cable weight
		Temperature Range
-30°C up to +105°C	-30°C up to +105°C	- during operation
-5°C up to +50°C	-5°C up to +50°C	- during installation
		Electrical Properties at 20 °C
43.6 Ω/km	43.6 Ω/km	Conductor resistance (loop) max.
30 Ω/km	30 Ω/km	Screen resistance nom.
60 nF/km	60 nF/km	Mutual capacitance nom.
0.7 mH/km	0.7 mH/km	Inductance nom.
2 nF/km	2 nF/km	Capacit. unbalance to earth max.
100 Ω ± 20 Ω	100 Ω ± 20 Ω	Impedance at f = 31.25 kHz
3.0 dB/km	3.0 dB/km	Attenuation at f = 39 kHz max.
1.7 µs/km	1.7 µs/km	Propagation delay change max. (f = 7.9 kHz - 39 kHz)
		Other properties
		Flame retardant
UL 13 (vertical tray)	UL 13 (vertical tray)	- Test on single cable
IEC 60332-3-24 (Cat. c)	IEC 60332-3-24 (Cat. c)	- Test on bunched cables
ICEA S-73-532	ICEA S-73-532	Oil resistance
UL 1581 section 1200	UL 1581 section 1200	Sunlight resistance

Further cable variations, part numbers and UL listed types on page 46.


**FOUNDATION™ Fieldbus
H1 100 Ω**
Overview of part numbers and cable variations

Cable	Type description	Size	Part number			
			UL-approval (75 °C)*		EN 50288-7 (70 °C)	
			orange	blue	orange	blue
70 °C / 75 °C						
Basic	FB-02YS(St+Ce)Y-fl	1 x 2 x AWG 18/7	76770102	76770103	76770605	76770606
Basic, zero halogen	FB-02YS(St+Ce)H	1 x 2 x AWG 18/7	79260102	79260103	79260605	79260606
Basic with steel wire armour	FB-02YS(St+Ce)YSWAY-fl	1 x 2 x AWG 18/7	7677102U	7677103U	7677605U	7677606U
Basic with steel wire armour, zero halogen	FB-02YS(St+Ce)HSAWAH	1 x 2 x AWG 18/7	7926102U	7422302W	---	---
Basic with steel wire armour, lead sheath	FB-02YS(St+Ce)YMYSWAY-fl	1 x 2 x AWG 18/7	---	---	82380002	82380003
Fast Assembly	FB-02YS(St+C)Y-fl	1 x 2 x AWG 18/7	74220103	74220102	74220603	74220604
Fast Assembly, zero halogen	FB-02YS(St+C)H	1 x 2 x AWG 18/7	74360103	74360102	74360603	74360604
Flex	FB-02YS(St+Ce)Y-fl	1 x 2 x AWG 18/19	76770203	76770202	76770607	76770608
Flex, zero halogen	FB-02YS(St+Ce)H	1 x 2 x AWG 18/19	79260203	79260202	79260607	79260608
Long Distance	FB-2Y(St+Ce)Y-fl	1 x 2 x AWG 14/7	79290107	79290106	79290607	79290608
Long Distance	FB-2Y(St+Ce)Y-fl	1 x 2 x AWG 16/7	79290105	79290104	79290605	79290606
Long Distance, zero halogen	FB-2Y(St+Ce)H	1 x 2 x AWG 14/7	79300107	79300106	79300607	79300608
Long Distance, zero halogen	FB-2Y(St+Ce)H	1 x 2 x AWG 16/7	79300105	79300104	79300606	79300605
Long Distance with steel wire armour	FB-2Y(St+Ce)YSWAY-fl	1 x 2 x AWG 16/7	82030000	82030001	---	---
Eco	FB-02YS(St)Y-fl	1 x 2 x AWG 18/7	74250100	74250101	74250601	74250602
Eco, zero halogen	FB-02YS(St)H	1 x 2 x AWG 18/7	79270100	79270101	79270601	79270602
Eco with steel wire armour	FB-02YS(St)YSWAY-fl	1 x 2 x AWG 18/7	74150022	74150021	7425601U	7425602U
Eco with steel wire armour, zero halogen	FB-02YS(St)HSAWAH	1 x 2 x AWG 18/7	82430003	82430002	---	---
Multipair	FB-02YS(St)Y-fl PiMF	2 x 2 x AWG 18/7PiMF	---	---	74250008	74250009
Multipair with steel wire armour	FB-02YS(St)YSWAY-fl PiMF	2 x 2 x AWG 18/7PiMF	---	---	74790008	74790038
Multipair with steel wire armour	FB-02YS(St)YSWAY-fl PiMF	5 x 2 x AWG 18/7PiMF	---	---	74790009	74790030
Multipair with steel wire armour	FB-02YS(St)YSWAY-fl PiMF	10 x 2 x AWG 18/7PiMF	---	---	74790010	74790040

* UL file E107687



Overview of part numbers and cable variations

FOUNDATION™ Fieldbus
H1 100 Ω

Cable	Type description	Size	Part number			
			UL-approval		EN 50288-7	
			orange	blue	orange	blue
90 °C						
Basic	FB-2X(St+Ce)Y-fl	1 x 2 x AWG 18/7	76990007	76990008	76990000	76990003
Basic, zero halogen	FB-2X(St+Ce)H	1 x 2 x AWG 18/7	---	---	82330000	82330003
Basic with steel wire armour	FB-2X(St+Ce)YSWAY-fl	1 x 2 x AWG 18/7	77580023	77580024	77580003	77580018
Basic with steel wire armour, zero halogen	FB-2X(St+Ce)HSWAH	1 x 2 x AWG 18/7	---	---	82340000	---
Long Distance	FB-2X(St+Ce)Y-fl	1 x 2 x AWG 14/7	76990012	76990010	76990006	76990005
Long Distance	FB-2X(St+Ce)Y-fl	1 x 2 x AWG 16/7	76990011	76990009	76990001	76990004
Long Distance, zero halogen	FB-2X(St+Ce)H	1 x 2 x AWG 16/7	---	---	82330001	82330002
Long Distance with steel wire armour	FB-2X(St+Ce)YSWAY-fl	1 x 2 x AWG 14/7	77580028	77580026	77580022	77580021
Long Distance with steel wire armour	FB-2X(St+Ce)YSWAY-fl	1 x 2 x AWG 16/7	77580027	77580025	77580020	77580019
Long Distance w. steel wire armour, zero halogen	FB-2X(St+Ce)HSWAH	1 x 2 x AWG 16/7	---	---	82340001	82340002
Multipair with steel wire armour	FB-2X(St)YSWAY-fl PiMF	2 x 2 x AWG 16/7 PiMF	---	---	72410003	---
Multipair with steel wire armour	FB-2X(St)YSWAY-fl PiMF	5 x 2 x AWG 18/7 PiMF	---	---	75370025	75370023
Multipair with steel wire armour, lead sheath	FB-2X(St)YMYSWAY-fl PiMF	5 x 2 x AWG 18/7 PiMF	---	---	82310004	82310002
Eco	FB-2X(St)Y-fl	1 x 2 x AWG 18/7	---	---	80830005	80830006
Eco, zero halogen	FB-2X(St)H	1 x 2 x AWG 18/7	---	---	80340001	80340002
Eco with steel wire armour	FB-2X(St)YSWAY-fl	1 x 2 x AWG 18/7	---	---	75370006	75370032
Eco with steel wire armour, zero halogen	FB-2X(St)HSWAH	1 x 2 x AWG 18/7	---	---	80350002	80350000
Eco with corrugated steel tape	FB-2X(St)Y(SR)Y-fl	1 x 2 x AWG 18/7	---	---	82560001	82560002
105 °C						
Basic	FB-9Y(St+Ce)Yw-fl	1 x 2 x AWG 18/7	---	---	82460002	82460000
Basic with steel wire armour	FB-9Y(St+Ce)YwSWAYw-fl	1 x 2 x AWG 18/7	---	---	81370000	81370001
Multipair with steel wire armour	FB-9Y(St)YwSWAYw-fl PiMF	5 x 2 x AWG 18/7 PiMF	---	---	89880002	89880004
Eco	FB-9Y(St)Yw-fl	1 x 2 x AWG 18/7	---	---	83170000	83170001
Eco with steel wire armour	FB-9Y(St)YwSWAYw-fl	1 x 2 x AWG 18/7	-----	---	89880000	89880001

