

DIQ/S 281

UNIVERSAL TRANSMITTER FOR ONE DIGITAL SENSOR



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Contents

1	Overview	7
1.1	Structure and function	7
1.2	Interfaces	8
1.2.1	USB interface	8
1.2.2	Fieldbus interface (DIQ/S 281-MOD)	9
1.3	Behavior of the system to a power failure	9
2	Safety	10
2.1	Safety information	10
2.1.1	Safety information in the operating manual	10
2.1.2	Safety signs on the product	10
2.1.3	Further documents providing safety information	10
2.2	Safe operation	11
2.2.1	Authorized use	11
2.2.2	Requirements for safe operation	11
2.2.3	Unauthorized use	11
2.3	User qualification	11
3	Installation	12
3.1	Scopes of delivery	12
3.2	Basic principles of installation	12
3.2.1	Requirements of the measurement location	12
3.3	Safety requirements of the electrical installation	12
3.4	Installation guidelines for lightning protection	13
3.5	Connecting the sensor	15
3.5.1	IQ sensor with SNCIQ cable	15
3.5.2	IQ sensor with permanently mounted cable	17
3.6	On-site mounting of the DIQ/S 281	19
3.6.1	General information	19
3.6.2	Mounting on a mounting stand with the SSH/IQ sun shield	20
3.6.3	Mounting under the SD/K 170 sun shield	22
3.6.4	Top hat rail mounting	23
3.6.5	Panel mounting	24
3.7	Electrical connections: General instructions	27
3.8	Connecting the voltage supply	28
3.8.1	DIQ/S 281-CR2 (mains power version)	29
3.8.2	DIQ/S 281-CR2/24V (24 V version)	32
3.9	Connections to the relay and current outputs	35
3.9.1	General installation instructions	35
3.9.2	Usage of the auxiliary voltage	37
3.10	Commissioning	38

3.11	Installation examples	40
3.11.1	Connection of a sensor without compressed air cleaning	40
3.11.2	Connection of a sensor with compressed air cleaning	41
3.11.3	Connection of a sensor that is located at a distance (without compressed air cleaning)	43
3.12	Figures of the terminal strips	44
4	Operation	45
4.1	Operating elements	45
4.1.1	Overview of the operating elements	45
4.1.2	Display	46
4.1.3	Keys	48
4.2	General operating principles	48
4.2.1	Navigating in menus, lists and tables	49
4.2.2	Entering texts or numerals	50
4.3	Access to the DIQ/S 281 with active access control	52
4.4	Display of current measured values	53
4.5	Messages and log book	53
4.5.1	Message types	53
4.5.2	Log book	54
4.5.3	Viewing detailed message texts	56
4.5.4	Acknowledge all messages	57
4.6	Calibration data	58
4.6.1	Calibration entries in the log book	58
4.6.2	Calibration history	59
4.7	Status info of sensors and outputs	59
4.8	General course when calibrating, cleaning, servicing or repairing an IQ sensor	60
4.8.1	Maintenance condition of IQ sensors	61
4.8.2	Switching on the maintenance condition	62
4.8.3	Switching off the maintenance condition	63
4.9	USB interface	63
4.10	Info on software versions	64
4.11	Software-Update for the DIQ/S 281 and sensors	64
5	Settings/setup	66
5.1	Selecting the language	66
5.2	Terminal settings of the DIQ/S 281	66
5.3	Access control	67
5.3.1	Activating the access control	68
5.3.2	Activating the instrument block	70
5.3.3	Electronic key	71
5.3.4	Access to the DIQ/S 281 with active access control	72
5.4	Settings for sensors	72
5.5	Editing the list of outputs	74
5.6	Alarm settings	75
5.6.1	General information	75
5.6.2	Setting up / editing alarms	75

5.6.3	Alarm output to display	78
5.6.4	Alarm output as relay action	79
5.7	System settings	79
5.7.1	Setting the date and time	79
5.7.2	Location altitude / average air pressure	80
5.7.3	<i>Function code</i>	81
6	Outputs	82
6.1	Outputs of the DIQ/S 281	82
6.2	Basic information on relay functions	83
6.2.1	Monitoring	83
6.2.2	Limit indicator	83
6.2.3	Proportional output	84
6.3	Entering / editing the name of an output	91
6.4	Linking the output with a sensor	92
6.5	Deleting a link with an output	93
6.6	Setting the relay outputs	94
6.6.1	Relay action	95
6.6.2	<i>System monitoring</i>	96
6.6.3	<i>Sensor monitoring</i>	97
6.6.4	<i>Limit indicator</i>	98
6.6.5	<i>Frequency controller</i>	98
6.6.6	<i>Pulse-width output</i>	100
6.6.7	<i>Cleaning</i>	100
6.6.8	<i>Manual control</i>	104
6.6.9	<i>Alarm contact</i>	104
6.7	Setting the current outputs	105
6.7.1	<i>Recorder</i>	106
6.7.2	<i>PID controller</i>	107
6.7.3	<i>Fixed current value</i>	111
6.8	Checking the condition of the outputs	112
6.9	Behavior of linked outputs	112
6.9.1	Behavior in case of error	112
6.9.2	Behavior in non-operative condition	113
7	Maintenance and cleaning	114
7.1	Maintenance	114
7.2	Cleaning	114
8	What to do if	115
8.1	Information on errors	115
8.2	Errors: causes and elimination	115
8.3	Replacing system components	116
8.3.1	Replacing passive components	116
8.3.2	Replacing the IQ sensor	116

- 9 Technical data118**
 - 9.1 DIQ/S 281 118
 - 9.2 DIQ/JB 123
 - 9.3 DIQ/CHV 124
 - 9.4 Space required by mounted components 125

- 10 Accessories and options126**

- 11 Messages127**
 - 11.1 Explanation of the message codes 127
 - 11.1.1 Error messages 127
 - 11.1.2 Informative messages 128

- 12 Index129**

1 Overview

1.1 Structure and function

One digital single sensor (one sensor for one main parameter) can be connected to the universal transmitter DIQ/S 281.

This means one main parameter (e.g. pH, D.O., turbidity value...) and one secondary parameter in addition (e.g. temperature) can be displayed and administrated.

Each sensor is automatically recognized after being connected and immediately starts measuring.

The universal transmitter has two relay outputs and two current outputs to be connected to existing process control systems.



Suitable sensors for the universal transmitter DIQ/S 281 are listed in the WTW catalog or on the Internet.

Branches	The DIQ/JB branching module (accessory) is a simple passive module for the branching or extending of SNCIQ lines.
Relay and current outputs	<p>The relay- and current outputs can be linked with the sensor. Linked outputs can be used to monitor sensors and for the output of measured values.</p> <p>A relay output can be programmed as:</p> <ul style="list-style-type: none"> ● Monitoring relay ● Limit monitor ● Proportional output of measured values (pulse width or frequency output) ● Control unit of a sensor cleaning system driven by compressed air. <p>A current output can be programmed as:</p> <ul style="list-style-type: none"> ● Analog output ● PID controller
Modbus	Details see operating manual "Fieldbus linking"
Compressed air-driven cleaning system	The universal transmitter DIQ/S 281 is prepared for the compressed air-driven, time-controlled sensor cleaning function. For this, a DIQ/CHV valve module and if necessary a CH cleaning head is required (both available as accessories). The cleaning procedure is controlled by the Universal Transmitter. The universal transmitter provides the supply voltage and control relay for the compressed air valve in the DIQ/CHV valve module. This enables a simple setup and uncomplicated wiring.

Example of a simple system

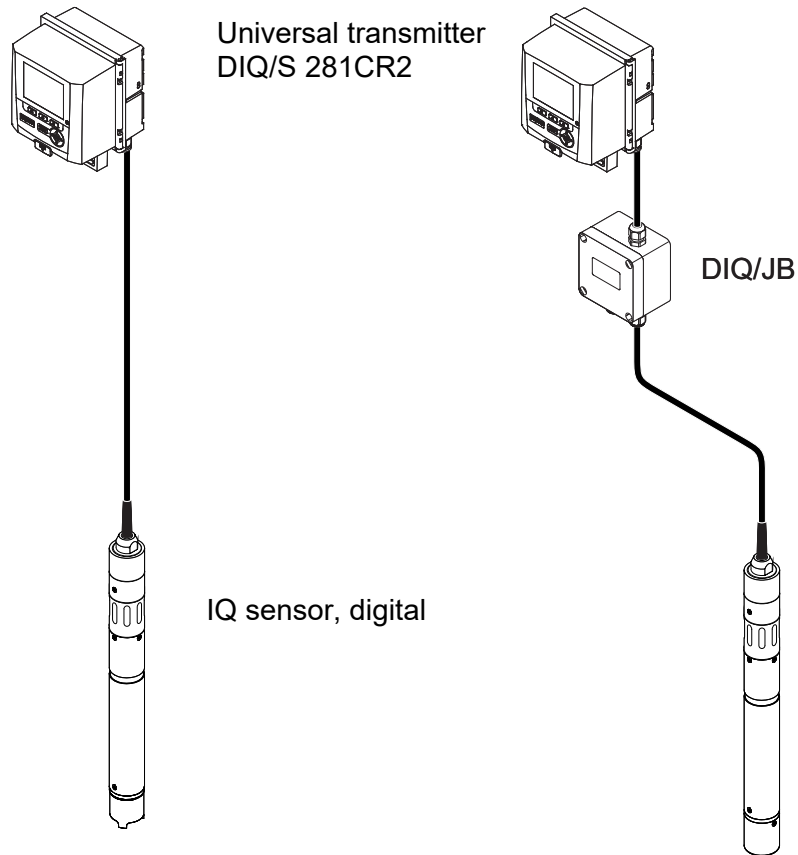


figure 1-1 Simple systems with one sensor

1.2 Interfaces

1.2.1 USB interface

The USB interface of the DIQ/S 281 provides the following functions:

- Connection of a USB memory device to carry out a software update (see section 4.11)
- Connection of a USB memory device to be used as an electronic key for simple access to the system when access control is switched on (see section 5.3.3)
- Connection of a USB hub for the reproduction of the USB interface.

Note:

The USB interface is designed for USB memory devices with a maximum power consumption of 1 watt. USB memory devices with a higher power consumption have to be supplied with power by an extra power supply. If these instructions are not complied with, the availability of the system can be adversely affected.



The USB interface is equipped with a protective cover. Only remove the protective cover when you want to connect a USB device. Immediately close the USB connection again when you have removed the USB device. When the USB connection is open, there is a danger of corrosion.

1.2.2 Fieldbus interface (DIQ/S 281-MOD)

The following variants of the DIQ/S 281 have a fieldbus interface:

DIQ/S 281 variant	Fieldbus connection
DIQ/S 281-MOD	Modbus RTU/RS 485

1.3 Behavior of the system to a power failure

- The system configuration is permanently retained. It consists of the following settings:
 - Sensor settings
 - Settings and links of the relay outputs
 - Settings of the current outputs
 - System settings (display language, air pressure/altitude, passwords etc.)
- Linked relay outputs switch to the non-active condition (open).
- Current outputs switch to the non active-condition (0 mA).
- A restart is carried out automatically when the power returns. The continues working with the settings of the time prior to the power failure. If the power failure lasted several hours the system clock has to be reset.

2 Safety

2.1 Safety information

2.1.1 Safety information in the operating manual

This operating manual provides important information on the safe operation of the product. Read this operating manual thoroughly and make yourself familiar with the product before putting it into operation or working with it. The operating manual must be kept in the vicinity of the product so you can always find the information you need.

Important safety instructions are highlighted in this operating manual. They are indicated by the warning symbol (triangle) in the left column. The signal word (e.g. "CAUTION") indicates the level of danger:



WARNING

indicates a possibly dangerous situation that can lead to serious (irreversible) injury or death if the safety instruction is not followed.



CAUTION

indicates a possibly dangerous situation that can lead to slight (reversible) injury if the safety instruction is not followed.

indicates a situation where goods might be damaged if the actions mentioned are not taken.

2.1.2 Safety signs on the product

Note all labels, information signs and safety symbols on the product. A warning symbol (triangle) without text refers to safety information in this operating manual.

2.1.3 Further documents providing safety information

The following documents provide additional information, which you should observe for your safety when working with the measuring system:

- Operating manuals of other components of the measuring system
- Safety datasheets of calibration and maintenance equipment (e.g. cleaning solutions).

2.2 Safe operation

2.2.1 Authorized use

The authorized use of the DIQ/S 281 Universal Transmitter consists of its use in online analysis. Only the operation and running of the sensor according to the instructions and technical specifications given in this operating manual is authorized (see chapter 9 TECHNICAL DATA). Any other use is considered unauthorized.

2.2.2 Requirements for safe operation

Note the following points for safe operation:

- The product may only be operated according to the authorized use specified above.
- The product may only be operated under the environmental conditions mentioned in this operating manual.
- The product may only be supplied with power by the energy sources mentioned in this operating manual.
- The product may only be opened if this is explicitly described in this operating manual (example: connecting electrical lines to the terminal strip).

2.2.3 Unauthorized use

The product must not be put into operation if:

- it is visibly damaged (e.g. after being transported)
- it was stored under adverse conditions for a lengthy period of time (storing conditions, see chapter 9 TECHNICAL DATA).

2.3 User qualification

Target group The DIQ/S 281 Universal Transmitter was developed for online analysis. Some maintenance activities, e.g. changing the membrane caps in D.O. sensors, require the safe handling of chemicals. Thus, we assume that the maintenance personnel is familiar with the necessary precautions to take when dealing with chemicals as a result of their professional training and experience.

Special user qualifications The following installation activities may only be performed by a qualified electrician:

- Connection of the DIQ/S 281 to the power supply.
- Connecting external, line voltage-carrying circuits to relay contacts.

3 Installation

3.1 Scopes of delivery

The following parts are included in the scope of delivery:

- Universal transmitter DIQ/S 281
- Accessory kit with:
 - Contact carrier with screws
 - ISO cap nuts with screws and ring washers
 - Cable glands with sealing gaskets
- Operating manual.

3.2 Basic principles of installation

3.2.1 Requirements of the measurement location

The measurement location must meet the environmental conditions specified in section 9.1 DIQ/S 281.

Controlled environmental conditions

Work on the open instrument (e.g. during mounting, installation, maintenance) may only be carried out under controlled environmental conditions:

Temperature	+ 5 °C ... + 40 °C (+ 41 ... +104 °F)
Relative humidity	≤ 80 %

3.3 Safety requirements of the electrical installation

Electrical equipment (such as motors, contactors, cables, lines, relays, switches, instruments) must meet the following requirements:

- Compliance with national regulations (e.g. NEC, VDE and IEC)
- Suitability for the electrical conditions at the place of installation
 - Maximum operational voltage
 - Maximum operational current
- Suitability for the ambient conditions at the place of installation
 - Temperature resistance (minimum and maximum temperature)
 - Stability against UV light in the case of outdoor usage
 - Protection against water and dust (IP type of protection).
- Suitable fuse protection of the electrical circuit
 - Overcurrent protection devices

- (according to the technical data of the instrument input or output)
- Overvoltage limitations of overvoltage category II
 - Suitable external separator (e.g. switch or circuit-breaker) for the power supply of permanently installed instruments with separate power connection
 - compliant with the following regulations
 - IEC 60947-1
 - IEC 60947-3
 - in the vicinity of the instruments (recommendation)
 - Flame resistant (cable and lines), compliant with the following regulations
 - UL 2556 VW-1 (for USA, Canada)
 - IEC 60332-1-2 (outside the USA, Canada)

3.4 Installation guidelines for lightning protection

During the use of the DIQ/S 281 universal transmitter, particularly in outdoor areas, adequate protection against (electrical) surges must be provided. A surge is a summation phenomenon of surge voltage and surge current. It is generated through the indirect effect of a lightning event or switching operation in the mains, in the grounding system and in information technology lines.

To be adequately protected against the damaging effects of surges, an integrated concept of the following protective measures is required:

- internal device-related protective measures and
- external protective measures of the installation environment.

The internal device-related protective measures are already integrated in the WTW online instrumentation as so-called 'lightning protection' (see chapter 9 TECHNICAL DATA).

The external protective measures of the installation environment can be carried out with respect to the following guidelines:

- 1 All lines of systems must be
 - a) installed inside (or else close to) the grounded metallic mounting constructions, e.g. handrails, pipes and posts if possible
 - b) or, particularly in the case of longer lines, laid in the ground.

Background: The formation of highly lightning hazardous inductive loops between the cables and ground is avoided through the low clearance of the grounded metal construction or by installation in the ground.

- 2 Only IQ cable material may be used. This cable material is an important prerequisite for the hazard-free discharging of the surge without inadmissibly high overvoltages developing along the line at the same time that could have a damaging effect on the individual components.
- 3 All metallic mounting constructions (handrails, pipes, posts etc.) on which

DIQ modules are installed must be connected to the local potential equalization system and the grounding system or must be individually sufficiently grounded locally according to the codes of practice.

For the individual grounding of the measuring point the mounting construction must be solidly connected by means of a large-area auxiliary electrode with the measuring medium.

Metallic control shafts/pipes and other large-area metallic bodies that reach into the measuring medium are, for example, ideal for use in the grounding of the mounting construction. This creates a set path for the main surge. As a result it is possible to avoid the surge being discharged via the cable and via the valuable sensor in the measuring medium.

- 4 It is recommended to attach a metallic or nonmetallic sun shield to each outside location of the DIQ modules. Sun shields protect the electric field lines in the area of the DIQ module due to an advantageous development of the electrical field lines in the area of the MIQ module and promote the dissipation of the surge via the mounting construction.
- 5 The line voltage for the supply of the DIQ/S 281 must comply with overvoltage category II. Generally this is ensured through the public operator of the power supply networks. In company-owned networks, e.g. in all power supply systems owned by wastewater treatment plants, this must be kept separate by a potential equalization and a surge protection system for the plant.
- 6 One part of the safety and lightning protection concept is based on the high-grade protective insulation of the DIQ/S 281. It does not have or require any protective ground conductor or earth terminal. Avoid any direct contact of any SENSOR connections or the metallic sensor enclosures with the local grounding or potential equalization system and with metallic construction elements (see point 8).
- 7 Additional external lightning protection measures, e.g. the use of overvoltage surge arresters, are not necessary for protection against the indirect effects of lightning and could possibly result in malfunctions.
- 8 For the realization of the internal lightning protection of the system (e.g. wastewater treatment plant control stands) and for the protection of external resources, cable entry points into buildings or distributions coming from the DIQ/S 281 must be carried out as follows:
 - The shield of SNCIQ or SNCIQ-UG cables can be connected to the local potential equalization with a gas overvoltage arrester. Use shield clamps for the contacting of the shield. The shield of the cable must not be opened under any circumstances.
 - 0/4-20 mA interfaces must be realized with shielded cables. The cable shield must be connected directly to the potential equalization(s) provided. If plant potential equalization systems are provided on both sides, the shield must also be connected on both sides. The inner conductors must have no contact with the potential equalization.
 - Relay lines should be connected to the local potential equalization in order to provide general and consistent protection via gas overvoltage surge arresters.

3.5 Connecting the sensor

The sensor is connected to the SENSORNET connector of the DIQ/S 281.

General installation instructions

Lines must always be installed separately at a minimum distance of 20 cm from other lines that carry a voltage greater than 60 V.

The free end of the sensor cable was stripped in the factory and all the wires are fitted with wire end sleeves.

Tools

- Phillips screwdriver
- Small screwdriver.

3.5.1 IQ sensor with SNCIQ cable

NOTE

The sensor cable may only be connected to the *SENSORNET* connector. *No wire of the cable may be connected with an external electrical potential. Otherwise, malfunctions could occur.*

- 1 On the left-hand side of the DIQ/S 281, remove the two countersunk screws and open the enclosure.

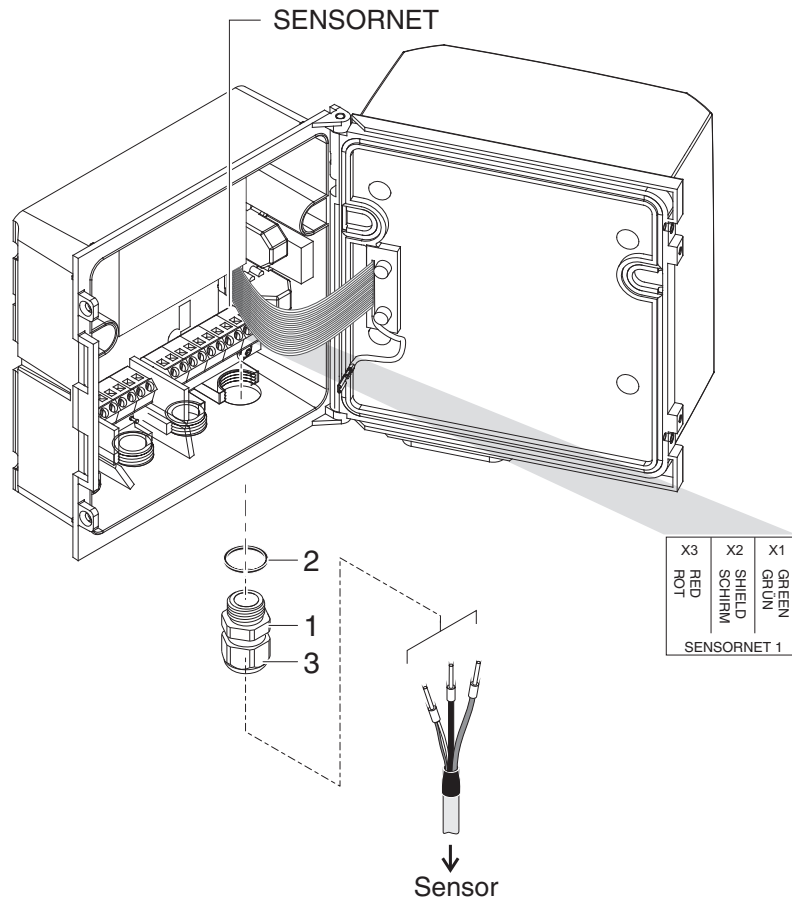


figure 3-1 Connecting the cable (example DIQ/S 281CR2)

- 2 Screw the cable gland (no. 029 212, pos. 1 in figure 3-1) with the sealing (pos. 2) into the housing at the mounting position for the SENSORNET connection (see label on the bottom of the housing)
- 3 Loosen the cap nut (pos. 3 in figure 3-1).
- 4 Feed the sensor cable through the cable gland into the enclosure.

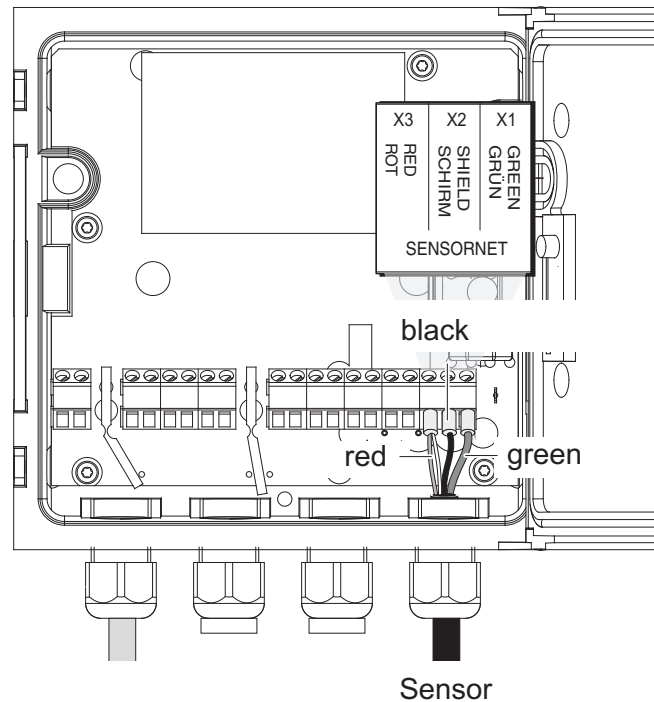


figure 3-2 SENSORNET connector (example DIQ/S 281 CR2)

- 5 Connect the cable ends to the terminal strip. At the same time, look out for the designations of the terminals (red / shield / green).
- 6 Tighten the cap nut (pos. 3 in figure 3-1).
- 7 Close the enclosure.



The complete assignment of the terminal strip is shown in section 3.12.

For further instructions on the mounting of the sensor at the application location, please refer to the relevant manual (immersion depth, etc.).

3.5.2 IQ sensor with permanently mounted cable

NOTE

The sensor cable may only be connected to the *SENSORNET* connector. *No wire of the cable may be connected with an external electrical potential. Otherwise, malfunctions could occur.*

- 1 On the left-hand side of the DIQ/S 281, remove the two countersunk screws and open the enclosure.

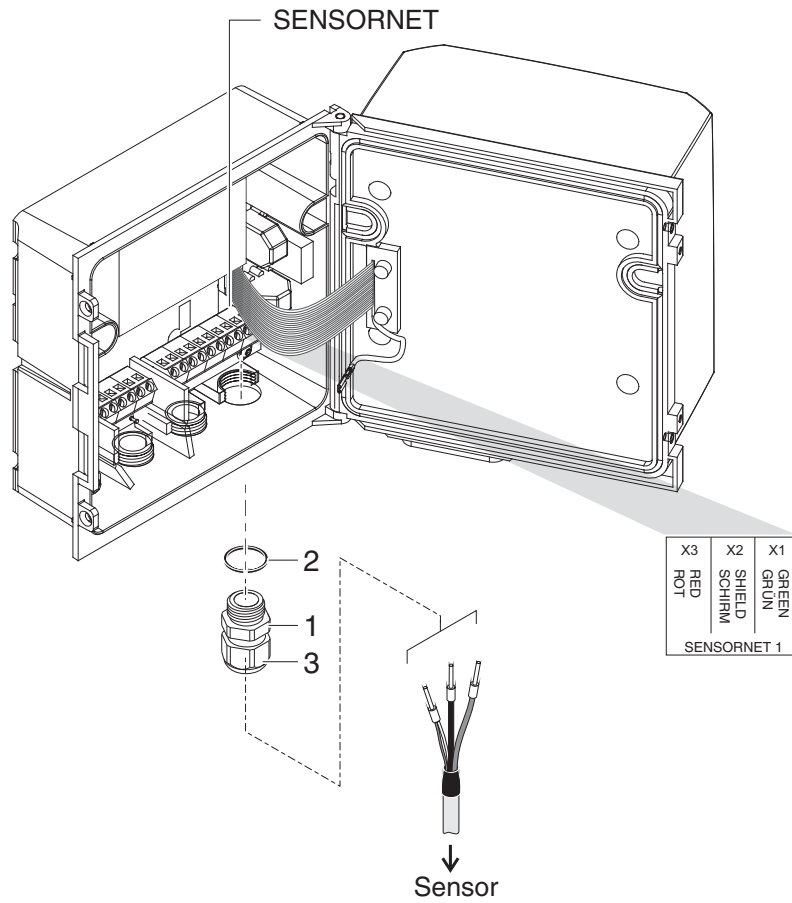


figure 3-3 Connecting the cable (example DIQ/S 281CR2)

- 2 Screw the cable gland (no. 029 212, pos. 1 in figure 3-1) with the sealing (pos. 2) into the housing at the mounting position for the SENSORNET connection (see label on the bottom of the housing)
- 3 Loosen the cap nut (pos. 3 in figure 3-1).
- 4 Feed the sensor cable through the cable gland into the enclosure.

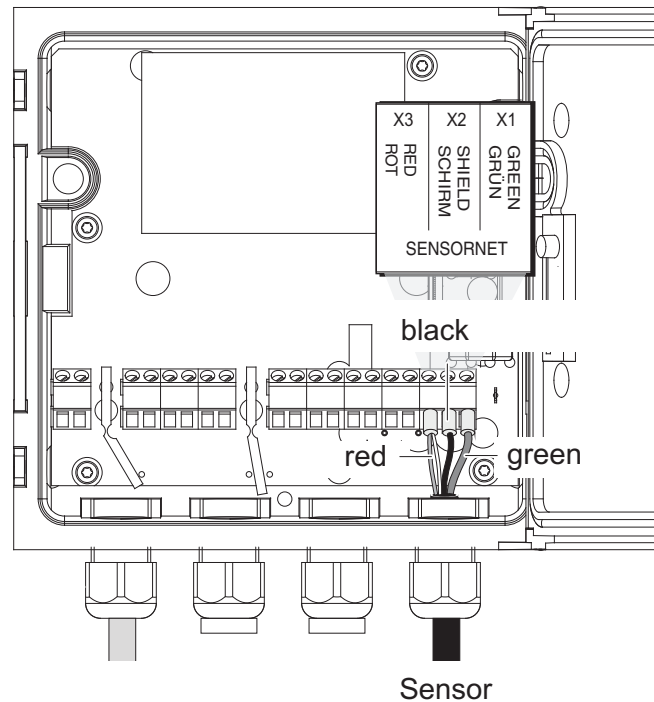


figure 3-4 SENSORNET connection

- 5 Connect the cable ends to the terminal strip. When doing so, look out for the designations of the terminals (white & brown / shield / green).
- 6 Tighten the cap nut (pos. 3 in figure 3-1).
- 7 Close the enclosure.



The complete assignment of the terminal strip is shown in section 3.12.

For further instructions on the mounting of the sensor at the application location, please refer to the relevant manual (immersion depth, etc.).

3.6 On-site mounting of the DIQ/S 281

3.6.1 General information

The universal transmitter DIQ/S 281 is designed for stationary installation. With the aid of mounting accessories, the setup can be adjusted to meet various requirements.

Components installed outside must always be protected by a sun shield against the effects of the weather (snow, ice and direct solar radiation). Otherwise, mal-

functions can result. Always mount the universal transmitter in an upright position. Do not under any circumstances install the universal transmitter without rain protection with the lid facing upwards (danger of retained humidity and penetration of moisture).

No contact base may be mounted on the back of the module (danger of short-circuit!) if the module is mounted on a wall, a sun shield, or a top hat rail.

