Technical Description

FBP FieldBusPlug

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.

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1. PROFIBUS DP, Introduction

1.1 ISO/OSI model

PROFIBUS DP is actually 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:

<table>
<thead>
<tr>
<th>ISO/OSI</th>
<th>Transmitting CPU</th>
<th>Receiving CPU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Layer 7</td>
<td>Application layer</td>
<td>Application layer</td>
</tr>
<tr>
<td>Layer 2</td>
<td>Data-link layer</td>
<td>Data-link layer</td>
</tr>
<tr>
<td>Layer 1</td>
<td>Physical layer</td>
<td>Physical layer</td>
</tr>
</tbody>
</table>

As a result of the ISO/OSI layer model each layer can be defined separately and (nearly) independently 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

- **Party Line**
- **Party Line with branch and drop**
- **Ring**

The PROFIBUS DP realized with PDP21 or PDP22 represents a real Party Line topology that supports high baud rates up to 12 Mbit/s best possible.

Branches and Drops cause reflections which result in a dramatic reduction of the max. baud rate. With repeaters this influence can be equalized partially.
1. PROFIBUS DP, Introduction (continued)

1.3 Overview of transferred data

<table>
<thead>
<tr>
<th>Group</th>
<th>Type / example *</th>
<th>Direction</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cyclic data exchange</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Monitored signals</td>
<td>DI = digital input</td>
<td>read</td>
<td></td>
</tr>
<tr>
<td>(inputs)</td>
<td>AI = analog input</td>
<td>read</td>
<td></td>
</tr>
<tr>
<td>Commands (outputs)</td>
<td>DO = digital output</td>
<td>write</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AO = analog output</td>
<td>write</td>
<td></td>
</tr>
<tr>
<td>Diagnosis</td>
<td>Faults and</td>
<td>read</td>
<td></td>
</tr>
<tr>
<td></td>
<td>warnings</td>
<td></td>
<td>DP/V0 and DP/V1</td>
</tr>
<tr>
<td>Configuration,</td>
<td>Qty. of DI, DO,...++</td>
<td>read / write</td>
<td></td>
</tr>
<tr>
<td>Identification</td>
<td>product code..</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bus specific data</td>
<td>baud rate, time-out..</td>
<td>read / write</td>
<td></td>
</tr>
<tr>
<td>Block parameters**</td>
<td>Control function…</td>
<td>write</td>
<td></td>
</tr>
<tr>
<td></td>
<td>trip class …</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acyclic data exchange</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single parameters</td>
<td>Control function…</td>
<td>read / write</td>
<td>DP/V1 only</td>
</tr>
<tr>
<td></td>
<td>trip class …</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* 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:

<table>
<thead>
<tr>
<th>PROFIBUS DP-V0</th>
<th>PROFIBUS DP-V1</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Üblich</strong></td>
<td><strong>mit PDP21/22</strong></td>
</tr>
<tr>
<td>6 bytes PROFIBUS standard diagnosis data</td>
<td>6 bytes PROFIBUS standard diagnosis data</td>
</tr>
<tr>
<td>1 byte length of slave diag.</td>
<td>1 byte communication status</td>
</tr>
<tr>
<td>1 byte device specific diag.</td>
<td></td>
</tr>
<tr>
<td><strong>n+2 bytes User-specific diagnosis data</strong></td>
<td><strong>n+5 bytes User-specific diagnosis data</strong></td>
</tr>
<tr>
<td>0: Communication FBP &lt;-&gt; Device running</td>
<td>0: Kommunikation zw. FBP und Gerät läuft</td>
</tr>
<tr>
<td>1: Communication lost</td>
<td>1: Kommunikation gestört</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

PROFIBUS DP Master Class 1
(usually a control system / station):
— continuous cyclic data transfer to all (or selected) slaves
— transfer of other basic data
 - write and read bus specific data
   ( baud rate, time-out,....)
 - write configuration data
 - write block parameters
 - read diagnosis data
Some Master Class 1 are able to
— read and write single parameters
(acyclic data transfer)

