Operating Manual

DF31DP

digiCLIP

HBM

A2172–2.0 en

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Safety information

Appropriate use

The digiCLIP module with connected transducers is to be used exclusively for measurement tasks and directly related control tasks. Use for any purpose other than the above is deemed to be inappropriate.

In the interests of safety, the device should only be operated as described in the Operating Manual. It is also essential to observe the appropriate legal and safety regulations for the application concerned during use. The same applies to the use of accessories.

The device must not be connected directly to the mains supply. The supply voltage must be 18 to 30 V DC.

General dangers of failing to follow the safety instructions

The digiCLIP module is a state of the art unit and as such is failsafe. The device may give rise to further dangers if it is inappropriately installed and operated by untrained personnel.

Any person instructed to carry out installation, commissioning, maintenance or repair of the device must have read and understood the Operating Manual and in particular the technical safety instructions.

Conditions at the place of installation

Protect the device from direct contact with water (IP20).

Maintenance and cleaning

The digiCLIP module is maintenance free. Please note the following points when cleaning the housing:

- Before cleaning, disconnect the device from the power supply.
- Clean the housing with a soft, slightly damp (not wet!) cloth. You should **never** use solvent, since this could damage the labeling on the front panel.
- When cleaning, ensure that no liquid gets into the device or connections.

Remaining dangers

The scope of supply and performance of the digiCLIP covers only a small area of measurement technology. In addition, equipment planners, installers and operators should plan, implement and respond to the safety engineering considerations of measurement technology in such a way as to minimize remaining dangers. Prevailing regulations must be complied with at all times. There must be reference to the remaining dangers connected with measurement technology.
Any risk of remaining dangers when working with digiCLIP is pointed out in this manual by means of the following symbols:

Symbol:  **WARNING**

Meaning: **Dangerous situation**

Warns of a **potentially** dangerous situation in which failure to comply with safety requirements **can** lead to death or serious physical injury.

Symbol:  **CAUTION**

Meaning: **Potentially dangerous situation**

Warns of a **potentially** dangerous situation in which failure to comply with safety requirements **could** lead to damage to property and slight or moderate physical injury.

Symbol:  **NOTE**

Means that important information about the product or its handling is being given.

Symbol: CE

Meaning: **CE mark**

The CE mark enables the manufacturer to guarantee that the product complies with the requirements of the relevant EC directives (the Declaration of Conformity can be found at http://www.hbm.com/HBMdoc).

Working safely

Error messages should only be acknowledged once the cause of the error is removed and no further danger exists.

The device complies with the safety requirements of DIN EN 61010 Part 1 (VDE 0411 Part 1).

To ensure adequate immunity from interference, use only the *Greenline* shielding concept (place the shield of the transducer cable onto the connection provided for the purpose).

The digiCLIP module must be operated with a separated extra-low voltage (supply voltage 18 to 30 V DC). The supply voltage lead must be no more than 3 m long. **Connecting to a direct voltage network in accordance with EN 61326 is not permitted.** Instead you must use a power pack mounted, for example, in the control cabinet, together with the digiCLIP modules.

CAUTION

This is a Class A unit. This unit can cause radio interference in living areas. In this case, the operator may be requested to implement appropriate measures.

Conversions and Modifications

The digiCLIP module must not be modified from the design or safety engineering point of view except with our express agreement. Any modification shall exclude all liability on our part for any damage resulting therefrom.

In particular, any repair or soldering work on motherboards is prohibited. When exchanging complete modules, use only original parts from HBM.

Qualified personnel

This device is only to be installed and used by qualified personnel, strictly in accordance with the specifications and the stated safety rules and regulations. It is also essential to observe the appropriate legal and safety regulations for the application concerned during use. The same applies to the use of accessories.

Qualified personnel means persons entrusted with the installation, assembly, commissioning and operation of the product, who possess the appropriate qualifications for their function.

Maintenance and repair work on an open device with the power on must only be carried out by trained personnel who are aware of the dangers involved. During installation and operation, operating personnel must act in accordance with the electrostatic discharge safety measures.

1 Introduction

1.1 Scope of supply and accessories

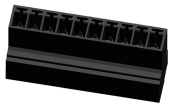
Scope of supply:

- 1 digiCLIP module — Order No.: 1−DF31DP
- Coded plug connector for sensor connection — Order no.: 3−3312.0404
- Plug-in terminal for PROFIBUS and Supply voltage — Combicon Order No.: CR−MSTB
- Coded plug connector for digital IN/OUT (2 pieces)
  - 24 V / 0 V — Order No.: 3−3312.0418
  - IN / OUT — Order No.: 3−3312.0444
- digiCLIP Operating Manual

CD−ROM with free setup software (digiCLIP Assistant); (the latest Assistant can be downloaded free of charge under http://www.hbm.com/support)

Accessories:

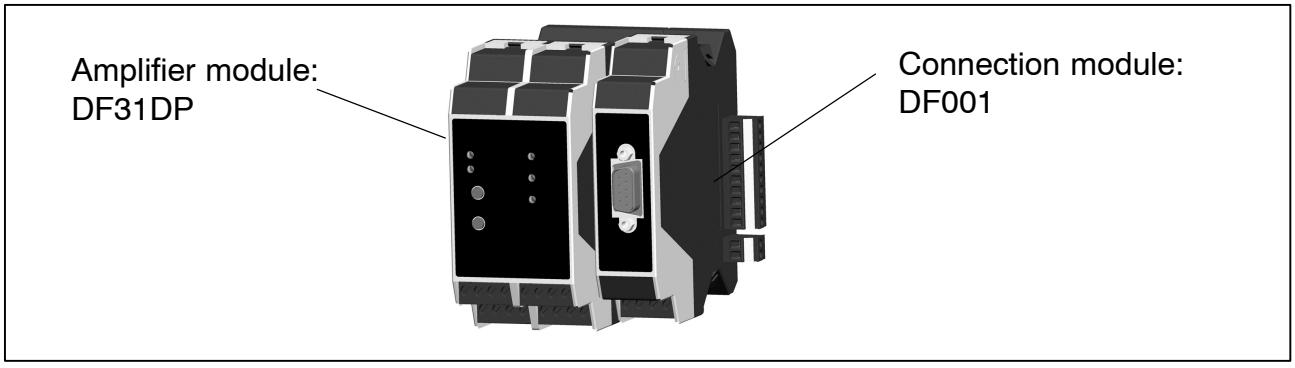
- 1 connector set: Order No.: 1−digiCLIP−ST

  containing 1 ”PROFIBUS” connector terminal  and

  1 male and 1 female connector for ”synchronization” 

  (needed for two-tier installation in the control cabinet)

- Connection module for frontal assignment of the rear terminal strip (bus and power supply) — Order no.:1−DF001



1.2 General

The DF31DP module from the digiCLIP product line is a carrier-frequency amplifier suitable for connecting force transducers, pressure transducers, torque transducers and load cells.

The DF31DP module is set up and parameterized by means of the digiCLIP Setup Assistant and a simple interface under MS–Windows.

The Setup Assistant also provides extensive Online Help, with descriptions of all the functions and many tips for the DF31DP.

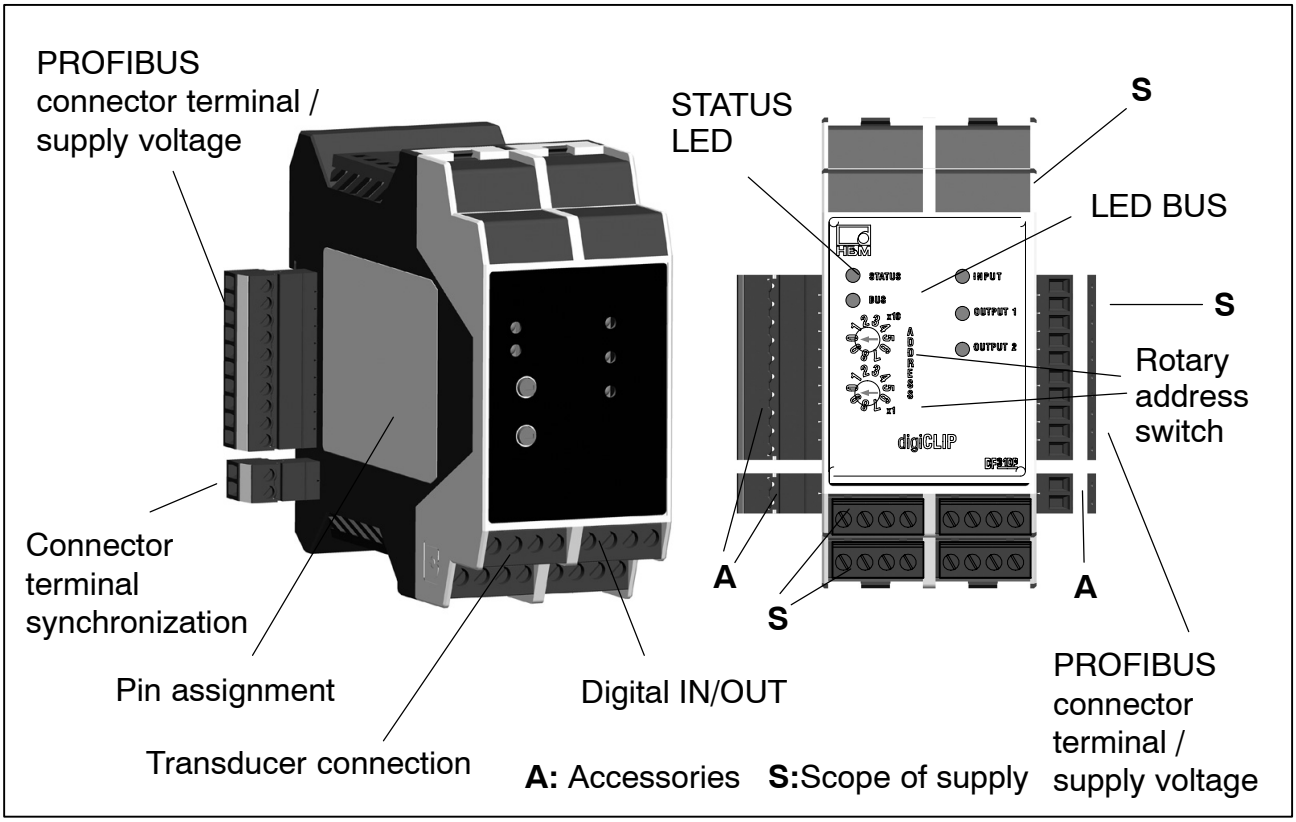


Fig.1.1: digiCLIP module

2 Installation

The modules are mounted on support rails in accordance with DIN EN 60715 by hooking on the top edge and engaging the spring plate at the bottom edge.

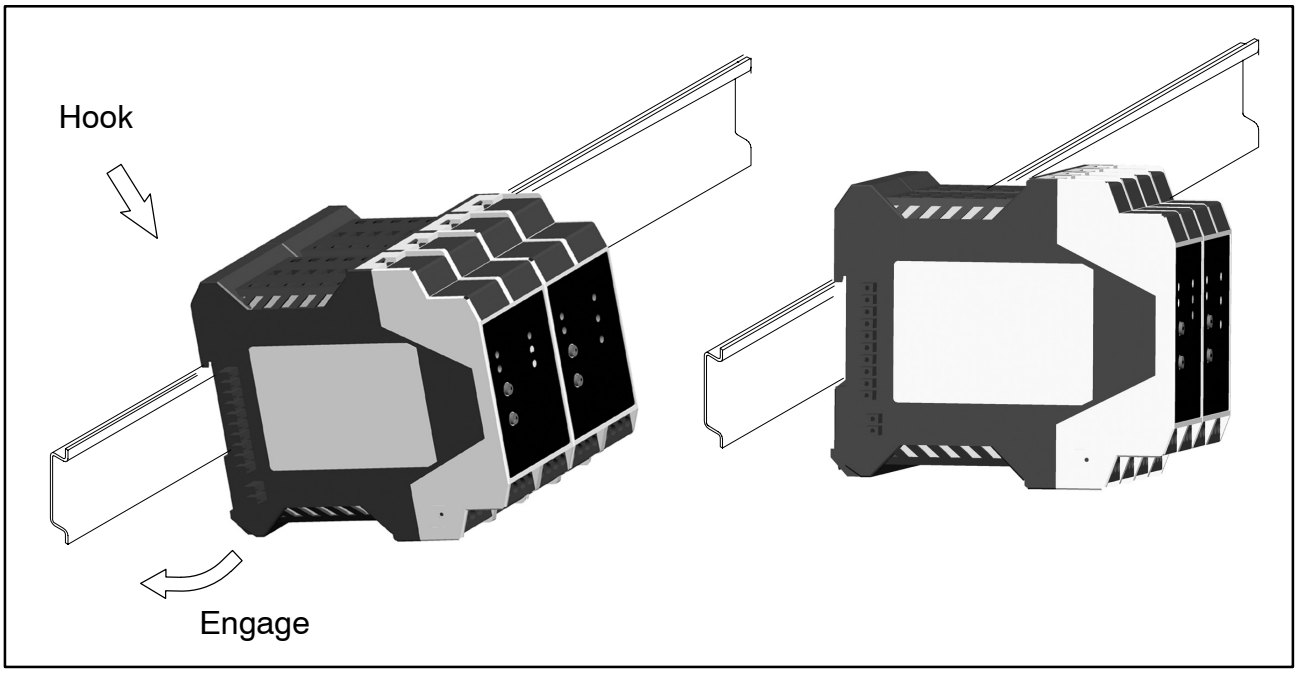


Fig.2.1 Mounting on a support rail

To remove, press down on the spring plate with a screwdriver and detach the housing.

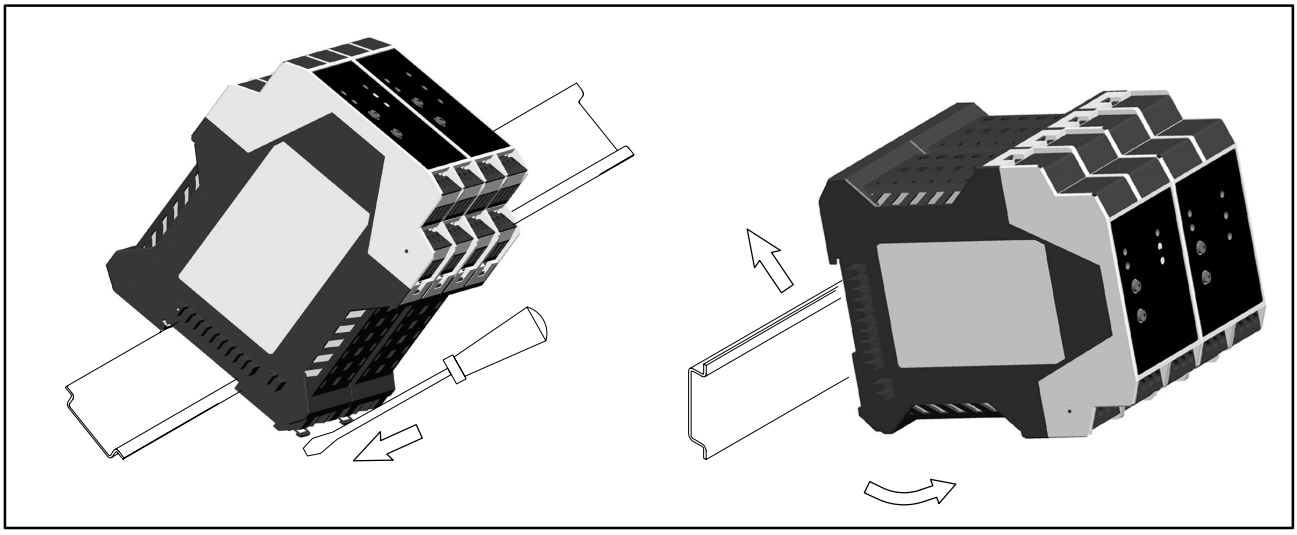


Fig.2.2: Removal

CAUTION

The support rail should be connected to grounded conductor potential .

Several modules can simply be intermated. The rear multipoint connector with internal wiring makes the local connection for supply voltage, PROFIBUS and synchronization.

Interconnecting several modules:

- Intermate modules 1, 2 and 3
- When mounting at several levels: mate the SYNC–OUT connector to module 3 (see Fig.2.4 and Fig.3.4) and connect to SYNC–IN of the first module of the next level

