

Instruction manual

2280 Swing Fork with digital output



Georg Fischer Piping Systems Ltd CH-8201 Schaffhausen
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Observe instruction manual

The instruction manual is part of the product and an important element within the safety concept.

- Read and observe instruction manual.
- Always keep instruction manual available for the product.
- Pass on instruction manual to all subsequent users of the product.

1. Intended use

The product is applicable for level switching or flow switching tasks of normal and explosive liquids. Overflow or dry run protection as well as pump control is also possible with the product in low/high fail-safe operation mode.

2. Safety and warning instructions

This manual contains warning instructions that shall warn against injuries or material losses. Always read and observe those warning instructions.

DANGER	• Imminent danger! Non-observance may result in major injuries or death.
WARNING	• Possible danger! Non-observance may result in major injuries.
CAUTION	• Dangerous situation! Non-observance may result in minor injuries
NOTICE	• Dangerous situation! Non-observance may result in material losses.

3. Safety and responsibility

In order to provide safety in the plant, the operator is responsible for the following measures:

- Products may only be used for its intended purpose, see intended purpose
- Never use a damaged or defective product. Immediately sort out damaged product.
- Make sure that the piping system has been installed professionally and serviced regularly.
- Products and equipment shall only be installed by persons who have the required training, knowledge or experience.
- Regularly train personnel in all relevant questions regarding locally applicable regulations regarding safety at work, environmental protection especially for pressurised pipes.

The personnel is responsible for the following measures:

- Know, understand and observe the instruction manual and the advices therein.

4. Technical Data

4.1 General	
Medium pressure	40 bar, PP flange: 6 bar see „Temperature diagrams“
Electrode lengths	0,69 m to 3 m
Material of wetted parts	DIN 1.4571, PFA coating
Medium temperature	-40°C ... +130°C, see table „Temperature classification“
Ambient temperature	Type xxx: -40°C ... +70°C, see table „Temperature classification“ Type xxx: -25°C ... +70°C
Liquid density	≥ 0.7 kg/dm ³
Liquid viscosity	≤ 10.000 mm ² /s (cSt)
Response time	when immersed: 0.5 sec when free: when free: ≤ 1 s, see response time diagram
Output mode indication	Bi-colour (LED)
Operation test	Output can be changed by test magnet

4.2. 2-Wire DC, Ex approved version

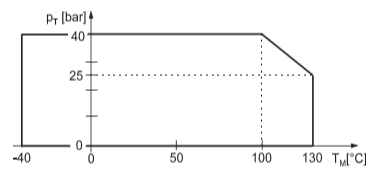
Type	2-wire DC 2280-S-XXX0-X 2280-S-XXXC-X
Electric connection	Connector
Ingress protection	IP 65 IP 68
Output	DC current change: When free: 9 ± 1 mA When immersed: 14 ± 1 mA
Consumption	< 0.5 W
Power supply (U)	15 ... 29 V DC provided by Ex remote switching unit for the Ex version
Setting operation mode	By switch on the remote switching unit (Low fail-safe, High fail-safe)
Electrical protection	Class III
Ex protection mark	Ex II 1G Ex ia IIC T6... T4 Ga
Intrinsically safe data	U < 29 V, I < 100 mA P < 1.4 W, C _{eq} < 7 nF L _{eq} = 0 For temperature classes see 9.1

4.3. 3-Wire DC version

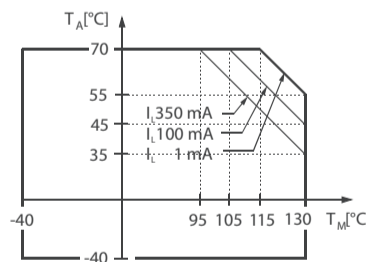
Type	3-wire DC	
	2280-S-5WX0-X	2280-S-5WXC-X
Electric connections (wire cross section)	Connector	Integral cable (5 x 0.5 mm ²) max. length 30 m
Mechanical protection	IP 67	IP 68
High/low mode setting	Switch selectable	Wire selectable
Output	Filed selectable, PNP/NPN transistor switch	Filed selectable, galvanically PNP/NPN transistor switch
Output protection	Reverse polarity, overcurrent and short-circuit protection	
Supply voltage	12 ... 55 V DC	
Consumption	< 0.6 W	
Voltage drop in switched-on state	< 4.5 V	
Electrical protection	Class III	
Current load:	<ul style="list-style-type: none"> • max. continuous: I_{max} = 350 mA DC / U_{max} = 55 V DC • min. continuous: - • max. impulse: - 	
Residual current (in switched off state)	< 100 µA	

