SEIKOM ELECTRONIC

Operating instructions
FlowGuard® FT407

Magnetic inductive flow meter

Version 1.0

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Contents

1. DESCRIPTION

The FlowGuard® FT407 flow meter is based on the well-known Faraday's law of electromagnetic induction, according to which an electric voltage is induced when a conductive liquid flows through the magnetic field of the flow meter. This voltage is picked up by electrodes in direct contact with the measuring medium and evaluated in the electronic unit.

The FlowGuard® FT407 is only suitable for measuring the flow of electrically conductive liquids with a minimum conductivity of 20 µS/cm. The higher the velocity of the flowing medium, the higher the measuring accuracy of the device.

1.1 Storage conditions

The temperature during transport and storage of the measuring device should be within the range of -10 … 50°C.

1.2 Warranty

Improper installation or use of the flow meters, as well as failure to comply with the installation or operating conditions specified in this manual, may void the warranty.

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2. INSTALLATION IN THE PIPE

2.1 Important information for selecting the location

Outdoor conditions

Make sure the device isn't exposed to the weather and that the measuring medium in the flow sensor can't freeze, as this would damage the measuring tube.

When installing the device outdoors, the manufacturer recommends a protective box or cover to prevent direct sunlight from overheating the measuring unit.

Sources of interference

The following points are among the most common causes of interference with a steady flow of liquid:

- Abrupt changes in the pipe cross-section if they are not designed as a cone with an angle of $\alpha \leq 7°$ (where α is the angle formed by the beveled walls of the pipe reduction).
- Incorrectly centered seals, seals with a small inner diameter, or seals made of soft, elastic materials that are pressed into the inner pipe cross-section after the flanges are tightened.
- Anything that impedes the flow of fluid, e.g., protective tubes, branch pipes, T-pieces, elbows, bends, slides, taps, flaps, shut-off valves, control valves, shut-off flaps, and check valves. Pipe outlets from containers, heat exchangers, and filters.
- Intense magnetic fields in the vicinity of the measuring device.

There must be **no sources of interference** in the straight pipe sections that could impair the uniform flow. They must be located in the pipe after the flow sensor or as far away from it as possible. Sources of interference can significantly reduce the measuring range and accuracy of the flow meters.

Vibration

It is recommended to support the connecting pipes on both sides of the flow meter to partially eliminate vibrations. The level and range of vibrations must be below 2.2 in the frequency range of 20 ... 50 Hz according to IEC 068-2-34.

Actual location

The flow sensor must not be located at the highest point of the pipe, which may be closed off by air, or in sloping or even horizontal pipes with open ends where air can enter.

