BUS CABLES FOR INDUSTRIAL APPLICATIONS

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THE GG GROUP AT A GLANCE

The GG Group is a family-owned international group of companies specializing in the manufacturing of high-quality cables and cable systems for the automotive and industrial sectors. We work closely together with our customers to develop innovative solutions for their needs.

Founded in Vienna in 1940, we're known for innovative solutions, technical expertise and top-quality products, while always utilizing our resources sustainably.

As a leading supplier of cables for energy and data transmission, as well as for the automotive industry and special industrial applications, we serve high-profile customers in these sectors all over the world. We're a system supplier who's been developing, designing and manufacturing high-quality products for many years.

With Industry 4.0, the traditional automation pyramid is disappearing and there is a growing trend towards faster, complex transmission of data, even at the sensor and actuator level. Since the reliability of such systems plays a crucial role, cables are key elements.

PROFINET and Industrial Ethernet cables from the GG Group impress with their excellent quality in terms of data transmission, reliability, flexibility and robustness.

But traditional fieldbus systems are also still in use and becoming increasingly popular all the time. Bus cables can now be found in all industrial applications. Networking with bus systems ensures that traditional wiring is reduced, cutting costs and saving time.

CONTENTS

SPE – THE NEW STANDARD

The basics

SPE stands for Single-Pair Ethernet and is a data transmission system in the Ethernet environment. The technology originated in the automotive sector. The focal point for the development of Ethernet-capable single-pair data cables in cars was the demand for more intelligent components in mass (e.g. sensors for distance measurement and control, image & sound transmission etc.).

The requirements for cabling in this application are clear: to transmit large data packets quickly over short distances with as little installation space as possible. Outside of automotive applications, multi-pair cables in categories 5e to 7A are currently the standard.

To utilize the advantages of an SPE cable outside of automotive applications, the needs and possibilities of other fields of application at the GG Group with a focus on industry had to find their way into standardization via consumers and the market. All the necessary components are being developed to enable a foreseeable market launch of the SPE system.

As the name implies, Single-Pair Ethernet is capable of being integrated into existing Ethernet systems. As described above, one hurdle is the need for new hardware. Due to the transmission of the same information over one wire pair instead of four wire pairs, it's not currently possible to connect SPE via a standard Ethernet plug (e.g. RJ45). Instead, plugs with SPE's own plug faces have already become established. SPE hybrid cables and plugs which also have independent plug faces already defined via standardization are currently in development.

As a specialist for industrial data cables and an active member of the PROFINET organization, the GG Group has already laid the foundation for the upcoming INDUSTRIAL SPE and PROFINET One Pair Cable. All standard market transmission and use cases from AWG26 to AWG18 (0.14 mm^2 to 0.88 mm^2) have been developed and tested.

The current focus of development is on establishing a further-optimized highflex cable carrier version that can withstand more than two million cycles in the cable carrier, followed by a highly dynamic type of robotics and the designs acc. to the upcoming released PROFINET cabling guideline.

In the long term, SPE will become the leading Ethernet standard. Integration of the GG Group SPE product family into the overall product portfolio is the right decision for an investment in the future.

Advantages and challenges

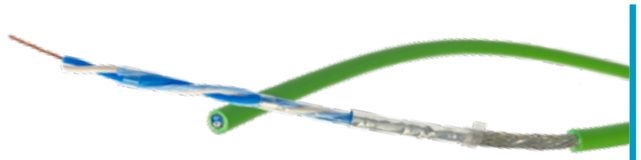
All the known advantages and disadvantages of Ethernet-based bus systems.

OTHER ADVANTAGES:
A reduced CO_2 balance, tighter bending radius, no need for batteries/rechargeable batteries (rare metals) compared to wireless technology, installation space savings, reduced connection time, reduced susceptibility to faults, an installation length of up to 1,000 m and PoDL (Power over Data Line)

Standardization

In the industrial sector, cables are subject to the specifications of the IEC 61156 series, which is strictly separated according to the installation type. The typical transmission distance between two interfaces including connection at both ends is defined by IEC 11801-1.

Separate standards apply for each application. The following standards apply explicitly to SPE:



For industrial SPE, see Page 26

Standard	Type	Frequency	Mbit/s*	Comment
IEC 61156-11 Horizontal floor wiring IEC 61156-12 Work area wiring	T1C	1,250 MHz	1,000	–11 is currently still defined as T1D. IEC will publish a correction soon. –12 with T1 types still in CD phase at IEC. Publication planned for 2025
IEC 61156-11 Horizontal floor wiring IEC 61156-12 Work area wiring	T1B	600 MHz	100	–11 is currently still defined as T1C. IEC will publish a correction soon. –12 with T1 types still in CD phase at IEC. Publication planned for 2025
IEC 61156-13 Horizontal floor wiring IEC 61156-14 Work area wiring	T1A1000	20 MHz	10	Use up to 1,000 m
IEC 61156-13 Horizontal floor wiring IEC 61156-14 Work area wiring	T1A400	20 MHz	10	Use up to 400 m

*) According to interim status 2024 of IEC 11801-1 draft 2022

User organizations

In addition to the international standardization bodies, both new and well-known user organizations have been formed. The following user organizations are currently working with SPE on standardizing the technology as effectively as possible. The aim of all organizations is to ensure the simplest and most efficient market launch possible for users.

APPLICATIONS

FIXED INSTALLATION
Cables are not moved, e.g.: Installation in cable trays, horizontally in walls, e.g. connection of production systems

FLEXIBLE INSTALLATION
Cables are rarely moved, and if so then with large bending radius or are exposed to vibrations. **TYPICAL:** Installation in and next to production facilities, e.g. connection of production systems

CABLE CARRIER APPLICATION
Cables are subjected to continuous bending loads over their entire length. **TYPICAL:** Installation in uniaxially translating production systems

TORSION APPLICATION
Cables are continuously rotated around the longitudinal axis. **TYPICAL:** Installation in axially fixed rotating production systems, e.g. robots making screw connections

ROBOTICS APPLICATION
Cables are continuously moved, twisted and bent. **TYPICAL:** Installation in multi-axis moving production systems, e.g. welding robots

GARLAND APPLICATION
Cables are bent at certain points using rollers. The lengths between the rollers are freely suspended. **TYPICAL:** Installation in telescopic applications, e.g. crane jibs

FEATURES

VERY SHORT PROCESSING TIME
Product designs optimized for processing, e.g. Quick-fit technology

STANDARD PROCESSING TIME
Conventional product designs

VERY GOOD FLAME RESISTANCE
Compliance with high-energy flame tests, e.g. IEC 60332-3-24, UL 1685 FT4/Flame exposure test and UL 1581 Cable flame test

GOOD FLAME RESISTANCE
Compliance with low-energy flame tests, e.g. IEC 60332-1-2 and UL 1581 FT2/FT1/VW1

SUFFICIENT FLAME RESISTANCE,
e.g. IEC 60332-1-2, IEC 60332-2-2, UL 1581 FT2 and ISO 6722-1

LOW FLAME RESISTANCE
Compliance with standardized flame tests is not a given

HALOGEN FREE, LOW ACIDITY
Compliance with IEC 60754-2, e.g. LSZH, LSZH, polyolefin materials

HALOGEN FREE, HIGHER ACIDITY
Compliance with IEC 60754-1 and DIN VDE 0472 Part 815, e.g. TPU and TPE materials

CONTAINS HALOGENS
Compliance with halogen-free tests is not a given, e.g. PVC, FEP and ETFE materials

VERY GOOD OIL RESISTANCE
Slight decrease in tensile strength and elongation at break after ageing, e.g. UL OIL RES and EN material specifications. A change in the sheathing color is not part of the assessment.

SUFFICIENT OIL RESISTANCE
No standard-related requirements
Sufficient durability in the field

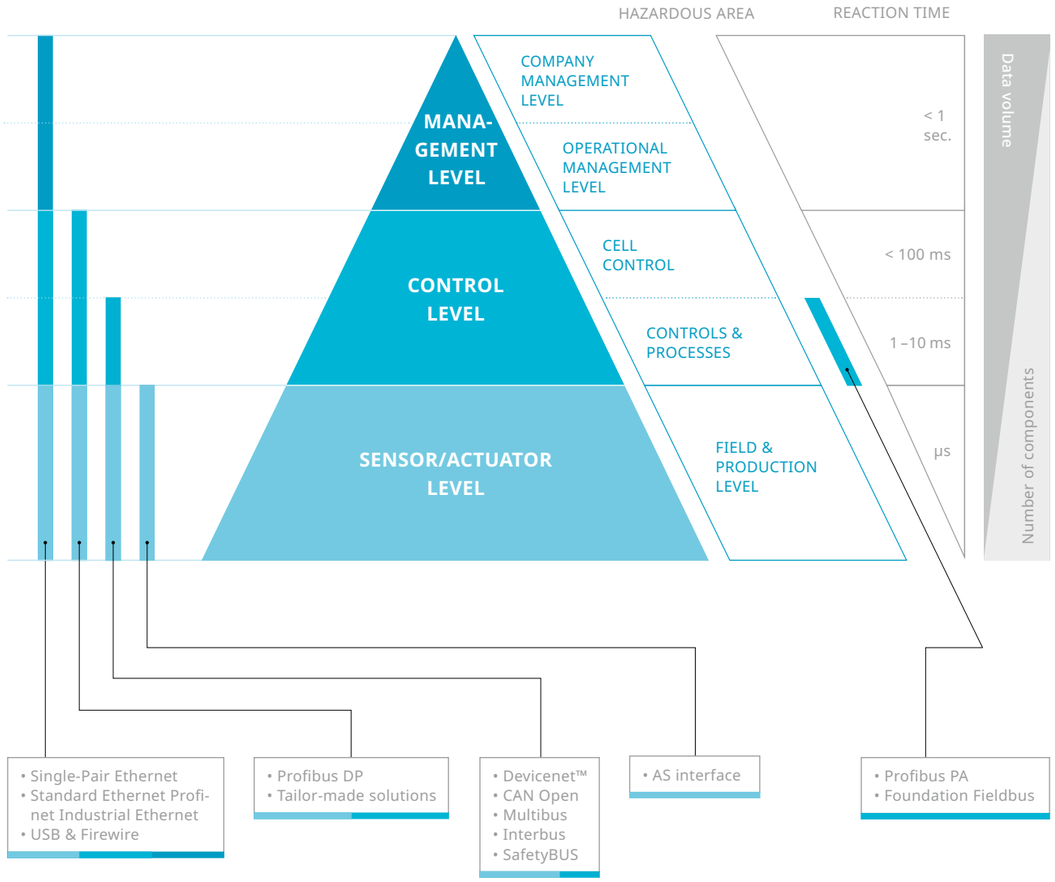
LOW OIL RESISTANCE
No standard-related specifications
Use in direct contact with oils is not recommended

VERY GOOD UV RESISTANCE
Slight decrease in tensile strength and elongation at break after ageing, e.g. UL SUN RES. A change in the sheathing color is not part of the evaluation.

SUFFICIENT UV RESISTANCE
Decrease in tensile strength and elongation at break after ageing, e.g. UL SUN RES. A change in the sheathing color is not part of the evaluation.

LOW UV RESISTANCE
No standard-related specifications. Application in the vicinity of direct intensive UV radiation is not recommended.

COMMUNICATION STRUCTURE



Please note:

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ASi – ACTUATOR SENSOR INTERFACE

Application

ASi cables, standardized in EN 50295/IEC 62026, are used to connect devices at the lowest field level (sensors and actuators). Both data and energy are transmitted via an unshielded, geometrically coded two-core flat cable. The special geometry of these cables prevents incorrect contacting (reverse polarity protection).

Easy installation is ensured using penetration technology. The TPE insulating and sheathing materials used exhibit rubber-like behavior, and comparable products are far surpassed in terms of oil resistance.

For even better oil resistance and/or cable carrier applications, we recommend our PUR version. If maximum flame resistance is required, our PVC version with a c(UL)us CMG listing is the best choice. In addition, all cables meet the requirements of EU Directive 2011/65 (RoHS).

Mechanical properties

OPERATING TEMPERATURE
–40°C to +105°C, fixed installation (TPE)
–40°C to +80°C, fixed installation (PUR)
–40°C to +90°C, fixed installation (PVC)
–30°C to +70°C, moving (PUR)

MINIMUM BENDING RADIUS
12 mm, fixed installation
24 mm, moving

Electrical properties

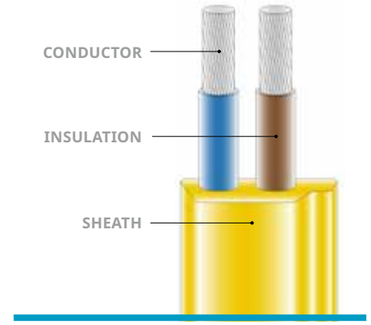
CONDUCTOR RESISTANCE: 13.7 Ohm/km (1.5 mm²)
Max. 8.21 Ohm/km (2.5 mm²)
OPERATING VOLTAGE: Max. 300 V
(peak value, not for heavy current purposes)
TEST VOLTAGE: 2.0 kV

DID YOU KNOW...

that the lug not only serves to define the position of the wire colors in a form-fitting manner? It can also be used as a sealing lip in certain applications.

INFO

The GG Group is the first and only manufacturer to offer an ASi cable with an AWM style for TPE. In addition to its rubber-like properties, this material features good oil resistance.



Structure

CONDUCTOR: Ultra-fine-stranded, tinned copper wire, 1.5 mm² or 2.5 mm²

INSULATION: Thermoplastic elastomer (TPE), polyolefin or special mixture based on polyvinyl chloride (PVC)

SHEATH: Thermoplastic elastomer (TPE), thermoplastic polyurethane mixture (PUR), matt, low adhesion, halogen free and flame resistant or special mixture based on polyvinyl chloride (PVC), yellow (similar to RAL 1012), black (similar to RAL 9005) or red (similar to RAL 3000) on request

DIMENSIONS: Approx. 10.0 x 4.0 mm

DID YOU KNOW...

that the easiest way to contact ASi cables is stripping and removal of the insulation with JOKARI® pliers no. 29050 and no. 20075 when connecting with terminals? Contacting with the piercing technique, in which the conductors are contacted directly by piercing the sheathing and insulation, is even more efficient.

NOTES:

Material number	Product designation	Sheath [Type]	OD/DIA. [mm]	Cu number [kg/km]	Weight [kg/km]	UL approvals/Features		Properties	Appli-cation
90301	ASi BUS flex 2x1.5 TPE GE	TPE	4.0 x 10.0	30.0	66	--			
90302	ASi BUS flex 2x1.5 TPE SW	TPE	4.0 x 10.0	30.0	66	--			
110563	ASi BUS flex 2x1.5 TPE RT	TPE	4.0 x 10.0	30.0	66	--			
80479	ASi BUS flex 2xAWG16 FR-TPE GE c(UR)us AWM 21439	TPE	4.0 x 10.0	30.0	66	• c(UR)us AWM 21439 105°C 300V I/II A/B FT2			
80489	ASi BUS flex 2xAWG16 FR-TPE SW c(UR)us AWM 21439	TPE	4.0 x 10.0	30.0	66	• c(UR)us AWM 21439 105°C 300V I/II A/B FT2			
107364	ASi BUS highflex 2xAWG16 FR-PUR GE c(UR)us AWM 20549	PUR	4.0 x 10.0	30.0	60	• c(UR)us AWM 20549 80°C 300V I/II A/B FT2	• Highly dynamic applications		
107366	ASi BUS highflex 2xAWG16 FR-PUR SW c(UR)us AWM 20549	PUR	4.0 x 10.0	30.0	60	• c(UR)us AWM 20549 80°C 300V I/II A/B FT2	• Highly dynamic applications		
110612	ASi BUS flex 2xAWG16 FR-PVC GE c(UL)us CMG	PVC	4.0 x 10.0	30.0	68	• (UL) CL2 90°C • c(UL)us CMG 90°C • c(UR)us AWM 2095 80°C 300V I/II A/B FT2			
110614	ASi BUS flex 2xAWG16 FR-PVC SW c(UL)us CMG	PVC	4.0 x 10.0	30.0	68	• (UL) CL2 90°C • c(UL)us CMG 90°C • c(UR)us AWM 2095 80°C 300V I/II A/B FT2			
124051	ASi BUS flex 2xAWG16 FR-PVC RT c(UL)us CMG	PVC	4.0 x 10.0	30.0	68	• (UL) CL2 90°C • c(UL)us CMG 90°C • c(UR)us AWM 2095 80°C 300V I/II A/B FT2			
143740	ASi BUS Long Distance highflex 2xAWG14 FR-PUR GE c(UR)us AWM 20549	PUR	4.0 x 10.0	50.0	76	• c(UR)us AWM 20549 80°C 300V I/II A/B FT2	• Highly dynamic applications • Long-distance applications		
143742	ASi BUS Long Distance highflex 2xAWG14 FR-PUR SW c(UR)us AWM 20549	PUR	4.0 x 10.0	50.0	76	• c(UR)us AWM 20549 80°C 300V I/II A/B FT2	• Highly dynamic applications • Long-distance applications		

NOTES:

PROFIBUS DP/FMS/FIP

Application

PROFIBUS (Process Field Bus) is a fieldbus standard that is standardized in EN 61158 and EN 61784 (formerly EN 50170) and supports a wide range of applications in production automation. PROFIBUS cables from the GG Group enable devices from different manufacturers to communicate easily without the need for special interface adaptation. This cable is suitable for PROFIBUS DP (Decentralized Peripherals), PROFIBUS FMS (Fieldbus Message Specification) and FIP (Factory Instrumentation Protocol).