4.4 Temperature diagrams

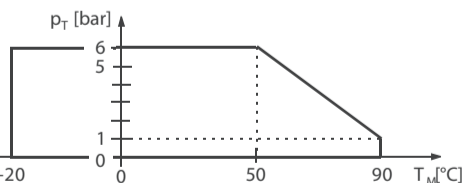
Pressure (p_r) as a function of temperature (t_M) for all versions (except PP flanged version):



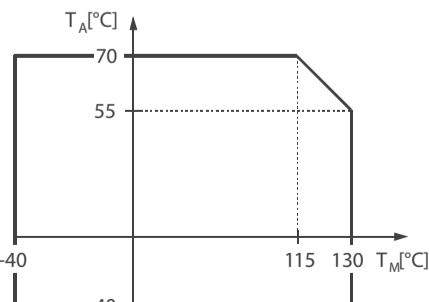
Temperature limits of DC versions, (I_L) load current:



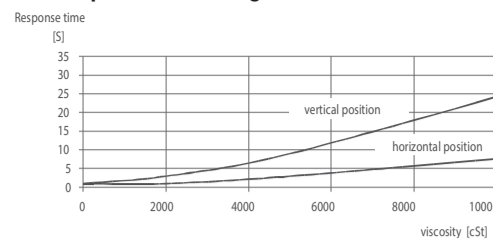
Pressure (p_r) as a function of temperature (t_M) for PP flanged version:



Temperature limits of AC versions, (TA) ambient temperature, (T_M) medium temperature:

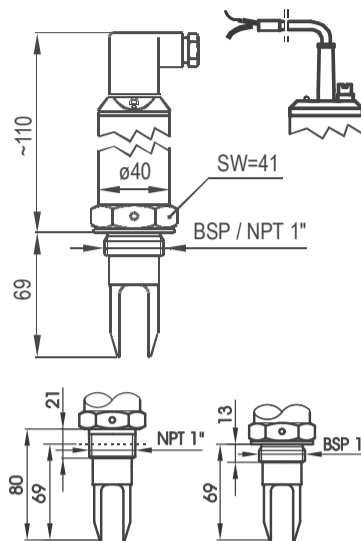


4.5 Response time diagram

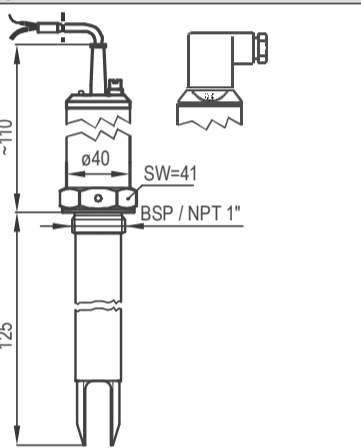


5. Dimensions

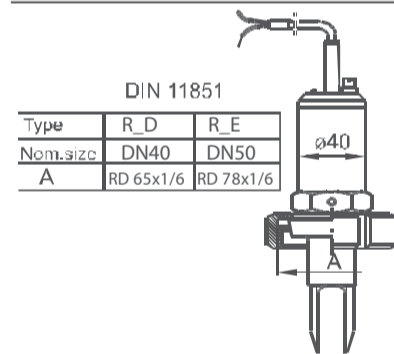
Type 2280-S-XXXX-1 (short)



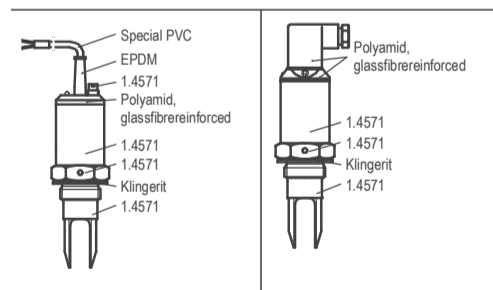
Type 2280-S-XXXX-2



Pipe coupling:

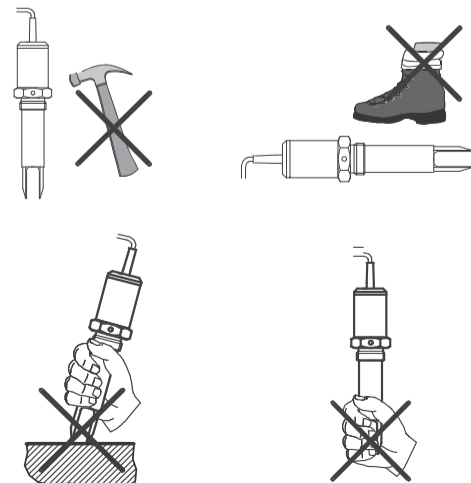


6. Materials

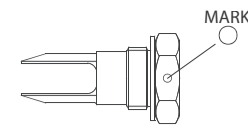


7. Installation

• Prevent the device from any mechanical damage.