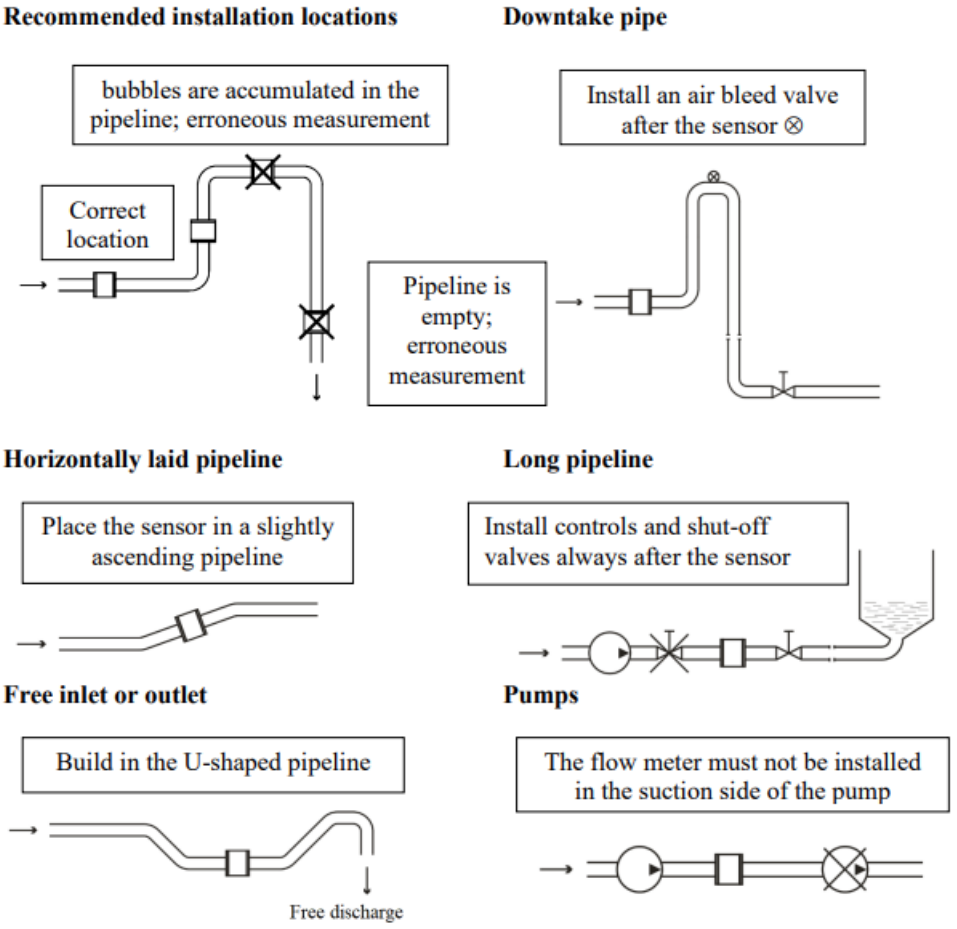
During long-term measurements of very low flow rates Q < 0.1 m/s, impurities may accumulate. Sufficient pressure must be maintained at the installation point of the flow sensor to prevent gas or vapor bubbles from being expelled from the liquid. Small bubbles, which are always present in liquids, can accumulate on one of the electrodes, which can lead to a malfunction of the measuring device. Gas bubbles are also expelled during an abrupt drop in pressure. Therefore, shut-off valves and similar elements should be installed **downstream of the flow sensor**. For the same reason, the flow sensor should not be installed on the suction side of the pump.

To prevent bubbles from accumulating in the flow sensor at low flow rates, it is advisable, for example, to ensure that the pipe rises slightly or that the flow sensor is located in the vertical section of the pipe.

For correct operation of the measuring device, the flow sensor should be constantly flooded with the measured liquid to prevent incorrect display of the supplied liquid quantity if the pipe is empty. The measuring device must be positioned so that the flow sensor is not exposed to air. In an open system, the flow sensor is installed in the lower position of the U-profile pipe to ensure that the liquid cannot flow out of the sensor.

Examples of installation

The trouble-free and accurate operation of the measuring device depends on its correct placement in the system. The most common methods of placement are shown in the following figures:



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The fluid flow in the flow sensor should be **uniform and free of turbulence**. For this reason, straight pipe sections with the same internal diameter as the flow meter should be installed before and after the flow sensor (permissible deviation of +5%). ×The recommended minimum length of the straight sections is 5× DN before the flow sensor and 3 DN after the flow sensor, where DN is the internal diameter of the flow meter in millimeters. The same principles apply before and after the flow sensor for bidirectional flow measurement.