PROFIBUS DP Master Class 2
(usually an operator station / PC)
— gets access to one slave after request (initiate) for a limited time,
— reads and writes acyclic data
Some Master Class 2 are able to
— read cyclic data
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 to 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

Standard Topology, only FieldBusPlugs as slaves

![Diagram showing PROFIBUS line components]

Installation of the PROFIBUS line step by step:

⚠️ Attention:
Observe precautions for handling electrostatic discharge when mounting / dismounting 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)

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

- **Topology if only one or few FBP slaves are connected**
  - Bus master
  - FBP Slave
  - Slaves with Dsub9 connector
  - PDA11 (PROFIBUS DP adapter cable Dsub9-M12, with feed-in, length 0.5 m)
  - PDA12 (PROFIBUS DP adapter cable M12-Dsub9-M12, length 0.5 m / 0.5 m. The supply is fed through)
  - PDM11 (PROFIBUS DP cable with male connector). (Dsub9 connector is not included)

- **Topology if also other PROFIBUS slaves are connected**
  - Bus master
  - Slaves with Dsub9 connector
  - FBP Slave
  - PDA11 (PROFIBUS DP adapter cable Dsub9-M12, with feed-in, length 0.5 m)
  - PDA12 (PROFIBUS DP adapter cable M12-Dsub9-M12, length 0.5 m / 0.5 m. The supply is fed through)
  - PDM11 (PROFIBUS DP cable with male connector). (Dsub9 connector is not included)

Standard PROFIBUS DP cable and connector, customer prepared/mounted
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

- **Bus master**: PROFI-BUS Master
- **Slaves with Dsub9 connector**: PROFI-BUS-Slave
- **Power supply 24VDC**: PDF11 (PROFIBUS DP cable with plug, length 0.5 m. Brown and blue cores not used. Dsub9 connector not included)
- **PDM11**: PROFI-BUS DP-Feed-In Connector: T-unit + 1 connector

If only one FBP slave is connected the power supply of the UMC22 can be used.
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.

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)

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:

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 surveyes 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

![Calculation Scheme](image)
Supply (continued)

2.8 Power Supply via Bus Cable, Calculation (continued)

Calculation procedure

1. Define number of slaves, e.g. including 10% spare slaves:
   Example: 25 slaves --> Master at the row of the 26th slave.

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

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

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

It is necessary to consider also the max. length of the signal lines, see
chapter "4. Technical Data".
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
- when entering / leaving a cabinet
- every third or forth FieldBusPlug
- 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:

![Diagram of grounding rail and shield connection](image)

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:

- 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**

Control cabinet 1

Control cabinet 2

Connection to grounded metallic parts of the installation not longer than 25 cm, cross section min. 10 mm² (or 10 cm / 4 mm²)
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.

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

* 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 DP V1 (PDP22) created by Brigitte Bien Date 2005-08-05
** changes at WD100, Vendorname = ABB (for AC100 system)
GSD file for the Plug PDP22 valid for:

DEVICE / ID / Firmware-version / device index

sensor (direct) / / / / - / a1
MS911 / 1549 310000 RXXX / / - / a1
MS922 / 1549 320000 RXXX / / - / a1
MS931 / 1549 410000 RO100 / / - / a1
LNC22 V3.0, 3.10 / 1549 310000 RO100 / / V3.0 V3.10 / a3 / a1
LNC22 V3.10, 3.20 / 1549 310000 R0200 / / V3.20 / b2
LNC22 V4.30 / 1549 310000 R0300 / / V4.30 / b3
PST Softstarter / CU 01.00.00, CU 01.01.00 / / - / -
PST Softstarter / CU 02.00.01, CU 02.01.00 / / - / -
PST Softstarter / CU 03.01.02 / / - / -
PST Softstarter / CU 03.04.01 / / - / -
Wireless WD100 / / WDI100_V0.01_REV_5 / -
ABB Sace / EP010 - PR220DS (TMAX) / / - / -
ABB Sace / EP010 - PR12K (EMAX) / / - / -
Sensorpart / / Sensorpart / / - / -
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

