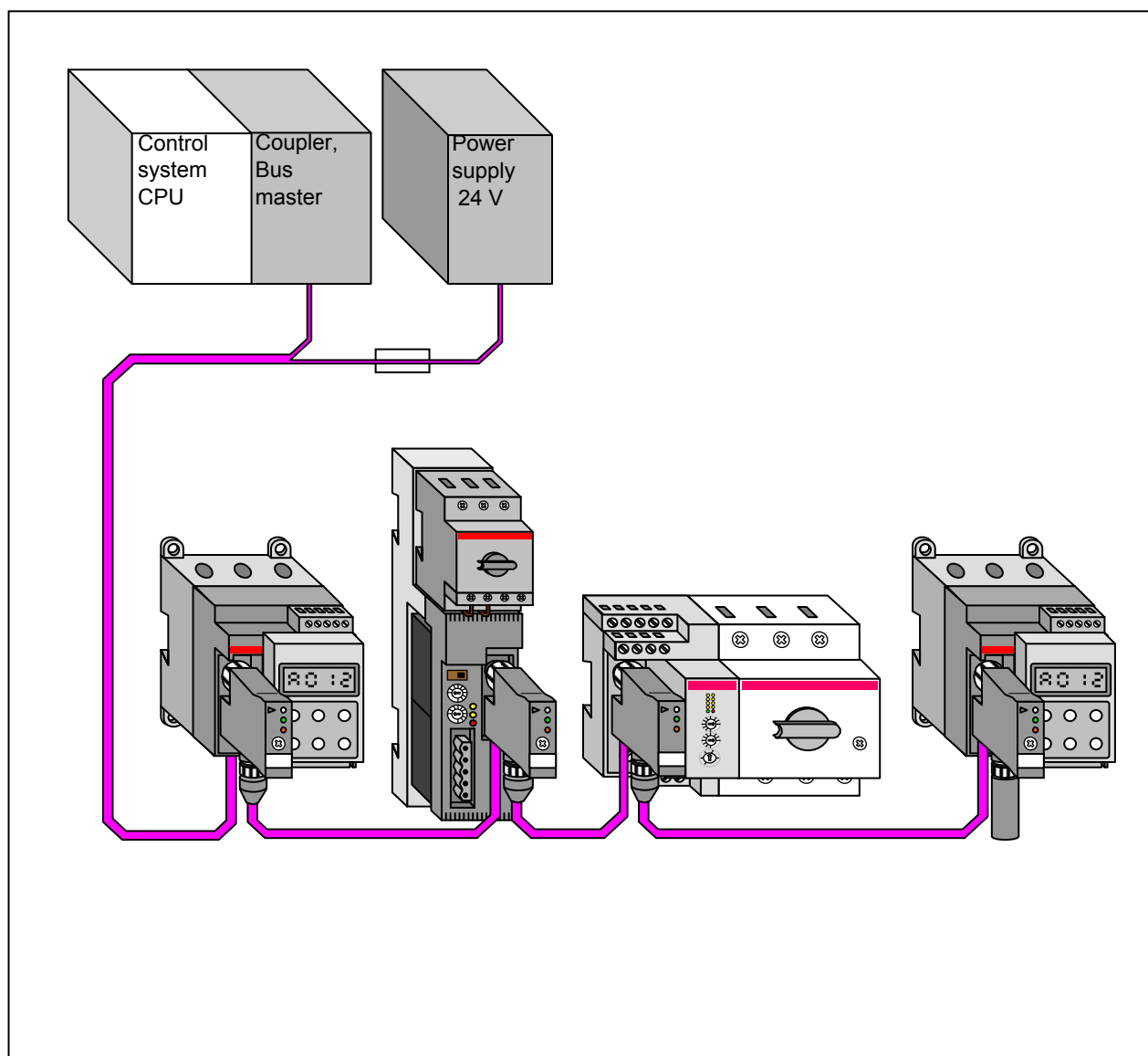




V6

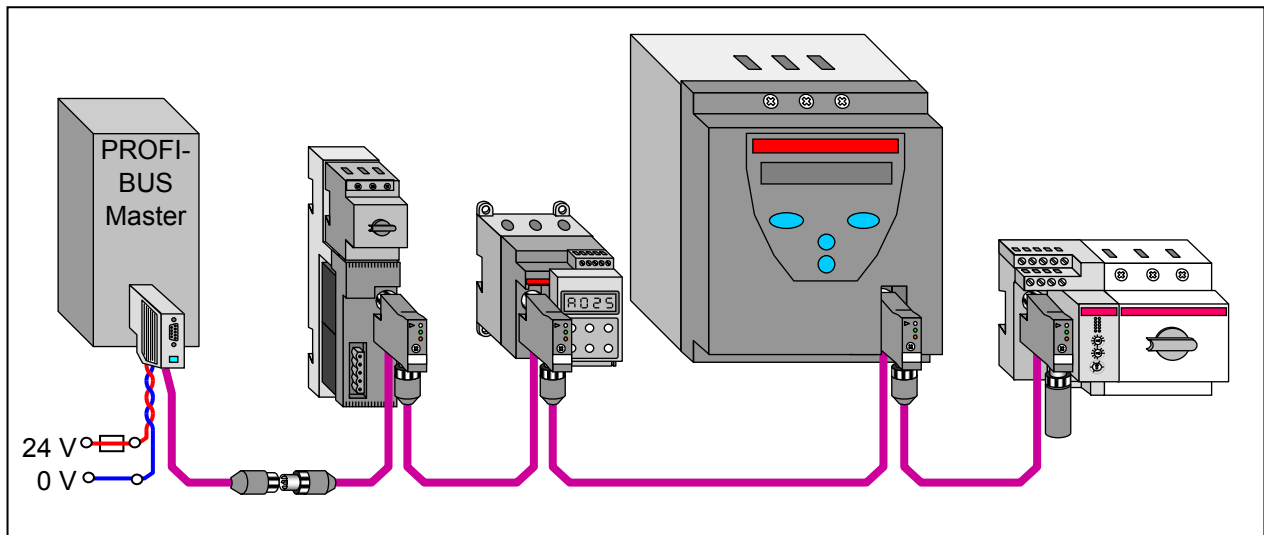
PDP21-FBP
PROFIBUS DP-V0 FieldBusPlug

PDP22-FBP
PROFIBUS DP-V1 FieldBusPlug





Fieldbus configurations with the PROFIBUS FieldBusPlug PDP21 and PDP22 are easy to project and fast to install. Failures e.g. due to poor connection, termination resistors on wrong positions etc. are avoided.



Contents

Page

1. PROFIBUS DP, Introduction	3
1.1 ISO/OSI model	3
1.2 Typical Bus Topologies	3
1.3 Overview of transferred data	4
1.4 PROFIBUS DP-V0 <---> PROFIBUS DP-V1	5
1.5 PROFIBUS DP Master Class 1, PROFIBUS DP Master class 2	7
1.6 Profiles, short overview	8
2. PROFIBUS built with PDP21 and PDP22	9
2.1 Slaves with FieldBusPlug	9
2.2 Important Features of Bus Lines Created with PDP21 / PDP22	9
2.3 Building a PROFIBUS DP line with FieldBusPlugs	10
2.4 Topology examples	11
2.5 Topologies with Repeater	14
2.6 Topologies with Optical Link	16
2.7 Power Supply, INT / EXT	16
2.8 Power Supply via Bus Cable, Calculation	17
2.9 Grounding, Shielding	19
3. Data Structure, Addressing	21
3.1 Communication between FieldBusPlug and Device	21
3.2 Slave with DP-V0 or DP-V1 FieldBusPlug, Data Overview	21
3.3 Configuration of a PROFIBUS line with FBP slaves in the bus master	22
3.4 Addressing	26
4. Technical Data	27
4.1 Bus Cable and Bus Length	27
4.2 PDP21, PDP22, Pin Assignment	28
4.3 PDP21, PDP22, Indicators on the Front Plate	29
4.4 PDP21, PDP22, Technical Data	30
4.5 PDP21, PDP22, Ordering data	31
4.6 PDP21, PDP22, Dimensions	32
4.7 Accessories	33



1. PROFIBUS DP, Introduction

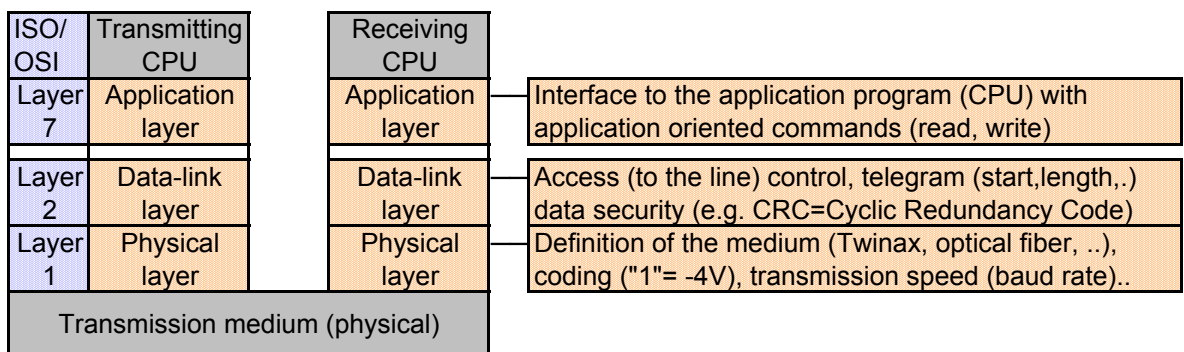
1.1 ISO/OSI model

PROFIBUS DP is actual the most common fieldbus for industrial applications worldwide and is standardized in IEC61158 together with other fieldbus protocols.

The definition of the PROFIBUS is based on the experience concerning data transmission collected during long years.

One basis is the ISO/OSI layer model that represents an ordering and description scheme for data transmission systems. It divides the way between the CPU interface and the physical medium into seven layers.

Fieldbus systems normally use only three of them:

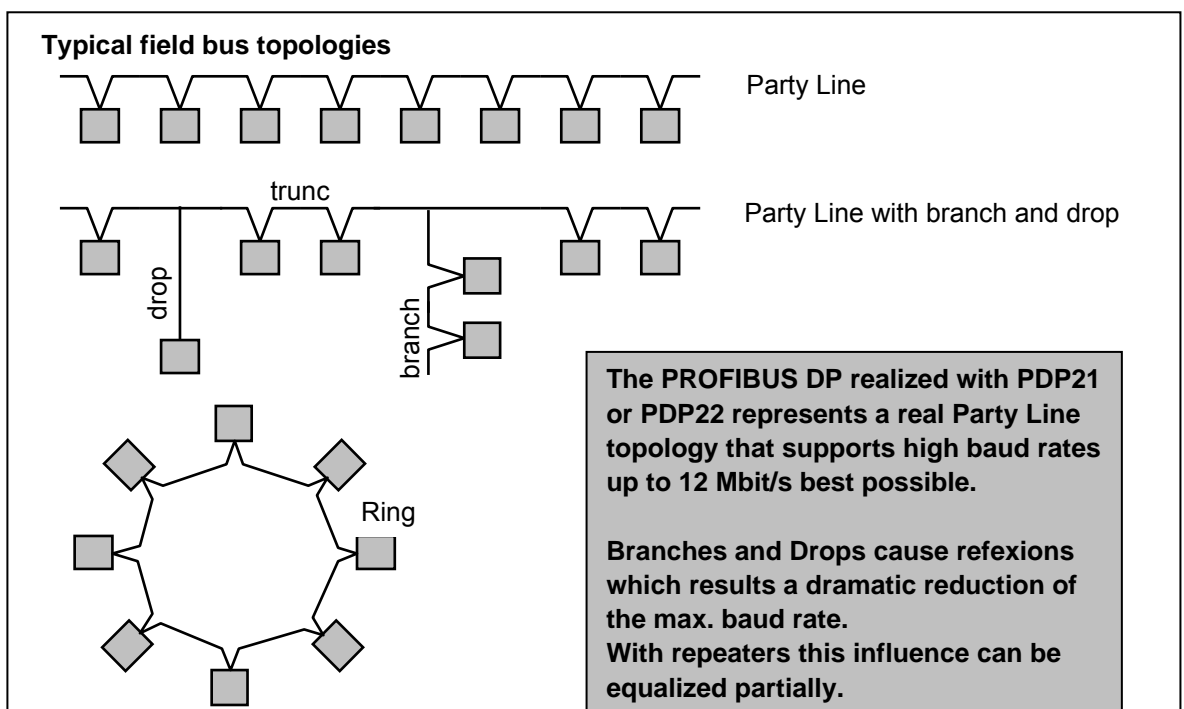


As a result of the ISO/OSI layer model each layer can be defined separately and (nearly) independent of the other layers.

Indeed it is possible and common to use conventional cables but also optical fibers as physical layer for the PROFIBUS DP or have a mixture of both in a single bus configuration.

For the application layer there are also different versions possible e.g. PROFIBUS DP-V0, PROFIBUS DP-V1 but also others that are not regarded here.

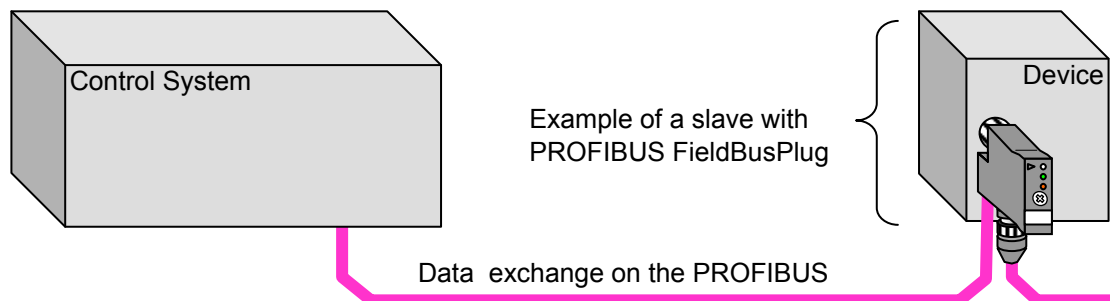
1.2 Typical Bus Topologies





1. PROFIBUS DP, Introduction (continued)

1.3 Overview of transferred data



	Group	Type / example *	Direction	Comment
Cyclic data exchange	Monitored signals (inputs)	DI = digital input	read	<div style="border: 1px solid black; padding: 5px; display: inline-block;"> DP/V0 and DP/V1 </div>
		AI = analog input	read	
	Commands (outputs)	DO=digital output	write	
		AO=analog output	write	
other basic data transfer	Diagnosis	Faults and warnings	read	<div style="border: 1px solid black; padding: 5px; display: inline-block;"> DP/V0 and DP/V1 </div>
	Configuration, Identification	Qty. of DI, DO,...+ product code..	read / write	
	Bus specific data	baud rate, time -out..	read / write	
	Block parameters**	Control function... trip class ...	write	
Acyclic data exchange	Single parameters	Control function... trip class ...	read / write	DP/V1 only

* The quantities of bytes / words are defined by the connected device.

** Block parameters are transferred during power-up.

The PDP22 (PROFIBUS DP-V1) allows to suppress the block parameter transfer (executed e.g. during power-up) by setting the appropriate parameter. This parameter "Block-Parameter" is not sent to the device and cannot be set via the device, but has to be configured within the parameter area for the PDP22 itself.

In the programming tool 07AC1131 used for the CPU 07KT98 the parameter's value is 'Ignore Block Parameters' or 'Use Block Parameters' resp. in the PDP22 parameter part.



