

Operating Instructions

FXFF904

Flow Sensor with IO-Link



EN



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1 General

1.1 Information Concerning these Instructions

- These instructions make it possible to use the product safely and efficiently.
- These instructions are an integral part of the product and must be kept on hand for the entire duration of its service life.
- Local accident prevention regulations and national work safety regulations must be complied with as well.
- The product is subject to further technical development, and thus the information contained in these operating instructions may also be subject to change. The current version can be found at www.automationdirect.com in the product's separate download area.



INFORMATION

The operating instructions must be read carefully before using the product and must be kept on hand for later reference.

1.2 Explanation of Symbols

- Safety precautions and warnings are emphasized by means of symbols and signal words.
- Safe use of the product is only possible if these safety precautions and warnings are adhered to.

The safety precautions and warnings are laid out in accordance with the following principle:

SIGNAL WORD

Type and source of danger!

Possible consequences in the event that the hazard is disregarded.

→ Measures for averting the hazard.

The meanings of the signal words, as well as the scope of the associated hazards, are listed below:



DANGER

This signal word indicates a hazard with a high degree of risk which, if not avoided, results in death or severe injury.



WARNING

This signal word indicates a hazard with a medium degree of risk which, if not avoided, may result in death or severe injury.



CAUTION

This signal word indicates a hazard with a low degree of risk which, if not avoided, may result in minor or moderate injury.



NOTICE

This signal word draws attention to a potentially hazardous situation which, if not avoided, may result in property damage.



INFORMATION

Information draws attention to useful tips and suggestions, as well as information on efficient, error-free use.

1.3 Limitation of Liability

- The product has been developed in consideration of the current state-of-the-art technology, as well as applicable standards and guidelines. Subject to change without notice.
- A valid declaration of conformity can be accessed at www.automationdirect.com in the product's separate download area.
- wenglor sensoric elektronische Geräte GmbH (hereinafter referred to as "wenglor") excludes all liability in the event of:
 - Non-compliance with the instructions
 - Use of the product for purposes other than those intended.
 - Use by untrained personnel.
 - Use of unapproved spare parts.
 - Unapproved modification of products.
- These operating instructions do not include any guarantees from wenglor with regard to the described procedures or specific product characteristics.
- wenglor assumes no liability for printing errors or other inaccuracies contained in these operating instructions unless wenglor was verifiably aware of such errors at the point in time at which the operating instructions were prepared.

1.4 Copyrights

- The contents of these instructions are protected by copyright law.
- All rights are reserved by wenglor.
- Commercial reproduction or any other commercial use of the provided content and information, in particular graphics and images, is not permitted without previous written consent from wenglor.

2 For Your Safety

2.1 Use for Intended Purpose

The flow sensor measures the flow velocity of aqueous and oily media in closed pipe systems. The wenglor flow sensor operates according to the calorimetric measuring principle. This allows both the flow velocity and the media temperature to be monitored. The sensor detects changes in both process parameters and converts them into an electrical signal.

The sensors can be parameterized via IO-Link and adapted to the respective application. Depending on the setting and connection, two switching outputs or 1 switching and 1 analog output (4...20 mA/0...10 V) are available.

This Product Can Be Used in the Following Industry Sectors:

- Special-purpose mechanical engineering
- Heavy mechanical engineering
- Logistics
- Automotive industry
- Food industry
- Packaging industry
- Pharmaceuticals industry
- Plastics industry
- Woodworking industry
- Consumer goods industry
- Paper industry
- Electronics industry
- Glass industry
- Steel industry
- Aviation industry
- Chemicals industry
- Alternative energies
- Raw materials extraction

2.2 Use for Other than the Intended Purpose

- Not a safety component in accordance with 2006/42/EC (Machinery Directive).
- The product may be used only with accessories supplied or approved by wenglor, or in combination with approved products. A list of approved accessories and combination products can be found at www.automationdirect.com on the product detail page.