Installation options

The most important types of installation for the universal transmitter are described in the following chapters:

- **Mounting with sun shield SSH/IQ:**
(see section 3.6.2).
- **Mounting to the sun shield SD/K 170**
The sun shield SD/K 170 provides room for the universal transmitter. The sun shield can be mounted to round or square section pipes (e.g. rails) with the aid of the MR/SD 170 mounting kit (section 3.6.3).
- **Wall mounting:**
The universal transmitter is permanently fixed to a wall. For wall mounting, use the WMS/IQ mounting set (see chapter 10 ACCESSORIES AND OPTIONS).
- **Panel mounting:**
The universal transmitter is mounted in the aperture of a switch panel. The dimensions of the aperture are 138 mm x 138 mm. The panel may not be thicker than 10 mm (section 3.6.5).
To install the interface (MOD) of the DIQ/S 281-MOD behind the panel, use the PMS/IQ-X accessory (see section 10).
- **Top hat rail mounting:**
The universal transmitter is mounted on a 35 mm top hat rail with the aid of a bracket, e.g. in a control cabinet. The connection can be released again with one simple movement (section 3.6.4).

The following chapters describe the mounting of the universal transmitter.

3.6.2 Mounting on a mounting stand with the SSH/IQ sun shield

Materials and tools required

- SSH/IQ sun shield (see chapter 10 ACCESSORIES AND OPTIONS).
- 4 mm set screw wrench
- Phillips screwdriver.

Mounting the sun shield on a mounting stand

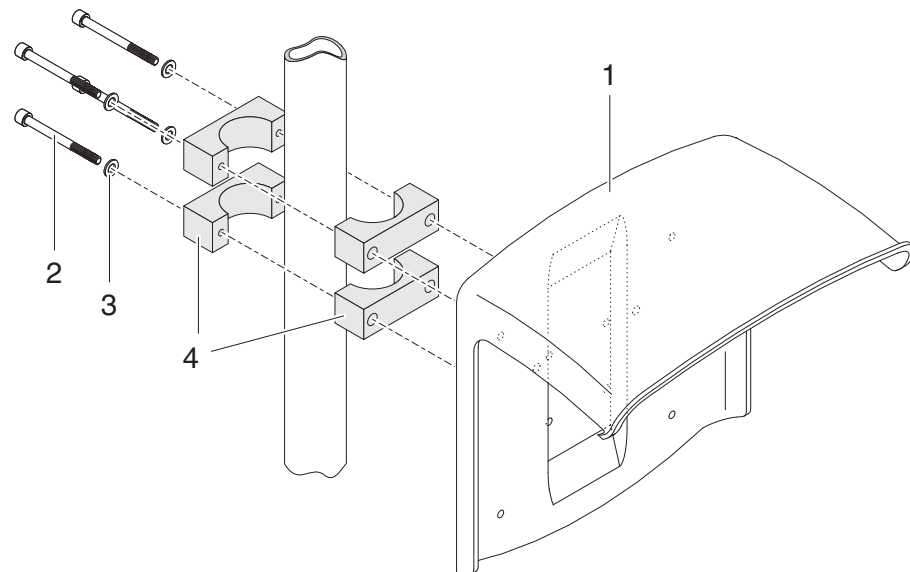


figure 3-5 Mounting the SSH/IQ sun shield on a mounting stand

- 1 Screw the sun shield (pos. 1 in figure 3-5) with the four hexsocket head screws (pos. 2), the washers (pos. 3) and the clamps (pos. 4) at the required height on the mounting stand from the back.

Premounting the ISO blind nuts

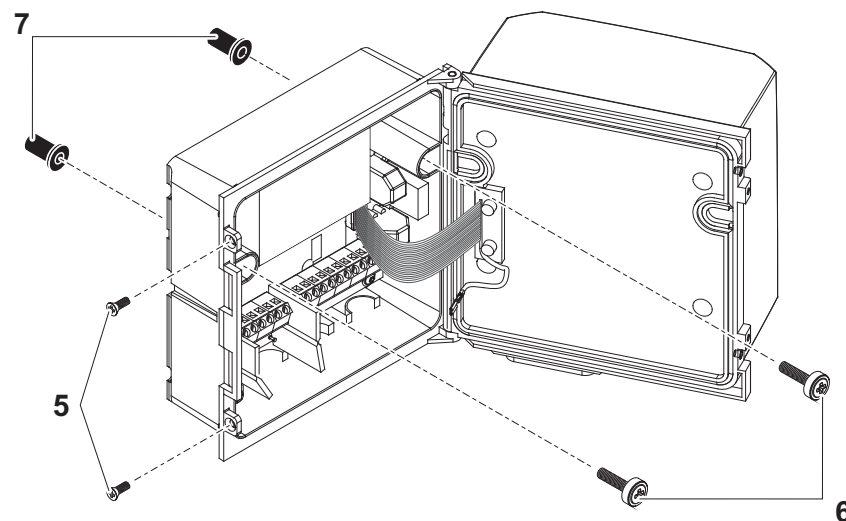


figure 3-6 Mounting the sun shield: Premounting the ISO blind nuts

- 2 Remove the two countersunk screws (pos. 5 in figure 3-6) and swing open the lid.
- 3 Insert the cheese-head screws (pos. 6 in figure 3-6) with the plastic washers in the drilled mounting holes and loosely screw in the ISO blind nuts (pos. 7).

**Mounting the DIQ/
S 281 on the sun
shield**

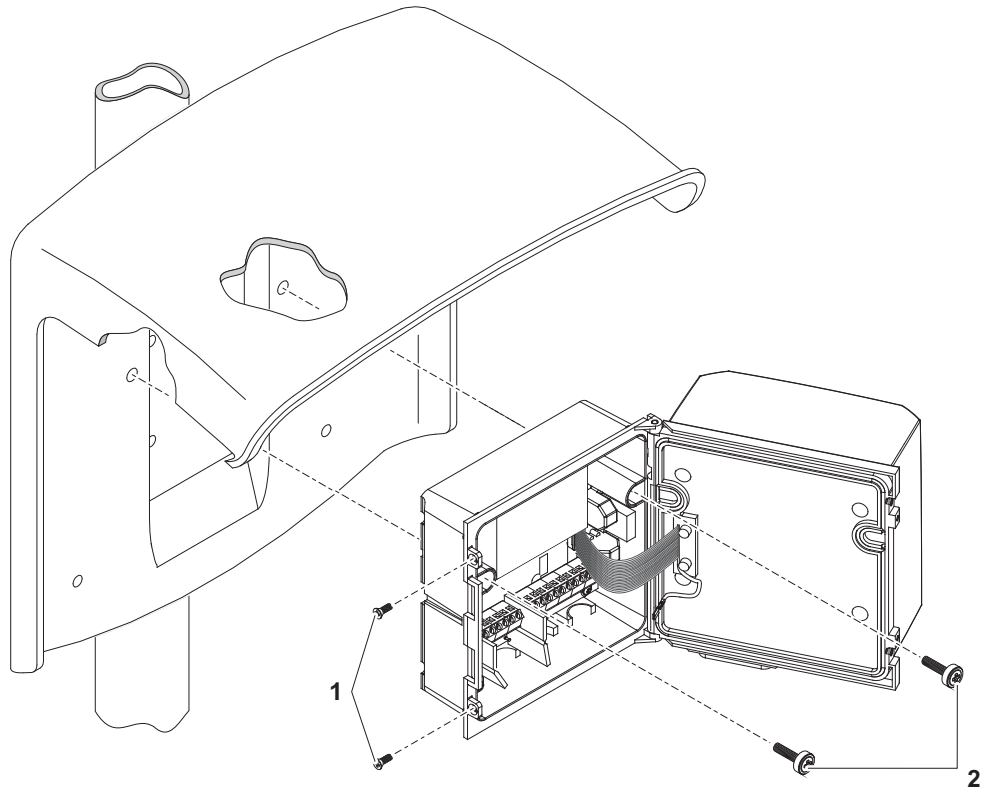


figure 3-7 Mounting the DIQ/S 281 on the sun shield SSH/IQ

- 4 Position the universal transmitter on the sun shield and fix it into place with the two screws (pos. 6 in figure 3-6).
- 5 Close the lid and fix it with the two countersunk screws (pos. 5 in figure 3-6).

3.6.3 Mounting under the SD/K 170 sun shield

The SD/K 170 sun shield can be mounted directly on a wall, on a mounting stand or on a railing. The MR/SD 170 mounting kit is also required for mounting on a mounting stand or railing.



How to mount the sun shield at the installation location is described in the instructions for the sun shield or mounting kit.

Materials required

- SD/K 170 sun shield (see chapter 10 ACCESSORIES AND OPTIONS)
- The MR/SD 170 mounting kit is also required for mounting the sun shield on a mounting stand or railing (see chapter 10 ACCESSORIES AND OPTIONS).

Tools

- Phillips screwdriver.

Mounting the DIQ/ S 281 with sun shield

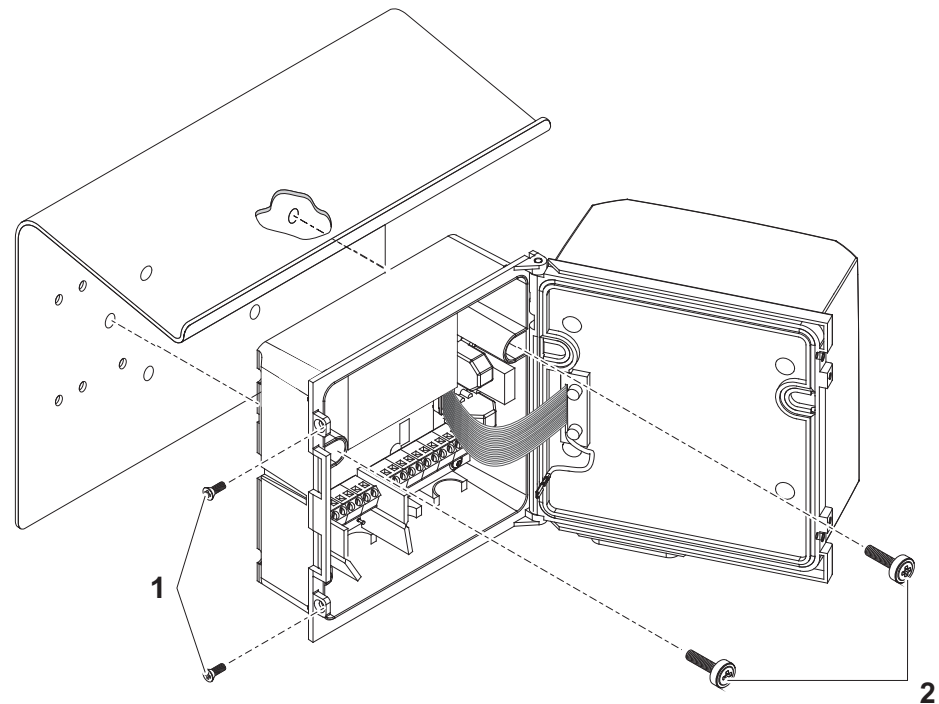


figure 3-8 Mounting the DIQ/S 281 with sun shield SD/K 170

- 1 Remove the two countersunk screws (pos. 1 in figure 3-8) and swing open the module lid.
- 2 Position the universal transmitter on the sun shield and fix it into place with the two screws (pos. 2 in figure 3-8).
- 3 Close the lid and fix it with the two countersunk screws (pos. 1 in figure 3-8).

3.6.4 Top hat rail mounting

Materials required ● THS/IQ kit for top hat rail mounting (see chapter 10 ACCESSORIES AND OPTIONS).

Tools ● Phillips screwdriver.

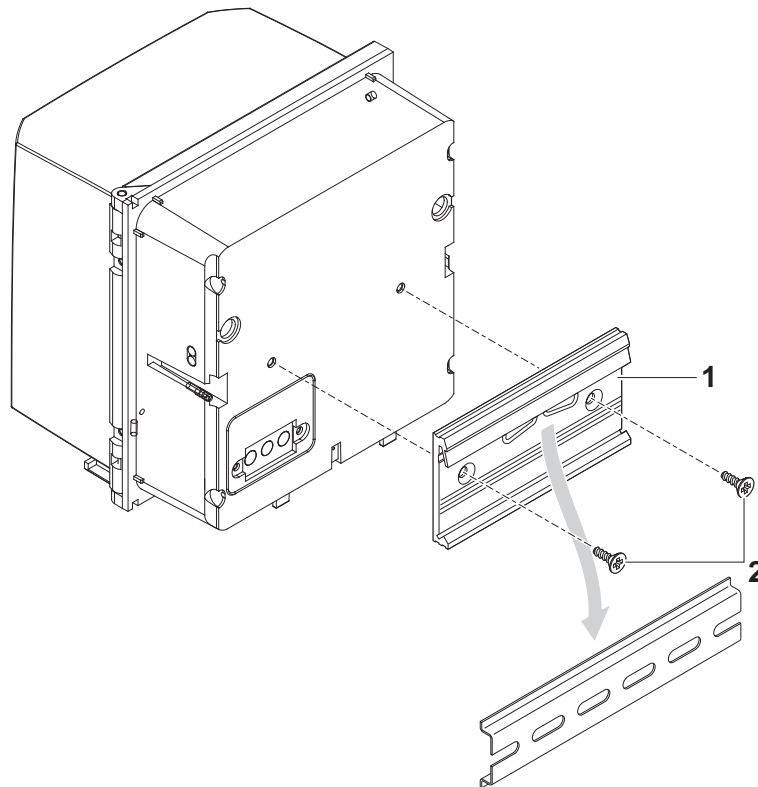
**Mounting the DIQ/
S 281 on a top hat
rail**

figure 3-9 Mounting the DIQ/S 281 on a top hat rail

- 1 Screw the clamping assembly (pos. 1 in figure 3-9) on the back of the universal transmitter with the two plastic tapping screws (pos. 2).
- 2 Attach the universal transmitter to the top hat rail from above using the clamping assembly and press against the rail until the clamping assembly clicks into place. The universal transmitter can be moved sideways afterwards.
- 3 To unhook the universal transmitter, press it downward and pull it forward at the bottom.

3.6.5 Panel mounting

Variants of the DIQ/S 281 without fieldbus interface can be mounted to a switch panel with the PMS/IQ mounting set.

For variants of the DIQ/S 281 with fieldbus or Ethernet interface, we recommend using the PMS/IQ-X mounting set. It enables to mount the DIQ/S 281 in the switch panel so that the fieldbus or Ethernet interface is accessible behind the switch panel.

Switch panel mounting sets	Switch panel mounting set	Switch panel aperture	Max. thickness of the switch panel
DIQ/S 281-CR2	PMS/IQ	138 x 138 mm	10 mm
DIQ/S 281-MOD	PMS/IQ-X	186 x 186 mm	8 mm

Switch panel mounting with PMS/IQ-X

Details on panel mounting with the PMS/IQ-X mounting set are given in the operating manual of the PMS/IQ-X.

Switch panel mounting with PMS/IQ

Panel mounting with the PMS/IQ mounting set is described below:

Materials required

- PMS/IQ kit for panel mounting (see chapter 10 ACCESSORIES AND OPTIONS).

Tools

- 3 mm set screw wrench (contained in the panel installation kit).

Switch panel aperture

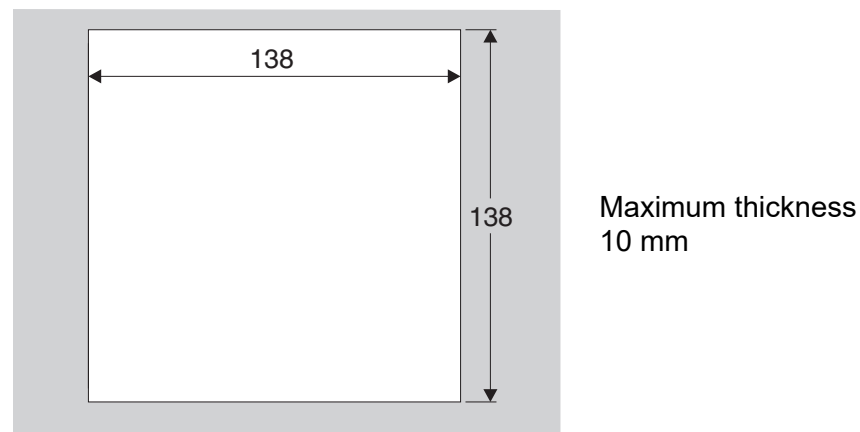
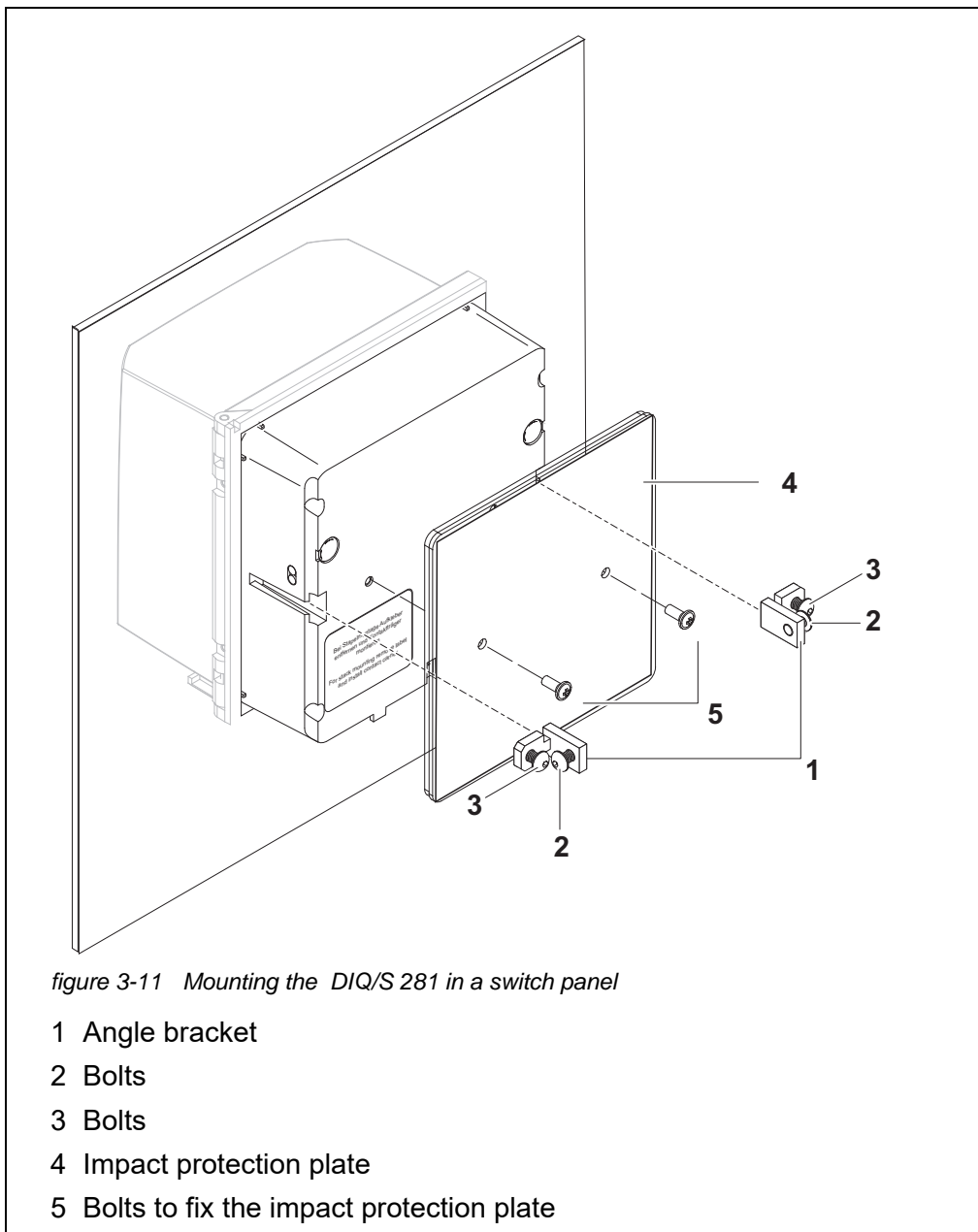


figure 3-10 Mounting aperture in the switch panel (dimensions in mm)

Mounting the DIQ/S 281 in a switch panel



- 1 Insert the universal transmitter in the panel aperture from the front.
- 2 Slightly unscrew the bolts (pos. 2 and 3) of the two angle brackets (pos. 1 in figure 3-11), but do not remove them.
- 3 Push in the two angle brackets - as shown in figure 3-11 - into the lateral guides of the universal transmitter up to the stop.
- 4 Tighten the bolts (pos. 2).
- 5 Screw in the bolts (pos. 3) until the bolts rest snugly against the panel.

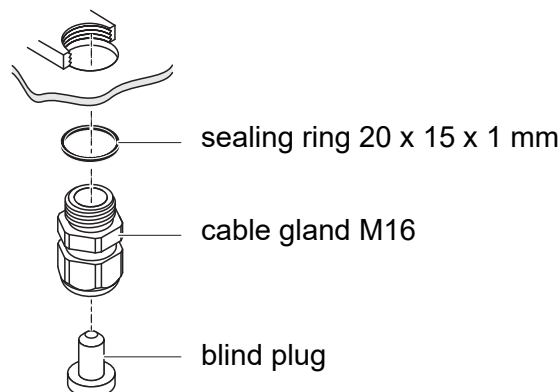
- 6 Fix the impact protection plate (Pos. 4) to the back of the DIQ/S 281 with the bolts (Pos. 5).

3.7 Electrical connections: General instructions

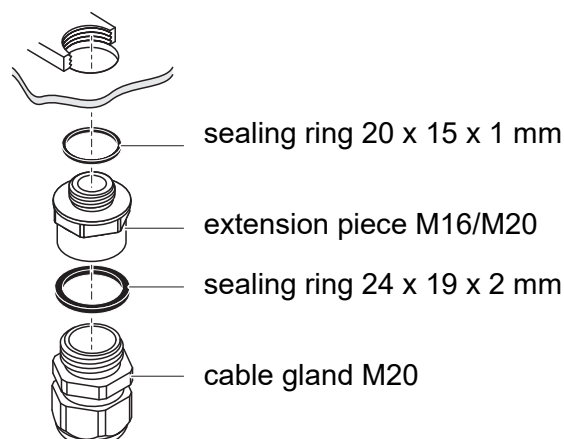
Cable glands

All electric cables are fed from below through openings prepared in the enclosure of the DIQ/S 281 and the DIQ modules. Cable glands with different clamping ranges are included with the DIQ/S 281 to provide sealing between the cable and enclosure as well as for strain relief. Select the suitable cable gland for the relevant cable type and cable diameter:

- **Small**, clamping range 4.5 to 10 mm.
This cable gland is suitable for all cables (earth cable after stripping the outer insulation, see section 3.6) and sensor connection cables.



- **Large**, clamping range 7 to 13 mm.
This cable gland is required for cable sheaths with an outside diameter of more than 10 mm and is screwed into the enclosure via an extension piece.



If necessary, you can order more big cable glands (see chapter 10 ACCESSORIES AND OPTIONS).

**General
installation
instructions**

Observe the following points when attaching connecting wires to the terminal strip

- Shorten all wires to be used to the length required for the installation
- Always fit all the ends of the wires with wire end sleeves before connecting them to the terminal strip
- Any wires that are not used and project into the enclosure must be cut off as closely as possible to the cable gland.
- Screw a small cable gland with sealing ring into each remaining free opening and close it with a blind plug.

**WARNING**

No free wires are allowed to project into the housing. Otherwise, there is a danger that areas safe to contact could come into contact with dangerous voltages. Always cut off any wires that are not in use as closely as possible to the cable gland.

3.8 Connecting the voltage supply

The two following paragraphs describe how to connect both models of the DIQ/S 281 universal transmitter to the voltage supply.

3.8.1 DIQ/S 281-CR2 (mains power version)



WARNING

If the power supply is connected incorrectly, it may represent a danger to life from electric shock. Pay attention to the following points during installation:

- The DIQ/S 281 universal transmitter may only be connected by a trained electrician.
- The connection of the DIQ/S 281 universal transmitter to the power supply may only be carried out when it is not carrying any voltage.
- The power supply must fulfill the specifications given on the nameplate and in chapter 9 TECHNICAL DATA.
- When installed in a building, a switch or power switch must be provided as an interrupt facility for the DIQ/S 281.

The interrupt facility must

- be installed in the vicinity of the DIQ/S 281 universal transmitter, easily accessible by the user, and
- be labeled as the interrupt facility for the DIQ/S 281 universal transmitter.
- After the DIQ/S 281 universal transmitter has been installed, it may only be opened if the line voltage has been switched off beforehand.

Materials required

- Wire end sleeves, suitable for the power line, with suitable crimping tool
- 1 x cable gland with sealing ring (included in scope of delivery of the DIQ/S 281).

Tools

- Cable stripping knife
- Wire stripper
- Phillips screwdriver
- Small screwdriver.

Preparing the power cable

- 1 Cut off the cable to the required length.
- 2 Strip the cable insulation for approx. 45 mm.
- 3 Bare the wires of phases L and N and fit them with wire end sleeves.
- 4 If present, cut off the ground wire at the end of the cable sheath.

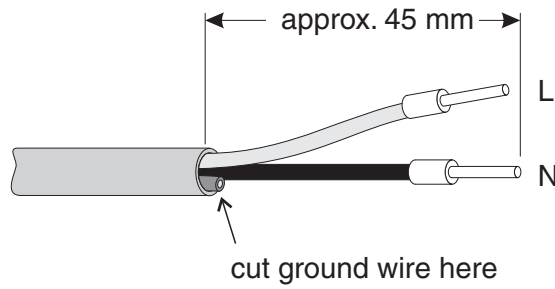


figure 3-12 Prepared power cable.

The ground wire must not project into the enclosure. Otherwise, malfunctions could occur.

Connecting the power line

- 5 On the left-hand side of the DIQ/S 281, remove the two countersunk screws and open the enclosure.

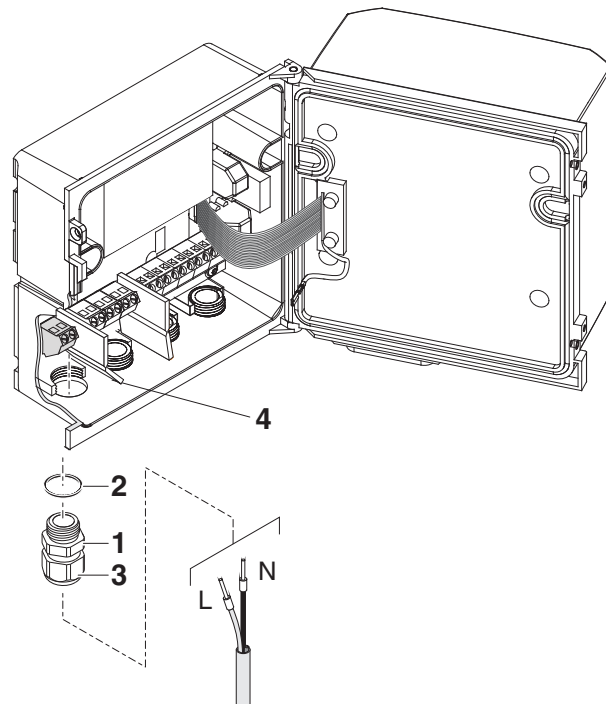


figure 3-13 Inserting the supply line.

- 6 Screw a cable gland (pos. 1 in figure 3-13) with sealing ring (pos. 2) into the enclosure below the power supply connection.
- 7 Loosen the coupling ring (pos. 3).
- 8 Feed the power line through the cable gland into the enclosure. When doing so bend the flexible divider (pos. 4) to the right.

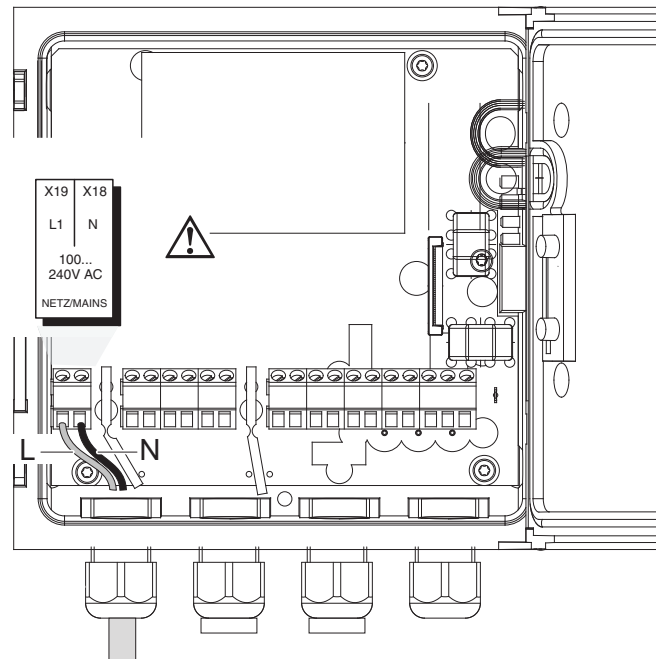


figure 3-14 Line power connection.



The complete assignment of the terminal strip is shown in section 3.12.

- 9 Connect phases L and N to the terminal strip. Make sure that the cable assignment agrees with the specification on the terminal label under the terminal strip.
- 10 Tighten the cap nut (pos. 3 in figure 3-13).



WARNING

No free wires are allowed to project into the housing. Otherwise, there is a danger that areas safe to contact could come into contact with dangerous voltages. Always cut off any wires that are not in use as closely as possible to the cable gland.

- 11 Close the enclosure of the DIQ/S 281.

3.8.2 DIQ/S 281-CR2/24V (24 V version)



WARNING

If the 24 V AC/DC supply is connected incorrectly, it may represent a danger to life from electric shock. Pay attention to the following points during installation:

- The DIQ/S 281 universal transmitter may only be connected by a trained electrician.
- The 24 V AC/DC supply must meet the specifications quoted on the name plate and in chapter 9 TECHNICAL DATA (protective low voltage SELV).
- The connection of the DIQ/S 281 universal transmitter to the power supply may only be carried out when it is not carrying any voltage.
- When installed in a building, a switch or power switch must be provided as an interrupt facility for the universal transmitter DIQ/S 281.
The interrupt facility must
 - be installed in the vicinity of the DIQ/S 281 universal transmitter, easily accessible by the user, and
 - be labeled as the interrupt facility for the DIQ/S 281 universal transmitter.