Depending on the bit rate, segment lengths of up to 1,200 m can be achieved. For easy contacting and quick installation, we recommend using our quick-fit versions. By using different sheathing materials, we always have the right cable for your application. For export to the North American market, we supply products with the corresponding UL approvals. The GG Group is a member of the PROFIBUS User Organization (PNO).

Mechanical properties

OPERATING TEMPERATURE
–40°C to +80°C, fixed installation
–25°C to +70°C, fixed installation (PE)
–25°C to +80°C, fixed installation (LSZH)
–40°C to +105°C, fixed installation
(PROFIBUS DP Extemp)
Highly flexible:
–30°C to +70°C, moving (PUR)
–10°C to +70°C, moving (PVC)

MINIMUM BENDING RADIUS
8 x cable diameter, fixed installation (moving)
Highly flexible: 15 x cable diameter, moving (quick-fit version, versions for torsion and with integrated power supply)

DID YOU KNOW...

that the standardization according to PROFIBUS FMS and Sinec L1 is no longer current and valid? The current transmission standards are the PROFIBUS Design Guideline and IEC 61784-5-3.

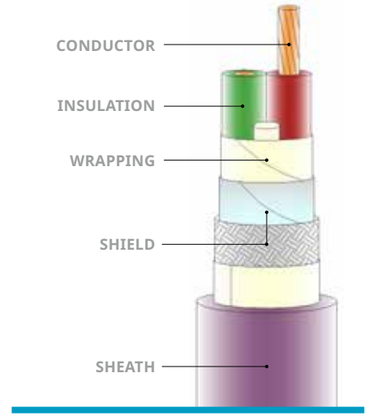
Electrical properties

CHARACTERISTIC IMPEDANCE: 150 ±15 Ohm
LOOP IMPEDANCE:
Max. 110.0 Ohm/km (solid wire)
Max. 175.2 Ohm/km (7-core stranded wire)
Max. 39.0 Ohm/km (energy)
Highly flexible:
Max. 133.0 Ohm/km
Max. 39.0 Ohm/km (energy, 1.0 mm²)
Max. 26.6 Ohm/km (energy, 1.5 mm²)
OPERATING CAPACITY: Nom. 30 nF/km
OPERATING VOLTAGE: Max. 250 V
(peak value, not for heavy current purposes)

SUPPORTED PLUG TYPES
• 9-pin D-Sub plug • 5-pin M12 plug
• Hybrid plug-in plugs

MAX. CABLE LENGTH / BUS SEGMENT

PROFIBUS DP	*1.5 Mbit/s = 200 m*
9.6 kbit/s = 1,200 m	*12.0 Mbit/s = 100 m*
19.2 kbit/s = 1,200 m	
93.75 kbit/s = 1,200 m	***FIP***
187.5 kbit/s = 1,000 m	*1.0 Mbit/s = 200 m*
500 kbit/s = 400 m	*2.5 Mbit/s = 200 m*



Structure

CONDUCTOR: Data cable: Bare copper wire, 0.64 mm = AWG22 or 7-core, bare copper wire, AWG24; Power supply: stranded, bare copper wire, 1.0 mm², *highly flexible: Ultra-fine-stranded, bare copper wire (data cable: approx. dia. 0.65 mm or dia. 0.8 mm, Power supply: 1.0 mm² or 1.5 mm²)*

INSULATION: Data cable: Foam skin polyolefin (red and green), Power supply: *highly flexible: Polyolefin or special mixture based on polyvinyl chloride (PVC) (color coding according to DIN VDE 0293 – colored or numbered)*

WRAPPING: Plastic foil or inner sheath (for quick-fit version) *highly flexible: Sliding winding (optional) or inner sheath (for quick-fit version)*

SHIELD: Aluminum composite foil, braiding made of tinned copper wires

SHEATH: Special mixture based on polyvinyl chloride (PVC), thermoplastic, halogen-free, low smoke zero halogen (LSZH), thermoplastic polyurethane mixture (PUR) or polyethylene (PE); violet (similar to RAL 4001), black (similar to RAL 9005) or blue (similar to RAL 5015)

DID YOU KNOW...

that "DP" stands for "Decentralized Peripherals" and uses the RS-485 specifications as the physical level?

NOTES:

Material number	Product designation	Sheath [Type]	OD/DIA. [mm]	Cu number [kg/km]	Weight [kg/km]	UL approvals/Features		Properties	Appli-cation
50171	PROFIBUS DP 1x2x0.64-150 FR-PVC VI	PVC	8.0	30.0	60	--			
80749	PROFIBUS DP 1x2x0.64-150 FR-PVC VI c(UL)us CMX	PVC	8.0	30.0	60	• c(UL)us CMX 75°C • c(UR)us AWM 20601 80°C 300V I/II A/B FT2			
80750	PROFIBUS DP Burial 1x2x0.64-150 FR-PVC/PE VI/SW	PVC	10.0	30.0	98	--	• Direct Burial		
110615	PROFIBUS DP Extemp 1x2x0.64-150 FR-PVC VI	PVC	8.0	30.0	60	--	• Increased temperature range, up to 105°C		
50175	PROFIBUS DP 1x2x0.64-150 FC FR-PVC VI	PVC	8.0	30.0	74	--	• Quick-fit version		
106649	PROFIBUS DP 1x2x0.64-150 FC FR-PVC VI c(UL)us CMG	PVC	8.0	30.0	76	• (UL) CL3 75°C • c(UL)us CMG 75°C • c(UR)us AWM 20201 60°C 600V I/II A/B FT1	• Quick-fit version		
110617	PROFIBUS DP 1x2x0.64-150 FC FR-PVC BL c(UL)us CMG	PVC	8.0	30.0	76	• (UL) CL3 75°C • c(UL)us CMG 75°C • c(UR)us AWM 20201 60°C 600V I/II A/B FT1	• Quick-fit version • Application in potentially explosive atmospheres		
80752	PROFIBUS DP 1x2x0.64-150 FC LSZH VI c(UL)us CM	LSZH	8.0	30.0	83	• c(UL)us CM 75°C • c(UR)us AWM 22482 80°C 600V I/II A/B FT2	• Quick-fit version		
80753	PROFIBUS DP 1x2x0.64-150 FC FR-PUR VI c(UL)us CMX	PUR	8.0	30.0	89	• c(UL)us CMX 75°C • c(UR)us AWM 21198 80°C 300V I/II A/B FT2	• Quick-fit version		
99865	PROFIBUS DP 1x2x0.64-150 FC PE SW	PE	8.0	30.0	71	--	• Use in the food industry • Quick-fit version		
110619	PROFIBUS DP flex 1x2x0.64L-150 FR-PVC VI c(UL)us CMG	PVC	8.0	30.0	67	• (UL) CL3 75°C • c(UL)us CMG 75°C • c(UR)us AWM 21694 60°C 600V I/II A/B FT1			
110630	PROFIBUS DP flex 1x2x0.64L-150+3x1.0 FR-PVC VI c(UR)us AWM 21694	PVC	9.8	60.0	108	• c(UR)us AWM 21694 60°C 600V I/II A/B FT1	• For connection to Siemens ET 200C • Integrated power supply		
105979	PROFIBUS DP highflex 1x2x0.64L-150 FR-PUR VI	PUR	8.0	30.0	65	--	• Highly dynamic applications		
106594	PROFIBUS DP highflex 1x2x0.64L-150 FR-PUR VI c(UL)us CMX	PUR	8.0	30.0	65	c(UL)us CMX 75°C	• Highly dynamic applications		
107368	PROFIBUS DP highflex 1x2x0.64L-150 FC FR-PUR VI c(UL)us CMX	PUR	8.0	30.0	80	c(UL)us CMX 75°C	• Quick-fit version • Highly dynamic applications		
119934	PROFIBUS DP highflex 1x2x0.64L-150 FC FR-PUR BL c(UL)us CMX	PUR	8.0	30.0	80	c(UL)us CMX 75°C	• Quick-fit version • Highly dynamic applications		

Material number	Product designation	Sheath [Type]	OD/DIA. [mm]	Cu number [kg/km]	Weight [kg/km]	UL approvals/Features		Properties	Appli-cation
107373	PROFIBUS DP Torsion 1x2x0.8L-150 FR-PUR VI c(UL)us CMX	PUR	8.0	31.0	70	• c(UL)us CMX 75°C	• For torsion and robot applications		
110644	PROFIBUS DP Festoon 1x2x0.64L FR-PVC VI c(UL)us CMG	PVC	8.0	30.0	65	• (UL) CL3 75°C • c(UL)us CMG 75°C • c(UR)us AWM 21694 60°C 600V I/II A/B FT1	• For garland suspension (cable trolley)		
80809	PROFIBUS DP highflex 1x2x0.64L-150+3x1.0 FR-PUR VI c(UL)us CMX	PUR	10.0	60.0	118	• c(UL)us CMX 75°C • c(UR)us AWM 21198 80°C 300V I/II A/B FT2	• Highly dynamic applications • For connection to Siemens ET 200C • Integrated power supply		
110645	PROFIBUS DP highflex 1x2x0.64L-150+2x1.5 FR-PUR VI c(UL)us CMX	PUR	11.0	60.0	140	• c(UL)us CMX 75°C • c(UR)us AWM 21198 80°C 300V I/II A/B FT2	• Highly dynamic applications • For connection to ECOFAST systems • Integrated power supply		
110646	PROFIBUS DP highflex 1x2x0.64L-150+2x1.5 FR-PVC VI c(UL)us CMG	PVC	11.0	60.0	150	• c(UL)us CMG 75°C • c(UR)us AWM 21694 60°C 600V I/II A/B FT1	• Highly dynamic applications • For connection to ECOFAST systems • Integrated power supply		
80923	PROFIBUS DP highflex 1x2x0.64L-150+4x1.5 FR-PUR VI	PUR	11.3	90.0	165	––	• Highly dynamic applications • For connection to ECOFAST systems • Integrated power supply		
110653	PROFIBUS DP highflex 1x2x0.64L-150+4x1.5 FR-PVC VI c(UL)us CMG	PVC	11.3	90.0	175	• c(UL)us CMG 75°C • c(UR)us AWM 21694 60°C 600V I/II A/B FT1	• Highly dynamic applications • For connection to ECOFAST systems • Integrated power supply		

NOTES:

PROFIBUS PA

Application

PROFIBUS (Process Field Bus) PA (Process Automation), like PROFIBUS FMS and PROFIBUS DP, is also standardized in EN 61158 and EN 61784 (formerly EN 50170) and is specially designed for use in process automation. PROFIBUS PA cables are used to connect sensors and actuators (data and power supply to the devices), especially in potentially explosive atmospheres.

Versions with increased conductor cross sections are available for longer transmission distances. Apart from the standard version, all PROFIBUS PA cables we manufacture are supplied with the corresponding UL approvals for the North American market.

Mechanical properties

OPERATING TEMPERATURE
–40°C to +80°C, fixed installation
–10°C to +70°C, moving

MINIMUM BENDING RADIUS
5 x cable diameter, fixed installation
10 x cable diameter, moving

Electrical properties

CHARACTERISTIC IMPEDANCE: 100 Ohm ±20 Ohm at 31.25 kHz
LOOP IMPEDANCE: Max. 39.0 Ohm/km (1.0 mm²)
Max. 36.4 Ohm/km (AWG18, solid)
Max. 43.8 Ohm/km (AWG18, 7-core)
Max. 27.4 Ohm/km (AWG16)
Max. 17.2 Ohm/km (AWG14)
OPERATING CAPACITY: Nom. 52 nF/km
OPERATING VOLTAGE: Max. 250 V
(peak value, not for heavy current purposes)

SUPPORTED PLUG TYPES
• 4-pin M12 plug

INFO

FOUNDATION Fieldbus and PROFIBUS PA are identical technologies in the physical layer.
The difference is communication. PROFIBUS PA systems are compatible with PROFIBUS DP and therefore have additional access to different components.

Structure

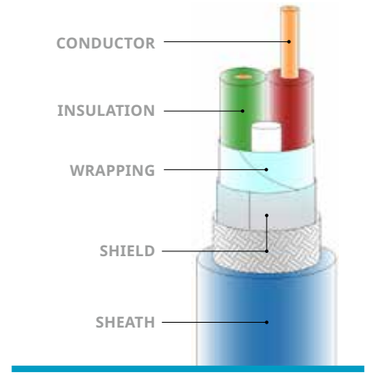
CONDUCTOR: Finely stranded, bare copper wire, 1.0 mm², solid, bare copper conductor (quick-fit version) or multi-stranded, bare copper wire AWG18, AWG16 or AWG14

INSULATION: Polyolefin or foam skin polyolefin (red and green)

WRAPPING: Plastic foil or inner sheath (for quick-fit version)

SHIELD: Plastic-laminated aluminum foil (optional) and drain wire of tinned copper wire (optional), tinned copper wire braiding

SHEATH: Special mixture based on polyvinyl chloride (PVC), blue (similar to RAL 5015) for use in hazardous areas or black (similar to RAL 9005)



DID YOU KNOW...

that with PROFIBUS PA, unlike with PROFIBUS DP, the transmission of energy is possible over the data pair?

NOTES:

Material number	Product designation	Sheath [Type]	OD/DIA. [mm]	Cu number [kg/km]	Weight [kg/km]	UL approvals/Features		Properties	Appli-cation
68234	PROFIBUS PA flex 1x2x1.0-100 FR-PVC BL	PVC	8.0	45.0	84	--	• Installation in potentially explosive atmospheres		
80998	PROFIBUS PA flex 1x2x1.0-100 FR-PVC SW	PVC	8.0	45.0	84	--			
81132	PROFIBUS PA 1x2xAWG18-100 FC FR-PVC BL c(UL)us CMG	PVC	8.0	45.0	97	• (UL) CL3 75°C • c(UL)us CMG 75°C • c(UR)us AWM 21694 60°C 600V I/II A/B FT1	• Installation in potentially explosive atmospheres • Quick-fit version		
81253	PROFIBUS PA 1x2xAWG18-100 FC FR-PVC SW c(UL)us CMG	PVC	8.0	45.0	97	• (UL) CL3 75°C • c(UL)us CMG 75°C • c(UR)us AWM 21694 60°C 600V I/II A/B FT1	• Quick-fit version		
143743	PROFIBUS PA flex 1x2xAWG18-100 FR-PVC BL c(UL)us CMG	PVC	8.0	45.0	84	• (UL) PLTC 75°C • c(UL)us CMG 75°C • c(UR)us AWM 21694 60°C 600V I/II A/B FT1	• Installation in potentially explosive atmospheres		
143744	PROFIBUS PA flex 1x2xAWG18-100 FR-PVC SW c(UL)us CMG	PVC	8.0	45.0	84	• (UL) PLTC 75°C • c(UL)us CMG 75°C • c(UR)us AWM 21694 60°C 600V I/II A/B FT1			
80949	PROFIBUS PA flex 1x2xAWG16-100 FR-PVC BL c(UL)us CMG	PVC	9.0	66.0	108	• (UL) PLTC 75°C • c(UL)us CMG 75°C • c(UR)us AWM 21694 60°C 600V I/II A/B FT1	• Installation in potentially explosive atmospheres		
81076	PROFIBUS PA flex 1x2xAWG16-100 FR-PVC SW c(UL)us CMG	PVC	9.0	66.0	108	• (UL) PLTC 75°C • c(UL)us CMG 75°C • c(UR)us AWM 21694 60°C 600V I/II A/B FT1			
110809	PROFIBUS PA flex 1x2xAWG14-100 FR-PVC BL c(UL)us CMG	PVC	10.5	77.0	143	• (UL) PLTC 75°C • c(UL)us CMG 75°C • c(UR)us AWM 21694 60°C 600V I/II A/B FT11	• Installation in potentially explosive atmospheres		
110865	PROFIBUS PA flex 1x2xAWG14-100 FR-PVC SW c(UL)us CMG	PVC	10.5	77.0	143	• (UL) PLTC 75°C • c(UL)us CMG 75°C • c(UR)us AWM 21694 60°C 600V I/II A/B FT1			

NOTES:

FOUNDATION™ FIELDBUS

Application

The FOUNDATION™ Fieldbus cables we manufacture follow the FOUNDATION™ Fieldbus recommendation for type A cables and IEC 61158.

The cables are designed for use in process automation, including in potentially explosive atmospheres, with maximum permissible transmission lengths of up to 1,900 meters. Cables for longer transmission distances are also available. All cables are supplied with the corresponding UL approvals for the North American market.

