Operating Manual

DF31CAN

digiCLIP

HBM

A2173-1.2 en

Contents **Page**

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

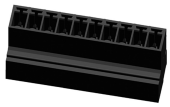
Scope of supply:

- 1 digiCLIP module — Order No.: 1−DF31CAN
- Coded plug connector for sensor connection — Order No.: 3−3312.0404
- Plug-in terminal for CANBUS 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)

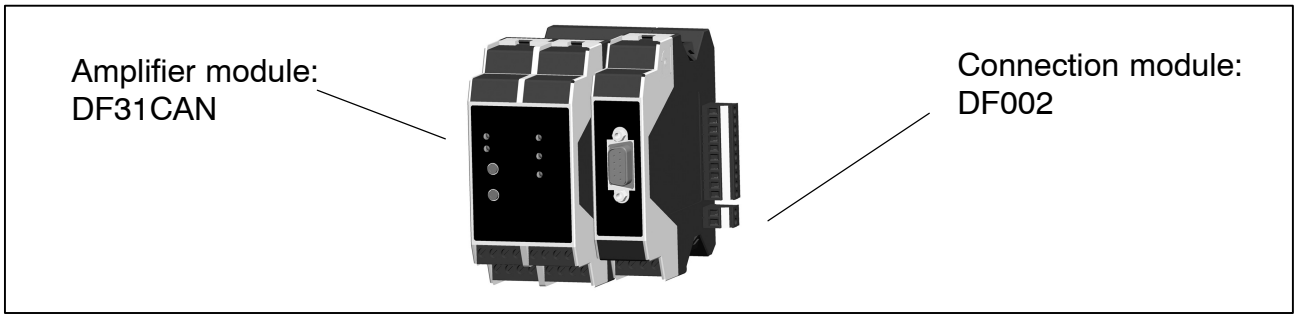
Accessories:

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

  ontaining 1 ”CAN bus” connector terminal  and

  1 male and 1 female connector for ”synchronization” (needed for two-tier installation in the control cabinet) 

- Setup Toolkit for digiCLIP with a CAN to USB adapter, a connection cable and free setup software (digiCLIP Assistant)
  Order No.: 1−digiCLIP−Setup
- Connection module for frontal assignment of the rear terminal strip (bus and power supply) Order No.: 1−DF002



1.2 General

The DF31CAN module from the digiCLIP product line is a carrier-frequency amplifier suitable for connecting force transducers, pressure transducers, torque transducers and load cells.

The DF31CAN 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 DF31CAN.

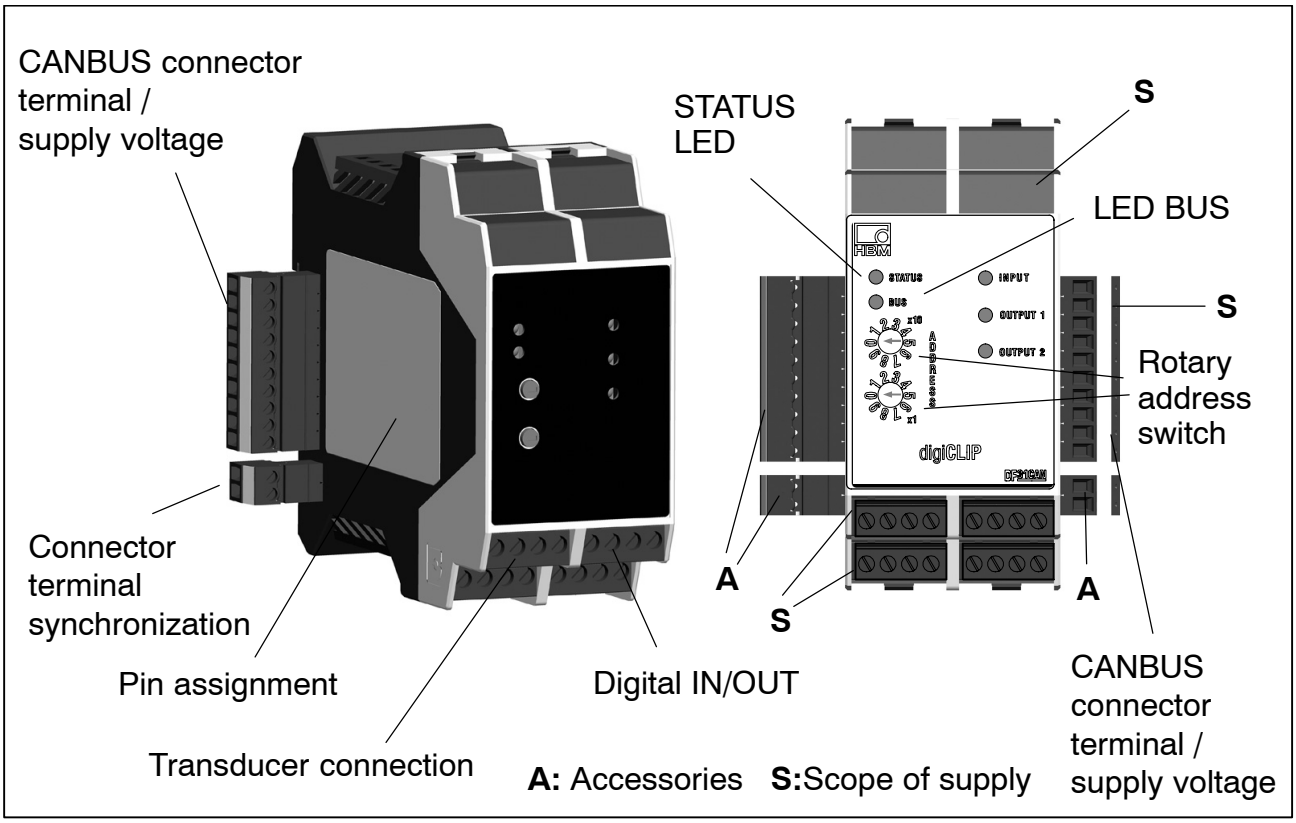


Fig.1.1: digiCLIP module

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.

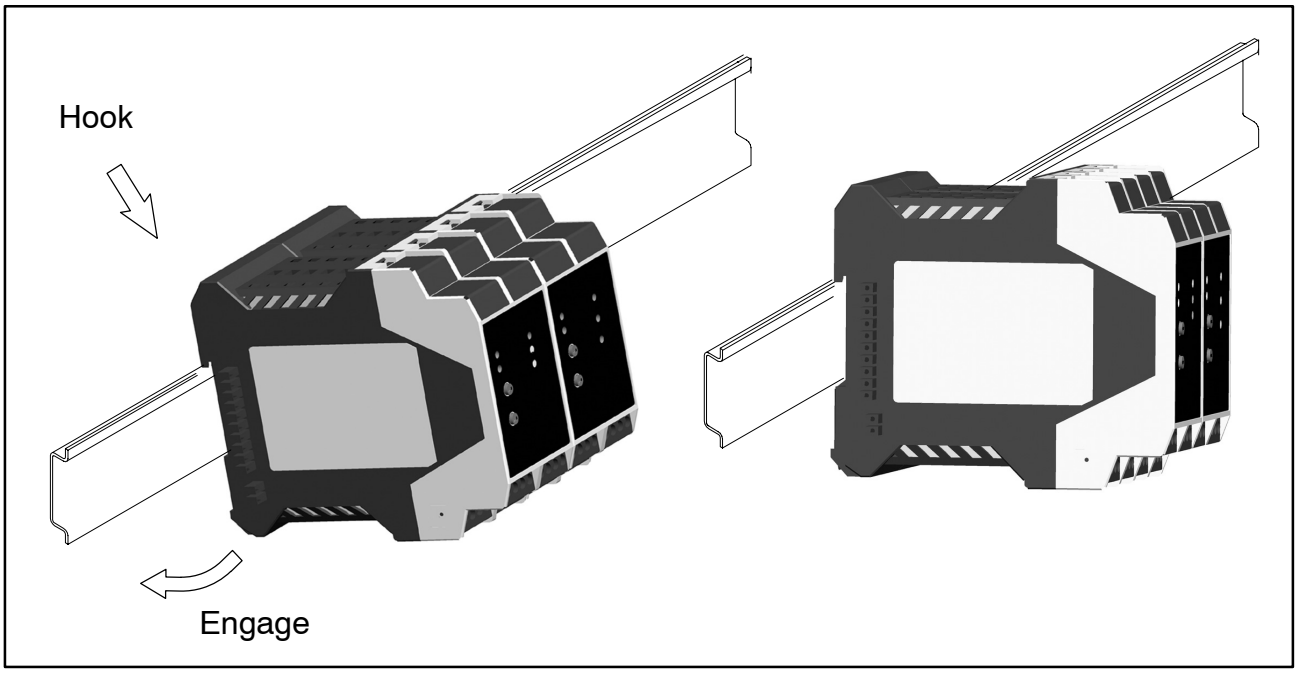


Fig.2.1 Mounting on a support rail

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

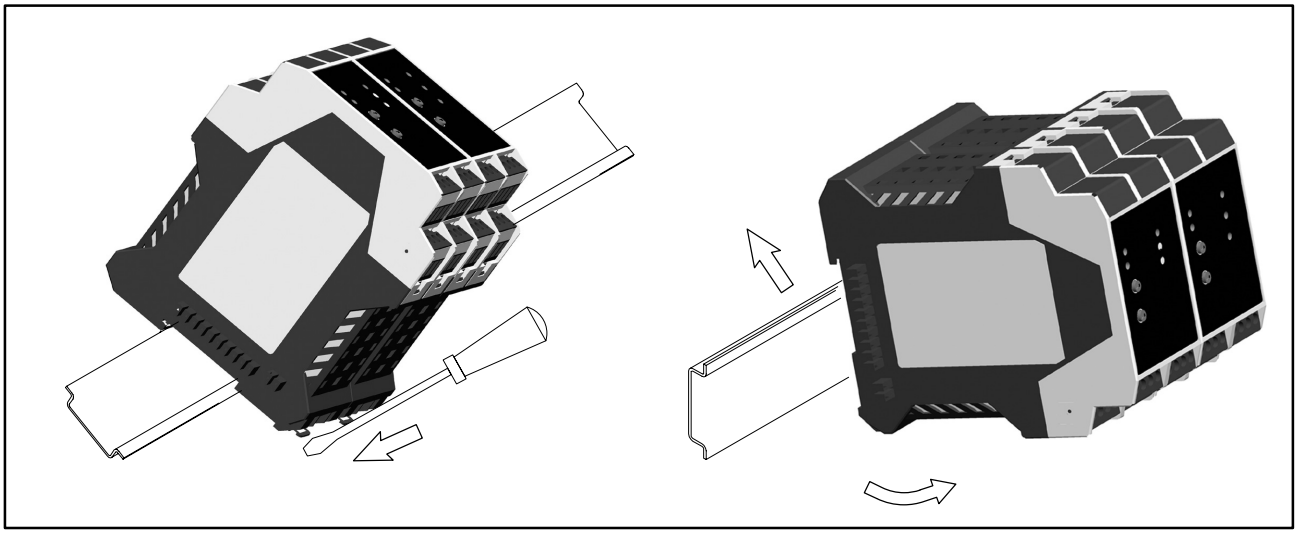


Fig.2.2: Removal

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, CAN bus 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

