MA 40 DP-k, MA 41 DP-k, MA 42 DP-k and MA 41 DP-k HS
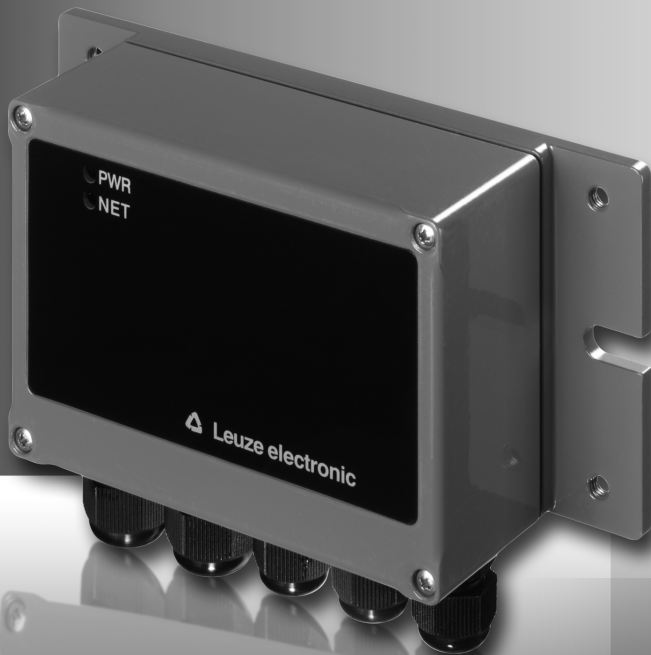## Modular Connector Units for Leuze Ident- and RS 232-Devices on PROFIBUS DP

PWR
NET

△ Leuze electronic

Leuze electronic

Sales and Service

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Postal code areas
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40000-53999
54000-55999
56000-65999
97000-97999

Sales Region East
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Postal code areas
01000-19999
39000-39999
98000-99999

Sales Region South
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Fax 07021/9850911

Postal code areas
66000-96999

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Berlin
Düsseldorf
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Countapulse Controls (PTY.) Ltd.
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Fax Int. + 27 116 1575-13

Bit description of the control bytes

Module	Output data	Description	Addr.	Data type	Value range	Default	CR to module
aa 2 −12 words Output consistent	R-ACK	**R**ead-**Ack**nowledge (read confirmation) Toggle bit: Indicates to the MA 4x DP-k that the "old" data has been processed and that new data can be received. At the end of a read cycle, this bit must be toggled in order to be able to receive the next data set.	0.0	Bit	0 ->1: Ready for the next transmission 1 ->0: Ready for the next transmission	0	**em** (Input, 2-12 words consistent)
ab 2 −12 words Output consistent	OUT bit 0	Output bit (no function)	0.1	Bit	0: No function 1: No function	0	
ac 2 −12 words Output consistent	OUT bit 1	Output bit (switching output) Setting the bit activates the connected Ident device (trigger). This only applies for MA 40 DP-k and MA 42 DP-k!	0.2	Bit	0: Deactivates Ident device 1: Activates Ident device	0	
ad 2 −12 words Output consistent	VER	**Ver**sion query (System command, for the MA 4x DP-k) Setting this bit triggers a version query of the MA 4x DP-k. For this purpose, the Service and PROFIBUS switch positions must be set. Output example upon activation: COM-DPS Leuze V2.0 17.09.1997 I 10 Words 217 O 4 Words 227 9600, 8, 1, N	0.3	Bit	0: No function 1: Transmits "V" on the RS 232	0	
ae 2 −12 words Output consistent	RSTD	**R**eset **D**ecoder (System command) Setting this bit sends a string which can be configured with "ComPro" to the connected Ident device. The default setting is "PC20" (reset to factory parameters). [STX] PC20 [CR] [LF]	0.4	Bit	0: No action is performed 1: Defined online command is transmitted	0	
af 2 −12 words Output consistent	RRB	**R**eset **R**eceive **B**uffer (reset receive buffer) Setting the RRB bit resets the transmit buffer of the MA 4x DP-k independent of other operation.	0.5	Bit	0->1 and 1->0 Resets the receive buffer	0	**el, ee** (Input, 2-12 words consistent)
ag 2 −12 words Output consistent		Reserved	0.6	Bit	0: No function 1: No function	0	
ah 2 −12 words Output consistent	EN	**En**able (Activate device) This bit **must** always be set to "1" during operation. This bit activates data exchange between MA 4x DP-k and PLC.	0.7	Bit	0: Device deactivated 1: Device activated	0	**eh** (Input, 2-12 words consistent)
ai 2 −12 words Output consistent	DLC0 … DLC4	**D**ata **L**ength **C**ode (Number of user data in bytes) Number of output bytes to be transmitted. Specified as hex value in binary format.	1.0 … 1.4	Bit	1h (00001b) … 16h (10110b)	0h (00000b)	**an, ao, ap, aq, ar, as** (Output, 2-12 words consistent)
ak 2 −12 words Output consistent	SDO	**S**end **D**ata **O**nce (Send data directly) Toggle bit: Changing this bit forwards data from the control directly to the RS 232 interface or the connected Ident system via the MA 4x DP-k. The data length must first be registered in the DLC bits. The maximum data length is dependent on the configuration of the output words. By default, max. 6 bytes are possible.	1.5	Bit	0->1: Data directly to RS 232 1->0: Data directly to RS 232	0	**ai** (Output, 2-12 words consistent)
al 2 −12 words Output consistent	SFB	**S**end **D**ata from **B**uffer (Send data from the transmit buffer of the MA 4x DP-k to the RS 232) Toggle bit: Changing this bit transmits all data which was copied via the CTB bit to the transmit buffer of the MA 4x DP-k to the RS 232 interface or the connected Ident system.	1.6	Bit	0->1: Data to RS 232 1->0: Data to RS 232	0	**am** (Output, 2-12 words consistent)
am 2 −12 words Output consistent	CTB	**C**opy to **T**ransmit **B**uffer (transfer data to the transmit buffer) Toggle bit: Changing this bit writes the data from the PLC to the transmit buffer of the MA 4x DP-k. The data length must first be registered in the DLC bits. This is used, for example, for long command strings which must be transmitted to the connected Ident device.	1.7	Bit	0->1: Data in buffer 1->0: Data in buffer	0	**ai, al** (Output, 2-12 words consistent)
an 2 −12 words Output consistent 4 words Output consistent Is standard configuration	Data	User information with 2 words length consistent.	2 … 5		0 … FFh	00h	**ea** (Input, 2-12 words consistent) **ak, al, am** (Output, 2-12 words consistent)

1   General information

1.1   Explanation of symbols

The symbols used in this operating manual are explained below.

⚠ **Attention!**
This symbol appears before text passages which must absolutely be observed. Failure to heed this information can lead to injuries to personnel or damage to the equipment.

○ **Notice!**
This symbol indicates text passages containing important information.

1.2   Declaration of conformity

The MA 40 DP-k, MA 41 DP-k, MA 42 DP-k and MA 41 DP-k HS modular connector units have been developed and produced in accordance with the applicable European standards and directives.

○ **Notice!**
A copy of all declarations of conformity available for the product can be found in the appendix of this handbook (see chapter 12.1 "EU Declaration of Conformity" on page 87).

The manufacturer of the product, Leuze electronic GmbH + Co. KG in D-73277 Owen/Teck, possesses a certified quality assurance system in accordance with ISO 9001.

$$CE$$

1.3   Description of functions MA 4x DP-k

The MA 4x DP-k modular connector unit serves to connect Leuze Ident systems (IDS) as BCL 8, BCL 22, BCL 32 and BCL 80, RFM 12, RFM 32, RFM 62, VR and hand-held scanners directly to the PROFIBUS DP. This is accomplished by transmitting the data from the IDS via a RS 232 (V.24) interface to the MA 4x DP-k where a module converts it into the PROFIBUS DP format. The data format of the RS 232 interface corresponds to the standard Leuze data format.

1.4   Definition of Terms

For better understanding of the explanations provided in this document, a definition of terms follows below:

- **Perspective of I/O data in the description:**
  Output data is data which is sent by the control to the MA.
  Input data is data which is sent by the MA to the control.

- **Bit designation:**
  The 1st bit or byte begins with count number "0" and means bit/byte 2^0.

- **Toggle bits:**
  Control toggle bit: An action is performed on each change of state, e.g. bit SDO: On each change of state, the registered data is sent by the PLC to the MA4xDP-k.

- **Status toggle bit:**
  Each change of state indicates that an action was performed, e.g. bit BLR: Each change of state indicates that new received data was transmitted to the PLC.

- **Data length:**
  Size of a valid, continuous data packet in bytes.

- **Online command:**
  These commands refer to the respective, connected Ident device and may be different depending on the device. These commands are not interpreted by the MA4xDP-k, but are instead transmitted transparently (see description of Ident device).

- **Consistent:**
  Data which belongs together with regard to content and which must not be separated is referred to as consistent data. When Identifying objects, it must be ensured that the data is transmitted completely and in the correct order, otherwise the result is falsified.

- **IDS:**
  Ident systems, e.g. barcode readers, RFID readers, VisionReader…

- **CR:**
  Cross reference

2 Safety notices

2.1 General safety notices

Documentation

All entries in this technical description must be heeded, in particular those in section "Safety notices". Keep this technical description in a safe place. It should be accessible at all times.

Safety regulations

Observe the locally applicable legal regulations and the rules of the employer's liability insurance association.

Repair

Repairs must only be carried out by the manufacturer or an authorised representative.

2.2 Safety standards

The devices of the series MA 4x DP-k were developed, manufactured and tested in accordance with the applicable safety standards. They correspond to the state of the art.

2.3 Intended use

⚠️ **Attention!**
The protection of personnel and the device is guaranteed only if the device is operated in a manner corresponding to its intended use.

Areas of application

The MA 4x DP-k modular connector unit is used to connect Leuze Ident systems (IDS) such as BCL 8, BCL 22, BCL 32 and BCL 80 as well as RFM 12, RFM 32, RFM 62, VR and handheld scanners directly to the PROFIBUS DP.

2.4 Working safely

⚠️ **Attention!**
Access to or changes on the device, except where expressly described in this operating manual, are not authorised.

Safety regulations

Observe the locally applicable legal regulations and the rules of the employer's liability insurance association.

Qualified personnel

Mounting, commissioning and maintenance of the device may only be carried out by quali-
fied personnel.
Electrical work must be carried out by a certified electrician.

3   Commissioning steps at a glance

Notice!

*Below you will find a **short description for the initial commissioning** of the PROFIBUS gateway MA 4x DP-k. Detailed explanations for the listed points can be found throughout the handbook.*

① Mechanical design

Mounting the device MA 4x DP-k

There are two different types of mounting arrangements for the MA 4x DP-k.

1. **MA 40 DP-k:**
   • Using a mounting device (BT 56) on the dovetail fastening groove.
   • Using a mounting device (BT 57) via 4 M4x13 blind mounting holes.
2. **MA 41 DP-k / MA 42 DP-k**
   • Using 4 threaded holes (M6) or
   • Using the provided M8 screws in the lateral fastening grooves in the mounting plate.

Notice!

Ideally, the MA 4x DP-k should be mounted so that it is easily accessible near the Ident device in order to ensure good operability, e.g. for configuring the connected device.

➔ **chapter 5.1 on page 26**

② Connecting the voltage supply and PROFIBUS

Connecting the voltage supply

Connection terminals for the voltage supply of the MA 4x DP-k and the connected IDS.

Input voltage:	18 … 36 V DC
Power consumption:	3.5 W max., MA 4x DP-k without IDS
	E.g. with IDS: 9 W max., MA 4x DP-k with BCL 80
Terminal 17, 18:	V_IN (pos. operating voltage)
Terminal 19, 20:	GND_IN (Reference potential, Ground)
Terminal 21:	PE (protective conductor; earth)

⚠ *Attention!*

Always connect the protective conductor PE! Only when this is connected is interference suppression ensured.

Notice!

The terminals for V_IN and GND_IN are double for ease of wiring. Thus, the supply voltage can be passed from one read station to the next.

Connecting the PROFIBUS interface

The MA 4x DP-k is connected to the PROFIBUS via spring terminals. Ensure that the correct polarity of the connection wires are used, failure to do this will lead to improper functioning of the PROFIBUS.
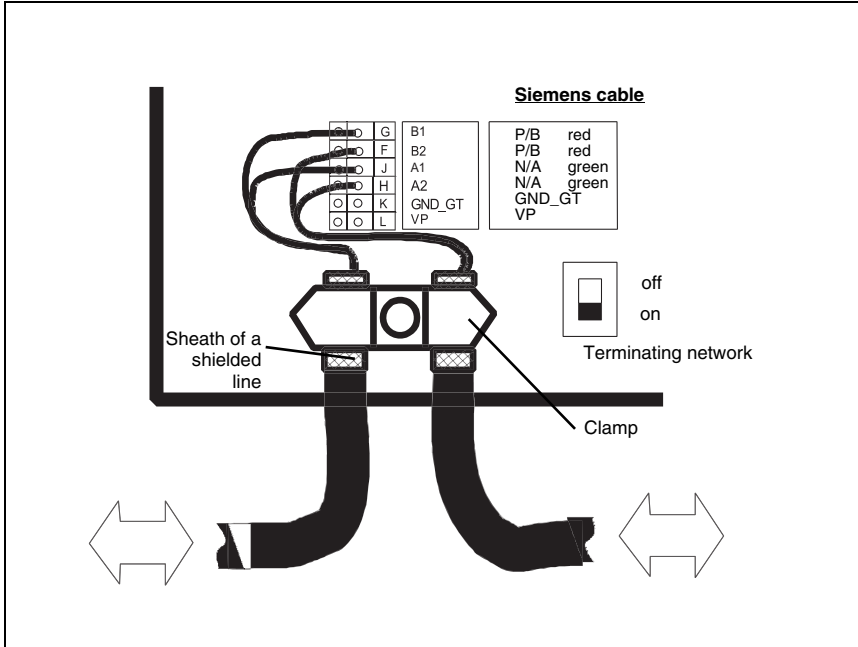
Figure 3.1:   Connection of the PROFIBUS

⚠ **Attention!**

If the MA 4x DP-k is the last physical device on the bus, then the terminating network switch must be switched on here, and switched to off at all other devices. The terminating network is equipped with pull-up and pull-down resistors.

Shielding connection

The shield is connected to the MA 4x DP-k via the clamp. Pull back approx. a finger width of the braided shield of the PROFIBUS cable over the outer insulation and tighten the clamp over the cable. Ensure that there are no small strands of the shielding sticking into the electronics. Leave the remaining wires long enough that they can be easily connected to the spring terminals.

The 9 pin Sub-D plug acc. to PROFIBUS standard DIN 19 245 is connected as follows:

Signal description	Terminals MA 4x DP-k	Remark	Colour
B1 / B2	G, F	corresp. to RS 485 B	red
A1 / A2	J, H	corresp. to RS 485 A	green
Shield	Screw clamp	braided shielding of the PROFIBUS line	

Table 3.1:   Assignments of the 9-pin Sub-D connector

Setting the PROFIBUS address

The station address of the MA 4x DP-k on the PROFIBUS is set using two rotary switches and a jumper.

Jumper "Hundreds" right:	Address range 0 … 99
Jumper "Hundreds" left:	Address range larger than 100

Notice!

The station address for the MA 4x DP-k (slave) can only be set between 2 and 126, other addresses are not allowed. An address change made at the switches does not take effect until following the next cold start (switching-on of operating voltage).
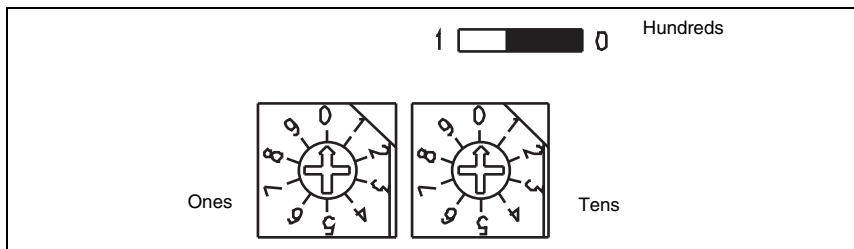
Figure 3.2:   Using the rotary switches/jumper to set addresses

➔ **chapter 6.1, beginning on page 30**

PROFIBUS manager

Install the GSE file associated with the MA 4x DP-k in the PROFIBUS manager of your control. You can find the GSE file at **www.leuze.de -> Download -> Identify -> Modular interfacing units**.

Activate the required modules:

- • 10 words input consistent　　　 hex identifier (0xD9)
- • 4 words output consistent　　　　hex identifier (0xE3)
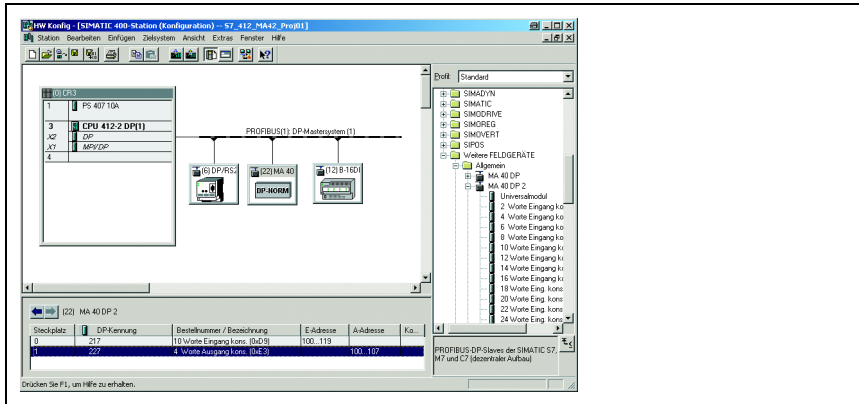
Figure 3.3:　Example PROFIBUS manager

Store the slave address for the MA 4x DP-k in the PROFIBUS manager. Ensure that the address is the same as the address configured in the device.

③ Connecting the switching input

The MA 4x DP-k has a galvanically isolated switching input. This is used to activate the connected Ident system (IDS) by means of a trigger sensor.

The following devices can be activated via the switching input:

- • BCL 22
- • BCL 32
- • BCL 80
- • RFI
- • RFM xx
- • VR 2300

Not but:

- • BCL 8
- • BCL 90

Connection terminals:	9-12
Input voltage:	12 … 36 V DC
Insulation voltage:	500 V

The switching input is equipped with a bi-directional optical coupler and wired with protective resistors. The switching voltage and GND can be externally applied or taken from the operating voltage VDD_SE and GND_SE.

Attention!