Mechanical properties

OPERATING TEMPERATURE
–40°C to +80°C, fixed installation
–10°C to +70°C, moving

MINIMUM BENDING RADIUS
5 x cable diameter, fixed installation
10 x cable diameter, moving

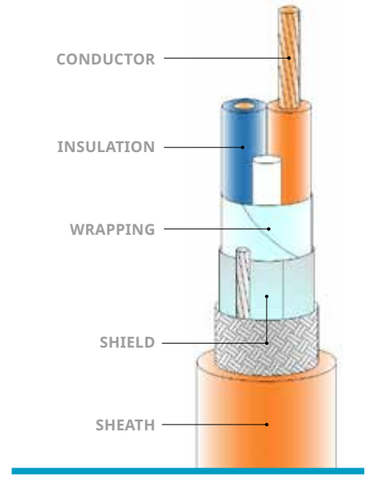
Electrical properties

CHARACTERISTIC IMPEDANCE: 100 Ohm ±20 Ohm at 31.25 kHz
LOOP IMPEDANCE: Max. 43.8 Ohm/km (AWG18)
Max. 27.4 Ohm/km (AWG16)
Max. 17.2 Ohm/km (AWG14)
OPERATING CAPACITY: Max. 60 nF/km
OPERATING VOLTAGE: Max. 300 V
(peak value, not for heavy current purposes)

SUPPORTED PLUG TYPES
- 4-pin 7/8” plug
- 4-pin M12 plug

INFO

FOUNDATION Fieldbus and PROFIBUS PA are identical technologies in the physical layer. FOUNDATION Fieldbus systems communicate at defined intervals and without a request from the master. This leads to increased supervision, and checks are carried out outside the controller cycles.



Structure

CONDUCTOR: Stranded bare copper wire, AWG18, AWG16 or AWG14

INSULATION: Polyolefin or foam skin polyolefin (orange and blue)

WRAPPING: Plastic foil

SHIELD: Plastic-laminated aluminum foil, tinned copper drain wire and braiding made of tinned copper wires (except for Eco variant)

SHEATH: Special mixture based on polyvinyl chloride (PVC), blue (similar to RAL 5015) for use in hazardous areas or orange (similar to RAL 2003)

NOTES:

Material number	Product designation	Sheath [Type]	OD/DIA. [mm]	Cu number [kg/km]	Weight [kg/km]	UL approvals/Features		Properties	Appli-cation
143745	FOUNDATION™ Fieldbus Eco flex EX 2xAWG18-100 FR-PVC BL c(UL)us CMG	PVC	7.4	23.0	65	• (UL) PLTC 75°C • c(UL)us CMG 75°C • c(UR)us AWM 21694 60°C 600V I/II A/B FT1	• Economical design • Application in potentially explosive atmospheres		
143747	FOUNDATION™ Fieldbus Eco flex 2xAWG18-100 FR-PVC OR c(UL)us CMG	PVC	7.4	23.0	65	• (UL) PLTC 75°C • c(UL)us CMG 75°C • c(UR)us AWM 21694 60°C 600V I/II A/B FT1	• Economical design		
81255	FOUNDATION™ Fieldbus flex EX 2xAWG18-100 FR-PVC BL c(UL)us CMG	PVC	8.0	45.0	84	• (UL) PLTC 75°C • c(UL)us CMG 75°C • c(UR)us AWM 21694 60°C 600V I/II A/B FT1	• Economical design		
81288	FOUNDATION™ Fieldbus flex 2xAWG18-100 FR-PVC OR c(UL)us CMG	PVC	8.0	45.0	84	• (UL) PLTC 75°C • c(UL)us CMG 75°C • c(UR)us AWM 21694 60°C 600V I/II A/B FT1			
81261	FOUNDATION™ Fieldbus flex EX 2xAWG16-100 FR-PVC BL c(UL)us CMG	PVC	9.0	66.0	108	• (UL) PLTC 75°C • c(UL)us CMG 75°C • c(UR)us AWM 21694 60°C 600V I/II A/B FT1	• Application in potentially explosive atmospheres		
81302	FOUNDATION™ Fieldbus flex 2xAWG16-100 FR-PVC OR c(UL)us CMG	PVC	9.0	66.0	108	• (UL) PLTC 75°C • c(UL)us CMG 75°C • c(UR)us AWM 21694 60°C 600V I/II A/B FT1			
81262	FOUNDATION™ Fieldbus flex EX 2xAWG14-100 FR-PVC BL c(UL)us CMG	PVC	10.5	77.0	143	• (UL) PLTC 75°C • c(UL)us CMG 75°C • c(UR)us AWM 21694 60°C 600V I/II A/B FT1	• Application in potentially explosive atmospheres		
81316	FOUNDATION™ Fieldbus flex 2xAWG14-100 FR-PVC OR c(UL)us CMG	PVC	10.5	77.0	143	• (UL) PLTC 75°C • c(UL)us CMG 75°C • c(UR)us AWM 21694 60°C 600V I/II A/B FT1			

NOTES:

INDUSTRIAL SPE & PROFINET 1-PAIR

Application

Single-Pair Ethernet cables extend the existing Ethernet infrastructure with an additional cabling option. Conventionally, 2- to 4-pair cables are used. By reducing the dimensions, and consequently, the weight, SPE Ethernet is finding its way onto the sensor-actuator level for the first time and will replace conventional BUS systems with the extended intelligent possibilities of the Ethernet standard in the long term. This requires a wide range of transmission characteristics from 10 Mbit/s to 1 Gbit/s in accordance with IEC 61156 specifications.

The products cover a cross-section range from AWG26 to AWG18. The highly flexible versions for torsional stress are designed for at least five million cycles. The focus of products offered by GG to date has been on plant engineering. All materials are optimized for use in industrial environments. The cables are equipped with the corresponding approvals for European and North American regions (e.g. with UL approvals in accordance with UL13/444/758). This means that the basic requirements for every exporter are met.

In addition, SPE types are already available in accordance with the PROFINET standard, typically PROFINET with standardized AWG22 conductors. Assembly can be simplified even further by choosing Fast-Connect versions. The data elements for SPE hybrid solutions are available, and depending on the plug connector system selected, the final SPE hybrid cable can be designed according to your individual customer requirements.

Mechanical properties

OPERATING TEMPERATURE
–40°C to +80°C, fixed installation
Highly flexible:
–10°C to +70°C, moving
–30°C to +70°C, moving (PUR)

MINIMUM BENDING RADIUS
8 x cable diameter, fixed installation
Highly flexible: 15 x cable diameter, moving

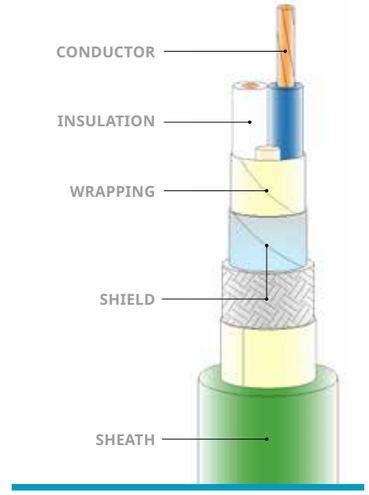
DID YOU KNOW...

that the origin of Single-Pair Ethernet is automotive data transmission?

Electrical properties

CHARACTERISTIC IMPEDANCE: 100 ±5 Ohm
LOOP IMPEDANCE:
Max. 280.0 Ohm/km (AWG26, 7-core)
Max. 175.2 Ohm/km (AWG24, 7-core)
Highly flexible:
Max. 110.8 Ohm/km (AWG22, 7-core)
Max. 108.6 Ohm/km (AWG22, solid)
Max. 44.4 Ohm/km (AWG18, 7-core)
Max. 43.6 Ohm/km (AWG18, solid)
OPERATING CAPACITY: Nom. 50 nF/km
OPERATING VOLTAGE: Max. 125 V
(peak value, not for heavy current purposes)

HF PROPERTIES:
Static: IEC 61156-11 (T1-B up to 600 MHz/T1-C up to 1.25 GHz), flexible: IEC 61156-12 (T1-B up to 600 MHz T1-C up to 1.25 GHz), long-distance static: IEC 61156-13 (T1A-400/T1A-1000 up to 20 MHz), long-distance flexible: IEC 61156-14 (T1A-400W/T1A-1,000 W up to 20 MHz)



Structure

CONDUCTOR: Data cable: Solid bare copper conductor, AWG18/ AWG22, 7-core bare copper conductor, AWG26/AWG24/AWG22/AWG18

INSULATION: Polyolefin or foam skin polyolefin (blue/white)

WRAPPING: Plastic foil (additional extruded core sheathing for quick-fit versions)

SHIELD: Aluminum composite foil and braiding made of tinned copper wires

SHEATH: Special polyvinyl chloride-based mixture (PVC), *highly flexible: Thermoplastic polyurethane mixture (PUR),* matt, low adhesion, halogen free and flame resistant, green (similar to RAL 6018) or blue (similar to RAL 5015)

DID YOU KNOW...

that there is a rule of thumb for using the same cable for short and long distance communication? If the cable achieves T1B at 600 MHz according to IEC 61156-12, T1A400W with 20 MHz according to IEC 61156-14 will most likely also be fulfilled.

NOTES:

Fast-Connect is a registered trademark of Siemens AG.

Material number	Product designation	Sheath [Type]	OD/DIA. [mm]	Cu number [kg/km]	Weight [kg/km]	UL approvals/Features		Properties	Appli-cation
192592	PROFINET Type A 1 Pair T1-C 2x AWG22-100 FR-PVC GN c(UL)us CM	PVC	5.8	20.0	43	• (UL) PLTC 75°C • c(UL)us CM 75°C • c(UR)us AWM 21695 80°C 600V I/II A/B FT1	• PROFINET applications		
169390	PROFINET Type B 1 Pair T1-C flex 2x AWG22-100 FR-PVC GN c(UL)us CM	PVC	5.8	20.0	43	• (UL) PLTC 75°C • c(UL)us CM 75°C • c(UR)us AWM 21695 80°C 600V I/II A/B FT1	• PROFINET applications		
192593	PROFINET Type A 1 Pair T1-C 2x AWG22-100 FC FR-PVC GN c(UL)us CMX Out-door-CMG	PVC	6.1	20.0	49	• (UL) PLTC-ER 75°C • c(UL)us CMX Outdoor-CMG 75°C • c(UR)us AWM 2570 80°C 600V I/II A/B FT1	• PROFINET applications • Quick-fit version		
189985	PROFINET Type B 1 Pair T1-C flex 2x AWG22-100 FC FR-PVC GN c(UL)us CMX Out-door-CMG	PVC	6.1	20.0	49	• (UL) PLTC-ER 75°C • c(UL)us CMX Outdoor-CMG 75°C • c(UR)us AWM 2570 80°C 600V I/II A/B FT1	• PROFINET applications • Quick-fit version		
186908	PROFINET Type B 1 Pair T1-B flex 2x AWG22-100 FR-PUR GN c(UR)us AWM 21223	PUR	5.8	22.0	40	• c(UR)us AWM 21223 80°C 600V I/II A/B FT1	• PROFINET applications		
176625	PROFINET Type C 1 Pair T1-B Torsion 2x AWG22-100 FR-PUR GN c(UR)us AWM 21223	PUR	5.8	20.0	41	• c(UR)us AWM 21223 80°C 600V I/II A/B FT1	• PROFINET applications • Highly dynamic applications		
190128	INDUSTRIAL SPE T1-B flex 2x AWG24-100 FR-PVC GN c(UR)us AWM 21695	PVC	5.3	17.5	35	• c(UR)us AWM 21695 80°C 600V I/II A/B FT1			
190623	INDUSTRIAL SPE T1-B flex 2x AWG24-100 FR-PUR GN c(UR)us AWM 21238	PUR	5.3	17.5	32	• c(UR)us AWM 21238 80°C 600V I/II A/B FT1			
186844	INDUSTRIAL SPE T1-B flex 2x AWG26-100 FR-PVC GN c(UR)us AWM 21695	PVC	4.5	15.0	27	• c(UR)us AWM 21695 80°C 600V I/II A/B FT1			
186845	INDUSTRIAL SPE T1-B flex 2x AWG26-100 FR-PUR GN c(UR)us AWM 21238	PUR	4.5	15.0	25	• c(UR)us AWM 21238 80°C 600V I/II A/B FT1			
176605	INDUSTRIAL SPE T1-B Torsion 2x AWG26-100 FR-PUR GN c(UR)us AWM 21238	PUR	4.5	15.0	27	• c(UR)us AWM 21238 80°C 600V I/II A/B FT1	• Highly dynamic applications		
174960	INDUSTRIAL SPE T1-A 2x AWG18-100 FR-PVC BL c(UL)us CMG	PVC	8.0	45.0	96	• (UL) PLTC 75°C • c(UL)us CMG 75°C • c(UR)us AWM 2570 80°C 600V I/II A/B FT1			
181559	INDUSTRIAL SPE T1-A flex 2x AWG18-100 FR-PVC BL c(UL)us CMG	PVC	8.0	45.0	95	• (UL) PLTC 75°C • c(UL)us CMG 75°C • c(UR)us AWM 2570 80°C 600V I/II A/B FT1			
163600	INDUSTRIAL SPE T1-A flex 2x AWG18-100 FR-PUR BL c(UR)us AWM 21238	PUR	8.0	45.0	75	• c(UR)us AWM 21238 80°C 600V I/II A/B FT1			

PROFINET TWO-PAIR

DID YOU KNOW...

that the PROFINET type C_IDC_cable is supplied with transmission capabilities in accordance with IEC 61156-5? In motion, however, the transmission evaluation is carried out in accordance with IEC 61156-6.

Application

The manufacturer-independent PROFINET standard enables transfer rates of up to 100 Mbit/s. The special feature is the consistent use of a uniform conductor cross section of AWG22, regardless of whether for fixed installation (type A) or limited flexible use (type B) indoors. Cables for use in a control cabinet (cabinet cables) are an exception.

The standard cables and the variant with rodent protection are supplied in an easy-to-install quick-contact version. All cables, with the exception of the high-temperature version, are approved for the North American market.

Highly flexible: The PROFINET concept of the uniform cross-section was also taken into account in the highly flexible version (type C) in order to enable transfer rates of up to 100 Mbit/s in the cable carrier. The special shielding and the particularly rugged polyurethane shielding guarantee that the cable can withstand even the most extreme requirements in harsh industrial environments. The PVC version is used in applications where high flame resistance is required. Both variants are also available in versions suitable for insulation displacement connection (IDC). The range is supplemented by a cable suitable for torsional stress and a cable suitable for garland suspension.

Other than the torsion cable, the highly flexible PROFINET cables are supplied with an easy-to-install quick contact design, and all products have the relevant approvals for export to the North American market.

Mechanical properties

OPERATING TEMPERATURE
–40°C to +80°C, fixed installation
–25°C to +80°C, fixed installation (LSZH)
–50°C to +180°C (briefly up to 205°C), fixed installation (FEP)
Highly flexible:
–10°C to +70°C, moving (PVC only for flexible versions)
–30°C to +70°C, moving (PUR)

MINIMUM BENDING RADIUS
10 x cable diameter, fixed installation
Highly flexible: 15 x cable diameter, moving

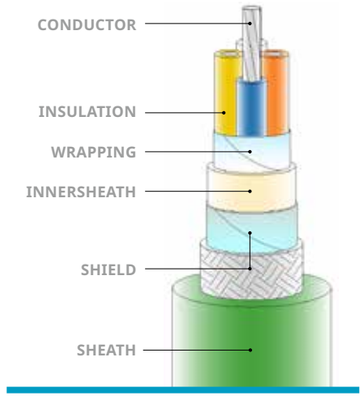
DID YOU KNOW...

that the PROFINET type C cable is the only type that allows a sheath color other than yellow-green RAL 6018?