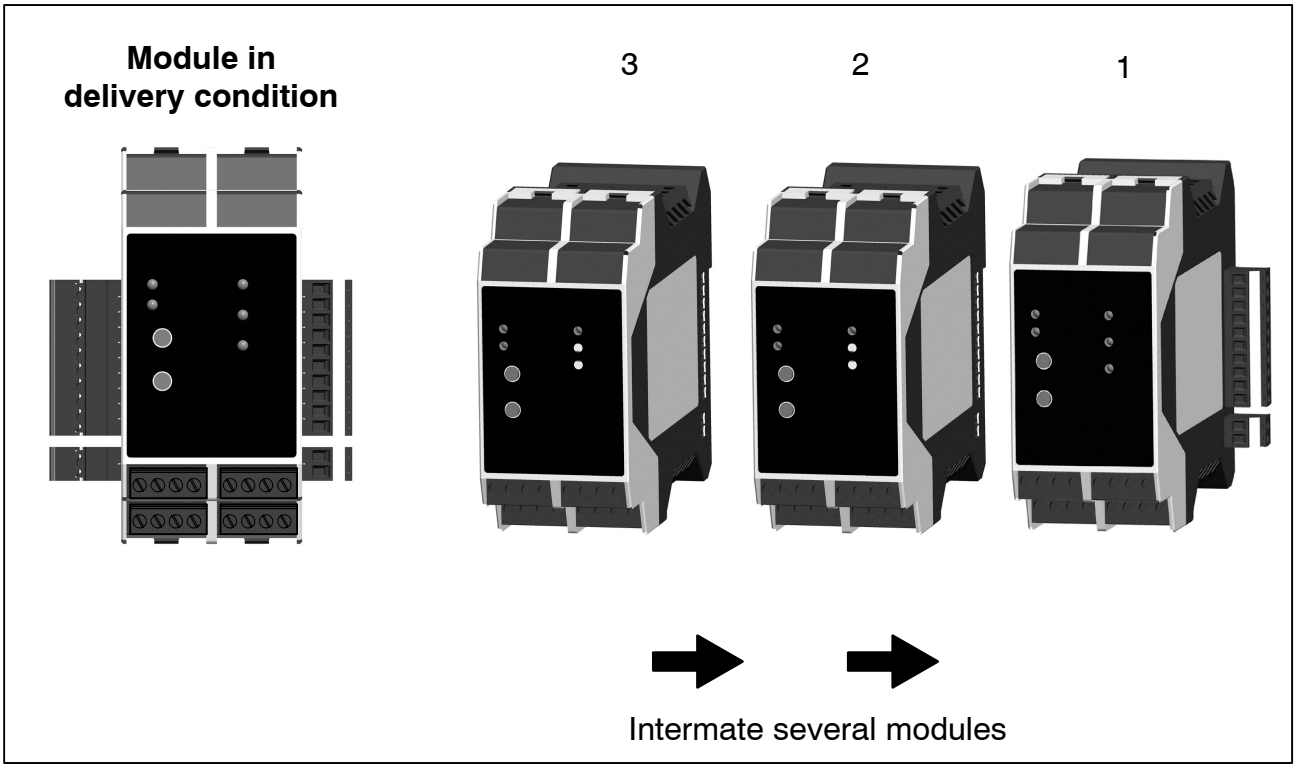


Fig.2.3 Module installation

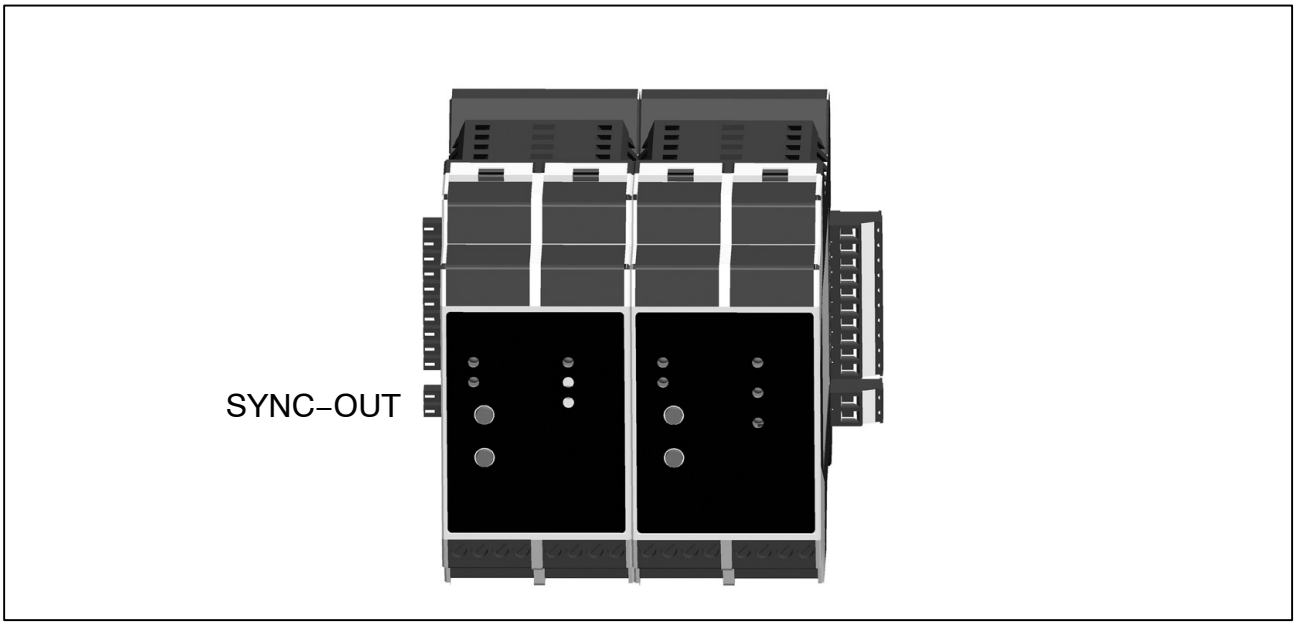


Fig.2.4: Modules mounted side-by-side

3 Electrical connection

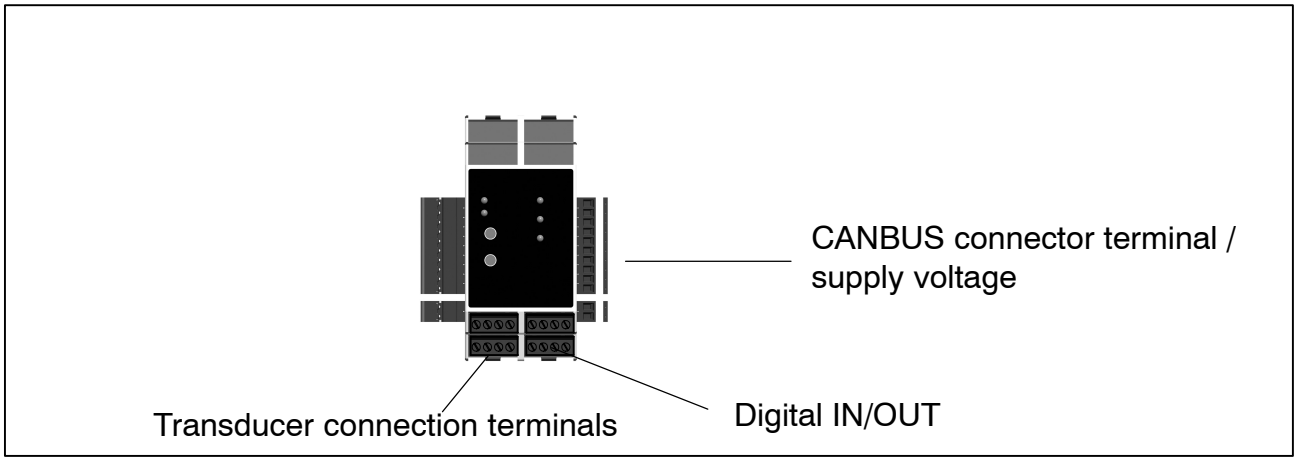
Transducers can be connected to the module in a strain gage full-bridge circuit.

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.

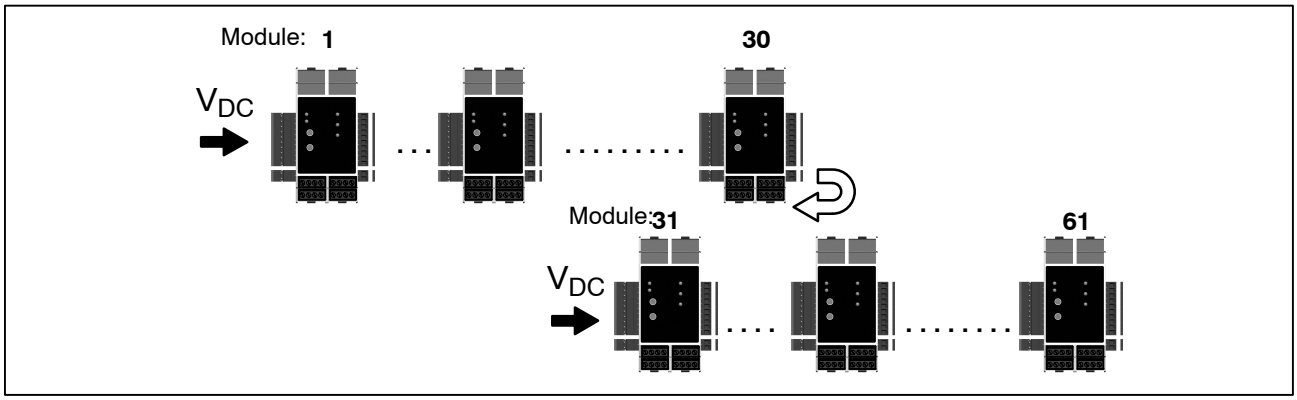
The CAN bus and the power supply can be connected via the 10–pin terminal strip at the side or via an adapter module. The clamping area is 0.05 mm^2 to 2 mm^2. Connection module DF002 can be used as an alternative.

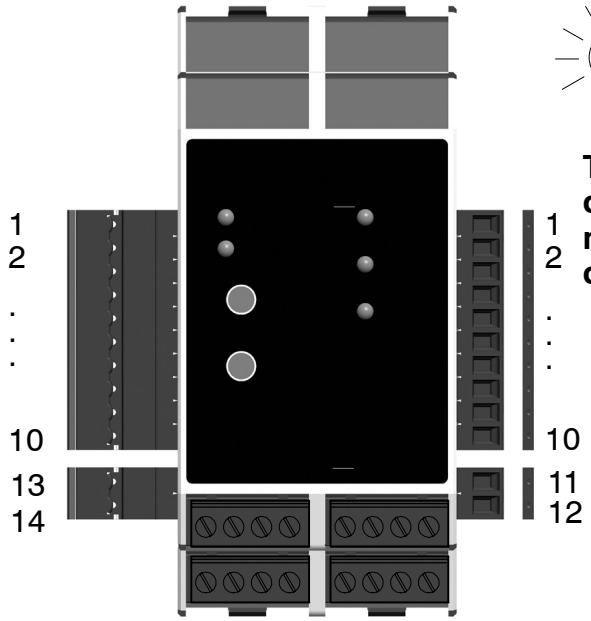
End sleeves (without plastic collars, length 10 mm) should be used on the strands to connect the wires to the terminals.



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

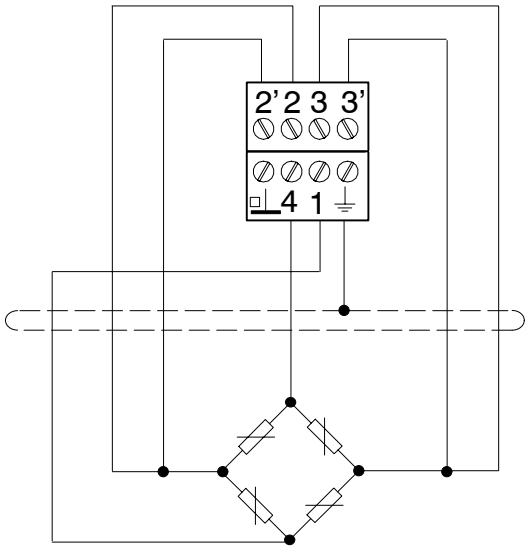
The Reserve connections must have nothing connected to them.

Assignment

PIN

1	Reserve
2	Reserve
3	Reserve
4	Reserve
5	CAN_GND
6	CAN_H
7	CAN_L
8	⏚
9	+24V
10	GND 24 V
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.

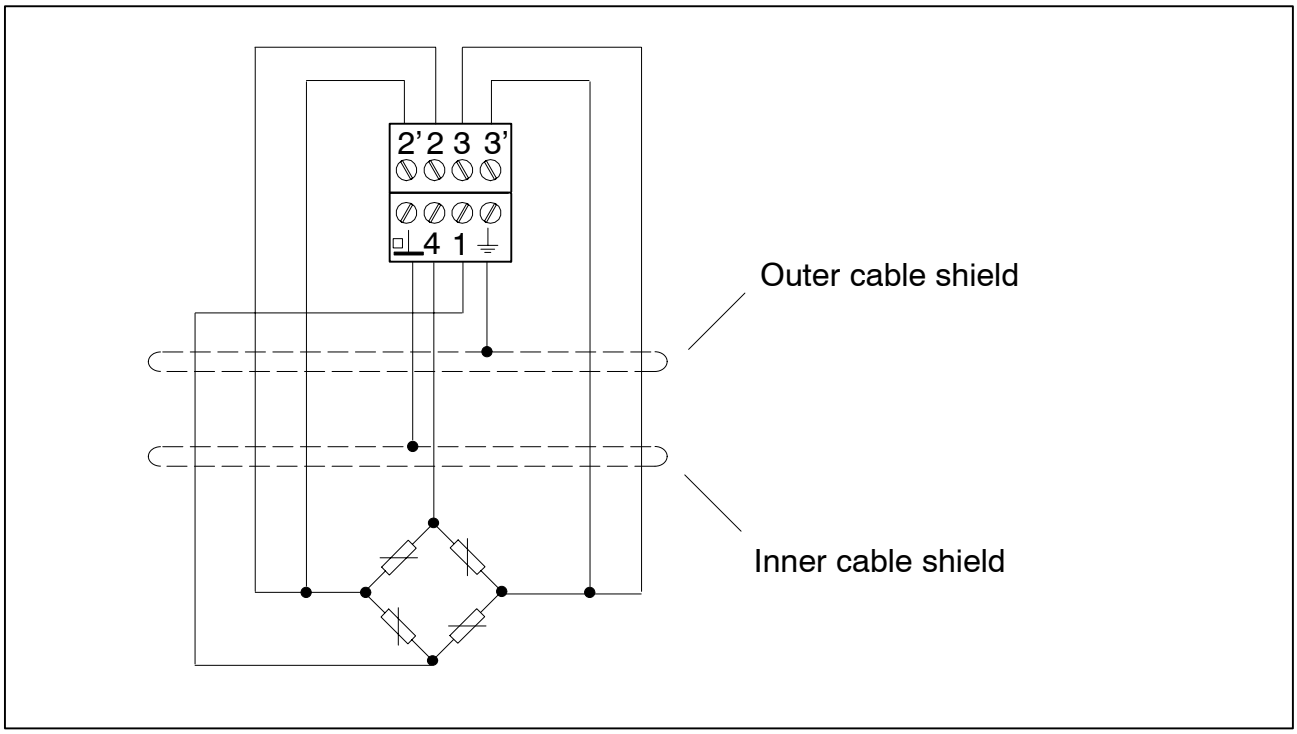


Fig.3.2: Transducer connection in six–wire configuration

Transducer connection in four-wire configuration

When connecting 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.