The jumpers above the spring terminals (switching input selection) must be set to "Terminals".
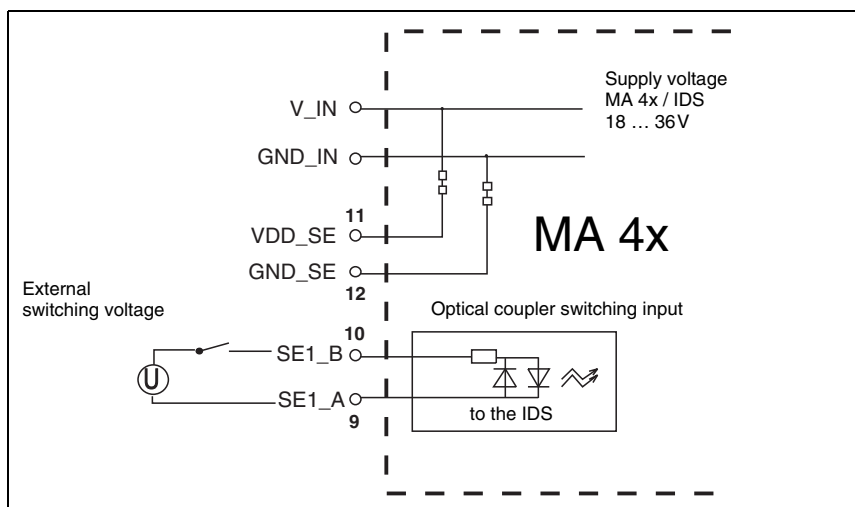
Figure 3.4:   Connection of the switching input with an external switching voltage
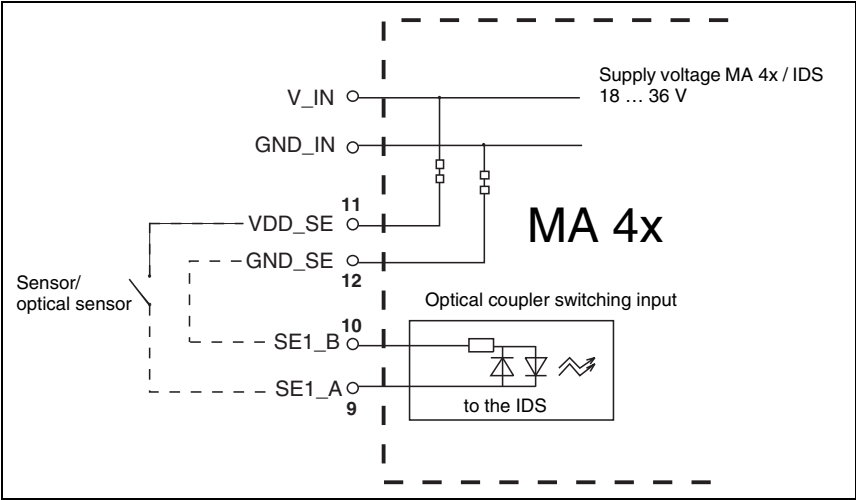
Figure 3.5:   Connection of the switching input without an external switching voltage

It is possible to activate the switching input via the PROFIBUS. For this purpose, you must set the jumpers above the terminals to "PROFIBUS" and attach a wire bridge between terminals GND_SE and SE1_B (cf. figure 3.6).
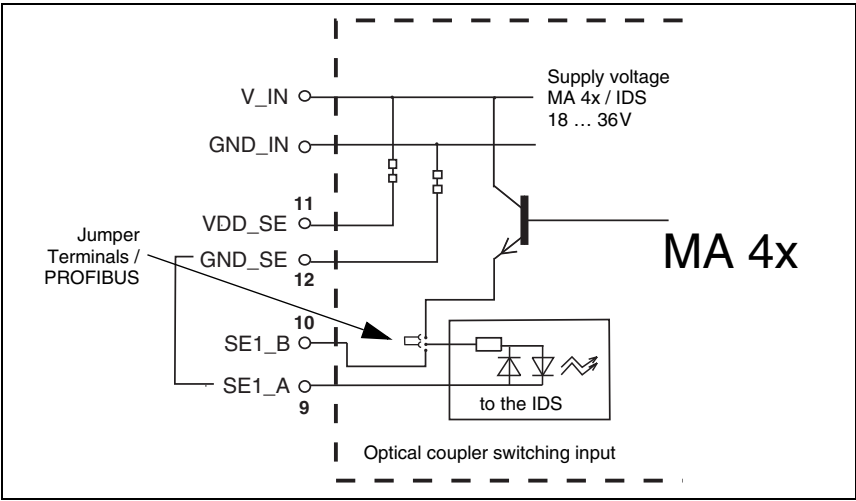
Figure 3.6:   Switching via the PROFIBUS

④ ## Connecting external devices with RS 232 (V.24) interface

In place of an IDS, you can connect an external device with an RS 232 interface to the MA 4x DP-k. To do this, use spring terminals 1-4.

⚠ ***Attention!***
An external device and an IDS must not be connected to the MA 4x DP-k simultaneously, as only one RS 232 interface can be operated.

Voltage supply +5 V

The VCC terminal provides a supply voltage of +5V DC with respect to GND. This can be used to power smaller consumers (e.g. hand-held scanners or similar) up to **max. 100 mA** from the MA 4x DP-k. Devices with higher current consumption require their own power supply or the MA 41 DP-k HS.
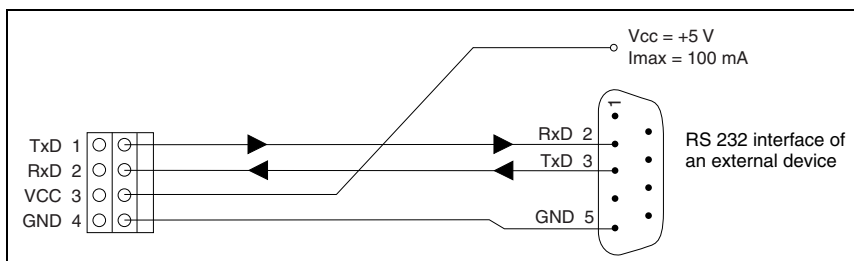
Figure 3.7:   Connection of an external device via RS 232

The MA 41 DP-k HS is equipped with a voltage supply with short-circuit proof 5V/1A and a 0.3m connection cable with a 9-pin Sub-D connector, e.g. for hand-held scanners. Further information on this topic can be found in chapter 4.7.

○
ⓘ ***Notice!***
If your external device cannot be set to the standard data format (9600, 8-N-1), it is possible to change the RS 232 interface format of the PROFIBUS module. This can be performed with the aid of the "ComPro" configuration program (see chapter 8.1 "Working with the "ComPro" software"). The program is included in the delivery contents.

A special cable is necessary for configuring the BCL 8 via the service interface of the MA 41 DP-k. Further information on this topic can be found in chapter 4.8.
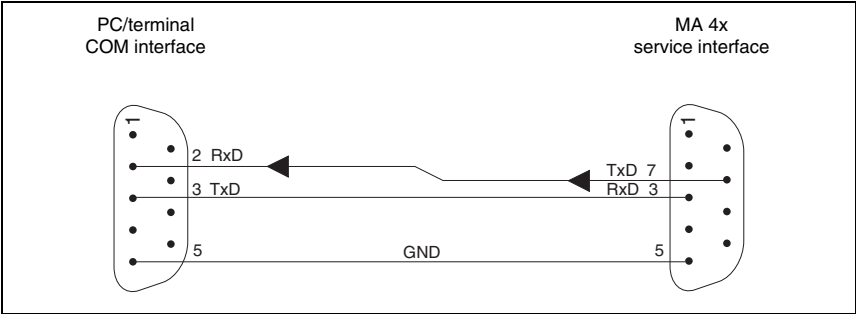
Figure 3.8:   Cable for configuring the BCL 8 via the service interface

⑤ Termination

⚠ *Attention!*
If the MA 4x DP-k is the last physical device on the bus, then the terminating network switch must be switched on here, and switched to off at all other devices. The terminating network is equipped with pull-up and pull-down resistors.

⑥ Basic operation

As a rule, the following bits should be used.

1	EN	Bit 7 in Out byte 0	During operation, this bit must always be set to "1"
2	VALID	Bit 7 in In byte 0	As acknowledgement to EN, this bit is set to "1".
3	Out bit 1	Bit 2 in Out byte 0	Activation of the Ident system (reading gate) "1" = reading gate on and "0" = reading gate off
4	Input data byte 1-18	Byte 2-19	Data (data length max. 18 bytes) is read and displayed here in hex format.
5	BLR	Bit 7 in In byte 1	Indicates that values from the MA 4x DP-k were transmitted to the control.
6	R-ACK	Bit 0 in Out byte 0	The reading must be confirmed with this toggle bit (change from "0" ==> "1" and "1" ==> "0"). No further data transmission occurs without a bit change.

⑦ Sequence diagram

Sequence of data transmission slave→master and master→slave
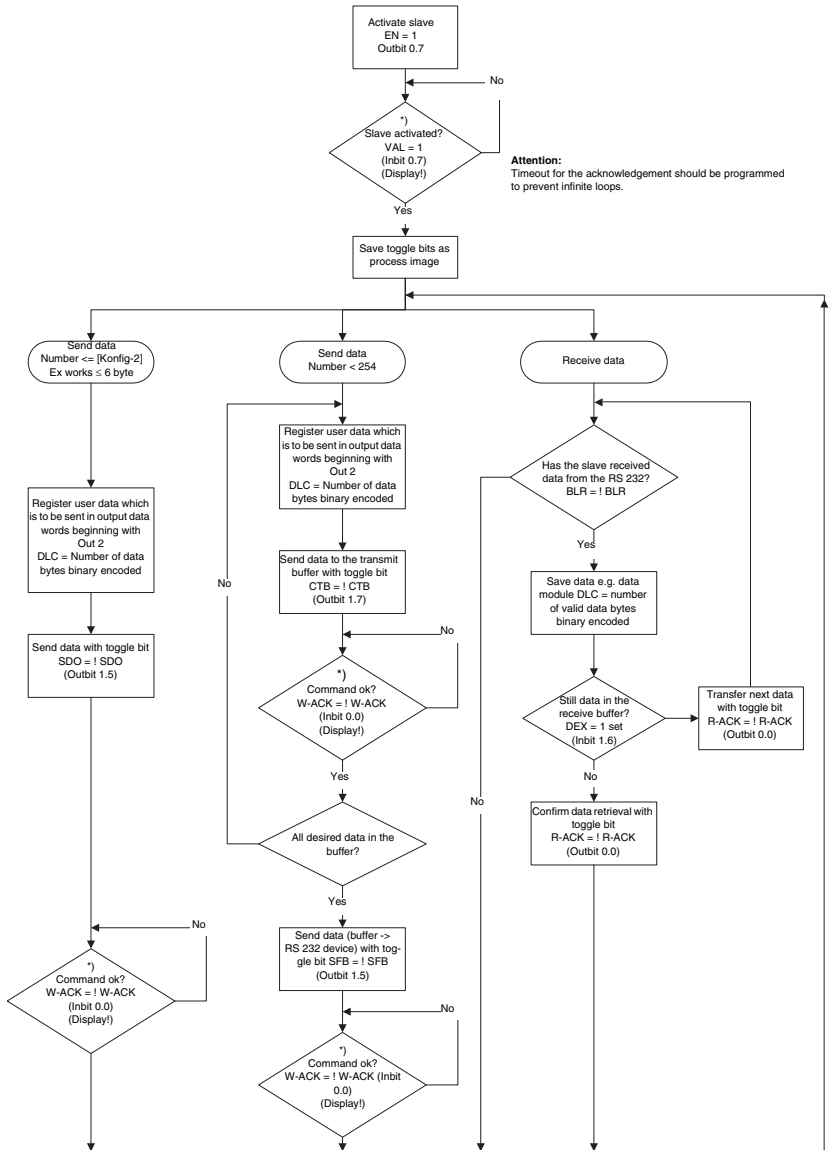
Figure 3.9:   Flowchart of data transmission

4   Specifications MA 4x DP-k

4.1   General Specifications MA 4x DP-k

Electrical data

Interface type	PROFIBUS DP V-0, up to 12 MBd / RS 232
Service interface	RS 232 internal, with data format,
	9600 Bd, 8 data bits, no parity, 1 stop bit
	9 pin Sub-D connector
Switching input	12 … 36 V DC
Green LED	device ready (Power On)
Yellow LED	PROFIBUS operating status
Operating voltage	18 … 36 V DC
Power consumption	max. 9 VA with IDS
	3.5 VA without IDS

Indicators

Green LED	Power
Yellow LED	PROFIBUS operating status

Mechanical data

Protection class	IP 65	
Weight	640 g	
Dimensions (W x H x D)	MA 40:	130 x 90 x 93 mm
	MA 41:	130 x 90 x 55 mm
	MA 42:	130 x 90 x 55 mm
Housing	diecast aluminium	

Environmental data

Operating temperature range	0°C … +50°C
Storage temperature range	-20°C … +60°C
Air humidity	max. 90% rel. humidity, non-condensing
Vibration	tested acc. to IEC 68.2.6
Shock	tested acc. to IEC 68.2.27
Electromagnetic compatibility	tested acc. to IEC 801

4.2 Dimensioned drawings
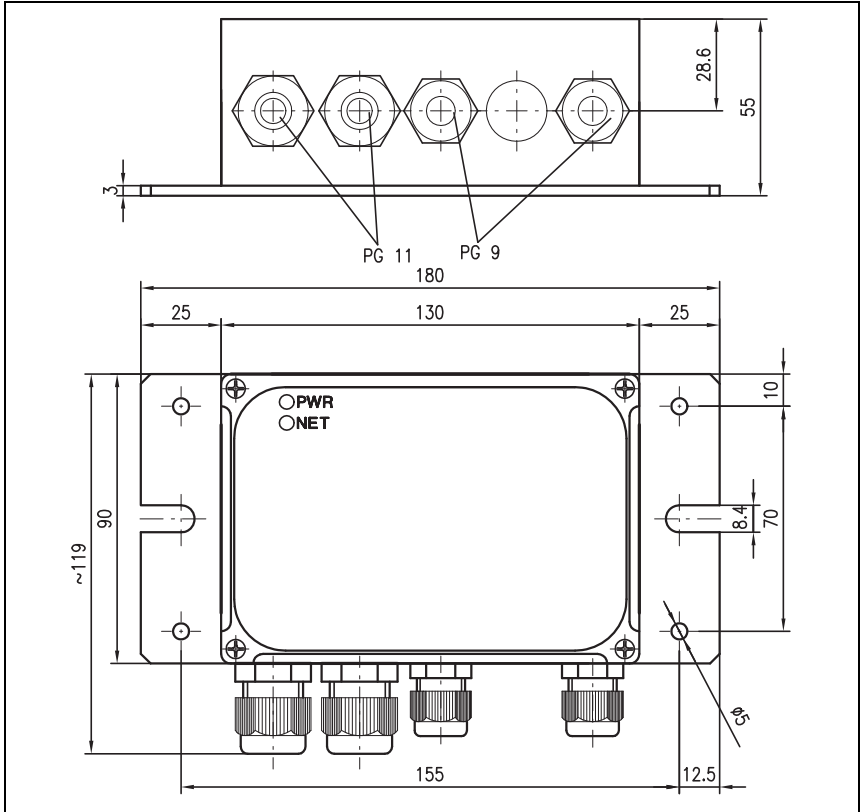
Figure 4.1: Dimensioned drawing MA 4x DP-k

4.3 Consistent data

Definition of consistent

"Data which belongs together with regard to content and which must not be separated is referred to as consistent data. For example, data from analogue components must always be handled consistently, i.e. the value of an analogue component must not be falsified by reading out at two different points in time."

This also applies for the data of a barcode scanner. It must be ensured that the data is transmitted completely and in the correct order. To ensure that this is the case for our devices, the MA 4x DP-k device group was developed; this device group is described below.

4.4 Function of MA 4x DP-k

General Information

The MA 4x DP-k modular connector unit serves to connect Leuze Ident systems (IDS) as BCL 8, BCL 22, BCL 32 and BCL 80 directly to the PROFIBUS DP. This is accomplished by transmitting the data from the scanner via a RS 232 (V.24) interface to the MA 4x DP-k where a module converts it into the PROFIBUS DP format. The data format of the RS 232 interface corresponds to the standard Leuze data format.
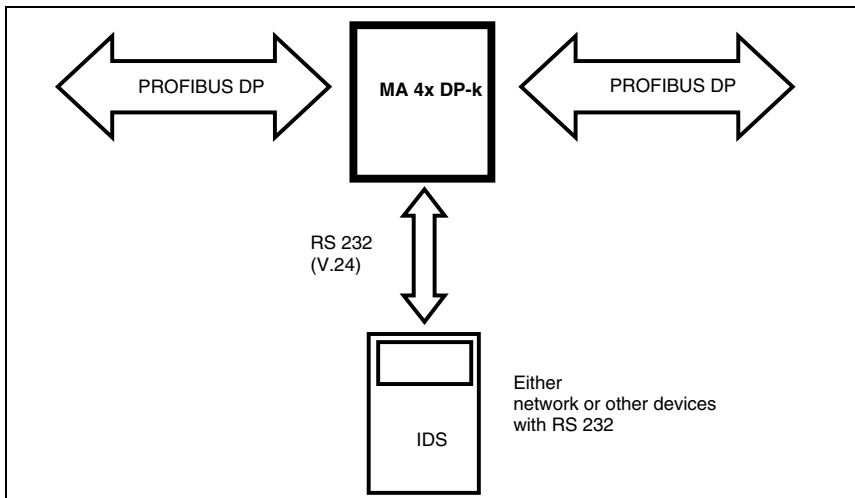
Figure 4.2:   Connection of a Leuze IDS (BCL, RFI, RFM, VR) to the PROFIBUS DP

All stationary Leuze barcode readers are preset ex works to this data format. Thus, it is not necessary to adapt the protocol to the RS 232 interface. The BCL 80 barcode reader can be connected directly to the MA 40 DP-k using the L-shaped housing cover or mounted sepa-rate from the MA (KB040-xx) and connected via a connection cable. This is a particular advantage for poorly accessible systems.

The cable of the BCL 22 barcode reader or of the RFI- and RFM-devices is guided through cable bushings with PG cable glands into the MA 42 DP-k and connected there with the PCB connectors.

The MA 41 DP-k is intended as a gateway for any RS 232 devices, e.g. BCL 90 with MA 90, hand-held scanners, scales or for coupling a multiNet network.

The RS 232 lines are internally connectable using spring terminals. All cables can be connected to the device using the 5 stable PG cable glands which provide strain relief and protection against contamination.

Technically, the MA 41 and MA 42 are equivalent to the MA 40. The functions described here therefore apply to all three device versions. The specific features of the individual device types are described where necessary.

The data format of the RS 232 interface can be adapted with the "ComPro" software (see chapter 8).

4.5   Control elements of the MA 4x DP-k

Control elements MA 4x DP-k

Following is a description of the control elements of the MA 4x DP-k. The illustration shows the MA 4x DP-k with the housing cover opened.
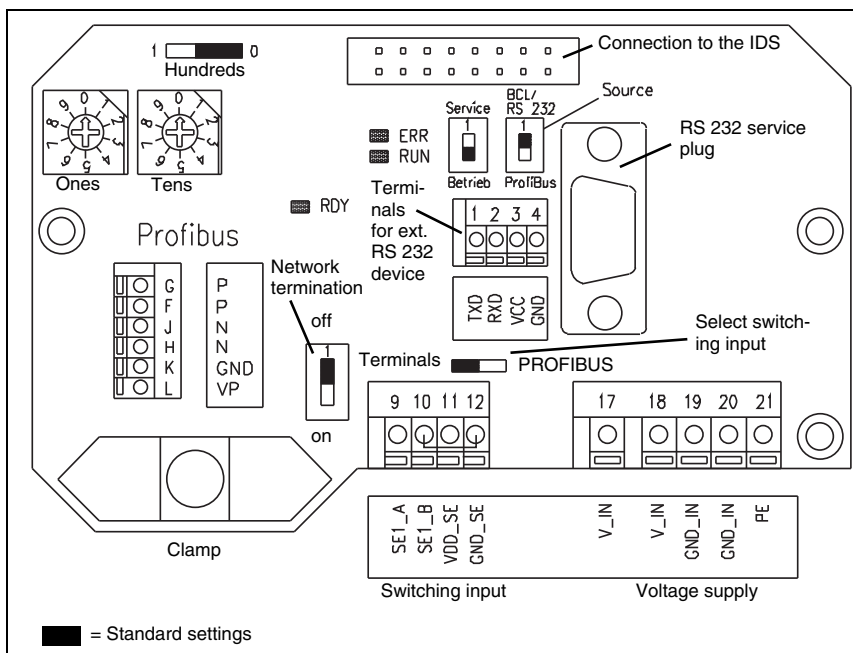
Figure 4.3:   Front view: Control elements of the MA 4x DP-k

For MA 40 DP-k, a ribbon cable in the cover plugs into the "Connection to the IDS".

For MA 41 DP-k, MA 41 DP-k HS and MA 42 DP-k an auxiliary PCB plugs into the "Connection to the IDS".

