

Signet 2537 Paddlewheel Flowmeter

3-2537.090 Rev. K 07/17

Operating Instructions**Description**

The 2537 Paddlewheel Flowmeter Series offer low flow, low power and high resolution with various output options such as a Volumetric Pulse, Pulse Divider, Flow Switch, Digital (S³L), or 4 to 20 mA. This unit can be configured on-site directly through the built-in user interface.

- The 4 to 20 mA model provides a blind current loop output.
- The Digital (S³L) model provides a Digital (S³L) output for use with the Signet 8900 Multi-Parameter Controller or 9900 Transmitter.
- The Multi model uses a single relay (mechanical or solid state) and has three selectable operating modes:
 - Divider Mode scales the paddlewheel frequency down to accommodate low frequency input devices.
 - Total Mode outputs one pulse per a set volume of fluid.
 - Flow Switch Mode uses a single relay for Hi or Lo alarm operation.

A small LCD enables the 2537 to be programmed without any external equipment. During normal operation the display is not visible.

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For earlier versions of this sensor, the Rev. C version of the 2537 manual is available at www.gfsignet.com, under **Resource Center**.

Select **Sensors and Instrumentation**, click **Archived Products**, select 2537, click **Instruction Manuals**.

Warranty Information

Refer to your local Georg Fischer Sales office for the most current warranty statement.

All warranty and non-warranty repairs being returned must include a fully completed Service Form and goods must be returned to your local GF Sales office or distributor. Product returned without a Service Form may not be warranty replaced or repaired.

Signet products with limited shelf-life (e.g. pH, ORP, chlorine electrodes, calibration solutions; e.g. pH buffers, turbidity standards or other solutions) are warranted out of box but not warranted against any damage, due to process or application failures (e.g. high temperature, chemical poisoning, dry-out) or mishandling (e.g. broken glass, damaged membrane, freezing and/or extreme temperatures).

Product Registration







Thank you for purchasing the Signet line of Georg Fischer measurement products.

If you would like to register your product(s), you can now register online in one of the following ways:

- Visit our website **www.gfsignet.com**. Under **Service and Support** click on **Product Registration Form**
- If this is a pdf manual (digital copy), [click here](#)

Safety Information

1. Depressurize and vent system prior to installation or removal.
2. Confirm chemical compatibility before use.
3. DO NOT exceed maximum temperature or pressure specs.
4. ALWAYS wear safety goggles or faceshield during installation and/or service.
5. DO NOT alter product construction.
6. If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired
7. **This device is not approved for use or installation in hazardous locations.**

| | |
|---|---|
|  | Caution / Warning / Danger Indicates a potential hazard. Failure to follow all warnings may lead to equipment damage, injury, or death |
|  | Personal Protective Equipment (PPE) Always utilize the most appropriate PPE during installation and service of Signet products. |
|  | Pressurized System Warning Sensor may be under pressure, take caution to vent system prior to installation or removal. Failure to do so may result in equipment damage and/or serious injury. |
|  | Hand Tighten Only Overtightening may permanently damage product threads and lead to failure of the retaining nut. |
|  | Do Not Use Tools Use of tool(s) may damage product beyond repair and potentially void product warranty. |
|  | Note / Technical Notes Highlights additional information or detailed procedure. |

Chemical Compatibility

Georg Fischer Signet products are manufactured in a variety of wetted materials to suit various liquids and chemicals.

All plastic materials including typical piping types (PVC, PVDF, PP and PE) are more or less permeable to contained media, such as water or volatile substances, including some acids. This effect is not related to porosity, but purely a matter of gas diffusion through the plastic.

If the plastic material is compatible with the medium according to the application guidelines, the permeation will not damage the plastic itself. However, if the plastic encloses other sensitive components, as is the case with GF Signet plastic paddlewheel sensors, these may be affected or damaged by the media diffusing through the plastic body and rotor.

Failures of PVDF paddlewheel sensors when used in hot nitric acid applications have been reported. PVDF is known to allow for substantial permeation of nitric acid constituents without being damaged itself. No clear guideline can be given here, since the damaging effect to the sensor is highly dependent on temperature, pressure and concentration.

Utilizing sensors in applications with aggressive substances is possible. On special request GF Signet can provide sensors with a different internal resin encapsulation (potting) that will delay the damaging effect of acids to the sensors.

For all Special Product inquiries or to place an order, please email signet-specialproduct@georgfischer.com.



WARNING!



Paddlewheel Retaining Nuts:

The retaining nuts of paddlewheel sensors are not designed for prolonged contact with aggressive substances. Strong acids, caustic substances and solvents or their vapor may lead to failure of the retaining nut, ejection of the sensor and loss of the process fluid with possibly serious consequences, such as damage to equipment and serious personal injury. Retaining nuts that may have been in contact with such substances, e.g. due to leakage or spilling, must be replaced.

Paddlewheel Maintenance:

Paddlewheel flow sensors are subject to wear and may require maintenance and replacement of mechanical parts (rotors, pin, O-rings, bearings, retainers, etc.). The frequency of recommended maintenance will vary based upon application specifications, characteristics of the measured fluid, and installation details. These can include, but are not limited to: process flowrate, occurrence of water hammer, fluid corrosiveness and abrasiveness, sensor installation relevant to other equipment.

GF Signet offers individual replacement parts and rotor replacement kits, which include replacement instructions, allowing customers to perform field maintenance and reduce application down-time. Please refer to the Paddlewheel Replacement section (page 15) or contact your local GF Sales Representative with any questions.

515, 2536, 8510, 8512, 2537 Only:

To support our customers, the GF Signet Repair Department offers services to recertify the plastic paddlewheel products to factory specification. Contact your distributor or visit www.gfsignet.com for more information.

Specifications

General

| | |
|----------------------------|--|
| Flow Rate Range | 0.1 m/s to 6 m/s (0.3 ft/s to 20 ft/s) |
| Pipe Size Range | DN15 to DN200 (½ in. to 8 in.) |
| Min. Reynolds Number | 4500 |
| Wiring Ports | ½ in. NPT threads; liquid-tight connector accepts cables 7 mm to 10 mm OD (0.275 in. to 0.394 in.) |

Materials

| | |
|--------------------|--------------|
| Case | PBT, Yellow |
| Inside Cover | Valox, Black |

Wetted Materials

-P0, -P1

| | |
|-------------------|--|
| Sensor Body | Glass Filled Polypropylene |
| O-Rings | FKM |
| Pin | Titanium |
| Rotor | PVDF, Black; optional ETFE with or without carbon fiber reinforced PTFE sleeve for rotor pin |

-T0

| | |
|-------------------|--|
| Sensor Body | PVDF, Natural |
| O-Rings | FKM |
| Pin | PVDF, Natural |
| Rotor | PVDF, Natural; optional ETFE with or without carbon fiber reinforced PTFE sleeve for rotor pin |

Performance

| | |
|-----------------------------|--|
| Input Frequency Range | 1 to 1000 Hz |
| System Response | 100 ms update rate nominal |
| Paddlewheel Frequency | 49 Hz per m/s nominal (15 Hz per ft/s nominal) |
| Linearity | ±1% of maximum range @ 25 °C (77 °F) |
| Repeatability | ±0.5% maximum range @ 25 °C (77 °F) |

Electrical

Relay Specifications

| | |
|-------------------------|---------------------------------|
| Dry Contact SPDT | 5 A @ 30 VDC, 5 A @ 250 VAC |
| Solid-State Relay | 100 mA @ 40 VDC, 70 mA @ 33 VAC |

Power Requirements

Multi:

| | |
|----------------------------------|---|
| with Dry-Contact Relay | 24 VDC nominal ±10%, regulated, 30 mA max. current |
| with Solid-State Relay | 5 to 24 VDC nominal ±10%, regulated, 30 mA max. current |
| Digital (S ³ L) | 5.0 VDC min. to 6.5 VDC max., 30 mA max. current (1.5 mA nominal) |
| 4 to 20 mA | 400 mV max. ripple voltage, 30 mA max. current |

Reverse Polarity and

| | |
|-------------------------------|----------------------|
| Short Circuit Protected | Up to 40 V, 1 hour |
| Over-Voltage Protection | > 40 VDC over 1 hour |

Output

| | |
|----------------------------|-------------------------------|
| Signal Averaging | Programmable 0 to 100 seconds |
| Sensitivity Response | Programmable 0 to 9 scale |

Pulse Divider/Total Pulse Output

| | |
|-----------------------------|-----------------|
| Pulse Divider Setting | 1.0000 to 99999 |
| Maximum pulse rate | 300 Hz |
| Maximum pulse width | 50 ms |

Flow Switch Output

| | |
|-------------------|---------------------------------|
| Relay Modes | Low, High |
| Time Delay | 0.0 to 6400.0 seconds |
| Hysteresis | Adjustable in Engineering Units |

Digital (S³L) output

| | |
|----------------------------|---|
| Type | Serial ASCII, TTL level 9600 bps |
| Maximum Cable Length | Application dependent (See 8900 manual) |

Current output (Passive 4 to 20 mA)

| | |
|------------------------------|-------------------------------|
| Loop Accuracy | ±32 µA (@ 25 °C @ 24 VDC) |
| Loop Resolution | 5 µA |
| Temp. Drift | ±1 µA per °C max. |
| Power Supply Rejection | ±1 µA per V |
| Maximum Cable Length | 305 m (1,000 ft) |
| Max. Loop Resistance | 600 Ω @ 24 VDC, 1 KΩ @ 32 VDC |

Environmental Requirements

| | |
|---------------------------|-----------------------------------|
| Enclosure Rating | NEMA 4X/IP65 |
| Storage Temperature | -10 °C to 75 °C (14 °F to 167 °F) |
| Ambient Temperature | 0 °C to 65 °C (32 °F to 150 °F) |
| Relative Humidity | 0 to 90% RH, non-condensing |
| Altitude | 2000 m (6,562 ft) |
| Pollution Degree | 2 |

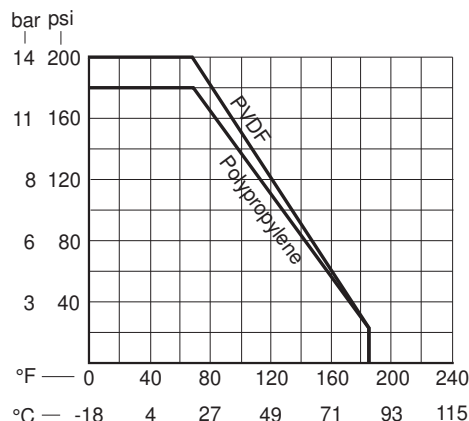
Pressure/Temperature Ratings

Polypropylene Body

- 12.5 bar (180 psi) max. @ 20 °C (68 °F)
- 1.7 bar (25 psi) max. @ 85 °C (185 °F)

PVDF Body

- 14 bar (200 psi) max. @ 20 °C (68 °F)
- 1.7 bar (25 psi) max. @ 85 °C (185 °F)



Intended Use

This product is intended for use in industrial water treatment and wastewater treatment applications where the chemical content and the fluid temperatures are consistent with the specifications listed herein.

This device is not approved for use or installation in flammable liquids.

Standards and Approvals

- CE, UL
- NSF (3-2537-xC-Px versions only)
- China RoHS (Go to www.gfsignet.com for details)
- Manufactured under ISO 9001 for Quality, ISO 14001 for Environmental Management and OHSAS 18001 for Occupational Health and Safety.

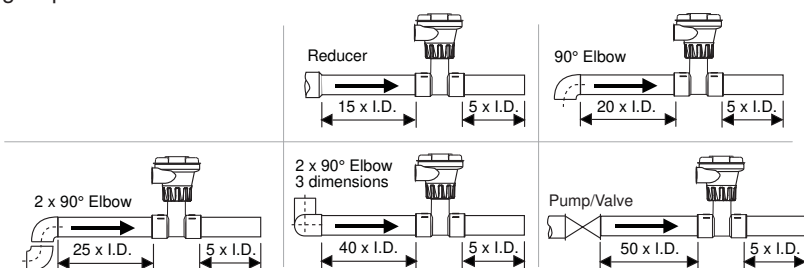
FC Declaration of Conformity according to FCC Part 15

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:
 (1) This device may not cause harmful interference, and
 (2) This device must accept any interference received, including interference that may cause undesired operation.

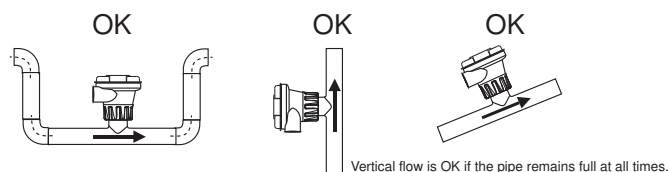
Location of Fitting

Recommended sensor upstream/downstream mounting requirements:

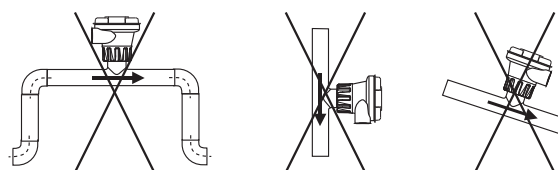
Select a location with sufficient length of straight pipe immediately upstream of the sensor.



Locating the sensor in a trap or where the flow is upward helps to protect the sensor from exposure to air bubbles when the system is in operation.



These configurations are not recommended because it is difficult to keep the pipe full.



Sensor Mounting Position

Horizontal pipe runs:

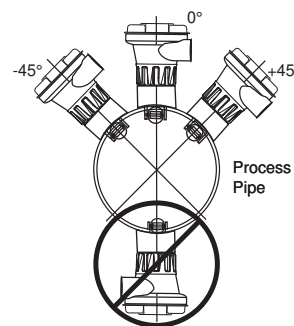
Mount sensor in the upright (0°) position for best performance. Mount at a maximum of 45° when air bubbles are present (pipe must be full).

Do not mount on the bottom of the pipe when sediments are present.

Vertical pipe runs:






Mount sensor in any orientation; however, downward flow is not recommended.





Upward flow is preferred to ensure full pipe.



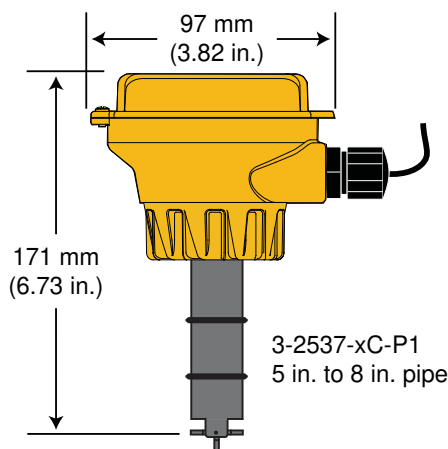
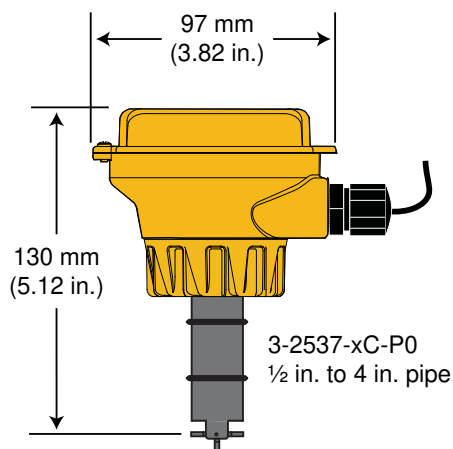
Pipe Fittings

Georg Fischer Signet offers a wide selection of installation fittings that control the position of the paddlewheel in relation to the dimensions of the pipe.

| Type | Description |
|--|---|
| Plastic tees  | <ul style="list-style-type: none"> 0.5 to 2 inch versions (MPVC or CPVC) 2.5 to 4 inch versions (PVC) |
| PVC Glue-on Saddles  | <ul style="list-style-type: none"> Available in 10 and 12 inch sizes only Cut 2-1/2 inch hole in pipe Weld in place using solvent cement |
| PVC Saddles  | <ul style="list-style-type: none"> 2 to 4 inch, cut 1-7/16 inch hole in pipe 6 to 8 inch, cut 2-1/8 inch hole in pipe |
| Iron Strap-on saddles  | <ul style="list-style-type: none"> 2 to 4 inch, cut 1-7/16 inch hole in pipe Over 4 inch, cut 2-1/8 inch hole in pipe Special order 14 in. to 36 in. |
| Metric Wafer Fitting  | <ul style="list-style-type: none"> For pipes DN65 to 200 mm PP or PVDF |

| Type | Description |
|--|---|
| Iron, Carbon Steel, 316 SS Threaded tees  | <ul style="list-style-type: none"> 0.5 to 2 in. versions Mounts on threaded pipe ends |
| Carbon steel & stainless steel Weld-on Weldolets  | <ul style="list-style-type: none"> 2 to 4 inch, cut 1-7/16 inch hole in pipe Over 4 inch, cut 2-1/8 inch hole in pipe |
| Fiberglass tees  | <ul style="list-style-type: none"> 1.5 in. to 2 in. PVDF insert |
| Metric Union Fitting  | <ul style="list-style-type: none"> For pipes from DN 15 to 50 mm PP or PVDF |

Dimensions



Installation

Plastic sensor installation tips

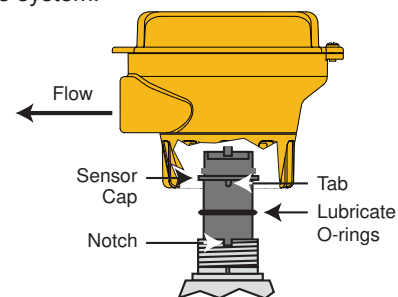
- Inspect the sensor O-rings for nicks and other damage that may compromise the seal.
- Lubricate O-rings with a non-petroleum based, viscous lubricant (grease) compatible with the system.
- Using an alternating/twisting motion, lower the sensor into the fitting, making sure the conduit ports on the yellow housing are pointing in the direction of flow.
- Engage one thread of the sensor cap then turn the sensor until the alignment tab is seated in the fitting notch.



HAND-TIGHTEN THE THREADED NUT ONTO THE INSTALLATION FITTING. DO NOT USE TOOLS!



DO NOT USE THREAD SEALANT OR LUBRICANTS ON THE FITTING THREADS OR THE SENSOR CAP.

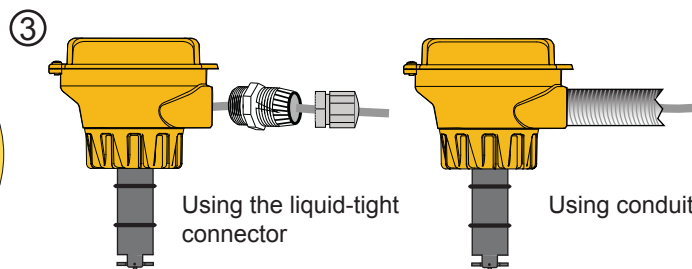
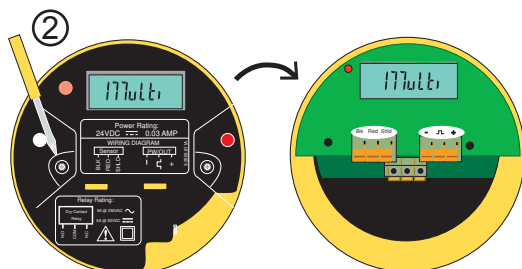
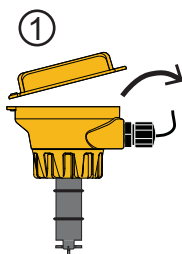


Wiring

Electrical connections to this product should be made only by qualified personnel.

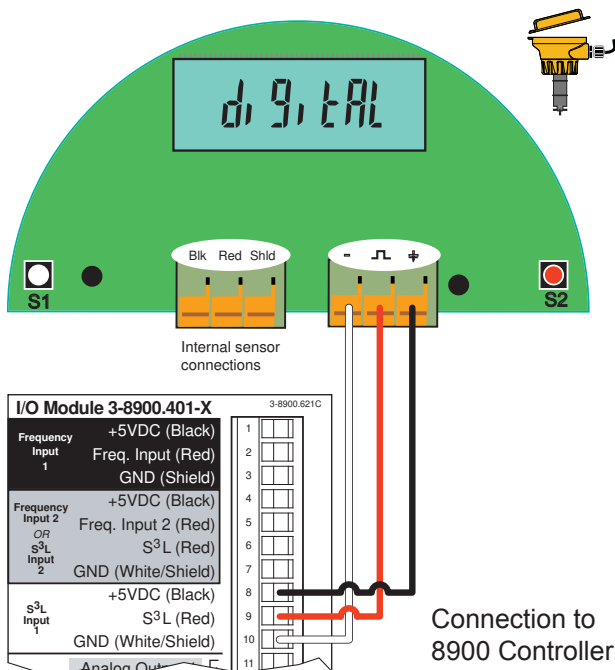
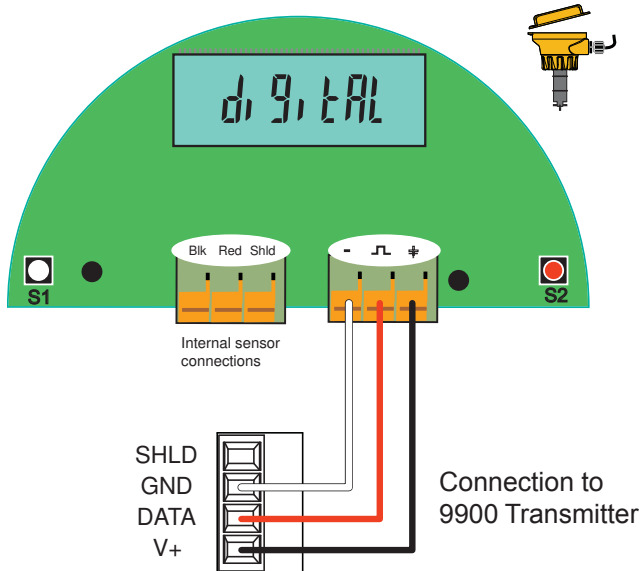
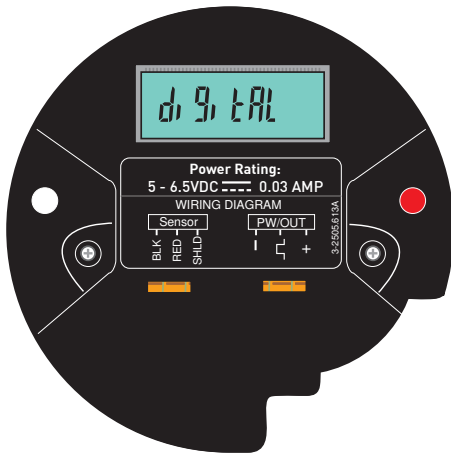
To access the wiring terminals:

1. Turn yellow cap 1/4 turn counterclockwise to remove.
2. Remove the two retaining screws and remove the black cover.
 - Route all cables through the conduit ports before connecting them to the terminals.
 - Wiring terminals are rated for 16 to 22 AWG conductors.
 - The cable must be 7 mm to 10 mm in diameter (0.275 in. to 0.394 in.) to seal properly in the liquid tight connector.
3. The conduit ports have 1/2 inch NPT threads. After routing the cables, seal the port with a liquid tight conduit connector (3-9000.392-1) or with conduit.
 - For conduit installations:
 - Thread conduit with 1/2 in. NPT threads directly into the conduit port.
 - For conduit with ISO threads, use the black thread adapter included with the connector kit.
 - To comply with NEC requirements, do not use any metal conduit in the installation.



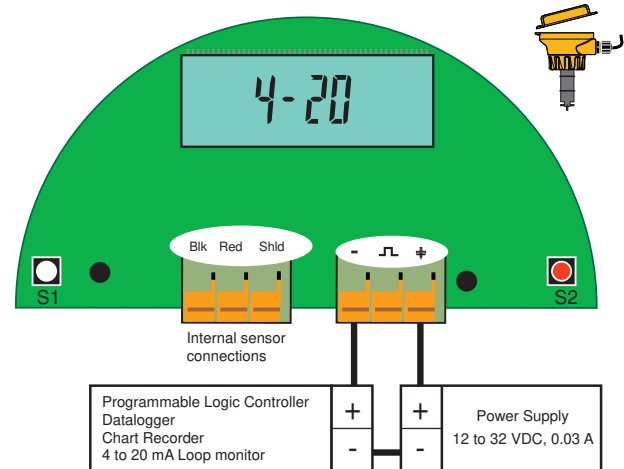
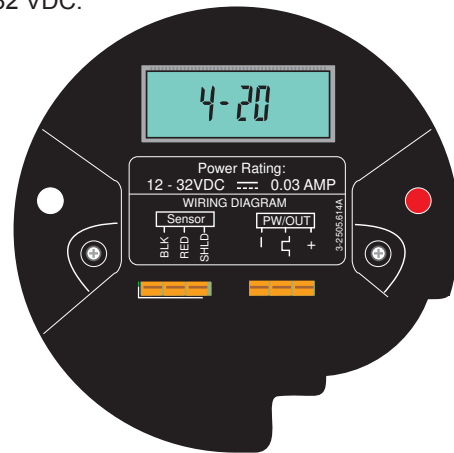
Digital (S³L) Output Wiring

The Digital (S³L) output is compatible with the 3-8900 Multi-Parameter Controller and the 3-9900 Transmitter.



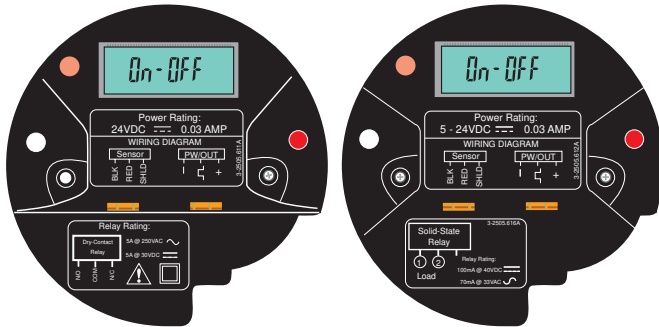
4 to 20 mA Output Wiring

- The 4 to 20 mA output can be connected to Chart Recorders, PLCs or any device that requires a 4 to 20 mA signal.
- The 4 to 20 mA model requires an external power source of 12 to 32 VDC.



Flow Switch Output (On-Off)

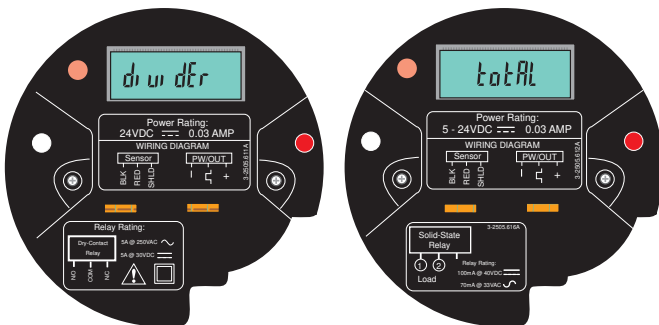
- The Flow Switch mode allows a single relay that is programmable as a HIGH setpoint or LOW setpoint.
- The relay may be a dry-contact type or a solid state type:



- The **Dry Contact Relay** requires an external power source of 24 VDC \pm 10%.
- The **Solid State Relay** requires an external power source of 5 to 24 VDC.

Pulse Output

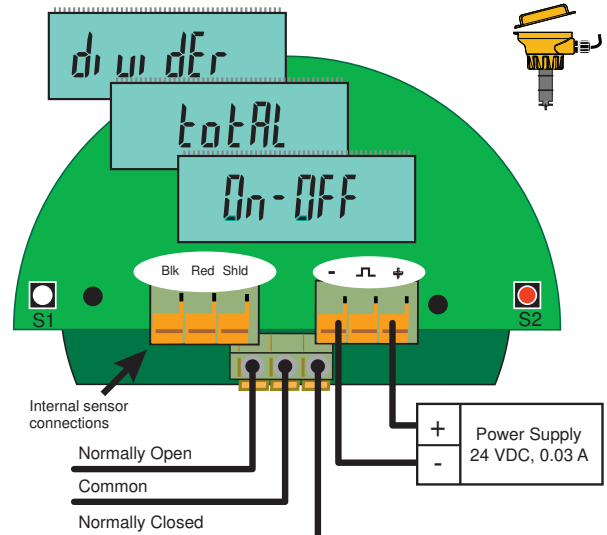
- The "Multi" mode allows a single relay that is programmable as a Flow Switch, Volumetric pulse output or as a simple pulse divider output.
- The relay may be a dry-contact type or a solid state type.



- The **Dry Contact Relay** requires an external power source of 24 VDC \pm 10%.
- The **Solid State Relay** requires an external power source of 5 to 24 VDC.
- Solid State Relay requires a pull-up resistor (10K ohm recommended). Consult your instrument/ PLC manual for wiring information.

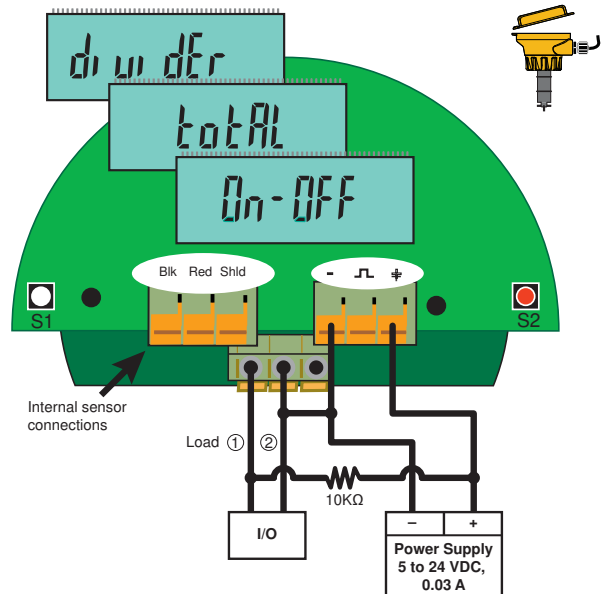
Dry Contact Relay Wiring

- The wiring is identical for On-OFF and Pulse modes.



Solid State Relay Wiring

- The wiring is identical for On-OFF and Pulse modes.



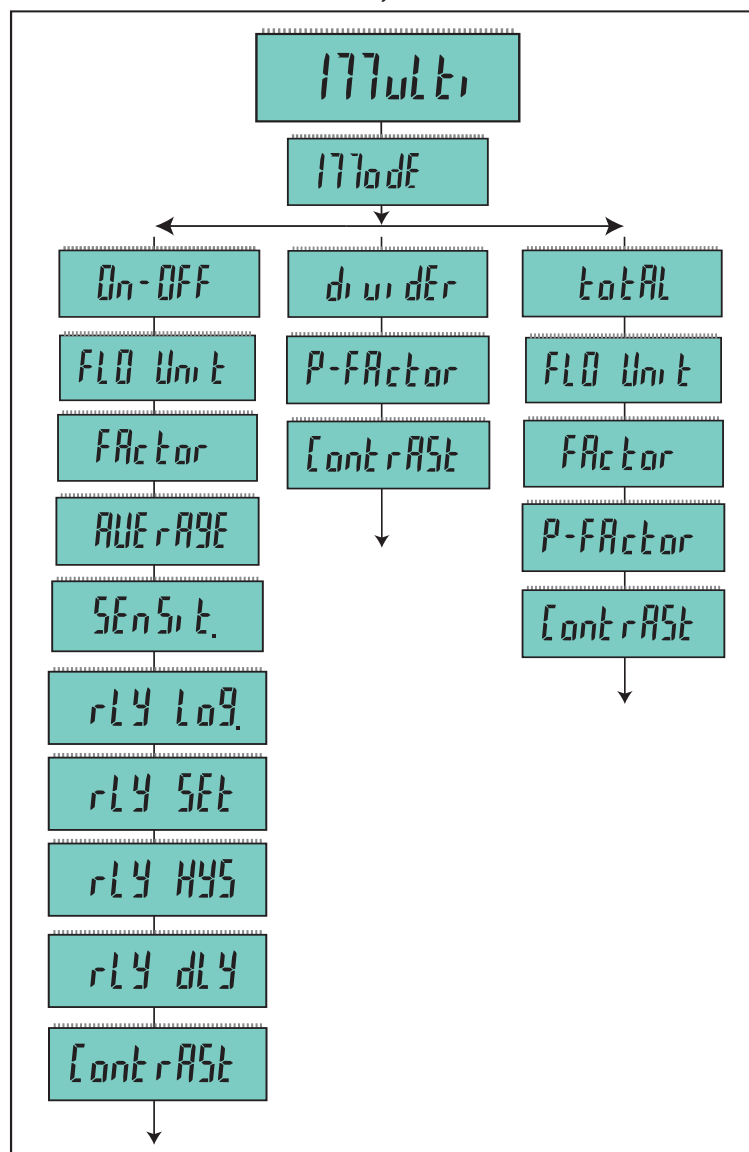
Operation

The 2537 Flowmeter is available in three different models. The programming menus vary significantly from one model to another. This chart is provided inside the yellow cover to assist in navigating the menus in the 2537.

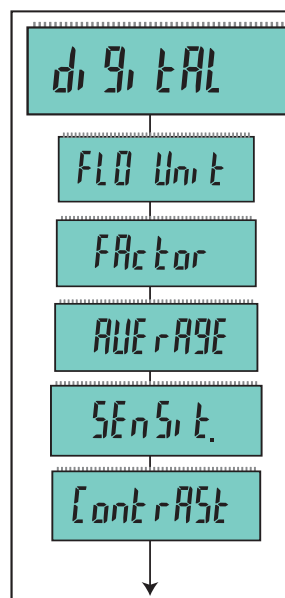
| Mode | Action | | |
|------|----------------------|----------------------------|---------------|
| View | → Display Flow Rate | → Go to MENU | Go to VIEW |
| Menu | 1X → Next Menu | 1X → Display Current Value | Previous Mode |
| | | → Go to Edit | Previous Mode |
| | | 1X → Shift digit to right | Previous Mode |
| Edit | 1X → Increment Value | → Go to SAVE | Previous Mode |
| SAVE | 1X → Toggle | 1X → Store Change | N/A |

Menus

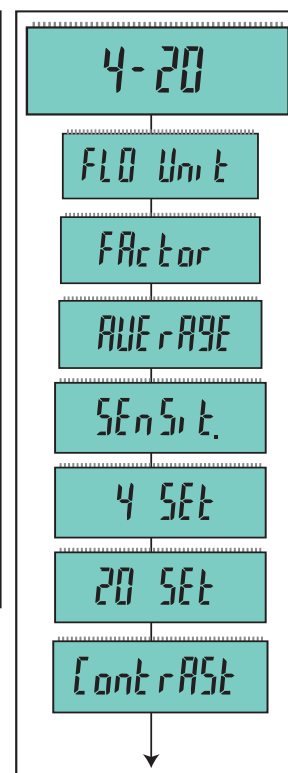
3-2537-1C-XX, 3-2537-2C-XX



3-2537-5C-XX



3-2537-6C-XX



VIEW Mode Function

- All models display the model name: **Multi**, **Digital** or **4-20**.
- If the white key (S1) is held down for three seconds, the flow rate is displayed for 10 minutes before reverting back to the model name.
- In the **Multi** Model, if the “Multi” menu item is set to “divider”, then the divided pulse output will be displayed in pulses / seconds (p/s).

Menu Details

This table shows the definition of each menu function, the setting parameters and the page where detailed instructions can be located.

| Menu Function | Definition | Setting Parameters | More Information |
|------------------|---|----------------------------|------------------|
| Flow Unit | Liters or Gallons per sec., min., hour or day | See list on page 10 | page 10 |
| K-Factor | Set PULSES per VOLUME UNIT | 0.0001 to 999999 | page 10 |
| Average | Smooths out erratic flow conditions | 0 to 100 seconds | page 11 |
| Sensitivity | Overrides Average for large rate changes | 0 to 9 | page 11 |
| Mode | Select the output mode | Total or Divider or On-OFF | page 12 |
| P-Factor | As PULSE DIVIDER, divides input freq. | 1.0000 to 99999 | page 12 |
| P-Factor | As PULSE TOTAL, multiplies K-Factor | 1.0000 to 99999 | page 12 |
| Relay Logic | Select Hi alarm or Lo alarm mode | Hi or Lo | page 13 |
| Relay Set | Set Relay Setpoint | 0.0000 to 99999 | page 13 |
| Relay Hysteresis | Rate inside Setpoint to DEENERGIZE relay | 0.0000 to 99999 | page 13 |
| Relay Delay | Time delay before relay is ENERGIZED | 0000.0 to 6400.0 | page 13 |
| 4 Set | Set flow RATE to be represented by 4 mA | 0.0000 to 99999 | page 10 |
| 20 Set | Set flow RATE to be represented by 20 mA | 0.0000 to 99999 | page 10 |
| Contrast | Adjust visibility of liquid crystal display | 1 to 3 | page 10 |

Set Flow Units




This function is available on these versions of the 2537:

177uLt, d, g, tAL
4-20






Select the volumetric units for the flow measurement:

| | |
|---|------------------------------|
| $\frac{L}{s}$ Liters/second | $\frac{g}{s}$ Gallons/second |
| $\frac{L}{m}$ Liters/minute (Factory setting) | $\frac{g}{m}$ Gallons/minute |
| $\frac{L}{h}$ Liters/hour | $\frac{g}{h}$ Gallons/hour |
| $\frac{L}{d}$ Liters/day | $\frac{g}{d}$ Gallons/day |

Example: Set the Flow Units to Gallons per minute:

-  FLO Unit
-  FLO Unit
-  FLO Unit

Save the new setting:

 SAVE ? n
 SAVE ? y
 Storing...
 Go to next menu item
 Return to Normal Operation

Set 4 and Set 20

This function is available on these versions of the 2537:







4-20

These two functions are used to span the 4 to 20 mA output signal to the required range.

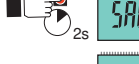




The factory setting is 4 to 20 mA = 0 to 10.000

Only the 20 mA span is illustrated here.

Example: Set 20 mA = 500 GPM.

-  FLO Unit
-  20 Set
-  10000
-  50000
-  50000
-  50000








Save the new setting:

 SAVE ? n
 SAVE ? y
 Storing...
 Go to next menu item
 Return to Normal Operation

Set K-Factor

A K-Factor is the number of pulses a sensor will generate for each engineering unit of fluid that passes the sensor. The factory setting is 60.0000. Locate the K-Factor in the tables on page 14 and 15.

Example: Set the K-Factor to 63.5 Pulses per Gallon:






-  FLO Unit
-  FAc tor
-  06 0000
-  06 0000
-  06 3000
-  06 3000
-  06 3500

This function is available on the above versions of the 2537:

177uLt, d, g, tAL
4-20

FAc tor
00001
999999

Save the new setting:



 SAVE ? n
 SAVE ? y
 Storing...
 Go to next menu item
 Return to Normal Operation

Set Contrast

This function is available on these versions of the 2537:

177uLt, d, g, tAL
4-20

All models of the 2537 have the CONTRAST adjustment. It is always located at the end of the menu.

