OneTemp pty ltd
measure | control | record

JUMO

Type 406010

MID flow rate transmitter

Operating instructions

V1.00/EN/00533691

MID flow rate transmitter

Table of contents:

1. OPERATING INSTRUCTIONS

Keep these instructions so they are accessible for every user.

The operating instructions contain important information about safety!

Failure to comply with these instructions may lead to dangerous situations.

- These operating instructions must be read and understood.

1.1. Method of presentation

DANGER!

Warns of an imminent danger!

- Failure to comply will result in death or severe injuries.

WARNING!

Warns of a possibly hazardous situation!

- Failure to comply may result in severe injuries or even death.

CAUTION!

Warns of a possible hazard!

- Failure to comply may result in moderate or minor injuries.

NOTE!

Warns of physical damage!

- Failure to comply may result in damage to the instrument or system.

Identifies important additional information, tips and recommendations that are important for your safety and proper functionality of the instrument.

Refers to information in these operating instructions or in other documentation.

→ Marks a step you must perform in a work sequence.

2. INTENDED USE

Use of the flow rate transmitter not in conformity with its intended purpose may result in hazards for persons, systems in the vicinity and the environment.

- The type 406010 transmitter is only designed for measuring flow rate in liquids.
- Protect the instrument against electromagnetic interference, UV radiation and the effects of weather for outdoor applications.
- When using the instrument, comply with the permissible data, operating and usage conditions in the contract documents and operating instructions.
- Proper transport, storage and installation as well as careful operation and maintenance are requirements for reliable and trouble-free operation.
- Use the instrument only in conformity with its intended purpose.

2.1. Restrictions

When exporting the instrument, observe any restrictions that may be in effect.

2.2. Foreseeable misuse

- Do not use this instrument in areas with an explosion hazard.
- Do not use this instrument to measure the flow rate of gases.
- Do not use liquids that are not compatible with the materials of which the instrument is made.
- Do not use this instrument in an area that is incompatible with the materials of which the instrument is made.
- Do not load the enclosure mechanically (for example by placing objects on it or using it as a stepping stool).
- Do not make any external changes to instrument enclosures. Do not paint any part of the instrument.

2.3. Warranty

The warranty requires use of the type 406010 in conformity with its intended purpose, taking into consideration the usage conditions specified in this manual.

3. SAFETY INSTRUCTIONS

These safety instructions do not cover the following conditions:

- Random events and events that could occur during assembly, operation and maintenance of the instruments.
- Local safety requirements; the operator is responsible for complying with local safety requirements, also as they relate to installation and maintenance personnel.

Danger due to high pressure in the system!

Danger due to electrical voltage!

Danger due to high liquid temperatures!

Danger due to the nature of the liquid!

General hazardous situations.

To protect against injuries, ensure that:

- The system cannot be activated unintentionally.
- Installation and maintenance work may only be performed by authorized and qualified specialists with suitable tools.
- After an interruption in the electrical power supply, a controlled restart of processes is guaranteed.

General hazardous situations.

To protect against injuries, ensure that:

- You operate the device only in flawless condition and in compliance with the operating instructions.
- The general state of the art is maintained in application planning and operation of the instrument.

NOTE!

Chemical compatibility of materials that come in contact with the liquid.

- Check systematically to ensure chemical compatibility of the materials of which the instrument is made and the products with which it could come in contact (for example alcohols, strong or concentrated acids, aldehydes, bases, esters, aliphatic compounds, ketones, aromatic or halogenated hydrocarbons, oxidation agents and agents containing chlorine).

NOTE!

Components/modules subject to electrostatic hazard!

- The instrument contains electronic components that respond sensitively to electrostatic discharge (ESD). Contact with electrostatically charged persons or objects will endanger these components. In the worst case they will be destroyed immediately or fail after start-up.
- Observe the requirements of EN 61340-5-1 and 5-2 to minimize or prevent the possibility of damaged caused by an abrupt electrostatic discharge!
- Make certain as well that you do not touch electronic components when the supply voltage is applied!

The type 406010 instrument was developed in accordance with the state of the art and recognized safety rules. Despite this fact, some dangers may remain.

Failure to comply with these instructions or unauthorized manual changes to the instrument will release the manufacturer from any liability. The warranty of the instrument and accessory parts will also be voided!

4. DESCRIPTION

4.1. Scope of application

The type 406010 is designed for measuring the flow rate of neutral or slightly aggressive liquids with a conductivity greater than 20 µS/cm in pipes with nominal widths from DN15 to DN400.

4.2. General description

4.2.1. Layout

The type 406010 consists of an electronics module and a measuring transducer made of stainless steel.

The measuring transducer consists of two electrodes and a magnet system.

The electrical connection is made by two cable glands and a connection on a 6-pin terminal strip.

The 406010 transmitter requires an 18-36 VDC power supply and has

- one frequency output
- one relay output
- one current output 4-20 mA

4.2.2. Operating principle

The magnet system of the measuring transducer generates a magnetic field in the liquid that is perpendicular to the direction of

flow, see Figure 1. The electrodes of the measuring transducer ensure reliable electrical contact with the liquid. As the liquid flows past, a voltage is measured between the two electrodes. This voltage is proportional to the flow velocity of the liquid.

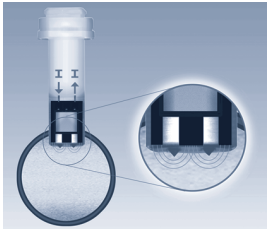


Figure 1: Operating principle of the measuring transducer

4.3. Available versions

Sensor	Material		Order number
	Sensor	Sensor seal	
Short	Stainless steel	FKM	40/00519002
Long	Stainless steel	FKM	40/00519006

5. TECHNICAL DATA

5.1. Operating principles

Ambient temperature (during operation)	-10 °C – 60 °C
Relative humidity	< 80 %, non-condensing
Protection	IP65, with connected cable and tightened cable gland and cover of the electronics module screwed on tightly
Max. altitude above sea level	2000 m

5.2. Compliance with standards and guidelines

Type 406010 has the CE mark and meets the requirements of the standards and guidelines specified in the CE Declaration of Conformity.

5.3. General technical data

5.3.1. Mechanical data

Table 1 : Element in contact with the liquid

Element	Material
Sensor fitting	Stainless steel 1.4404 / 316L
Electrodes	Stainless steel 1.4404 / 316L
Fitting of the electrodes	PEEK
Sensor seal	FKM (FDA-approved)

Table 2 : Elements not in contact with the liquid

Element	Material
Enclosure, cover, union nut	Fiberglass-reinforced PPA
Screws on the cover	Stainless steel
Cable gland	PA
Cover seal	EPDM
Cable gland seal	Neoprene

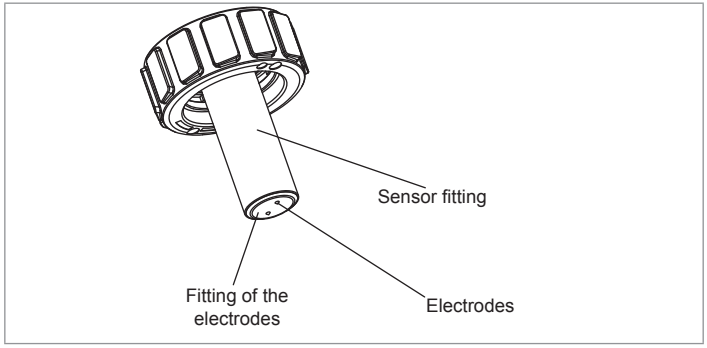


Figure 2: Sensor elements

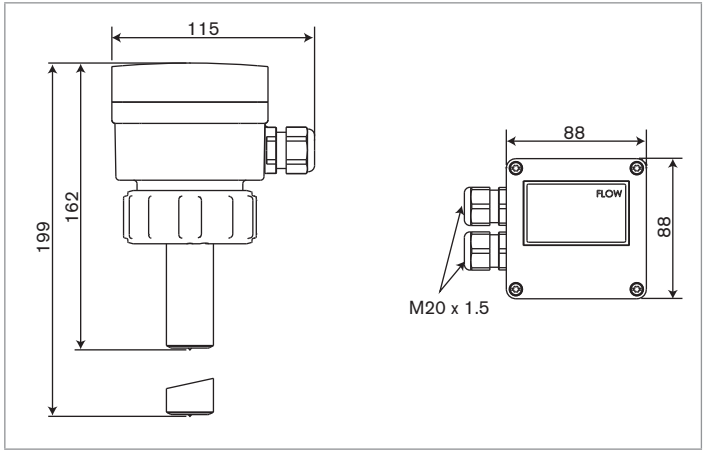


Figure 3: Dimensions of type 406010 [mm]

5.3.2. General data

Diameter of the pipes	DN15 to DN400
Type of fittings	406090
Temperature of the liquid	The temperature of the liquid can be restricted by the pressure of the liquid and the material of fitting 406090 (see Figure 4). -15 - +150 °C
Pressure of the liquid	The pressure of the liquid can be restricted by the temperature of the liquid and the material of fitting 406090 (see Figure 4). • PN10 with plastic fitting • PN16 with metal fitting
Conductivity of the liquid	> 20 µS/cm
Measuring range	0.2 m/s to 10 m/s
Measuring accuracy • With teach-in • With standard K factor	For measured values from 1 to 10 m/s and -15 °C < T_{liquid} < +130 °C • ≤ ±2 % of the measurement • ≤ ±4 % of the measurement
Linearity	≤ ±(1 % of the measurement value + 0.1% of the full scale) with final value of the measuring range = 10 m/s
Repeatability	≤ 0.25 % of the measurement value

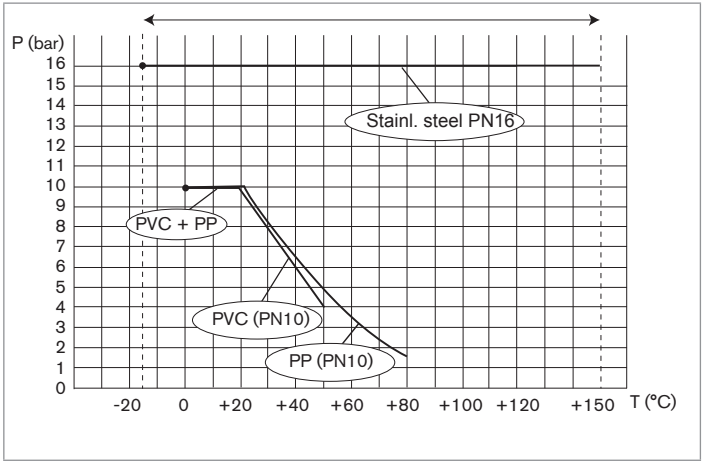


Figure 4: Dependency between the temperature and pressure of the liquid for 406010 in a 406090 fitting of stainless steel, PVC or PP

5.3.3. Electrical data

Power supply	DC 18-36 V, filtered and regulated
Consumption	220 mA (at 18 VDC in the version with current output - without load)
Current output	
• Output type	• 4-20 mA, sink or source (depending on the wiring)
• Update interval	• 100 ms
• Max. loop impedance	• 1100 Ω at 36 VDC, 330 Ω at 18 VDC
Frequency output	
• Frequency	• 0-240 Hz
• Clock ratio	• 50 % ± 1 %
• Max. current	• 100 mA max.
• Protection against short circuit and against short circuit and reverse polarity	• Yes
Relay output	• Normally (currentless) open or normally closed, depending on the wiring • 3 A, 250 VAC max.
Alarm • Full scale exceeded • To indicate errors	• 22 mA and 256 Hz • 22 mA and 0 Hz

5.3.4. Electrical connections

Connection type	Via two cable glands M20x1.5
Properties of the cable	
• Cable type	• Shielded
• Cross-section	• 0.75 mm²
• Diameter of each cable:	
- With one single cable per cable gland	- 6 – 12 mm
- With two cables in one cable gland	- 4 mm, seal for multi-feedthrough included with delivery

5.3.5. K factors

Type 406010 measures the flow velocity of the liquid (m/s) and converts it into a current I (mA) and a frequency f (Hz).

The current I and frequency f are proportional to the flow rate Q (l/s). The proportionality factor is referred to as the "K factor":

$$f = K_1 * Q$$

$$I = K_2 * Q + 4$$

where the unit of measure for K_1 and K_2 is Imp/l

The following formulas are used to calculate factors K_1 and K_2, which are required to convert the current or frequency into a flow rate:

Full scale	Factor K_1	Factor K_2
10 m/s	$K_1 = \frac{100}{K_{fitting}}$	$K_2 = \frac{20}{3*K_{fitting}}$
5 m/s	$K_1 = \frac{200}{K_{fitting}}$	$K_2 = \frac{40}{3*K_{fitting}}$
2 m/s	$K_1 = \frac{500}{K_{fitting}}$	$K_2 = \frac{100}{3*K_{fitting}}$

where $K_{fitting}$ = K factor of the fitting type 406090 that is used.