Rechargeable battery systems should have a deep discharge protection. The DIQ/S 281 CR2/24V does not have any built-in deep discharge protection.

Materials required

- Wire end sleeves, suitable for the 24 V AC/DC feed line, with suitable crimping tool
- 1 x cable gland with sealing ring (included in scope of delivery of the DIQ/S 281).

Tools

- Cable stripping knife
- Wire stripper
- Phillips screwdriver
- Small screwdriver.

Preparing the 24 V AC/DC line

- 1 Cut off the cable to the required length.
- 2 Strip the cable insulation for approx. 45 mm.
- 3 Bare the wires 1 and 2 and fit them with wire end sleeves.

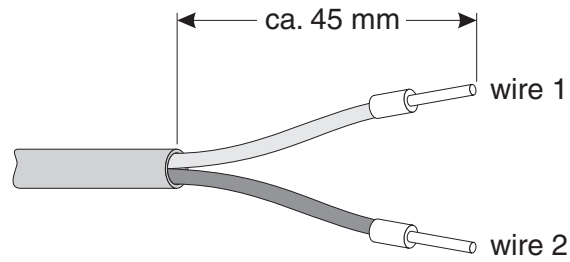


figure 3-15 Prepared 24 V AC/DC line.

Connecting the 24 V AC/DC line

- 4 On the left-hand side of the DIQ/S 281, remove the two countersunk screws and open the enclosure.

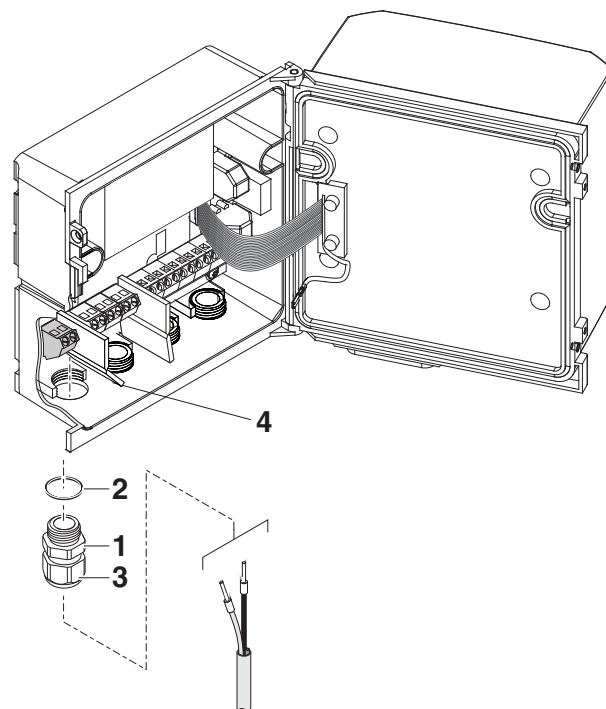


figure 3-16 Inserting the 24V AC/DC line

- 5 Screw a cable gland (pos. 1 in figure 3-16) with sealing ring (pos. 2) into the enclosure below the 24 V AC/DC connection.
- 6 Loosen the coupling ring (pos. 3).
- 7 Feed the 24 V AC/DC line through the cable gland into the enclosure. When doing so bend the flexible divider (pos. 4) to the right.

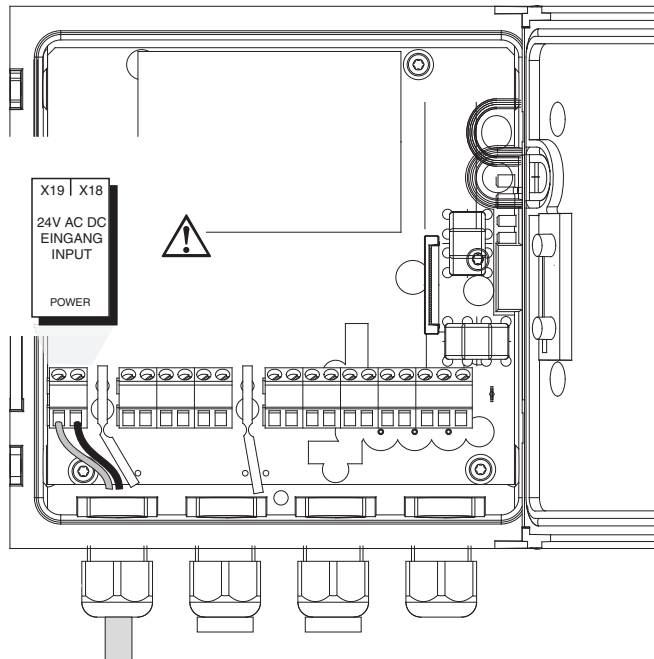


figure 3-17 24 V AC/DC connection.



The complete assignment of the terminal strip is shown in section 3.12.

- 8 Connect wires 1 and 2 to the terminal strip. Make sure that the cable assignment agrees with the specification on the terminal label under the terminal strip.
- 9 Tighten the cap nut (pos. 3 in figure 3-16).

No free wires are allowed to project into the housing. Otherwise there is the danger of short circuits that can cause a fire. Always cut off any wires that are not in use as closely as possible to the cable gland.

- 10 Close the enclosure of the DIQ/S 281.

3.9 Connections to the relay and current outputs

3.9.1 General installation instructions



WARNING

If external electrical circuits that are subject to the danger of physical contact are incorrectly connected to the relay contacts, there may be a danger of life threatening electric shock. Electrical circuits are regarded to be subject to the danger of physical contact when there are voltages higher than the Safety Extra Low Voltage (SELV).

Pay attention to the following points during installation:

- Electrical circuits subject to the danger of physical contact may only be connected by a qualified electrician.
- Electrical circuits subject to the danger of physical contact may only be connected when they are voltage-free.
- If electrical circuits subject to the danger of physical contact are switched with a relay, no circuit that is not subject to this danger (e. g. the DIQ/CHV module) may be operated on the further relays.
- Switching voltages and switching currents on the relay contacts must not exceed the values specified in chapter 9 TECHNICAL DATA. Protect electrical circuits against currents that are too high with an electrical fuse.
- Only single-phase consumers can be switched with the relays. Under no circumstances may multiphase consumers be switched with the aid of several relays (example: three-phase current driven pumps). Always switch multiphase consumers via a protective relay.
- After the Universal Transmitter DIQ/S 281 has been installed, it may only be opened if all external voltages have been switched off beforehand.

Materials required

- Wire end sleeves, suitable for the connecting wires, with suitable crimping tool
- 4 x cable gland with sealing ring (scope of delivery of the DIQ/S 281)

Tools

- Cable stripping knife
- Wire stripper
- Phillips screwdriver
- Small screwdriver

**Connecting lines
to the terminal
strip**

- 1 On the left-hand side of the DIQ/S 281, remove the two countersunk screws and open the enclosure.

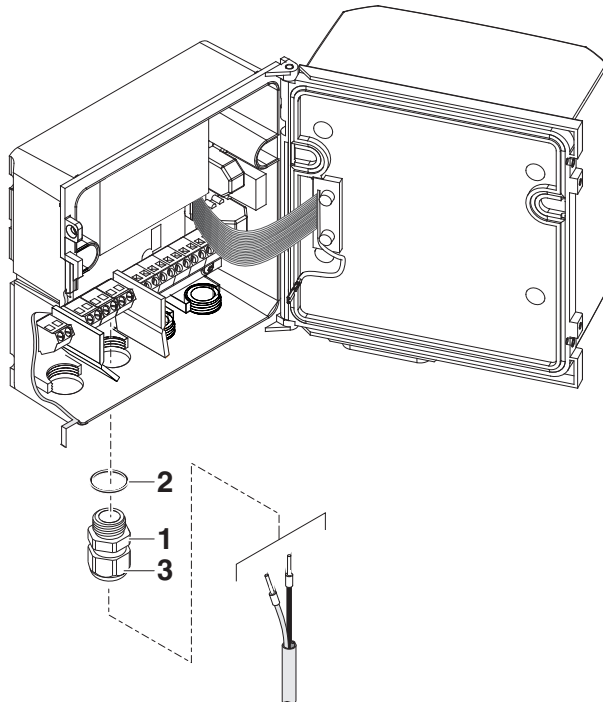



figure 3-18 Inserting lines



The complete assignment of the terminal strip is shown in section 3.12.

- 2 Screw a cable gland (pos. 1 in figure 3-18) with the sealing ring (pos. 2) into the enclosure below the respective connections.
- 3 Loosen the coupling ring (pos. 3).
- 4 Feed the line through the cable gland in the enclosure.
- 5 Connect the wires to the terminal strip. While doing so, pay attention to the specifications on the label located under the terminal strip.
- 6 Tighten the coupling ring (pos. 3).



WARNING
 No free wires are allowed to project into the housing. Otherwise, there is a danger that areas safe to contact could come into contact with dangerous voltages. This could result in life threatening electric shock when working with the universal transmitter DIQ/S 281. Always cut off any wires that are not in use as closely as possible to the cable gland.

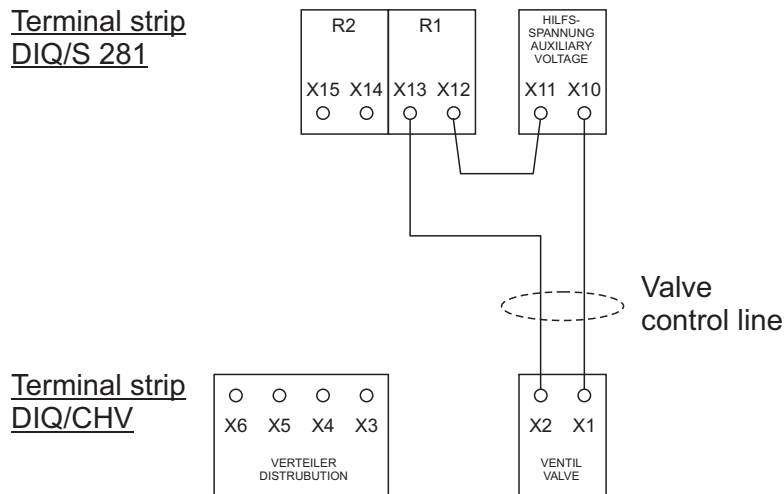
7 Close the enclosure of the DIQ/S 281.

3.9.2 Usage of the auxiliary voltage

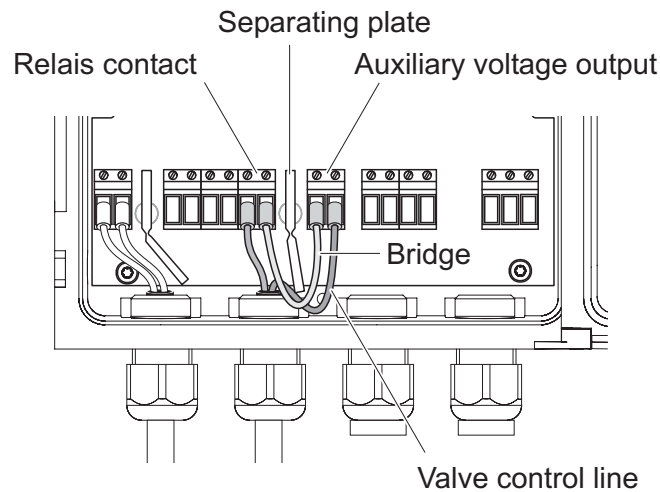
The universal transmitter DIQ/S 281 has a 24 V output (designation HILFSSPANNUNG or AUXILIARY VOLTAGE on the terminal strip). You can use this auxiliary voltage for the relay-controlled opening of the valve in a DIQ/CHV valve module for the compressed air-driven sensor cleaning function. To do so, you have to connect the auxiliary voltage output, a free relay contact and the valve connection in the DIQ/CHV in series. Bridge a terminal of the auxiliary voltage output with a terminal of a relay output and run a control line from the remaining terminals to the valve module.

The auxiliary voltage must not be used for other purposes.

Connection scheme for one sensor with compressed air cleaning



Run the bridge below the divider so the bridge does not bump against the circuit board in the lid when the enclosure is closed.



3.10 Commissioning

Start checklist and system start

Before starting the system, carry out the system check using the following checklist. Always carry out the check:

- before the initial commissioning
- before any further commissioning if the system has been previously extended or modified.

Start checklist:

- 1 Are all components correctly connected with each other (see section 3.5, if necessary, section 3.6)?
- 2 Is the universal transmitter correctly connected to the power supply (see section 3.8)?
- 3 Do the line voltage and line frequency agree with the data on the name plate of the universal transmitter?
- 4 Is the sensor ready for measuring, e.g. a D.O. sensor filled with electrolyte solution?

Starting the system

Switch on the power supply of the DIQ/S 281. As soon as the system is successfully initialized, the measured value display appears. With a sensor not yet providing any measurement values, "Init" appears temporarily:



Select your system language during the first system start. The selected system language can be changed in the *Einstellungen/Settings* menu at any time.

Initial start phase The Universal Transmitter is initialized during the first start phase. All components are automatically registered with the Universal Transmitter DIQ/S 281. The system then performs a self test. This process can take several seconds. During this period, the following display appears:

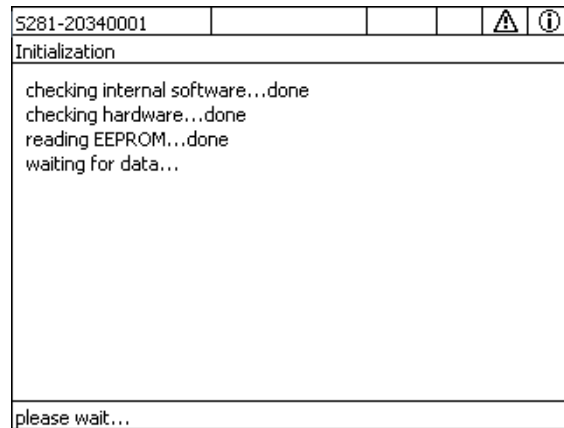


figure 3-19 Display during the initialization process

Second start phase As soon as the Universal Transmitter is successfully initialized, the measured value display appears. In the case of IQ sensors that are not yet providing measured values, "Init" appears temporarily

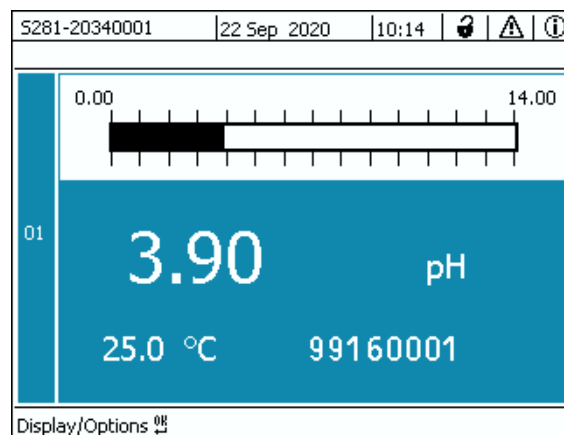


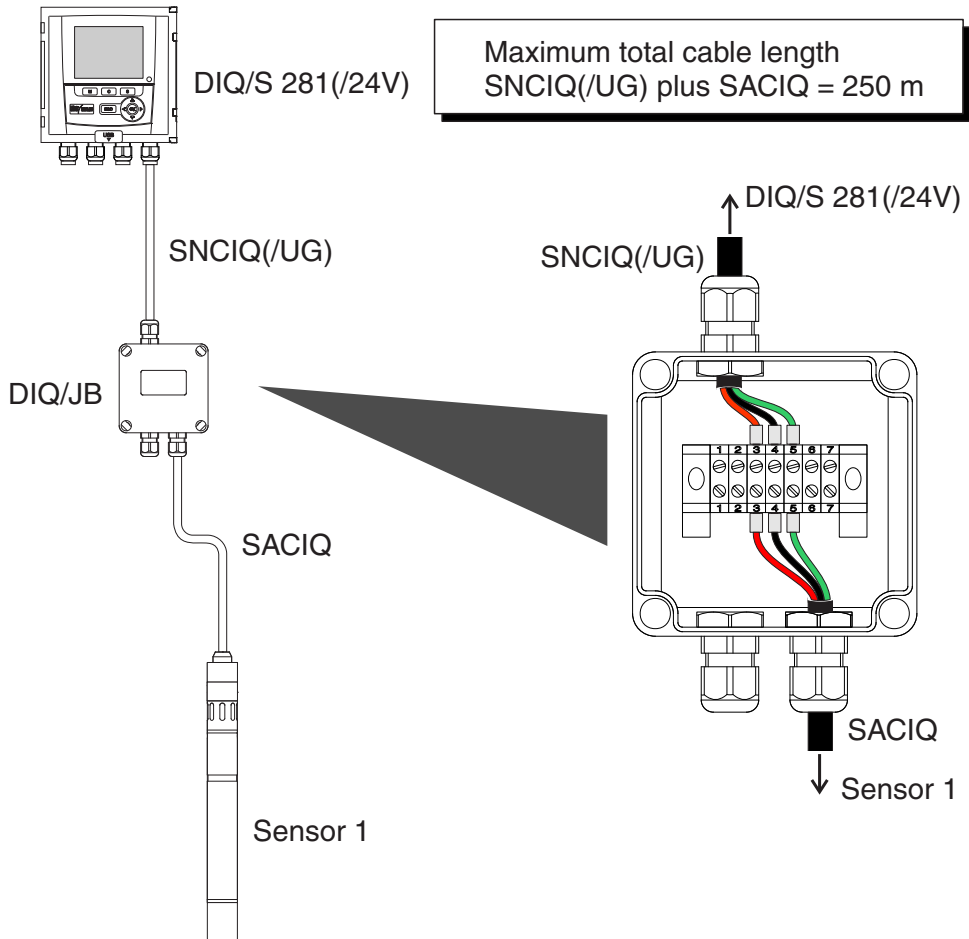
figure 3-20 Display after initialization of the terminal



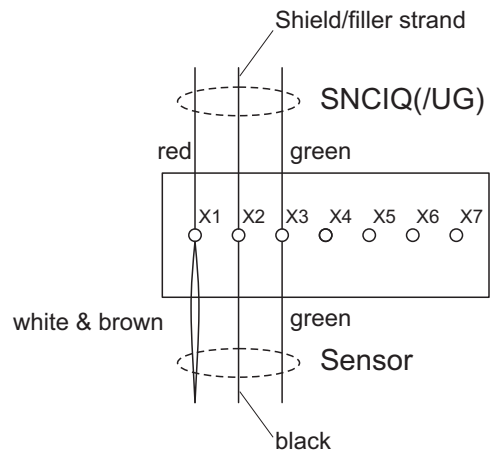
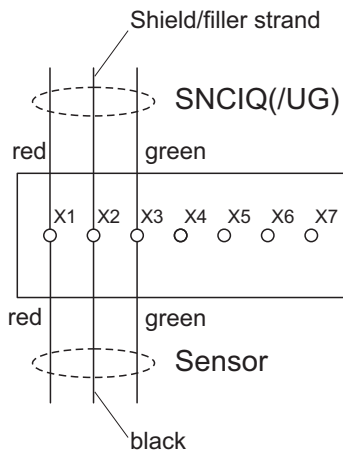
If the system start failed, see chapter 8 WHAT TO DO IF

3.11 Installation examples

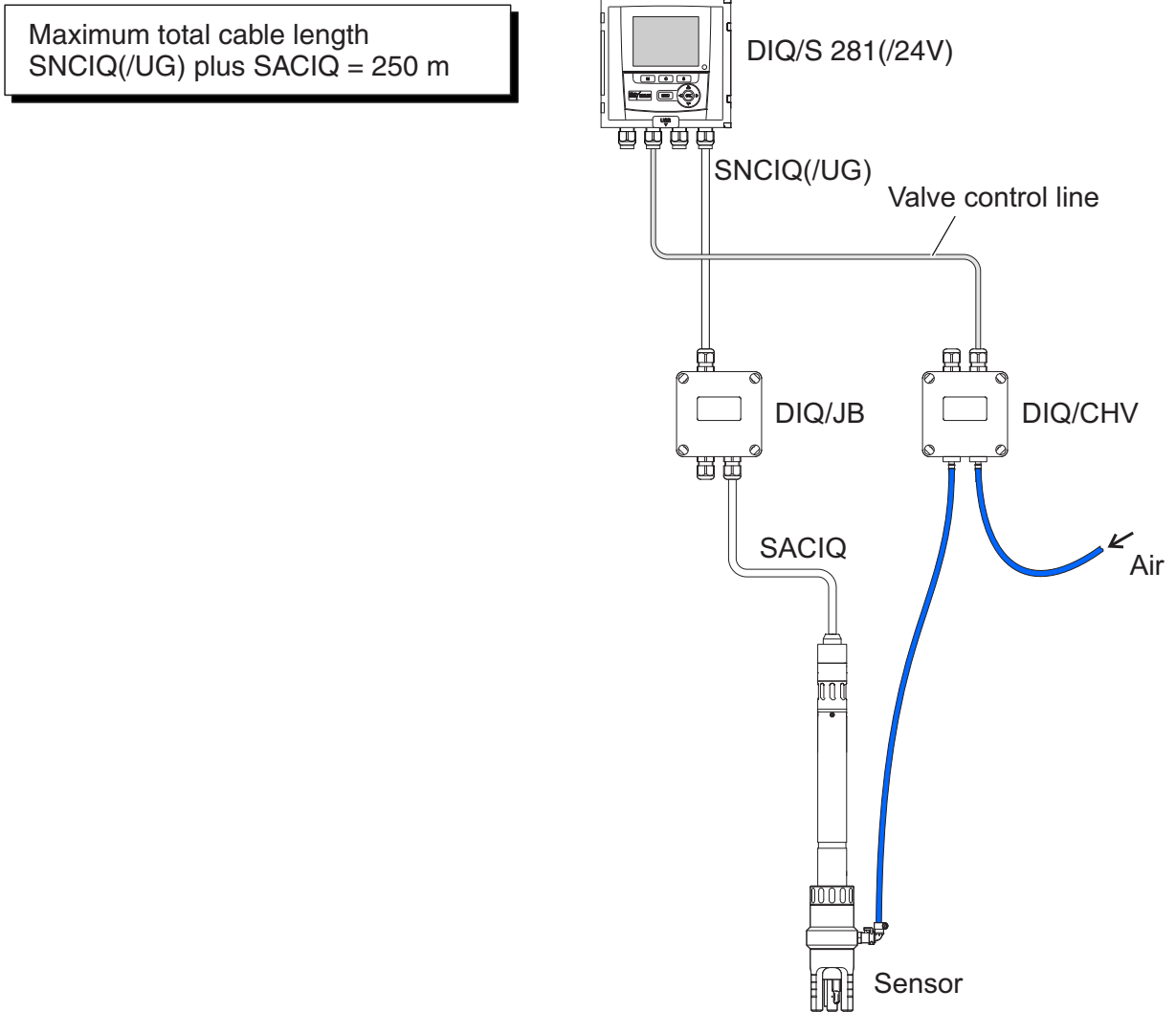
3.11.1 Connection of a sensor without compressed air cleaning



Connection diagram, terminal strip DIQ/JB



3.11.2 Connection of a sensor with compressed air cleaning



**Connection
scheme of valve
control**

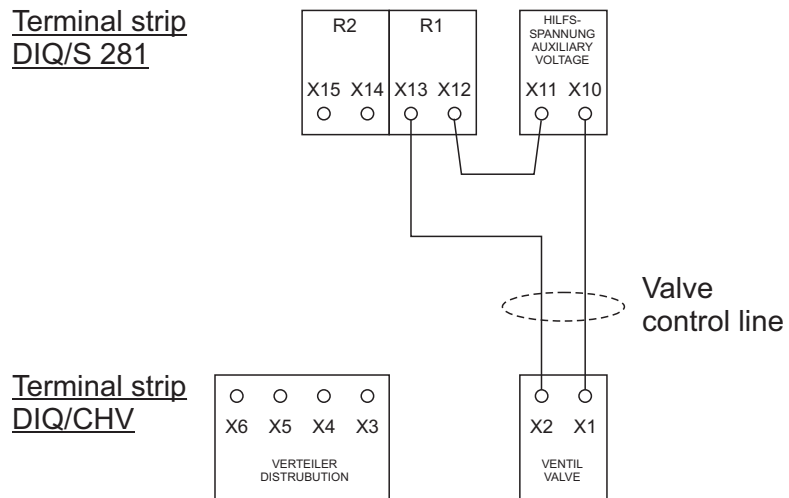
Example:

Relay 1 controls the cleaning of the sensor.

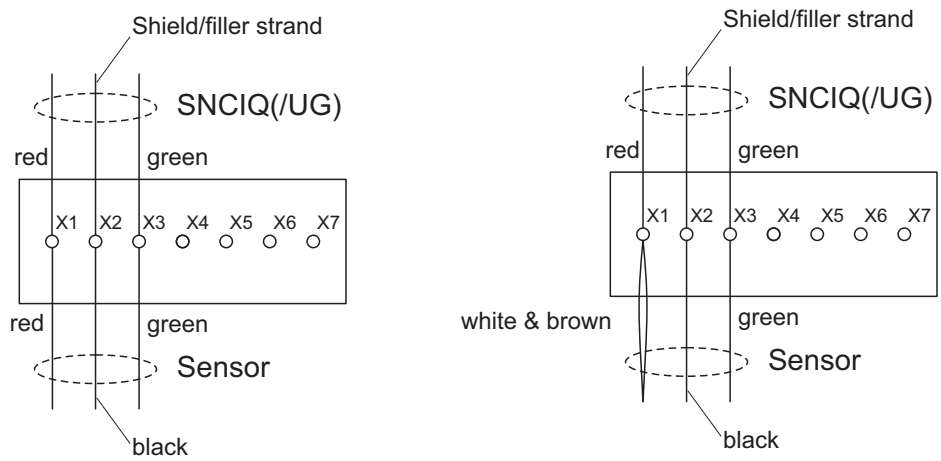
In this configuration, the free switching contact (here: R2) may be used to switch SELV voltages only.



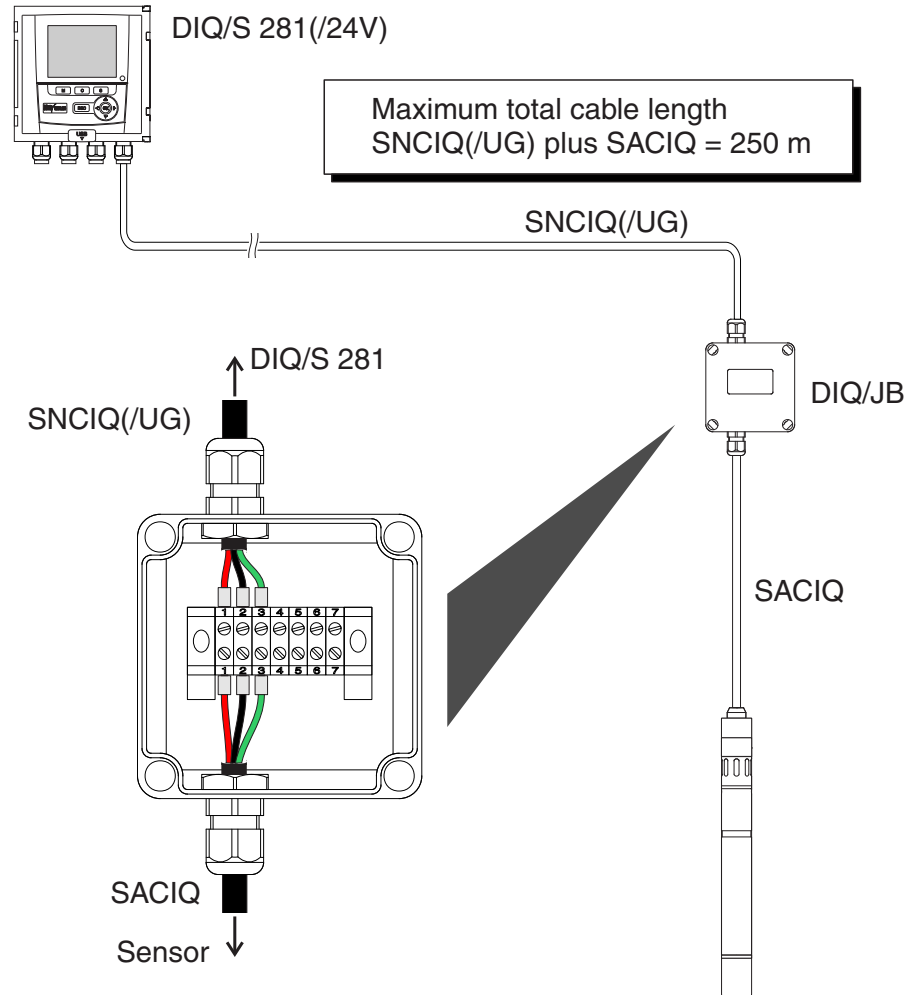
No free wires are allowed to project into the housing. Otherwise, there is a danger that areas safe to contact could come into contact with dangerous voltages. Always cut off any wires that are not in use as closely as possible to the cable gland.