-  To access the adjustment, enter the menu and scroll until the Contrast display appears.
-  Repeat until :






ContrAST

Choose:

1
OR
2
OR
3

Three levels of adjustment are available. The factory setting of 3 is the highest contrast setting.

Save the new setting:

 SAVE ? n
 SAVE ? y
 Storing...
 Go to next menu item
 Return to Normal Operation

Averaging and Sensitivity Settings

- Because ideal flow conditions are often impossible to achieve, the flow rate is often erratic, which causes erratic readings in control features (e.g., relays, 4 to 20 mA loops, etc.) that are associated with the flow rate.
- The best solution to these problems is to correct any piping deficiency that causes the instability. This may involve longer straight runs upstream, reducing the pipe size to maintain a full pipe at all times, and other installation changes. In many situations, however, these measures are simply not possible.
- The 2537 meter provides two tools that are designed to "work around" these deficiencies. The Averaging and the Sensitivity features should be studied before making adjustments.

Averaging Time in Seconds (Factory set: 0 seconds)

- Set the time the meter will use as the averaging period. The range is from 0 (no average applied to input) to 100 (seconds of averaging applied to input).

Use higher averaging times to smooth the display and current output where the flow in the pipe is erratic.

Quick Response Sensitivity (Factory set: 0)

- Set the relative degree of change in the flow rate required to allow the 2537 to disable the AVERAGING and jump to a new flow rate immediately. The scale is from 0 (least sensitive, averaging is never disabled.) to 9 (a very small change in flow rate will disable the averaging).

■■■■■ No AVERAGING, no SENSITIVITY

With AVERAGING set to 0 (zero) and with SENSITIVITY set to zero, the 2537 responds to every unstable shift in the flow. The dashed red line represents the actual output of the flow sensor in unstable flow conditions.

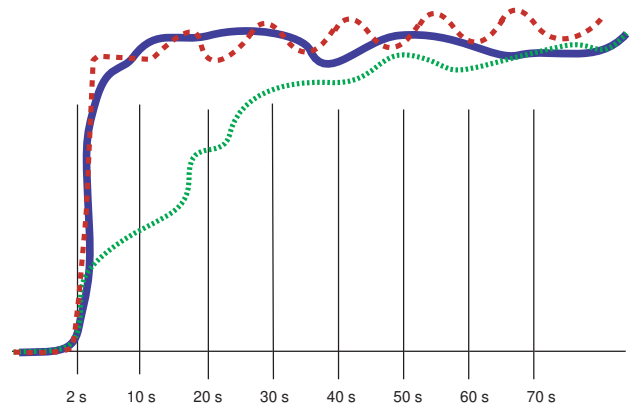
■■■■■■■■ AVERAGING only

With AVERAGING set to 50 seconds and SENSITIVITY still set to zero the flow rate is stabilized, but a sharp change in flow rate is not represented for 50 seconds or longer (dotted green line).

———— AVERAGING and SENSITIVITY

With AVERAGING at 50 seconds and SENSITIVITY set to 4 OR 5, the flow rate is stabilized, while the sudden shift in flow is reflected very quickly (solid blue line).

NOTE: The SENSITIVITY function is ineffective if the AVERAGING function is set to zero (seconds).



Set Averaging

This function is available on these versions of the 2537:

di gital 4-20

The factory setting is 0 (zero).

Minimum value

000 s

Maximum value

100 s

Example: Set the Averaging for 50 seconds.

1. FLO Unit
2. AVE r AGE
3. 000 s
4. 050 s
5. 050 s

Save the new setting:

1. SAVE ? n
2. SAVE ? 4
3. Storing.

Go to next menu item Return to Normal Operation

Set Sensitivity

This function is available on these versions of the 2537:

On-OFF 4-20

The factory setting is 0 (zero).

Minimum value

0

Maximum value

9

Example: Set the Sensitivity to 5.

1. FLO Unit
2. SEnS it.
3. 000 s
4. 005 s

Save the new setting:

1. SAVE ? n
2. SAVE ? 4
3. Storing.

Go to next menu item Return to Normal Operation

Multi Mode

This function is available on these versions of the 2537:

177uLt,

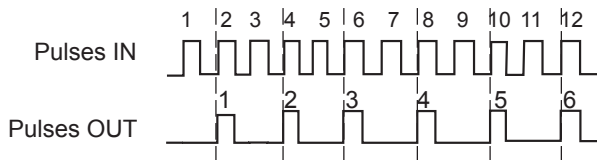
Select **DIVIDER** or **TOTAL** operation.
The factory setting is TOTAL.

PULSE DIVIDER Output = Input pulses ÷ P-Factor

DIVIDER allows you to set a scaling value (P-Factor) from 1.0000 to 99999.

Example: If the P-Factor is set for 2, then the 2537 will output one pulse for every 2 pulses received from the sensor. This selection enables the output frequency to be scaled down to match associated equipment capabilities.

When using the PULSE DIVIDER output, associated equipment must divide the K-Factors in this manual by the P-Factor for correct calibration.



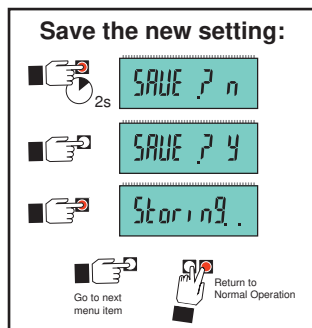
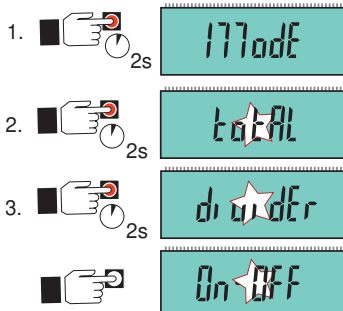
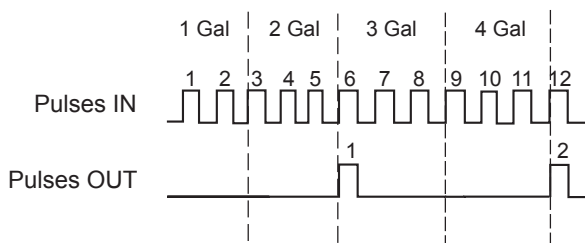
PULSE TOTAL Output = Input pulses ÷ (K-Factor × P-Factor)

TOTAL is a traditional pump pulse function. This selection will allow the entry of a K-Factor to define a volumetric unit, then set a P-Factor to define the number of volumetric units required to generate one pulse out.

Example:

Set the Total Pulse output so there is one pulse out for each 2 gallons that passes the sensor if the K-Factor is 3.0.

1. K-Factor = 3.0 (pulses in per gallon)
2. P-Factor = 2 (gallons out per pulse)



P-Factor

This function is available on the above versions of the 2537:

177uLt,

di vider

total

The factory setting is 1.0000

P-Factor

Minimum value

1.0000

Maximum value

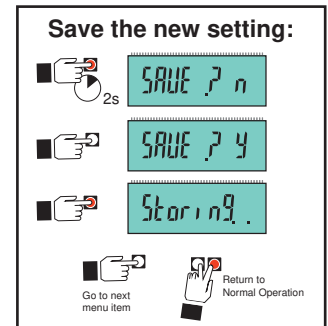
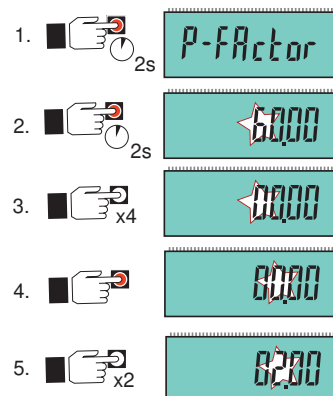
99999

In PULSE DIVIDER mode the P-Factor divides:

The pulse stream from the paddlewheel sensor will be divided by the P-Factor. The resulting frequency is output through a relay.

In PULSE TOTAL mode the P-Factor multiplies:

The pulse stream from the paddlewheel sensor is divided by the K-Factor MULTIPLIED by the P-factor. The resulting frequency is output through a relay.



Set Relay Operation

The On-OFF mode has one relay (SPDT or solid-state) that can be programmed as a HIGH (Hi) alarm or a LOW (Lo) alarm.

177uLt,

On-OFF

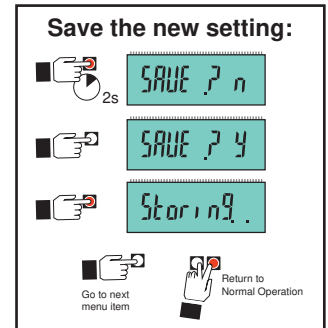
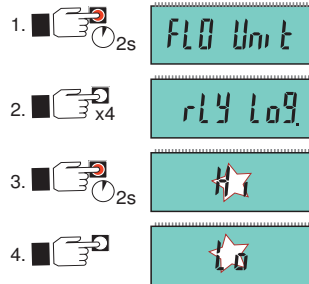
1. Select HI or LO Relay Alarm logic

A HI alarm will be activated when the flow rate rises ABOVE the setpoint.

A LO alarm will be activated when the flow rate falls BELOW the setpoint.

The factory setting is Hi(gh).

Example: Change the Relay Logic to Low:

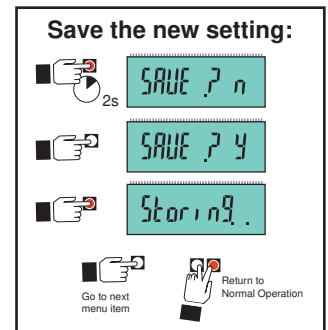
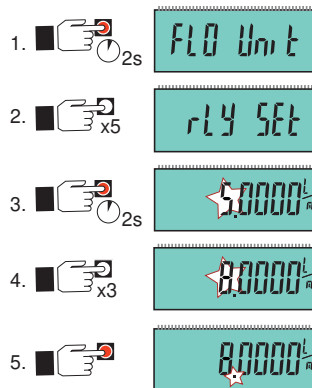


2. Program the SETPOINT.

The SETPOINT is the flow rate where the relay will be energized. The factory setting is 5.0000.

Minimum value 0.0000 $\frac{L}{m}$
Maximum value 99999 $\frac{L}{m}$

Example: Change the Setpoint to 8.0000:

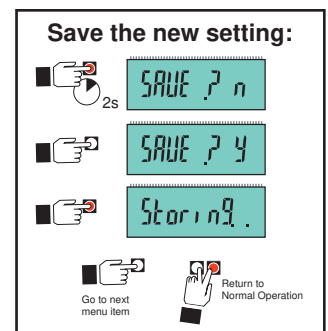
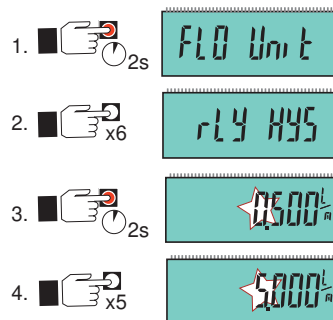


3. Program the HYSTERESIS.

Hysteresis holds a relay energized until the flow rate moves this amount past the setpoint. The factory setting is 0.5000.

Minimum value 0.0000 $\frac{L}{m}$
Maximum value 99999 $\frac{L}{m}$

Example: Change the Hysteresis to 5.0000:

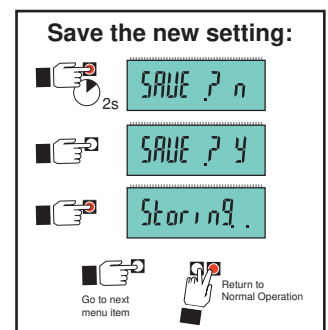
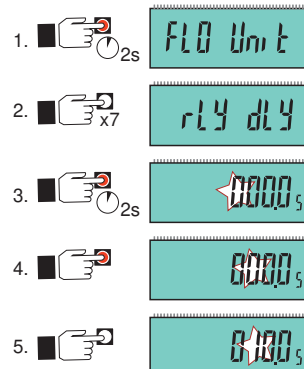


4. Program the DELAY.

When the flow rate reaches the setpoint, the 2537 will wait this long (in seconds) before triggering the alarm. The factory setting is 0000.0 seconds.

Minimum value 00000
Maximum value 64000

Example: Change the Delay to 10.0:

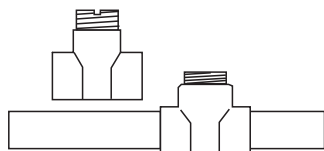


K-Factor

When using the PULSE DIVIDER mode, associated equipment must divide the K-Factors by the P-Factor.

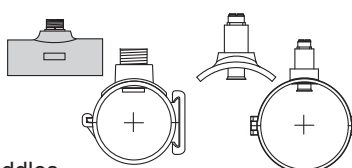
A **K-Factor** is the number of pulses a sensor will generate for each engineering unit of fluid that passes the sensor. K-Factors for water are listed below in U.S. gallons and liters.

For example, in a 1 inch SCH 80 PVC pipe, using the MPV8T010 PVC fitting, the 2537 paddlewheel generates 335.53 pulses per gallon of water passing the rotor.



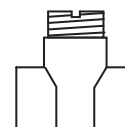
Molded Tees

| PIPE SIZE (IN.) | FITTING | 2537 SENSOR | |
|--|-------------------------------------|-------------|--------|
| | | U.S. GAL | LITERS |
| SCH 80 MOLDED TEES FOR SCH 80 PVC PIPE | | | |
| 1/2 | MPV8T005F MPV8T005 MCPV8T005F | 1027.1 | 271.37 |
| 3/4 | MPV8T007F MPV8T007 MCPV8T007F | 583.19 | 154.08 |
| 1 | MPV8T010F MPV8T010 MCPV8T010F | 335.53 | 88.65 |
| 1-1/4 | MPV8T012F MPV8T012 MCPV8T012F | 178.79 | 47.24 |
| 1-1/2 | MPV8T015F MPV8T015 MCPV8T015F | 121.42 | 32.08 |
| 2 | MPV8T020F MPV8T020 MCPV8T020F | 71.44 | 18.87 |
| 2-1/2 | PV8T025 | 42.994 | 11.359 |
| 3 | PV8T030 | 26.652 | 7.0414 |
| 4 | PV8T040 | 15.006 | 3.9645 |



Saddles

| PIPE SIZE (IN.) | FITTING | 2537 SENSOR | |
|--|---------|-------------|--------|
| | | U.S. GAL | LITERS |
| SCH 80 PVC SADDLES FOR SCH 80 PVC PIPE | | | |
| 2 | PV8S020 | 66.739 | 17.633 |
| 2-1/2 | PV8S025 | 42.994 | 11.359 |
| 3 | PV8S030 | 26.652 | 7.0414 |
| 4 | PV8S040 | 15.006 | 3.9645 |
| 6 | PV8S060 | 8.3246 | 2.1994 |
| 8 | PV8S080 | 5.0164 | 1.3253 |
| SCH 80 PVC SADDLE ON SCH 40 PVC PIPE | | | |
| 2 | PV8S020 | 54.700 | 14.452 |
| 2-1/2 | PV8S025 | 37.159 | 9.8175 |
| 3 | PV8S030 | 23.697 | 6.2608 |
| 4 | PV8S040 | 13.456 | 3.5552 |
| 6 | PV8S060 | 7.4594 | 1.9708 |
| 8 | PV8S080 | 4.5292 | 1.1966 |



Metal Tees

| PIPE SIZE (IN.) | FITTING | 2537 SENSOR | |
|-------------------------------------|---------|-------------|--------|
| | | U.S. GAL | LITERS |
| CARBON STEEL TEES ON SCH 40 PIPE | | | |
| 1/2 | CS4T005 | 756.00 | 199.74 |
| 3/4 | CS4T007 | 438.69 | 115.90 |
| 1 | CS4T010 | 286.78 | 75.768 |
| 1-1/4 | CS4T012 | 121.22 | 32.026 |
| 1-1/2 | CS4T015 | 91.139 | 24.079 |
| 2 | CS4T020 | 54.468 | 14.391 |
| STAINLESS STEEL TEES ON SCH 40 PIPE | | | |
| 1/2 | CR4T005 | 734.20 | 193.98 |
| 3/4 | CR4T007 | 412.10 | 108.88 |
| 1 | CR4T010 | 252.70 | 66.764 |
| 1-1/4 | CR4T012 | 128.12 | 33.849 |
| 1-1/2 | CR4T015 | 77.320 | 20.428 |
| 2 | CR4T020 | 45.780 | 12.095 |
| GALVANIZED IRON TEES ON SCH 40 PIPE | | | |
| 1 | IR4T010 | 213.01 | 56.277 |
| 1-1/4 | IR4T012 | 127.75 | 33.751 |
| 1 1/2 | IR4T015 | 94.401 | 24.941 |
| 2 | IR4T020 | 59.420 | 15.699 |
| BRONZE TEES ON SCH 40 PIPE | | | |
| 1 | BR4T010 | 213.01 | 56.277 |
| 1-1/4 | BR4T012 | 127.75 | 33.751 |
| 1-1/2 | BR4T015 | 94.401 | 24.941 |
| 2 | BR4T020 | 59.420 | 15.699 |
| COPPER TEE ON COPPER PIPE SCH K | | | |
| 1/2 | CUKT005 | 917.84 | 242.50 |
| 3/4 | CUKT007 | 428.27 | 113.15 |
| 1 | CUKT010 | 256.43 | 67.749 |
| 1-1/4 | CUKT012 | 176.44 | 46.615 |
| 1-1/2 | CUKT015 | 115.69 | 30.565 |
| 2 | CUKT020 | 63.385 | 16.746 |
| COPPER TEE ON COPPER PIPE SCH L | | | |
| 1/2 | CUKT005 | 858.22 | 226.74 |
| 3/4 | CUKT007 | 385.74 | 101.91 |
| 1 | CUKT010 | 241.64 | 63.841 |
| 1-1/4 | CUKT012 | 170.90 | 45.152 |
| 1-1/2 | CUKT015 | 112.03 | 29.598 |
| 2 | CUKT020 | 61.74 | 16.310 |



Union Tees

| PIPE SIZE | FITTING | 2537 SENSOR | |
|--|---------|-------------|--------|
| | | U.S. GAL | LITERS |
| POLYPROPYLENE TEES (DIN/ISO, BS, ANSI) | | | |
| DN15 | PPMT005 | 952.87 | 251.75 |
| DN20 | PPMT007 | 563.10 | 148.77 |
| DN25 | PPMT010 | 291.60 | 77.042 |
| DN32 | PPMT012 | 169.22 | 44.709 |
| DN40 | PPMT015 | 103.90 | 27.450 |
| DN50 | PPMT020 | 60.789 | 16.060 |
| DN65 | PPMT025 | 41.498 | 10.964 |
| DN80 | PPMT030 | 26.786 | 7.0769 |
| DN100 | PPMT040 | 17.415 | 4.6011 |
| DN125 | PPMT050 | 10.168 | 2.6864 |
| DN150 | PPMT060 | 7.3119 | 1.9318 |
| DN200 | PPMT080 | 3.9946 | 1.0554 |



Union Tees

| PIPE SIZE | FITTING | 2537 SENSOR | |
|---|---------|-------------|--------|
| | | U.S. GAL | LITERS |
| PVDF FITTINGS (DIN/ISO AND BS AND ANSI) | | | |
| DN15 | SFMT005 | 827.26 | 218.56 |
| DN20 | SFMT007 | 489.87 | 129.42 |
| DN25 | SFMT010 | 283.55 | 74.915 |
| DN32 | SFMT012 | 158.59 | 41.899 |
| DN40 | SFMT015 | 86.980 | 22.980 |
| DN50 | SFMT020 | 50.385 | 13.312 |
| PVC FITTINGS (DIN/ISO) - EUROPE ONLY | | | |
| DN15 | PVMT005 | 972.37 | 256.90 |
| DN20 | PVMT007 | 485.69 | 128.32 |
| DN25 | PVMT010 | 297.27 | 78.540 |
| DN32 | PVMT012 | 170.25 | 44.980 |
| DN40 | PVMT015 | 103.71 | 27.400 |
| DN50 | PVMT020 | 59.500 | 15.720 |
| DN65 | PVMT025 | 34.973 | 9.2400 |
| DN80 | PVMT030 | 24.981 | 6.6000 |
| DN100 | PVMT040 | 16.275 | 4.3000 |
| DN150 | PVMT060 | 8.1756 | 2.1600 |
| DN200 | PVMT080 | 4.0878 | 1.0800 |

K-Factor

Weldolets and Brazolets



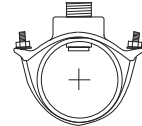
| PIPE SIZE (IN.) | FITTING | 2537 SENSOR | |
|--|---------|-------------|--------|
| | | U.S. GAL | LITERS |
| STAINLESS STEEL WELDOLETS ON SCH 40 PIPE | | | |
| 2-1/2 | CR4W025 | 37.600 | 9.9339 |
| 3 | CR4W030 | 24.340 | 6.4306 |
| 4 | CR4W040 | 13.920 | 3.6777 |
| 5 | CR4W050 | 10.860 | 2.8692 |
| 6 | CR4W060 | 7.5200 | 1.9868 |
| 8 | CR4W080 | 4.3400 | 1.1466 |
| CARBON STEEL WELDOLETS ON SCH 40 PIPE | | | |
| 2-1/2 | CS4W025 | 37.600 | 9.9339 |
| 3 | CS4W030 | 24.340 | 6.4306 |
| 4 | CS4W040 | 13.920 | 3.6777 |
| 5 | CS4W050 | 10.860 | 2.8692 |
| 6 | CS4W060 | 7.5200 | 1.9868 |
| 8 | CS4W080 | 4.3400 | 1.1466 |
| COPPER/BRONZE BRAZOLETS ON SCH 40 PIPE | | | |
| 2-1/2 | BR4B025 | 37.600 | 9.934 |
| 3 | BR4B030 | 24.340 | 6.431 |
| 4 | BR4B040 | 13.920 | 3.678 |
| 5 | BR4B050 | 10.860 | 2.869 |
| 6 | BR4B060 | 7.5200 | 1.987 |
| 8 | BR4B080 | 4.3400 | 1.147 |

Wafer Fittings



| PIPE SIZE | FITTING | 2537 SENSOR | |
|--|----------------------|-------------|--------|
| | | U.S. GAL | LITERS |
| POLYPROPYLENE WAFER FITTINGS (DIN/ISO) | | | |
| DN65 | PPMTE025 PPMTF025 | 41.498 | 10.964 |
| DN80 | PPMTE030 PPMTF030 | 26.786 | 7.0769 |
| DN100 | PPMTE040 PPMTF040 | 17.415 | 4.6011 |
| DN125 | PPMTE050 PPMTF050 | 10.168 | 2.6864 |
| DN150 | PPMTE060 PPMTF060 | 7.3119 | 1.9318 |
| DN200 | PPMTE080 PPMTF080 | 3.9946 | 1.0554 |
| PVDF WAFER FITTINGS (DIN/ISO) | | | |
| DN65 | SFMTF025 | 36.133 | 9.5465 |
| DN80 | SFMTF030 | 24.715 | 6.5297 |
| DN100 | SFMTF040 | 16.120 | 4.2589 |
| DN125 | SFMTF050 | 8.8624 | 2.3415 |
| DN150 | SFMTF060 | 6.4543 | 1.7052 |
| DN200 | SFMTF080 | 4.0720 | 1.0758 |

Iron Saddles

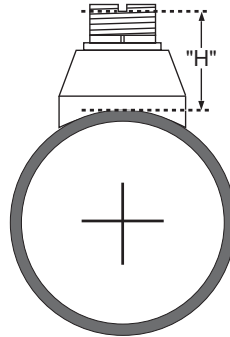


| PIPE SIZE (IN.) | FITTING | 2537 SENSOR | |
|------------------------------------|---------|-------------|--------|
| | | U.S. GAL | LITERS |
| SCH 80 IRON SADDLES ON SCH 80 PIPE | | | |
| 2 | IR8S020 | 64.720 | 17.099 |
| 2-1/2 | IR8S025 | 42.480 | 11.223 |
| 3 | IR8S030 | 26.420 | 6.980 |
| 4 | IR8S040 | 14.700 | 3.884 |
| 5 | IR8S050 | 12.180 | 3.218 |
| 6 | IR8S060 | 8.4400 | 2.230 |
| 8 | IR8S080 | 4.9000 | 1.295 |
| SCH 80 IRON SADDLE ON SCH 40 PIPE | | | |
| 2 | IR8S020 | 53.640 | 14.172 |
| 2-1/2 | IR8S025 | 37.600 | 9.934 |
| 3 | IR8S030 | 23.220 | 6.135 |
| 4 | IR8S040 | 13.260 | 3.503 |
| 5 | IR8S050 | 11.040 | 2.917 |
| 6 | IR8S060 | 7.2400 | 1.913 |
| 8 | IR8S080 | 4.4000 | 1.162 |

H-Dimension

The plastic insert in Weldolet fittings MUST be removed during the welding process. When reinstalled, it is important that the insert be threaded to the proper height ("H" dimension).

| Weldolet | "H" dimension | |
|-------------|---------------|-------|
| Part number | inches | mm |
| CS4W020 | 2.38 | 60.45 |
| CS4W025 | 2.33 | 59.18 |
| CS4W030 | 2.32 | 58.92 |
| CS4W040 | 2.30 | 58.42 |
| CS4W050 | 3.09 | 78.48 |
| CS4W060 | 2.96 | 75.18 |
| CS4W080 | 2.73 | 69.34 |



| Weldolet | "H" dimension | |
|-------------|---------------|-------|
| Part number | inches | mm |
| CR4W020 | 2.38 | 60.45 |
| CR4W025 | 2.33 | 59.18 |
| CR4W030 | 2.32 | 58.92 |
| CR4W040 | 2.30 | 58.42 |
| CR4W050 | 3.09 | 78.48 |
| CR4W060 | 2.96 | 75.18 |
| CR4W080 | 2.73 | 69.34 |

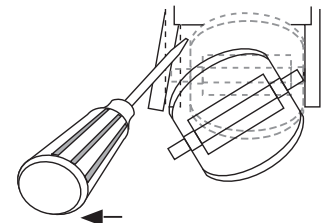
Maintenance and Cleaning

The 2537 requires very little maintenance.

- If the paddlewheel becomes fouled, it can be cleaned with mild detergents and a small brush.
- The electronics portion of the 2537 does not require maintenance or cleaning.

Rotor Replacement Procedure

1. To remove the rotor, insert a small screwdriver between the rotor and the ear of the sensor.
2. Twist the screwdriver blade to flex the ear outward enough to remove one end of the rotor and pin. DO NOT flex the ear any more than necessary! If it breaks, the sensor cannot be repaired.
3. Install the new rotor by inserting one tip of the pin into the hole, then carefully flex the opposite ear back enough to slip rotor into place.



Ordering Information

| Mfr. Part No. | Code | Description |
|--|-------------|---|
| 2537 system for 0.5 in. to 4 in. pipes: | | |
| Polypropylene body, Black PVDF rotor, Titanium pin, FPM O-rings | | |
| 3-2537-1C-P0 | 159 001 291 | Pulse/Flow Switch, DCR, -P0, Integral Mount |
| 3-2537-2C-P0 | 159 001 292 | Pulse/Flow Switch, SSR, -P0, Integral Mount |
| 3-2537-5C-P0 | 159 001 295 | Digital (S ³ L), Integral Mount |
| 3-2537-6C-P0 | 159 001 296 | 4 to 20 mA, Integral Mount |

| | | |
|--|-------------|---|
| 2537 system for 5 in. to 8 in. pipes: | | |
| Polypropylene body, Black PVDF rotor, Titanium pin, FPM O-rings | | |
| 3-2537-1C-P1 | 159 001 303 | Pulse/Flow Switch, DCR, -P1, Integral Mount |
| 3-2537-2C-P1 | 159 001 304 | Pulse/Flow Switch, SSR, -P1, Integral Mount |
| 3-2537-5C-P1 | 159 001 307 | Digital (S ³ L), Integral Mount |
| 3-2537-6C-P1 | 159 001 308 | 4 to 20 mA, Integral Mount |

| | | |
|---|-------------|---|
| 2537 system for 0.5 in. to 4 in. pipes: | | |
| Natural PVDF body, Natural PVDF rotor and pin, FPM O-rings | | |
| 3-2537-1C-T0 | 159 001 315 | Pulse/Flow Switch, DCR, -T0, Integral Mount |
| 3-2537-2C-T0 | 159 001 316 | Pulse/Flow Switch, SSR, -T0, Integral Mount |
| 3-2537-5C-T0 | 159 001 319 | Digital (S ³ L), Integral Mount |
| 3-2537-6C-T0 | 159 001 320 | 4 to 20 mA, Integral Mount |

Accessories

| Mfr. Part No. | Code | Description |
|---------------|-------------|---|
| 3-2536.320-1 | 198 820 052 | Rotor, PVDF Black |
| 3-2536.320-2 | 159 000 272 | Rotor, PVDF Natural |
| 3-2536.320-3 | 159 000 273 | Rotor, ETFE |
| 3-2536.321 | 198 820 054 | Rotor and Pin, PVDF Natural |
| 3-2536.322-1 | 198 820 056 | Sleeved Rotor, PVDF Black |
| 3-2536.322-2 | 198 820 057 | Sleeved Rotor, PVDF Natural |
| 3-2536.322-3 | 198 820 058 | Sleeved Rotor, ETFE |
| M1546-1 | 198 801 182 | Rotor Pin, Titanium |
| M1546-2 | 198 801 183 | Rotor Pin, Hastelloy-C |
| M1546-3 | 198 820 014 | Rotor Pin, Tantalum |
| M1546-4 | 198 820 015 | Rotor Pin, Stainless Steel |
| P51545 | 198 820 016 | Rotor Pin, Ceramic |
| 1220-0021 | 198 801 000 | O-Ring, FKM |
| 1224-0021 | 198 820 006 | O-Ring, EPDM |
| 1228-0021 | 198 820 007 | O-Ring, FFKM |
| P31536 | 198 840 201 | Sensor Plug, Polypro |
| 3-8050.390-1 | 159 001 702 | Retaining Nut Replacement Kit, NPT, Valox® |
| 3-8050.390-3 | 159 310 116 | Retaining Nut Replacement Kit, NPT, PP |
| 3-8050.390-4 | 159 310 117 | Retaining Nut Replacement Kit, NPT, PVDF |
| 3-9000.392-1 | 159 000 839 | Liquid tight connector kit, NPT (1 piece) |
| 3-9000.392-2 | 159 000 841 | Liquid tight connector kit, PG 13.5 (1 piece) |
| 7310-1024 | 159 873 004 | 24 VDC Power Supply, 10W, 0.42 A |
| 7310-2024 | 159 873 005 | 24 VDC Power Supply, 24W, 1.0 A |
| 7310-4024 | 159 873 006 | 24 VDC Power Supply, 40W, 1.7 A |
| 7310-6024 | 159 873 007 | 24 VDC Power Supply, 60W, 2.5 A |
| 7310-7024 | 159 873 008 | 24 VDC Power Supply, 96W, 4.0 A |



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 For the most up-to-date information, please refer to our website at www.gfsignet.com



Installation instructions Submersible pressure transmitter

PS3xxx

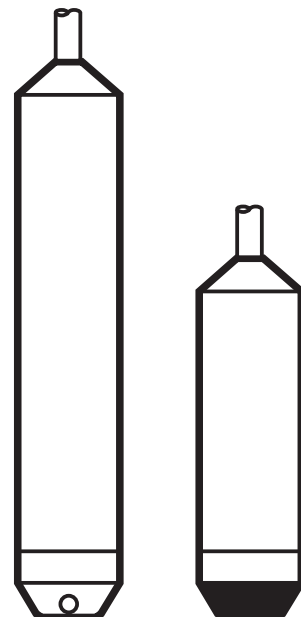
PS3xxA

PS4xxx

UK

06/2017

14014571.05



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1 Preliminary note

1.1 Symbols used

► Instructions

> Reaction, result

→ Cross-reference



Important note

Non-compliance may result in malfunction or interference.



Information

Supplementary note.

2 Safety instructions

- Read this document before setting up the product and keep it during the entire service life.
- Only use the product for its intended purpose (→ Functions and features).
- Only use the product for permissible media (→ Technical data).
- If the operating instructions or the technical data are not adhered to, personal injury and/or damage to property may occur.

- The manufacturer assumes no liability or warranty for any consequences caused by tampering with the product or incorrect use by the operator.
- Installation, electrical connection, set-up, operation and maintenance of the product must be carried out by qualified personnel authorised by the machine operator.
- Protect units and cables against damage.
- Avoid static and dynamic overpressure exceeding the given overload pressure (→ Technical data) by taking appropriate measures.
- The indicated bursting pressure (→ Technical data) must not be exceeded. Even if the bursting pressure is exceeded only for a short time, the unit may be destroyed. CAUTION: risk of injury!
- For submersible pressure transmitters PS3xxA: Adhere to the remarks for safe use in hazardous areas (→ ATEX operating instructions).

3 Items supplied

For the measuring range and the cable length please refer to the data sheet of the corresponding submersible pressure transmitter.

The submersible pressure transmitters PS3xxA are approved for use in hazardous areas.

The following components are available as accessories (to be ordered separately):

| | Order no. |
|--|-----------|
| Cable clamp fastener for placing the submersible pressure transmitter in the tank* | E30399 |
| Filter element for fixing on the capillary ventilation* | E30400 |
| Splitter box for electrical connection* | E30401 |
| Additional weight to increase the dead weight of the unit | E30402 |

*CAUTION: use only outside the hazardous area.

4 Functions and features

The unit detects the hydrostatic pressure and converts it into an analogue output signal. The output signal changes in proportion with the level of the tank.

Applications

- Liquids.
- Tanks, containers, wells, streaming water, drill holes, wastewater plants.

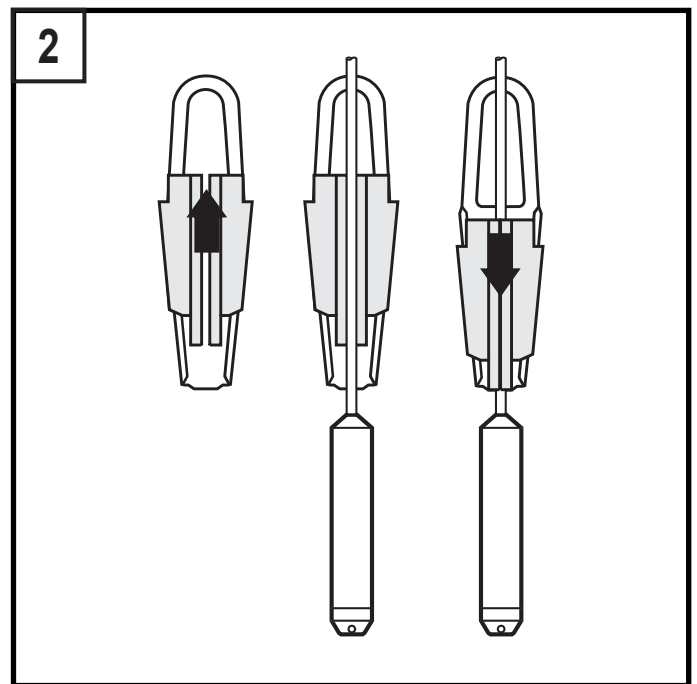
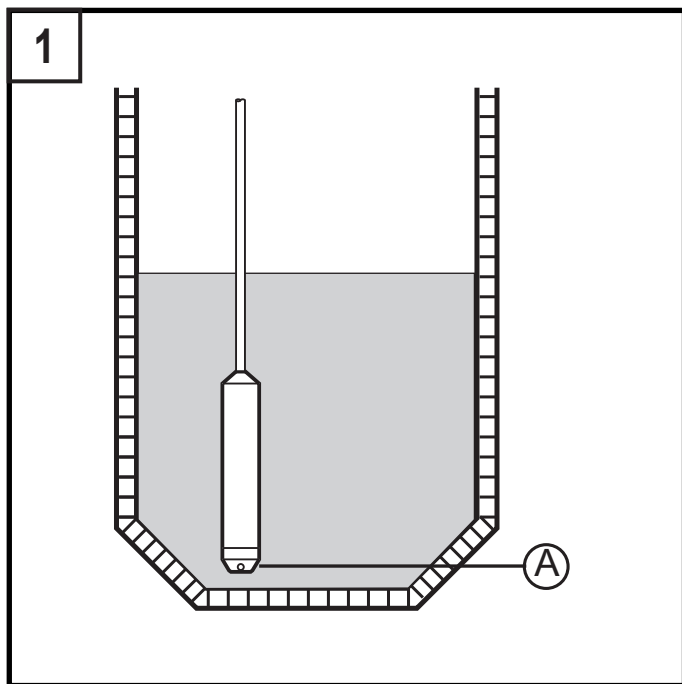


Pressure Equipment Directive (PED):

The units comply with the Pressure Equipment Directive and are designed and manufactured for group 2 fluids in accordance with the sound engineering practice. Use of group 1 fluids on request!

5 Installation

- Place the unit in the tank such that it is as close as possible to the tank bottom (→ Fig. 1). For fixing with cable clamp fastener → Fig. 2.



- For viscous media: unscrew and remove the protective cap (A).
- In order to prevent or reduce oscillating movements of the unit: unscrew the protective cap (A), screw the additional weight (order no. E30402) to the unit.

The unit operates on the principle of relative pressure. A capillary tube ensures pressure compensation. It is inserted through the connection cable.

- Make sure that the capillary tube is not blocked. If necessary, install a filter element (order no. E30400). Or use the splitter box with ventilation (order no. E30401) for the electrical connection.



In wet environments there is the risk that water penetrates into the unit through the capillary tube and causes damage to it. In this case use the filter element or the splitter box with ventilation.



The filter element and the splitter box are only allowed for use outside hazardous areas.

**5.1 Requirements for the mounting location
(applies to PS3xxA)**

Strong electromagnetic fields in the frequency range < 2.7 GHz may lead to increased measurement errors up to 1 % of the span. Do not install the units near strong sources of electromagnetic interference (e.g. transmitters, radio equipment) or, if necessary, use a sheath current filter.

UK

6 Electrical connection



The unit must be connected by a qualified electrician.
The national and international regulations for the installation of electrical equipment must be adhered to.
Voltage supply to EN 50178, SELV, PELV.
For submersible pressure transmitters PS3xxA: For use in hazardous areas: connection to intrinsically safe supply isolators (Ex ia).