Element	Function
PROFIBUS DP	Connection terminals for PROFIBUS DP
Ribbon cable connection to the IDS	Connects the Sub-D connector in the housing cover to the electronics in the MA 40 DP-k base
Terminals for ext. RS 232 device	Optionally, an external device with an RS 232 interface can be connected here to the IDS
Service switch	1: Service mode 2: Standard operation=PROFIBUS DP

Element	Function
Source switch	Changing over the transmit data to Monitor/Service: 1: IDS (or ext. RS 232) / outgoing data 2: PROFIBUS module / incoming data
Service plug	Sub-D 9-pin male, RS 232 interface for service/setup operation, monitoring data in standard operation
Switching input	Terminals 9 … 12: Connection terminals for switching input 12 … 36V (any polarity) for activating the IDS. Potential-free/not potential-free operation can be selected.
Changeover switching input	Source for the switching input of the IDS Terminal: External switch or photoelectric sensor can be con-nected PROFIBUS: The switching input of the IDS is activated via the PROFIBUS
Operating voltage	Terminals 17 … 21: Connection terminals for operating voltage (18 … -36VDC) MA 4x DP-k and connected IDS xx

Table 4.1:   Control elements of MA 4x DP-k

Indicator LEDs

Two LEDs are located on the rear of the device that indicate the operating status of the MA 4x DP-k:
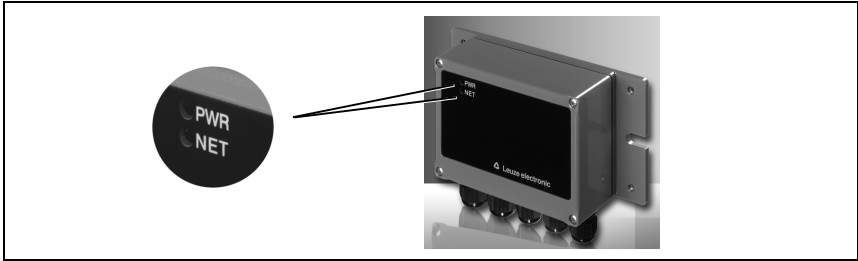
Figure 4.4:   Rear view: LEDs on the MA 4x DP-k

LED desig.	Status	Explanation
PWR green	Power LED	Operation display, illuminates when the operating voltage is applied
NET yellow	PROFIBUS operat-ing status	Dark: Initialisation phase of the PROFIBUS Continuous light: Illuminates as soon as the initialisa-tion of the PROFIBUS has been successfully com-pleted. Flashing: Interference on the PROFIBUS For details, see see chapter 9 "Diagnostics and trou-bleshooting"

Table 4.2:   Meaning of the status display

4.6   Description of the auxiliary PCB in the MA 42 DP-k
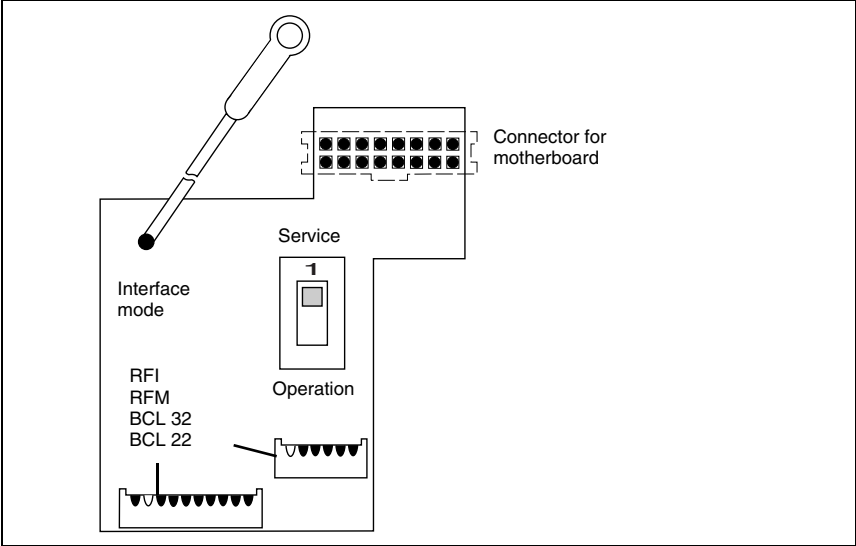
Figure 4.5:   Front view of the MA 42 DP-k auxiliary PCB

Element	Function
RFI RFM BCL 32 BCL 22	Connection terminals for PCB connectors RFI, RFM, BCL 32, BCL 22 and VR with KB031
Connector for mother-board	Connection with the basic electronics of the MA 42 DP-k
Interface mode (service switch)	1: Service mode 2: Standard operation

Table 4.3:   Operational controls of the MA 42 DP-k auxiliary PCB

4.7 Description of the auxiliary PCB in the MA 41 DP-k HS
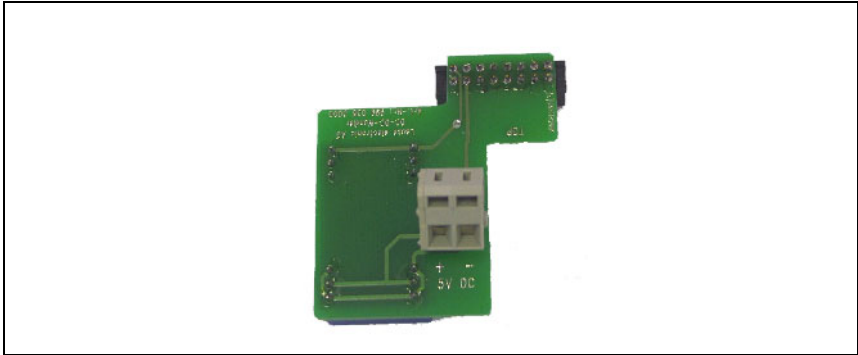
Figure 4.6: Front view of the MA 41 DP-k HS auxiliary PCB

Element	Function
+5 V (1 A max.) GND	Voltage-supply connection terminals for connecting a hand-held scanner or BCL 8

Table 4.4: Operational controls of the MA 41 DP-k HS auxiliary PCB

Notice!
The RS 232 data interface is connected via terminals 1-4 on the motherboard of the MA 41 DP-k HS.

4.8 Operating modes of the MA 4x DP-k

For fast commissioning, the MA 4x DP-k offers the additional operating mode "Service mode" in addition to the Standard mode. In this operating mode e.g., the IDS can be configured on the MA 4x DP-k and the communication can be tested on the PROFIBUS. To do this, you need a PC/laptop with a suitable terminal program, as BCLConfig from Leuze or similar.

Service switch

Select between operation and service with the service switch:

Pos. 2: Operation (monitoring of the service interface possible)

Pos. 1: Service (IDS interface - PROFIBUS interrupted)

Attention!
When using the MA 42 DP-k, be aware that the switch on the auxiliary PCB (see figure 4.5) must be switched over together with the service switch on the motherboard.

Source switch

Use the Source switch to select whether the MA 4x DP-k (PROFIBUS module) or the IDS is addressed.

Pos. 2: PROFIBUS module

Pos. 1: IDS/BCL (RS 232 ext.)

This results in four possible switch settings for the MA 4x DP-k:

1. **Operation / monitor IDS/BCL:**
   The IDS is connected to the PROFIBUS. The transmitted data of the IDS can be monitored at the service interface, i.e. can be output to a terminal.
2. **Operation / monitor PROFIBUS:**
   The IDS is connected to the PROFIBUS. The transmitted data of the PROFIBUS module to the IDS can be monitored.
3. **Maintenance / IDS/BCL:**
   With this setting, you can communicate directly with the Ident system at the MA 4x DP-k. You can send online commands via the service interface, configure the BCL (setup) and output the data which is read by the scanner.
4. **Maintenance / PROFIBUS:**
   With this switch setting, your PC/terminal is connected with the PROFIBUS module. This can be used to receive and analyse data telegrams from the PROFIBUS via the RS 232 interface. For example, transmission problems on the PROFIBUS can be quickly localised.
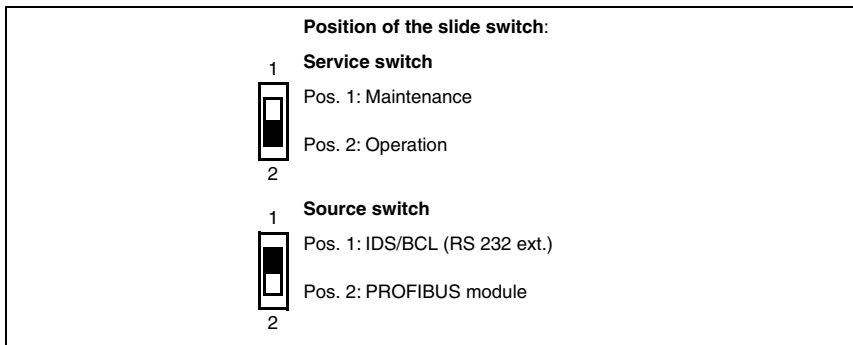
Figure 4.7:   Switch positions of the Service and Source switches

Service interface

The service interface can be reached by removing the housing cover on the MA 4x DP-k and consists of a 9-pin Sub-D connecter (male). A crossed RS 232 connection cable is required to make the RxD, TxD and GND connections. A hardware handshake via RTS, CTS is not supported at the service interface.
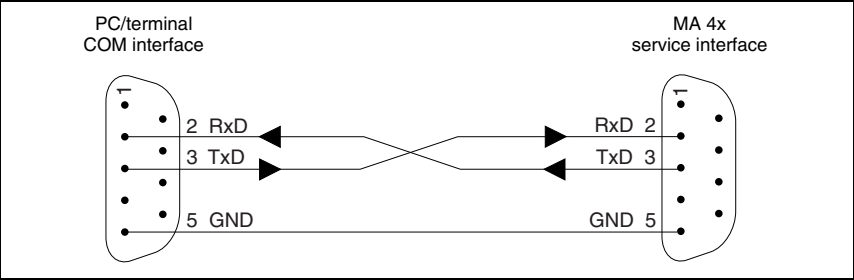
Figure 4.8:   Connecting the service interface to a PC/terminal

Attention!

On the service PC, always select the default data format 9600 baud, 8 data bits, no parity, 1 stop bit and **STX, data, CR, LF**.

Notice!

To configure the devices connected to the external interface, e.g. BCL 8 (terminals 1 - 4), a cable specially configured for this purpose is necessary. Both switches must be in position 3: Service / IDS/BCL.
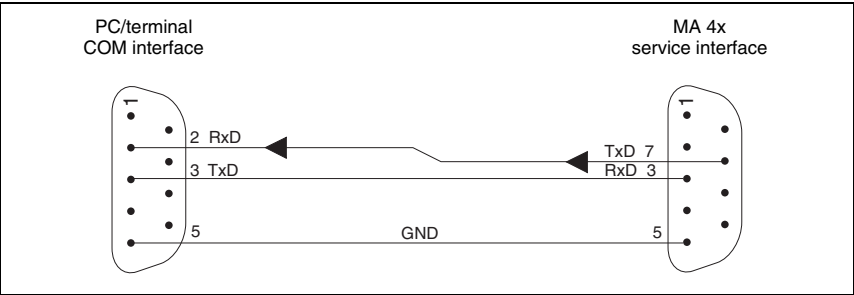
Figure 4.9:   Cable for configuring the BCL 8 via the service interface
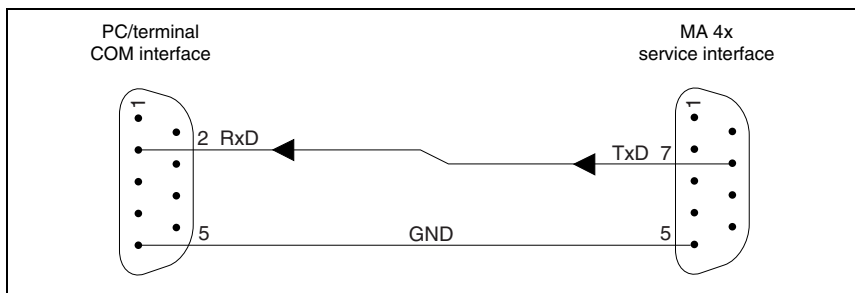
Figure 4.10: Cable configuration during monitoring

○
Ⱦ **Notice!**
*If data communication of the external interface is to be monitored, a cable specially config-
ured for this purpose is necessary.*

5 Mounting

○
⊥⊥ ***Notice!***
ⁿ   *To mount the respective Ident devices, please observe the notices in the corresponding op-*
    erating instructions.

5.1 Mounting of MA 4x DP-k

There are two different types of mounting arrangements for the MA 4x DP-k.

1. MA 40 DP-k:
    • Using a mounting device (BT 56) on the dovetail fastening groove.
    • Using a mounting device (BT 57) via 4 M4x13 blind mounting holes.

2. MA 41 DP-k / MA 42 DP-k / MA 41 DP-k HS
    • Using 4 threaded holes (M6) or
    • Using the provided M8 screws in the lateral fastening grooves in the mounting
      plate.

5.1.1 MA 40 DP-k

Fastening grooves and 4 M4x13 blind fastening holes are available (on the side) for
mounting the MA 40DP-k.
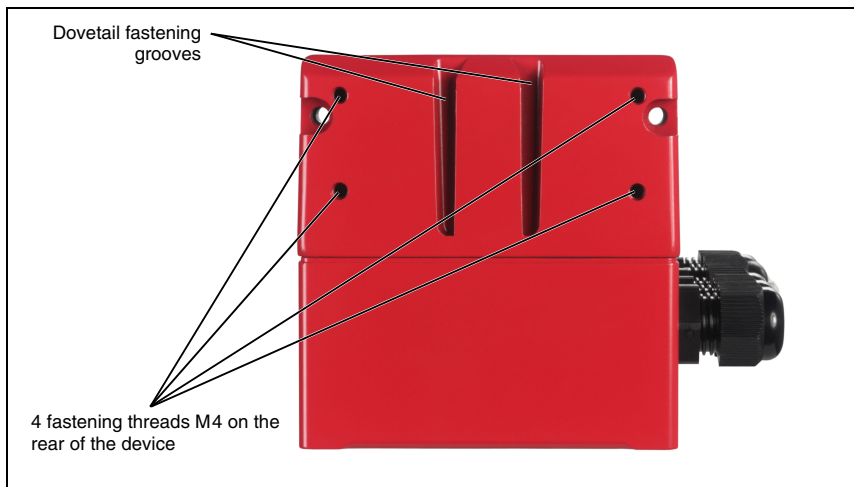
Figure 5.1:   MA 40 DP-k mounting options

BT 56 mounting device

The BT 56 mounting device is available for mounting the MA 40 DP-k using the fastening grooves. It is designed for rod installation (Ø 16 mm to 20 mm). For ordering instructions, please refer to chapter 10.2 on page 85.

Clamping jaws for mounting on the MA 4x DP-k

Clamp profile for mounting to round or oval pipes Ø 16 … 20 mm

All dimensions in mm

A Rod holder, turnable 360°
B Rods Ø 16 … 20 mm
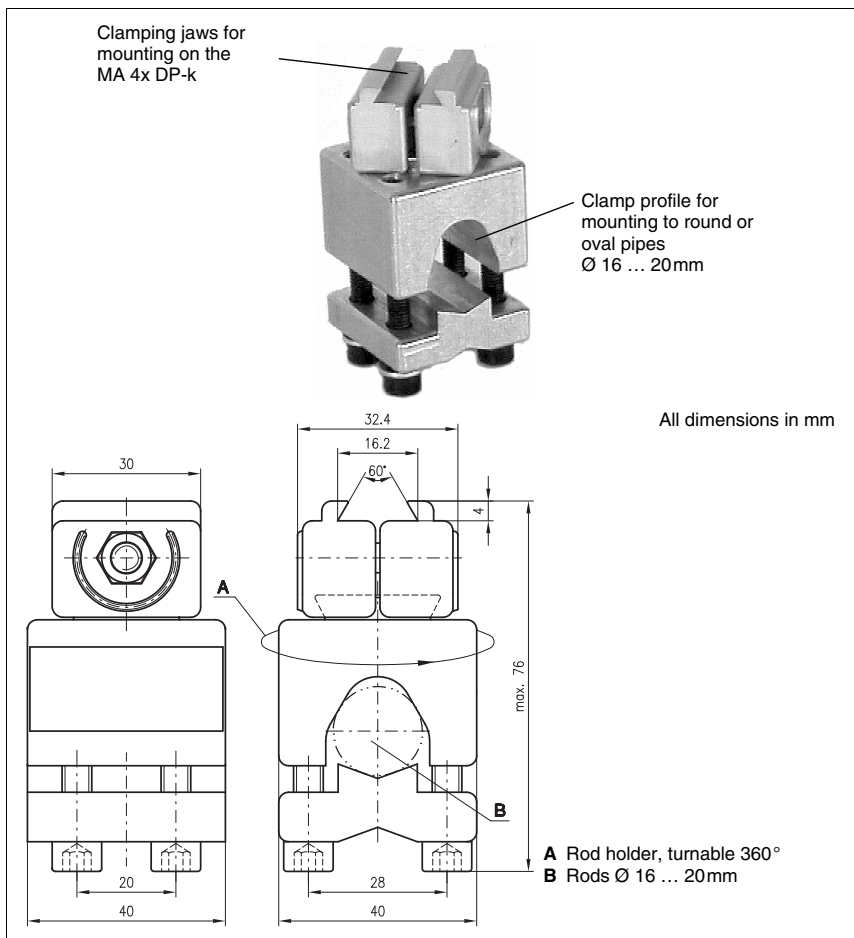
Figure 5.2:   BT 56 mounting device

BT 57 mounting device

The BT 57 mounting device is available for mounting the MA 40 DP-k via the mounting holes (on the side). The matching M4x10 screws are included with the BT. For ordering instructions, please refer to chapter 10.2 on page 85.

All dimensions in mm

A M8x18 round-head screw; A8 lock washer, M8 hexagonal nut
B ITEM joint
C M4x8 oval-head screw (4x), A4 lock washer (4x)
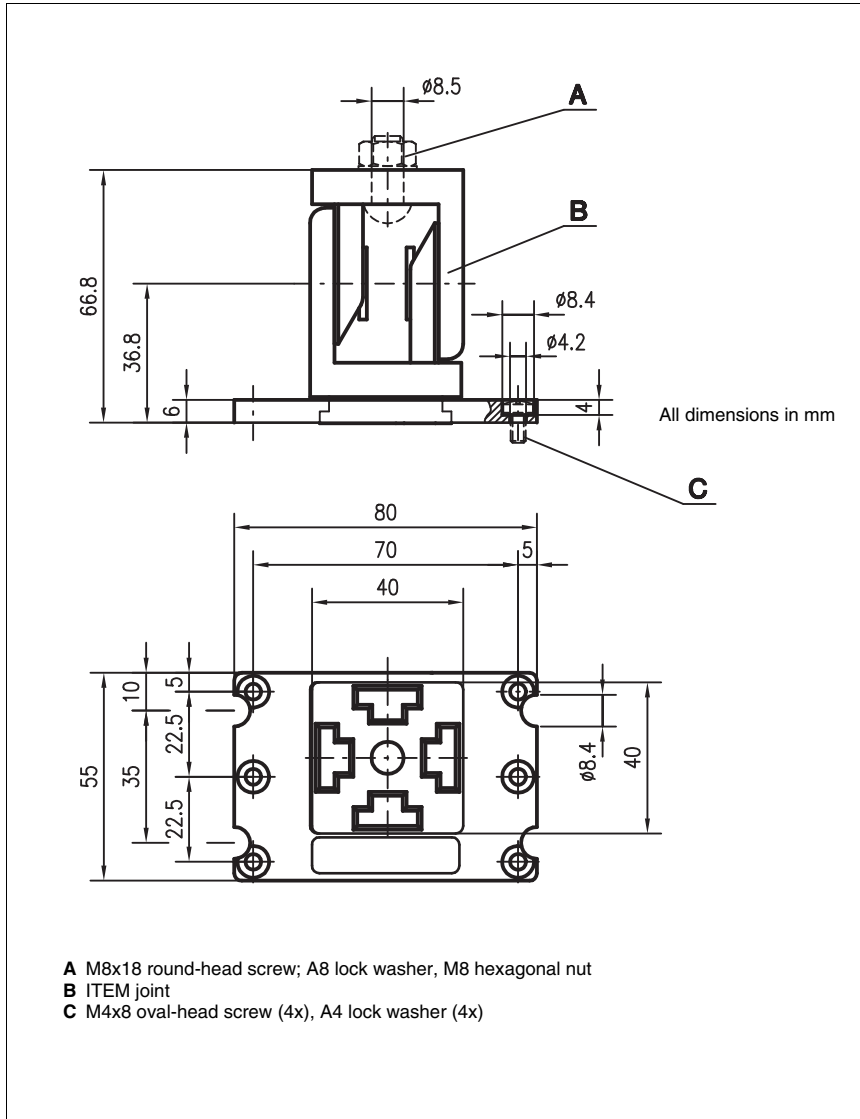
Figure 5.3:   BT 57 mounting device

5.1.2   MA 41 DP-k / MA 42 DP-k / MA 41 DP-k HS

These devices can be mounted to the lateral fastening grooves in the mounting plate by means of 4 threaded holes (M6) or by means of the included M8 screws.
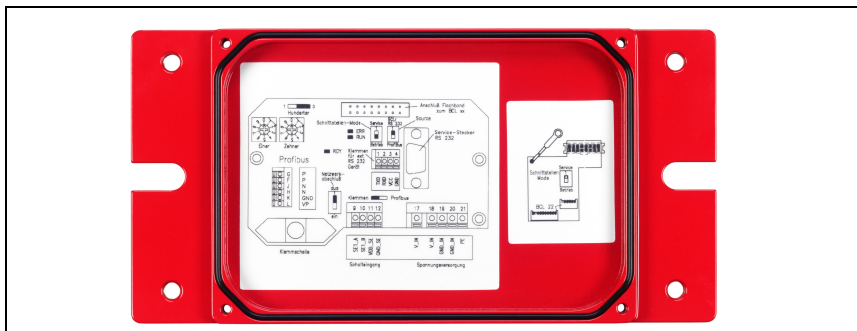
Figure 5.4:   MA 41 DP-k / MA 42 DP-k / MA 41 DP-k HS mounting options

