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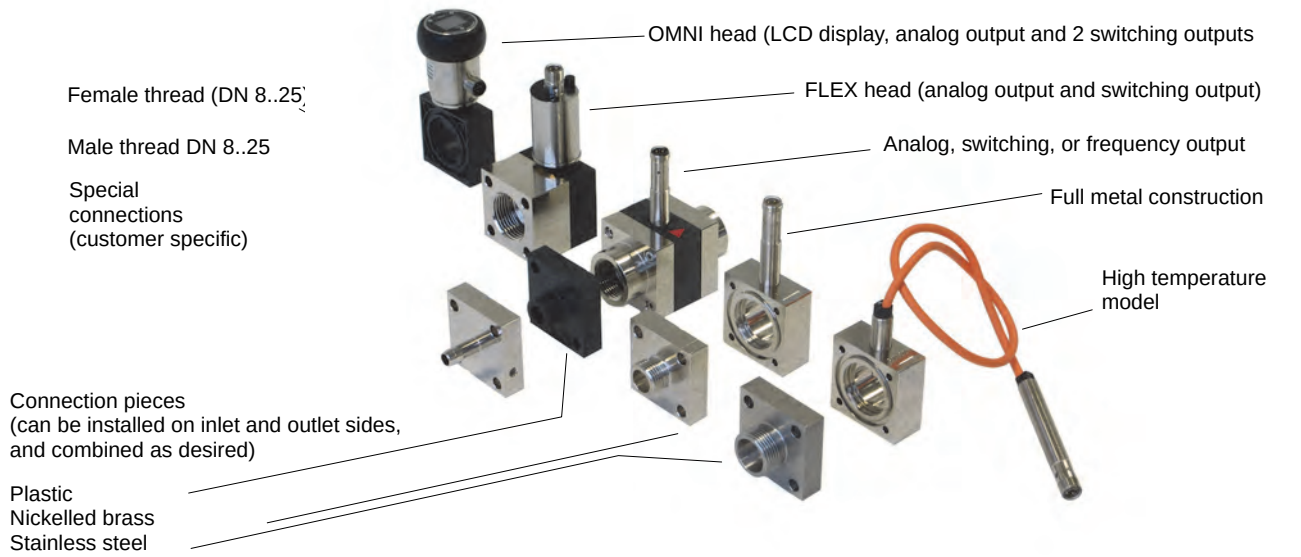
Flow - dynamic diaphragm



Characteristics

System	Flow Dynamic diaphragm
Evaluation	Display Switching Measurement
Nominal widths	DN 8..25
Range	0.4..100 l/min
Media	Water Aqueous emulsions Aggressive media
Pressure resistance	Max. 100 bar
Medium temperature	0..150 °C

Applications

- **Industrial metering and monitoring technology**
- **Starting systems for high pressure cleaners**
- **Machine tools for emulsion control**
- **Laser coolant monitoring with very rapid reaction time**
- **Sawing emulsion monitoring for semiconductor saws**

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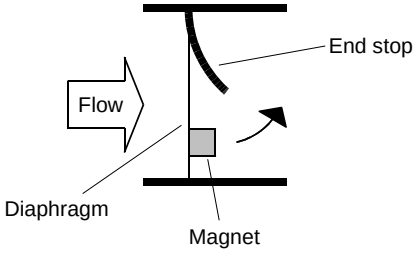
Function and benefits

- **Very large metering range**
- **Fast response time**
- **Robust with end stop**
- **Lowest dispersal in the series (100 % individual calibration)**
- **Modular concept**

A thin elastic diaphragm made of stainless steel, which covers the entire flow cross-section, is deflected by the flowing fluid, and thereby pushes against an arched end stop (therefore, overexpansion cannot occur!).



There is a plastic-coated magnet on the diaphragm. When there is a deflection, its magnetic field changes, and this is detected by a sensor outside the area of flow.

Flexible diaphragm made of stainless steel, with plastic-coated magnet.

Since the diaphragm only bends, and functions without a bearing, there is almost no frictional effect and extremely little wear.
The movement occurs practically free of hysteresis, and the test results have very good reproducibility. The diaphragms low bulk results in a rapid response time. The almost complete covering of the flow cross-section in the neutral position enables a very low metering range start value.