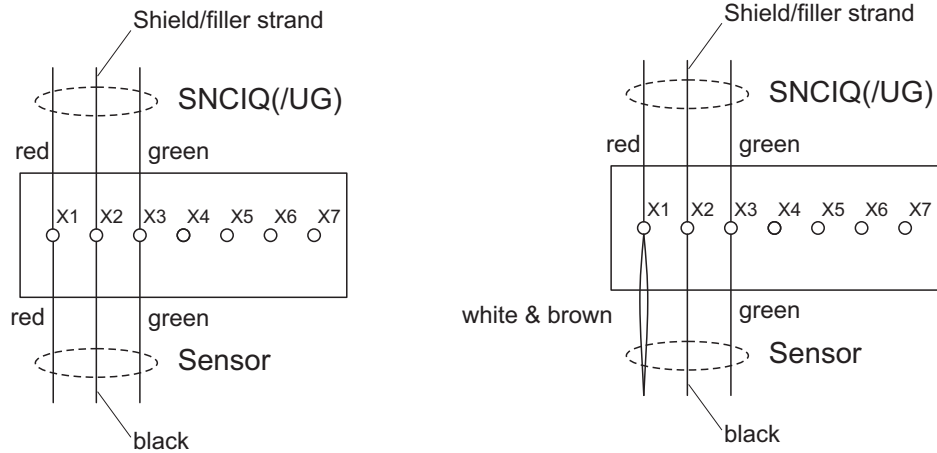
**Connection
diagram,
terminal strip
DIQ/JB**



**3.11.3 Connection of a sensor that is located at a distance
(without compressed air cleaning)**

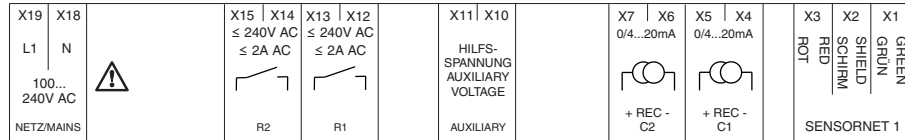


Connection diagram, terminal strip DIQ/JB

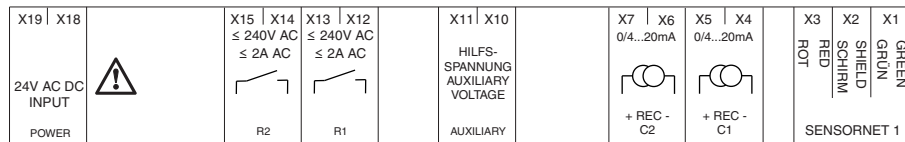


3.12 Figures of the terminal strips

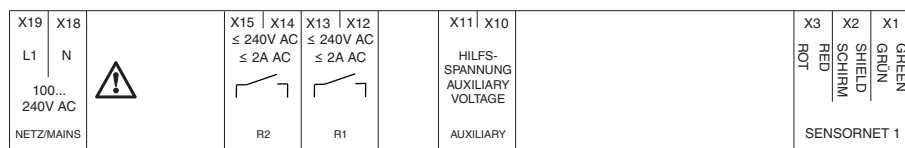
DIQ/S 281 -CR2



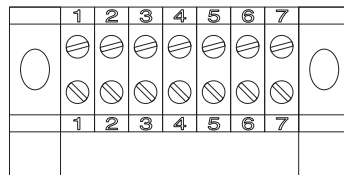
DIQ/S 281 -CR2 /24V



DIQ/S 281 -MOD

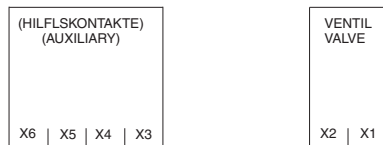


DIQ/JB



(7 passive, potential-free terminals for line extension)

DIQ/CHV



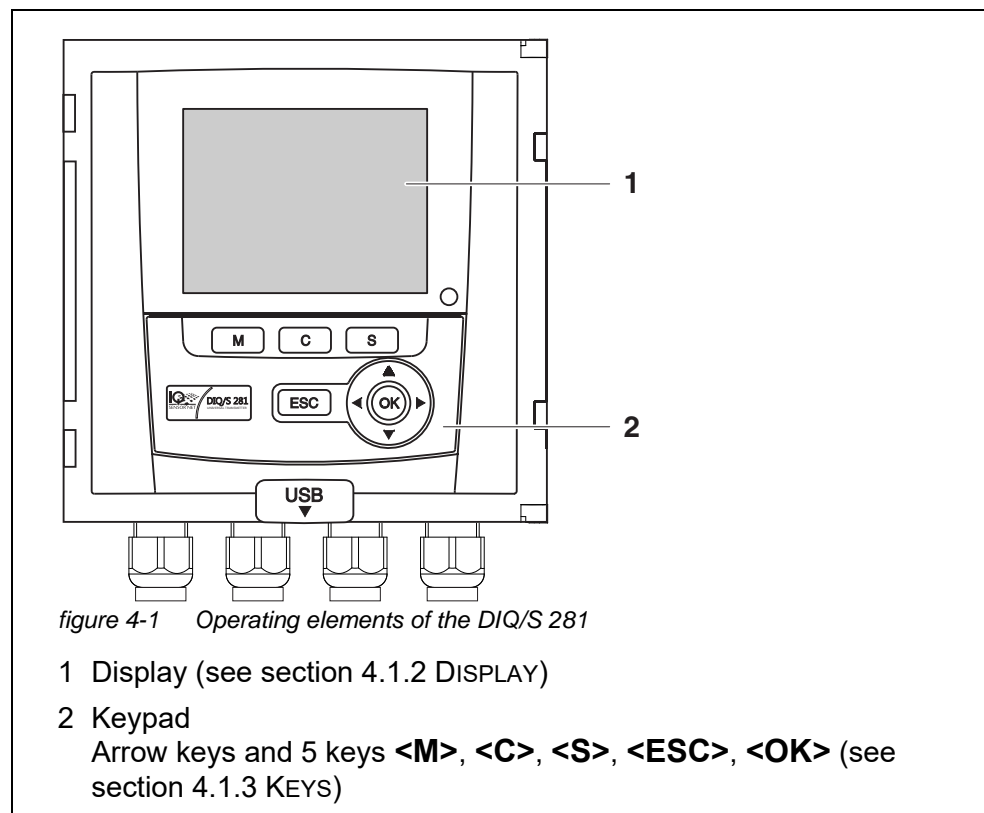
4 Operation

4.1 Operating elements

4.1.1 Overview of the operating elements

The Universal Transmitter is equipped with a large display for the clear presentation of current measured values, the graph of measured values, status displays and message texts.

The 5 keys **<M>**, **<C>**, **<S>**, **<ESC>**, **<OK>** and the arrow keys **<▲▼◀▶>** are used to operate the DIQ/S 281 Universal Transmitter.



4.1.2 Display

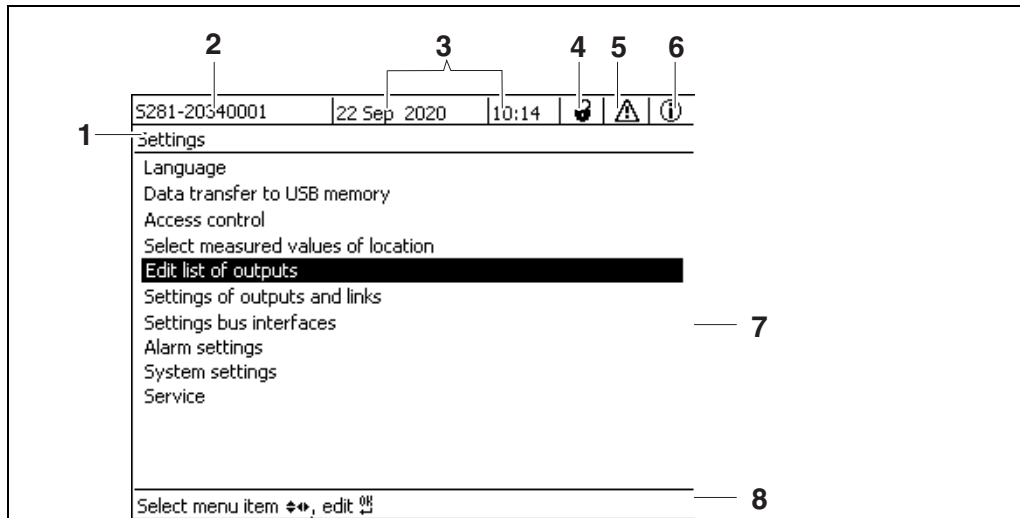


figure 4-2 Display

- 1 Name of the display indication (is skipped in the measured value display)
- 2 Name of the instrument (and series number, e.g. S281-20340001)
- 3 Date, time
- 4 User right (details see below)
- 5 Error symbol :
If the error symbol flashes, a new or unacknowledged error message is present in the log book that requires immediate action (see section 4.5.3).
- 6 Info symbol :
If the info symbol flashes, new or unacknowledged information is present in the log book (see section 4.5.3).
- 7 Display range for measured values, menus, lists, etc.
- 8 Help line with operating instructions

Detail on the user right (4)

	<u>Lock open</u> : No access control, settings released System settings can be changed
	<u>Crown</u> : Administrator authorization Configuration and running operation of the system
	<u>Tool</u> : Maintenance authorization Running operation of the system and maintenance activities
	<u>Eye</u> : Monitoring permission Only read permission, no operation of the system

Measured value display

The measured value display contains the following information:

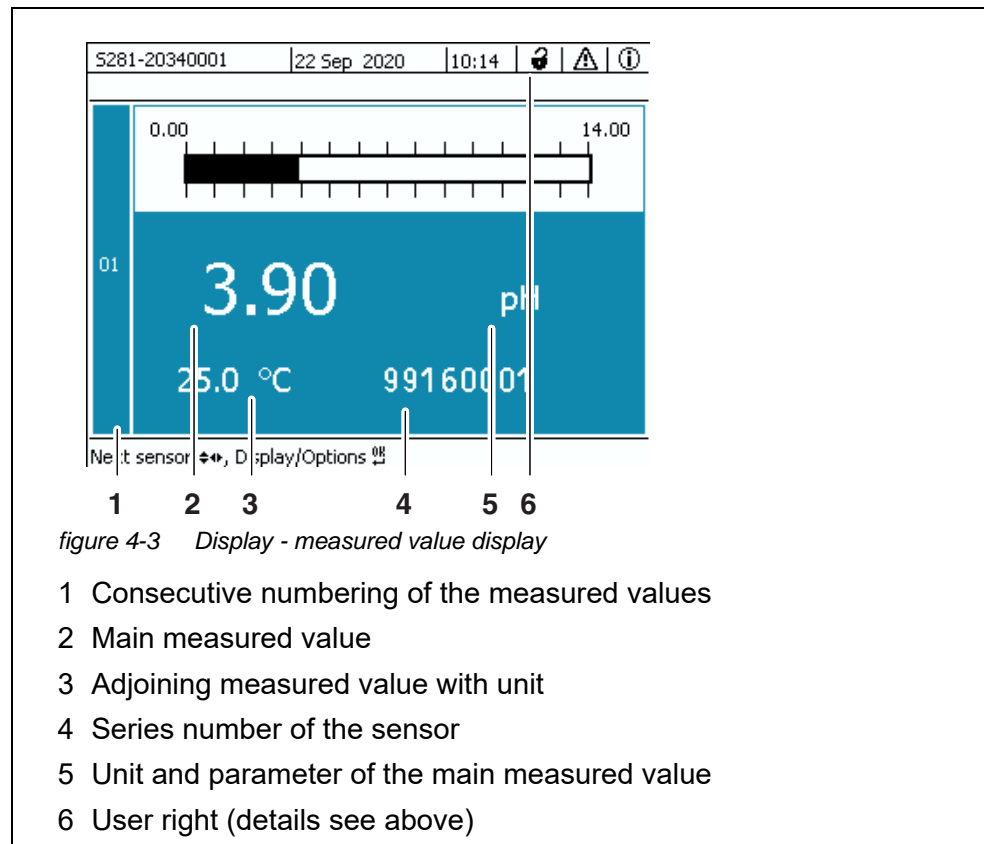


figure 4-3 Display - measured value display

- 1 Consecutive numbering of the measured values
- 2 Main measured value
- 3 Adjoining measured value with unit
- 4 Series number of the sensor
- 5 Unit and parameter of the main measured value
- 6 User right (details see above)

Special displays

<i>Init</i>	Sensor is being initialized <ul style="list-style-type: none"> ● during commissioning or ● if a new IQ sensor is recognized that is not yet giving measured values
----	Invalid measured value
<i>Cal</i>	Sensor is being calibrated
<i>Clean</i>	Cleaning system active, sensor is offline
<i>Error</i>	Sensor is inactive or defective
<i>OFL</i>	Measuring range undercut or exceeded (overflow)
Display flashes	Sensor in maintenance condition

4.1.3 Keys

Key	Function
<M>	Display measured values
<C>	Start calibration of the IQ sensor shown in the measured value display
<S>	Open the <i>Einstellungen/Settings</i> menu
<ESC>	Change to the higher menu levels or abort entries without storing them
<OK>	Confirm selection
<▲▼◀▶> (arrow keys)	Highlight and select: <ul style="list-style-type: none"> ● Menu items ● Entries ● Columns or fields ● Letters or numerals



The selection highlighted with the arrow keys is displayed as white text on a blue background.

4.2 General operating principles

The operation of the DIQ/S 281 is standardized and user-friendly.

- Select an item with the arrow keys <▲▼◀▶>
 - Highlight individual elements in menus, lists and tables, e.g. menu entries, list elements, columns or fields
 - Select a setting in selection fields
 - Select a character in text entry fields
- Confirm a selection with the <OK> key.
- Break off an action and change to the next higher level with the <ESC> key.
- Start a calibration procedure with the <C> key.
- Switch to the settings with the <S> key.
- Change to the measured value display and break off current actions with the <M> key.



Short operating instructions are given in the help lines on the display.

Examples of the operating principles are given below:

- Navigation in menus, lists and tables (see chapter 4.2.1)
- Entering text and numerical values (see chapter 4.2.2)

4.2.1 Navigating in menus, lists and tables

- 1 Open the *Einstellungen/Settings* menu with **<S>**.
Menu appear in the form of a list on the display, e.g. the *Einstellungen/Settings* menu shown here.

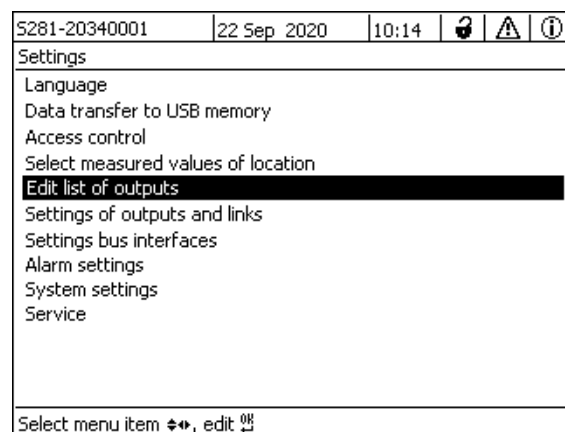


figure 4-4 *Einstellungen/Settings*

- 2 Select a menu item (e.g. *System settings*) with **<▲▼◀▶>**.
Move the highlighting (reverse video display, blue background) in the list of menu items with the arrow keys **<▲▼◀▶>**.
- 3 Confirm the menu item (e.g. *System settings*) with **<OK>**.
The display (e.g. *System settings*) opens.
Confirm the selection and move to a new display by pressing the **<OK>** key.
- 4 Return to a higher level with **<ESC>**.
or:
Switch to the measured value display with **<M>**.

4.2.2 Entering texts or numerals

You can assign names to the outputs. Example:

- 1 Open the *Einstellungen/Settings* menu with **<S>**.
- 2 Select the *Edit list of outputs* menu item with **<▲▼◀▶>**.
- 3 Confirm the *Edit list of outputs* menu item with **<OK>**.
The *Edit list of outputs* display opens. A column is highlighted.
- 4 Select the *Name* column with **<▲▼◀▶>**.
- 5 Confirm the *Name* column with **<OK>**.
An output name is highlighted.
- 6 Select an output name with **<▲▼◀▶>**.

S281-20340001		22 Sep 2020	10:14	🔒	⚠	ℹ
Edit list of outputs						
No.	Model/Channel	Ser. no.	Name			
D01	DIQ/S281-CR2/R1	99200004				
D01	DIQ/S281-CR2/R2	99200004				
D01	DIQ/S281-CR2/C1	99200004				
D01	DIQ/S281-CR2/C2	99200004				
Select ⚡, edit output names 🗑						

figure 4-5 Edit list of outputs

- 7 Confirm the selection with **<OK>**.
The name of the selected output is edited.

S281-20340001		22 Sep 2020	10:14			
Edit list of outputs						
No.	Model/Channel	Ser. no.	Name			
D01	DIQ/S281-CR2/R1	99200004	z			
D01	DIQ/S281-CR2/R2	99200004				
D01	DIQ/S281-CR2/C1	99200004				
D01	DIQ/S281-CR2/C2	99200004				
Select \leftrightarrow , edit output names OK						

figure 4-6 Edit list of outputs



The following letters, numerals and special characters can be entered: **AaBb . . Zz0 . . 9µ%&/ () +-=><! ? _ ° .**

- 8 Select a letter or numeral with **<▲▼◀▶>**.
- 9 Confirm the letter with **<OK>**.
The character p appears behind the last letter.

S281-20340001		22 Sep 2020	10:14			
Edit list of outputs						
No.	Model/Channel	Ser. no.	Name			
D01	DIQ/S281-CR2/R1	99200004	z			
D01	DIQ/S281-CR2/R2	99200004				
D01	DIQ/S281-CR2/C1	99200004				
D01	DIQ/S281-CR2/C2	99200004				
Select \leftrightarrow , edit output names OK						

figure 4-7 Edit list of outputs

- 10
 - Add a new character
Select the character to be added with <▲▼◀▶> and confirm with <OK>.
 - or
 - Delete the last character
Select the character with <▲▼◀▶> and confirm with <OK>.
 - or
 - Adopt the name
Select the character with <▲▼◀▶> and confirm with <OK>.
- 11 Repeat steps 8 to 10 until the whole name has been entered.



You can break off entering the name with <ESC>. The old name is retained.

4.3 Access to the DIQ/S 281 with active access control



Access control is switched off in the delivery condition. No login to the DIQ/S 281 is required.

As soon as an access control of any type is enabled, access to the DIQ/S 281 is protected completely or partly.

Access to the system is enabled as follows:

- Connecting the electronic key to the USB interface (Universal Transmitter), if the administrator has enabled this function
- Entering a password

Extended access control:



In the *Display/Options / Change user rights* menu, enter the password with the arrow keys and confirm with OK.



Extended access control with instrument block:

Press the any button.

In the password query, enter the password with the arrow keys and confirm with OK.



Further details on access control (see section 5.3)

4.4 Display of current measured values

The measured value is displayed numerically and as a rod.

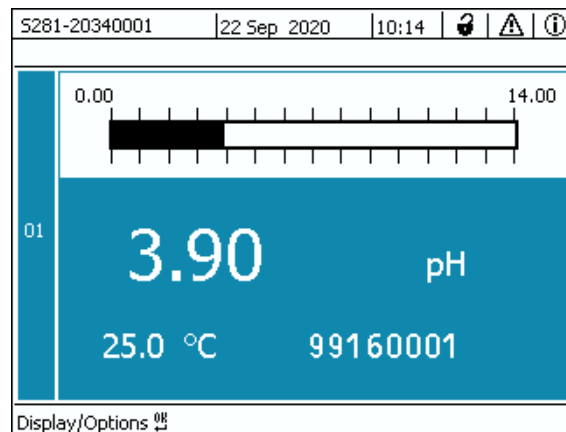


figure 4-8 Measured value



4.5 Messages and log book

The DIQ/S 281 Universal Transmitter continuously monitors the status of the entire system. If the DIQ/S 281 identifies any system changes, a message appears. New messages can be recognized by the flashing information symbol or error symbol on the display.

All messages are recorded in the log book.

4.5.1 Message types

The system differentiates two types of messages:

- **Error** 
 - Indicates a critical status in the system or an individual system component that requires immediate action.
 - In the case of new error messages, the error symbol flashes on the display.
- **Information** 
 - Information that does not require immediate action.
 - In the case of new information, the info symbol flashes on the display.



In the case of errors, immediately open the detailed message text in the log book and perform the recommended actions. If the actions have been performed, mark the message as read (see section 4.5.3).

4.5.2 Log book

The log book is a list with all the messages from all modules. The log book contains up to 1000 entries. If there are more than 1000 messages, the oldest entries are deleted.

New messages can be recognized by the flashing information symbol or error symbol. The log book always contains the latest message in the first position. They do not yet have a checkmark in the status field.

The flashing of the info or error symbol only stops after all detailed message texts in the log book have been opened and marked with a checkmark (✓) (see section 4.5.3).

Structure of the log book

5281-20340001		22 Sep 2020	10:14			
Log book of entire system						
	SYS	EI9173	26 Mai 2020	10:29		
	SYS	II4173	26 Mai 2020	10:29		
	SYS	II2173	26 Mai 2020	10:27		✓
	SYS	EI5173	26 Mai 2020	10:27		✓
	SYS	II2173	26 Mai 2020	10:25		✓
	SYS	EI5173	26 Mai 2020	10:25		✓
	SYS	EI5173	26 Mai 2020	10:25		✓
	SYS	EI5173	26 Mai 2020	10:24		✓
	SYS	II2173	26 Mai 2020	10:22		✓
	SYS	EI5173	26 Mai 2020	10:22		✓
	SYS	II2173	26 Mai 2020	10:08		✓
	SYS	EI5173	26 Mai 2020	09:45		✓
Open message/acknowledge message						
1	2	3	4	5		

figure 4-9 Log book of entire system

- 1 Message category (error or info symbol)
- 2 Module that triggered the message.
 SYS system (Universal Transmitter, controller)
 S01 IQ sensor (number 01)
 D01 DIQ/S 281 output (number 01)
- 3 Message code
- 4 Date and time of the message
- 5 Status field of the message
 ✓ Message was acknowledged
 No checkmark Message was not acknowledged

The system provides the following log books:

- *Log book of entire system:*
List of all messages from all modules
- *Log book of sensor:*
List of all messages of the IQ sensor.

There is a detailed message text for each message of a module that is ready for operation. The detailed message text on each message is given in the log book (see section 4.5.3) and in the operating manual of the registering module.

Structure of the message code

The message code consists of 6 characters and can contain numerals and letters, e.g.: I121171.

I12 171

Position	Information	Explanation
1 - 3	Short message form	The short form of the message contains the following information of the message: Category, type and type number
	1: possible categories	<ul style="list-style-type: none"> ● Info message (I) ● Error message (E)
	2: possible types	<ul style="list-style-type: none"> ● Calibration data (C) ● Installation and commissioning (I) ● Instructions for service and repair (S) ● Application instructions (A)
	3: Type number	Each type contains subtypes (0..9A..Z)
4 - 6	Module code	The three-digit module code designates the module that generated the message. The module code can be found in the chapter LISTS of the respective component operating manual.

Example: The "171" module (Universal Transmitter DIQ/S 281) sends a message with the short message form "II2".
Message code II2171 This is an info message (I) of the type Installation (I) with the type number (2). The detailed message text of the short form message (II2) can be found in the log book and in the operating manual of the component that sent it.



The detailed message text in the log book contains a precise description of the message code and, if required, any further actions.

The detailed message texts can also be found in the component operating manuals of the individual components.



The log book shows the current status at the point of time it was opened. If new messages arrive while a log book is open, these do not appear in the log book. As usual, you are informed of new messages by flashing info or error symbols. The current log book with the new messages can be viewed by closing and reopening the log book.

4.5.3 Viewing detailed message texts

- 1 Switch to the measured value display with **<M>**.
- 2 Open the *Display/Options* menu with **<OK>**.
- 3 Using **<▲▼◀▶>** and **<OK>**, select and open the *Log book of entire system*.
A list of log book entries appears.
- 4 Using **<▲▼◀▶>** and **<OK>** select and confirm a new log book entry (unchecked).
The message text with further information on the selected log book entry appears.

5281-20340001		22 Sep 2020	10:14			
Log book of entire system						
	SYS	EI9173	26 Mai 2020	10:29		
	SYS	II4173	26 Mai 2020	10:29		
	SYS	II2173	26 Mai 2020	10:27		✓
	SYS	EI5173	26 Mai 2020	10:27		✓
	SYS	II2173	26 Mai 2020	10:25		✓
	SYS	EI5173	26 Mai 2020	10:25		✓
	SYS	EI5173	26 Mai 2020	10:25		✓
	SYS	EI5173	26 Mai 2020	10:24		✓
	SYS	II2173	26 Mai 2020	10:22		✓
	SYS	EI5173	26 Mai 2020	10:22		✓
	SYS	II2173	26 Mai 2020	10:08		✓
	SYS	EI5173	26 Mai 2020	09:45		✓

figure 4-10 Log book of entire system

- 5 Acknowledge the message with **<OK>**. A checkmark appears in the log book entry.
- 6 Exit the message text with **<ESC>**.



Acknowledgment of a new message text in the log book marks the message as read. When all errors or information messages are acknowledged, the symbols no longer flash.

With the *Acknowledge all messages* function you can acknowledge all messages at the same time (see section 4.5.4).



Message texts are stored in the modules that caused them. Therefore, further information on a log book entry for an IQ sensor such as, e.g. calibration messages, instructions and help texts are only accessible in the case of connected components that are ready for operation.

If a message text is not available because, e.g. a module is not connected with the system, you can look up the detailed text of the message as follows:

- Messages of the system are given in this operating manual (see section 11.1).
- Messages of a module are given in the respective component operating manual of the module.

4.5.4 Acknowledge all messages

- 1 Switch to the measured value display with **<M>**.

- 2 Open the *Einstellungen/Settings* menu with **<S>**.
- 3 Using **<▲▼◀▶>**, select the menu item, *Service* and confirm with **<OK>**.
- 4 Using **<▲▼◀▶>**, select the menu item, *Acknowledge all messages* and confirm with **<OK>**. A security prompt opens.
- 5 Using **<▲▼◀▶>**, select *Acknowledge* and confirm with **<OK>**. All messages are acknowledged. Error symbol and info symbol do no longer flash.

4.6 Calibration data



Details on calibration are given in the operating manual for the IQ sensor.

Each calibration of IQ sensors that are able to be calibrated causes an entry to be made in the log book. Log book entries contain the following information:

- Calibration date
- Calibration successful or not successful.

The detailed calibration data of the last calibrations are integrated in the *Calibration history of sensor overview*.



All calibration data are stored in the IQ sensor. In order to view the calibration data of an IQ sensor, the IQ sensor must be connected to the DIQ/S 281 and must be ready for operation.

4.6.1 Calibration entries in the log book

The date and time of a calibration are entered in the log book. The respective message text contains an indication as to whether a calibration was successful or not. The values determined with calibration can be viewed in the calibration history (see section 4.6.2).

- 1 Call up the measured value display with **<M>**.
- 2 Confirm with **<OK>**.
The *Display/Options* menu opens.
- 3 Using **<▲▼◀▶>**, highlight the menu item, *Log book of sensor*, and confirm with **<OK>**. Calibration entries in the log book are held in message code (ICxxxx and ECxxxx).

- 4 Select and open a calibration entry (ECxxxx or ICxxxx) with **<▲▼◀▶>** and **<OK>**.
- 5 Exit the *Log book of sensor* window with **<M>** or **<ESC>**.

4.6.2 Calibration history

The calibration history contains the detailed calibration data of the last calibrations.

- 1 Call up the measured value display with **<M>**.
- 2 Confirm with **<OK>**.
The *Display/Options* menu opens.
- 3 Using **<▲▼◀▶>**, highlight the menu item, *Calibration history of sensor*, and confirm with **<OK>**.
The calibration history with the results of the last calibration procedures opens.
- 4 Exit the *Calibration history of sensor* window with **<M>** or **<ESC>**.

4.7 Status info of sensors and outputs

The display of the instrument status provides a simple overview of the current status of the sensor (sensor info) the outputs.

The status display can be reached in the *Einstellungen/Settings/Service/List of all components* menu.

- 1 Call up the measured value display with **<M>**.
- 2 Open the *Einstellungen/Settings* menu with **<S>**.
- 3 Using **<▲▼◀▶>**, highlight the menu item, *Service*, and confirm with **<OK>**. The *Service* dialog window opens.
- 4 Using **<▲▼◀▶>**, highlight the menu item, *List of all components*, and confirm with **<OK>**.
The *List of all components* dialog window opens.
- 5 Highlight the required component with **<▲▼◀▶>** and confirm with **<OK>**.
 - Output module: The *Status of output channels* window opens up.
 - Sensor: The sensor info opens up
(for details, refer to the operating manual of the selected sensor).

S281-20340001 22 Sep 2020 10:31 🔒 ⚠️ ⓘ			
Status of output channels			
No.	Name	Chan.	Status
D01		R1	open
D01		R2	open
D01		C1	0.00 mA
D01		C2	0.00 mA
Return ESC			

figure 4-11 List of all components with sensor info

- 6 Exit the *Status of output channels* window with **<M>** or **<ESC>**.

4.8 General course when calibrating, cleaning, servicing or repairing an IQ sensor

When an IQ sensor is calibrated, cleaned, serviced or repaired, the maintenance condition for the IQ sensor should always be switched on.

In the maintenance condition

- the system does not react to the current measured value or the condition of the selected IQ sensor
- linked outputs are frozen
- IQ sensor errors do not prompt changes in the conditions of linked outputs.