DANGER

Risk of personal injury or property damage in case of use for other than the intended purpose!

Use for other than the intended purpose may lead to hazardous situations.

→ Observe instructions regarding use for intended purpose.

2.3 Personnel Qualifications

- Suitable technical training is a prerequisite.
- In-house electronics training is required.
- Trained personnel who use the product must have (permanent) access to the operating instructions.



DANGER

Risk of personal injury or property damage in case of incorrect initial start-up and maintenance!

Personal injury and damage to equipment may occur.

→ Adequate training and qualification of personnel

2.4 Modification of Products



DANGER

Risk of personal injury or property damage if the product is modified!

Personal injury and damage to equipment may occur. Noncompliance may result in loss of the CE and/or UKCA mark and voiding of the warranty.

→ Modification of the product is not permitted

2.5 General Safety Precautions



INFORMATION

These instructions are part of the product and must be kept for the entire service life of the product.

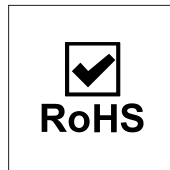
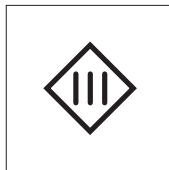
In the event of changes, you can find the latest version of the operating instructions at www.automationdirect.com in the download area for the product.

Read the operating instructions carefully before using the product.

Protect the sensor from contamination and mechanical impact.

The product may only be installed and removed in pipe systems that are depressurized and cooled down.

2.6 Approvals and protection classes



3 Technical Data

3.1 General information

	FXFF904
Sensor-specific data	
Measuring range	10...400 cm/s
Temperature of the medium, flow measurement	0...125 °C**
Temperature of the medium, temperature measurement	-25...150 °C
Setting Range	10...400 cm/s
Medium	Water
Measuring error (total)	≤ 2 %
Response time in case of temperature jump	10 s
Temperature measurement error	± 1 °C
Step response time T90	< 5 s
Ambient conditions	
Ambient temperature	-25...80 °C
Storage temperature	-25...80 °C
Pressure Resistance	100 bar
EMC	DIN EN 61326-1
Shock resistance per DIN IEC 68-2-27	30 g / 11 ms
Vibration resistance per DIN IEC 60068-2-6	5 g (10...2000 Hz)
Electrical data	
Supply Voltage	12...32 V DC
Supply Voltage with IO-Link	18...30 V DC
Current Consumption (U _b = 24 V)	< 40 mA
Number of Switching Outputs	2
Number of analog outputs	1
Analog Output	4...20 mA
Signal source	Flow
Response Time	1...5 s
Switching Output/Switching Current	± 100 mA
Residual Current Switching Output	< 250 µA
Switching Output Voltage Drop	< 2 V
Load Current Voltage Output	≤ 20 mA
Short Circuit Protection	yes
Reverse Polarity Protection	yes
Interface	IO-Link V1.1
Protection Class	III
Operating delay time	< 10 s
Mechanical data	
Setting Method	IO-Link
Housing Material	Stainless steel, V4A (1.4404/316L)
Material in contact with media	Stainless steel, V4A (1.4404/316L)
Degree of Protection	IP69K * IP68 *
Connection	M12 × 1; 4-pin
Process Connection	Cutting/locking ring

	FXFF904
Process Connection Length (PCL)	84 mm
Probe Length (PL)	75 mm
Rod diameter	6 mm
Safety technology data	
MTTFd (EN ISO 13849-1)	1210.41 a
Output functions	
Output	PNP Analog Output
Circuit	NO
Adjustable parameters	
Output	Analog Output Push-pull NPN PNP
Signal source	Flow Temperature
Circuit	NC NC/NO NO
Other parameters	2 switching points Selectable measurement range
General data	
Scope of delivery	1 × initial start-up instructions 1 × sensor

* Tested by wenglor

** The sensors have been calibrated for water and specified for this medium. Technically, the sensors are suitable for a temperature of medium down to -25°C. To achieve a temperature below 0°C, another medium must be added to the water. This results in a different measurement result, which is why use below 0°C must be tested individually for the mixture used.