1. PROFIBUS DP, Introduction (continued)

1.4 PROFIBUS DP-V0 <---> PROFIBUS DP-V1

Commands and monitoring signals

The transfer of Commands and Monitoring signals is the essential task of the fieldbus and the connected units. They control and inform mainly about the process, e.g. start a motor and inform if it runs correctly, and are the same for DP-V0 and DP-V1.

Command and monitoring telegrams represent the cyclic data transfer.

Diagnosis

The Diagnosis telegram delivers detailed information if there is any problem, particularly in the process. A trip caused by overload of a motor is an example. Diagnosis data are automatically read by the PROFIBUS master if it gets a general fault info within a monitoring telegram.

Complete Diagnosis telegram:

PROFIBUS DP-V0				
Üblich		mit PDP21/22		
6 bytes	PROFIBUS standard diagnosis data	6 bytes	PROFIBUS standard diagnosis data	Data is processed by the Profibus-Master, so the user is not able to access the data directly.
n+2 bytes	User-specific diagnosis data	1 byte	length of slave diag.	Diagnosis of PDP21/22 itself: Length of user specific diagnosis including this lengthbyte.
		1 byte	communication status	Communication status: 0: Communication FBP <=> Device running 1: Communication lost
		n bytes	device specific diag.	Diagnostic data received from device; refer to device manual

PROFIBUS DP-V1				
Üblich		mit PDP22		
6 bytes	PROFIBUS standard diagnosis data	6 bytes	PROFIBUS standard diagnosis data	Data is processed by the Profibus-Master, so the user is not able to access the data directly.
n+5 bytes	User-specific diagnosis data	1 byte	length of slave diag.	Diagnosis of PDP21/22 itself: Length of user specific diagnosis including this lengthbyte.
		1 byte	diag.-type	Diagnosis-Type = 0x81 fix (Status Message)
		1 byte	slot (=0)	Slot = 0 (fix)
		1 byte	statusspecific	Statusspecific = 0 (no further specification)
		1 byte	communication status	Communication status: 0: Kommunikation zw. FBP und Gerät läuft 1: Kommunikation gestört
		n bytes	device specific diag.	Diagnostic data received from device; refer to device manual

Remark: Due to compatibility reasons the DP-V1 plug PDP22 can handle the DP-V0 diagnosis telegram also. Use the parameter 'DPV0 Diagnosis Format' (default) or 'DPV1 Diagnosis format' in the PDP22 parameter part.



1. PROFIBUS DP, Introduction (continued)

1.4 PROFIBUS DP-V0 <---> PROFIBUS DP-V1 (continued)

Configuration, Identification and other data

Configuration, Identification and other data are necessary to start the operation and communication with the PROFIBUS DP slave. These data are created during configuring/selecting the bus line including the slaves/devices and are sent to the FieldBusPlugs directly after power-up. All slaves compare the expected configuration with their real configuration and confirm if they agree as a supposition to start the data exchange.

Additionally some general data such as Baud rate and Time-out are transferred.

Parameters

Parameters are necessary to adapt the device to the process.

E.g. for the device UMC22 the parameter 'Set current' that has to be set correctly to enable the UMC22 to protect the connected motor perfectly against overload.

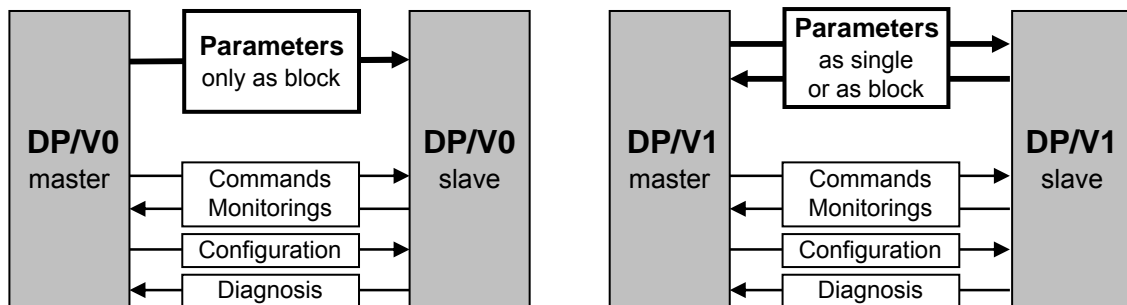
Parameters can also include service oriented data such as 'Operation hours'.



1. PROFIBUS DP, Introduction (continued)

1.4 PROFIBUS DP-V0 <---> PROFIBUS DP-V1 (continued)

The main difference between the PROFIBUS DP versions DP-V0 and DP-V1 is:



DP-V0 only allows to write the complete parameter set in one block.

The bus master sends the parameter block to the slave during power-up of the slave/device. Some control systems also allow to send the parameter block during normal operation.

DP-V1 offers reading and writing single parameters.

The possibility to read single parameters is an important advantage: If e.g. during commissioning the 'Set current' for a motor is modified locally by the electrician, then the control system must be able to read this value to back it up into its data base.

The PDP22 (PROFIBUS DP-V1) also allows to suppress the block parameter transfer. This avoids that the parameters are overwritten during power-up of the slave / device.

The appropriate parameter is evaluated in the PDP21 / PDP22 and is not sent to the device and cannot be set via the device.

The appropriate parameter is 'Ignore V0 Parameters' or 'Use V0-Parameters' resp. and is available in the .GSD file for DP-V1, see chapter "3. Data Structure, Addressing", "3.3 Configuration of a PROFIBUS line with FBP slaves in the bus master".

In former times a separate master class 2 was needed to read and write single parameters. Actually most of the control systems offer a class 1 master capable to perform acyclic DP-V1 services to read and write all data types.

Note: In all cases only the bus master can start the data exchange on the PROFIBUS DP bus.

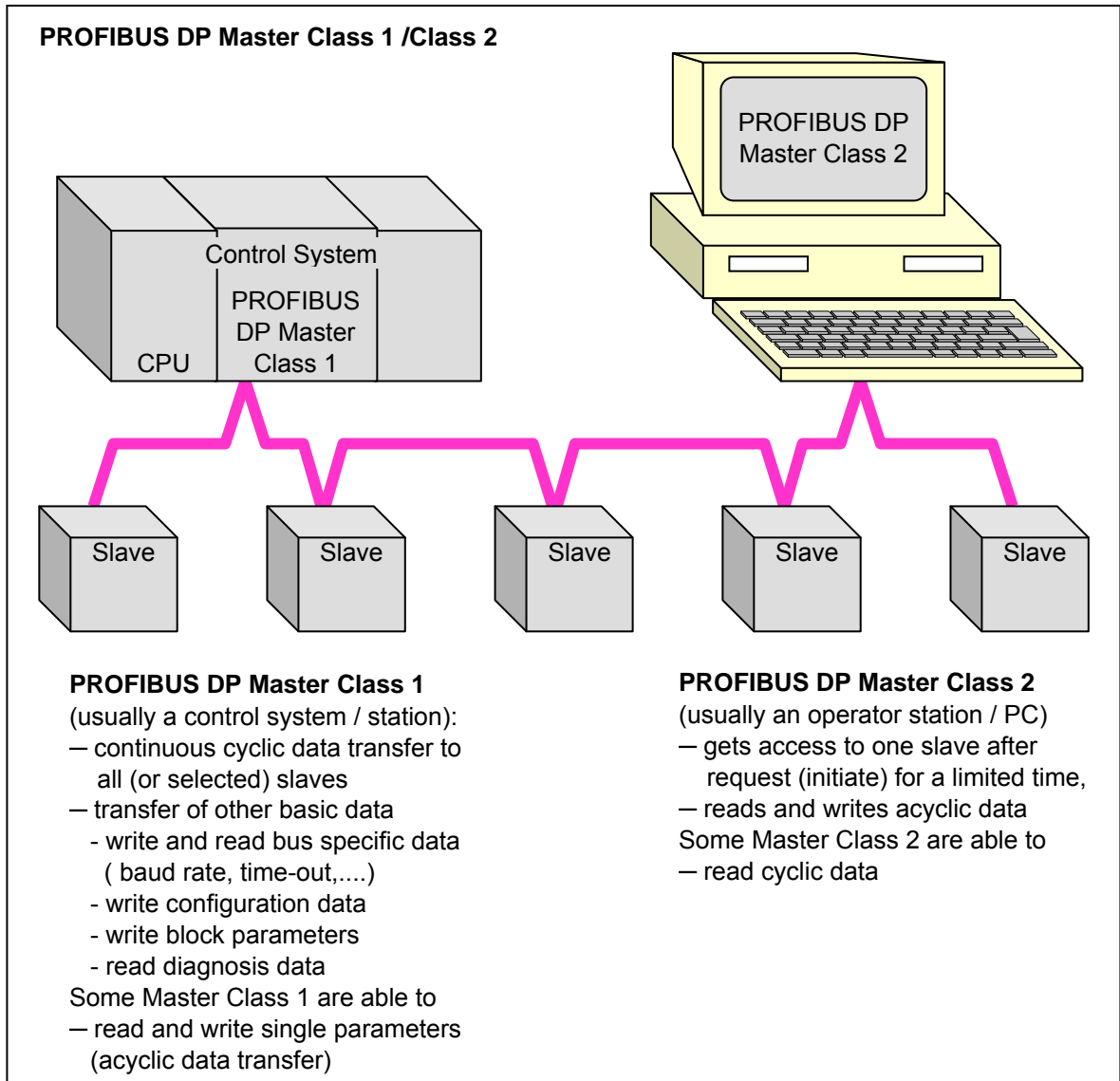


Warning: When DP-V1 is used sending block parameters during normal operation can cause faults. The slave changes to the wait status until it receives the next cyclic data telegram. Following this can cause e.g. temporarily motor switch off. In addition it is not guaranteed that the parameter block is accepted by the slave.



1. PROFIBUS DP, Introduction (continued)

1.5 PROFIBUS DP Master Class 1, PROFIBUS DP Master class 2





1. PROFIBUS DP, Introduction (continued)

1.6 Profiles, short overview

There are two main groups of Profiles:

- **General Application Profiles**

General Application Profiles describe functions and characteristics that relate to more than just one application. They also can be used together with specific application profiles.

One example is PROFIsafe that is used to support safety-related applications. (Note: The FieldBusPlugs PDP21 and PDP22 do not support PROFIsafe)

- **Specific Application Profiles**

Specific Application Profiles are defined for a lot of applications such as encoders, panel devices etc.

The scope of the profiles is to provide the possibility to replace a slave from one manufacturer by a similar slave from another manufacturer without modifying other parts of an installation.

But due to the increasing complexity of the different slaves that offer more and more intelligence it is not fully possible (e.g. due to manufacturer specific data).

However, a profile helps for better understanding of specific slaves.

The FieldBusPlug system as an universal bus connection system supports different profiles, depending on the device type.

E.g. the UMC22 uses the bit assembly of Motor Managing Starters defined in the Low Voltage Switch Gear profile. But not all bits are used as well as additional (manufacturer specific) information is provided.



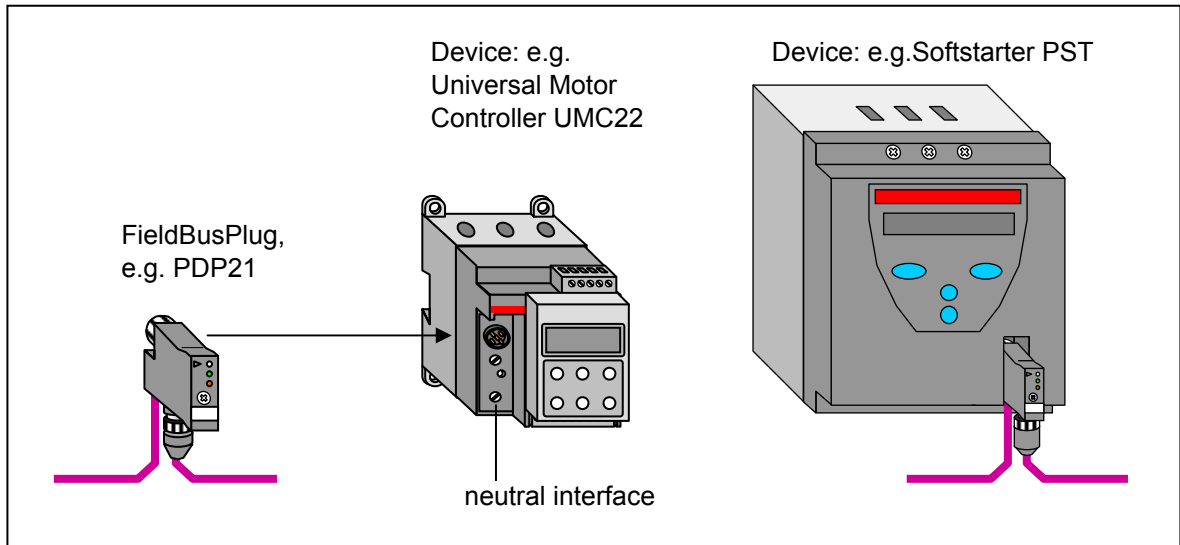
2. PROFIBUS built with PDP21 and PDP22

2.1 Slaves with FieldBusPlug

The main feature of the FieldBusPlug system is that all device types with the neutral FBP interface can be connected to several fieldbuses using the appropriate FieldBusPlug type.

This means that a PROFIBUS DP-V0 slave (or DeviceNet, ... slave) is built up of a device with the neutral interface and the PROFIBUS DP-V0 FieldBusPlug PDP21-FBP.

Examples:



One of the most important tasks during commissioning is to adjust the correct slave address carefully. Commands sent to the wrong slave can cause severe problems. For more details see the appropriate chapter in this document.

2.2 Important Features of Bus Lines Created with PDP21 / PDP22

1) The PDP21 / PDP22 represents a tee unit.

This means: If the bus node built in the PDP21 / PDP22 fails all remaining FieldBusPlugs are still connected with the bus master.

2) All PDP21 / PDP22 connected to a bus line are supplied via the bus cable.

This means: To supply the FieldBusPlugs a power supply unit is necessary that is situated best near the bus master.

This is not a disadvantage because without bus master the data transmission is not possible. The advantage is that - under some circumstances - it is possible to supply the devices via the bus cable with 24 VDC saving local supplies.

For more info see chapter "Supply" and the description of the devices.

3) A bus line built with PDP21 / PDP22 is a real party line without branches or drops.

This means: The max. baud rate 12 Mbit/s is possible, supposed the termination on both ends is done correctly and the max. bus length is not exceeded.

4) The contacts - pins and jacks - are gold plated.

This means: Concerning the contacts the PDP21 / PDP22 avoid that faults caused by loose or bad contacts.