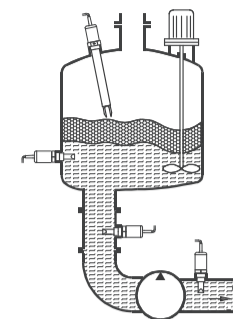
For positioning the fork-tines, use the marking on the hexagonal neck.



- If directional positioning of the fork-tines is needed (side mounting), use the PTFE tape to seal the thread and position the fork-tines to the desired direction.
- In this case vertical positioning of the fork-tines is suggested

Low viscosity liquids

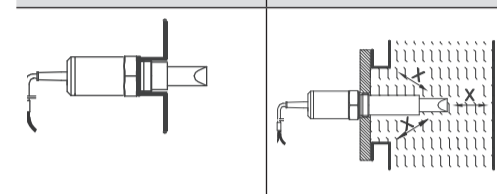
On applications, where the fork-tines are easily freed from the process medium, any of the mountings shown to the right is possible.



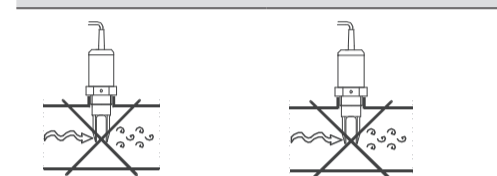
High viscosity liquids

On applications, where the fork-tines are not freed from the process medium, the horizontal mounting is recommended.

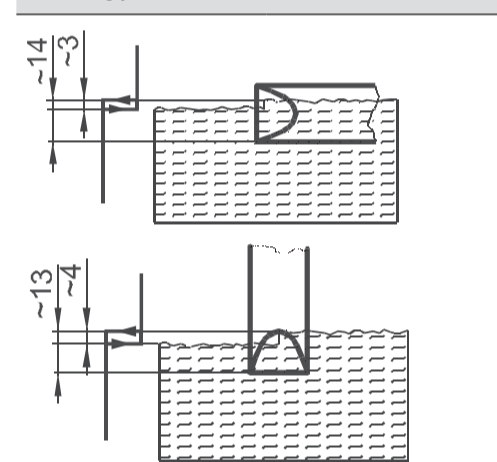
Threaded version: **Flanged version, critical distances x > 5mm:**



For pipe mounting, fork-tines must be parallel to the direction of flow:



Switching point and differential for water at 25°C:



Switching point as well as the switching differential depends on liquid density and mounting position.

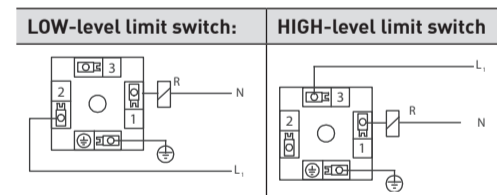
8. Wiring

8.1. 2-Wire AC versions

WARNING
Risk of injury or damage when power up the product.

- Do not power up the device without a load connected in series with the unit and without grounding it.

8.1.1 Version with connector



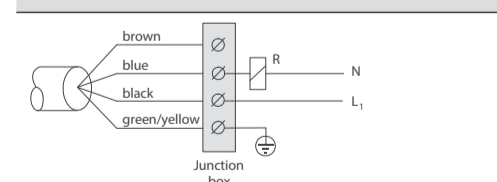
Terminal block cover can be rotated in 90° steps to ensure appropriate cable positioning.

8.1.2 Version with cable

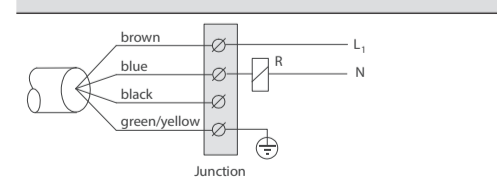
This version is with 4 wire cable equipped. Only one of the black and brown wires is used, dependent on the operating mode (High or low).

- Provide also a terminal block connection for the unused wire.