* UL file E107687

Modbus allows for communication between many devices connected to the same network, for example a system that measures temperature and humidity and communicates the results to a computer. Modbus is often used to connect a supervisory computer with a remote terminal unit (RTU) in supervisory control and data acquisition (SCADA) systems.

LEONI Modbus cables are available as one pair or multipair cable. The cable is used for connecting Modbus components and is suitable for indoor installations.

Serial communication protocol



Cable programme

Modbus 105 Ω

The Business Unit Industrial Projects offers products for Modbus which are optimised for the miscellaneous applications in automation technology.

The laying-up of cables are pairs with screen.

Characteristics

- Flame retardant
- Permanent installation
- Halogen free
- Silicon free
- Oil resistant
- RoHS compliant

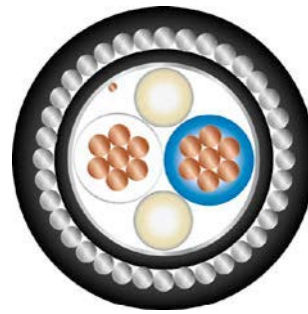
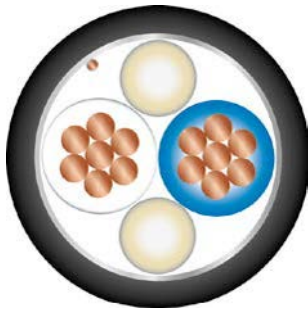
Following cable versions are available:

Single pair

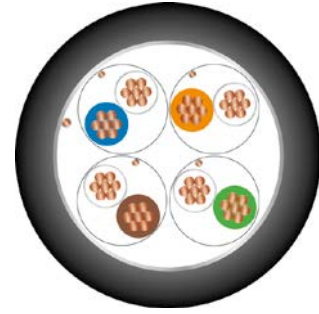
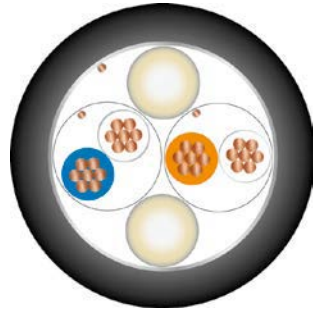
- Standard version for fixed installation.

Multi pair

- Standard version for fixed installation.



Single pair 70 °C	Single pair 70 °C with steel wire armour	MOD Bus 105 Ω
For transmission of digital signals in instrument and control systems.	For transmission of digital signals in instrument and control systems. Suitable for direct burial and increased mechanical stresses.	Application
82090004	72410004	Design Part No.
FB-2Y(St)Y-fl	FB-2Y(St)YSWAY-fl	Type description
1 x 2 x 0,75mm ²	1 x 2 x 0,75mm ²	Size
black	black	Outer sheath colour
plain annealed copper wire, stranded, size 0.75mm ²	plain annealed copper wire, stranded, size 0.75mm ²	Construction Conductor
polyethylene PE	polyethylene PE	Insulation
blue, white	blue, white	Colour code
plastic coated aluminium tape in contact with tinned copper drain wire	plastic coated aluminium tape in contact with tinned copper drain wire	Collective screen
	polyvinyl chloride PVC, black	Inner sheath 1 material
	galvanised round steel wires	Armour
polyvinyl chloride PVC	polyvinyl chloride PVC	Outer sheath
7.5 x cable diameter	10 x cable diameter	Min. bending radius (single bending)
7.5 mm	12.1 mm	Outer dia.
70 kg/km	263 kg/km	Cable weight
-5 °C up to +50 °C	-5 °C up to +50 °C	Temperature range -during installation
-30 °C up to +70 °C	-30 °C up to +70 °C	-during operation
50 Ω/km	50 Ω/km	Electrical properties Conductor resistance (loop) max.
105 Ω	105 Ω	Impedance at 1 MHz
54 nF/km	54 nF/km	Mutual capacitance nom.
		Other properties Flame retardant
UL 13 (vertical tray)	UL 13 (vertical tray)	- Test on single cable
IEC 60332-3-24 (Cat. c)	IEC 60332-3-24 (Cat. c)	- Test on bunched cables
ICEA S-73-532	ICEA S-73-532	Oil resistance
UL 1581 section 1200	UL 1581 section 1200	Sunlight resistance



MOD Bus 105 Ω

Multipair 70 °C

Multipair 70 °C

Application

For transmission of digital signals in instrument and control systems.

For transmission of digital signals in instrument and control systems.

Design

Part. No.

82090005

82090006

Type description

FB-2Y(St)Y-fl PiMF

FB-2Y(St)Y-fl PiMF

Product size

2 x 2 x 0.75 mm²/7 PiMF4 x 2 x 0.75 mm²/7 PiMF

Colour

black

black

Construction

Conductor

plain annealed copper wire, stranded, size: 0.75 mm²plain annealed copper wire, stranded, size: 0.75 mm²

Insulation

polyethylene PE

polyethylene PE

Colour code

white/blue, white/orange

white/blue, white/orange, white/green, white/brown

Individual screen

plastic coated aluminium tape in contact with tinned copper drain wire

plastic coated aluminium tape in contact with tinned copper drain wire

Collective screen

plastic coated aluminium tape in contact with tinned copper drain wire

plastic coated aluminium tape in contact with tinned copper drain wire

Armour

Outer sheath material

polyvinyl chloride PVC

polyvinyl chloride PVC

Min. bending radius - repeated bending

7.5 x cable diameter

7.5 x cable diameter

Outer dia.