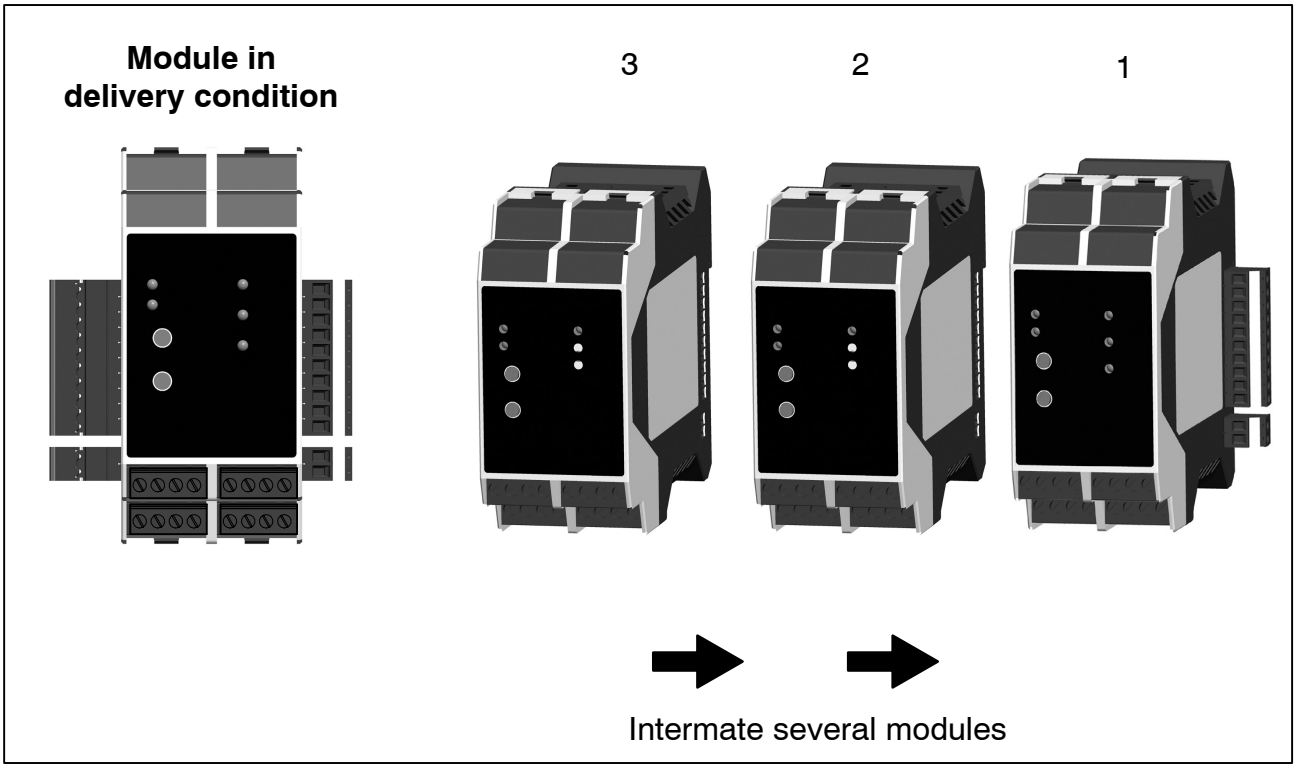


Fig.2.3 Module installation

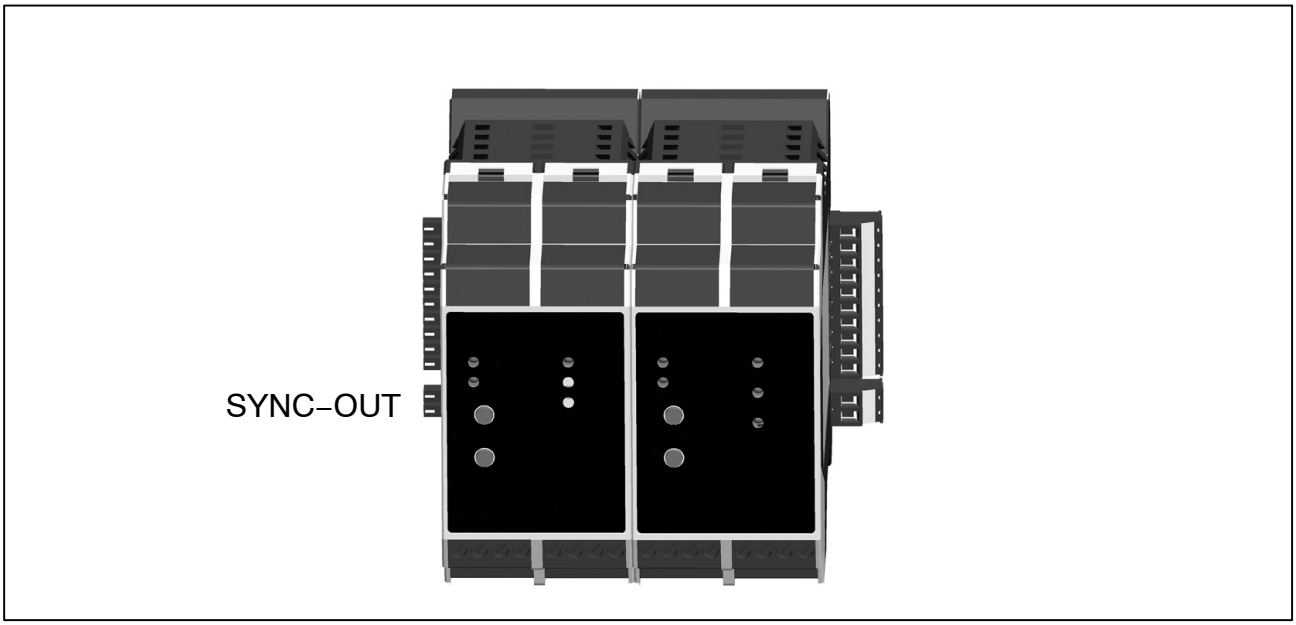


Fig.2.4: Modules mounted side-by-side

3 Electrical connection

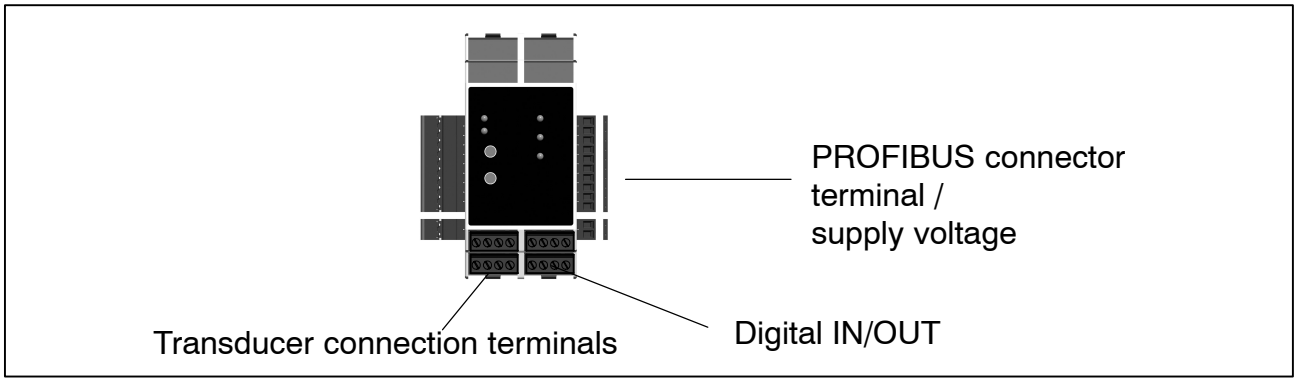
Transducers can be connected to the module in a strain gage full-bridge circuit.

The transducers are connected via 2 screw terminals on the front. Use the strain relief provided. The shield of the transducer cable must make contact over a large area. The clamping area is 0.2 mm^2 to 3.3 mm^2.

If several conductors are to be connected to a terminal, the line cross-section must be adapted accordingly.

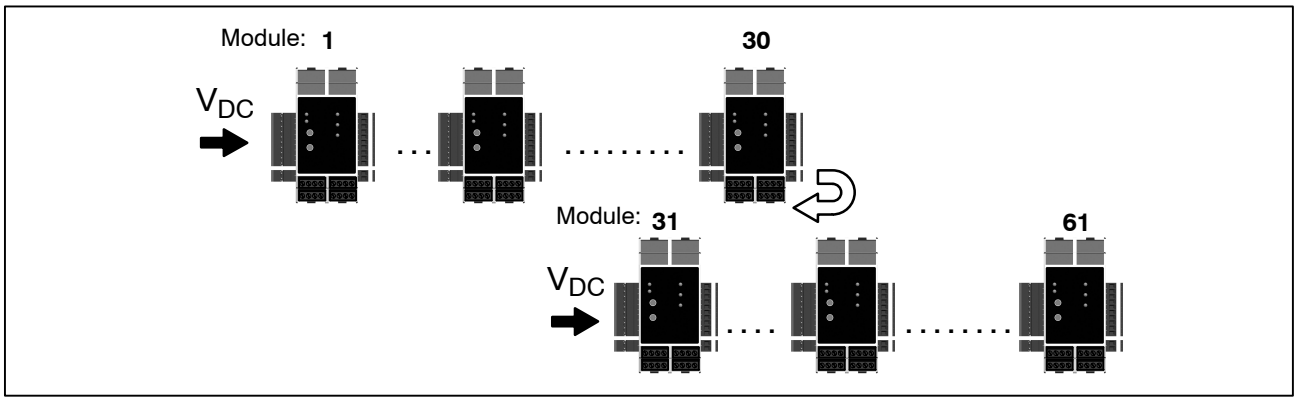
The Profibus and the power supply can be connected via the 10−pin terminal strip at the side, or via an adapter module. The clamping area is 0.05 mm^2 to 2 mm^2.

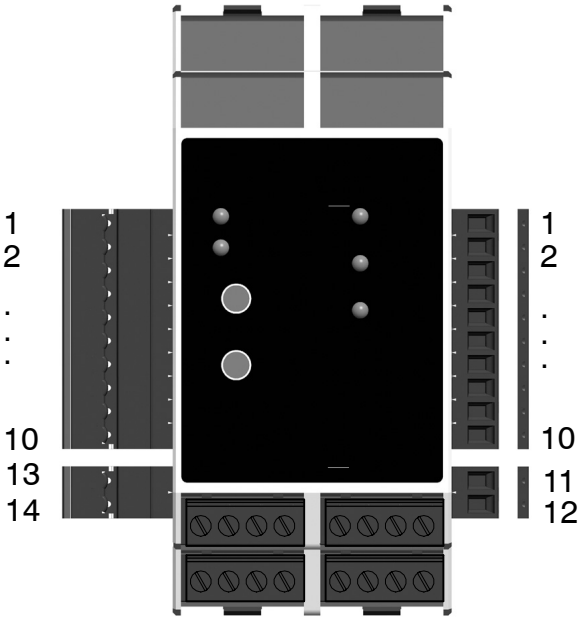
End sleeves (without plastic collars, length 10 mm) should be used on the strands to connect the wires to the terminals.



NOTE

To ensure that the electric load-carrying capacity of the plug terminals is not exceeded, a maximum of 30 modules can be intermated when **one** voltage source is connected.
If there are more than 30 modules, the series must be split and an **additional** voltage source connected.





NOTE

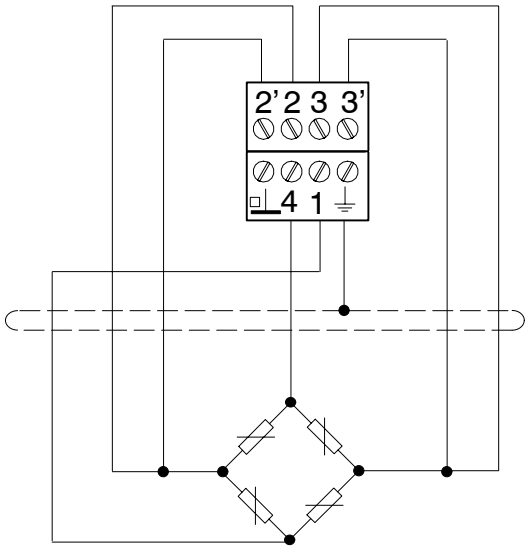
The Reserve connections must have nothing connected to them.

Assignment

PIN

1	Reserve
2	CNTR–P
3	Reserve
4	VP
5	DGND
6	LINE_A
7	LINE–B
8	⏚
9	+24V
10	0V
11	SYNC IN +
12	SYNC IN –
13	SYNC OUT +
14	SYNC OUT–

Labeling



NOTE

The DGND terminal (Pin 5) does not correspond to the ground potential of the amplifier ⏚, however, it corresponds to the ground potential of the Profibus.

Terminal markings on the transducer connection terminals (view from below)

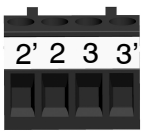


Fig.3.1: Plug-in terminal assignment (single-shielded cable)

Terminal	**Function**	**Color** (HBM cable)
1	Measurement signal (+)	WH (white)
2	Excitation voltage (–)	BK (black)
2'	Sense lead (–)	GY (gray)
3	Excitation voltage (+)	BU (blue)
3'	Sense lead (+)	GN (green)
4	Measurement signal (–)	RD (red)
⏚	Cable shield / grounding	

Transducer connection in six-wire configuration

The transducer connection terminals are coded with coding tabs to prevent confusion when attaching them to the female connectors.

Six-wire circuitry is used for connection (with two sense leads).

NOTE

With double-shielded cables, the inner shield is connected to ground, the outer shield to the housing connection.

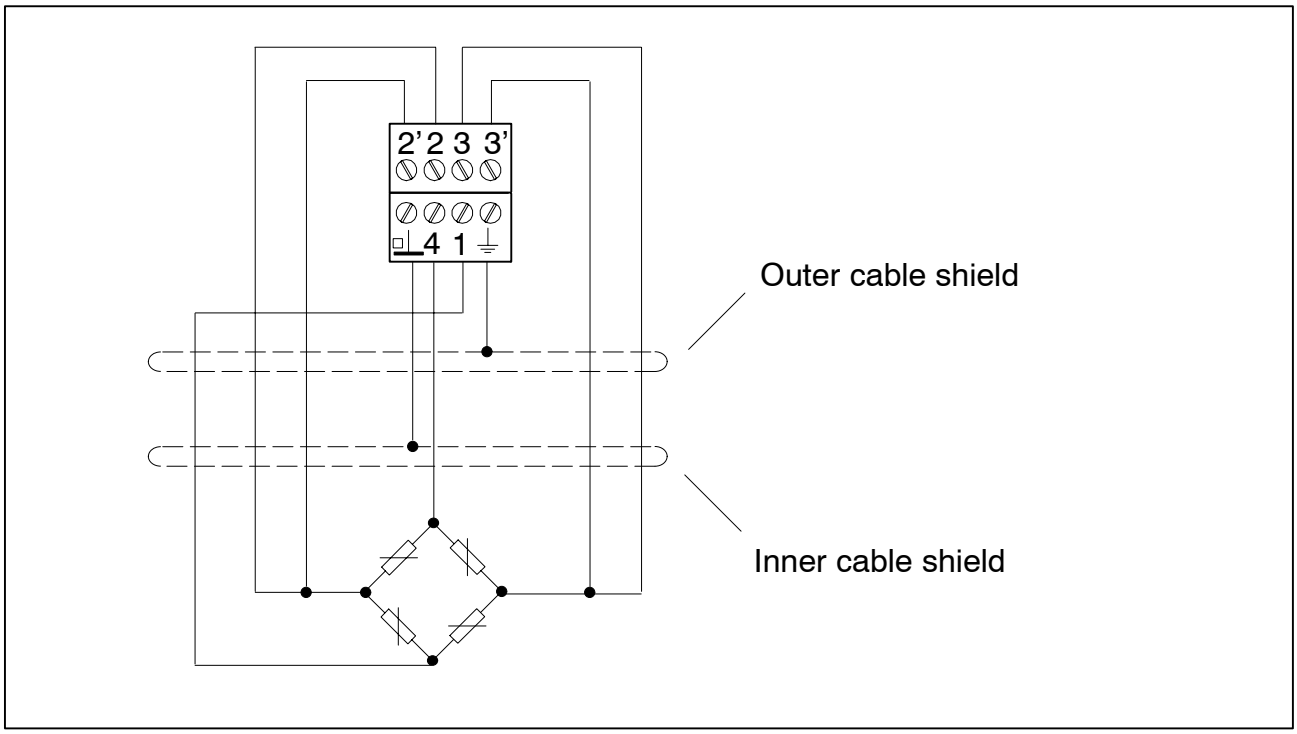


Fig.3.2: Transducer connection in six–wire configuration

Transducer connection in four-wire configuration

When connecting in four-wire circuitry, the connections for long lead compensation are missing. So line influences have to be calibrated in. This can be done by the digiCLIP Assistant in the ”2–point scaling” range.

When connecting in four-wire circuitry, TEDS functionality is not available.

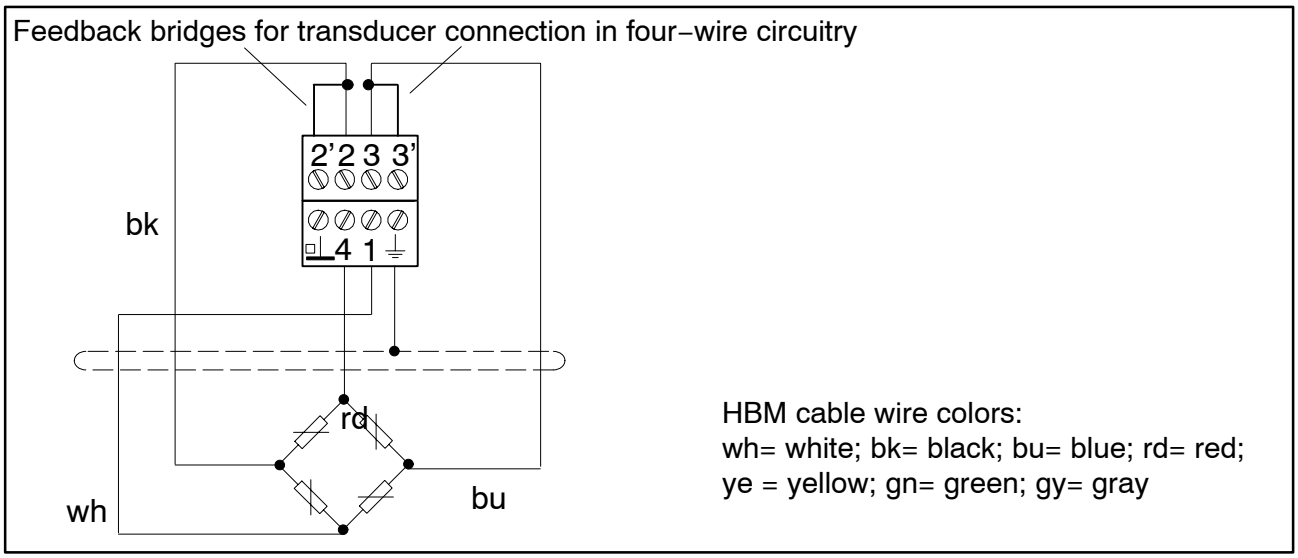


Fig.3.3: Four−wire connection with feedback bridges

When connecting a transducer in four-wire circuitry, the sense leads must be connected to the relevant bridge excitation line (PIN 2’−2 and Pin 3’−3) by jumpers, as otherwise a sensor error will be detected.

NOTE

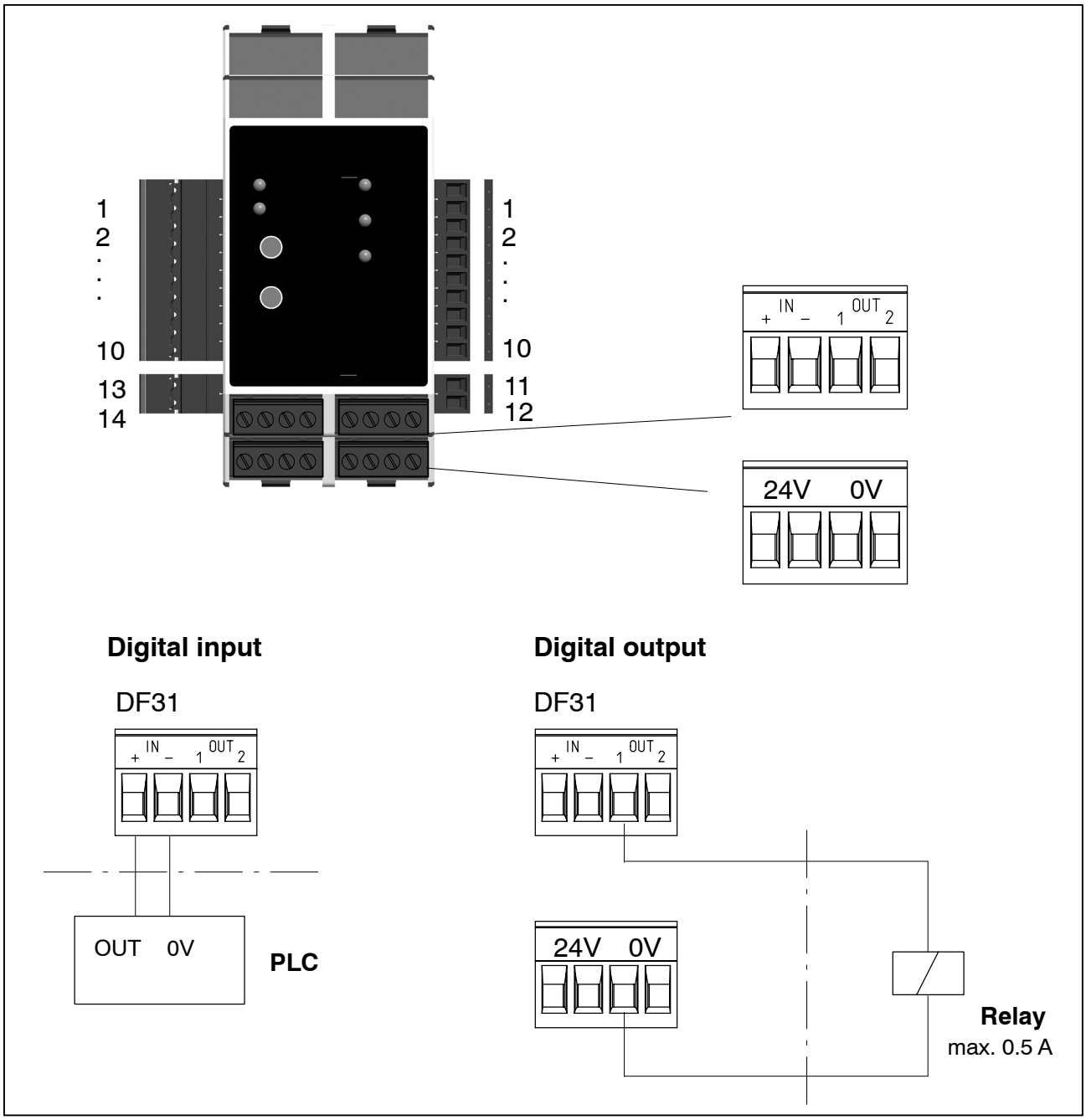
Use standard HBM cables for connecting the transducers. When using other shielded, low-capacitance measurement cables, attach the shield of the transducer cable to the cable shield connection in accordance with HBM Greenline information. The power supply for the digiCLIP modules must not come from a direct voltage network. We recommend a local voltage supply, in the control cabinet.