LOW-level limit switch:



HIGH-level limit switch:



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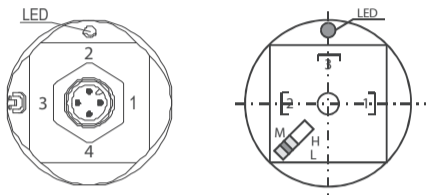
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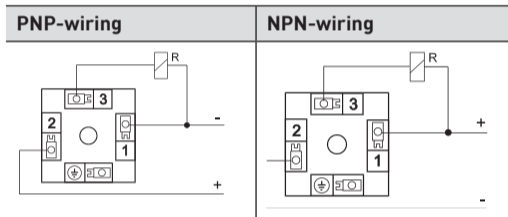
8.2 3-Wire DC versions

In case of overload caused by short circuit, transistor will switch on and off, and LED will start to blink.

8.2.1 Version with connector

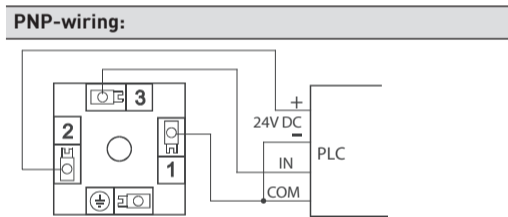


8.1.2.1 Wiring of 3-Wire DC version with connector in case of relay application



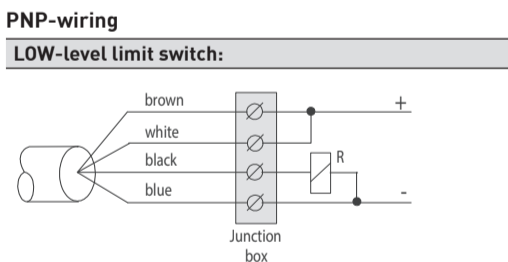
Terminal block cover can be rotated in 90° steps to ensure appropriate cable positioning.

8.1.2.2 Wiring of 3-Wire DC version with connector in case of PLC application

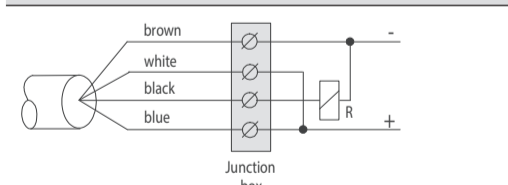


8.2.2 Version with cable

8.2.2.1 Wiring in case of relay application

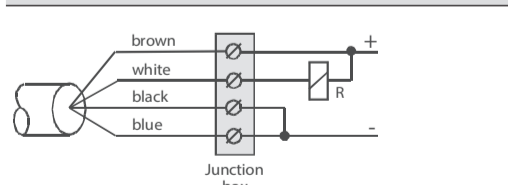


HIGH-level limit switch:

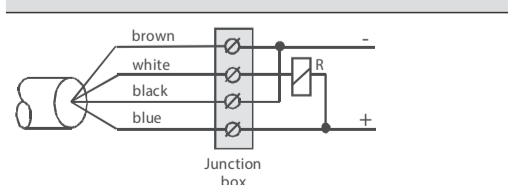


NPN-wiring

LOW-level limit switch:

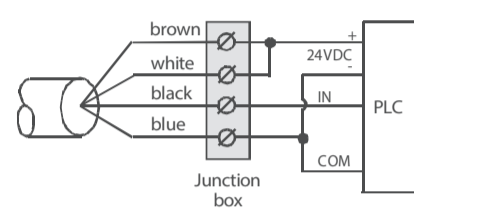


HIGH-level limit switch:

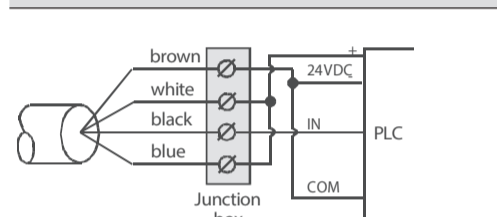


8.2.2.2 Wiring of 3-Wire DC version with connector in case of PLC application

LOW-level limit switch:



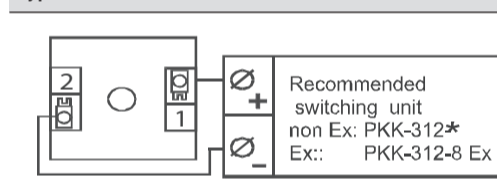
HIGH-level limit switch:



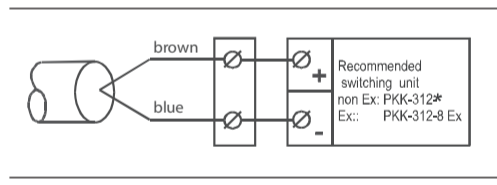
8.3 2-Wire DC versions, normal or EX

8.3.1 Version with connector

Type 2280-S-5XWB0:



8.3.1 Version with cable 2280-S-5XWBC



9. Putting into operation, adjustment

• Check connecting of the wires and position of the mode of operation switch (if there is).
After connection and power up the tuning fork is operational.