Electrical properties

CHARACTERISTIC IMPEDANCE: 100 ±5 Ohm at 100 MHz
LOOP IMPEDANCE: Max. 115.0 Ohm/km (AWG22)
Highly flexible: Max. 110.8 Ohm/km
Max. 181.8 Ohm/km (AWG24)
Max. 115.0 Ohm/km (energy, 0.34 mm^2)
Max. 26.6 Ohm/km (energy, 1.5 mm^2)
OPERATING CAPACITY: Nom. 48 nF/km
OPERATING VOLTAGE: Max. 125 V
(peak value, not for heavy current purposes)
HF PROPERTIES: Cat. 5e according to IEC 61156-5 (AWG22)
Cat. 5e according to IEC 61156-6 (AWG24)

SUPPORTED PLUG TYPES
- PROFINET-compliant RJ45 plugs
- M12 plug
- Hybrid plug-in plugs



Structure

CONDUCTOR: Solid, bare copper conductor (type A), (highly flexible: Ultra-fine-stranded; type C) 7-core, tinned stranded copper wire, AWG22 (type B), or 7-core, tinned stranded copper wire, AWG24 (cabinet cable) (data cable), power supply 0.34 mm^2 or 1.5 mm^2

INSULATION: Data cable: Polyolefin or foam skin polyolefin (white, yellow, blue and orange), Power supply: Polyolefin or special mixture based on polyvinyl chloride (PVC) (color coding according to DIN VDE 0293 – colored or numbered)

WRAPPING: Plastic foil (additional extruded core sheathing for quick-fit versions)

SHIELD: Aluminum composite foil *(highly flexible: conductive sliding winding)* and braiding made of tinned copper wires

SHEATH: Special mixture based on polyvinyl chloride (PVC), thermoplastic, halogen-free, flame-resistant polymer compound (LSZH) or fluoroethylene propylene (FEP), green (similar to RAL 6018)

INFO

4-pair PROFINET cables can be found in the Industrial Ethernet section. We recommend the use of our fiber optic cables for connections between buildings and for use in case of high electromagnetic interference. They can be found under the heading PoF/PcF bus cables in this catalog

NOTES:

Material number	Product designation	Sheath [Type]	OD/DIA. [mm]	Cu number [kg/km]	Weight [kg/km]	UL approvals/Features		Properties	Appli-cation
81494	PROFINET Type A Cat. 5e 2x2xAWG22-100 FC FR-PVC GN c(UL)us CMG	PVC	6.5	32.0	68	• (UL) PLTC 75°C • c(UL)us CMG 75°C • c(UR)us AWM 20201 60°C 600V I/II A/B FT1	• Quick-fit version		
76381	PROFINET Type A Cat. 5e 2x2xAWG22-100 FC LSZH GN c(UR)us AWM 22482	LSZH	6.5	32.0	71	• c(UR)us AWM 22482 80°C 600V I/II A/B FT2	• Quick-fit version		
75269	PROFINET Type B Cat. 5e 2x2xAWG22-100 FC FR-PVC GN c(UL)us CMG	PVC	6.5	32.0	69	• (UL) PLTC 75°C • c(UL)us CMG 75°C • c(UR)us AWM 20201 60°C 600V I/II A/B FT1	• Quick-fit version		
143749	PROFINET Type B Outdoor Cat. 5e 2x2xAWG22-100 FC FR-PVC SW c(UL)us CMG	PVC	6.5	32.0	69	• (UL) PLTC 75°C • c(UL)us CMG 75°C • c(UR)us AWM 20201 60°C 600V I/II A/B FT1	• Quick-fit version • Outdoor installation • Increased UV resistance		
76415	PROFINET Type B Cat. 5e 2x2xAWG22-100 FC LSZH GN c(UR)us AWM 22482	LSZH	6.5	32.0	72	• c(UR)us AWM 22482 80°C 600V I/II A/B FT2	• Quick-fit version		
110910	PROFINET Type B Cat. 5e 2x2xAWG22-100+4x0.34 LSZH GN c(UR)us AWM 22482	LSZH	8.5	54.0	108	• c(UR)us AWM 22482 80°C 600V I/II A/B FT2	• Integrated power supply		
110915	PROFINET Type B Cat. 5e 2x2xAWG22-100+4x1.5 LSZH GN c(UR)us AWM 22482	LSZH	10.3	94.0	153	• c(UR)us AWM 22482 80°C 600V I/II A/B FT2	• Integrated power supply		
130176	PROFINET Cabinet Cable Cat. 5e 2x2xAWG24-100 FR-PVC GN c(UR)us AWM 20601	PVC	5.2	22.0	37	• c(UR)us AWM 20601 80°C 300V I/II A/B FT2	• PROFINET cabinet cable applications		
130180	PROFINET Cabinet Cable Cat. 5e 2x2xAWG24-100 LSZH GN c(UR)us AWM 22482	LSZH	5.2	22.0	39	• c(UR)us AWM 22482 80°C 600V I/II A/B FT2	• PROFINET cabinet cable applications		
130179	PROFINET Cabinet Cable Cat. 5e 2x2xAWG24-100 FR-PUR c(UR)us AWM 21198	PUR	5.2	22.0	37	• c(UR)us AWM 21198 80°C 300V I/II A/B FT2	• PROFINET cabinet cable applications		
81536	PROFINET Type C Cat. 5e 2x2xAWG22-100 FC FR-PUR GN c(UL)us CMX	PUR	6.5	32.0	68	• c(UL)us CMX 75°C • c(UR)us AWM 21198 80°C 300V I/II A/B FT2	• Quick-fit version • Highly dynamic applications		
110866	PROFINET Type C Cat. 5e 2x2xAWG22-100 FC IDC FR-PUR GN c(UL)us CMX	PUR	6.5	32.0	68	• c(UL)us CMX 75°C • c(UR)us AWM 21198 80°C 300V I/II A/B FT2	• Quick-fit version • Highly dynamic applications		

NOTES:

Material number	Product designation	Sheath [Type]	OD/DIA. [mm]	Cu number [kg/km]	Weight [kg/km]	UL approvals/Features		Properties	Appli-cation
81535	PROFINET Type C Cat. 5e 2x2xAWG22-100 FC FR-PVC GN c(UL)us CMG	PVC	6.5	32.0	70	• (UL) PLTC 75°C • c(UL)us CMG 75°C • c(UR)us AWM 20201 60°C 600V I/II A/B FT1	• Quick-fit version • Highly dynamic applications		
110867	PROFINET Type C Cat. 5e 2x2xAWG22-100 FC IDC FR-PVC GN c(UL)us CMG	PVC	6.5	32.0	70	• (UL) PLTC 75°C • c(UL)us CMG 75°C • c(UR)us AWM 20201 60°C 600V I/II A/B FT1	• Quick-fit version • Highly dynamic applications • Suitable for insulation displacement connection		
110868	PROFINET Type C Cat. 5e Torsion 2x2xAWG22-100 FR-PUR GN c(UL)us AWM 21198	PUR	6.5	32.0	54	• c(UR)us AWM 21198 80°C 300V I/II A/B FT2	• For torsion and robot applications		
110869	PROFINET Type C Cat. 5e Festoon 2x2xAWG22-100 FC IDC FR-PVC GN c(UL)us CMG	PVC	6.5	32.0	74	• (UL) PLTC 75°C • c(UL)us CMG 75°C • c(UR)us AWM 20201 60°C 600V I/II A/B FT1	• For garland suspension (cable trolley) • Quick-fit version • Suitable for insulation displacement connection		
189302	PROFINET Type R Cat. 5e 4xAWG22-100 FR-PUR GN c(UR)us AWM 21238	PUR	6.5	X	58	• c(UR)us 21238 80°C 600V I/II A/B FT2	• Cable carrier, torsion, alternate bending applications in robots		
194198	PROFINET Type R Cat. 5e 4xAWG22-100 FC FR-PUR GN c(UR)us AWM 21238	PUR	6.5	X	63	• c(UR)us 21238 80°C 600V I/II A/B FT2	• Cable carrier, torsion, alternate bending applications in robots		

NOTES:

INDUSTRIAL ETHERNET

DID YOU KNOW...

that the transmission characteristics of a Cat. 7 according to IEC 61156-5/-6 for near-end crosstalk (NEXT) can only be achieved by applying a pair shield?

Application

GG Group Industrial Ethernet cables are used in the field of industrial automation and are intended for fixed or partially flexible installation indoors.

The cables are available in 2- and 4-pair versions and enable data transfer rates of up to 1,024 Mbit/s. The sheathing materials and shielding are specially designed for use in harsh industrial environments. Approvals for the North American market are a must for every exporter. With DRIVE CLiQ cables, there is a cable for pure data transmission and a version with an integrated power supply.

Highly flexible: Through consistent further development of the cables, the GG Group has succeeded in guaranteeing the increased requirements of Category 6A, even for use in cable carriers. Of course the cables are suitable for use in harsh industrial environments and have excellent resistance to oil and chemicals, for data transmission rates of up to 10 Gbit/s. The latest cables in this product group meet and exceed the Category 7 requirements in accordance with IEC 61156. For DRIVE CLiQ systems, there are two versions suitable for cable carriers with integrated power supply, depending on the requirements in the cable carrier. The range is supplemented by cables for the real-time-based EtherCAT® system.

Mechanical properties

OPERATING TEMPERATURE
–40°C to +80°C, fixed installation
–25°C to +80°C, fixed installation (LSZH)
–50°C to +180°C (briefly up to 205°C), fixed installation (FEP)
Highly flexible:
–10°C to +70°C, moving
–30°C to +70°C, moving (PUR)

MINIMUM BENDING RADIUS
8 x cable diameter, fixed installation
Highly flexible: 15 x cable diameter, moving

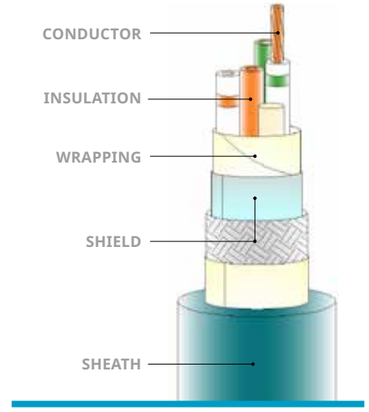
DID YOU KNOW...

that the typical plug connectors for Cat.7A are TERA or GG45? The RJ45 cannot be used.

Electrical properties

CHARACTERISTIC IMPEDANCE: 100 ±5 Ohm at 100 MHz
LOOP IMPEDANCE:
Max. 187.6 Ohm/km (AWG24, solid)
Max. 175.2 Ohm/km (AWG24, 7-core)
Max. 280.0 Ohm/km (AWG26)
Max. 110.8 Ohm/km (AWG22, energy)
Max. 115.0 Ohm/km (AWG22)
Max. 146.2 Ohm/km (AWG23)
OPERATING CAPACITY: Nom. 48 nF/km
OPERATING VOLTAGE: Max. 125 V
(peak value, not for heavy current purposes)
HF PROPERTIES: Cat. 5e according to IEC 61156-5 (solid) or IEC 61156-6 (7-core) Cat. 7 according to IEC 61156-5 (AWG22) or IEC 61156-6 (AWG23 and AWG26)

SUPPORTED PLUG TYPES
- RJ45 plug (suitable for industrial use)
- RJ45 plug with integrated power contacts
- M8 plug



Structure

CONDUCTOR: Data cable: Solid, bare copper conductor, AWG24, 7-core, bare copper wire, AWG26 or AWG24 or ultra-fine-stranded bare copper wire, AWG26, Power supply: Stranded, bare copper wire, AWG22

INSULATION: Data cable: (Foam skin) polyolefin or fluoroethylene propylene (FEP) (color coding according to IEC 60708, DRIVE CLiQ cables: green, yellow, pink and blue) or polyolefin (white, yellow, blue and orange) (EtherCAT®), Power supply: Polyolefin (red and black)

WRAPPING: Plastic foil *(highly flexible: Thermoplastic elastomer – TPE)*

SHIELD: Aluminum composite foil and braiding made of tinned copper wires

SHEATH: Special mixture based on polyvinyl chloride (PVC), thermoplastic polyurethane mixture (PUR), matt, low adhesion, halogen free and flame resistant, thermoplastic, halogen-free, low smoke zero halogen (LSZH) or fluoro-ethylene propylene (FEP), green (similar to RAL 6018)

DRIVE CLiQ

is a serial real-time interface based on Ethernet technology between the main drive components, including motors and encoders, and reduces the variety of parts. Electronic type plates in the devices enable automatic identification of all drive components via the DRIVE CLiQ cable. Manual data entry during commissioning or replacement is no longer necessary. Unlike conventional resolver cables, DRIVE CLiQ cables can be unplugged and plugged in under tension, which further reduces downtimes.

ETHERCAT®

is an Ethernet-based real-time fieldbus system which sets new performance standards. Thanks to its flexible topology and easy configuration, handling is similar to a conventional fieldbus system. Thanks to cost-effective implementation, it is now possible to use the system in applications where using Ethernet-based systems was unthinkable in the past. With EtherCAT®, the complex Ethernet star topology can be replaced by a simple line or tree structure, thereby eliminating the need for expensive infrastructure components. Any Ethernet devices can be integrated using a switch or switch port.

Material number	Product designation	Sheath [Type]	OD/DIA. [mm]	Cu number [kg/km]	Weight [kg/km]	UL approvals/Features	Properties	Appli-cation
131877	INDUSTRIAL ETHERNET Cat. 5e 4x2xAWG24-100 FR-PVC GN c(UL)us CMG	PVC	6.5	35.0	60	• (UL) CL3 75°C • c(UL)us CMG 75°C • c(UR)us AWM 20601 80°C 300V I/II A/B FT1		
131881	INDUSTRIAL ETHERNET Cat. 5e 4x2xAWG24-100 FR-PUR GN c(UL)us CMX	PUR	6.5	35.0	57	• c(UL)us CMX 75°C • c(UR)us AWM 20549 80°C 300V I/II A/B FT1		
131885	INDUSTRIAL ETHERNET Cat. 5e 4x2xAWG24-100 LSZH GN	LSZH	6.5	35.0	60			
113251	INDUSTRIAL ETHERNET Cat. 5e flex 4x2xAWG26-100 FR-PVC GN c(UL)us CMG	PVC	6.2	30.0	49	• (UL) CL2 75°C • c(UL)us CMG 75°C • c(UR)us AWM 20601 80°C 300V I/II A/B FT1		
131882	INDUSTRIAL ETHERNET Cat. 5e flex 4x2xAWG26-100 FR-PUR GN c(UL)us CMX	PUR	6.2	30.0	55	• c(UL)us CMX 75°C • c(UR)us AWM 20549 80°C 300V I/II A/B FT2		
131886	INDUSTRIAL ETHERNET Cat. 5e flex 4x2xAWG26-100 LSZH GN	LSZH	6.2	30.0	55			
107026	INDUSTRIAL ETHERNET Cat. 5e flex 2x2xAWG24-100 FR-PVC GN c(UL)us CMG	PVC	6.8	30.0	57	• c(UL)us CMG 75°C • c(UR)us AWM 20601 80°C 300V I/II A/B FT1		
107025	INDUSTRIAL ETHERNET Cat. 5e flex DC 2x2xAWG24-100 + 2xAWG22 FR-PVC GN c(UR)us AWM 20601	PVC	7.0	38.0	64	• c(UR)us AWM 20601 80°C 300V I/II A/B FT1		
136763	INDUSTRIAL ETHERNET Cat. 5e flex EC 4xAWG26-100 FR-PVC GN c(UR)us AWM 20601	PVC	4.9	20.0	32	• c(UR)us AWM 20601 80°C 300V I/II A/B FT1		
143750	INDUSTRIAL ETHERNET Cat. 5e flex EC 4xAWG26-100 FR-PUR GN c(UR)us AWM 20549	PUR	4.9	20.0	32	• c(UR)us AWM 20549 80°C 300V I/II A/B FT2		
81538	INDUSTRIAL ETHERNET Cat. 5e highflex 2x2xAWG26-100 FC FR-PUR BL	PUR	5.8	20.0	41	--		
81567	INDUSTRIAL ETHERNET Cat. 5e highflex 4x2xAWG26-100 FC FR-PUR BL	PUR	6.3	27.0	55	--		
143791	INDUSTRIAL ETHERNET Cat. 5e highflex 4xAWG26-100 FR-PUR GN c(UR)us AWM 20549	PUR	4.8	18.0	30	• c(UR)us AWM 20549 80°C 300V I/II A/B FT2		
116180	INDUSTRIAL ETHERNET Cat. 5e highflex 4x2xAWG26-100 FR-PUR GN c(UR)us AWM 20549	PUR	6.8	28.0	54	• c(UR)us AWM 20549 80°C 300V I/II A/B FT2		
136644	INDUSTRIAL ETHERNET Cat. 5e highflex EC 4xAWG26-100 FR-PUR GN c(UR)us AWM 20549	PUR	5.3	20.0	35	• c(UR)us AWM 20549 80°C 300V I/II A/B FT2		
123686	INDUSTRIAL ETHERNET Cat. 5e torsion 4x2xAWG26-100 FR-PUR GN c(UR)us AWM 20549	PUR	7.1	26.0	57	• c(UR)us AWM 20549 80°C 300V I/II A/B FT2		
106993	INDUSTRIAL ETHERNET Cat. 5e highflex DC 2x2xAWG26-100 + 2xAWG22 FR-PUR GN c(UL)us CMX	PUR	7.0	38.0	65	• c(UL)us CMX 75°C • c(UR)us AWM 20549 80°C 300V I/II A/B FT1		