2. PROFIBUS built with PDP21 and PDP22 (continued)

2.2 Important Features of Bus Lines Created with PDP21 / PDP22 (continued)

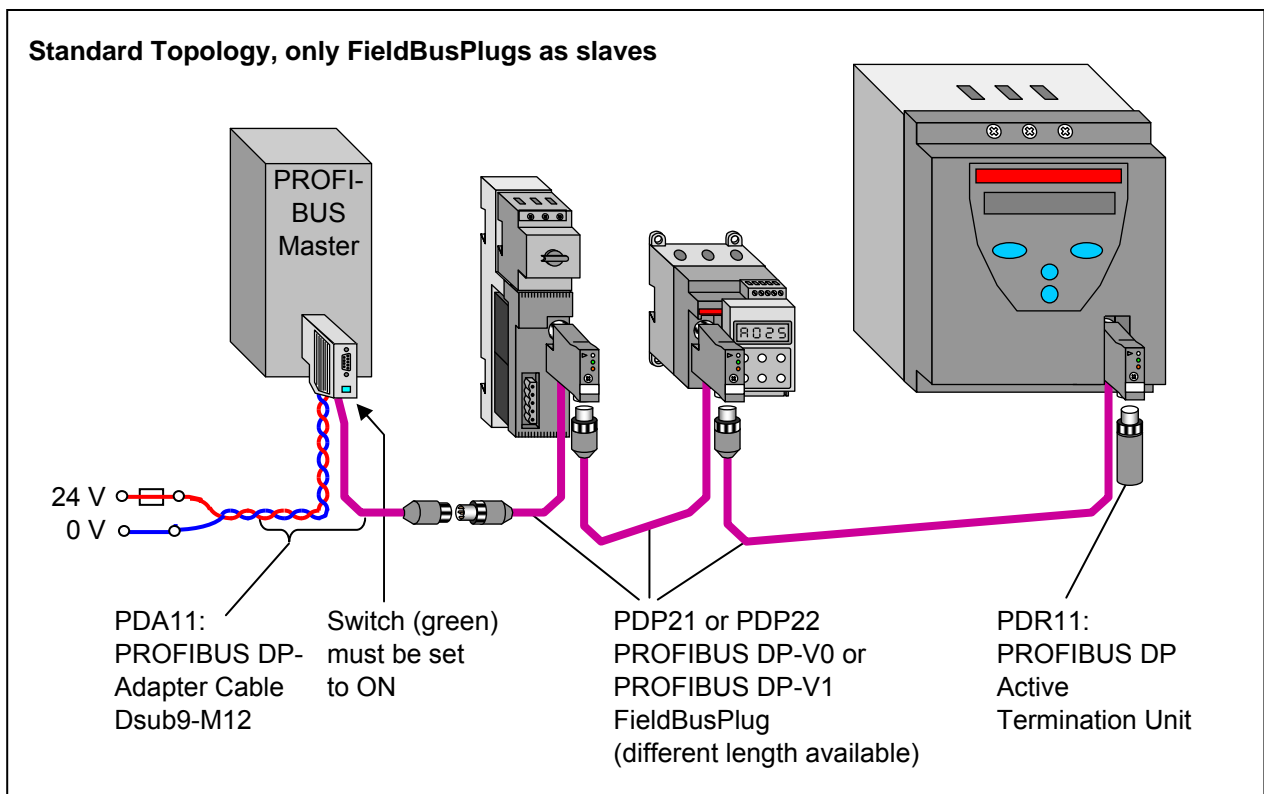
5) Only at the ends of the bus line termination resistors are possible.

This means: In the standard topology as shown below only at the ends of the line terminations are possible.

At the Dsub9 connector mounted on the bus master the termination resistor set has to be switched ON and at the other end of the bus line the termination unit must be mounted.

Regarding the situation that 80 - 90% of the problems in conventional wired PROFIBUS lines are caused by loose contact or wrong termination, the FieldBus Plug system guarantees a faultless data transmission line between the master and the slaves.

2.3 Building a PROFIBUS DP line with FieldBusPlugs



Installation of the PROFIBUS line step by step:



Attention:

Observe precautions for handling electrostatic discharge when mounting / dismantling the plug.

- Connect PDA11 (Adapter Cable Dsub9-M12) to the bus master.
- Do not forget to set the termination switch on the PDA11 (green) to ON.
- Connect the red and blue strand of the PDA11 with a 24 V DC power supply (+ red, – blue).
- Connect the first PDP21 or PDP22 to the PDA11, then the next PDP21 or PDP22 and so on. Tighten the knurled knob carefully. The roughness felt during tightening shall result in resistance to vibration.
- Do not forget to mount the PDR11 (active PROFIBUS termination unit).



2. PROFIBUS built with PDP21 and PDP22 (continued)

2.3 Building a PROFIBUS DP line with FieldBusPlugs (continued)

A fault free and stable data transmission urgently requests the perfect termination of the bus line on both ends and nowhere else.

This has to be regarded also when repeaters or optical converters are used.

The max. number of stations per segment is 32 limited physically by the RS485 standard line drivers and receivers. This includes also repeaters and similar components.

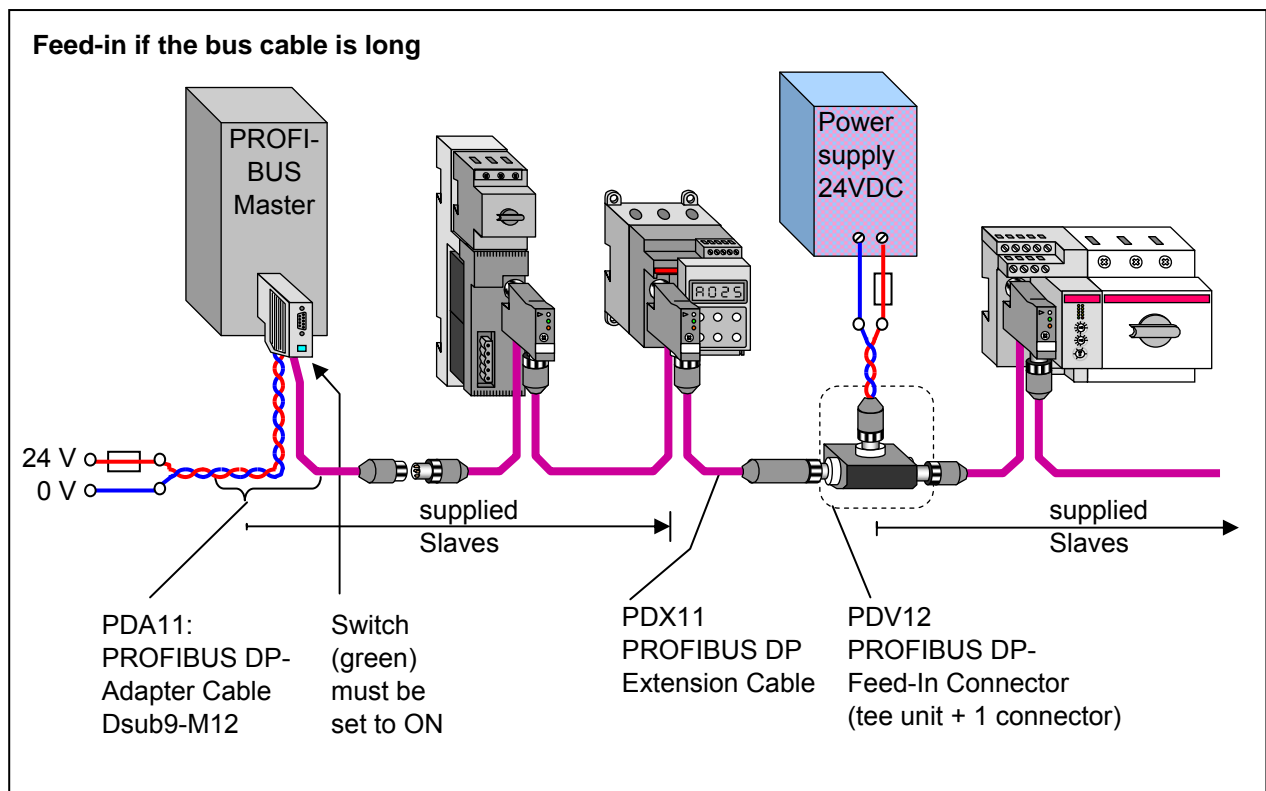
For more than 32 stations repeaters or RS485 to optical fiber converters can be used.

Another limit is set by the max. number 125 of slave addresses. The available range is 1 through 125. More details see chapter "3. Data Structure, Addressing!", sub clause "3.4 Addressing"

2.4 Topology examples

Feed-in if the bus cable is long

If the distance between the bus master and the slaves is longer it may be necessary to feed in 24 VDC for the FieldBusPlugs on a second place. Check with: "Supply Calculation" scheme.

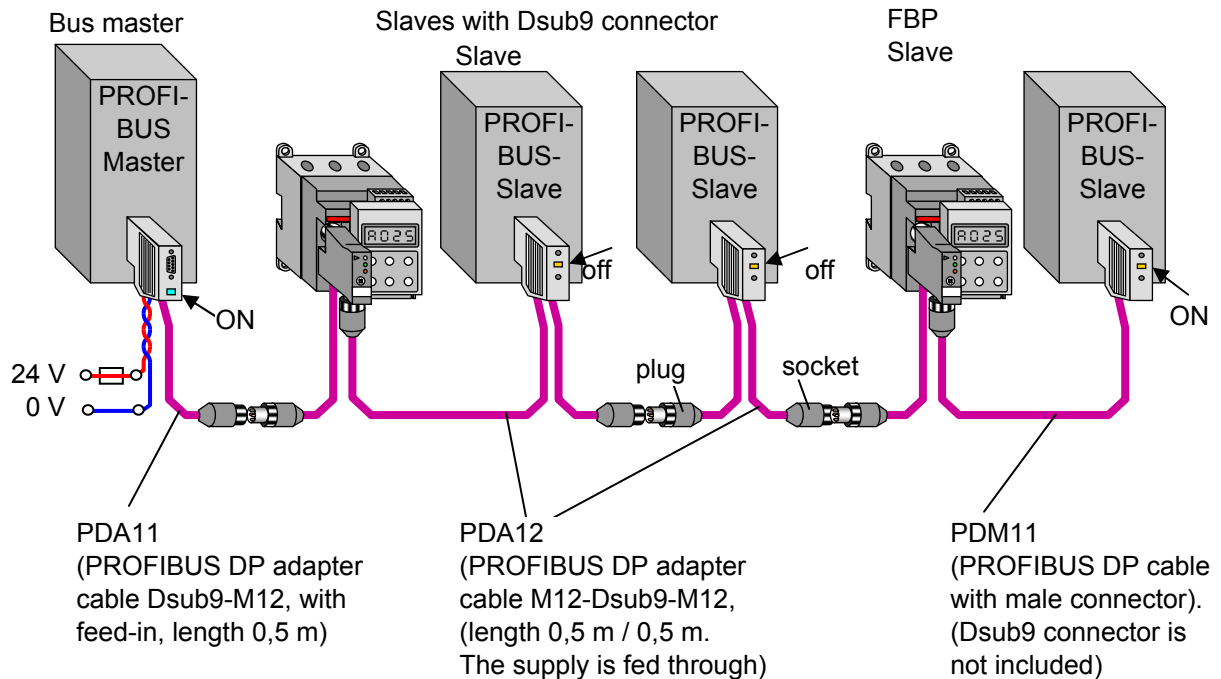




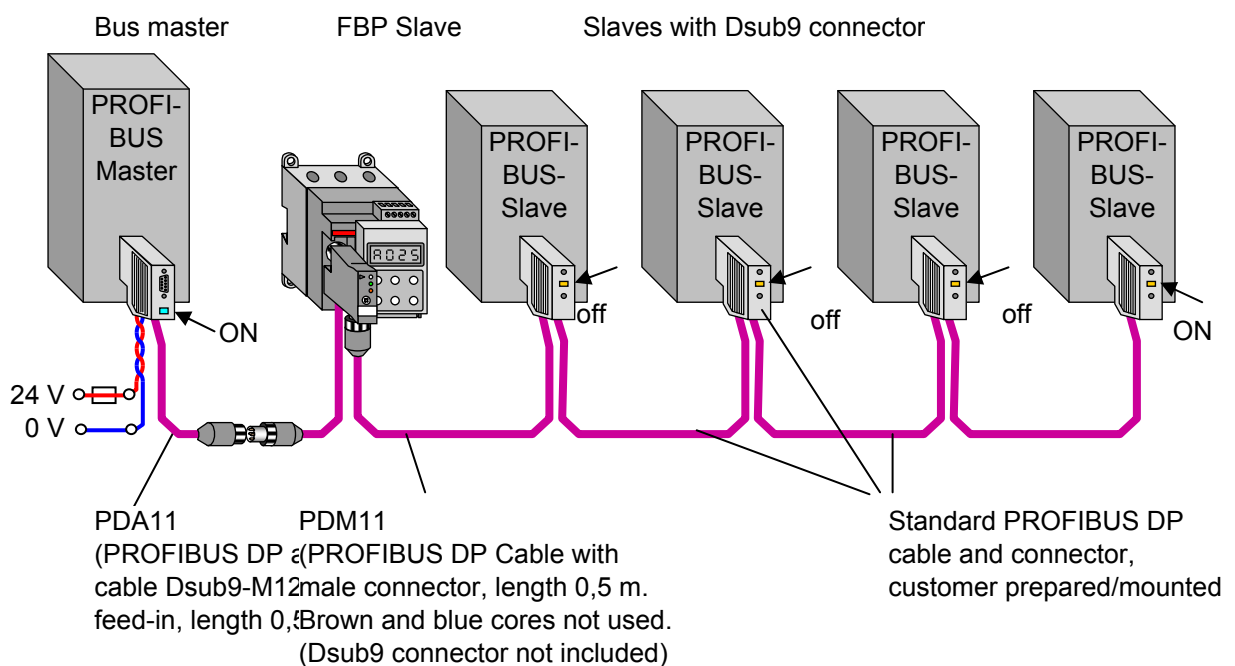
2. PROFIBUS built with PDP21 and PDP22 (continued)

2.4 Topology examples (continued)

Topology if also other PROFIBUS slaves are connected



Topology if only one or few FBP slaves are connected



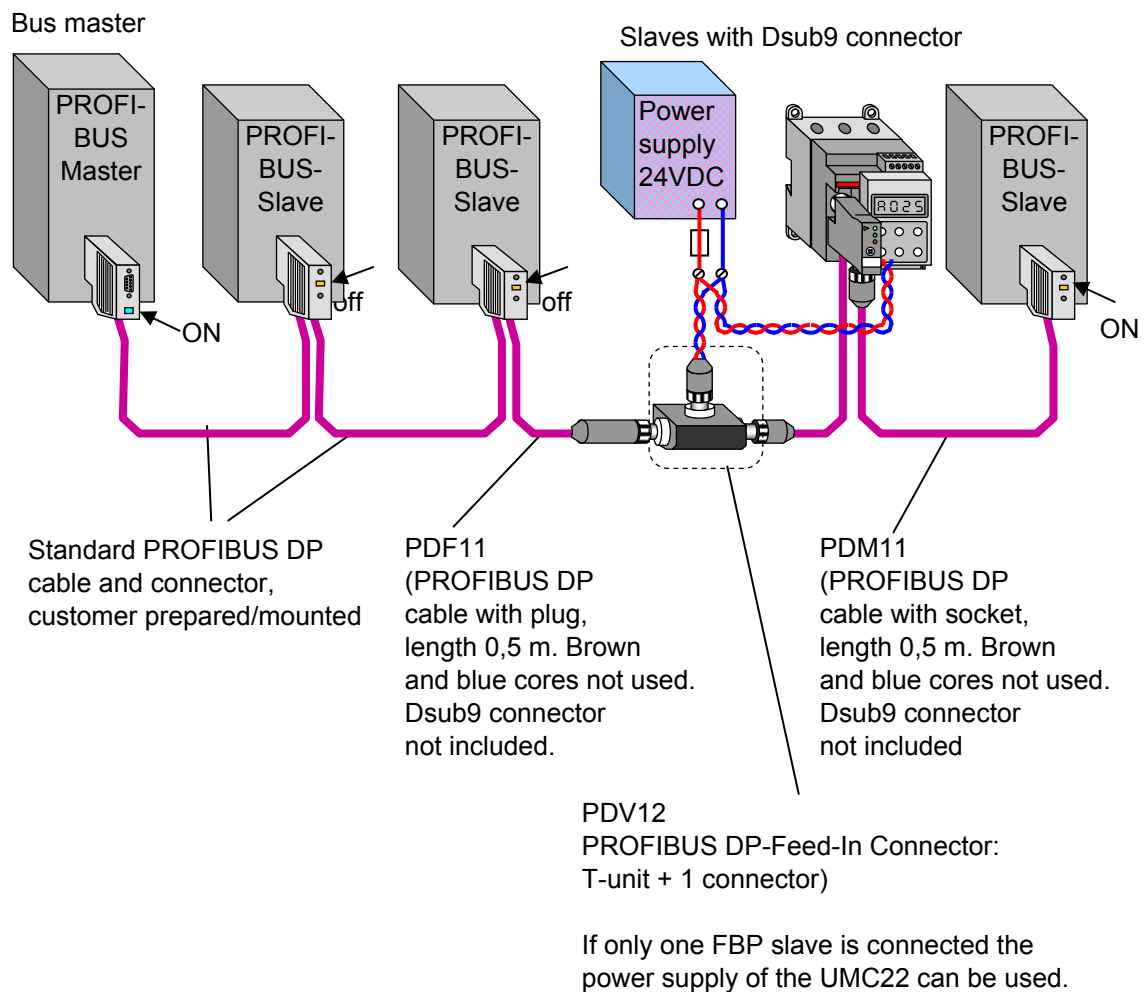
Even when slaves other than FieldBusPlugs are used the termination must be made correctly.