The evaluation of the entire flow cross-section means that there are no problems when routing pipes. Run-in and run-out sections are not necessary. The shaped end stop and the elastic properties of the diaphragm mean that even severe water hammer causes no damage. The low number of parts coming into contact with the medium as well as the bend of the diaphragm guarantee a low tendency towards soiling and material adhesion. The flange construction simplifies installation and service.

Through a range of options, the XF system is flexibly adaptable to very varied requirements.

- The widest range of materials and connection possibilities.
- High-temperature model
- Resistance to backflows
- Minimum value measurement

Programmability of parameters

All XF sensors from HONSBERG are a part of the family of intelligent sensors. They have a microcontroller which enables a multitude of parameter changes.
By standard, all three main electronics have the capability of making local changes. In addition, a device configurator can be used to change all saved parameters of a device at any time, if desired or necessary.

LABO-XF
- / U / F / C / S

Pulse programming on pin 2:
Apply the supply voltage level for 1 second and save the current value as the full scale value (for analog outputs) or as a switching value (for limit switches).

FLEX-XF

Programming with magnet clip:
Hold the magnet to the marking for 1 second and save the present value as the full scale value (for analog outputs) or as a switching value (for limit switches).

OMNI-XF

Programming with magnet ring:
With the aid of the display and of the movable ring, numerous parameters can be conveniently set on the spot.

ECI-1

If required, all parameters can be set at any time on all intelligent sensors, using the ECI-1 device configurator.

Universal switching outputs

The push-pull transistor outputs enable the simplest installation.
You install the output like an NPN switch and it is an NPN switch; you install the output like a PNP switch and it is a PNP switch – without programming or wire breaks.
You are assured a resistance to short circuits and pole reversal and an overload or short circuit is also shown in the display with OMNI electronics.

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Device overview

Device		Range l/min	Pressure	Medium temperature	Supply voltage	Displays	Output signal		Page
							Switching	Measuring	
LABO-XF-S		0.6..80 (0.4..100)	PN 16..100	0..70 °C (150 °C)	10..30 V DC	Signal LED	1 x Push-Pull	-	**4**
LABO-XF-I		0.6..80 (0.4..100)	PN 16..100	0..70 °C (150 °C)	10..30 V DC	Signal LED	-	4..20 mA	**9**
LABO-XF-U		0.6..80 (0.4..100)	PN 16..100	0..70 °C (150 °C)	15..30 V DC	Signal LED	-	0..10 V	**9**
LABO-XF-F		0.6..80 (0.4..100)	PN 16..100	0..70 °C (150 °C)	10..30 V DC	Signal LED	-	Frequency 0..2 kHz (push-pull)	**9**
LABO-XF-C		0.6..80 (0.4..100)	PN 16..100	0..70 °C (150 °C)	10..30 V DC	Signal LED	-	X pulses / litre (push-pull)	**9**
FLEX-XF		0.6..80 (0.4..100)	PN 16..100	0..70 °C (150 °C)	18..30 V DC	Signal LED	1 x Push-Pull	0/4..20 mA 0..10 V or 0..2 kHz	**13**
OMNI-XF		0.6..80 (0.4..100)	PN 16..100	0..70 °C (150 °C)	18..30 V DC	Graphic LCD illuminated transflective and signal LED	2 x Push-Pull	0/4..20 mA or 0..10 V	**18**
OMNI-C-XF (counter)		Totaliser / consumption counter from one increment to 9999 m³	PN 16..100	0..70 °C (150 °C)	18..30 V DC	Graphic LCD illuminated transflective and signal LED	2 x Push-Pull	-	**23**

ECI-1	All LABO, FLEX, and OMNI parameters can be set or modified using the ECI-1 configurator.	**27**
Options	● LABO transmitter – Temperature up to 150 ° ● OMNI – Tropical model	**28**
Accessories	● Type ZV / ZE (Filter) ● KB.... (Round plug connector 4/5-pin) ● OMNI-TA (Panel meter) ● OMNI-C-TA (Panel counter) ● OMNI-remote ● EEZ-904 (External universal counter)	**29**

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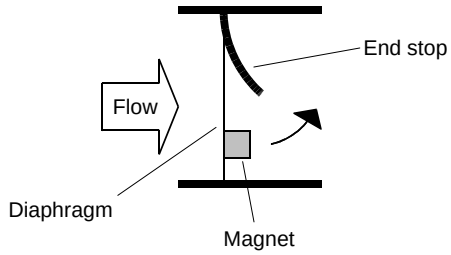
Flow Switch LABO-XF-S

- **Very short response time**
- **High overload protection**
- **Metering range 1:80**
- **Low pressure loss**
- **Compact design**

Characteristics

A thin elastic diaphragm made of stainless steel, which covers the entire flow cross-section, is deflected by the flowing fluid, and thereby pushes against an arched end stop.