The sensors are UL-certified for indoor use only.

The following table defines the tightening torques for the plugs and mounting options to ensure compliant and error-free operation:

Connection type	Tightening torque in Nm
Power and signal connection	
M12	0.4



CAUTION

- The pressure resistance specified in the technical data always refers to the sensor rod.
- The pressure resistance of the system also depends on the mounting component (adapter) used and is at most as high as the specified value for the weakest component.

3.1.1 Default Settings

Function O1	Output	Switching output
	Measurement, physical quantity	Flow
	Output function	PNP NO

Funktion O2	Switching point 1	2 m/s
	Switching point 2	1.5 m/s
	Output	Analog output
	Measurement, physical quantity	Flow
	Output function	Current: 4...20 mA
	Initial value, analog output	0 m/s
	Final value, analog output	4 m/s

3.2 Permissible flow velocity

Maximum permissible flow velocity depending on the temperature of medium and pressure.

Pressure	flow velocity	temperature of medium
PN25 (25 bar)	400 cm/s	20 °C
		60 °C
		100 °C
		150 °C
PN40 (40 bar)	400 cm/s	20 °C
		60 °C
		100 °C
		150 °C
PN64 (64 bar)	400 cm/s	20 °C
		60 °C
		100 °C
		150 °C
PN100 (100 bar)	400 cm/s	20 °C
		60 °C
		100 °C
		150 °C

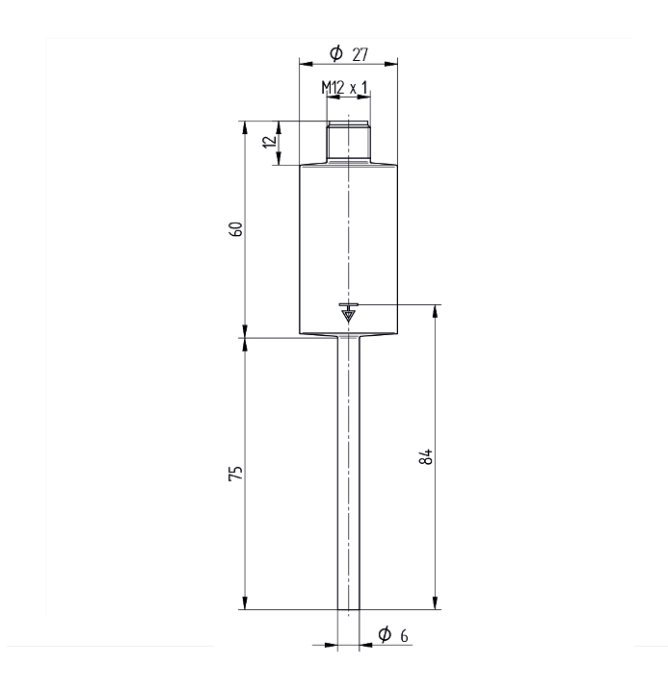
3.3 Volumetric Flow

The flow sensor measures the flow velocity at the sensor tip. To determine the volumetric flow within the pipe system, the pipe's internal diameter and the flow velocity are required.

The volumetric flow can be easily determined using the wenglor flow calculator. This is available for download on the website www.automationdirect.com.

Flow velocity / nominal width in- side Ø	DN25 28.5 mm	DN40 43.1 mm	DN65 70.3 mm	DN100 107.1 mm
100 cm/s	33 l/min	80 l/min	220 l/min	521 l/min
150 cm/s	50 l/min	120 l/min	330 l/min	782 l/min
200 cm/s	66 l/min	160 l/min	441 l/min	1043 l/min
250 cm/s	83 l/min	200 l/min	551 l/min	1303 l/min
300 cm/s	100 l/min	239 l/min	661 l/min	1564 l/min
350 cm/s	116 l/min	279 l/min	771 l/min	1824 l/min
400 cm/s	133 l/min	319 l/min	881 l/min	2085 l/min