Material number	Product designation	Sheath [Type]	OD/DIA. [mm]	Cu number [kg/km]	Weight [kg/km]	UL approvals/Features	Properties	Appli-cation
143752	INDUSTRIAL ETHERNET Cat. 5e highflex DC plus 2x2xAWG25-100 + 2xAWG22 FR-PUR GN c(UR)us AWM 20549	PUR	7.0	40.0	63	• c(UR)us AWM 20549 80°C 300V I/II A/B FT1		
128319	INDUSTRIAL ETHERNET Cat. 6 highflex 4x2xAWG25-100 FC FR-PUR GN c(UL)us CMX	PUR	7.8	34.0	70	• c(UL)us CMX 75°C • c(UR)us AWM 20549 80°C 300V I/II A/B FT1		
137132	INDUSTRIAL ETHERNET Cat. 6 highflex 4x2xAWG26-100 FR-PUR GN c(UL)us CMX	PUR	7.8	34.0	80	• c(UL)us CMX 75°C • c(UR)us AWM 20549 80°C 300V I/II A/B FT1		
131895	INDUSTRIAL ETHERNET Cat. 7 4x2xAWG22-100 FR-PVC GN c(UL)us CMG	PVC	8.8	53.0	103	• (UL) CL3 75°C • c(UL)us CMG 75°C • c(UR)us AWM 20601 80°C 300V I/II A/B FT1		
143756	INDUSTRIAL ETHERNET Cat. 7 4x2xAWG22-100 FC FR-PVC GN c(UL)us CMG	PVC	9.6	44.0	106	• c(UL)us CMG 75°C • c(UR)us AWM 20601 80°C 300V I/II A/B FT1		
131900	INDUSTRIAL ETHERNET Cat. 7 4x2xAWG22-100 FR-PUR GN c(UL)us CMX	PUR	8.8	53.0	83	• c(UL)us CMX 75°C • c(UR)us AWM 20549 80°C 300V I/II A/B FT1		
131903	INDUSTRIAL ETHERNET Cat. 7 4x2xAWG22-100 LSZH GN	LSZH	8.8	53.0	96			
143753	INDUSTRIAL ETHERNET Cat. 7 flex 4x2xAWG23-100 FR-PVC GN c(UL)us CMG	PVC	8.8	48.0	90	• c(UL)us CMG 75°C • c(UR)us AWM 2095 80°C 300V I/II A/B FT1		
143754	INDUSTRIAL ETHERNET Cat. 7 flex 4x2xAWG23-100 FR-PUR GN c(UL)us CMX	PUR	8.8	48.0	90	• c(UL)us CMX 75°C • c(UR)us AWM 20549 80°C 300V I/II A/B FT1		
143755	INDUSTRIAL ETHERNET Cat. 7 flex 4x2xAWG23-100 LSZH GN	LSZH	8.8	48.0	93	--		
113253	INDUSTRIAL ETHERNET Cat. 7 flex 4x2xAWG26-100 FR-PVC GN c(UL)us CMG	PVC	7.5	33.0	53	• (UL) CL3 75°C • c(UL)us CMG 75°C • c(UR)us AWM 20601 80°C 300V I/II A/B FT1		
113244	INDUSTRIAL ETHERNET Cat. 7 flex 4x2xAWG26-100 FR-PUR GN c(UL)us CMX	PUR	7.5	33.0	59	• c(UL)us CMX 75°C • c(UR)us AWM 20549 80°C 300V I/II A/B FT1		
131904	INDUSTRIAL ETHERNET Cat. 7 flex 4x2xAWG26-100 LSZH GN	LSZH	7.5	33.0	66			

NOTES:

INTERBUS

Application

INTERBUS is a fieldbus system standardized in the European EN 50254, international IEC 61158 and national DIN 19258 standards. The system was developed by Phoenix Contact.

INTERBUS cables from the GG Group are used as remote bus cables (type RBC) or installation remote bus cables with integrated power supply (type INBC) in the field of production automation.

There are versions available for indoor installation as well as cables with increased UV resistance for outdoor use and for direct installation in the ground, all of which naturally also have the corresponding approvals for the North American market.

Highly flexible: The GG Group has developed remote bus cables (type RBC) and installation remote bus cables with integrated power supply (type INBC) for Interbus systems for permanent use on machines and in cable carriers. These cables also feature improved resistance to oil, chemicals and UV radiation and are halogen free.

Mechanical properties

OPERATING TEMPERATURE
–40°C to +80°C, fixed installation
–10°C to +70°C, moving
Highly flexible:
–30°C to +70°C, moving

MINIMUM BENDING RADIUS
8 x cable diameter, fixed installation
Highly flexible: 15 x cable diameter, moving

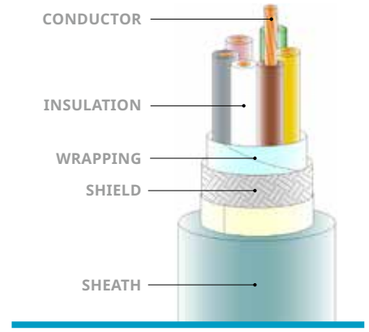
Electrical properties

CHARACTERISTIC IMPEDANCE: 100 ±15 Ohm
LOOP IMPEDANCE: Max. 186.0 Ohm/km
Highly flexible: Max. 159.8 Ohm/km
Max. 39.0 Ohm/km (energy)
OPERATING CAPACITY: Max. 60 nF/km
OPERATING VOLTAGE: Max. 250 V
(peak value, not for heavy current purposes)

SUPPORTED PLUG TYPES
- 9-pin D-Sub plug
- 5-pin M12 plug
- 9-pin round plug connector

INFO

Maximum cable lengths of a bus segment: 500 kbit/s = Max. 400 m



Structure

CONDUCTOR: Stranded or finely stranded, bare copper wire, 0.22 mm² *(highly flexible: 0.25 mm²)* (data cable) or 1.0 mm² (power supply)

INSULATION: Polyolefin (data cable: color coding according to DIN 47100 or Power supply: red, blue and yellow/green)

WRAPPING: Plastic foil *(highly flexible: sliding winding)*

SHIELD: Braiding made of tinned copper wires

SHEATH: Special mixture based on polyvinyl chloride (PVC), green (similar to RAL 6017), violet (similar to RAL 4001) or black (similar to RAL 9005) *(highly flexible: thermoplastic polyurethane mixture (PUR), matt, low adhesion, halogen free and flame resistant)*

NOTES:

Material number	Product designation	Sheath [Type]	OD/DIA. [mm]	Cu number [kg/km]	Weight [kg/km]	UL approvals/Features		Properties	Appli-cation
81661	INTERBUS highflex 3x2xAWG24-100 FR-PUR GN	PUR	7.8	39.0	67	--	• Highly dynamic applications		
81662	INTERBUS highflex 3x2xAWG24-100 FR-PUR GN c(UL)us CMX	PUR	7.8	39.0	67	• c(UL)us CMX 75°C • c(UR)us AWM 21198 I/II A/B FT2	• Highly dynamic applications		
88604	INTERBUS highflex 3x2xAWG24-100 FR-PUR VI	PUR	7.8	39.0	67	--	• Highly dynamic applications		
106834	INTERBUS highflex 3x2xAWG24-100 FR-PUR VI c(UL)us CMX	PUR	7.8	39.0	67	• c(UL)us CMX 75°C • c(UR)us AWM 21198 I/II A/B FT2	• Highly dynamic applications		
81704	INTERBUS highflex 3x2xAWG24-100+3xAWG18 FR-PUR GN	PUR	7.9	62.0	95	--	• Highly dynamic applications • Integrated power supply		
81781	INTERBUS highflex 3x2xAWG24-100+3xAWG18 FR-PUR GN c(UL)us CMX	PUR	7.9	62.0	95	• c(UL)us CMX 75°C • c(UR)us AWM 21198 I/II A/B FT2	• Highly dynamic applications • Integrated power supply		
88483	INTERBUS highflex 3x2xAWG24-100+3xAWG18 FR-PUR VI	PUR	7.9	62.0	95	--	• Highly dynamic applications • Integrated power supply		
88602	INTERBUS highflex 3x2xAWG24-100+3xAWG18 FR-PUR VI c(UL)us CMX	PUR	7.9	62.0	95	• c(UL)us CMX 75°C • c(UR)us AWM 21198 I/II A/B FT2	• Highly dynamic applications • Integrated power supply		
81597	INTERBUS flex 3x2xAWG24 FR-PVC GN	PVC	7.3	37.0	68	--			
81638	INTERBUS flex 3x2xAWG24 FR-PVC GN c(UL)us CMX	PVC	7.3	37.0	68	• c(UL)us CMX 75°C • c(UR)us AWM 20601 I/II A/B FT2			
28111	INTERBUS flex 3x2xAWG24 FR-PVC VI	PVC	7.3	37.0	68	--			
106830	INTERBUS flex 3x2xAWG24 FR-PVC VI c(UL)us CMX	PVC	7.3	37.0	68	• c(UL)us CMX 75°C • c(UR)us AWM 20601 80°C 300V I/II A/B FT2			
81649	INTERBUS flex Burial 3x2xAWG24 FR-PVC SW	PVC	9.0	37.0	72	--	• Direct Burial		
81650	INTERBUS flex Burial 3x2xAWG24 FR-PVC SW c(UL)us CMX	PVC	9.0	37.0	72	• c(UL)us CMX 75°C • c(UR)us AWM 20601 80°C 300V I/II A/B FT2	• Direct Burial		

NOTES:

Material number	Product designation	Sheath [Type]	OD/DIA. [mm]	Cu number [kg/km]	Weight [kg/km]	UL approvals/Features		Properties	Appli-cation
81640	INTERBUS flex 3x2xAWG24+3xAWG18 FR-PVC GN	PVC	7.9	60.0	89	––	• Integrated power supply		
81642	INTERBUS flex 3x2xAWG24+3xAWG18 FR-PVC GN c(UL)us CMX	PVC	7.9	60.0	89	• c(UL)us CMX 75°C • c(UR)us AWM 20601 80°C 300V I/II A/B FT2	• Integrated power supply		
106831	INTERBUS flex 3x2xAWG24+3xAWG18 FR-PVC VI	PVC	7.9	60.0	89	––	• Integrated power supply		
106832	INTERBUS flex 3x2xAWG24+3xAWG18 FR-PVC VI c(UL)us CMX	PVC	7.9	60.0	89	• c(UL)us CMX 75°C • c(UR)us AWM 20601 80°C 300V I/II A/B FT2	• Integrated power supply		
81651	INTERBUS flex Burial 3x2xAWG24+3xAWG18 FR-PVC SW	PVC	9.7	60.0	89	––	• Integrated power supply • Direct Burial		
81652	INTERBUS flex Burial 3x2xAWG24+3xAWG18 FR-PVC SW c(UL)us CMX	PVC	9.7	60.0	89	• c(UL)us CMX 75°C • c(UR)us AWM 20601 80°C 300V I/II A/B FT2	• Integrated power supply • Direct Burial		

NOTES:

MULTIBUS

Application

Bus cables for fixed and conditionally flexible installation indoors with transfer rates of up to 1 Mbit/s.

Depending on the number of wire pairs (there are one-, two- and three-pair versions), the cables are suitable for use in a wide variety of fieldbus systems, such as the DIN measurement bus, BITBUS (IEEE 1118), Local Operating Network (LON), SUCOnet-P, Modulink-P, VariNet-P *(highly flexible: although they are particularly suitable for use on frequently moving machine parts and for force-guided use in energy supply chains, but not for robot applications).* Cables with a c(UL)us CMX listing are available for export.

Highly flexible: The cables are extremely resistant to most mineral oils and greases and are also halogen free and flame resistant. A distinction is made here between one-, two- and three-pair versions (and cables with and without UL approval) as well.

Mechanical properties

OPERATING TEMPERATURE
–40°C to +80°C, fixed installation
–10°C to +70°C, moving
Highly flexible: –30°C to +70°C

MINIMUM BENDING RADIUS
8 x cable diameter, fixed installation
Highly flexible: 15 x cable diameter, moving

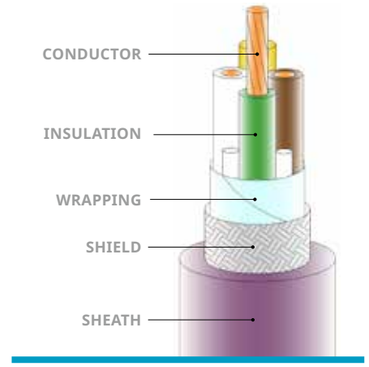
Electrical properties

CHARACTERISTIC IMPEDANCE: 100 to 120 Ohm
LOOP IMPEDANCE: Max. 186.0 Ohm/km
Highly flexible: 159.8 Ohm/km
OPERATING CAPACITY: Max. 60 nF/km
OPERATING VOLTAGE: Max. 250 V
(peak value, not for heavy current purposes)

SUPPORTED PLUG TYPES
• 9-pin D-Sub plug
• 5-pin M12 plug

MAX. CABLE LENGTH/BUS SEGMENT

9.6 – 93.75 kbit/s = 1,200 m	*187.5 kbit/s = 1,000 m*	*500 kbit/s = Max. 400 m*



Structure

CONDUCTOR: Stranded, bare copper wire, 0.22 mm²
Highly flexible: Ultra-fine-stranded bare copper wire, 0.25 mm²

INSULATION: Polyolefin (color coding according to DIN 47100)

WRAPPING: Plastic foil *(highly flexible: sliding winding)*

SHIELD: Braiding made of tinned copper wires

SHEATH: Special mixture based on polyvinyl chloride (PVC)
Highly flexible: Thermoplastic PUR polyurethane mixture, matt, low adhesion, halogen free and flame resistant) violet (similar to RAL 4001)

NOTES:

Material number	Product designation	Sheath [Type]	OD/DIA. [mm]	Cu number [kg/km]	Weight [kg/km]	UL approvals/Features		Properties	Appli-cation
80638	MULTIBUS highflex 1x2xAWG24-110 FR-PUR VI	PUR	6.0	17.0	39	--	• Highly dynamic applications		
80657	MULTIBUS highflex 1x2xAWG24-110 FR-PUR VI c(UL)us CMX	PUR	6.2	25.0	48	• c(UL)us CMX 75°C • c(UR)us AWM 21198 80°C 300V I/II A/B FT2	• Highly dynamic applications		
80716	MULTIBUS highflex 2x2xAWG24-110 FR-PUR VI	PUR	7.9	33.0	65	--	• Highly dynamic applications		
80742	MULTIBUS highflex 2x2xAWG24-110 FR-PUR VI c(UL)us CMX	PUR	7.9	35.0	70	• c(UL)us CMX 75°C • c(UR)us AWM 21198 80°C 300V I/II A/B FT2	• Highly dynamic applications		
80747	MULTIBUS highflex 3x2xAWG24-110 FR-PUR VI	PUR	8.0	39.0	72	--	• Highly dynamic applications		
80748	MULTIBUS highflex 3x2xAWG24-110 FR-PUR VI c(UL)us CMX	PUR	8.0	39.0	72	• c(UL)us CMX 75°C • c(UR)us AWM 21198 80°C 300V I/II A/B FT2	• Highly dynamic applications		
80568	MULTIBUS flex 1x2xAWG24-110 FR-PVC VI	PVC	5.7	18.0	43	--			
80607	MULTIBUS flex 1x2xAWG24-110 FR-PVC VI c(UL)us CMX	PVC	5.7	23.0	48	• c(UL)us CMX 75°C • c(UR)us AWM 21198 80°C 300V I/II A/B FT2			
80624	MULTIBUS flex 2x2xAWG24-110 FR-PVC VI	PVC	7.1	28.0	61	--			
80634	MULTIBUS flex 2x2xAWG24-110 FR-PVC VI c(UL)us CMX	PVC	7.1	32.0	65	• c(UL)us CMX 75°C • c(UR)us AWM 21198 80°C 300V I/II A/B FT2			
80635	MULTIBUS flex 3x2xAWG24-110 FR-PVC VI	PVC	7.4	37.0	64	--			
80637	MULTIBUS flex 3x2xAWG24-110 FR-PVC VI c(UL)us CMX	PVC	7.4	37.0	64	• c(UL)us CMX 75°C • c(UR)us AWM 21198 80°C 300V I/II A/B FT2			

NOTES:

CAN – CONTROLLER AREA NETWORK

Application

Originally a bus system from the automotive sector which is very popular in the field of production automation and is standardized according to ISO 11898.

The cables are designed for fixed and conditionally flexible indoor installation, whereby segment lengths of up to 1,000 m can be achieved depending on the conductor cross section and transmission rate. Optimum data transmission thanks to low-capacity insulation with a reduced outer diameter.

For the North American market, the standard cables are equipped with a UL CMX listing. On request, we can also supply cables with a higher UL CMG/PLTC listing.

Highly flexible: Specially designed for highly flexible use on frequently moving machine parts and in energy supply chains, the GG Group's CAN bus cables combine optimum data transmission thanks to low-capacitance insulation and a small outer diameter with increased mechanical strength and improved resistance to oil, UV and microbes. The cables are also halogen free and flame resistant.

