

Technical Guideline

Data Cables for the

INTERBUS Sensor/Actuator Bus

Supplement of DIN E 19258

Version 1.0

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General

Modern automation concepts use serial networking on the "lowest level", which is the level of sensors and actuators at machines and in plants. Unlike traditional parallel wiring, serial networks have an enormous rationalization potential, in particular due to reduced cabling costs, shorter startup times as well as a greater flexibility of machines and plants. Reliable transmission is an important factor for a bus system in the field of automation technology. Since the process area close to sensors must use low-cost electronics, reliable transmission depends on the transmission media, the topology and the self-diagnostics of the bus system. Thus fieldbus devices and their transmission lines must be compatible against electromagnetic interference. Today's automation technology uses copper lines and, in environments with high interference, optical fibers as transmission media.

There is a guideline for INTERBUS, which has been recognized in the meantime as the draft standard DIN E 19258 by the German Institute for Standardization. This standard describes a transmission medium which is built upon the proven RS-485 interface. The technical guideline for INTERBUS data cables is therefore to be seen as an addition to the INTERBUS draft standard.

Source of Supply

The technical guideline for data transmission through copper cables in the INTERBUS system can be obtained like the guideline for optical transmission and the INTERBUS guideline from the
INTERBUS CLUB Germany e.V. The address is:

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1. Technical Data

1.1. INTERBUS Remote Bus (2-Wire)

Characteristic quantity (20°C)	Value	Test method
Number of conductors	3 x 2, twisted pair, with common shield	
Conductor cross section	Min. 0.2 mm ²	
Direct current conductor resistance per 100m	Max. 9.6 Ω	IEC 189-1 clause 5.1
Characteristic impedance	120Ω ± 20 % at f=0.064 MHz 100Ω ± 15 Ω at f>1MHz	IEC 1156-1 clause 3.3.6
Dielectric strength - Conductor / conductor - Conductor / shield	1000 Vr.m.s., 1 min 1000 Vr.m.s., 1 min	IEC 189-1 clause 5.2
Insulation resistance (after dielectric strength test)	Min. 150 MΩ for a cable of 1 km	IEC 189-1 clause 5.3
Maximum transfer impedance - at 30 MHz	250 mΩ/m	IEC 96-1
Working capacitance at 800 Hz	Max. 60 nF for a cable of 1 km	IEC 189-1 clause 5.4

Characteristic quantity (20°C)	Value	Test method
Min. near end cross talk loss (NEXT) for a cable of 100 m - at 0.772 MHz - at 1 MHz - at 2 MHz - at 4 MHz - at 8 MHz - at 10 MHz - at 16 MHz - at 20 MHz	61 dB 59 dB 55 dB 50 dB 46 dB 44 dB 41 dB 40 dB	IEC 1156-1 clause 3.3.4
Max. attenuation for a cable of 100 m cable - at 0.256 MHz - at 0.772 MHz - at 1 MHz - at 4 MHz - at 10 MHz - at 16 MHz - at 20 MHz	1.5 dB 2.4 dB 2.7 dB 5.2 dB 8.4 dB 11.2 dB 11.9 dB	IEC 1156-1 clause 3.3.2

1.1.1. Mechanical Requirements for Standard Cable

Cable with limited flexibility for loose laying (occasional movement is possible) and fixed laying in dry or damp rooms.

Quantity	Value
Temperature range	-20°C to +70°C
Color coding of the conductors	Acc. to DIN 47100
Sheath color	Green, RAL 6017
Maximum outside diameter	8 mm
Minimum bending radius	64 mm
Connection method	Suitable for - subminiature D connector, 9 pos. (DIN 41652) - IP 65 circular connector IP65, 9 pos. (Coninvers)

Deviation from the mechanical requirements is permitted for special applications if the electrical cable characteristics correspond to the data specified above. The connection method of the cable has to be selected so that the specified electrical data is not considerably impaired. Special care is required when the connection method for the shield is selected. The shield must be connected in such a way that the conductor cross section is not reduced and that as much of the conductor as possible is covered by the shield. The twisting of the conductor pairs must be maintained close to the connection contact. It should be avoided to connect two cables directly with each other, because this results in loss through reflection at the connection point and the effectiveness of the shield is impaired. This is especially true if different cable types are interconnected.

If connection points cannot be avoided or the electrical values cannot be achieved for a special cable, a single-case test must clarify whether this cable can still be used, for instance, by reducing the permissible transmission distance.