- ▶ Disconnect power.
- ▶ Connect the unit as follows:

| PS3xxA / PS4xxx | | PS3xxx | |
|--------------------------------------|-------|--------------|---------------|
| | | | |
| Core colours | | Core colours | |
| BN | brown | BN | brown |
| GN | green | WH | white |
| 1: screen (connected to the housing) | | GY | grey (screen) |

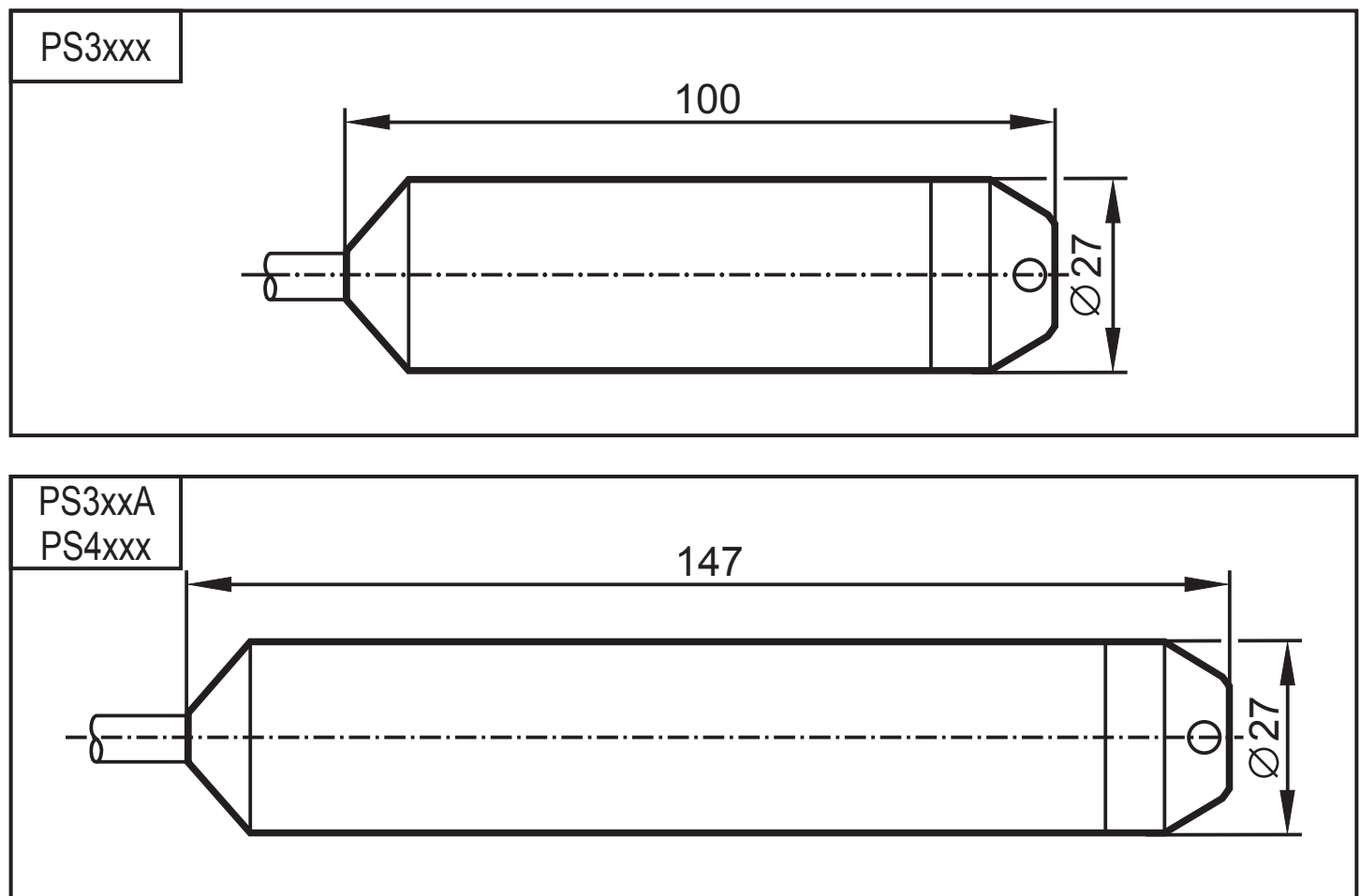
7 Maintenance, repair and disposal

The unit has to be included in the recurrent pressure test of the tank.

Only the manufacturer is allowed to repair the unit.

After use dispose of the unit in an environmentally friendly way in accordance with the applicable national regulations.

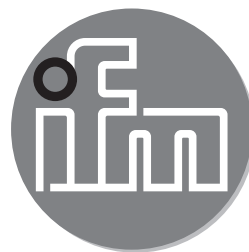
8 Scale drawing



9 Technical data

For the measuring range, the permissible overload pressure and the bursting pressure please refer to the data sheet of the corresponding submersible pressure transmitter.

More information at www.ifm.com

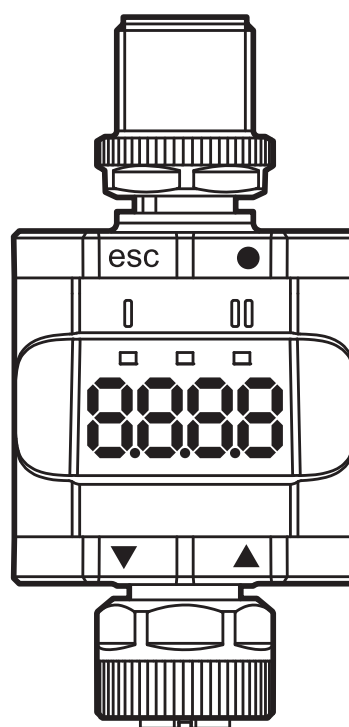


Operating instructions
Analogue limit display

DP2200

UK

80235112 / 00 12 / 2017



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1 Preliminary note

This document applies to the threshold display DP2200. Keep this document during the entire duration of use of the device.

WARNING

Adhere to the warning notes and safety instructions (→ 2 Safety instructions).

1.1 Symbols and warnings used

- ▶ Instructions
- > Reaction, result
- [...] Designation of keys, buttons or indications
- Cross-reference



Important note

Non-compliance may result in malfunction or interference.



Information

Supplementary note.

WARNING

Warning of serious personal injury.

Death or serious irreversible injuries may result.

2 Safety instructions

2.1 General

Adhere to the operating instructions. Non-observance of the instructions, operation which is not in accordance with use as prescribed below, wrong installation or incorrect handling can affect the safety of operators and machinery.

The installation and connection must comply with the applicable national and international standards. Responsibility lies with the person installing the device.

The system installer is responsible for the safety of the system into which the device is integrated.

2.2 Target group

The device must be installed, connected and put into operation by a qualified electrician.

2.3 Electrical connection

Disconnect the device externally before handling it.

Make sure that the external voltage is generated and supplied according to the requirements for safety extra-low voltage (SELV) since this voltage is supplied without further measures to the connected sensors.

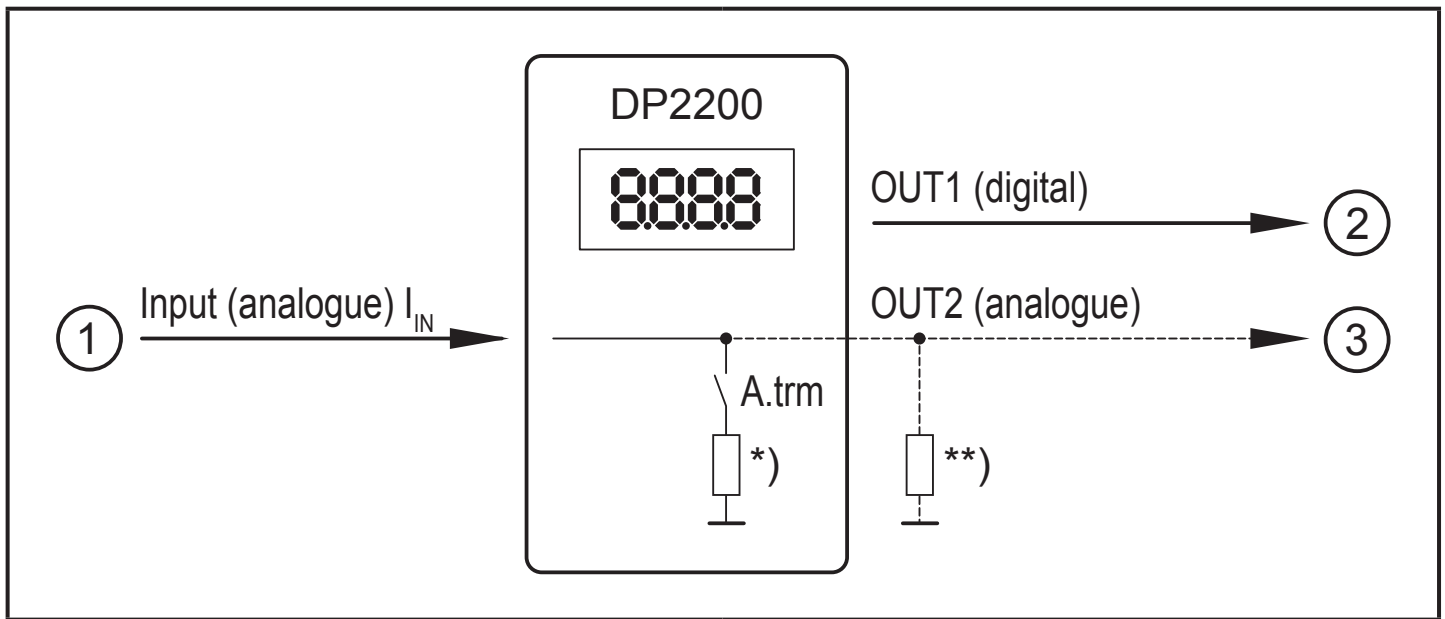
The wiring of all signals in connection with the SELV circuit of the device must also comply with the SELV criteria (safety extra-low voltage, safe electrical isolation from other electric circuits).

If the externally supplied or internally generated SELV voltage is externally grounded, the responsibility lies with the user in accordance with the applicable national installation regulations. All statements in these operating instructions refer to the unit the SELV voltage of which is not grounded.

The consumption of current which exceeds the value given in the technical data is not allowed.

3 Functions and features

3.1 Block diagram



Inputs/outputs of the device

- | | |
|---|-----------------------------------|
| 1: IN (analogue input I_{IN}) | A.trm = analogue termination OUT2 |
| 2: OUT1 (digital output) | *) switchable internal load |
| 3: OUT2 (analogue output $I_{OUT} = I_{IN}$) | **) external load (optional) |



The current loop of the analogue input must be terminated. Only one load may be connected, either an internal or an external load.

(→ 8.4.2 A.trm – analogue termination for OUT2)

(→ 12 Fault correction)

3.2 General application and functionality

The device is used for the evaluation of an analogue signal (4...20 mA) from a connected sensor or another device with analogue output (4...20 mA). The device has one analogue current input and two outputs: output 1 (digital) and optionally output 2 (analogue current output).



The device is intended for indoor use only.

Observe the operating conditions (→ 11 Technical data).

There are basically two modes in which the device can be operated:

- As stand-alone device

The device compares the measured current value with the set parameters and switches its output according to the selected parameters. This mode is without IO-Link functionality. The parameters can, however, also be set with an IO-Link tool.

- As IO-Link device

The device operates as an "analogue/IO-Link converter".

The evaluation of the measured current value depends on the parameters which are set with IO-Link tools or a PLC via IO-Link communication or directly on the device.

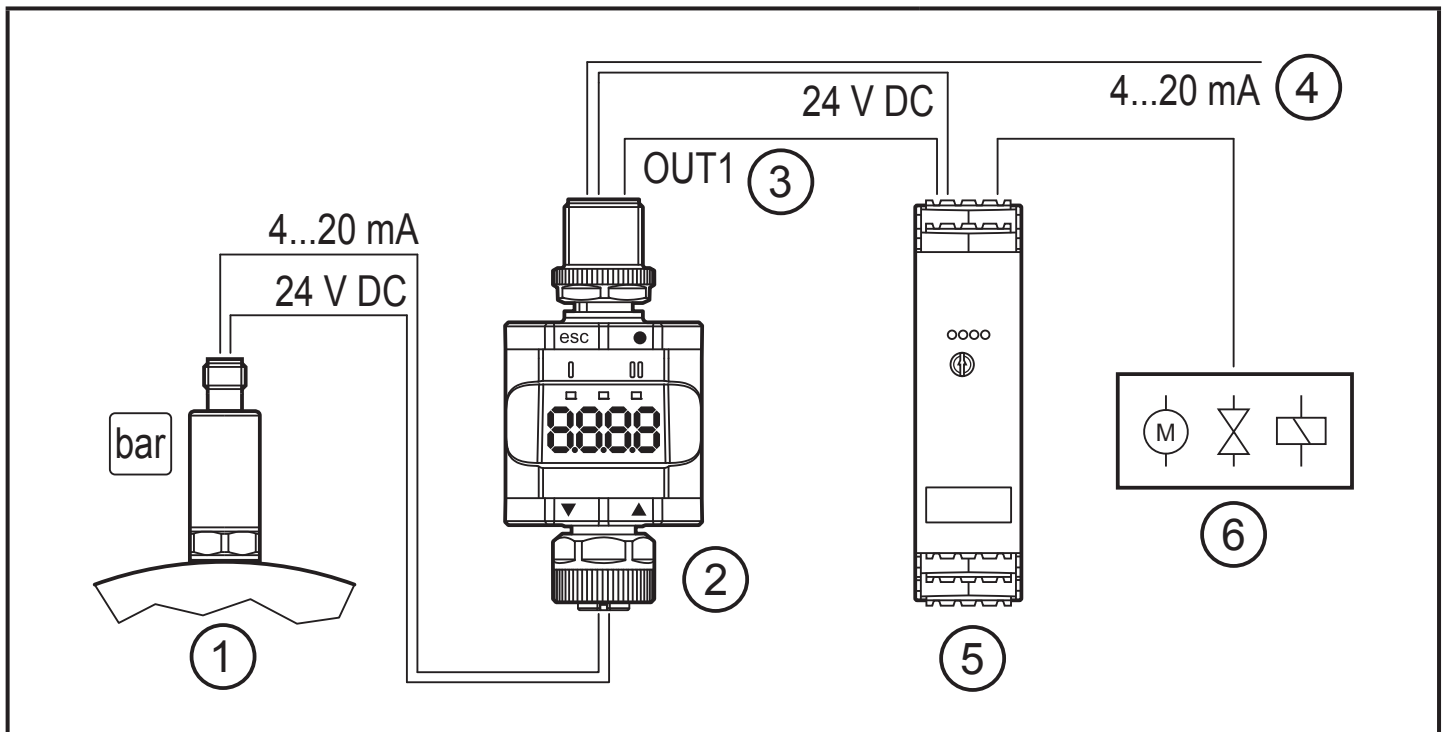


In some points parameter setting via IO-Link tools or PLC is different from parameter setting via the menu (→ 8 Parameters).

3.3 Use as a stand-alone device without IO-Link

The device compares the measured current value with the set parameters and switches its output according to the selected function (→ 7 Operation).

The measured value is shown on the alphanumerical display. The displayed value can be scaled by the user (2-point scaling).



Application example without IO-Link master

- 1: Sensor with analogue output (e.g. pressure sensor)
- 2: Threshold display
- 3: Digital output
- 4: Looping through an analogue input signal

- 5: Control monitor
- 6: Relay output for switching electric motors, valves etc.

3.4 Application as an IO-Link device

3.4.1 General information

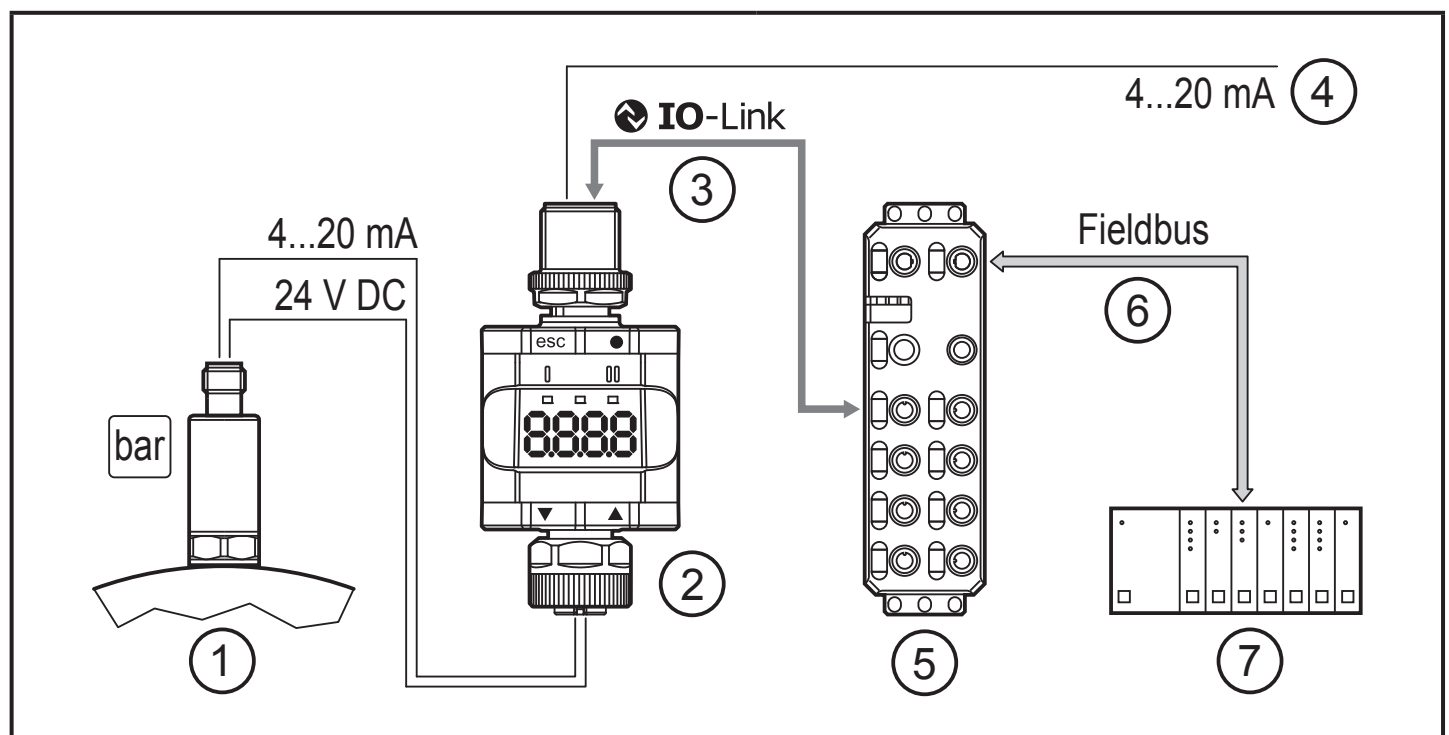
The device has an IO-Link communication interface which requires an IO-Link-capable module (IO-Link master).

The IO-Link interface allows direct access to the process and diagnostic data and enables setting of the parameters of the unit during operation.

It is possible to set parameters via a point-to-point connection. You will find further information about IO-Link and all necessary information about the required IO-Link hardware and software at:

www.ifm.com/de/io-link.

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Application example with IO-Link master

- | | |
|---|---|
| 1: Analogue sensor (e.g. pressure sensor) | 4: Looping through an analogue input signal |
| 2: Threshold display | 5: IO-Link master |
| 3: Fully bidirectional IO-Link communication | 6: Fieldbus (e.g. Profibus, Profinet etc.) |
| - Remote display: reading and displaying the measured current | 7: PLC |
| - Remote parameter setting: reading and changing the parameter setting. | |

3.4.2 Functionality

In the IO-Link SIO mode, the device has the same functionality as a stand-alone device. The measured value is also displayed.

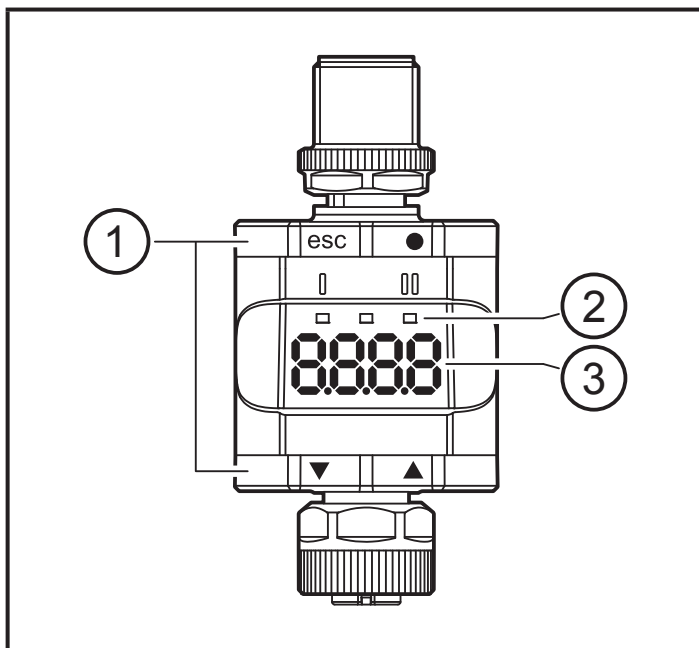
Additionally, the device converts the measured current and transmits the value via IO-Link connection to the PLC.

3.4.3 IO Device Description (IODD)

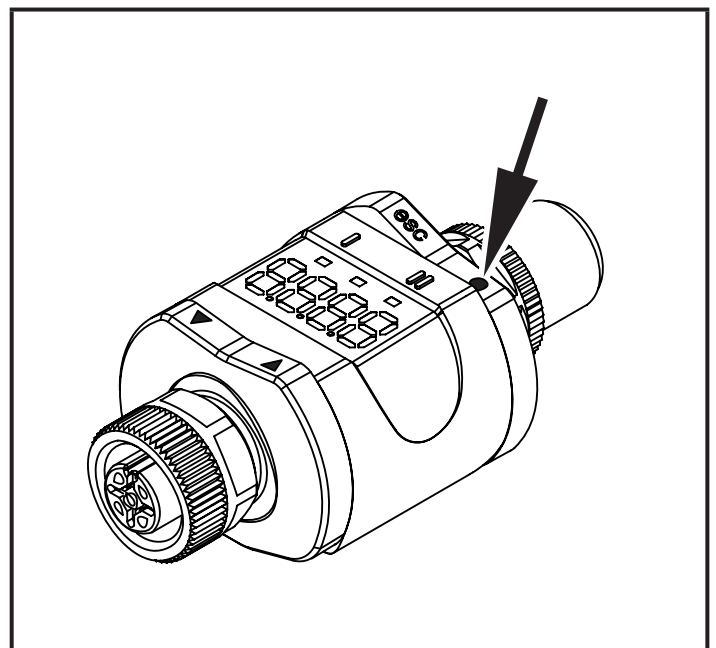
You will find the IODDs necessary for the configuration of the IO-Link device and detailed information about process data structure, diagnostic information and parameter addresses at:

www.ifm.com

4 Operating and display elements



- 1: Push rings (pushbuttons)
- 2: LEDs
- 3: Display



Here the Enter button is shown pressed, as an example [●].

4.1 Push rings (buttons)

- To execute an [esc], [•], [▼] or [▲] command, press the corresponding corner of a push ring.

| Button | | Function |
|--------|--------|--|
| [esc] | Escape | Return to the previous menu. Exit parameter setting without saving the new value. |
| [•] | Enter | Enter menu mode (→ 8.2 Menu structure). Selection of the parameter and acknowledgement of a parameter value. |
| [▼] | Down | Selection of a parameter. Setting a parameter value (scrolling by holding down, incrementally by pressing repeatedly). |
| [▲] | Up | |

UK

When [▼] or [▲] is pressed during the operating mode for 1 second, the unit is displayed. The displayed unit depends on the parameter C.uni (→ 8.5).



To ensure correct operation of the push rings (buttons), do not install or place the device directly on a metal surface.

For the installation use the mounting clip (→ 5 Installation).

4.2 LEDs

| LED | | Colour | Status | Description |
|-------|------|--------|--------|---|
| I | OUT1 | yellow | on | Output 1 switched. |
| Power | | green | on | Voltage supply OK. Device in operating mode. |
| | | | off | Device in programming mode. |
| II | - | - | - | Without function |

Error signals and diagnostics (→ 12 Fault correction)

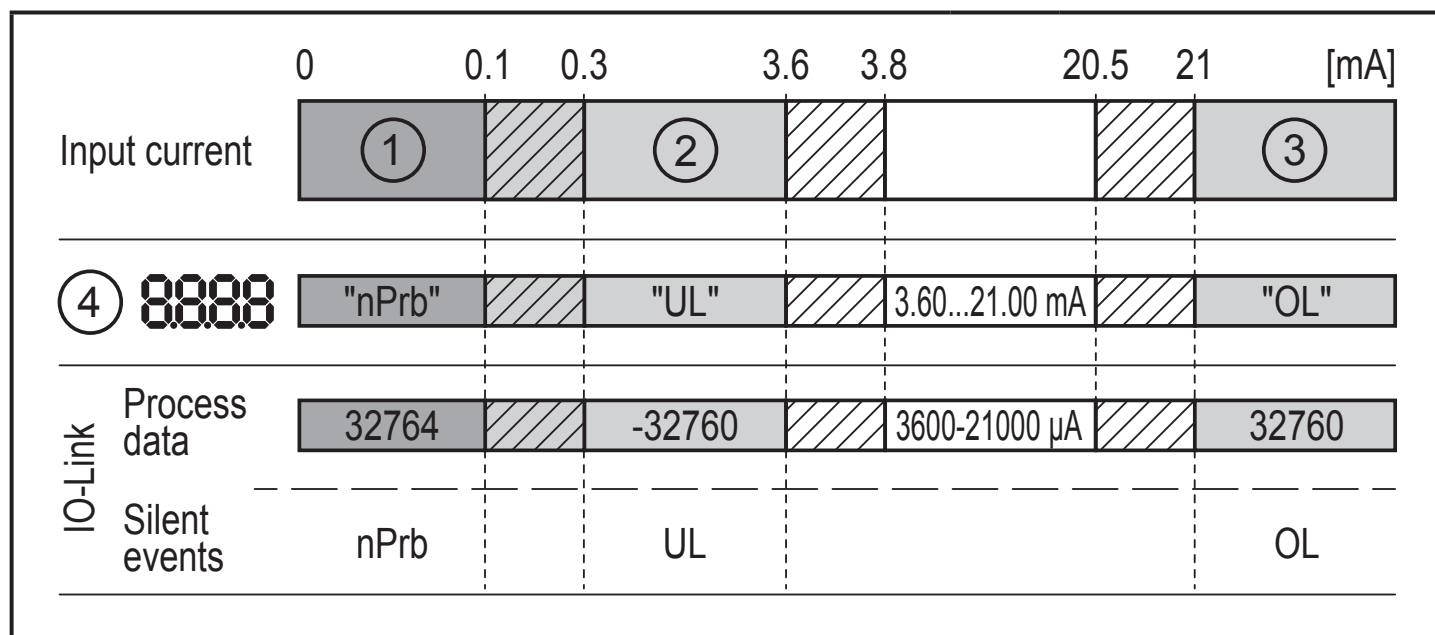
4.3 Display

| Colour | Description |
|-----------|--|
| Red/green | 7-segment LED display, 4 digits, with colour change. |

Error signals and diagnostics (→ 12 Fault correction)

In the operating mode the input current value is displayed. The scaling depends on the parameter ScAL (→ 8.4.5).

4.3.1 Representation of the measured current value



1: No measured data

2: Input current below the range (-)

3: Input current above the range (+)

4: Displayed message or displayed value.

The input current is displayed here without scaling.

nPrb: No sensor

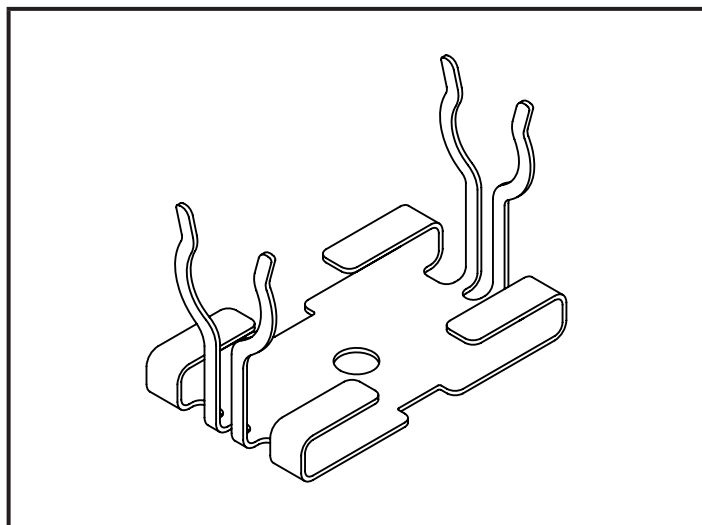
UL: Process value too low

OL: Process value too high

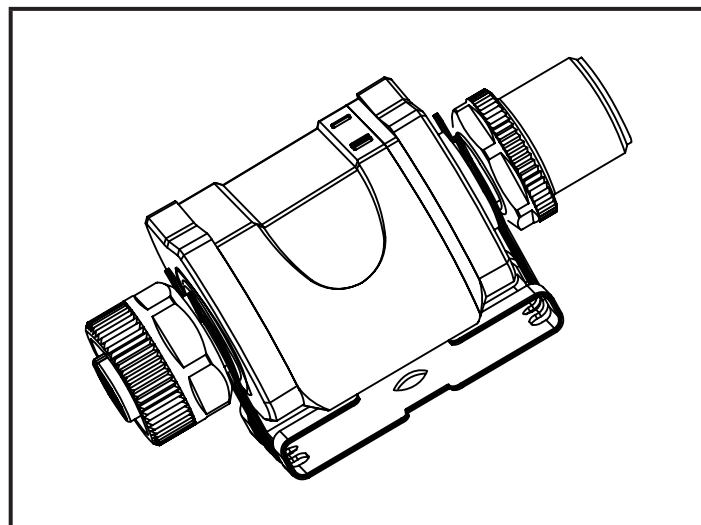
Hysteresis range

5 Installation

If required, the device can be fixed with a mounting clip.



Mounting clip (fasten with M4 screw or cable ties)



Mounting clip with display attached

The mounting clip is not supplied with the device.

More information about the available accessories at:
www.ifm.com

6 Electrical connection

⚠ **WARNING**

The device must be connected by a qualified electrician.

The national and international regulations for the installation of electrical equipment must be adhered to.

Voltage supply to SELV, PELV.

⚠ **WARNING**

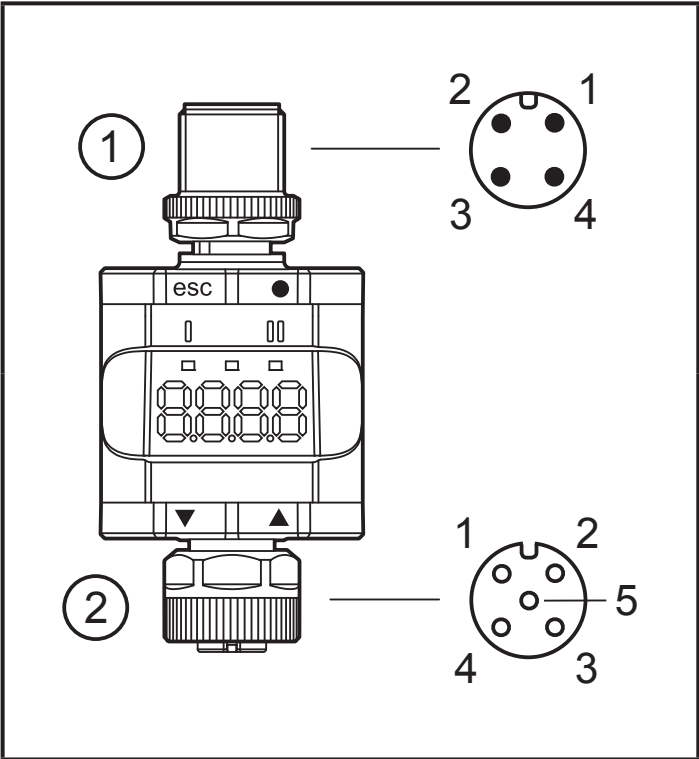
► Protect the supply voltage.

| Potential | M12 connector (1) | Fuse |
|---------------------|-------------------|----------------|
| L+ / supply voltage | pin 1 | ≤ 2 A time-lag |

► Alternatively supply the device via a limited energy circuit according to IEC 61010-1.

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- Disconnect power.
- Connect the device according to the table below.



| Pin | 4-pole M12 connector (1) |
|-----|--------------------------------------|
| 1 | L+ / supply voltage |
| 2 | OUT2: analogue output |
| 3 | L- / supply voltage |
| 4 | OUT1: digital output (SIO) / IO-Link |

| Pin | 5-pole M12 socket (2) |
|-----|----------------------------|
| 1 | L+ / sensor supply |
| 2 | Analogue input (4...20 mA) |
| 3 | L- / sensor supply |
| 4 | Not used |
| 5 | Not used |

- 1: Evaluation side
- 2: Sensor side

! Always use the intended connection cables to connect sensors or other devices with the device.

See also application examples (→ 3 Functions and features)



To ensure the protection rating fully tighten the screws of the used M12 connectors. Protection rating (→ 11 Technical data).

6.1 Maximum length of the connection cables

Without IO-Link on either side: 30 m.

With IO-link communication on the master side: 20 m.



All cables must be provided with a strain relief min. 200 mm behind the connectors.

7 Operation

After power on, the device is in the operating mode (SIO). It carries out its measurement and evaluation functions and provides output signals according to the set parameters (→ 8 Parameters).

7.1 Functions output 1

OUT1 (connector, pin 4):

- Digital output (status according to the set switching function)
- IO-Link interface

Selectable switching functions:

- Hysteresis functions, normally open / normally closed (→ 8.3.1)
- Window functions, normally open / normally closed (→ 8.3.2)

OUT1 changes its status if the input signal is above or below the set switching limits. First the set point SP1 is set, then the reset point rP1 (→ 8.3.1).



The hysteresis defined remains even if SP1 is changed again. Changing the parameter rP1 also changes the hysteresis.

The width of the window can be set by means of the difference between FH1/FL1.

FH1 = upper value

FL1 = lower value

7.2 Functions output 2

OUT2 (connector, pin 2):

- Analogue output (looping through the analogue input signal).

8 Parameters

8.1 General

Irrespective of the operating mode (stand-alone device/SIO or IO-Link device) there are two options to set the parameters of the device:

- directly on the device via the menu
- or via an IO-Link tool.

Access via an IO-Link tool has a higher priority than parameter setting via the menu.



Some parameters can only be set via the IO-link interface (→ 8.5 Parameters via IO-Link).



If the device was locked via IO-link, it can also only be unlocked via the IO-Link interface (→ 8.5.2 S.Loc – software locking).

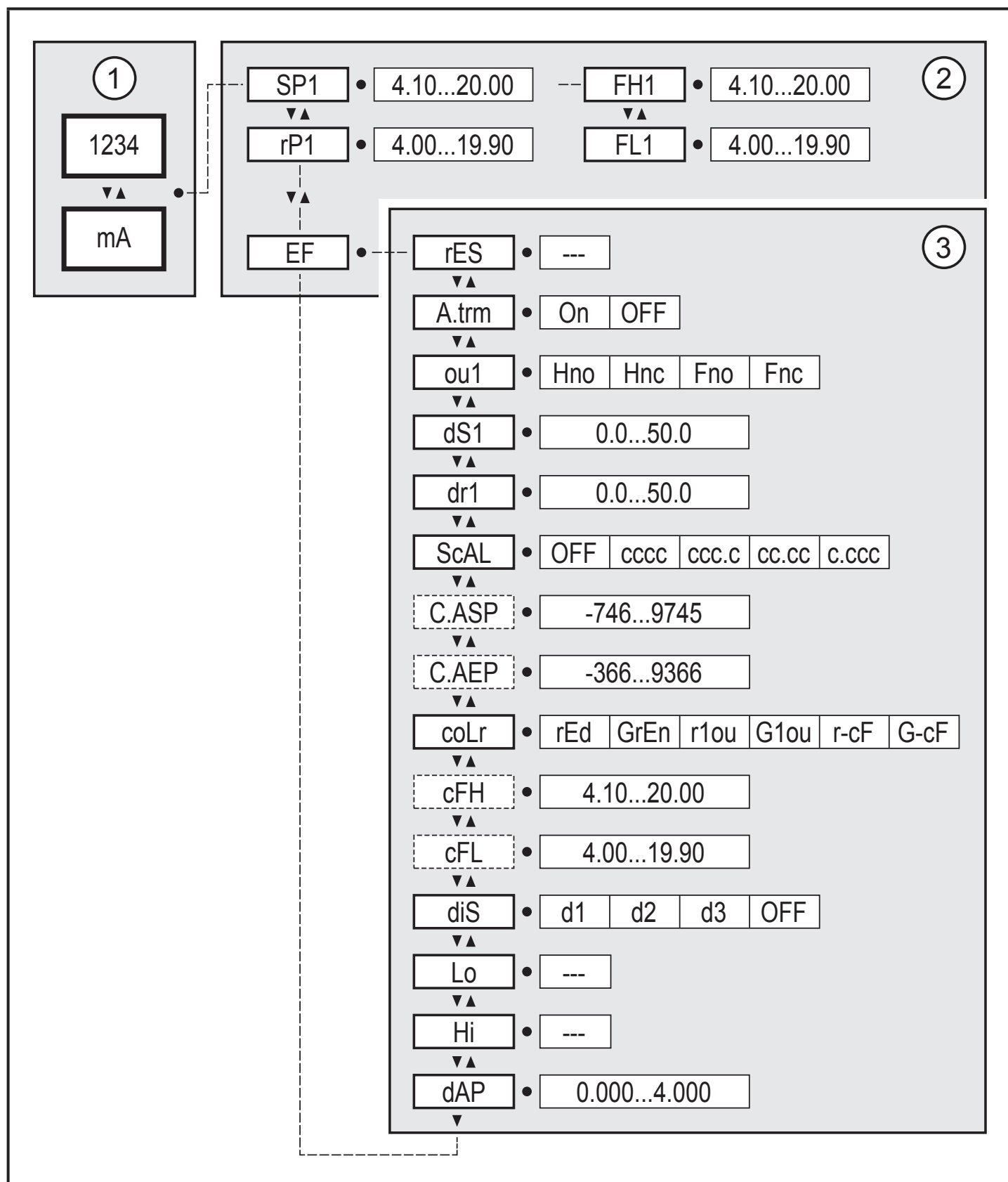
The scaling parameter ScAL only influences the display and not the transferred process data or the actual switching threshold values.

Via IO-Link the current value is always transferred in μA (→ 4.3.1 Representation of the measured current value). The switching thresholds can be set in steps of 0.01 mA.