PmrText = 10000
Text(0) = "Use Block-Parameters"
Text(1) = "Ignore Block-Parameters"
EndPmrText

PmrText = 10001
Text(0) = "DPV0 Diagnosis Format"
Text(1) = "DPV1 Diagnosis Format"
EndPmrText
```

Example for 07AC1131 / 07KT98

```
Hardware-Configuration

07KT97
07KT 97-DFM [DP-Master]
PDP22-FBP (V1) [DP-Slave]
```

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Value</th>
<th>Allowed Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Block-Parameter&quot;</td>
<td>Use Block-Parameters</td>
<td>Unsigned 0 0 0 1</td>
</tr>
<tr>
<td>&quot;Diagnosis Format&quot;</td>
<td>DPV0 Diagnosis Format</td>
<td>Unsigned 0 0 0 1</td>
</tr>
</tbody>
</table>
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

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

```plaintext
<table>
<thead>
<tr>
<th>Base Parameters</th>
<th>Input/Output</th>
<th>Parameter</th>
<th>Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacturer:</td>
<td>ABB</td>
<td>Revision:</td>
<td>V1.7</td>
</tr>
<tr>
<td>HW Release:</td>
<td>V1.0</td>
<td>SW Release:</td>
<td>V1.0</td>
</tr>
<tr>
<td>File Name:</td>
<td>ABB_082D GSD</td>
<td>Steventype:</td>
<td>5GFieldBusPlug@ProfibusDP</td>
</tr>
</tbody>
</table>

**Automatic Definition of the other Variables**

**Coupler slot [2]**

<table>
<thead>
<tr>
<th>Tel. Data</th>
<th>Word</th>
<th>Byte</th>
<th>Bit</th>
<th>Meaning Byte or lowest bit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input to PLC (Monitor)</td>
<td>%IW1.4</td>
<td>%IB1.8</td>
<td>%IX1.4.0...1.4.7</td>
<td>RUN REVERSE**</td>
</tr>
<tr>
<td></td>
<td>%IW1.5</td>
<td>%IB1.10</td>
<td>%IX1.5.6...1.5.7</td>
<td>Motor Current, High Byte</td>
</tr>
<tr>
<td></td>
<td>%IW1.6</td>
<td>%IB1.11</td>
<td>%IX1.5.8...1.5.15</td>
<td>Motor Current, Low Byte</td>
</tr>
</tbody>
</table>

| Output from PLC (Commands) | %QW1.8 | %QB1.16 | %QX1.8.0...1.8.7 | RUN REVERSE** |
| | %QW1.9 | %QB1.18 | %QX1.9.0...1.9.7 | not used** |
| | %QW0.0 | %MB0.0 | %QX0.0.0...0.0.7 | not used** |
| | %QW0.1 | %MB0.1 | %QX0.8.0...0.1.15 | not used** |

* **lowest bit as example (UMC22)**

**f) Prepare Diagnosis monitoring with dedicated function blocks**

07AC1131 / 07KT89 offers dedicated function blocks:

```
<table>
<thead>
<tr>
<th>Diag</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>DPM_SLV/DAEG</td>
<td>EN</td>
<td>DONE</td>
</tr>
<tr>
<td></td>
<td>CONO</td>
<td>ERR</td>
</tr>
<tr>
<td></td>
<td>SLV</td>
<td>STAT_1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>STAT_2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>STAT_3</td>
</tr>
<tr>
<td></td>
<td>MSTR</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EXT_DIAG_LEN</td>
<td></td>
</tr>
<tr>
<td></td>
<td>EXT_DIAG_DATA</td>
<td></td>
</tr>
</tbody>
</table>
```
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.

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.).

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.