Mechanical properties

OPERATING TEMPERATURE
–40°C to +80°C, fixed installation (PVC)
–40°C to +70°C, fixed installation (PE)
–10°C to +70°C, moving (PVC)
Highly flexible: –30°C to +70°C, moving

MINIMUM BENDING RADIUS
8 x cable diameter, fixed installation
Highly flexible: 15 x cable diameter, moving

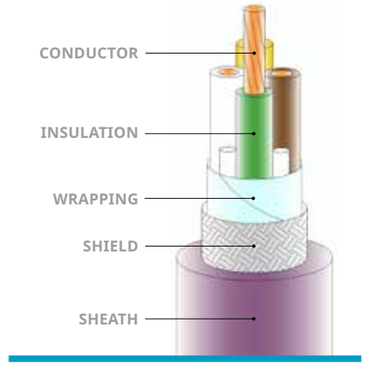
MAX. CABLE LENGTH/BUS SEGMENT

0 m to 40 m: AWG24, AWG22
40 m to 300 m: AWG22, AWG20
300 m to 600 m: AWG20
600 m to 1,000 m: AWG19

Electrical properties

CHARACTERISTIC IMPEDANCE: 120 ±12 Ohm
LOOP IMPEDANCE:
Max. 175.2 Ohm/km (AWG24)
Max. 110.8 Ohm/km (AWG22)
Max. 68.8 Ohm/km (AWG20)
Max. 55.0 Ohm/km (AWG19)
OPERATING CAPACITY: Max. 40 nF/km
OPERATING VOLTAGE: Max. 250 V
(peak value, not for heavy current purposes)

SUPPORTED PLUG TYPES
• 9-pin D-Sub plug



Structure

CONDUCTOR: 7-core, bare copper wire, AWG24, AWG22, AWG20 or AWG19

INSULATION: Polyolefin foam skin (color coding according to DIN 47100)

WRAPPING: Plastic foil *(highly flexible: sliding winding)*

SHIELD: Braiding made of tinned copper wires

SHEATH: Special mixture based on polyvinyl chloride (PVC) *(highly flexible: thermoplastic PUR polyurethane mixture, matt, low adhesion, halogen free and flame resistant),* violet (similar to RAL 4001)

DID YOU KNOW...

that only braiding is usually used for shielding? The additional establishment of a foil shield considerably improves the shielding properties of the cable.

NOTES:

Material number	Product designation	Sheath [Type]	OD/DIA. [mm]	Cu number [kg/km]	Weight [kg/km]	UL approvals/Features		Properties	Appli-cation
82345	CAN BUS highflex 2x2xAWG20-120 FR-PUR VI c(UL)us CMX	PUR	10.1	59.0	118	• c(UL)us CMX 75°C • c(UR)us AWM 21198 80°C 300V I/II A/B FT2	• Highly dynamic applications		
82210	CAN BUS highflex 1x2xAWG20-120 FR-PUR VI c(UL)us CMX	PUR	7.7	42.0	61	• c(UL)us CMX 75°C • c(UR)us AWM 21198 80°C 300V I/II A/B FT2	• Highly dynamic applications		
82193	CAN BUS highflex 2x2xAWG22-120 FR-PUR VI c(UL)us CMX	PUR	9.5	52.0	87	• c(UL)us CMX 75°C • c(UR)us AWM 21198 80°C 300V I/II A/B FT2	• Highly dynamic applications		
82189	CAN BUS highflex 1x2xAWG22-120 FR-PUR VI c(UL)us CMX	PUR	6.9	33.0	47	• c(UL)us CMX 75°C • c(UR)us AWM 21198 80°C 300V I/II A/B FT2	• Highly dynamic applications		
82096	CAN BUS highflex 2x2xAWG24-120 FR-PUR VI c(UL)us CMX	PUR	8.4	33.0	72	• c(UL)us CMX 75°C • c(UR)us AWM 21198 80°C 300V I/II A/B FT2	• Highly dynamic applications		
82060	CAN BUS highflex 1x2xAWG24-120 FR-PUR VI c(UL)us CMX	PUR	6.5	24.0	44	• c(UL)us CMX 75°C • c(UR)us AWM 21198 80°C 300V I/II A/B FT2	• Highly dynamic applications		
182038	CAN BUS flex 1x2xAWG24-120 FR-PVC VI c(UL)us CMX	PVC	5.8	17.0	40	• c(UL)us CMX 75°C • c(UR)us AWM 20601 80°C 300V I/II A/B FT2			
81825	CAN BUS flex 2x2xAWG24-120 FR-PVC VI c(UL)us CMX	PVC	7.5	35.0	60	• c(UL)us CMX 75°C • c(UR)us AWM 20601 80°C 300V I/II A/B FT2			
81826	CAN BUS flex 1x2xAWG22-120 FR-PVC VI c(UL)us CMX	PVC	6.8	26.0	56	• c(UL)us CMX 75°C • c(UR)us AWM 20601 80°C 300V I/II A/B FT2			
81856	CAN BUS flex 2x2xAWG22-120 FR-PVC VI c(UL)us CMX	PVC	8.5	46.0	72	• c(UL)us CMX 75°C • c(UR)us AWM 20601 80°C 300V I/II A/B FT2			
81950	CAN BUS flex 1x2xAWG20-120 FR-PVC VI c(UL)us CMX	PVC	7.5	42.0	66	• c(UL)us CMX 75°C • c(UR)us AWM 20601 80°C 300V I/II A/B FT2			
82020	CAN BUS flex 2x2xAWG20-120 FR-PVC VI c(UL)us CMX	PVC	9.6	59.0	99	• c(UL)us CMX 75°C • c(UR)us AWM 20601 80°C 300V I/II A/B FT2			
135423	CAN BUS flex 1x2xAWG19-120 FR-PVC VI c(UL)us CMX	PVC	8.7	53.0	87	• c(UL)us CMX 75°C • c(UR)us AWM 20601 80°C 300V I/II A/B FT2			

NOTES:

Material number	Product designation	Sheath [Type]	OD/DIA. [mm]	Cu number [kg/km]	Weight [kg/km]	UL approvals/Features		Properties	Appli-cation
135424	CAN BUS flex 2x2xAWG19-120 FR-PVC VI c(UL)us CMX	PVC	11.6	81.0	147	• c(UL)us CMX 75°C • c(UR)us AWM 20601 80°C 300V I/II A/B FT2			
133160	CAN BUS Burial 2x2xAWG20-120 FR-PVC/PE VI/SW	PVC/PE	9.8	59.0	138	--	• Direct Burial		
143759	CAN BUS Burial 2x2xAWG19-120 FR-PVC/PE VI/SW	PVC/PE	11.6	81.0	194	--	• Direct Burial		
99502	CAN BUS highflex 1x4xAWG24-120 FR-PUR VI c(UR)us AWM 21198	PUR	6.5	25.0	53	• c(UR)us AWM 21198 80°C 300V I/II A/B FT2	• Compact design		
140389	CAN BUS flex 1x4xAWG22-120 FR-PVC VI c(UL)us CMG	PVC	7.8	39.0	89	• (UL) PLTC-ER 75°C • c(UL)us CMG 75°C • c(UR)us AWM 2464 80°C 300V I/II A/B FT1	• Compact design		
105406	CAN BUS highflex 1x4xAWG22-120 FR-PUR VI c(UL)us CMX	PUR	7.5	42.0	64	• c(UL)us CMX 75°C • c(UR)us AWM 21198 80°C 300V I/II A/B FT2	• Compact design		
155381	CAN Bus Extemp flex 1x4xAWG22-120 FR-PUR SW	PUR	7.6	33.0	61	--	• Compact design • ECE-R 118 approval • Increased temperature range, up to 105°C		
155382	CAN Bus Extemp flex 1x4xAWG22-120 FR-PUR SW	PUR	8.3	41.0	70	--	• Compact design • ECE-R 118 approval • Increased temperature range, up to 105°C		
148506	CAN BUS highflex 1x4xAWG21-120 FR-PUR VI c(UL)us CMX	PUR	8.1	55.0	75	• c(UL)us CMX 75°C • c(UR)us AWM 21198 80°C 300V I/II A/B FT2	• Compact design		
128430	CAN BUS Burial 1x4xAWG20-120 FR-PVC/PE VI/SW	PE	7.7	45.0	111	--	• Direct Burial • Compact design		
18955	CAN BUS flex 1x4xAWG20-120 FR-PUR VI c(UR)us 20601	PVC	8.5	45.0	94	• c(UR)us AWM 20601 80°C 300V I/II A/B FT2	• Compact design		
155383	CAN Bus Extemp flex 1x4xAWG19-120 FR-PUR SW	PUR	7.6	59.0	95	--	• Compact design • ECE-R 118 approval • Increased temperature range, up to 105°C		

NOTES:

DEVICENET™

DID YOU KNOW...

that the specifications for DeviceNet cables are now defined by IEC 62026-3 in addition to the ODVA® specifications?

Application

DeviceNet™ is a bus system developed by Allen Bradley (Rockwell Automation) based on proven CAN technology.

The thick versions (2xAWG18 & 2xAWG15) are usually used as backbone cables (trunk cables), while the thin versions (2xAWG24 & 2xAWG22) are generally used as stub cables (drop cables) for connecting various industrial devices (e.g. PLC controllers, limit switches etc.) to the backbone cable. The thin cable can also be used as a supply line, however, though shorter transmission lengths are achieved at the same data rate. The middle cable (2xAWG20 & 2xAWG18) can be used for both applications, although length and data rate restrictions must be observed. All cables are supplied with the relevant approvals for the North American market as standard.

Highly flexible DeviceNet™ cables from the GG Group have been specially designed for use in cable carriers.

Mechanical properties

OPERATING TEMPERATURE
–40°C to +80°C, fixed installation (PVC)
–25°C to +80°C, fixed installation (LSZH)
–10°C to +70°C, moving
Highly flexible:
–40°C to +80°C (PUR), moving
–10°C to +80°C (PVC), moving

MINIMUM BENDING RADIUS
5 x cable diameter, fixed installation
Highly flexible: 10 x cable diameter, moving

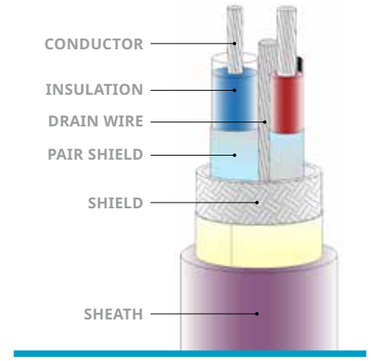
Electrical properties

CHARACTERISTIC IMPEDANCE: 120 ±12 Ohm
LOOP IMPEDANCE:
Max. 181.8 Ohm/km (AWG24)
Max. 114.8 Ohm/km (AWG22)
Max. 71.6 Ohm/km (AWG20)
Max. 45.4 Ohm/km (AWG18)
Max. 22.6 Ohm/km (AWG15)
OPERATING CAPACITY: Nom. 40 nF/km
OPERATING VOLTAGE: Max. 300 V
(peak value, not for heavy current purposes)

SUPPORTED PLUG TYPES
• 9-pin D-Sub plug • 5-pin M12 plug
• 5-pin 7/8" plug

MAX. CABLE LENGTH/BUS SEGMENT

Supply line (trunk cable), thick, 2xAWG18 & 2xAWG15:	*Supply line (trunk cable), thin, 2xAWG24 & 2xAWG22:*	*Stub cable (drop cable):*	*Stub cables (drop cable) Cumulative length:*
125 kbit/s = 500 m	*125 kbit/s = 100 m*	*125 kbit/s = 6 m*	*125 kbit/s = 156 m*
250 kbit/s = 250 m	*250 kbit/s = 100 m*	*250 kbit/s = 6 m*	*250 kbit/s = 78 m*
500 kbit/s = 100 m	*500 kbit/s = 100 m*	*500 kbit/s = 6 m*	*500 kbit/s = 39 m*



Structure

CONDUCTOR: Stranded, tinned copper wire, data pairs: AWG18, AWG20 or AWG24, Power supply: AWG15, AWG18 or AWG22

INSULATION: Data cable: Foam skin polyolefin (white and blue), Power supply: Polyolefin or special mixture based on polyvinyl chloride (PVC) (red and black)

PAIR SHIELD: Aluminum composite foil

DRAIN WIRE: Stranded, tinned copper wire, AWG18 or AWG22

SHIELD: *(highly flexible: conductive sliding winding and* braiding made of tinned copper wires

SHEATH: Special mixture based on polyvinyl chloride (PVC), gray (similar to RAL 7001) or thermoplastic, halogen-free, low smoke zero halogen (LSZH), violet (similar to RAL 4001)

DID YOU KNOW...

that the position of the assembly is identical over the entire length despite paired stranding? The reason for this is the identical position of all stranding points.

NOTES:

Material number	Product designation	Sheath [Type]	OD/DIA. [mm]	Cu number [kg/km]	Weight [kg/km]	UL approvals/Features		Properties	Appli-cation
65040	DeviceNet™ highflex 1x2xAWG18-120+1x2xAWG15 FR-PUR VI c(UL)us CMX	PUR	12.2	94.0	195	• (UL) CL2X 75°C • c(UL)us CMX 75°C • c(UR)us AWM 21198 80°C 300V I/II A/B FT1	• Trunk cable applications according to ODVA		
65041	DeviceNet™ highflex 1x2xAWG24-120+1x2xAWG22 FR-PUR VI c(UL)us CMX	PUR	7.0	36.0	62	• (UL) CL2X 75°C • c(UL)us CMX 75°C • c(UR)us AWM 21198 80°C 300V I/II A/B FT1	• Drop cable applications according to ODVA		
65047	DeviceNet™ highflex 1x2xAWG18-120+1x2xAWG15 FR-PVC GR c(UL)us CMG	PVC	12.2	94.0	203	• (UL) PLTC 75°C • c(UL)us CMG 75°C • c(UR)us AWM 20201 60°C 600V I/II A/B FT1	• Trunk cable applications according to ODVA		
65049	DeviceNet™ highflex 1x2xAWG24-120+1x2xAWG22 FR-PVC GR c(UL)us CMG	PVC	7.0	36.0	66	• (UL) CL2 75°C • c(UL)us CMG 75°C • c(UR)us AWM 20201 60°C 600V I/II A/B FT1	• Drop cable applications according to ODVA		
65033	DeviceNet™ flex 1x2xAWG18-120+1x2xAWG15 FR-PVC GR c(UL)us CMG	PVC	12.2	88.0	201	• (UL) PLTC 75°C • c(UL)us CMG 75°C • c(UR)us AWM 2464 80°C 300V I/II A/B FT1	• Trunk cable applications according to ODVA		
65039	DeviceNet™ flex 1x2xAWG24-120+1x2xAWG22 FR-PVC GR c(UL)us CMG	PVC	7.0	34.0	66	• (UL) CL2 75°C • c(UL)us CMG 75°C • c(UR)us AWM 20201 60°C 600V I/II A/B FT1	• Drop cable applications according to ODVA		
65030	DeviceNet™ highflex 1x2xAWG18-120+1x2xAWG15 LSZH VI c(UL)us 22842	LSZH	12.2	88.0	209	• c(UR)us AWM 22842 I/II A/B FT1	• Trunk cable applications according to ODVA		
65031	DeviceNet™ highflex 1x2xAWG24-120+1x2xAWG22 LSZH VI c(UL)us 22842	LSZH	7.0	34.0	67	• c(UR)us AWM 22842 I/II A/B FT1	• Drop cable applications according to ODVA		
143763	DeviceNet™ flex 2xAWG20-120+2xAWG18 FR-PVC GR c(UL)us CMG	PVC	10.6	67.0	137	• (UL) CL2 75°C • c(UL)us CMG 75°C • c(UR)us AWM 20201 60°C 600V I/II A/B FT1	• Trunk/drop cable applications according to ODVA		

NOTES:

SAFETY BUS

Application

SAFETY BUS is a safe, open fieldbus system for the decentralized networking of safety-related applications in automation technology. The GG Group offers a cable for fixed and conditionally flexible installation as well as a highly flexible version for use in the cable carrier. While the special wire insulation in the standard cable is protected by inner sheathing (quick-fit version) and PVC sheathing, the cable carrier version uses abrasion-resistant PUR sheathing.

New additions to the range are a halogen-free, highly flame-resistant version for protecting high concentrations of people and property and a rugged version for occasional movement.

Most of our cables are approved for the North American market.

Mechanical properties

OPERATING TEMPERATURE
–40°C to +80°C, fixed installation
–25°C to +80°C, fixed installation (LSZH)
–10°C to +70°C, moving
–30°C to +70°C, moving (PUR)

MINIMUM BENDING RADIUS
8 x cable diameter, fixed installation
10 x cable diameter, moving

Electrical properties

CHARACTERISTIC IMPEDANCE: 100 to 120 Ohm at 1 MHz
CONDUCTOR RESISTANCE: 26 Ohm/km
OPERATING CAPACITY: Nom. 45 nF/km
OPERATING VOLTAGE: Max. 250 V
(peak value, not for heavy current purposes)

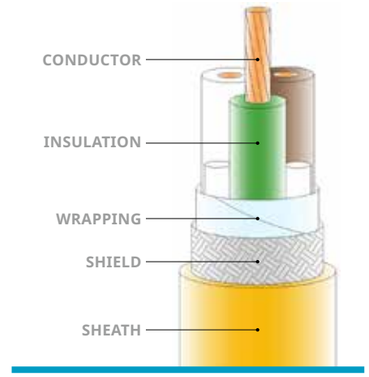
SUPPORTED PLUG TYPES
• 9-pin D-Sub plug

MAX. CABLE LENGTH/BUS SEGMENT

50 kbit/s = 1,000 m	*250 kbit/s = 250 m*
125 kbit/s = 500 m	*500 kbit/s = 100 m*

DID YOU KNOW...

that the Safetybus organization no longer exists? This means that there are no valid specifications and that every current Safetybus cable is a tailor-made solution.