If a scaling is set, the menu settings of the switching thresholds (SP, rP etc.) are also scaled. Via IO-Link, however, the settings continue to be displayed and executed in steps of 0.01 mA (resolution 14 bits).

8.2 Menu structure



1: Operating mode (→ 7)

2: Main menu (→ 8.3)

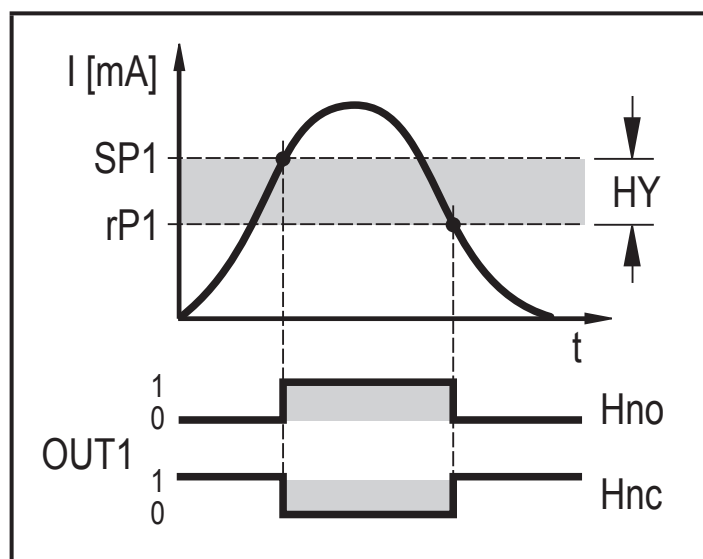
3: Extended functions (→ 8.4)

Parameter list and factory settings (→ 14)

8.3 Parameters of the main menu

8.3.1 SP1/rP1 – set point/reset point OUT1

Upper/lower limit for measuring current at which OUT1 switches with hysteresis setting. Only displayed if the hysteresis function [Hno] or [Hnc] is set in [ou1].



SP: Set point
rP: Reset point
HY: Hysteresis
Hno: Hysteresis function normally open
Hnc: Hysteresis function normally closed

Hysteresis functions

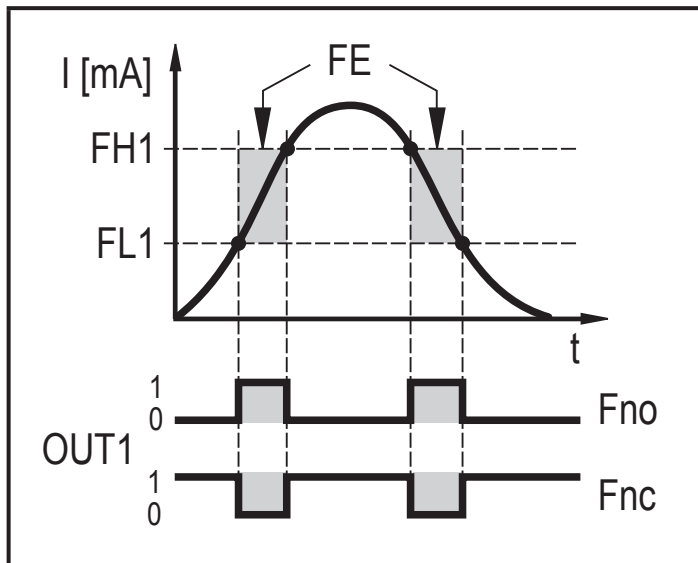
- Select [SP1] and set the value at which output OUT1 is set.
- Select [rP1] and set the value at which output OUT1 is reset.

 [rP1] is always lower than [SP1]. The device only accepts values which are lower than the value for [SP1].

 [rP1] follows the changes of [SP1] and keeps the set hysteresis.

8.3.2 FH1/FL1 – min/max switching limits for window function

Upper/lower limit for measuring current at which OUT1 switches within the window setting. The parameters are only displayed if the window function [Fno] or [Fnc] is set in [ou1].



FH: Window upper value

FL: Window lower value

FE: Window

Fno: Window function normally open

Fnc: Window function normally closed

Window functions

► Select [FH1] and set the upper limit value.

► Select [FL1] and set the lower limit.



[FL1] is always lower than [FH1]. The device only accepts values which are lower than the value for [FH1].



[FL1] follows the changes of [FH1] and keeps the set hysteresis.

8.3.3 EF – extended functions

The parameter opens the extended functions menu.

(→ 9.3.3 Change from the main menu to the extended functions menu)

8.4 Parameters of the extended functions (EF)

8.4.1 rES – restore factory setting

Resets all parameters to the factory setting (→ 14).

- ▶ Select [rES].
- ▶ Press [●].
- ▶ Press and hold [▲] or [▼] until [----] is displayed.
- ▶ Briefly press [●].

8.4.2 A.trm – analogue termination for OUT2

- [OFF] = OUT2 is externally connected, e.g. to the analogue input of another device.
- [On] = OUT2 is not connected and the current path is terminated internally.



Note the following for proper current measurement and evaluation:

If the internal analogue termination is set to [On], output OUT2 must not be connected.

8.4.3 ou1 – output function for OUT1

Switching signal for the current limits.

See also (→ 8.3.1) and (→ 8.3.2).

- [Hno] = hysteresis function / normally open
- [Hnc] = hysteresis function / normally closed
- [Fno] = window function / normally open
- [Fnc] = window function / normally closed

8.4.4 dS1/dr1 – switching delay/switch-off delay for OUT1

Value: 0.0...50.0 s (0.0 = delay time is not active)

8.4.5 ScAL – scaling of the displayed value

The setting acts like a multiplier for the parameters [C.ASP/C.AEP].

- [OFF] = measured current value is not scaled.
- [cccc] = scaling without decimal place (x 0001).
- [ccc.c] = scaling with 1 decimal place (x 000.1).
- [cc.cc] = scaling with 2 decimal places (x 00.01).
- [c.ccc] = scaling with 3 decimal places (x 0.001).

8.4.6 C.ASP/C.AEP - customer-specific analogue start/end point

Settings for scaled display values.

The parameters are only displayed when [ScAL] is set to [cccc], [ccc.c], [cc.cc] or [c.ccc].

C.ASP value: -746 ... 9745 corresponds to 4 mA.

C.AEP value: -366 ... 9366 corresponds to 20 mA.



If a scaling is set via [ScAL], the C.AEP value also has to be adapted accordingly:

With [ScAL] = [ccc.c] → C.AEP value x 10

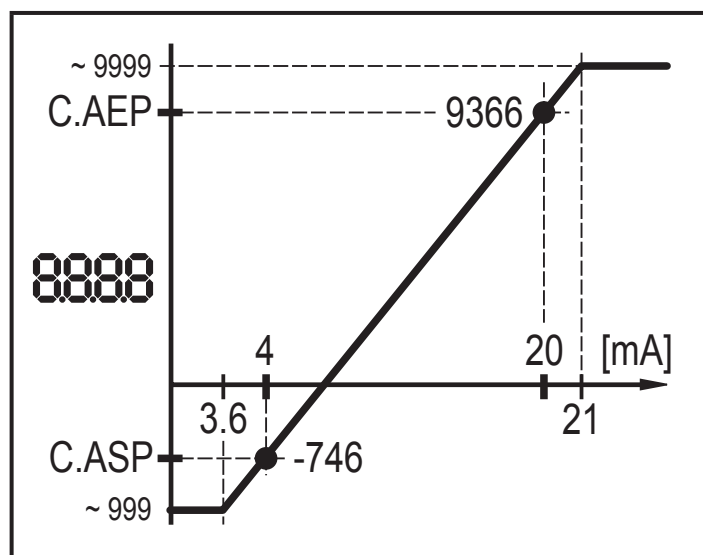
With [ScAL] = [cc.cc] → C.AEP value x 100

With [ScAL] = [c.ccc] → C.AEP value x 1000

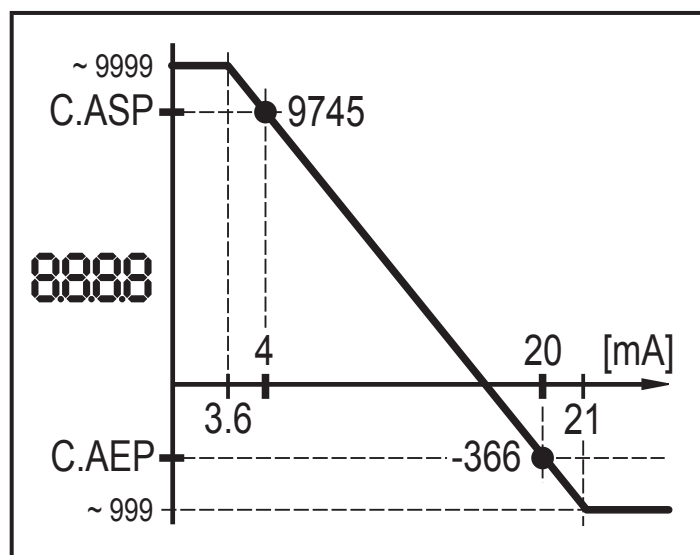


All displayed current values are interpolated based on a 2-point approximation ([SP1]+[rP1], [FH1]+[FL1], [cFH]+[cFL], [Lo]+[Hi]).

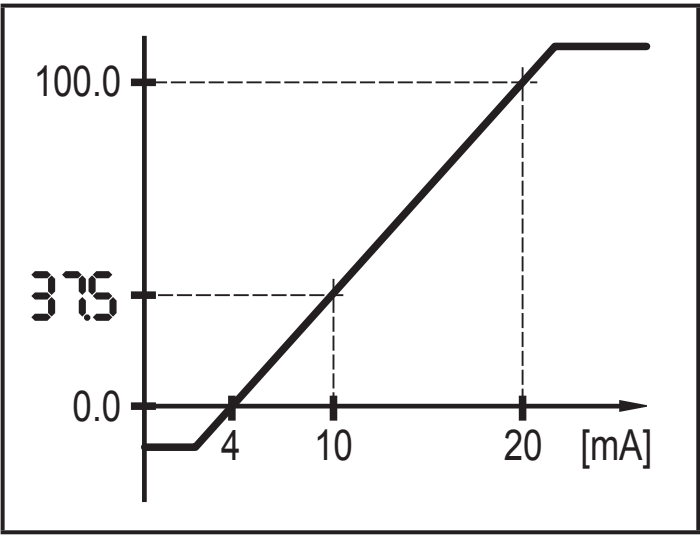
IO-Link process data and parameters are not influenced by scaling.



C.ASP = min. value
C.AEP = max. value



C.ASP = max. value
C.AEP = min. value



| Menu setting example | |
|----------------------|-------|
| ScAL | ccc.c |
| C.ASP | 0.0 |
| C.AEP | 100.0 |
| Input | 10 mA |
| Display | 37.5 |

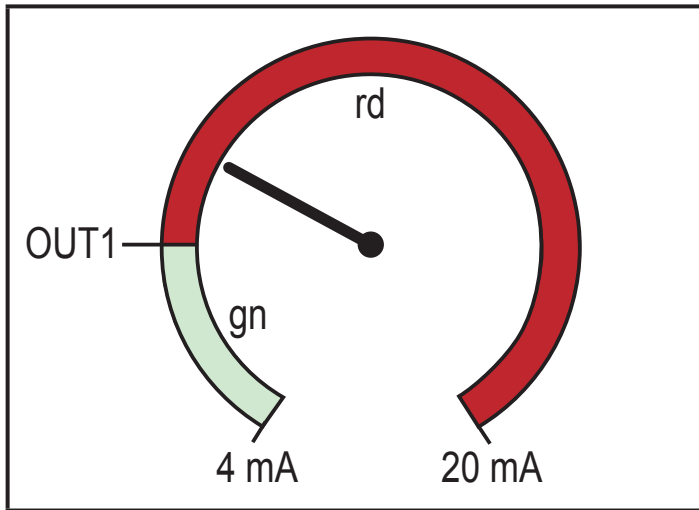
UK

Example with scaled display value

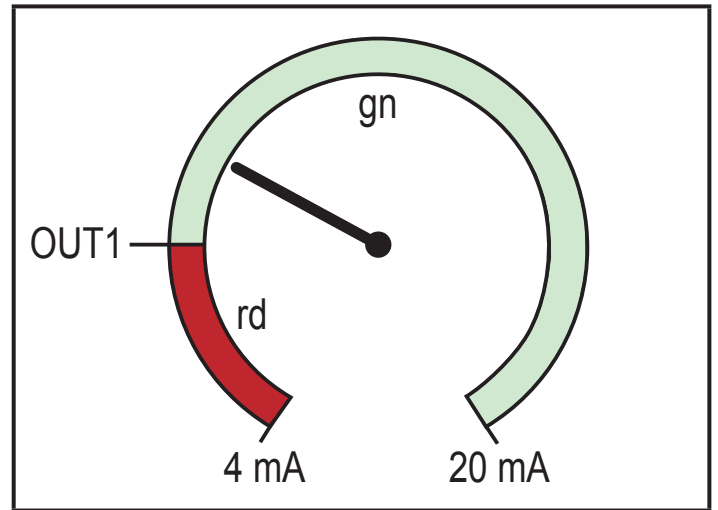
8.4.7 coLr – display colours and colour changes

Assignment of the display colours "red" and "green" within the measuring range.

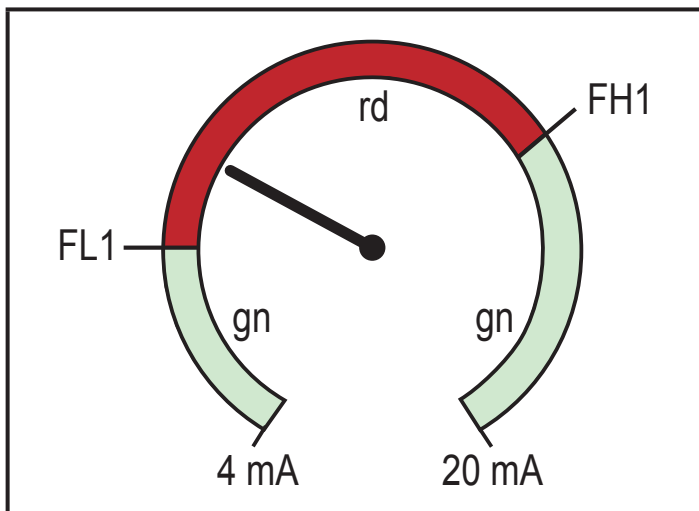
- [rEd] = continously red (independent of the measured value).
- [GrEn] = continously green (independent of the measured value).
- [r1ou] = red when OUT1 switches.
- [G1ou] = green when OUT1 switches.



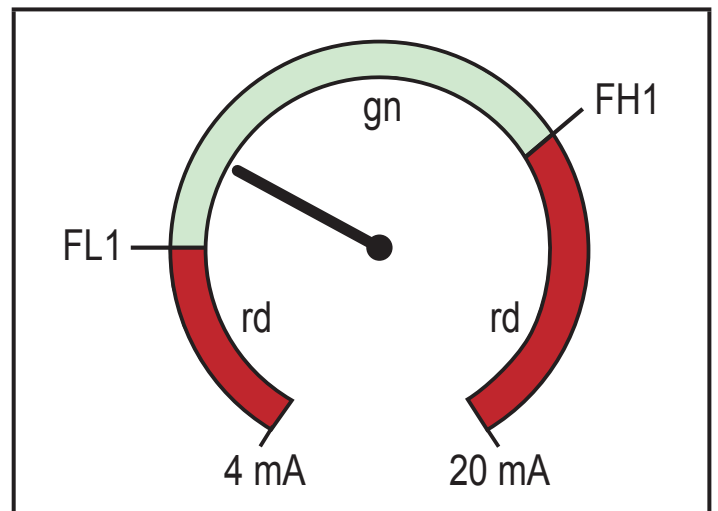
Hysteresis function with [r1ou]



Hysteresis function with [G1ou]



Window function with [r1ou]



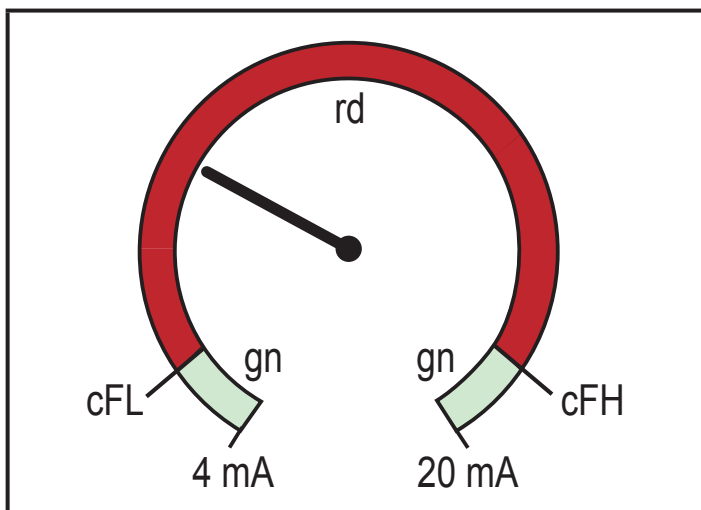
Window function with [G1ou]

- [r-cF] = red when the measured value is between the values [cFL] and [cFH].
- [G-cF] = green when the measured value is between the values [cFL] and [cFH].

8.4.8 cFH/cFL – upper/lower value for colour change

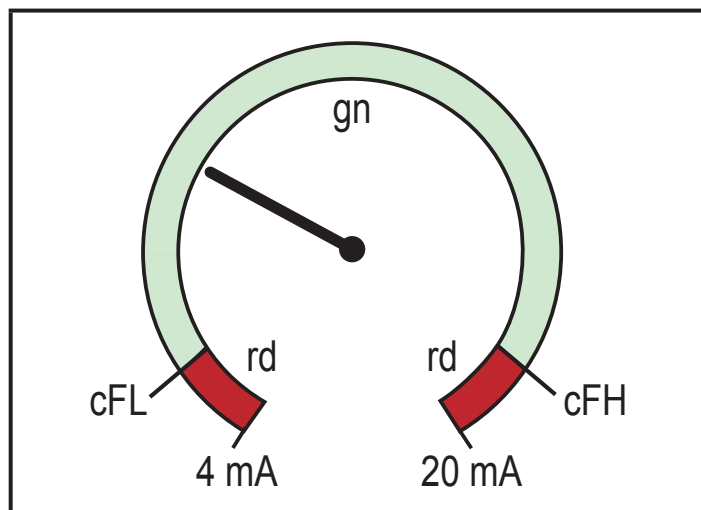
If [coLr] is set to [r-cF] or [G-cF]:

- ▶ Select [cFH] and set the upper limit.
Setting range corresponds to the measured values. The lowest setting value is [cFL].
- ▶ Select [cFL] and set the lower limit.
Setting range corresponds to the measured values. The highest setting value is [cFH].



Function [r-cF]

For b/w printouts: gn = green, rd = red



Function [G-cF]

8.4.9 diS – refresh rate of the displayed value

- [OFF] = the measured value display is deactivated in the operating mode.
- [d1] = update of the measured values every 50 ms.
- [d2] = update of the measured values every 200 ms.
- [d3] = update of the measured values every 600 ms.



Even with an unsteady current value, [d1] provides optimum readability.

8.4.10 Lo/Hi – min/max measured input values

- [Lo] = minimum measured value
- [Hi] = maximum measured value

Delete memory:

- ▶ Select [HI] or [Lo].
- ▶ Press and hold [▲] or [▼] until [----] is displayed.
- ▶ Briefly press [●].

8.4.11 dAP – damping

Damping of the measured analogue value.

Setting also influences the set point, the IO-Link process data and the display.

Value: 0.000...4.000 s (T value: 63 %).

At 0.000 damping is not active.

8.5 Parameters via IO-Link

The following functions or parameters are only available via IO-Link tools.

8.5.1 C.uni – customer-specific unit

Customer-specific unit with max. 4 characters.

8.5.2 S.Loc – software locking

Value: ON/OFF

The device is locked for local menu settings.



Unlocking only via IO-Link.

8.5.3 Application-specific tag

Customer-specific application description, max. 32 characters long.

Value: “ *** ” / can be freely defined by the customer

8.5.4 Reset [Hi] and [Lo] memory

Reset of both memories: [Hi] and [Lo].

9 Parameter setting



During parameter setting the device remains in the operating mode. It continues its monitoring functions with the existing parameters until the parameter setting has been completed.

9.1 Parameter setting in general

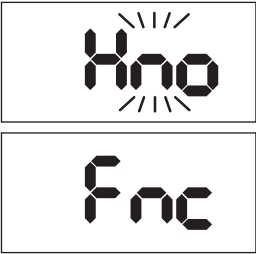


Each parameter setting consists of 6 steps:

| Step | Button |
|---|------------------|
| 1 Change from operating mode to parameter setting mode. | [●] |
| 2 Select the requested parameter [SP1], [rP1] etc. | [▼] or [▲] |
| 3 Change to the programming mode of the parameter. | [●] |
| 4 Select or change the parameter value. | [▼] or [▼] > 2 s |
| 5 Acknowledge the set parameter value. | [●] |
| 6 Return to the operating mode. | [esc] |

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9.2 Programming example [ou1] – output function for OUT1

| Step | Display |
|---|---------|
| 1 Change from operating mode to parameter setting mode. | |
| ▶ Press [●] to get to the menu. > The first parameter is displayed. | SP 1 |
| 2 Select the requested parameter, here [ou1]. | |
| ▶ Press [▼] until [EF] is displayed. | EF |
| ▶ Press [●] to get to the extended functions menu. > The first parameter of the extended functions is displayed. | rES |
| ▶ Press [▼] until the requested parameter [ou1] is displayed. | ou 1 |
| 3 Change to the programming mode of the parameter. | |
| ▶ Press [●] to change to the programming mode. > The currently set parameter value is displayed. | Hno |

| | |
|--|---|
| <p>4 Select or change the parameter value (here e.g. [Fnc]).</p> <ul style="list-style-type: none"> ▶ Press [▼] or [▲] for min. 2 s. > The currently set parameter value flashes (here e.g. [Hno]). > After 2 s.: <ul style="list-style-type: none"> - value is changed continuously by keeping the button pressed. - value is changed incrementally by pressing the button once. <p>Numerical values (→ 9.3.4)</p> |  |
| <p>5 Acknowledge the set parameter value.</p> <ul style="list-style-type: none"> ▶ Briefly press [•]. > The parameter is displayed again. > The new setting value is saved. |  |
| <p>Setting of other parameters:</p> <ul style="list-style-type: none"> ▶ Press [▼] or [▲] until the requested parameter is displayed. | |
| <p>6 Return to the operating mode.</p> <ul style="list-style-type: none"> ▶ Press [esc]. <ul style="list-style-type: none"> - Press [▼] or [▲] several times until the current measured value is displayed. - Or wait for the timeout function (approx. 30 s). > The device is again in the operating mode. > The current value is displayed. |  |

9.3 Notes on programming

9.3.1 Lock / unlock

The device can be locked electronically to prevent unauthorised setting. Set parameter values and settings can be displayed but not changed.

To lock the device:

- ▶ Make sure that the device is in the normal operating mode.
- ▶ Press [esc] + [▲] simultaneously for 10 s.
- > [Loc] is displayed.
- > Device is locked.
- > [Loc] is briefly displayed if you try to change parameter values.

For unlocking:

- ▶ Press [esc] + [▲] simultaneously for 10 s.
- > [uLoc] is displayed.

On delivery the device is not locked.



Customer locking

If [C.Loc] is displayed when an attempt is made to modify a parameter value, an IO-Link communication is active (temporary locking).



Software locking

If [S.Loc] is displayed, the sensor is permanently locked via software. This locking can only be removed with an IO-Link parameter setting software.

9.3.2 Timeout

If no button is pressed for 30 s during parameter setting, the device returns to the operating mode with the unchanged value.

UK

9.3.3 Change from the main menu to the extended functions menu

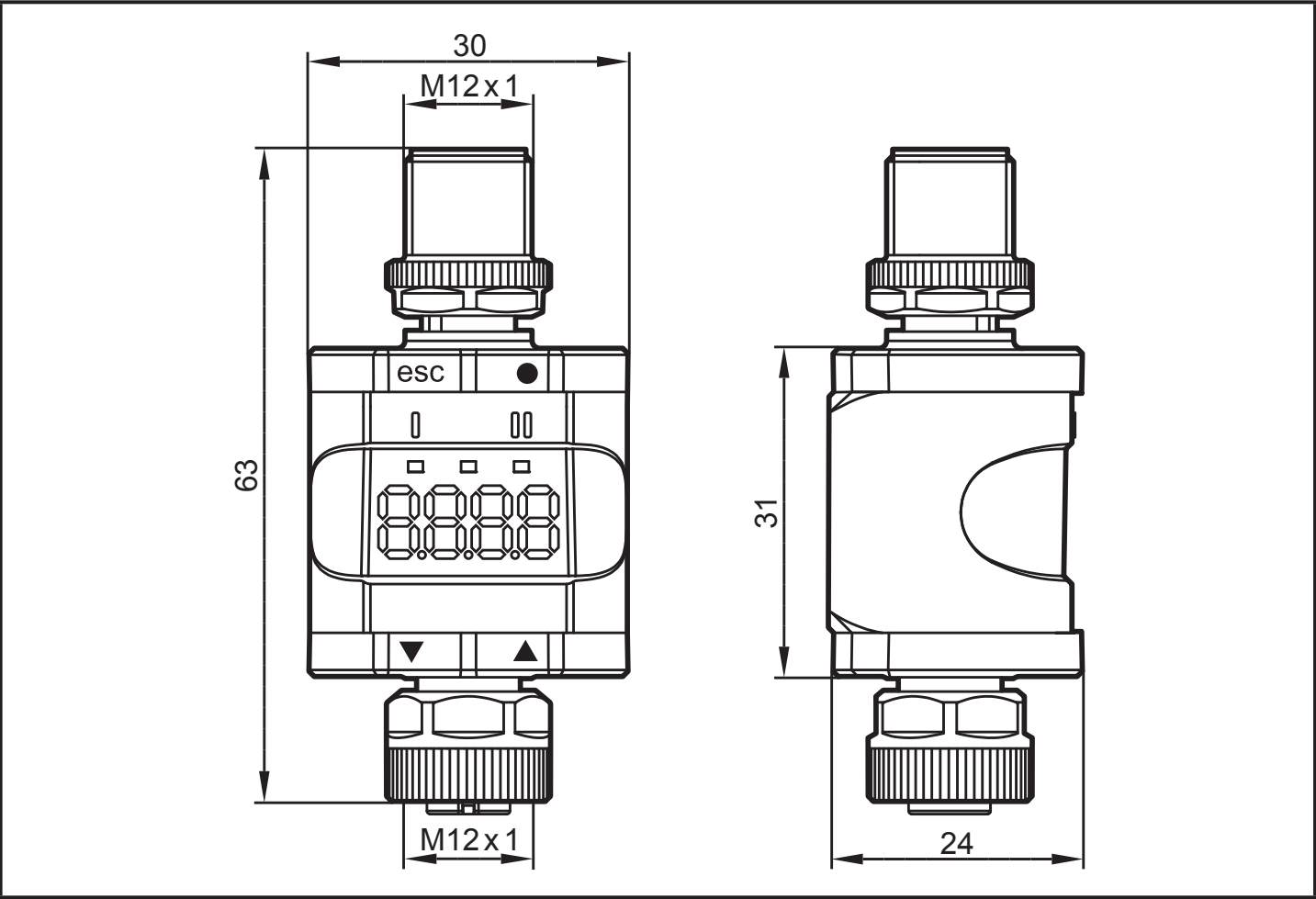
- ▶ Press [●] to get to the menu.
- ▶ Press [▲] or [▼] until [EF] is displayed.
- ▶ Press [●].
- > The first parameter of the extended functions menu is displayed ([rES]).

9.3.4 Numerical entries with [▼] or [▲]

- ▶ Press [▲] or [▼] for minimum 2 s.
- > After 2 s:
 - value is changed continuously by keeping the button pressed.
 - value is changed incrementally by pressing the button once.

Value is incrementally reduced with [▼] and increased with [▲].

10 Scale drawing



Dimensions [mm]

11 Technical data

| | | |
|-----------------------------|--------|---|
| Operating voltage DC | [V] | 18...30 |
| Nominal voltage DC | [V] | 24 |
| Power consumption | [W] | ≤ 1 |
| Auxiliary supply for sensor | [V] | from the operating voltage |
| Current for sensor | [mA] | ≤ 800 |
| Sensor type | | sensor with analogue current output: 4...20 mA 2-wire or 3-wire sensor |
| Accuracy | [% FS] | 0.5 |
| Protection rating | | IP 67 * |
| Ambient temperature | [°C] | -25...60 ** |
| Storage temperature | [°C] | -25...70 |

| | | |
|------------------------------|-------|---|
| Max. perm. relative humidity | [%] | 90 (31 °C) linearly decreasing to 50 (40 °C) non condensing |
| Maximum operating altitude | [m] | 2000 above sea level |
| Permissible air pressure | [hPa] | 750...1060 |
| Connectors | | M12 connector, 4-pole M12 socket, 5-pole |

*) With screwed and firmly tightened M12 connectors
(→ 6 Electrical connection)

**) For IO-Link operating mode and turned off display: -25...70 °C

UK

11.1 IO-Link device

| | | |
|--|------|--------------------|
| Transmission type | | COM2 (38.4 kbaud) |
| IO-Link revision | | 1.1 |
| SDCI standard | | IEC 61131-9 |
| IO-Link device ID | | 610 d / 00 02 62 h |
| SIO mode | | yes |
| Input load current at input C/Q to V0 (ILL) | [mA] | 50 |
| Required master port type | | A |
| Process data analogue | | IN: 1 |
| Process data binary | | IN: 1 |
| Min. process cycle time | [ms] | 3.2 |

11.2 Approvals/standards

EC declarations of conformity, approvals etc. can be downloaded at:
www.ifm.com

11.2.1 Reference to UL

The electrical supply must only be made via SELV/PELV circuits.

Supply of the device to limited energy according to chapter 9.4 UL 61010-1.

The external circuits have to be isolated as required by figure 102 in UL 61010-2-201.

The device is designed to be safe at least under the following conditions:

- Indoor use
- Altitude up to 2000 m
- Maximum relative humidity 90% RH, non-condensing
- Pollution degree 3
- For connecting the device and the IO-Link devices use UL certificated cables of category CYJV 2/7/8 having suitable ratings.
- IP class was not evaluated by UL.
- No special treatment is needed during cleaning the device.

12 Fault correction

| Display | LED | | Error | Fault correction |
|---------|-----|-------|--|--|
| | I | Power | | |
| OFF | ○ | ○ | Supply voltage too low. | Check/correct the supply voltage (→ 6) and (→ 11). |
| SC1 | ✕ | -- | Excessive current at switching output OUT1. | Check switching output OUT1 for short-circuit or excessive current. Remove the fault. |
| C.Loc | -- | -- | Parameter setting via pushbuttons locked due to active IO-Link transmission. | Wait until parameter setting via IO-Link is finished. |
| S.Loc | -- | -- | Parameter setting via pushbuttons disabled by software. | Unlocking only possible via IO-Link interface/IO-Link parameter setting software. |
| Loc | -- | -- | Parameter setting via pushbuttons disabled. | Unlock buttons (→ 9.3.1). |
| OL | -- | ● | Process value too high (measured current > 21 mA). | Check connected sensor and current range (→ 4.3.1). Check the setting for internal or external analogue termination for OUT2 (→ 8.4.2). |
| UL | -- | ● | Process value too low (measured current < 3.6 mA). | |
| nPrb | -- | ● | No sensor connected to the analogue input. | |

Legend:

- off
- on
- ✕ flashing
- any

UK

13 Maintenance, repair, disposal

13.1 Maintenance

The device is maintenance-free.

13.2 Cleaning the housing surface

- ▶ Disconnect the device.
- ▶ Clean the device from dirt using a soft, chemically untreated and dry cloth.



Micro-fibre cloths without chemical additives are recommended.

13.3 Repair

The device must only be repaired by the manufacturer.

- ▶ Observe the safety instructions.

13.4 Disposal

- ▶ Dispose of the device in accordance with the national environmental regulations.

14 Parameter list and factory settings

| Parameter | | Factory settings | User settings |
|----------------|--|----------------------|---|
| SP1/FH1 | Set point OUT1 | 6.00 | |
| rP1/FL1 | Reset point OUT1 | 5.00 | |
| A.trm | Analogue termination OUT2 | On | <input type="checkbox"/> OFF <input type="checkbox"/> On |
| ou1 | Output function OUT1 | Hno | <input type="checkbox"/> Hno <input type="checkbox"/> Hnc <input type="checkbox"/> Fno <input type="checkbox"/> Fnc |
| dS1 | Switching delay OUT1 | 0.0 s | |
| dr1 | Switch-off delay OUT1 | 0.0 s | |
| ScAL | Scaling value | OFF | <input type="checkbox"/> OFF <input type="checkbox"/> cccc <input type="checkbox"/> ccc.c <input type="checkbox"/> cc.cc <input type="checkbox"/> c.ccc |
| C.ASP | Customised analogue start point | ---- | |
| C.AEP | Customised analogue end point | ---- | |
| C.uni * | Customised unit | mA | |
| coLr | Colour display | rEd | <input type="checkbox"/> rEd <input type="checkbox"/> GrEn <input type="checkbox"/> r1ou <input type="checkbox"/> G1ou <input type="checkbox"/> r-cF <input type="checkbox"/> G-cF |
| cFH | Colour change, upper limit value | 20.00 | |
| cFL | Colour change, lower limit value | 4.00 | |
| diS | Display refresh rate | d2 (200 ms) | <input type="checkbox"/> OFF <input type="checkbox"/> d1 (50 ms) <input type="checkbox"/> d2 (200 ms) <input type="checkbox"/> d3 (600 ms) |
| Lo | Lower measured input value | ---- | |
| Hi | Upper measured input value | ---- | |
| dAP | Damping of the measured analogue value | 0.060 s (= 60 ms) | |

*) can only be configured via IO-Link and parameter setting software (→ 8.5)



Level



Pressure



Flow



Temperature



Liquid
Analysis



Registration



Systems
Components



Services



Solutions

Operating Instructions

Chloromax CCS142D

Digital sensor with Memosens technology for
measurement of free chlorine

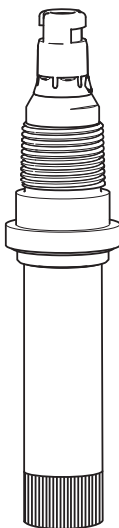


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1 Safety instructions

1.1 Designated use

Oxidizing agents such as chlorine or anorganic chlorine compounds are used for disinfection of water. Their dosing must be carefully controlled to suit the application. Too low a concentration makes the degree of disinfection questionable. Too high a concentration increases the costs and can result in corrosion effects, impairment of taste or skin irritation.

The sensor has been specially designed for this purpose. It is used for continuous measurement of free chlorine in water.

When used in connection with a measurement and control system, it permits the optimum disinfection status to be maintained.

Any other use than the one described here compromises the safety of persons and the entire measuring system and is not permitted.

The manufacturer is not liable for damage caused by improper or non-designated use.

1.2 Installation, commissioning and operation

Please note the following items:

- Installation, commissioning, operation and maintenance of the measuring system must only be carried out by trained technical personnel.
Trained personnel must be authorized for the specified activities by the system operator.
- Electrical connection must only be carried out by a certified electrician.
- Technical personnel must have read and understood these Operating Instructions and must adhere to them.
- Before commissioning the entire measuring point, check all the connections. Ensure that electrical cables and hose connections are not damaged.
- Do not operate damaged products and secure them against unintentional commissioning. Mark the damaged product as being defective.
- Measuring point faults may only be rectified by authorized and specially trained personnel.
- If faults can not be rectified, the products must be taken out of service and secured against unintentional commissioning.
- Repairs not described in these Operating Instructions may only be carried out at the manufacturer's or by the service organization.

1.3 Operational safety

The sensor has been designed and tested according to the state of the art and left the factory in perfect functioning order.

Relevant regulations and European standards have been met.

As the user, you are responsible for complying with the following safety conditions:

- Installation instructions
- Local prevailing standards and regulations.

1.4 Return

If the sensor has to be repaired, please return it *cleaned* to the sales center responsible. Please use the original packaging, if possible.

Before returning the device, please clarify all formalities – such as obtaining an identification number – with your sales center.





Please enclose the completed "Declaration of Hazardous Material and De-Contamination" (copy the second last page of these Operating Instructions) with the packaging and the transportation documents.

No repair without completed declaration!




1.5 Notes on safety icons and symbols

1.5.1 Safety icons

The structure, signal words and safety colors of the signs comply with the specifications of ANSI Z535.6 ("Product safety information in product manuals, instructions and other collateral materials").

| Safety message structure | Meaning |
|---|---|
|  DANGER Cause (/consequences) Consequences if safety message is not heeded ► Corrective action | This symbol alerts you to a dangerous situation. Failure to avoid the situation will result in a fatal or serious injury. |
|  WARNING Cause (/consequences) Consequences if safety message is not heeded ► Corrective action | This symbol alerts you to a dangerous situation. Failure to avoid the situation can result in a fatal or serious injury. |
|  CAUTION Cause (/consequences) Consequences if safety message is not heeded ► Corrective action | This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury. |
|  NOTICE Cause/situation Consequences if safety message is not heeded ► Action/note | This symbol alerts you to situations that can result in damage to property and equipment. |

1.5.2 Document symbols

-  Additional information, tips
-  Permitted or recommended
-  Forbidden or not recommended

2 Identification

2.1 Product structure

| | | | | | |
|----------|--|--|---|---|---------------------------------------|
| | | | | | Measuring range |
| | | | A | | 0.05 to 20 mg/l (0.05 to 20 ppm) |
| | | | G | | 0.01 to 5 mg/l (0.01 to 5 ppm) |
| | | | | | Approval |
| | | | A | | Non-hazardous area |
| | | | | | Sensor head type |
| | | | S | | Thread NPT 3/4, Memosens plug-in head |
| | | | | | Cable length |
| | | | | 8 | Standard: without cable |
| | | | | | Accessories |
| | | | | 0 | None |
| CCS142D- | | | | | Complete order code |

2.2 Scope of delivery

The scope of delivery comprises:

- 1 chlorine sensor
- 1 bottle with electrolyte (50 ml)
- 1 replacement cartridge with pretensioned membrane
- 1 Operating Instructions in English

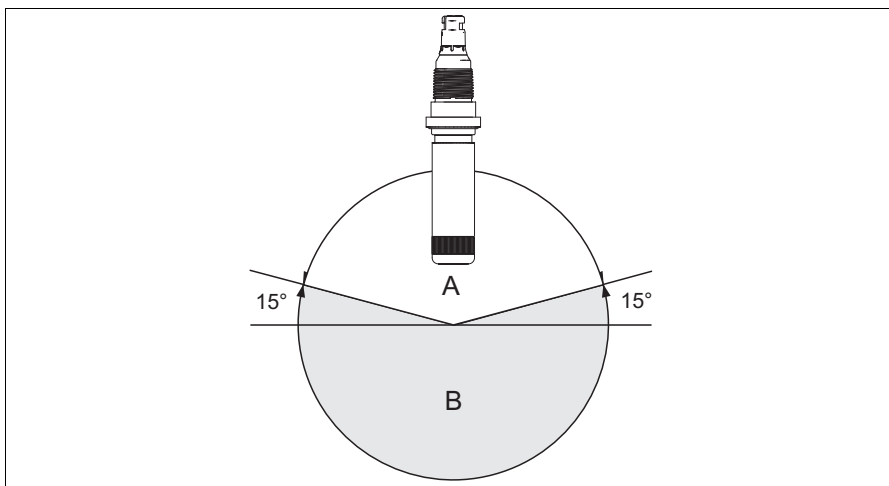
3 Installation

3.1 Incoming acceptance, transport, storage

- Make sure the packaging is undamaged!
Inform the supplier about any damage to the packaging.
Keep the damaged packaging until the matter has been settled.
- Make sure the contents are undamaged!
Inform the supplier about damage to the contents. Keep the damaged products until the matter has been settled.
- Check that the order is complete and agrees with your shipping documents.
- The packaging material used to store or to transport the product must provide shock protection and humidity protection. The original packaging offers the best protection. Also, keep to the approved ambient conditions (see "Technical data").
- If you have any questions, please contact your supplier or your local sales center.