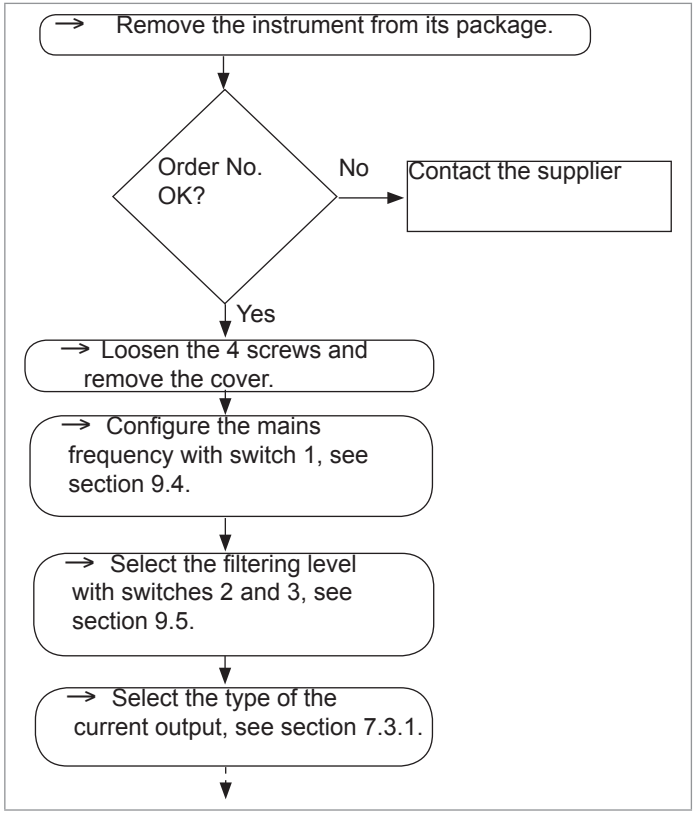
Example:

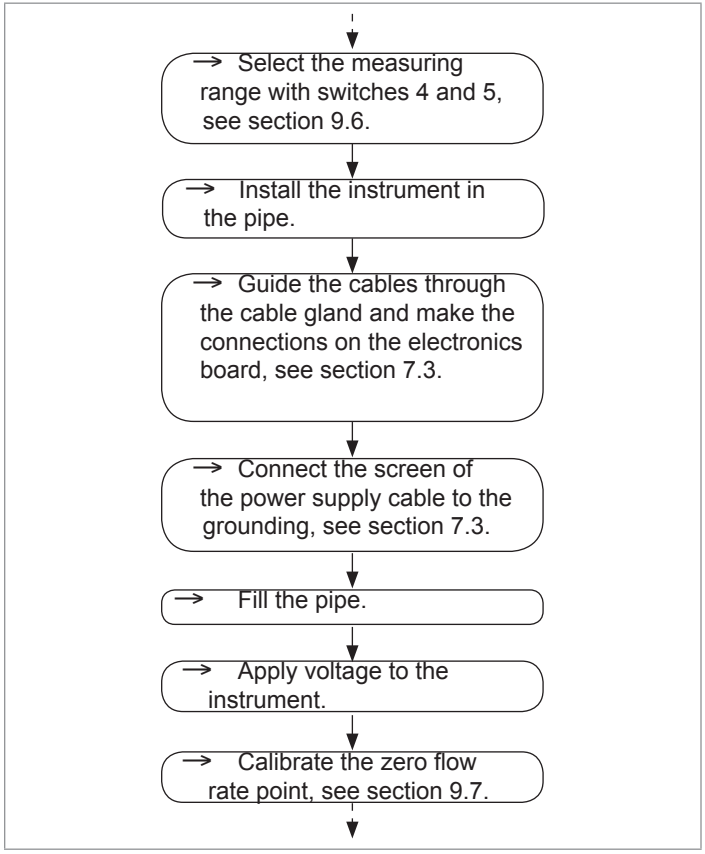
If the full scale for the instrument is set to 5 m/s, the value of the current output will be:

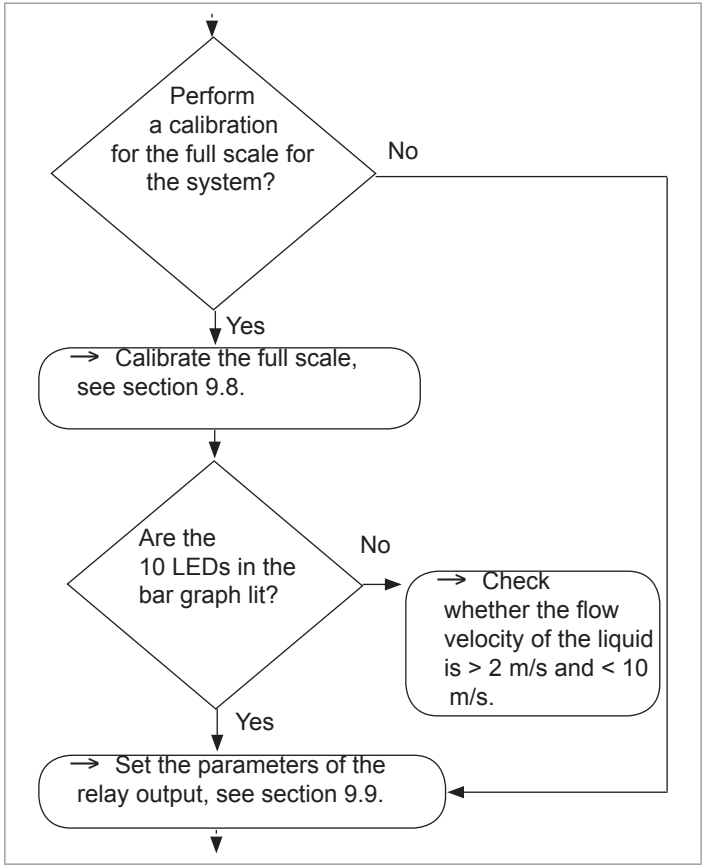
$$I = \frac{40}{3*K_{fitting}} Q + 4$$

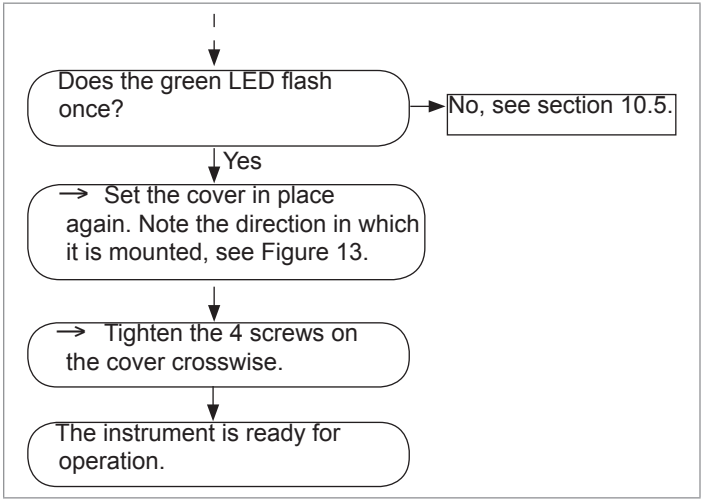
where I is indicated in mA, $K_{fitting}$ in Imp/l and Q in l/s.

6. QUICK INSTALLATION




→ Select the measuring range with switches 4 and 5, see section 9.6.
→ Install the instrument in the pipe.
→ Guide the cables through the cable gland and make the connections on the electronics board, see section 7.3.
→ Connect the screen of the power supply cable to the grounding, see section 7.3.
→ Fill the pipe.
→ Apply voltage to the instrument.
→ Calibrate the zero flow rate point, see section 9.7.


Perform a calibration for the full scale for the system?
No
Yes
→ Calibrate the full scale, see section 9.8.
Are the 10 LEDs in the bar graph lit?
No
→ Check whether the flow velocity of the liquid is > 2 m/s and < 10 m/s.
Yes
→ Set the parameters of the relay output, see section 9.9.



7. INSTALLATION AND WIRING

7.1. Safety instructions

DANGER!

Danger of injury due to high pressure in the system!

- Before loosening the process connections, stop liquid circulation and release the pressure.

Danger of injury due to high liquid temperatures!

- Always wear protective gloves when touching the instrument.
- Before loosening the process connections, stop liquid circulation and empty the pipe.

Danger of injury due to the nature of the liquid!

- Observe the rules in force in the area of accident protection and safety related to the use of hazardous liquids.

Danger of injury through electrical shock!

- Always turn off the power before starting work and protect it against being turned on again!
- Do not unscrew the cover when current is flowing in the instrument.
- Observe the accident protection and safety requirements for electrical instruments!

WARNING!

Danger of injury due to improper Installation!

- Fluid and electrical installations must only be performed by authorized and qualified specialists with suitable tools!
- Always used suitable safety equipment (properly dimensioned fuses and/or circuit breakers).
- Observe the installation instructions for the fitting you are using.

Danger of injury through turning the system on unintentionally and uncontrolled restart!

- Protect the system against being activated unintentionally.
- Ensure that the instrument is restarted in a controlled manner every time after manual changes.

WARNING!

Danger of injury through failure to observe the temperature/pressure dependency of the liquid.

- Observe the temperature/pressure dependency of the liquid, depending on the type of materials the fitting is made of (see Figure 4).

7.2. Installation in the pipe

DANGER!

Danger of injury due to high pressure in the system!

- Before loosening the process connections, stop liquid circulation and release the pressure.

Danger of injury due to high liquid temperatures!

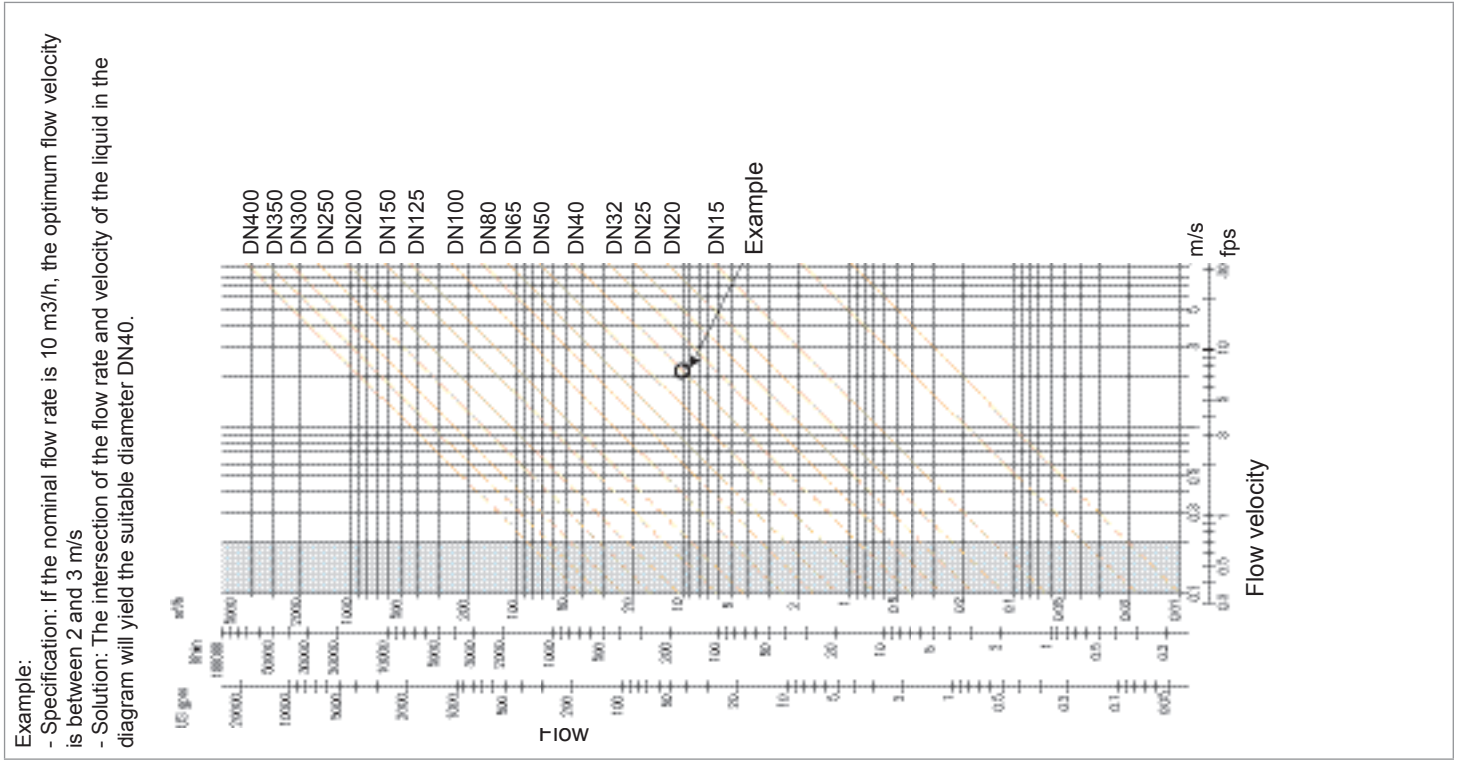
- Always wear protective gloves when touching the instrument.
- Before loosening the process connections, stop liquid circulation and empty the pipe.

Danger of injury due to the nature of the liquid!

- Observe the rules in force in the area of accident protection and safety related to the use of hazardous products.

7.2.1. Recommendations for installation

→ Select a fitting that is suitable for the flow velocity of the liquid in your system; see the following diagram:



→ Install the instrument on the pipe in such a manner that the minimum intake and outlet distances are observed after the pipes are laid; see standard EN ISO 5167-1 und Figure 5:

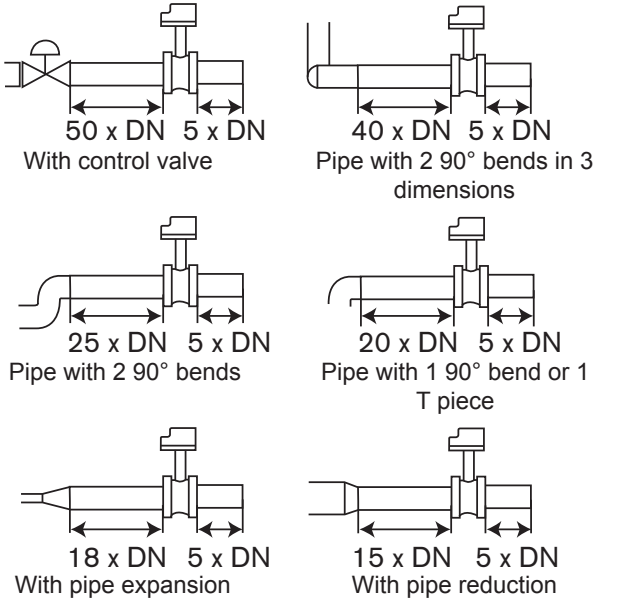


Figure 5: Minimum intake and outlet distances depending on the layout of the pipes.

→ Observe the following additional installation conditions to ensure correct function of the measuring instrument:

- Install the sensor preferably at an angle of 45° in reference to the horizontal centered in the pipe to prevent accumulations on the electrodes and measurement errors due to possible air bubbles (see Figure 6).