2. PROFIBUS built with PDP21 and PDP22 (continued)

2.4 Topology examples (continued)

Topology if only one FBP slave distant from the bus master is connected



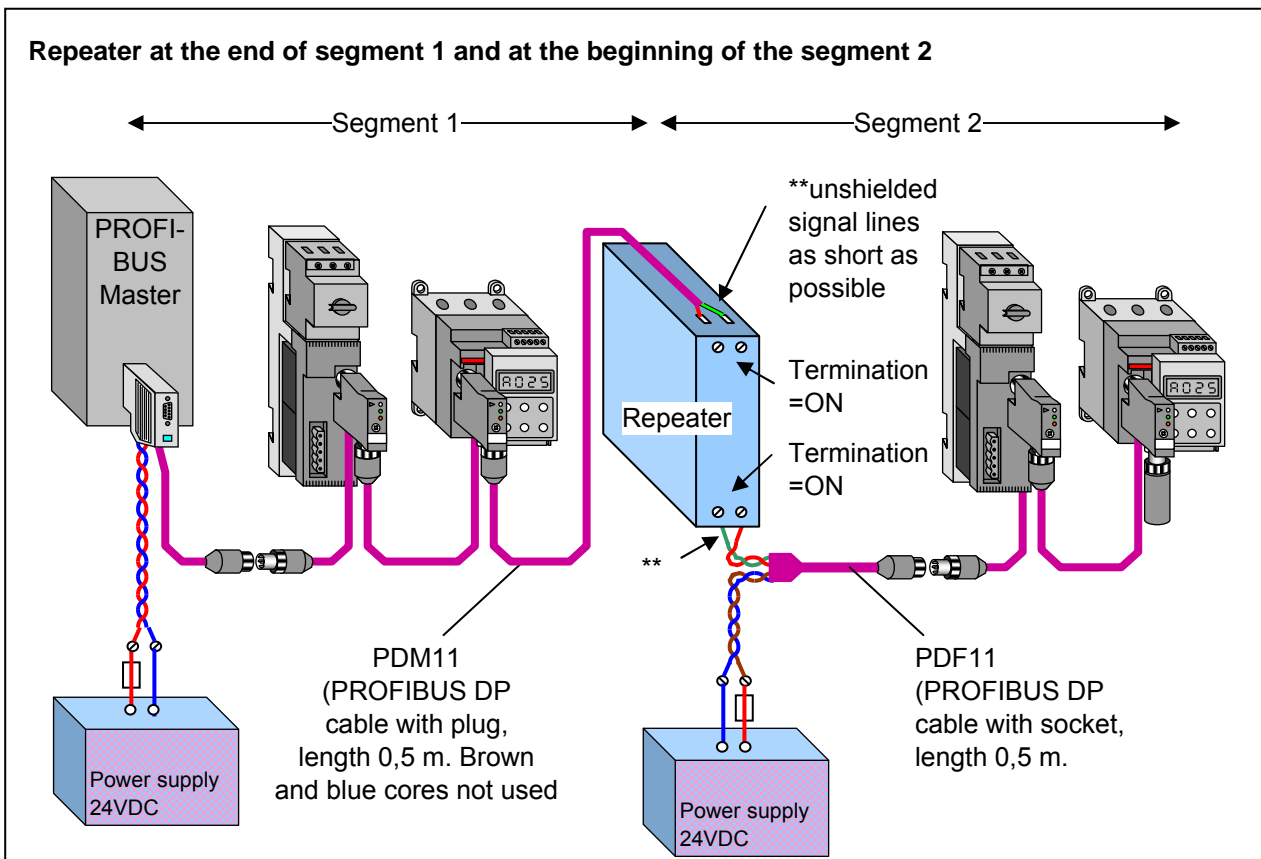


2. PROFIBUS built with PDP21 and PDP22 (continued)

2.5 Topologies with Repeater

Repeaters are necessary when:

- the number of stations (bus master + slaves) is higher than 32 or
- branches are necessary or
- a longer bus length is required.



Note:

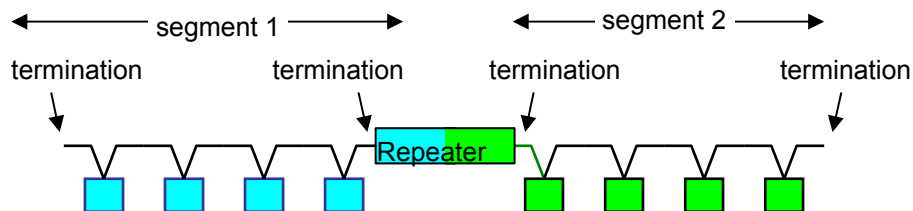
- Repeaters have to be calculated as physical stations also within the max. number 32 stations per segment. Thus only 30 slaves can be connected to a segment.
- Each segment can have the allowed bus length referring chapter "4. Technical Data"
- Set baud rate on the repeater carefully according to the manufacturer's instruction. Most of the repeaters do not support baud rates up to 12 Mbit/s.
- Regard termination carefully. Repeaters normally have built in termination that can be switched on. Consult manufacture's instruction.
- Do not use more repeaters than necessary. Repeaters decrease the stability of the whole field bus system and make it more sensitive for electromagnetic influence.
- Keep unshielded cores as short as possible.
- Take care for perfect grounding of the shields.



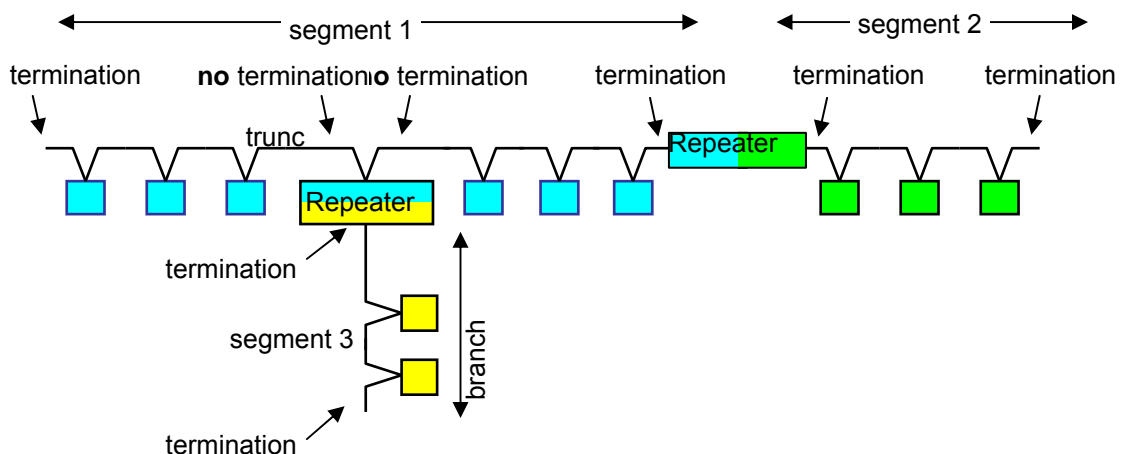
2. PROFIBUS built with PDP21 and PDP22 (continued)

2.5 Topologies with Repeater (continued)

Termination example: two segments



Termination example: two segments + branch



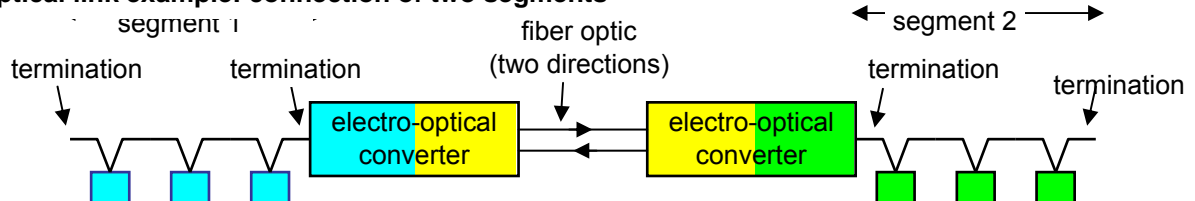
2.6 Topologies with Optical Link

Together with optical links several aspects need to be regarded:

- Type of fiber -glass or plastic, distances, laying procedure etc.
- Connector types and the method to mount on plastic fibers and glass fibers
- Topologies - line, star, ring etc.

Only a simple topology example is shown:

Optical link example: connection of two segments



The optical link with the two converters has a behaviour similar to a repeater.



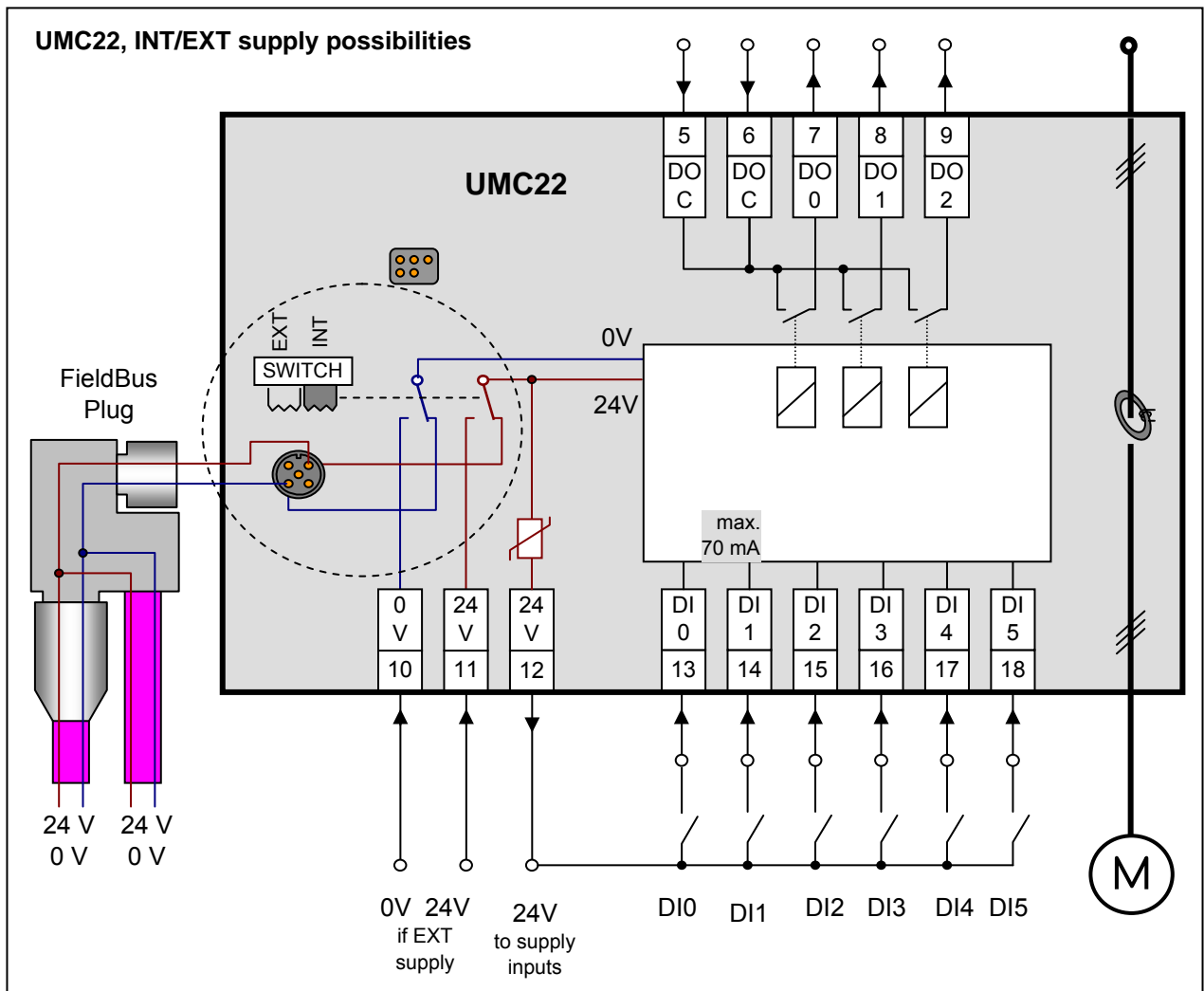
2. PROFIBUS built with PDP21 and PDP22 (continued)

2.7 Power Supply, INT / EXT

The supply of the FieldBusPlug is always made via the bus cable. This enables the FieldBusPlug to monitor the actual -e.g.faulty- status to the control station even when it is removed from the device or when power down appears on the device.

Additional it is possible to supply simple components such as proximity switches or the devices MSD11 and MSR22 via the bus cable of the FieldBusPlug.

Some devices allow to be supplied externally (via terminals) or internally (via bus cable) setting the EXT/INT switch to EXT or INT resp. Consult documentation of the device.



When the signal contacts connected to DI0 - DI5 are distant to the UMC22 or the wiring to these contacts can not be surveyed well the EXT = external supply should be provided urgently.
If INT = internal supply (via the bus cable) is used a short circuit 24V<---0V on the inputs circuits of the UMC22 can cause the complete failure of the PROFIBUS.

Larger devices cannot be supplied via the bus line, the supply current per device should not exceed 200 mA. Max. current per bus line total 4 A.



2. PROFIBUS built with PDP21 and PDP22 (continued)

2.7 Power Supply, INT / EXT (continued)

To be noticed:

- Prefer separate supply units or separately fused supply circuits for the FieldBusPlug line and the devices.
- Check carefully whether the switches of the devices are set to EXT before delivering to the installation site.
- Check the supply situation using the calculation scheme in the chapter below. Don't forget to check the total bus length.



Supply of FBP-Line must be protected by external fuse 4 A max.