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

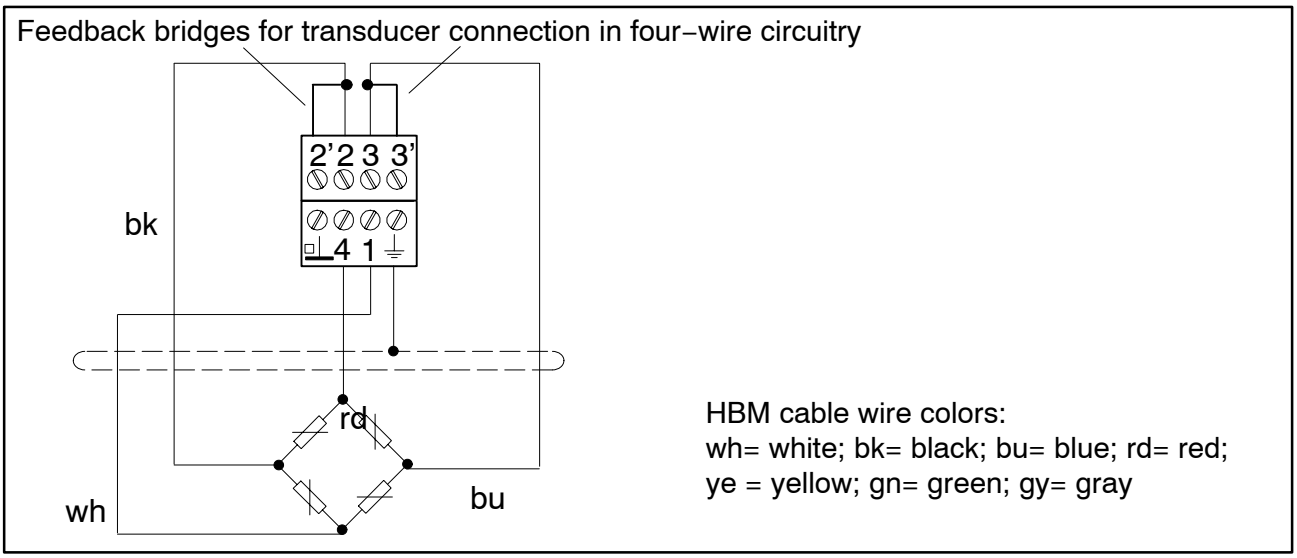


Fig.3.3: Four−wire connection with feedback bridges

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.

NOTE

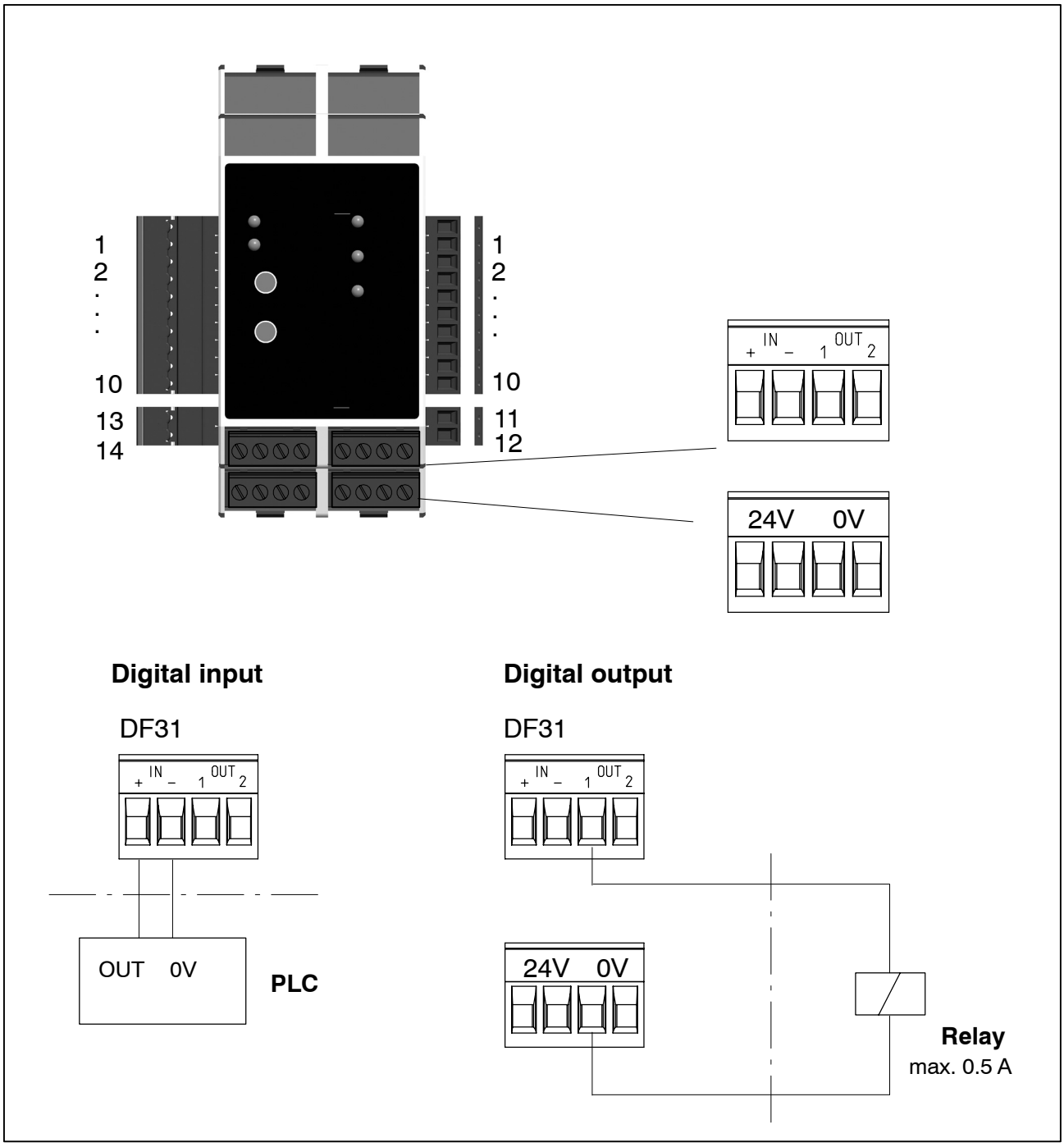
Use standard HBM cables for connecting the transducers. When using other shielded, low-capacitance measurement cables, attach the shield of the transducer cable to the cable shield connection in accordance with HBM Greenline information.

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).

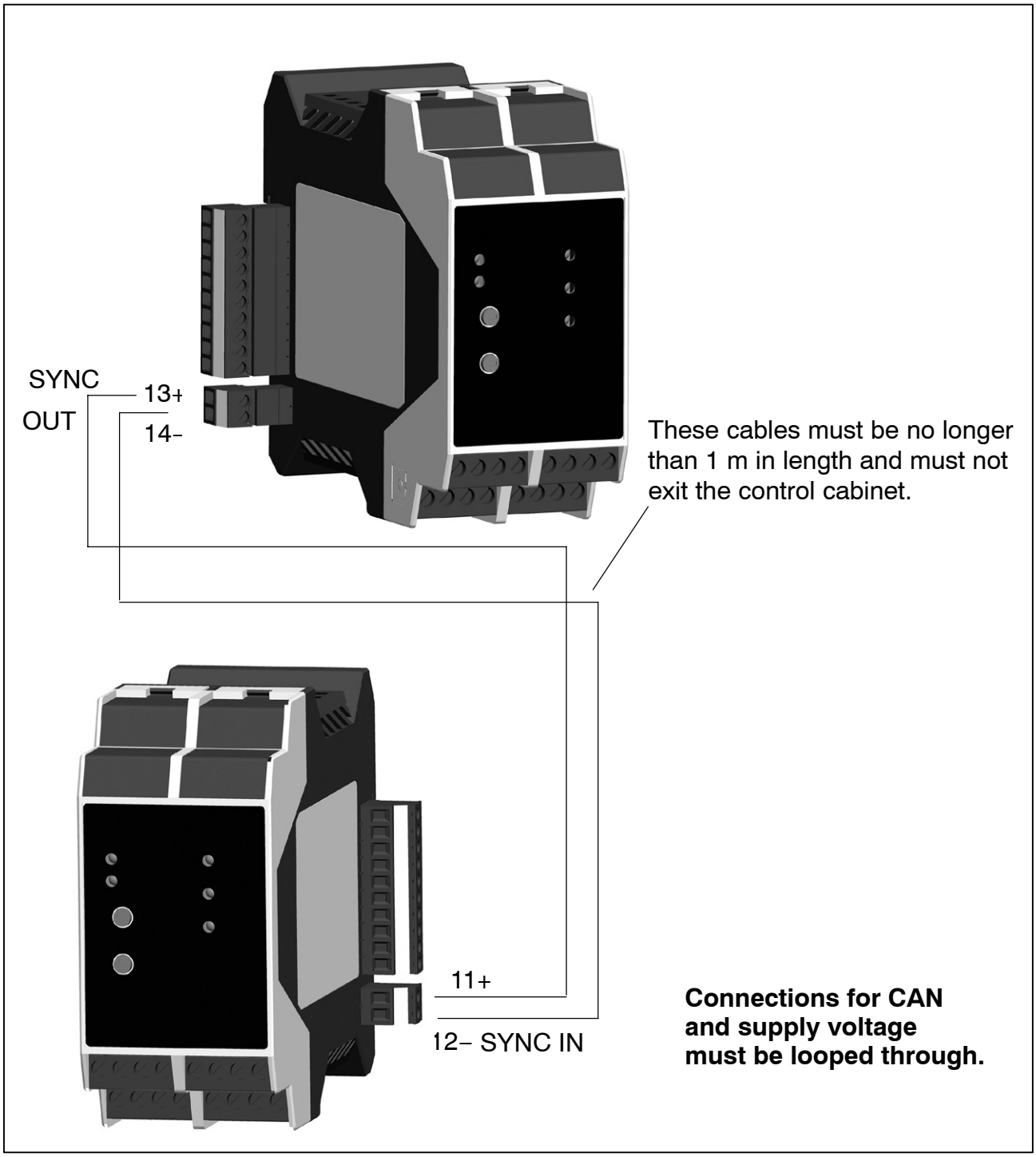


Fig.3.4: Mounting at several levels

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 99 modules can be interconnected.

3.4 CAN bus installation

Located on the front of the DF002 connection module is a 9−pin D−Sub connection socket for the CANBUS connection. As an alternative, the CANBUS connection can also be made via the 10−pin connector terminal at the side.

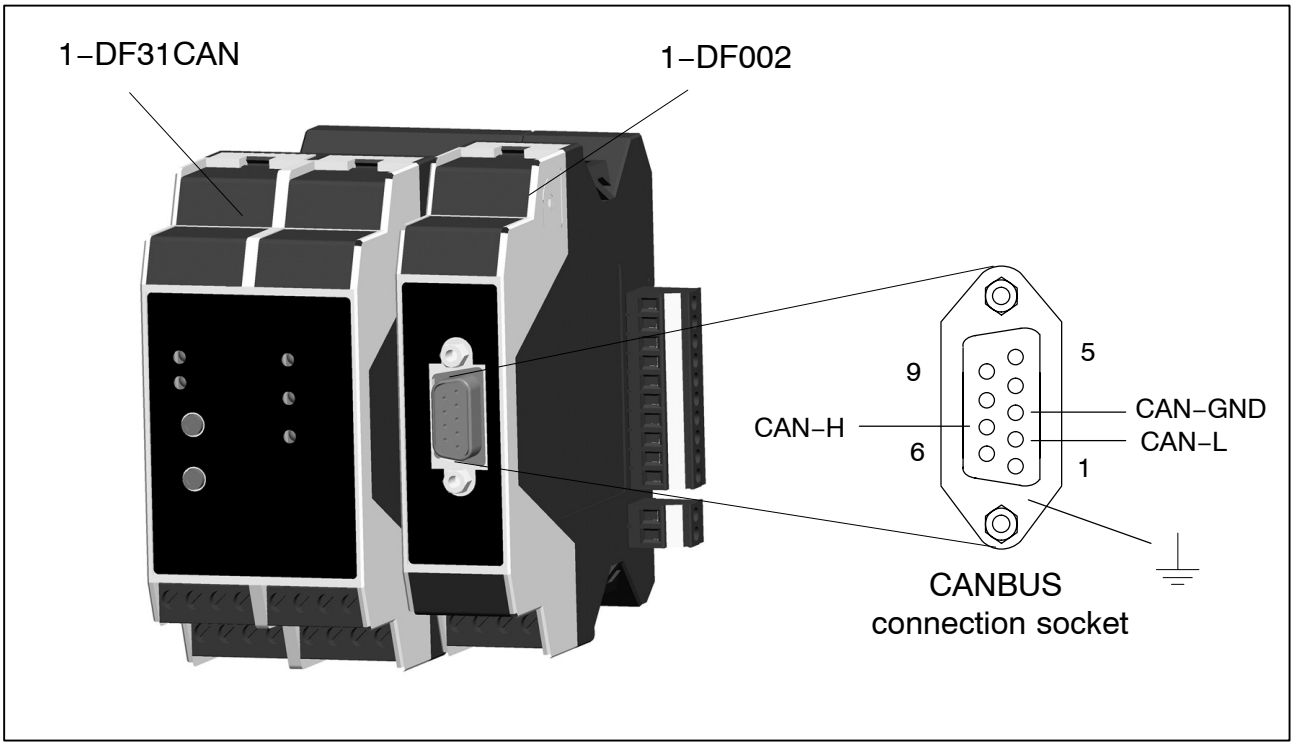


Fig.3.5: CANBUS connector

The CANopen system is cabled in a bus topology with (120 ohm) termination resistors at the start and at the end. Stub lines should be avoided if possible.

The cable should be run as a shielded, twisted-pair cable, and should have an impedance of 120 ohms and a resistance of 70 mOhm/m. Data is transmitted

by the CAN-H and CAN-L signals, with a common GND as the data ground. There is also the option to incorporate a 24-volt supply voltage.