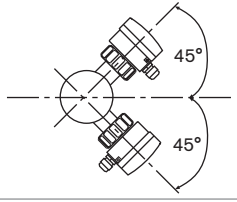
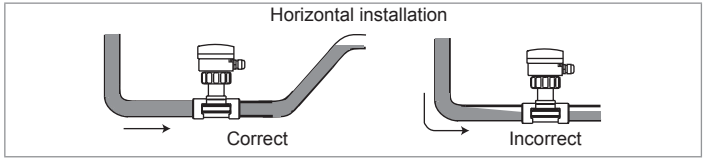


Figure 6: Installation angle of the transmitter in reference to the pipe

- Mace certain the pipe is always filled (see Figure 7).
- Make certain the liquid is flowing upward (see Figure 7).
- Prevent formation of air bubbles in the pipe on the sensor (see Figure 8).
- Always position the instrument upstream from points at which liquids with increased conductivity (for example acids, bases and saline solutions) are introduced.



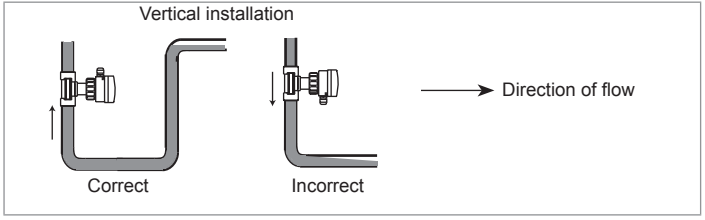


Figure 7: Filling the pipe

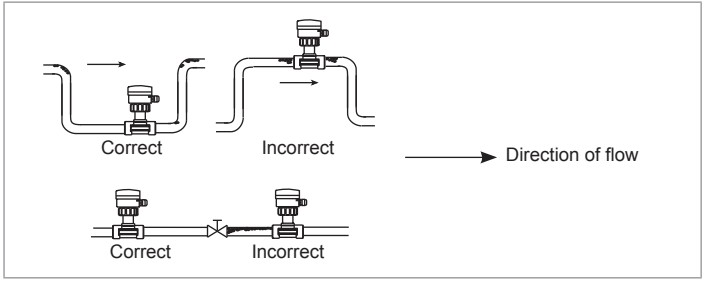


Figure 8: Air bubbles in the pipe

→ If necessary, use a flow conditioner to improve measuring accuracy.

7.2.2. Installation instructions

→ Follow the installation recommendations given in section 7.2.1and in the manual for the fitting type 406090.

→ Install the fitting in the pipe.

→ Place the union nut (see item 3 in Figure 9) on the fitting.

→ Fasten the ring (item 2 inFigure 9) in the groove (item 5 in Figure 9).

→ Insert the instrument (item 1 in Figure 9) in the fitting, positioning the cable bushings parallel to the pipe.

→ Tighten the union nut (item 3 in Figure 9) on the transmitter manually.

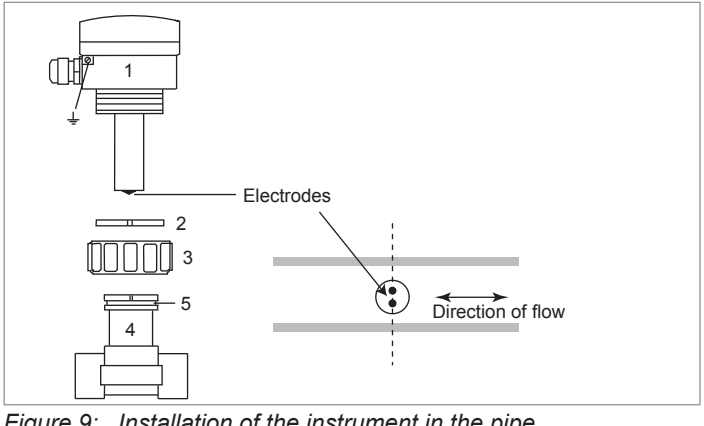


Figure 9: Installation of the instrument in the pipe

7.3. Electrical wiring

DANGER!

Danger of injury through electrical shock!

- Always turn off the power before starting work and protect it against being turned on again!
- Observe the accident protection and safety requirements for electrical instruments!

NOTE!

Use cables with a permissible operating temperature suitable for the application.

Use a high-quality (filtered and regulated) power supply.

→ Install a safety device for the power supply consisting of a 300 mA fuse and a switch.

→ Avoid laying the cable in the vicinity of high-voltage or high-frequency cables. If you cannot avoid laying the cable close to high-voltage or high-frequency cables, keep a minimum distance of 30 cm.

→ Loosen the 4 cover screws to gain access to the electronics board of the instrument (see Figure 10).

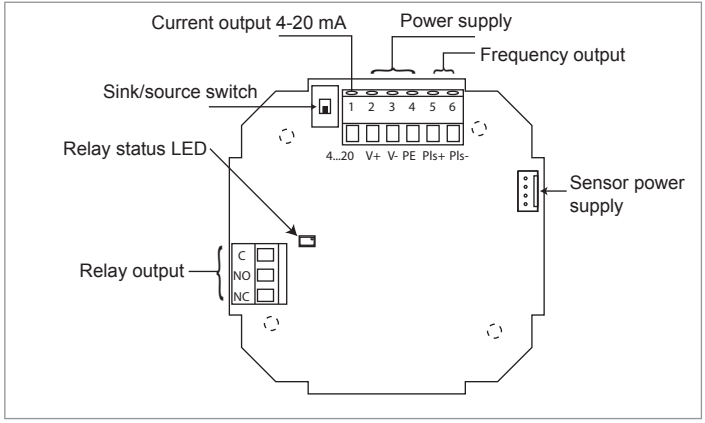


Figure 10: Electronics board type 406010

→ Unscrew the union nut of the cable glands.

NOTE!

The instrument is not leak-proof if one or more of the cable glands is not used

→ Insert the plug included with delivery in the cable gland that is not used.

→ Retighten the union nut of the cable gland.

→ Guide the cables through the cable gland.

Ensure equipotential bonding of the installation (power supply - 406010):

→ Connect the different grounding cables of the system with each other to compensate for differences in potential that could form between the two grounding points.

→ Connect the screen of the power supply cable with terminal No. 4 of the terminal strip on the electronics board inside the enclosure (Figure 11). The version with stainless steel sensor has a second cable from the sensor.

→ Connect the negative pole of the power supply to ground to suppress the effects of common mode currents. If the connection cannot be made directly, a capacitor with 100 nF/50 V can be switched between the negative pole and ground (item 1 in Figure 12).

- If the pipes in the system are made of metal,

→ connect the different devices made of metal (valve, pump, etc.) (item 2 in Figure 12) in the vicinity of the transmitter to the same ground.

- If the pipes in the system are made of plastic,

→ Insert metal pieces (not included with delivery) upstream and downstream from the transmitter (item 2 in Figure 12).

→ Connect the metal pieces to the same ground (Figure 12).

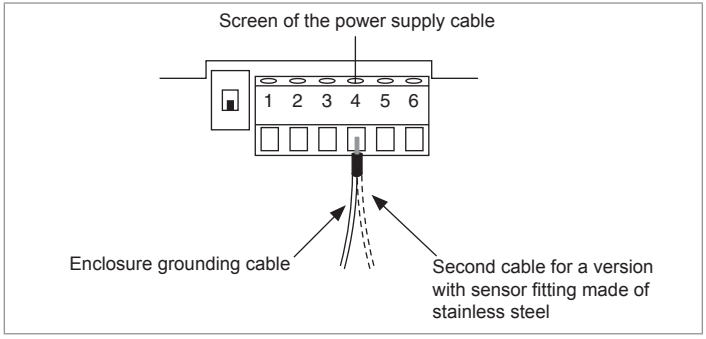


Figure 11: Terminal strip for grounding connection

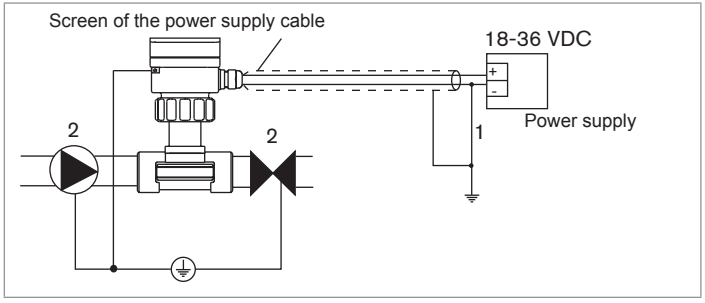


Figure 12: Transmitter grounding

→ Connect the 4-20 mA current output (see section 7.3.1).

→ Connect the frequency output (see section 7.3.2).

→ Connect the relay output (see section 7.3.3).

→ Set the enclosure cover in place again as shown in Figure 13.

→ Retighten the 4 screws on the cover crosswise.

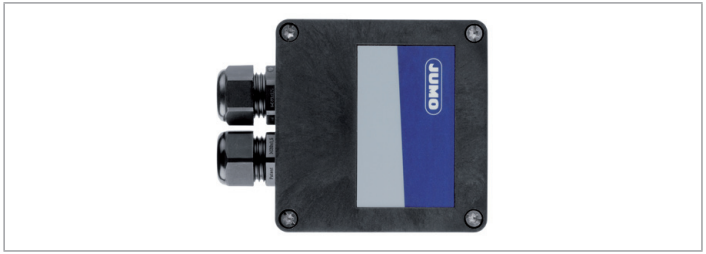


Figure 13: Cover position of type 406010

7.3.1. Wiring of current output 4-20 mA

DANGER!

Danger of injury through electrical shock!

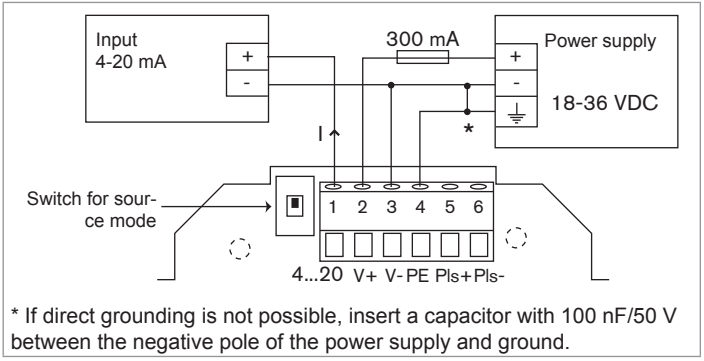
- Always turn off the power before starting work and protect it against being turned on again!

The current output of the 406010 can be connected in source or sink mode.

→ Move the switch of the terminal box to the position for source mode or sink mode (see Figure 14 or Figure 15).

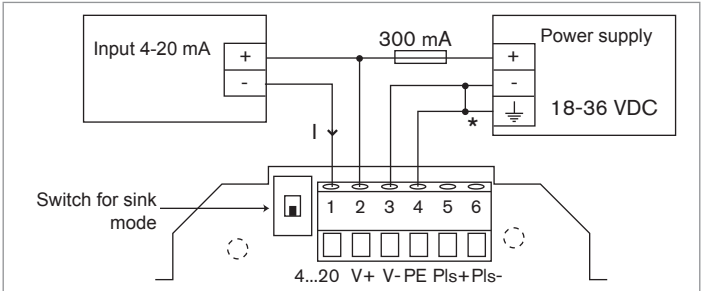
→ Connect the 4-20 mA current output in source mode (see Figure 14) or sink mode (see Figure 15).

→ Make the grounding (see Figure 14 or Figure 15).



* If direct grounding is not possible, insert a capacitor with 100 nF/50 V between the negative pole of the power supply and ground.

Figure 14: Connection of the current output in source mode



* If direct grounding is not possible, insert a capacitor with 100 nF/50 V between the negative pole of the power supply and ground.

Figure 15: Connection of the current output in sink mode

7.3.2. Wiring of the frequency output

→ Connect the frequency output

- to a programmable controller in PNP mode or in NPN mode (see Figure 17)
- or to a load such as an electromechanical counter or relay (see Figure 18)
- or to a load such as an electronic counter with its own power supply (see Figure 19)

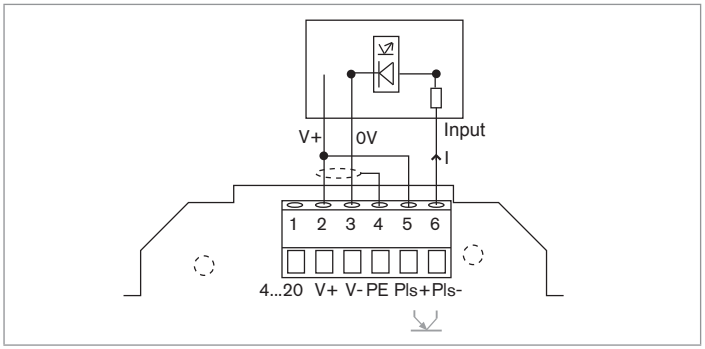


Figure 16: Connection of the frequency output in PNP mode to a programmable controller

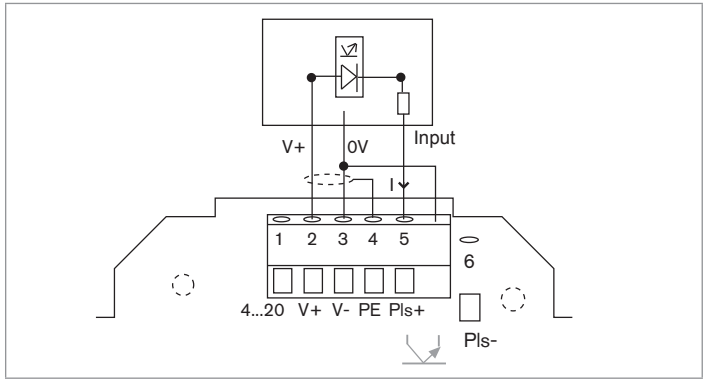


Figure 17: Connection of the frequency output in NPN mode to a programmable controller

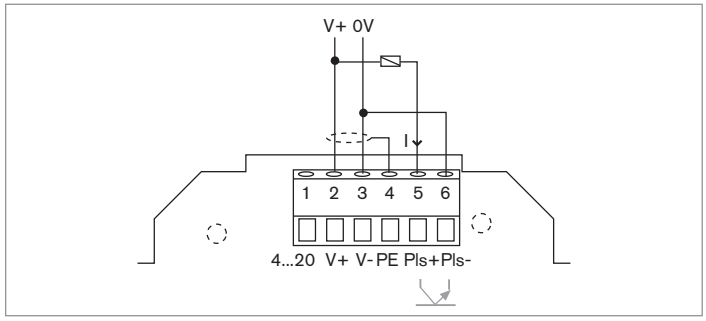


Figure 18: Connection of the frequency output to an electromechanical counter or to a relay