3.2 Installation conditions

3.2.1 Installation position



a0008140

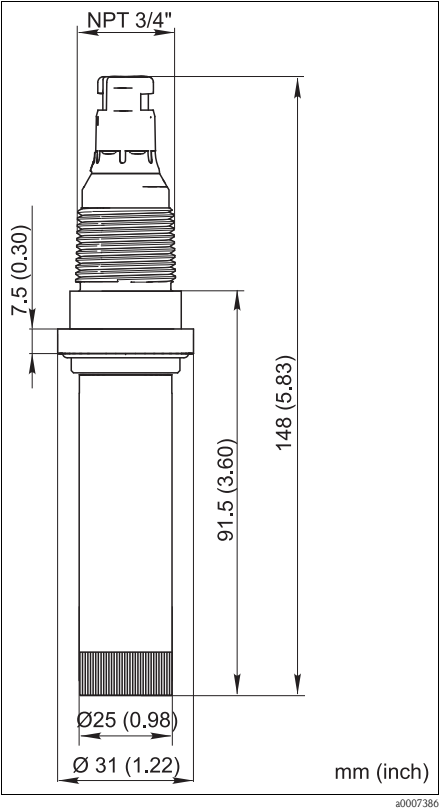
Fig. 1: Installation position

- A Permissible angle of installation
B Non-permissible angle of installation

The sensor must be installed with an angle of inclination of at least 15° to the horizontal in an assembly, support or a suitable process connection. Other angles are not permissible. Do **not** install the sensor overhead.

i Make sure you comply with the instructions for installing sensors. You will find them in the Operating Instructions for the assembly used.

3.2.2 Dimensions



3.3 Installation

3.3.1 Measuring system

A complete measuring system consists of:

- A CCS142D chlorine sensor
- An assembly, e.g. Flowfit CCA250
- A Memosens data cable CYK10
- A transmitter, e.g. Liquiline CM44x

Optional:

- RM junction box for cable extension
- When using the assembly CCA250: additional sensor(s), e.g. pH sensor CPS71D

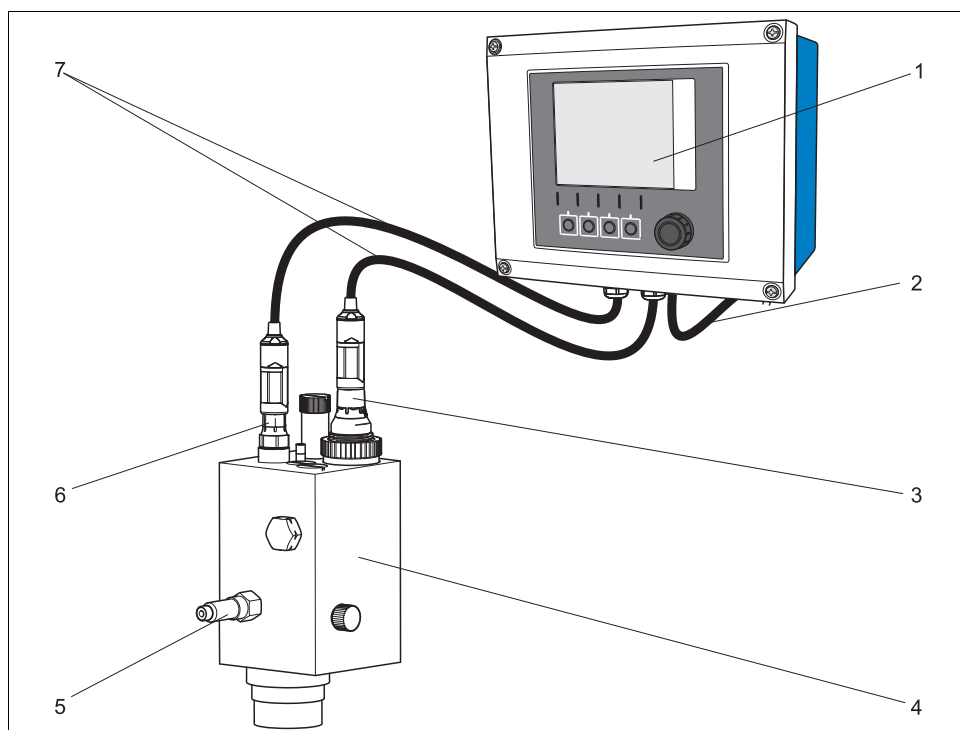


Fig. 3: Measuring system

- 1 Liquiline CM44x transmitter with weather protection cover
- 2 Power supply line for transmitter
- 3 CCS142D chlorine sensor
- 4 Flowfit CCA250 assembly
- 5 Inlet to assembly (outlet on rear, not shown in graphic)
- 6 CPS71D pH sensor
- 7 CYK10 measuring cable

3.3.2 Installation in CCA250 flow assembly

The flow assembly CCA250 is designed for on-site installation of the sensor. In addition to the chlorine or chlorine dioxide sensor, a pH and an ORP sensor can be installed. A needle valve regulates the flow within the range of 30 to 120 l/h (7.9 to 31.7 US.gal/h).

When installing the sensor, note the following:

- The flow must be at least 30 l/h (7.9 US.gal/h).
If the flow drops below this value or stops completely, this can be detected by an inductive proximity switch and an alarm signal plus locking of the dosage pumps can be triggered.
- If the medium is fed back into a surge tank, pipeline or the like, ensure that the thus generated back pressure on the sensor does not exceed 1 bar (14.5 psi) and remains constant.
- Negative pressure at the sensor, e.g. by feedback of medium to the suction side of a pump, must be avoided.

For further installation instructions, see the Operating Instructions of the flow assembly.

3.3.3 Installation in other flow assemblies

When using other flow assemblies than the CCA250 ensure the following:

- The flow velocity against the membrane is at least 15 cm/s (0.49 ft/s).
- The flow direction is upward so that carried bubbles are removed and do not collect in front of the membrane.
- The membrane is directly struck by the flow.

3.3.4 Installation in CYA112 immersion assembly

Alternatively, the sensor can be installed in an immersion assembly with threaded connection NPT ¾", e.g. CYA112.

Please note the following when installing the sensor:

- Hold the sensor securely in position and screw the assembly handtight onto the sensor. This prevents the cables from twisting and cable rupture.
- To improve the sealing effect, we recommend you wrap a thin PTFE tape around the thread for assemblies with an NPT ¾" thread.

Additional installation instructions can be found in the Operating Instructions for the assembly.

3.4 Post-installation check

- Check the membrane for leak tightness und replace it if necessary.
- Is the sensor installed in an assembly and is not suspended from the cable?

4 Wiring


⚠ WARNING

Device is energized

Inappropriate connection can cause serious injuries or death

- ▶ The electrical connection must only be carried out by a certified electrician.
- ▶ Technical personnel must have read and understood the instructions in this manual and must adhere to them.
- ▶ **Prior to beginning** any wiring work, make sure voltage is not applied to any of the cables.

4.1 Direct connection to the transmitter

Digital sensors with Memosens technology are connected via the CYK10 data transmission cable (→  4). For the wiring diagram refer to the Operating Instructions of the used transmitter.

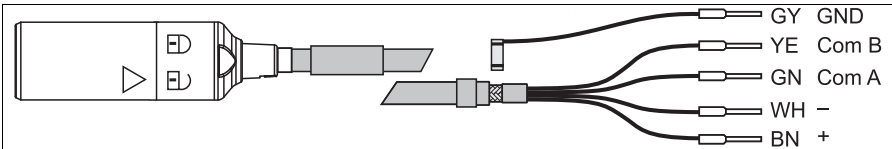


Fig. 4: CYK10 data transmission cable

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To extend the cable, an RM junction box and a CYK81 extension cable is required.

4.2 Connection via junction box

To extend the sensor cable, the connection has to take place using a junction box RM (→ Accessories). The extension to the transmitter is established by means of the CYK81 special measuring cable. The maximum permissible cable length is 100 m (328 ft).

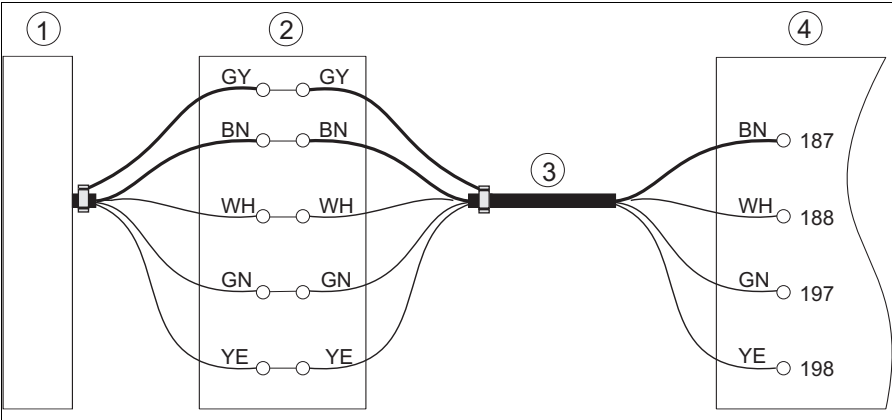


Fig. 5: Wiring diagram with junction box RM

- 1 Sensor
- 2 Junction box
- 3 Extension cable
- 4 Transmitter

4.3 Post-connection check

| Instrument status and specifications | Remarks |
|---|--|
| Are the sensor, assembly, junction box or cable damaged? | Visual inspection |
| Electrical connection | Remarks |
| Does the supply voltage of the transmitter match the specifications on the nameplate? | 24 V DC/AC/100 ... 230 V AC |
| Are the installed cables strain-relieved and not twisted? | |
| Is the cable type route completely isolated? | Power cable/weak current cable |
| Are the power supply and signal cable correctly connected to the transmitter? | Use the connection diagram of CM44x. |
| Are all the screw terminals properly tightened? | |
| Are all the cable entries installed, tightened and sealed? | For lateral cable entries: cable loops downwards for water to be able to drip off. |
| Are all the cable entries installed downwards or lateral? | |

5 Function

5.1 Sensor design

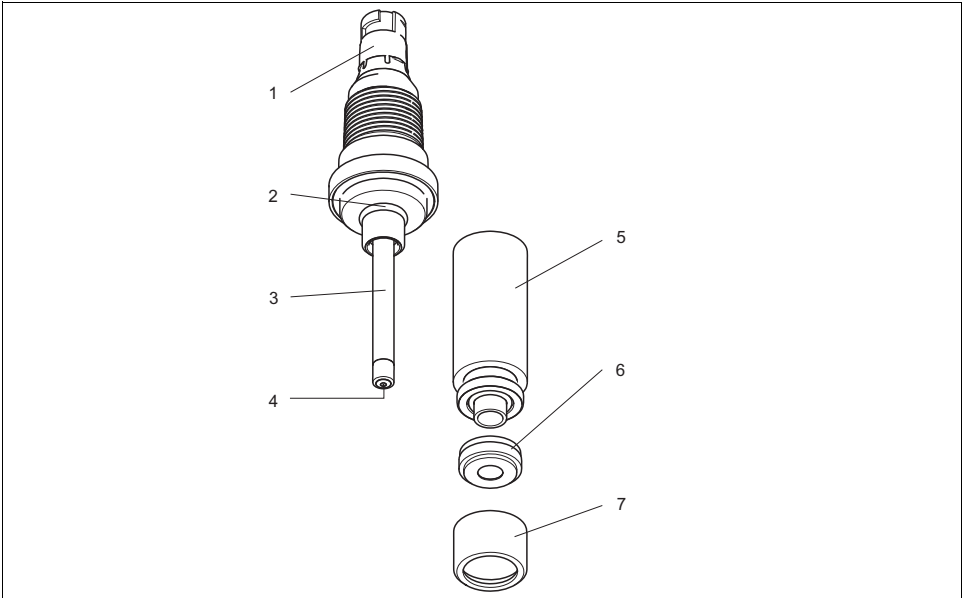


Fig. 6: Sensor design

| | | | |
|---|-------------------------------------|---|---|
| 1 | Memosens plug-in head | 5 | Measuring chamber |
| 2 | O-ring | 6 | Membrane cap with dirt-repellent membrane |
| 3 | Large anode, silver/silver chloride | 7 | Scew cap for fixing the membrane cap |
| 4 | Gold cathode | | |

The sensor consists of the following function units:

- Measuring chamber
 - for protection of anode and cathode from medium
 - with large electrolyte volume guaranteeing a long service life in combination with the large anode and the small cathode
- Sensor shaft with
 - large anode
 - cathode embedded in plastic
 - temperature sensor
- Membrane cap with
 - robust PTFE membrane
 - special support grid between cathode and membrane for a specified and constant electrolyte film and thus a relatively constant indication even at varying pressures and flows

5.2 Operating principle

5.2.1 Measuring principle

The concentration of free chlorine is determined according to the amperometric measuring principle. The hypochlorous acid (HOCl) contained in the medium diffuses through the sensor membrane and is reduced to chloride ions (Cl^-) on the gold cathode. On the silver anode, silver is oxidized to silver chloride. The electron release of the gold cathode and electron acceptance on the silver anode result in a current flow which is proportional to the free chlorine concentration in the medium under constant conditions. The concentration of hypochlorous acid in the medium depends on the pH value. This dependence can be compensated by measuring the pH value in the flow assembly.

The transmitter transforms the current signal into the measuring unit concentration in mg/l.

5.2.2 Influences on the measuring signal

pH dependence of measurement of free chlorine

Molecular chlorine (Cl_2) has pH values of < 4 . Hypochlorous acid (HOCl) and hypochlorite (OCl^-) remain within the range of pH 4 to 11 as components of free chlorine. As hypochlorous acid dissociates with an increasing pH value to form hypochlorite ions (OCl^-) and hydrogen ions (H^+), the amounts of the individual components in free chlorine change with the pH value (Fig. 7). For example, if the amount of hypochlorous acid is 97% at pH 6, it drops to about 3% at pH 9.

Hypochlorous acid has a highly disinfecting effect in an aqueous solution but the disinfecting effect of hypochlorite is extremely low. Therefore, chlorine is not suitable as a disinfecting agent at high pH values.

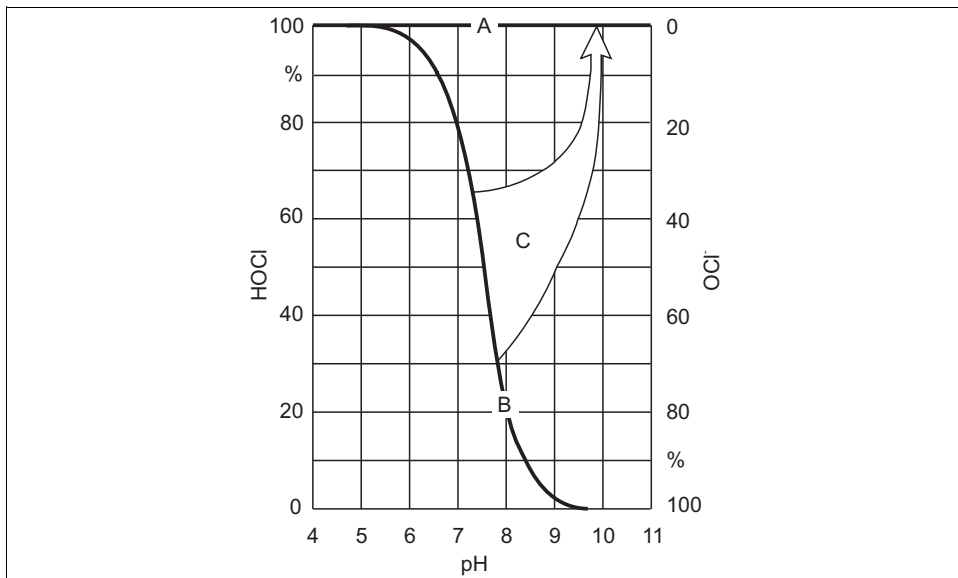


Fig. 7: Schematic diagram of pH compensation

- A Measured value **with** pH compensation
 B Measured value **without** pH compensation
 C pH compensation

CCS142D chlorine sensors selectively measure the amount of hypochlorous acid in amperometric measurement. They do not measure the amount of hypochlorite ions because these ions do not permeate through the sensor membrane.

pH compensation of chlorine sensor signal for free chlorine

To calibrate and inspect the chlorine measuring system, a colorimetric reference measurement must be carried out using the DPD method. Free chlorine reacts with diethyl-p-phenylenediamine and forms a red dye. The intensity of the red pigmentation increases proportionally to the chlorine content. In the DPD method the measuring water is constantly buffered to a pH value of about 6.3. Therefore, the pH value of the measuring water is not included in the DPD measurement. Due to the buffer function in the DPD method, all components of free chlorine are detected and thus the total free chlorine is measured.

If you select pH compensation in the transmitter, the sum of hypochlorous acid and hypochlorite corresponding to the DPD measurement is calculated from the hypochlorous acid measured by the sensor and the pH value in the region of pH 4 to 9. For this calculation, the curve shown in Fig. 7 is stored in the transmitter.

Note! When free chlorine is measured with the pH compensation function on, always perform calibration in the pH-compensated operating mode.

When you use pH compensation, the measured chlorine value displayed and applied to the instrument output corresponds to the DPD measured value even if the pH values fluctuate. If you do not use pH compensation, the measured chlorine value only corresponds to the DPD measurement if the pH value remains unchanged compared with the calibration. Without pH compensation the chlorine measuring system must be recalibrated when the pH value changes.

Accuracy of pH compensation

The accuracy of the pH compensated measured chlorine value depends on the sum of several single measured deviations (chlorine, pH, temperature, DPD measurement etc.). High amounts of hypochlorous acid (HOCl) during chlorine calibration have positive effects on the accuracy whereas low amounts of hypochlorous acid have negative effects. Inaccuracy of the pH compensated chlorine value increases the bigger the pH difference between operation and calibration gets or the more inaccurate the single measured values are.

Calibration of free chlorine measurement taking into account the pH value

The reference measurement (DPD method, photometer) determines the complete free chlorine by buffering to pH 6.3. In contrast to this, amperometric measurement only determines the HOCl components. The pH compensation causes the HOCl value to be increased to the actual value of free chlorine. During operation, pH compensation is active up to a pH value of 9. Since there is hardly any HOCl left at this pH value and the measured current is very low, calibration of the complete measuring system makes sense only up to a pH value of the medium of 8 or 8.2.

| Sensor | pH value | HOCl content | Uncompensated value | Compensated value |
|-----------|----------|--------------|---------------------|-------------------|
| CCS142D-G | 8.2 | 15 % | 12 nA | 80 nA |
| CCS142D-A | 8 | 20 % | 4 nA | 20 nA |

Above these pH values the total measured error of the measuring system is unacceptable.

Flow

The membrane-covered sensor requires a minimum flow velocity of 15 cm/s (0.5 ft/s) in order to function properly. When using the CCA250 flow assembly, this value corresponds to a flow rate of 30 l/h (8 gal/h) (upper edge of float at level of red bar mark). At higher flow rates, the measuring signal is virtually flow independent. At lower flow rates, the measuring signal depends on the flow. If an INS proximity switch is installed in the assembly, too low flow rates can reliably be detected, allowing to signal an alarm or to block the dosage pumps if required.

Temperature

Changes in the medium temperature influence the measuring signal. A temperature increase causes the measured value to increase (approx. 4% per K), a temperature reduction causes it to decrease. Therefore the temperature should remain constant after calibration of the chlorine measuring point or a recalibration must be performed if the temperature has changed. Since chlorine measurement by Chloromax CCS142D with Liquiline M includes automatic temperature compensation, the temperature does not need to remain constant and recalibrations after temperature changes are not required.

6 Commissioning

- Read also the instructions on commissioning and operation in the Operating Instructions of the used transmitter.
- The power supply of the transmitter and the sensor may not be interrupted. After longer power interruption (> 2 h), the sensor must be recommissioned (polarization time).
- After commissioning, the sensor must be kept permanently wet.
- Do not switch off the measuring system during interval operation! Dosing devices may be controlled by timer switches.
However, if no disinfectant is dosed over a long period of time (several weeks), the sensor must be disconnected from the transmitter, opened, emptied and stored dry (see chapter "Storage").

6.1 Installation and function check

Before first commissioning, check if:

- the sensor is correctly installed
- the electrical connection is correct.

6.2 Polarization

The voltage applied between cathode and anode by the transmitter polarizes the surface of the gold electrode. Therefore, after switching on the transmitter with connected sensor, you have to wait until the polarization period has elapsed before you can start the calibration.

To achieve a stable display value, the sensors need the following polarization periods:

First commissioning:

| | |
|------------|---------|
| CCS142D-A: | 60 min. |
| CCS142D-G: | 90 min. |

Recommissioning:

| | |
|------------|---------|
| CCS142D-A: | 30 min. |
| CCS142D-G: | 45 min. |

6.3 Calibration

Reference measurement according to the DPD method

The calibration of the measuring system requires a colorimetric reference measurement according to the DPD method. Chlorine reacts with diethyl-p-phenylenediamine (DPD) by producing a red dye, the intensity of the red color being proportional to the chlorine concentration.

The intensity of the red dye is measured by a photometer (e.g. CCM182, see accessories) and displayed as chlorine concentration.

Requirements

The sensor reading is stable (no drifts or unsteady values for at least 5 minutes). This is normally fulfilled, when:

- The polarization period is finished.
- The flow is constant and within the correct range.
- The sample medium and the sensor are at the same temperature.
- The pH value is within the admissible range.

Zero-point adjustment

A zero-point adjustment is not required thanks to the zero stability of the membrane-covered sensor. If you, however, wish to perform a zero-point adjustment, operate the sensor in chlorine-free water for at least 15 min.

Slope calibration

For slope calibration, perform the following steps:

1. Ensure a constant pH value and temperature of the medium.
2. Take a sample for DPD measurement. The sampling location has to be close to the installed sensor. Use the sampling tap if available.
3. Enter the measured value into the transmitter (see Operating Instructions of the transmitter).
4. After initial installation of the sensor, check the calibration by DPD measurement 24 hours later.

 Carry out a slope calibration every time the membrane or electrolyte is changed.

7 Maintenance

Check the measurement at regular intervals; depending on the respective conditions at least once a month.

Perform the following tasks:

- If the membrane is visibly soiled, clean the sensor (see section "Cleaning the sensor").
- Refill the sensor with electrolyte once per season or every 12 months. Depending on the chlorine content on site, this period can be reduced or extended (see section "Refilling the electrolyte").
- Calibrate the sensor when necessary (see section "Calibration").

7.1 Cleaning the sensor

CAUTION

Hydrochloric acid and surface tension reducing chemicals

Diluted hydrochloric acid causes irritations when in contact with skin or eyes. Surface tension reducing chemicals can penetrate into the sensor membrane and cause measuring faults due to blocking.

- When using diluted hydrochloric acid, wear protective clothing like protective gloves and goggles. Avoid splashes.
- Do not use chemicals reducing the surface tension.

If the membrane is visibly soiled, proceed as follows:

1. Remove the sensor from the flow assembly.
2. Clean the membrane mechanically with a gentle water jet or put it for some minutes in 1 to 5 % hydrochloric acid without chemical additives.

7.2 Replacing the membrane

1. Unscrew the measuring chamber (pos. 1) from the shaft.
2. Unscrew the front screw cap (pos. 3).
3. Remove the membrane cap (pos. 2) and replace it by a CCY14-WP replacement cartridge.
4. Refill the measuring chamber with CCY14-F electrolyte (see section "Refilling the electrolyte").

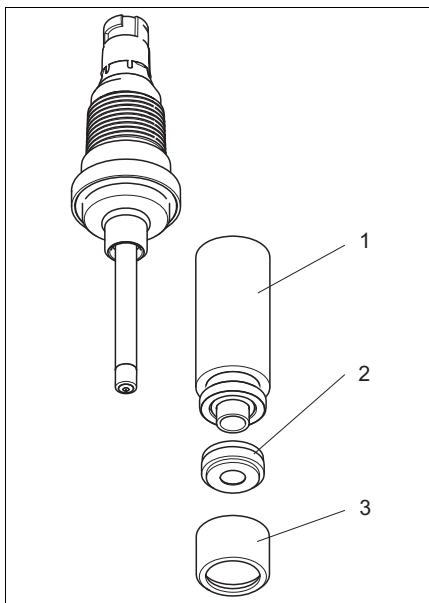


Fig. 8: Membrane replacement

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- | | |
|---|-------------------|
| 1 | Measuring chamber |
| 2 | Membrane cap |
| 3 | Screw cap |

7.3 Refilling the electrolyte

NOTICE

Membrane or electrodes damaged, air bubbles

Measuring errors up to total failure of the measuring point

- ▶ Do not touch or damage the membrane or electrodes.
- ▶ The electrolyte is chemically neutral and not hazardous. However, do not swallow it and avoid contact with the eyes.
- ▶ Keep the electrolyte bottle closed after use. Do not transfer the electrolyte into other containers.
- ▶ Do not store the electrolyte for more than 1 year. The electrolyte may not show a yellow color (use by date, see label).
- ▶ Avoid forming air bubbles when pouring the electrolyte into the membrane cap.

Proceed as follows to fill in the electrolyte:

1. Unscrew the measuring chamber from the sensor shaft.

2. Hold the measuring chamber at an angle and fill in about 7 to 8 ml (0.24 to 0.27 fl.oz) electrolyte, up to the internal thread of the measuring chamber.
3. Tap the filled measuring chamber several times on a flat surface so that adherent air bubbles can detach and rise.
4. Insert the sensor shaft vertically from above into the measuring chamber.
5. Slowly tighten the measuring chamber to the stop. Excess electrolyte is pressed out at the sensor bottom during the tightening.

7.4 Storing the sensor

During short-term interruptions in measurement:

- If it is ensured that the assembly will not drain off, you can leave the sensor in the assembly.
- If the assembly might drain off, remove the sensor from the assembly. To keep the membrane of the uninstalled sensor wet, moisten the inner sponge of the protection cap and slide the cap onto the measuring chamber.

During long-term interruptions in measurement, particularly if dehydration is possible:

- Empty the sensor.
- Rinse the measuring chamber and electrode shaft with cold water and let them dry.
- Screw the sensor down loosely and not to the stop so that the membrane remains unstressed.
- Proceed according to chapter "Commissioning" when recommissioning the sensor.

7.5 Regenerating the sensor

During measurement, the electrolyte in the sensor is gradually exhausted by chemical reactions. The silver chloride layer, applied to the anode at the factory, continues to grow epitaxially during sensor operation. This has no effect on the reaction taking place at the cathode.

A change in color of the silver chloride layer, however, indicates effects on the reaction at the cathode. Therefore, ensure by visual inspection that the grey-brown color of the anode has not changed. If the anode color has changed, e.g. if it is spotted, white or silvery, the sensor must be regenerated. Send it to the manufacturer for this purpose.

7.6 Reconditioning the sensor

Long-term operation (> 3 months) in chlorine-free media, i.e. with very low sensor currents, may lead to a deactivation of the sensor.

This deactivation is a continuous process that results in a lower slope and longer response times.

After long-term operation in a chlorine-free medium, the sensor must be reconditioned.

You need the following materials for reconditioning:

- Demineralized water
- Polishing sheet (see "Accessories")
- Beaker
- Approx. 100 ml (3.381 fl.oz) of chlorine bleaching lye NaOCl approx. 13 %, pharmaceutical quality (available at chemical stores or pharmacies)


⚠ WARNING

Bleaching lye

Bleaching lye is a corrosive substance and causes dangerous gases to develop if it comes in contact with acids.

- ▶ Wear suitable protective clothing such as safety gloves and protective goggles.
- ▶ Avoid contact with the eyes and skin.
- ▶ Avoid bleaching lye coming into contact with acids.
- ▶ Observe additional information on the safety data sheet.

Proceed as follows:

1. Close the medium inlet and outlet and make sure that no medium can squirt out of the assembly.
2. Remove the sensor from the assembly.
3. Unscrew the measuring chamber and put it aside.
4. Polish the gold cathode of the sensor using the polishing sheet:
 - Place a wetted strip of the sheet in your hand.
 - Polish the gold cathode by moving it circularly on the strip.
 - Rinse the sensor with demineralized water.
5. Top up the electrolyte if required (see chapter "Refilling the electrolyte") and screw the measuring chamber back into place.
6. Fill the beaker with chlorine bleach liquor to about 10 mm (0.39") and position it safely.
7.  **Caution!**
The sensor must not touch the liquid.

Place the sensor in the gaseous phase about 5 to 10 mm (0.2" to 0.39") above the chlorine bleach liquor.

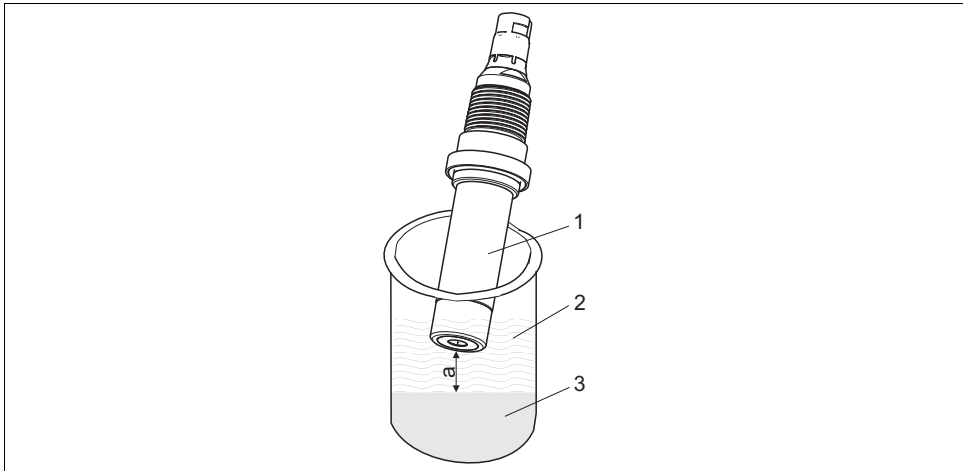


Fig. 9: Reconditioning of the sensor above chlorine bleach liquor

- | | | | |
|---|---|---|--|
| 1 | Sensor | 3 | Chlorine bleach liquor |
| 2 | Gaseous phase of chlorine bleach liquor | a | Distance between sensor and liquid, 5 to 10 mm |

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8. The sensor current will now increase. The absolute value and the speed of increase depend on the temperature of the chlorine bleach liquor.
 - When the sensor current has reached a value of several hundred nA, leave the sensor under these conditions over a period of 20 min.
 - If the recommended current value cannot be reached, cover the beaker to avoid quick air change.
9. After the 20 min. have elapsed, re-install the sensor in the assembly.
10. Re-establish the medium flow. The sensor current will normalize.
11. After sufficient settling time (no noticeable drift), calibrate the measuring chain.

8 Accessories

8.1 Connection accessories

CYK10 Memosens data cable

- For digital sensors with Memosens technology
- Ordering according to product structure, see Technical Information (TI376C/07/en)

CYK81 measuring cable

- Non-terminated measuring cable for extension of sensor cables of e.g. Memosens sensors, CUS31/CUS41
- 2 wires, twisted pair with shield and PVC-sheath (2 x 2 x 0.5 mm² + shield)
- Sold by the meter, order no.: 51502543

Junction box RM

- For cable extension (e.g. for Memosens sensors)
- 5 terminals
- Cable entries: 2 x Pg 13.5
- Material: PC
- Ingress protection: IP 65
- Order no.: 51500832

8.2 Installation accessories

Flowfit CCA250

- Flow assembly for chlorine, chlorine dioxide, pH and ORP sensors
- Ordering acc. to product structure, see Technical Information TI062C/07/en

8.3 Maintenance / calibration

CCM182

- Microprocessor-controlled photometer for determining chlorine and pH value
- Measuring range for chlorine: 0.05 – 6 mg/l
- Measuring range for pH value: 6.5 – 8.4
- Order no.: CCM182-0

CCY14-WP

- 2 replacement cartridges ready-made for CCS140/141/142D chlorine and CCS240/241 chlorine dioxide sensors
- Order no. 50005255

CCY14-F

- Electrolyte for CCS140 / CCS141 / CCS142D chlorine sensors; 50 ml
- Order no. 50005256

Polishing sheets COY31-PF

- 10 pieces for cleaning of the gold cathode
- For oxygen and chlorine sensors
- Order no. 51506973

Service kit CCS14x

- For chlorine sensors CCS140/CCS141/CCS142D
- 2 replacement cartridges, filling electrolyte 50 ml, polishing sheets
- Order no. 71076921

9 Troubleshooting

9.1 Troubleshooting instructions

Troubleshooting must take account of the whole measuring system. The measuring system comprises:

- Transmitter
- Electrical connections and lines
- Assembly
- Sensor

The possible causes of failures listed in the following table primarily refer to the sensor. Make sure that the following operating conditions are met before commencing troubleshooting:

- Constant pH value after chlorine calibration, not required for measurement in the "pH compensated" mode of operation
- Constant temperature after calibration, not required for measurement in the "temperature compensated" mode of operation
- Minimum flow rate of 30 l/h (7.9 gal/h) (red bar mark when using the CCA250 assembly)
- No use of organic chlorination agents

If the value measured by the sensor differs significantly from that of the DPD method, first consider all possible malfunctions of the photometric DPD method (see Operating Instructions of the photometer). If necessary, repeat the DPD measurement several times.

| Error | Possible cause | Remedy |
|-------------------------------|---|--|
| No display, no sensor current | No supply voltage at the transmitter | Establish mains connection. |
| | Connection cable between sensor and transmitter interrupted | Establish cable connection. |
| | No electrolyte filled into the measuring chamber | Fill measuring chamber (see chapter "Refilling the electrolyte"). |
| | No input flow of medium | Establish flow, clean filter. |
| Display value too high | Polarization of the sensor not yet completed | Wait for complete polarization (see chapter "Polarization"). |
| | Membrane defective | Replace membrane cap. |
| | Shunt resistance (e.g. moisture contact) in the sensor shaft. | Open measuring chamber, rub gold cathode dry. If the display of the transmitter does not return to zero, there is a shunt. |
| | Interference of foreign oxidants on the sensor | Examine medium, check chemicals. |

| Error | Possible cause | Remedy |
|---------------------------------|---|--|
| Display too low | Measuring chamber not completely tightened | Tighten measuring chamber or screw cap tight. |
| | Membrane soiled | Clean membrane. |
| | Air bubble in front of membrane | Release air bubble. |
| | Air bubble between cathode and membrane | Open measuring chamber, fill in some electrolyte, tap. |
| | Input flow of medium too low | Establish correct input flow (see chapter "Influences on measuring signal"). |
| | Interference of foreign oxidants on the DPD reference measurement | Examine medium, check chemicals (see chapter "Operating principle"). |
| | Use of organic chlorination agents | Use agents acc. to DIN 19643 (water replacement may be required). |
| Display fluctuates considerably | Hole in membrane | Replace membrane cap. |
| | External voltage in medium | Measure voltage between the PMC pin and the protective ground of the transmitter (both AC and DC ranges). For values exceeding approx. 0.5 V, find and eliminate external cause. |

9.2 Return

If the sensor has to be repaired, please return it *cleaned* to the sales center responsible. Please use the original packaging, if possible.

Before returning the device, please clarify all formalities – such as obtaining an identification number – with your sales center.

Please enclose the completed "Declaration of Hazardous Material and De-Contamination" (copy the second last page of these Operating Instructions) with the packaging and the transportation documents.

No repair without completed declaration!

9.3 Disposal

Please dispose of the device in accordance with the local regulations.

10 Technical data

10.1 Input

10.1.1 Measured variable

Free chlorine: hypochlorous acid (HOCl)

10.1.2 Measuring range

- **CCS142D-A:**
0.05 to 20 mg/l Cl₂ (25 °C (77 °F), pH 7.2)
- **CCS142D-G:**
0.01 to 5 mg/l Cl₂ (25 °C (77 °F), pH 7.2)

10.1.3 Depolarization current

- **CCS142D-A:**
approx. 25 nA per mg/l Cl₂ (25 °C (77 °F), pH 7.2)
- **CCS142D-G:**
approx. 80 nA per mg/l Cl₂ (25 °C (77 °F), pH 7.2)

10.2 Performance characteristics

10.2.1 Response time for free chlorine

T₉₀ < 2 min
in applications involving mainly active chlorination

10.2.2 Reference operating conditions

25 °C (77 °F)
pH 7.2

10.2.3 Measured value resolution

- **CCS142D-A:**
approx. 15 µg/l Cl₂
- **CCS142D-G:**
approx. 5 µg/l Cl₂

10.2.4 Maximum measured error

1 % of measured value

10.2.5 Repeatability

- Sensor: ± 1 %
- Reference method: depending on version

Calibration standards do not have long-term stability.