Structure

CONDUCTOR: Stranded or fine-stranded bare copper wire, 0.75 mm²

INSULATION: Foam skin polyolefin (white, brown and green)

WRAPPING: Sliding winding or common wire sheath (for quick-fit version)

SHIELD: Braiding made of tinned copper wires

SHEATH: Special mixture based on polyvinyl chloride (PVC), thermoplastic, halogen-free, low smoke zero halogen (LSZH) or thermoplastic polyurethane mixture (PUR), matt, low adhesion, halogen free and flame resistant, yellow (similar to RAL 1003)

NOTES:

Material number	Product designation	Sheath [Type]	OD/DIA. [mm]	Cu number [kg/km]	Weight [kg/km]	UL approvals/Features	Properties	Appli-cation
110800	SAFETYBUS highflex 3xAWG19-110 FC FR-PVC GE c(UL)us CMX	PVC	8.0	49.0	85	• c(UL)us CMX 75°C • c(UR)us AWM 2464 80°C 300V I/II A/B FT1		
143760	SAFETYBUS flex 3xAWG19-110 LSZH GE	LSZH	7.8	49.0	75			
117566	SAFETYBUS flex 3xAWG19-110 FR-PUR GE c(UL)us CMX	PUR	7.8	49.0	72	• c(UL)us CMX 75°C • c(UR)us AWM 20549 80°C 300V I/II A/B FT1		
110801	SAFETYBUS highflex 3xAWG19-110 FR-PUR GE c(UL)us CMX	PUR	8.0	49.0	74	• c(UL)us CMX 75°C • c(UR)us AWM 20549 80°C 300V I/II A/B FT1		

NOTES:

USB & FIREWIRE CABLES

Application

The Universal Serial Bus (USB) was developed by Intel and is a serial bus system for connecting a computer to external devices. FireWire (IEEE 1394) was previously developed by Apple as a serial interface, whereby the devices can also communicate with each other without a host.

These standards, which are popular in the office world, are increasingly finding their way into industry. This is why the GG Group offers USB and FireWire cables with excellent shielding and tough PUR sheathing for harsh industrial environments. For each bus system, one version is available for standard transmission distances in accordance with the relevant regulation and one version for significantly longer transmission distances. The USB cable for longer transmission distances is also suitable for use in cable carriers.

This is complemented by the c(UR)us recognition of all cables.

Mechanical properties

OPERATING TEMPERATURE
–40°C to +80°C, fixed installation
–10°C to +70°C, moving

MINIMUM BENDING RADIUS
8 x cable diameter, fixed installation
15 x cable diameter, moving

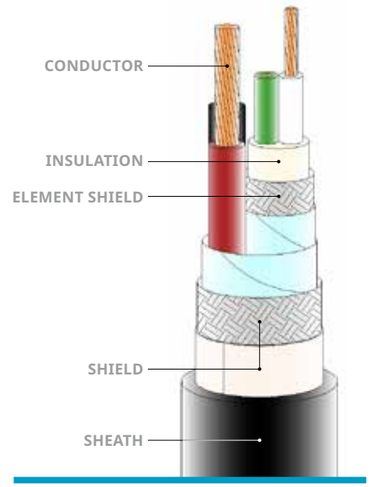
Electrical properties

CHARACTERISTIC IMPEDANCE: 90 Ohm ±15% (USB)
110 ±6 Ohm (FireWire)
LOOP IMPEDANCE:
Max. 290.0 Ohm/km (AWG26)
Max. 181.8 Ohm/km (AWG24)
Max. 114.8 Ohm/km (AWG22)
Max. 71.6 Ohm/km (AWG20)
OPERATING VOLTAGE: Max. 250 V
(peak value, not for heavy current purposes)

SUPPORTED PLUG TYPES
- USB 2.0 plug
- IEEE 1394 plug

MAX. CABLE LENGTH/BUS SEGMENT

USB	*FIREWIRE*
2 x AWG24 + 2 x AWG20 = 10.0 m	*2 x 2AWG26 + 2 x AWG22 = 4.5 m*
	2 x 2AWG24 + 2 x AWG22 = 10.0 m



Structure

CONDUCTOR: Stranded or fine-stranded, tinned copper wire Data pairs: AWG26 or AWG24 *(FireWire)*, AWG24 *(USB)*, Power supply: AWG20 *(USB)*, AWG22 *(FireWire)*

INSULATION: Data pairs: Polyolefin, green and white *(USB)*, foam skin polyolefin, red, green, orange and blue *(FireWire)*, Power supply: Special mixture based on polyvinyl chloride (PVC), red and black *(USB)*, white and black *(FireWire)*

ELEMENT SHIELD: Aluminum composite foil (optional)

SHIELD: Aluminum composite foil or conductive sliding winding and braiding made of tinned copper wires

SHEATH: Thermoplastic polyurethane mixture (PUR), matt, low adhesion and flame resistant, black (similar to RAL 9005)

NOTES:

Material number	Product designation	Sheath [Type]	OD/DIA. [mm]	Cu number [kg/km]	Weight [kg/km]	UL approvals/Features		Properties	Appli-cation
110873	USB highflex 2xAWG24-120+2xAWG20 FR-PUR SW c(UR)us AWM 21198	PUR	6.3	39.0	56	• c(UR)us AWM 21198 80°C 300V I/II A/B FT2	• Highly dynamic applications		
110875	FireWire flex 2x2xAWG26-110+2xAWG22 FR-PUR SW c(UR)us AWM 21198	PUR	7.0	34.0	64	• c(UR)us AWM 21198 80°C 300V I/II A/B FT2	• Highly dynamic applications		
110886	FireWire flex 2x2xAWG26-110+2xAWG24 FR-PUR SW c(UR)us AWM 21198	PUR	7.0	41.0	68	• c(UR)us AWM 21198 80°C 300V I/II A/B FT2	• Highly dynamic applications		

NOTES:

POF WIRES & BUS CABLES

Application

The use of POF (polymer optical fibers) for optical signal transmission combines simple installation with the advantages of fiber optic transmission systems (no interference from electrical and magnetic fields etc.).

Special material combinations guarantee trouble-free use in harsh industrial environments. GG Group POF bus cables can be used for a wide variety of bus systems (e.g. PROFIBUS, INTERBUS etc.) by using suitable interfaces or media converters.

The simplex and duplex single cores are mainly used for low mechanical loads, e.g. in cabinets etc. Sheathed cables for increased mechanical loads and our POF hybrid cables complete the product range. The cables listed here are just a selection from our wide range.

We'd be happy to design a cable according to your specifications.

Mechanical properties

OPERATING TEMPERATURE
–50°C to +80°C POF *wires*
–20°C to +70°C POF *bus cables*

INSTALLATION TEMPERATURE
–10°C to +50°C

MINIMUM BENDING RADIUS
10 x cable diameter

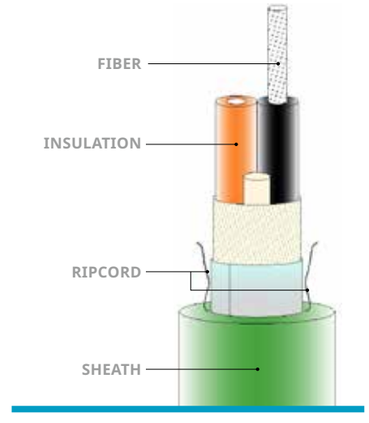
Optical properties

DAMPING
Max. 160 dB/km at 650 nm (laser)
Max. 230 dB/km at 660 nm (LED)
BANDWIDTH: Min. 10 MHz x 100 m
NUMERICAL APERTURE: 0.5

SUPPORTED PLUG TYPES
- ST (BFOC) plug
- FSMA plug
- HFBR 4501/4503/4506/4511/4513/4516/4531/4532/4533 plug
- F05 plug (TOSLINK compatible), F07 plug (TOSLINK compatible)
- SCRJ plug

INFO

Transmission lengths: Max. 80 m



Structure

FIBER: Data cable: Step index fiber made of polymethyl methacrylate (PMMA) POF 980/1,000 µm

INSULATION: Data cable: Polyolefin or polyamide (PA), orange, black, red, green, blue, white and gray, Power supply: Polyolefin (blue and brown) or special mixture based on polyvinyl chloride (PVC), black (with codes)

RIPCORD: Aramid (optional)

SHEATH: Special mixture based on polyvinyl chloride (PVC) or thermoplastic polyurethane mixture (PUR), matt, low adhesion, halogen free and flame resistant, violet (similar to RAL 4001), red (similar to RAL 3000) or green (similar to RAL 6018) (optional)

NOTES:

Material number	Product designation	Sheath [Type]	OD/DIA. [mm]	Cu number [kg/km]	Weight [kg/km]	UL approvals/Features		Properties	Appli-cation
51890	POF SIMPLEX 1 P980/1000 PE SW	PE	2.2	--	4	--	• Other colors: OR (orange), RT (red), GN (green), WS (white), GR (gray) etc.		
110851	POF SIMPLEX 1 P980/1000 PA SW	PA	2.2	--	4	--	• Other colors: OR • For high mechanical loads		
51956	POF DUPLEX 2 P980/1000 PE SW	PE	4.4 x 2.2	--	8	--			
26494	POF DUPLEX 2 P980/1000 PA SW	PA	4.4 x 2.2	--	8	--	• For high mechanical loads		
110853	POF BUS CABLE 1 P980/1000 PE/FR-PUR RT	PE/PUR	3.6	--	11	--	• For SERCOS applications		
110854	POF BUS CABLE highflex 1 P980/1000 PE/FR-PUR RT	PE/PUR	5.5	--	30	--	• Highly dynamic applications		
74255	POF BUS CABLE highflex 1 P980/1000 PE/FR-PUR RT	PE/PUR	6.0	--	30	--	• For high mechanical loads • For SERCOS applications • Highly dynamic applications		
68872	POF BUS CABLE highflex heavy 1 P980/1000 PE/FR-PUR RT	PE/PUR	6.0	--	33	--	• For very high mechanical loads • For SERCOS applications • Highly dynamic applications		
110924	POF BUS CABLE 2 P980/1000 PE/FR-PUR VI	PE/PUR	6.0	--	31	--	• For high mechanical loads • For INTERBUS applications		
55709	POF BUS CABLE heavy 2 P980/1000 PA/FR-PUR RT	PA/PUR	6.0	--	34	--	• For very high mechanical loads • For INTERBUS applications		
84159	POF BUS CABLE 2 P980/1000 PA/FR-PVC VI	PA/PVC	7.8	--	59	--	• For PROFIBUS applications		
110861	POF BUS CABLE 2 P980/1000 PA/FR-PVC GN	PA/PVC	7.8	--	59	--	• For PROFINET applications		

NOTES:

Material number	Product designation	Sheath [Type]	OD/DIA. [mm]	Cu number [kg/km]	Weight [kg/km]	UL approvals/Features		Properties	Appli-cation
110857	POF BUS CABLE highflex 2 P980/1000 PE/FR-PUR VI	PE/PUR	6.0	--	31	--	• For high mechanical loads • Highly dynamic applications		
110860	POF BUS CABLE highflex heavy 2 P980/1000 PA/FR-PUR GN	PA/PUR	8.0	--	53	--	• For very high mechanical loads • For PROFIBUS/PROFINET applications • Highly dynamic applications		
106844	POF BUS CABLE highflex 4 P980/1000 PE/FR-PUR VI	PE/PUR	7.5	--	50	--	• For high mechanical loads • Highly dynamic applications		
110859	POF HYBRIDBUS CABLE highflex 2 P980/1000+2x1.0 PE/FR-PUR VI	PE/PUR	7.5	20.0	63	--	• For high mechanical loads • For PROFIBUS/PROFINET applications • Highly dynamic applications • Integrated power supply		
84180	POF HYBRIDBUS CABLE highflex 2 P980/1000+ 4x1.5 PA/FR-PVC/FR-PUR VI	PA/PVC/PUR	9.4	60.0	120	--	• For high mechanical loads • For PROFIBUS ECOFAST applications • Highly dynamic applications • Integrated power supply		
146421	POF BUS CABLE heavy 2 P980/1000 PA/FR-PUR GN	PA/PUR	8.0	--	34	--	• For very high mechanical loads • For PROFIBUS/PROFINET applications		
173385	POF BUS CABLE highflex heavy 2 P980/1000 PA/FR-PUR RT	PA/PUR	8.0	--	35	--	• For very high mechanical loads		
173386	POF BUS CABLE heavy 2 P980/1000 PA/FR-PUR RT	PA/PUR	8.0	--	34	--	• For very high mechanical loads		

NOTES:

PCF WIRES & BUS CABLES

Application

GG Group PCF (polymer-cladded fiber) bus cables are characterized by less damping and therefore longer transmission distances than POF. In principle, the same transmitter and receiver components can be used as with POF.

The cables are intended for fixed indoor installation, with the polyurethane-coated cables in particular offering excellent resistance to most mineral oils and greases. The cables can be used for almost any bus system using suitable hardware.

The diameter-minimized simplex wire is predestined for use in the SERCOS systems standardized in ISO and EN 61491, for example. Variants for outdoor applications and direct installation in the ground are also available.

Mechanical properties

OPERATING TEMPERATURE
–20°C to +70°C

INSTALLATION TEMPERATURE
–10°C to +50°C

MINIMUM BENDING RADIUS
10 x cable diameter
20 x cable diameter
(Mat. number 110926, 110927, 110931 and 111038).

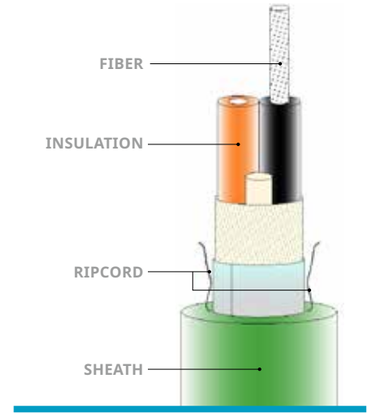
Optical properties

DAMPING:
Max. 10 dB/km at 650 nm (laser)
Max. 8 dB/km at 850 nm (LED)
BANDWIDTH: Min. 17 MHz x km at 650 nm (laser)
Min. 20 MHz x km at 850 nm (LED)
NUMERICAL APERTURE: 0.37

SUPPORTED PLUG TYPES
- ST (BFOC) plug
- FSMA plug
- HFBR 4521 plug
- SC plug
- FC plug
- LC plug
- F05 plug (TOSLINK compatible)
- F07 plug (TOSLINK compatible)

INFO

Transmission lengths: Max. 500 m



Structure

FIBER: Stepped index fiber made of glass coated with special polymer (PCF) 200/230/500 µm, filling: Petrolatum (optional)

INSULATION: Special mixture based on polyvinyl chloride (PVC) or thermoplastic, halogen-free and flame-resistant polymer compound (LSZH), thermoplastic polyurethane mixture (PUR), matt, low adhesion, halogen free and flame resistant orange, black, red, green or blue

RIPCORD: Aramid (optional)

SHEATH: Special mixture based on polyvinyl chloride (PVC), thermoplastic, halogen-free and flame-resistant polymer compound (LSZH), thermoplastic polyurethane mixture (PUR), matt, low adhesion, halogen free and flame resistant or polyethylene (PE), green (similar to RAL 6018), orange (similar to RAL 2003), red (similar to RAL 3000) or black (similar to RAL 9005) (optional)

NOTES:

Appli-cation	Product designation	Sheath [Type]	OD/DIA. [mm]	Cu number [kg/km]	Weight [kg/km]	UL approvals/Features		Properties	Appli-cation
110862	PCF SIMPLEX 1 K200/230 FR-PVC OR	PVC	2.2	--	4	--			
104731	PCF SIMPLEX 1 K200/230 FR-PVC SW	PVC	2.2	--	4	--			
110863	PCF SIMPLEX 1 K200/230 LSZH OR	LSZH	2.9	--	9	--	• Indoor applications		
60171	PCF SIMPLEX 1 K200/230 FR-PUR SW	PUR	2.9	--	8	--			
110864	PCF BUS CABLE 1 K200/230 FR-PVC/FR-PVC OR	PVC/PVC	5.0	--	26	--			
57909	PCF BUS CABLE Indoor 1 K200/230 LSZH/LSZH OR	LSZH/LSZH	3.8 x 6.6	--	30	--	• INTERBUS applications • Indoor applications		
84181	PCF BUS CABLE 2 K200/230 FR-PVC/FR-PVC GN	PVC/PVC	7.2	--	61	--	• PROFIBUS/PROFINET applications • Indoor and outdoor applications		
110926	PCF BUS CABLE highflex 2 K200/230 FR-PVC/ FR-PUR GN	PVC/PUR	8.8	--	68	--	• Highly dynamic applications • PROFIBUS/PROFINET applications		
110927	PCF BUS CABLE highflex 2 K200/230 FR-PVC/ FR-PVC GN	PVC/PVC	8.8	--	75	--	• Highly dynamic applications • PROFIBUS/PROFINET applications • Increased flame resistance		
110928	PCF BUS CABLE Outdoor 2 K200/230 LSZH/PE SW	LSZH/PE	7.0	--	39	--	• Outdoor applications		
83163	PCF BUS CABLE highflex 2 K200/230 FR-PVC/FR-PUR RT	PVC/PUR	7.0	--	44	--	• Highly dynamic applications		
110929	PCF BUS CABLE highflex 2 K200/230 FR-PVC/FR-PUR RT	PVC/PUR	7.4	--	59	--	• Highly dynamic applications		
110930	PCF BUS CABLE highflex 2 K200/230 FR-PVC/FR-PVC RT	PVC/PVC	7.4	--	66	--	• Highly dynamic applications		
110931	PCF BUS CABLE Outdoor 2 K200/230 LSZH/PE SW	LSZH/PE	10.5	--	88	--	• INTERBUS applications • Outdoor applications • Longitudinally watertight		
111038	PCF BUS CABLE Burial 2 K200/230 RP PE SW	PE	7.5	--	49	--	• Direct Burial • Non-metallic rodent protection • Longitudinally and transversely watertight		

HYBRID CABLES

A mixture of different conductor dimensions, also known as hybrid cables, are commonplace in GG Group's production. Typically, the design combines a data element with energy-transmitting wires. Due to the wide variety of cable core designs and the individual needs of each customer, we do not list specific GG Group article numbers.