The maintenance condition for IQ sensors is automatically activated

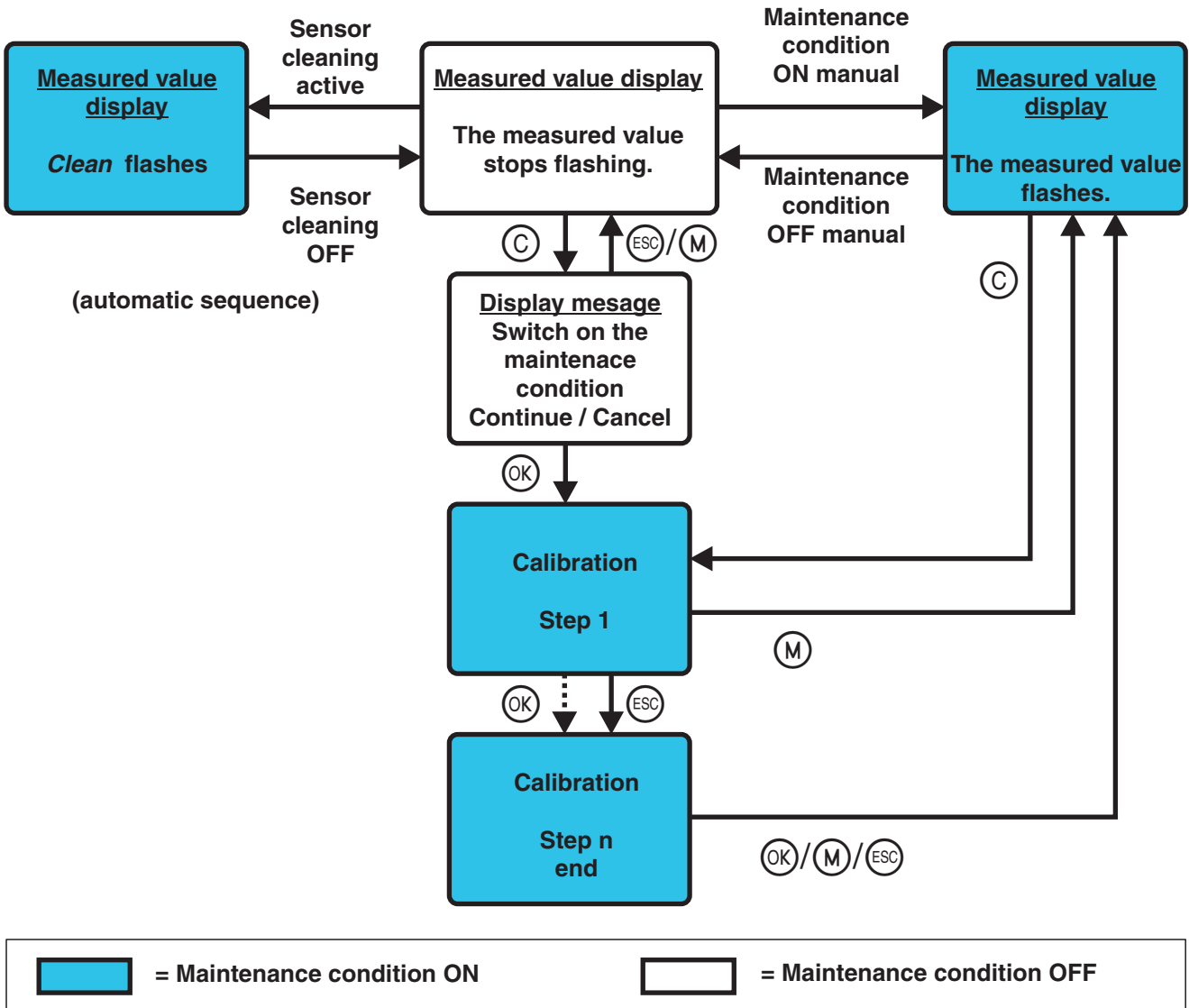
- during calibration. After calibration the IQ sensor remains in the maintenance condition until the maintenance condition is switched off manually (see section 4.8.3)
- during a compressed air cleaning cycle.

Therefore, keep to the following course when you calibrate, clean, service or repair an IQ sensor.

- Outlet**
- 1 Switch on the maintenance condition for the IQ sensor (see section 4.8.2).
The display of the sensor in the measured value display flashes.
 - 2 Pull the sensor out of the sample.
 - 3 Perform the calibration in the laboratory, cleaning, maintenance or repair (removing and replacing) of the sensor (about these topics, see the component operating manual of the corresponding sensor).
 - 4 Submerge the sensor in the sample again.
 - 5 Wait until the measured value no longer changes.
 - 6 Switch off the maintenance condition for the sensor (see section 4.8.3).
The display of the sensor in the measured value display no longer flashes.

4.8.1 Maintenance condition of IQ sensors

The following diagram gives you an overview of when an IQ sensor is in the maintenance condition.



4.8.2 Switching on the maintenance condition

Switch on the maintenance condition manually when you want to clean, service or repair (remove and replace) an IQ sensor.

- 1 Call up the measured value display with **<M>**.
- 2 Open the *Display/Options* menu with **<OK>**.
- 3 Using **<▲▼◀▶>**, highlight the menu item, *Switch maintenance condition on/off*, and confirm with **<OK>**.
A window that informs you about the maintenance condition opens up.
- 4 Use **<OK>** to confirm *Continue*. The selected sensor is in the maintenance condition. Linked outputs are frozen.

- 5 Call up the measured value display with **<M>**.
The display of the sensor in the measured value display flashes.

Subsequently, perform the cleaning, maintenance or repair work (removal and replacement).

When you have finished calibrating, cleaning, servicing or repairing the sensor, switch off the maintenance condition manually (see section 4.8.3).

4.8.3 Switching off the maintenance condition

- 1 Call up the measured value display with **<M>**.
The display of the sensor in the measured value display flashes.
- 2 Open the *Display/Options* menu with **<OK>**.
- 3 Using **<▲▼◀▶>**, highlight the menu item, *Switch maintenance condition on/off*, and confirm with **<OK>**.
A window that informs you about the maintenance condition opens up.
- 4 Use **<OK>** to confirm *Continue*.
The maintenance condition of the sensor is switched off. Linked outputs are released.
- 5 Call up the measured value display with **<M>**.
The display of the sensor in the measured value display does not flash.



If a power failure occurs, the outputs automatically are in the non-operative condition (relays: open, current output: 0 A; see component operating manual of the output module). After the end of the power failure the outputs work as defined by the user again.

If a power failure occurs while an IQ sensor that is linked with an output is in the maintenance condition, the current and relay outputs work as defined by the user after the maintenance condition has been switched off only (see section 4.8.3).

4.9 USB interface

The USB interface on the DIQ/S 281 can be used for the following actions:

- Carrying out a software update
(see section 4.11)
- Accessing the system with the Electronic Key
(see section 4.3)

4.10 Info on software versions

The system informs you of the current versions of the software of the individual components.

- 1 Call up the measured value display with **<M>**.
- 2 Open the *Einstellungen/Settings* menu with **<S>**.
- 3 Using **<▲▼◀▶>**, highlight the menu item, *Service*, and confirm with **<OK>**. The *Service* dialog window opens.
- 4 Using **<▲▼◀▶>**, highlight the menu item, *List of all components*, and confirm with **<OK>**.
The *List of all components* dialog box opens.

S281-20340001		22 Sep 2020	10:14	🔒	⚠	ℹ
List of all components						
No.	Model	Ser. no.	Softw. vers.			
SYS	CTRL TC2020	99000001	9.01			
S01	SensolYt700IQ	99160001	2.18			
Select ↔ , view component status 📄						

figure 4-12 List of all components

- 5 Exit the *List of all components* dialog box with **<M>** or **<ESC>**.



If the software version of a component is not up-to-date, you can carry out a software update via the USB interface (see section 4.11).

4.11 Software-Update for the DIQ/S 281 and sensors

With a Software-Update, you maintain the latest state of the instrument software for the Universal Transmitter DIQ/S 281 and all active components.

The update packet with the current instrument software for active components and detailed instructions on how to proceed are available on the Internet at www.WTW.com.

The instrument software is transferred to the DIQ/S 281 via the USB port and with the aid of a USB memory device.



A Software-Update does not change the measurement settings, measurement data and calibration data.



You can view the software versions of all components in the dialog box, *List of all components* (see section 4.10).

5 Settings/setup

5.1 Selecting the language

A list shows all the available system languages.

- 1 Open the *Einstellungen/Settings* menu with **<S>**.
- 2 Using **<▲▼◀▶>** and **<OK>**, select and confirm the menu item, *Language*.
The *Language* display opens.

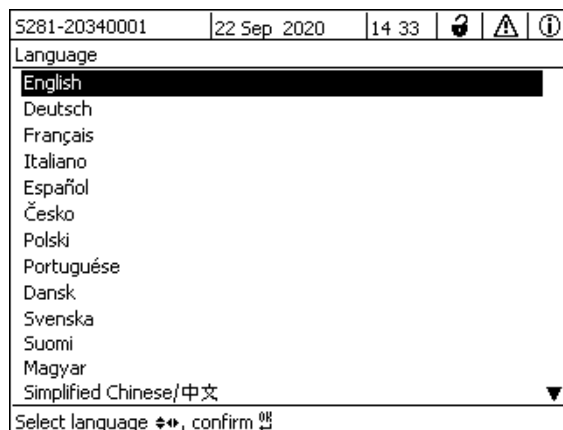


figure 5-1 Language

- 3 Select a language from the list with **<▲▼◀▶>** and confirm with **<OK>**.
The active language is marked with a checkmark.
- 4 Switch to the higher menu level with **<ESC>**.
or:
Switch to the measured value display with **<M>**.



If the selected system language is not available in a component, all indications of this component (e.g. sensor, Universal Transmitter, output module) appear in the standard language, *English*. To activate the selected system language for this component, a software update of the component is required (see section 4.11).

5.2 Terminal settings of the DIQ/S 281

The terminal settings include:

- *Terminal name*

- *Illumination brightness*
- *Illumination brightness (standby)*

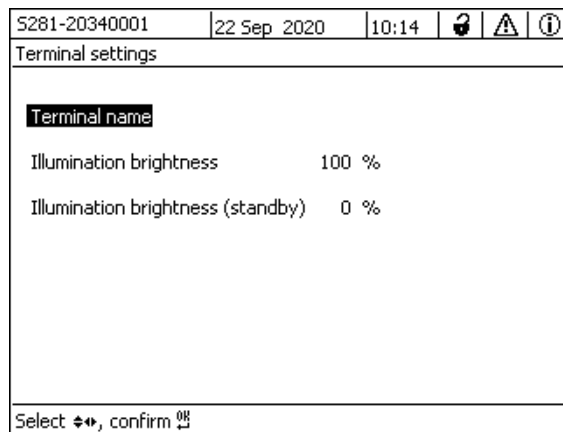


figure 5-2 Terminal settings

Setting	Selection/Values	Explanation
<i>Terminal name</i>	AaBb..Zz 0..9μ%&/() + -= > < ! ? _ °	User-defined character string with max. 15 characters
<i>Illumination brightness</i>	Auto 0 ... 100 %	Brightness of the display during operation of the terminal
<i>Illumination brightness (standby)</i>	Auto 0 ... 50 %	Brightness of the display during operation if no key is pressed for a longer period of time

5.3 Access control

Use the *Access control* function to define the safety settings for the DIQ/S 281.

The DIQ/S 281 provides the following levels of system security:

- Access control
(4 authorization levels, see section 5.3.1):
 - No access control
 - Administrator authorization
 - Maintenance authorization
 - Read permission
- Access control with instrument block (see section 5.3.2):



Access to the system with active access control (see section 4.3).

Default settings

Access control is switched off in the delivery condition. Every user can carry out all functions.

Saving the password

If access control for the DIQ/S 281 is active and the administrator password is lost, rapid administrator access to the DIQ/S 281 is no longer possible.

To avoid losing the administrator password, we recommend saving it. This also applies to the use of the electronic key.

To save the administrator password, you can save it on an electronic key, for example, and/or note it down on paper or on a PC. Keep the passwords in a safe place.



If the DIQ/S 281 is locked and the administrator password lost, you can unlock the system with a master password. Please contact the service department.

The master password is valid for 7 days.

If you have unlocked the DIQ/S 281 with the master password, we recommend to note down the normal administrator password and keep it in a safe place.



5.3.1 Activating the access control

Access control provides three preconfigured user rights in the system. Each user type can be protected with its own password.

User right

The current user right is shown on the display with the following symbols.

Validity	User right	Symbol	User rights
System-wide	Settings are unlocked (access control switched off)		All functions in the system are accessible to all users
	<i>Administration</i>		<ul style="list-style-type: none"> ● Access only with password ● Change system settings ● Assign user rights ● Calibration ● View measured values ● Carry out software updates

Validity	User right	Symbol	User rights
	Maintenance		<ul style="list-style-type: none"> ● Access only with password ● Calibration ● View measured values
	Viewer		<ul style="list-style-type: none"> ● Without instrument block: Access without password ● With instrument block: Access only with password ● View measured values
For the instrument on which the function was activated	Instrument block		<ul style="list-style-type: none"> ● Instrument block switched off: User rights as for <i>Viewer</i>. ● Instrument block active: The DIQ/S 281 is blocked. Only the IQ SENSOR NET logo is displayed. Access only with password.

Switching on the access control

- 1 Open the *Einstellungen/Settings* menu with **<S>**.
- 2 Using **<▲▼◀▶>** and **<OK>**, select and confirm the menu item, *Access control*.
The *Extended access control* dialog window opens.
User right and instrument block can be selected.

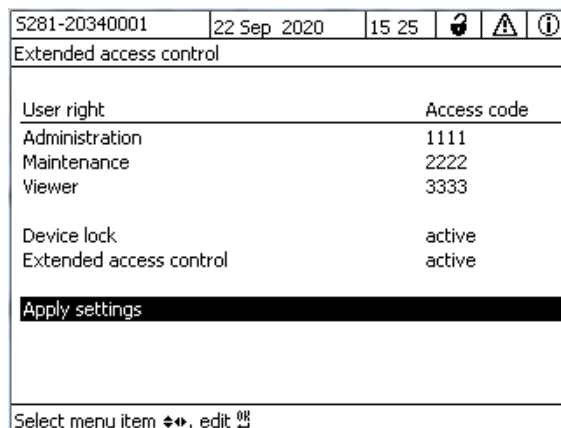


figure 5-3 *Einstellungen/Settings* -> *Access control* -> *Extended access control*

The instrument automatically generates a password for each user right. This password can be accepted or changed.

- 3 Press <▲▼◀▶> to select a user right and confirm with <OK>. If necessary, change the password in the selection dialog and/or save the password to a connected USB memory.
- 4 Note passwords.
For reasons of safety the administrator password at least should be saved in such a way that it can be accessed in an emergency.
- 5 Press <▲▼◀▶> to select the *Apply settings* function and confirm with <OK>.
A security prompt opens.
- 6 Using <▲▼◀▶>, select *OK* and confirm with <OK>.
The settings are adopted.
The *Extended access control* window is still open.
The current passwords are visible.
The *Viewer* user right is active.

Switching off the access control

- 1 Press <OK> to open the *Display/Options / Change user rights* menu.
The password query is displayed.
- 2 Enter and confirm the administrator password with <▲▼◀▶> and <OK>.
- 3 Open the *Einstellungen/Settings* menu with <S>.
Deactivate the access control.
Take over the setting.

5.3.2 Activating the instrument block

With the function *Device lock* you can protect the Universal Transmitter not only against unauthorized operating bus also against unauthorized reading of the current measured values. By activating the instrument block the password for viewing the measured values is activated.

After a selected interval without user entries, the system is automatically blocked. The display shows only the IQ SENSOR NET logo.

Switching on the instrument block

- 1 Call up the access control (see section 5.3.1).
- 2 Press <▲▼◀▶> to select the *Device lock* function and confirm with <OK>.
A checkmark appears next to the function.
- 3 Press <▲▼◀▶> to select the *Apply settings* function and confirm with <OK>.
A security prompt opens.

- 4 Using <▲▼◀▶>, select *OK* and confirm with <OK>. The settings are adopted. The *Access control* dialog window is still open. The current passwords are visible.

Switching off the instrument block

- 1 Press <OK> to open the *Display/Options / Change user rights* menu. The password query is displayed.
- 2 Enter and confirm the administrator password with <▲▼◀▶> and <OK>.
- 3 Open the *Einstellungen/Settings* menu with <S>. Deactivate the access control. Take over the setting.

5.3.3 Electronic key

The administrator can simplify access to the DIQ/S 281 by saving the password to USB memory. The USB memory thereby becomes an electronic key.

When the electronic key is connected to the DIQ/S 281, the user right stored there with the relevant password is automatically read out. The user of the electronic key is logged on to the system with his user right without any further password prompt.

When the electronic key is disconnected, the DIQ/S 281 automatically switches to the lowest user right.

Passwords for different IQ SENSOR NET systems can be saved to every electronic key.

For each IQ SENSOR NET system only one password can be saved to each electronic key.

Saving a password to an electronic key

- 1 Connect the USB memory to the USB-A interface.



Administrator rights are required when the access control is active.

- 2 Open the *Einstellungen/Settings* menu with <S>.
- 3 Using <▲▼◀▶> and <OK>, select and confirm the menu item, *Access control*. The *Access control* dialog window opens.

- 4 Press <▲▼◀▶> to select an authorization level and confirm with <OK>.
- 5 Using <▲▼◀▶>, select the menu item, *Save access code on USB memory* and confirm with <OK>. The password for the selected authorization level is saved to the USB memory device.

5.3.4 Access to the DIQ/S 281 with active access control

- Administrator access through entering the password:
 - After 10 minutes without key-pressing, the highest protection level is automatically activated.
 - Select the menu *Display/Options / Viewing only*. The highest level of protection is activated.
- Administrator access through connecting the electronic key: The protection is restored by disconnecting the electronic key

5.4 Settings for sensors

Sensor settings include the measured parameter, measuring range and, if necessary, compensations.

Sensor settings The following diagram shows the operating steps to call up the sensor setting

menu and enhanced sensor functions:

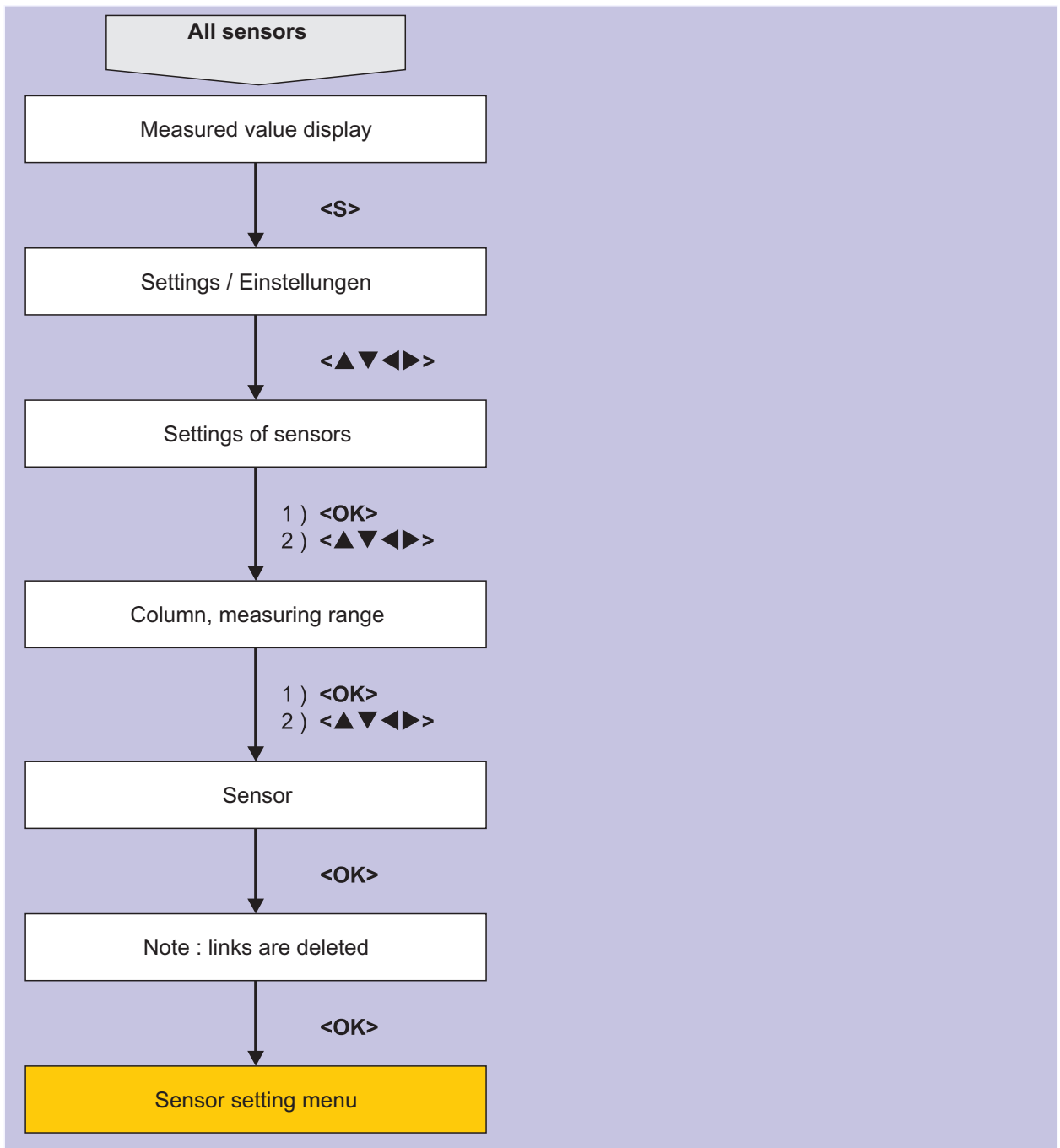


figure 5-4 Calling up the sensor settings



If the measuring mode or measured parameter are changed, a link of the sensor with a relay is erased!

Details on sensor settings are given in the operating manual for the IQ sensor.

5.5 Editing the list of outputs

The *Edit list of outputs* display provides an overview of all outputs, links and inactive datasets.



Linking outputs and sensors (see section 6.4).

For the easier identification of the outputs, you can assign an individual name to each output in the *Edit list of outputs* display.

- 1 Open the *Einstellungen/Settings* menu with **<S>**.
- 2 Using **<▲▼◀▶>** and **<OK>**, select and confirm the menu item, *System settings -> Edit list of outputs*. The *Edit list of outputs* overview opens.
- 3 Press **<▲▼◀▶>** to highlight a name in the *Name* column and confirm with **<OK>**.

5281-20340001		22 Sep 2020	10:14			
Edit list of outputs						
No.	Model/Channel	Ser. no.	Name			
D01	DIQ/5281-CR2/R1	99200004				
D01	DIQ/5281-CR2/R2	99200004				
D01	DIQ/5281-CR2/C1	99200004				
D01	DIQ/5281-CR2/C2	99200004				
Select , edit output names						

figure 5-5 Edit list of outputs -> enter a name

- 4 Enter the name with **<▲▼◀▶>** and **<OK>** and confirm with **<OK>** (see also section 4.2.2).

5281-20340001		22 Sep 2020	10:14			
Edit list of outputs						
No.	Model/Channel	Ser. no.	Name			
D01	DIQ/S281-CR2/R1	99200004	708			
D01	DIQ/S281-CR2/R2	99200004				
D01	DIQ/S281-CR2/C1	99200004				
D01	DIQ/S281-CR2/C2	99200004				
Select \leftrightarrow , edit output names OK						

figure 5-6 Edit list of outputs -> enter a name

5.6 Alarm settings

5.6.1 General information

Under this menu item you can specify reactions on certain alarm events.

An alarm event is when a certain measured value (limiting value) of a sensor is exceeded or undercut.

Alarm events can be relayed as follows:

- As a message on the display
- As a relay action



An alarm message via display or relay cannot be acknowledged or switched off. An alarm only disappears if the cause for the alarm was eliminated or the *Alarm settings* were changed or erased.

5.6.2 Setting up / editing alarms

- 1 Open the *Einstellungen/Settings* menu with **<S>**.
- 2 Using **<▲▼◀▶>** and **<OK>**, select and confirm the menu item, *Alarm settings*.
The *Alarm link overview* dialog window opens.
Alarms that have already been set up have entries in the *Sensor* column.

S281-20340001			22 Sep 2020	10:14			
Alarm link overview							
Alarm	Sensor	Designation					
A01							
A02	S01 20341000	lack of oxygen					
A03							
A04							
A05							
A06							
A07							
A08							
A09							
A10							
Select , Set alarm							

figure 5-7 Alarm settings -> Alarm link overview



The sensor number and serial number is displayed in the *Sensor* column.

- 3 Select an alarm *A01* to *AXX* to be edited with <▲▼◀▶>. To set up a new alarm without entry select in the *Sensor* column. Then confirm with <OK>. When a new alarm is set up a list with all sensors appears first. Alarm links that are already available can be erased or edited (for editing continue with step 5).

S281-20340001				22 Sep 2020	10:14			
Select sensor for alarm link								
No.	Model	Ser. no.	Sensor name					
S01	SensolYt700IQ	99160001	Zulauf					
Select sensor , confirm								

figure 5-8 Select sensor for alarm link

- 4 To set up a new alarm, select a sensor from the list with <▲▼◀▶> and confirm with <OK>. The *Set alarm link* display opens.

5281-20340001	22 Sep 2020	10:14			
Set alarm link					
Measured variable	Main variable				
Limit value	Upper limit				
Upper limit	48.0 mg/l				
Hysteresis	6.00 mg/l				
Designation					
Relay output	D01 R.1				
Accept					
Cancel					
Adjust setting \leftrightarrow , confirm \rightarrow					

figure 5-9 Set alarm link

- 5 Edit the setting table. The required operating steps are described in detail in section 4.2 GENERAL OPERATING PRINCIPLES.

Alarm links setting table

Menu item	Selection/Values	Explanations
<i>Measured variable</i>	<ul style="list-style-type: none"> ● <i>Main variable</i> ● <i>Adjoining variable</i> 	<p><i>Main variable</i> designates the actual measured parameter of the sensor (e.g. pH, oxygen, etc.).</p> <p><i>Adjoining variable</i> designates an additional measured parameter (e.g. temperature).</p>
<i>Limit value</i>	<ul style="list-style-type: none"> ● <i>Lower limit</i> ● <i>Upper limit</i> 	<p>Type of the alarm event.</p> <p><i>Lower limit</i>: An alarm is triggered if the defined limit value is undercut.</p> <p><i>Upper limit</i>: An alarm is triggered if the defined limit value is exceeded.</p>
<i>Lower limit / Upper limit</i>	within the measuring range (sensor-dependent)	Limit value for the alarm event
<i>Hysteresis</i>	0 - 10 % of the measuring range	Hysteresis for the limit value
<i>Designation</i>	(max. 20 characters)	User-defined designation for easier identification in the alarm message.

Menu item	Selection/Values	Explanations
<i>Relay output</i>	Dxx / .../ Ry <i>No relay output</i>	Opens a list with all relay outputs where the <i>Alarm contact</i> is set. Dxx: number of the output module .../Ry: relay output channel Here you can select a relay output. When the alarm event occurs, it carries out the specified action (Open or Close). For details, see section 5.6.3 ALARM OUTPUT TO DISPLAY.
<i>Accept</i>		The settings are taken over in the setting table by pressing <OK> . The display switches to the next higher level.
<i>Cancel</i>		The display switches to the next higher level without storing the new settings.

5.6.3 Alarm output to display

When an alarm event occurs, a window with a text message appears.

```

ALARM A02  00:04  30 Sept 2005
Oxygen depletion

SO2 TriOxmatic700IQ
01341000 Site 1

< 2.2 mg/l O2
1/1
    
```

1

2

3

4

5

figure 5-10 Example of an alarm message on the display

- 1 Alarm no. Axx and date and time of the alarm event
- 2 User-defined designation
- 3 Sensor number and model name of the sensor that triggered the alarm event
- 4 Series number and name of the sensor that triggered the alarm event
- 5 Description of the event with specification of the limiting value:
 "<" = Undercut
 ">" = Exceeded

Operating instructions

If there are several alarm messages indicated on the display, you can scroll through the messages with **<▲▼◀▶>**. This can be recognized from the page number in the right lower corner. The latest message is always on the first position.

Pressing **<M>** hides the alarm messages and switches to the measured value display. After one minute the alarm messages appear again if what caused them is still present.

5.6.4 Alarm output as relay action

The relay outputs of the DIQ/S 281 can be configured so a relay action is triggered when an alarm event occurs (Open or Close). For this the *Alarm contact* function must be set for the relay output in the *Settings of outputs and links*.

The *Alarm contact* function is only available for relays that are not linked with a sensor. If necessary, an existing link must be erased. For details please refer to the operating manual of the output module.

5.7 System settings

System settings include:

- *Language* (see section 5.1)
- *Date/Time* (see section 5.7.1)
- *Location altitude/Air pressure* (see section 5.7.2)
- *Settings bus interfaces* (variant DIQ/S 281-MOD)
- *Function code*

5.7.1 Setting the date and time

The real time clock is used for the display of date and time in the measured value display and in log book entries.

- 1 Open the *Einstellungen/Settings* menu with **<S>**.
- 2 Using **<▲▼◀▶>** and **<OK>**, select and confirm the menu item, *System settings -> Date/Time*.
The *Date/Time* display opens.
- 3 Press **<▲▼◀▶>** to select *Set date* or *Set time*.
- 4 Confirm the selection with **<OK>**.
A field is highlighted, e.g. *Year*.

S281-20340001	22 Sep 2020	10:14			
Date/Time					
Set date					
Year	2020				
Month	Sep				
Day	22				
Set time					
Hour	10				
Minute	43				
Select , confirm					

figure 5-11 Date/Time

- 5 Press **<▲▼◀▶>** and **<OK>** to select and confirm a number. The next field is highlighted, e.g. *Month*.
- 6 Complete the entries on the display *Date/Time*.



The clock in the DIQ/S 281 bridges periods of power failure of up to several hours. After a longer power failure, the clock starts precisely at the time of the failure. A message and an entry in the log book provide information on the power failure and the necessity for resetting the clock.

5.7.2 Location altitude / average air pressure

Air pressure values can be set within a range of 500 to 1100 mbar.

- 1 Open the *Einstellungen/Settings* menu with **<S>**.
- 2 Using **<▲▼◀▶>** and **<OK>**, select and confirm the menu item, *System settings -> Location altitude/Air pressure*. The *Location altitude/Air pressure* display opens.

5281-20340001	22 Sep 2020	10:14	🔒	⚠️	①
Location altitude/Air pressure					
Set altitude of location					
Loc. altitude:	590 m	amsl			
Set air pressure					
Air pressure:	1013 mbar				
Select ⬅➡, confirm ⏹					

figure 5-12 Location altitude/Air pressure

- 3 Press <▲▼◀▶> to select *Set altitude of location* or *Set air pressure* and confirm with <OK>.
- 4 Press <▲▼◀▶> to change the values for *Loc. altitude:* or *Air pressure:* and confirm with <OK>.

5.7.3 Function code

Function for the service staff.

6 Outputs

6.1 Outputs of the DIQ/S 281

Functioning of the outputs

- Relay outputs work as openers or closers.
- Current outputs provide a current depending on the measured value.