12.5 mm

14.4 mm

Cable weight

160 kg/km

230 kg/km

Temperature Range

- during operation

-30°C up to +70°C

-30°C up to +70°C

- during installation

-5°C up to +50°C

-5°C up to +50°C

Electrical Properties at 20 °C

Conductor resistance (loop)

50 Ω/km

50 Ω/km

nom. Mutual capacitance

54 nF/km

54 nF/km

Impedance at f = 1 MHz

105 Ω

105 Ω

Other properties

Flame retardant

- Test on single cable

UL 13 (vertical tray)

UL 13 (vertical tray)

- Test on bunched cables

IEC 60332-3-24 (Cat. c)

IEC 60332-3-24 (Cat. c)

Oil resistance

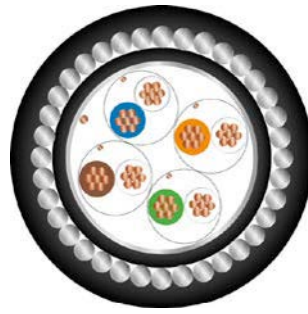
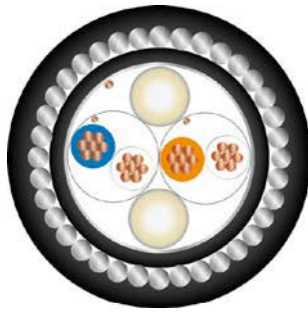
ICEA S-73-532

ICEA S-73-532

Sunlight resistance

UL 1581 section 1200

UL 1581 section 1200



Multipair 70 °C with steel wire armour		MOD Bus 105 Ω
For transmission of digital signals in instrument and control systems. Suitable for direct burial and increased mechanical stresses.	For transmission of digital signals in instrument and control systems. Suitable for direct burial and increased mechanical stresses.	Application
		Design
72410002	72410005	Part. No.
FB-2Y(St)YSWAY-Fl PiMF	FB-2Y(St)YSWAY-Fl PiMF	Type description
2 x 2 x 0.75 mm ² /7 PiMF	4 x 2 x 0.75 mm ² /7 PiMF	Product size
black	black	Colour
		Construction
plain annealed copper wire, stranded, size: 0.75 mm ²	plain annealed copper wire, stranded, size: 0.75 mm ²	Conductor
polyethylene PE	polyethylene PE	Insulation
white/blue, white/orange	white/blue, white/orange, white/green, white/brown	Colour code
plastic coated aluminium tape in contact with tinned copper drain wire	plastic coated aluminium tape in contact with tinned copper drain wire	Individual screen
plastic coated aluminium tape in contact with tinned copper drain wire	plastic coated aluminium tape in contact with tinned copper drain wire	Collective screen
polyvinyl chloride PVC, black	polyvinyl chloride PVC, black	Inner sheath 1 material
galvanised round steel wires	galvanised round steel wires	Armour
polyvinyl chloride PVC	polyvinyl chloride PVC	Outer sheath material
10 x cable diameter	10 x cable diameter	Min. bending radius - repeated bending
17.3 mm	19.8 mm	Outer dia.
475 kg/km	610 kg/km	Cable weight
		Temperature Range
-30°C up to +70°C	-30°C up to +70°C	- during operation
-5°C up to +50°C	-5°C up to +50°C	- during installation
		Electrical Properties at 20 °C
50 Ω/km	50 Ω/km	Conductor resistance (loop)
54 nF/km	54 nF/km	Mutual capacitance nom.
105 Ω	105 Ω	Impedance at f = 1 MHz
		Other properties
		Flame retardant
UL 13 (vertical tray)	UL 13 (vertical tray)	- Test on single cable
IEC 60332-3-24 (Cat. c)	IEC 60332-3-24 (Cat. c)	- Test on bunched cables
ICEA S-73-532	ICEA S-73-532	Oil resistance
UL 1581 section 1200	UL 1581 section 1200	Sunlight resistance

Control Area Network (CAN) was originally made for the automotive market, but in the meantime it is being used more and more as a bus standard for industrial applications. FieldLink bus cables for CAN systems are applied for the exchange of digital information, control apparatus net for faster data transmission.

LEONI Business Unit Industrial Projects offers shielded industrial bus cables for CAN standard, which are available as one pair or multipair cable. The cable is used for connecting CAN bus components and is suitable for indoor installations.

Control Area Network



Cable programme

CAN Bus 120 Ω

The Business Unit Industrial Projects offers products for CAN Bus, which are optimised for the miscellaneous applications in automation technology.

The laying-up of cables are pairs with screen.

Characteristics

- Flame retardant
- Permanent installation
- Zero halogen
- Silicon free
- Oil resistant
- RoHS compliant

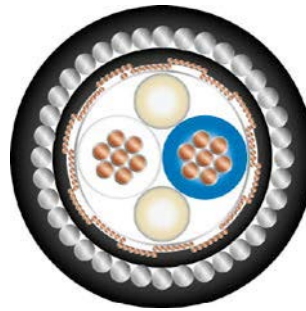
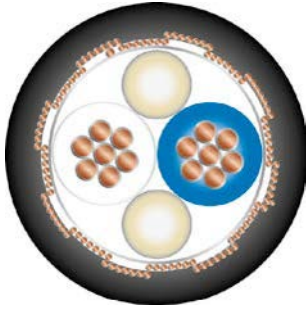
Following cable versions are available:

Single pair

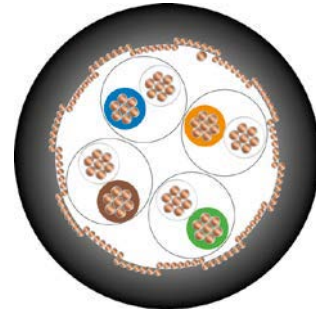
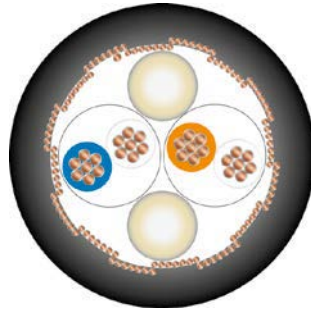
- Standard version for fixed installation.

Multi pair

- Standard version for fixed installation.



Single pair 90 °C	Single pair 90 °C with steel wire armour	CAN Bus 120 Ω
For transmission of CAN (Control Area Network) bus signals or computer signals with RS 485 or RS 422 interface.	For transmission of CAN (Control Area Network) bus signals or computer signals with RS 485 or RS 422 interface. Suitable for direct burial and increased mechanical stresses.	Application
82620000	78510004	Design
FB-v2X(St+Ce)Y-fl	FB-v2X(St+Ce)YSWAY-fl	Part. No.
1 x 2 x AWG 24/7	1 x 2 x AWG 24/7	Type description
black	black	Product size
		Outer sheath colour
tinned annealed copper wire, stranded, size: AWG 24	tinned annealed copper wire, stranded, size: AWG 24	Conductor
cross-linked polyethylene XLPE	cross-linked polyethylene XLPE	Insulation
white/blue	white/blue	Colour code
plastic coated aluminium tape, metallic surface outside, in contact with tinned copper drain wire and tinned copper wire braid, opt. coverage approx. 80 %	plastic coated aluminium tape, metallic surface outside, in contact with tinned copper drain wire and tinned copper wire braid, opt. coverage approx. 80 %	Collective screen
	polyvinyl chloride PVC	Inner sheath 1 material
	galvanised round steel wires	Armour
polyvinyl chloride PVC	polyvinyl chloride PVC	Outer sheath material
7.5 x cable diameter	10 x cable diameter	Min. bending radius - repeated bending
10.0 mm	14.6 mm	Outer dia.
105 kg/km	360 kg/km	Cable weight
-30°C up to +90°C	-30°C up to +90°C	Temperature Range
-5°C up to +50°C	-5°C up to +50°C	- during operation
		- during installation
184.8 Ω/km	184.8 Ω/km	Electrical Properties at 20 °C
42 nF/km	42 nF/km	Conductor resistance (loop) max.
0.7 mH/km	0.7 mH/km	Mutual capacitance nom.
120 Ω ± 10 Ω	120 Ω ± 10 Ω	Inductance nom.
24 dB/km	24 dB/km	Impedance at f = 1 MHz
		Attenuation at f = 1 MHz nom.
		Other properties
		Flame retardant
UL 13 (vertical tray)	UL 13 (vertical tray)	- Test on single cable
IEC 60332-3-24 (Cat. c)	IEC 60332-3-24 (Cat. c)	- Test on bunched cables
ICEA S-73-532	ICEA S-73-532	Oil resistance
UL 1581 section 1200	UL 1581 section 1200	Sunlight resistance