Recommendations

- In the event of turbulent flow, the calming pipe sections must be extended or a flow equalizer must be installed.
- When mixing a mixture of substances, the flow meter must be installed either before the mixing point or at a sufficient distance after it (at least 30× DN, where DN is the internal diameter of the measuring device in millimeters), as otherwise the display will be unstable.
- Do not install the sensor on the suction side of pumps to avoid the risk of a vacuum and possible damage to the measuring tube casing.
- Pumps, elbows, and bends that are located in different planes close behind each other should be at least 20× DN in front of the flow sensor. In the case of a separate elbow or bend, placement 10× DN in front of the measuring device is recommended.
- When using piston, diaphragm, and hose pumps, it is necessary to install a pulse damper in the system.
- To ensure maximum accuracy, it is important to ensure that the sensor is permanently flooded (e.g., by installing the sensor in a U-shaped pipe), even if the sensor is equipped with empty pipe detection. This serves as an additional safety measure for detecting an unflooded pipe.

2.2 Installation in the pipe

In the event of interference with the measuring circuit, the pipe system must be considered as filled with medium, regardless of the test status indicated by the empty pipe on the measuring device.

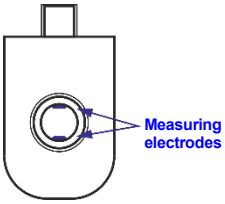
When preparing the pipe, make sure the two connection ends **are aligned** so that the seating surfaces are flat and the flow meter housing isn't exposed to excessive tensile and bending stress.

During electrical welding, no welding current must flow through the flow sensor and the power supply must be disconnected at all times. Welding equipment must not be used near the flow meter due to possible thermal damage.

The installation itself is carried out using suitable mounting wrenches corresponding to the flow meter thread connection and using a seal (not included in the scope of delivery). When tightening, use another wrench on the thread connection of the device to secure it. Ensure that the device is at the correct angle so that the liquid can flow through the flow meter in the direction **indicated** by the **arrow** on the sensor label.

Installation position

The flow meter is installed in vertical pipes in any position. In horizontal piping, make sure that the sensor is installed with its measuring electrodes in a horizontal position. In horizontal pipes where the measuring device is positioned with the connection facing upwards, it is necessary to place the device in the U-profile so that the electrodes are constantly immersed.

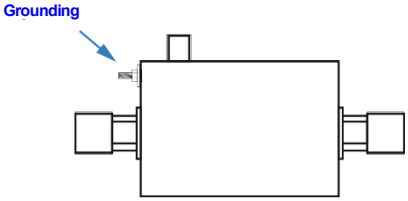


Please note the following points during installation:

- Do not drop the sensor on the floor.
- Check the electrodes for contamination (do not touch the electrodes, as this will contaminate them)
- If an additional seal is used, ensure that it does not impair the flow profile of the detector between the flanges and the pipe, as this will increase the likelihood of flow measurement errors.

Grounding

For reliable and correct operation of the FlowGuard® FT407, it is necessary to provide proper protective and operational grounding. The grounding conductor must not transmit any interference voltages, so that other electrical devices must not be grounded via this conductor. The flow sensor is equipped with an M5 stainless steel grounding screw with washer and nut for proper connection of the sensor housing. If a piping system is not properly grounded, the grounding point of the measuring device must be connected to the electrical potential of the earth to achieve proper grounding and ensure that the measuring device can operate reliably.



Electrodes

The cleanliness of the electrodes can affect the accuracy of the measurement; if they are very dirty, this can even cause the measurement function to be interrupted (isolation from the liquid). It is not necessary to clean the electrodes immediately after delivery before installing them in the pipe. If the electrodes show signs of contamination, clean them with a soft cloth or use a chemical cleaning agent. Be careful not to damage the lining! In routine operation, it is not necessary to clean the flow meter during the entire operating life of the flow sensor for most liquids; self-cleaning by the liquid flow is sufficient (recommended speed above 2 m/s).

Temperature of the medium

For the measuring device, it is necessary to maintain the medium temperature at up to 70°C. If this temperature is exceeded, the proper functioning of the evaluation electronics is no longer guaranteed or there is a risk of damage to the evaluation electronics.