3.4 Housing Dimensions



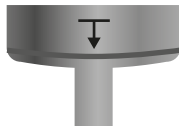
Dimensions in mm (1 mm = 0.03937 inch)



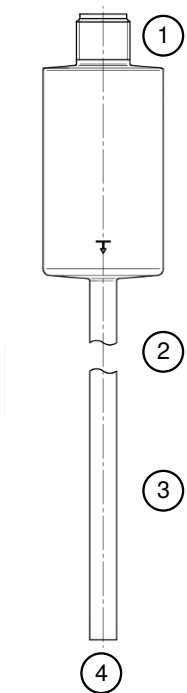
INFORMATION

There is a mark on the sensor sleeve (see fig.).

This is the reference (starting point) for the process connection length (see data sheet or instructions) and helps to position the sensor correctly in the pipe system.



3.5 Layout



1	connector plug	2	process connection
3	Sensor rod	4	measuring probe

4 Transport and Storage

4.1 Transport

Upon receipt of shipment, the goods must be inspected for damage in transit. In the case of damage, conditionally accept the package and notify the manufacturer of the damage. Then return the device, making reference to damage in transit.

4.2 Storage

The following points must be taken into consideration with regard to storage:

- Do not store the product outdoors.
- Store the product in a dry, dust-free place.
- Protect the product against mechanical impacts.
- Protect the product against exposure to direct sunlight.



NOTICE

Risk of property damage in case of improper storage!

The product may be damaged.

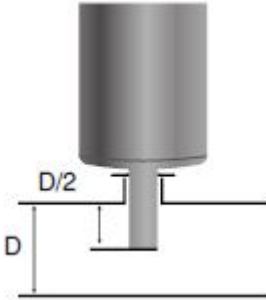
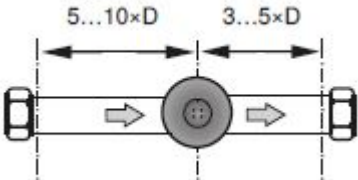
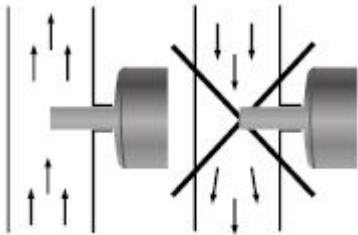
→ Storage instructions must be complied with.

5 Installation and Electrical Connection

5.1 Installation

Installation instructions

Conditions for correct flow velocity measurement:

	In order to correctly detect the flow rate, the tip of the sensor is positioned ideally in the middle of the pipe.
	To ensure correct flow velocity measurement, sufficient distance must be maintained from cross-sectional changes and pipe bends. The distances specified are to be understood as minimum distances. The specified values may vary depending on the type of interference.
	Install the sensors in closed systems and riser pipes because the detection of the flow rate is faulty in pipes which are open at the bottom.



NOTICE

Risk of property damage in case of improper installation!

The product may be damaged!

→ Comply with installation instructions.



CAUTION

Risk of personal injury or property damage during installation!

Personal injury and damage to the product may occur.

→ Ensure a safe installation environment.

5.2 Electrical Connection

- Wire the sensor according to the connection diagram.
- Switch on the supply voltage (see section Technical Data [► 7]).
- Connect the sensor to 12–32 V DC.
- When operated with IO-Link:

- An IO-Link master with class A port must be used because pin 5 is not connected in the case of a class A port.
- In the case of excessive interference, a shielded cable should be used.

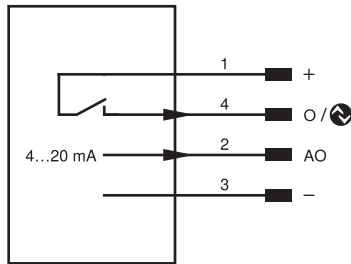


DANGER

Risk of personal injury or property damage due to electric current.