There is a plastic-coated magnet on the diaphragm. When there is a deflection, its magnetic field changes, and this is detected by a sensor outside the area of flow.

Flexible diaphragm made of stainless steel, with plastic-coated magnet.

The integrated converter / counter make available an electronic switching output (push-pull) with adjustable characteristics (minimum/maximum) and hysteresis, which responds when an adjustable limit is fallen short of or exceeded. If desired, the switching value can be set to the currently existing flow using "teaching".
Models with analog or pulse output are also available (see separate data sheets). Because the diaphragm only bends, and functions without a bearing, there is almost no friction effect. The movement therefore occurs practically free of hysteresis, and the switching point has very good reproducibility.

The diaphragm's low bulk results in a short response time. The almost complete covering of the flow cross-section in the neutral position enables a very low response threshold. As soon as the slightest flow exists, the diaphragm is of necessity deflected. The evaluation of the entire flow cross-section means that there are no problems when routing pipes. Run-in and run-out sections are not necessary.

The shaped end stop and the elastic properties of the diaphragm mean that even severe water hammer causes no damage. The low number of media contact parts guarantees reliable operation and a low tendency to contamination.

There are flanged connection pieces on the inlet and outlet; these are available in various nominal widths and materials. By removing the four bolts of the flange connection, it is simple to remove the measurement unit for servicing, while the connections remain in the pipework.

Technical data

Sensor	dynamic diaphragm
Nominal width	DN 8..25
Process connection	female thread G $^1/_4$..G 1, optionally male thread or hose nozzle
Switching ranges	1..100 l/min (water) for standard range see table "Ranges", minimum value range 0.4..6 l/min optionally available
Measurement accuracy	Standard ranges: ±3 % of the measured value, minimum 0.25 l/min Minimum value range: ±3 % of the measured value, minimum 0.1 l/min
Pressure loss	max. 0.5 bar at the end of the metering range
Pressure	Plastic construction: PN 16 Full metal construction: PN 100
Media temperature	0..70 °C with high temperature option 0..150 °C
Ambient temperature	0..70 °C
Storage temperature	-20..+80 °C
Materials medium-contact	Body: PPS, CW614N nickelled or stainless steel 1.4404 Connections: POM, CW614N nickelled or stainless steel 1.4404 Seals: FKM Diaphragm: stainless steel 1.4031k Magnet holder: PPS Adhesive: epoxy resin
Materials, non-medium-contact	Sensor tube: CW614N nickelled Adhesive: epoxy resin Flange bolts stainless steel Full metal construction: steel
Supply voltage	10..30 V DC
Power consumption	< 1 W (for no-load outputs)
Switching output	transistor output "push-pull" (resistant to short circuits and polarity reversal) I_{out} = 100 mA max.
Display	yellow LED (On = Normal / Off = Alarm / rapid flashing = programming)
Electrical connection	for round plug connector M12x1, 4-pole
Ingress protection	IP 67
Weight	see table "Dimensions and weights"
Conformity	CE

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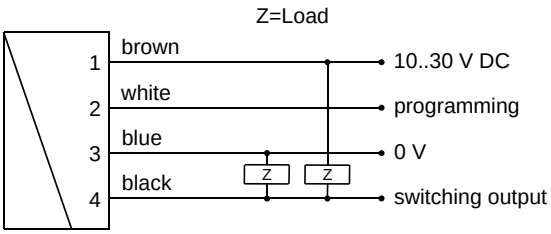
Ranges

Nominal width		Switching range l/min H_2O	Q_{max} recommended
DN 8..25	❍	0.4.. 6.0	120
DN 8..25	●	1.0.. 15.0	
DN 10.0.25	●	1.0.. 25.0	
DN 15.0.25	●	1.0.. 50.0	
DN 20.0.25	●	1.0.. 80.0	
DN 25 *	❍	1.0..100.0	

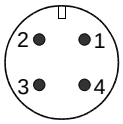
* Inner pipe diameter ≥ Ø22.5

Special ranges are available.