2.3 Checking the installation

After installing the flow sensor in the pipe, check the following:

- According to the type label, if a corresponding measuring device is available at the given measuring point (pressure, temperature, dimensions, etc.).
- Whether the direction of the arrow on the device matches the direction of flow in the pipe.
- Correct position of the measuring electrodes (horizontal).
- Accuracy of the flow sensor grounding.
- Accuracy of the length of the pipe's settling sections
- If the sensor is protected against vibrations and mechanical damage.

3. WIRING

Workers performing electrical work are subject to the requirements of the general state building regulations and DIN standards for work on electrical installations.

If the following work is carried out improperly, the resulting faults are not covered by the warranty.

Before manipulating the measuring device in any way, switch off the power supply.

3.1 Wiring of the flow meter

Evaluation device

The evaluation device is supplied as standard for a power supply of 24 V DC ±15% / 250 mA.

The signal outputs of the flow meter may only be connected to devices for which accident prevention is ensured by safe low voltage and for which the voltages generated do not exceed the limits specified for safe low voltage.

The measuring device is connected electrically via a 4-pin M12x1 plug. All signals are **active**.

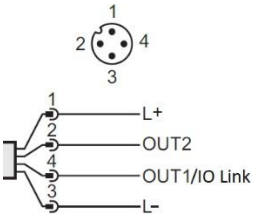
Standard cable connection

PIN 1 - +Vdd (24 V DC ±15%)

PIN 2 Configurable output OUT2
(PNP open collector - positive potential)

PIN 3 - GND

PIN 4 IO-LINK/ configurable output OUT1



3.2 Configurable output OUT1

The OUT1 output can be configured as a pulse output, status output, FlowSwitch, or alternatively as a fault. This output is also used for C/Q communication via the IO-Link protocol.

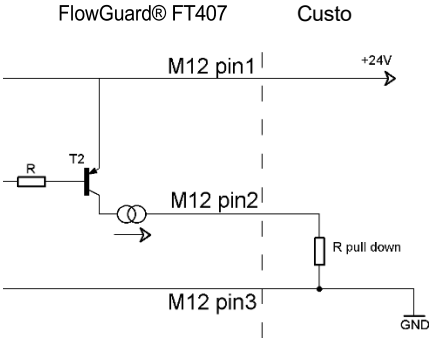
Active output with current overload protection.

OUT1 configuration options:

- Volume pulses in positive flow direction **+IMP**
- Volume pulses in negative flow direction **-IMP**
- Bidirectional volume pulses **±IMP**
- FlowSwitch status output with hysteresis **+FS**
- Status output fault **Err**

3.3 Configurable output OUT2

Output OUT2 can be configured as a pulse output, status output, FlowSwitch, or alternatively as an error or 4 … 20 mA analog output.
Active output with open collector (PNP) and current overload protection



* Wiring example

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OUT2 configuration options:

- 4 … 20 mA output in positive direction **+AO**
- Bidirectional 4 …20 mA output **±AO**
- Volume pulse in positive direction **+IMP**
- Volume pulse in negative direction **-IMP**
- Bidirectional volume pulse **±IMP**
- FlowSwitch status output with hysteresis **+FS**
- Status output fault **Err**

3.4 Check the wiring

Once the wiring is complete, a check is necessary:

- Check the connection cables for damage.
- Check cables for strain relief.
- Check that the cables are correctly connected to the terminals.
- Check that the supply voltage matches the specifications on the type plate.

4. COMMISSIONING

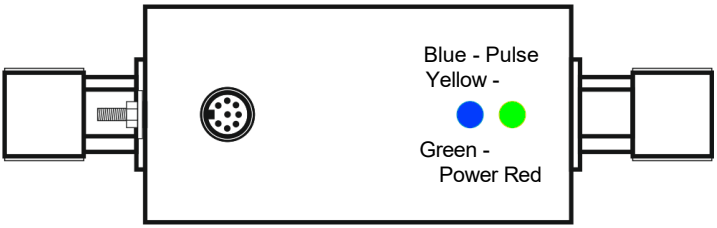
Before connecting to the power supply, check that the device has been installed correctly in accordance with the sections "Installation in the pipe" and "Wiring."