On the DIQ/28x you can do the following:

- Assign names for the outputs (see section 6.3).
- Link any outputs with the sensor (see section 6.4)
- Erase links between outputs and the sensor (see section 6.5)
- Set up outputs (see section 6.6 and section 6.7)
- Check the conditions of the outputs (see section 6.8)

Basis information on the use of relay outputs is given in section 6.2.

Functions for current and relay outputs

Relay output (see section 6.6)

- *System monitoring*
- *Sensor monitoring*
- *Limit indicator*
- *Frequency controller*
- *Pulse-width output*
- *Cleaning*
- *Sensor-controlled*
- *Manual control*
- *Alarm contact*

Current output (see section 6.7)

- *Recorder*
- *PID controller*
- *Fixed current value*

6.2 Basic information on relay functions

This chapter describes general basic information concerning the following relay functions:

- Monitoring (see section 6.2.1)
- Limit indicator (see section 6.2.2)
- Proportional output (see section 6.2.3)

6.2.1 Monitoring

When using a relay for monitoring, a relay action (*Open*, *Close*) occurs when certain states occur. This function is suitable, for example, for the monitoring of errors in the system.



For monitoring functions, use the relay preferably as normally closed (see section 6.6.1). In the case of an error, the relay opens. As a result, the monitoring function operates even if, for instance, the supply voltage fails.

6.2.2 Limit indicator

With a limit indicator, a relay switches when a specified limiting value is exceeded or undercut.

Limit indicators can be used in the following way:

- Monitoring a limiting value using a relay:
when a limiting value (upper or lower limiting value) is exceeded or undercut, a relay switches. The *Open* or *Close* relay actions are possible in each case (see page 84).
- Monitoring two limiting values using two relays:
If the upper limiting value is exceeded or undercut, a relay switches, and if the lower limiting value is exceeded or undercut, another relay switches. The *Open* or *Close* relay actions are possible in each case (see page 84).



If the simple monitoring function (*Open*, *Close*) with one or two relays is not sufficient, use proportional output (see section 6.2.3).

Monitoring limiting values using one or two relays

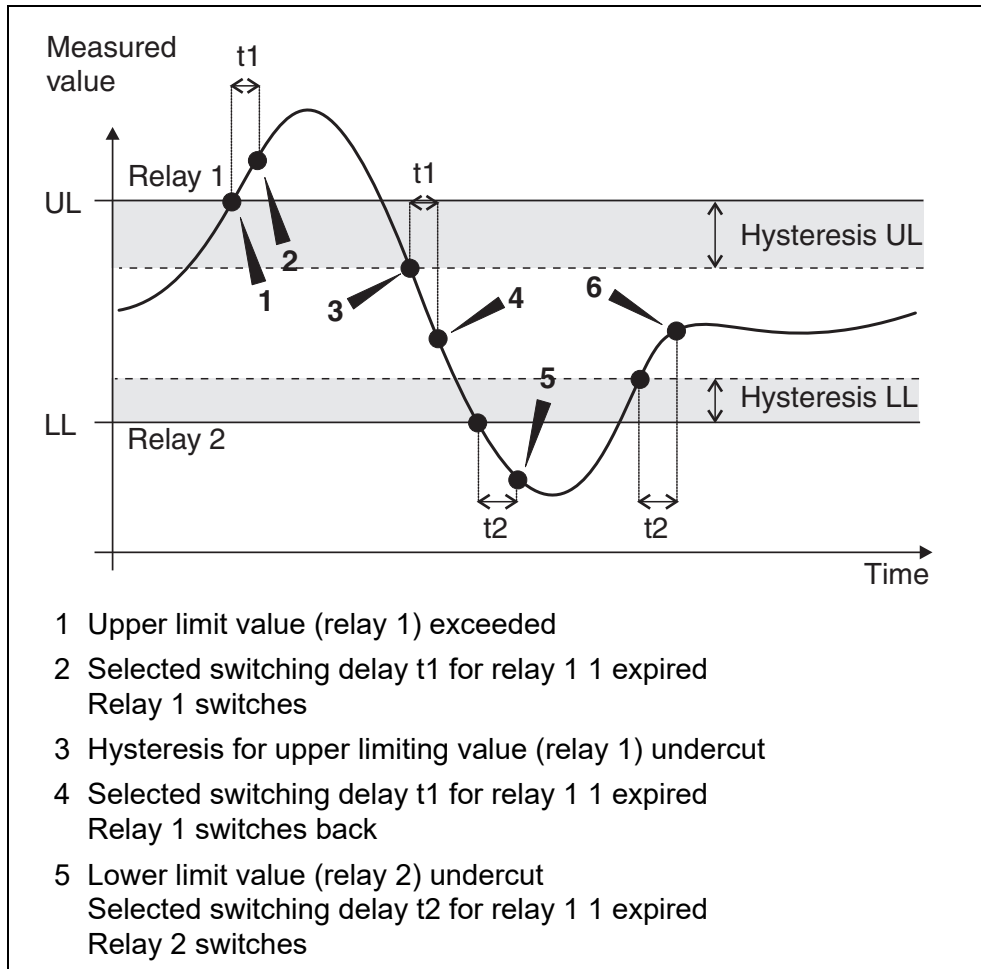


figure 6-1 Switching points for relays with the function of a limit indicator

A switching delay (t) can be set up for each relay for switching processes. This is the time period for which a limiting value must be exceeded before the relay switches. This prevents frequent switching if the measured values are close to the limiting value.

6.2.3 Proportional output

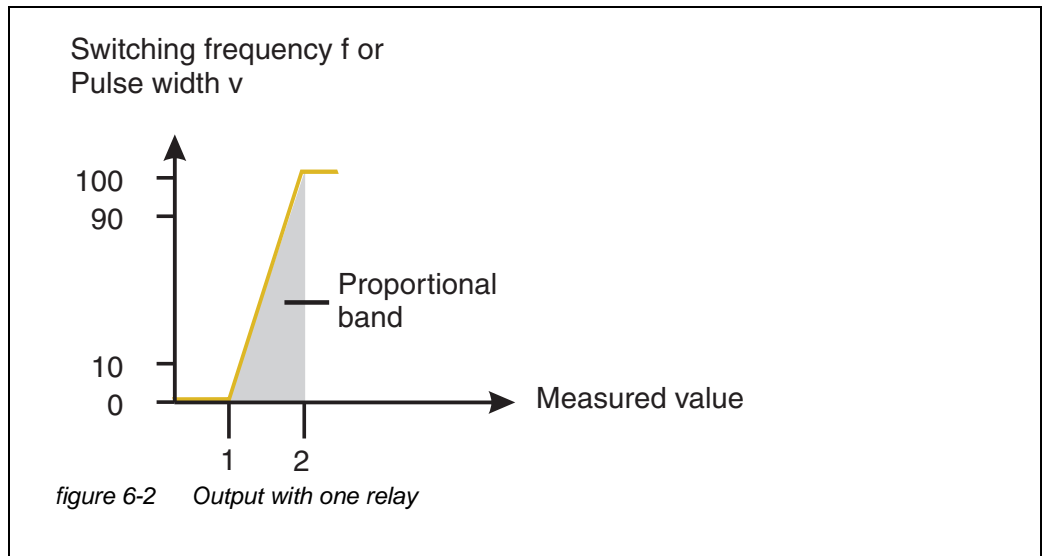
In the case of proportional output, a relay switches cyclically on and off in a defined measured value range (proportional range). At the same time, the relay switches with a:

- duration of operation that corresponds to the measured value (pulse-width output, see page 86) or
- switching frequency (frequency output, see page 86).

Proportional outputs can be used in the following way:

- Output with one relay:
An output range is defined with a *Start value* and an *End value*. No output takes place above and below the output range (see page 85).
- Output with two relays:
An output range is defined for each relay with a *Start value* and an *End value*. One relay outputs in the upper output range and a further relay in the lower output range (see page 85).

Output with one relay



Output with two relays

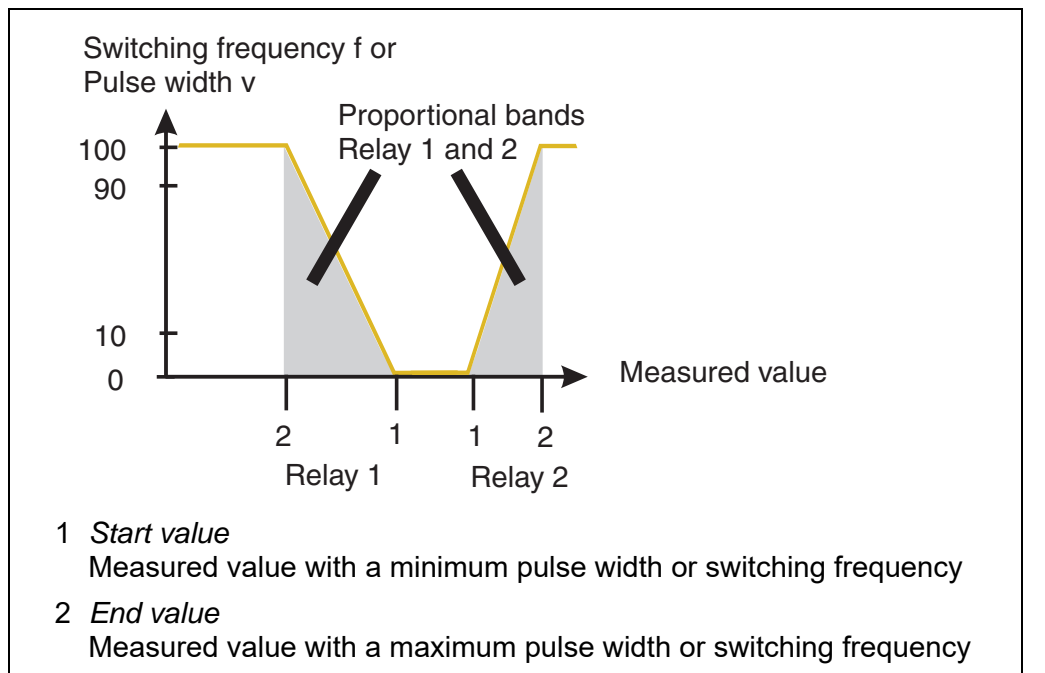
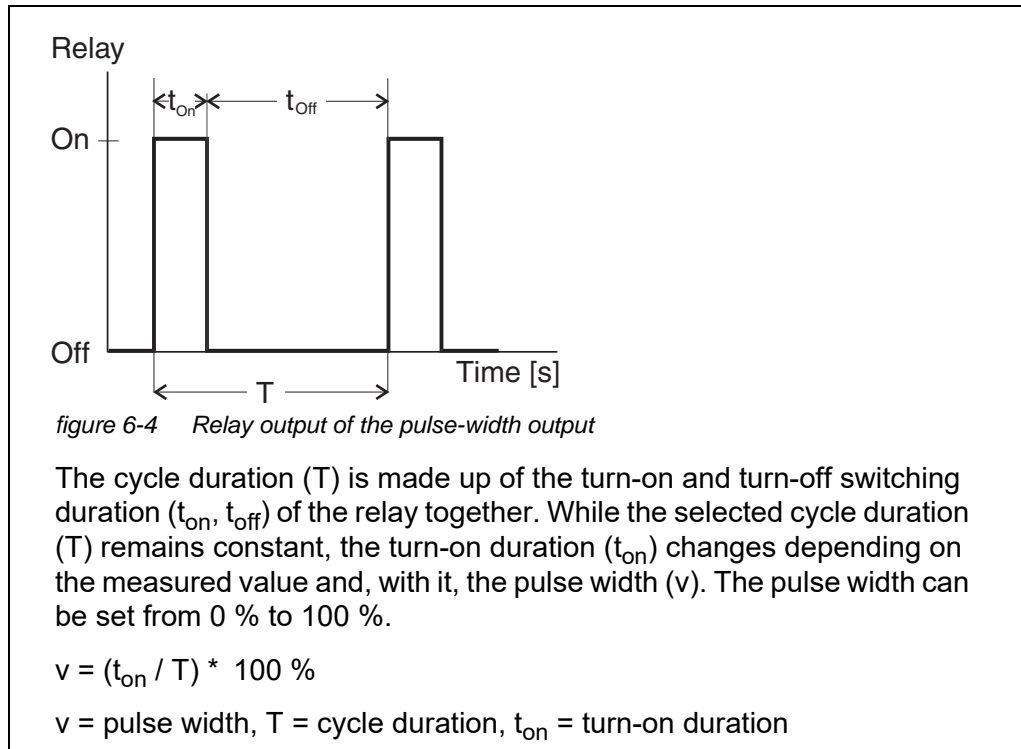


figure 6-3 Output with two relays

Pulse width output The output of the pulse width is used, e.g. for controlling valves.

Pulse-width regulation changes the duration of operation (t_{on}) of the output signal. Depending on the position of the measured value in the proportional range, the relay is operated for a longer or shorter period.



- If the measured value is at the end of the proportional range (*End value*), the turn-on duration (t_{on}) is long, the turn-off duration is short. This means the relay operates for a longer period.
- If the measured value is at the beginning of the proportional range (*Start value*), the turn-on duration (t_{on}) is short, and the relay operates for a correspondingly shorter period.

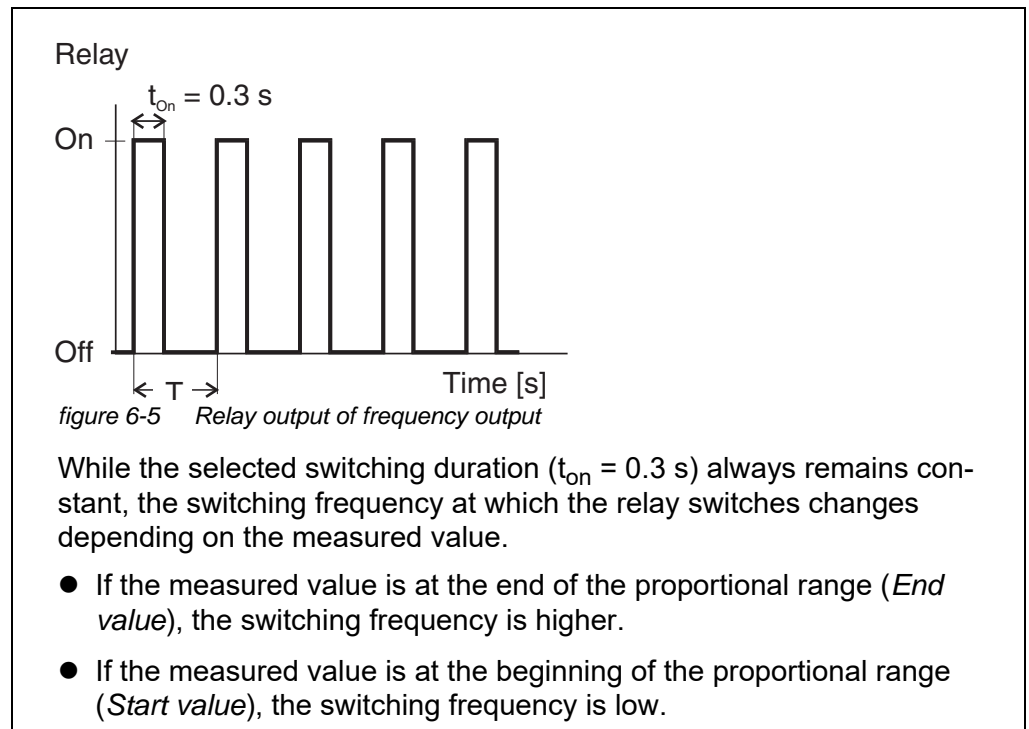


If the duration of the closing or opening pulse is shorter than 0.1 s, the relay remains open or closed for the complete cycle duration.

Frequency output Switching frequency output is used, e.g. for controlling dosing pumps.

In contrast to the pulse-width output, the pulse width is not modulated with the frequency output but the switching frequency of the output signal. Depending on the position of the measured value in the proportional range, the relay is

switched more often or less often.



Characteristic curves

Through the selection of the *Start value* and *End value*, the proportional output can be operated with a positive or negative characteristic curve.

- **Positive characteristic curve:**
Select the *End value* to be greater than the *Start value*.
The turn-on duration or frequency increases with an increasing measured value (see page 89).
- **Negative characteristic curve:**
Select the *End value* to be smaller than the *Start value*.
The turn-on duration or frequency decreases with an increasing measured value (see page 90).

The maximum values for the pulse width or switching frequency are assigned to the *End value* value and the minimum values for turn-on duration or frequency are assigned to the *Start value* value.

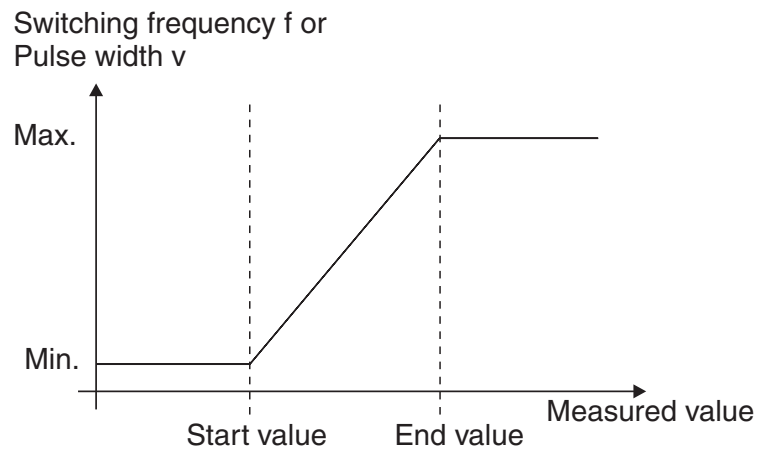


figure 6-6 Positive characteristic curve

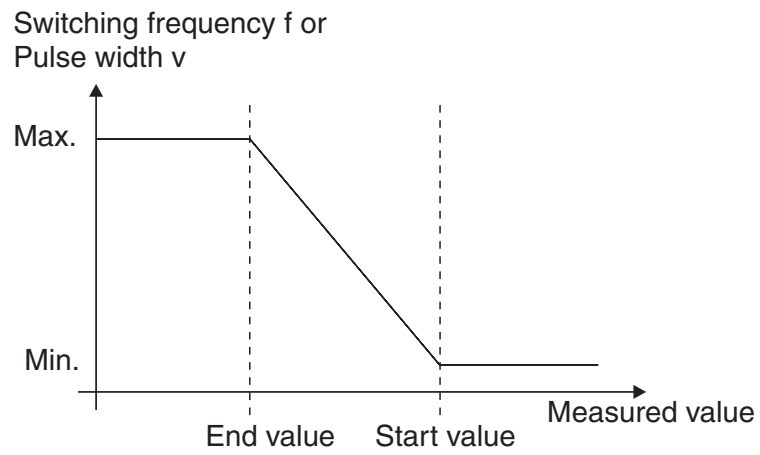


figure 6-7 Negative characteristic curve

Positive characteristic curve The proportional output range begins above the initial value. If the proportional range is undercut or exceeded, the selected behavior comes into force.

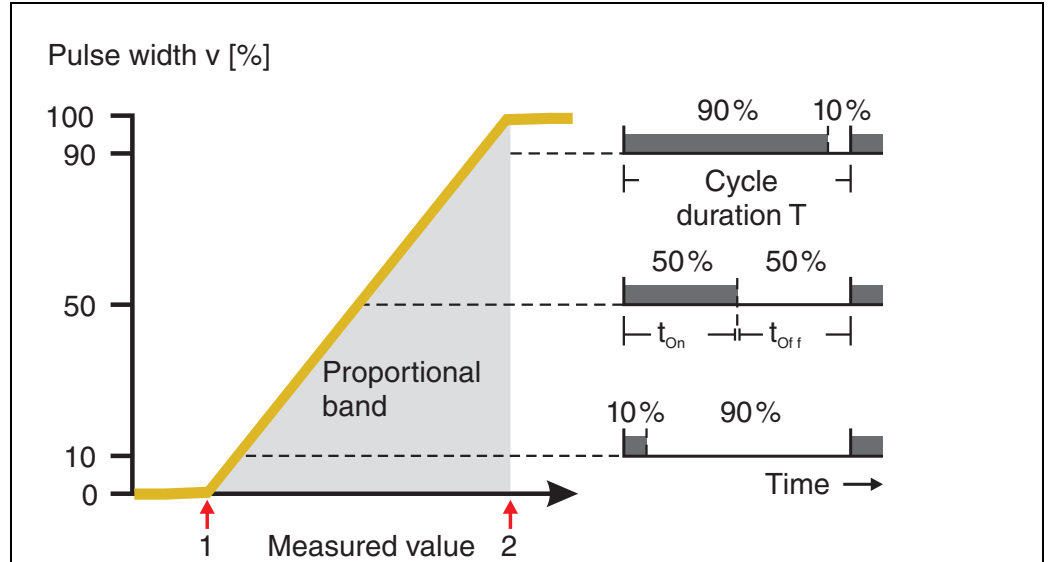


figure 6-8 Pulse width output

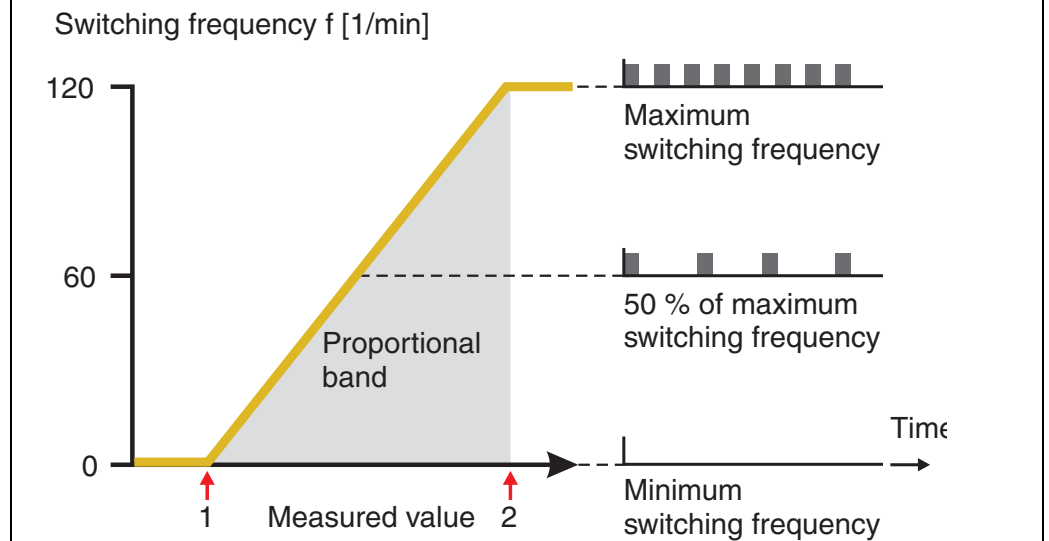
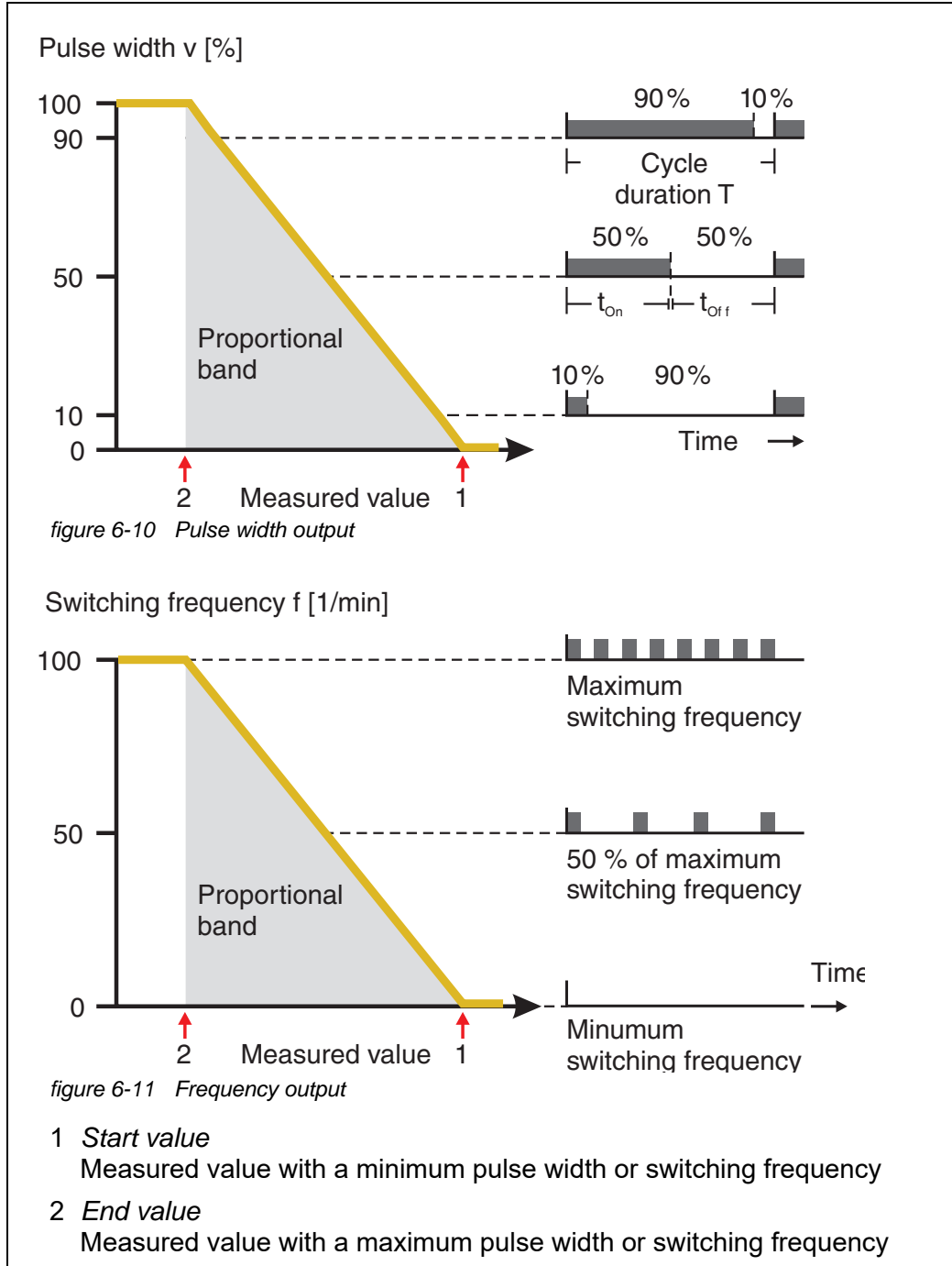


figure 6-9 Frequency output

- 1 *Start value*
Measured value with a minimum pulse width or switching frequency
- 2 *End value*
Measured value with a maximum pulse width or switching frequency

Negative characteristic curve

The proportional output range begins below the initial value. If the proportional range is undercut or exceeded, the selected behavior comes into force.



6.3 Entering / editing the name of an output

For easier identification of the outputs, an individual name can be given to each output in the *Edit list of outputs* overview.

- 1 Open the *Einstellungen/Settings* menu with **<S>**.
- 2 Using **<▲▼◀▶>** and **<OK>**, select and confirm the menu item, *System settings -> Edit list of outputs*.
The *Edit list of outputs* display opens.
- 3 Press **<▲▼◀▶>** to highlight a name in the *Name* column and confirm with **<OK>**.

No.	Model/Channel	Ser. no.	Name
D01	DIQ/S281-CR2/R1	99200004	
D01	DIQ/S281-CR2/R2	99200004	
D01	DIQ/S281-CR2/C1	99200004	
D01	DIQ/S281-CR2/C2	99200004	

Select ◀▶, edit output names ^{OK} ▶

figure 6-12 *Edit list of outputs*

- 4 Select a letter, number or special character with **<▲▼◀▶>** and confirm with **<OK>**.
- 5 Complete the name of the output and confirm with **<OK>**.

6.4 Linking the output with a sensor

- 1 Open the *Einstellungen/Settings* menu with **<S>**.
- 2 Using **<▲▼◀▶>** and **<OK>**, select and confirm the menu item, *System settings -> Settings of outputs and links*. The *Settings of outputs and links* display opens.
- 3 Press **<▲▼◀▶>** to highlight the **&** column and confirm with **<OK>**.
- 4 Select an output with **<▲▼◀▶>** and confirm with **<OK>**. The *Link with...* display opens.
The display shows a list of sensors that can be linked.

5281-20340001		22 Sep 2020	09 47	🔒	⚠	ℹ
Link with...						
	No.	Sensor name	Measuring range			
	501	99190001	COND	AutoRange		
Select sensor ◀▶, confirm OK						

figure 6-13 Settings of outputs and links: Link with...

- 5 Using **<▲▼◀▶>**, select a sensor and confirm with **<OK>**.
The output is linked with the sensor.



In the overview *Settings of outputs and links*, field *Ser. no.*, outputs that are linked with sensors have the name of the linked sensor.

6.5 Deleting a link with an output

If a link between a current or relay output and a sensor is no longer required, you can erase the link.

- 1 Open the *Einstellungen/Settings* menu with **<S>**.
- 2 Using **<▲▼◀▶>** and **<OK>**, select and confirm the menu item, *System settings -> Settings of outputs and links*. The *Settings of outputs and links* display opens.
- 3 Press **<▲▼◀▶>** to highlight the **&** column and confirm with **<OK>**.
- 4 Select a linked output with **<▲▼◀▶>** and confirm with **<OK>**.

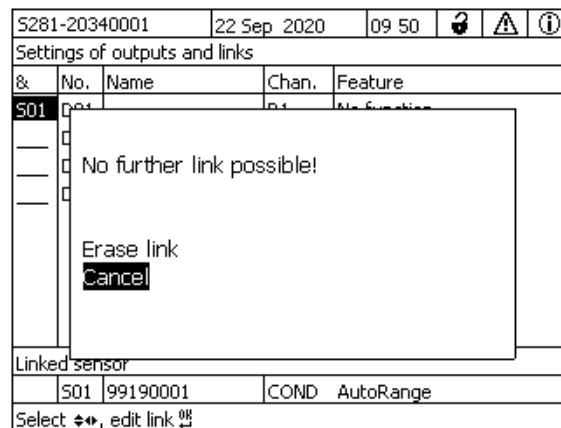


figure 6-14 Settings of outputs and links: Erase link

- 5 Using **<▲▼◀▶>**, select *Erase link* and confirm with **<OK>**. A safety query appears.
- 6 Using **<▲▼◀▶>**, select *Erase link* and confirm with **<OK>**. The link is deleted.