CAN Bus 120 Ω

Multipair 90 °C

Multipair 90 °C

Application

For transmission of CAN (Control Area Network) bus signals or computer signals with RS 485 or RS 422 interface.

For transmission of CAN (Control Area Network) bus signals or computer signals with RS 485 or RS 422 interface.

Design

Part. No.

79240000

79240002

Type description

FB-v2XCeY-fl PiMF

FB-v2XCeY-fl PiMF

Product size

2 x 2 x AWG 24/7 PiMF

4 x 2 x AWG 24/7 PiMF

Outer sheath colour

black

black

Construction

Conductor

tinned annealed copper wire, stranded, size: AWG 24

tinned annealed copper wire, stranded, size: AWG 24

Insulation

cross-linked polyethylene XLPE

cross-linked polyethylene XLPE

Colour code

white/blue, white/orange

white/blue, white/orange, white/green, white/brown

Individual screen

plastic coated aluminium tape, metallic surface outside, in contact with collective screen

plastic coated aluminium tape, metallic surface outside, in contact with collective screen

Collective screen

tinned copper wire braid, opt. coverage approx. 80 %, in contact with stranded tinned copper drain wire

tinned copper wire braid, opt. coverage approx. 80 %, in contact with stranded tinned copper drain wire

Outer sheath material

polyvinyl chloride PVC

polyvinyl chloride PVC

Armour

Min. bending radius

7.5 x cable diameter

7.5 x cable diameter

- repeated bending

Outer dia.

10.0 mm

11.5 mm

Cable weight

105 kg/km

130 kg/km

Temperature Range

- during operation

-30°C up to +90°C

-30°C up to +90°C

- during installation

-5°C up to +50°C

-5°C up to +50°C

Electrical Properties at 20 °C

Conductor resistance (loop) max.

184.8 Ω/km

184.8 Ω/km

Mutual capacitance nom.

42 nF/km

42 nF/km

Inductance nom.

0.7 mH/km

0.7 mH/km

Impedance at f = 1 MHz

120 Ω ± 10 Ω

120 Ω ± 10 Ω

Attenuation at f = 1 MHz nom.

24 dB/km

24 dB/km

Other properties

Flame retardant

- Test on single cable

UL 13 (vertical tray)

UL 13 (vertical tray)

- Test on bunched cables

IEC 60332-3-24 (Cat. c)

IEC 60332-3-24 (Cat. c)

Oil resistance

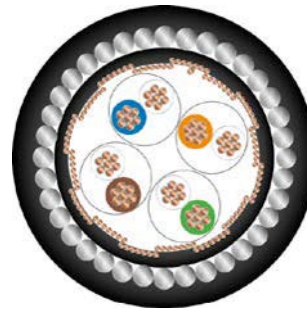
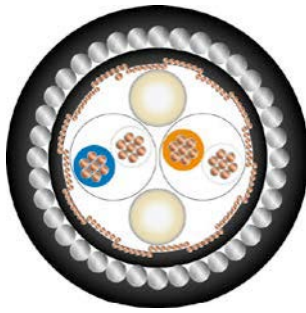
ICEA S-73-532

ICEA S-73-532

Sunlight resistance

UL 1581 section 1200

UL 1581 section 1200



Multipair 90 °C with steel wire armour		CAN Bus 120 Ω
For transmission of CAN (Control Area Network) bus signals or computer signals with RS 485 or RS 422 interface. Suitable for direct burial and increased mechanical stresses.		Application
7924000U		Design
FB-v2XCeYSWAY-fl PiMF		Part. No.
2 x 2 x AWG 24/7 PiMF		Type description
black		Product size
tinned annealed copper wire, stranded, size: AWG 24		Outer sheath colour
cross-linked polyethylene XLPE		Construction
white/blue, white/orange		Conductor
plastic coated aluminium tape, metallic surface outside, in contact with collective screen		Insulation
tinned copper wire braid, opt. coverage approx. 80 %, in contact with stranded tinned copper drain wire		Colour code
polyvinyl chloride PVC, black		Individual screen
galvanised round steel wires		Collective screen
polyvinyl chloride PVC		Inner sheath 1 material
10 x cable diameter		Armour
14.6 mm		Outer sheath material
360 kg/km		Min. bending radius - repeated bending
-30°C up to +90°C		Outer dia.
-5°C up to +50°C		Cable weight
184.8 Ω/km		Temperature Range
42 nF/km		- during operation
0.7 mH/km		- during installation
120 Ω ± 10 Ω		Electrical Properties at 20 °C
24 dB/km		Conductor resistance (loop) max.
		Mutual capacitance nom.
		Inductance nom.
		Impedance at f = 1 MHz
		Attenuation at f = 1 MHz nom.
		Other properties
UL 13 (vertical tray)		Flame retardant
IEC 60332-3-24 (Cat. c)		- Test on single cable
ICEA S-73-532		- Test on bunched cables
UL 1581 section 1200		Oil resistance
		Sunlight resistance

Conventional links based on copper cables are now often reaching the limits of their capacity.

The use of GigaLine® fiber optic cables offers for the most diverse bus applications (e.g. High Speed Ethernet – HSE) advantages in the following cases:

When...

- electromagnetic effects can occur
- reliable potential separation is required
- broad transmission ranges are required
- low attenuation and thus long channels are necessary
- when crosstalk must not occur
- sparks must not emerge (for explosive environments)
- low weight and small dimensions are an advantage
- increased security against tapping is required.

GigaLine®



Cable programme

Fiber optic cables

LEONI offers the comprehensive GigaLine® product range for virtually all applications.

Besides easy-to-assemble indoor cables with compact wire technology for the patch and floor area, universal cables for the backbones indoors and outdoors and the classical outdoor cables, the Business Unit Industrial Projects offers manufacturing options for a large number of additional designs such as GigaLine® outdoor cables:

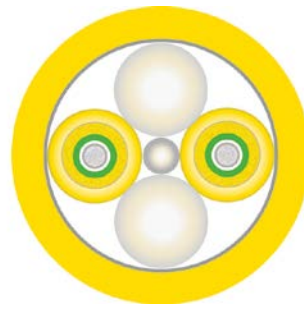
Following cable versions are available:

Indoor and outdoor cables

- Breakout cables
- Universal (LSZH) cables

Characteristics

- with corrugated steel sheath
- with steel tape
- with SWA armour
- with additional lead covering
as protection against chemicals
- zero halogen
- flame retardant.