A maximum of 127 nodes can be connected in a CANopen network. The transmission speed can be adjusted in specified steps in the 10 kbit/s to 1 Mbit/s range.

The length of a CANopen network depends on the transmission speed, and is shown in the table below.

Bit rate (kbit/s)	Line length (m)
1000	25
500	100
250	250
125	500
100	600
50	1000

3.5 CAN bus line termination

The CAN bus is connected via the 10–pin plug-in terminal. A maximum of 99 digiCLIP devices can be connected in one bus segment – each with different CAN addresses – (in accordance with the CANopen specification).

In the **first** and **last** bus nodes, the CAN bus needs a termination resistor of 120 Ω (min. 1/4 W). The bus line must have no more than two termination resistors. The digiCLIP has an integrated termination resistor which is activated by a slide switch. The alternative is for the termination resistor to be connected to the connection terminals. When the digiCLIP is delivered, this slide switch is in the ”OFF” position.

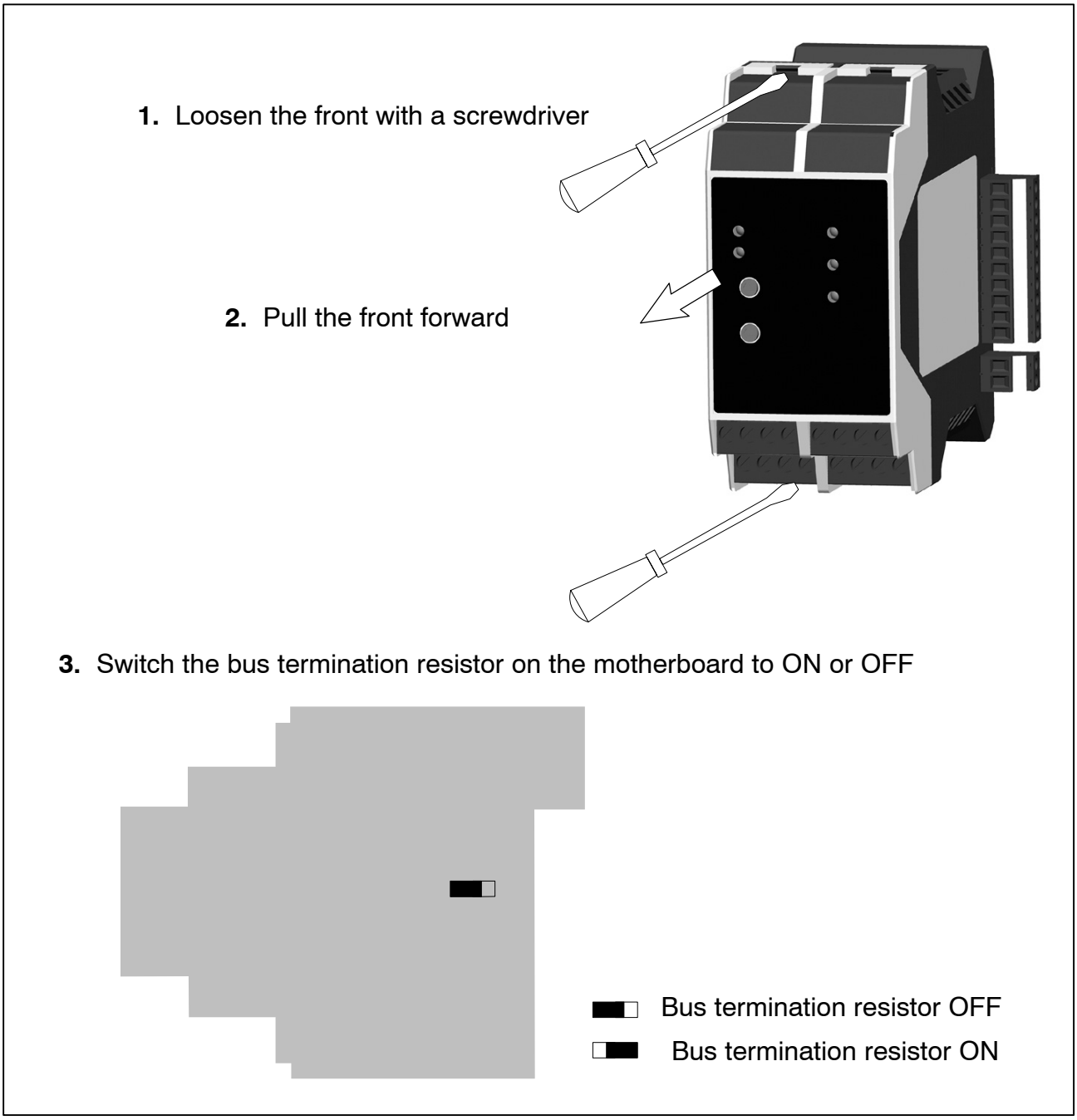
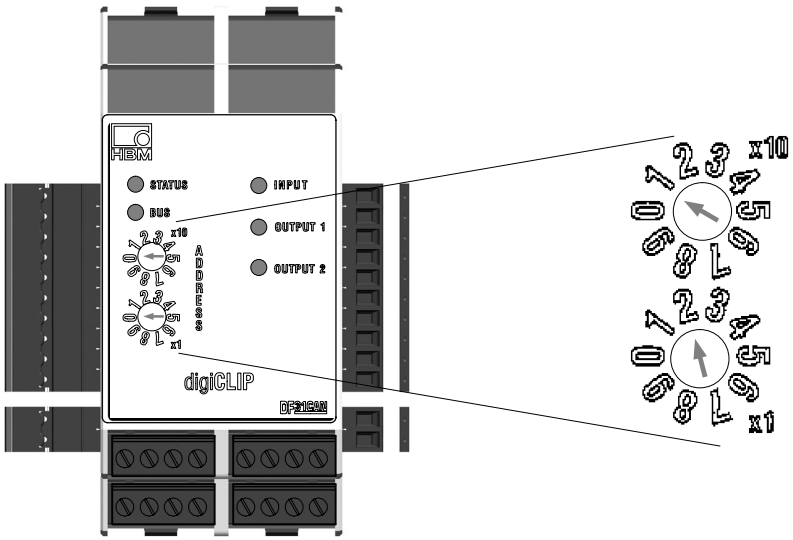


Fig.3.6: Slide switch for the CAN bus termination resistor

3.6 Selecting the module address

Address 1 to address 99 can be set as the module address.



Example:

Address 12 is set

3.7 Automatic bit rate detection

Each time it is activated, the digiCLIP applies the last bit rate to be selected. Should the bit rate have been changed in the CAN network, proceed as follows:

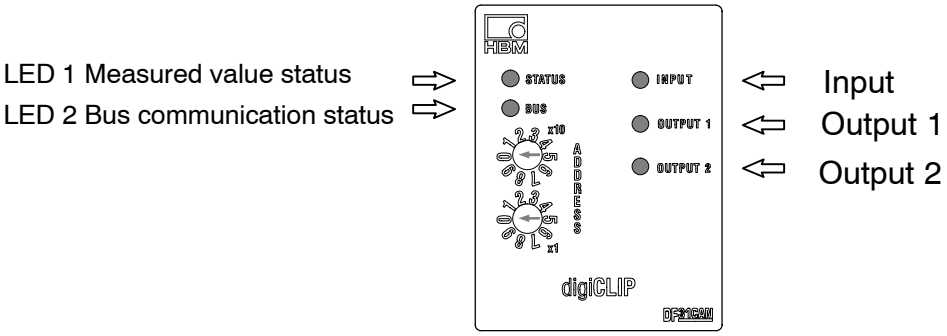
- Connect the digiCLIP
- Activate the digiCLIP
- Use the rotary switch to change the address (any value)
  - The lower LED flashes yellow/red (sensitized to receive data)
- Transmit data (e.g. start the digiCLIP Assistant)
  - Lower LED stays on or flickers yellow

As of now, the bit rate is automatically registered and applied.

In the delivery condition, the bit rate is set to 1 MBit/s.

3.8 Display LED status, error messages

Two LEDs show the operating states. The upper LED relates to measurement acquisition, the lower to communication.



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. The digiCLIP status is “operational”, the transmission rate is set.
Orange	No error at the interface, normal operation. The digiCLIP status is “pre–operational”, the transmission rate is set.
Flickering orange-dark or green-dark	No error at the interface, normal operation with data traffic on the CAN-BUS.
Flashing orange-red	The digiCLIP status is “pre-operational”, automatic bit rate detection is running.
Red	Error on the CANBUS, 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 parameterize and scaling this measurement system, the display and measured value recording.

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

Procedure

- The digiCLIP must be ready for operation.
- Connect the PC's CAN bus interface to the digiCLIP (this can also be done while operation is ongoing).
- Should the PC not have its own CAN bus interface, you can use the CAN to USB adapter (1−digiCLIP Setup).
- Make sure that the digiCLIP is not being parameterized from elsewhere at the same time (no further SDO Transfer active)
- Start the digiCLIP Assistant.
- When you start the software for the first time, you must choose the CAN network to be used 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 CAN 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 CANopen bus

- Check whether the CANBUS interface is correctly installed on the PC; see the CAN adapter installation instructions and the operating requirements.
- If the digiCLIP is not using the same bit rate (also called the baud rate) as the CAN network, 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 CANBUS 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 50 kbit/s and 1 Mbit/s for CANopen. Check that the specified network uses a permissible bit rate.
- On the CANBUS, verify for several devices that each digiCLIP has its own CAN 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 CAN bus are correctly set: the resistors for the first and last devices on the bus (or PC) must be activated (DIP switches on the digiCLIP). If you are using more than one device, **no** resistors can be activated on any of the other devices.
- Call the PCANStat program from Peak (Windows **Start** menu, **Programs → PCAN**).
  The program indicates which nodes are available on the CANBUS at the PC end. The entry PCANLight_USB_Client should be available for DeviceNet, the entry HBM_Client for CANopen, and the CAN network selected for CANopen should be displayed.
  It will also be obvious from the status for the PC CAN interface whether the CANBUS is working correctly *(OK)*. BUS HEAVY, for example, can also be caused by a faulty connection. In this situation, check all the cable connections.

  NOTE:
  The display in the PCANStat window is only updated when the data is transferred. Therefore, once changes have been made, find the devices, so that you can recognize the changes, or reset the CANBUS.

- Call the PCANStat program from Peak (Windows **Start** menu, **Programs →PCAN**).
  Right-click on the area for the PC's CAN interface and reset the CANBUS. Then, in the digiCLIP Assistant, find the devices again:
  Interface → Find devices.

More information can be found in the online Help on the system-CD.

5 Parameterizing 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.

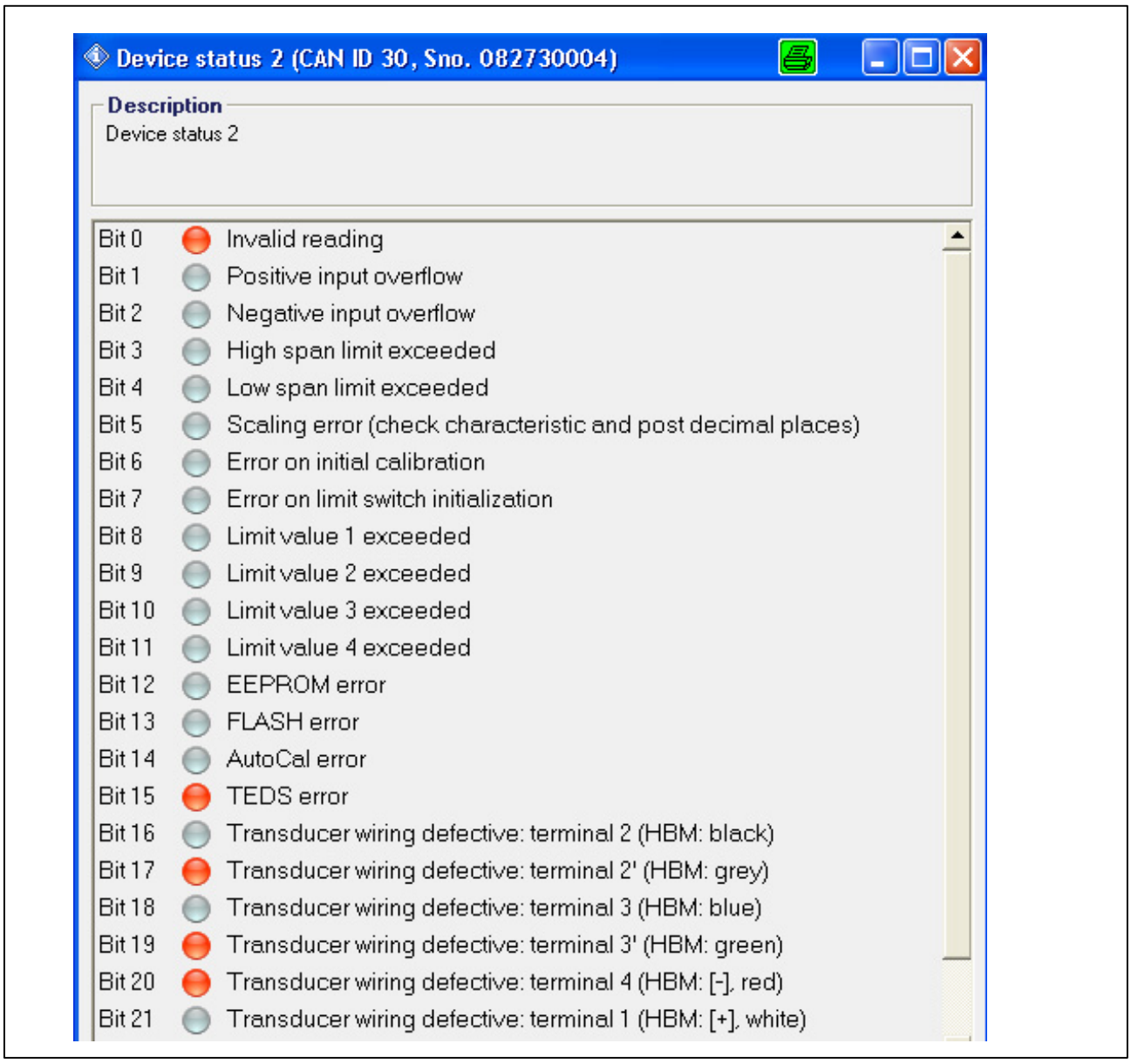


Fig. 5.1: Assistant: Device status

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).