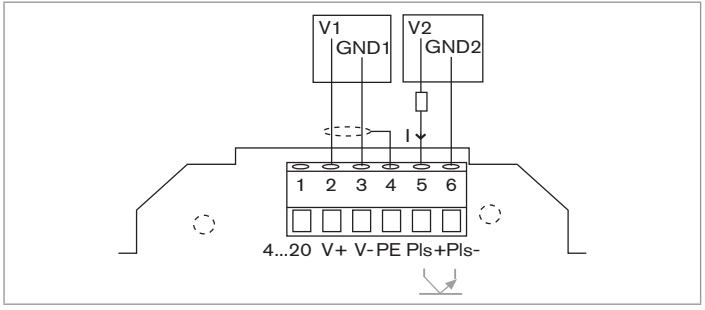


Figure 19: Connection of the frequency output to an electronic counter with its own power supply

7.3.3. Wiring of the relay output

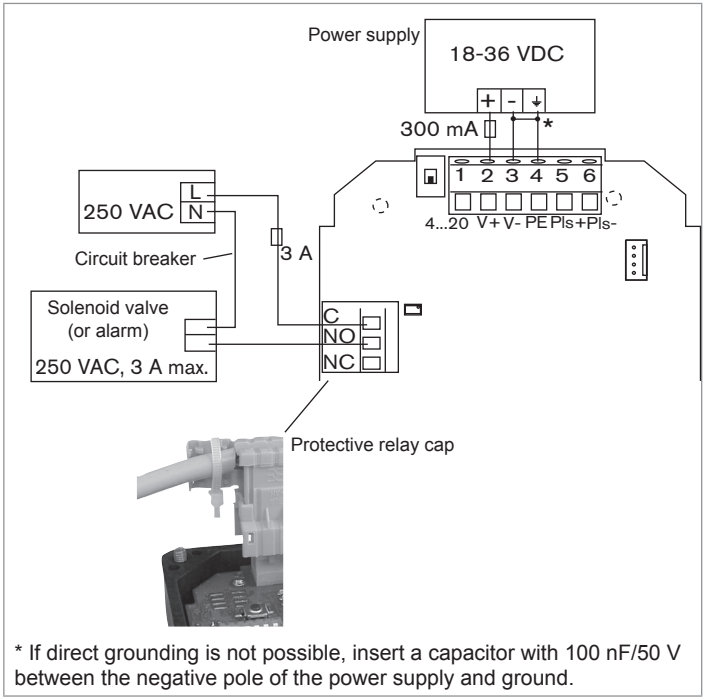
Depending on the connection to the electronics board of the 406010 transmitter, the relay output works either in normally open mode (NO) or in normally closed mode (NC).

→ Install a safety device for the relay consisting of a fuse (3 A max.) and a circuit breaker suitable for the application.

Do not connect a hazardous voltage and a SELV/PELV to the relay at the same time.

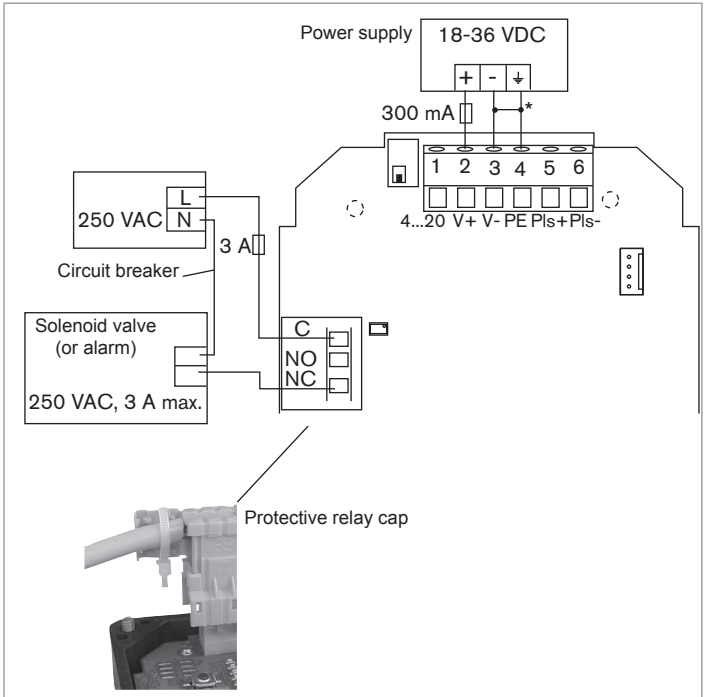
→ Open the relay output in NO mode (see Figure 20) or in NC mode (see Figure 21).

→ Make the grounding; see Figure 20 or Figure 21.



* If direct grounding is not possible, insert a capacitor with 100 nF/50 V between the negative pole of the power supply and ground.

Figure 20: Connection of the relay output in NO mode



* If direct grounding is not possible, insert a capacitor with 100 nF/50 V between the negative pole of the power supply and ground.

Figure 21: Connection of the relay output in NC mode

8. START-UP

8.1. Safety instructions

WARNING!

Danger of injury due to improper commissioning!

Improper operation may result in injuries as well as damage to the instrument and the surrounding area.

- You must ensure before commissioning that the machine operators are familiar with the content of the operating instructions and understand it completely.
- Take special care to ensure compliance with the safety instructions and intended use.
- The instrument/system must only be placed in operation by sufficiently trained personnel.

NOTE!

Danger of damage to the instrument by the environment!

- Protect the instrument against electromagnetic interference, UV radiation and the effects of weather for outdoor applications.

If voltage is applied to the instrument and the cover is open, protection against electrical shock is no longer ensured.

9. OPERATION AND FUNCTION

9.1. Safety instructions

DANGER!

Danger of injury through electrical shock!

- Observe the applicable accident protection and safety requirements for electrical instruments!

WARNING!

Danger of injury due to improper operation!

Improper operation may result in injuries as well as damage to the instrument and the surrounding area.

- The operating personnel must be familiar with and understand the content of the operating instructions.
- Take special care to ensure compliance with the safety instructions and intended use.
- The instrument/system must only be operated by sufficiently trained personnel.

9.2. Electronics board

The 406010 transmitter has 2 operating modes: reading mode and configuration mode. The functions of each operating mode are summarized in the table below:

Mode	Functions
Read	To display • the flow velocity of the liquid measured by the transmitter • the values set for operation of the relay.
Configuration	• To calibrate the transmitter. • To configure the relay parameters.

The instrument can be configured with the 5 switches, push-button, green LED, red LED and bar graph (see Figure 22).

Green LED:

flashes once every second: Current is flowing in the instrument.

flashes 1 to 5 times: Indicates the parameter represented by the bar graph

Bar graph with 10 LEDs:

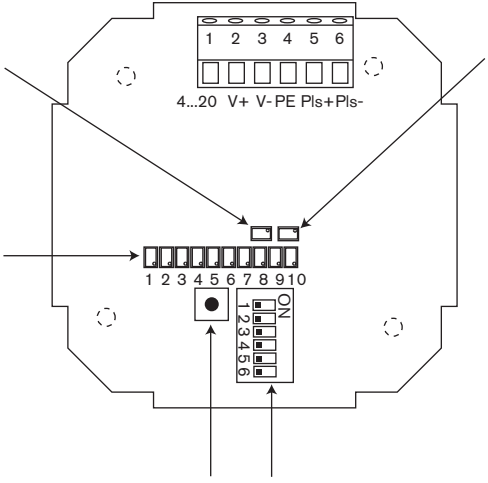
makes it possible to display and set transmitter parameters:

- 1 LED lit = 10 % of the full scale (or 10 seconds)
- in reading mode

LED flashes x times = x % of the full scale (or x seconds)

- in configuration mode

LED flashes 1 times = 1 % of the full scale (or 1 second)



Red LED:

- : Instrument in reading mode
- : Instrument is in configuration mode
- flashes 1 to 5 times: Error (see section 10.5)

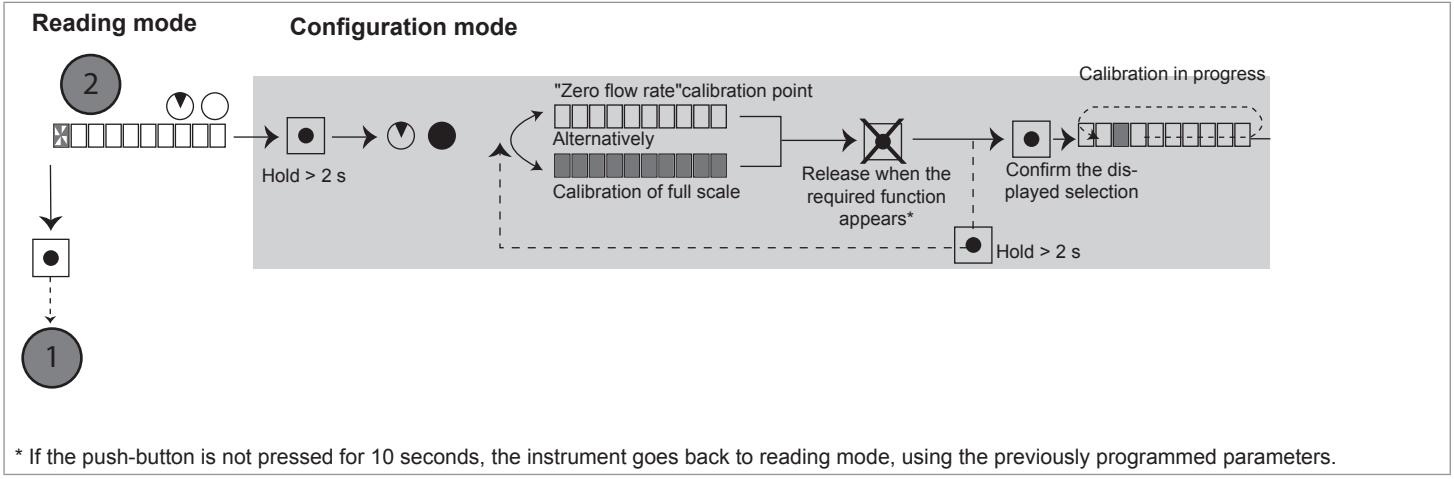
Push-button

Switches 1 to 5: Transmitter configuration (mains frequency, filtering level of measured values, measuring range)

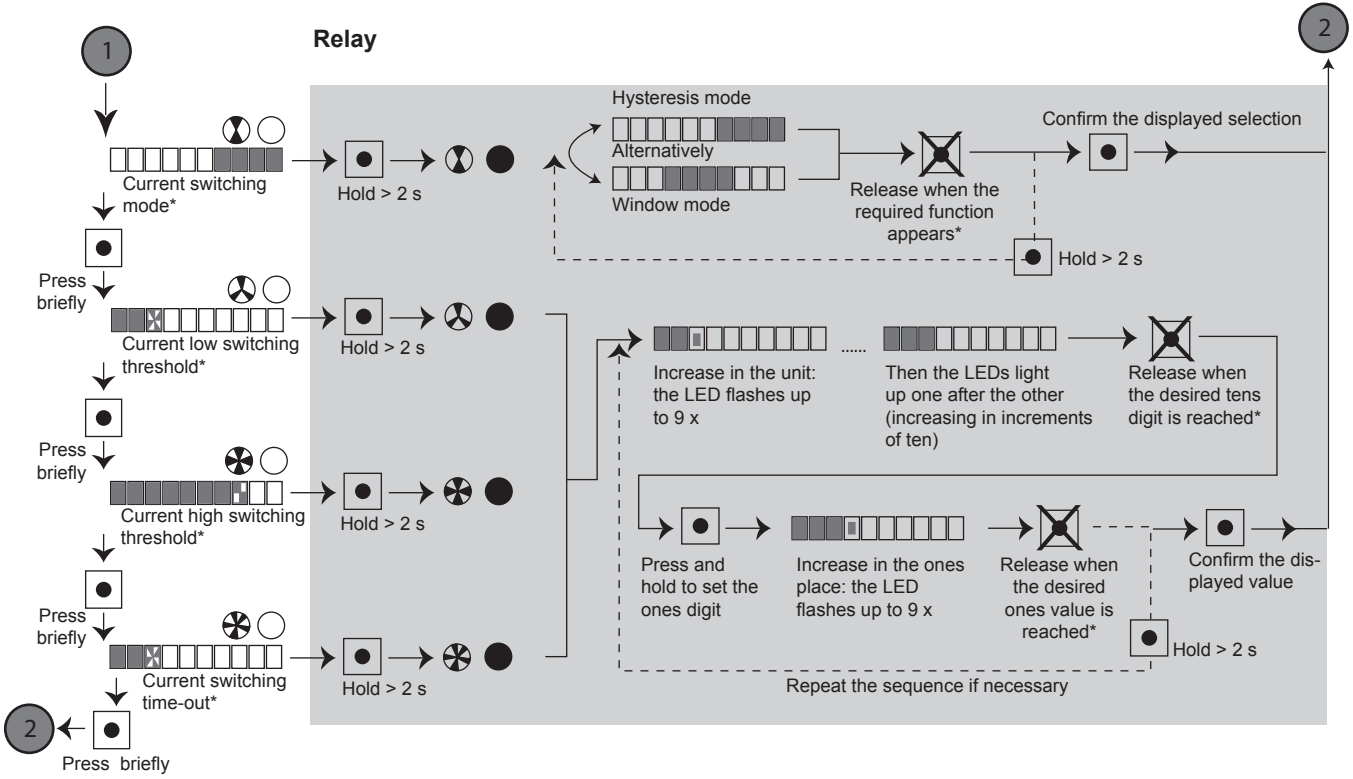
Switch 6: not used

Figure 22: Electronics board type 406010

9.3. Reading and configuration modes



* If the push-button is not pressed for 10 seconds, the instrument goes back to reading mode, using the previously programmed parameters.



* If the push-button is not pressed for 10 seconds, the instrument goes back to reading mode, using the previously programmed parameters.

9.4. Selecting the mains frequency

The mains frequency can be configured with switch 1.

→ Depending on the mains frequency, set switch 1 to the ON or OFF position (see Figure 22 and the table below).