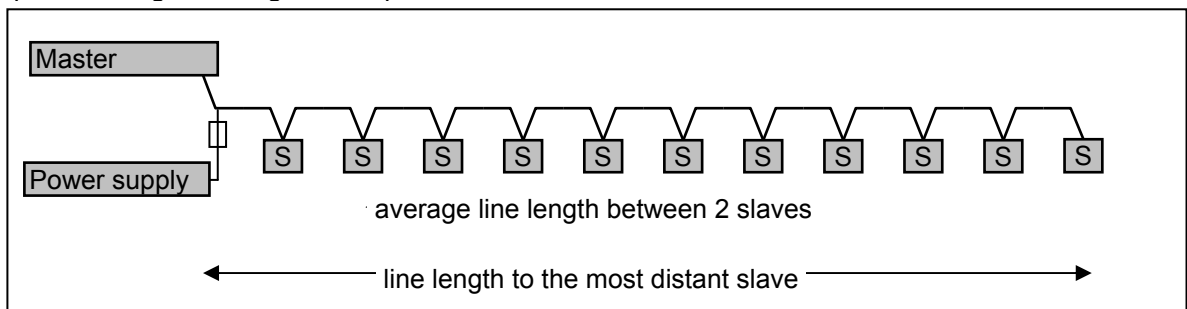
2.8 Power Supply via Bus Cable, Calculation

Supposed all devices are supplied externally, the supply has to feed the PDP21 or PDP22 connected to the bus. The supply current depends on the voltage (typical values):

Supply voltage:	19,2 V	24 V	31,2 V
Supply current typ.	46 mA	37 mA	31 mA

To simplify the calculation the scheme below uses the highest of the currents but - on the other hand - does not regard the increased copper resistance and voltage loss for higher environment temperatures.

All slaves **even the slave most distant from the supply unit need to be supplied with min. 19.2 VDC** including ripple. That means that the power supply unit at the beginning of the line has to provide a higher voltage to compensate the loss due to the line resistance.



The recommended power supply unit can be adjusted to 28 VDC:

Power Supply 24V / 5A adjustable

Order code: 1SVR423416R0100

Type: CP-24/5.0

Remark: The max. number of physical stations on one bus segment is 32, defined by the RS485 standard. That means: For more than 31 slaves an additional segment (coupled with repeater) has to be provided that needs normally a separate supply unit.

In accordance with this fact the calculation below provides max 31 slaves + one master. Normally each repeater and RS485 / fiber-optic converter represent also one physical station each on the RS485 bus line.

The calculation with the calculation scheme below takes into account:

- The most distant slave - situated at the end of the scheme - needs at least: 19,2 VDC
- Line resistance (0.5 mm²) (can be changed): 0,075 Ohm/m

Additional info:

max. output voltage of above recommended supply unit

28 V



Supply (continued)

2.8 Power Supply via Bus Cable, Calculation (continued)

Calculation procedure

1. Define number of slaves, e.g. including 10% spare slaves:

25

Example: 25 slaves ---> Master at the row of the 26th slave.

2. Define average length of the bus line between the slaves:

4,0 m

The total length appears in the row of the master, green cell.

It is necessary to consider also the max. length of the signal lines, see chapter "4. Technical Data".

Individual length can be filled in the green cells near the slaves.

3. Fill in current of the slaves:

46 mA

Individual currents can be filled in in the yellow cells near the slaves.

Result: **Voltage** in the row of the master to be delivered by the power supply, total **Current** and total **Bus Length**.

Number of Slaves	Single Lengths (can be fixed individually)	Sum Bus Length	Single Current (can be fixed individually)	Sum Current	Voltage on the Slave
	V	V	V	V	V
31 1 Slave	4,0 m	124,0 m	46 mA	1472 mA	26,04 V
30 1 Slave	4,0 m	120,0 m	46 mA	1426 mA	25,62 V
29 1 Slave	4,0 m	116,0 m	46 mA	1380 mA	25,20 V
28 1 Slave	4,0 m	112,0 m	46 mA	1334 mA	24,80 V
27 1 Slave	4,0 m	108,0 m	46 mA	1288 mA	24,42 V
26 1 Slave	4,0 m	104,0 m	46 mA	1242 mA	24,04 V
Master 1 Slave	4,0 m	100,0 m	46 mA	1196 mA	23,69 V
25 1 Slave	4,0 m	96,0 m	46 mA	1150 mA	23,34 V
24 1 Slave	4,0 m	92,0 m	46 mA	1104 mA	23,01 V
4 1 Slave	4,0 m	12,0 m	46 mA	184 mA	19,28 V
3 1 Slave	4,0 m	8,0 m	46 mA	138 mA	19,24 V
2 1 Slave	4,0 m	4,0 m	46 mA	92 mA	19,21 V
1 1 Slave	4,0 m	0,0 m	46 mA	46 mA	min 19,20 V

Results - The power supply unit has to deliver min. 23,7 V incl. ripple and tolerances
 off this - The power supply unit has to deliver min. 1200 mA
 example - The bus length is 100 m. Note: **Consider length and baud rate.**

↑ some lines are hidden / "Format", "Rows", "unhide"



2. PROFIBUS built with PDP21 and PDP22 (continued)

2.9 Grounding, Shielding

Grounding Principles

The PROFIBUS FieldBusPlug cable as well as the standard PROFIBUS cable is equipped with a perfect shield: Aluminium coated foil and braided litz.

Regarding EMC, laboratory measurements have proved that grounding is not necessary when the PROFIBUS DP is built up with PDP21 / PDP22 only, normal industrial environment supposed.

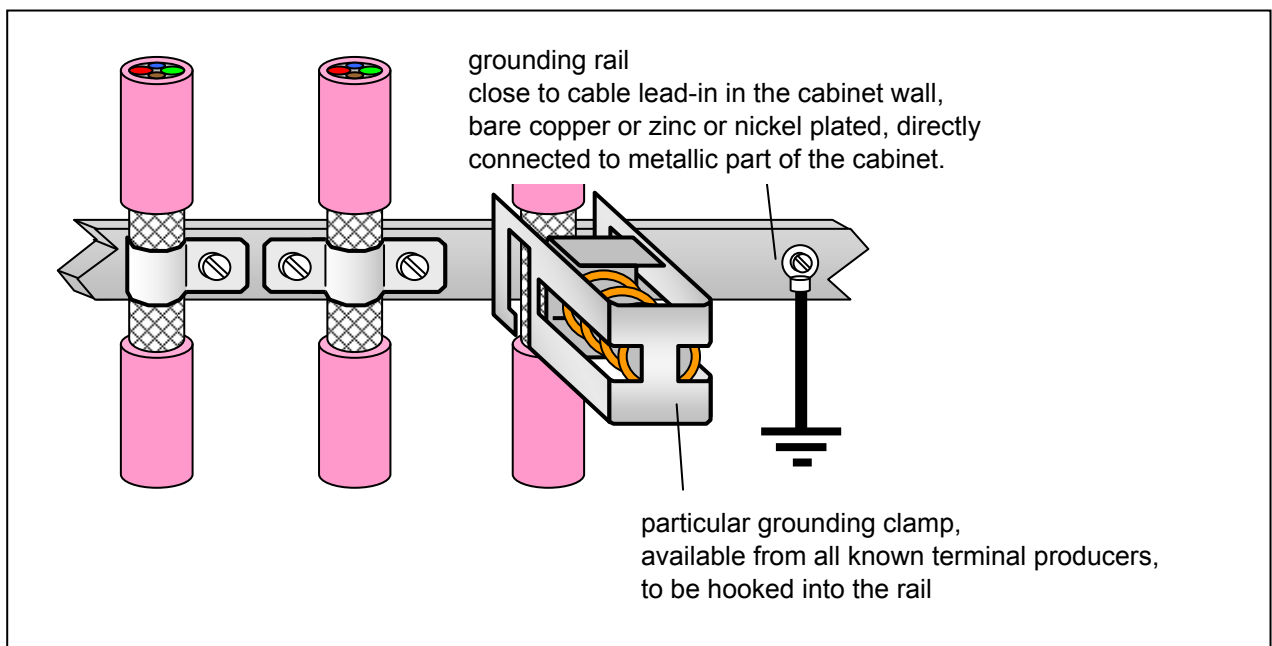
According to IEC60204 / EN60204 (chapter 6.3.3) all metallic parts must be grounded to avoid that they - in case of an insulation fault, unexpected and unobserved - are connected to a dangerous voltage.

It is urgently recommended to connect the shield to ground:

- at the PROFIBUS DP master and
- when entering / leaving a cabinet and
- every third or forth FieldBusPlug and
- when connecting other - non FieldBusPlug slaves - in accordance with the manufacturer's instruction.

Efficient grounding of the shield

Best workmanship is to remove the sheath partially and to fix the shield directly onto a metallic rail or surface with a clip or a saddle:



The grounding rail must be close to the cable lead-in in the cabinet wall and should be zinc or nickel plated for proper long term connection.

The rail must be mounted directly on the metallic part of the cabinet. Zinc plated parts and plates are to be preferred inside the cabinets.

Painted surfaces inside the cabinet or aluminium plates hinder proper connection.

Also long litz wire connecting the shield to the cabinet wall results in bad EMC data. For the litz wire with the length up to length 10 cm the flexible lead should have minimum 6 mm².

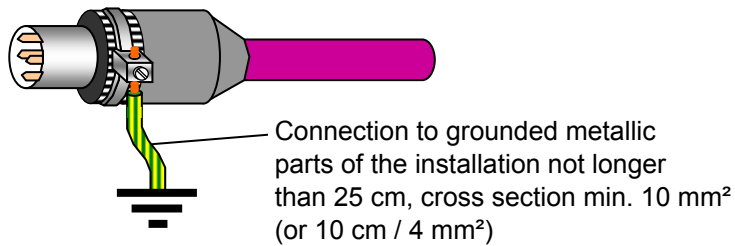


2. PROFIBUS built with PDP21 and PDP22 (continued)

2.9 Grounding, Shielding (continued)

Particularly in installations outside of cabinets where IP65 is used the grounding with tube clip can be used:

Grounding with tube clip

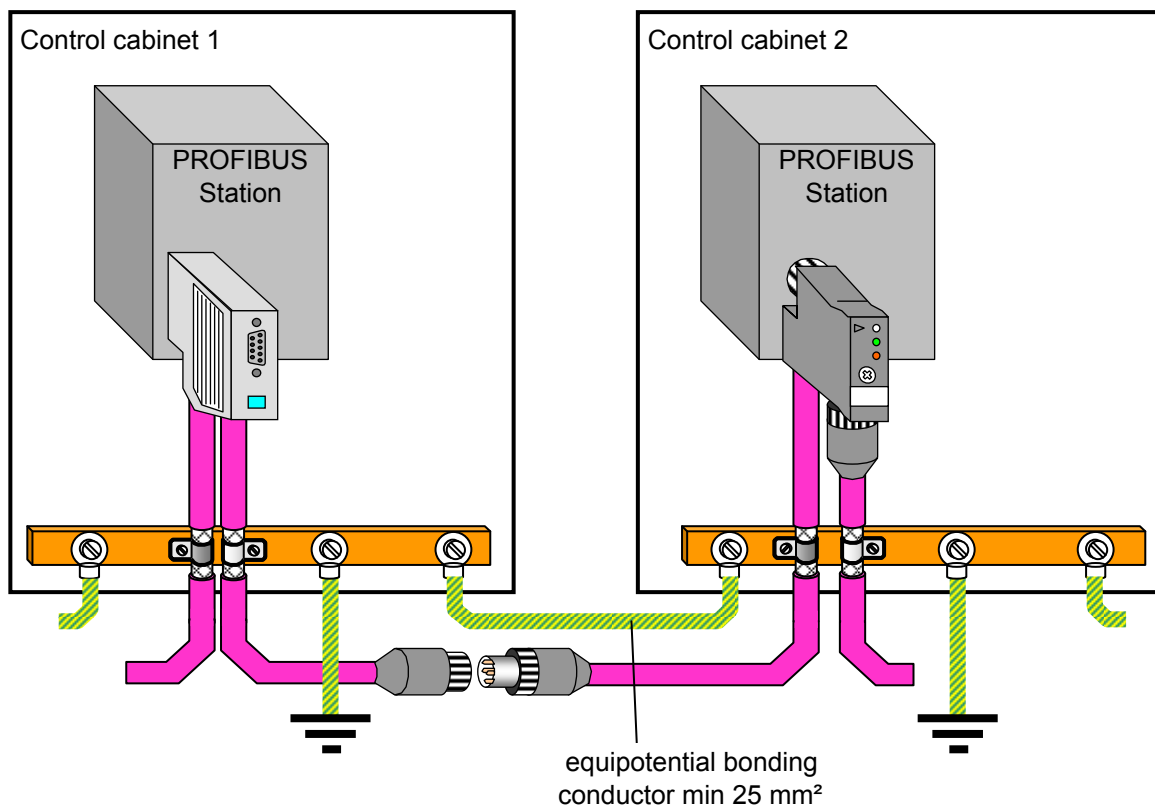


Wide spread or distant parts of an installation may have different grounding potential if there is not a good metallic connection between. The voltage difference is low but the equalizing current can be high.

Because of the the small cross section the shield of bus cables is not able to lead large equalizing currents.

Therefore it is mandatory to add in these cases a equipotential bonding conductor with a cross section of at least 25 mm².

Equipotential bonding





3. Data Structure, Addressing

3.1 Communication between FieldBusPlug and Device

The data exchange between the PROFIBUS FieldBusPlugs and the device can be performed in two ways:

Direct mode (parallel communication)

Signals are exchanged directly via the connections of the field bus-neutral interface.

Scope of data: max. 1 command (digital output) and 2 monitoring signals (digital inputs). If the FieldBusPlug does not receive any telegram from the terminal device during power-up, this mode of data exchange will be set.

This mode is used only for very simple devices e.g. proximity switches.

Serial mode (serial communication)

Signals are exchanged using a serial data protocol via the field bus-neutral interface.

Binary, analog, parameter and diagnostic data are sent and received. As soon as the FieldBusPlug receives a valid telegram from the device, this mode of data exchange will be set non-volatile.

Note: Nearly all devices connected to PROFIBUS DP-V0 and DP-V1 use the serial mode.

In all cases the PDP21 and PDP22 behave as an input and output module even when the serial mode is active. In the following the serial mode is regarded.

3.2 Slave with DP-V0 or DP-V1 FieldBusPlug, Data Overview

During the initialization phase, the device sends its specific configuration data to the PDP21/22: Quantity of Commands, Monitoring signals, Diagnosis bytes and Parameters.

	Group	Type / example	Max. quantity / presentation on the	Direction	Example: UMC22
Cyclic data*	Monitored signals (inputs)	DI = digital input	0 – 16 bytes (128 bits)	read	2 bytes
		AI = analog input	0 – 16 words	read	1 word
	Commands (outputs)	DO=digital output	0 – 16 bytes (128 bits)	write	2 bytes
		AO=analog output	0 – 16 words	write	0
Other basic functions *	Diagnosis	Faults and warnings	1 byte from PDP21/PDP22 0 – 8 bytes from device	read	1 byte + 4 bytes
	Configuration, Identification	Qty. of DI, DO,...+ product code...	automatically defined and transferred during power up	read / write	autom.
	block parameters	Control function... trip class ...	0 - 236 bytes	write	42 bytes
Acyclic data**	single parameters	Control function... trip class ...	0 - 255, 1 - 4 bytes each	read / write	26
Master to FBP only	Bus specific data	Baud rate, Time-out,...	adjusted during configuratn, transferred during power-up	read / write	autom.

* DP-V0 and DP-V1 ** DP-V1 only

This table shows the maximum of data that can be handled by the PDP21/PDP22. Devices use only a part of these quantities, see the UMC22 as an example in the right column.

If the configuration created in the bus master and sent to the PDP21/PDP22 meets the configuration from the device, the PDP21 / PDP22 informs the busmaster that the communication can be started.



3. Data Structure, Addressing (continued)

3.3 Configuration of a PROFIBUS line with FBP slaves in the bus master

Indeed a field bus line built partly or completely equipped with FieldBusPlug slaves meets definitely the PROFIBUS DP standard. The certificate for the PROFIBUS DP-V0 is available.