Do not switch on the measuring device during installation before the system has been filled with the measuring medium, and switch off the measuring device before the system is discharged. After switching on the measuring device, the green LED on the top cover next to the M12 connector lights up and confirms the supply voltage on the control board; the parameters of the measuring device then stabilize (approx. 5 seconds). After this period, the measuring device starts measuring.

Status display of the measuring device:

The status is continuously indicated by two indicator LEDs located on the upper cover of the evaluation unit. The status indicated by the LEDs can be as follows:

LED1	LED2	Description	Power failure
Green LED	-	The measuring device is OK and the flow is zero or negative	4 mA
Green LED	Blue LED flashing	The measuring device is OK and the flow is positive when the blue LED indicates indicates transmission of volume pulses	4 … 20 mA
Red LED	-	Measuring device is defective, maintenance required	<4 mA
Red LED	Yellow LED	Measuring device is temporarily outside the parameters	<4 mA
-	-	Error in the supply voltage	-



Flow direction:

The arrow indicates the direction of flow of the liquid in the sensor and thus the correct orientation of the flow meter for installation in the pipe.

Basic parameter settings

The parameters of the sensor or those of the flow meter are set by the manufacturer in accordance with "Factory settings (p. 20)" or in the order, and the basic data is indicated on the flow meter. Changes can be made based on the specifications of the flow meter via IO-Link or via the buttons and the LCD display.

Safety instructions for the operator

Any interference with the inductive flow sensor and the evaluation unit itself by the operator is not permitted and may result in direct scalding by the medium. Always carry out the electrical connection when the power is disconnected. If the medium temperature is high, the flow meter itself may become hot, so caution is advised and scalding of the device must be avoided.

5. IOLINK PARAMETERS

Serial	Serial
Calibration constant	Nominal value Calibration constant for the flow rate
Calibration offset	Calibration constant for the minimum flow rate (non-linear)
Flow direction	Flow direction
Transient time	Settling time (insensitivity) after Excitation commutation
Excitation time	½ excitation period [ms]
Excitation current limit	Limit value for current detection by excitation coils
Low flow shut-off	Start of measurement - shutdown at low flow
Flow switch point	Trigger point of the flow switch function
Hysteresis switch point	Hysteresis of the flow switch in5 of the trigger point
Pulse output [imp/L]	Pulse output constant
Pulse width	Pulse output - Pulse width/gap
Flow rate 4 mA	4 mA current loop Flow rate
Flow rate 20 mA	20 mA current loop Flow rate
Calibration constant 4 mA	4 mA current loop Calibration constant
Calibration constant 20 mA	20 mA current loop Calibration constant
Out1 - CQ (IO-Link) **- Pulse output - Forward flow (+Imp)** **- Pulse output - reverse flow (-Imp)** **- Pulse output - Forward/reverse flow (±Imp)** **- Flow switch (+FS)** **- Error status output (Err)**	Out1 Output configuration (CQ IOLink)
Out2 **- Current loop - forward flow (+AO)** **- Current loop - Forward/reverse flow (±AO)** **- Pulse output - Forward flow (+Imp)** **- Pulse output - reverse flow (-Imp)** **- Pulse output - Forward/reverse flow (±Imp)** **- Flow switch (+FS)** **- Error status output (Err)**	Out2 Output configuration
Empty tube test	Empty tube test ON/OFF
Detection limit for empty pipe noise	Noise amplitude for evaluating the empty tube tests
Number of detections of empty pipe noises	Number of overlap repetitions for evaluating the empty tube test