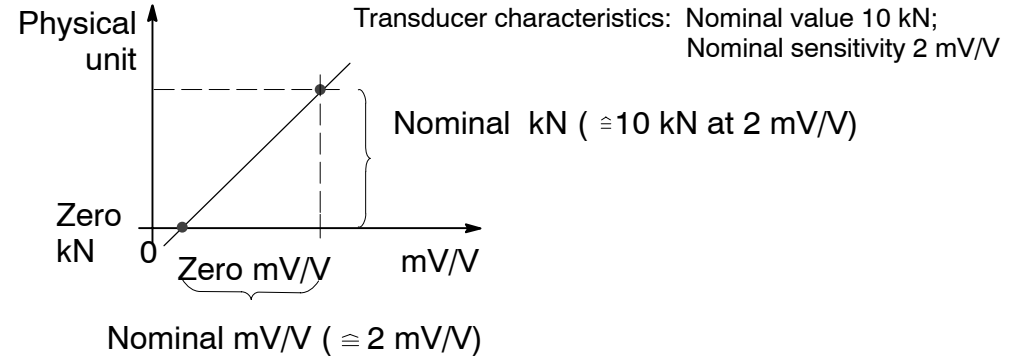
After a loss of voltage, or after switching the digiCLIP back on, all the parameters last available in the EEprom are automatically reloaded into the device (RAM).

NOTE

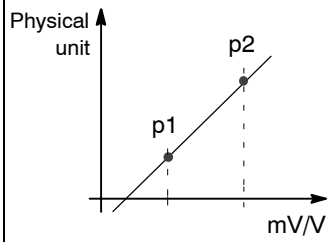
Apart from the factory settings, the digiCLIP only has one parameter set (measurement program) that can be stored in the device. But additional parameter sets can be stored on a PC and then reloaded, using the Assistant. There is no offline mode, that is, creating / changing a parameter set without a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

5.1 Clarification of significant parameters

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

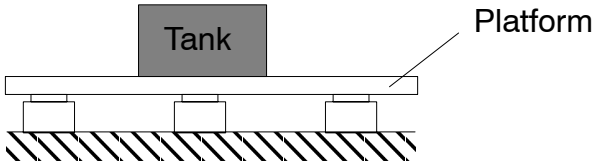
2. Load transducer with 4 kg

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:



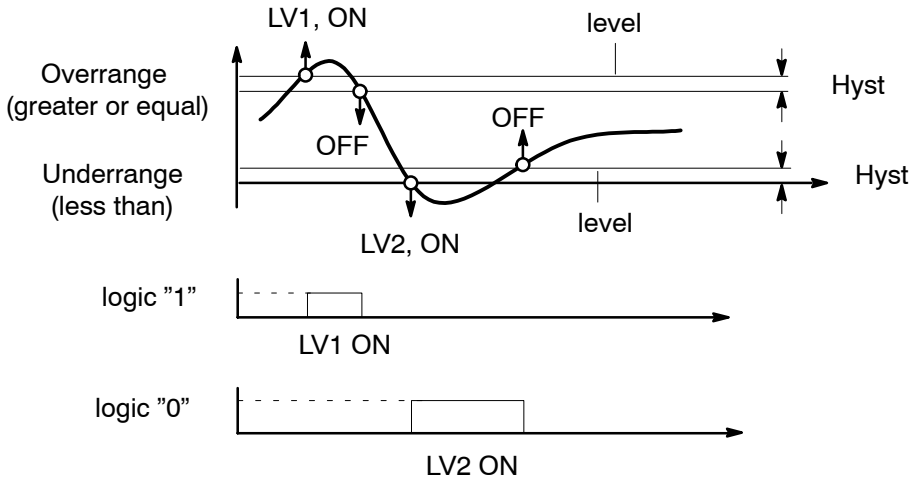
Weighing steps	Action	Display Gross	Net
Put on the platform (35 kg)	> 0<	before 35 kg after 0 kg	before 35 kg after 0 kg
Put on the container (8 kg)	> T<	before 8 kg after 8 kg	before 8 kg after 0 kg

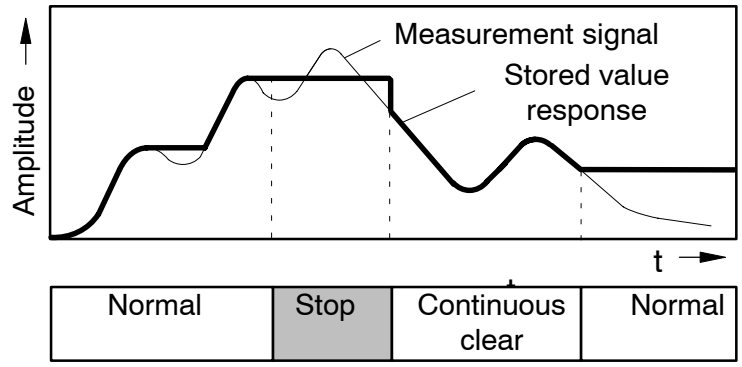
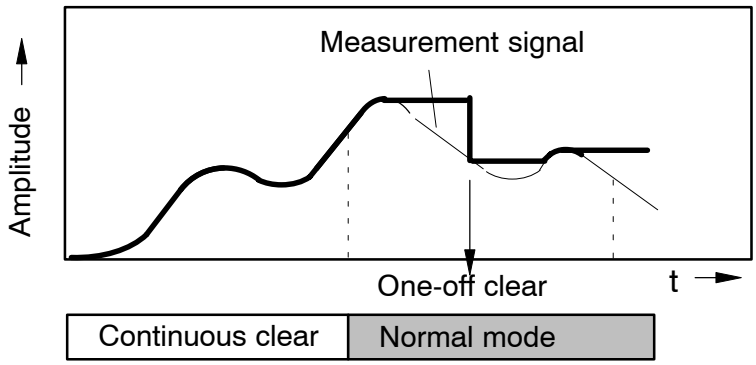
Filters / frequencies	0,05 Hz	1 Hz	20 Hz
	0.1 Hz	2 Hz	50 Hz
	0.2 Hz	5 Hz	100 Hz
	0.5 Hz	10 Hz	

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



<table>
<tr><td colspan="2">The choice of source for the peak value signal is: gross/net</td></tr>
<tr><td colspan="2">The peak value can be cleared.</td></tr>
<tr><td rowspan="2">Peak values</td><td>Example 1
 
</td></tr>
<tr><td>Example 2
 
</td></tr>
</table>

5.2 Parameterizing 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 Parameterization with TEDS

If a transducer with TEDS, containing the parameterization data for a full bridge is connected, this can be used to parameterize 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”), a CAN error message is generated 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.

Example 1:

Torque transducer connected, display required in kilonewton meters, ”kNm”

Stored in the TEDS are:

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 2, physical	2.5 kNm
Char. curve point 2, 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 N
Maximum Force/Weight	1000.0 N
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.

If, instead of using the digiCLIP Assistant, you are parameterizing directly by SDO commands, you must use Object 3576 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 are defined in accordance with CiA DR303–2. English units of measurement are supplied in accordance with the table below. If value = ”00000000” is set, the unit used for conversion is the one stored in the TEDS.

When the TEDS is successfully activated, objects 3231 and 6131 are also changed accordingly.

The CAN objects for using TEDS are located in Section 6.7.9 .

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.

5.2.3 Parameters of the required physical conversion unit

Value (hex)	Required unit	Conversion
FA4B0000	µg	$1 \cdot 0^{-6}$ 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 N·m
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	$1\ 10 \cdot 10^{-6}$ m
00EC0001	in	$25.4\ 10^{-3}$ 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	$1\ 10^{-6}$ m/m
FE000000	%	
FD000000	‰	0.1 %
FA000000	ppm	$0.1 \cdot 10^{-3}$ %

6 CAN interface description

The digiCLIP module has an inbuilt CAN interface which can be used both for transmitting measured values and for module parameterization. Different bit rates can be selected up to a maximum of 1 Mbit/s. The interface protocol is adapted to the CANopen Standard, in particular DS301 and DS404.

CANopen was developed by CiA (CAN in Automation), the users' and manufacturers' organization for CANopen, and has been standardized in European standard EN 50325-4 since the end of 2002.

CANopen uses layers 1 and 2 of the CAN standard originally developed for use in automotive applications (ISO 11898–2) as its transmission technology. In automation, these have been extended with regard to connector pin assignment, transmission rates and application layer, on the recommendations of the industrial association of the CiA.

6.1 Cyclic data transmission

The cyclic data are transmitted as so-called "Process Data Objects" (PDOs, in accordance with the CANopen definition). Interesting measured values are transmitted cyclically from the measurement device under a previously defined CAN Identifier, without any further identification. A query message is not required. A parameter setting determines how often the PDOs are transmitted (see object dictionary).

PDOs are transmitted event-oriented, cyclically or as broadcast objects on request. A maximum of 8 bytes of data can be transferred within a PDO. Transmission and acceptance of PDOs across the network can be synchronized in conjunction with a synchronization message ("synchronous PDOs"). This allows both the bus load and the network response time to be reduced to a minimum. CANopen achieves a high communication capacity at a comparably low bit rate. The allocation of application objects to a PDO can be set using a structural description ("PDO–Mapping") stored in the object dictionary (OD), and can thus be adapted to the particular requirements of use for a device.

Data formats longer than one byte are always transmitted in LSB/MSB order. As well as these pre–defined PDOs, others can be set up in accordance with CANopen definitions (CiA–DS 301) via so-called mapping (see section 6.5.2). Appropriate tools are available on the market. The exchange of cyclic PDOs only starts once the module has been brought to the "Operational" state.

6.2 Parameterization

Messages for device parameterization are transmitted as so-called “Service Data Objects” (SDOs, in accordance with the CANopen definition). The various parameters are addressed by an index number and a sub–index number. For the assignment of these index numbers, please refer to the object dictionary (see section 6.5).

Data formats longer than one byte are always transmitted in LSB–MSB order.

Transmission of the SDOs is a confirmed data transfer, in each case with two CAN objects, in the form of a point-to-point connection between two network nodes. The relevant object dictionary entry is addressed by specifying the index and sub-index of the entry. There is no limit to the length of message that can be transmitted, although this is associated with an additional protocol overhead.

6.2.1 Generated error codes for SDO communication (”SDO abort codes”)

Error code (hex)	Error description
05 03 00 00	Incorrect toggle bit
06 01 00 00	Object access not supported, not permitted
06 02 00 00	Object does not exist in the dictionary
06 04 00 41	Object cannot be mapped to PDO
06 04 00 42	Number or length of the objects to be mapped exceeds the maximum PDO length
06 04 00 43	General parameter compatibility error
06 06 00 00	Hardware error
06 07 00 10	Unknown data type
06 07 00 12	Data type length too long
06 07 00 13	Data type length too short
06 09 00 11	Sub-index does not exist
06 09 00 30	Measuring range monitoring exceeded
06 09 00 31	Measuring range monitoring exceeded at the upper limit
06 09 00 32	Measuring range monitoring exceeded at the lower limit
08 00 00 00	General error
08 00 00 20	Data cannot be transferred

6.3 EMERGENCY messages

EMERGENCY messages are a high-priority reaction used to indicate critical changes of state, without this information being requested. An EMERGENCY message is only sent when the device is in the ”operational” state and the event changes from the normal state to the error state. The RESET message is sent when the error that lead to the EMERGENCY event is removed.

Notes on the limit value switches:

Each of the 4 limit value switches can be set up so that when its state changes, an EMERGENCY message is sent. If several limit value switches are activated in this way, a message is not sent every time there is a change of state, instead the following applies.
All the limit value switches are in the ”0” state. If one of the limit value switches now changes state, an EMERGENCY message is sent. If there are further limit overshoots at the other limit value switches, no additional message is transmitted. A RESET message will only be transmitted once all the limit value switches have assumed the ”0” state.

6.3.1 Protocol of an EMERGENCY message

CAN Identifier	128 (080 hex) + module address
1st … 2nd data byte	EMERGENCY message, part 1
3rd data byte	Error status
4th data byte	EMERGENCY message, part 2
5th … 8th data byte	For DF31CAN always = 00

6.3.2 Generated EMERGENCY messages

1st … 2nd data byte (hex)	4th data byte (hex)	Description of the EMERGENCY message
00 00	00	No error or error just cleared (RESET message); the error status in the 3rd data byte is also = 00.
50 10	00	Self−test: FLASH program memory error; unreliable program execution
50 20	00	Autocalibration error (”Auto−Cal”)
50 30	00	Transducer connection faulty or TEDS cannot be read [1)]
63 10	00	Scaling error
81 10	00	PDO transfer rate cannot be adhered to; measured values are being lost
F0 01	00	Measurement input overload
F0 11	00	Limit value switch; see note
FF 00	01	Gross measured value range monitoring overshoot
FF 00	02	Error when reading or editing initial calibration values
FF 00	03	Error when parameterizing limit value switches
FF 00	04	Error when reading or writing the EEPROM

1) TEDS data availability is only monitored if this has been activated (object 3581 or digiCLIP Assistant: ”Always use TEDS” checked)

6.4 Data types

CANopen 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

6.5 Data structures

6.5.1 PDO CommPar

Sub–Index	Data type	Description
0	u8	Number of entries
1	u32	CAN Identifier of the PDO, see below [1)]
2	u8	Transmission type, see below
3	u16	Cut–off time; value is not evaluated
4	u8	Priority group; value is not evaluated

1) RTR functionality is not supported, therefore Bit 30 must always be set.
Example: CAN–Node_ID = 05, 1 PDO: Value = 40000185 hex.