Wiring



Connection example: PNP NPN

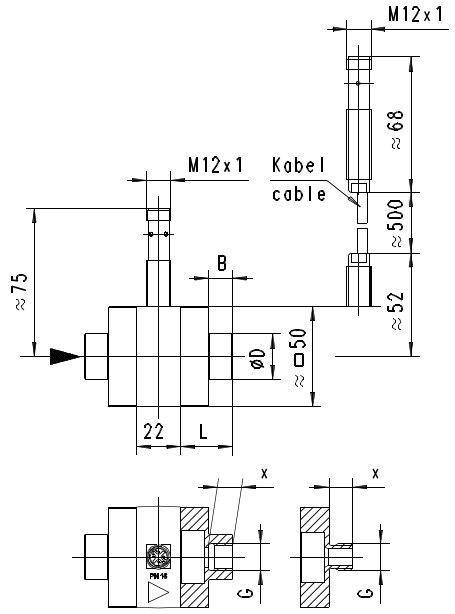


Before the electrical installation, it must be ensured that the supply voltage corresponds to the data sheet.

It is recommended to use shielded wiring.

The push-pull output) can as desired be switched as a PNP or an NPN output.

Dimensions and weights



Connection pieces

G	DN	L	B	X	ØD Metal / Plastic	Weight* kg Metal / plastic
G 1/4	DN 8	26	12	12	22,5 / 33	0.245 / 0.055
G 3/8	DN 10					0.240 / 0.050
G 1/2	DN 15	28	14	14	28,0 / 37	0.250 / 0.055
G 3/4	DN 20	30	16	16	35,0 / 42	0.270 / 0.060
G 1	DN 25		-	18	-	0.400 / 0.085
G 1/4 A	DN 8	26	-	12	-	0.230 / 0.045
G 3/8 A	DN 10		-		-	0.230 / 0.045
G 1/2 A	DN 15	28	-	14	-	0.240 / 0.050
G 3/4 A	DN 20	30	-	16	-	0.235 / 0.050
G 1 A	DN 25	32	-	18	-	0.235 / 0.050

*Weights per connection, excluding bolts

Body

Construction	Weight* kg
Plastic	ca. 0.100
Metal	ca. 0.400

*Weights incl. internal parts, sensor and bolts for connection pieces

Options

Through a range of options, the XF system is flexibly adaptable to very varied requirements.

Full metal construction
The standard version has a plastic body with a pressure resistance of 16 bar. A metalled body (nickelled brass) with a pressure resistance of 100 bar is optionally available. The higher operating pressure requires a combination with metal connection pieces. Switching value settings in the range 1..80 l/min are possible.

High temperature
If the full metal model with high temperature sensors is fitted, operation at media temperatures up to 150 °C is possible. Here, the primary sensor element is located in the housing of the measurement unit, while the converter / counter are located away from housing via a 50 cm long heat-resistant cable.

Note:Operation using the plastic body is also possible at temperatures greater than 70 °C. However, it should be noted that this reduces the stability to pressure .

Resistance to backflows
With forward flows, the diaphragm pushes against an arched end stop, and is undamaged by flow rates which are significantly higher than the intended metering range, or by water hammer. For flows or pressure surges in the reverse direction, in the standard version the diaphragm pushes against a circumferential plastic support ring, and almost completely closes the flow cross-section. This causes pressure to build up which can damage the diaphragm. In applications where such conditions can arise (e.g. from elastic hoses to the rear of the measuring equipment) the use of the "resistance to backflows" option is recommended. Here, the plastic support ring is replaced by another arched end stop made of stainless steel, so that the diaphragm is provided with the same overload and pressure surge resistance in the reverse direction as in the forward direction. However, a switching value setting in the reverse direction is not possible.

The "resistance to backflows" option is mandatory for bodies made of metal.

Minimum value measurement
For switching ranges up to 6 l/min, the sensitivity and therefore the stability of the measuring system can be increased, and so switching value settings even less than 1 l/min, i.e. from 0.4 l/min become possible. For this, the sensor is installed on the opposite side of the housing. This option is not available for metal housings and models with resistance to backflows.