Mains frequency	Position of switch 1
50 Hz	OFF
60 Hz	ON

9.5. Filter selection

The filter can be used to smooth the fluctuations in the flow rate indicated by the bar graph and the current and frequency outputs. Type 406010 can be operated with or without the filter.

The filter can be activated and deactivated with switch 2.

→ Set switch 2 to the desired mode (see Figure 22 and the table below).

Activate filter	Position of switch 2
No	OFF
Yes	ON

If the filter is active, the filtering level can be selected with switch 3: slow or fast.

The "slow" filter is used to smooth strong fluctuations in the flow rate (for example liquids with air bubbles), see Figure 23.

The "fast" filter is used to smooth weak fluctuations in the flow rate (see Figure 23).

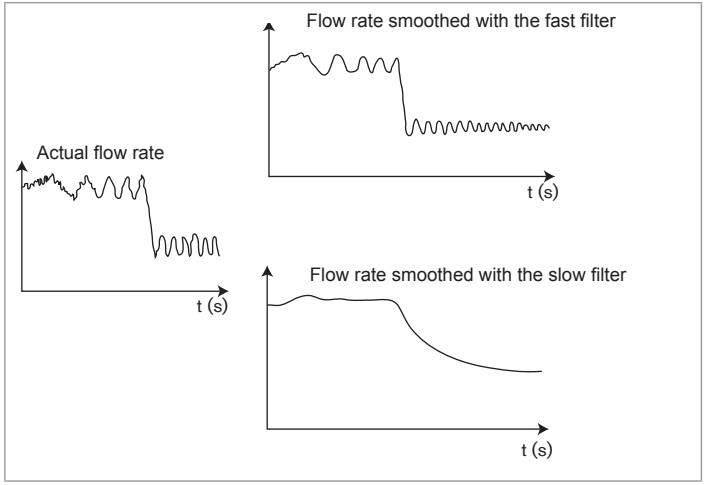


Figure 23: Filtering level of the flow rate

→ Set switch 3 to the desired filtering level (see Figure 22 and the table below).

Filtering level of the flow rate	Position of switch 3
Slow (response time 10 to 90 % = 14 s)	OFF
Fast (response time 10 to 90 % = 5 s)	ON

9.6. Selecting a measuring range

Output signals are proportional to the measured flow velocity of the liquid. The measuring range of the transmitter can be adapted to the application with switches 4 and 5.

→ Configure switches 4 and 5 to select the measuring range (see Figure 22 and the table below).

Measuring range	Position of switch 4	Position of switch 5
0 to 2 m/s	ON	OFF
0 to 5 m/s	OFF	ON
0 to 10 m/s	OFF	OFF
0 to the calibrated full scale (between 2 and 10 m/s)	ON	ON

After the measuring range is changed, the percentages programmed for the low and high thresholds apply to the new selected full scale.

9.7. Calibration of zero flow rate

→ Calibrate the transmitter during commissioning and after every maintenance operation.

- Before calibrating the zero flow rate point during commissioning:

  → Immerse the measuring element in the liquid 24 h before calibration.

- After every maintenance operation, before calibrating the zero flow rate:

  → Immerse the measuring element in the liquid 1 h before calibration.

→ Make certain before calibration that the pipe does not contain any air bubbles and the liquid is not moving.

→ Fill the pipe with liquid.

→ Stop the flow.

→ Calibrate the "zero flow rate" point (see Figure 24 and Figure 25).

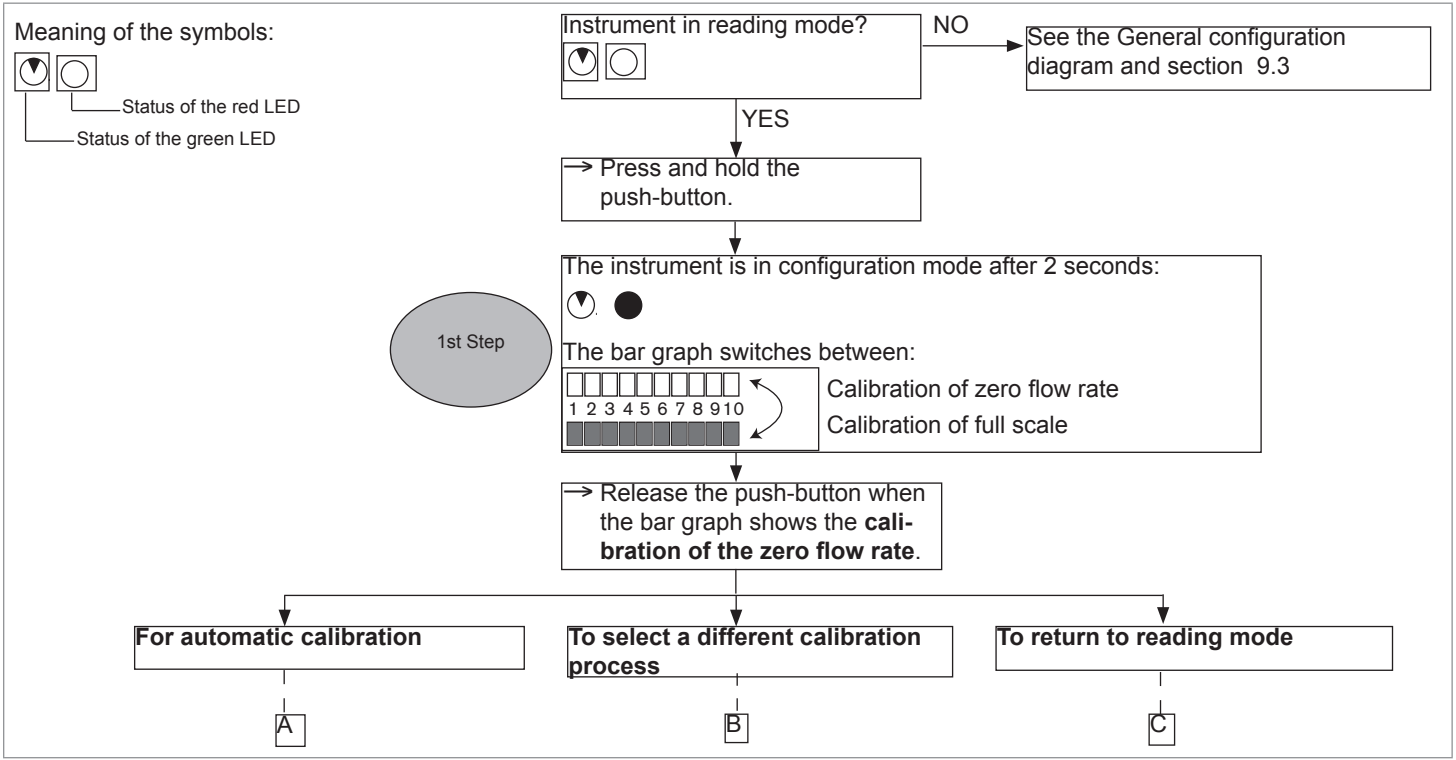


Figure 24: Calibration of the zero flow rate point, part 1

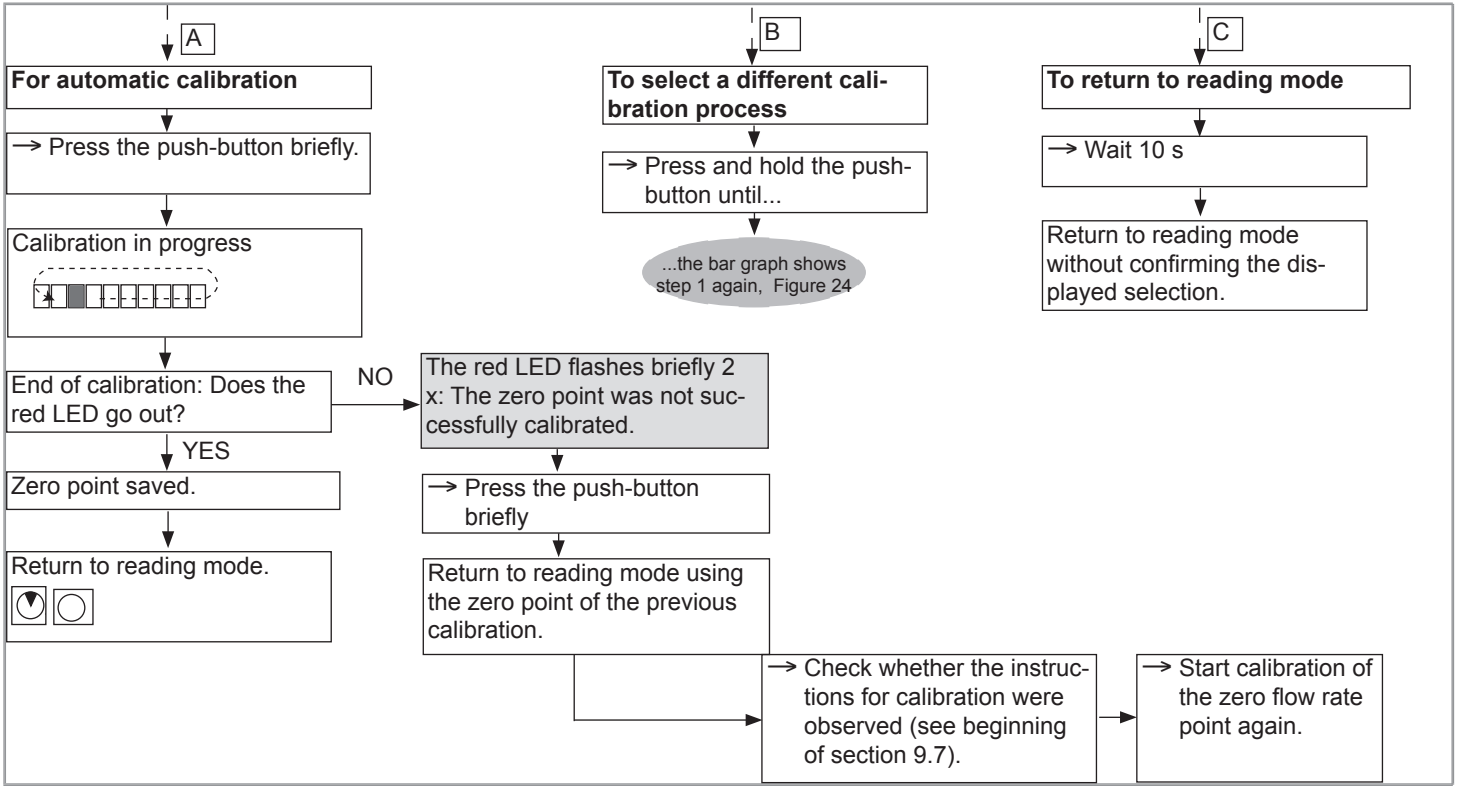


Figure 25: Calibration of the zero flow rate point, part 2

9.8. Calibration of full scale

Figure 26 and Figure 27 illustrate the relationship between the measured flow velocity of the liquid and the frequency or current value delivered by the outputs.

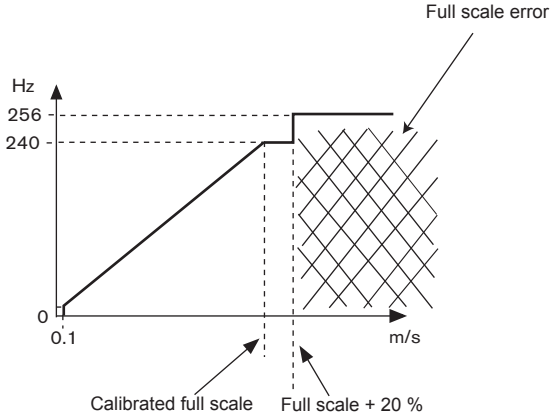


Figure 26: Relationship between the measured flow velocity of the liquid and the value of the frequency output

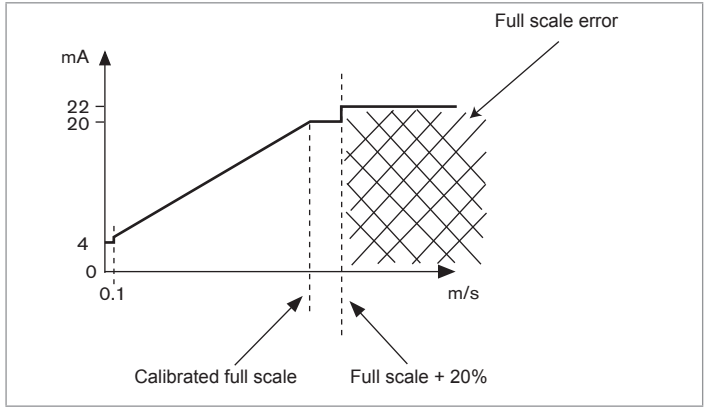


Figure 27: Relationship between the measured flow velocity of the liquid and the value of the current output

If none of the predefined measuring ranges are suitable, the measuring range of the 406010 transmitter can be adapted to the relevant application.

The minimum value of the measuring range is 0 m/s.

→ Set switches 4 and 5 to ON (see Figure 22).

→ Install the type 406010 instrument in the pipe as described in section 7.

→ Allow the liquid to circulate in the pipe at the maximum speed.

→ Calibrate the full scale, see Figure 28 and Figure 29.