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.
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. RAL 4001
- Bending radius (fixed installation): 10 times jacket diameter
- Temperature range (fixed inst.): -30°C ... + 80°C

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:

<table>
<thead>
<tr>
<th>Data rate [kBit/s]</th>
<th>9.6</th>
<th>19.2</th>
<th>45.45</th>
<th>93.75</th>
<th>187.5</th>
<th>500</th>
<th>1500</th>
<th>3000</th>
<th>6000</th>
<th>12000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bus length [m]</td>
<td>800</td>
<td>800</td>
<td>800</td>
<td>800</td>
<td>650</td>
<td>300</td>
<td>160</td>
<td>80</td>
<td>80</td>
<td>80</td>
</tr>
<tr>
<td>max. Drop length* [m]</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>*</td>
<td>6.6</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

* 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 Assignement

Field bus neutral interface to the terminal device (socket)

Pin assignment for parallel mode:
1  +24V (standard power supply unit)
2  digital input (DI 1)
3  0 V (standard power supply unit)
4  digital input (DI 0)
5  digital output (DO 0)

Pin assignment for serial mode:
1  +24V (standard power supply unit)
2  Diagnosis pin
3  0 V (standard power supply unit)
4  Serial data
5  Serial data

Passive plug at the cable end, to previous FieldBusPlug or to bus master

PROFIBUS DP/V0 (PDP21) or PROFIBUS DP/V1 (PDP22) slave circuitry

PROFIBUS interface. Here the passive plug of the next FieldBusPlug is plugged in.

At the end of the bus line the termination unit PDR11 must be mounted for correct termination.

Pin assignment:
1  +24 V DC (brown)
2  Bus-N = A (green)
3  0 V DC (blue)
4  Bus-P = B (red)
5  Shield (bare)

Passive plug / cable of the next FieldBusPlug

Internal potential separation

24 VDC 1
0 V 3

Signal N/A 2

Signal P/B 4

EXT = external supply

Device Example: UMC22

Example: UMC22

Internal potential separation

PDP21, PDP22
4. Technical Data (continued)

4.3 PDP21, PDP22, Indicators on the Front Plate

Meaning of the LED’s

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

Modes of data communication between FieldBusPlug and device:
according to PROFIBUS DP specifications
parallel and serial

Scope of data:
round cable, black, 2 x 0.34 mm² for supply voltage
2 x 0.25 mm² for data lines
2 connected shields

PDP21, PDP22 pin assignment:
1 +24 V DC (brown)
2 Bus-N = A (green)
3 0 V DC (blue)
4 Bus-B = A (red)
5 Shield (bare)

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**

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Order number</th>
</tr>
</thead>
<tbody>
<tr>
<td>PDP21-FBP.025</td>
<td>PROFIBUS DP-V0 FieldBusPlug 0,25 m</td>
<td>1SAJ240000R0003</td>
</tr>
<tr>
<td>PDP21-FBP.050</td>
<td>PROFIBUS DP-V0 FieldBusPlug 0,5 m</td>
<td>1SAJ240000R0005</td>
</tr>
<tr>
<td>PDP21-FBP.100</td>
<td>PROFIBUS DP-V0 FieldBusPlug 1 m</td>
<td>1SAJ240000R0010</td>
</tr>
<tr>
<td>PDP21-FBP.200</td>
<td>PROFIBUS DP-V0 FieldBusPlug 2 m</td>
<td>1SAJ240000R0020</td>
</tr>
<tr>
<td>PDP21-FBP.500</td>
<td>PROFIBUS DP-V0 FieldBusPlug 5 m</td>
<td>1SAJ240000R0050</td>
</tr>
</tbody>
</table>

**Ordering Data: PROFIBUS DP/V1**

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Order number</th>
</tr>
</thead>
<tbody>
<tr>
<td>PDP22-FBP.025</td>
<td>PROFIBUS DP-V1 FieldBusPlug 0.25 m</td>
<td>1SAJ240100R1003</td>
</tr>
<tr>
<td>PDP22-FBP.050</td>
<td>PROFIBUS DP-V1 FieldBusPlug 0.5 m</td>
<td>1SAJ240100R1005</td>
</tr>
<tr>
<td>PDP22-FBP.100</td>
<td>PROFIBUS DP-V1 FieldBusPlug 1 m</td>
<td>1SAJ240100R1010</td>
</tr>
<tr>
<td>PDP22-FBP.500</td>
<td>PROFIBUS DP-V1 FieldBusPlug 5 m</td>
<td>1SAJ240100R1050</td>
</tr>
</tbody>
</table>
4. Technical Data (continued)