Operating diagram

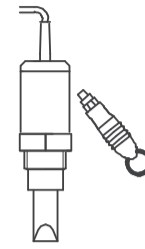
Power supply	Fork	Mode	LED	Output
im-merged	im-merged	HIGH	red	OFF
		LOW	green	ON
ON	free	HIGH	green	ON
		LOW	red	OFF
NONE	Free or im-merged	HIGH or LOW	not lit	OFF

Operating diagram of the 2-Wire DC version

Fork	LED	Output
Immersed	red	14 ± 1 mA
Free	green	9 ± 1 mA

Operating test

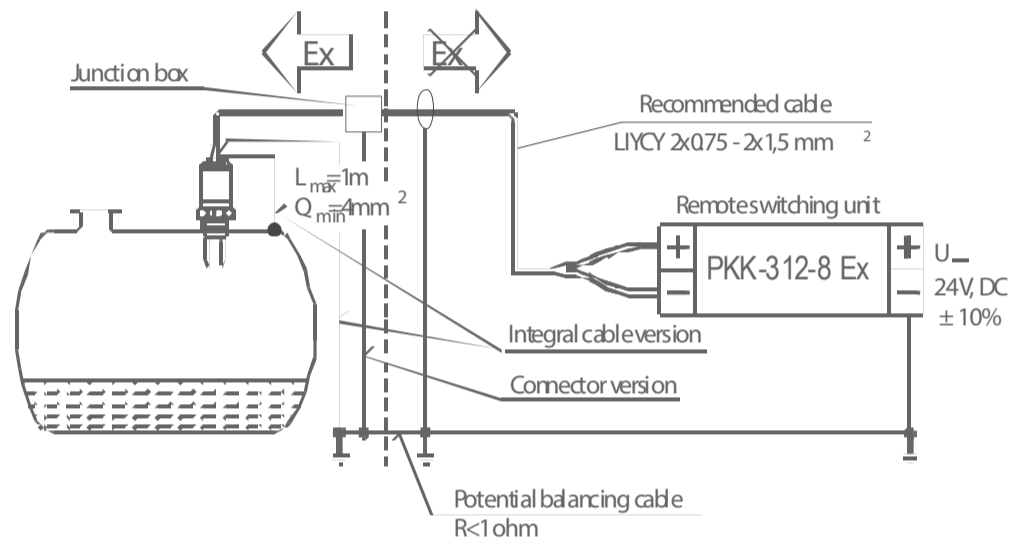
Correct operation of the switching circuit of an installed device can be tested with the optional test magnet (RPS-101). Moving the test magnet in front of the marking on the cover of the housing, the device must perform a switching (LED changes colour).



9.1 Applying Ex approved models

Applying Ex approved models take into consideration the table of allowed temperatures listed below:

Temperature classification	T6	T5	T4
T _{ambient}	70°C	60°C	60°C
T _{medium}	70°C	75°C	130°C

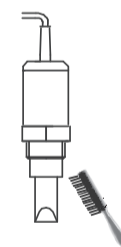


9.2 Conditions of safe operation

- ATEX II 1 GEx ia IIC T6...T4 Ga and II 1G Ex ia IIB TE... T4 Ga approved vibrating forks should be powered by intrinsically safe (Ex ia IIC or IIB) certified and approved devices.
 - The cleaning of these units are allowed only with a wet rag.
 - Junction box shall be applied for versions with cable connection. Junction box shall meet the appropriate protection requirements.
- The instrument has built-in overvoltage protection, so:
- Outer grounding of the electric housing shall be connected to the steel silo wall with a minimal 4mm² cross sectioned, shielded copper cable - outside the Zone 0 - within the distance of 1m from the boundary of the Zone 0.
 - According to point 6.3.12 of EN 60079-11 standard dielectric strength test is not allowed to perform with the instrument.

10. Maintenance, Repair

In some instances, the sensor probe may need occasional cleaning to remove surface deposits. This must be carried out gently, without harming the vibrating section of the vibrating fork.



11. Storage

Ambient temperature: -25 to +60°C
Relative humidity: max. 98%

12. Accessories

- Warranty card
- Declaration of conformity
- RPS-101 type test magnetic-screwdriver (optional)
- 1 pc sealing ring (2mm thick KLINGER OILIT)
- Sliding sleeve for adjustable types: RPH-112 (optional)

13. Dismantling

- Make sure that the connection cable is de-energized and can be freely rotated.
- Make sure that the tank is depressurized and has been drained to a level that is at least below that of the sensor mounting position.