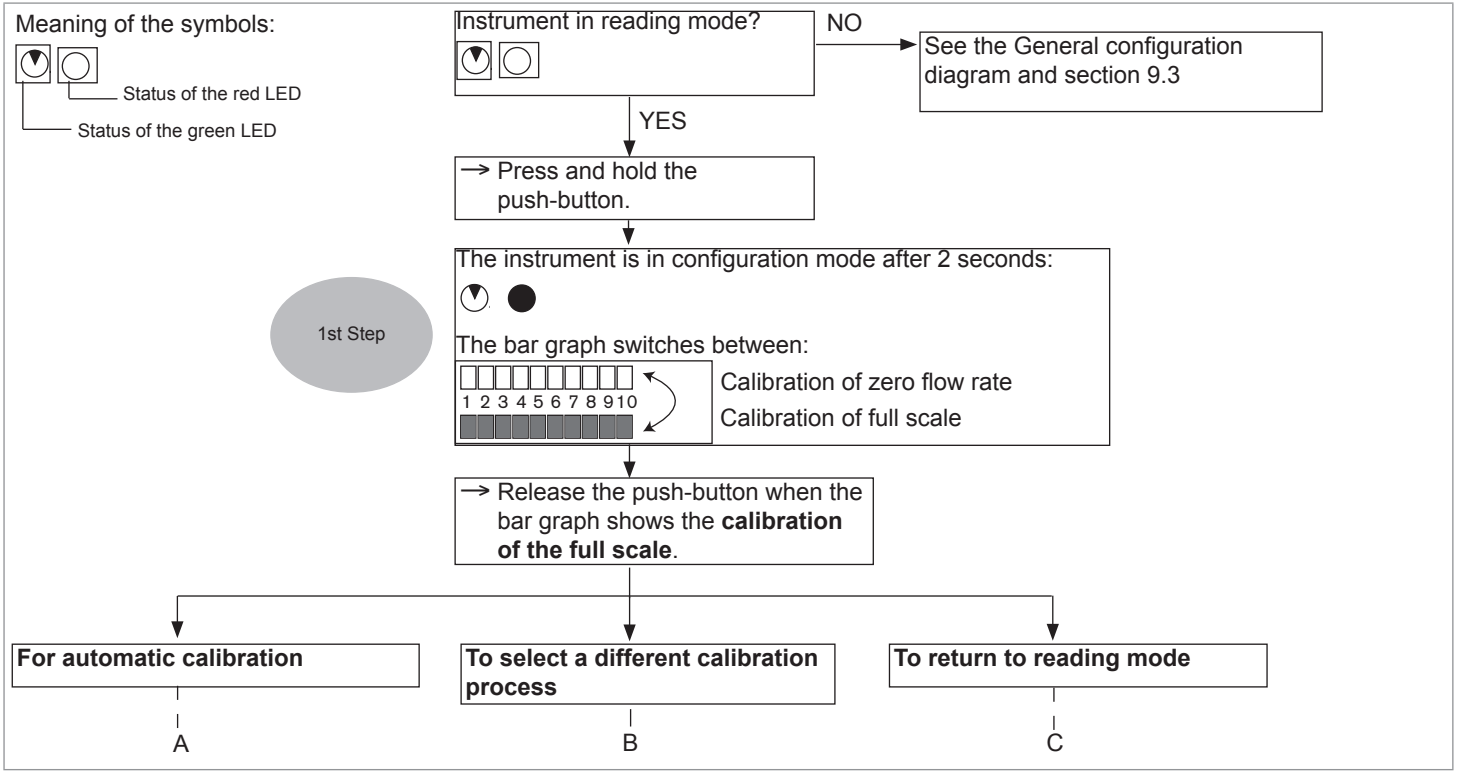


Figure 28: Calibration of full scale, part 1

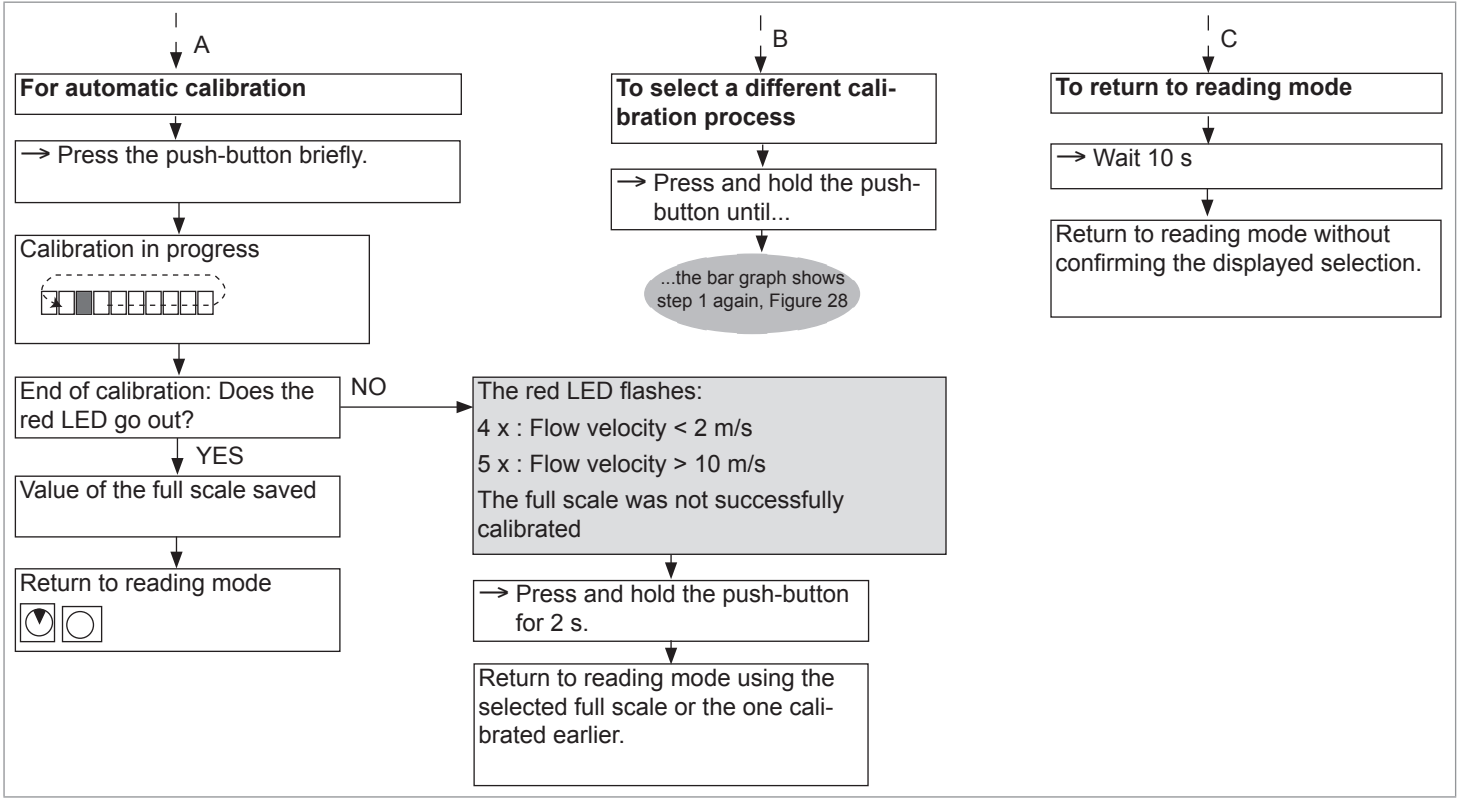


Figure 29: Calibration of full scale, part 2

9.9. Programming the relay output

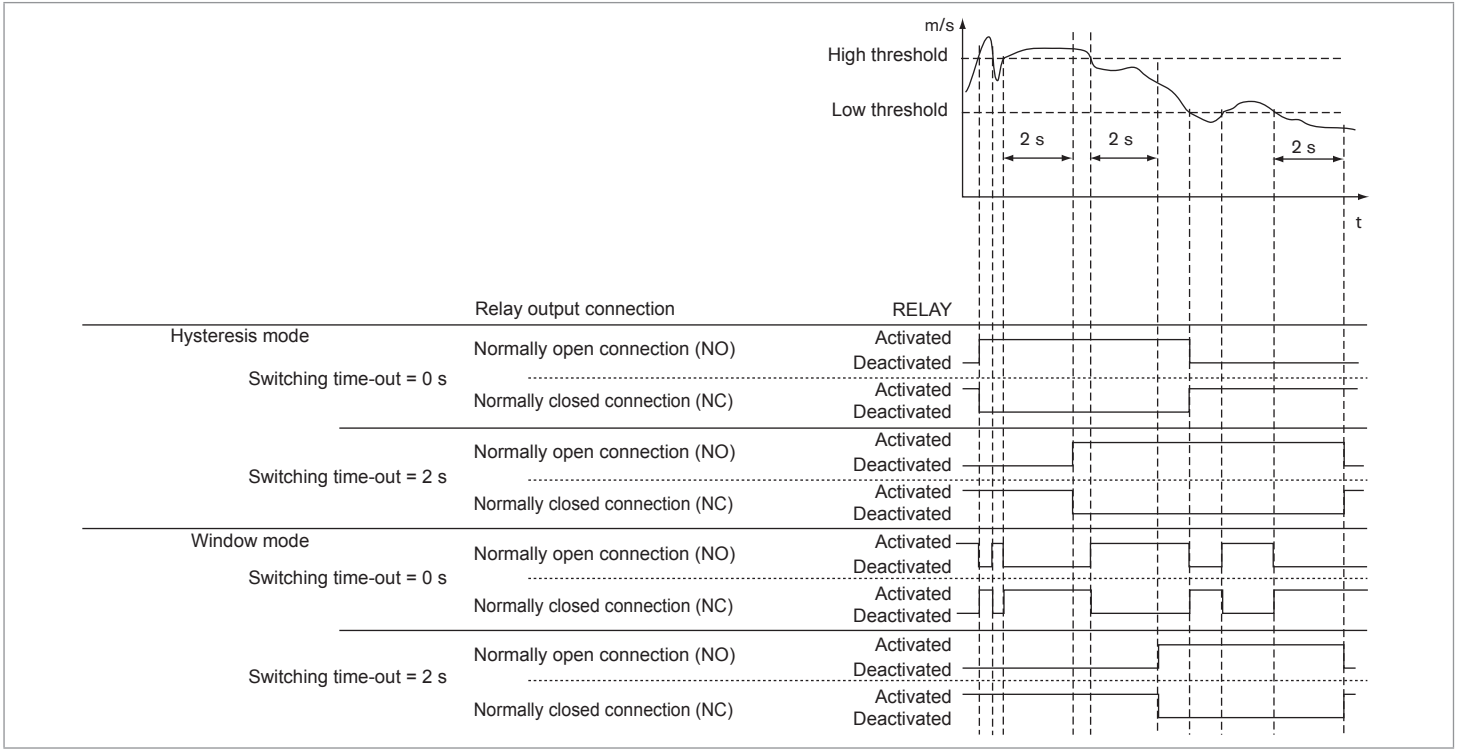


Figure 30: Status of the relay output depending on the configuration of parameters and measured flow velocity

The wiring of the relay on the electronics board determines how the relay works: normally open (NO) or normally closed (NC).

The following parameters of the relay output are configurable:

- The switching mode: window or hysteresis (see section 9.9.1)
- The value of the low switching threshold, as a percentage of the full scale (see section 9.9.2)
- The value of the high switching threshold, as a percentage of the full scale (see section 9.9.2)
- from 0 to 100 seconds (see section 9.9.3).

9.9.1. Select the switching mode of the relay output

There are two switching modes available for the relay, window mode and hysteresis mode.

In window mode the relay output switches as soon as one of the threshold values is detected (see Figure 31 and Figure 32).

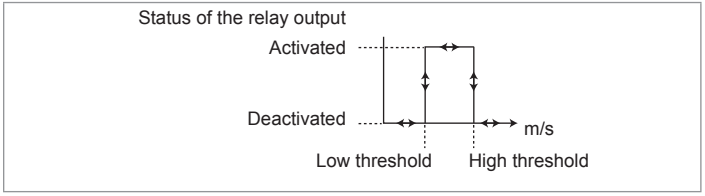


Figure 31: Change in the status of the relay output in window mode with a relay that is wired as normally open (NO)

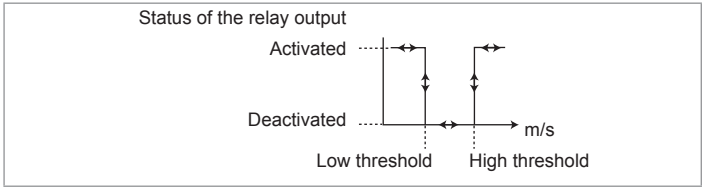


Figure 32: Change in the status of the relay output in window mode with a relay that is wired as normally closed (NC)

In hysteresis mode (see Figure 33 and Figure 34) the relay output switches

- when the high threshold is detected if the flow velocity of the liquid is increasing.
- when the low threshold is detected if the flow velocity of the liquid is decreasing.

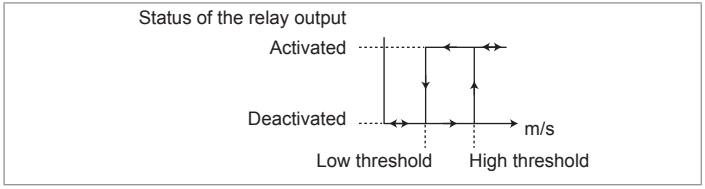


Figure 33: Change in the status of the relay output in hysteresis mode with a relay that is wired as normally open (NO)

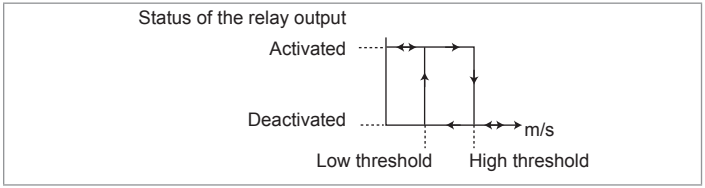
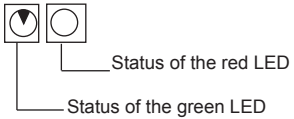


Figure 34: Change in the status of the relay output in hysteresis mode with a relay that is wired as normally closed (NC)

→ Select the switching mode of the relay (see Figure 35 and Figure 36).