10.2.6 Nominal slope

- **CCS142D-A:**
-25 nA per mg/l
- **CCS142D-G:**
-80 nA per mg/l

10.2.7 Drift

< 1.5 % per month

10.2.8 Polarization time

- **CCS142D-A:**
Commissioning: 60 min
Reoperation: 30 min
- **CCS142D-G:**
Commissioning: 90 min
Reoperation: 45 min

10.2.9 Electrolyte operating time

At average medium concentrations of 1 mg/l Cl

- **CCS142D-A:**
> 5 years
- **CCS142D-G:**
> 3 years

10.2.10 Chlorine intrinsic consumption

At average medium concentrations of 1 mg/l Cl and reference conditions

- **CCS142D-A:**
25 ng Cl per hour
- **CCS142D-G:**
100 ng Cl per hour

10.3 Environment

10.3.1 Storage temperature

Filled with electrolyte: 5 to 50 °C (41 to 122 °F)
Without electrolyte: -20 to 60 °C (-4 to 140 °F)

10.3.2 Ingress protection

IP 68 (up to the mounting collar Ø 36 mm (Ø 1.42"))

10.4 Process

10.4.1 Process temperature

0 to 45 °C (32 to 113 °F), non-freezing

10.4.2 Process pressure

Medium in the CCA250 assembly: max. 1 bar (14.5 psi)

10.4.3 pH range

Calibration

CCS142D-A: 4 to 8 pH

CCS142D-G: 4 to 8.2 pH

Measurement: 4 ... 9 pH

Chlorine measurement possible up to pH 9 with limited accuracy.

10.4.4 Flow

in the CCA250 assembly: min. 30 l/h (8 US.gal./h)

10.4.5 Flow rate

min. 15 cm/s (0.5 ft/s)

10.5 Mechanical construction

10.5.1 Design, dimensions

see chapter "Installation conditions"

10.5.2 Weight

approx. 0.1 kg (0.22 lbs)

10.5.3 Material

approx. 0.1 kg (0.22 lbs)

10.5.4 Cable length

max. 100 m (330 ft), incl. cable extension

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Declaration of Hazardous Material and De-Contamination

RA No.

Please reference the Return Authorization Number (RA#), obtained from Endress+Hauser, on all paperwork and mark the RA# clearly on the outside of the box. If this procedure is not followed, it may result in the refusal of the package at our facility.

Because of legal regulations and for the safety of our employees and operating equipment, we need the "Declaration of Hazardous Material and De-Contamination", with your signature, before your order can be handled. Please make absolutely sure to attach it to the outside of the packaging.

Type of instrument / sensor _____ **Serial number** _____

☐ **Used as SIL device in a Safety Instrumented System**

Process data

Temperature _____ [°F] _____ [°C]
Conductivity _____ [µS/cm]

Pressure _____ [psi] _____ [Pa]
Viscosity _____ [cp] _____ [mm²/s]

Medium and warnings



| | Medium /concentration | Identification CAS No. | flammable | toxic | corrosive | harmful/ irritant | other * | harmless |
|--------------------------------|-----------------------|---------------------------|-----------|-------|-----------|----------------------|---------|----------|
| Process medium | | | | | | | | |
| Medium for process cleaning | | | | | | | | |
| Returned part cleaned with | | | | | | | | |

* explosive; oxidising; dangerous for the environment; biological risk; radioactive

Please tick should one of the above be applicable, include safety data sheet and, if necessary, special handling instructions.

Description of failure

Company data

| | |
|---------------|--------------------------------------|
| Company _____ | Phone number of contact person _____ |
| Address _____ | Fax / E-Mail _____ |
| _____ | Your order No. _____ |

"We hereby certify that this declaration is filled out truthfully and completely to the best of our knowledge. We further certify that the returned parts have been carefully cleaned. To the best of our knowledge they are free of any residues in dangerous quantities."

www.endress.com/worldwide

Endress+Hauser 
People for Process Automation

BA419C/07/EN/01.11
FM9



Technical Information

Memosens CPS31D and Ceratex CPS31

pH electrodes, analog and digital with Memosens technology

For drinking water and swimming pool water

Gel-filled reference system with ceramic diaphragm



Application

- Drinking water
- Swimming pool water
- pH compensation for measuring free chlorine

Your benefits

- One or three ceramic diaphragms
- Optional salt ring for extended operating life
- Very low level of ion depletion in electrolyte
- Gel filling, no electrolyte refill required
- Can be used up to 4 bar (60 psi) absolute pressure
- Can be used up to 80 °C (176 °F)
- Shaft length 120 mm
- Memosens plug-in head
- ESA or GSA plug-in head

Further benefits offered by Memosens technology

- Maximum process safety thanks to non-contact, inductive signal transmission
- Digital data transmission ensures data security
- Very easy to use as sensor-specific data are stored in the sensor
- Recording of sensor load data in the sensor enables predictive maintenance

Function and system design

| | |
|--|---|
| Measuring principle | <p>pH measurement</p> <p>The pH value is a measure of the acid or base character of a medium. Depending on the pH value of the medium, the electrode's membrane glass provides an electrochemical potential. This is the result of H⁺ ions selectively penetrating the outer layer of the membrane. As a result, an electrochemical boundary layer forms here with an electric potential. An integrated Ag/AgCl reference system forms the required reference electrode.</p> <p>The transmitter converts the measured voltage into the corresponding pH value according to the Nernst equation.</p> |
| General characteristics | <p>Durability</p> <p>Depending on the version, the electrode can withstand pressures up to 4 bar (60 psi) and temperatures up to 80 °C (176 °F).</p> |
| Communication and data processing with CPS31D | <p>Measuring system data which digital sensors can save in the sensor include:</p> <ul style="list-style-type: none"> ■ Manufacturer data <ul style="list-style-type: none"> – Serial number – Order code – Date of manufacture ■ Calibration data <ul style="list-style-type: none"> – Date of calibration – Calibrated slope at 25 °C (77 °F) – Calibrated zero point at 25 °C (77 °F) – Temperature offset – Number of calibrations – Serial number of the transmitter used to perform the last calibration ■ Operating data <ul style="list-style-type: none"> – Temperature application range – pH application range – Date of initial commissioning – Maximum temperature value – Operating hours at temperatures above 80 °C / 100 °C (176 °F / 212 °F) – Operating hours for very low and very high pH values (Nernst voltage below –300 mV, above +300 mV) – Number of sterilizations – Glass membrane impedance <p>The data listed above can be displayed using the Mycom S CPM153, Liquiline M CM42 and Liquiline CM44x transmitters.</p> |
| Dependability with CPS31D | <p>Reliability</p> <p>Memosens technology digitizes the measured values in the sensor and transmits them to the transmitter via a non-contact connection in a way that is free from any potential interference. The result:</p> <ul style="list-style-type: none"> ■ Automatic error message generation if the sensor fails or the connection between sensor and transmitter is interrupted ■ Immediate error detection increases measuring point availability |

Maintainability

Sensors with Memosens technology have integrated electronics that save calibration data and other information, such as total hours of operation and operating hours under extreme measuring conditions etc. Once the sensor has been connected, the sensor data are automatically sent to the transmitter and used to calculate the current measured value.

Saving the calibration data makes it possible to calibrate and adjust the sensor irrespective of the measuring point. The result:

- Convenient calibration in the measuring lab under optimum external conditions improves the quality of the calibration.
- Measuring point availability is dramatically increased by the quick and easy replacement of precalibrated sensors.
- The availability of the sensor data makes it possible to accurately determine the maintenance intervals of the measuring point and enables predictive maintenance.
- The sensor history can be documented using external storage media and evaluation programs. The sensor's field of application can be determined based on its previous history.

Integrity

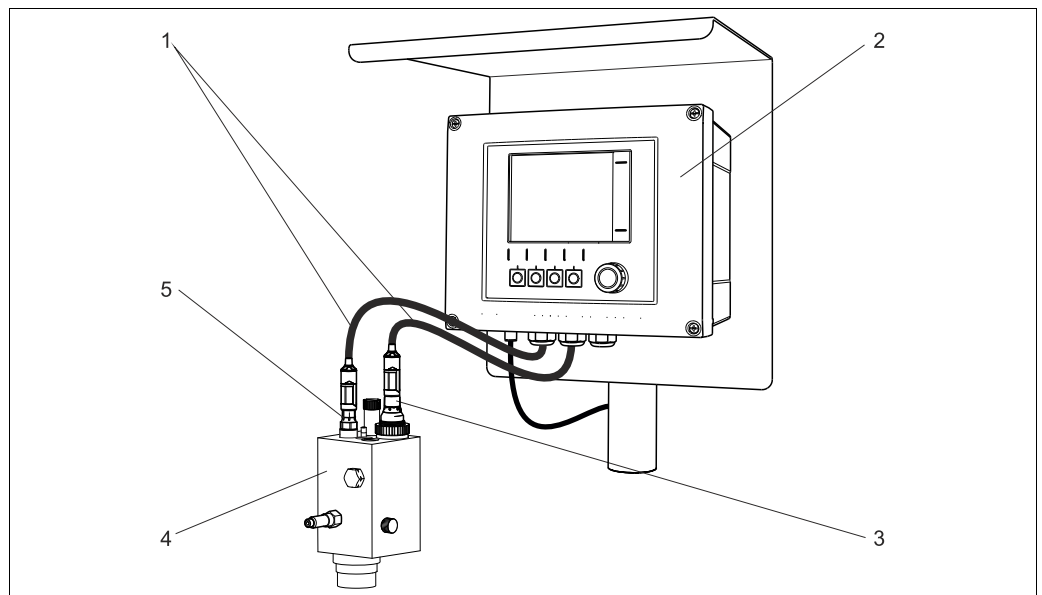
With its inductive transmission of the measured value via a non-contact plug-in connection, Memosens guarantees maximum process safety and offers the following advantages:

- All problems caused by moisture are eliminated:
 - The plug-in connection is free from corrosion
 - Moisture cannot corrupt the measured value
 - Plug-in system can even be connected under water
- The transmitter is galvanically decoupled from the medium.
- EMC safety is guaranteed by screening measures in the digital measured value transmission.

Measuring system

A complete measuring system comprises:

- pH electrode CPS31D or CPS31
- Transmitter, e.g. Liquiline CM44x (for CPS31D with Memosens technology)
- Measuring cable, e.g. CYK10 for CPS31D
- Immersion, flow or retractable assembly, e.g. Flowfit CCA250



Example of a measuring system: pH compensation for chlorine measurement

- 1 Cable CYK10
- 2 Liquiline CM44x transmitter
- 3 Chlorine sensor CCS142D
- 4 Flowfit assembly CCA250
- 5 pH electrode CPS31D

Input

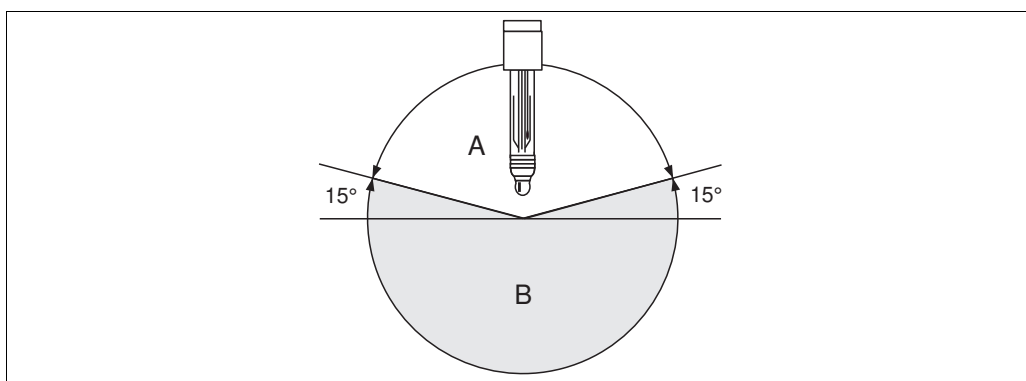
| | |
|--------------------|-------------|
| Measured variables | pH value |
| | Temperature |

| | | |
|-----------------|--------------|---------------------------|
| Measuring range | pH: | 1 to 12 |
| | Temperature: | 0 to 80 °C (32 to 176 °F) |

Installation

Installation instructions

Do not install the electrodes upside down. The inclination angle must be at least 15° from the horizontal. A smaller inclination angle is not permitted as it could cause an air bubble to form in the glass sphere and prevent the inner electrolyte from completely wetting the pH membrane.



a0003133

Electrode installation; angle at least 15° from the horizontal

A Permitted orientation
B Incorrect orientation

NOTICE

Before screwing in the electrode, make sure the threaded connection of the assembly is clean and runs smoothly.

- ▶ Hand tighten the electrode (3 Nm)! (Information valid only when installing with Endress+Hauser assemblies.)
- ▶ Also pay attention to the installation instructions provided in the Operating Instructions of the assembly used.

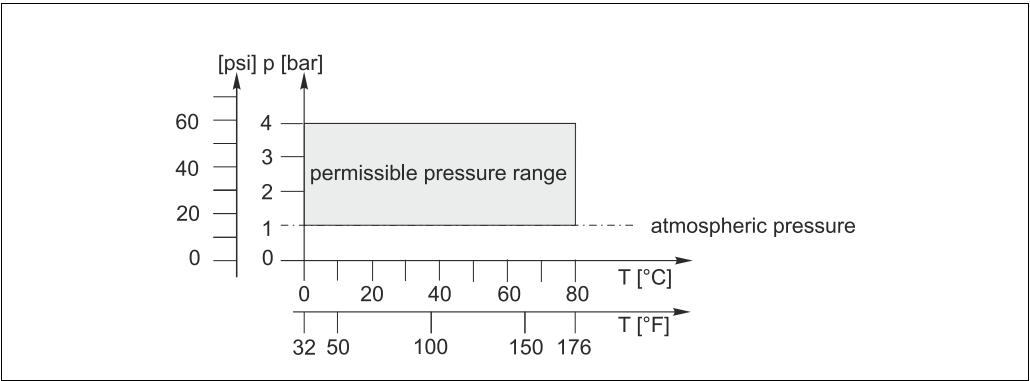
Environment

| | | |
|---------------------------|---|--|
| Ambient temperature range | <div>NOTICE</div> Risk of damage due to frost <ul style="list-style-type: none">▶ The sensor must not be used at temperatures below −15 °C (5 °F). | |
| | | |
| Storage temperature | 0 to 50 °C (32 to 120 °F) | |
| Degree of protection | IP 67: | GSA plug-in head (with closed connector system) |
| | IP 68: | ESA plug-in head (1 m (3.3 ft) water column, 50 °C (120 °F), 168 h) |
| | IP 68: | Memosens plug-in head (10 m (33 ft) water column, 25 °C (77 °F), 45 days, 1 M KCl) |

Process

| | | |
|-----------------------------|--|--|
| Process temperature range | 0 to 80 °C (32 to 176 °F) | |
| Process pressure (absolute) | 1 to 4 bar (15 to 60 psi) | |
| | <div>CAUTION</div> Sensor is exposed to pressure when used for longer periods under increased process pressure <p>Risk of injury due to glass breakage</p> <ul style="list-style-type: none">▶ Do not apply too much heat to sensors of this type if they are being used under reduced process pressure or under atmospheric pressure.▶ Wear protective goggles and suitable gloves when handling this type of sensor. | |

Pressure-temperature load

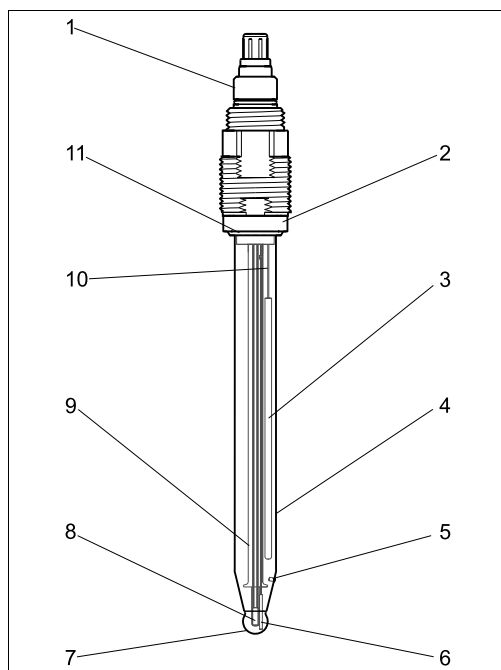


Pressure-temperature load

| | |
|----------------------|--|
| Minimum conductivity | 100 µS/cm |
| | 50 µS/cm for "AC" version (three diaphragms) |

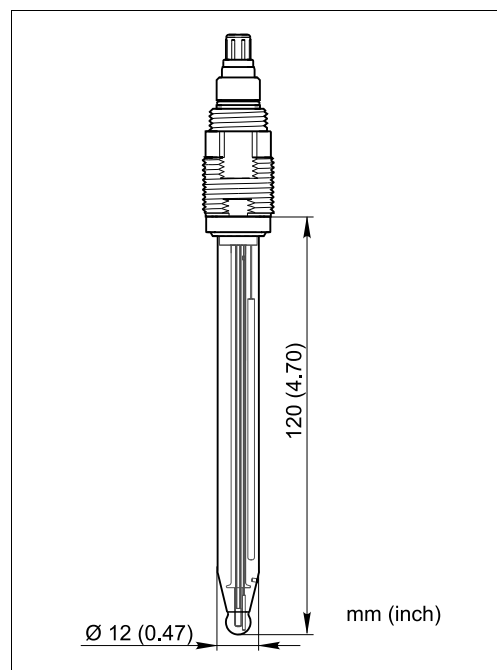
Mechanical construction

Design, dimensions CPS31



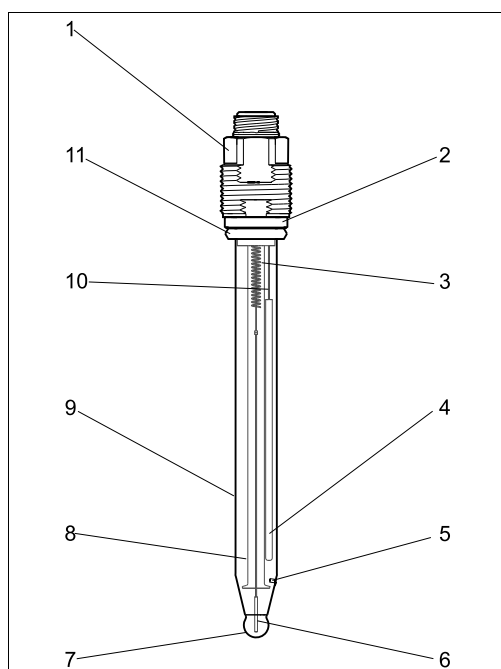
CPS31 with ESA plug-in head

- 1 ESA electrode plug-in head, Pg 13.5
- 2 Pressure ring
- 3 Capillaries
- 4 Shaft tube
- 5 Diaphragm
- 6 Ag/AgCl internal reference lead



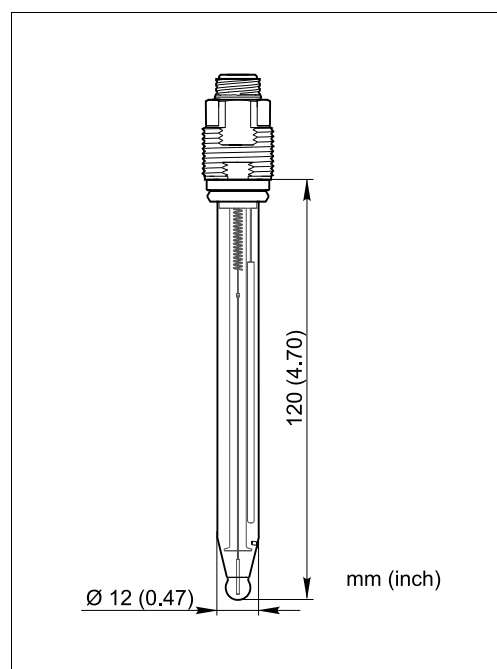
CPS31 with ESA plug-in head

- 7 pH membrane glass
- 8 Temperature probe
- 9 Internal tube
- 10 Leads, external
- 11 O-ring



CPS31 with GSA plug-in head

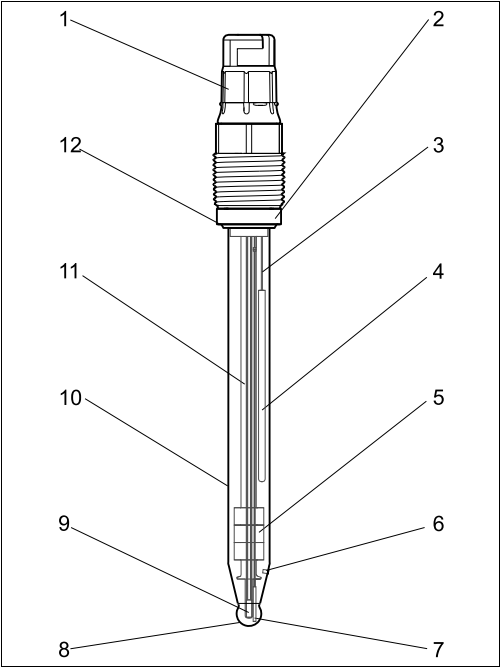
- 1 GSA electrode plug-in head, Pg 13.5
- 2 Pressure ring
- 3 Compression spring
- 4 Capillaries
- 5 Diaphragm
- 6 Ag/AgCl internal reference lead



CPS31 with GSA plug-in head

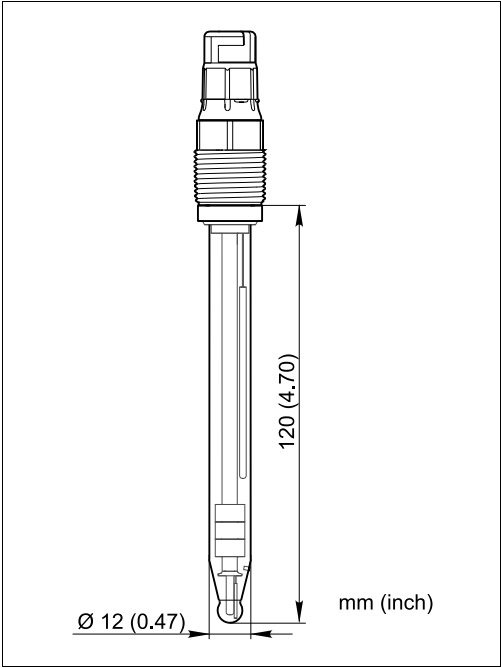
- 7 pH membrane glass
- 8 Internal tube
- 9 Shaft tube
- 10 Lead, external
- 11 O-ring

Design, dimensions CPS31D



CPS31D

- 1 Memosens plug-in head
- 2 Pressure ring
- 3 Lead, external
- 4 Capillaries
- 5 Salt rings (optional)
- 6 Diaphragm



CPS31D

- 7 Ag/AgCl internal reference lead
- 8 pH membrane glass
- 9 Temperature probe
- 10 Shaft tube
- 11 Internal tube with leads
- 12 O-ring

| | | |
|--------------------|---|--|
| Weight | 0.1 kg (0.22 lbs) | |
| Materials | Electrode shaft pH membrane glass Metal lead Diaphragm | Glass Type A Ag/AgCl Ceramic |
| Process connection | Pg 13.5 | |
| Temperature sensor | CPS31D: CPS31: | NTC 30K Pt 100 |
| Plug-in heads | CPS31D: CPS31: | Memosens plug-in head for digital, non-contact data transmission ESA, GSA |
| Reference system | Ag/AgCl, gel, 3M KCl Optional: Salt ring, KCl-saturated | |

Certificates and approvals

TÜV certificate ESA and Memosens plug-in head

Pressure resistance 16 bar (232 psi), minimum three times the safety pressure

Electromagnetic compatibility of CPS31D

Interference emission and interference immunity as per EN 61326: 2006

Ordering information

Product pages

You can create a valid and complete order code on the Internet with the Configurator tool.

Enter the following addresses in the browser to access the relevant product page:

www.products.endress.com/cps31

www.products.endress.com/cps31d

Product Configurator

1. You can find the following options on the right-hand side of the product page:

Product page function

- :: Add to product list
- :: Price & order information
- :: Compare this product
- :: Configure this product

2. Click "Configure this product".
3. The Configurator opens in a separate window. You can now configure your device and receive the complete and valid order code.
4. Now export the order code as a PDF or Excel file. To do so, click the corresponding button at the top of the page.

Accessories

Assemblies (selection)

Cleanfit CPA472

- Compact plastic retractable assembly for installation in tanks and pipes, for manual or pneumatically remote-controlled operation
- Order according to product structure (--> Online Configurator, www.products.endress.com/cpa472)
- Technical Information TI00223C/07/EN

Cleanfit CPA475

- Retractable assembly for installation in tanks and pipes under sterile conditions
- Order according to product structure (--> Online Configurator, www.products.endress.com/cpa475)
- Technical Information TI00240/C/07/EN

Unifit CPA442

- Installation assembly for food, biotechnology and pharmaceuticals, with EHEDG and 3A certificate,
- Order according to product structure (--> Online Configurator, www.products.endress.com/cpa442)
- Technical Information TI00306/C/07/EN

Dipfit CPA111

- Immersion and installation assembly for open and closed containers
- Order according to product structure (--> Online Configurator, www.products.endress.com/cpa111)
- Technical Information TI00112C/07/EN

Flowfit CPA250

- Flow assembly for pipe installation of pH/ORP sensors with Pg 13.5 and 120 mm (4.72") installation length
- Order according to product structure (--> Online Configurator, www.products.endress.com/cpa250)
- Technical Information TI00041C/07/EN

Ecofit CPA640

- Adapter for 120 mm pH sensors
- Order according to product structure (--> Online Configurator, www.products.endress.com/cpa640)
- Technical Information TI00264C/07/EN

Buffer solutions

High quality buffer solutions of Endress+Hauser - CPY20

Solutions which are traced by a DAkkS-accredited Endress+Hauser buffer laboratory (DkkS = German Accreditation Body) to a primary reference material of the PTB and to standard reference material of the National Institute of Standards and Technology (NIST) in accordance with DIN 19266 are used as secondary reference buffer solutions.

- Order according to product structure (-> Online Configurator, www.products.endress.com/cpy20)

Measuring cable

Memosens data cable CYK10

- For digital sensors with Memosens technology
- Order according to product structure (--> Online Configurator, www.products.endress.com/cyk10)
- Technical Information TI00118C/07/EN

Measuring cable CPK9

- For sensors with ESA plug-in head, for high-temperature and high-pressure applications, IP 68
- Order as per product structure
- Technical Information TI00501C/07/EN

Special measuring cable CPK1

- For pH/ORP electrodes with GSA plug-in head
- Order as per product structure
- Technical Information TI00501C/07/EN

www.addresses.endress.com

Operating Instructions

Turbimax CUE21 / CUE22

Turbidimeter for online measurement

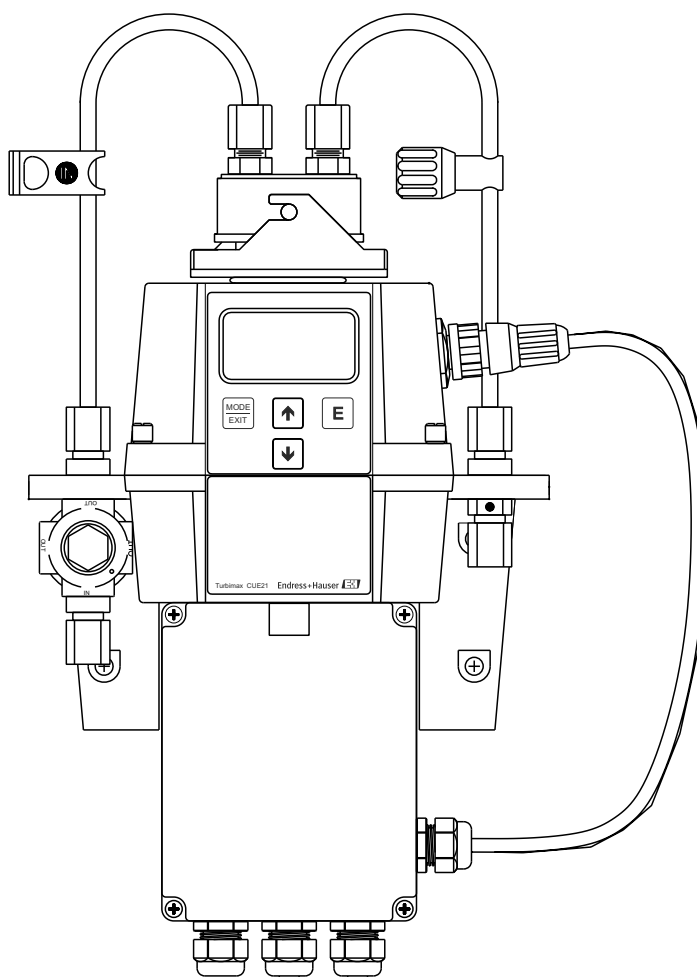






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1 Document information

1.1 Safety information

| Structure of information | Meaning |
|--|---|
|  DANGER Causes (/consequences) Consequences of non-compliance (if applicable) ► Corrective action | This symbol alerts you to a dangerous situation. Failure to avoid the dangerous situation will result in a fatal or serious injury. |
|  WARNING Causes (/consequences) Consequences of non-compliance (if applicable) ► Corrective action | This symbol alerts you to a dangerous situation. Failure to avoid the dangerous situation can result in a fatal or serious injury. |
|  CAUTION Causes (/consequences) Consequences of non-compliance (if applicable) ► Corrective action | This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or more serious injuries. |
|  NOTICE Cause/situation Consequences of non-compliance (if applicable) ► Action/note | This symbol alerts you to situations which may result in damage to property. |


1.2 Symbols

| Symbol | Meaning |
|---|-----------------------------------|
|  | Additional information, tips |
|  | Permitted or recommended |
|  | Not permitted or not recommended |
|  | Reference to device documentation |
|  | Reference to page |
|  | Reference to graphic |
|  | Result of a step |

2 Basic safety instructions

2.1 Requirements for personnel

- Installation, commissioning, operation and maintenance of the measuring system may be carried out only by specially trained technical personnel.
- The technical personnel must be authorized by the plant operator to carry out the specified activities.
- The electrical connection may be performed only by an electrical technician.
- The technical personnel must have read and understood these Operating Instructions and must follow the instructions contained therein.
- Measuring point faults may be repaired only by authorized and specially trained personnel.

 Repairs not described in the Operating Instructions provided may only be carried out directly by the manufacturer or by the service organization.

2.2 Designated use

The turbidimeters from the Turbimax CUE21 / CUE22 series are designed for online measurement of turbidity in process water and drinking water.

The infrared device CUE21 meets the design criteria for turbidity measurement specified by ISO 7027 and DIN 27027.

The white light device CUE22 meets the design criteria specified by US EPA 180.1.

Use of the device for any purpose other than that described, poses a threat to the safety of people and of the entire measuring system and is therefore not permitted.

The manufacturer is not liable for damage caused by improper or non-designated use.

2.3 Workplace safety

As the user, you are responsible for complying with the following safety conditions:

- Installation guidelines
- Local standards and regulations

Electromagnetic compatibility

- The product has been tested for electromagnetic compatibility in accordance with the applicable European standards for industrial applications.
- The electromagnetic compatibility indicated applies only to a product that has been connected in accordance with these Operating Instructions.

2.4 Operational safety

1. Before commissioning the entire measuring point, verify that all connections are correct. Ensure that electrical cables and hose connections are undamaged.
2. Do not operate damaged products, and safeguard them to ensure that they are not operated inadvertently. Label the damaged product as defective.
3. If faults cannot be rectified:
Take the products out of operation and safeguard them to ensure that they are not operated inadvertently.

2.5 Product safety

The product is designed to meet state-of-the-art safety requirements, has been tested, and left the factory in a condition in which it is safe to operate. The relevant regulations and European standards have been observed.

3 Incoming acceptance and product identification

3.1 Incoming acceptance

1. Verify that the packaging is undamaged.
 - ↳ Notify your supplier of any damage to the packaging.
Keep the damaged packaging until the matter has been settled.
2. Verify that the contents are undamaged.
 - ↳ Notify your supplier of any damage to the delivery contents.
Keep the damaged products until the matter has been settled.
3. Check the delivery for completeness.
 - ↳ Check it against the delivery papers and your order.
4. Pack the product for storage and transportation in such a way that it is protected against impact and moisture.
 - ↳ The original packaging offers the best protection.
The permitted ambient conditions must be observed (see "Technical data").

If you have any questions, please contact your supplier or your local sales center.

3.2 Product identification

3.2.1 Nameplate

The nameplate provides you with the following information on your device:

- Manufacturer identification
- Order code
- Extended order code
- Serial number
- Ambient and process conditions
- Safety information and warnings

 Compare the data on the nameplate with your order.

3.2.2 Product identification

Product page

www.endress.com/cue21

www.endress.com/cue22

Interpreting the order code

The order code and serial number of your product can be found in the following locations:

- On the nameplate
- In the delivery papers

Obtaining information on the product

1. Go to the product page for your product on the Internet.
2. In the navigation area on the right-hand side, select "Check your device features" under "Device support".
 - ↳ An additional window opens.

3. Enter the order code from the nameplate into the search field.
 - ↳ You will receive information on each feature (selected option) of the order code.

3.3 Scope of delivery

The scope of delivery comprises:

- 1 turbidimeter Turbimax CUE21 or CUE22
- 1 field terminal box
- 1 packet of desiccant
- 1 tubing kit including
 - 1 shutoff clamp
 - 1 flow controller
 - 2 connecting tubes with fittings for flow-through assembly
 - 1 vent screw for drain tube (used in pressurized systems)
- 1 Operating Instructions BA00395C



If you have any questions, please contact your supplier or your local sales center.

3.4 Certificates and approvals

The product meets the requirements of the harmonized European standards. As such, it complies with the legal specifications of the EC directives. The manufacturer confirms successful testing of the product by affixing to it the **CE** mark.

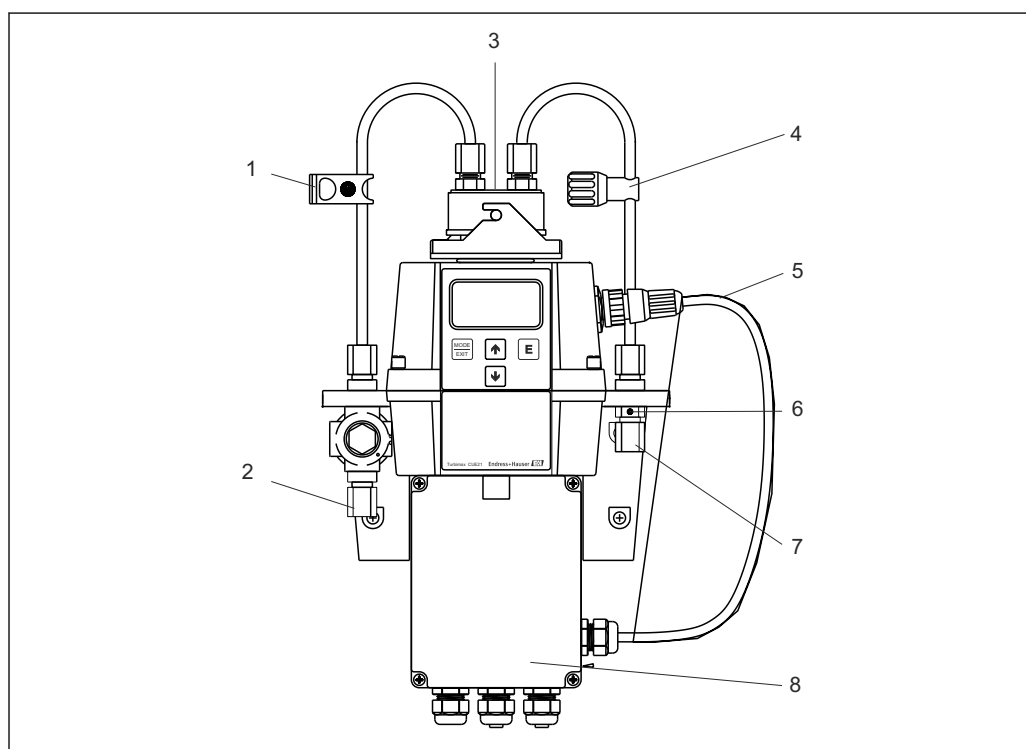
4 Installation

4.1 Installation requirements

4.1.1 Measuring system

A complete measuring system comprises:

- Turbimax turbidimeter with installed cuvette and desiccant pouch
- Connecting tube with
 - fittings for flow-through assembly
 - Shutoff clamp
 - Flow controller
 - Vent screw for drain tube (in pressurized systems)
- Sensor interconnect cable



A0025595

1 Turbimax CUE21 (example)

1 Shutoff clamp

2 Connection for intake tube ¹⁾

3 Flow assembly

4 Flow controller

5 Sensor interconnect cable

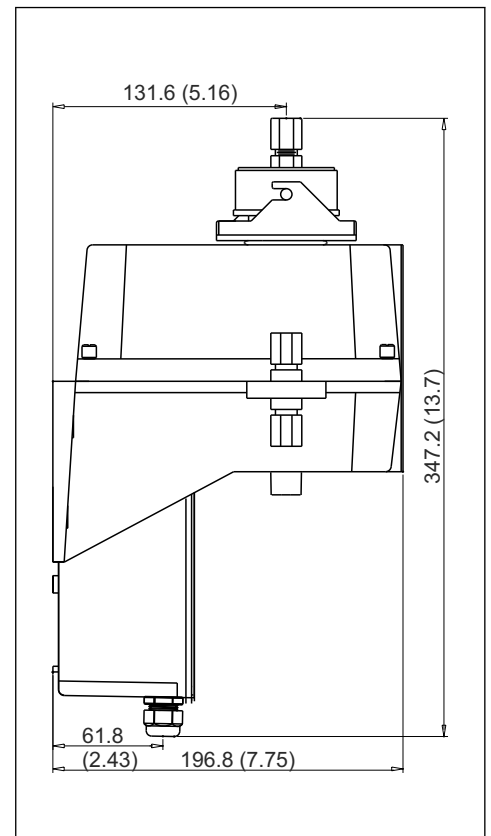
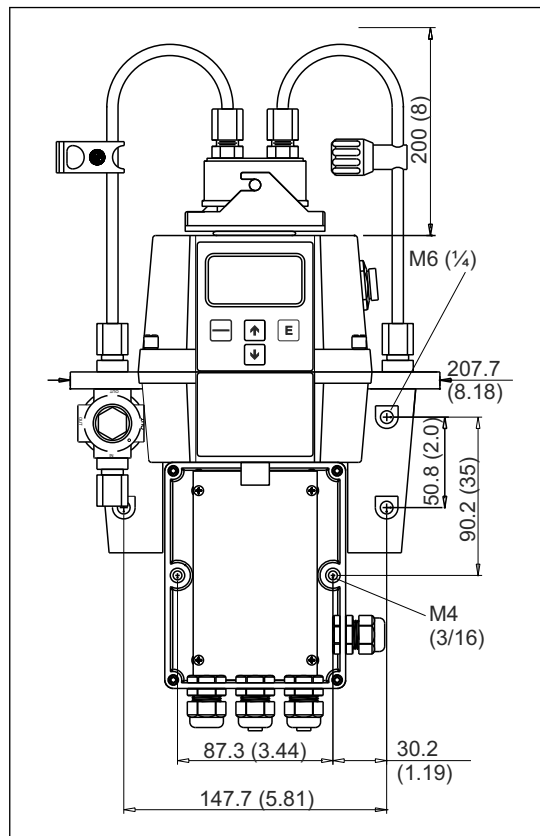
6 Vent for drain tube

7 Connection for drain tube ¹⁾

8 Terminal box

1) OD 8 mm (0.31 inch), ID 4.75 mm (3/16 inch)

4.1.2 Mounting dimensions



2 Mounting dimensions - front view
Dimensions in mm (inch)

3 Mounting dimensions - lateral view

4.2 Mounting the measuring device

4.2.1 Wall mounting

The device is designed for wall mounting. If wall mounting is not practicable, the device can be mounted on any suitable level surface.