CAUTION

Media that is detrimental to people's health and the environmental may escape!
Risk of personal injury or damage to the environment caused by these media.

- Wear the prescribed protective clothing.
- Collect any media that escapes and dispose of it in accordance with local regulations. Consult the safety data sheet.

14. Disposal

- Before disposing of the different materials, separate them into recyclables, normal waste, and special waste.
- Comply with local legal regulations and provisions when recycling or disposing of the product, the individual components, and the packaging.
- Comply with national regulations, standards, and guidelines.

CAUTION

Parts of the product may be contaminated with media that are harmful to health and the environment meaning that simple cleaning is not sufficient!

Risk of personal injury and damage to the environment caused by these media.

Prior to disposing of the product:

- Collect leaking media and dispose of it according to the local regulations. Consult the safety data sheet.
- Neutralize any media residue that is present in the product.
- Separate materials (plastics, metals, etc.) and dispose of them according to the local regulations.



A product marked with this symbol must be sent for separate collection of electrical and electronic devices.

If you have questions regarding the disposal of the product, please contact your national GF Piping Systems representative.

15. Disclaimer

The technical data are not binding. They neither constitute expressly warranted characteristics nor guaranteed properties nor a guaranteed durability. They are subject to modification. Our General Terms of Sale apply.

Instruction manual

**2280 Swing Fork
with relay output**



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- ▶ Read and observe the instruction manual.
- ▶ Always have the instruction manual available at the product.
- ▶ Pass on the instruction manual to all subsequent users of the product.

1 Intended use

The tuning fork switch is used for level measuring and for detecting the limit level of liquids.

2 About this document

This document contains all necessary information for the installation, operation and maintenance of the product.

3 Safety and responsibility

- ▶ Only use the product as intended, see intended use.
- ▶ Do not use the product if it is damaged or faulty. Throw out the product immediately if it is damaged.
- ▶ Make sure that the piping system has been installed professionally and that it is inspected regularly.
- ▶ The product must only be installed by persons who have the required training, knowledge and experience.
- ▶ Regularly train personnel on all questions pertaining to the locally accepted regulations on occupational safety and environmental protection, especially on pressure-retaining pipelines.

The personnel is responsible for the following measures:

- ▶ Know, understand and follow the instruction manual and the advices therein.

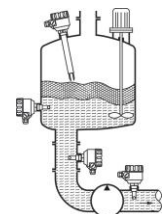
4 Scope of delivery

- ▶ 2280 Tuning fork switch with relay output
- ▶ Instruction manual
- ▶ 1 x gasket, 2 mm thick, made of KLINGER OILIT (for G1" process connection only)
- ▶ 2 x 3-pole connector plugs (3 x 3-pole connector plugs when 2 output relays)
- ▶ 2 x M20 x 1.5 cable entry

5 Transport and storage

- ▶ Protect the product against external force during transport (impact, stroke, vibrations, etc.).
- ▶ Transport and/or store the product in unopened, undamaged original packaging.
- ▶ Protect the product from dust, dirt and moisture, as well as heat and ultraviolet radiation.
- ▶ Make sure that the product has not been damaged by either mechanical or thermal influences.
- ▶ Check the product for transport damage before assembly.

6 Function



The tuning fork switch is used for level measuring and for detecting the limit level of liquids. Example: overflow prevention, no-load protection, pump control.

The product can be installed in several ways.

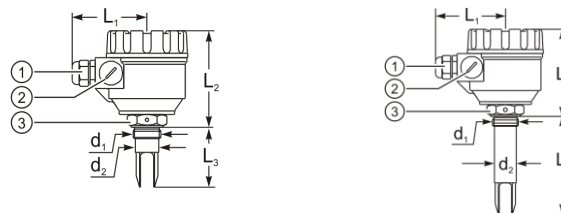
- ▶ When mounting laterally the position of the fork needs to be taken into account!
- Can be used for the following liquids:
- ▶ Low viscosity: Mounting in any position (horizontal, vertical, diagonal).
 - ▶ High viscosity: Vertical mounting exclusively (from the top), as otherwise the tuning fork frees up only with difficulty.