5.2   Device arrangement

Ideally, the MA 4x DP-k should be mounted so that it is easily accessible near the Ident device in order to ensure good operability, e.g. for configuring the connected device.
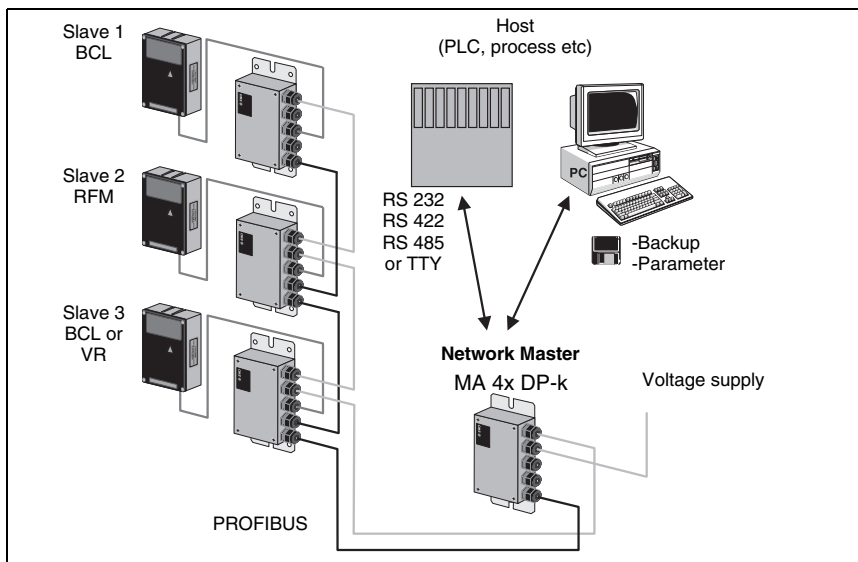
Figure 5.5:   Example device arrangement: Networking via PROFIBUS

6   Device parameters and interfaces
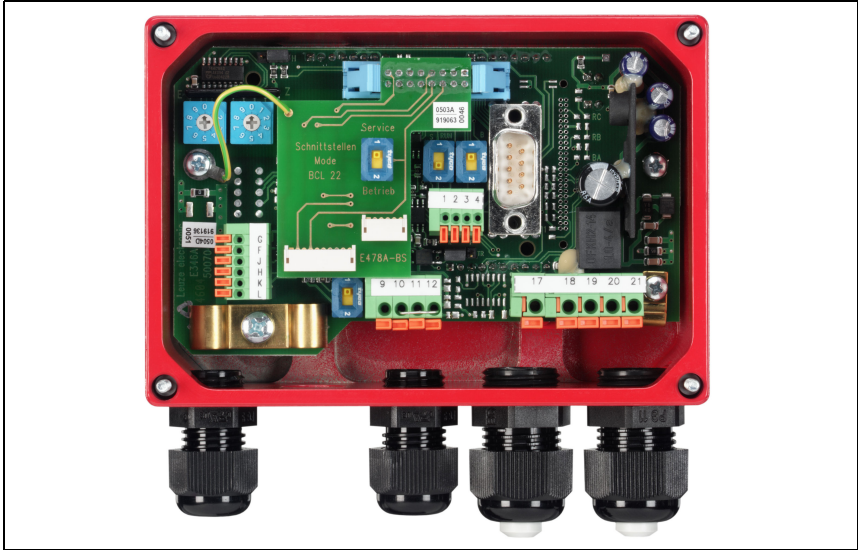
Figure 6.1:   Open MA 42 DP-k

6.1   PROFIBUS

6.1.1   General information

The MA 4x DP-k is designed as a PROFIBUS device (PROFIBUS DP-V0 acc. to IEC 61784-1) with a baud rate of up to 12 MB. The device fulfils the functionality of a bidirectional gateway. It only transforms RS 232 data to the PROFIBUS DP protocol and vice versa. Thus, only the MA 4x DP-k appears as a slave in the PROFIBUS configuration tool, not the connected Ident system.

The modules predefined in the MA 4x DP-k must be used in the configuration tool. The following modules are configured ex works:

- Input module: 10 words (20 bytes), input consistent (0xD9)
- Output module: 4 words (8 bytes), output consistent (0xE3)

If settings other than those shown here are necessary, they must first be set in the MA 4x DP-k via the "ComPro" configuration software. Information on "ComPro" see chapter 8 on page 74.

6.1.2   Connecting the PROFIBUS interface

The MA 4x DP-k is connected to the PROFIBUS via spring terminals. Ensure that the correct polarity of the connection wires is used, failure to do this will lead to improper functioning of the PROFIBUS.
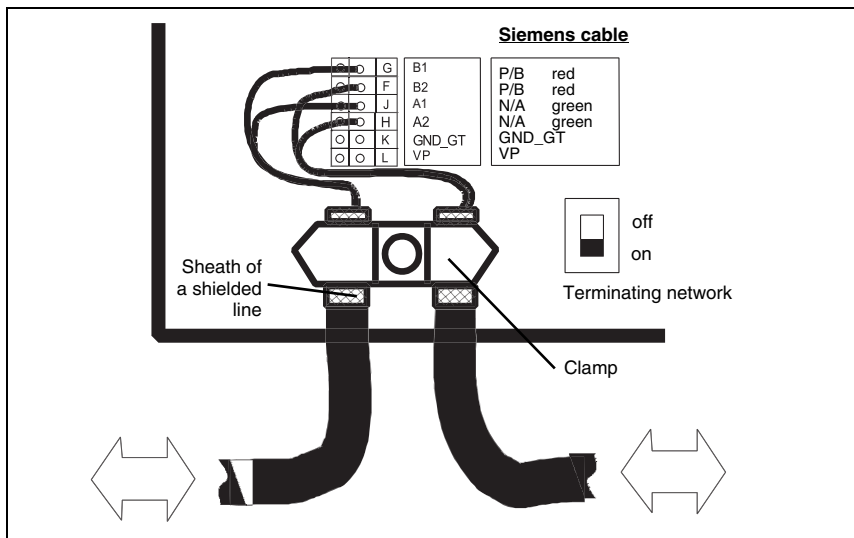
Figure 6.2:   Connection of the PROFIBUS

Attention!

If the MA 4x DP-k is the last physical device on the bus, then the terminating network switch must be switched on here, and switched to off at all other devices. The terminating network is equipped with pull-up and pull-down resistors.

Shielding connection

The shield is connected to the MA 4x DP-k via the clamp. Pull back approx. a finger width of the braided shield of the PROFIBUS cable over the outer insulation and tighten the clamp over the cable. Ensure that there are no small strands of the shielding sticking into the electronics. Leave the remaining wires long enough that they can be easily connected to the spring terminals.

The 9 pin Sub-D plug of the PROFIBUS standard DIN 19 245 is connected as follows:

Signal description	Terminals MA 4x DP-k	Remark	Colour
B1 / B2	G, F	corresp. to RS 485 B	red
A1 / A2	J, H	corresp. to RS 485 A	green
Shield	Screw clamp	braided shielding of the PROFIBUS line	

Table 6.1:   Assignments of the 9-pin Sub-D connector

6.1.3 PROFIBUS address

Setting the station address

The station address of the MA 4x DP-k on the PROFIBUS is set using two rotary switches and a jumper.

Jumper "Hundreds" right:	Address range 0 … 99
Jumper "Hundreds" left:	Address range larger than 100

Notice!

The station address for the MA 4x DP-k (slave) can only be set between 2 and 126, other addresses are not allowed. An address change made at the switches does not take effect until following the next cold start (switching-on of operating voltage).
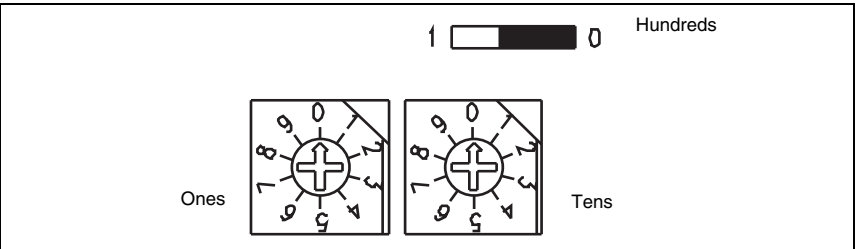
Figure 6.3:   Using the rotary switches/jumper to set addresses

6.1.4 General information on the GSE file, loading the configuration file

To integrate the MA 4x DP-k in the PROFIBUS, it must be registered (configured) on the master. The type of registration is dependent on your configuration tool.

With the DPK_2600.GS* GSE file, the MA 4x DP-k can be inserted in the PROFIBUS as a slave. All slave-specific data is stored in this file.

The GSE file can be found at **www.leuze.de -> Download -> Identify -> Modular inter-facing units** or on the included CD. This file contains all data necessary for operating the MA 4x DP-k, such as baud rate, data width and definition of the status and control bits. The changes made in the configuration tool are not stored in the GSE file, but rather in the corresponding project of the controller's connection group.

6.2   Variable configuration of the input/output data words

The MA 4x DP-k can be configured with a variable data width of input and output words (max. 12 input and 12 output words).

- First, the MA 4x DP-k must be adapted to the changed data width by changing and booting the database. The "ComPro" configuration program, described on page 74, is available for this purpose.
- The configuration of the master is set by transferring the corresponding memory modules in the configuration tool.

6.2.1   Adapting the input and output width in the device master file or control

Factory setting: **10 input words**   (0xD9) with consistency
                        4 output words   (0xE3) with consistency

These values can be adapted to customer-specific needs between the values of 2-12 words. Various input and output widths are included as an option in the device master file (*.GSE). They must be appropriately registered in the master during configuration.

6.2.1.1 I/O data configuration table

The following configurations are possible:

Input consistent

Data words	Config (hex)	Config (decimal)
2	D1 hex	209
3	D2 hex	210
4	D3 hex	211
5	D4 hex	212
6	D5 hex	213
7	D6 hex	214
8	D7 hex	215
9	D8 hex	216
10	D9 hex	217
11	DA hex	218
12	DB hex	219

Output consistent:

Data words	Config (hex)	Config (decimal)
2	E1 hex	225
3	E2 hex	226
4	E3 hex	227
5	E4 hex	228
6	E5 hex	229
7	E6 hex	230
8	E7 hex	231
9	E8 hex	232
10	E9 hex	233
11	EA hex	234
12	EB hex	235

6.2.2   Preparing the control system for consistent data transmission

During programming the control system must be prepared for the consistent data transmission. This varies from control system to control system. The following possibilities are available for the Siemens control systems.

S7

The specific function blocks SFC 14 for input data and SFC 15 for output data must be integrated in the program. These are standard function blocks and are used to facilitate consistent data transmission.

S5 with IM 308C

- Up to Release 5 together with Comprofibus software up to Release 2 and
- Release 6 and above together with Comprofibus software Release 3 and above

Here, the function block FB 192 must be integrated, which is used to transmit the consistent data.

S5 with IM 308B

With the IM 308B consistent data transmission must be programmed via load transfer commands. The IM 308B does not detect xxx.GSE files, only xxx.200 files.

6.2.3   Adapting the input and output width in the MA 4x DP-k by means of software download

Adjustable input and output width

Changing to a different input and output word width on the slave is only possible by means of software download via the service interface of the MA 4x DP-k using a special cable (see chapter 8).

The parameters are stored in a database in the EEPROM of the MA 4x DP-k. The "ComPro" software tool (see page 74) is necessary for changing these values.

By default, the **10 input data words** and **4 output data words** are set.

The adjustment range is **2 … 12 words** for both I and O data.

6.3   Setting the read parameters on the Ident system

Commissioning IDS

To commission a read station, you must prepare the IDS on the MA 4x DP-k for its reading task. To do this, connect the IDS to the MA 4x DP-k. Depending on the IDS, this occurs either via a connection cable (accessory no.: KB 040-3000) or directly on the MA 4x DP-k. The service plug and corresponding switches can be accessed with the housing cover open. Commissioning is now performed by carrying out the following steps:

Select the switch position "Service/BCL/IDS" and connect a PC to the service plug via an RS 232 cable.

Connecting the service interface

On the PC, call up a terminal program (e.g. BCLConfig) and check whether the interface (COM 1 or COM 2) to which you have connected the MA 4x DP-k is set to data format 9600 baud, 8 data bits, no parity, 1 stop bit. You can download the config-tool from **www.leuze.de -> Download -> Identify** for BCL, RFID, VR etc.

In order to communicate with the connected IDS, the **STX, data, CR, LF** framing must be set on the PC terminal program, as the IDS is preconfigured ex works for this frame character.

STX (02h):	Prefix 1
CR (0Dh):	Postfix 1
LF: (0Ah):	Postfix 2

Operation

Switch the MA 4x DP-k to switch position 1: Operation / monitor IDS/BCL. The IDS is now connected to the PROFIBUS. Activation of the IDS can now occur via the switching input on the MA 4x DP-k, via the process data word Out-bit 1 (Bit 0.2) or by transmitting a "+" command to the IDS (see chapter "Connecting the switching input"). For further information on the PROFIBUS transmission protocol, see chapter 6.4 "Operating the MA 4x DP-k on the PROFIBUS".

In operation mode, data at the serial interface between the IDS and the PROFIBUS module can be monitored via the service plug. You can switch between "Monitor IDS" and "Monitor PROFIBUS" using the "Source" switch.

6.4 Operating the MA 4x DP-k on the PROFIBUS

6.4.1 Structure of the data exchange

All operations are performed by control and status bits. Two bytes of control information and two bytes of status information are available for this purpose. The control bits are a part of the output module and the status bits are a part of the input bytes.

Input module
10 words, input consistent

Status byte 0
Status byte 1
Input data
18 bytes (default)
Display in hex format

Output module
4 words, output consistent

Status byte 0
Status byte 1
Output data
6 bytes (default)
Display in hex format

6.4.2   Functionality of the data exchange

6.4.2.1   Reading slave data

Description

If the decoder transmits data to the MA 4x DP-k PROFIBUS connection, the data is stored temporarily in a buffer. Immediately thereafter, n bytes (n = 2 to 22) of user data with the information: "number of valid data" (DLC) and the toggled status bit "BLR" (**Bl**ock **R**eady) are sent to the master. The master, which checks the status bit and determines a change, can immediately evaluate the first user byte (max. 2 - 22).

If no further user data is present in the output buffer of the MA 4x DP-k ("DEX" bit = "0"), the "R-ACK" bit must be toggled once as read confirmation to release data transmission for the next read cycle.

If the buffer still contains more data ("DEX" bit = 1), the next remaining user data present in the buffer is transmitted by toggling the "R-ACK" control bit. This process is to be repeated until the "DEX" bit returns to "0"; all data has then been removed from the buffer. "R-ACK" must be toggled here again once more as a terminating read confirmation in order to release data transmission for the next read cycle.

6.4.2.2   Writing slave data

Individual data 4-24 bytes

The transmission of data from the master to the slave utilises the shared (fast) transmission of command and user data. Here, too, the system responds to a change, not to the state.

State name	State	Action
Idle	Decoder is ready to receive data	If transmission is desired: Transfer data to the PROFIBUS output buffer flag "SDO" (**S**end actual **d**ata **o**nce)
Data ready	Decoder has received data	Wait until "W-ACK" has been toggled
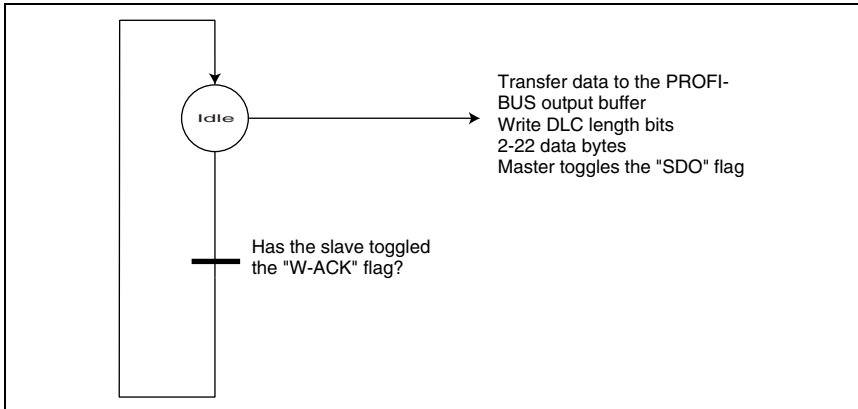
Figure 6.4:   Machine state: Writing individual data

Block writing (up to 254 bytes)

If more than 2 … 22 byte user data is to be sent to a slave at once, it can be written to the buffer of the MA 4x DP-k as a block. The data sent by the master to the slave is then collected in a "transmit buffer" by setting the "CTB" bit (**C**opy to **t**ransmit **b**uffer) (up to 254 bytes).

The data is sent from the buffer to the connected device (BCL or other device) via the serial interface with a single command: "SFB" bit (**S**end data **f**rom transmit **b**uffer).

Afterward, the buffer is again empty and can be written with new data.

6.4.3   Characteristics of data transmission

Padding unused input data bytes with 00h

During data transmission from the slave to the master, the user data is copied to the input data bytes of the master and the length byte (DLC = **D**ata **L**ength **C**ode) set accordingly. The unused input data bytes are automatically overwritten with 00h. This allows for a double inspection of the transmitted data:

• Specification of the valid data bytes by means of DLC length encoding.
• Invalid data bytes are overwritten with 00h.

6.4.4   Description of the input bytes (status bytes)

The input bytes (status bytes) contain:
- 4 system status bits
- 2 input bits
- 5 handshake bits
- 5 bits Data Length Code (DLC), which indicate the number of valid data bytes which follow.

The remaining 2 … 22 input bytes contain the user data of the BCL or the data which was received by the serial interface.

Overview of the input bytes (status bytes)

Module	Input data	Description	Addr.	Data type	Value range	Default	CR to module
ea 2 –12 words Input consistent	W-ACK	**W**rite-**Ack**nowledge (write confirmation) Toggle bit: Indicates that the data was successfully sent by the PLC to the MA 4x DP-k.	0.0	Bit	0->1: Successfully written 1->0: Successfully written	0	**ak, al, am** (Output, 2-12 words consistent)
eb 2 –12 words Input consistent	TX-BUSY	**T**ransmit is active (data transmission active) Indicates whether data is currently being transmitted by the MA 4x DP-k via the RS 232 to the connected Ident device.	0.1	Bit	0: No transmission 1: Data is being transmitted	0	
ec 2 –12 words Input consistent	IN bit 0	Input bits (no function) Bit permanently set to "1"	0.2	Bit	1	1	
ed 2 –12 words Input consistent	IN bit 1	Input bits (no function) Bit permanently set to "1"	0.3	Bit	1	1	
ee 2 –12 words Input consistent	RBO	**R**eceive **B**uffer **O**verflow (Receive buffer overflow) Indicates that more than 240 bytes of data is present in the receive buffer. Is autom. reset, if receive buffer contains < 200 bytes of data.	0.4	Bit	0->1: Receive buffer > 240 bytes 1 ->0: Receive buffer < 200 bytes	0	**aa** (Output, 2-12 words consistent) **el** (Input, 2-12 words consistent)
ef 2 –12 words Input consistent	TBO	**T**ransmit **B**uffer **O**verflow (Transmit buffer overflow) Indicates that more than 254 bytes of data was written with the CTB bit in the transmit buffer.	0.5	Bit	0 -> 1 Receive buffer > 254 bytes 1 ->0 Receive buffer < 254 bytes	0	**al** (Output, 2-12 words consistent)
eg 2 –12 words Input consistent	ERR	Module/Command **Err**or (Error) Indicates that an impermissible command / parameter was transmitted	0.6	Bit	0: No error 1: Error	0	

Module	Input data	Description	Addr.	Data type	Value range	Default	CR to module
eh 2 –12 words Input consistent	VALID	**Device Ready** (Ready indicator) Indicates that the MA 4x DP-k is ready for data exchange. Is set to "1" if the EN bit in **output byte** 0.7 is set to "1".	0.7	Bit	0: Device not ready 1: Device ready	0	**ah** (Output, 2-12 words consistent)
ei 2 –12 words Input consistent	DLC0 … DLC4	**D**ata **L**ength **C**ode (Number of user data in bytes) Number of transmitted input bytes is entered as hex value in binary format.	1.0 …1.4	Bit	1h (00001b) … 16h (10110b)	0h (00000b)	**en, eo, ep, eq, er, es** (Input, 2-12 words consistent)
ek 2 –12 words Input consistent	D-NEW	**D**ata **New** in Receive Buffer (receive new data) Indicates the arrival of new data for the length of the set time (default 500 ms). Setting is made via the "ComPro" config. software.	1.5	Bit	0: Existing data is older than the set duration 1: Existing data is new	0	**aa** (Output, 2-12 words consistent)
el 2 –12 words Input consistent	DEX	**D**ata **ex**ist (Data in transmit buffer) Indicates that further data is stored in the transmit buffer which is ready for transmission to the control.	1.6	Bit	0: No data in the transmit buffer 1: Further data in the transmit buffer	0	**aa** (Output, 2-12 words consistent)
em 2 –12 words Input consistent	BLR	Next **bl**ock **r**eady to transmit (new block ready) Toggle bit: Indicates whether the MA 4x DP-k has transmitted data from the transmit buffer to the input data area of the PLC.	1.7	Bit	0->1: Data transmitted 1->0: Data transmitted	0	**aa** (Output, 2-12 words consistent)
en 2 words Input consistent	Data	User information with 2 words length consistent.	2…5	Bytes	0 … FFh	00h	**aa** (Output, 2-12 words consistent)
eo 4 words Input consistent	Data	User information with 4 words length consistent.	2…9	Bytes	0 … FFh	00h	**aa** (Output, 2-12 words consistent)
ep 6 words Input consistent	Data	User information with 6 words length consistent.	2…13	Bytes	0 … FFh	00h	**aa** (Output, 2-12 words consistent)
eq 8 words Input consistent	Data	User information with 8 words length consistent.	2…17	Bytes	0 … FFh	00h	**aa** (Output, 2-12 words consistent)
er 10 words Input consistent	Data Standard module	User information with 10 words length consistent.	2…21	Bytes	0 … FFh	00h	**aa** (Output, 2-12 words consistent)
es 12 words Input consistent	Data	User information with 12 words length consistent.	2…25	Bytes	0 … FFh	00h	**aa** (Output, 2-12 words consistent)

Input data length: 2 bytes consistent + 2 … 12 words user data depending on module

Structure of the input bytes (status bytes)

7	6	5	4	3	2	1	0	
VALID	ERR	TBO	RBO	IN bit 1	IN bit 0	TX-BUSY	W-ACK	byte 0

7	6	5	4	3	2	1	0	
BLR	DEX	D-NEW	DLC4	DLC3	DLC2	DLC1	DLC0	byte 1
			2^4	2^3	2^2	2^1	2^0	

Input data byte 0	
Input data byte 1	
Input data byte 2	
Input data byte 3	
Input data byte 4	Depending on
Input data byte 5	configuration
Input data byte 6	2 to 22
Input data byte 7	data bytes
Input data byte 8	
Input data byte 9	
Input data byte 10	
Input data byte 11	
Input data byte 12	
Input data byte 13	
Input data byte 14	
Input data byte 15	
Input data byte 16	
Input data byte 17	
Input data byte 18	
Input data byte 19	
Input data byte 20	
Input data byte 21	

Figure 6.5:   Structure of the input bytes (status bytes)

The bits of the input bytes have the following meaning:

Bits of the input byte (status byte) 0

Bit no.	Designation	Meaning
0	W-ACK	Write acknowledge
1	TX-BUSY	Transmit is active (RS 232 transmission is running)
2,3	IN bit 0, IN bit 1	Input bits (control of the BCL/IDS), reserved
4	RBO	Receive Buffer Overflow
5	TBO	Transmit Buffer Overflow
6	ERR	Module/Command Error
7	VALID	Data valid, ready

Notice!