1.2. INTERBUS Installation Remote Bus (2-Wire)

The installation remote bus is a special variation of the standard 2-wire remote bus which carries the power supply for the bus logic circuitries of the following devices. The cable is mainly used for IP 65 equipment. The electrical characteristics for the data lines correspond to those of the 2-wire remote bus cable.

Characteristic quantity (20°C)	Value	Test method
Number of conductors	3 x 2 data lines, twisted pairs, and 3 power supply lines common shield	
Conductor cross section of the data lines	Min. 0.2 mm ²	
Conductor cross section of the power supply lines	Min. 1.0 mm ²	
Direct current conductor resistance for 100m of every data line	Max. 9.6 Ω	IEC 189-1 clause 5.1
Direct current conductor resistance for 100m of every power supply line	Max. 2.2 Ω	IEC 189-1 clause 5.1
Characteristic impedance of the twisted pairs (data lines)	120Ω ± 20 % at f=0.064 MHz 100Ω ± 15 Ω at f>1MHz	IEC 1156-1 clause 3.3.6
Dielectric strength - Conductor / conductor - Conductor / shield	1000 Vr.m.s., 1 min 1000 Vr.m.s., 1 min	IEC 189-1 clause 5.2
Insulation resistance (after the dielectric strength test)	Min. 150 MΩ for a cable of 1 km	IEC 189-1 clause 5.3
Maximum transfer impedance - at 30 MHz	250 mΩ/m	IEC 96-1
Working capacitance of the data lines at 800 Hz	Max. 60 nF for a cable of 1 km length	IEC 189-1 clause 5.4

Characteristic quantity (20°C)	Value	Test method
Min. near end cross talk loss (NEXT) for a cable of 100 m		IEC 1156-1 clause 3.3.4
- at 0.772 MHz	61 dB	
- at 1 MHz	59 dB	
- at 2 MHz	55 dB	
- at 4 MHz	50 dB	
- at 8 MHz	46 dB	
- at 10 MHz	44 dB	
- at 16 MHz	41 dB	
- at 20 MHz	40 dB	
Max. attenuation for a cable of 100 m		IEC 1156-1 clause 3.3.2
- at 0.256 MHz	1.5 dB	
- at 0.772 MHz	2.4 dB	
- at 1 MHz	2.7 dB	
- at 4 MHz	5.2 dB	
- at 10 MHz	8.4 dB	
- at 16 MHz	11.2 dB	
- at 20 MHz	11.9 dB	

1.2.1. Mechanical Requirements

Cable with limited flexibility for loose laying (occasional movement is possible) and fixed laying in dry or damp rooms.

Quantity	Value
Temperature range	-20°C to +70°C
Color coding of the data lines	Acc. to DIN 47100
Color coding of the power supply lines	Rod, blue and yellow/green
Sheath color	Green RAL 6017
Maximal outside diameter	8 mm
Minimum inside diameter of the cable sheath	5 mm
Minimum bending radius	80 mm
Connection method	Suitable for IP65 circular connector, 9 pos. (Coninvers)

1.3. INTERBUS Local Bus

Technical characteristics	Value
Number of conductors	14
Cross section	0.14 mm ²
Shield coverage	> 70 %
Loop resistance of a conductor pair	< 150 Ω/km
Insulation resistance	> 20 MΩ*km
Operating capacitance	< 120 nF/km
Test voltage conductor/shield	600V
Test voltage conductor/conductor	1250V
Cable material	PVC
Cable color	Gray, RAL 7032

2. Certification Procedure for Data Cables

Analogous to the certification of devices with INTERBUS interface, the certification committee of the INTERBUS CLUB decides with the help of a test report whether the data cable is suitable or not. For this purpose the applicant submits a test report to the manufacturer. The report contains the results of the specified test criteria. The certification committee of the INTERBUS CLUB checks whether the requirements specified in the INTERBUS CLUB guideline for data cables are met. If this is the case the committee grants the right to carry the INTERBUS test mark - the certification symbol for data cable - and allocates a certification number.

3. Certification Symbol

Every manufacturer of data cables is authorized to carry the certification symbol for data cables (Figure 1) provided that the cables comply with the technical specifications of this guideline. Also, the manufacturer must have submitted the "Mark Authorization Certificate Application" to the INTERBUS and this application must have been accepted.

With this certificate the manufacturer declares that the technical specifications of this guideline are kept for all batches with the certification symbol.

The certification symbol consists of the term "INTERBUS-Compatible-RBC" in black letters on green background (RAL 6017) and the "INTERBUS compatibility symbol" (see figure below).

Figure 1: Certification symbol on the data cable