Supported transmission rates of the Transmit PDO (Sub–index 2, ”Transmission type”)

Value	Description
0	No PDO is transmitted
1	Cyclic transmission immediately a SYNC message is received
2…240	Cyclic transmission once n SYNC messages are received; n corresponds to the value of the transmission type
254	Cyclic transmission in accordance with the setting by Object 3400, independently of the SYNC message

6.5.2 PDO Mapping

Sub–Index	Data type	Description
0	u8	Number of entries
1	u32	1. mapped object
2	u32	2. mapped object
...		...
8	u32	8. mapped object

Structure of a PDO Mapping entry

Index (16–bit)	Sub–index (8–bit)	Object length in bits (8–bit)

The total of the object lengths of a PDO Mapping must not exceed 64 bits. If, for example, the object lengths of the first two mapped objects are each 32 bits, objects 3 to 8 are not available

6.6 Electronic data sheet – EDS file

The functionality and properties of a CANopen device are described in ASCII format in the standardized, electronic data sheet (Electronic Data Sheet, EDS). The EDS should be understood as a kind of form, describing all the data and functionalities of a device that are accessible via the network.

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

6.7 CAN object dictionary, in function group order

The object dictionary (OD) structures the data of a CANopen device, clearly arranging them in a table. This includes all the device parameters and all the current process data, which are also accessible via the SDO.

The object dictionary is divided into areas containing general data about the device (device identification, manufacturer's name, etc.), as well as describing the communication parameters or specific device functionality. An object dictionary entry ("object") is identified by a 16-bit index and an 8-bit sub-index.

The "application objects" of a device, such as the input and output signals, the device parameters, the device functions or the network variables, are made accessible in a standardized form over the network by the object dictionary entries.

6.7.1 Communication profile

The CANopen communication profile (documented in CiA DS-301), governs how devices exchange data with one another. As with all other fieldbus protocols, a distinction is made between real-time data and parameter data. These data types are totally different in character, and CANopen always assigns suitable communication elements to them.

Index (hex)	Index (dec)	Sub–Index	Access[1]	Data type[2]	Value	Description	Definition[3]	Parameter set[4]
1000	4096	0	RO	u32	00220194 hex (constant)	Device supports Alarm and Analog Input Blocks in accordance with CiA DS404	DS404	–
1001	4097	0	RO	u8	Bit 0 corresponds to bit 0 set in Index 6150; bit 1…7 always = 0	Error register with status; preferably monitor status from Index 6150 and Index 2011!	DS404	–
1002	4098	0	ROP	u32	see Index 2011, sub-index 1	Manufacturer-specific error register; corresponds to system status 2	HBM	–
1003	4099	0	RO	u8		Error states: number of entries	DS301	–
1003	4099	1 …	RO	u32		Error states	DS301	–
1004	4100	0	RO	u32	hex (constant)	Max. number of supported Receive and Transmit PDOs	DS301	–
1004	4100	1	RO	u32		Max. number of supported synchronous Receive and Transmit PDOs		
1004	4100	2	RO	u32		Max. number of supported asynchronous Receive and Transmit PDOs		
1005	4101	0	RW	u32		COB–ID SYNC	DS301	C
1008	4104	0	RO	VS	Visible string	Manufacturer device name (20 characters)	DS301	–
1009	4105	0	RO	VS	Visible string	Manufacturer hardware version (13 characters)	DS301	–
100A	4106	0	RO	VS	Visible string	Manufacturer firmware version (8 characters)	DS301	–
100B	4107	0	RO	u32	Node ID	Device address	DS301	–
100C	4108	0	RW	u16		Node guarding: Guard time	DS301	C

1) RW: Read and write accessf
RO: Read access only
WO: Write access only
ROP: Read access only by SDO and PDO
WOP: Write access only by SDO and PDO
RWP: Read and write access by SDO and PDO
Objects with the addition ”P” can be mapped in an SDO or PDO.

2) The format describes the data type, as noted in Section 6.4.

Index (hex)	Index (dec)	Sub–Index	Access[1]	Data type[2]	Value	Description	Definition[3]	Parameter set[4]
100D	4109	0	RW	u8		Node guarding: Life time	DS301	C
100E	4110	0	RW	u32		Node guarding: Identifier	DS301	C
1014	4116	0	RW	u32	COB–ID EMCY	EMERGENCY message identifier	DS301	–
1018	4120	1	RO	u32	HBM: 011D hex	CANopen Vendor–ID	DS301	–
1018	4120	2	RO	u32	DF31CAN: 0302hex	CANopen Product–ID	DS301	–
2083	8323	0	RO	VS	Visible String (12 characters)	HBM serial number	HBM	–
2084	8324	1	RW	VS	Visible String (16 characters)	Channel name, defined individually by user	HBM	A

3) HBM: HBM-specific definition;

DS301: Definition from CiA Draft Standard 301, DS404: Definition from CiA Draft Standard 404; DR303: Definition from CiA Draft Recommendation 303

4) Parameter set column: A: Value is stored in the application parameter set; C: Value is stored in the communication parameter set; _ : Value is not stored in a parameter set

6.7.2 Parameter set and factory setting

In the digiCLIP Assistant, click on ”Store parameter in device” or ”Restore factory setting” to read or write the application parameter set. This is marked in the tables by an ”A”. The communication parameters are written and loaded in the extra ”PDO Details” dialog. The objects concerned are marked in the tables by a ”C”.

Index (hex)	Index (dec)	Sub–Index	Access	Data type	Value	Description	Definition	Parameter set
1010	4112	0	RO	u8		Protect parameters: supported functions (maximum supported sub-index)	DS301	–
1010	4112	1	RW	u32	Write: 65766173 hex	Protect all current application (”A”), communication (”C”) and PDO Mapping parameters (Index 1000…9FFF).	DS301	–

Index (hex)	Index (dec)	Sub–Index	Access	Data type	Value	Description	Definition	Parameter set
1010	4112	2	RW	u32	Write: 65766173 hex	Protect only the current communication (”C”) and PDO Mapping parameters (Index 1000…1FFF).	DS301	–
1010	4112	3	RW	u32	Write: 65766173 hex	Protect only the current application parameters (”A”) (Index 2000…3FFF and 6000…9FFF).	DS301	–
1011	4113	0	RO	u8		Restore factory setting: supported functions (maximum supported sub–index)	DS301	–
1011	4113	1	RW	u32	Write: 64616F6C hex	Factory setting: Restore all applications (”C”) and PDO Mapping Parameters (Index 1000...9FFF)	DS301	–
1011	4113	2	RW	u32	Write: 64616F6C hex	Factory setting: Only restore applications (”A”)	DS301	–
1011	4113	3	RW	u32	Write: 64616F6C hex	Factory setting: Only restore communications (”C”) and PDO Mapping Parameters	DS301	–

6.7.3 Measured values

Index (hex)	Index (dec)	Sub–Index	Access	Data type	Value	Description	Definition	Parameter set
2002	8194	1	ROP	i32		Max. peaks measured value	HBM	–
2003	8195	1	ROP	i32		Min. peaks measured value	HBM	–
2004	8196	1	ROP	i32		Peak–to–peak measured value	HBM	–
3002	12290	1	ROP	r32		Max. peaks measured value	HBM	–
3003	12291	1	ROP	r32		Min. peaks measured value	HBM	–
3004	12292	1	ROP	r32		Peak–to–peak measured value	HBM	–
6130	24880	1	ROP	r32		Gross measured value	DS404	–
6140	24896	1	ROP	r32		Net measured value	DS404	A
9130	37168	1	ROP	i32		Gross measured value	DS404	–
9140	37184	1	ROP	i32		Net measured value	DS404	–

6.7.4 Device status

Index (hex)	Index (dec)	Sub–Index	Access	Data type	Value	Description	Definition	Parameter set
1001	4097	0	RO	u8	Bit 0 correspond s to bit 0 set in Index 6150; bit 1…7 always = 0	Error register with status; for reasons of compatibility, preferably monitor status from Index 6150, 2010 and Index 2011!	DS404	–
1002	4098	0	ROP	u32	see Index 2011, sub–index 1	Manufacturer-specific error register; corresponds to system status 2	HBM	–

Index (hex)	Index (dec)	Sub–Index	Access	Data type	Value	Description	Definition	Parameter set
2010	8208	1	ROP	u8		System status 1 Bits 0…2: as Index 6150, bits 0…2 Bit 3: CAN bus error or warning Bits 4…7: Limit value switches 1…4 triggered	HBM	–
2011	8209	1	ROP	u32		System status 2 (copy in Index 1002): Bit 0: Measured value invalid (as Index 6150, Bit 0) Bit 1: Positive measurement input overload Bit 2: Negative measurement input overload Bit 3: Pos. measuring range overshoot (see Index 6149, 9149) Bit 4: Neg. measuring range overshoot (see Index 6148, 9148) 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 (as Index 2010, bits 4…7) 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…23: *reserved* Bit 24: CAN: "Bus OFF" Bit 25: CAN: "Tx not ok" Bit 26: CAN: "Main error" Bits 27…31: *reserved*	HBM	–

Index (hex)	Index (dec)	Sub–Index	Access	Data type	Value	Description	Definition	Parameter set
2012	8210	0	RO	u8	0: digiCLIP is SLAVE 1: digiCLIP is MASTER	Hardware synchronization	HBM	–
2013	8211	0	RO	u8	0: identical 1: not identical	Check whether the current application parameters match the data in the EEPROM	HBM	–

1) TEDS data availability is only monitored if this has been activated (object 3581 or digiCLIP Assistant: ”Always use TEDS” checked)

Index (hex)	Index (dec)	Sub–Index	Access	Data type	Value	Description	Definition	Parameter set
6150	24912	1	ROP	u8	Status bits, see footnote 1)	Status as per DS404	DS404	–
6F20	28448	1	ROP	u8		Random count value (”Life counter”)	DS404	–

1) Index 6150: Bit 0 is set when an error occurs which influences the measured value. So when this bit is set, it means that the measured value is invalid. This is the case, for example, with a measurement input overload, a faulty transducer connection, an undefined choice of excitation voltage and for all scaling errors. This bit is cleared when the cause of the error is removed. It is not set when range monitoring is exceeded.
Bit 1 is set when the measurement input is overloaded in the positive direction or when the gross measured value exceeds range monitoring in the positive direction. See Objects 6148, 6149, 9148 and 9149.
Bit 2 is set accordingly for overshoots in the negative direction.

6.7.5 Device control

Index (hex)	Index (dec)	Sub–Index	Access	Data type	Value	Description	Definition	Parameter set
2268	8808	1	RWP	u8	Control byte 1:[1)] Bit 0: Run zeroing (see Index 6125) Bit 1: Run taring (see Index 6139) Bit 2: Continuous clear of max. peak–value memory (see Index 2262) Bit 3: Continuous clear of min. peak–value memory (see Index 2263) Bit 4: One–off clear of max. peak–value memory (see Index 2264) Bit 5: One–off clear of min. peak–value memory (see Index 2265) Bit 6: Stop max. peak–value memory (see Index 2266) Bit 7: Stop min. peak–value memory (see Index 2267)		HBM	A[2)]
2269	8809	1	RW	u8	Bit n = 1: Function enabled Bit n = 0: Function inhibited	Control byte 1 Mask The bits correspond to Index 2268. When bit = 1, the corresponding control byte bit (Index 2268) is executed; when bit = 0, the corresponding control word bit is ignored and assumed to be ”0”.	HBM	A
226A	8810	1	RWP	u8	Control byte 2[3)] : Bit 0: Run autocalibration (”Auto–Cal”) Bit 1: Run zeroing (”Auto–Zero”) Bit 2: Run taring (”Auto–Tare”) Bit 7: Read out TEDS and trigger TEDS calibration		HBM	–
226B	8811	1	RW	u8	Bit n = 1: Function enabled Bit n = 0: Function inhibited	Control byte 2 Mask Bits correspond to Index 226A. When bit = 1, the corresponding control byte bit (Index 226A) is executed; when bit = 0, the corresponding control byte bit is ignored and assumed to be ”0”.	HBM	A

Index (hex)	Index (dec)	Sub–Index	Access	Data type	Value	Description	Definition	Parameter set
6111	24849	1	WO	u32	696C6163 hex (constant)	Trigger one–off autocalibration (”Auto–Cal”)	DS404	–
6125	24869	1	WO	u32	7A65726F hex (constant)	Trigger zeroing (”Auto–Zero”)	DS404	–
6139	24889	1	WO	u32	74617261 hex (constant)	Trigger taring (”Auto–Tare”)	DS404	–

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 command bits are set at the same time, this is the sequence that is followed: zeroing, taring, autocalibration. Bit 7, for calibrating by TEDS, must not be set at the same time as the other control bits of Object 226A.