T-bit means toggle bit, i.e. this bit changes its state on each event ("0" → "1" or "1" → "0").

6.4.4.1 Detailed description of the bits (input byte 0)

Bit 0: Write handshake W-ACK

Input data	Description	Addr.	Data type	Value range	Default	CR to module
W-ACK	**W**rite-**Ack**nowledge (write confirmation) Write handshake Write acknowledge is indicated via this bit. The WACK bit is toggled by the MA 4x DP-k whenever a transmit command has been successfully executed. This applies both for the direct transmission with SDO as well as for the transmission of the data in the transmit buffer with the CTB command and sending the transmit buffer contents with the SFB command.	0.0	Bit	0->1: Successfully written 1->0: Successfully written	0	**ak, al, am aa** (Output, 2-12 words consistent)

Bit 1: Write handshake TX-BUSY

Input data	Description	Addr.	Data type	Value range	Default	CR to module
TX-BUSY	Transmit is active (data transmission active) If the MA 4x DP-k sends data from the transmit buffer via the serial interface, this flag bit is set to high ("1") until the transmission process has concluded. No new transmission can be initiated via the PROFIBUS while this bit is set.	0.1	Bit	0: No transmission 1: Data is being transmitted	0	

Bits 2, 3: Input bits, switching inputs IN bit 0, IN bit 1

Input data	Description	Addr.	Data type	Value range	Default	CR to module
IN bit 0 IN bit 1	Input bits (no function) These bits are transmitted directly to the port pins of the microcontroller and are connected as inputs. In the context of IDS, no function. These pins are always set to "1" with pull-up resistors.	0.2 0.3	Bit	1	1	

Bit 4: RBO system message

Input data	Description	Addr.	Data type	Value range	Default	CR to module
RBO	**R**eceive **B**uffer **O**verflow (Receive buffer overflow) This flag bit is set to high ("1") if more than 240 bytes are collected in the receive buffer. This signals to the master that it must switch to the receive routine in order to prevent data losses. The bit is automatically reset if less than 200 bytes remain in the receive buffer. While the RBO bit is set, the RTS signal of the serial interface is deactivated.	0.4	Bit	0->1: Receive buffer > 240 bytes 1 ->0: Receive buffer < 200 bytes	0	**aa** (Output, 2-12 words consistent) **el** (Input, 2-12 words consistent)

Bit 5: TBO system message

Input data	Description	Addr.	Data type	Value range	Default	CR to module
TBO	**T**ransmit **B**uffer **O**verflow (Transmit buffer overflow) If more than 254 bytes were written to the transmit buffer with the CTB command, this flag bit is set to high ("1"). This instructs the master to send the data with the SFB command via the serial interface and thereby empty the transmit buffer.	0.5	Bit	0 -> 1 Receive buffer > 254 bytes 1 ->0 Receive buffer < 254 bytes	0	**al** (Output, 2-12 words consistent)

Bit 6: ERR system message

Input data	Description	Addr.	Data type	Value range	Default	CR to module
ERR	Module/Command **Err**or (Error) The Error flag-bit is set to high ("1") whenever an impermissible command or impermissible control parameter was transmitted to the MA 4x DP-k. This bit is also set in the event of a module error, to allow the PROFIBUS master to branch to an appropriate error routine.	0.6	Bit	0: No error 1: Error	0	

Bit 7: VALID system message

Input data	Description	Addr.	Data type	Value range	Default	CR to module
VALID	**Device Ready** (Ready indicator) If the EN bit is set in the control word, the MA 4x DP-k activates the serial interface and enables the transmit and receive buffers. The Valid flag-bit is set to signal to the master that the MA 4x DP-k is ready and active. If this bit is low ("0"), the MA 4x DP-k is not ready for transmitting or receiving serial data. The Valid bit is automatically set to low ("0") if the module is not correctly configured or the EN bit in the control word is set to low ("0").	0.7	Bit	0: Device not ready 1: Device ready	0	**ah** (Output, 2-12 words consistent)

Bits of the input byte (status byte) 1

Bit no.	Designation	Meaning
0 … 4	DLC0 … DLC4	**D**ata **L**ength **C**ode (length of the following user data)
5	D-NEW	**D**ata **New** in Receive Buffer (receive new data)
6	DEX	**D**ata **ex**ist (data in transmit buffer)
7	BLR	Next **bl**ock **r**eady to transfer (new block ready)

6.4.4.2 Detailed description of the bits (input byte 1)

Bits 0 … 4: Read handshake DLC0 … DLC4

Input data	Description	Addr.	Data type	Value range	Default	CR to module
DLC0 … DLC4	**D**ata **L**ength **C**ode (Number of user data in bytes) Stored in this bit is the number of valid data bytes which follows. Value range: **00h** to **12h** (0 to 18 dec. for 10 word input)	1.0 … 1.4	Bit	1h (00001b) … 16h (10110b)	0h (00000b)	**en, eo, ep, eq, er, es** (Input, 2-12 words consistent)

Bit 5: Read handshake D-NEW

Input data	Description	Addr.	Data type	Value range	Default	CR to module
D-NEW	**D**ata **New** in Receive Buffer (receive new data) After a datablock has been registered in the data bytes from the receive buffer, the Data New bit is always set to high ("1") for a defined time and, after the timeout time set in the configuration has elapsed (default: 500ms), automatically reset. This bit is not absolutely necessary for the normal handshake for transmission security, but can be used to assist in evaluating the age of the user data.	1.5	Bit	0: Existing data is older than the set duration 1: Existing data is new	0	**aa** (Output**,** 2-12 words consistent)

Bit 6: Read handshake DEX

Input data	Description	Addr.	Data type	Value range	Default	CR to module
DEX	**D**ata **ex**ist (Data in transmit buffer) This flag bit is always set to high ("1") by the MA 4x DP-k as long as data which was received via the serial interface is present in the receive buffer.	1.6	Bit	0: No data in the transmit buffer 1: Further data in the transmit buffer	0	**aa** (Output**,** 2-12 words consistent)

Bit 7: Read handshake BLR

Input data	Description	Addr.	Data type	Value range	Default	CR to module
BLR	Next **bl**ock **r**eady to transmit (new block ready) The Block Ready toggle bit changes its state whenever the MA 4x DP-k has removed received data from the receive buffer and registered it in the corresponding receive-data bytes. This signals to the PROFIBUS master that the quantity of data indicated in the DLC bits to be present in the input data bytes originated in the data buffer and is current.	1.7	Bit	0->1: Data transmitted 1->0: Data transmitted	0	**aa** (Output**,** 2-12 words consistent)

6.4.5 Description of the output bytes (control bytes)

Overview of the output bytes (control bytes)

Module	Output data	Description	Addr.	Data type	Value range	Default	CR to module
aa 2 –12 words Output consistent	R-ACK	**R**ead-**Ack**nowledge (read confirmation) Toggle bit: Indicates to the MA 4x DP-k that the "old" data has been processed and that new data can be received. At the end of a read cycle, this bit must be toggled in order to be able to receive the next data set.	0.0	Bit	0->1: Ready for the next transmission 1->0: Ready for the next transmission	0	**em** (Input, 2-12 words consistent)
ab 2 –12 words Output consistent	OUT bit 0	Output bit (no function)	0.1	Bit	0: No function 1: No function	0	
ac 2 –12 words Output consistent	OUT bit 1	Output bit (switching output) Setting the bit activates the connected Ident device (trigger). This only applies for MA 40 DP-k and MA 42 DP-k!	0.2	Bit	0: Deactivates Ident device 1: Activates Ident device	0	
ad 2 –12 words Output consistent	VER	**Ver**sion query (system command, for the MA 4x DP-k) Setting this bit triggers a version query of the MA 4x DP-k. For this purpose, the Service and PROFIBUS switch positions must be set. Output example upon activation: COM-DPS Leuze V2.0 17.09.1997 I 10 Words 217 O 4 Words 227 9600, 8, 1, N	0.3	Bit	0: No function 1: Transmits "V" on the RS 232	0	
ae 2 –12 words Output consistent	RSTD	**R**eset **D**ecoder (System command) Setting this bit sends a string which can be configured with "ComPro" to the connected Ident device. The default setting is "PC20" (reset to factory parameters). [STX] PC20 [CR] [LF]	0.4	Bit	0: No action is performed 1: Defined online command is transmitted	0	
af 2 –12 words Output consistent	RRB	**R**eset **R**eceive **B**uffer (reset receive buffer) Setting the RRB bit resets the transmit buffer of the MA 4x DP-k independent of other operation.	0.5	Bit	0->1 and 1->0 Resets the receive buffer	0	**el, ee** (Input, 2-12 words consistent)
ag 2 –12 words Output consistent		Reserved	0.6	Bit	0: No function 1: No function	0	
ah 2 –12 words Output consistent	EN	Enable (activate device) This bit **must** always be set to "1" during operation. This bit activates data exchange between MA 4x DP-k and PLC.	0.7	Bit	0: Device deactivated 1: Device activated	0	**eh** (Input, 2-12 words consistent)

Module	Output data	Description	Addr.	Data type	Value range	Default	CR to module
ai 2 –12 words Output consistent	DLC0 … DLC4	**D**ata **L**ength **C**ode (Number of user data in bytes) Number of output bytes to be transmitted. Specified as hex value in binary format.	1.0 … 1.4	Bit	1h (00001b) … 16h (10110b)	0h (00000b)	**an, ao, ap, aq, ar, as** (Output, 2-12 words consistent)
ak 2 –12 words Output consistent	SDO	**S**end **D**ata **O**nce (Send data directly) Toggle bit: Changing this bit forwards data from the control directly to the RS 232 interface or the connected Ident system via the MA 4x DP-k. The data length must first be registered in the DLC bits. The maximum data length is dependent on the configuration of the output words. By default, max. 6 bytes are possible.	1.5	Bit	0->1: Data directly to RS 232 1->0: Data directly to RS 232	0	**ai** (Output, 2-12 words consistent)
al 2 –12 words Output consistent	SFB	**S**end **D**ata from **B**uffer (Send data from the transmit buffer of the MA 4x DP-k to the RS 232) Toggle bit: Changing this bit transmits all data which was copied via the CTB bit to the transmit buffer of the MA 4x DP-k to the RS 232 interface or the connected Ident system.	1.6	Bit	0->1: Data to RS 232 1->0: Data to RS 232	0	**am** (Output, 2-12 words consistent)
am 2 –12 words Output consistent	CTB	**C**opy to **T**ransmit **B**uffer (transfer data to the transmit buffer) Toggle bit: Changing this bit writes the data from the PLC to the transmit buffer of the MA 4x DP-k. The data length must first be registered in the DLC bits. This is used, for example, for long command strings which must be transmitted to the connected Ident device.	1.7	Bit	0->1: Data in buffer 1->0: Data in buffer	0	**ai, al** (Output, 2-12 words consistent)
an 2 words Output consistent	Data	User information with 2 words length consistent.	2…5		0 … FFh	00h	**ea** (Input, 2-12 words consistent) **ak, al, am** (Output, 2-12 words consistent)
ao 4 words Output consistent	Data Standard module	User information with 4 words length consistent.	2…9		0 … FFh	00h	**ea** (Input, 2-12 words consistent) **ak, al, am** (Output, 2-12 words consistent)

Module	Output data	Description	Addr.	Data type	Value range	Default	CR to module
ap 6 words Output con-sistent	Data	User information with 6 words length consistent.	2…13		0 … FFh	00h	**ea** (Input, 2-12 words consistent) **ak, al, am** (Output, 2-12 words consistent)
aq 8 words Output con-sistent	Data	User information with 8 words length consistent.	2…17		0 … FFh	00h	**ea** (Input, 2-12 words consistent) **ak, al, am** (Output, 2-12 words consistent)
ar 10 words Output con-sistent	Data	User information with 10 words length consistent.	2…21		0 … FFh	00h	**ea** (Input, 2-12 words consistent) **ak, al, am** (Output, 2-12 words consistent)
as 12 words Output con-sistent	Data	User information with 12 words length consistent.	2…25		0 … FFh	00h	**ea** (Input, 2-12 words consistent) **ak, al, am** (Output, 2-12 words consistent)

Output data length: 2 bytes consistent + 2 … 12 words user data depending on module

Structure of the output bytes (control bytes)

7	6	5	4	3	2	1	0	
EN	CNF	RRB	RSTD	VER	OUT bit 1	OUT bit 0	R-ACK	byte 0

7	6	5	4	3	2	1	0	
CTB	SFB	SDO	DLC4	DLC3	DLC2	DLC1	DLC0	byte 1
			2^4	2^3	2^2	2^1	2^0	

Output data byte 0	
Output data byte 1	
Output data byte 2	
Output data byte 3	Depending on
Output data byte 4	configuration
Output data byte 5	2 to 22
Output data byte 6	data bytes
Output data byte 7	
Output data byte 8	
Output data byte 9	
Output data byte 10	
Output data byte 11	
Output data byte 12	
Output data byte 13	
Output data byte 14	
Output data byte 15	
Output data byte 16	
Output data byte 17	
Output data byte 18	
Output data byte 19	
Output data byte 20	
Output data byte 21	

Table 6.2:   Structure of the output bytes (control bytes)

The bits of the output bytes have the following meaning:

Bits of the output byte (control byte) 0

Bit no.	Designation	Meaning
0	R-ACK	Read Acknowledge
1 … 2	OUT bit 0, OUT bit 1	Set the switching inputs (IDS)
3	VER	VERsion (query the version data)
4	RSTD	Reset Decoder (hardware reset of the BCL)
5	RRB	Reset Receive Buffer
6	CNF	Configuration mode active (configuration of interface data)
7	EN	Transmit/Receive Enable

6.4.5.1 Detailed description of the bits (output byte 0)

Bit 0: Read handshake R-ACK

Output data	Description	Addr.	Data type	Value range	Default	CR to module
R-ACK	**R**ead-**Ack**nowledge (read confirmation) This toggle bit is switched by the master after valid received data has been read out of the input bytes and the next datablock can be requested. If the MA 4x DP-k detects a signal change in the R-ACK bit, the next bytes are automatically written from the receive buffer to the input data words and the BLR bit toggled.	0.0	Bit	0->1: Ready for the next transmission 1->0: Ready for the next transmission	0	**em** (Input**,** 2-12 words consistent)

Bits 1 … 2: Read handshake OUT bit 0/1, set the switching outputs

Output data	Description	Addr.	Data type	Value range	Default	CR to module
OUT bit 0	Output bit (no function)	0.1	Bit	0: No function 1: No function	0	
OUT bit 1	Output bit (switching output) Setting the bit activates the connected Ident device (trigger). This only applies for MA 40 DP-k and MA 42 DP-k! **Attention!** Only OUT bit 1 wired → Switching input of the decoder), OUT bit 0 has no function Transmission of the output bits occurs independent of the firmware, i.e. even if the Valid bit or the EN bit is not set.	0.2	Bit	0: Deactivates Ident device 1: Activates Ident device	0	

Bit 3: System command VER

Output data	Description	Addr.	Data type	Value range	Default	CR to module
VER	**Ver**sion query (System command, for the MA 4x DP-k) This bit has no function when used with BCL-, RFM- and RFI-devices!	0.3	Bit	0: No function 1: Transmits "V" on the RS 232	0	

Bit 4: System command RSTD

Output data	Description	Addr.	Data type	Value range	Default	CR to module
RSTD	**Re**set **De**coder (System command) Setting ("0") → ("1") of the RSTD flag bit sends a given string (can be set in "Com-Pro") via the serial interface. Defined as the default string is: [STX] P C 2 0 [CR] [LF] (This resets the system parameters of a BCL(IDS?) read head)	0.4	Bit	0: No action is performed 1: Defined online command is transmitted	0	

Bit 5: System command RRB

Output data	Description	Addr.	Data type	Value range	Default	CR to module
RRB	**R**eset **R**eceive **B**uffer (reset receive buffer) Setting ("1") and resetting ("0") the RRB flag bits resets the receive buffer independent of other operation. Thus, it is possible for the master to remove data from receive buffer which is no longer needed without having to read out the data. Even if an overflow of the receive buffer has occurred, this bit can be used to reset the receive buffer to a defined state.	0.5	Bit	0->1 and 1->0 Resets the receive buffer	0	**el, ee** (Input, 2-12 words consistent)

Bit 6: System command CNF

Output data	Description	Addr.	Data type	Value range	Default	CR to module
CNF	Reserved	0.6	Bit	0: No function 1: No function	0	

Bit 7: System command EN

Output data	Description	Addr.	Data type	Value range	Default	CR to module
EN	**En**able (Activate device) This flag bit **must** always be set to "1" during normal operation in order to activate data exchange between master and slave. If this bit is set, the MA 4x DP-k indicates operational readiness by means of the set Valid flag bit in the status word. The EN bit is only set to low ("0") to enable the configuration of the parameters for the serial interface or to temporarily deactivate the module (receive disable).	0.7	Bit	0: Device deactivated 1: Device activated	0	**eh** (Input, 2-12 words consistent)

Bits of the output byte (control byte) 1

Bit no.	Designation	Meaning
0 … 4	DLC0 … DLC4	**D**ata **L**ength **C**ode (number of valid data bytes)
5	SDO	**S**end actual **D**ata **O**nce (send data directly to the RS 232 interface)
6	SFB	**S**end Data **f**rom Transmit **B**uffer (send data from the buffer to the RS 232)
7	CTB	**C**opy **T**o **T**ransmit-**B**uffer (copy data to the buffer)

6.4.5.2 Detailed description of the bits (output byte 1)

Bits 0 … 4: System commands DLC0 … DLC4

Output data	Description	Addr.	Data type	Value range	Default	CR to module
DLC0 … DLC4	**D**ata **L**ength **C**ode (Number of user data in bytes) Stored in this bit is the number of valid data bytes which follows. Specified as hex value in binary format.	1.0 … 1.4	Bit	1h (00001b) … 16h (10110b)	0h (00000b)	**an, ao, ap, aq, ar, as** (Output, 2-12 words consistent)

Bit 5: Write command SDO

Output data	Description	Addr.	Data type	Value range	Default	CR to module
SDO	**S**end **D**ata **O**nce (Send data directly) If this toggle bit is switched, the number of data bytes specified in the DLC (length code) is taken from the output data bytes and sent directly to the IDS via the serial interface of the MA 4x DP-k.	1.5	Bit	0->1: Data directly to RS 232 1->0: Data directly to RS 232	0	**ai** (Output, 2-12 words consistent)

Bit 6: Write command SFB

Output data	Description	Addr.	Data type	Value range	Default	CR to module
SFB	**S**end **D**ata from **B**uffer (Send data from the transmit buffer of the MA 4x DP-k to the RS 232) This toggle bit is switched whenever the content of the transmit buffer is to be output via the serial interface. After this bit has been toggled, the entire content of the transmit buffer is continuously transmitted via the serial interface. As long as the transmission is active (indicated by the Tx-Busy bit in the status word), no new transmit command can be output with the SDO, SFB or CTB bits by the PROFIBUS master.	1.6	Bit	0->1: Data to RS 232 1->0: Data to RS 232	0	**am** (Output, 2-12 words consistent)

Bit 7: Write command CTB

Output data	Description	Addr.	Data type	Value range	Default	CR to module
CTB	**C**opy to **T**ransmit **B**uffer (transfer data to the transmit buffer) The CTB toggle bit is switched whenever transmit data is not to be sent directly via the serial interface, but instead transferred to the transmit buffer. Before the CTB bit is toggled, the desired data bytes must be transferred to the output data bytes and the correct number of bytes which is to be sent registered in the DLC (length code).	1.7	Bit	0->1: Data in buffer 1->0: Data in buffer	0	**ai, al** (Output, 2-12 words consistent)

6.5 Initialisation of the serial interface → RS 232 (V.24) for Ident devices

The parameters of the serial interface can be set freely via the PROFIBUS and even changed by the master during operation. The MA 4x DP-k offers the following adjustments:

Baud rate	Parity check	Stop bits	Character length
2400 - 19200 baud	odd, even or none	1 or 2	7 or 8 bit

Attention!