6.6 Setting the relay outputs

- 1 Call up the measured value display with **<M>**.
- 2 Open the *Einstellungen/Settings* menu with **<S>**.
- 3 Using **<▲▼◀▶>**, highlight the menu item, *Settings of outputs and links*, and confirm with **<OK>**. The *Settings of outputs and links* display appears.
- 4 Using **<▲▼◀▶>**, highlight the *Feature* column. Confirm with **<OK>**.
- 5 Using **<▲▼◀▶>**, highlight a line for a relay output (Rx) in the column *Feature*. Confirm with **<OK>**.
The *Settings of outputs and links* display opens.
- 6 Using **<▲▼◀▶>**, highlight the menu item, *Relay function*, and confirm with **<OK>**.

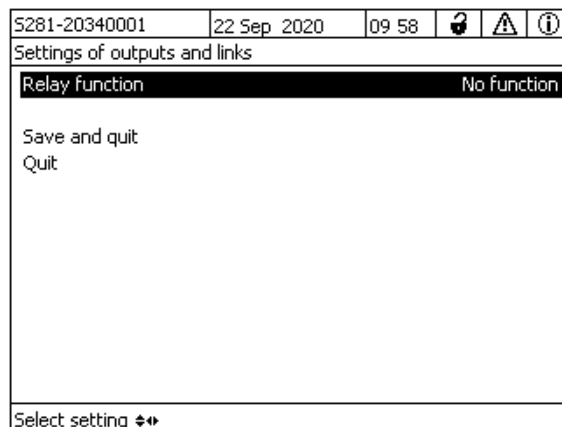


figure 6-15 *Settings of outputs and links*

- 7 Using **<▲▼◀▶>**, select one of the functions listed below. Confirm with **<OK>**.

Function	Description
<i>No function</i>	The relay output is not used.
<i>System monitoring</i>	see section 6.6.2
<i>Sensor monitoring</i>	see section 6.6.3
<i>Limit indicator</i>	see section 6.6.4
<i>Frequency controller</i>	see section 6.6.5
<i>Pulse-width output</i>	see section 6.6.6
<i>Cleaning</i>	see section 6.6.7
<i>Manual control</i>	see section 6.6.8
<i>Alarm contact</i>	see section 6.6.9

- 8 Make the settings for the relay outputs with <▲▼◀▶> and <OK>. The settings comprise the relay action (see section 6.6.1) and sensor dependent settings.
- 9 Using <▲▼◀▶> and <OK>, highlight and confirm *Save and quit*. The new settings are stored.

As soon as a function was selected for a relay output, you can select a relay action (see section 6.6.1).

6.6.1 Relay action

The following actions of the relay can be defined in the *Action* setting:

Settings	Explanations
<i>Open</i>	The relay should open on every event.
<i>Close</i>	The relay should close on every event.



Preferably set up the relay output as normally closed for monitoring functions (*ActionOpen*).

6.6.2 System monitoring

Function The *System monitoring* function enables the monitoring of system errors. In order to set up the *System monitoring* function for a relay output, the relay output must not be linked with a sensor (see section 6.4).

It can be used to monitor the following system errors.

Settings	Settings	Selection	Explanations
	<i>Power failure</i>	<i>On</i> <i>Off</i>	The <i>Power failure On</i> function monitors the supply voltage of the DIQ/S 281. If the voltage falls below the critical value, the relay switches.
	<i>Communication</i>	<i>On</i> <i>Off</i>	The <i>Communication On</i> function monitors the functioning of the DIQ/S 281.
	<i>Collective error message</i>	<i>On</i> <i>Off</i>	<i>Collective error message On</i> function simultaneously monitors the proper functioning of all sensors and the functioning of the combination output module to be monitored. (for details, see below this table)
	<i>Action</i>	<i>Open</i>	For all functions of the <i>System monitoring</i> , the relay action is set to <i>Open</i> .

Collective error message In the case of a *Collective error* message, the relay opens if one of the following malfunctions occurs:

- The sensor, which is properly registered to the DIQ/S 281, does not provide a valid main measured value
- The sensor, which is properly registered to the DIQ/S 281, does not provide a valid secondary measured value
- The internal output module has not received any new data DIQ/S 281 for 2 minutes.

In any case, the relay remains open for 10 seconds and only closes when the malfunction is no longer present.

In the following cases, the relay does not open despite an invalid measured value:

- The sensor is being calibrated
- The sensor is in the maintenance condition
- The sensor is being cleaned with the aid of a valve module in the system (compressed air operated cleaning system).

6.6.3 Sensor monitoring

Function The *Sensor monitoring* function enables the monitoring of sensor errors and the maintenance condition.

In order to set up the *Sensor monitoring* function for a relay output, the relay output must be linked with the sensor (see section 6.4).

Settings	Setting	Selection	Explanation
	<i>Error</i>	<i>Special</i>	Special sensor errors are monitored and can prompt a relay action.
		<i>All</i>	All sensor errors (special ones and general ones) are monitored and can prompt a relay action.
		<i>Off</i>	Sensor errors are not monitored.
	<i>Mainten. Condition</i>	<i>On</i> <i>Off</i>	Switching on and off the maintenance condition (see section 4.8) is monitored and can prompt a relay action.
	<i>Action</i>	<i>Open</i> <i>Close</i>	Relay action (see section 6.6.1)



Preferably set up the relay output for monitoring functions as an opener (*Action Open*, see section 6.6.1).

Sensor messages include errors and information that are registered by the sensor.

Special sensor errors The special sensor errors are sensor-dependent. Details of this are given in the component operating manual of the respective sensor.

General Sensor errors		
Init		This can prompt a relay action for a short time, depending on the starting behavior of the system
----		Invalid measured value, or defective sensor
Error		Communication with sensor interrupted
OFL		Measuring range undercut or exceeded (overflow)

6.6.4 Limit indicator

Function The characteristic of the limit indicator is laid down in the *Limit value UL*, *Limit value LL*, *Hysteresis UL* and *Hysteresis LL* settings. The fundamentals of the function are described in the introductory chapter (see section 6.2.2).

In order to set up the *Limit indicator* function for a relay output, the relay output must be linked with a sensor (see section 6.4).

Settings	Setting	Selection/Values	Explanation
	<i>Limit values</i>	<i>UL main variable</i> <i>LL main variable</i> <i>UL adjoining var.</i> <i>LL adjoining var.</i>	<i>Main variable</i> designates the actual measured parameter of the sensor (e.g. pH, oxygen, etc.). <i>Adjoining variable</i> designates an additional measured parameter (e.g. temperature).
	<i>Limit value UL</i>	Upper or lower limiting value	Minimum difference between the upper and lower limit value: 5 % of the measuring range
	<i>Limit value LL</i>	Any value within the measuring range (sensor-dependent)	
	<i>Hysteresis UL</i>	0 - 5% of the measuring range	Hysteresis for <i>Limit value UL</i> and <i>Limit value LL</i> .
	<i>Hysteresis LL</i>		
	<i>Behavior at error</i>	<i>Open</i> <i>Close</i> <i>Unchanged</i>	The relay opens, closes or remains unchanged in the case of system errors or sensor errors (see page 112).
	<i>Action</i>	<i>Open</i> <i>Close</i>	Relay action (see section 6.6.1)
	<i>Switching delay</i>	0 ... 3600 s	The time period for which a limiting value must be exceeded before the relay operates. Prevents frequent switching for measured values that are close to the limiting value.

6.6.5 Frequency controller

Function The characteristic of the frequency output is laid down in the *Start value*, *End value*, *Frequency (f) min.* and *Frequency (f) max.* settings. The fundamentals of

the function are described in the introductory chapter (see section 6.2.3).

In order to set up the *Frequency controller* function for a relay output, the relay output must be linked with a sensor (see section 6.4).

Settings	Setting	Selection/Values	Explanation
	<i>Measured variable</i>	<i>Main variable</i> <i>Adjoining variable</i>	<i>Main variable</i> designates the actual measured parameter of the sensor (e.g. pH, oxygen, etc.). <i>Adjoining variable</i> designates an additional measured parameter (e.g. temperature).
	<i>Start value</i>	within the measuring range (sensor-dependent)	Minimum spacing: 5 % of the measuring range
	<i>End value</i>		
	<i>Frequency (f) min.</i>	0 to 120 1/min	Minimum spacing: 10 1/min
	<i>Frequency (f) max.</i>		
	<i>Frequency with error</i>	0 to 120 1/min	In case of system errors or sensor errors (see page 112), the relay switches with the frequency specified.
	<i>Action</i>	<i>Open</i> <i>Close</i>	Relay action (see section 6.6.1)

Characteristic curve If a value for *End value* that is greater than the *Start value* is entered, the output has a positive characteristic curve.

In order to obtain a negative characteristic curve, a value for *End value* must be entered that is smaller than the value for *Start value*.

6.6.6 Pulse-width output

Function The characteristic of the pulse width output is laid down in the *Start value*, *End value*, *Pulse width (v) min.* and *Pulse width (v) max.* settings. The fundamentals of the function are described in the introductory chapter (see section 6.2.3).

In order to set up the *Pulse-width output* function for a relay output, the relay output must be linked with a sensor (see section 6.4).

Settings	Setting	Selection/Values	Explanation
	<i>Measured variable</i>	<i>Main variable</i> <i>Adjoining variable</i>	<i>Main variable</i> designates the actual measured parameter of the sensor (e.g. pH, oxygen, etc.). <i>Adjoining variable</i> designates an additional measured parameter (e.g. temperature).
	<i>Start value</i>	within the measuring range (sensor-dependent)	Minimum spacing: 5 % of the measuring range
	<i>End value</i>		
	<i>Pulse width (v) min.</i>	0 ... 100 %	Minimum spacing: 10 % of the <i>Cycle duration (T)</i>
	<i>Pulse width (v) max.</i>		
	<i>Cycle duration (T)</i>	5 ... 100 s	Length of the switching period T $T = (t_{on} + t_{off})$
	<i>Error pulse width</i>	0 ... 100 %	In case of system errors or sensor errors (see page 112), the relay switches with the pulse-width specified.
	<i>Action</i>	<i>Open</i> <i>Close</i>	Relay action (see section 6.6.1)

Characteristic curve You can specify the minimum and maximum pulse width (v). This determines the steepness of the characteristic curve of the output.

6.6.7 Cleaning

Function The *Cleaning* function enables the time controlled automatic start of the sensor cleaning function with the aid of a relay of the combination output module. The relay controls the DIQ/CHV valve module and switches the compressed air for the CH sensor cleaning head on or off.

In order to set up the *Cleaning* function for a relay output, the relay output must be linked with a sensor (see section 6.4).

The relay of the combination output module assigned always works as a closer.

The cleaning cycle consists of *Cleaning duration* and *Adjustment time*.

During the cleaning cycle the *Clean* display flashes. The outputs linked with this sensor are frozen. The maintenance condition (see section 4.8) is active.

After the *Cleaning duration*, the relay is opened. During the following *Adjustment time* the outputs remain blocked.

The outputs linked with this sensor are only released when the cleaning cycle is complete. The *Clean* display disappears. The maintenance condition is finished.

Testing the operativeness

You can test the operativeness of the cleaning system as follows: Manually open or close the relay with the *Manual control* function (see section 6.6.8) and, while doing so, check the behavior of the cleaning system.

Alternatively, you can test the operativeness of the cleaning system by checking the performance of the function at the start time set up (reference time \pm interval). To perform a test immediately, the reference time can be set so that the next cleaning cycle will start in a few minutes (settings: see following table).

Settings	Setting	Selection/Values	Explanation
	<i>Reference time (h)</i>	0 ... 23 h	Time at which a cleaning cycle is started. Further cleaning cycles will be performed at the times specified by the cleaning interval.
	<i>Reference time (min)</i>	0 ... 60 min	
	<i>Interval unit</i>	1 .. 7 d 1 .. 24 h 5 .. 60 min	Selection of range and unit for the <i>Reinigungsintervall</i> .
	<i>Cleaning interval</i>	1/2/3/4/5/6/7 d or: 1/2/3/4/6/8/12/24 h or: 5/10/15/20/30/60 min	Repeat interval for the cleaning function: Time between the start time of a cleaning cycle and the start time of the next cleaning cycle*.
	<i>Cleaning duration</i>	0 ... 300 s	Duration of the cleaning
	<i>Adjustment time</i>	0 ... 900 s	Time extension to allow the sensor to adjust to the test sample after cleaning.

* With short cleaning intervals, the adjustable values for the *Cleaning duration* and *Adjustment time* are limited. The following values apply:

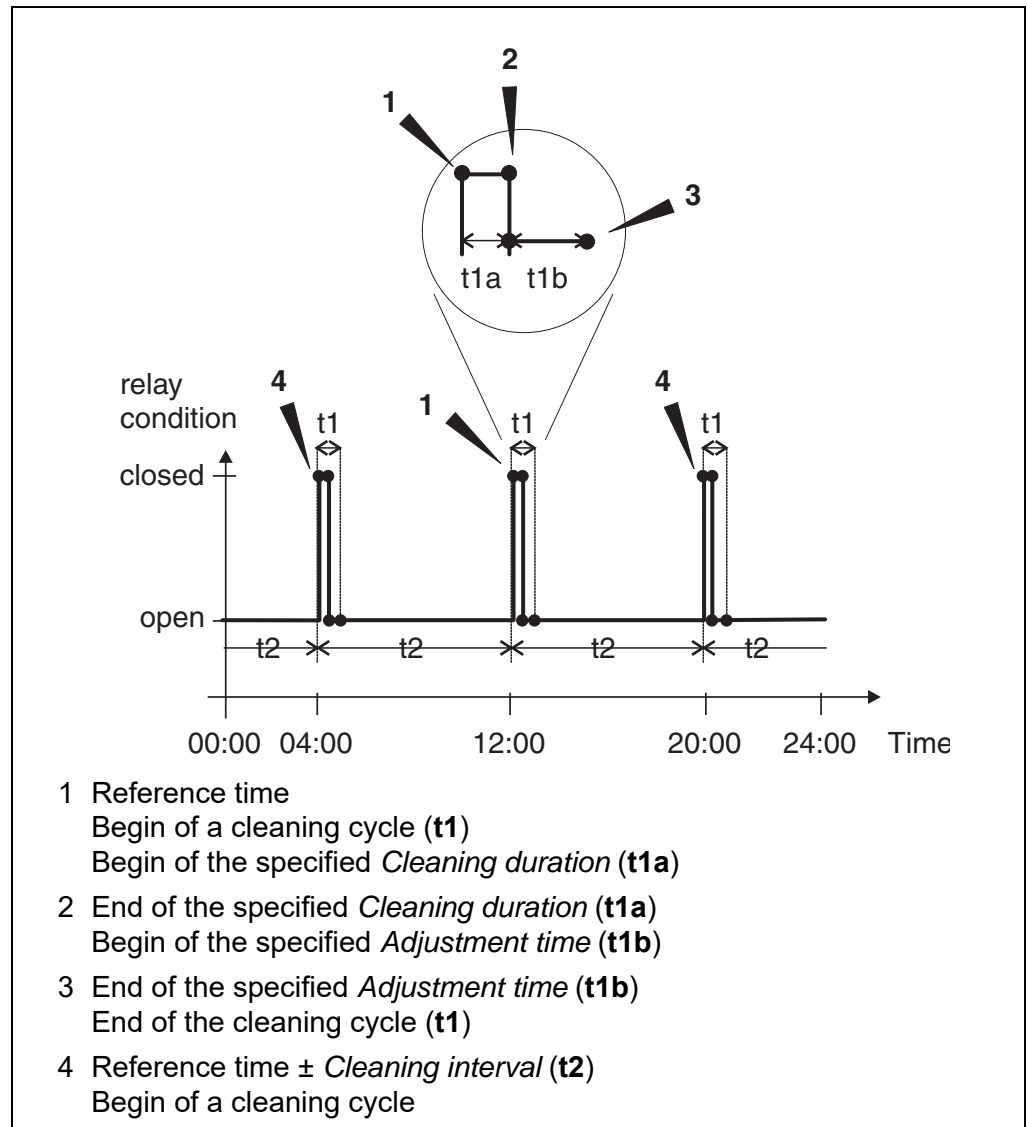
<i>Cleaning interval</i>	<i>Cleaning duration</i>	<i>Adjustment time</i>
≤ 10 min	max. 60 s	max. 120 s
≤ 20 min	max. 180 s	max. 300 s



With this, the cleaning times are fixed. They only change when the *Reference time (h)* is changed.

The reference time and all further cleaning times relate to the date and time of the system clock. How to set the system clock is described in the system operating manual.

Example	Setting	Result
	<i>Reference time (h):</i> 12	Reference time: 12:00 hours
	<i>Reference time (min):</i> 0	This specifies the following start times:
	<i>Interval unit:</i> <i>Hours (h)</i>	04:00, 12:00 and 20:00 hours
	<i>Cleaning interval:</i> 8 h	



Canceling the cleaning

A running cleaning cycle is canceled:

- Automatic
 - if the sensor switches to the inactive condition during the cleaning cycle
- Manual
 - By pressing the **<C>** key
 - By switching on the maintenance condition

Each time the cleaning cycle is canceled, the relay opens immediately.

If the cleaning cycle is canceled automatically, the outputs linked to the sensor are released immediately.

If the cleaning cycle is canceled manually, the sensor is in the maintenance condition. The linked outputs are only released after the maintenance condition was terminated manually.

The next cleaning cycle will be performed at the time set up.



In case of a power failure, all relays open. The cleaning cycle is canceled. The outputs linked with the sensor change to the non-active condition (see section 6.9.2). As soon as the power is available, the outputs are released again. The next cleaning cycle will be performed at the time set up.

6.6.8 Manual control

Function The *Manual control* function can be used to test the operativeness of an instrument that is connected to the relay. To do so, close or open the relay manually and, while doing so, check the behavior of the connected instrument.

Setting	Selection/Values	Explanation
<i>Relay function</i>	<i>Manual control</i>	The selected relay action is carried out with <i>Save and quit</i> .
<i>Action</i>	<i>Open</i> <i>Close</i>	Relay action (see section 6.6.1)



The settings for other functions in the *Relay function* menu as, for example, *Frequency controller* and *Pulse-width output* are retained while the *Manual control* is carried out.

6.6.9 Alarm contact

Function The *Alarm contact* function triggers a relay action (opening or closing) if a defined alarm event takes place. The *Alarm contact* function is only available for relays that are not linked with a sensor. If necessary, an existing link must be erased.

Setting	Selection/Values	Explanation
<i>Relay function</i>	<i>Alarm contact</i>	The selected relay action is carried out with <i>Save and quit</i> .
<i>Action</i>	<i>Open</i> <i>Close</i>	Relay action (see section 6.6.1)

6.7 Setting the current outputs

- 1 Call up the measured value display with **<M>**.
- 2 Open the *Einstellungen/Settings* menu with **<S>**.
- 3 Using **<▲▼◀▶>**, highlight the menu item, *Settings of outputs and links*, and confirm with **<OK>**. The *Settings of outputs and links* display appears.
- 4 Using **<▲▼◀▶>**, highlight the *Feature* column. Confirm with **<OK>**.
- 5 Using **<▲▼◀▶>**, highlight a line for a current output (Cx) in the column *Feature*. Confirm with **<OK>**.
The *Settings of outputs and links* display opens.
- 6 Using **<▲▼◀▶>**, highlight the menu item, *Current output*, and confirm with **<OK>**.

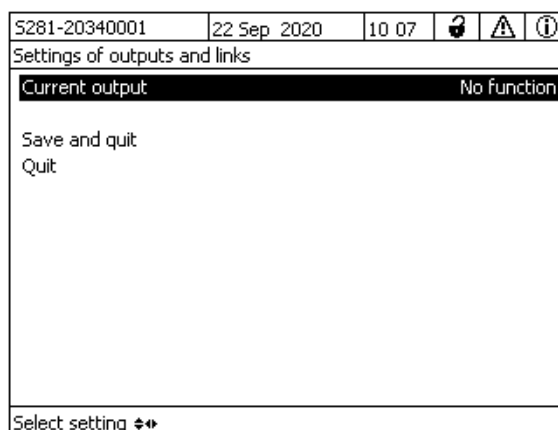


figure 6-16 *Settings of outputs and links*

- 7 Select and confirm a function with **<▲▼◀▶>** and **<OK>**.

Function	Settings
<i>No function</i>	The current output is not used.
<i>Recorder</i>	see section 6.7.1
<i>PID controller</i>	see section 6.7.2
<i>Fixed current value</i>	see section 6.7.3

- 8 Make the settings for the current output with **<▲▼◀▶>** and **<OK>**.

- 9 Using <▲▼◀▶> and <OK>, highlight and confirm *Save and quit*. The new settings are stored.

6.7.1 Recorder

Function The measured values of the linked sensor at the current output are set up as current intensity in the *Recorder* application. The output of measured values is laid down in the *Recorder type*, *Start value* and *End value* settings.

Settings	Setting	Selection/Values	Explanation
	<i>Recorder type</i>	0 to 20 mA or 4 to 20 mA	
	<i>Start value</i>	(sensor dependent)	Minimum spacing: ≤ 5 % of the measuring range (sensor-dependent)
	<i>End value</i>		
	<i>Measured variable</i>	<i>Main variable</i> <i>Adjoining variable</i>	<i>Main variable</i> designates the actual measured parameter of the sensor (e.g. pH, oxygen, etc.). <i>Adjoining variable</i> designates an additional measured parameter (e.g. temperature).
	<i>Attenuation</i>	0 ... 40 mA/s	Speed of change of the output current (mA/s) in the case of erratic changes of the input signal.
	<i>I -> UFL/OFL</i>	<i>Error</i>	Current values outside the range between <i>Start value</i> and <i>End value</i> are regarded as an error. The current output reacts as specified under <i>Behavior at error</i> (see below).
		<i>Limitation</i>	The current at the output is limited to the <i>Start value</i> or <i>End value</i> .
	<i>Behavior at error</i>	<i>Fixed current value</i>	In the case of system errors and sensor errors, the current output delivers the fixed current value that was specified. Possible values: 0 ... 21 mA.

	Unchanged
--	-----------

	The current at the output remains unchanged.
--	--

6.7.2 PID controller

Function The *PID controller* function can use an output as a controller output. The regulator can be configured as a **Proportional** regulator with switchable **Integral** and **Differential** regulator parts (**PID Controller**).

The control response of the PID controller is described by the following formula:

$$I_{Regler} = I_0 + K \left(x_e + \frac{I}{T_i} \int x_e dt + T_d \frac{dx_e}{dt} \right)$$

with:

$$K = \frac{I_{max} - I_{min}}{X_p}$$

$$x_e = x_{soll} - x_{ist}$$

$$I_{min} \leq I_{Regler} \leq I_{max}$$

$I_{Controller}$ Current on the controller output at time t

I_0 Current on the output if $x_{actual} = x_{set}$

K Amplification

X_p Proportional range

x_e Control difference

x_{actual} Actual value (current measured value)

x_{set} Set value

ti Integral algorithm

td Differential control part

t Time

I_{min} Lower current limitation

I_{max} Upper current limitation

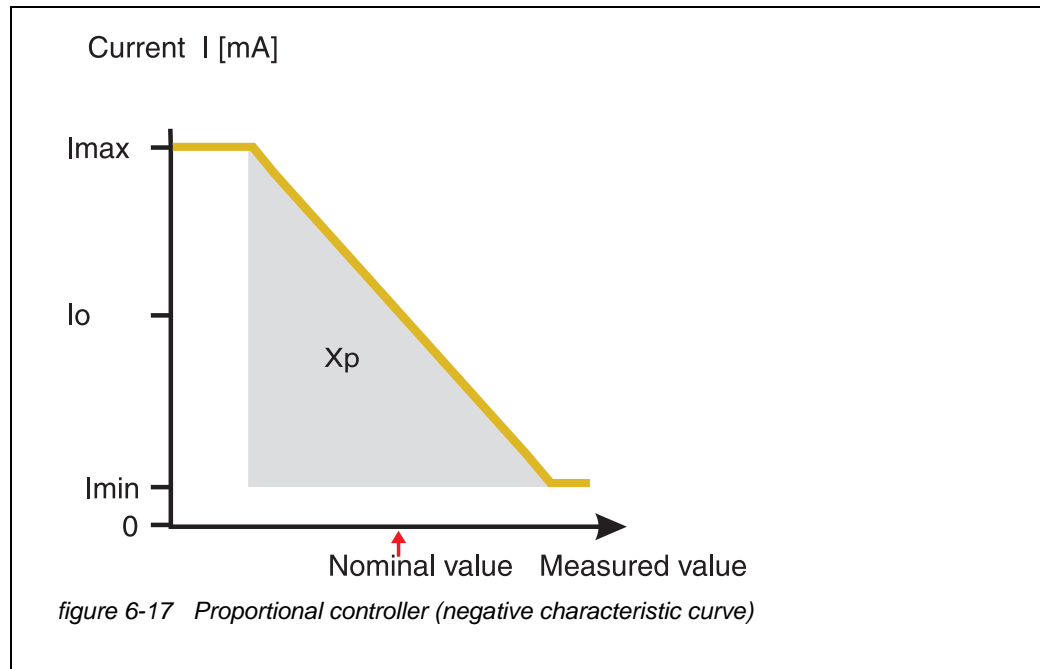
The adjustable control parameters are x_{set} , I_0 , X_p , I_{min} , I_{max} , ti and td (see setting table on page 110).

By activating or deactivating the Integral (*ti*) and Differential (*td*) controller part, the following controller types can be configured:

Regulator type	<i>td</i> [s]	<i>ti</i> [s]
P controller	0	0
PI controller	0	1 to 9999
PD controller	1 to 9999	0
PID controller	1 to 9999	1 to 9999

Characteristic curve of the proportional controller

For a pure P controller the correlation between the measured value and current *I* on the controller output results in the following characteristic curve:



The proportional range *Xp* is limited by the measurement range of the linked sensor. If a value is entered for the parameter *Xp* that is greater than zero, the controller has a positive characteristic curve (example figure 6-17). To obtain a positive characteristic curve, a negative value must be entered for *Xp*.

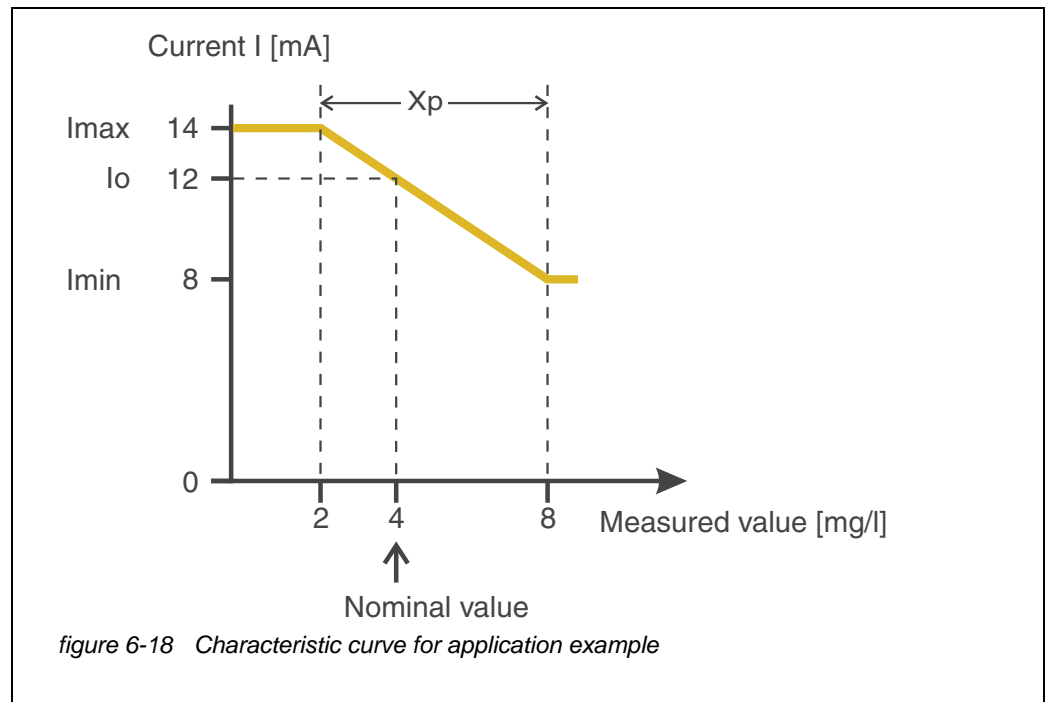
Application example

- Regulation of the oxygen concentration
- Sensor: TriOxmatic 700 IQ (measuring range: 0 to 60 mg/l)

Control parameter	Value
<i>Nominal value</i>	4 mg/l
<i>Xp</i>	10 % of the measuring range or 6 mg/l

I_{min}	8 mA
I_{max}	14 mA
I_o	12 mA
t_i	0 s (no I algorithm)
t_d	0 s (no D algorithm)

The control parameters result in the following (negative) characteristic curve:



The controller works with the following amplification:

$$K = \frac{6 \text{ mA}}{6 \text{ mg/l}} = 1 \frac{\text{mA}}{\text{mg/l}}$$

Within the proportional range an increase of the concentration by 1 mg/l causes a reduction of the output current by 1 mA. If the measured concentration is 5 mg/l, for example, 11 mA is output:

$$I_{\text{Regler}} = 12 \text{ mA} + 1 \frac{\text{mA}}{\text{mg/l}} \cdot (4 \text{ mg/l} - 5 \text{ mg/l})$$

$$I_{\text{Regler}} = 12 \text{ mA} + 1 \frac{\text{mA}}{\text{mg/l}} \cdot (-1 \text{ mg/l}) = 11 \text{ mA}$$

The highest concentration at which the controller still works in the proportional range is 8 mg/l (corresponding to $I_{\text{min}} = 8 \text{ mA}$) and the lowest is 2 mg/l (corresponding to $I_{\text{max}} = 14 \text{ mA}$).