Handling and operation

Installation

The device is supplied with connection pieces mounted. These may be removed for the installation in the pipework.
The sensor can be operated in any location. However, the lowest tendency to contamination occurs when the diaphragm swings from bottom to top. If possible. installation should therefore be made either with flow from bottom to top, or horizontal. In the latter case, the sensor in the minimum value range model (max. 6 l/min, see options) should point downwards; for all other versions it should point upwards. Factory adjustment is made with flow horizontal.

It should be ensured that the sensor is installed in the direction of the flow arrow. In spite of its low bulk, the diaphragm is very robust; nevertheless it should not be buckled or compressed through force during installation or removal.

The bolts in the housing pass all the way through it, and must be completely removed if the sensor body is replaced. Afterwards, as normal with a flanged part, the body can be pulled out without loosening the screw connections.

Note

The switching value can be programmed by the user via "teaching". If desired, programmability can be blocked by the manufacturer.

The ECI-1 device configurator with associated software is available as a convenient option for programming all parameters by PC, and for adjustment.

Operation and programming

The switching value is set as follows:

- Apply the flow rate to be set to the device.
- Apply an impulse of at least 0.5 seconds and max. 2 seconds duration to pin 2 (e.g. via a bridge to the supply voltage or a pulse from the PLC), in order to accept the measured value.
- When the teaching is complete, pin 2 should be connected to 0 V, so as to prevent unintended programming.

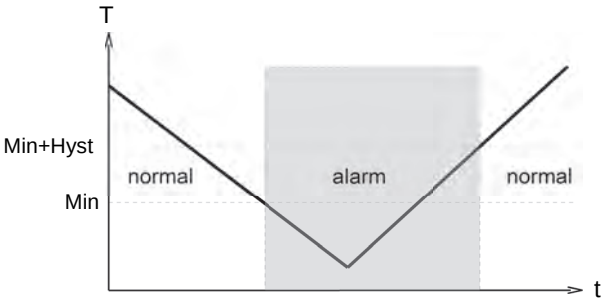
The device has a yellow LED which flashes during the programming pulse. During operation, the LED serves as a status display for the switching output.

In order to avoid the need to transit to an undesired operating status during the teach-in, the device can be provided ex-works with a teach-offset. The teach-offset point is added to the currently measured value before saving. The offset point can be positive or negative.

Example: The switching value should be set to 80 l/min. However, it is possible only to reach 60 l/min without problems. In this case, the device would be set using a teach-offset of +20 l/min. At a flow rate of 60 l/min in the process, teaching would then store a value of 80 l/min.

The limit switch can be used to monitor minima or maxima.

With a minimum-switch, falling below the limit value causes a switchover to the alarm state. Return to the normal state occurs when the limit value plus the set hysteresis is once more exceeded.



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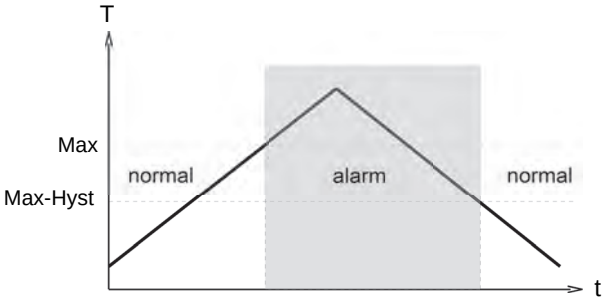
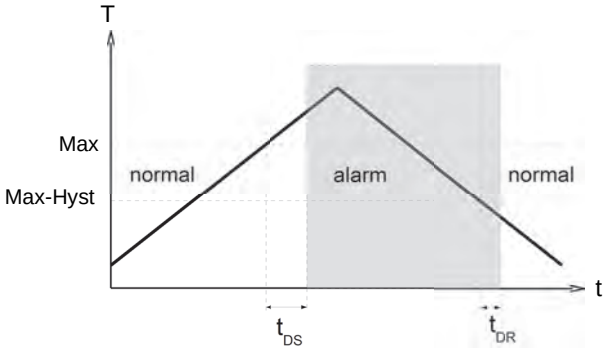
With a maximum-switch, exceeding the limit value causes a switchover to the alarm state. Return to the normal state occurs when the measured value once more falls below the limit value minus the set hysteresis.