*For proper operation, the transmission parameters must match those of the connected RS 232 device, e.g. BCL 80. The presetting for all device types (MA 4x DP-k and IDS) is the data format **9600 baud, 8-None-1**. Change these settings in the MA 4x DP-k only if the RS 232 participant cannot be configured to this default data format.*
The RFI/RFM devices are permanently set to this data format.

7   Examples

7.1   Scanner activation via PROFIBUS, reading the RS 232 data by the Ident system (≤ 18 bytes)

The following description applies for devices BCL 22/BCL 32/BCL 80/RFM 12/RFM 32/ RFM 62/RFI 32/VR 2300

Activating the scanner via PROFIBUS Out bit 1

The MA 4x DP-k offers the possibility of activating or deactivating a connected IDS (BCL xx) via output byte 0, bit 2 (Out bit 1). For this purpose, the MA 4x DP-k must be prepared for activation by the PROFIBUS as described in chapter "Connecting the switching input" on page 10.

In terms of logic, this means:

- "0" Reading gate off
- "1" Reading gate on

The length of time between activation and deactivation is referred to as the "reading gate". The reading gate is opened by setting the bit and can be closed by two events:

- By resetting the bit to "0" (NO READ)
- By reading a valid data carrier or barcode. In this case, the bit must still be reset after a defined length of time, otherwise no new activation is possible (hold function).

Sequence:

Set Out bit 1 to "1": Laser beam on the BCL switches on, IDS activates

Output data:

BYTE	0	1	2	3	4	5	6	7
MODEL	CONTROL 0	CONTROL 1	DAT 1	DAT 2	DAT 3	DAT 4	DAT 5	DAT 6
ASCII								
BIN/HEX	1000 0100	0000 0000	00	00	00	00	00	00

Case 1:

Reset Out bit 1 to "0": IDS deactivates, laser beam on the BCL switches off, the IDS sends a NO READ telegram

Output data:

BYTE	0	1	2	3	4	5	6	7
MODEL	CONTROL 0	CONTROL 1	DAT 1	DAT 2	DAT 3	DAT 4	DAT 5	DAT 6
ASCII								
BIN/HEX	1000 0000	0000 0000	00	00	00	00	00	00

Input data:

BYTE	0	1	2	3	4	5	6	7	8	9
MODEL	STATUS 0	STATUS 1	DAT 1	DAT 2	DAT 3	DAT 4	DAT 5	DAT 6	DAT 7	DAT 8
ASCII			STX	↑	CR	LF				
BIN/ HEX	1000 1100	1000 0100	02	18	0D	0A	00	00	00	00

Case 2:

A valid label is present in the reading field, the scanner sends the code contents, in the example "1234567…".

Input data:

BYTE	0	1	2	3	4	5	6	7	8	9
MODEL	STATUS 0	STATUS 1	DAT 1	DAT 2	DAT 3	DAT 4	DAT 5	DAT 6	DAT 7	DAT 8
ASCII			STX	1	2	3	4	5	6	7
BIN/ HEX	1000 1100	0000 1101	02	31	32	33	34	35	36	37

Notice!

After saving the data, read activation must be reset (see Case 1 on page 56).

Preparing for data transmission

```
        ┌──────────────────┐
        │   Preparing for  │
        │   communication  │
        └──────────────────┘
                 │
        ┌──────────────────┐
        │  Activate slave  │
        │      EN = 1      │
        │    Outbit 0.7    │
        └──────────────────┘
                 │            ◄──── No ───┐
                 ▼                        │
              ╱     ╲                     │
            ╱    *)    ╲                  │
          ╱ Slave activated? ╲           │
         ╱      VAL = 1        ╲──────────┘
          ╲    (Inbit 0.7)    ╱        *) Attention:
            ╲  (Display!)   ╱          Timeout for the acknowledgement should be programmed
              ╲          ╱             to prevent infinite loops.
                 │ Yes
                 ▼
        ┌──────────────────┐
        │ Save toggle bits │
        │  as process image│
        └──────────────────┘
                 │
                 ▼
        ┌──────────────────┐
        │   Receive data   │
        └──────────────────┘
                 │
                 ▼
              ╱     ╲
            ╱ Has the slave╲
          ╱ received data   ╲
         ╱ from the RS 232?  ╲
          ╲   BLR = ! BLR   ╱
            ╲             ╱
                 │ Yes
                 ▼
        ┌──────────────────┐
        │ Save data e.g.   │
        │ data module DLC =│
        │ number of valid  │
        │ data bytes binary│
        │ encoded          │
        └──────────────────┘
                 │
                 ▼
              ╱     ╲              ┌──────────────────┐
            ╱ Still data╲          │ Transfer next    │
          ╱ in the      ╲── ──────►│ data with toggle │
         ╱ receive buffer?╲        │ bit R-ACK = !    │
          ╲  DEX = 1 set ╱         │ R-ACK (Outbit0.0)│
            ╲(Inbit 1.6)╱          └──────────────────┘
                 │ No
                 ▼
        ┌──────────────────┐
        │ Confirm data     │
        │ retrieval with   │
        │ toggle bit       │
        │ R-ACK = ! R-ACK  │
        │   (Outbit 0.0)   │
        └──────────────────┘
```

Figure 7.1:   Preparing for data transmission

Triggering the Ident device and reading the data
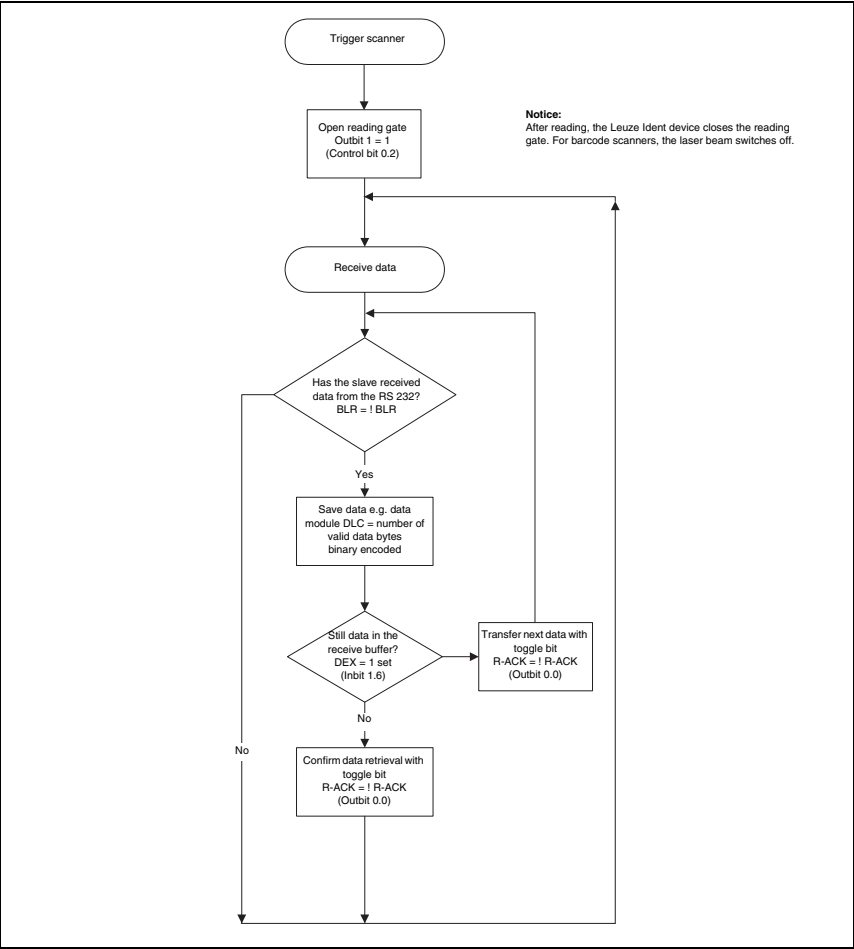
Figure 7.2:   Activating IDS and reading the data

A programming example can be found on the Internet at **www.leuze.de -> Download -> Identify -> Modular interfacing units**.

7.2   Sequence of events during data transmission to MA 4x DP-k

Sending online commands

All online commands (see operating instructions for Ident systems) can be transmitted to the IDS via the PROFIBUS. For this purpose, the data must be framed and the number of data must be registered in the in the peripheral area of the appropriate byte.

Example:

Format (8 bytes/4 data words) output:

BYTE	0	1	2	3	4	5	6	7
MODEL	CONTROL 0	CONTROL 1	DAT 1	DAT 2	DAT 3	DAT 4	DAT 5	DAT 6

7.2.1 Sending short online commands ($\leq$ 6 bytes) to the Ident system, reading the RS 232 answer from the Ident system
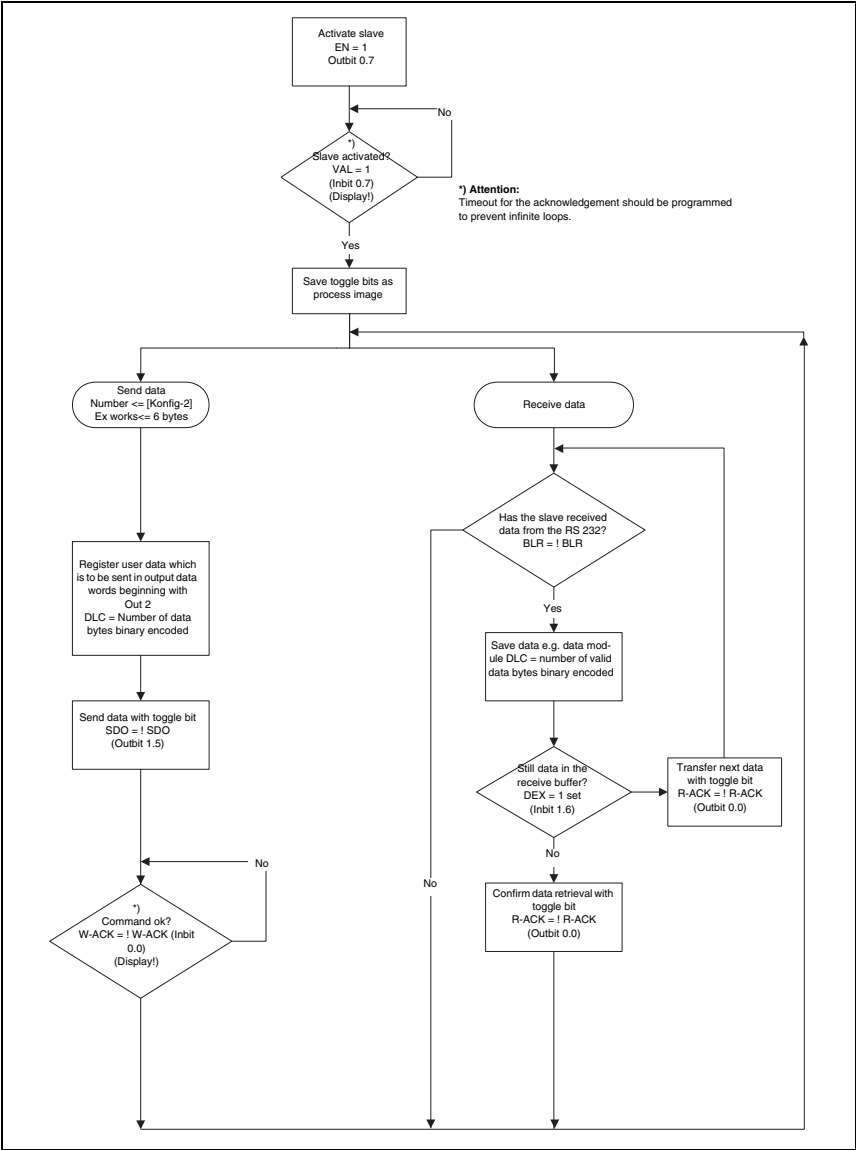
Figure 7.3: Diagram of data transmission with short online commands

7.2.1.1 Activating scanner/IDS using the "+" command

Scanner/IDS activation

The laser switches on/IDS is active and attempts to decode. If a valid code could be decoded, the read result is written to the read buffer of the MA 4x DP-k where it can be read out via the PROFIBUS.

Data to be transmitted:

ASCII	STX	+	CR	LF
Hex	02	2B	0D	0A

Sequence:

- Activation of the MA 4x DP-k: EN = "1"
- Register data bytes in output data bytes 0 to 3
- Register data length DLC "04h = 00100b" in control byte 1
- Toggle bit SDO (Send Data Once) in control byte 1: the data telegram is transmitted to the scanner/IDS.
- Reset the DLC bits

Output data:

BYTE	0	1	2	3	4	5	6	7
MODEL	CONTROL 0	CONTROL 1	DAT 1	DAT 2	DAT 3	DAT 4	DAT 5	DAT 6
ASCII			STX	+	CR	LF		
BIN/HEX	1000 0000	0010 0100	02	2B	0D	0A	00	00

7.2.1.2 Deactivating scanner/IDS using the "-" command

Scanner/IDS deactivation

If the laser beam was still on/IDS was still active and decoding was not successful, the laser beam switches off/the IDS is deactivated and the NO READ character "↑" is output via the PROFIBUS (18h).

Data to be transmitted:

ASCII	STX	-	CR	LF
Hex	02	2D	0D	0A

Sequence:

- Activation of the MA 4x DP-k: EN = "1"
- Register data bytes in output data bytes 0 to 3
- Set DLC bits "04h = 00100" in control byte 1
- Toggle bit SDO in control byte 1: data telegram is transmitted to the scanner/IDS
- Reset the DLC bits

Output data:

BYTE	0	1	2	3	4	5	6	7
MODEL	CONTROL 0	CONTROL 1	DAT 1	DAT 2	DAT 3	DAT 4	DAT 5	DAT 6
ASCII			STX	-	CR	LF		
BIN/HEX	1000 0000	0010 0100	02	2D	0D	0A	00	00

Reading gate

If these two online commands are sent to the scanner/IDS one after the other, it is equivalent to a reading gate, i.e. at the end of the reading gate ("-" command), the scanner/IDS must transmit a read result to the PROFIBUS master.

Notice!

For space reasons, only 5 of the 10 input words are shown here; the remaining bytes are all occupied with user data.

Before receiving a reading, the input data area looks like:

Input data:

BYTE	0	1	2	3	4	5	6	7	8	9
MODEL	STATUS 0	STATUS 1	DAT 1	DAT 2	DAT 3	DAT 4	DAT 5	DAT 6	DAT 7	DAT 8
ASCII										
BIN/HEX	1000 1100	0000 0000	00	00	00	00	00	00	00	00

After receiving a message, the following data is in the input range:

Input data:

BYTE	0	1	2	3	4	5	6	7	8	9
MODEL	STATUS 0	STATUS 1	DAT 1	DAT 2	DAT 3	DAT 4	DAT 5	DAT 6	DAT 7	DAT 8
ASCII			STX	↑	CR	LF				
BIN/HEX	1000 1100	1100 0100*)	02	18	0D	0A	00	00	00	00

*) On 1110 0100 for 500ms

The BLR status bit has been toggled, DLC contains 04 bytes, the data telegram **STX ↑ CR LF** is in the input data area.

On a valid reading, the (bar)code data of the read code is present beginning at byte 2. If the code is longer than the maximum number of data bytes, bit DEX is also set. This indicates to the master that additional data is still present in the buffer of the MA 4x DP-k.

In this case, the current data must be temporarily relocated to a safe data area and bit R-ACK subsequently toggled. The next data block is thereby transferred out of the buffer by the slave. This process is to be repeated until bit DEX is "0".

Notice!
Toggle bit R-ACK again to overwrite all input data with "00h".

This procedure for sending commands via the serial interface applies in an analogous way for all online commands, whereby the setup of the framing protocol set for the IDS must be taken into account.

7.2.2 Sending long online commands (> 6 bytes) to the Ident system, reading the RS 232 answer from the Ident system
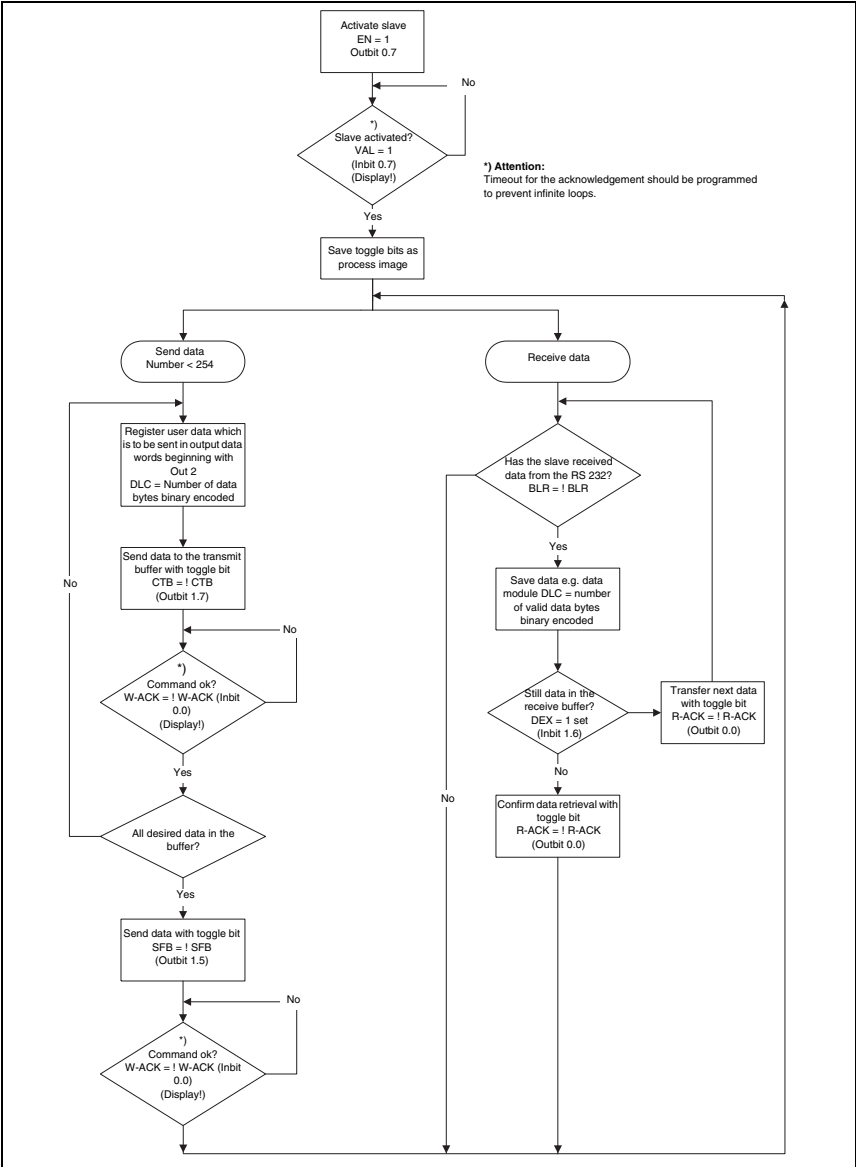
Figure 7.4: Diagram of data transmission with long online commands

The basic telegram structure corresponds to that in the previous example.

Also to be observed is:

- The entire command is divided into transmittable pieces of max. 6 bytes and trans-ferred in the appropriate order with the aid of the CTB bit to the buffer of the MA 4x DP-k.
- The number of bytes to be transmitted is defined by the DLC (Data Length Code) bits.
- The protocol frame STX | Data | CR | LF refers to the entire telegram which is to be transmitted, not to the pieces.