But when connecting a PROFIBUS DP to a control system problems may appear. But they have a general reason and are not caused particularly by the FieldBusPlug version of the PROFIBUS DP.

Different control systems with built in PROFIBUS DP interfaces have different behaviour and need more or less different measures in configuring the slaves and in starting the data exchange.

Additional requirements appear when PROFIBUS DP/V1 is used. Some control systems require e.g. a Device Type Manager (DTM) or other supplements depending on the engineering system to offer a comfortable interface.

Following few hints (in brackets: for the ABB CPU 07KT89 and the programming tool 07AC1131)

a) Preparation of the control system programming tool:

- Install PROFIBUS DP configurator if not available (in 07AC1131 available)
- Read the actual .GSD file using the appropriate menu (copy to\AC1131\Library\PLCConf)

PDP21: ABB_078F.GSD

PDP22: ABB_082D.GSD

To find out whether the .GSD file fits to the selected device consult the header:

```

=====
#Profibus_DP
;
; Version: 1.81 for ePlug DPV1 (PDP22) created by Brigitte Dien Date 2005-08-05
; ** changes at WDI100, Vendorname = ABB (for AC500 system)
;
; GSD file for the Plug PDP22 valid for:
;
;   DEVICE / ID / firmware-version / device index
; -----
;   Sensor (direct) / - / - / - / all
;   MSD11 / 1SAJ 310000 Rxxxx / - / all
;   MSR22 / 1SAJ 320000 Rxxxx / - / all
;   MFI21 / 1SAJ 410000 R0100 / - / all
;   UMC22 V3.0, 3.10 / 1SAJ 510000 R0100 / V3.0 V3.10 / a30 a31
;   UMC22 V3.10, 3.20 / 1SAJ 510000 R0200 / V3.20 / b32
;   UMC22 V3.30 / 1SAJ 510000 R0300 / V3.30 / b33
;   PST Softstarter / CU 01.00.00, CU 01.01.00 / - / -
;   PST Softstarter / CU 02.00.01, CU 02.01.00 / - / -
;   PST Softstarter / CU 03.03.02 / - / -
;   PST Softstarter / CU 03.04.01 / - / -
;   wireless WDI100 / - / WDI100_ver0_Rev9_5 / -
;   ABB Sace / EP010 - PR22DS (TMAX) / - / -
;   ABB Sace / EP010 - PR12x (EMAX) / - / -
;   Sensopart / - / Revision 1.50 / -
;   Willy Vogel AG / UFD10 / - / -
;   Willy Vogel AG / UFD20 / - / -
;

```

b) Configuration of the Bus Master and the Bus Line:

- Busmaster - separate coupler or CPU with PROFIBUS DP interface (07KT98 - DPM)
- Bus line (baud rate, time out.....) if other than default or calculated values are desired.



3. Data Structure, Addressing (continued)

3.3 Configuration of a PROFIBUS line with FBP slaves in the bus master(continued)

c) Parametrization of the PROFIBUS DP slaves PDP21 / PDP22 itself:

Select the FieldBusPlug PDP21-FBP or PDP22-FBP resp.
 The PDP21 does not require any particular parameters.

Block transfer / single transfer of parameters

The PROFIBUS DP-V1 and , therefore, the PDP22 offers the possibility to read and write single parameters. This is an important advantage:

If e.g. during commissioning the 'Set current' for a motor is modified locally by the electrician the control system must be able to read this value to back up it in the data base.

Block transfer is automatically executed during power-up. This means: Modified parameters are overwritten during power-up.

The PDP22 (PROFIBUS DP-V1) offers to transfer single parameters. To suppress the block transfer during power-up a parameter can be set:

'Ignore Block Parameters': PDP22 does not hand over the block parameters to the device.

'Use Block Parameters': PDP22 transfers block parameters to the device (Default)

Diagnosis format DP-V0 / DP-V1

Due to compatibility reasons the DP-V1 plug PDP22 can handle the DP-V0 diagnosis telegram also. Use the parameter 'DPV0 Diagnosis Format' (default) or 'DPV1 Diagnosis format' in the PDP22 parameter part.

Refer to the file **ABB_082D.GSD** that is valid for the PDP22 and contains:

```

;=====
; special Parameter-Definitions for DPV1-Plug PDP22
;=====
PrmText = 10000
Text(0)  = "Use Block-Parameters"
Text(1)  = "Ignore Block-Parameters"
EndPrmText

PrmText = 10001
Text(0)  = "DPV0 diagnosis Format"
Text(1)  = "DPV1 diagnosis Format"
EndPrmText
    
```

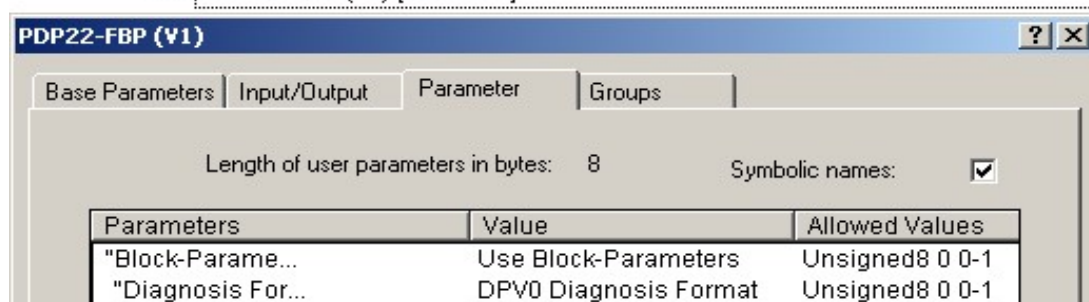
Example for 07AC1131 / 07KT98

Hardware-Configuration

07KT97

07 KT 97-DPM [DP-Master]

PDP22-FBP (V1) [DP-Slave]



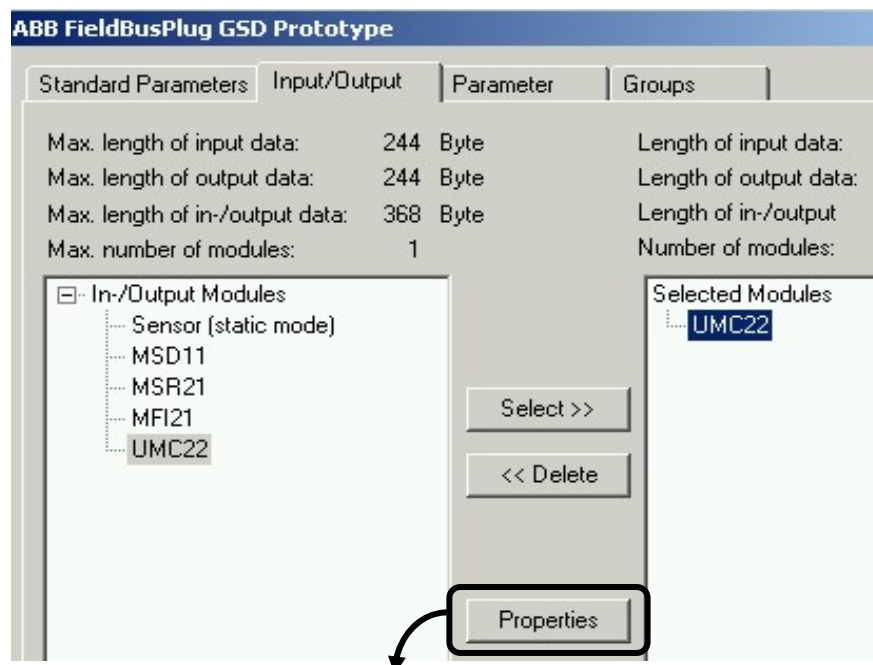


3. Data Structure, Addressing (continued)

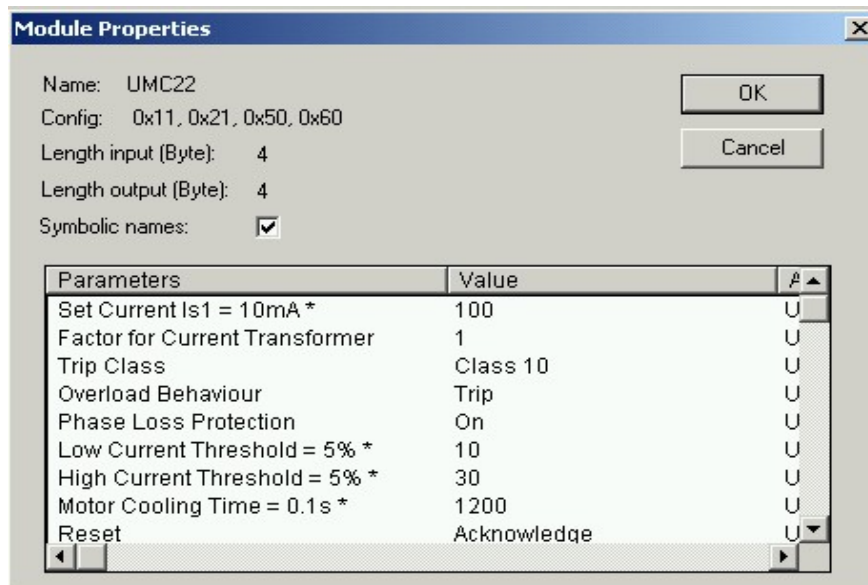
3.3 Configuration of a PROFIBUS line with FBP slaves in the bus master(continued)

d) Parametrization of the Device (Block Transfer)

Example:
UMC22 connected
to CPU 07KT98,
Programming tool
07AC1131



Example:
UMC22 connected
to CPU 07KT98,
Programming tool
07AC1131



Single Parameter Transfer

The possibility to read and write single parameters with PDP22 allows to create more comfortable tools for the commissioning phase that are more or less control system specific. One important example is the DTM = Device Type Manager.



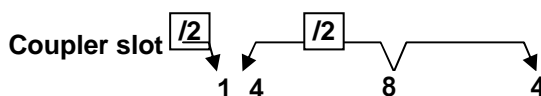
3. Data Structure, Addressing (continued)

3.3 Configuration of a PROFIBUS line with FBP slaves in the bus master(continued)

e) Assignment of the Commands/Monitoring signals to control system internal variables

Example: Assignment with the 07AC1131

Automatic Definition of the other Variables

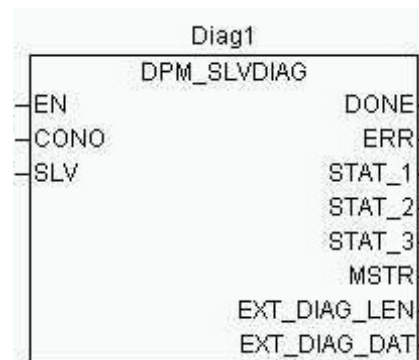


** lowest bit as example (UMC22)

Tel. Data	Word	Byte	Bit	Meaning Byte or lowest bit
Input to PLC (Monitor)	%IW1.4	%IB1.8 %IB1.9	%IX1.4.0...1.4.7 %IX1.4.8...1.4.15	RUN REVERSE** not used**
	%IW1.5	%IB1.10 %IB1.11	%IX1.5.0...1.5.7 %IX1.5.8...1.5.15	Motor Current, High Byte Motor Current, Low Byte
Output from PLC (Commands)	%QW1.8	%QB1.16 %QB1.17	%QX1.8.0...1.8.7 %QX1.8.8...1.8.15	RUN REVERSE** not used**
	%QW1.9	%QB1.18 %QB1.19	%QX1.9.0...1.9.7 %QX1.9.8...1.9.15	not used** not used**
Diagnosis to PLC	%MW0.0	%MB0.0 %MB0.1	%QX0.0.0...0.0.7 %QX0.0.8...0.0.15	not used** Relay 0 check-back fault**
		%MB0.2 %MB0.3	%QX0.1.0...0.1.7 %QX0.1.8...0.1.15	not used** Byte: Parameter number
	%MW0.1			

f) Prepare Diagnosis monitoring with dedicated function blocks

07AC1131 / 07KT89 offers
dedicated function blocks:





3. Data Structure, Addressing (continued)

3.4 Addressing

Address Range

The valid address range is 1 to 125 and can be used for masters or slaves. Normally only one or two bus masters are connected and they should preferably use the lowest valid addresses 0, 1 or 2).

Address 126 is a default address that does not allow data exchange. If one - only one - slave with address 126 is on the bus line the bus master can change it to a valid address (but never reverse), supposed the bus master is able to do so.

Remark: Be aware that a FieldBusPlug line allow only 32 stations per line due to the standard RS485 drivers/receivers. To connect more stations repeaters are necessary.

The PDP21 and PDP22 are adjusted to the address 100 by default from factory.

Address Adjustment

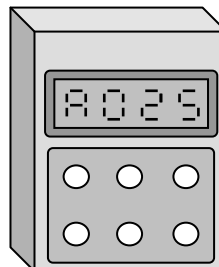
Adjustment of the addresses has to be done carefully. Sending commands to the wrong device can cause quite severe problems in the installation or machine.

The FieldBusPlug does not contain switches or other means to adjust the address. There are different possibilities to set the address:

1. The connected device contains address switches or other equivalent means. This is the normal situation for devices prepared to be connected to the PROFIBUS.
The particular advantage is that the slave address is assigned to the device, not to the FieldBusPlug even when it stores the address as well.



Address switches
e.g. from
MSR22



Control panel
(from UMC22)

In all cases the address adjusted in the device is dominating. With this address the combination FieldBusPlug and device starts operation and communication immediately with power on.

If the address adjusted in the device is higher than 125 the PDP21 / PDP22 uses the address stored in its EEPROM.

The address 126 can only be adjusted with the CAS21-FBP.0 (Addressing Set for PROFIBUS, DeviceNet, etc.). It consists of a small interface unit and a small PC software.

Some particular devices can be parametrized not to start when the addresses in the FieldBusPlug and in the device are different. Check the technical description of the device.

2. If the connected device does not offer means to adjust the address: This is typical for very simple devices e.g. proximity switches and also for the MSD11-FBP. In this case the address in the FieldBusPlug can be set:
 - Connect the FieldBusPlug to another device that has e.g. address switches and preset to the desired address. With switching on the FieldBusPlug receives and saves the address.
 - Use the CAS21-FBP.0 (Addressing Set for PROFIBUS, DeviceNet, etc.).



4. Technical Data

4.1 Bus Cable and Bus Length

Bus Cable

The actual FieldBusPlug-PROFIBUS cable contains

- a) Two cores for the bus signals

N/A = green = connector pin 2

P/B = red = connector pin 4

(Dsub9 connector:

N/A = pin 8, P/B = pin 3)

Characteristic wave impedance:

150 Ohm +/- 15 Ohm (for 3...20 MHz)

Cross section:

0.22 mm² = ca. AWG 24

Capacity typ.:

30 nF/km

Insulation:

PE foam

Shielded with:

metallized film

- b) Two cores to supply the plugs

+24 V = brown = connector pin 1

0 V = blue = connector pin 3

Cross section:

0.5 mm² = ca. AWG 20

Resistance:

38,9 Ohm/km

Insulation:

PE

- c) Outer shield and jacket

braided screen + drain wire = connector pin 5

for both signal and supply cores

Drain wire

0.5 mm² = ca. AWG 20

Jacket

PU, pink, colour ca. RAL4001

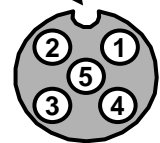
Bending radius (fixed installation)

10 times jacket diameter

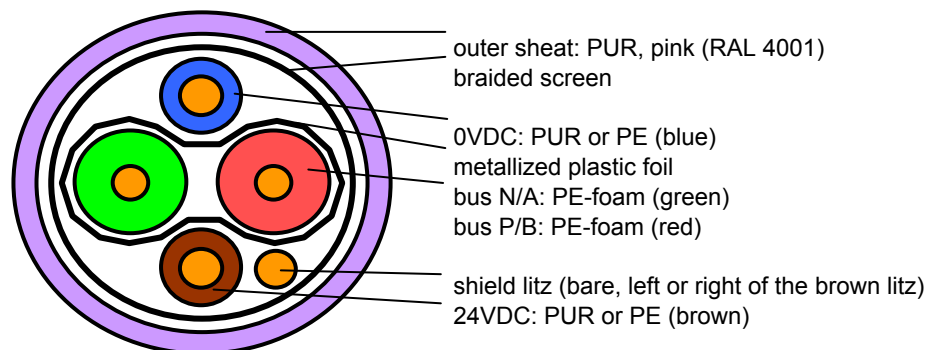
Temperature range (fixed inst.)