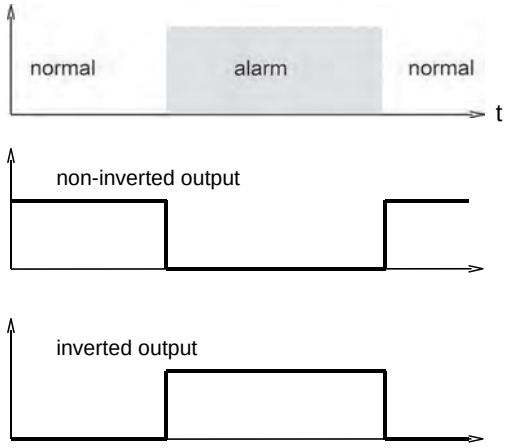


A switchover delay time (t_{DS}) can be applied to the switchover to the alarm state. Equally, one switch-back delay time (t_{DR}) of several can be applied to switching back to the normal state.



In the normal state the integrated LED is on, in the alarm state it is off, and this corresponds to its status when there is no supply voltage.

In the non-inverted (standard) model, while in the normal state the switching output is at the level of the supply voltage; in the alarm state it is at 0 V, so that a wire break would also display as an alarm state at the signal receiver. Optionally, an inverted switching output can also be provided, i.e. in the normal state the output is at 0 V, and in the alarm state it is at the level of the supply voltage.



A Power-On-Delay function (ordered as a separate option) makes it possible to maintain the switching output in the normal state for a defined period after application of the supply voltage.

Ordering code

	1.	2.	3.	4.	5.	6.	7.	8.
LABO - XF-	**S**							

9.	10.	11.	12.	13.
			S	

❍ = Option

1.	**Signal output**										
	S		push-pull (compatible with PNP and NPN)								
2.	**Nominal width**										
	008		DN 8 - G 1/4								
	010		DN 10 - G 3/8								
	015		DN 15 - G 1/2								
	020		DN 20 - G 3/4								
	025		DN 25 - G 1								
3.	**Process connection**										
	G		female thread								
	A	❍	male thread								
	T	❍	hose nozzle								
4.	**Connection material**										
	M		CW614N nickelled								
	P	❍	POM								
	K	❍	stainless steel								
5.	**Body material**										
	Q		PPS								
	M	❍	CW614N nickelled								
	K	❍	stainless steel								
6.	**Switching range**										
	006	❍	minimum value 0.4.. 6.0 l/min	●	●	●	●	●			●
	015		1.0.. 15.0 l/min	●	●	●	●	●	●	●	●
	025		1.0.. 25.0 l/min	●	●	●	●		●	●	●
	050		1.0.. 50.0 l/min	●	●	●			●	●	●
	080		1.0.. 80.0 l/min	●	●				●	●	●
	100	❍	1.0..100.0 l/min	●					●	●	●
7.	**Seal material**										
	V		FKM								
	E	❍	EPDM								
	N	❍	NBR								
8.	**Resistance to backflows**										
	O		without resistance to backflows								●
	R	❍	with resistance to backflows						●	●	●
9.	**Programming**										
	N		cannot be programmed (no teaching)								
	P	❍	programmable (teaching possible)								
10.	**Switching function**										
	L		minimum-switch								
	H		maximum-switch								
11.	**Switching signal**										
	O		standard								
	I	❍	inverted								
12.	**Electrical connection**										
	S		for round plug connector M12x1, 4-pole								
13.	**Optional**										
	H	❍	150 °C version (with 300 mm cable, only for metal housing)						●	●	

Options

Switching delay period (0.0..99.9 s) ☐☐.☐ s
(from Normal to Alarm)

Switch-back delay period (0.0..99.9 s) ☐☐.☐ s
(from Alarm to Normal)

Power-On-Delay period (0..99 s) ☐☐ s
(after connecting the supply, time during which the switching output is not activated)

Switching output fixed at ☐☐☐ l/min

Switching hysteresis ☐☐ %
Standard = 2 % of the metering range

Teach-offset ☐☐☐☐ %
(in percent of the metering range)
Standard = 0 %

Further options available on request.