Example:

First transfer with CTB

DLC = 6 bytes ==> 00110, entry, then toggle CTB

	Frame	Command				
Char	STX	P	T	0	0	2
Hex *	02	50	54	30	30	32

Second transfer with CTB

DLC = 6 bytes ==> 00110, next entry, then toggle CTB

	Address			Parameter		
Char	0	0	0	0	1	0
Hex *	30	30	30	30	31	30

Third transfer with CTB

DLC = 3 bytes ==> 00011, next entry, then toggle CTB

	Parameter	Frame				
Char	A	CR	LF			
Hex *	41	0D	0A			

*string to be transmitted

All data is now in the buffer of the MA 4x DP-k. Now toggle bit SFB to transmit the entire telegram to the RS 232. During transmission, the TX-Busy bit (input bit 0.1) is set to "1". Upon conclusion of the process, the W-Ack bit (input bit 0.0) toggles.

A programming example can be found on the Internet at **www.leuze.de -> Download -> Identify -> Modular interfacing units**.

7.3 Specific features for Leuze Ident systems

Detailed information on Leuze Ident systems can be found in the descriptions of the respective device type.

7.3.1 Specific features for the operation of an RFM / RFI in combination with the MA 42 DP-k

The basic telegram structure corresponds to that of the previous examples.

Notice!
*Also note that all characters which are sent to a transponder are **hex-encoded ASCII characters**. Each of these (hexadecimal) characters is, in turn, to be handled as an individual ASCII character and converted to hexadecimal format for transmission via the PROFIBUS.*

Example:

	Frame	Command						Data								Frame	
Plain text for data								T		e		s		t			
Char	STX	W	0	5	0	1	1	5	4	6	5	7	3	7	4	CR	LF
Hex *	02	57	30	35	30	31	31	35	34	36	35	37	33	37	34	0D	0A

7.3.2 Specific features for the BCL 8 on the MA 41 DP-k HS

The BCL 8 is connected to the MA 41 DP-k HS via terminals 1-4 (external RS 232 device). For this purpose, the KB 021 Z connection cable must be removed and cable KB 008-… A or KB 008-… R connected instead according to the following figure. Activation is only possible via online command ("+"), not via Outbit 1 (Outbit 0.2).
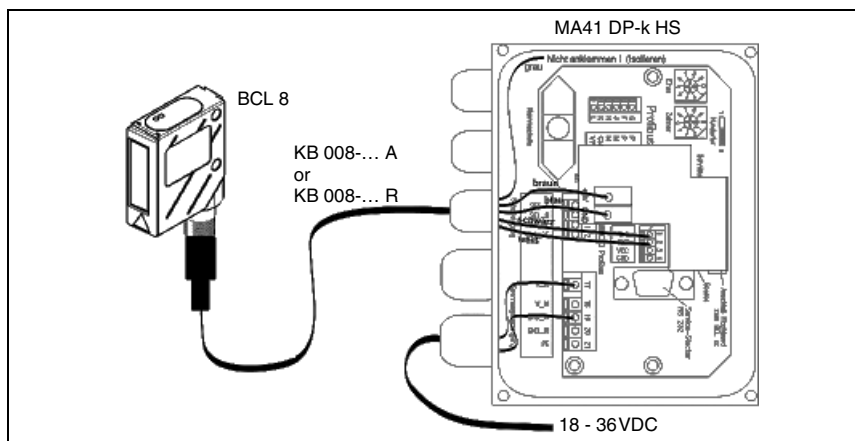
Figure 7.5:   Connection of the BCL 8 to the MA 41 DP-k HS

Pin assignments KB 008-… A or KB 008-… R

Wire colours for BCL 8 with KB 008-… A or KB 008-… R	Signal	Terminal in the MA 41 DP-k HS
white	RXD	2
black	TXD	1
brown	VCC	+5V
blue	GND	GND
grey	PE	21

A special cable is necessary for configuring the BCL 8 via the service interface of the MA 41 DP-k HS (see chapter 4.8 on page 22).

7.3.3 Specific features for the VR 2300 on the MA 42 DP-k

Serial interface COM 1 of the VR **must** be set to 9600 Bd with the VR setup tool. In addition, the trigger mode must be changed from "Free" (continuous reading) to "trigger" or "time-frame".

7.3.4   Specific feature for the use of hand-held scanners (barcode and 2D devices)

7.3.4.1 Cable-connected hand-held scanner on the MA 41 DP-k HS

The following hand-held scanners can be used:

- Z-3080, Z-3070, Z-3071 WA
- IT 3800g, IT 3800i
- IT 4600, IT 4800, IT 4715
- IT 6300

When using the MA 41 DP-k HS, the voltage supply of the hand-held scanner (5 V/at 1 A) can be connected to the interface by means of a cable via the 9-pin Sub-D connector.
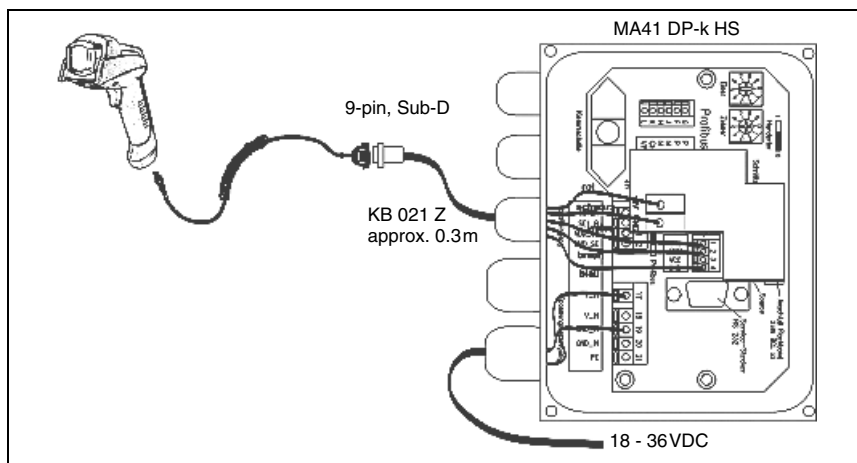
Figure 7.6:   Connection of the hand-held scanner to the MA 41 DP-k HS

Pin assignments of the KB 021 Z (already connected!)

Wire colours for hand-held scanner with KB 021 Z	Signal	Terminal in the MA 41 DP-k HS
brown	RXD	2
white	TXD	1
blue	GND	4
red	VCC	+5V
black	GND	GND
		Not present!

Configuration IT 3800g, IT 3800i

Factory setting

To configure the device, please scan the codes in the specified order. The reading is confirmed by a beep.

RS 232 baud rate:
9600 Bd

Terminal ID

Suffixes
CR/LF

Configuration IT 4600, IT 4800, IT 4715

Connection to MA 41 with standard setting

Configuration IT 6300 DPM or IT 6300 ILR

Factory setting

Return the IT 6300 to the base station so that the settings can be accepted. This procedure is concluded with audible confirmation signals.

To configure the device, please scan the codes in the specified order. The read operation is confirmed by an audible signal from the IT 6300.

Connection to MA 41 with standard setting
RS 232 interface

①

RS 232 baud rate: 9600

②

7.3.4.2 Wireless hand-held scanners on the MA 41 DP-k

The following hand-held scanners can be used:
- IT 3820
- IT 4820
- IT 6320

A 230 VAC connection (socket) is usually necessary for the charging station. Because only one data connection of the read station with the PROFIBUS connection is necessary, the MA 41 DP-k can be used. If necessary, the 9-pin Sub-D cable (KB021Z) can be ordered separately.

In this example, triggering occurs by means of a serial command via the PROFIBUS.
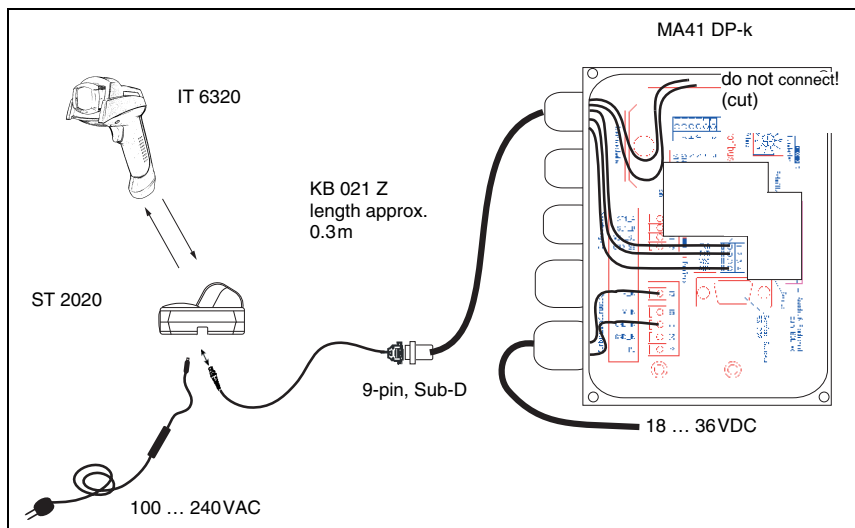
Figure 7.7:   Connection of the wireless hand-held scanner (e.g. IT 6320) to the MA 41 DP-k

Pin assignment KB 021 Z

Wire colours for hand-held scanner with KB 021 Z	Signal	Terminal in the MA 41 DP-k
brown	RXD	2
white	TXD	1
blue	GND	4
red	VCC	✂
black	GND	✂
bare (shield)	PE	21

The following codes for configuring the devices are necessary for these devices as well.

Configuration IT 3820

Factory setting
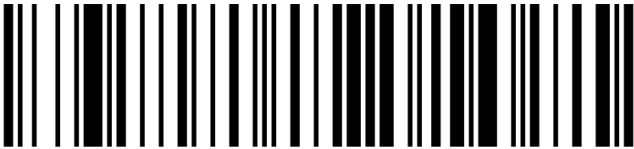
Return the IT 3820 to the base station so that the settings can be accepted. This procedure is concluded with audible confirmation signals.

To configure the device, please scan the codes in the specified order. The reading and reception at the ST 2020 base station are confirmed by a beep.

RS 232 baud rate:
9600 Bd

Terminal ID
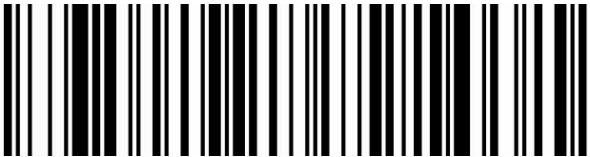
Suffixes
CR/LF

Configuration IT 4820

Connection to MA 41 with standard setting

Return the IT 4820 to the base station so that the settings can be accepted. This procedure is concluded with audible confirmation signals.
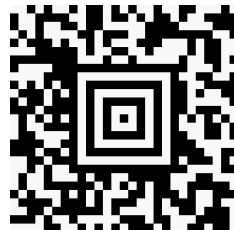
Configuration IT 6320 DPM or IT 6320 ILR

Factory setting

Return the IT 6320 to the base station so that the settings can be accepted. This procedure is concluded with audible confirmation signals.

To configure the device, please scan the codes in the specified order. The read operation is confirmed by an audible signal from the IT 6320.

RS 232 interface

①

RS 232 baud rate: 9600

②

8   Configuring the MA 4x DP-k with "ComPro"

For a customer-specific configuration of the MA 4x DP-k, the "ComPro" software and a boot cable, with which the database stored in the device can be loaded, changed and rebooted in the device, are required.

The "ComPro" software is a DOS program used to perform customer-specific configurations. The program was developed by the Hilscher company for configuring MA 4x DP-k bus slaves. The operation of this program is described in the following chapters.

You can download the "ComPro" configuration software from
www.leuze.de -> Download -> Identify -> Modular interface units.

The following database functions can be changed using "ComPro":

- Change the RS 232 parameters
- Change the input and output widths (data words)
- Change the reset string
- Change the timeout of control bit DNEW

The boot cable is a crossed RS 232 connection cable between PC and service interface which has an additional, connectable bridge between pins 4 and 8 of the 9-pin Sub-D socket that is plugged into the service interface.
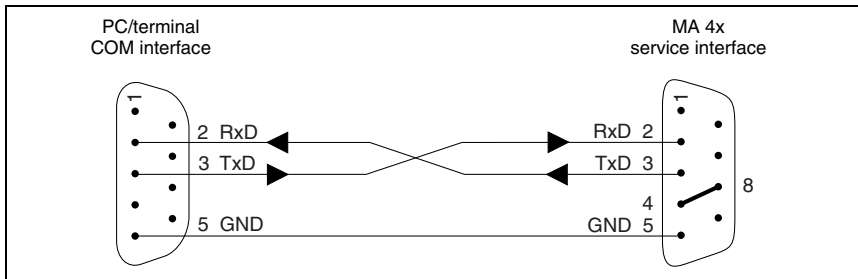
Figure 8.1:   Boot cable for MA 4x DP-k

8.1   Working with the "ComPro" software

The program is started with the "**cprun.bat**" file.
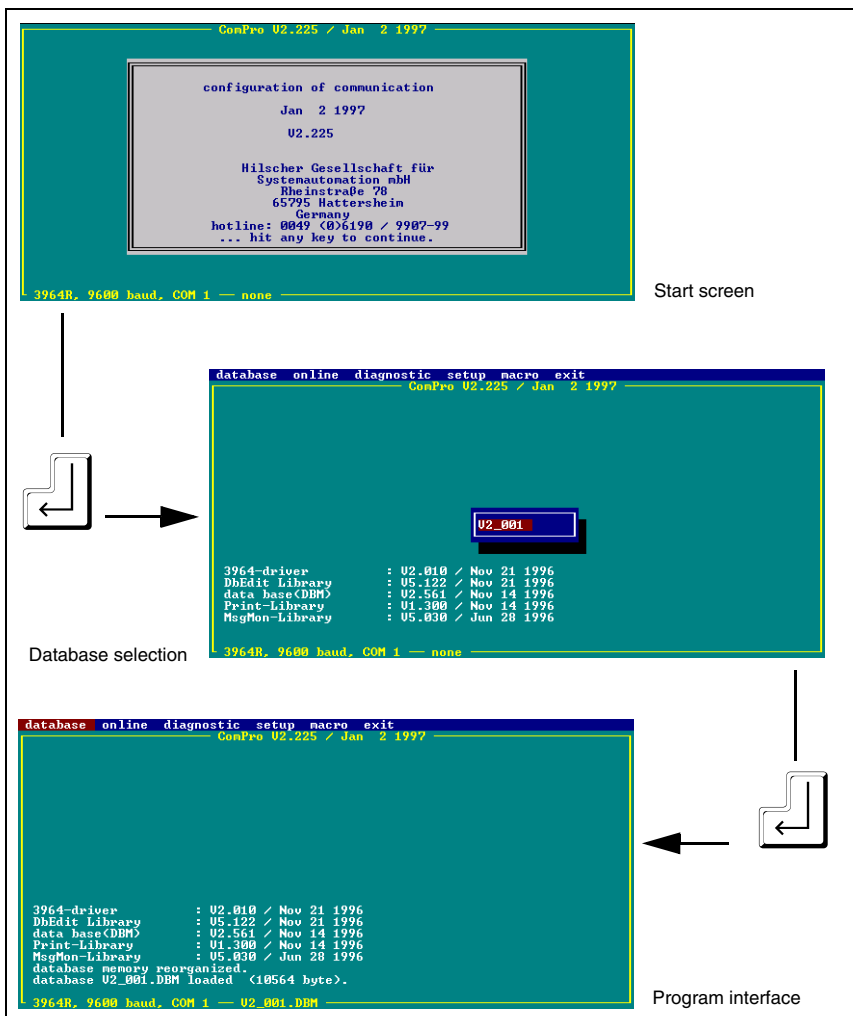
Figure 8.2:   Starting the program

After acknowledging the start window, a selection list appears in which the databases located in the directory are listed by file name. Select the desired file with the arrow keys and acknowledge with ENTER.

○
Ꭵ *Notice!*
This DOS program has no mouse functionality and can only be operated with the keyboard.

Description of the usable keys

↑ ← ↓ →	Arrow keys	Change the menu items
↵	Return (ENTER)	Select menu item
Esc	ESC	Back one level in the menu tree

If additional keys or key combinations are necessary, they are described in the respective menu window.

8.2   Bootstarting the MA 4x DP-k

With the MA 4x DP-k, the database as well as the software are stored on an EEprom. To initialise the writing and reading of the EEprom, a bootstart, as described in the following steps, must be performed.

- Voltage "off".
- Place a bridge between pins 4 and 8 on the service plug or cable (9-pin Sub-D from PC to MA 4x).
- Voltage "on".
- Set service switch to "Service".
- Set operating mode switch to "PROFIBUS".
- Under the **Online → System → Bootstart**
  pull-down menu, the notice "The system will be reset…" appears which can be confirmed with Enter after reading. The Esc key interrupts the process. After confirming, the message "Wait for hardware receipt" (see figure 8.1 on page 74) appears on the screen.
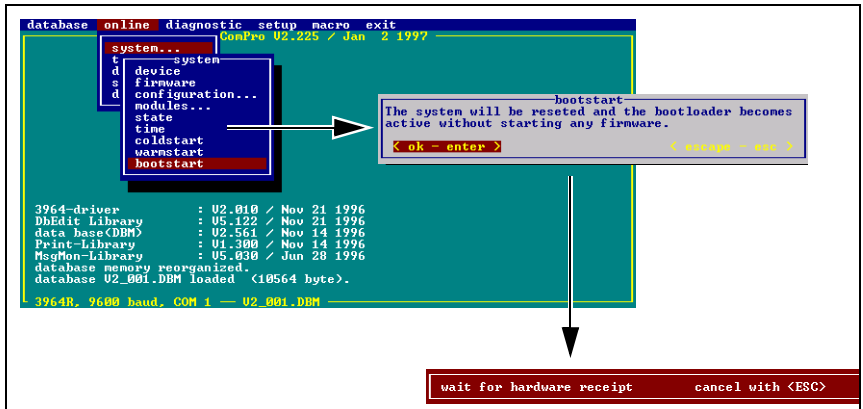
Figure 8.3:   Bootstarting the MA 4x DP-k

- Switch off the MA 4x DP-k.
- Switch the MA 4x DP-k back on.
- The message "Wait for hardware receipt" disappears.

The MA 4x DP-k is now initialised and ready for editing the database contained in the device.

8.3   Working with the database

There are two different ways to select databases:

1. Upload from the MA 4x DP-k
2. Load the database as a file from the PC

8.3.1   Uploading the database stored in the MA 4x DP-k

The database overview appears under the **Online** → **Database** → **Upload**
pull-down menu. Press Enter to confirm this overview and perform the upload.
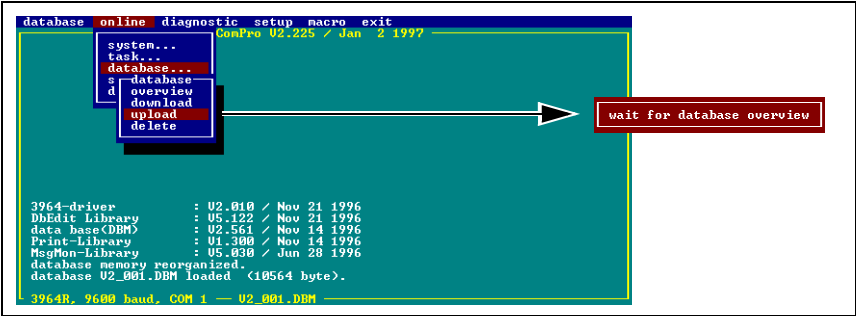
Figure 8.4:　Uploading the database stored in the MA 4x DP-k

8.3.2　Loading the database as a file from the PC

Under the **Database → Load**
pull-down menu, a selection list appears with the databases located in the directory. Select the desired database and confirm with Enter.
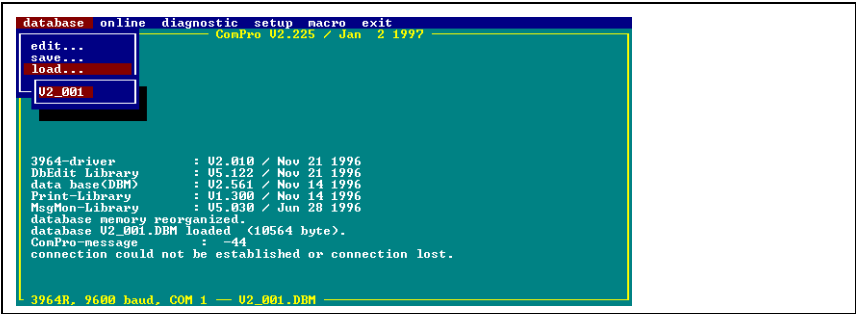
Figure 8.5:　Loading the database as a file from the PC

8.3.3   Editing the database

A menu appears under the **Database** → **Edit**
pull-down menu with the following configurable items:

- Config
- RS 232
- I/O pins
- Modules
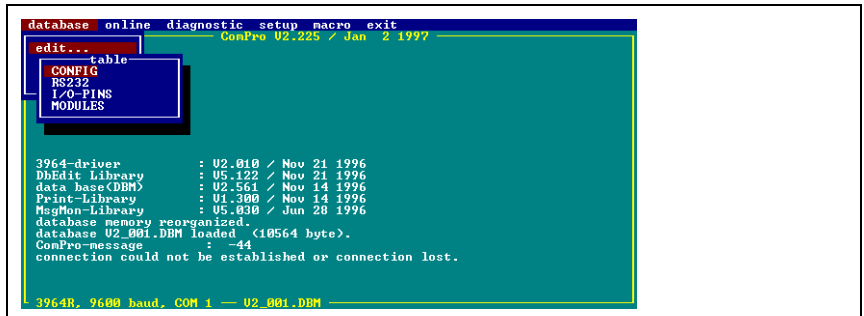
Figure 8.6:   Editing the database

Parameters: The parameters printed in bold are default values

CONFIG
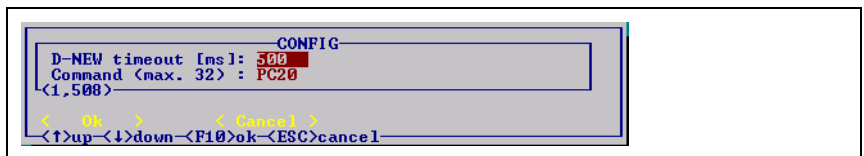
- Timeout time for the DNEW status bit adjustable from 1 to 508 ms
  Default = 500 ms
- Command. Set a maximum of 32 places. Online commands, which can be sent to the
  scanner with the RSTD command bit (bit 0.4), can be entered here.
  Default = PC20

RS 232
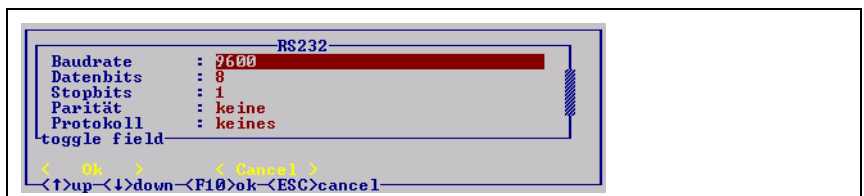
Notice!