Index (hex)	Index (dec)	Sub–Index	Access	Data type	Value	Description	Definition	Parameter set
6160	24928	1	RWP	u8	Bit 0: Auto–Cal Bit 1: Zeroing Bit 2: Taring	Control byte as per DS404 1)	DS404	A
6161	24929	1	RW	u8	Bit n = 1: Function enabled Bit n = 0: Function inhibited	Control byte Mask as per DS404	DS404	A

1) If several command bits are set at the same time, this is the sequence that is followed: zeroing, taring, autocalibration

6.7.6 Peak-value memory control

Index (hex)	Index (dec)	Sub-index	Access	Data type	Parameters	Description	Definition	Parameter set
2260	8800	1	RW	u8	0: Gross meas. value 1: Net meas. value	Input signal for max. peak-value memory	HBM	A
2261	8801	1	RW	u8	0: Gross meas. value 1: Net meas. value	Input signal for min. peak-value memory	HBM	A
2262	8802	1	RW	u8	0: Normal operation 1: continuous clear	Continuous clear of max. peak-value memory: Peak value follows current measured value	HBM	A
2263	8803	1	RW	u8	0: Normal operation 1: continuous clear	Continuous clear of min. peak-value memory: Peak value follows current measured value	HBM	A
2264	8804	1	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	HBM	–
2265	8805	1	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	HBM	–
2266	8806	1	RW	u8	0: Normal operation 1: stop	Stop max. peak−value memory: Peak−value memory remains unchanged, whatever the subsequent measured values	HBM	A
2267	8807	1	RW	u8	0: Normal operation 1: stop	Stop min. peak-value memory: Peak-value memory remains unchanged, whatever the subsequent measured values	HBM	A

6.7.7 Digital inputs and outputs

Index (hex)	Index (dec)	Sub–Index	Access	Data type	Parameters	Description	Definition	Parameter set
2300	8860	1	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	HBM	A
2301	8961	1	RW	u8	Action of digital input: [1)] Bit 0: Run zeroing (see Index 6125) Bit 1: Run taring (see Index 6139) Bit 2: Continuous clear of max. peak–value memory (see Index 2262) Bit 3: Continuous clear of min. peak–value memory (see Index 2263) Bit 4: One–off clear of max. peak–value memory (see Index 2264) Bit 5: One–off clear of min. peak–value memory (see Index 2265) Bit 6: One–off stop of max. peak–value memory (see Index 2266) Bit 7: One–off stop of min. peak–value memory (see Index 2267)		HBM	A
230F	8975	1	ROP	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: the Bit set if action active	HBM	–
2310	8976	1	ROP	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	HBM	–

Index (hex)	Index (dec)	Sub–Index	Access	Data type	Parameters	Description	Definition	Parameter set
2311	8977	1	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 (see Index 6149, 9149) Bit 5: Negative range overrun (see Index 6148, 9148) Bit 6: Overload of input amplifier Bit 7: General error with invalid measurement value	HBM	A
2312	8978	1	RW	u8	Signal source of digital output 2:	Bit assignment as for digital output 1	HBM	A

[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.

[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.

6.7.8 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, as defined in CANopen, 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 6.7.9 . If a scaling value is changed, the scaling values in the other representation are adapted automatically.

Index (hex)	Index (dec)	Sub–Index	Access	Data type	Parameters	Description	Definition	Parameter set
3130	12592	1	RW	r32		Span scaling: scaling value: mV/V zero point	HBM	A
3140	12608	1	RW	i32		Span scaling: scaling value: mV/V zero point	HBM	A
3131	12593	1	RW	r32		Span scaling: scaling value: phys. zero point	HBM	A
3141	12609	1	RW	i32		Span scaling: scaling value: phys. zero point	HBM	A
3132	12594	1	RW	r32		Span scaling: scaling value: mV/V span	HBM	A
3142	12610	1	RW	i32		Span scaling: scaling value: mV/V span	HBM	A
3133	12595	1	RW	r32		Span scaling: scaling value: phys. span.	HBM	A
3143	12611	1	RW	i32		Span scaling: scaling value: phys. span.	HBM	A
3120	12576	1	WO	u32	31746573 hex	Two-point scaling: Calibrate X1: set the current internal mV/V meas. value as scaling value point 1	HBM	–
3122	12578	1	WO	u32	32746573 hex	Two-point scaling: Calibrate X2: set the current internal mV/V meas. value as scaling value point 2	HBM	–
6120	24864	1	RW	r32		Two-point scaling: scaling value: mV/V point 1	DS404	A
9120	37152	1	RW	i32		Two-point scaling: scaling value: mV/V point 1	DS404	A
6121	24865	1	RW	r32		Two-point scaling: scaling value: phys. point 1	DS404	A
9121	37153	1	RW	i32		Two-point scaling: scaling value: phys. point 1	DS404	A
6122	24866	1	RW	r32		Two-point scaling: scaling value: mV/V point 2	DS404	A
9122	37154	1	RW	i32		Two-point scaling: scaling value: mV/V point 2	DS404	A
6123	24867	1	RW	r32		Two-point scaling: scaling value: phys. point 2	DS404	A

Index (hex)	Index (dec)	Sub–Index	Access	Data type	Parameters	Description	Definition	Parameter set
9123	37155	1	RW	i32		Two-point scaling: scaling value: phys. point 2	DS404	A
6132	24882	1	RW	u8	0…9	Decimal point position, the value range can be further restricted, subject to scaling.	DS404	A

6.7.9 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.

Index (hex)	Index (dec)	Sub–Index	Access	Data type	Parameters	Description	Definition	Parameter set
3574	13685	1	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	HBM	A
3576	13686	1	RW	u32		Physical reference unit, into which TEDS data are to be converted [2)]	HBM	A
3577	13687	1	WO	u32	73646574 hex	Activate scaling by TEDS	HBM	–
3578	13688	1	RO	i16		TEDS: Read out the last calibration date (number of days since January 1, 1998)	HBM	–
3579	13689	1	RO	i16		TEDS: Read out the calibration period	HBM	–
357A	13690	1	RO	VS	Visible string (3 char.)	TEDS: Read out the initials of the calibrator	HBM	–
357B	13691	1	RO	VS	Visible string (45 char.)	TEDS: Read out the transducer comments	HBM	–
357C	13692	1	OS	i16	OctetString (8 bytes)	TEDS: Read out transducer identification (T–ID)	HBM	–

1) Object 3574: 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) Object 3576: 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, a CAN error message is returned and scaling does not take place.

Index (hex)	Index (dec)	Sub–Index	Access	Data type	Parameters	Description	Definition	Parameter set
3581	13697	1	RW	u8	0: Do not use TEDS automatically 1: Always use TEDS	Always use TEDS[1)]	HBM	A
3582	13698	1	RO	u8	0: Manual scaling 1: Current scaling corresponds to the TEDS data	Current scaling took place on account of TEDS activation	HBM	–
358A	13706	1	RO	u16		Basic TEDS Template: ”Manufacturer”	HBM	–
358B	13707	1	RO	u16		Basic TEDS Template: ”Model”	HBM	–
358C	13708	1	RO	u8		Basic TEDS Template: ”Version letter”	HBM	–
358D	13709	1	RO	u16		Basic TEDS Template: ”Version number”	HBM	–
358E	13710	1	RO	u32		Basic TEDS Template: ”Serial number”	HBM	–

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.

6.7.10 Transducer settings

Index (hex)	Index (dec)	Sub–Index	Access	Data type	Parameters	Description	Definition	Parameter set
2131	8497	1	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	HBM	A
2132	8498	1	RO	u8	0:±4 mV/V 1:±10 mV/V	Measuring range	HBM	–
6110	24848	1	RO	u16	0047 hex (constant)	Transducer type	DS404	–
2125	8485	1	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.	HBM	–

6.7.11 Signal conditioning

Index (hex)	Index (dec)	Sub–Index	Access	Data type	Parameters	Description	Definition	Parameter set
31A0	12704	1	RW	r32		Write: Choice of filter frequency in Hz. [1] Reading the index returns the actually active filter frequency in Hz.	HBM	A
61A0	24992	1	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	DS404	A
6124	24868	1	RW	r32		Zero point	DS404	A
9124	37156	1	RW	i32		Zero point	DS404	A
6138	24888	1	RW	r32		Tare value	DS404	A
9138	37176	1	RW	i32		Tare value	DS404	A
3231	12849	1	RW	VS	Visible string	Physical unit as a string, exactly 12 characters in length. [2]	HBM	A
6131	24881	1	RW	u32	CiA constant	Physical unit as CiA constant	DS404 DR303 –2	A
6132	24882	1	RW	u8	0…9	Decimal point position, the value range can be further restricted, subject to scaling.	DS404	A

[1] Index 31A0: If the required frequency is not available in the device, the next highest possible one is set as the frequency. (See Index 61A0.) 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 resets Index 61A0.

[2] Objects 3131 and 6131: These values are only stored in the device, they are not evaluated. If Object 3231 is changed directly by SDO, this does not affect the entry in Object 6131. Conversely, Object 3231 is changed when Object 6131 is written, when there is a text to this effect stored in the device. Scaling by TEDS also causes the entries of these objects to change.

6.7.12 Other device functions

Index (hex)	Index (dec)	Sub–Index	Access	Data type	Parameters	Description	Definition	Parameter set
2020	8224	0	RW	u16	Index to be checked	Object type testing; if the Object is not available, Index 2022 supplies the return value = 0	HBM	–
2021	8225	0	RW	u8	Sub–index to be checked		HBM	–
2022	8226	0	RO	u16	Number of bytes of the CAN Object to be tested		HBM	–
2083	8323	0	RO	VS	Visible String (12 char.)	HBM serial number	HBM	–
2084	8324	1	RW	VS	Visible String (16 char.)	Channel name, defined individually by user	HBM	A
5E90	24208	0	RW	u8	”User–Tag” has no effect on the system	Can be used as a storage cell or for dummy accesses by the user	HBM	A
5E91	24209	0	RW	u16	”User–Tag” has no effect on the system	Can be used as a storage cell or for dummy accesses by the user	HBM	A
5E92	24210	0	RW	u32	”User–Tag” has no effect on the system	Can be used as a storage cell or for dummy accesses by the user	HBM	A
2081	8321	0	RW	u32	Write: 746F6F62 hex Read: 0: Normal operation, 1: System in restart	Write: Run a system restart; Read: System state	HBM	–
3561	13665	0	RW	u32	CiA date format (number of days since January 1, 1984)	Date of the last calibration; write with password protection	HBM	–

6.7.13 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” (see Objects 2010, 2011 and 6150).

Index (hex)	Index (dec)	Sub–Index	Access	Data type	Parameters	Description	Definition	Parameter set
6148	24904	1	RW	r32		Gross measured value range monitoring: Lower limit	DS404	A
6149	24905	1	RW	r32		Gross measured value range monitoring: Upper limit	DS404	A
9148	37192	1	RW	i32		Gross measured value range monitoring: Lower limit	DS404	A
9149	37193	1	RW	i32		Gross measured value range monitoring: Upper limit	DS404	A

6.7.14 Limit value monitoring

Implemented as an ”ALARM Block” according to CiA DS404. Limit value monitoring can transmit EMERGENCY messages (see Section 6.3.2).

Index (hex)	Index (dec)	Sub–Index	Access	Data type	Parameters	Description	Definition	Parameter set
6503	25859	1	RW	u32	Compare with: *Gross meas. value:* 61300120 hex or 91300120 hex *Net measured value:* 61400120 hex or 91400120 hex *Max. peak meas. value:* 20020120 hex or 30020120 hex *Min. peak meas. value:* 20030120 hex or 30030120 hex *Peak-to-peak meas. value:* 20040120 hex or 30040120 hex	Measured value source for limit value switch 1	DS404	A
6508	25864	1	RW	u8	inactive: 0 greater or equal: 2 less: 3	Level reference for limit value switch 1	DS404	A
6509	25865	1	RW	u8	Bit 0 = 0: inactive Bit 0 = 1: active Bit 15…1 always = 0	Only bit 0 supported: Transmit EMERGENCY message when limit value 1 exceeded	DS404	A

Index (hex)	Index (dec)	Sub–Index	Access	Data type	Parameters	Description	Definition	Parameter set
650A	25866	1	RW	r32		Threshold value for limit value switch 1, physical quantity	DS404	A
950A	38154	1	RW	i32		Threshold value for limit value switch 1, physical quantity	DS404	A
650B	25867	1	RW	r32	Value >= 0	Hysteresis for limit value switch 1, physical quantity	DS404	A
950B	38155	1	RW	i32		Hysteresis for limit value switch 1, physical quantity	DS404	A
650D	25869	1	RO	b8	0: not triggered 1: triggered	State of limit value switch 1	DS404	–
650E	25870	1	WO	b8	0: no action 1: clear	Clear hysteresis state of limit value switch 1	DS404	–
6513	25875	1	RW	u32	see Index 6503	Measured value source for limit value switch 2	DS404	A
6518	25880	1	RW	u8	see Index 6508	Level reference for limit value switch 2	DS404	A
6519	25881	1	RW	u8	Bit 0 = 0: inactive Bit 0 = 1: active Bit 15…1 always = 0	Only bit 0 supported: Transmit EMERGENCY message when limit value 2 exceeded	DS404	A
651A	25882	1	RW	r32		Threshold value for limit value switch 2	DS404	A
951A	38170	1	RW	i32		Threshold value for limit value switch 2	DS404	A
651B	25883	1	RW	r32	Value >= 0	Hysteresis for limit value switch 2	DS404	A
951B	38171	1	RW	i32		Hysteresis for limit value switch 2	DS404	A
651D	25885	1	RO	b8	0: not triggered 1: triggered	State of limit value switch 2	DS404	–
651E	25886	1	WO	b8	0: no action 1: clear	Clear hysteresis state of limit value switch 2	DS404	–