Connect the shield of the particular transducer cable via as short a lead as possible (< 5 cm). Alternatively, you can use the supplied cable holder, that also acts as strain relief. This ensures EMC protection.

Please also note:

- **When connecting the leads, measures need to be taken to prevent electrostatic discharge.**
- **The relevant connection diagram is printed on the side of the housing.**
- **digiCLIP modules are designed for installation in enclosed, metal housings (such as a control cabinet); however, they can be operated without any additional housing.**

3.1 Connecting the digital I/O



The frontal terminals ”24V” are connected to the side bus terminals ”+24V” (Pin 9). The frontal terminals ”0V” are connected to the side bus terminals ”0V” (Pin 10).

3.2 Operation with Zener barriers

To operate transducers in potentially explosive atmospheres, intrinsically safe measurement circuits (Ex II (1) GD, [EEx ia]IIC) must be set up on the digiCLIP by connecting safety barriers (Zener barriers) type SD01A. The safety barriers must also be mounted on the DIN rail like the digiCLIP modules. An ATEX test certificate must be available for the transducers used.

When operating with Zener barriers, the excitation voltage at the digiCLIP must be set to 1 V. This can be implemented using the digiCLIP Assistant in the menu ”Transducer – excitation voltage”. Further information on layouts, assembly and operation of the safety barriers can be found in the SD01A documentation.

NOTE

The TEDS transducer identification is not available for operations with Zener barriers. Operation with cable lengths >100m and transducer resistances < 80 Ohm is not permitted.

3.3 Synchronization of the carrier frequency

The first device (starting from the right) is used as the master when synchronizing. All the subsequent modules are automatically set as slaves and work at the carrier frequency of the first module. Should the connection between the modules be interrupted, the first module after the interruption is automatically set as the master and synchronizes the subsequent modules.

If the modules are divided among several rails, use the 2−pin synchronization connectors, 1−digiCLIP−ST; (see Fig.3.4).

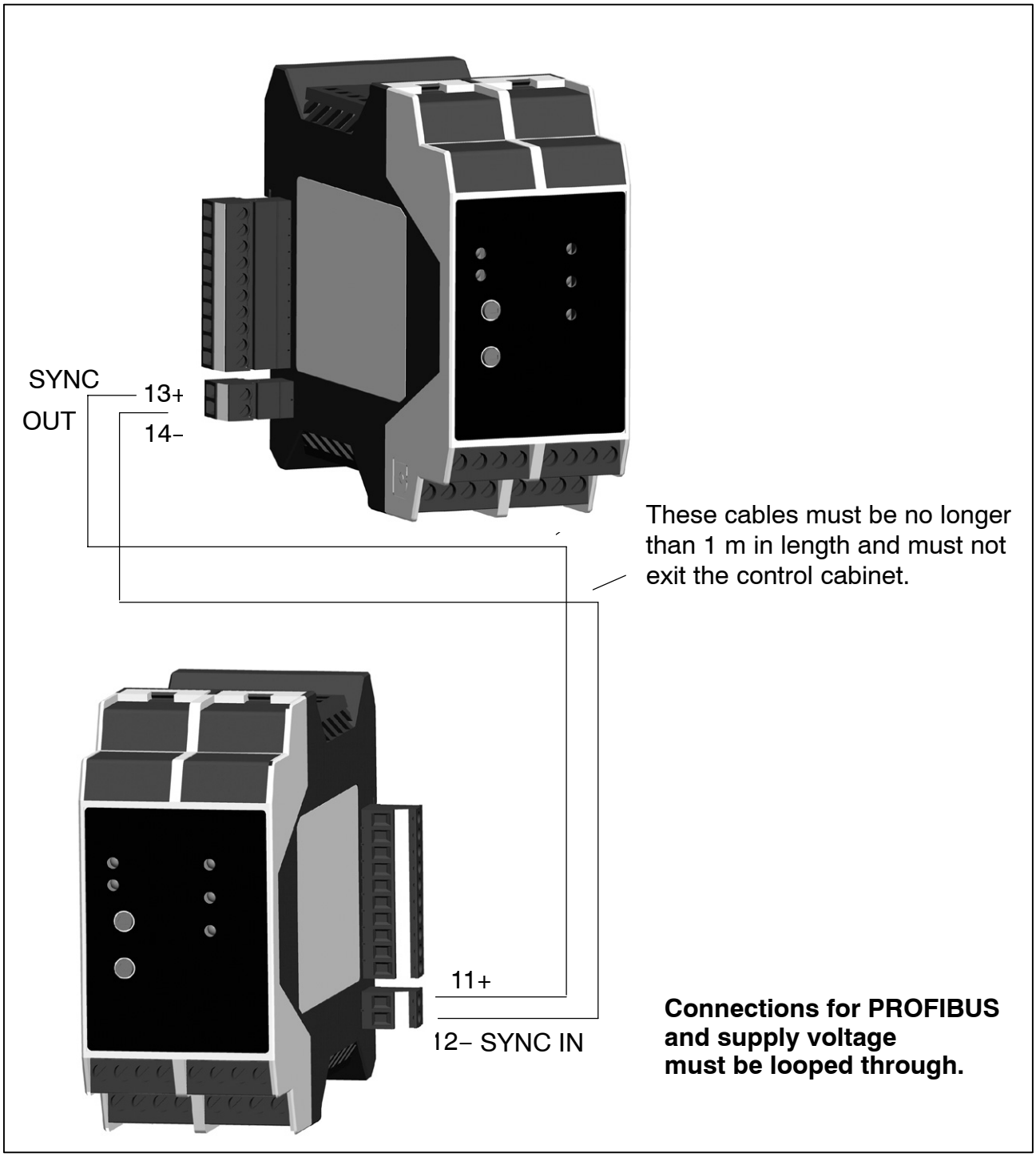


Fig.3.4: Mounting at several levels

Synchronizing:

Synchronization is advisable for transducers with carrier frequency excitation when

- the transducer cables of several devices run side by side
- the measuring points are unshielded and are close together

Synchronization prevents differences in the carrier frequency causing disturbing superpositions. A maximum of 97 modules can be interconnected.

3.4 Profibus installation

The Profibus system is cabled in a bus topology (linear or tree structure) with active termination resistors at the start and at the end. Stub lines should be avoided if possible at bit rates faster than 1.5 Mbit/s. The cable should be run as a shielded, twisted-pair cable, and should have an impedance of 150 ohm and a resistance of 110 ohm/km. Data is transmitted by the Line-A and Line-B signals, with a common GND as the data ground. There is also the option to incorporate a 24-volt supply voltage.

Located on the front of the DF001 connection module is a 9−pin D−Sub connection socket for the PROFIBUS connection. As an alternative, the PROFIBUS connection can also be made via the 10−pin connector terminal at the side.

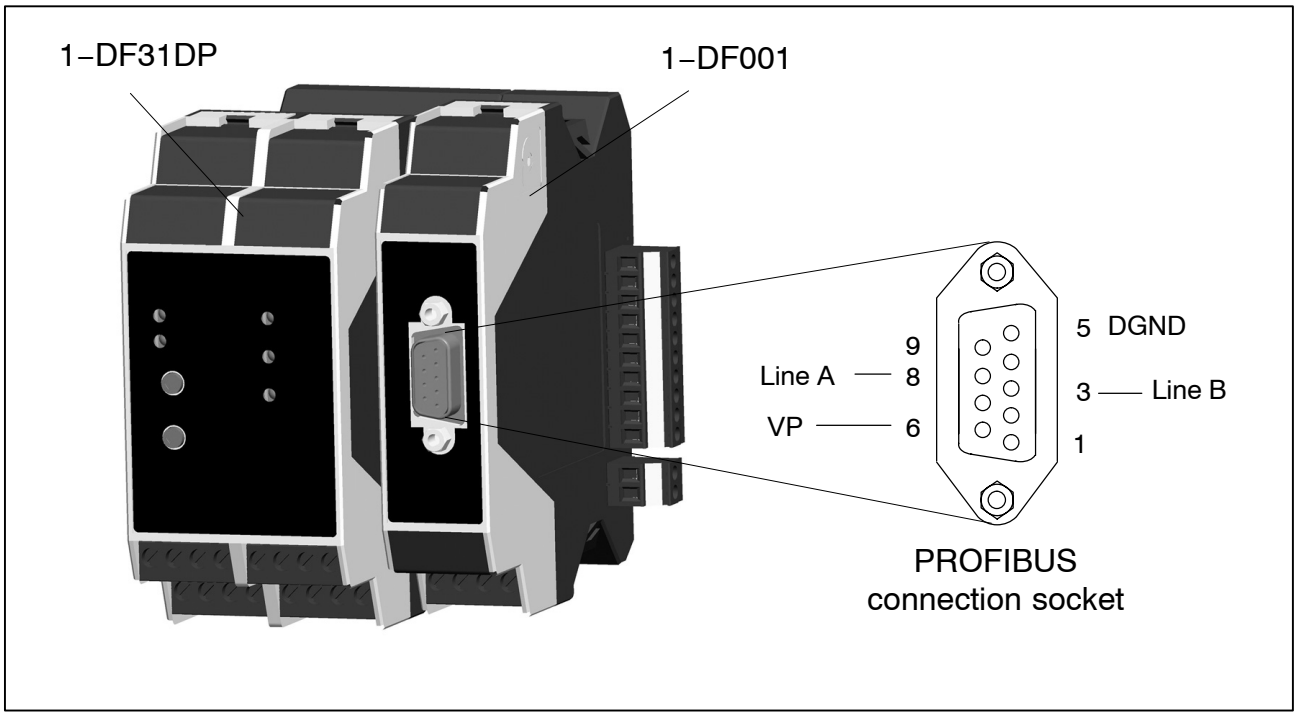


Fig.3.5: PROFIBUS-connector (9−pin sub−D connection socket)

Please note that there is a termination resistor connected to the first and last PROFIBUS nodes (there is usually a slide switch for this on the housing of the PROFIBUS connector).

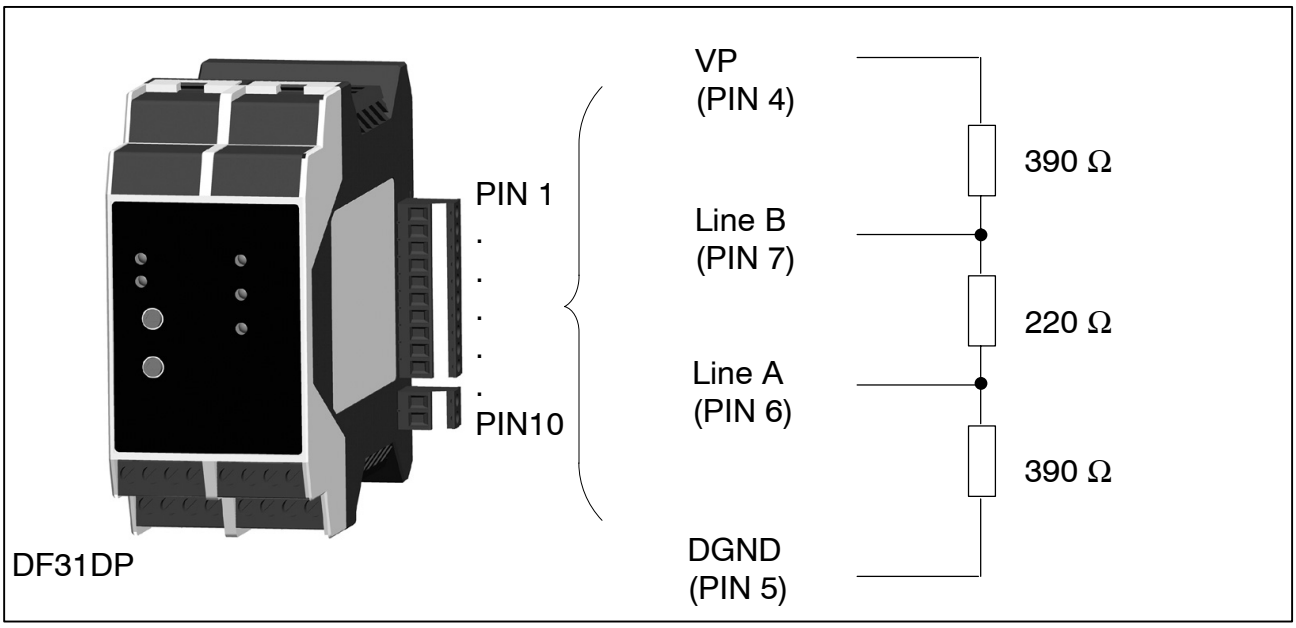


Fig.3.6: Connect the termination resistor, 10−pin side multipoint connector (without DF001 module)

Example:

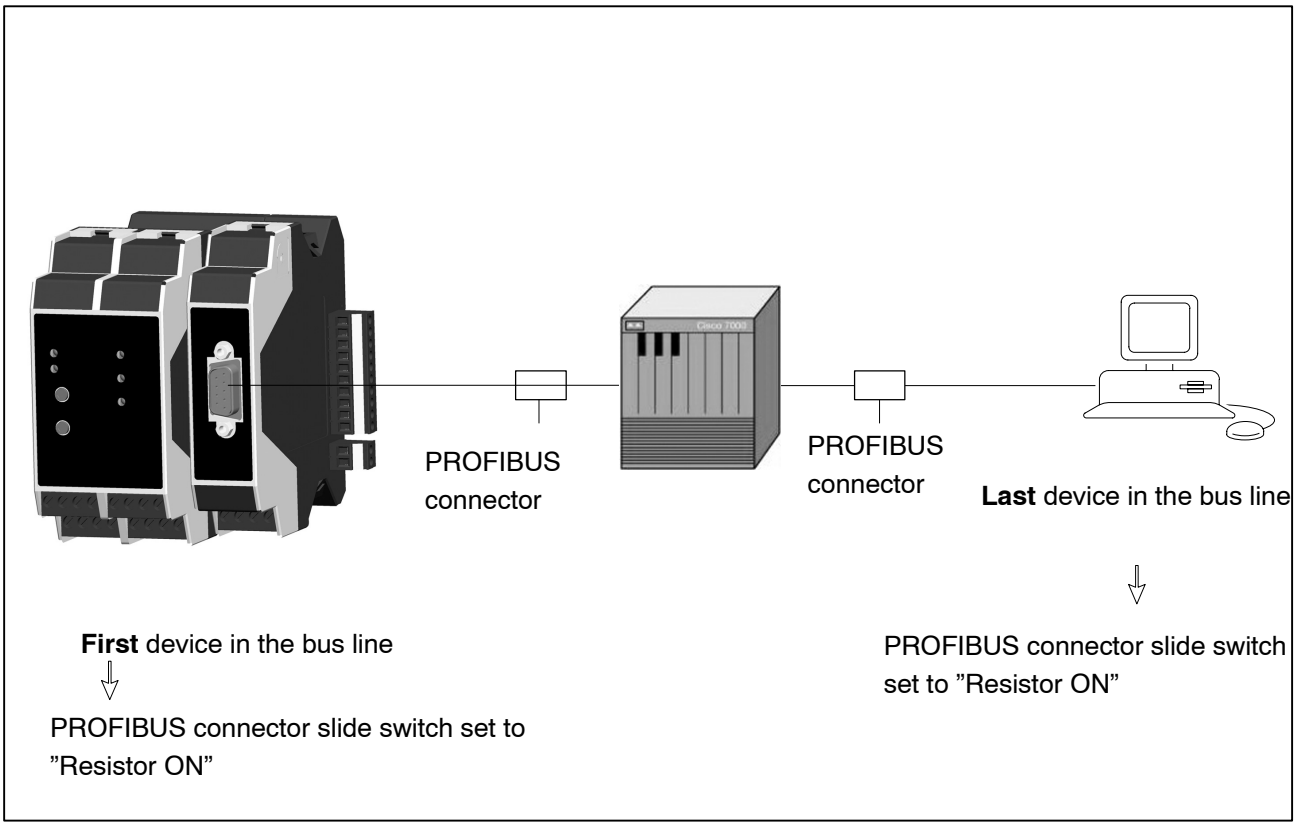


Fig.3.7: PROFIBUS operation

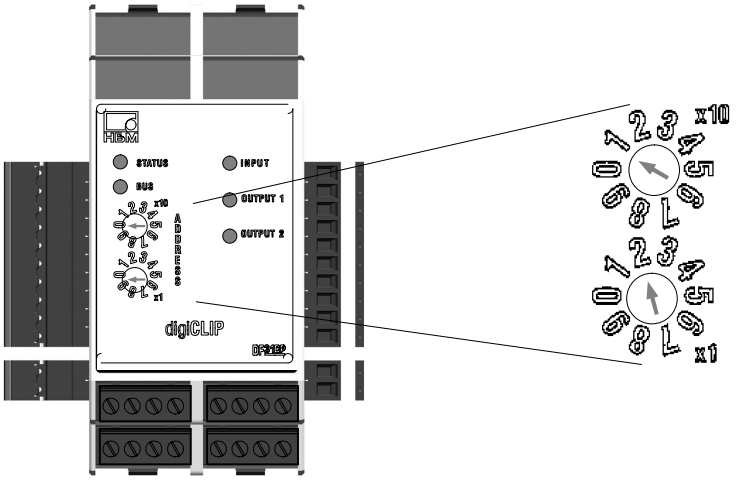
A maximum of 32 nodes can be connected in a Profibus DP segment. Using repeaters, a maximum of 126 can be operated in a DP network. The transmission speed can be adjusted in specified steps in the 9.6 kbit/s to 12 Mbit/s range. The length of a Profinet DP network depends on the transmission speed, and is shown in the table below.

The cable length of each segment depends on the transmission rate:

Cable length (m)	Transmission rate
1200	max. 93.75 kbit/s
1000	187.5 kbit/s
400	500 kbit/s
200	1.5 Mbit/s
100	12 Mbit/s

3.5 Selecting the module address

Address 3 to address 99 can be set as the module address.