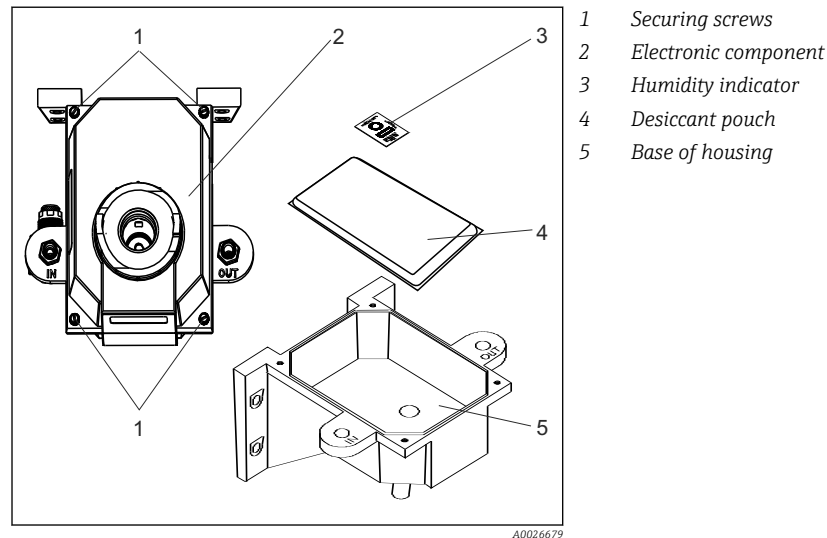
- Ensure that the temperature does not exceed the maximum permitted operating temperature range (0 to 50 °C (32 to 122 °F)).
- Leave approx. 20 cm (8 inch) of free space above the device to ensure that there is sufficient room for calibration and cuvette maintenance. (→ 2)
- Mount the device as close as possible to the sampling point to ensure fast response times (within 2 to 3 m (6 to 10 ft)).

1. Drill mounting holes for the M4 mounting screws to install the field terminal box.
2. Drill mounting holes for the M6 mounting screws to install the device housing on top of the terminal box.
3. Mount the terminal box.
4. Mount the rest of the device on top of the terminal box.

4.2.2 Installing the desiccant pouch

The device is equipped with a continuous vapor purge system. A replaceable desiccant pouch in the lower portion of the instrument dries the air. System heat is used to warm the

air. A fan located inside the device ensures that heated air circulates continuously around the optical path and the flow-through cuvette.



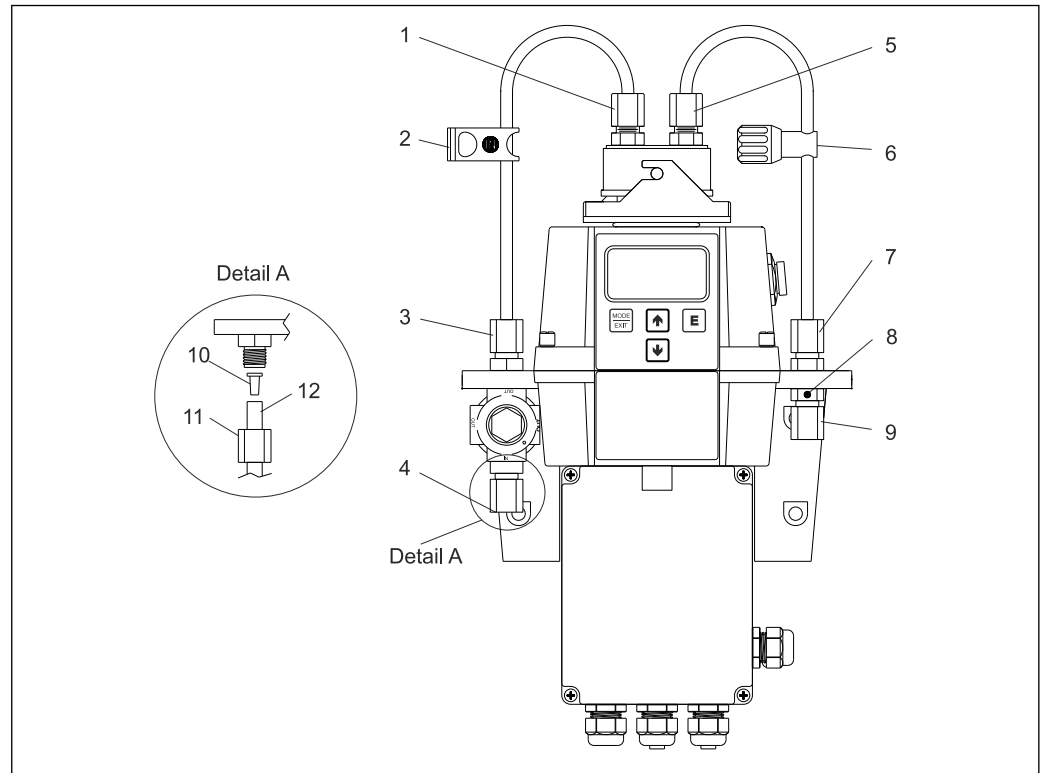
4 Installing the desiccant pouch

1. Unscrew the four corner screws (item 1).
2. Remove the electronic component of the device (item 2).
3. Open the bag protecting the desiccant pouch (item 4), and place the pouch with the humidity indicator (item 3) in the base of the housing (item 5).
 - ➔ Ensure that you install the desiccant pouch immediately after opening the bag to prevent premature degradation of the desiccant.
4. Return the electronic component of the device to its original position.
5. Tighten the four corner screws.

i To prevent premature saturation of the desiccant, it is recommended that you keep the measurement chamber covered at all times.

4.2.3 Plumbing the measuring device

- The device requires only a very low overpressure in the flow assembly to operate, approx. 0.069 bar (1 psi).
- The flow controller is rated for a maximum overpressure of 13.8 bar (200 psi).
- The minimum flow rate for the flow-through cuvette is 100 ml/min to 1 l/min (0.026 to 0.26 US gal/min).
- The maximum permitted medium temperature is 50 °C (122 °F).



A0025699

- | | | | |
|---|----------------------------|----|---------------------------|
| 5 | Recommended plumbing | 7 | Connection for drain tube |
| 1 | Connection for intake tube | 8 | Vent for drain tube |
| 2 | Shutoff clamp | 9 | Connection for drain tube |
| 3 | Connection for intake tube | 10 | Use |
| 4 | Connection for intake tube | 11 | Nut |
| 5 | Connection for drain tube | 12 | Tubing (not supplied) |
| 6 | Flow controller | | |

i The device is equipped for plumbing using tubing with OD 8 mm (0.31 inch), ID 4.75 mm (3/16 inch). If the device is going to be exposed to sunlight, opaque tubing should be used to prevent algae growth.

Plumbing the device

1. Push the shutoff clamp (item 2) over one of the supplied tubes.
2. Connect the tube to the upper part of the intake tubing connection (item 3) and to the connection on top of the device (item 1).
3. Push the flow controller (item 6) over the second tube supplied.
4. Connect the tube to the upper part of the drain tubing connection (item 7) and to the connection on top of the device (item 5).
5. Connect a tube with an internal diameter of 4.75 mm (3/16 inch) to the lower part of the intake tubing connection (item 4) to supply the sensor with a reliable sample flow.
6. Connect a tube with an internal diameter of 4.75 mm (3/16 inch) to the lower part of the drain tubing connection (item 9) to route the sensor drain to a suitable drain on site.
 - ↳ The vent in the drain tube (item 8) allows for pressure compensation, thus helping to prevent bubble formation in the cuvette.
7. If your CUE21 / CUE22 is integrated in a high-pressure system, insert the 6:32 seal screw provided into the vent hole and tighten it.

4.3 Post-installation check

1. After mounting, check all the connections to ensure they are secure and leak-tight.
2. Check all cables and hoses for damage.
3. Check whether the cables are routed such that they are free from electromagnetic interference influences.

5 Electrical connection

⚠ WARNING

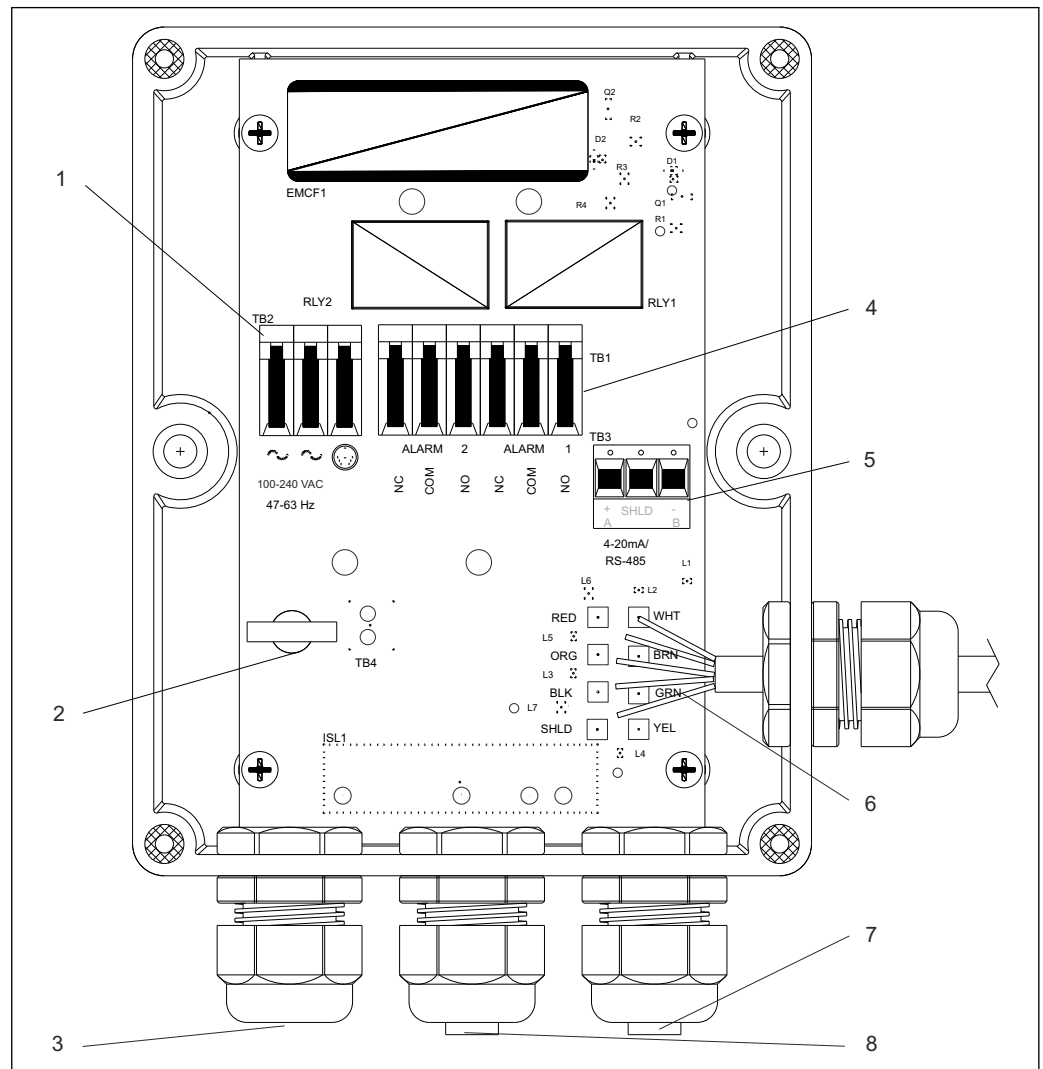
Device is live

Incorrect connection may result in injury or death.

- ▶ The electrical connection may be performed only by an electrical technician.
- ▶ The electrical technician must have read and understood these Operating Instructions and must follow the instructions contained therein.
- ▶ **Prior** to commencing connection work, ensure that no voltage is present on any cable.

5.1 Connection requirements

- ▶ The device is equipped with a power supply of 100 to 240 V AC, 47 to 63 Hz. Before connecting the device, verify that the line voltage matches these specifications.
- ▶ Place a circuit breaker upstream from the mains connection to facilitate maintenance work.



6 Field terminal box

1 Terminal strip, power supply

2 Power cable strain relief

3 Power cable gland

4 Alarm terminal strip, 240 VA, 2 A

5 4 to 20 mA / RS485 terminal strip

6 Sensor wiring

7 4 to 20 mA / RS485 cable gland


8 Alarm cable gland

A0025701

5.2 Connecting RS-485 cables

The digital RS-485 half-duplex (2-wire) interface operates with differential levels that are not susceptible to electrical interference. That is why cable lengths of up to 914 m (3000 ft) can be used. The last device on each bus may require terminating with a 120-ohm resistor to eliminate signal reflection on the line.

- ▶ Do not run the RS-485 cables in the same conduit as the power cable.

 If you are using the device in a process control system without galvanically isolated inputs, you must use a passive barrier e.g. RB223 (see "Accessories") to connect the CUE21/22.

5.3 Connecting relays

The relays for alarm 1 and alarm 2 are mechanical relays rated at 240 V AC and 2 A.

- ▶ Please note that the relays are labeled NO (Normally Open), NC (Normally Closed) and C (Common).

The alarm relays are configured to be "fail-safe" i.e. under normal operating conditions, the device is supplied with current and is not in an alarm condition. How these alarm relays function is described in the "Configuring the alarms" section.

5.4 Connecting the current output

The 4-20 mA output is supplied by a 15 V DC power source and can operate recording devices with loads of up to 600 Ω . This output is isolated from line power and earth ground.

- ▶ Do not run the analog current cables in the same conduit as the power cable.

How this output works is described in the "Selecting the output" section.

5.5 Ensuring the degree of protection

Only the mechanical and electrical connections which are described in these instructions and which are necessary for the required, designated use, may be carried out on the device delivered.

- ▶ Exercise care when carrying out the work.

Otherwise, the individual types of protection (Ingress Protection (IP), electrical safety, EMC interference immunity) agreed for this product can no longer be guaranteed due, for example, to covers being left off or cable (ends) which are loose or insufficiently secured.

5.6 Post-connection check

| Device condition and specifications | Notes |
|--|-------------------|
| Is there any external damage to the device and cables? | Visual inspection |

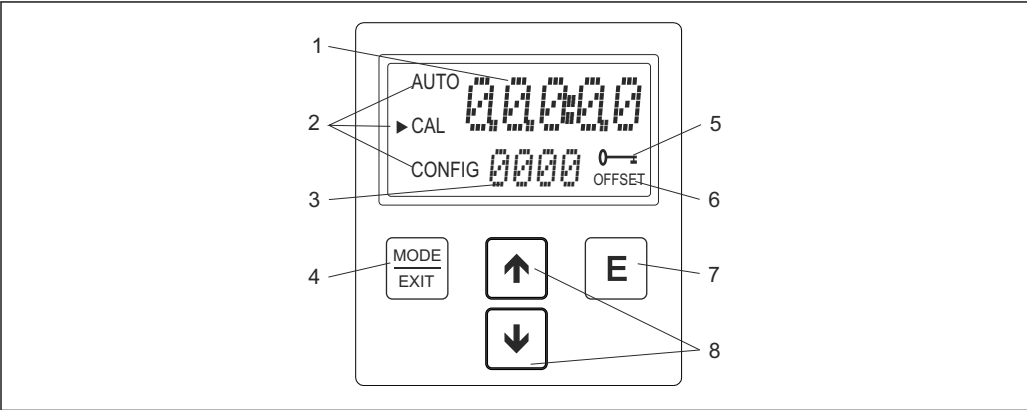
| Electrical connection | Notes |
|---|-----------------------------|
| Are the installed cables strain-relieved and not twisted? | Visual inspection |
| Cable run without loops and cross-overs? | |
| Is the cable type run completely isolated at the point of installation? | Power cables / signal lines |
| Are all the screws terminals properly tightened? | |

| Electrical connection | Notes |
|--|---|
| Are all cable entries mounted, tightened and leak-tight? | For lateral cable entries, make sure the cables loop downwards to allow water to drip off |
| Are the PE distributor blocks grounded (if present)? | Grounding is carried out at the point of installation. |

6 Operation options

6.1 Overview





6.1.1 Display and operating elements



A0025727

- | | | | |
|---|---|---|--------------------------------------|
| 1 | Displays turbidity value and user guidance during configuration | 5 | Icon indicates use of an access code |
| 2 | Indicates operating mode: AUTO (measurement), CAL (calibration), CONFIG (configuration) | 6 | Indicates OFFSET mode |
| 3 | Displays error message and user guidance | 7 | Confirms a selected option or mode |
| 4 | Switches between modes | 8 | Keys used to change settings |

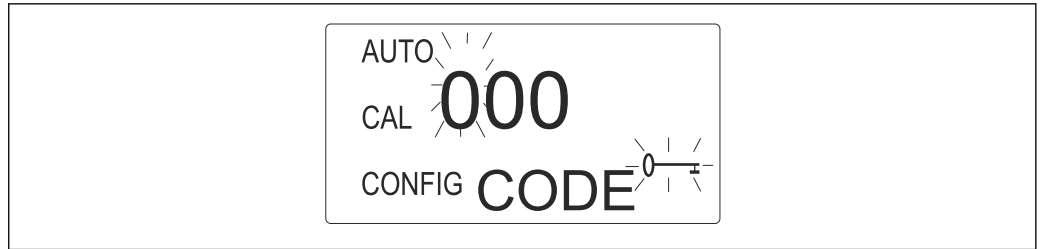
6.1.2 Key functions

| | |
|---|--|
|  | Switches between the operating modes of the device: CAL, CONFIG and AUTO (measurement) |
|  | Confirms the highlighted or selected option or mode |
|  | Scrolls up through the menu. Increases numerical values. |
|  | Scrolls down through the menu. Decreases numerical values. |


6.2 Operating concept

6.2.1 Access code

The device is equipped with a security feature. An access code protects it from unintentional or undesired changes to the configuration and to the calibration data. The access code can be enabled in the configuration mode.




A0026267

 7 Access protection enabled: Prompt to enter code

- ▶ If access protection is enabled:
Enter the code 333.
 - ↳ You can access the CAL or CONFIG menus.
The access code cannot be changed.

6.2.2 Menu structure

The device has three operating modes that can be selected using the  key:

- **AUTO**
Standard operating mode for displaying current measured values
- **CAL**
Calibration mode for performing calibration procedures
- **CONFIG**
Setup mode for configuring customer-specific settings



Configuration menu (CONFIG)

The configuration menu is split into several submenus. The following submenus are available:

- **Output selection**
- **RS-485 port configuration**
- **Alarm configuration**
- **Security access configuration**
- **Offset configuration**
- **Advanced settings**

The extended settings are grouped together to prevent them from being modified accidentally:

- Response speed
- Displayed resolution
- LCD backlight brightness
- Displayed units
- Ultrasonic cleaning
- RS485 parameters
- Desiccant alarm

 For a detailed explanation of the submenus, see the "Instrument configuration" section. (→  19)

7 Commissioning

7.1 Function check

- ▶ Verify that all connections are correct.
- ▶ In particular, verify that all tubes are firmly attached and are not leaking.
- ▶ Ensure that the supply voltage is within the permitted range of 100 to 240 V AC!

7.2 Switching on the measuring device

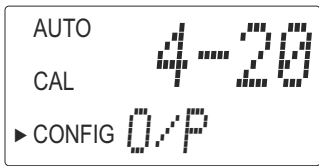
Familiarize yourself with the operation of the device prior to switching it on. To do so, read the "Basic safety instructions" and "Operation" sections in particular.

1. Switch on the power supply to the device.
2. Wait until the device has warmed up (typically 45 to 60 minutes when commissioning the device for the first time).
 - ↳ When a continuous process stream is flowing through the device, the device will output the turbidity level measured in the sample to the LC display. In addition, the equivalent signal is output on the analog (4-20 mA) or digital output, depending on the options selected.
3. Configure the device according to your needs.

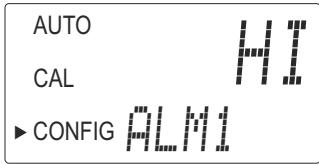
8 Operation

8.1 Configuring the measuring device

8.1.1 Selecting the output


| Function | Options | Info |
|---|---|---|
| Output (O/P)  | <ul style="list-style-type: none"> ■ 4-20 ■ 485 ■ OFF | |
| 4-20 | | |
| 4 mA value | 0 to 1000 NTU | Set the lower turbidity limit value (LOLM) that corresponds to the 4 mA output level. |
| 20 mA value | 0 to 1000 NTU | Set the upper turbidity value (UPLM) that corresponds to the 20 mA output level. |
| 485 | | |
| Baud | <ul style="list-style-type: none"> ■ 1200 ■ 2400 ■ 4800 ■ 9600 ■ 19200 | Set the correct baud rate for operation of the I/O port. |
| Addr | 1 ... 255 | Select the desired device address. |
| MBUS | <ul style="list-style-type: none"> ■ ASCII ■ RTU | Select ASCII or RTU. |

8.1.2 Configuring the alarms

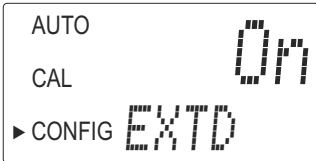
| Function | Options | Info |
|---|---|---|
| Alarm 1 (ALM1)  | <ul style="list-style-type: none"> ■ HI ■ LO ■ OFF | |
| Set point (S/P) | 0 to 1000 NTU | Set the desired alarm set point. |
| Delay on (DLY _▲) | 1 to 30 s | Set the desired number of seconds for the "Delay on" function. |
| Delay off (DLY _▼) | 1 to 30 s | Set the desired number of seconds for the "Delay off" function. |
| Alarm 2 (ALM2) | <ul style="list-style-type: none"> ■ HI ■ LO ■ OFF | |
| Set point (S/P) | 0 to 1000 NTU | Set the desired alarm set point. |

| Function | Options | Info |
|-------------------------------|-----------|---|
| Delay on (DLY _▲) | 1 to 30 s | Set the desired number of seconds for the "Delay on" function. |
| Delay off (DLY _▼) | 1 to 30 s | Set the desired number of seconds for the "Delay off" function. |


8.1.3 Access code

| Function | Options | Info |
|---|---|---|
| Alarm 1 (ALM1)  | <ul style="list-style-type: none"> On OFF | If the security feature is switched on to restrict access, you are required to enter an access code if you wish to switch from AUTO to a different operating mode. The only valid code is 333. This code cannot be changed. |


8.1.4 Advanced settings

| Function | Options | Info |
|---|---|---|
| Extended settings (EXTD)  | <ul style="list-style-type: none"> On OFF | Switch on the "Extended settings" function to access the configuration of the following options: <ul style="list-style-type: none"> Response speed Displayed resolution LCD backlight brightness Units Ultrasonic cleaning RS-485 parameters Desiccant alarm |

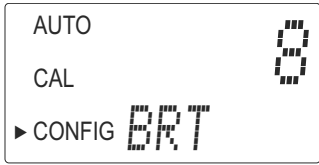
Response speed

| Function | Options | Info |
|--|-----------------------------------|--|
| Response speed (RESP)  | 1 to 100 % Factory setting: 10 | Select the desired response speed for the NTU values that are displayed and output. Select the lowest speed (highest number) to avoid displaying the effects of air and other anomalies. Select the highest speed if there are rapid changes taking place in the process that require monitoring. The displayed number is a relative speed. The approximate response time (in seconds) is calculated by multiplying the displayed number by 5. |

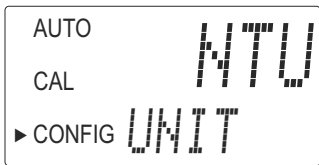
Displayed resolution

| Function | Options | Info |
|---|--------------------------------------|---|
| Resolution (RES)  | 1 to 0.0001 Factory setting: 0.01 | For readings below 10 NTU the device can display values with a resolution of up to four digits to the right of the decimal point. |

LCD backlight brightness

| Function | Options | Info |
|---|-------------------------------|---|
| LCD backlight brightness (BRT)  | 1 to 10 Factory setting: 8 | Adjust the backlighting for the display if necessary. |

Units

| Function | Options | Info |
|---|---|--|
| Units (UNIT)  | <ul style="list-style-type: none"> ■ NTU ■ FNU Factory setting: NTU | Select the desired unit for displaying the turbidity level: NTU (Nephelometric Turbidity Units) or FNU (Formazin Nephelometric Units). |

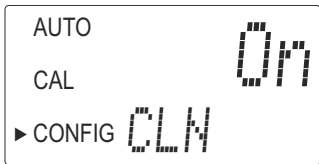
Ultrasonic cleaning

The "Ultrasonic cleaning" option is used for continuous cleaning of the flow-through cuvette. It is not intended to clean cuvettes that are already dirty, or to replace manual cleaning entirely. However, this system will increase the cleaning intervals dramatically. To operate correctly, the use of a cuvette with an ultrasonic transducer is required. The system transmits an ultrasonic frequency through a spring to a piezo transducer that is joined to the base of the flow-through cuvette. The cuvette's detection system works only in AUTO mode.

The system can detect the following error conditions:


- Incorrect cuvette installed
- Error has occurred in the transducer
- Transducer not making contact with the spring

If an error has occurred, the message "CLN" appears in the lower part of the display. The alarms are set and 2mA is sent to the current output. The ultrasonic cleaning function is switched on as standard. After a cuvette has been inserted, the message "Dry" appears for a duration of 30 minutes in the lower part of the display. During this time, the desiccant removes residual moisture from the ultrasonic transducer and no ultrasonic cleaning takes place. At the same time, the error message "CLN" is reset and appears only after the 30 minutes have elapsed.

| Function | Options | Info |
|--|--|--|
| Ultrasonic cleaning (CLN)  | <ul style="list-style-type: none"> ■ On ■ OFF On | The ultrasonic cleaning function can be turned off if desired. |

RS-485 parameters

Using basic programs, such as the Hilgraeve HyperTerminal (included in most Microsoft Windows software packages), the Turbimax can provide basic communication functions. You could also use Visual Basic or other programs. The standard communication parameters are: 8 bits, no parity and 1 stop bit. You can modify these parameters using the following menus. They will appear only if RS-485 was selected as the output (→ 19).

| Function | Options | Info |
|--|--|--|
| Bits (BITS)  | <ul style="list-style-type: none"> ■ 7 ■ 8 Factory setting: 8 | Select the required number of data bits for your communication software. |
| Parity (PRTY) | <ul style="list-style-type: none"> ■ nOnE ■ ODD ■ E Factory setting: nOnE | Select the required parity bit for your communication software. |
| Stop | <ul style="list-style-type: none"> ■ 1 ■ 2 Factory setting: 1 | Select the required stop bit for your communication software. |

Sample communication

The master computer requests a report from the Turbimax.


- To this end, the master transmits the following to the Turbimax:
 - Byte #1 the initial character "." in ASCII or "3A" Hex
 - Byte #2 the address of the Turbimax being queried
 - Byte #3, 4 "CR LF" in ASCII or "0D 0A" in Hex
- The Turbimax responds with:
 - The same initial character "." in ASCII or "3A" Hex
 - Its address
 - The display value for the turbidity content
 - The unit

Communication would proceed as follows:

- The master computer requests a report from address 1: : **1 CRLF**
 - ↳ The Turbimax, which is located at address 1, responds with: : **001 0.0249 NTU**

Desiccant alarm

If the humidity detector in the Turbimax indicates that the humidity of the internal environment may lead to condensation, the device outputs the warning DESC. If desired, the desiccant warning can activate the alarms and send 2 mA to the current output.

| Function | Options | Info |
|---|--|--|
| Desiccant alarm (DESC)  | <ul style="list-style-type: none"> ■ OFF ■ On Factory setting: OFF | Select "On" to activate the alarms as soon as the desiccant can no longer fulfil its function. |

8.2 Instrument calibration

The device was calibrated and tested prior to leaving the factory. Therefore, it is possible to use it directly out of the box. Under normal conditions, recalibration is recommended at least once every three months.¹⁾

Types of calibration

- Complete three-point calibration

This calibration is used if accuracy is required across the entire measuring range of the device, from 0.02 to 1000 NTU (CUE21) or 0.02 to 100 NTU (CUE22). If accuracy is required only in the range below 10.0 NTU, e.g. for drinking water, calibration may also be performed using only a 10.0 NTU and 0.02 NTU calibration standard.

- Offset

This method of calibration can be used if accuracy is required only in the immediate vicinity of the turbidity value of the sample.



- The relay contacts remain in the last valid condition while the device is in calibration mode.
- The device has a timeout function which causes it to revert automatically to AUTO mode after 15 minutes of inactivity.
- During calibration, the fan located inside the device is switched off in order to extend the service life of the desiccant. The fan is switched on during calibration countdowns and after the device returns to AUTO mode or after five minutes (whichever comes first). It is recommended that the measurement chamber be kept covered during calibration and that the flow-through cuvette be inserted immediately after calibration to prevent premature saturation of the desiccant.

8.2.1 Calibrations standards

To achieve the specified level of accuracy across the entire measuring range of the device, we recommend the following calibration standards:

- 0.02 NTU
- 10.0 NTU
- 1000 NTU (CUE21)
100 NTU (CUE22)

These calibrations standards are more stable than formazin and have a shelf life of 12 months. Prior to calibration, verify the expiry dates to ensure that these calibration standards have not expired. If you are using formazin to calibrate the device, ensure that a fresh formazin stock solution is used so that the specified accuracy is achieved.



- A shelf life of 12 months is guaranteed for the 10.0 NTU calibration standard only if it is stored in the plastic bottle. Once it is transferred to a glass cuvette, it must be used for calibration immediately and then disposed of.

8.2.2 Indexing cuvettes

To achieve the highest possible level of accuracy and to allow for normal scratches and signs of wear and tear on the cuvette glass when calibrating, we recommend that the cuvettes be indexed. Calibration standards and standard kits purchased from Endress+Hauser are supplied with indexing rings

The following steps allow repeatable indexing of calibration standards:

1. Shut off the flow using the shutoff clamp provided.
2. Remove the flow assembly with the flow-through cuvette.
3. Insert the calibration standard while the device is in AUTO mode.

1) The EPA recommends that online turbidimeters be calibrated using a calibration standard at least once every three months if they are used for EPA reporting.

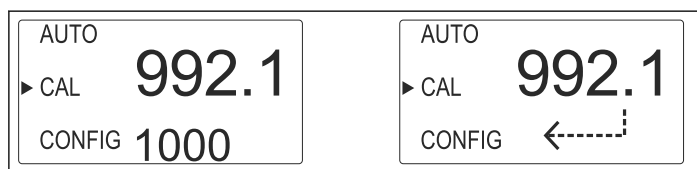
4. Slowly rotate the calibration standard inside the optical path one complete revolution (360°).
 - ↳ While rotating the standard slowly, observe the measured value. Locate the position at which the lowest reading is displayed.
5. With the calibration standard positioned at the point with the lowest reading, install the indexing ring over the cap on the calibration standard. Make sure that the pointer of the indexing ring faces directly forward.


When using the standards in future, always insert them in such a way that the pointer of the indexing ring faces forward. Slowly rotate the calibration standard back and forth by approx. 5° to find the lowest value. The calibration standard is now indexed and ready for use.


8.2.3 Three-point calibration

First calibration point

1. Press the MODE/EXIT key until the calibration function is displayed.
 - ↳ The arrow appears beside "CAL". The lower part of the display alternates between 1000 (CUE21) or 100 (CUE22) (the value of the requested calibration standard) and ←-----┐. The upper part of the display shows the current measured value.





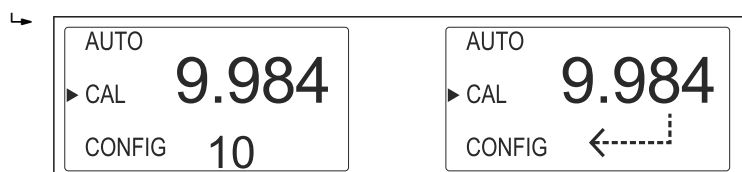
If you wish to perform a two-point calibration for drinking water, press the  key to bypass the 1000 NTU or 100 NTU and to proceed with the second calibration point.

2. If the flow assembly with the flow-through cuvette has not yet been removed, remove it now.
3. Insert the requested calibration standard (1000 NTU or 100 NTU) so that the pointer of the indexing ring faces directly forward.
4. Find the lowest measured value by rotating the standard slowly back and forth by 5°.
 - ↳ Leave the standard in the position with the lowest reading.
5. Press the  key to accept the calibration.
 - ↳ In the lower part of the display, the stabilization time for this calibration step is counted down.


Second calibration point

1. The lower part of the display alternates between 10 and ←-----┐, thereby requesting the 10.0 NTU calibration standard.


If the display does not alternate between 10 and ←-----┐, press the  or  key until the specified information appears.

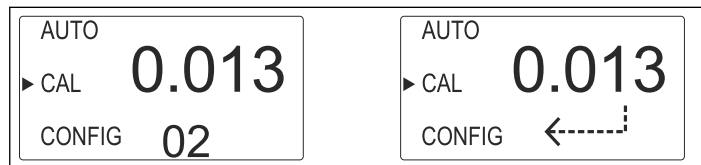



2. Insert the requested calibration standard so that the pointer of the indexing ring faces directly forward.

3. Find the lowest measured value by rotating the standard slowly back and forth by 5°.
 - ↳ Leave the standard in the position with the lowest reading.
4. Press the  key to accept the calibration.
 - ↳ In the lower part of the display, the stabilization time for this calibration step is counted down.

Third calibration point

The lower part of the display alternates between 02 and , thereby requesting the 0.02 NTU calibration standard.



1. Insert the requested calibration standard so that the pointer of the indexing ring faces directly forward.
2. Find the lowest measured value by rotating the standard slowly back and forth by 5°.
 - ↳ Leave the standard in the position with the lowest reading.
3. Press the  key to accept the calibration.
 - ↳ In the lower part of the display, the stabilization time for this calibration step is counted down.

When calibration is complete, the device returns to AUTO mode.

8.2.4 Offset




In certain instances, it can be useful to use an offset instead of a three-point calibration. However, an offset cannot be used in lieu of regular calibration. Using this method, the device will provide accurate turbidity values only in the immediate vicinity of the sample value and not for the entire measuring range.

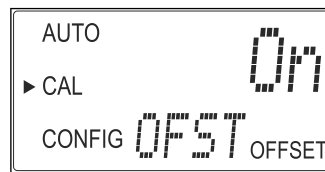





The OFFSET icon is illuminated as soon as an offset is used. The maximum offset is 1.00 NTU. If the device deviation is greater than 1 NTU, a full calibration is recommended.

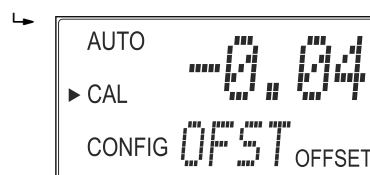
Configuring the offset

1. Take a sample of the process medium that is being monitored by the device, and record the turbidity values reported by the device.
2. Measure the turbidity of the sample using a laboratory turbidimeter (e.g. Turbimax CUE23 / CUE24).
3. Compare the turbidity value reported by the device to the value measured in the lab.
 - ↳ If the values are very close, no offset adjustment is required and the procedure can be stopped at this point.
 - ↳ If the values differ substantially (but by less than 1 NTU), continue the procedure to configure an offset.
4. Select the offset function by pressing the MODE/EXIT key until the arrow appears next to CONFIG.

5. Press the  key until OFST is displayed in the lower line.
- ↳ At this point, the upper line of the display indicates the operating status of the offset function. If the function is switched off, switch it on by pressing  or .



6. The offset is the difference between the NTU value measured by the device and the value measured by the lab device. **Example:** CUE21 / CUE22 measures 0.016 NTU, while the lab device calculates a value of 0.012 NTU for the same sample. Entering an offset of -0.04 results in the CUE21 / CUE22 also displaying 0.012 NTU. Select the desired offset value using the  or  keys. Press the  key to accept the value.



This completes offset configuration. The device is still in configuration mode (CONFIG). Press the MODE/EXIT key to return to AUTO mode.

9 Diagnostics and troubleshooting

9.1 General troubleshooting

9.1.1 Troubleshooting instructions

The device performs continuous diagnostic monitoring. Any errors are displayed in a queue in the bottom line of the display.

The Turbimax provides three levels of fault detection:

- **Warning**

A warning is simply a message on the display indicating that a problem exists. No alarms are activated. If, for example, the desiccant alarm function is disabled and the desiccant becomes saturated, the warning DESC will appear on the display.

- **Error**

An error indicates a fault or a problem that can usually be corrected by the operator. This includes, for example, a lamp outage (LAMP) or an incorrect calibration (CAL). If an error occurs, both alarm relays are activated and the current output is maintained at 2 mA. While the device continues to display values, you should not rely on these values as their accuracy is not known.

- **Failure**

A failure is a system fault. This is a problem that cannot be corrected by the operator. The unit must be returned to the factory for service. These failures consist of failures in the CPU, A/D, EEPROM or other devices internal to the instrument. If a failure occurs, the device will not function properly and will display the message FAIL in the bottom line of the display. Both alarm relays are activated and the current output is maintained at 2 mA.

9.1.2 Process-related errors

| Error | Possible cause | Tests or remedial action |
|---|--|---|
| Display values are higher than expected | Bubbles in solution | Ensure that vent in drain tube is open and not obstructed (→ 10) |
| | Condensate or leaky cuvette | Check flow-through cuvette for condensate or leaks |
| | Flow-through cuvette dirty | Clean cuvette (→ 29). |
| | Device is no longer correctly calibrated | Recalibrate device (→ 23) |
| Display values are incorrect | Bubbles in solution | see above |
| | Debris in flow-through cuvette | Remove debris from cuvette |
| Display values are lower than expected | Device is no longer correctly calibrated | Recalibrate device (→ 23) |
| Upper part of display flashing | Sample has exceeded permitted range | Check sample. Turbidity of sample may be too high to be read by the device. |

9.2 Diagnostic information on local display

| Diagnostic message | Possible cause | Tests or remedial action |
|--------------------|---------------------------|---|
| MA | 4 to 20 mA loop is open | Check wiring (→ 13, → 19). |
| DESC | Desiccant pouch saturated | Replace desiccant pouch (→ 30). |
| LAMP | Lamp failed | Have lamp replaced. Contact sales office. |

| Diagnostic message | Possible cause | Tests or remedial action |
|--------------------|--|---|
| FLOW | Sample flow has stopped | Restore flow |
| CLN | Ultrasonic transducer in flow-through cuvette not making contact | Rotate the flow-through cuvette slightly to improve the connection. If the problem persists, replace the cuvette. |
| | Flow-through cuvette removed | Insert flow-through cuvette |
| FAIL | Major system fault | Contact sales office. |
| DRY | Drying period | Disappears automatically after a period of 30 minutes. |

10 Maintenance

Take all the necessary precautions in time to ensure the operational safety and reliability of the entire measuring system.