Index (hex)	Index (dec)	Sub–Index	Access	Data type	Parameters	Description	Definition	Parameter set
6523	25891	1	RW	u32	see Index 6503	Measured value source for limit value switch 3	DS404	A
6528	25896	1	RW	u8	see Index 6508	Level reference for limit value switch 3	DS404	A
6529	25897	1	RW	u8	Bit 0 = 0: inactive Bit 0 = 1: active Bit 15…1 always = 0	Only bit 0 supported: Transmit EMERGENCY message when limit value 3 exceeded	DS404	A
652A	25898	1	RW	r32		Threshold value for limit value switch 3	DS404	A
952A	38186	1	RW	i32		Threshold value for limit value switch 3	DS404	A
652B	25899	1	RW	r32	Value >= 0	Hysteresis for limit value switch 3	DS404	A
952B	38187	1	RW	i32		Hysteresis for limit value switch 3	DS404	A
652D	25901	1	RO	b8	0: not triggered 1: triggered	State of limit value switch 3	DS404	–
652E	25902	1	WO	b8	0: no action 1: clear	Clear hysteresis state of limit value switch 3	DS404	–
6533	25907	1	RW	u32	see Index 6503	Measured value source for limit value switch 4	DS404	A
6538	25912	1	RW	u8	see Index 6508	Level reference for limit value switch 4	DS404	A
6539	25913	1	RW	u8	Bit 0 = 0: inactive Bit 0 = 1: active Bit 15…1 always = 0	Only bit 0 supported: Transmit EMERGENCY message when limit value 4 exceeded	DS404	A
653A	25914	1	RW	r32		Threshold value for limit value switch 4	DS404	A
953A	38202	1	RW	i32		Threshold value for limit value switch 4	DS404	A
653B	25915	1	RW	r32	Value >= 0	Hysteresis for limit value switch 4	DS404	A

Index (hex)	Index (dec)	Sub–Index	Access	Data type	Parameters	Description	Definition	Parameter set
953B	38203	1	RW	i32		Hysteresis for limit value switch 4	DS404	A
653D	25917	1	RO	b8	0: not triggered 1: triggered	State of limit value switch 4	DS404	–
653E	25918	1	WO	b8	0: no action 1: clear	Clear hysteresis state of limit value switch 4	DS404	–
6600	26112	1	ROP	u8	Bit 0 = switch 1 ...Bit 3 = switch 4	State of limit value switches 1…4	DS404	A
6602	26114	0	ROP	b8	0: no switch triggered 1: min. one switch triggered	Overall state of all limit value switches	DS404	A
6610	26128	0	WOP	b8	0: no action 1: clear all switches	Clear hysteresis states of all limit value switches	DS404	A

6.7.15 PDO-Transfer

Index (hex)	Index (dec)	Sub–Index	Access	Data type	Parameters	Description	Definition	Parameter set
3400	13312	0	RW	u32	0: PDO Transfer with sampling rate (dependent on filter frequency) 1…260000: time–controlled cycle time in 0.1 ms, asynchronous to sampling rate	Transmission cycle time of the PDO, when PDO transmission type = 254 (”asynchronous manufacturer specific”) is selected; see ”PDO–CommPar” data structure in Section 6.5.1	HBM	A
3401	13313	0	RO	u32	Actual PDO cycle time in 1 µs	Transmission cycle time of the PDO in [µs], when PDO transmission type = 254 is selected, otherwise return value = 0.	HBM	A
3402	13314	0	RW	u8	0: set ”pre–operational” 1: set ”operational” 2: change state	Write: Change state of this module only between ”operational” and ”pre–operational”. Read supplies the current state (0/1).	HBM	–
3403	13315	0	RW	u8	0: start ”pre–operational” 1: start ”operational”	”Operational” state of this module once supply voltage activated. ”Operational” state is then only selected if Index 6F60 = 1 is also set.	HBM	A
6F60	28512	0	RW	b8	1: enabled 0: inhibited	Enable PDO Transfer	DS404	–

6.7.16 Dynamic PDO Mapping

Index (hex)	Index (dec)	Sub-Index	Access	Data type	Parameters	Description	Definition	Parameter set
1400	5120	0	RW	u8		1. Receive PDO parameter: number of entries	DS301	C
1400	5120	1…4	RW		PDO Comm-Par	1. Receive PDO parameter	DS301	C
1401	5121	0	RW	u8		2. Receive PDO parameter: number of entries	DS301	C
1401	5121	1…4	RW		PDO Comm-Par	2. Receive PDO parameter	DS301	C
1600	5632	0	RW	u8		1. Receive PDO Mapping: number of entries	DS301	C
1600	5632	1…4	RW	u32	PDO Mapping	1. Receive PDO Mapping	DS301	C
1601	5633	0	RW	u8		2. Receive PDO Mapping: number of entries	DS301	C
1601	5633	1…4	RW	u32	PDO Mapping	2. Receive PDO Mapping	DS301	C
1800	6144	0	RW	u8		1. Transmit PDO parameter: number of entries	DS301	C
1800	6144	1…4	RW		PDO Comm-Par	1. Transmit PDO parameter	DS301	C
1801	6145	0	RW	u8		2. Transmit PDO parameter: number of entries	DS301	C
1801	6145	1…4	RW		PDO Comm-Par	2. Transmit PDO parameter	DS301	C
1A00	6656	0	RW	u8		1. Transmit PDO Mapping: number of entries	DS301	C
1A00	6656	1…4	RW	u32	PDO Mapping	1. Transmit PDO Mapping	DS301	C
1A01	6657	0	RW	u8		2. Transmit PDO Mapping: number of entries	DS301	C
1A01	6657	1…4	RW	u32	PDO Mapping	2. Transmit PDO Mapping	DS301	C

6.8 CAN examples

Example 1:

Reading the gross measured value as a REAL32 value via SDO transfer from digiCLIP with device address 3.

Protocol to digiCLIP (all values as a hex number):

Identifier	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
0603	**40**	**30**	**61**	**01**	**X**	**X**	**X**	**X**
CAN Identifier	Read	Index low byte	Index high byte	Sub–index 01 = channel x 02 = channel y	don't care			

Explanation:

06**03**: Device address 3

Byte 2 **30** ; Byte 3 **61;** Byte 4 **01**: Index 6130, Sub–index 01

Response from digiCLIP:

Identifier	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
0583	**43**	**30**	**61**	**01**	**r0**	**r1**	**r2**	**r3**
CAN Identifier	Read acknowledgement	Index low byte	Index high byte	Sub–index	Measured value as REAL32 with Low Byte first			

Example 2:

Setting the filter cut-off frequency to 100 Hz.

Protocol to digiCLIP:

Identifier	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
0603	**2B**	**A0**	**61**	**01**	**78**	**X**	**X**	**X**
CAN Identifier	Write	Index low byte	Index high byte	Sub–index	100 Hz	don't care		

Response from digiCLIP:

Identifier	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8
0583	**60**	**A0**	**61**	**01**	**X**	**X**	**X**	**X**
CAN Identifier	Write acknowledgement	Index low byte	Index high byte	Sub–index	don't care			

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.

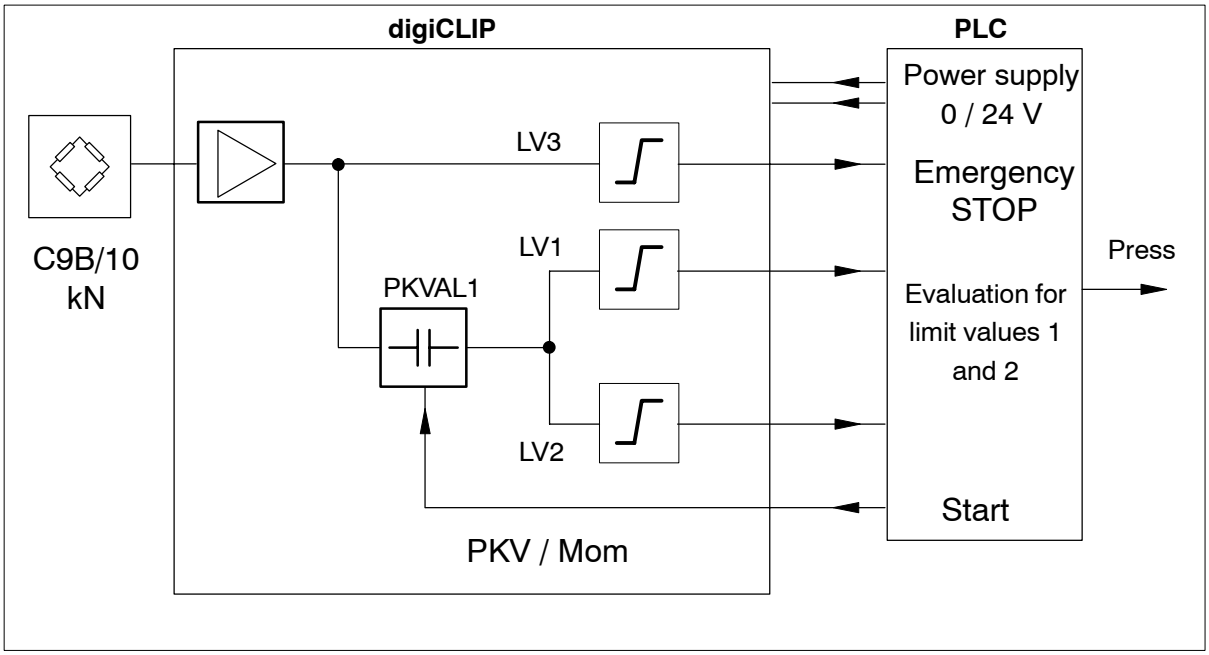
The state of limit value switches 1 to 4 is regularly read with Object 6600 (PDO operation).

LV1 source = net measured value

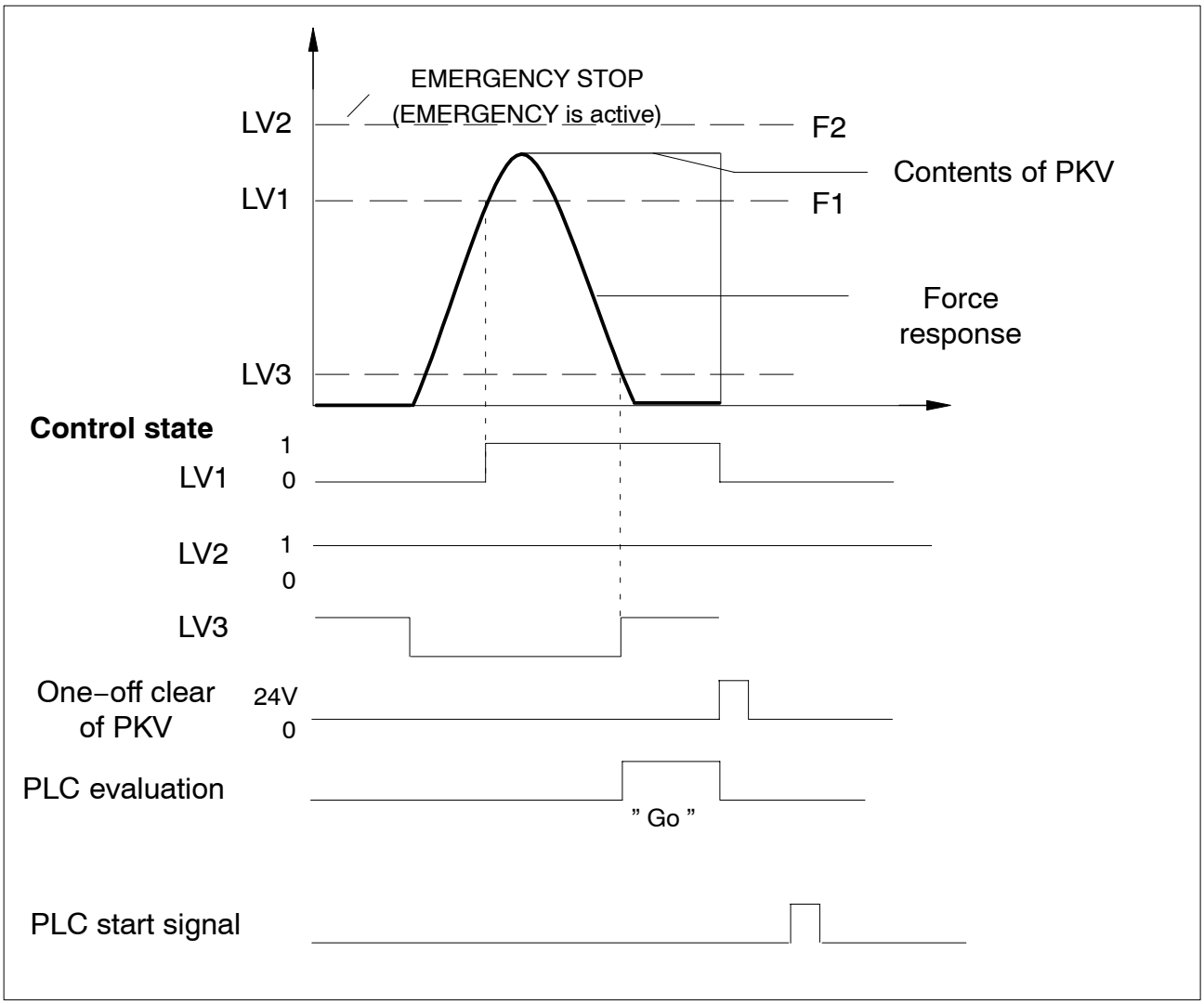
LV2 = gross measured value (machine protection)

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 (Cutoff function). The input signal is the gross measured value. If limit LV2 is exceeded, a PDO signal is generated. 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 sending the relevant SDO.

PLC evaluation of the limit value report:

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

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7–Nr. 2002.2173
A2173–2.0 en