-30°C ... + 80°C

mechanical
A coding



view to pins
(X13 of the
PDP21/22)



Attention:

Exchange of bus signal lines with supply lines can cause destruction of the plug.

Bus length versus Data rate

The max. data rate depends directly on the bus length:

Data rate [kBit/s]	9.6	19.2	45.45	93.75	187.5	500	1500	3000	6000	12000
Bus length [m]	800	800	800	800	650	300	160	80	80	80
max. Drop length* [m]	*	*	*	*	*	6.6	0	0	0	0

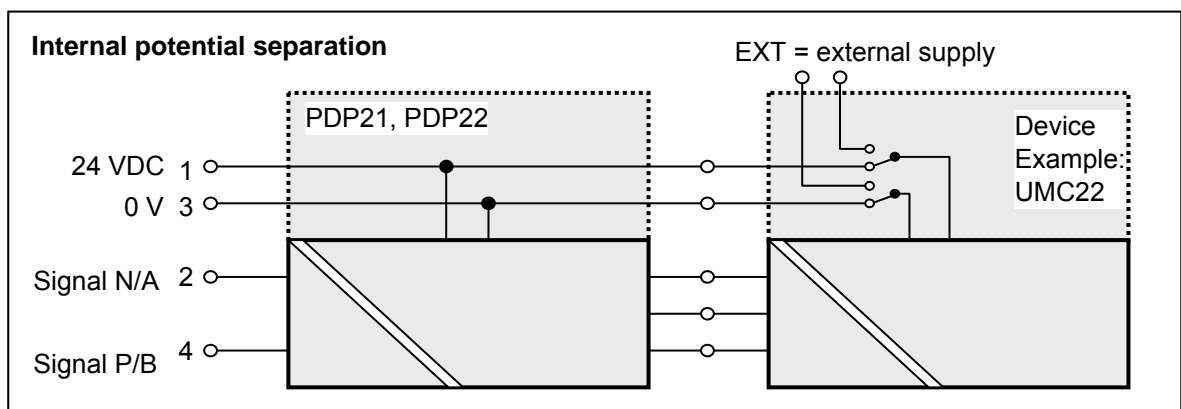
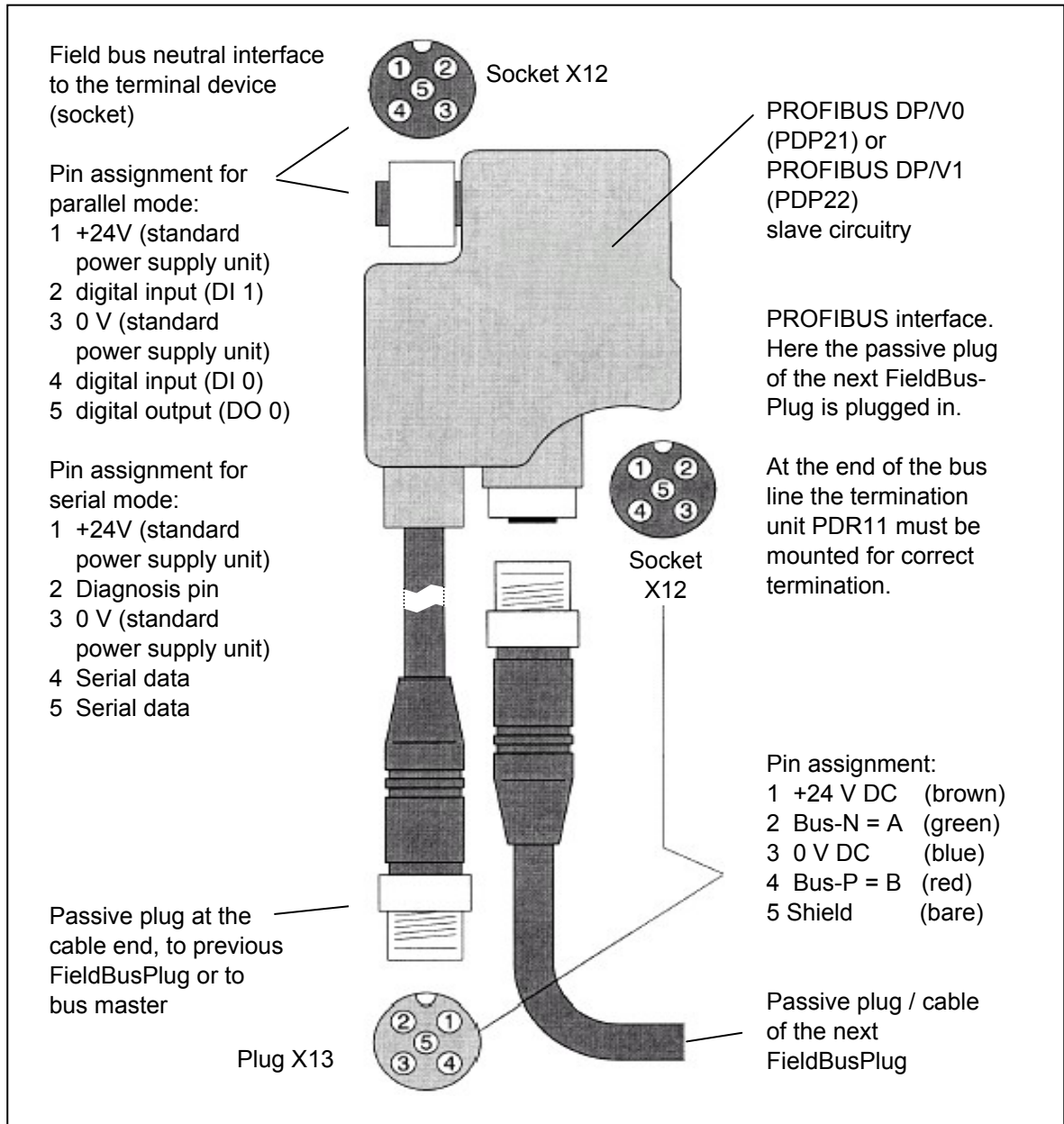
* The max drop length is defined by the standard only for 500 kBit/s but for lower data rates higher drop lengths are possible. Higher data rates do not allow drop lines.

Regarding the supply - voltage loss etc. - see chapter "2. PROFIBUS built with PDP21 and PDP22" sub clause "2.8 Power Supply via Bus Cable, Calculation".



4. Technical Data (continued)

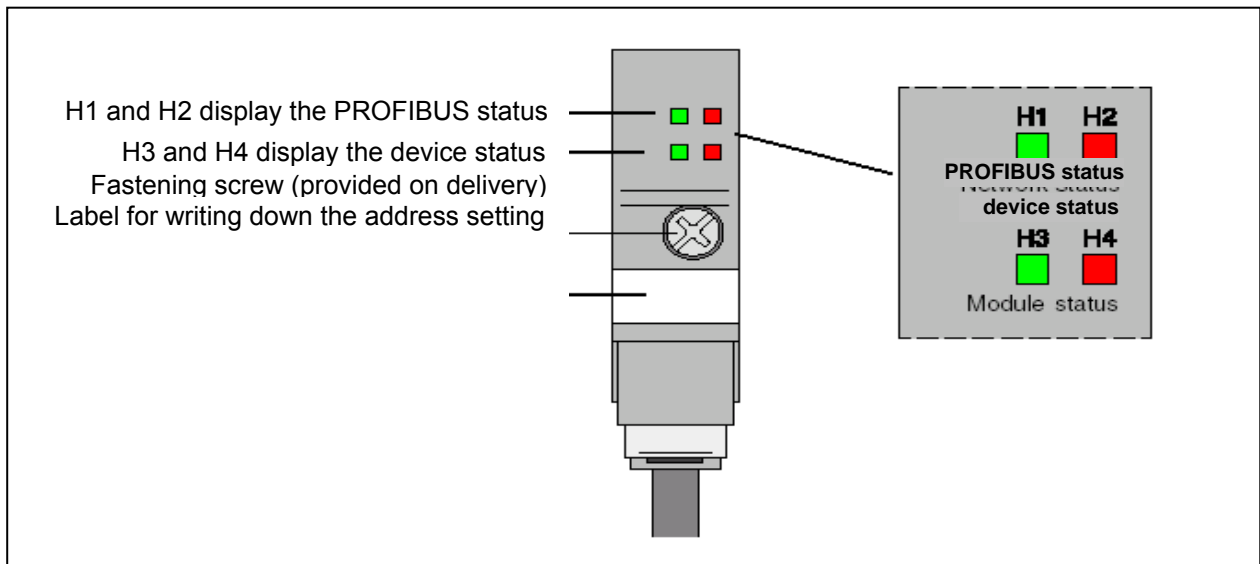
4.2 PDP21, PDP22, Pin Assignment





4. Technical Data (continued)

4.3 PDP21, PDP22, Indicators on the Front Plate



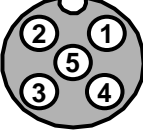
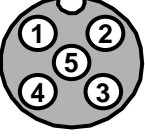
Meaning of the LED's

PROFIBUS status		Device status		Status / Cause
LED green H1	LED red H2	LED green H3	LED red H4	
off	off	off	off	Power supply is missing
On	flashes			Possible errors: - No connection to the bus master, e.g. PROFIBUS not operating. - The PDP21 / PDP22 has a slave address that is not configured in the bus master. - Parameter length and slave address are correct but I/O configuration of the slave does not meet the configuration sent by the bus master.
flashes	On			The device parameters received from The bus master are formal incorrect, e.g. of other length.
off	On			Connection to the bus master is interrupted longer than the time-out set by the bus master before interruption.
On	off			Normal data exchange to the PROFIBUS DP master.
		On	off	Normal data exchange to the terminal device.
flashes	flashes	flashes	flashes	Plug is under self-test during power-up
		flashes	off	Plug is waiting for configuration data, to be sent from the device (number of input/output bytes, number of parameter bytes, internal baud rate etc.). Note: If no data has been sent by the terminal device within 3 s, the plug switches to the parallel mode.
		off	flashes	Error: can be remedied, e.g. connection to the terminal device is broken.
		off	On	Error: cannot be remedied, e.g. incorrect checksum in the flash. Exchange plug.



4. Technical Data (continued)

4.4 PDP21, PDP22, Technical Data

Supply voltage	24 V DC + 30% / - 20% (19.2 ... 31.2 V DC) protected by external fuse 4 A max.
Safety insulation	PELV according to EN60950
Current consumption	
at 19.2 V	46 mA
at 24,0 V	37 mA
at 31.2 V	31 mA
Mounting	on the terminal device, fixed with a screw (provided on delivery) or by M12 box nut fixing
Power line failure bridging time, to be performed by the power supply unit	min. 10 ms
Recommended power supply unit	Type: CP-24/5.0 adj. Order number: 1SVR 423 416 R0100 can be adjusted to max. voltage 28 V DC
Bus termination	active bus-line terminator 150 Ω at both ends of the bus, the bus master units (or repeaters) often offer a bus-line terminator at the start of the bus line.
Modes of data communication between FieldBusPlug and device	parallel and serial
Scope of data	according to PROFIBUS DP specifications
Construction of the FieldBusPlug cable	round cable, black, 2 x 0.34 mm ² for supply voltage 2 x 0.25 mm ² for data lines 2 connected shields
PDP21, PDP22 pin assignement	<div> <div> 1 +24 V DC (brown) 2 Bus-N = A (green) 3 0 V DC (blue) 4 Bus-B = A (red) 5 Shield (bare) </div> <div>   </div> </div>
Warning:	Exchange of bus signal lines with supply lines can cause destruction of the plug.
Load capacity of plugs and cables	max. 4 A
Degree of protection	IP 65, if M12 box nut fixing is used at the terminal device (e.g. sensor) IP 20, if mounting is performed using the supplied fastening screw (e.g. for UMC22-FBP)
Ambient temperature	
storage	-20...+70 °C
operation	0...+60 °C
Dimensions	see following
Total power dissipation PDP21, PDP22	max. 0.9 W
Weight	
plug with cable 0.25 m	0.09 kg
plug with cable 0.5 m	0.10 kg
plug with cable 1 m	0.13 kg
plug with cable 5 m	0.35 kg
Bus address setting	- with address switches or similar on the terminal device - with addressing set CAS21-FBP
Address range	1 to 126, recommended 3 to 125 0 to 2 and 126 to 128 are reserved for particular tasks
Diagnosis with LEDs	see chapter "PDP21, PDP22, Indicators on the Front Plate"



4. Technical Data (continued)

4.5 PDP21, PDP22, Ordering data

Ordering Data: PROFIBUS DP/V0

Type	Description	Order number
PDP21 - FBP . 025	PROFIBUS DP-V0 FieldBusPlug 0,25 m	1SAJ240000R0003
PDP21 - FBP . 050	PROFIBUS DP-V0 FieldBusPlug 0,5 m	1SAJ240000R0005
PDP21 - FBP . 100	PROFIBUS DP-V0 FieldBusPlug 1 m	1SAJ240000R0010
PDP21 - FBP . 200	PROFIBUS DP-V0 FieldBusPlug 2 m	1SAJ240000R0020
PDP21 - FBP . 500	PROFIBUS DP-V0 FieldBusPlug 5 m	1SAJ240000R0050