GigaLine®

GigaLine® DXO Indoor breakout cable		GigaLine® AT Indoor breakout cable	Fiber Optic Cables
Floor cabling, suitable for direct plug mounting and splicing	Floor cabling, suitable for direct plug mounting and splicing.	Application Dimension Type Outer sheath colour Part no. Construction Fiber Core Strain relief Inner sheath Wrapping Outer sheath Weight Minimum bending radius during Installation during operation Temperature range during Installation during operation during operation Tensile stress Transverse compression strength Other properties Flame retardant Connectors/glands	
2 G/E ... (Figure O)	2 G/E ... (round in shape)		
KL-J-V(ZN)HH	KL-AT-V(ZN)HY-fl		
yellow or orange	yellow or orange		
multi mode 50/125 µm or 62.5/125 µm and single mode 9..10/125 µm fiber qualities as well as colour code see page 65	multi mode 50/125 µm or 62.5/125 µm and single mode 9..10/125 µm fiber qualities as well as colour code see page 65		
compact wires Ø approx. 0.9 mm	compact wires Ø approx. 0.9 mm		
aramid yarn over the core	aramid yarn over the core		
zero halogen compound, Ø approx. 2.1 mm, yellow, continuously numbered	zero halogen compound, Ø approx. 2.1 mm, yellow, continuously numbered		
	swellable tape		
low smoke zero halogen compound LSZH approx. 3.1 x 5.2 mm	polyvinyl chloride PVC Ø 8.5 mm		
approx. 18 kg/km	approx. 18 kg/km		
min. 150 mm	min. 150 mm		
min. 35 mm	min. 35 mm		
min. 65 mm	min. 65 mm		
-5 °C up to +50 °C -10 °C up to +60 °C	-5 °C up to +50 °C -25 °C up to +70 °C		
max. 600 (2 x 300) N	max. 1200 N		
permanent: max. 500 N/dm short-term: max. 750 N/dm	permanent: max. 1000 N/dm short-term: max. 1500 N/dm		
acc. to IEC 60332-1			
please see our catalogue datacom-cable and cabling systems or visit our homepage www.leoni-datacom.com			



GigaLine®

Fiber Optic Cables

GigaLine® DQ

Universal cable, longitudinally watertight

GigaLine® DQ

Outdoor cable, longitudinally watertight

Application	Campus-/backbone cabling, suitable for splicing, indoor installation in the case of increased mechanical requirements, outdoor installation in dry tubes.	Campus-/backbone cabling, suitable for splicing, outdoor installation (direct burial) or in tubes.
Dimension	1 x m G/E	1 x m G/E...
Type	KL-U-DQ(ZN)BH	KL-A-DQ(ZN)B2Y
Outer sheath colour	yellow	black
Part no.		
Construction		
Fiber	multi mode 50/125 µm or 62.5/125 µm and single mode 9..10/125 µm fiber qualities as well as colour code see page 65	multi mode 50/125 µm or 62.5/125 µm and single mode 9..10/125 µm fiber qualities as well as colour code see pages 65
Core	filled loose tube, central	filled loose tube, central
Strain relief	glass rovings as rodent protection under outer sheath	glass rovings as rodent protection under outer sheath
Inner sheath		
Wrapping	swellable tape	swellable tape
Outer sheath	low smoke zero halogen compound LSZH ≤ 12 fiber: Ø approx. 7.0 mm ≤ 24 fiber: Ø approx. 7.5 mm	polyethylene PE ≤ 12 fiber: Ø approx. 7.0 mm ≤ 24 fiber: Ø approx. 7.5 mm
Weight	≤ 12 fiber: approx. 48 kg/km ≤ 24 fiber: approx. 55 kg/km	≤ 12 fiber: approx. 38 kg/km ≤ 24 fiber: approx. 43 kg/km
Minimum bending radius		
during Installation	min. 15 x outer-Ø	min. 15 x outer-Ø
during operation	min. 20 x outer-Ø	min. 20 x outer-Ø
Temperature range		
during Installation	-5 °C up to +50 °C	-5 °C up to +50 °C
during operation	-10 °C up to +60 °C	-25 °C up to +70 °C
Mechanical properties		
Tensile stress	max. 1750 N	max. 1750 N
Transverse compression strength	permanent: max. 1500 N/dm short-term: max. 2500 N/dm	permanent: max. 1500 N/dm short-term: max. 2500 N/dm
Other properties		
Flame retardant	acc. to IEC 60332-3-24 (CAT C)	
Connectors/glands	please see our catalogue datacom-cable and cabling systems or visit our homepage www.leoni-datacom.com	


GigaLine®

GigaLine® DQ Outdoor cable, longitudinally watertight		Fiber Optic Cables
Campus-/backbone cabling, suitable for splicing, outdoor installation (direct burial) or in tubes	Campus-/backbone cabling, suitable for splicing, outdoor installation (direct burial) or in tubes, and increased mechanical stresses.	Application
1 x m G/E...	1 x m G/E...	Dimension
KL-A-DQ(ZN)2YW2Y	KL-A-DQ(ZN)B2YSWAYfl	Type
black	black	Outer sheath colour
		Part Number
		Construction
multi mode 50/125 µm or 62.5/125 µm and single mode 9..10/125 µm fiber qualities as well as colour code see pages 65	multi mode 50/125 µm or 62.5/125 µm and single mode 9..10/125 µm fiber qualities as well as colour code see pages 65	Fiber
filled loose tube, central	filled loose tube, central	Core
aramid yarn over the core	aramid yarn over the core	Strain relief
polyethylene PE, black	polyethylene PE, black	Inner sheath
swellable tape	swellable tape	Wrapping
corrugated steel sheath	galvanised round steel wires SWA-Ø: 0.9 mm	Armour
polyethylene PE ≤ 12 fiber: Ø approx. 12.5 mm ≤ 24 fiber: Ø approx. 13.0 mm	polyvinyl chloride PVC ≤ 12 fiber: Ø approx. 12.5 mm ≤ 24 fiber: Ø approx. 13.0 mm	Outer sheath
≤ 12 fiber: approx. 160 kg/km ≤ 24 fiber: approx. 170 kg/km	≤ 12 fiber: approx. 250 kg/km ≤ 24 fiber: approx. 265 kg/km	Weight
		Minimum bending radius
min. 15 x outer-Ø min. 20 x outer-Ø	min. 15 x outer-Ø min. 20 x outer-Ø	During installation During operation
		Temperature Range
-5 °C up to +50 °C -25 °C up to +70 °C	-5 °C up to +50 °C -25 °C up to +70 °C	during Installation during operation
		Mechanical Properties
max. 2500 N	max. 1750 N	Tensile stress
permanent: max. 2500 N/dm short-term: max. 3500 N/dm	permanent: max. 1000 N/cm short-term: max. 3000 N/cm	Transverse compression strength
		Other Properties
	acc. to IEC 60332-1	Flame retardant
please see our catalogue datacom-cable and cabling systems or visit our homepage www.leoni-datacom.com		Connectors/Glands