Settings	Setting	Selection/Values	Explanation
	<i>Measured variable</i>	<i>Main variable</i> <i>Adjoining variable</i>	<i>Main variable</i> designates the actual measured parameter of the sensor (e.g. pH, oxygen, etc.). <i>Adjoining variable</i> designates an additional measured parameter (e.g. temperature).
	<i>Nominal value</i>	within the measuring range (sensor-dependent)	Nominal value the measured value is regulated to
	<i>Xp</i>	5 ... 100 % -5 ... -100 % % of the measuring range	Proportional range of the controller. Negative values result in a positive characteristic curve.
	<i>Imin</i>	0 ... 20 mA	Lower current limitation *
	<i>Imax</i>	0 ... 20 mA	Upper current limitation * * Note: Spacing between <i>Imin</i> and <i>Imax</i> : at least 5 mA

Setting	Selection/Values	Explanation
<i>Io</i>	0 ... 20 mA	Current value on the output if the measured value equals the <i>Nominal value</i>
<i>ti</i>	0 ... 9999 s	Hold-back time: Integral part of the controller (0 = not effective)
<i>td</i>	0 ... 9999 s	Reset time: Differential part of the controller (0 = not effective)
<i>Behavior at error</i>	<i>Fixed current value</i>	In the case of an error, the current output supplies the current value defined in the <i>Current with error</i> field (any in the range 0 ... 21 mA).
	<i>Unchanged</i>	In the case of an error, the current on the output remains unchanged.

6.7.3 Fixed current value

Function The *Fixed current value* function can be used to test the operativeness of the instruments connected to the outputs: output different current values to the output and, while doing so, check the behavior of the connected instrument.

Setting	Selection/Values	Explanation
<i>Current output</i>	<i>Fixed current value</i>	Using <i>Save and quit</i> , the nominal amperage that was input as <i>Inom</i> is output.
<i>Inom</i>	0 ... 20 mA	The nominal amperage that is output.



The settings for other functions in the *Current output* menu as, for example, *PID controller* and *Recorder* are retained while the *Fixed current value* is carried out.

6.8 Checking the condition of the outputs

This function provides a simple overview of the conditions of all outputs of the combination output module (see section 4.7).

For the relays, the displayed condition is *open* or *closed*.

For the current outputs, the current value present at the outputs is displayed.

6.9 Behavior of linked outputs

6.9.1 Behavior in case of error

For linked relay outputs or current outputs, you can determine the behavior of the outputs in case of errors.

Depending on the use of the output, the behavior in case of errors is set in the following menus:

Output	Menu
<i>Frequency controller</i>	<i>Frequency with error</i> (see section 6.6.5)
<i>Pulse-width output</i>	<i>Error pulse width</i> (see section 6.6.6)
<i>Recorder</i>	<i>Current with error</i> (see section 6.7.1)

Error events The specified behavior occurs with the following events or conditions:

- The linked sensor does not provide any valid measured value (display of *Init*, *Error*, "-----", or *OFL*)
- Communication with the DIQ/S 281 is interrupted for more than 2 minutes.
- The supply voltage for the DIQ/S 281 is too low.
- In the function *Recorder*, the measured value of the linked sensor is outside the range between *Start value* and *End value*.

Freezing the conditions of the outputs

Irrespective of the behavior in case of error that was defined, the following situations cause the conditions of the outputs to be frozen:

- The linked sensor is in the maintenance condition (display of *Cal*, *Clean*, or flashing measured value).
- Communication with the DIQ/S 281 is temporarily interrupted. After an interruption of 2 minutes the output changes to the behavior defined for error.

Restoring the normal functioning

The relay or current output automatically returns to its normal condition as soon as all errors have been eliminated and all conditions that caused the freezing of the outputs were eliminated.

6.9.2 Behavior in non-operative condition

An output is non-operative when no function is activated for the output.

An output becomes non-operative in case of

- Power failure
(As soon as the supply voltage is sufficient again, the non-operative condition of the outputs ends. The outputs function as specified by the user again.)
- Erasing a link to a sensor
- Changing the *Measuring mode* sensor setting for a linked sensor
- Changing the *Measuring range* sensor setting for a linked sensor



Before editing sensor settings a note appears on the display to inform you that links will be erased when you change the *Measuring mode* or *Measuring range* sensor setting.

**Settings in the
non-active
condition**

Current output

Current: 0 A

Relay output

Relay: Open

7 Maintenance and cleaning

7.1 Maintenance

Maintenance activities	Component	Maintenance
	IQ sensors	Depending on the type of sensor (see the component operating manual of the sensor)
	DIQ modules	No maintenance required

7.2 Cleaning

DIQ modules Clean components mounted in the open of gross contamination as necessary. We recommend cleaning the worst of the dirt on the enclosure and the area directly around it each time before opening in order to prevent contamination from entering the open enclosure.

To clean the module, wipe the enclosure surfaces with a damp, lint-free cloth. If compressed air is available on site, blow off the worst of the dirt beforehand. Keep the enclosure closed while doing so.

Do not use high-pressure water blasters for cleaning (danger of water penetration!). Also do not use aggressive cleaning agents such as alcohol, organic solvents or chemical detergents. These types of cleaning agent can attack the surface of the housing.



The enclosure and the window of the display are made of plastic. Thus, avoid contact with acetone and similar detergents. Remove any splashes immediately.

IQ sensors The cleaning of the IQ sensors depends greatly on the respective application. Instructions for this are given in the respective component operating manual.

A valve module for the compressed air-operated cleaning of sensors is available as an accessory.

8 What to do if ...

8.1 Information on errors

Log book The DIQ/S 281 system performs a comprehensive cyclical self test during operation. While doing so, the system identifies all states that deviate from normal operation and enters corresponding messages in the log book (information or error message).

With the aid of the log book, you can call up instructions on how to clear the error directly on the Universal Transmitter. The log book is described in detail in section 4.5 MESSAGES AND LOG BOOK.



Information on possible errors of IQ sensors is given in the chapter WHAT TO DO IF ... of the respective component operating manual.

8.2 Errors: causes and elimination

The system no longer reacts to entries	Cause	Remedy
	– System error	Reset the system: – Switch off the power supply and switch it on again after 10 s
"Error" in the measured value display	Cause	Remedy
	– Communication with the IQ Sensor interrupted	– Check the cable connection
	– Error in the IQ sensor	– Disconnect the IQ sensor and reconnect it after 10 s
The selected system language was not activated for all components	Cause	Remedy
	– A system language was selected that is not available in at least one component (sensor, Universal Transmitter, output module). The standard language, <i>English</i> , was activated instead of the selected system language.	– Contact the service department, as a software update is required for the relevant components.

8.3 Replacing system components



It is always possible to replace components and assign a substitute if the software state of the substitute component is as high as or higher than the software version of the original component.

8.3.1 Replacing passive components

Passive components include all components that the universal transmitter cannot recognize.

These include:

- DIQ/JB (branching module)
- DIQ/CHV (module for automatic compressed air cleaning)
- Cables (SNCIQ, SACIQ).



WARNING

If the universal transmitter DIQ/S 281 is opened during operation, there is a danger to life due to possible hazard of electric shock. The Universal Transmitter DIQ/S 281 may only be opened while the mains voltage is switched off. Secure the line voltage against being switched on again. Only ever replace components while the DIQ/S 281 is switched off. Defective components are removed in the reverse order to the installation (see chapter 3 INSTALLATION).

8.3.2 Replacing the IQ sensor

Inactive datasets of IQ sensors

If an IQ sensor is removed from the system, its settings remain stored in the Universal Transmitter. A dataset contains the following information:

- Serial number of the IQ sensor (and, with it, the type of sensor)
- All sensor settings
- All characteristics of the link with an output.

If no suitable inactive dataset is available, a newly connected IQ sensor is automatically recognized as a new component.



The current calibration data of the IQ sensor is always stored in the sensor. If an IQ sensor is connected that is ready for operation and calibrated, this can be used immediately without the need for recalibration.

When an IQ sensor is connected to the system, the system checks whether an inactive dataset is available for the sensor type.

If an inactive dataset for the sensor type is available, the inactive dataset is automatically assigned to the newly connected sensor. The IQ sensor starts operating with the settings from the inactive dataset.



Examples:

- The sensor is reconnected after completion of some maintenance- or repair work.
- The sensor is being replaced by another sensor of the same type. The replacement sensor should at least have the software status of the active IQ sensor.

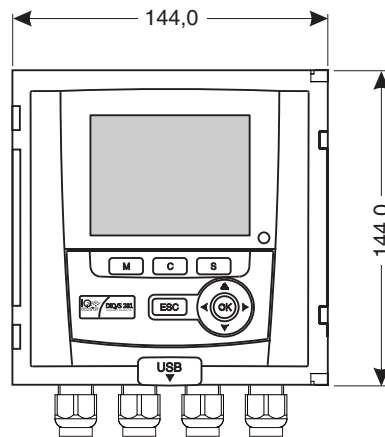
This mechanism ensures that the IQ sensor retains its settings and links if it was removed for maintenance or if the system was temporarily switched off.

9 Technical data

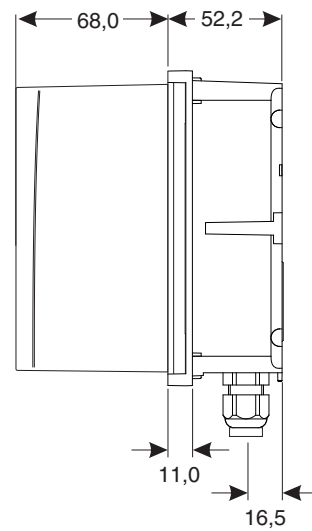
9.1 DIQ/S 281

Dimensions DIQ/S 281-CR2

Front view:



Lateral view:



Rear view:

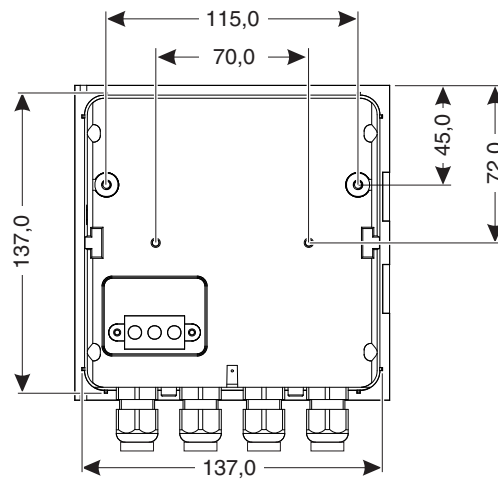
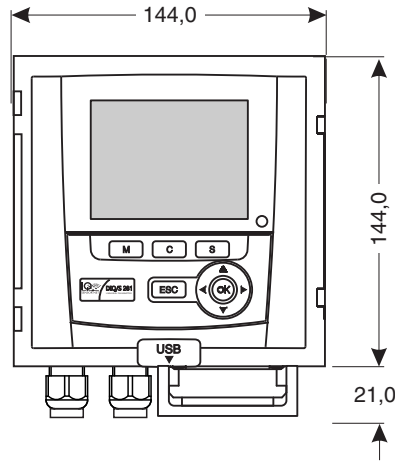


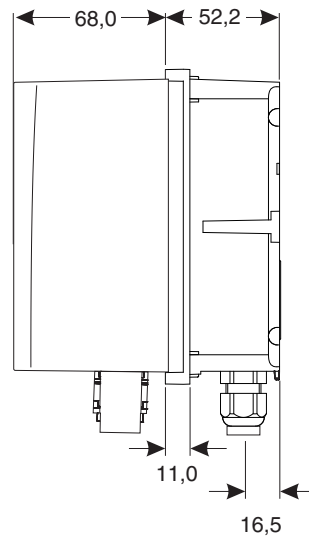
figure 9-1 Dimension drawing of the DIQ/S 281 (dimensions in mm)

**Dimensions
DIQ/S 281-MOD**

Front view:



Lateral view:



Rear view:

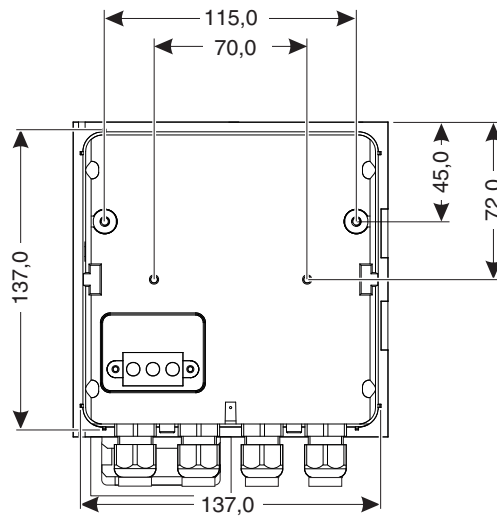


Fig. 9-2 Dimension drawing DIQ/S 281-MOD, (dimensions in mm)

**Mechanical
structure**

Enclosure material	Polycarbonate with 20 % glass fiber
Weight	Approx. 1.2 kg
Type of protection	IP 67 (not suitable for conduit connection)

Test certificates CE

Ambient conditions	Temperature	
	Mounting/installation/maintenance	+ 5 °C ... + 40 °C (+ 41 ... +104 °F)
	Operation	- 20 °C ... + 55 °C (- 4 ... + 131 °F)
	Storage	- 25 °C ... + 65 °C (- 13 ... + 149 °F)
	Relative humidity	
	Mounting/installation/maintenance	≤ 80 %
	Yearly average	≤ 90 %
	Dew formation	Possible
	Site altitude	Max. 2000 m above sea level

Electrical data DIQ/S 281CR2 (240 V AC/DC mains version)	Power supply	Nominal voltage: 100 ... 240 VAC ± 10 % Frequency:50/60 Hz according to DIN IEC 60038 Line power connection:2 pin, N and L Line cross-section of mains connection: Europe:1.5 ... 4.0 mm ² USA:AWG 14 ... 12 Fuse rating on the operator side: max. 16 A
	Protective class	II
	Overvoltage category	II
	Power consumption	max. approx. 20 W

Electrical data DIQ/S 281CR2 /24V (24 V AC/DC version)	Supply	Nominal voltage: 24 V AC/DC ± 10 % protective low voltage SELV (Safety Extra Low Voltage) AC frequency:50/60 Hz according to DIN IEC 60038 Connection:2 pin Line cross-section of connections: Europe:1.5 ... 4.0 mm ² USA:AWG 14 ... 12 Fuse rating on the operator side: max. 16 A Switch-on current: 1.5 A AC/DC (100 ms)
	Power consumption	max. approx. 20 W

Electrical connections
DIQ/S 281-CR2

The electrical connections are inside the housing.
Assignment of the terminal strips: See section 3.12.

Relay
(2 x)

Output	Galvanically separated
Max. switching voltage	240 VAC or 24 VDC
Max. switching current	2 A (AC and DC)
Installation requirements	Fuse rating on the operator side: max. 2 A
Relay functions	Programmable as: <ul style="list-style-type: none"> – Opener or closer – Limit monitor – Monitoring of the warning and error signals of the DIQ/S 281 – Proportional frequency output – Proportional pulse width output

Current outputs
(2 x)

Output	Galvanically separated from the sensors
Output current	Can be switched between 0 - 20 mA and 4 - 20 mA In the case of errors, can be set to: 0 ... 21 mA
Max. initial output voltage	13 V, in the case of missing or incorrect burden
Accuracy	0.3 % of current value \pm 50 μ A, load max. 500 Ω
Functions	Programmable: <ul style="list-style-type: none"> – Recorder attenuation, adjustable 0 - 40 mA/s – Error behavior can be set as required 0 ... 21 mA – Error behavior according to Namur NE43 can be selected – Positive and negative characteristic curve – PID controller

Connecting terminals

Terminal type	Screw-type terminal strip, accessible by raising the lid
Terminal ranges	Solid wires: 0.2 ... 4.0 mm ² AWG 24 ... 12 Flexible wires: 0.2 ... 2.5 mm ²

EMC product and system characteristics	Cable glands	Suitable for cable diameter	4.5 ... 10 mm or 7 ... 13 mm
		EN 61326	EMC requirements for electrical resources for control technology and laboratory use – Resources for industrial areas, intended for indispensable operation – Interference emission limits for resources of class A
		System lightning protection	Extended protective characteristics as opposed to EN 61326
	FCC, class A		
Meter safety	Applicable norms		– EN 61010-1 – UL 61010-1 – CAN/CSA C22.2#61010-1
USB-A interface	Version		USB 2.0
	Usage		Software updates, Electronic Key



Immediately close the USB connection with the protective cover when you have removed the USB device.
 When the USB connection is open, there is a danger of corrosion.

Fieldbus connection	DIQ/S 281 variant	Fieldbus connection
	DIQ/S 281-MOD	Modbus RTU (RS 485)*

* Connection via 9-pin D-SUB socket on the underside of the housing, compatible with Phoenix connector (IP67).

9.2 DIQ/JB

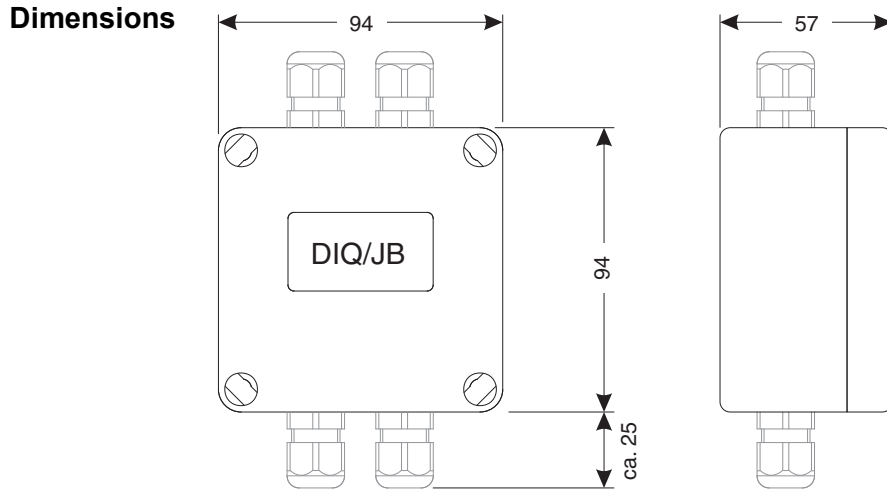
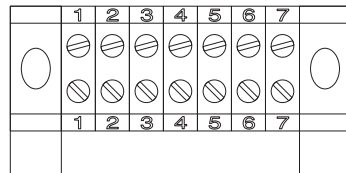


figure 9-3 Dimension drawing of DIQ/JB (dimensions in mm)

Mechanical structure	Enclosure material	Polystyrene
	Weight	Approx. 0.2 kg
	Type of protection	IP 66 (not suitable for conduit connection)

Electrical connections



(7 passive, potential free terminals for line extension or branching)

Connecting terminals	Terminal type	Screw-type terminal strip
	Terminal ranges	Solid wires: 0.2 ... 4.0 mm ² AWG 24 ... 12 Flexible wires: 0.2 ... 2.5 mm ²
	Cable feeds	Prepared openings for installing two screwed cable glands M16 x 1.5 both on the upper and underside

9.3 DIQ/CHV

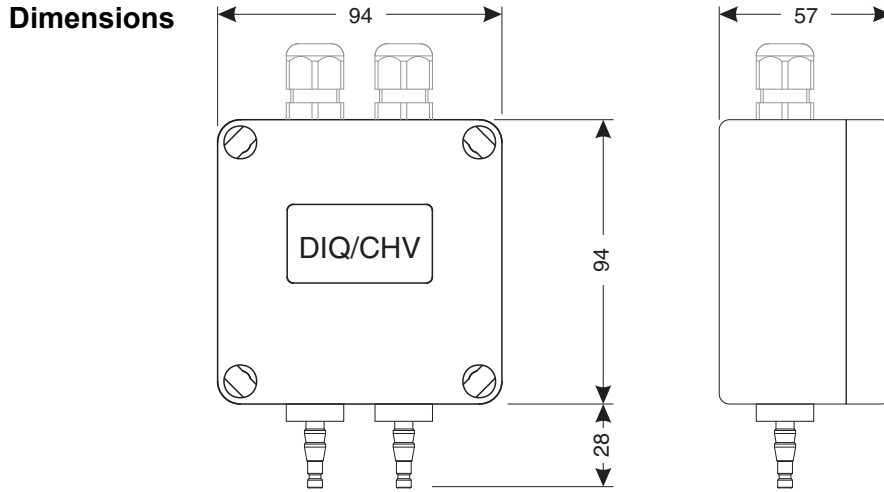
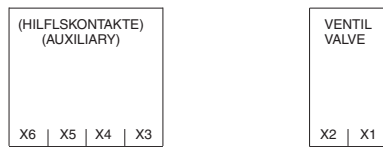


figure 9-4 Dimension drawing of DIQ/CHV (dimensions in mm)

Mechanical structure	Enclosure material	Polystyrene
	Weight	Approx. 0.3 kg
	Type of protection	IP 66 (not suitable for conduit connection)

- Electrical connections**
- 1 x valve switching contact
 - 4 x potential free terminals to connect the interface cable

Terminal strip inside the enclosure:



Connecting terminals	Terminal type	Screw-type terminal strip
	Terminal ranges	Solid wires: 0.2 ... 4.0 mm ² AWG 24 ... 12 Flexible wires: 0.2 ... 2.5 mm ²
	Cable feeds	Prepared openings for installing two screwed cable glands M16 x 1.5 on the upper side

Valve circuits	Switching voltage	Approx. 22 V
	Max. switching current	Approx. 40 mA

NOTE

The valve may only be operated with the auxiliary voltage of the DIQ/S 281 universal transmitter.

Compressed air	Required air quality	Dry, free of dust and oil
	Operating pressure	Max. 5×10^5 Pa (5 bar) absolute
	Connections on the DIQ/CHV	6 mm hose nozzles

9.4 Space required by mounted components

Wall mounting and top hat rail mounting

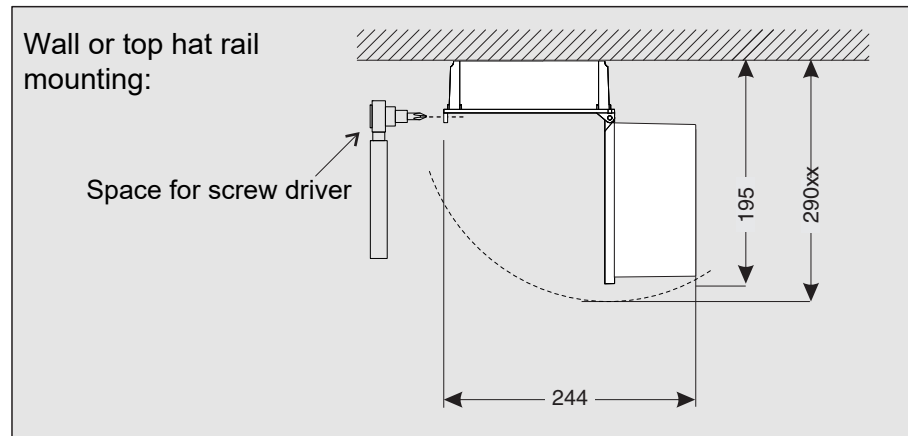


figure 9-5 Space required for wall and top hat rail mounting: (dimensions in mm)

Panel mounting (PMS/IQ)

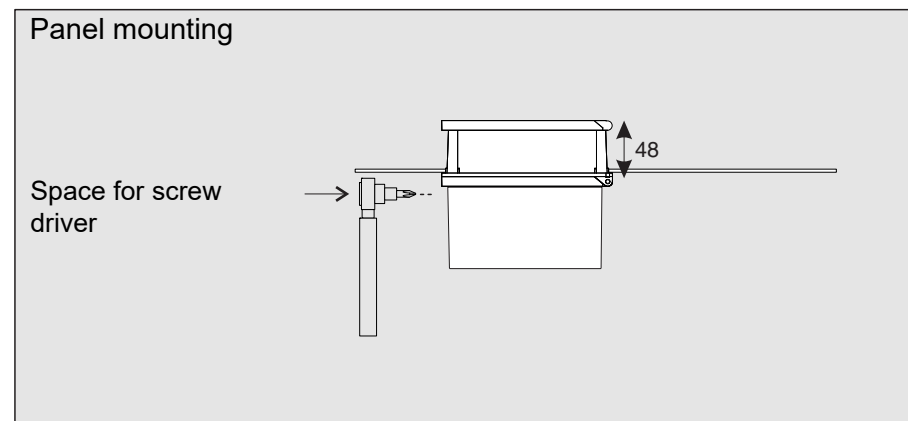


figure 9-6 Space required for panel mounting (PMS/IQ) (dimensions in mm)

10 Accessories and options

Description	Model	Order no.
IQ SENSOR NET cable - please specify required length in m when ordering	SNCIQ SNCIQ/UG	480046 480047
IQ sensor connection cable		
1.5 m	SACIQ-1.5	480040
7.0 m	SACIQ-7.0	480042
15.0 m	SACIQ-15.0	480044
Special length up to max. 100 m	SACIQ-SO	480041V
20 m (seawater version)	SACIQ-20.0 SW	480045
25 m (seawater version)	SACIQ-25.0 SW	480066
50 m (seawater version)	SACIQ-50.0 SW	480060
Special length (seawater version)	SACIQ-SO SW	480064V
Set of 4 cable glands M20 for cable sheaths with an outer diameter greater than 10 mm	EW/1	480051
Branching module	DIQ/JB	472005
Valve module	DIQ/CHV	472007
Sun shield for a unit of up to two stacked DIQ modules plus docked Universal Transmitter	SSH/IQ	109295
Sun shield for a single DIQ module plus docked Universal Transmitter	SD/K 170	109284
Mounting kit for fixing the SD/K 170 sun shield on horizontal or vertical pipes	MR/SD 170	109286
Kit for wall mounting of a DIQ module	WMS/IQ	480052
Set for panel mounting of DIQ modules	PMS/IQ	480048
Set for panel mounting of the DIQ/S 281-MOD. The interface (MOD) is mounted behind the panel.	PMS/IQ-X	480049
Kit for mounting of DIQ modules on a 35 mm top hat rail in accordance with EN 50022	THS/IQ	480050

11 Messages

11.1 Explanation of the message codes

The log book contains a list with all the messages from all modules. Each message consists of message code, date and time. You can obtain more detailed information by opening the full message text (see section 4.5).

The full message text comes from the component that has triggered the message. Therefore, these texts are only available from components which are connected to the system and ready for operation.

If a message text is not available, because the component is not connected to the system, you can look up the texts of the messages in the operating manual of the respective component.

The following lists contain the message codes and the related message texts that are shown on the display. Error messages and info messages are listed separately.

General explanations on the subjects of messages, message codes and log book are given in section 4.5 of this system operating manual.

Module code	Component
171	DIQ/S 281

11.1.1 Error messages

Message code	Message text
EI4171	<i>Max. components of this component type exceeded Danger of system overload * Check and adapt the components for this type</i>
EI5171	<i>Component cannot be reached or not present * Component has been removed from the system, insert component again * Connex. to component cut., Check sys. installation acc. to op. manual</i>
EI6171	<i>Incompatible terminal software * Contact service</i>
EI7171	<i>Incompatible controller software * Contact service</i>

Message code	Message text
EI8171	<i>Connection to the component instable * Check installation and cable lengths, Follow installation instructions * Set SN terminator switch acc. to operating manual * Check environmental effects * Component defective, contact service</i>
EI9171	<i>Power failure occurred * Check date and time and, if necessary, adjust them</i>

11.1.2 Informative messages

Message code	Message text
II1171	<i>Language not available, Default language German * Contact service</i>
II2171	<i>New IQ Sensor Net component identified</i>
II3171	<i>New IQ Sensor Net component recorded * See component lists</i>
II4171	<i>IQ Sensor Net component recorded as replacement component * See component lists</i>
II5171	<i>Link sensor - output has been erased * if necessary, link sensor again</i>
II9171	<i>Date and time have been set</i>

12 Index

A

Access control	67
Air pressure	80
Ambient conditions	120
Arrow keys .. 48, 83, 86, 92, 95, 97, 102, 104, 111,	113
Auxiliary voltage	
Terminal strip	44
Usage	37

C

Calibration data	58
Calibration history	59
Cleaning	
of module enclosures	114
Current outputs	
Terminal strip	44

D

Dimensions	
DIQ/S 182	119
DIQ/S 281	118
DIQ/S 28X	119
DIQCHV	124
DIQJB	123
Display	46
Display of measured values	53

E

Effects of the weather	20
Electrical data	
DIQ/S (24 V version)	120
DIQ/S (line power version)	120
EMC characteristics	122
Entering texts	50
Error	53

F

Function code	81
---------------------	----

I

Inactive dataset	
Sensors	116
Information	53

Initialization	39
----------------------	----

K

Keys	48
------------	----

L

Language	66
Lightning protection	
External protective measures	13
Installation guidelines	13
Internal protective measures	13
Line power connection	
24 V version	32
Log book	53, 115
Calibration entry	58
Structure	54

M

Maintenance condition	60
Measured value display	39, 47
Messages	53
Code	55
Texts	56
Types	53

O

Operating elements	45
Operating principles	48

P

PID controller (mA output)	107
Power failure	9
Power supply	
Mains power version	29

R

Relay	
Terminal strip	44

S

Self-test	39
SENSOR connection	17, 19
SENSOR connection (terminal strip)	44
Setting the date	79

Setting the time	79
Settings	66
Air pressure	80
Alarms	75
Date	79
Site altitude	80
Terminal	66
Time	79
Site altitude	80
Software status	
Of all components	64
Special user qualifications	11
Start checklist	38
Starting the system	38
Status info	59
System settings	79

T

Target group	11
Terminal connections	122
Terminal settings	66
Terminal strips (figures)	44
Types of installation	20

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- 1) The tissue in plants that brings water upward from the roots;
- 2) a leading global water technology company.

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