Live parts may cause damage to persons and equipment.

→ The electrical device may only be connected by qualified personnel.



Pin	Pin function	Polarity	Circuit	Signal type
1	Supply voltage +			
2	Analog output			4...20 mA
3	Supply voltage 0 V			
4	Switching output	PNP	NO	

5.3 Diagnosis

Required action in case of fault:



INFORMATION

Shut down the machine.

If the error cannot be eliminated, please contact wenglor's support department.

Do not operate in case of indeterminate malfunctioning.

The machine must be shut down if the error cannot be definitively explained or properly eliminated.



DANGER

Risk of personal injury or property damage in case of non-compliance!

The system's safety function is disabled. Personal injury and damage to equipment.

→ Required action as specified in case of fault.

6 Cleaning

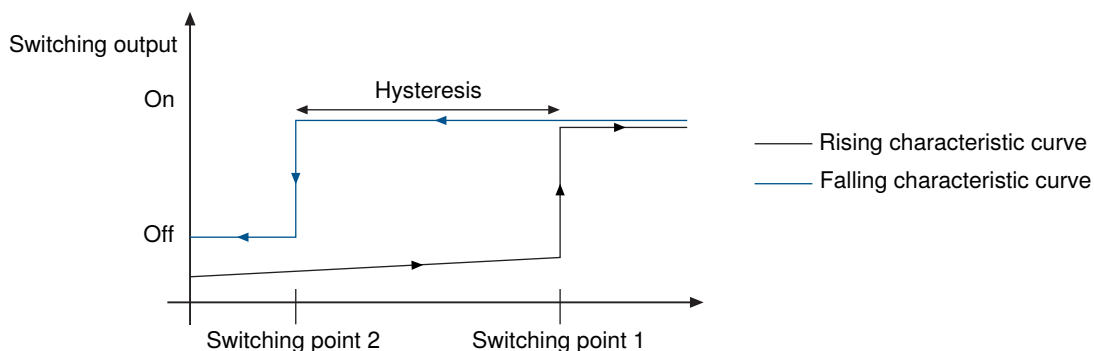
For external cleaning, observe the permissible ambient temperature and degree of protection. When selecting a cleaning agent, the resistance of the materials must be taken into account. A resistance list is available for download at www.automationdirect.com.

7 Function Description

The functions described in the following section can be set via IODD using IO-Link.

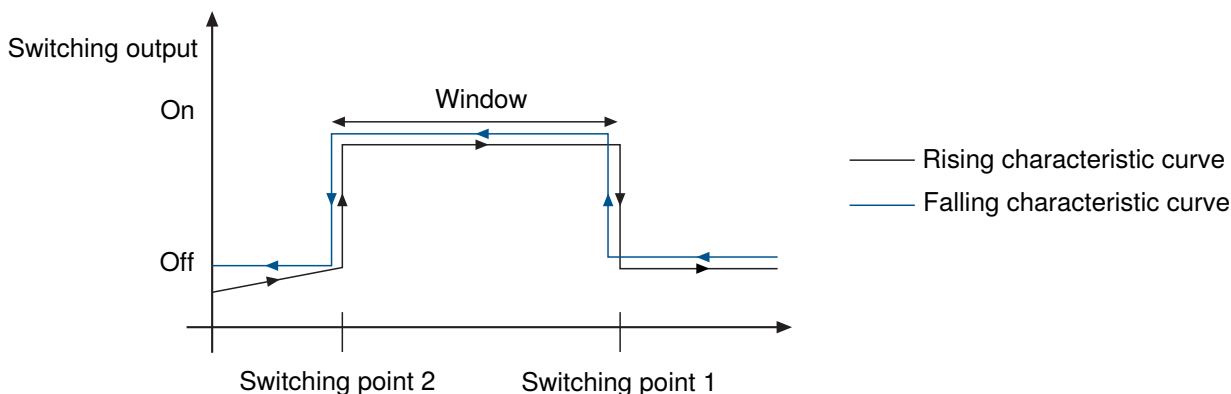
7.1 Hysteresis

Depending on the settings selected for switching points 1 and 2, the sensor's switching performance can be adjusted to the application.