7 Technical specifications

Data	Values
Model	2280-S-xxxT-X
Wetted parts	stainless steel 1,4571 [X6 CrNiMoTi 17122]

Data	Values	
Housing material	Plastic: PBT fiberglass-reinforced, hardly inflammable (DuPont®)	
Medium temperature	-40 to +130 °C	
Ambient temperature	-30 to +70 °C	
Max. operating pressure	40 bar	
Installation length	short version 69 mm standard version 125 mm	
Medium density	≥ 0.7 kg/dm ³	
Medium viscosity	≤ 10.000 mm ² /s (cSt)	
Delay time	upon covering	≤ 0.5 s
	upon freeing up	≤ 1 s (see Delay time - Viscosity)
Switching status display	two-color LED	
Setting min./max. safety	with switch selectable	
Output	SPDT relay, 250 VAC, 8 A, AC 1	
Electr. connection/wire cross-section	2 x M20 x 1.5, wire Ø 6 - 12 mm / 0.75 - 2.5 mm ²	
Supply voltage	20 - 255 VAC and 20 - 60 VDC	
Power input	1.2 - 17 VA _{AC} ; < 3 W _{DC}	
Protection against accidental contact	Class I	
Protection rating	IP67 (NEMA 6)	
Weight	0.95 kg + 1.2 kg/m	
Storage conditions	Ambient temperature	-25 to +60 °C
	Relative humidity	max. 98 %

8 Dimensions



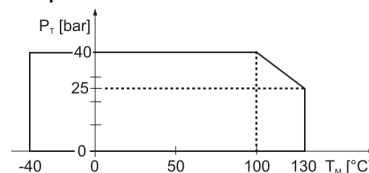
Short version

Standard version

1	2 x M20 x 1.5 (gland)	L ₁	89 mm	L ₄	125 mm
2	2 x NPT ½" (gland)	L ₂	111 mm	d ₁	BSP 1" / NPT 1"
3	Hexagonal collar SW41	L ₃	69 mm	d ₂	Ø 28 mm

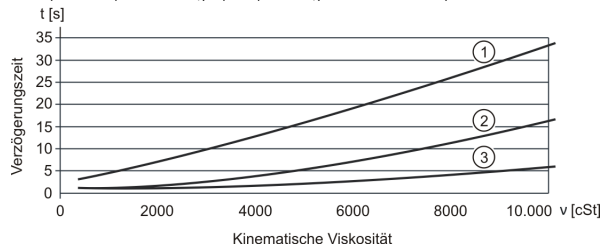
9 Graphs

Temperature - Pressure



Delay time - Viscosity

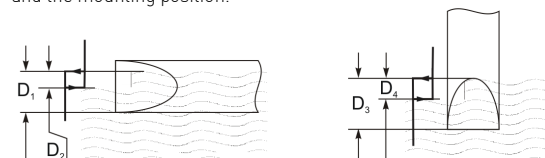
Delay time upon freeing up depending on the viscosity of the medium:



1	Fully immersed	2	Semi-immersed	3	Only tip immersed
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Switching point, switching hysteresis

The switching point and the switching hysteresis are subject to the density of the medium and the mounting position.



D ₁	~14 mm	D ₃	~13 mm
D ₂	~3 mm	D ₄	~4 mm

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10 Installation

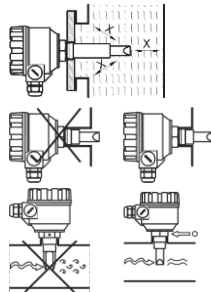
Checking the installation conditions

- ▶ Are the working pressure and temperature values being observed?

Checking the mounting position

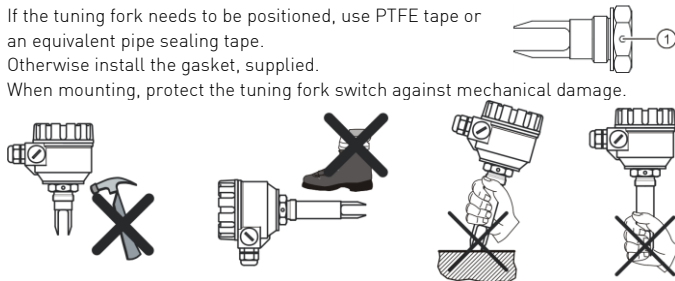
The tuning fork switch can be mounted at almost any angle in the tank. The requirements are as follows:

- ▶ The liquid can flow out of the sensor gap.
- ▶ Turbulence from around inlet/outlet valves or agitators must be avoided.
- ▶ The distance between the sensor gap and tank walls (other fittings in the tank) must be at least $x = 5$ mm to ensure that no pockets of air or liquid can form.
- ▶ The threaded guide should stop as flush with the wall of the tank as possible to ensure that no pockets of air or liquid can form.
- ▶ When mounting on pipes, the sensor gap must always be aligned in parallel with the direction of flow.