Each type represents a solution individually designed for the customer. The design is tailored to an optimum combination of security, transmission, application and further processing options.

If you're looking for your personal customized solution for a hybrid cable, your development partner of choice is the GG Group.

It's best to contact our sales team directly with your idea. To be well informed in advance and have the opportunity to define your needs precisely beforehand, we'd like to demonstrate the breadth of feasibility options using the following examples.

GG FARMSPEED® HYBRID

PROFINET HYBRID

CABLES FOR Y-CODED PLUGS

GG TRUCKSPEED® HYBRID

CAN HYBRID

ENCODER CABLES

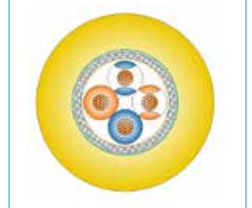
ENCODER CABLES

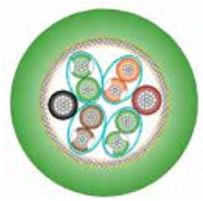
INDIVIDUAL SOLUTIONS

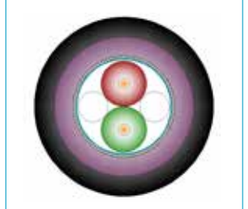
TAILOR-MADE SOLUTIONS

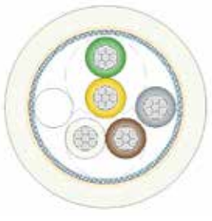
Whether it's for simple cable or hybrid cable designs, the GG Group has the right solution for your application. Special adaptations for your individual ideas and requirements are possible at any time. The products listed in this catalog represent an excerpt from the GG Group's standard portfolio.

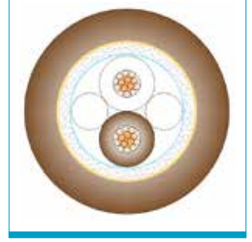
Special features, such as increased dynamic requirements, rodent protection, adjustment of plastic colors, increased flame resistance, lack of halogen, UV resistance, oil resistance, reduced dimensions and many others can be established at any time upon consultation with your GG Group technical or sales team.

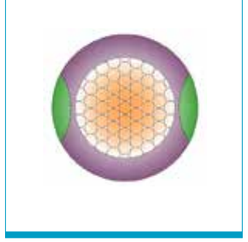


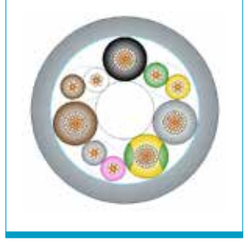












LEGAL REQUIREMENTS, APPROVALS & GUIDELINES

Depending on the region, country and specific application, the same cable must fulfill different requirements. In this respect, all legal, standard-related, application-specific and customary market specifications must be known and applied to the products accordingly. The following content is distinguished by the GG Group for the products in this catalog.

Legal requirements

"CONFORMITÉ EUROPÉENNE", or European Conformity, is a mandatory legal requirement of the European Union. All products that are subject to CE directives and reach the European end consumer market without further processing through production within the EU or through imports must bear the CE mark. This implies that the applicable EU directives are complied with. The following EU directives apply to cables:

RoHS "EU Directive 2011/65/EU"

Restriction of (the use of certain) hazardous substances. As the name implies, it prevents hazardous, usually toxic, substances from being processed or distributed. There are regular updates that expand the list of excluded substances. All components used in a cable must not contain RoHS-listed chemical products.

Low-Voltage Directive "EU Directive 2014/35/EU"

This directive ensures the functionality and safety of electrically operated components and machines. The restriction here is that only content between 50 V and 1,000 V AC voltage or 75 V and 1,500 V DC voltage is affected. In addition, individual end products are excluded, e.g. elevators, ships, trains, medical equipment etc.

Regardless of the cable type, e.g. data cable, power cable, single core etc., all cables whose rated or operating voltage defined by the manufacturer is within the specified limits are affected.

Construction Product Regulation "EU Directive 2011/305/EU"

The CPR, or Construction Product Regulation, guarantees the safety of buildings. Depending on the type of building, different safety standards apply. In a public building, e.g. a hospital, stricter requirements apply than in a private residence or warehouse.

The directive only applies to cables that are permanently installed in a building. Affected cables are grouped into classes from "Aca" (non-flammable) to "Fca" (highly flammable). In the industrial environment, especially in the process automation sector, CPR verification is typically not required. If it is, the typically required cable classes are Fca (highly flammable) and Eca/Dca (normally flammable).

The GG Group only supplies products that meet CE specifications. If the requirements change, all content is checked and communicated transparently with the customer, and the products are modified accordingly together. CPR certificates currently up to and including Dca are available and are established on a product-specific basis according to customer requirements.

"UK CONFORMITY ASSESSED" was established by the United Kingdom in the course of its withdrawal from the European Union. The UKCA requirements are mandatory legal requirements of the United Kingdom, and all products entering the UK consumer market must comply with the requirements. The UKCA guidelines are structured in the same way as the CE system and are very similar in content (identical, for the most part). As with the CE system, a UKCA marking is required as part of the conformity process.

Current UK government guidelines (2024) continue to allow a CE mark on a product to be sufficient for export to the UK indefinitely. This means that separate UKCA conformity and marking are no longer necessary for imports into the United Kingdom if the end product has CE conformity. Contents that fall under the Construction Product Regulation are an exception to this.

They are only covered by the CE system until June 2027. After this, CPR content must be approved by a UKCA-accredited testing laboratory and produced with UKCA compliance.

Due to unlimited continued use of the CE mark for RoHS and the low-voltage line, GG Group products are also UKCA compliant. CPR certificates for use in the UK are also available and must be established on a product-specific basis.

UNDERWRITERS LABORATORIES, or UL for short, is an American institution that organizes and issues approvals for electrical components and machines. There are different classifications. A distinction is made between "UL Listed" and "UL Recognized" approvals.

UL listings are explicitly anchored in US legislation in the documents of the National Fire Protection Agency, or NFPA for short. These documents deal with the safety of all electrical content. NFPA 79 for industrial machinery and NFPA 70 for building cabling are explicitly relevant for cables in industrial use.

UL Recognized are not part of the NFPA documents, but nevertheless form an independent, necessary basis for approval. The term AWM, or appliance wiring material, is commonly used in the market. This system is organized in "styles."

UL approvals are now also becoming established in Europe as a result of customer requirements in terms of safety. The reason for this is the standardization of cables in Europe, which is outdated and therefore often has gaps and does not describe the current state of the art.

The following UL standards are typical for industrially used data and low-voltage cables.

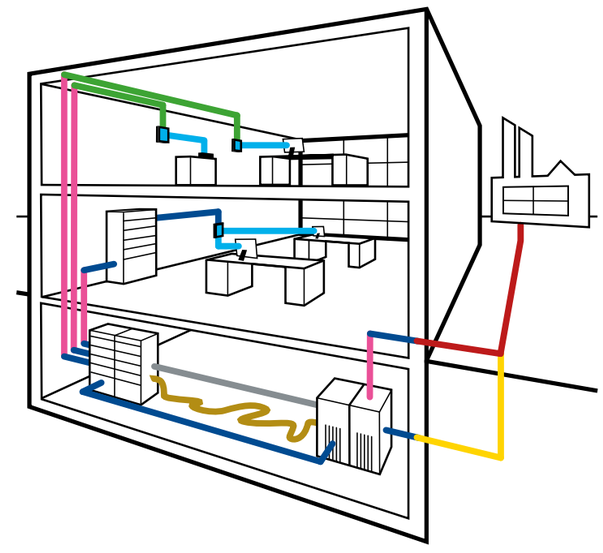
Communication cables "UL 444"

Communication cables are defined up to a rated voltage of 300 V, but are not labeled as such. Depending on the type of installation, UL places increasing demands on the flame resistance of the products. Communication cables are typically recognized by the preceding "CM" in the designation. UL 444 products are used for cabling in buildings. The possible types are described in the following table.

Power limited circuit cables "UL 13"

According to the NFPA, control circuits are divided into classes from 1 to 3. Cables for the transmission of energy with voltages up to 300 V within these classes are regulated by UL 13. Power limited circuit cables divide cables according to Class 2 "CL2" or Class 3 "CL3". The difference between the cables lies in the parameters of the mandatory electrical tests. Similar to the products from UL 444, the cable types are defined for different types of installation. The possible types are described in the following table.

Type UL 444	Type UL 13	Use	Fire test	Additional information
CMX	CL2X/CL3X	Horizontal, no bundling	VW1	Typical for patch cables
CM/CMG	CL2/CL3	Horizontal, bundling	Flame exposure test/FT4	General FT4 is similar to the IEC 60332-3 flame tests
CMR	CL2R/CL3R	Vertical across levels	Riser test	Riser = Riser pipe
CMP	CL2P/CL3P	Ceilings and floors	Steiner Tunnel test	Plenum = Distribution channels
CMX Outdoor > CM/CMG > CMR > CMP	––	Open installation in outdoor areas & permissible installation type depending on the add-on type	VW1 and fire test required depending on add-on type	Burying is not permitted. Add-on type tests are required.
––	PLTC	Horizontal, bundling, cable tray	Flame exposure test/FT4	The only type that allows installation in cable trays. Approved for Class 3.
––	PLTC-ER	Horizontal, bundling, cable tray, open installation indoors	Flame exposure test/FT4	ER = Exposed run Additional type tests are required.
––	PLTC Direct Burial	Horizontal, bundling, cable tray, open installation outdoors, including burying	Flame exposure test/FT4	Add-on type tests are required.



Appliance wiring material “UL 758”

UL Recognized products are defined via AWM styles. A distinction is made between AWM styles defined for “internal wiring” (wiring within a device) or “external wiring” (external connection of a device).

In terms of content, the only difference is the flame test. Internal wiring requires the “horizontal flame test,” and external wiring requires the “cable flame test.” Both fire tests are single-cable fire tests.

The horizontal flame test is by far the easiest fire test to pass. **The cable flame test is much more difficult to pass and places higher demands on the cable than the VW1 fire test,** which is required for listings.

The operating temperature and rated voltage are also specified for each AWM style. Both contents are unlimited, and therefore rated voltages above 300 V can be applied to the products.

AWM products are not permitted for buildings or structures. According to the NFPA, however, only cables of the same rated voltage class may be installed in parallel. For this reason, AWM styles with a higher rated voltage are specified for some cables in addition to the listings.

All of the above-mentioned UL approvals, with the exception of plenary approvals, are offered in full by the GG Group.

THE CANADIAN STANDARDS ASSOCIATION, or CSA for short, is the Canadian equivalent of UL and is the certification that is anchored in Canadian legislation. Many UL standards are shared between the US and Canada. The CSA may also be covered with American UL approval. This is the case with UL 444 communication cables and UL 758 appliance wiring material types.

UL approval is therefore sufficient for use in Canada, depending on the applicable standard. The communication cables are identical in content. There are major differences in the AWM cables, which can be reconciled. CSA AWM is to be regarded as an extension to UL AWM. The main difference is that the fire tests and application are different. An FT2 flame test (very similar to the horizontal wiring test for internal wiring) enables external device connection in Canada. Typical fire tests in CSA standardization are the FT2, FT1, VW1 and FT4 tests.

The GG Group does not have separate CSA approval. All CSA requirements are covered with the existing UL approvals.

Active and inactive user organizations

User organizations are consortia – usually in the form of associations – of multiple manufacturers, users, organizations and research institutions on a certain topic. Their aim is to make this topic, which in the cabling sector is usually communications technology, as easily accessible and uncomplicated as possible for the end user. The aim is to cover all technical content (hardware and software), from the raw material to the end user, and to achieve consistent standardization. This typically takes the form of free, publicly accessible publications and guidelines, which are developed by committees and through regular coordination between the experts of component manufacturers and system manufacturers as part of the organization’s activities.

All participation costs are covered by the companies themselves. The content is exclusively the technologies and specifications of the organization. Exchanging information on the economic content of individual companies is typically punished with exclusion from the organization and can lead to a complaint being filed with the competition authority. These strict measures rule out the formation of a cartel.

The following user organizations are groups considered to be the most important for the GG Group’s industrial products. This is just a selection of the existing organizations.

PROFIBUS & PROFINET INTERNATIONAL

The aim of PROFIBUS & PROFINET International (or PI for short), known informally as the PROFIBUS User Organization (PNO), is to advance process automation technologically and, due to the resulting diversity, to standardize the two main systems: PROFIBUS and PROFINET.

The GG Group has been part of PI/PNO for some time and, as an innovative cable manufacturer, has contributed to several cabling guidelines for PROFIBUS and PROFINET, including the latest one.

SINGLE-PAIR ETHERNET “SPE”

Two international user organizations have been formed for the new Single-Pair Ethernet or One-Pair Ethernet (SPE) technology, which uses the Ethernet communication standard: the Single-Pair Ethernet Partner Network, or SPEPN for short, and the Single-Pair Ethernet System Alliance, or SPESA for short. Both organizations essentially focus on the growing technology of SPE. Plug faces vary. Each organization has its own design which has

to be accepted and established in the market. In the meantime, SPE has also been included in the PROFINET Cabling Guide, but with a neutral plug. This means that all plugs are approved for PROFINET.

As a cable manufacturer, the GG Group takes a neutral position. Existing SPE cables from the GG Group are fully compatible with all plug faces.

CAN IN AUTOMATION, or CiA for short, is an international group focusing on Controller Area Network, or CAN, applications. The aim is to create standardization for CAN-specific content, and the focus lies on the entire series of the ISO 11898 standard.

THE OPEN DEVICENET'S VENDORS ASSOCIATION, or ODVA for short, is an international user organization that focuses on promoting DeviceNet and Ethernet IP technology for process automation.

THE AS INTERFACE, or ASi for short, defines the international standard for an intelligent cabling system. The difference to the other user organizations described so far is that the transmission of electricity plays a much greater role than the transmission of data itself. The special trapezoidal shape of the cable cross-section is distinctive for recognizing the ASi system in the field.

DECENTRALIZED AND STANDARDIZED INSTALLATION TECHNOLOGY, or DESINA for short, is a disbanded user organization in the DACH region of Europe from the early 2000s. The aim was to standardize cables for use in mechanical engineering. Resistance to lubricants and cable sheathing colors were defined here. Cables could be tested and listed at DESINA in a similar way to UL. Due to the fact that **DESINA no longer exists** and there are no currently valid and available DESINA specifications, cables can no longer be or become DESINA listed.

In this respect, the GG Group cannot currently declare DESINA conformity. Requirements regarding resistance, sheathing colors and printing are worked out together with our customer on a product-specific basis and anchored in the product data sheet.

SAFETYBUS
Similar to DESINA, a user organization called Safety Network International was established for the SafetyBUS system at the end of the 1990s. The decision was made in the mid-2010s to discontinue SafetyBUS, so the specifications defined at that time are no longer available or valid.

The aim was to define the system in such a way as to ensure that the data communicated is consistent in terms of time and content in order to safeguard against risks. Very specific cable designs were specified. The underlying specifications were IEC 61508 with safety requirement level SIL 3. The safeguarding of data transmission in the event of a risk is now carried out via standardization and is therefore part of the legal requirements with the corresponding product declaration.

Products offered by the GG Group comply with the latest edition of the SafetyBUS specifications. Due to the absence of the user organization and the resulting lack of validity of the specifications, product designs deviating from the last specification have appeared on the market. Due to growing and changing technical requirements in safety technology, new SafetyBUS designs can be jointly developed based on customer-specific requirements.

NOTES:

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