Correction of process data	The measured values for the IOLink data display/processing and the pulse output use a different calculation algorithm. The difference correction of the measurement methods is set to -4. The value is specified in tenths of a percent (standard= -0.4%)
Out1 High-speed pulse width	Pulse width in fast pulse mode when "Pulse width = 0" is set. In this case, the pulses have a width of several tens of µs. The exact width depends on the CPU load. Default value = 2 (50 µs in the version without LCD)
Raw data flow	Digital value of the AD converter, which is directly proportional to the flow rate
Saturation ratio	The value of the signal from the AD converter that is closest to the saturation limits of the amplifier. This allows you to estimate whether the signal is moving within a safe range before saturation. The saturation limits at which an alarm is triggered are <-973677; +973677> The saturation limits at which the measuring device stops measuring are <-1048576; +1048576>.

5.1 List "Event" IOLINK

Type of event	***Description***
Warning	Warning - Amplifier saturation!
Warning	Warning - Empty tube!
Notification	Warning - Simulation active!
Warning	Warning - Imp Out overflow!

Device hardware error (power coil failed)

5.2 **Process data IOLINK** flow

rate 2 bytes integer Volume 4

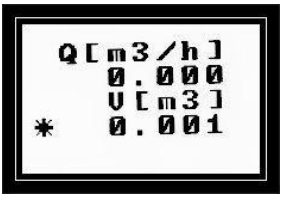
bytes floating point number

6. Display and settings

If you want to change parameters, you must start the setup mode within 3 minutes after switching on the
measuring device (the command to change the settings is sent via the communication interface or the E key is pressed and held for approx. 4 seconds). After this time, the current settings can only be viewed (changing parameters is locked). The parameters are changed with the↑ key and the values are confirmed with the E key.

Basic view of the display

- Current flow rate Q [m^3 /h]
- Volumetric meter V [m^3]
  Both values are displayed with 3 decimal places.

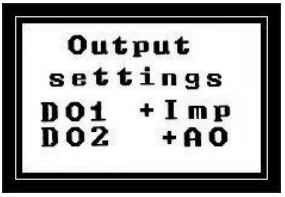


Display settings

- Configuration of outputs Out1 and Out2

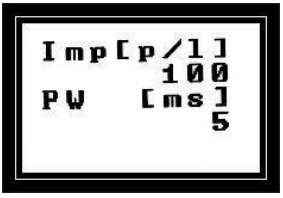
  Configuration

+AO	4 … 20 mA output in positive direction
±AO	Bidirectional 4 … 20 mA output
+Imp	Volume pulse in positive direction
-Impulse	Volume pulse in negative direction
±IMP	Bidirectional volume pulse
+FS	FlowSwitch status output with hysteresis
Err	Status output fault



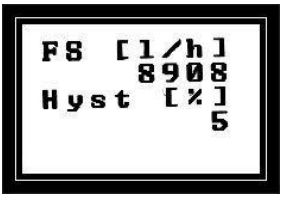
- Pulse output constant

  Enables setting of the pulse constant (**Imp**) and the pulse width/interval (**PW**)



- Flow control output status (FlowSwitch)

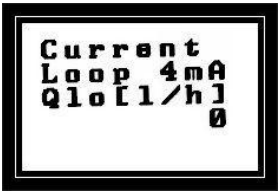
  Enables setting of trigger points **FS** with hysteresis **Hyst**

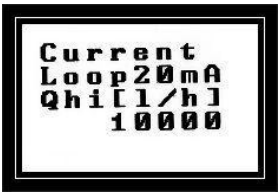


- Current loop setting

  Qlo Lower flow limit for 4 mA current

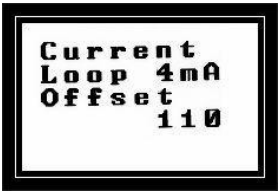
  Qhi Upper flow limit for 20 mA current

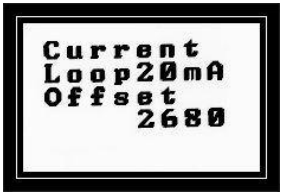




Offset:

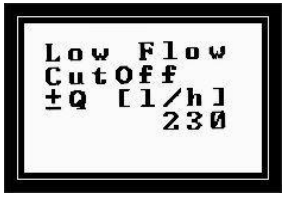
4 mA Calibration constant for current 4 mA
20 mA Calibration constant for current 20 mA





- Settings for interrupting the flow

  Allows the minimum flow rate to be set. A flow rate below the set value is displayed as 0.