GigaLine®

Fiber Optic Cables

Overview of part numbers and cable variations

Cable	Description	Type	Size	Part number			
				Fiber type			
				G 50/125	G50/125 OM3	G 62.5/125	E 9/...10/125
GigaLine® DXO	Indoor breakout cable, zero halogen, oval	KL-AT-V(ZN)HH	2 G/E	8DA20011 orange	8DA50011 orange	8DB70011 orange	8DC70010 yellow
GigaLine® DX	Indor breakout cable, round	KL-AT-V(ZN)HY-fl	2 G/E	8BA22004 orange	8BA52004 orange	8BB77004 orange	8BC72004 orange
GigaLine® DQ	Universal cable, zero halogen, longitudinally watertight	KL-U-DQ(ZN)BH	1 x 2 G/E	8UA200A1	8UA500A1	8UB700A1	8UC700A1
			1 x 4 G/E	8UA200A2	8UA500A2	8UB700A2	8UC700A2
			1 x 6 G/E	8UA200A3	8UA500A3	8UB700A3	8UC700A3
			1 x 8 G/E	8UA200A4	8UA500A4	8UB700A4	8UC700A4
			1 x 10 G/E	8UA200A5	8UA500A5	8UB700A5	8UC700A5
			1 x 12 G/E	8UA200A6	8UA500A6	8UB700A6	8UC700A6
			1 x 16 G/E	8UA200A7	8UA500A7	8UB700A7	8UC700A7
			1 x 20 G/E	8UA200A8	8UA500A8	8UB700A8	8UC700A8
			1 x 24 G/E	8UA200A9	8UA500A9	8UB700A9	8UC700A9
GigaLine® DQ	Universal cable, longitudinally watertight	KL-A-DQ(ZN)B2Y	1 x 2 G/E	8AA200A1	8AA500A1	8AB700A1	8AC700A1
			1 x 4 G/E	8AA200A2	8AA500A2	8AB700A2	8AC700A2
			1 x 6 G/E	8AA200A3	8AA500A3	8AB700A3	8AC700A3
			1 x 8 G/E	8AA200A4	8AA500A4	8AB700A4	8AC700A4
			1 x 10 G/E	8AA200A5	8AA500A5	8AB700A5	8AC700A5
			1 x 12 G/E	8AA200A6	8AA500A6	8AB700A6	8AC700A6
			1 x 16 G/E	8AA200A7	8AA500A7	8AB700A7	8AC700A7
			1 x 20 G/E	8AA200A8	8AA500A8	8AB700A8	8AC700A8
			1 x 24 G/E	8AA200A9	8AA500A9	8AB700A9	8AC700A9

GigaLine®

Overview of part numbers and cable variations

Fiber Optic Cables

Cable	Description	Type	Size	Part number			
				Fiber type			
				G 50/125	G50/125 OM3	G 62.5/125	E 9/...10/125
GigaLine® DQ	Outdoor cable, longitudinally watertight, with corrugated steel sheath armoured	KL-A-DQ(ZN) 2YW2Y	1 x 2 G/E	8AA20041	8AA50041	8AB70041	8AC70041
			1 x 4 G/E	8AA20042	8AA50042	8AB70042	8AC70042
			1 x 6 G/E	8AA20043	8AA50043	8AB70043	8AC70043
			1 x 8 G/E	8AA20044	8AA50044	8AB70044	8AC70044
			1 x 10 G/E	8AA20045	8AA50045	8AB70045	8AC70045
			1 x 12 G/E	8AA20046	8AA50046	8AB70046	8AC70046
			1 x 16 G/E	8AA20047	8AA50047	8AB70047	8AC70047
			1 x 20 G/E	8AA20048	8AA50048	8AB70048	8AC70048
			1 x 24 G/E	8AA20049	8AA50049	8AB70049	8AC70049
GigaLine® DQ	Outdoor fiber optic cable, longitudinally watertight with SWA-armour	KL-A-DQ(ZN) B2YSWAYfl	1 x 2 G/E	8AA2W0A1	8AA5W0A1	8AB7W0A1	8AC7W0A1
			1 x 4 G/E	8AA2W0A2	8AA5W0A2	8AB7W0A2	8AC7W0A2
			1 x 6 G/E	8AA2W0A3	8AA5W0A3	8AB7W0A3	8AC7W0A3
			1 x 8 G/E	8AA2W0A4	8AA5W0A4	8AB7W0A4	8AC7W0A4
			1 x 10 G/E	8AA2W0A5	8AA5W0A5	8AB7W0A5	8AC7W0A5
			1 x 12 G/E	8AA2W0A6	8AA5W0A6	8AB7W0A6	8AC7W0A6
			1 x 16 G/E	8AA2W0A7	8AA5W0A7	8AB7W0A7	8AC7W0A7
			1 x 20 G/E	8AA2W0A8	8AA5W0A8	8AB7W0A8	8AC7W0A8
			1 x 24 G/E	8AA2W0A9	8AA5W0A9	8AB7W0A9	8AC7W0A9

GigaLine® fiber qualities



Fiber specifications	G50/125 OM2e	G50/125 OM3	G50/125 OM3e	G62.5/125 OM1e	E9...10/125 OS1e
Attenuations coefficient					
at 850 nm	max. 2.5 dB/km	max. 2.5 dB/km	max. 2.5 dB/km	max. 3.0 dB/km	
at 1300 nm	max. 0.7 dB/km	max. 0.7 dB/km	max. 0.7 dB/km	max. 0.7 dB/km	
at 1310 nm					max. 0.36 dB/km
at 1383 nm					max. 0.40 dB/km
at 1550 nm					max. 0.22 dB/km
Bandwidth					
at 850 nm	min. 600 MHz x km	min. 1500 MHz x km	min. 3500 MHz x km	min. 250 MHz x km	
at 1300 nm	min. 1200 MHz x km	min. 500 MHz x km	min. 500 MHz x km	min. 800 MHz x km	
Laser bandwidth					
at 850 nm		min. 2000 MHz x km	min. 4700 MHz x km		
Dispersion					
at 1310 nm					max. 3.5 ps/nm x km
at 1550 nm					max. 18 ps/nm x km
Segment length 1 Gigabit-Ethernet					
at 850 nm (1000 BASE SX)	min. 750 m	min. 900 m	min. 1000 m	min. 500 m	
at 1300 nm (1000 BASE LX)	min. 2000 m	min. 550 m	min. 550 m	min. 1000 m	
Segment length 10 Gigabit-Ethernet					
at 850 nm (10G BASE-SR)	min. 150 m	min. 300 m	min. 550 m	min. 65 m	
at 1300 nm 10G BASE-LX4)	min. 900 m	min. 300 m	min. 300 m	min. 450 m	
Numerical aperture					
nominal value	0.20	0.20	0.20	0.275	0.12
Refraction index (nominal value)					
at 850 nm	1.483	1.483	1.483	1.497	
at 1300 nm	1.478	1.478	1.478	1.493	
at 1310 nm					1.467
at 1550 nm					1.467
Test load					
	100 kpsi	100 kpsi	100 kpsi	100 kpsi	100 kpsi