NOTICE

Effects on process and process control

- ▶ When carrying out any work on the system, take into account possible repercussions for process control or the process itself.
- ▶ For your own safety, only use genuine accessories. With genuine parts, the function, accuracy and reliability are also ensured after maintenance work.

10.1 Cleaning the flow-through cuvette

The cuvettes should always be clean and free of marks and scratches.

1. Clean the inside of the cuvette using a cleaning solution.
2. Rinse the cuvette several times using distilled or deionized water.
3. If external dirt or scratches cannot be removed:
Replace the cuvette. To do so, read the next section.

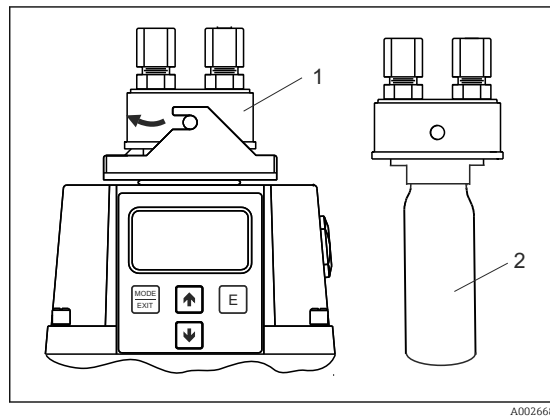
10.2 Replacing the flow-through cuvette

NOTICE

Moisture on the cuvette or transducer

High risk of damage to sensor electronics or transducer

- ▶ Check the cuvette prior to installation. It must be completely dry.



8 Replacing the cuvette

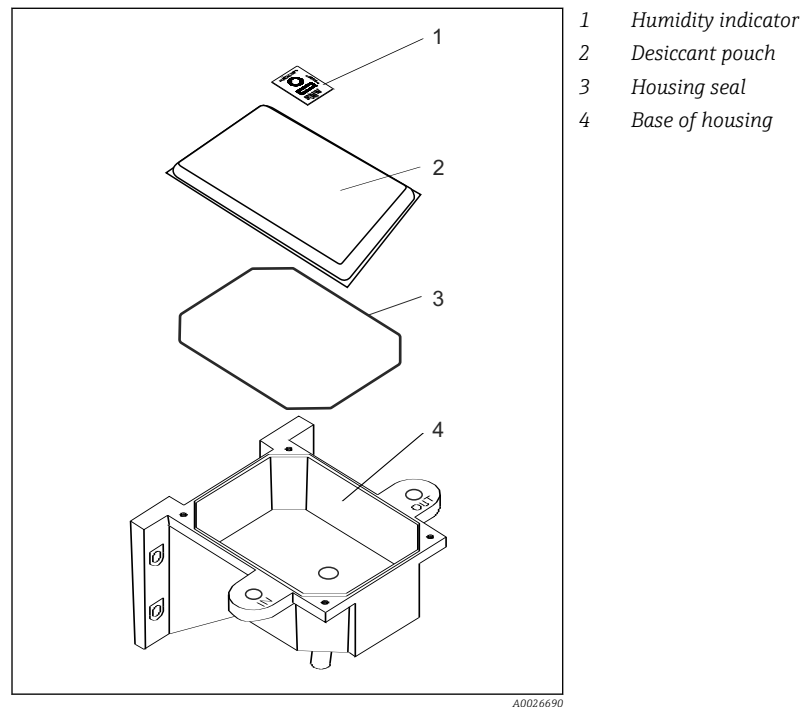
- 1 Flow assembly
- 2 Cuvette

1. Shut off flow at the Turbimax using the shutoff clamp provided.
2. Remove the flow assembly (item 1) from the device.
3. Unscrew the old cuvette (item 2).
4. Verify that the new cuvette is clean, dry and free of scratches or other marks.
Carefully screw the cuvette into the flow assembly making sure not to leave fingerprints on the cuvette.
5. Insert the cuvette with the flow assembly into the device and lock the flow assembly.
↳ After inserting the clean cuvette, the message "DRY" is displayed during the drying phase.

10.3 Replacing the desiccant pouch

Correct use of the desiccant supplied is essential in maintaining the performance of the device. In addition, the housing seal must be maintained to guarantee the standard service life of the desiccant. Inspect this seal each time the desiccant pouch is replaced.

Replace the desiccant when the device outputs a desiccant alarm (DESC).



9 Replacing desiccant

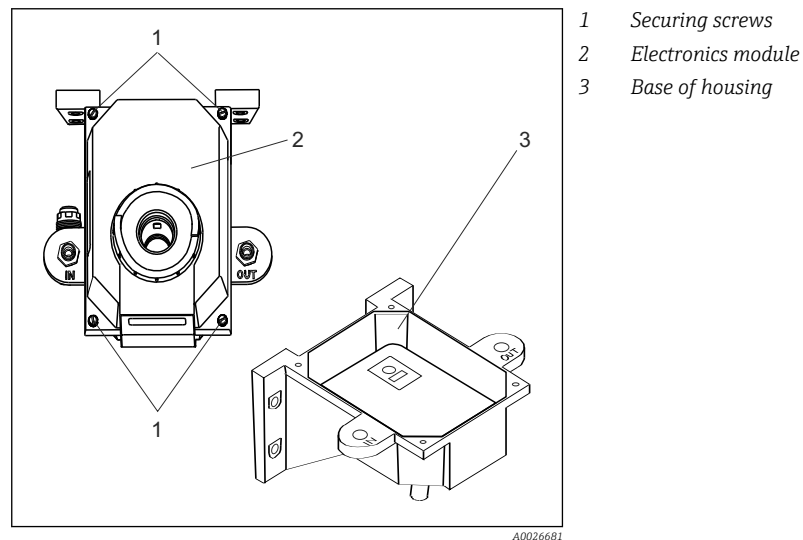
1. Switch off the power supply to the device.
2. Unscrew the four corner screws (item 1).
3. Remove the device's electronic component.
4. Remove the used desiccant pouch (item 2).
5. Check the housing seal (item 3) on the base of the housing.
↳ Replace it if necessary.
6. Open the bag protecting the new desiccant pouch and place the desiccant pouch and the humidity indicator (item 1) in the base of the housing (item 4).
↳ Ensure that you install the desiccant pouch immediately after opening the bag to prevent premature degradation of the desiccant.
7. Return the electronic component of the device to its original position.
8. Tighten the four corner screws.
9. Switch the power supply to the device back on.
↳ The device starts up. Wait for initialization.
10. To speed up detection of the new desiccant, the device must be reset.
This is done by removing the sensor interconnect cable from the device for 2 seconds and then reconnecting it.


11 Repairs

11.1 Spare parts

| Description and contents | Order number |
|---|--------------|
| Electronic service module for CUE21, infrared | 71030103 |
| Electronic service module for CUE22, white light | 71030104 |
| Terminal box CUE21 / CUE22 | 71030105 |
| Desiccant with indicator card, refill pack | 51518578 |
| Tubing kit including: <ul style="list-style-type: none"> ▪ 1 shutoff clamp ▪ 1 flow controller ▪ 2 connecting tubes with fittings for flow assembly ▪ Vent for drain tube | 51518579 |
| Replacement cuvette with ultrasonic transducer for use of the ultrasonic cleaning function | 51518576 |
| Pressure regulator for CUE21/22 | 71085512 |

11.2 Replacing the electronics module



 10 Replacing the electronics module

1. Unscrew the four corner screws (item 1).
2. Remove the electronics module (item 2) from the housing base (item 3).
3. Place the new electronics module on the housing base.
4. Secure using the four screws.

11.3 Replacing the lamp

The lamps in the device have an operating life of approx. 10 years.

Should the lamp need to be replaced, please contact your sales office.

11.4 Return

The product must be returned if repairs or a factory calibration are required, or if the wrong product was ordered or delivered. As an ISO-certified company and also due to legal regulations, Endress+Hauser is obliged to follow certain procedures when handling any returned products that have been in contact with medium.

To ensure swift, safe and professional device returns, please read the return procedures and conditions at www.endress.com/support/return-material.

11.5 Disposal

The device contains electronic components and must therefore be disposed of in accordance with regulations on the disposal of electronic waste.

Observe the local regulations.

12 Accessories



The following are the most important accessories available at the time this documentation was issued. For accessories not listed here, please contact your service or sales office.

12.1 Calibration solutions

Calibration kit CUE21 / CUE23 / CUE24

- Complete measuring range:
 - 0.02 NTU
 - 10.0 NTU
 - 1000 NTU
- Order No.: 51518580

Calibration kit CUE22

- Complete measuring range:
 - 0.02 NTU
 - 10.0 NTU
 - 100 NTU
- Order No.: 71030102

12.2 Flow chamber

Flow chamber CUE21 / CUE22

- To suppress air bubbles
- Order no.: 51518575

12.3 Passive barrier

RB223

- Loop-powered passive barrier
- For galvanic isolation of active signal circuits (0 to 20 mA)
- Product Configurator on the product page: www.endress.com/rb223



Technical Information RB223, TI00132R

13 Technical data

13.1 Input

| | | |
|--------------------|-----------|---------------------|
| Measured variables | Turbidity | |
| Measuring ranges | CUE21: | 0 to 1000 NTU / FNU |
| | CUE22: | 0 to 100 NTU / FNU |

13.2 Output

| | | |
|---------------------------------|--|---------------|
| Output signal | 0/4 to 20 mA | |
| Signal on alarm | Error current: 2 mA | |
| Load | max. 600 Ω | |
| Relay output | Switching voltage: | max. 240 VAC |
| | Switching current: | max. 2 A |
| Communication interface | Bi-directional RS-485, optional Modbus | |
| Limit value and alarm functions | Setpoint adjustment: | |
| | CUE21 | 0 to 1000 NTU |
| | CUE22 | 0 to 100 NTU |
| | Alarm delay: | 0 to 30 s |

13.3 Power supply

| | |
|------------------------|---|
| Supply voltage | 100 to 240 VAC, 47 to 63 Hz, 80 VA switching power supply |
| Overvoltage protection | Category II |
| Protection class | 2 |

13.4 Performance characteristics

| | |
|-----------------------|---|
| Response time | adjustable from 1 to 100 % (approx. 5 to 500 s) |
| Reference temperature | 25 °C (77 °F) |

| | | |
|---------------------------|---------------------------|---|
| Measured value resolution | 0.0001 NTU (below 10 NTU) | |
| Maximum measured error | below 40 NTU: | ± 2 % of display value or ± 0.02 NTU - depending on which value is higher |
| | above 40 NTU: | ± 5 % of display value |
| Repeatability | ± 1 % of reading | |

13.5 Environment

| | | |
|----------------------|---|--|
| Ambient temperature | 2 to 50 °C (36 to 120 °F) | |
| Storage temperature | -20 to +60 °C (0 to 140 °F) | |
| Humidity | 0 to 95 %, non-condensating | |
| Altitude | <2000 m (6500 ft) | |
| Degree of protection | IP66 | |
| Pollution degree | The product is suitable for pollution degree 2. | |

13.6 Process

| | | |
|---------------------|--|--|
| Process temperature | 2 to 50 °C (36 to 120 °F) | |
| Process pressure | max. 13.78 bar (200 psi), controlled by integrated flow controller | |
| Flow | 0.1 to 1 l/min (0.026 to 0.26 US gal/min) | |

13.7 Mechanical construction

| | | |
|------------|------------------|--|
| Dimensions | H x W x D: | 347 x 208 x 197 mm (13.7 x 8.18 x 7.75 inch) |
| Weight | 2.0 kg (4.4 lbs) | |

| | | |
|---------------|--------------------------|--|
| Materials | Housing: | ABS |
| | Flow assembly: | Nylon |
| | Cuvette: | Borosilicate glass |
| | Cuvette seal: | Silicone |
| | Fittings (assembly): | Polypropylene |
| | Locking pins (assembly): | Stainless steel (AISI 304 or AISI 303) |
| | Intake tubing: | Stainless steel (AISI 316) |
| | | |
| Light sources | CUE21: | Infrared LED, 860 nm |
| | CUE22: | White light tungsten lamp, ~600 nm, 2250 K |

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www.addresses.endress.com

ifm electronic



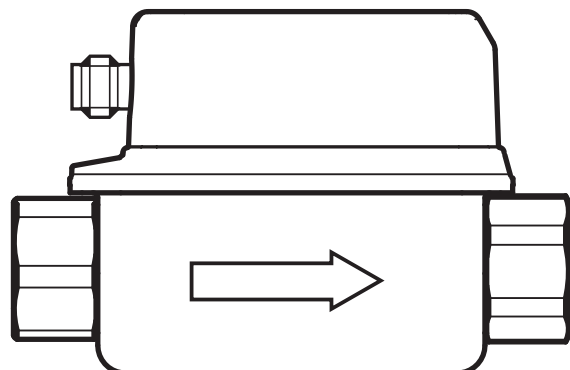
Operating instructions
Vortex flow meter

efector300®

SVxxx4

UK

80226711 / 00 06 / 2015





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Technical data, approvals, accessories and further information at www.ifm.com.

1 Preliminary note

1.1 Symbols used

- Instructions
- > Reaction, result
- [...] Designation of pushbuttons, buttons or indications
- Cross-reference
-  Important note
Non-compliance can result in malfunction or interference.
-  Information
Supplementary note.

UK

1.2 Warning signs used



CAUTION

Warning of personal injury.
Slight reversible injuries may result.

2 Safety instructions

- Please read this document prior to set-up of the unit. Ensure that the product is suitable for your application without any restrictions.
- If the operating instructions or the technical data are not adhered to, personal injury and/or damage to property can occur.
- Improper or non-intended use may lead to malfunctions of the unit or to unwanted effects in your application. That is why installation, electrical connection, set-up, operation and maintenance of the unit must only be carried out by qualified personnel authorised by the machine operator.
- In order to guarantee the correct condition of the device for the operating time it is necessary to use the device only for media to which the wetted materials are sufficiently resistant (→ Technical data).
- The responsibility whether the measurement devices are suitable for the respective application lies with the operator. The manufacturer assumes no liability for consequences of misuse by the operator. Improper installation and use of the units result in a loss of the warranty claims.

CAUTION

For medium temperatures above 50 °C (122 °F) some parts of the housing can heat up to over 65 °C (149 °F). Risk of burns.

- ▶ In this case do not touch the unit.
- ▶ Protect the housing against contact with flammable substances and unintentional contact.
- ▶ Do not press the pushbuttons manually; instead use another object (e.g. ballpoint pen).

3 Functions and features

The unit monitors water-based fluids (water, deionised water, cooling water). It detects the two process categories volumetric flow and medium temperature.



Pressure Equipment Directive (PED):

The units comply with the Pressure Equipment Directive and are designed and manufactured for group 2 fluids in accordance with the sound engineering practice. Use of group 1 fluids on request.

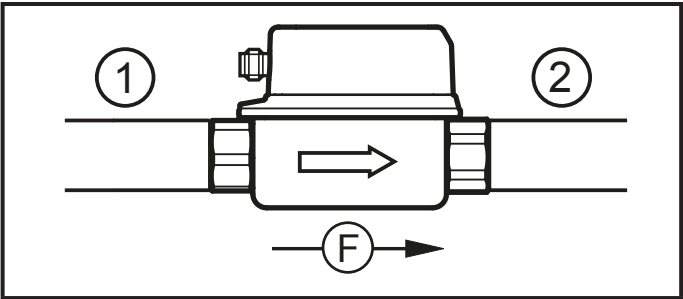
4 Function

- The unit detects the volumetric flow quantity based on the Vortex measuring principle.
- It features an IO-Link interface.
- The unit displays the current flow and temperature. It generates 2 output signals according to the parameter setting:
 - OUT1 / IO-Link: Analogue signal for temperature
 - OUT2: Analogue signal for volumetric flow quantity

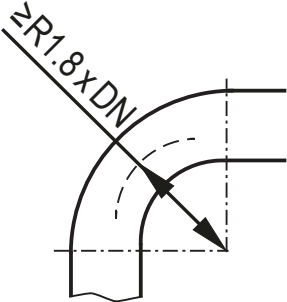
5 Installation

- ▶ Flow in the direction of the arrow. Observe the installation direction.
- ▶ Make sure that pipe and sensor have the same internal diameter.
- ▶ Avoid deposits, accumulated gas and air in the pipe system. Install the unit so that the measuring pipe is always completely filled with medium.
- ▶ Install in front of or in a rising pipe.
- ▶ Recommended tightening torque: 30 Nm
- ▶ Avoid disturbances on the inlet and outlet side. To do so, provide for the following inlet and outlet pipe lengths:

UK



DN = nominal width of the pipe
R = radius

| Disturbance | Inlet pipe length (1) | Outlet pipe length (2) |
|---|-----------------------------|----------------------------|
| Non-ideal bend | $\geq 5 \times \text{DN}$ | $\geq 1 \times \text{DN}$ |
| Ideal bend  | $\geq 0.5 \times \text{DN}$ | |
| Multiple bends (2 x 90°) | $\geq 15 \times \text{DN}$ | |
| Reduction of internal pipe diameter | $\geq 15 \times \text{DN}$ | $\geq 15 \times \text{DN}$ |
| Valve or pump | $\geq 25 \times \text{DN}$ | |

- ▶ Mount the unit in a way that no mechanical forces are exerted on the pipe. To do so, use angle brackets if required.
 - For direct installation, fix the unit on the surface using 4 self-tapping screws M4 DIN 7500. Maximum insertion depth in the housing: 5.5 mm.

- For installation using the fixing element: ifm mounting accessories at www.ifm.com.

► Avoid the following installation positions:

- Directly in front of a falling pipe.
- In a falling pipe.
- At the highest point of the pipe system.
- Directly in front of the spout of the pipe.
- On the suction side of a pump.

6 Electrical connection



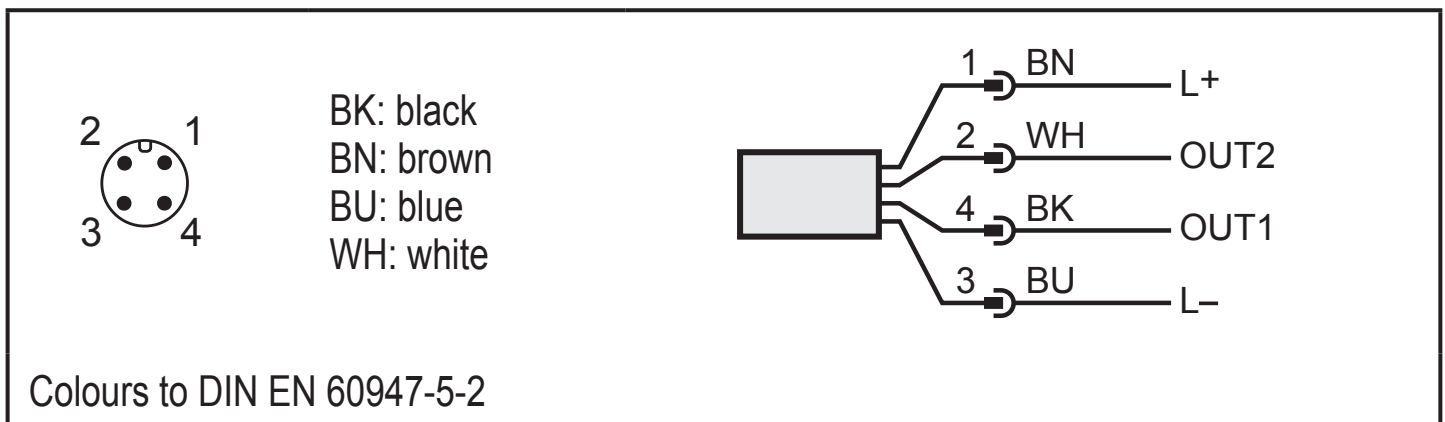
The unit must be connected by a qualified electrician.

The national and international regulations for the installation of electrical equipment must be adhered to.

Voltage supply according to EN 50178, SELV, PELV.

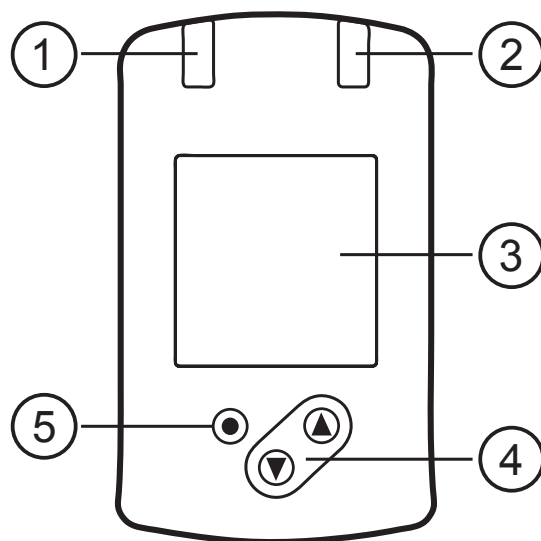
► Disconnect power.

► Connect the unit as follows:



| | |
|---------------------|--|
| Pin 1 | L+ |
| Pin 3 | L- |
| Pin 4 (OUT1) | <ul style="list-style-type: none"> • Analogue signal for temperature • IO-Link |
| Pin 2 (OUT2) | <ul style="list-style-type: none"> • Analogue signal for volumetric flow quantity |

7 Operating and display elements



1 and 2: LEDs

No function

3: TFT display

- Display of current process values (volumetric flow quantity, temperature)
- Display of the parameters and parameter values

4: Buttons [▲] and [▼]

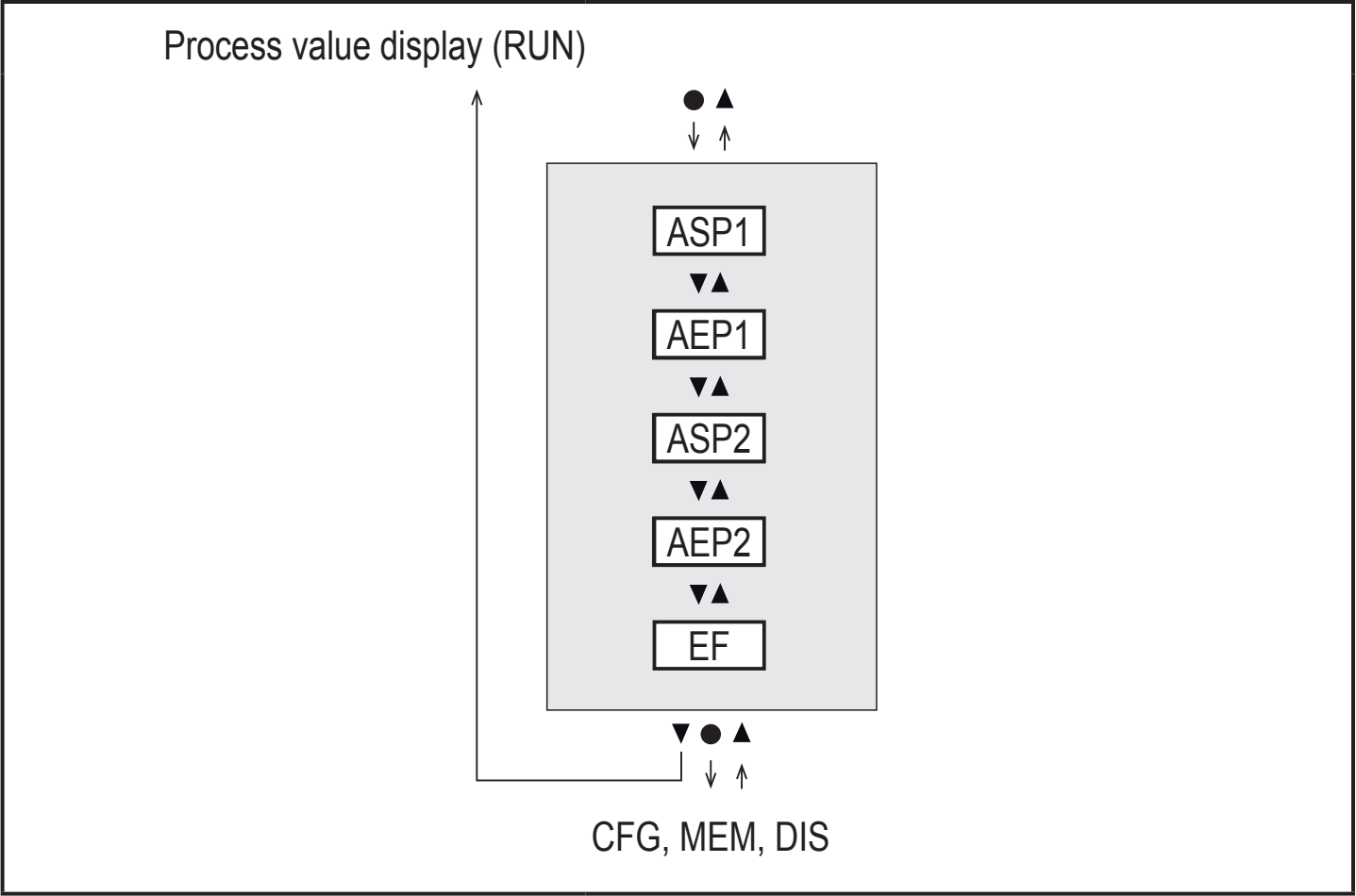
- Select parameters
- Change parameter values (hold button pressed)
- Change of the process value display in the normal operating mode (Run mode)
- Locking / unlocking (press buttons simultaneously > 10 seconds)

5: Button [●] = Enter

- Change from RUN mode to the main menu
- Change to setting mode
- Acknowledgement of the set parameter value

8 Menu

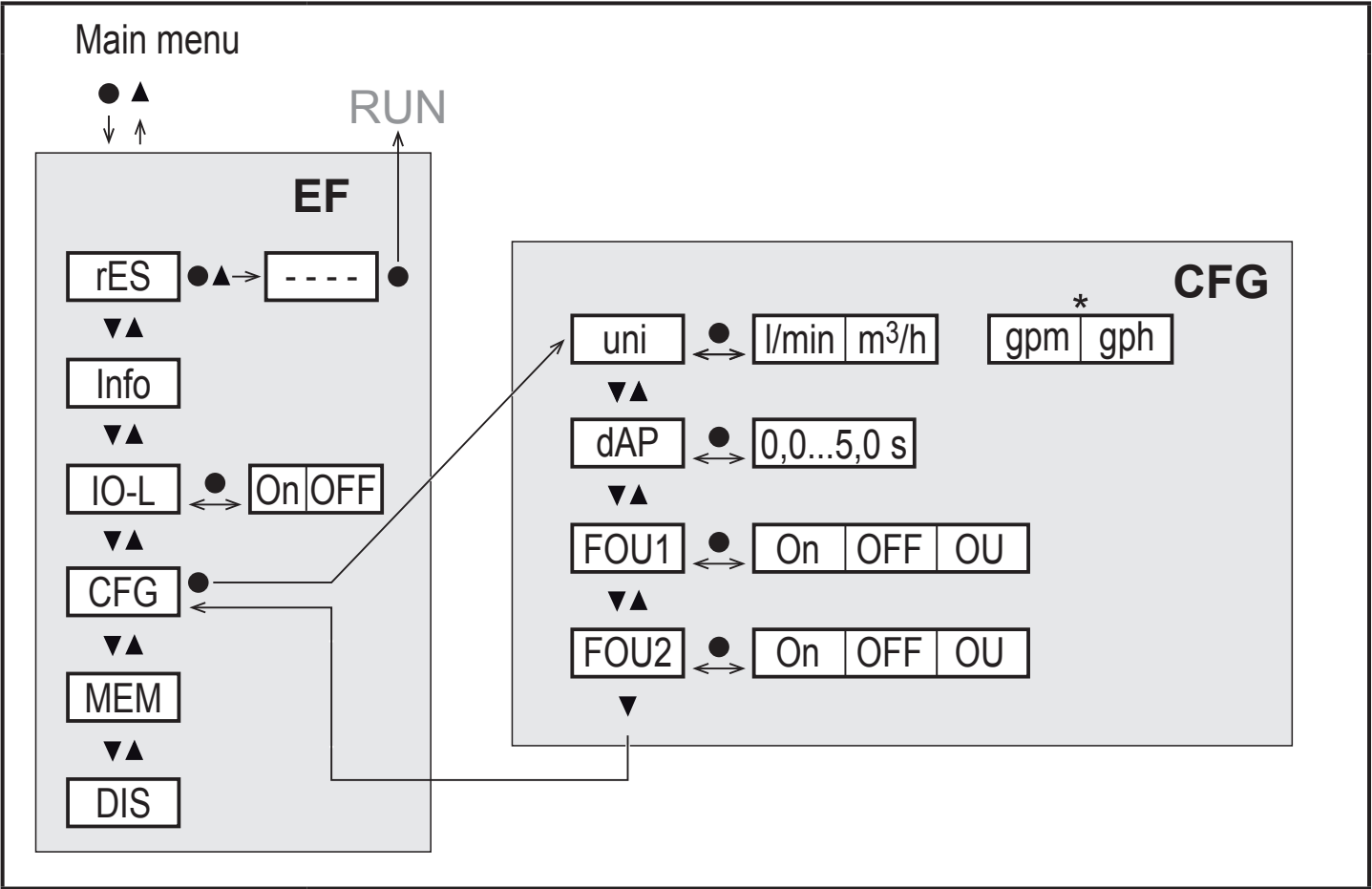
8.1 Main menu



8.1.1 Explanation main menu

| | |
|------|--|
| ASP1 | Analogue start value for temperature |
| AEP1 | Analogue end value for temperature |
| ASP2 | Analogue start value for volumetric flow |
| AEP2 | Analogue end value for volumetric flow |
| EF | Extended functions. Opening of the lower menu level. |

8.2 Extended functions – basic settings



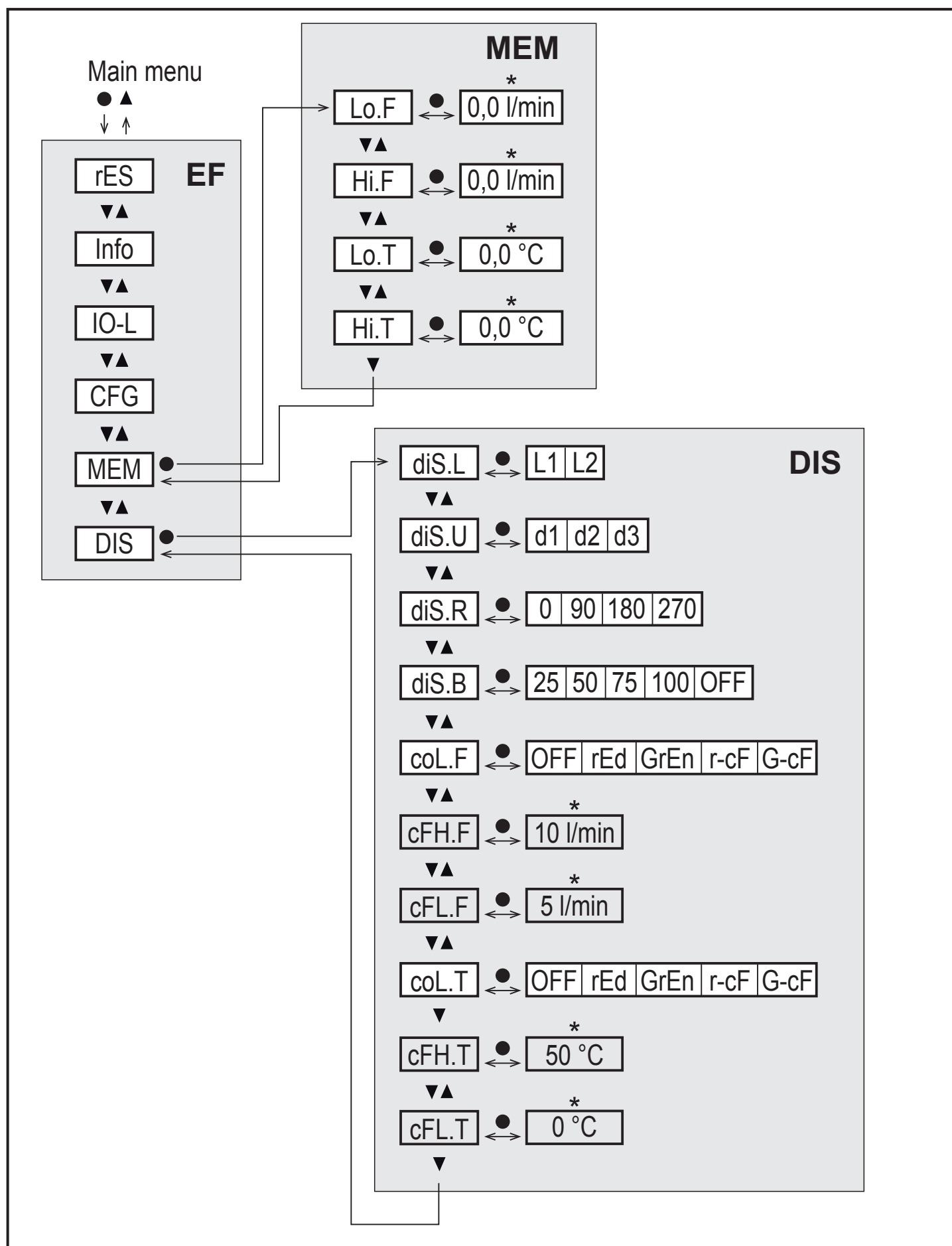
* For SVx6xx units: gpm / gph

| | |
|------|--------------------------------|
| rES | Restoring the factory settings |
| Info | Device information |
| IO-L | Activate IO-Link communication |
| CFG | Submenu basic settings |
| MEM | Submenu min/max memory |
| DIS | Submenu display settings |

8.2.1 Explanation basic settings (CFG)

| | |
|------|--|
| uni | Standard unit of measurement for volumetric flow |
| dAP | Measured value damping in seconds (only for volumetric flow) |
| FOU1 | Behaviour of output OUT1 in case of an error |
| FOU2 | Behaviour of output OUT2 in case of an error |

8.3 Extended functions – min / max memory – display



* For SVx6xx units: gpm, °F

■ The parameters are only displayed when selected r-cF oder G-cF.

8.3.1 Explanation min/max memory (MEM)

| | |
|------|--|
| Lo.F | Minimum value of the flow measured in the process |
| Hi.F | Maximum value of the flow measured in the process |
| Lo.T | Minimum value of the temperature measured in the process |
| Hi.T | Maximum value of the temperature measured in the process |

8.3.2 Explanation display function (DIS)

| | | |
|-------|--|-----------------------------------|
| diS.L | Standard layout of the display(L1: flow or L2: flow and temperature) | |
| diS.U | Update rate of display | |
| diS.R | Display rotation | |
| diS.B | Display brightness | |
| coL.F | Colour configuration volumetric flow | |
| coL.T | Colour configuration temperature | |
| OFF | No colour change | |
| rEd | Process value always red | |
| GrEn | Process value always green | |
| r-cF | Display red if measured value between limit values cFL...cFH | |
| G-cF | Display green if measured value between limit values cFL...cFH | |
| cFH.F | Upper limit value for colour change flow | Only if r-cF or G-cF is selected. |
| cFL.F | Lower limit value for colour change flow | |
| cFH.T | Upper limit value for colour change temperature | |
| cFL.T | Lower limit value for colour change temperature | |

UK

9 Parameter setting

Parameters can be set before installation and set-up of the unit or during operation.



If you change parameters during operation, this will influence the function of the plant.

► Ensure that there will be no malfunctions in your plant.

During parameter setting the unit remains in the operating mode. It continues to monitor with the existing parameter until the parameter setting has been completed.



The parameters can also be set via the IO-Link interface.

9.1 Parameter setting in general

| | |
|---|---|
| 1. Change from RUN mode to the main menu | [●] |
| 2. Selection of the requested parameter | [▲] or [▼] |
| 3. Change to setting mode | [●] |
| 4. Modification of the parameter value | [▲] or [▼] > 1 s |
| 5. Acknowledgement of the set parameter value | [●] |
| 6. Return to the RUN mode | > 30 seconds (timeout) or press [▲] + [▼] simultaneously until the RUN mode is reached. |

10 Troubleshooting

| Display | Type | Description |
|---------------------------------|---------|--|
| [Err] | Error | Unit faulty / malfunction |
| Off | Error | Supply voltage too low or setting diS.B = OFF |
| [PArA] | Error | Parameter setting outside the valid range |
| [cr.UL] | Error | Measured value smaller than -30 %, critically low temperature |
| [cr.OL] | Error | Measured value greater than 130 %, critical excess flow / temperature |
| [🔒 Locked via key] | Warning | Setting pushbuttons on the unit locked, parameter change rejected. |
| [🔒 Locked via Communication] | Warning | Parameter setting locked via pushbuttons, parameter setting active via IO-Link communication. |
| [🔒 Locked via system] | Warning | Setting buttons locked via parameter software, parameter change rejected. |
| [UL] | Warning | Below the detection zone: Measured value lower than -20 % of the final value of the measuring range. |
| [OL] | Warning | Detection zone exceeded: Measured value greater than 120 % of the final value of the measuring range. |

11 Factory setting

| Parameter | Factory setting | User setting |
|---------------------|----------------------------|--------------|
| ASP1 (TEMP) | 0 % * | |
| AEP1 (TEMP) | 100 % * | |
| ASP2 (FLOW) | 0 % * | |
| AEP2 (FLOW) | 100 % * | |
| FOU1 (TEMP) | OFF | |
| FOU2 (FLOW) | OFF | |
| col.F (FLOW) | OFF | |
| col.T (TEMP) | OFF | |
| uni | l/min (SVx6xx: gpm) | |
| dAP | 0,6 s | |
| diS.L | L2 | |
| diS.U | d2 | |
| diS.R | 0 | |
| diS.B | 75 % | |
| cFH.F | MEW | |
| cFL.F | MAW | |
| cFH.T | MEW | |
| cFL.T | MAW | |

MEW = final value of the measuring range

MAW = initial value of the measuring range

* The percentage values refer to the final value of the measuring range.