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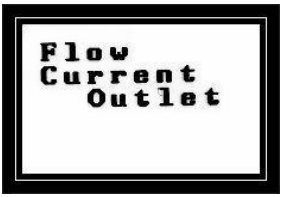
- Flow direction

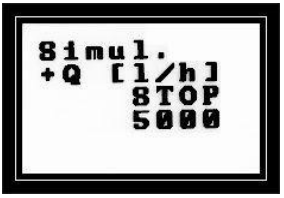
  Allows the flow direction (positive/negative) to be changed without changing the installation.



- Empty pipe test
  Enables the "empty pipe test" to be switched on and off.
  If the "empty pipe test" is activated, the **"empty pipe noise detection limit"** and **"empty pipe noise detection count"** registers must be configured**.**
  The values in the register represent the type of fluid; the factory setting is for water.
  Empty pipe noise detection limit= 2700
  Number of detection noises for empty pipes = 7

- Flow simulation

  Enables flow simulation, which is useful for better system testing.



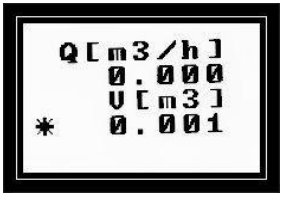
- Reset to factory settings

  Resets all input data to factory settings

6.1 Show warnings or errors Displays notifications

- "e" Error – Service required
- "w" Warning – Sensor is outside its parameters
- "*“ Empty pipe

The status of the flow meter is shown in the lower left corner of the display. Example: Empty pipe detected:



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7. TECHNICAL PARAMETERS

Technical parameters of the evaluation electronics

Power	24 V DC ±155 / 250 mA with reverse polarity protection
Input	3 VA
Electrical connection	M12x1, 4-pin
Display	4× LED, LCD display (4x8)
Design	Compact
Maximum medium temperature	70°C (, according to lining), at higher temperatures after consultation with the manufacturer
Size	DN 4 … 32
Lining material	PVDF
Electrode material	CrNi steel DIN 1.4571
Contact material	Stainless steel
in contact with medium	EPDM and silicone seals PVD
Measuring range (Qmin/Qmax)	unidirectional/bidirectional for 0.2 … 12 m/s (1/60)
Accuracy	1% for 1 … 10 m/s 2% for 0.2 … 1 m/s
Repeatability	up to 0.4% (for 0.1 … 10 m/s)
Min. conductivity of the medium	20 µS (at lower conductivity, by agreement with the manufacturer)
Control elements	2x button (LCD version only)
Outputs (active, 24 V):	Pulse status Analog 4 … 20 mA
Max. pulse power frequency	ver. A1, A2 (IOLINK / BlueThooth) – 10 kHz ver. A3 (LCD display and IOLINK) – 8 kHz
Current carrying capacity:	OUT1 – 50 mA OUT2 – 30 mA
Communication	IO-LINK or Bluetooth
Design	IO-LINK Bluetooth and IO-LINK LCD display and IO-LINK
I/O response	70 ms (current loop)
Process connection	Threaded (EN ISO 228-1)
Sampling	900 samples per second (standard)
Max. ambient temperature	55°C
Ambient humidity:	max. 90%
Pressure	PN25
Pressure loss	negligible
Protection class of the measuring device	IP65