GigaLine® abbreviations

Identification of the structural elements in fiber optic cables







	J – V (ZN) H H 4 G50 / 125 STB900 2.5 (example)
Application Indoor cable Universal cable Outdoor cable Indoor cable, breakout	J U A AT
Tube semi-tight tube filled loose tube, multi fiber filled loose tube, single fiber	V D W
Construction water blocking elements over cable core filling compound in cable core fiber optic cables with copper conductors non-metallic strain relief elements non-metallic strain relief elements and rodent protection elem. laminated aluminium sheath (LAP) central steel strain relief element steel wire armour corrugated steel tape armour	Q F S (ZN) (ZN)B (L) (ZS) B W
Inner sheath material PVC (polyvinyl chloride) PE (polyethylene) PA (polyamide) ETFE (ethylene-tetrafluoro-ethylene) PP (polypropylene) PUR (polyurethane) TPE-E (thermoplastic polyester elastomer, e.g. Hytrel) H low smoke zero halogen flame retardant (LSZH)	Y 2Y 4Y 7Y 9Y 11Y 12Y H
Outer sheath material same as inner sheath material	
number of tubes and fibers number of fibers number of loose tubes x number of fibers per loose tube	m nxm
Fiber type / fiber core diameter / fiber cladding diameter single mode fiber multi mode graded index fiber multi mode step index fiber (glass/glass) PCF, multi mode step index fiber(glass/plastic) PCF, multi mode graded index fiber(glass/plastic) POF, polymer optic fiber (plastic/plastic)	E G S K GK P
Optical transmission properties attenuation coefficient (dB/km), wavelength (nm), A = 650 nm, B = 850 nm, F = 1300 nm, H = 1550 nm bandwidth (MHz x km), (MHz x 100 m) at POF	

GigaLine® colour codes





Colour code for tubes

(in case of stranded loose tubes)

Tube	colour code
counting tube	red 
counting direction tube	white 
other tubes	green for G50/125 
	blue for G62.5/125 
	yellow for E9...10/125 
dummy elements	uncoloured 

Colour code for multi-fiber loose tubes

No of fiber	colour code	No of fiber	colour code with black ring marking
1	red 	13	red 
2	green 	14	green 
3	blue 	15	blue 
4	yellow 	16	yellow 
5	white 	17	white 
6	grey 	18	grey 
7	brown 	19	brown 
8	violet 	20	violet 
9	turquoise 	21	turquoise 
10	black 	22	transparent 
11	orange 	23	orange 
12	rose 	24	rose 

Stripping tools for fast assembly

Stripping Tool for PROFIBUS, FOUNDATION™ Fieldbus and PROFINET (Industrial Ethernet)

For assembly work with stripping tools LEONI created FA Fast Assembly bus cables, marked with FA.

Area of Application:

This stripping tool is solely intended for use as described in these instructions. Other uses may result in accidents, severe personal injury, or damage to the tool and/or cable. For your own safety, use only the Connectors/Glands or additional devices recommended in these instructions or by the manufacturer.

The adjusting screws have already been adjusted for the bus system specified on the stripping tool. Protect yourself from live parts do not work on live parts. Keep live parts away from the area in which you are working or cover them appropriately.

To avoid personal injury or damage to the tool or cable, ensure that repairs are carried out by authorised personnel only.

Data of the stripping tool:

- Length: 100 mm
- Weight: 65 g
- Preset cutting depth for ES-Bus Cables
- Exchangeable cassette with require blade intervals
- Blade cassette can be used from two sides



Preadjusted stripping tool

Do not change the setting of the adjusting screws. The adjusting screws have already been adjusted for the bus system specified on the stripping tool.

Exchanging the blade cassette

We recommend using a small slotted screwdriver to open the blade cassette compartment, especially if the tool is new. Warning: risk of injury.

Both sides of the PROFIBUS blade cassette can be used. Remove the cartridge, rotate it vertically by 180° and then put it back into place. When working with PVC sheaths, the cartridge should be replaced after it has been used approx. 3,000 times (2 x 1,500). In the case of PUR sheaths, the cassette must be replaced after it has been used 300 times (2 x 150). Replacement cassettes can be purchased from your LEONI distributor.



To do the assembly work in a professional manner, please follow the introduction step by step:

1. Determining the stripping length

The centimetre scale on the tool will help you to measure the length. For stripping length, please consult the connector manufacturer's operating instructions. Add 7 mm to the stripping length specified in manufacturer's instructions and use the tip of your thumbnail to mark the length.

2. Inserting the cable into the stripping tool

Insert the length of cable you have measured into the stripping tool using your thumb as a guide. Close the clamp by turning the dial, for best results first click the dial by two notches.

3. Stripping the cable by rotating the tool

Rotate the stripping tool twice around the cable in the direction of the arrow. Close the clamp completely and rotate the stripping tool twice more around the cable.

4. Removing the stripping tool from the cable

Pull the stripping tool lengthways away from the cable. Avoid tilting the tool as this could damage the wires inside.

If the results are not satisfactory, it is possible that the blade cassette needs to be rotated or replaced.

5. Removing scrap insulation sheath

After you have opened the clamp you can remove the scrap.

6. Slitting the plastic foil

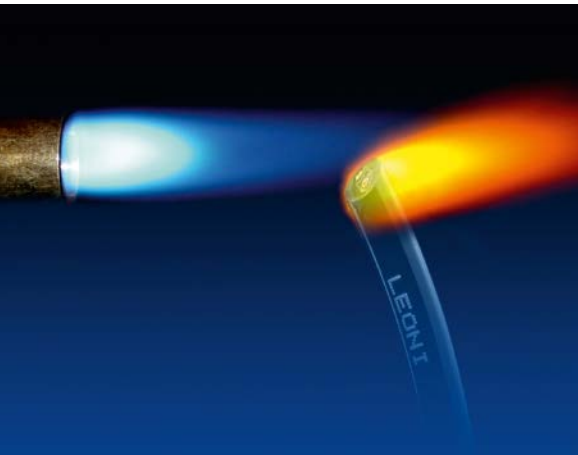
To remove the remaining plastic foil from the cable, slit the foil with a small slotted screwdriver.

7. Removing the plastic foil

The protective foil you have cut can now be removed easily. You can then attach the section of cable you have stripped to the connector.