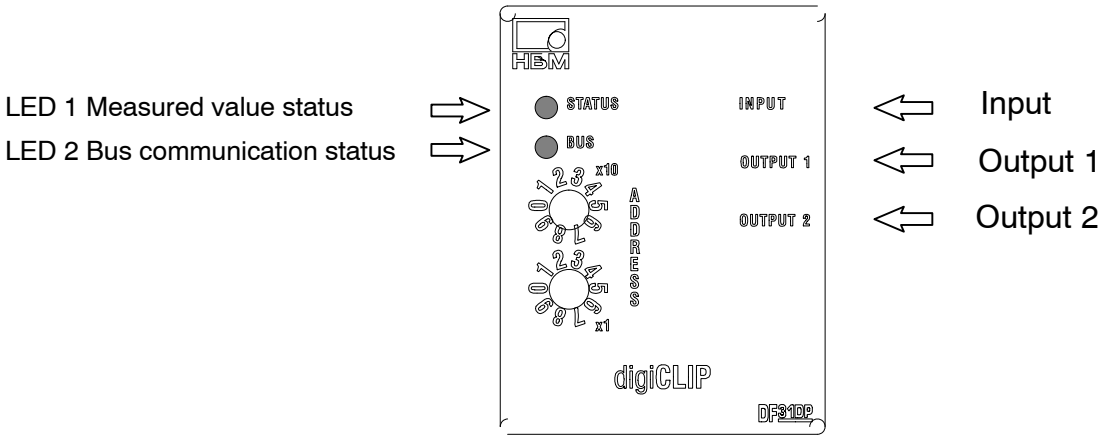
Example:

Address 12 is set

3.6 Automatic bit rate detection

The Profibus devices of the digiCLIP device series all support automatic bit rate detection up to a transmission speed of 12 Mbit.

3.7 Display LED status, error messages



When the device is activated, the LEDs indicate the following states:

STATUS LED (top): Measured value status	
Green	No error, normal operation, measured values valid.
Flashing green	No error, normal operation. However, the amplifier does not acquire the transducer signal, it acquires the internal reference signals
Orange	No error, normal operation, measured values valid, but out-of-range or limit value switch active.
Red	Error, measured values invalid. As there could be a number of different causes, you should use Device → Show device status, in the digiCLIP Assistant to call the status window and evaluate the detailed displays that are shown there.

BUS LED (bottom): Communication status	
Green	No error at the interface, normal operation. Real-time data exchange is active.
Orange	No error at the interface, normal operation. Real-time data exchange is not active.
Flickering orange-dark or green-dark	No error at the interface, normal operation with data traffic on the PROFI-BUS
Flashing orange-red	Automatic bit rate detection is running; should this status continue, check the bus termination.
Red	Error on the PROFIBUS, the digiCLIP is not working.

CAUTION

If the two LEDs flash red, quickly and alternately, there is a firmware error in the flash memory area, because a firmware update was incomplete, for example. Transfer the firmware again (see Software update, Firmware update). The digiCLIP does not work.

If the two LEDS show permanently red, an internal error is stopping the digiCLIP working. Switch the digiCLIP off and then back on again, to test whether the error is still present. If the error keeps occurring, please contact HBM Technical Support.

4 Commissioning

Mount one or more digiCLIP modules and connect the transducers.

- Activate bus termination resistance for the first and last modules
- Connect the power supply
- Synchronization is performed automatically
- Set the address for each module; addresses must not be duplicated
- The bit rate is set automatically

4.1 Operation with the digiCLIP Assistant

The digiCLIP Assistant allows you to set and scaling this measurement system, the display and measured value recording.

The software only shows devices of the digiCLIP product family. All other PROFIBUS nodes are ignored.

All the settings that can be made with the digiCLIP Assistant are made using the Profibus Class 2 protocol (DPV1–C2). If your control supports this protocol, you can also make these settings independently of the digiCLIP Assistant. All the setting options and values can be found in the object dictionary of this manual (Section 6.6).

Procedure

- The digiCLIP must be ready for operation.
- Connect the PC's PROFIBUS interface to the digiCLIP (this can also be done while operation is ongoing).
- The digiClip Assistant works with Hilscher and Siemens brand Profibus cards.
- Make sure that only one DPV1 Class 2 Master accesses the digiCLIP.
- Start the digiCLIP Assistant.
- When you start the software for the first time, you must choose the Profibus Master in a window. If you select *Use as standard*, this network will be chosen automatically the next time the system starts up.
- The digiCLIP Assistant finds all the devices and displays them in a list in the Devices area with their PROFIBUS address and serial number.
- Start a new search for connected devices via Interface → Devices.

NOTE

You can obtain the latest version of the relevant Assistant free of charge from http://www.hbm.com/support/.

4.2 No devices can be found on the PROFIBUS

- Check that your PROFIBUS interface is correctly installed on the PC (manufacturer's instructions). Also refer to the operating requirements.
- If the digiCLIP is not using the same bit rate (also called the baud rate) as the PROFIBUS, with the digiCLIP active, use the rotary switches to temporarily set a different address. Each time an address is changed, the bit rate used by the PROFIBUS is re-checked and if necessary, the particular bit rate is changed. Then use the digiCLIP Assistant to find devices again.
- The digiCLIP only supports bit rates between 45.45 kbit/s and 12 Mbit/s. Check that the PROFIBUS network uses a permissible bit rate.
- On the PROFIBUS, verify for several devices that each digiCLIP has its own PROFIBUS address (that there are no duplicate addresses in the network).
- The upper switch on the digiCLIP gives the more significant digit: a setting of 1 above and 2 below corresponds to the decimal address 12.
- Check that the termination resistors on the PROFIBUS bus are correctly set: the resistors for the first and last devices on the bus (or PC) must be activated (slide switch of PROFIBUS plug). If you are using more than one device, no resistors can be activated on any of the other devices.

5 Settings via the digiCLIP Assistant

First check that the sensor connection is healthy: Open the Status window by double-clicking on the displayed measured value or with *Device → Show device status*. Red LEDs for *Sensor connection* indicate whether and if so which wiring faults exist.

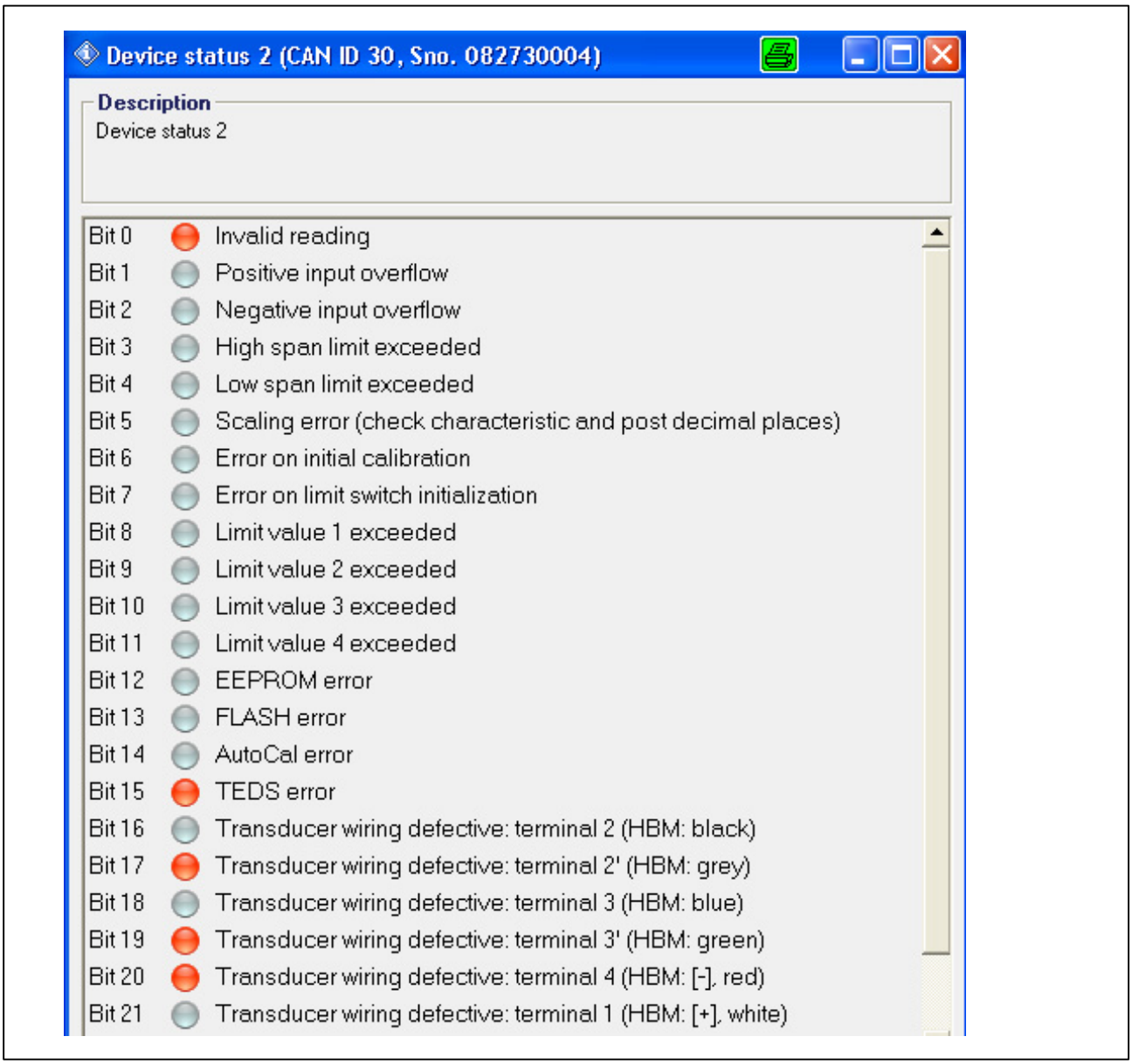


Fig. 5.1: Assistant: Device status

Then use the Assistant menus to set all the other device parameters.

Extensive Help is also available in the Assistant. The parameters are then present in the digiCLIP RAM.

To make them available again after a power failure, they still have to be saved in the digiCLIP EEprom memory (Assistant dialog: Save/load parameters –> Save parameters in device).

After a loss of voltage, or after switching the digiCLIP back on, all the parameters last available in the EEprom are automatically reloaded into the device (RAM).

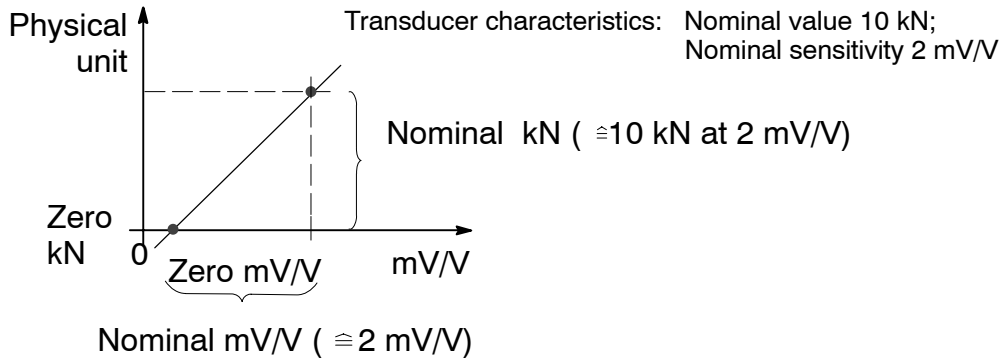
NOTE

Apart from the factory settings, the digiCLIP only has one parameter set (measurement program) that can be stored in the device. But additional parameter sets can be stored on a PC and then reloaded, using the Assistant. There is no offline mode, that is, creating / changing a parameter set without a connected device.

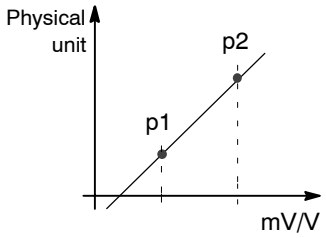
5.1 Clarification of significant settings

Scaling

Scaling in accordance with transducer characteristics



Alternative: 2–point scaling



Example: A calibration weight of 4 kg is used to calibrate a 10 kg load cell

1. Relieve the load on the transducer

Measure point 1	0.0457 mV/V
Char. curve point 1 physical	enter 0 kg

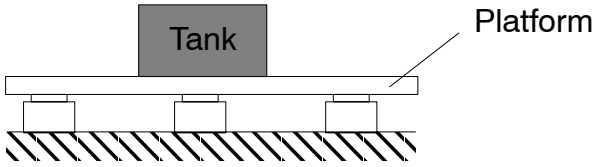
2. Load transducer with 4 kg

Measure point 2	0.873 mV/V
Char. curve point 2 physical	enter 4 kg

Taring / zeroing

Difference between taring and a zero balance: A zero balance (>0<) affects the gross and the net value. Taring (>T<) only affects the net value.

The difference between a zero balance and taring is made clear in this example:

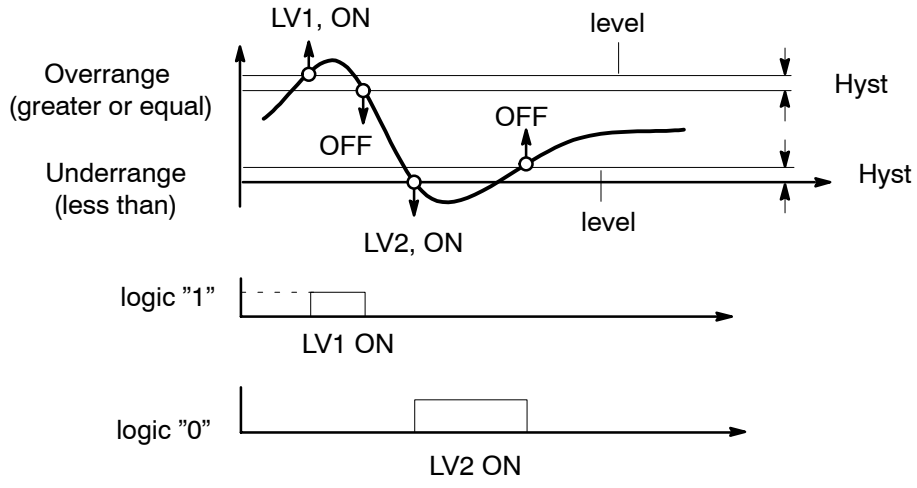


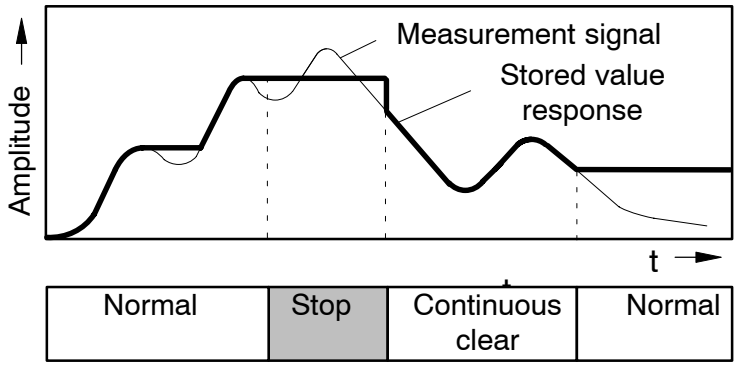
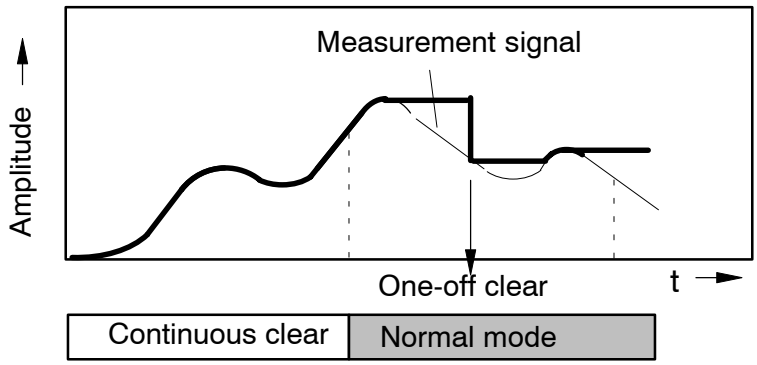
Weighing steps	Action	Display Gross	Net
Put on the platform (35 kg)	> 0<	before 35 kg after 0 kg	before 35 kg after 0 kg
Put on the container (8 kg)	> T<	before 8 kg after 8 kg	before 8 kg after 0 kg

Filters / frequencies	0.05 Hz 1 Hz 20 Hz 0.1 Hz 2 Hz 50 Hz 0.2 Hz 5 Hz 100 Hz 0.5 Hz 10 Hz
Autocal	The Autocal function briefly interrupts the measurement function to link the amplifier input with an internal reference. This evens out errors caused by aging and temperature. This function is executed **once** on demand.

Limit value switches 1...4	The choice of source for the limit value signal is: gross, net, peak value max/min/peak-to-peak

Limit value functions and parameters



The choice of source for the peak value signal is: gross/net	
The peak value can be cleared.	
Peak values	Example 1 
	Example 2 

5.2 Setting with TEDS

5.2.1 Electrical connection with TEDS

TEDS stands for ”Transducer Electronic Data Sheet”.

A transducer with an electronic data sheet as defined in the IEEE 1451.4 standard can be connected to the digiCLIP, making it possible for the amplifier to be set up automatically. A suitably equipped amplifier imports the transducer characteristics (electronic data sheet), translates them into its own settings and measurement can then start.

Six-wire circuitry must be used for TEDS to be connected.

5.2.2 Setting

If a transducer with TEDS, containing the parameterization data for a full bridge is connected, this can be used to set the amplifier automatically.

When the digiCLIP is activated, it automatically detects whether a TEDS is connected. When the transducer is replaced in the activated state, the new TEDS is also detected automatically.

Check the ”Always use TEDS” box to monitor TEDS functionality and protect scaling from manual intervention. If a transducer is being used without TEDS, this checkmark must be cleared.

To enable the data stored in the TEDS to be used for scaling, a setting must be made in the digiCLIP to indicate the physical unit in which the measured values are to be displayed. The scaling values stored in the TEDS are then automatically converted to the required unit. By specifying this conversion unit, scaling can also take place to a power of ten (e.g. ”kN”) or English units can be used both for the display and in the TEDS.

In the digiCLIP Assistant, in the ”TEDS” area, choose the desired conversion unit from the selection menu. If instead you want to use the unit stored in the TEDS directly, set this value to ”(auto)”.

When the TEDS is activated, its scaling data will be read out and converted to the required physical unit. Should the unit stored in the TEDS and the required conversion unit be incompatible because they describe different quantities (e.g.: torque transducer connected, conversion unit is ”N”), the status word is set and scaling does not take place.

If automatic activation of TEDS is set (checkmark: ”Always use TEDS”) the TEDS is read out automatically and scaling performed accordingly, whenever the digiCLIP supply voltage is turned on or a new transducer is connected in the on state.

If a scaling error is reported once the TEDS is activated, the reason may be that the value range specified by the two characteristic curve points is so great or so small, that the measured values cannot be displayed with the set decimal places. You then need to adapt the number of decimal places in the ”Scaling” area. It may possibly help to change to a different power of ten, such as. ”N” after ”kN”. To obtain more information, click on ”TEDS error status” in the digiCLIP Assistant. If you have not connected any transducers with TEDS, make sure that the ”TEDS always available” box is not checked.