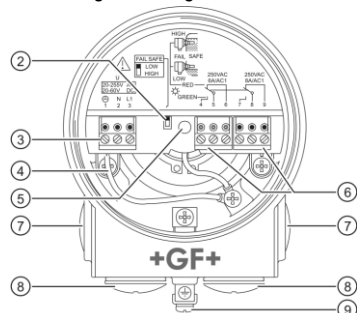
Mounting the tuning fork switch mechanically

- ▶ Make sure that the thread in the tank is free of contamination.
- ▶ If the tuning fork needs to be positioned, use PTFE tape or an equivalent pipe sealing tape. Otherwise install the gasket, supplied.
- ▶ When mounting, protect the tuning fork switch against mechanical damage.



- ▶ Carefully push the tuning fork switch into the opening and tighten on the hexagonal collar (SW41) so that the gap is accurate. Use the marking (1) on the hexagonal collar as a guide.
- ▶ Check whether the connection is tight.
- ▶ Carefully turn the housing by hand (max. 300°) so that the glands are pointing in the direction desired.

Connecting the tuning fork switch electrically



2	Mode	5	LED status	8	M20 x 1.5 (glands)
3	Distribution	6	Output	9	Grounding screw
4	Connection to ground	7	½" NPT (glands)		

- ▶ Ensure that the voltage values for the tuning fork switch correspond to those for the system.
- ▶ Make sure that the connection cable is de-energized.
- ▶ Carefully screw the housing cover and the glands (7, 8) off and set them aside on a clean surface.

- ▶ Do **not** connect AC and DC voltages to a common cable.
- ▶ Do **not** connect low potential and supply voltages to a common cable.
- ▶ Thread the supply cable with outside diameter 8 – 15 mm in.
- ▶ Fasten the separate wires in the appropriate terminal sockets with screws.
- ▶ For the connection to ground use the grounding screw (9) on the housing or the internal ground connection (4).
- ▶ Position the glands in place and carefully tighten so that protection rating IP67 is assured.

Setting the mode

Voltage	Tuning fork	Switch	Mode		Output
			Safety	LED status	
On			High Alarm	Red	Released
			Low Alarm	Green	Operated
			High Alarm	Green	Operated
			Low Alarm	Red	Released
Interrupti on	Free or covered	High or Low	Off	Released	

- ▶ Position the housing cover in place and carefully tighten so that protection rating IP67 is assured.
- ▶ Route the cables to the connection point and secure them at regular intervals using cable ties or similar.
- ▶ The tuning fork switch is operational once the supply voltage has been switched on.
- ▶ The switching process can be tested as follows:
 - Immerse the sensor in a beaker of water.
 - The switching output is switched.

11 Ordering information

Item No.	Type	Length	Description
159 300 240	2280-S-5WBT-1	69 mm	Stainless steel 1 SPDT relay, PBT housing, 1"
159 300 241	2280-S-5WBT-2	125 mm	
159 300 242	2280-S-5WNT-1	69 mm	
159 300 243	2280-S-5WNT-2	125 mm	

12 Dismantling

- ▶ Make sure that the connection cable is de-energized and can be freely rotated.
- ▶ Make sure that the tank is depressurized and has been drained to a level that is at least below that of the sensor mounting position.

CAUTION

Leakage of media harmful to health and the environment possible!

Risk of personal injury and damage to the environment caused by these media.

- ▶ Wear the protective clothing required.
- ▶ Collect leaking media and dispose of them pursuant to local regulations. Consult the safety data sheet.

13 Disposal

- ▶ Before disposing of the different materials, separate them into recyclables, normal waste and special waste.
- ▶ Comply with local legal regulations and provisions when recycling or disposing of the product, the individual components and the packaging.
- ▶ Comply with national regulations, standards and guidelines.

CAUTION

Parts of the product may be contaminated with media that are harmful to health and the environment meaning that simple cleaning is not sufficient!

Risk of personal injury and damage to the environment caused by these media.

Prior to disposing of the product:

- ▶ Collect leaking media and dispose of them pursuant to local regulations. Consult the safety data sheet.
- ▶ Neutralize any media residue that is present in the product.
- ▶ Separate materials (plastics, metals, etc.) and dispose of them pursuant to local regulations.



A product marked with this symbol must be sent for separate collection of electrical and electronic devices.
If you have questions regarding the disposal of the product, please contact your national GF Piping Systems representative.

14 Disclaimer

The technical data are not binding. They neither constitute expressly warranted characteristics nor guaranteed properties nor a guaranteed durability. They are subject to modification. Our General Terms of Sale apply.