In case of fire



Halogen content and smoke density

In areas where lives and material assets are endangered in case of a fire by toxic gases or smoke, so-called zero halogen, flame retardant cables are used

(LSZH = Low-Smoke-Zero-Halogen or FRNC = Flame-Retardant-Non-Corrosive)

The defined properties:

- low smoke characteristic according to IEC 61034
- light transmittance (L.T.) $\geq 60\%$
- amount of halogen acid according to IEC 60754-1, 0 %
- degree of acidity of gases according to IEC 60754-2, pH-value ≥ 4.3 and conductivity $c < 10 \mu\text{S/mm}$
- oxygen index of sheaths in accordance with ASTM-D 2863 (annex B), $\geq 35\%$

Improved fire behaviour

Cables with increased requirements with regard to the fire behaviour have to fulfil the following tests:

IEC 60332-1

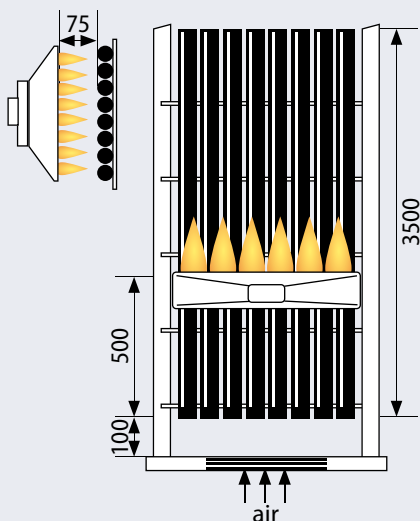
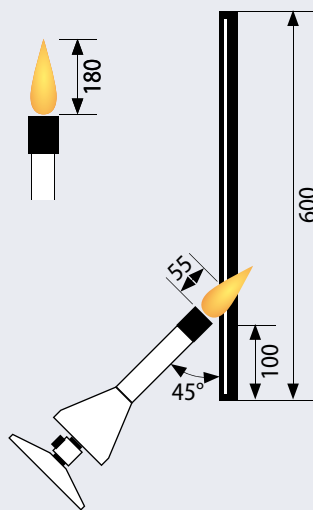
Test set-up: The single cable to be tested is fixed vertically and exposed to a Bunsen burner flame at a 45° angle to the vertical.

Flame temperature: Determined by the specified setting of the Bunsen burner flame.

Test duration:

- Cable with a diameter of $\leq 25 \text{ mm}$: 60 sec
- Cable with a diameter of $25 < D < 50 \text{ mm}$: 120 sec
- Cable with a diameter of $50 < D < 75 \text{ mm}$: 240 sec
- Cable with a diameter of $D > 75 \text{ mm}$: 480 sec

Compliance criterion: The fire damage must end at least 50 mm below the upper fixing clamp. The cable must be self-extinguishing.



IEC 60332-3-24 (cat. C)

Test set-up: Cable pieces mounted on a ladder in a test chamber

Total volume of

Non-metal material: 1.5 litre/m

Test duration: 20 minutes flame application time

Compliance criterion: max. 2.5 burnt length

Mechanical and chemical protection

Mechanical protection

The primary purpose of armour is to protect the cable against mechanical damage during installation and operation.

The most common armour designs with their most important features are the following:

A suitable protection can be achieved by corresponding measures:

Armour of galvanised round steel wires (SWA)



Very good mechanical protection; reasonably good flexibility; suitable for tensile loads; coverage of over 90 %

Armour of galvanised steel wire braid (Q)



Lightweight armour to withstand tensile loads; permits the smallest bending radii of all armour designs; used mainly for small cable diameters; a coverage of at least 80 % and a wire diameter of 0.3 mm are recommended to achieve sufficient mechanical protection

Armour of corrugated steel tape (SR)



100 % covering of the cable assembly; good protection against rodents.

Chemical protection

If the risk of oil and chemicals affecting the installed cable cannot be excluded this may affect the operation of the cables in long term.

The extent of the risk is determined by type, aggressive nature, condition and quantity of the medium, the duration of immersion and the temperature.

Lead sheath (M)



The safest, though most expensive protection against aromatic hydrocarbons and active chemicals.

Multilayer sheath ((L)2Y4Y)



Same as lead protection against aromatic hydrocarbons and active chemicals. This design combining aluminium tape and high density polyethylene HDPE sheath with a covering of polyamide PA (Nylon), represents an excellent barrier against penetrating chemicals and can be used as an alternative to lead sheath. Advantage: lighter, smaller diameter.

Oil resistant PVC sheath (Yö)

In contrast to standard PVC (Y) this compound is more resistant to oils and aliphatic hydrocarbons. It passes the oil resistance test according to IEC 60811-2-1.

Type designations for copper and **GigaLine®** fiber optic cables

The abbreviations used by LEONI for cables and construction elements refer as far as possible to DIN VDE standards.

0	Fiber optic communication cable	KL
1	Indoor cable Outdoor cable, breakout	I AT
2	Semi-loose tube Filled loose tube	V D
3	Non-metallic strain relief elements	(ZN)
4	Halogen-free flame-retardant sheath of basic element (AT only)	H
5	Halogen-free flame-retardant sheath	H
6	Number of fibers/ number of loose tubes x number of fibers per loose tube	n nxm
7	Multimode fiber Singlemode fiber	G E
8	Core diameter in μm (multimode fiber) Field diameter in μm (singlemode fiber)	
9	Cladding diameter in μm	
10	Attenuation coefficient in dB/km	
11	Wavelength B = 850 nm F = 1,300/1,310 nm H = 1,550 nm	B F H
12	Bandwidth in MHz for 1 km in the case of multimode fibers, dispersion parameter in ps/nm for 1 km in the case of singlemode fibers	

0	Fiber optic communication cable	KL
1	Outdoor cable Universal cable	A U
2	Filled loose tube	D
3	Filling compound in cable core Water blocking material in cable core	F Q
4	Non-metallic strain relief elements Non-metallic strain relief elements and rodent protection elements	(ZN) (ZN)B
5	Corrugated steel sheath Armour Outer sheath made of PE Layered sheath Halogen-free flame-retardant outer sheath suitable for direct burial Halogen-free flame-retardant outer sheath	W B 2Y (L)2Y Hc H
6	Number of fibers/number of loose tubes x number of fibers per loose tuber	n nxm
7	Multimode fiber Singlemode fiber	G E
8	Core diameter in μm (multimode fiber) Field diameter in μm (singlemode fiber)	
9	Cladding diameter in μm	
10	Attenuation coefficient in dB/km	
11	Wavelength B = 850 nm F = 1,300/1,310 nm H = 1,550 nm	B F H
12	Bandwidth in MHz for 1 km in the case of multimode fibers, dispersion parameter in ps/nm for 1 km in the case of single-mode fibers	

Fieldbus cables	FB-
Communication cable copper	KS-
Insulation of foamed polyethylene PE with skin layer	O2YS
Insulation or sheath of polyvinyl chloride (PVC)	Y
Sheath of oil-resistant polyvinyl chloride (PVC)	Yö
Sheath of polyvinyl chloride (PVC), reinforced	Yv
Sheath of flame-retardant polyvinyl chloride (PVC)	Yfl
Cable flame-retardant in compliance with IEC 60332-3-24	-fl
Insulation or sheath of cross linked polyethylene (XLPE)	2X
Insulation or sheath of polyethylene (PE)	2Y
Sheath of polyamide (PA)	4Y
Insulation or sheath of fluorinated ethylene-propylene (FEP)	6Y
Sheath of polyurethane (PUR)	11Y
Inner sheath of elastomer	3G
Laminated sheath with additional PA sheath	(L)2Y4Y
Sheath of zero halogen, flame retardant compounds (FRNC/LSZH)	H
Screen of aluminium bonded plastic tape	(St)
Screen of copper wire braid	C
Collective screen of aluminium bonded plastic tape and copper wire braid with drain wire	(St+Ce)
Collective screen of aluminium bonded plastic tape and copper wire braid	(St+C)
Pair in metal foil	PiMF
Lead sheath	M
Armour of galvanized steel wire braid	Q
Armour of 2 layers of galvanized steel tape	B
Armour of galvanized round steel wires	SWA
Armour of corrugated steel tape	(SR)