For an accurate analysis, it is advisable to display the data stored in the TEDS. To do this, in the digiCLIP Assistant, click on ”Details” in the ”TEDS” area.

TEDS transducer not connected:
Make sure that the ”Always use TEDS” box is not checked.

Example 1:
Torque transducer connected, display required in kilonewton meters, ”kNm”

Stored in the TEDS:

Minimum Force/Weight	1.0 Nm
Maximum Force/Weight	2500.0 Nm
Minimum Electrical Value	0.1 mV/V
Maximum Electrical Value	1.5 mV/V
Reference unit set in the digiCLIP (”kNm”)	03560000 (hex)

After scaling by TEDS, the scaling points are set as follows:

Char. curve point 1, physical	0.001 kNm
Char. curve point 1, electrical	0.1 mV/V
Char. curve point 1, physical	2.5 kNm
Char. curve point 1, electrical	1.5 mV/V

Example 2:

Force transducer connected, display required in English pounds, ”lb”.

Stored in the TEDS are:

Minimum Force/Weight	1.0 Nm
Maximum Force/Weight	1000.0 Nm
Minimum Electrical Value	–0.1 mV/V
Maximum Electrical Value	4.0 mV/V
Reference unit set in the digiCLIP (”lb”)	00EF0001 (hex)

After scaling by TEDS, the scaling points are set as follows:

Char. curve point 1, physical	0.225 lb
Char. curve point 1, electrical	–0.1 mV/V
Char. curve point 2, physical	224.81 lb
Char. curve point 2, electrical	4.0 mV/V

The data for the minimum and maximum excitation voltage in the TEDS is also checked. If the excitation voltage is too high or too low, it is automatically adapted in the digiCLIP. An excitation voltage of 2.5 V is preferable.

If, instead of using the digiCLIP Assistant, you are parameterizing directly with DPV1, you must use Slot 1, Index 21 to set the required conversion unit before activating the TEDS. The units available to you correspond to the selection list provided by the digiCLIP Assistant and can be found in the table below. If value = ”00000000” is set, the unit used for conversion is the one stored in the TEDS.

Once the TEDS is successfully activated, the value in Slot 1, Index 34 is also changed accordingly.

The DPV1 objects for using TEDS are located in Section 6.6.9 .

NOTE

If several transducer full bridges are connected to a digiCLIP amplifier input in parallel, their TEDS data should not be used for automatic scaling, as in this case, the distribution of the forces could lead to unwanted scaling. Clear the ”Always use TEDS” checkmark.

5.2.3 Parameters of the required physical conversion unit

Value (hex)	Required unit	Conversion
FA4B0000	µg	$1 \cdot 10^{-6}$ g
FD4B0000	mg	$1 \cdot 10^{-3}$ g
004B0000	g	
00020000	kg	
03020000	t	1000 kg
00210000	N	
03210000	kN	1000 N
06210000	MN	$1 \cdot 10^{6}$ N
00EF0001	lb	4.44822 N
00EE0001	oz	0.278 N
00ED0001	kgf	9.8 N
FE560000	Ncm	0.01 N·m
00560000	Nm	
03560000	kNm	1000 Nm
00EA0001	ozf–in	$7.06 \cdot 10^{-3}$ N·m
00E90001	ozf–ft	$84.73 \cdot 10^{-3}$ N·m
00E80001	lbf–in	1.12 N·m
00E70001	lbf–ft	1.35 N·m
00E60001	in oz	$7.06 \cdot 10^{-3}$ N·m
00E50001	ozf–ft	$84.73 \cdot 10^{-3}$ N·m
00E40001	in lb	$1.12 \cdot 10^{-1}$ N·m
00E30001	ft lb	1.35 N·m
004E0000	bar	$1 \cdot 10^{5}$ Pa
FD4E0000	mbar	100.0 Pa
00220000	Pa	
02220000	hPa	100.0 Pa
03220000	kPa	1000 Pa
06220000	MPa	$1 \cdot 10^{6}$ Pa
00AB0000	psi	6894.757 Pa
00010000	m	
FD010000	mm	$1 \cdot 10^{-3}$ m
FE010000	cm	$1 \cdot 10^{-2}$ m
FA010000	µs	$1 \cdot 10^{-6}$ m
00EC0001	in	$25.4 \cdot 10^{-3}$ m
00EB0001	ft	0.3048 m
00010300	m/s	
00EB0301	fps	0.304 m/s
00014700	m/min	1.66 m/s
FD550000	mm/s^2	$1 \cdot 10^{-3}$ m/s^2

Value (hex)	Required unit	Conversion
00550000	m/s^2	
00EB5701	ft/s^2	$3.048 \cdot 10^{-1}$ m/s^2
00EC5701	in/s^2	$2.54 \cdot 10^{-2}$ m/s^2
FA010100	µm/m	$1 \cdot 10^{-6}$ m/m
FE000000	%	
FD000000	‰	0.1 %
FA000000	ppm	$0.1 \cdot 10^{-3}$ %

6 PROFIBUS interface description

DP series digiCLIP modules have a PROFIBUS DP interface option (distributed peripherals) with a maximum transmission rate of 12 Mbit. They are designed to meet requirements for fast and efficient data exchange between a control/PLC (PC/control system) and the distributed peripherals. A DP system usually comprises a Master and – including repeaters – up to 126 Slaves. The Master reads input data from the Slaves in cycles and writes output data to the Slaves. Individual Slaves can fail or be deactivated, without disrupting ongoing bus operation. The full bus configuration is stored in the Master.
If a bus system has several Masters, each Master has its own, permanently assigned Slaves. The Master always exchanges the same number of data bytes with each of its Slaves, one after the other (in turn and always in a circle). This ensures that the total runtime is always constant:

- Each Slave must respond within a fixed time slot.
- The Slave must always respond with the same data length.
- With DF30DP or DF31DP, a maximum of 64 bytes are possible for each response. They can be split between input or output data as desired.

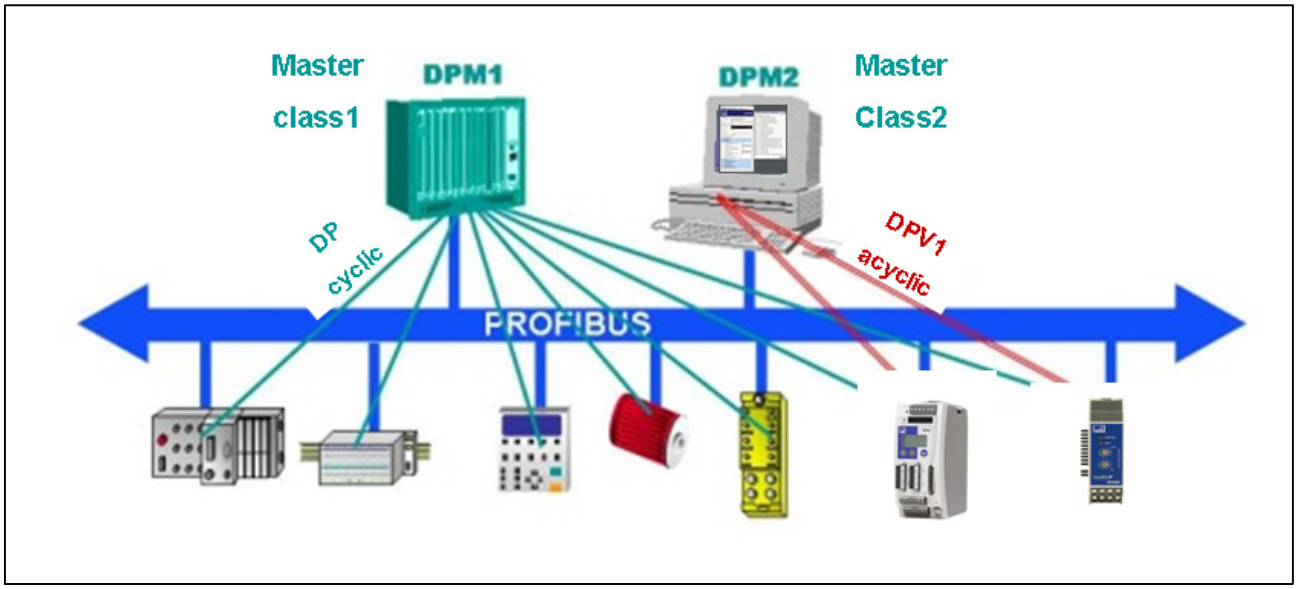


Fig.6.1: Design and configuration of a Profibus DP system

Profibus DP Slave

A Slave is a peripheral device (I/O, drives, HMI, valves, measurement transmitters), that reads in input information and provides output information to peripherals. The amount of input and output information depends on the device, and there can be max. 246 bytes of input data and max. 246 bytes of output data.

DP Master class 1 (DPM1)

These Masters control the cyclic data traffic, that is, they exchange process data with the slaves in a defined message cycle. Typical devices are a PLC or a PC.

DP Master class 2 (DPM2)

These Masters are engineering or operating units. They access the bus acyclically and allow intelligent field devices to be configured and parameterized.

6.1 Cyclic data exchange

Before you can communicate with the digiCLIP DF31DP on Profibus, you have to configure and parameterize the message contents. To do this, start your configuration software (such as Step 7) and load the GSD files from the digiCLIP system CD. You can then configure the information relevant to your application from the ”hardware catalog”.

The digiCLIP DF30DP and digiCLIP DF31DP devices are configured with the same GSD-file. digiCLIP DF31DP has the same Profibus DP functions as digiCLIP DF30DP. In addition, protocol data for the digital inputs and outputs are available in digiCLIP DF31DP.

NOTE:

The latest GSD file is always available as a free download on the HBM WebSite at http:://www.hbm.com/

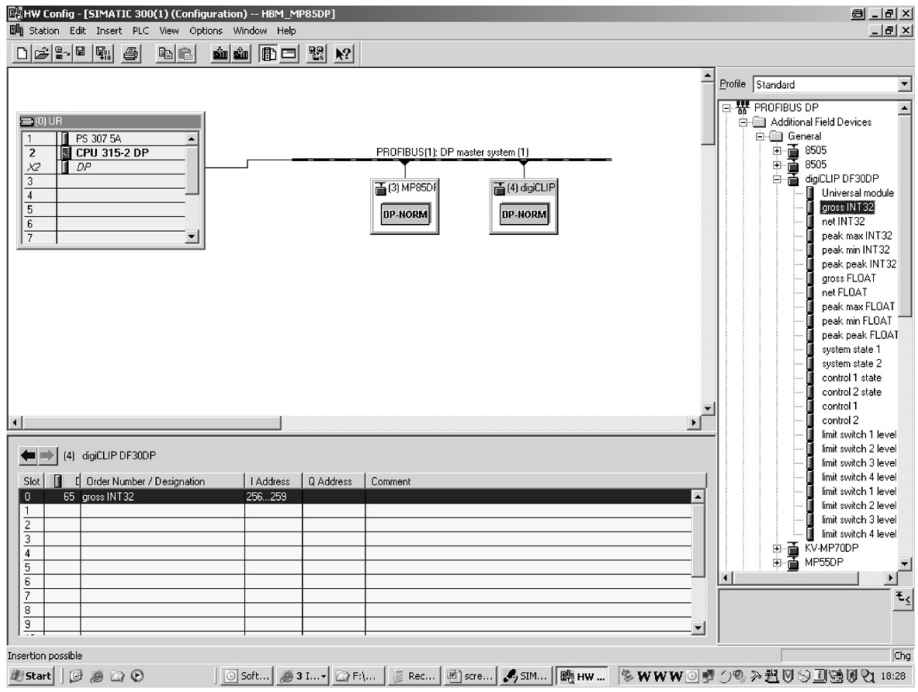
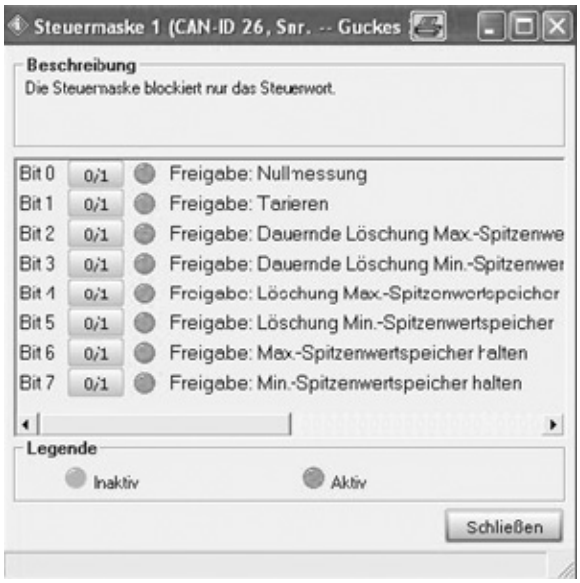


Fig.6.2: DF31DP configuration

Using the control templates in digiCLIP Assistant, individual functions that are to be triggered via control word (interface command) can be blocked or enabled through control bits. All functions are enabled in the default settings.



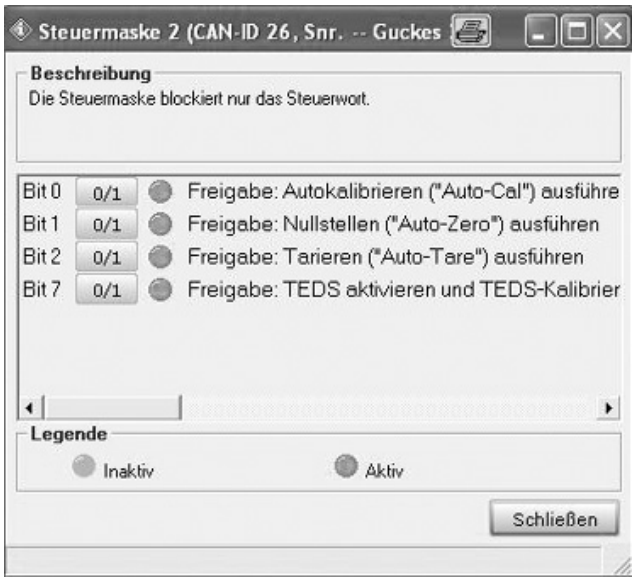


Fig.6.3: Parameterizing the digiCLIP

Notes for Simatic S7 PLC users:

- To transmit consistent data of 4 bytes, you must use special function block SFC14 to read and SFC15.
- With S7 3xx, a maximum of 32 bytes of consistent data can be transmitted.

6.1.1 **Input data** (from DF31DP to PLC)

The DF31DP allows the cyclic data described below to be transmitted via PROFIBUS DP.

Measured values are transmitted as a 32-bit floating-point number (FLOAT, 4 bytes) or a 32-bit fixed-point number (INT32, 4 bytes, two's complement, the decimal place must be known to the reading position).

Mixed representation is possible in a configuration. The number of decimal places set previously with the digiCLIP Assistant (Section 4.1) is taken as the basis for determining the values in a fixed-point representation.

The byte sequence corresponds to the Profibus standard. The most significant byte is always first (Motorola format). Non-documented bits are reserved and sometimes assigned with internal functions.

Designation	Description	length
Gross	Gross measured value	4 bytes
Net	Net measured value (gross less tare value)	4 bytes
Max	The contents of the Maximum memory	4 bytes
Min	The contents of the Minimum memory	4 bytes
Pk–Pk	Peak–to–Peak (difference between Max and Min)	4 bytes
System status 1	Status of the limit value switches and the general error bits	1 bytes
System status 2	Double word with differentiated error identification	4 bytes
Status control 1	Acknowledgment of control byte 1	1 bytes
Status control 2	Acknowledgment of control byte 2	1 bytes
Container Read	Value of the requested Read Container	4 bytes
Container Status	Error code and toggle bit of the Read/Write Container	1 bytes
Digital I/O voltage	Voltage state of digital I/O (DF31DP only)	1 bytes
Digital I/O logic	Logic state of digital I/O (DF31DP only)	1 bytes

System status 1:

Bit 0	Measured value invalid (due to overload, scaling error, hardware defect, for example)
Bit 1	Measurement input overloaded
Bit 2	Measuring range exceeded
Bit 3	0 (reserved)
Bit 4	Limit value switch 1 triggered
Bit 5	Limit value switch 1 triggered
Bit 6	Limit value switch 1 triggered
Bit 7	Limit value switch 1 triggered

The signal is activated when the bit is set.

System status 2:

Bit 0	Measured value invalid (as system status 1, bit 0)
Bit 1	Positive measurement input overload
Bit 2	Negative measurement input overload
Bit 3	Positive measurement input overrange
Bit 4	Negative measurement input overrange
Bit 5	Scaling error
Bit 6	Incorrect initial calibration values
Bit 7	Error when initializing limit value switches
Bits 8...11	Limit value switches 1...4 triggered
Bit 12	Hardware error: parameter memory (EEPROM)
Bit 13	Hardware error: parameter memory (FLASH)
Bit 14	Hardware error: Autocalibration
Bit 15	TEDS cannot be read [1)]
Bits 16...21	Transducer connection faulty
Bit 16	Terminal 2, HBM: Black
Bit 17	Terminal 2', HBM: gray
Bit 18	Terminal 3, HBM: Blue
Bit 19	Terminal 3', HBM: green
Bit 20	Terminal 4 (–), HBM: red
Bit 21	Terminal 1 (+), HBM: white
Bits 22...31	0 (reserved)

1) TEDS data availability is only monitored if this has been activated (digiCLIP Assistant: "Always use TEDS" checked)

The signal is activated when the bit is set.

6.1.2 **Output data** (from PLC to DF31DP)

Designation	Description	Length
Control byte 1	Control byte for triggering zeroing, taring, stopping and clearing peak–value memory	1 bytes
Control byte 2	Control byte for triggering zeroing, taring, autocalibration, scaling by TEDS, clearing the hysteresis states of the limit values	1 bytes
Limit value switches 1...4, level, INT32	Threshold value, separately for each limit value switch as an integer with a previously defined number of decimal places	4 bytes each
Limit value switches 1...4, level, FLOAT	Threshold value, separately for each limit value switch as a floating point number	4 bytes each
Read container	Write DPV1 Class 2 object	6 bytes
Read container	Read DPV1 Class 2 object; specify slot and index	2 bytes

Control 1:

Bit 0	Run zeroing
Bit 1	Run taring
Bit 2	Continuous clear of max. peak–values
Bit 3	Continuous clear of min. peak–values
Bit 4	One-off clear of max. peak–value memory
Bit 5	One–off clear of min. peak–value memory
Bit 6	Stop max. peak–value memory
Bit 7	Stop max. peak–value memory

If several control bits are set simultaneously, this sequence applies:

zeroing, taring, edit peak–value memory.

If several bits are set to control the peak–value memory, this is the priority that is applied (the first-named has the highest priority):

continuous clear, one-off clear

Control 2:

Bit 0	Run autocalibration
Bit 1	Run zeroing
Bit 2	Run taring
Bit 3	Clear the hysteresis status of all limit value switches
Bits 4..6	reserved
Bit 7	Read out TEDS and trigger scaling

If several control bits are set simultaneously, this sequence applies:

zeroing, taring, clear hysteresis states, autocalibration

Bit 7, for scaling by TEDS, must not be set at the same time as other control bits.

When setting with the digiCLIP Assistant, the two control bytes can each be given a bit mask. Then only the cleared functions can be run in cyclic operation. In the factory setting, all functions are cleared. It is possible to read back the control bytes as an acknowledgement.