Meaning of the symbols in the following diagram:



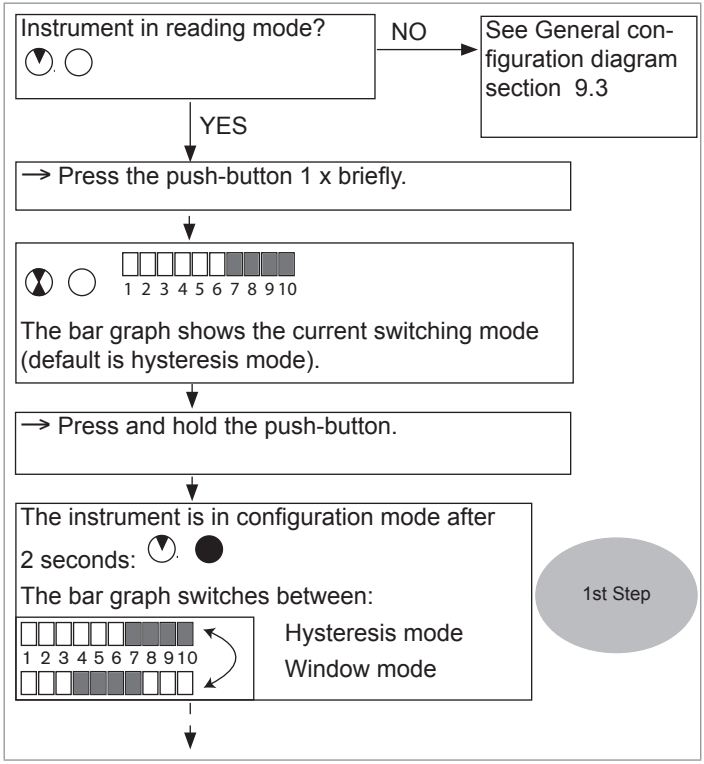


Figure 35: Selecting the switching mode of the relay, part 1

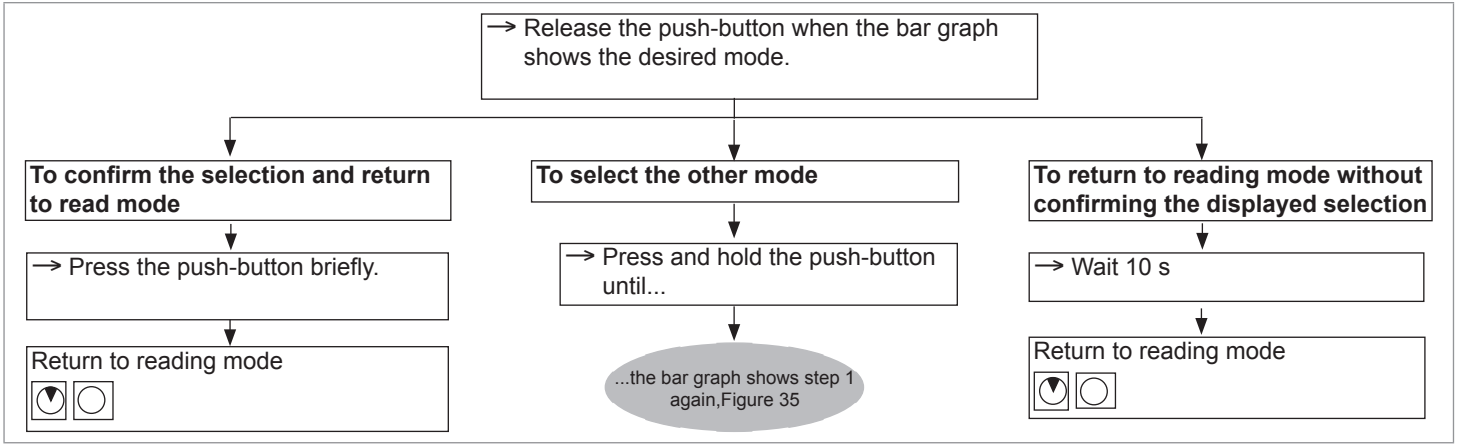


Figure 36: Selecting the switching mode of the relay, part 2

9.9.2. Displaying and configuring the high and low thresholds

The low switching threshold can be programmed in the range from 0 to the value of the high switching threshold.

The high switching threshold can be programmed within the range between the value of the high switching threshold and 100 % of the full scale.

Configuring the high and low switching thresholds consists of 2 steps:

- Configuring the tens digit
- Configuring the ones digit

→ Displaying and/or configuring the low and high switching thresholds (see Figure 37, Figure 38 and Figure 39).

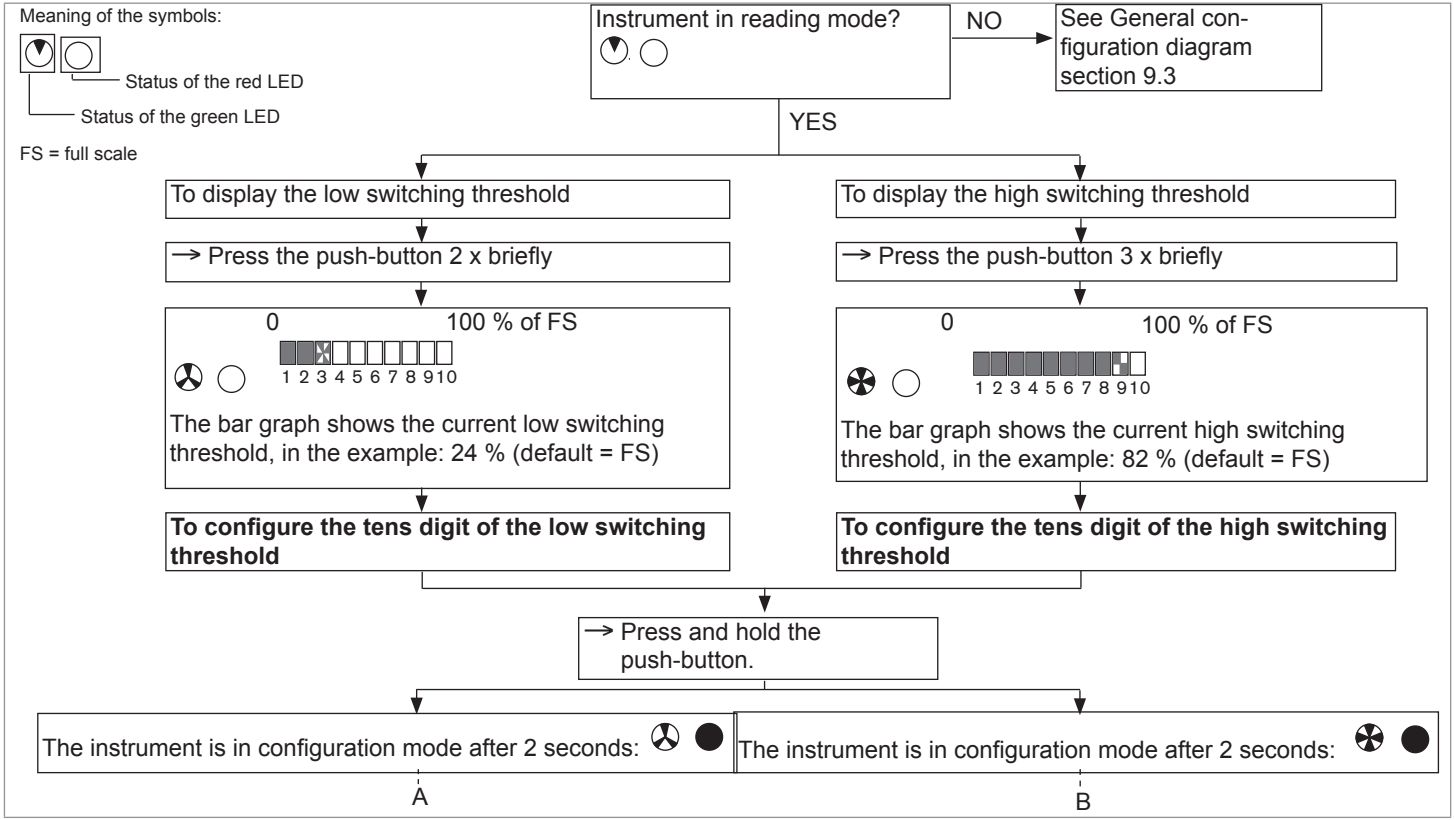


Figure 37: Configuring the switching thresholds of the relay, part 1

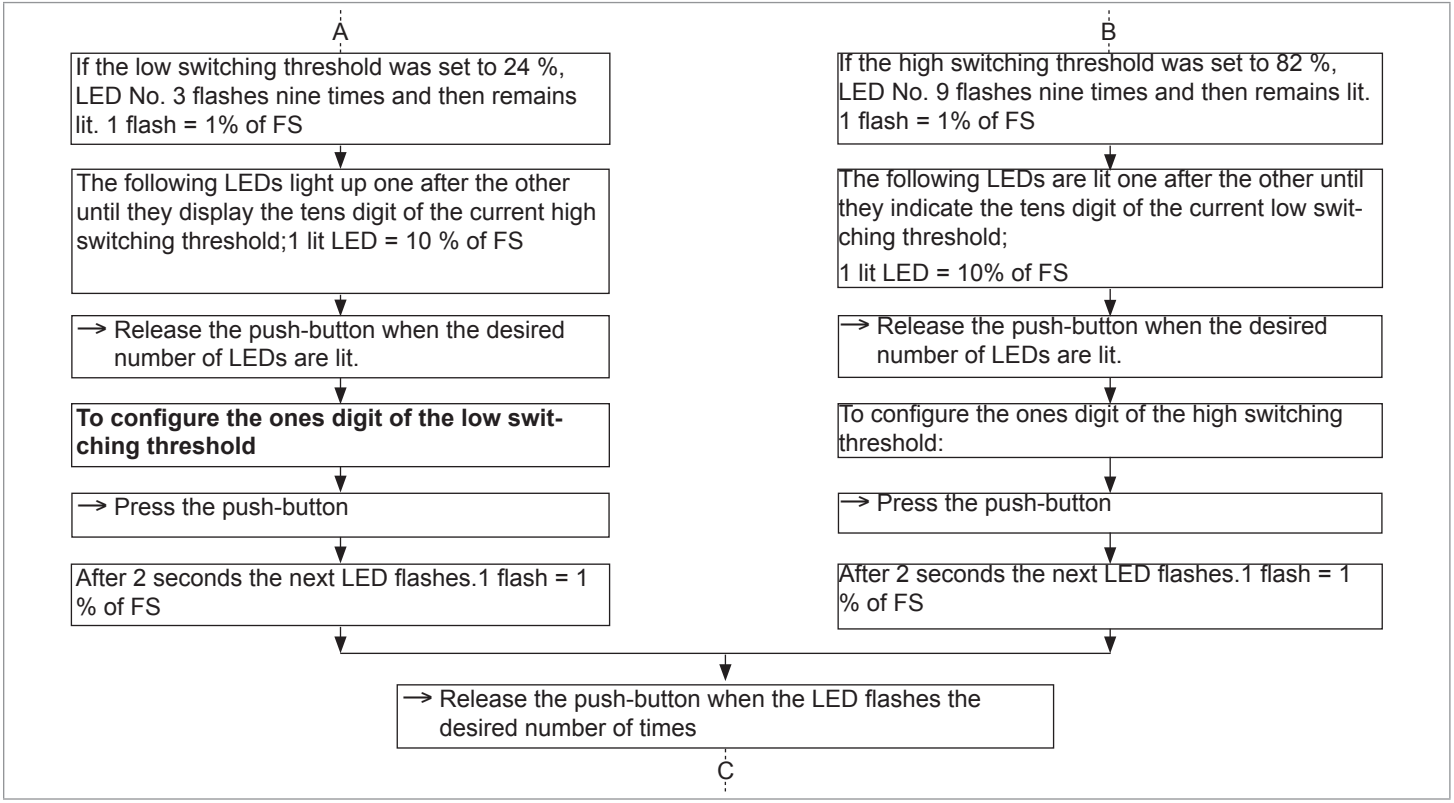


Figure 38: Configuring the switching thresholds of the relay, part 2

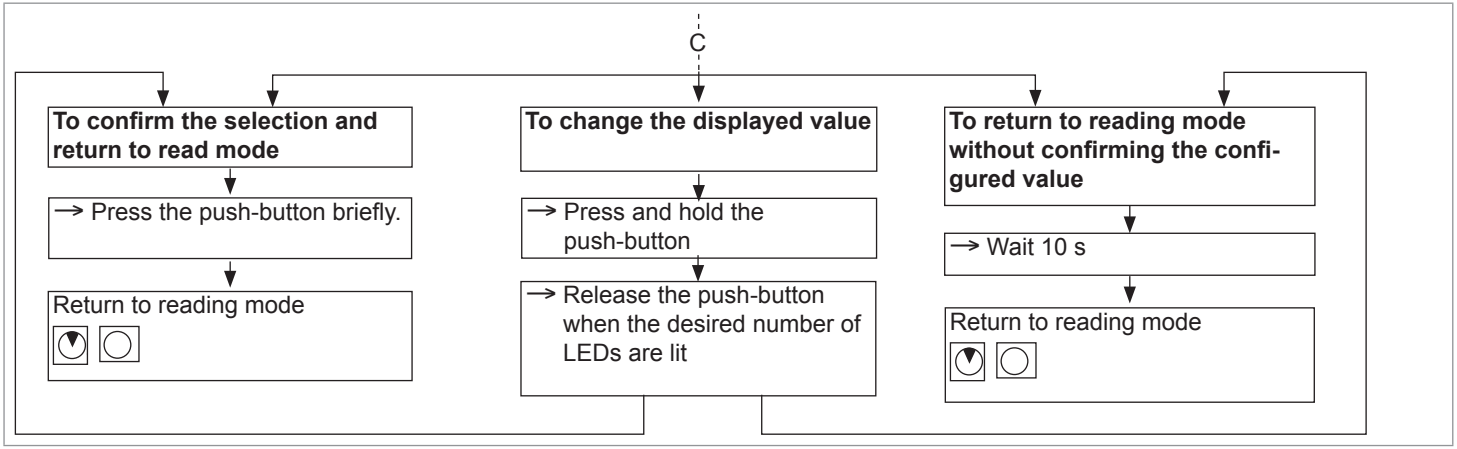


Figure 39: Configuring the switching thresholds of the relay, part 3

9.9.3. Displaying and configuring the switching time-out

Switching occurs if one of the thresholds (low or high) is exceeded for a longer time than the configured time-out. The time-out applies to both switching thresholds. If the time-out is 0, switching occurs immediately.

The switching time-out must be between 0 and 100 s

Configuring the switching timeout consists of 2 steps:

- Configuring the tens digit for seconds.
- Configuring the seconds (ones digit).

→ Displaying and/or configuring the switching time-out (see Figure 40, Figure 41 and Figure 42).