Use the spacebar to change the parameters.

- For baud rate, select from 2400 baud, 4800 baud, **9600** baud and 19200 baud.
- For data bits, select from 7 and **8** data bits
- For stop bits, select from 1 and **2** stop bits
- For parity, select from **none**, even and odd
- For protocol, select from **none** and Xon/Xoff

I/O pins
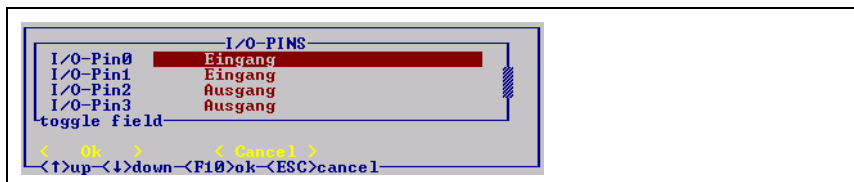
- Assignment of I/O pins - inputs and outputs

Attention

Make no changes to this configuration!

Modules
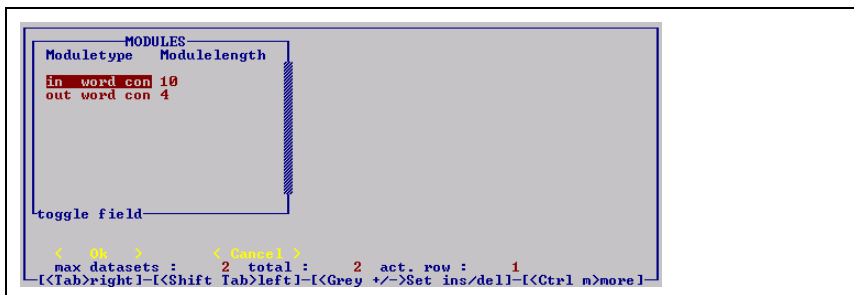
The input and output words can be configured in this input field. The window is divided into two rows and two columns.

Module type	Module length
in word con	10
out word con	4

The cursor functions are described at the bottom of the screen:

move right   =   Tab

move left   =   Shift   Tab

move up   =   ↑

move down   =   ↓

After the cell which is to be changed has been selected, it can be changed using the spacebar.

The following **module types** can be set:

in word con   ⇒   Input module with consistent data transmission
out word con   ⇒   Output module with consistent data transmission
word input   ⇒   Input module without consistency
word output   ⇒   Output module without consistency

The following **module lengths** can be set:

For the input and output modules, the module lengths can be set separately from one another to between 2 and 12 words.
The default values are **10 words of input data** and **4 words of output data**.

8.3.4   Booting database in the MA 4x DP-k

Under the **Online** → **Database** → **Download** pull-down menu, a warning notice appears which can be confirmed with Enter after reading. The download is performed.
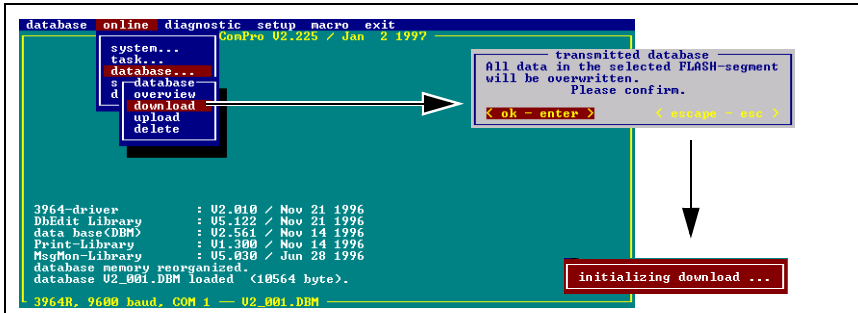
Figure 8.7:   Booting database in the MA 4x DP-k

After the database has been loaded, the device can be returned to the normal operating state.

- To do this, switch off the device
- Remove the bridge from pin 4 to pin 8
- Switch on the device

9 Diagnostics and troubleshooting

If problems should occur during commissioning of the MA 4x DP-k you can refer to the following table. Typical errors and their possible causes are described here as well as tips for their elimination.

Error description	Possible error cause	Measures
Error when switching on		
NET and PWR LED are off	• No voltage supply connected.	❑ Check the voltage supply for correct connection or polarity reversal.
Bus connection cannot be established. **NET** LED on housing is off. **RUN** LED inside the device flashes.	• Bus cable not / not correctly connected.	❑ Check the bus connection for correct connection or polarity reversal.
	• Wrong address set.	❑ Check that the address is set correctly check also the address jumper for addresses exceeding 100.
	• Address has not been activated	❑ After setting or changing addresses, switch the device off and on again.
	• Device has been configured incorrectly in the master (wrong I/O words entered). e.g. consistent and not consistent are mixed up.	❑ Check whether the master is configured with the values set in the MA 4x DP-k.
Bus connection is established the master cannot control or trigger the IDS via the OUT bit of the MA 4x DP-k.	• The service switch is set to Service	❑ Set the service switch to Operation.
	• The jumper connecting terminals 10 and 12 is not set	❑ Check that the jumper is set.
	• MA 41 DP-k is used as a gateway for a Leuze multiNet plus network	❑ This is standard setting OUT bit 1 only affects the directly connected IDS, not the downstream scanner network.
	• 0 bit 0.7 (EN) was not set	❑ Set 0-bit 0.7 (EN) so that communication can be established.
During data transmission, sporadic errors occur	• The last slave has not been terminated	❑ If a MA 4x DP-k is the last slave in the network, the terminating switch must be set to "2".
The RDY LED in the device flashes irregularly	• No database available	❑ Please load the appropriate database in the MA 4x DP-k (see chapter 8).
The control system does not receive data	• The control system cannot process the consistent data	❑ Particularly the Siemens S7 control system can only transmit small amounts of consistent data in this case the modules SFC 14 and 15 have to be integrated into the control program.

Notice!

*Please use **the page 83 as a master copy** should servicing be required.*

Cross the items in the "Measures" column which you have already examined, fill out the following address field and fax both pages together with your service contract to the fax number listed below.

Customer data (please complete) Leuze service fax number: +49 7021 573-199

Device type:	
Company:	
Contact partner / department:	
Phone (direct):	
Fax:	
Street / No:	
ZIP code/City:	
Country:	

10   Type overview and accessories

10.1   Type overview MA 4x DP-k

Part No.	Type designation	Remark
50033637	MA 40 DP-k	Connector unit for PROFIBUS DP with L-cover
50033638	MA 41 DP-k	Connector unit for PROFIBUS DP with flat housing cover
50035298	MA 42 DP-k	Connector unit for PROFIBUS DP with flat housing cover, device connection via system plug
50107512	MA 41 DP-k HS	Connector unit for PROFIBUS DP with flat housing cover, for hand-held scanners and BCL 8

10.2   Accessory mounting devices

Part No.	For …	Type designation	Remark
50027375	MA 40 DP-k	BT 56	Mounting device with dovetail and rod
50027167	MA 40 DP-k	BT 57	Mounting device with screw plate

11 Maintenance

11.1 General maintenance information

The MA 4x DP-k does not require any maintenance by the operator.

11.2 Repairs, servicing

Repairs to the device must only be carried out by the manufacturer.

↳ *Contact your Leuze distributor or service organisation should repairs be required.*
The addresses can be found on the inside of the cover and on the back.

Notice!
When sending devices to Leuze electronic for repair, please provide an accurate description of the error.

11.3 Disassembling, packing, disposing

Repacking

For later reuse, the device is to be packed so that it is protected.
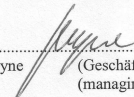
Notice!
Electrical scrap is a special waste product! Observe the locally applicable regulations regarding disposal of the product.

12 Appendix

12.1 EU Declaration of Conformity

⚠ **Leuze electronic**

EG-Konformitätserklärung
EC-Declaration of conformity

Hersteller:
Manufacturer:

    Leuze electronic GmbH + Co KG
    In der Braike 1
    73277 Owen / Teck
    Deutschland

erklärt, unter alleiniger Verantwortung, dass die folgenden Produkte:
declares under its sole responsibility, that the following products:

Gerätebeschreibung:
Description of Product:

    MA 4x DP-k

folgende Richtlinien und Normen entsprechen.
are in conformity with the standards an directives:

Zutreffende EG-Richtlinien:
Applied EC-Directive:

89/336/EWG	EMV-Richtlinie
73/23/EWG	Niederspannungs-Richtlinie

Angewandte harmonisierte Normen:
Applied harmonized standards:

EN 61000-6-2:2001	EMV Fachgrundnormen Störfestigkeit Industie
EN 61000-6-3:2001	EMV-Fachgrundnormen Störaussendung Mischgebiete
EN 61326-1:1997 + A1:1998 + A2:2001	EMV-Anwendernorm Leittechnik
EN 55022:1998 + A1:2000 + A2:2003	EMV-Funkstöreigenschaften ITE-Produkte
EN 55024:1998 + A1:2001 + A2:2003	EMV-Störfestigkeit, ITE-Produkte
EN 61000-4-2:1995 + A1:1998 + A2:2001	Entladung statischer Elektrizität (ESD)
EN 61000-4-3:2002	Hochfrequente elektromagnetischer Felder
EN 61000-4-4:1995	Schnelle transiente elektr. Störgrößen (Brust)
EN 61000-4-6:1996	Leitungsgeführte Störgrößen

Leuze electronic GmbH + Co KG   Owen, den .... *17.01.05* ....
Postfach 11 11
In der Braike 1
73277 Owen / Teck   ....
Deutschland   Michael Heyne (Geschäftsführer)
    (managing director)

12.2   ASCII table

HEX	DEC	CTRL	ABB	DESIGNATION	MEANING
00	0	^@	NUL	NULL	Null
01	1	^A	SOH	START OF HEADING	Start of heading
02	2	^B	STX	START OF TEXT	First character of text
03	3	^C	ETX	END OF TEXT	Last character of text
04	4	^D	EOT	END OF TRANSMISSION	End of transmission
05	5	^E	ENQ	ENQUIRY	Request to transmit data
06	6	^F	ACK	ACKNOWLEDGE	Positive response
07	7	^G	BEL	BELL	Bell symbol
08	8	^H	BS	BACKSPACE	Backspace
09	9	^I	HT	HORIZONTAL TABULATOR	Horizontal tabulator
0A	10	^J	LF	LINE FEED	Line feed
0B	11	^K	VT	VERTICAL TABULATOR	Vertical tabulator
0C	12	^L	FF	FORM FEED	Form feed
0D	13	^M	CR	CARRIAGE RETURN	Carriage return
0E	14	^N	SO	SHIFT OUT	Shift out
0F	15	^O	SI	SHIFT IN	Shift in
10	16	^P	DLE	DATA LINK ESCAPE	Data link escape
11	17	^Q	DC1	DEVICE CONTROL 1 (X-ON)	Device control 1
12	18	^R	DC2	DEVICE CONTROL 2 (TAPE)	Device control 2
13	19	^S	DC3	DEVICE CONTROL 3 (X-OFF)	Device control 3
14	20	^T	DC4	DEVICE CONTROL 4	Device control 4
15	21	^U	NAK	NEGATIVE (/Tape) ACKNOWL-EDGE	Negative acknowledge
16	22	^V	SYN	SYNCRONOUS IDLE	Synchronization
17	23	^W	ETB	END OF TRANSMISSION BLOCK	End of data transmission bloc
18	24	^X	CAN	CANCEL	Cancel
19	25	^Y	EM	END OF MEDIUM	End of medium
1A	26	^Z	SUB	SUBSTITUTE	Substitution
1B	27	^[	ESC	ESCAPE	Escape
1C	28	^\	FS	FILE SEPARATOR	File separator
1D	29	^]	GS	GROUP SEPARATOR	Group separator
1E	30	^^	RS	RECORD SEPARATOR	Record separator

HEX	DEC	CTRL	ABB	DESIGNATION	MEANING
1F	31	^_	US	UNIT SEPARATOR	Unit separator
20	32		SP	SPACE	Space
21	33		!	EXCLAMATION POINT	Exclamation point
22	34		"	QUOTATION MARK	Quotation mark
23	35		#	NUMBER SIGN	Number sign
24	36		$	DOLLAR SIGN	Dollar sign
25	37		%	PERCENT SIGN	Percent sign
26	38		&	AMPERSAND	Ampersand
27	39		'	APOSTROPHE	Apostrophe
28	40		(	OPENING PARENTHESIS	Opening parenthesis
29	41		)	CLOSING PARENTHESIS	Closing parenthesis
2A	42		*	ASTERISK	Asterisk
2B	43		+	PLUS	Plus
2C	44		,	COMMA	Comma
2D	45		-	HYPHEN (MINUS)	Hyphen (minus)
2E	46		.	PERIOD (DECIMAL)	Period (decimal)
2F	47		/	SLANT	Slant
30	48		0		
31	49		1		
32	50		2		
33	51		3		
34	52		4		
35	53		5		
36	54		6		
37	55		7		
38	56		8		
39	57		9		
3A	58		:	COLON	Colon
3B	59		;	SEMI-COLON	Semi-colon
3C	60		<	LESS THAN	Less than
3D	61		=	EQUALS	Equals
3E	62		>	GREATER THAN	Greater than
3F	63		?	QUESTION MARK	Question mark
40	64		@	COMMERCIAL AT	Commercial AT
41	65		A		

HEX	DEC	CTRL	ABB	DESIGNATION	MEANING
42	66		B		
43	67		C		
44	68		D		
45	69		E		
46	70		F		
47	71		G		
48	72		H		
49	73		I		
4A	74		J		
4B	75		K		
4C	76		L		
4D	77		M		
4E	78		N		
4F	79		O		
50	80		P		
51	81		Q		
52	82		R		
53	83		S		
54	84		T		
55	85		U		
56	86		V		
57	87		W		
58	88		X		
59	89		Y		
5A	90		Z		
5B	91		[	OPENING BRACKET	Opening bracket
5C	92		\	REVERSE SLANT	Reverse slant
5D	93		]	CLOSING BRACKET	Closing bracket
5E	94		^	CIRCUMFLEX	Circumflex
5F	95		_	UNDERSCORE	Underscore
60	96		'	GRAVE ACCENT	Grave accent
61	97		a		
62	98		b		
63	99		c		
64	100		d		

HEX	DEC	CTRL	ABB	DESIGNATION	MEANING
65	101		e		
66	102		f		
67	103		g		
68	104		h		
69	105		i		
6A	106		j		
6B	107		k		
6C	108		l		
6D	109		m		
6E	110		n		
6F	111		o		
70	112		p		
71	113		q		
72	114		r		
73	115		s		
74	116		t		
75	117		u		
76	118		v		
77	119		w		
78	120		x		
79	121		y		
7A	122		z		
7B	123		{	OPENING BRACE	Opening brace
7C	124		l	VERTICAL LINE	Vertical line
7D	125		}	CLOSING BRACE	Closing brace
7E	126		~	TILDE	Tilde
7F	127		DEL	DELETE (RUBOUT)	Delete

T

Bit description of the status bytes

Module	Input data	Description	Addr.	Data type	Value range	Default	CR to module
ea 2 –12 words Input consistent	W-ACK	**W**rite-**Ack**nowledge (write confirmation) Toggle bit: Indicates that the data was successfully sent by the PLC to the MA 4x DP-k.	0.0	Bit	0->1: Successfully written 1->0: Successfully written	0	**ak, al, am** (Output, 2-12 words consistent)
eb 2 –12 words Input consistent	TX-BUSY	Transmit is active (data transmission active) Indicates whether data is currently being transmitted by the MA 4x DP-k via the RS 232 to the connected Ident device.	0.1	Bit	0: No transmission 1: Data is being transmitted	0	
ec 2 –12 words Input consistent	IN bit 0	Input bits (no function) Bit permanently set to "1"	0.2	Bit	1	1	
ed 2 –12 words Input consistent	IN bit 1	Input bits (no function) Bit permanently set to "1"	0.3	Bit	1	1	
ee 2 –12 words Input consistent	RBO	**R**eceive **B**uffer **O**verflow (Receive buffer overflow) Indicates that more than 240 bytes of data is present in the receive buffer. Is autom. reset, if receive buffer contains < 200 bytes of data.	0.4	Bit	0->1: Receive buffer > 240 bytes 1 ->0: Receive buffer < 200 bytes	0	**aa** (Output, 2-12 words consistent) **el** (Input, 2-12 words consistent)
ef 2 –12 words Input consistent	TBO	**T**ransmit **B**uffer **O**verflow (Transmit buffer overflow) Indicates that more than 254 bytes of data was written with the CTB bit in the transmit buffer.	0.5	Bit	0->1: Receive buffer > 254 bytes 1 ->0: Receive buffer < 254 bytes	0	**al** (Output, 2-12 words consistent)
eg 2 –12 words Input consistent	ERR	Module/Command **Err**or (Error) Indicates that an impermissible command / parameter was transmitted	0.6	Bit	0: No error 1: Error	0	
eh 2 –12 words Input consistent	VALID	Device Ready (Ready indicator) Indicates that the MA 4x DP-k is ready for data exchange. Is set to "1" if the EN bit in **output byte** 0.7 is set to "1".	0.7	Bit	0: Device not ready 1: Device ready	0	**ah** (Output, 2-12 words consistent)
ei 2 –12 words Input consistent	DLC0 … DLC4	**D**ata **L**ength **C**ode (Number of user data in bytes) Number of transmitted input bytes is entered as hex value in binary format.	1.0 … 1.4	Bit	1h (00001b) … 16h (10110b)	0h (00000b)	**en, eo, ep, eq, er, es** (Input, 2-12 words consistent)
ek 2 –12 words Input consistent	D-NEW	**D**ata **New** in Receive Buffer (receive new data) Indicates the arrival of new data for the length of the set time (default 500ms). Setting is made via the "ComPro" config. software.	1.5	Bit	0: Existing data is older than the set duration 1: Existing data is new	0	**aa** (Output, 2-12 words consistent)
el 2 –12 words Input consistent	DEX	**D**ata **ex**ist (Data in transmit buffer) Indicates that further data is stored in the transmit buffer which is ready for transmission to the control.	1.6	Bit	0: No data in the transmit buffer 1: Further data in the transmit buffer	0	**aa** (Output, 2-12 words consistent)
em 2 –12 words Input consistent	BLR	Next **bl**ock **r**eady to transmit (new block ready) Toggle bit: Indicates whether the MA 4x DP-k has transmitted data from the transmit buffer to the input data area of the PLC.	1.7	Bit	0->1: Data transmitted 1->0: Data transmitted	0	**aa** (Output, 2-12 words consistent)
en 2 –12 words Input consistent 10 words Input consistent Is standard configuration	Data	User information with 2 words length consistent.	2 … 5	Bytes	0 … FFh	00h	**aa** (Output, 2-12 words consistent)