With one-off functions (zeroing, taring, one-off clear of peak value memory, autocalibration and TEDS scaling), the function is only run when the bit is changed from ”0” to ”1”.

If several bits are set to control the peak–value memory, this is the priority that is applied (the first-named has the highest priority):

continuous clear, one-off clear

6.1.3 Diagnosis

The DF31DP module makes a 5 bytes long device diagnosis available as an external diagnosis. A bit is reserved each time in the fifth byte for the various error causes. The particular bit is set as long as the malfunction exists.

byte	bits	Value	Significance
1		5	
2		129	
3		0	
4		0	
5	0	0 / 1	Measured value invalid
5	1	0 / 1	Input overloaded
5	2	0 / 1	Scaling error
5	3	0 / 1	Sensor connection faulty
5	4	0 / 1	Autocal error
5	5	0 / 1	Hardware defect
5	6	0	reserved
5	7	0	reserved

6.2 GSD-Datei

The physical properties of the device (e.g. bit rate, specific bit times, transmitted/received bytes per cycle) are described in a GSD file. The structure, content and coding of these device master data are standardized, so that configuration devices from different manufacturers can be used to configure any DP Slaves.

The GSD file does not indicate which data are transferred or how these have to be interpreted. You can find these elements in this operating manual and program them accordingly in the master.

The GSD files for the digiCLIP Profibus modules can be found on the digiCLIP system-CD or at www.hbm.com/support.

6.3 DPV1 parameterization / PLC–S7 operation

So-called DPV1 parameterization allows asynchronous parameterization messages to be exchanged parallel to Profibus DP mode with cyclic data exchange between the Master module and the DF31DP.

Alternatively, they can be sent from the DP Master (for example the PLC, the so-called Class 1 Master), or even in parallel from a second, so-called diagnostic Master (for example the programming unit, the Class 2 Master).

If the customer wishes to make use of DPV1 parameterization the relevant service routines must be called in the PLC. A basic distinction is made between setting up and releasing a connection and between read and write access to parameters.

The various parameters are addressed by so-called index numbers and slot numbers.

The DF31DP maps these index numbers to the commands described in the Operating Manual (see Tables below).

TIP:

Siemens Step7 Profibus DPV1 examples for DF30DP and DF31DP, for consistent (contiguous) data transmission over the Profibus with blocks SFC14 and SFC15 and amplifier parameterization via DPV1 functions using SFB52, can be found on the digiCLIP system-CD and at www.hbm.com/support.

More detailed information on DPV1 mode can be obtained from the manufacturer of the Master module.

e.g. from Siemens
www.ad.siemens.de/support
document number: 10259221
S7-Integration of DPV1 slaves

6.3.1 Azyklische Datenübertragung (Bedarfsdaten)

Acyclic transmission of data is necessary for all slave devices with many different parameters or options that have to be modified or optimized during operation. Typical examples include the setting and optimization parameters of a drive, such as limit values for rotational speed or torque, the mode of operation, or the error list.

Acyclic data are handled in parallel with, and in addition to, the cyclic transmission of process data, but with a lower priority. This should minimize any effect on the timing of the high-priority, cyclic transmission of process data.

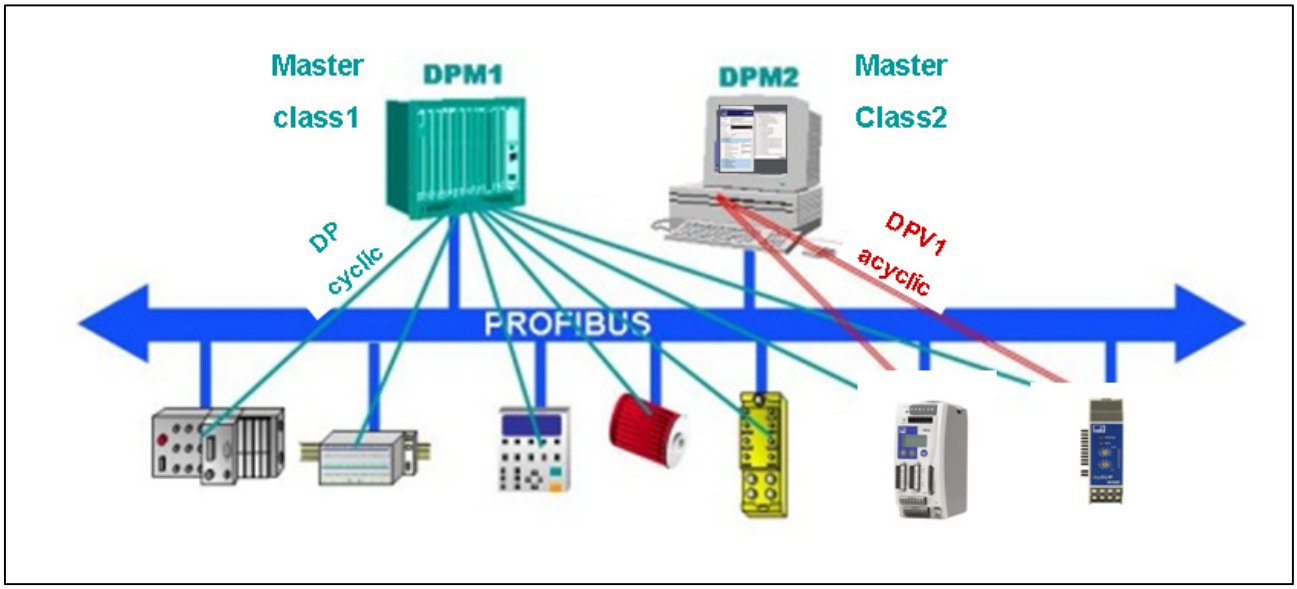


Fig.6.4: Cyclic and acyclic data transfer in a PROFIBUS network

6.3.2 Addressing required data

Required data are addressed device-related, by specifying slot, index and length. Data and parameters are addressed by specifying the slot number and index.

6.3.3 Operation with SIEMENS PLC–S7

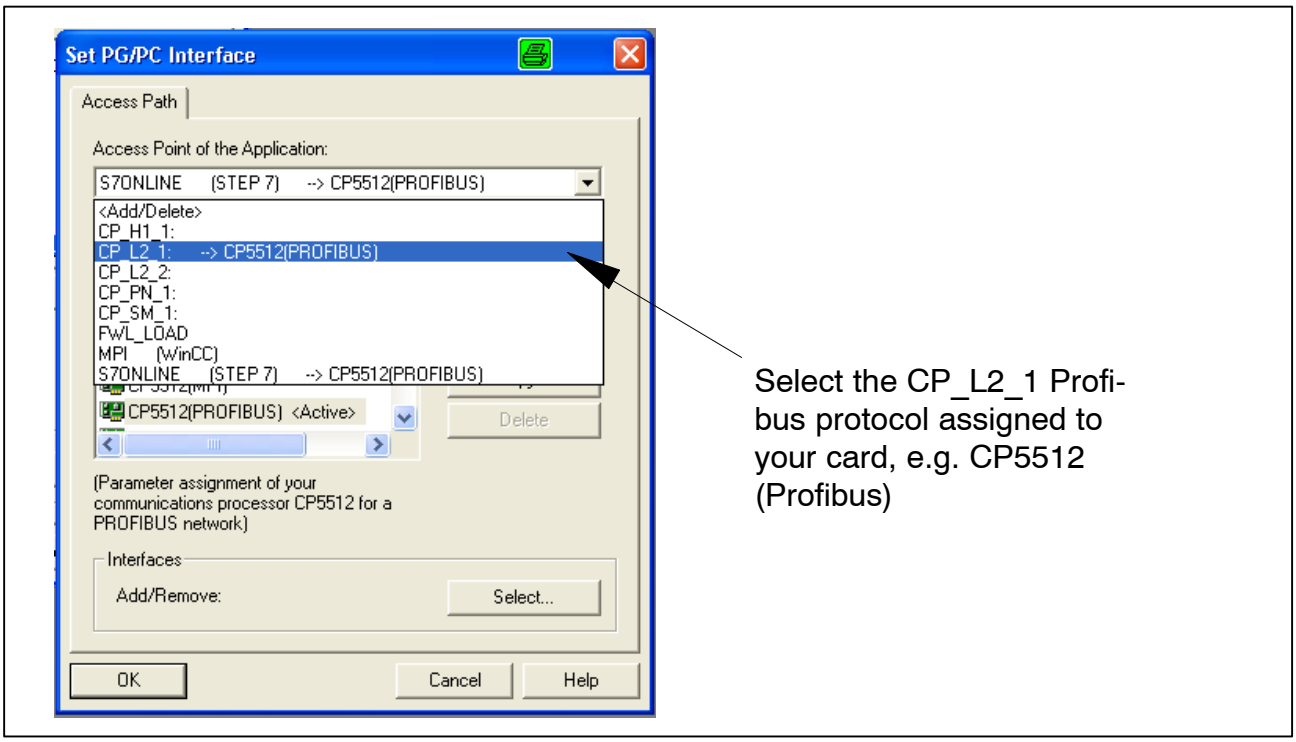
The following points must be noted to ensure full access in Class 2 Master operation on the digiCLIP module using the digiCLIP Assistants:

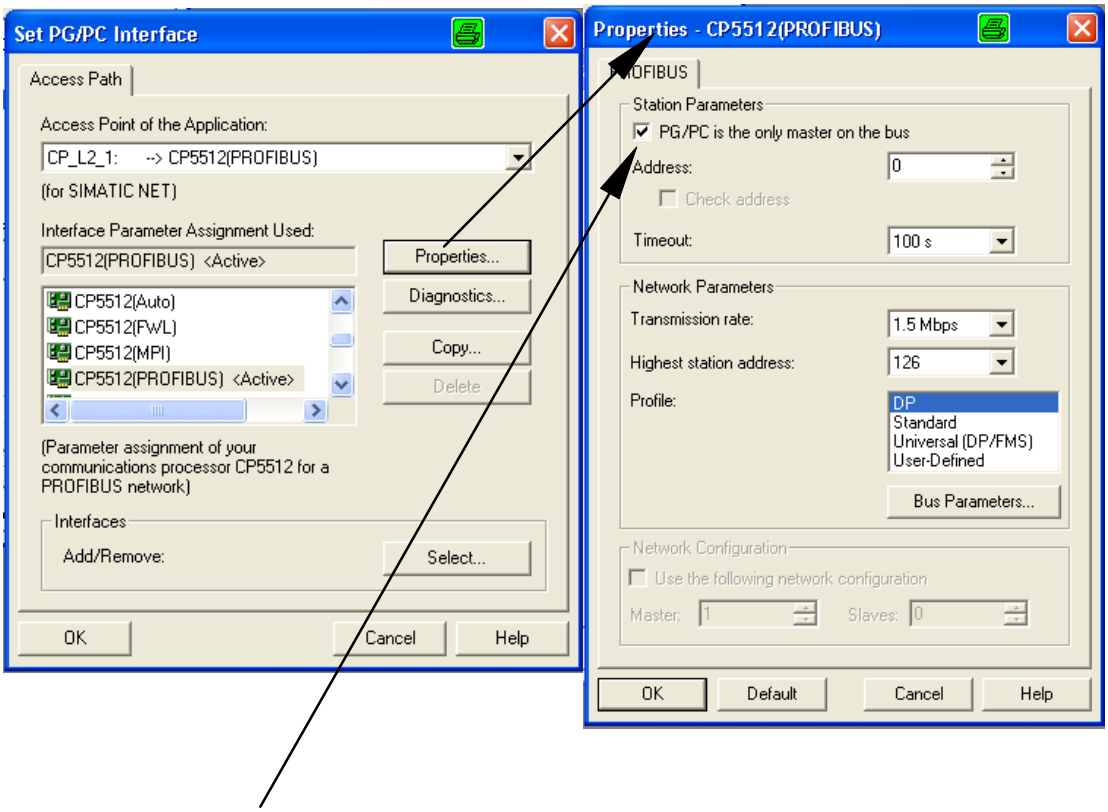
– SiematicNet must be installed. Please note that SiematicNet is not automatically installed with Step7V5.3. Please contact SIEMENS concerning the current SiematicNet packets.

– Use the current SIEMENS card CP5512 with Windows XP communication

To test the connection and the connected Profibus modules, the SIEMENS tool ”SiematicNet setup (Diagnosis)” can be used as follows. To call this tool  , use the Windows Control Panel:

– Dependent on the connected programming device, set e.g. CP_L2_1 as the ”access point”:





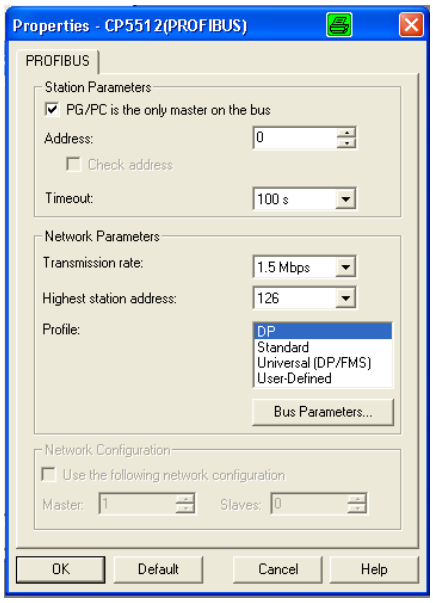
Check the box only if **one** master (PC or CP5512) is connected to the Profibus.
If a control (PLC e.g. CP315) is connected to the bus in addition, you **must not** check the box (multiple masters).

NOTE

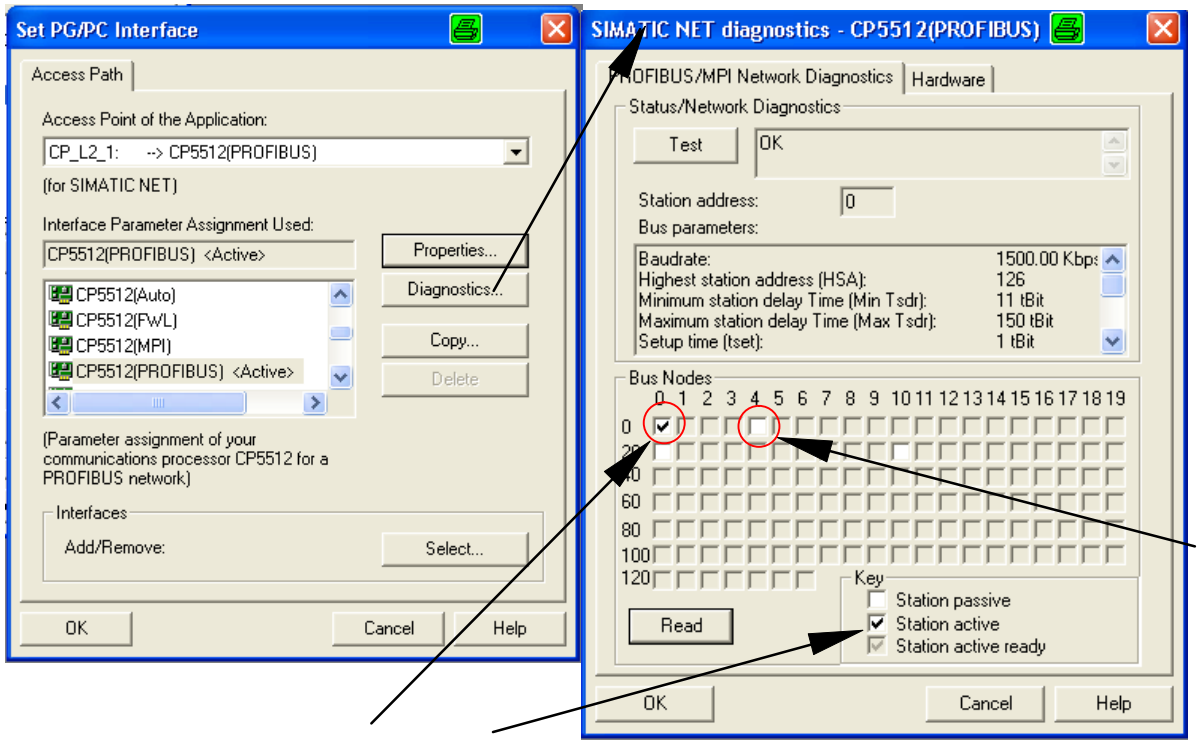
If you only use a 1:1 connection of programming device and digiCLIP modules, check ”PG/PC is the only master on the bus” (”Properties” tab).

Here the transmission rate and the Profibus profile (Profibus–DP) are also configured:

Here the transmission rate and the Profibus profile (Profibus–DP) are also configured:



– To perform a system check, click the ”Test” button:

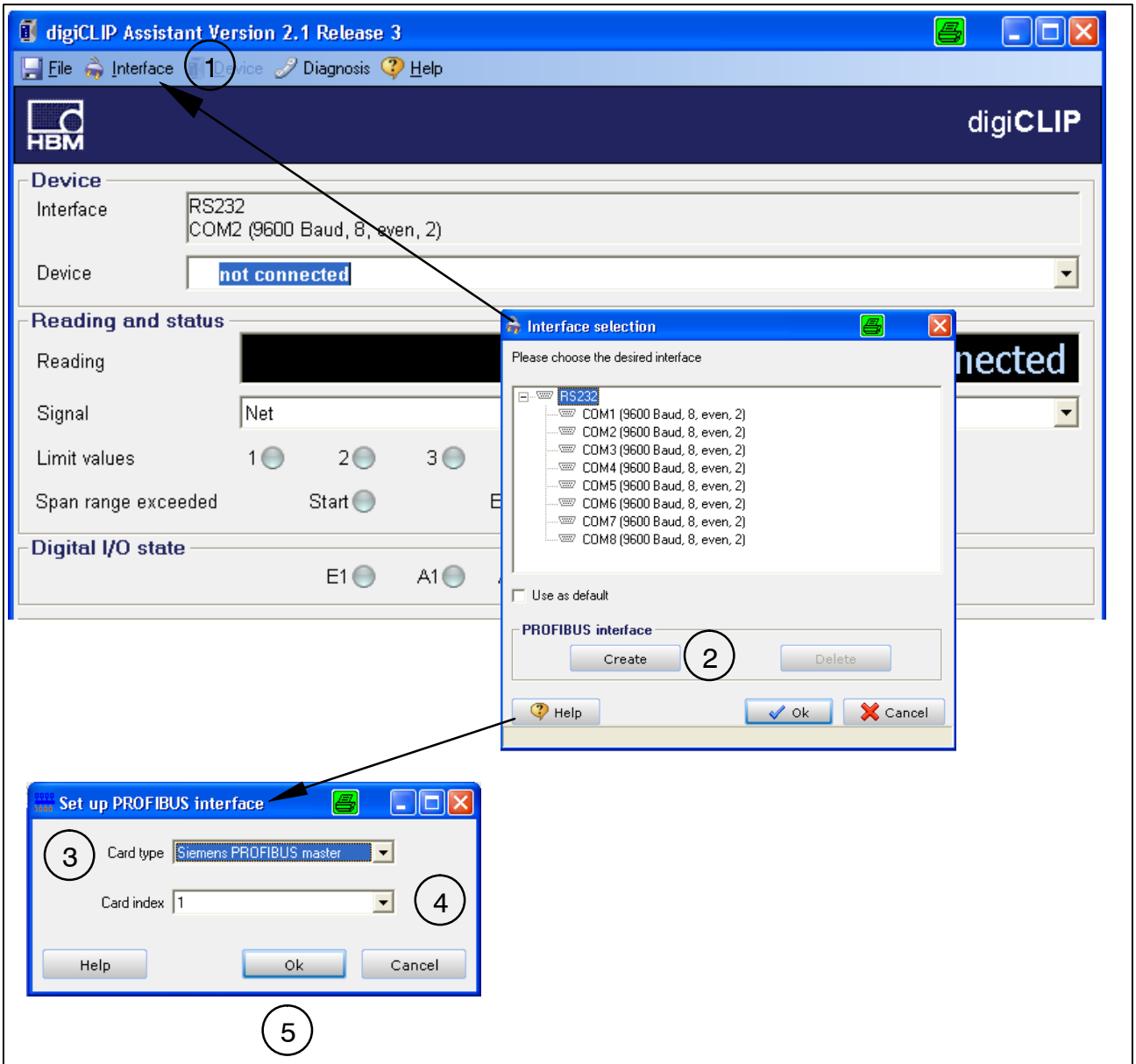


Master CP5512 and PLC, here only the PC is connected to the bus as the only master.