Factory configuration of outputs

OUT1 (pulse)	OUT2
Pulses in flow direction	4 … 20 mA in flow direction

8. TABLE WITH FLOW RATES FOR INDIVIDUAL DN SIZES

Nominal diameter [mm]	Qmin [m3/h]	Qmax [m3/h]
DN 4	0.02	0.5
DN 6	0.03	1
DN 8	0.04	2
DN 10	0.06	3
DN 15	0.2	7
DN 20	0.2	10
DN 25	0.35	15
DN 32	0.6	25

9. FACTORY SETTINGS

Pulse constants and current loop - factory settings

Nominal sensor	Pulse output		4 … 20 mA (in the range Qmin/Qmax 1/100)	
DN	Vout [imp/l]	Vout - Pulse width [ms]	Q[l/h] for 4 mA	Q[l/h] for 20 mA
4	10	4	0	500
6	100	4	0	1,000
8	10	4	0	2,000
10	10	4	0	3,000
15	10	4	0	7,000
20	10	4	0	10,000
25	10	4	0	15,000
32	10	4	0	25,000

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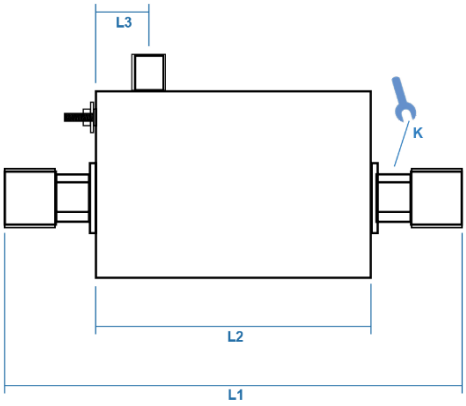
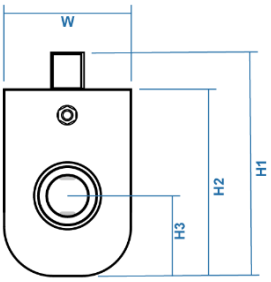
10. BASIC DIMENSIONS

Threaded version





Nominal diameter [mm]	Threaded connection	L1	L2	L3	W	H1	H2	H3	K	Weight of compact flow meter (kg)
4	½	161	97	16.5	49	80	70	32	17	1.2
6	½"	161	97	16.5	49	80	70	32	17	1.2
8	½	161	97	16.5	49	80	70	32	17	1.2
10	½	161	97	16.5	49	80	70	32	17	1.1
15	½	161	97	16.5	49	80	70	32	17	1
20	¾"	161	97	16.5	49	80	70	32	22	1
25	1"	209	117	26.5	60	97	83	40	27	1.5
32	1 ¼"	209	117	26.5	70	97	83	40	36	2

Nominal diameter [mm]	DN 15 ... DN 20	DN 25 ... DN 32
External dimensions of the CLAMP [mm]	34	50.5

11. FUNCTIONAL TESTS

The warranty claim will be void if the work described below is not carried out properly.

The power supply must always be switched off before starting any work on the measuring device.

11.1 Faults and their symptoms during measurement

Unstable displays and outputs may occur if:

- high proportion of solids
- latent non-homogeneity
- Mixed-in impurities
- ongoing chemical reactions within the measured substance
- Use of membrane pumps or piston pumps

12. ORDER NUMBER

Item number	**1317/**
Diameter	
See table "Available measuring ranges"	**DN04 … 32**
Process connection	
Thread (EN ISO 228-1)	**G**
Milk pipe screw connection (DIN11851)	**M**
Clamp (DIN32676)	**C**
Display	
Without	**O**
LCD	**L**
Bluetooth	**B**
Output signal	
IO-Link+ Pulse output	**1**
IO-Link + analog output (4 … 20 mA)	**2**

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13. SERVICE

All warranty and post-warranty repairs are carried out by the manufacturer, **SEIKOM-Electronic.**
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If the work described here is carried out improperly, your warranty claims for any resulting

warranty claims for any resulting failures.

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