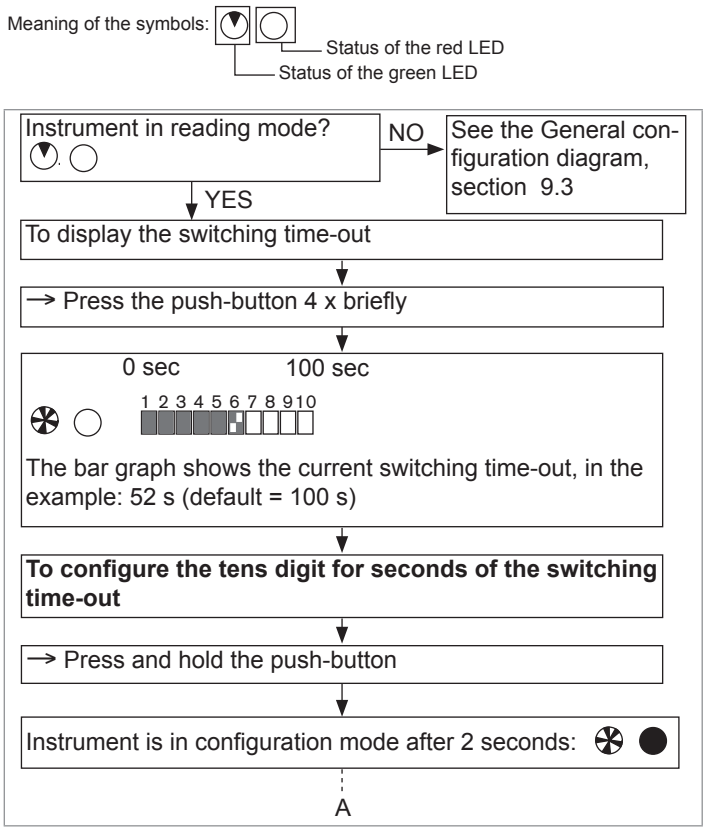


Figure 40: Configuring the switching time-out of the relay, part 1

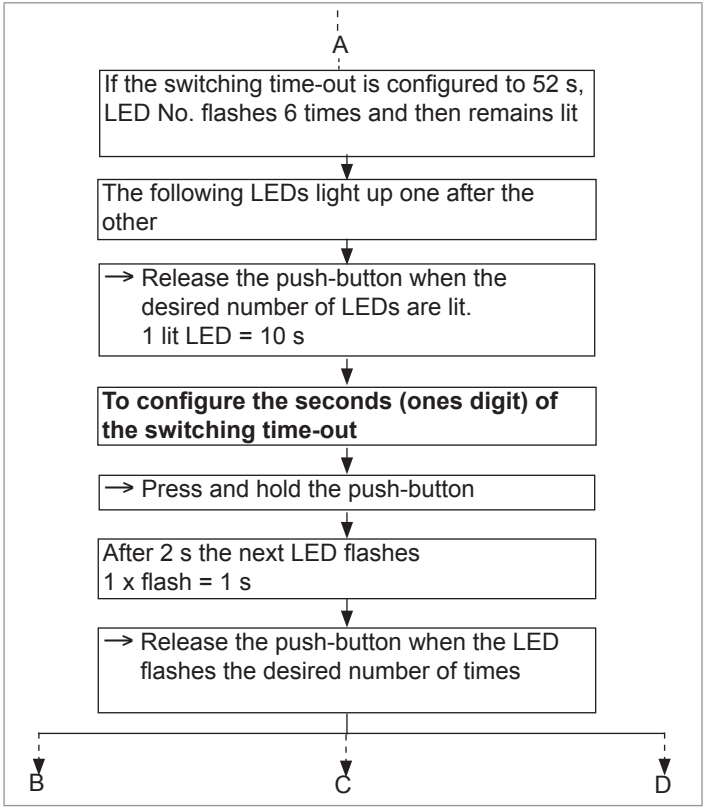


Figure 41: Configuring the switching time-out of the relay, part 2

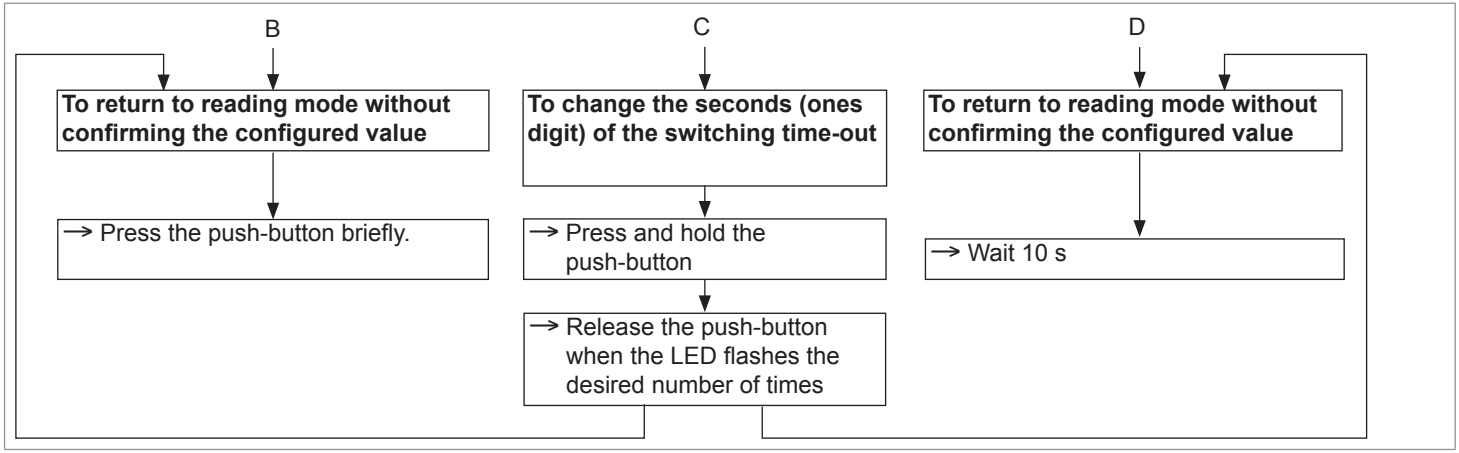


Figure 42: Configuring the switching time-out of the relay, part 3

10. MAINTENANCE, TROUBLESHOOTING

10.1. Safety instructions

DANGER!

Danger of injury due to high pressure in the system!

- Before loosening the process connections, stop liquid circulation and release the pressure.

Danger of injury through electrical shock!

- Always turn off the power before starting work and protect it against being turned on again!
- Observe the applicable accident protection and safety requirements for electrical instruments!

Danger of injury due to high liquid temperatures!

- Always wear protective gloves when touching the instrument.
- Before loosening the process connections, stop liquid circulation and empty the pipe.
- Keep readily flammable substances and media well away from the instrument

Danger of injury due to the nature of the liquid!

- Observe the rules in force in the area of accident protection and safety related to the use of aggressive liquids.

WARNING!

Danger due to improper maintenance work!

- Maintenance work must only be performed by authorized and qualified specialists with suitable tools!
- Ensure that the system is restarted in a controlled manner every time after manual changes.

10.2. Instrument maintenance

NOTE!

The instrument can be damaged by cleaning agents.

- The instrument should only be cleaned with a cloth that has been slightly moistened with water or a cleaning product that is compatible with the materials of the cloth and the instrument.
- Do not use any abrasive agents.

10.3. Maintenance of the electrodes

NOTE!

Dirty electrodes can result in measurement errors.

- Clean the elements in contact with the liquid regularly.
- Rinse the electrodes after cleaning.

10.4. Replacing the seal

NOTE!

Do not score or notch the seal.

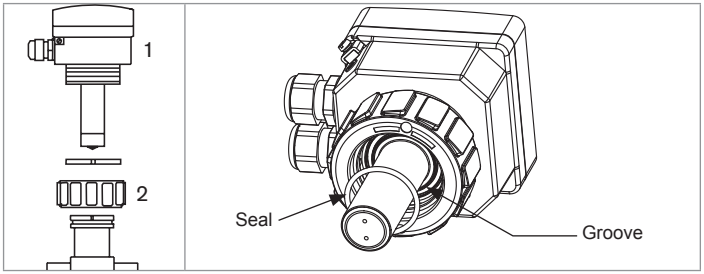


Figure 43: Disassembling the instrument and position of the seal

→ Loosen the union nut of the instrument (item 2).
→ Pull the instrument out of its fitting (see item 1).
→ Remove the seal from the groove.
→ Clean the seal groove.
→ Insert the new O-ring in the groove (see section11).
→ Insert the instrument in the fitting.
→ Tighten the union nut (item 2) manually.

10.5. Solving problems

DANGER!

Danger of injury due to high pressure in the system!

- Before loosening the process connections, stop liquid circulation and release the pressure.

Danger of injury through electrical shock!

- Always turn off the power before starting work and protect it against being turned on again!
- Observe the applicable accident protection and safety requirements for electrical instruments!

Danger of injury due to high liquid temperatures!

- Always wear protective gloves when touching the instrument.
- Before loosening the process connections, stop liquid circulation and empty the pipe.
- Keep readily flammable substances and media well away from the instrument

Danger of injury due to the nature of the liquid!

- Observe the rules in force in the area of accident protection and safety related to the use of aggressive liquids.

10.5.1. Problems indicated by signal LEDs

Problem	Status of the bar graph	Status of the red LED	Status of the green LED	Status of the current or frequency output	Meaning / causes	What to do
The instrument is not responding	Off	Flashes once briefly every 2 seconds	Flashes once every second	22 mA and 256 Hz	Measuring range exceeded by more than 20 %	→ Press the push-button briefly to acknowledge the error. → Check the selection with the diagram (see section 7.2.1).
The instrument is not responding	Off	Flashes 2 times briefly every 5 seconds	Flashes once every second	22 mA and 0 Hz	Calibration of the "zero flow rate" point failed.	→ Press the push-button briefly to acknowledge the error. → Check the intake/outlet distances (see section 7.2.1). → Start the calibration again (see section 9.7). → If the error persists, contact your Bürkert dealer.
The instrument is not responding	Off	Flashes 3 times briefly every 5 seconds	Flashes once every second	22 mA and 0 Hz	The instrument is out of service.	→ Contact the supplier.
The instrument is not responding	Off	Flashes 4 times briefly every 5 seconds	Flashes once every second	22 mA and 0 Hz	Calibration of the full scale failed because the flow velocity of the liquid is < 2 m/s.	→ Press the push-button briefly to acknowledge the error. → Check the flow velocity of the liquid. → Start the calibration of full scale again (see section 9.8).

Problem	Status of the bar graph	Status of the red LED	Status of the green LED	Status of the current or frequency output	Meaning / causes	What to do
The instrument is not responding	Off	Flashes 5 times briefly every 5 seconds	Flashes once every second	22 mA and 0 Hz	Calibration of the full scale failed because the flow velocity of the liquid is > 10 m/s.	→ Press the push-button briefly to acknowledge the error. → Check the flow velocity of the liquid. → Start the calibration of full scale again (see section. 9.8).
The instrument is not working.	Off	Off	Off	0 mA and 0 Hz	The instrument is not connected.	→ Connect the instrument.
					The installation fuse is in poor condition.	→ Replace the fuse.
					The installation switch is set to OFF.	→ Set the installation switch to ON.
				-	The power supply is incorrectly connected to the + and - terminals.	→ Check the wiring (see section 7.3.1, 7.3.2 and 7.3.3).
			Flashes irregularly or off	0 mA and 0 Hz	The power supply is not stabilized.	→ Replace the power supply.
			Off	0 mA and 0 Hz	The instrument is out of service.	→ Send the instrument back to the supplier.
Incorrect flow rate measurement.	-	Off	Flashes once every second	-	The K factor was calculated incorrectly.	→ Recalculate the K factor (see section 5.3.5).
	All LEDs are lit	Off	Flashes once every second	20 mA and 240 Hz	Measuring range exceeded by less than 20 %.	→ Select the larger measuring range (see section 9.6)

Problem	Status of the bar graph	Status of the red LED	Status of the green LED	Status of the current or frequency output	Meaning / causes	What to do
Flow rate measurement unstable	Unstable	Off	Flashes once every second	> 4 mA and > 0 Hz	The electrodes are dirty.	→ Clean the electrodes (see section10.3).
					The electrodes are not in contact with the liquid.	→ Make certain the electrodes are always in the liquid.
					Air bubbles appear in the liquid.	→ Follow the installation instructions (see section 7.2). → Select the "slow" filter (see section 9.5).
					The sensor was not immersed for 24 hours before calibrating the "zero flow rate" point.	→ Follow the calibration procedure (see section 9.7).
					The flow rate has very large fluctuations.	→ Select the "slow" filter (see section 9.5)
					The recommended intake and outlet distances are not observed.	→ Follow the installation instructions (see section 7.2).
The instrument is not producing any current or frequency.	Indicates a value	Off	Flashes once every second	0 mA and/or 0 Hz	The source/sink switch is set incorrectly.	→ Configure the source/sink switch is set correctly (see section 7.3.1).
					The outputs are wired incorrectly.	→ Check the wiring of the outputs (see section 7.3.1, 7.3.2 and 7.3.3)
The instrument does not display the zero flow rate.	On	Off	Flashes once every second	> 4 mA and > 0 Hz	Calibration of the "zero flow rate" point was performed incorrectly.	→ Perform a new calibration (see section 9.7).

11. SPARE PARTS AND ACCESSORIES

CAUTION!

Danger of injury and physical damage due to unsuitable parts!

Wrong accessories and unsuitable replacement parts can cause injuries and damage to the instrument and its environment.

- Use only original Jumo accessories and replacement parts.

→ If replacement parts or accessories are needed, please contact the supplier of the instrument.

12. PACKAGING AND TRANSPORT

CAUTION!

Transport damage!

An insufficiently protected instrument can be damaged by transport.

- The instrument must be packaged in a shockproof package and protected against moisture and dirt for transport.
- Do not expose the instrument to any temperatures outside the permissible temperature range for storage.
- Close the electrical interfaces with protective caps to protect against damage.

13. STORAGE

CAUTION!

Incorrect storage can result in damage to the instrument!

- The instrument must be stored in a dry and dust-free room!
- Storage temperature: -20 to +60°C.
- Relative humidity: < 80 %, non-condensing

14. DISPOSAL

→ Dispose of the instrument and packaging in an environmentally responsible way.

CAUTION!

Parts that are contaminated by liquids can damage the environment!

- Comply with applicable disposal regulations and environmental requirements!

Note:

Comply with national waste disposal regulations.

JUMO

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