Confirm all windows with OK after testing.

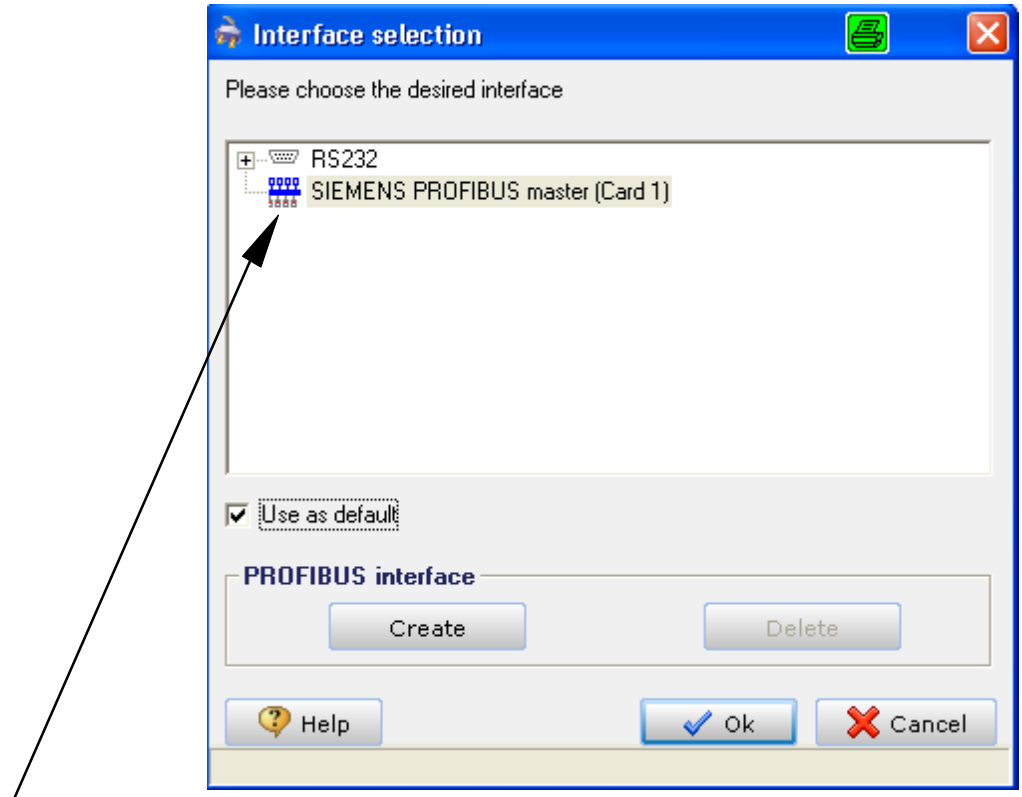
If the TEST is successful (message OK), the modules located on the bus can be displayed with the ”Read” button. Masters are shown as active stations and slaves as passive stations.

Making settings in the digiCLIP Assistant:

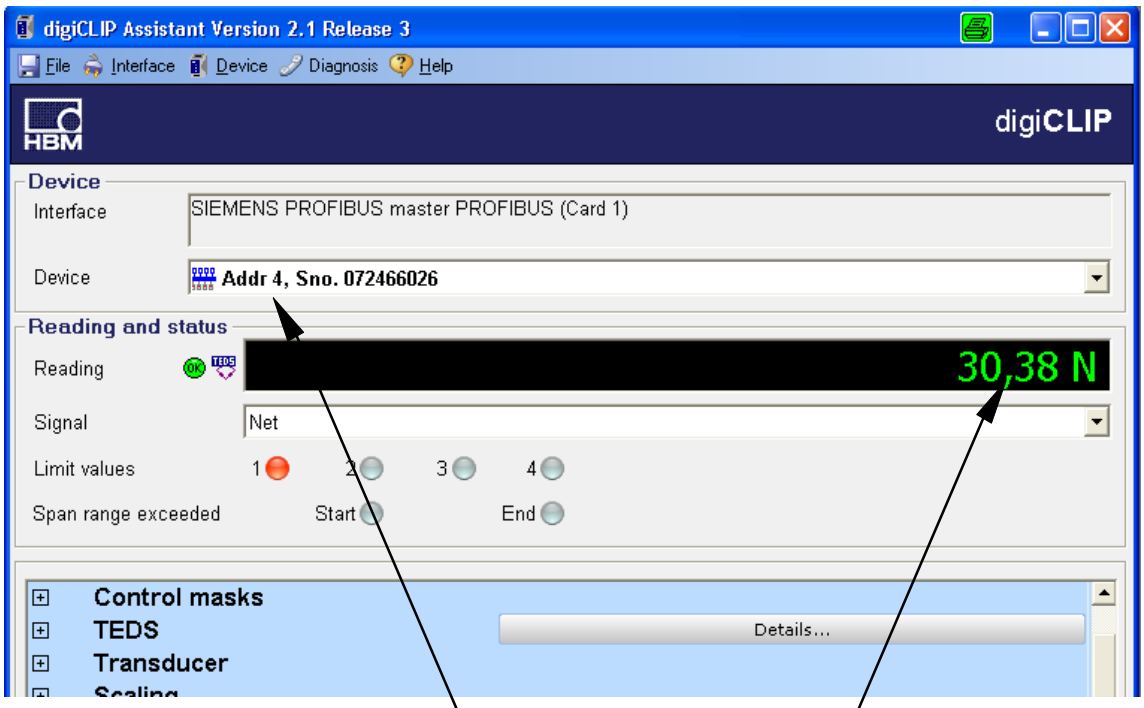


Open the digiCLIP Assistant; if an error message appears, cancel the error message and enter a Profibus interface.

1. Open the interface selection
2. Select or enter a new interface
3. Select the card type
4. Set the index to 1
5. Confirm with OK



Select the new Profibus interface and confirm with OK.



digiCLIP Profibus address and serial number

Measured value

The digiCLIP devices connected to the network are identified in a short period of time and can be parameterized.

6.4 Read-/Write Container for transmitting of DPV1 Class 2 commands in the real time channel

With Read and Write Containers, it is possible to use objects from the DPV1 dictionary in the real-time channel to set up and read out the measuring amplifier. This means that these objects will then also be available to users who do not have a master with DPV1 functionality available.

Read, write and status parameters are set up in the real-time message for this. If the entry in the Read or Write Container changes, this is edited and the toggle bit is then changed in the container status. The data must be written consistently.

All the objects from the object dictionary given a 1, 2 or 4 byte length by the data type are available. Objects with the ”VisibleString” and ”OctetString” data types cannot be used

6.4.1 Container Write

The write container sets a setting value in the amplifier as the output data, or triggers the relevant commands.

Output data format:

DPV1−C2−Slot (1 byte)	DPV1−C2−Index (1 byte)	Value (4 bytes)

The value must always be written as 4 bytes. If the data type is shorter than 4 bytes, the data must be entered ”right aligned”. For example, a value 2 bytes in length is written with two leading zero bytes.

As soon as the entry in the Write Container changes, the associated command is executed once and the Status Container is re-written.

6.4.2 Container Status

The Container Status provides the status information of the last editing of the Write/Read Container as one byte long input data. A toggle bit signals the conclusion of the command editing.

The toggle bit of the Container command is transmitted in bit 3. Bit 7 to Bit 4 contains the error code of the last Read/Write Container.

After a Write or Read Container has been modified, you must check that the Container status is changed and that the error bits are evaluated according to the following table.

As the error code and the toggle bit are re-set for each edited command, only either a Read or a Write Container must ever be changed at the same time.

Bit 7 ... 4	Bit 3	Bits 2...0
0	Toggle bit	Error code

Error code of the Container status:

Error code	Significance
0	No error
1	Value invalid, function not implemented
2	Value does not lie in valid value range, setting not implemented
3	Access blocked (e.g. object not present or read only status)
4	Object not present or function not available
5	Function is already started but not yet completed (e.g. Auto–Cal)
6	Hardware error
7	Other error state

Note:

If a setting is to be implemented on the transducer characteristic curve but is blocked because the function ”Always use TEDS” is activated, the setting is not implemented and the error code 3 is set.

If a Write or a Read command are to be executed repeatedly, a container change must be transmitted between each command. A ”dummy” command that does not change the settings or the measured values is available for this, at Slot 0, Index 00

6.4.3 Container Read

The read container is used to read out the setting values from the amplifier. The DPV1 Slot and Index output data must be written for this. The input data are then described with the current value from the amplifier and the Container Status is updated.

Output data format:

DPV1–C2–Slot (1 byte)	DPV1–C2–Index (1 byte)

Input data format:

Value (4 bytes)

As noted for the Write Container, the value is output ”right justified”. Accordingly, a value of the 2−byte long data type is generated with two leading zero bytes.

Once the value is updated, the toggle bit in Container Status is changed. In the case of an incorrect access or other read error, the error codes are set appropriately and additionally all bits for the Container input data are also set (value = FFFFFFFF hex).

Example:

In real-time mode, the filter frequency is to be changed, the current filter frequency checked and the threshold value of limit value switch 1 changed.

The associated messages are described as follows:

Reading the Container Status:

Container Status input data:

00

Setting the filter frequency of 10 Hz (Slot = 1, Index = 31 hex, value = 75 hex, 1−byte data type):

Container Write output data:

01	31	00	00	00	75

Reading the Container Status:

Container Status input data:

08

Reading the current filter frequency (Slot = 1, Index = 31 hex, 1−byte data type):

Container Write output data:

01	31

Input data:

00	00	00	75

Reading the Container Status:

Container Status input data:

00

Setting the limit value level to 1.30 (Slot = 1 hex, Index = 42 hex, floating point value = 3FA66666 hex, 4−byte data type):

Container Write output data:

01	42	3F	A6	66	66

Reading the Container Status:

Container Status input data:

08

You can also find further application examples, e.g. programming a SIEMENS STEP7, on the Internet at http://www.hbm.com Support Download Software.

6.5 Data types

Designation	Description	Abbreviation in the following tables
Boolean	Byte with the information in the least significant bit (Bit 0)	b8
Unsigned 8	Unsigned byte 8 bits in length	u8
Unsigned 16	Unsigned word 16 bits in length	u16
Unsigned 32	Unsigned integer 32 bits in length	u32
Integer16	Integer signed in the most significant bit and 16 bits in length	i16
Integer32	Integer signed in the most significant bit and 32 bits in length	i32
Real32	Signed floating-point number, 32 bits in length	r32
VisibleString	String that does not have to be concluded with a zero character (00 hex). The length of the string is defined in the object dictionary and must be adhered to exactly. In the following tables, the number of admissible characters is given in each case	VS
OctetString	Sequence of bytes each 8 bits in length	OS

6.6 PROFIBUS DPV1 object dictionary, sorted by function groups

6.6.1 Identification

Slot C2	Index (hex)	Access[1]	Data type[2]	Value	Description	Parameter set[3]
0	02	RO	VS	Visible string	Manufacturer device name (20 characters)	–
0	03	RO	VS	Visible string	Manufacturer hardware version (13 characters)	–
0	04	RO	VS	Visible string	Manufacturer firmware version (8 characters)	–
0	05	RO	u32	011D(hex)	Manufacturer ID	–
0	06	RO	u32	0702(hex)	Manufacturer product ID	–
0	07	RO	VS	Visible String (12 characters)	HBM serial number	–
0	16	RW	u32	Number of days since January 1, 1984	Calibration date; write with password protection	–
1	60	RW	VS	Visible String (20 characters)	Channel name, defined individually by user	–

1) RW: Read and Write access
RO: Read access only
WO: Write access only

2) The format describes the data type, as noted in Section 6.5.

3) Parameter set column: A: Value is stored in the parameter set; – : Value is not stored in the parameter set

6.6.2 Parameter set and factory setting

Slot C2	Index (hex)	Access	Data type	Value	Description	Parameter set
0	09	RW	u32	Write: 65766173 hex	All the current parameters marked with ”A” in the ”Parameter set” column are protected	–
0	0D	RW	u32	Write: 64616F6C hex	Restore the parameter factory settings (re-start then required)	–
0	15	RW	u32	Write: 746F6F62 hex Read: 0: Normal operation, 1: System in restart	Write: Run a system restart; Read: System state	–

6.6.3 Measured values

Slot C2	Index (hex)	Access	Data type	Value	Description	Parameter set
1	00	RO	r32		Gross measured value	–
1	01	RO	r32		Net measured value	–
1	02	RO	r32		Max. peaks measured value	–
1	03	RO	r32		Min. peaks measured value	–
1	04	RO	r32		Peak–to–peak measured value	–

6.6.4 Device status

Slot C2	Index (hex)	Access	Data type	Value	Description	Parameter set
1	05	RO	u8	System status 1 Bit 0: Measured value invalid Bit 1: Measurement input overloaded Bit 2: Measuring range exceeded Bits 4…7: Limit value switches 1…4 triggered		–
1	06	RO	u32	System status 2 Bit 0: Measured value invalid Bit 1: Positive measurement input overload Bit 2: Negative measurement input overload Bit 3: Pos. measuring range overflow Bit 4: Neg. measuring range overflow Bit 5: Scaling error Bit 6: Incorrect initial calibration values Bit 7: Error when initializing limit value switches Bits 8…11: Limit value switches 1…4 triggered Bit 12: Hardware error: Parameter memory (EEPROM) Bit 13: Hardware error: program memory (FLASH) Bit 14: Hardware error: Autocalibration Bit 15: TEDS error [1] Bits 16…21: Transducer connection faulty: Bit 16: Terminal 2', HBM: black Bit 17: Terminal 2, HBM: gray Bit 18: Terminal 3, HBM: blue Bit 19: Terminal 3', HBM: green Bit 20: Terminal 4 [–], HBM: red Bit 21: Terminal 1 [+], HBM: white Bits 22…31: *reserved*		–
0	11	RO	u8	0: digiCLIP is SLAVE 1: digiCLIP is MASTER	Hardware synchronization	–
0	10	RO	u8	0: identical 1: not identical	Check whether the current application parameters match the data in the EEPROM	–

1) TEDS data availability is only monitored if this has been activated (digiCLIP Assistant: "Always use TEDS" checked)

6.6.5 Device control

Slot C2	Index (hex)	Access	Data type	Value	Description	Parameter set
1	07	RW	u8	Control byte 1:[1)] Bit 0: Run zeroing Bit 1: Run taring Bit 2: Continuous clear of max. peak−value memory Bit 3: Continuous clear of min. peak−value memory Bit 4: One-off clear of max. peak−value memory Bit 5: One-off clear of min. peak−value memory Bit 6: Stop max. peak−value memory Bit 7: Stop min. peak−value memory		A[2)]
1	08	RW	u8	Bit n = 1: Function enabled Bit n = 0: Function inhibited	Control byte 1 mask When bit = 1, the corresponding bit of control byte 1 is executed; when bit = 0, the corresponding bit of control byte 1 is ignored and assumed to be ”0”.	A
1	09	RW	u8	Control byte 2[3)] : Bit 0: Run autocalibration (”Auto−Cal”) Bit 1: Run zeroing (”Auto−Zero”) Bit 2: Run taring (”Auto−Tare”) Bit 3: Clear all the limit value switch hysteresis states Bit 7: Read out TEDS and trigger TEDS calibration		–
1	0A	RW	u8	Bit n = 1: Function enabled Bit n = 0: Function inhibited	Control byte 2 mask When bit = 1, the corresponding bit of control byte 2 is executed; when bit = 0, the corresponding bit of control byte 2 is ignored and assumed to be ”0”.	A
1	0B	WO	u32	696C6163 hex (constant)	Trigger one-off autocalibration (”Auto−Cal”)	–
1	0C	WO	u32	7A65726F hex (constant)	Trigger zeroing (”Auto−Zero”)	–
1	0D	WO	u32	74617261 hex (constant)	Trigger taring (”Auto−Tare”)	–

1) If several command bits are set at the same time, this is the sequence that is followed: zeroing, taring, edit peak−value memory. If several bits are set to control the peak−value memory, this is the priority that is applied (the first-named has the highest priority): continuous clear, one-off clear, stop. The functions of bits 0, 1, 4 and 5 are only executed when there is a change of state from logic 0 to 1.

2) Only the state of bits 2, 3, 6 and 7 is protected in the application parameter set.

3) If several control bits are set simultaneously, this sequence applies: zeroing, taring, clearing hysteresis states, autocalibration. Bit 7, for calibration by TEDS, must not be set at the same time as other control bits. Functions are only executed when there is a change of state from logic 0 to 1.

6.6.6 Peak–value memory control

Slot C2	Index (hex)	Access	Data type	Value	Description	Parameter set
1	10	RW	u8	0: Gross measured value 1: Net measured value	Input signal for max. peak–value memory	A
1	11	RW	u8	0: Gross measured value 1: Net measured value	Input signal for min. peak–value memory	A
1	12	RW	u8	0: Normal operation 1: one-off clear	One-off clear of max. peak–value memory: Next measured value is current max peak value. Read returns = 1 until clearing has been executed in the device	–
1	13	RW	u8	0: Normal operation 1: one-off clear	One-off clear of min. peak–value memory: Next measured value is current min. peak value. Read returns = 1 until clearing has been executed in the device	–

6.6.7 Digital inputs and outputs

Slot C2	Index (hex)	Access	Data type	Value	Description	Parameter set
1	80	RW	u8	Bit 0: Polarity input Bit 4: Polarity output 1 Bit 5: Polarity output 2	Polarity of the digital input and the digital outputs: inverting if bit set	A
1	81	RW	u8	Action of digital input: [1] Bit 0: Run zeroing Bit 1: Run taring Bit 2: Continuous clear of max. peak−value memory Bit 3: Continuous clear of min. peak−value memory Bit 4: One-off clear of max. peak−value memory Bit 5: One-off clear of min. peak−value memory Bit 6: Stop max. peak−value memory Bit 7: Stop min. peak−value memory		A
1	82	RO	u8	Bit 0: Status input Bit 4: Status output 1 Bit 5: Status output 2	Electrical status of the digital input and the digital outputs [2]: Bit not set if 24V	–
1	83	RO	u8	Bit 0: Input status Bit 4: Output 1 status Bit 5: Output 2 status	Logic status of the digital input and the digital outputs allowing for the polarity: Bit set if action active	–

[1] If several bits are set at the same time, this is the sequence that is followed: zeroing, taring, edit peak−value memory. If several bits are set to control the peak−value memory, this is the priority that is applied (first-named has the highest priority): continuous clear, one-off clear, stop. The actions for Bit 0, Bit 1, Bit 4 and Bit 5 are carried out precisely when the input voltage changes from the quiescent level to the active level. The actions for Bit 2, Bit 3, Bit 6 and Bit 7 are carried out as long as the input voltage corresponds to the active level. The quiescent or active levels are defined with Index 2300. The reaction occurs at the latest with the next but one measurement value. The latency time of the electronic digital input can be found in the current data sheet.