4.6 PDP21, PDP22, Dimensions

All dimensions in mm
## 4. Technical Data (continued)

### 4.7 Accessories

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Order number</th>
</tr>
</thead>
<tbody>
<tr>
<td>PDX11-FBP.100</td>
<td>PROFIBUS DP Extension Cable 1m</td>
<td>1SAJ924001R0010</td>
</tr>
<tr>
<td>PDX11-FBP.300</td>
<td>PROFIBUS DP Extension Cable 3m</td>
<td>1SAJ924001R0030</td>
</tr>
<tr>
<td>PDX11-FBP.500</td>
<td>PROFIBUS DP Extension Cable 5m</td>
<td>1SAJ924001R0050</td>
</tr>
<tr>
<td>PDF11-FBP.050</td>
<td>PROFIBUS DP Cable with Female Connector</td>
<td>1SAJ924002R0005</td>
</tr>
<tr>
<td>PDM11-FBP.050</td>
<td>PROFIBUS DP Cable with Male Connector</td>
<td>1SAJ924003R0005</td>
</tr>
<tr>
<td>PDC11-FBP.999</td>
<td>PROFIBUS DP Round Cable 100 m</td>
<td>1SAJ924004R1000</td>
</tr>
<tr>
<td>PDF11-FBP.050</td>
<td>PROFIBUS DP Male Assembling Connector</td>
<td>1SAJ924005R0001</td>
</tr>
<tr>
<td>PDM11-FBP.050</td>
<td>PROFIBUS DP Female Assembling Connector</td>
<td>1SAJ924006R0001</td>
</tr>
<tr>
<td>Note:</td>
<td>Mount carefully. Loose contact causes communication problems. Instruction see below.</td>
<td></td>
</tr>
</tbody>
</table>

- **PDV11, PDV12, Circuit diagram**

<table>
<thead>
<tr>
<th>Pin</th>
<th>Description</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>24 VDC (brown)</td>
<td>Bus-N = A (green)</td>
</tr>
<tr>
<td>2</td>
<td>0 VDC (blue)</td>
<td>Bus-P = B (red)</td>
</tr>
<tr>
<td>3</td>
<td>Bus-N = A (green)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Bus-P = B (red)</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Shield wire</td>
<td></td>
</tr>
</tbody>
</table>
4. Technical Data (continued)
4.7 Accessories (continued)

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Order number</th>
</tr>
</thead>
<tbody>
<tr>
<td>PDA11-FBP</td>
<td>PROFIBUS DP Adapter Cable Dsub9-M12</td>
<td>1SAJ924009R0005</td>
</tr>
<tr>
<td>PDA12-FBP</td>
<td>PROFIBUS DP Adapter Cable M12-Dsub9-M12</td>
<td>1SAJ924010R0005</td>
</tr>
</tbody>
</table>

**PDA11, PDA12, Circuit Diagrams**

**PDA11**
- M12, view to socket
- Dsub9, view to socket
- +24 VDC (braun/brown)
- Bus-N = A (grün/green)
- Bus-P = B (rot/rot)
- 0 V (blau/blue)

**PDA12**
- M12, view to pins
- Dsub9, view to socket
- M12, view to socket
- +24 VDC (braun/brown)
- Bus-N = A (grün/green)
- Bus-P = B (rot/rot)
- 0 V (blau/blue)
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
PDP21-FBP        PROFIBUS DP-V0 FieldBusPlug
PDP22-FBP        PROFIBUS DP-V1 FieldBusPlug

V6  Technical Description