7.2 Window Size

- If switching points 1 and 2 are swapped, a window for a target/actual value comparison can be performed with only one switching output.
- For parameterization, see the interface protocol (available at www.wenglor.com on the product details page).



The hysteresis at the window limits is 5 cm/s for flow and 0.5 °C for temperature.

7.3 Remote Output

General explanation

- If the sensor is operated with IO-Link (pin 4), the available output (pin 2) can be used for control signals.
- The output can be configured as a switching or analog output.
- This means that an additional output in the control system can be saved and external components (e.g., lamps) can be switched via the sensor or controlled via an analog control signal (U/I) (e.g., valves).

Prerequisite

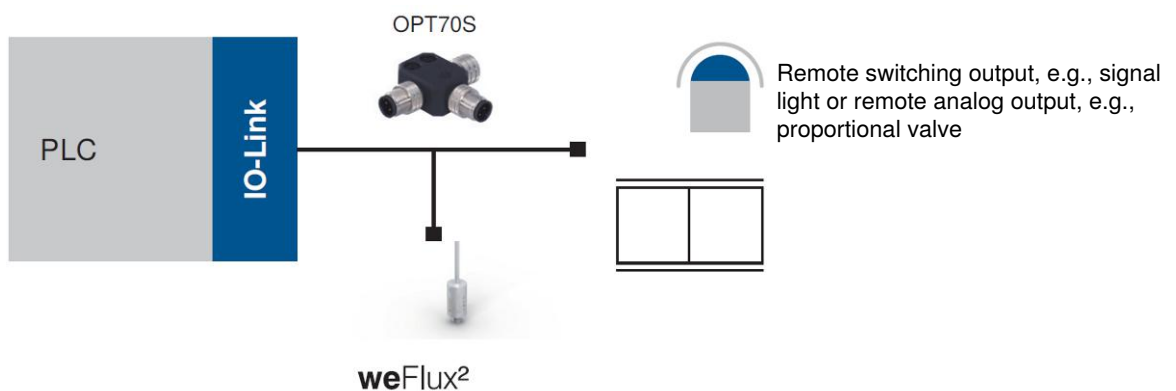
- The sensor must be operated via IO-Link.

Procedure

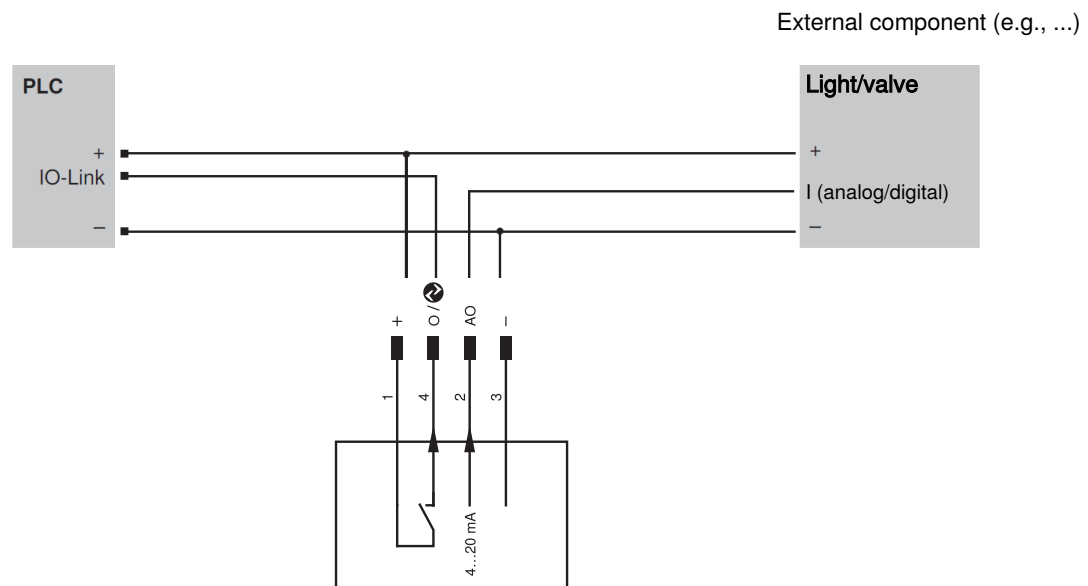
- Wiring and connection (see Wiring).
- Setting via IO-Link to specify whether pin 2 is a remote analog output (U/I) or the remote switching output.
- The controller sends the signal intended for the external component via IO-Link.
- The sensor transmits the signal to pin 2 (analog or switching output) and forwards it.
- The external component is controlled via the sensor output. An additional output on the controller is not required.
- The analog output can be scaled between 0...1000 (0 = 4 mA/0 V, 1000 = 20 mA/10 V).