Slot C2	Index (hex)	Access	Data type	Value	Description	Parameter set
1	85	RW	u8	Signal source of digital output 1: [3] Bit 0: Limit value switch 1 Bit 1: Limit value switch 2 Bit 2: Limit value switch 3 Bit 3: Limit value switch 4 Bit 4: Positive range overrun Bit 5: Negative range overrun Bit 6: Overload of input amplifier Bit 7: General error with invalid measurement value		A
1	86	RW	u8	Signal source of digital output 2: Bit assignment as for digital output 1		A

2) Short circuit of digital output is not recognized.

3) Several bits can be set simultaneously. The logic states ”or–linked” are then assigned at the digital output. The switching states of Bit 0 to 6 are updated with every measurement value. The status of Bit 7 indicates general errors that lead to invalid measurement values, such as transducer, scaling or TEDS errors. A reaction time greater than 400 ms must be assumed here. The latency time of the electronic digital input can be found in the current data sheet.

6.6.8 Scaling

There are three scaling methods available: With HBM transducers, the zero value and the span are most often available as scaling data. Two-point scaling can be used as an alternative. If a transducer with TEDS is connected, the scaling values can also be set with TEDS. The objects for TEDS can be found in Section 6.6.9 . If a scaling value is changed, the scaling values in the other representation are adapted automatically.

Slot C2	Index (hex)	Access	Data type	Value	Description	Parameter set
1	1A	RW	r32		Span scaling: scaling value: mV/V zero point	A
1	1B	RW	r32		Span scaling: scaling value: phys. zero point	A
1	1C	RW	r32		Span scaling: scaling value: mV/V span	A
1	1D	RW	r32		Span scaling: scaling value: phys. span.	A
1	14	WO	u32	31746573 hex	Two-point scaling: Calibrate X1: Set the current internal mV/V meas. value as scaling value point 1	–
1	15	WO	u32	32746573 hex	Two-point scaling: Calibrate X2: Set the current internal mV/V meas. value as scaling value point 2	–
1	16	RW	r32		Two-point scaling: scaling value: mV/V point 1	A
1	17	RW	r32		Two-point scaling: scaling value: phys. point 1	A
1	18	RW	r32		Two-point scaling: scaling value: mV/V point 2	A
1	19	RW	r32		Two-point scaling: scaling value: phys. point 2	A
1	35	RW	u8	0…9	Decimal point position, the value range can be further restricted, subject to scaling.	A

6.6.9 TEDS

If several transducers with TEDS are connected to an amplifier input, it is only ever the first TEDS to be found that is evaluated. In this case, automatic scaling by TEDS and the ”Always use TEDS” function should be dispensed with.

Slot C2	Index (hex)	Access	Data type	Value	Description	Parameter set
1	20	RW	u8		Write: Parameter = 1: Contact the first TEDS and load the data to the device memory[1]. Read: Return value = 1, if the data has been successfully read and is available, otherwise return value = 0	A
1	21	RW	u32		Physical reference unit, into which TEDS data are to be converted [2]	A
1	22	WO	u32	73646574 hex	Activate scaling by TEDS	–
1	23	RO	i16		TEDS: Read out the last calibration date (number of days since January 1, 1998)	–
1	24	RO	i16		TEDS: Read out the calibration period	–
1	25	RO	VS	Visible string (3 characters)	TEDS: Read out the initials of the calibrator	–
1	26	RO	VS	Visible string (45 characters)	TEDS: Read out the transducer comments	–
1	27	OS	i16	OctetString (8 bytes)	TEDS: Read out transducer identification (T–ID)	–

1) Whenever a transducer is connected and each time the device is re-started, the TEDS data are read into the device automatically, so that it is not normally necessary to address the TEDS specifically.

2) The physical reference unit is the quantity into which the scaling values are converted, when a TEDS has been read out. This method also allows non-metric units to be supported or a conversion, for example, from newtons (as stored in the TEDS) to kilonewtons (as required in the digiCLIP application). In many cases, the user will set the same unit here, as for displaying the measured values. If a required unit is not compatible with the TEDS data because, for example, a torque transducer has been connected, but newtons, the force transducer unit, have been selected, the error bit is set in the TEDS status word.

Slot C2	Index (hex)	Access	Data type	Value	Description	Parameter set
1	28	RW	u8	0: Do not use TEDS automatically 1: Always use TEDS	Always use TEDS[1)]	A
1	29	RO	u8	0: Manual scaling 1: Current scaling corresponds to the TEDS data	Current scaling took place on account of TEDS activation	–
1	2A	RO	u8	Bit 0: TEDS not available/cannot be read Bit 1: Scaling not possible (check decimal places) Bit 2: Required conversion unit does not match the transducer Bit 3: The excitation voltage in the TEDS is not supported	TEDS error status	–
1	2B	RO	u16		Basic TEDS Template: ”Manufacturer”	–
1	2C	RO	u16		Basic TEDS Template: ”Model”	–
1	2D	RO	u8		Basic TEDS Template: ”Version letter”	–
1	2E	RO	u16		Basic TEDS Template: ”Version number”	–
1	2F	RO	u32		Basic TEDS Template: ”Serial number”	–

1) ”Always use TEDS” causes the availability of the TEDS data to be monitored, the TEDS activates and scaling takes place in accordance with the TEDS data. Write access to scaling values is then declined.

6.6.10 Transducer settings

Slot C2	Index (hex)	Access	Data type	Value	Description	Parameter set
1	1E	RW	u8	0: 2.5 V 1: 1.0 V	Excitation voltage, 2.5 V sets the measuring range to ±4 mV/V, 1.0 V sets the measuring range to ±10 mV/V	A
1	1F	RO	u8	0:±4 mV/V 1:±10 mV/V	Measuring range	–
1	0E	RW	u8	0: Normal measurement mode 1: Internal zero signal 2: Internal calibration signal	Selecting the input amplifier signal. Normal measurement mode is always set after a new start.	–

6.6.11 Signal conditioning

Slot C2	Index (hex)	Access	Data type	Value (dec.)	Description	Parameter set
1	30	RW	r32		Write: Choice of filter frequency in Hz. [1)] Reading the index returns the actually active filter frequency in Hz.	A
1	31	RW	u8	120: 100 Hz, 119: 50 Hz, 118: 20 Hz, 117: 10 Hz, 116: 5 Hz, 115: 2 Hz, 114: 1 Hz, 113: 0.5 Hz, 112: 0.2 Hz, 111: 0.1 Hz, 110: 0.05 Hz	Filter frequency, Bessel-like	A
1	32	RW	r32		Zero point	A
1	33	RW	r32		Tare value	A
1	34	RW	VS	Visible string	Physical unit as a string, exactly 12 characters in length. [2)]	A
1	35	RW	u8	0…9	Decimal point position, the value range can be further restricted, subject to scaling.	A

1) If the required frequency is not available in the device, the next highest possible one is set as the frequency. When a frequency higher than the highest possible one is chosen, the error state is indicated and the previous filter coefficients are not changed. Writing this object re-sets Slot 1, Index 31.

2) These values are only stored in the device, they are not evaluated. Scaling by TEDS also causes this entry to change.

6.6.12 Range monitoring

Range monitoring does not lead to an error message when the limit value is exceeded. Instead, corresponding status bits are set to ”measuring range monitoring”.

Slot C2	Index (hex)	Access	Data type	Value	Description	Parameter set
1	36	RW	r32		Gross measured value range monitoring: Lower limit	A
1	37	RW	r32		Gross measured value range monitoring: Upper limit	A

6.6.13 Limit value monitoring

Slot C2	Index (hex)	Access	Data type	Value	Description	Parameter set
1	40	RW	u32	Compare with: *Gross measured value:* 61300120 hex *Net measured value:* 61400120 hex *Max. peak measured value:* 20020120 hex *Min. peak measured value:* 20030120 hex *Peak−to−peak measured value:* 20040120 hex	Measured value source for limit value switch 1	A
1	41	RW	u8	inactive: 0 greater or equal: 2 less: 3	Level reference for limit value switch 1	A
1	42	RW	r32		Threshold value for limit value switch 1, physical quantity	A
1	43	RW	r32	Value >= 0	Hysteresis for limit value switch 1, physical quantity	A
1	43	RW	i32		Hysteresis for limit value switch 1, physical quantity	A
1	44	RO	b8	0: not triggered 1: triggered	State of limit value switch 1	–
1	45	WO	b8	0: no action 1: clear	Clear hysteresis state of limit value switch 1	–
1	48	RW	u32	see Index 6503	Measured value source for limit value switch 2	A
1	49	RW	u8	see Index 6508	Level reference for limit value switch 2	A
1	4A	RW	r32		Threshold value for limit value switch 2	A
1	4B	RW	r32	Value >= 0	Hysteresis for limit value switch 2	A

Slot C2	Index (hex)	Access	Data type	Value	Description	Parameter set
1	4C	RO	b8	0: not triggered 1: triggered	State of limit value switch 2	–
1	4D	WO	b8	0: no action 1: clear	Clear hysteresis state of limit value switch 2	–
1	50	RW	u32	see Slot 1, Index 40	Measured value source for limit value switch 3	A
1	51	RW	u8	see Slot 1, Index 41	Level reference for limit value switch 3	A
1	52	RW	r32		Threshold value for limit value switch 3	A
1	53	RW	r32	Value >= 0	Hysteresis for limit value switch 3	A
1	54	RO	b8	0: not triggered 1: triggered	State of limit value switch 3	–
1	55	WO	b8	0: no action 1: clear	Clear hysteresis state of limit value switch 3	–
1	58	RW	u32	see Slot 1, Index 40	Measured value source for limit value switch 4	A
1	59	RW	u8	see Slot 1, Index 41	Level reference for limit value switch 4	A
1	5A	RW	r32		Threshold value for limit value switch 4	A
1	5B	RW	r32	Value >= 0	Hysteresis for limit value switch 4	A
1	5C	RO	b8	0: not triggered 1: triggered	State of limit value switch 4	–
1	5D	WO	b8	0: no action 1: clear	Clear hysteresis state of limit value switch 4	–
1	5E	RO	u8	Bit 0 = switch 1 … Bit 3 = switch 4	State of limit value switches 1…4	A
1	5F	WO	b8	0: no action 1: clear all switches	Clear hysteresis states of all limit value switches	A

7 Examples

The following example uses a measurement task to illustrate device functionality and the requisite settings.

Problem:

The forming process in a press is to be monitored, in order to achieve uniform product quality. The maximum force exerted by the press in each cycle is to be recorded. To safeguard the production process, this maximum force must lie between the lower (F1) and the upper (F2) force limit values.

Solution:

The force response measured by a strain gage force transducer (such as the C9B/10 kN; 1 mV/V) is amplified and assessed by the digiCLIP. The maximum force is recorded with the aid of the (maximum) peak−value memory and assessed with two limit value switches with regard to the upper and lower limits.

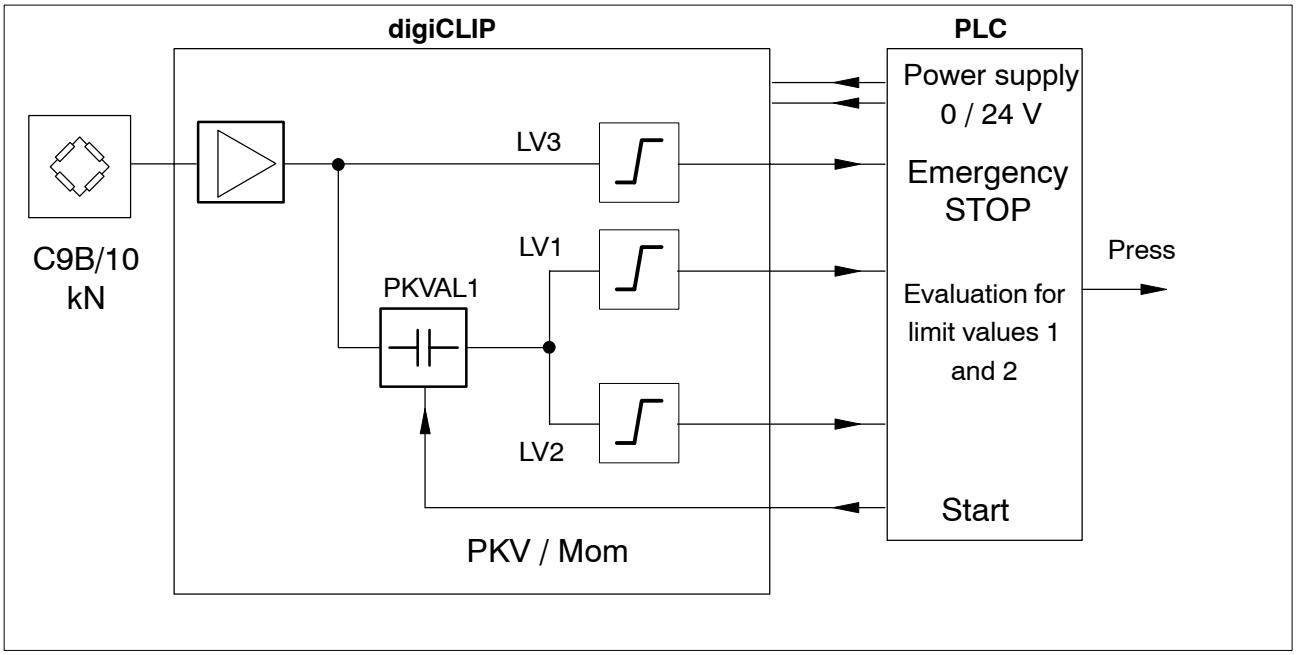
The state of limit value switches 1...4 is read regularly.

LV1 source = net measured value

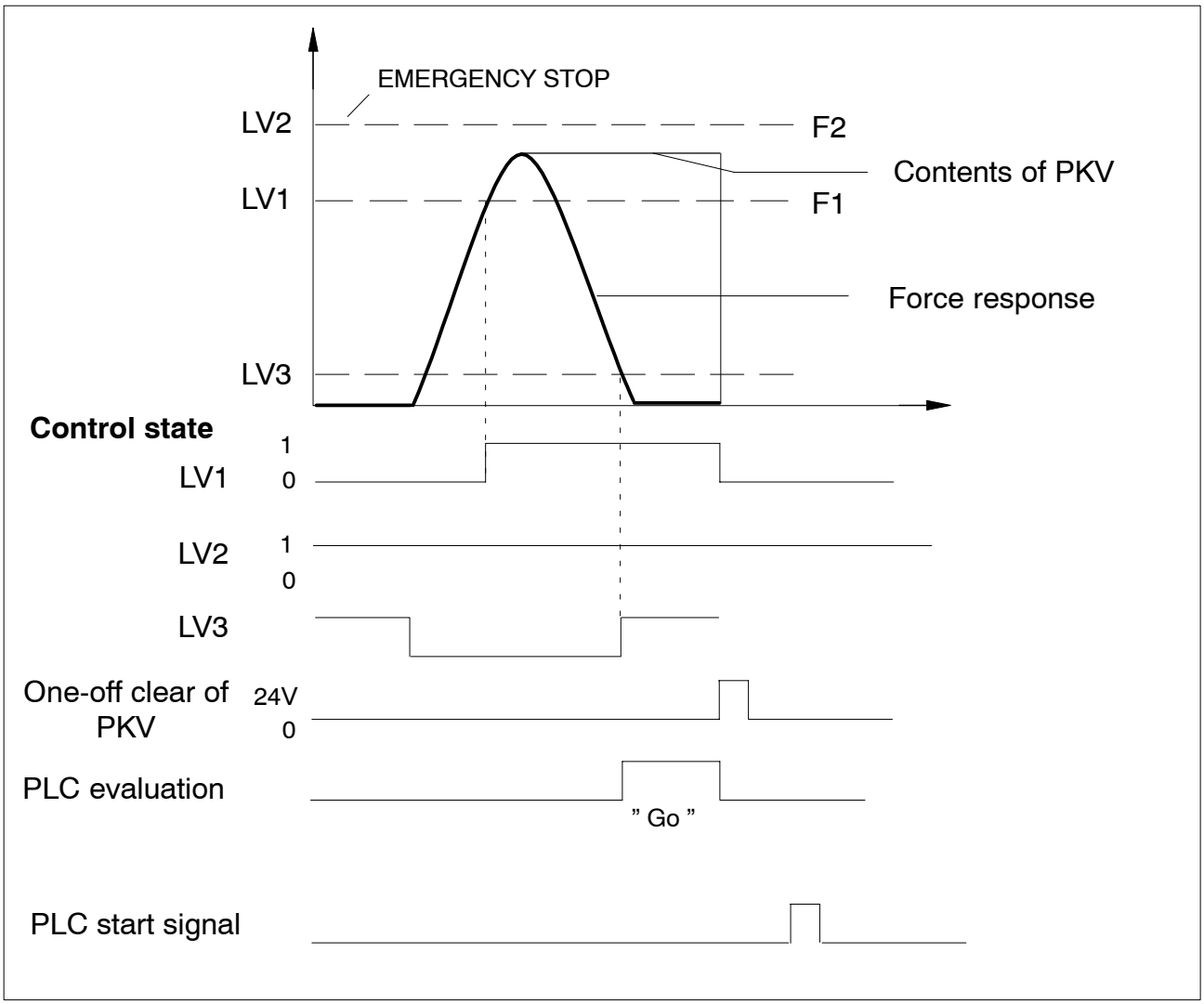
LV2 = gross measured value (machine protection)

A PLC takes over process control. As well as the control commands for the press, it gives the digiCLIP a start signal when the press cycle begins and once the process has run, enlists the help of the limit value outputs for ”Go/No−Go testing”.
The PLC start signal clears the contents of the peak−value memory via a digiCLIP control input.

Wiring diagram:



Timing diagram:



The following settings must be chosen:

LV1 Checks whether the lower force limit (F1) has been reached. The input signal is the output of the peak−value memory (maximum value). If limit LV1 is exceeded, a High signal is generated. A positive actuating direction with positive output logic must be set for this.

LV2 Checks whether the maximum load limit for the machine is exceeded (Emergency STOP function). The input signal is the gross measured value. Exceeding limit LV2 is indicated in 1 and 2. This is read immediately by the PLC and ensures that the press is quickly shut down.

LV3 Checks whether the press has returned to its starting position. Only then can the PLC start its ”Go / No−Go testing”.

PKV Records the maximum peak value of the force response. The input signal is the net measured value. The PKV is cleared by setting the relevant bit in the control byte.

PLC evaluation of the limit value report:

	Go	**Reject**	
LV1	1	0	1
LV2	1	1	0

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