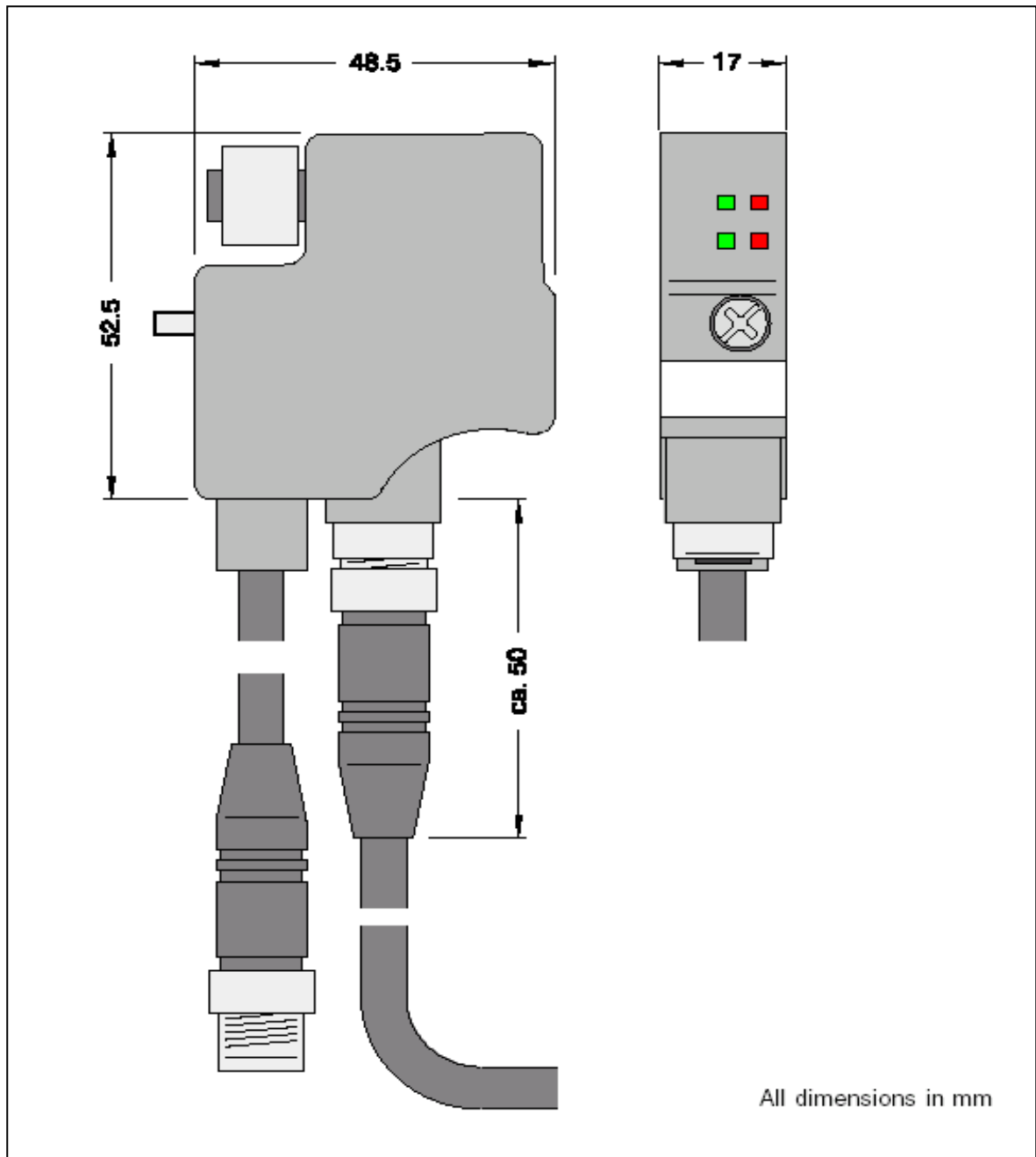
Ordering Data: PROFIBUS DP/V1

Type	Description	Order number
PDP22 - FBP . 025	PROFIBUS DP-V1 FieldBusPlug 0.25 m	1SAJ240100R1003
PDP22 - FBP . 050	PROFIBUS DP-V1 FieldBusPlug 0.5 m	1SAJ240100R1005
PDP22 - FBP . 100	PROFIBUS DP-V1 FieldBusPlug 1 m	1SAJ240100R1010
PDP22 - FBP . 500	PROFIBUS DP-V1 FieldBusPlug 5 m	1SAJ240100R1050



4. Technical Data (continued)


4.6 PDP21, PDP22, Dimensions










4. Technical Data (continued)

4.7 Accessories

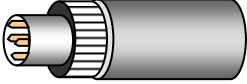
Type	Description	Order number
		
PDX11 - FBP . 100	PROFIBUS DP Extension Cable 1m	1SAJ924001R0010
PDX11 - FBP . 300	PROFIBUS DP Extension Cable 3m	1SAJ924001R0030
PDX11 - FBP . 500	PROFIBUS DP Extension Cable 5m	1SAJ924001R0050

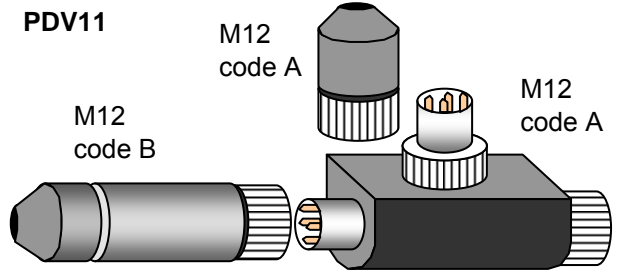
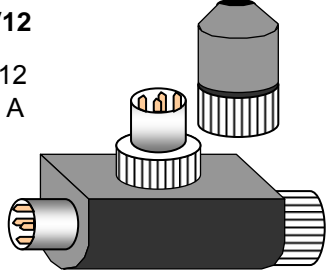
		
PDF11 - FBP .050	PROFIBUS DP Cable with Female Connector	1SAJ924002R0005
PDM11 - FBP .050	PROFIBUS DP Cable with Male Connector	1SAJ924003R0005

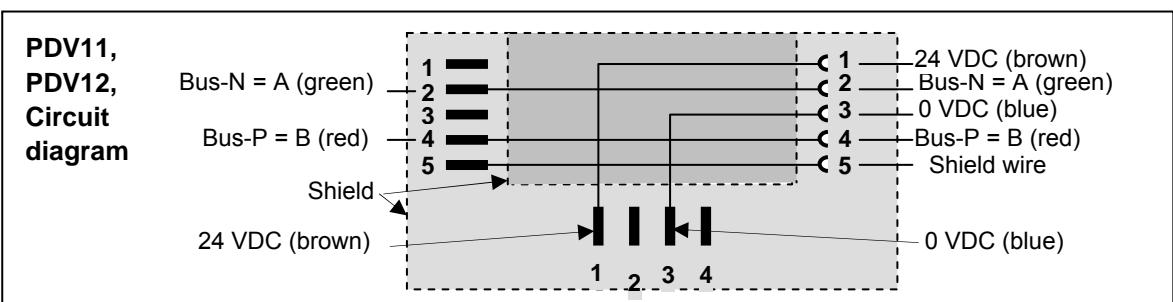
		
PDC11 - FBP . 999	PROFIBUS DP Round Cable 100 m	1SAJ924004R1000

		
PDM11 - FBP . 0	PROFIBUS DP Male Assembling Connector	1SAJ924005R0001
PDF11 - FBP . 0	PROFIBUS DP Female Assembling Connector	1SAJ924006R0001

Note: Mount carefully. Loose contact causes communication problems. Instruction see below.

		
PDR11 - FBP . 150	PROFIBUS DP Termination Unit	1SAJ924007R0001

<p>PDV11</p>  <p>M12 code B</p> <p>M12 code A</p> <p>M12 code A</p>	<p>PDV12</p>  <p>all M12 code A</p>	
PDV11 - FBP . 0	PROFIBUS DP Feed-In Connector Code B-A	1SAJ924008R0001
PDV12 - FBP . 0	PROFIBUS DP Feed-In Connector Code A-A	1SAJ924011R0001

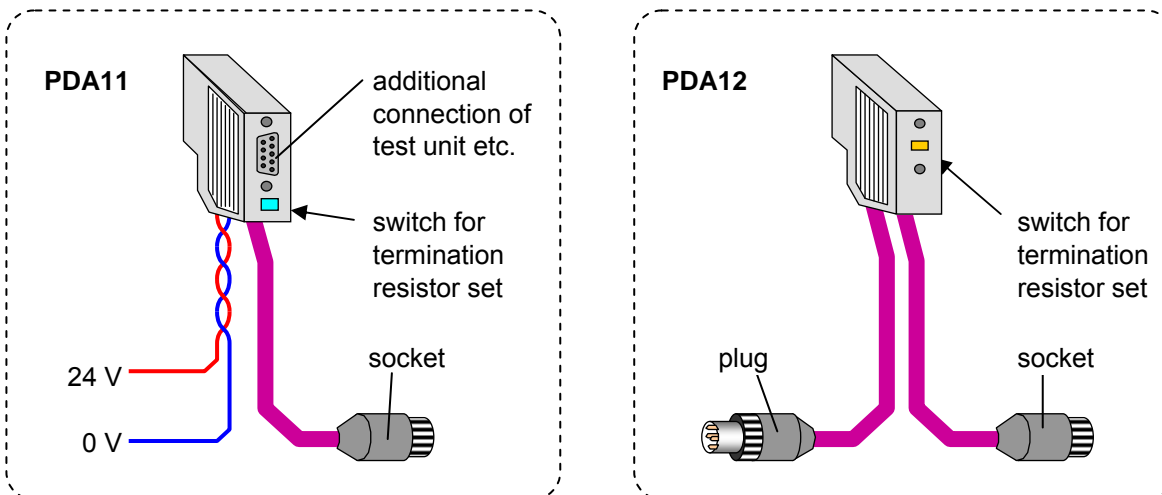




4. Technical Data (continued)

4.7 Accessories (continued)

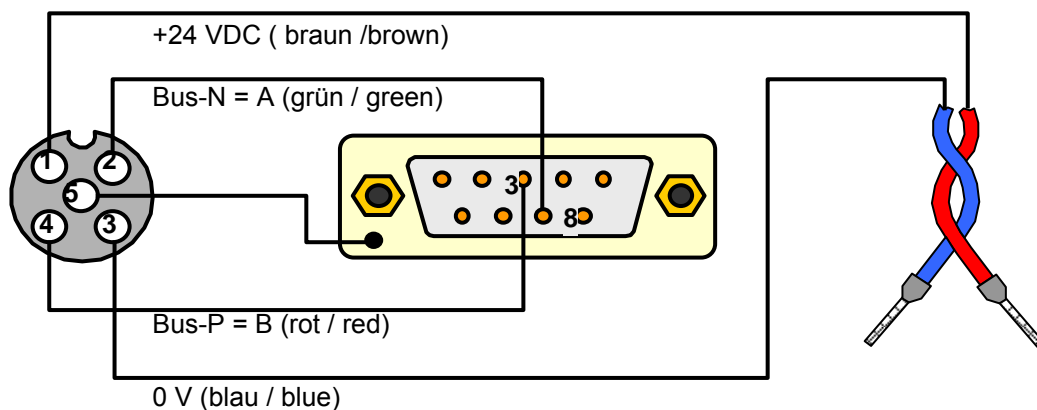
Type	Description	Order number
PDA11 - FBP . 050	PROFIBUS DP Adapter Cable Dsub9-M12	1SAJ924009R0005
PDA12 - FBP . 050	PROFIBUS DP Adapter Cable M12-Dsub9-M12	1SAJ924010R0005



PDA11, PDA12, Circuit Diagrams

PDA11 M12, view to socket

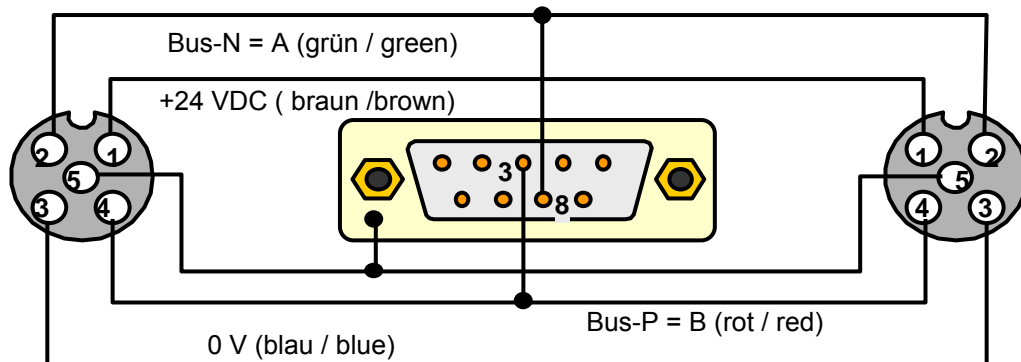
Dsub9, view to socket



PDA12 M12, view to pins

Dsub9, view to socket

M12, view to socket

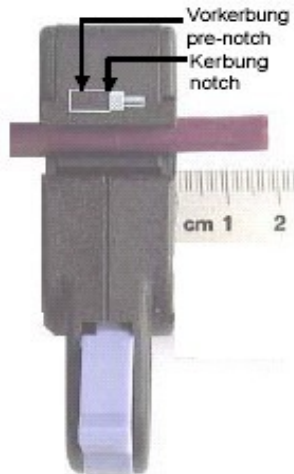




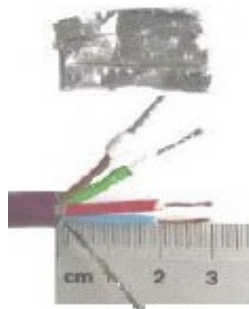
4. Technical Data (continued)

4.7 Accessories (continued)

PDM11, PDF11, Mounting instruction

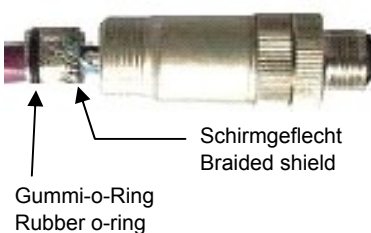
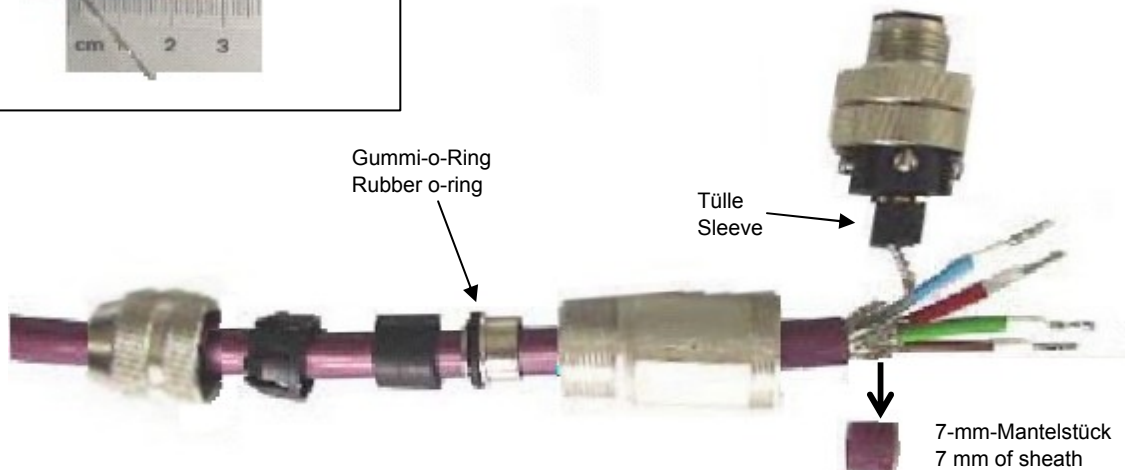


1. Stripping the insulation:
Cable juts out 18 mm from the shown tool.
Thus a piece of 7 mm in length is pre-notched.
Distance between notch and cable end: 30 mm
Type of the shown insulation-stripping tool:
PSM-STRIP-FC/PROFIB (PHOENIX)
Part No.2744623



2. Remove the sheath
3. Cut the shield carefully, the shield wire must not be cut
4. Remove the aluminium shield layer
5. Strip the insulation from the cores at a length of 10 mm
6. Put-on and crimp the wire-end ferrules

7. Shorten wire-end ferrules (metallic part ca. 5 mm)
8. Put the rubber O-ring in the notch
9. Stick the plug parts on to the cable
10. Shorten the shield wire, stick the sleeve on to the shield wire
11. Connect shield wire to pin 5 and pull the sleeve over it
12. Remove the 7 mm piece of sheath



13. Connect the PROFIBUS DP cores (green and red) to pin 2 and 4
14. Screw together the front parts of the plug
15. Fold the braided shield to the back part of the plug (with the O-ring)



16. Screw-on the clamp-type sleeve, done





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