Wiring

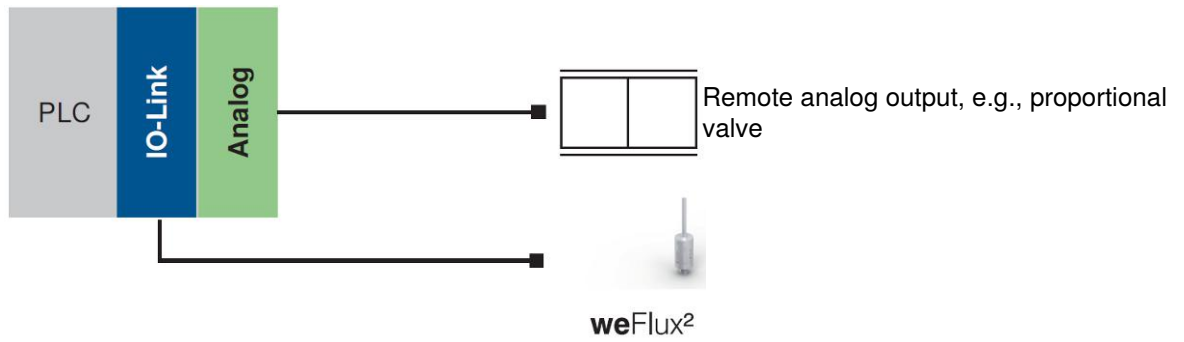
Wiring with remote output function:



Wiring:

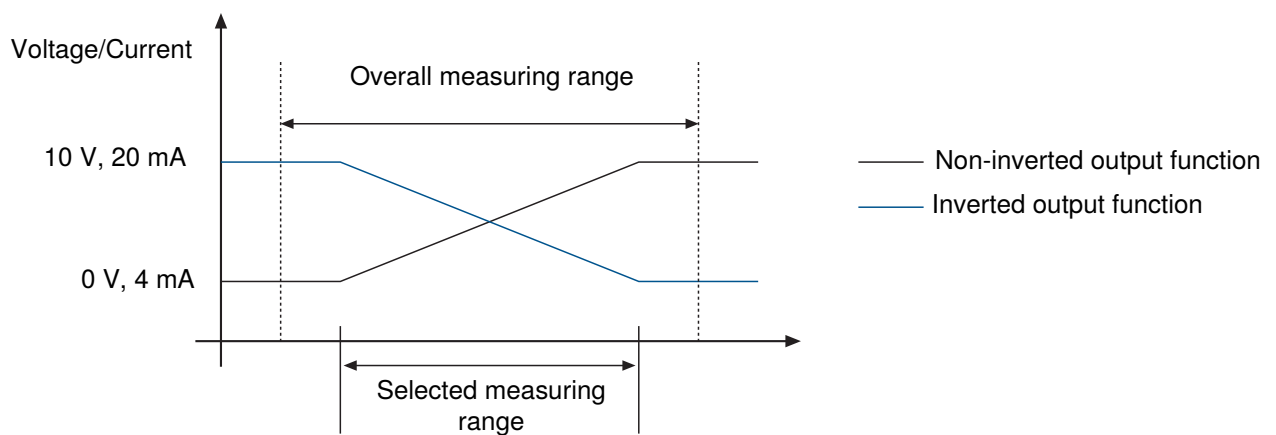


Wiring without remote output function:



7.4 Analog

Allocation of the analog starting point of 4 mA/0 V and the analog end point of 20 mA/10 V to the measuring range is freely selectable.



7.5 Filter

The filter represents the number of values used by the sensor to generate a mean value.

The higher the filter number, the longer the sensor's step response time T90 when the measured values change.

The filter only affects flow measurement.

Temperature is measured without filter. Temperature measurement data are reported cyclically every 3.6 seconds via IO-Link.

Filter	Number of measured values	Step response time T90
0	1	1.8 s
1	2	7.2 s
2 (default)	4	16 s
3	8	32 s
4	16	65 s (1 min)
5	32	131 s (2 min)
6	64	265 s (4 min)
7	128	529 s (9 min)
8	256	1,060 s (18 min)
9	512	2,120 s (35 min)
10	1,024	4,242 s (71 min)

8 Settings

Adjustable parameters via the IO-Link interface:

Sensor settings	
Temperature unit	°C °F
Output function Switching output	PNP NPN push-pull
Output function Analog output	4...20 mA 0...10 V
Function of output 1	Switching output Flow Switching output temperature
Function output 2	Switching output flow Switching output temperature Analog output flow Analog output temperature Remote switching output Remote analog output
filters	0...10, 0 = filters off
Output settings	
Output 1 (switching output)	
Switching point 1	Flow or temperature
Switching point 2	Flow or temperature
switching function	NO NC
Output 2 (switching output)	
– only visible if "Function output 2" is set to switching output –	
Switching point 1	Flow or temperature
Switching point 2	Flow or temperature
switching function	NO NC
Output 2 (analog output)	
– only visible if an analog output is selected for "Function output 2" –	
Start temperature (value for 4 mA / 0 V)	Flow or temperature
End temperature (value for 20 mA / 10 V)	Flow or temperature
analog output	Current 4...20 mA Voltage 0...10 V
Output 2 (remote switching output)	
– only visible if remote switching output is selected for "Function output 2" –	
output	Open/closed
Output 2 (remote analog output)	
– only visible if "Function Output 2" is set to Remote analog output –	
Analog value	0...1000
Sensor locks	
Write access lock	Yes No

Sensor settings	
Data storage lock	Yes
	No
Sensor commands	
Standard	Restore factory settings

Available process data via IO-Link interface:

- Status of switching outputs
- Warning message: unstable flow signal
- flow velocity
- Medium temperature



INFORMATION

The wenglor USB Master EFBL003 is required for setting and evaluation of the sensor using wTeach2.

9

IO-Link

The sensors can exchange IO-Link parameters and process data. Many additional settings can be made on the device using the parameters. Cyclical data and condition monitoring are transmitted via the process data.

To do this, the sensor is connected to a suitable IO-Link master (see product detail page/Complementary Products). The interface protocol and the IODD can only be found at www.automationdirect.com on the product detail page.

10 Maintenance Instructions



NOTICE

This wenglor product is maintenance-free.

Cleaning and inspection of the plug connections at regular intervals are advisable.

Do not clean the product with solvents or cleaning agents that could damage the product.

The product must be protected against contamination during initial start-up.

Contamination which adheres to the measuring probe distorts the measured value for flow rate.

11 **Proper Disposal**

wenglor sensoric GmbH does not accept the return of unusable or irreparable products. Respectively valid national waste disposal regulations apply to product disposal.

12 **Declarations of Conformity**

Declarations of conformity can be found on our website at www.automationdirect.com in the product's separate download area.