Accessories

- Cable/round plug connector (KB...)
  see additional information “Accessories”
- Device configurator ECI-1

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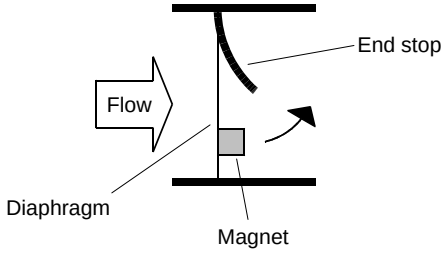
Flow Rate Transmitter LABO-XF-I / U / F / C

- **Very short response time**
- **High overload protection**
- **Measurement range 1:100**
- **Low pressure loss**
- **Compact design**
- **0..10 V , 4..20 mA , frequency/pulse output, complete configurable**

Characteristics

A thin elastic diaphragm made of stainless steel, which covers the entire flow cross-section, is deflected by the flowing fluid, and thereby pushes against an arched end stop.



There is a plastic-coated magnet on the diaphragm. When there is a deflection, its magnetic field changes, and this is detected by a sensor outside the area of flow.

Flexible diaphragm made of stainless steel, with plastic-coated magnet.

Because the diaphragm only bends, and functions without a swivel, there is almost no frictional effect. The movement therefore occurs practically free of hysteresis, and the test results have very good reproducibility. The diaphragm's low bulk results in a short response time. The almost complete covering of the flow cross-section in the rest position produces very high start-up sensitivity. As soon as the slightest flow exists, the diaphragm is of necessity deflected. The evaluation of the entire flow cross-section means that there are no problems when routing pipes. Run-in and run-out sections are not necessary. The shaped end stop and the elastic properties of the diaphragm mean that even severe water hammer causes no damage. The low number of media contact parts guarantees reliable operation and a low tendency to contamination.

There are flanged connection pieces on the inlet and outlet; these are available in various nominal widths and materials. By removing the four bolts of the flange connection, it is simple to remove the measurement unit for servicing, while the connections remain in the pipework.

The LABO-XF electronics make various output signals available:

- Analog signal 0/4..20 mA (LABO-XF-I)
- Analog signal 0/2..10 V (LABO-XF-U)
- Frequency signal (LABO-XF-F) or
- Value signal Pulse / x Litres (LABO-XF-C)

A model with switching output is also available.

If desired, the range end value can be set to the currently existing flow using "teaching".

Technical data

Sensor	dynamic diaphragm	
nominal width	DN 8.0.25	
Connection type	internal thread G $^1/_4$..G 1, optionally external thread or hose nozzle	
Measurement ranges	1..100 l/min (water) for standard ranges, see table "Ranges", minimum value range 0.4..6 l/min optionally available	
Measurement uncertainty	standard ranges: ±3 % of the measured value, minimum 0.25 l/min minimum value range: ±3 % of the measured value, minimum 0.1 l/min	
Pressure loss	max. 0.5 bar	
Pressure	plastic construction: full metal construction:	PN 16 PN 100
Media temperature	0..70 °C with high temperature option 0..150 °C	
Ambient temperature	0..70 °C	
Storage temperature	-20..+80 °C	
Construction materials media-contact	body: connections: seals: diaphragm: magnet holder: adhesive:	PPS, CW614N nickelled or stainless steel 1.4404 POM, CW614N nickelled or stainless steel 1.4404 fluorocarbon rubber stainless steel 1.4031k PPS epoxy resin
Construction materials, non-media-contact	sensor tube: adhesive: flange bolts:	CW614N nickelled epoxy resin stainless steel full metal construction: steel
Supply voltage	10..30 V DC at voltage output 10 V: 15..30 V DC	
Power requirement	< 1 W (for no-load outputs)	
Output data:	all outputs are resistant to short circuits and polarity-reversal protected	

Current output:	4..20 mA (0..20 mA available on request)
Voltage output:	0..10 V (2..10 V available on request) output current max. 20 mA
Frequency output:	transistor output "push-pull" I_{out} = 100 mA max. output frequency depends on measurement range, standard is 500 Imp/l (corresponds to 833.3 Hz at 100 l/min) minimum value range: 5000 Imp/l (corresponds to 500 Hz at 6 l/min) (other frequencies available on request)
Pulse output:	transistor output "push-pull" I_{out} = 100 mA max. pulse width 50 ms pulse valency is to be stated
Display	yellow LCD shows operating voltage (LABO-XF-I / U) or output status (LABO-XF-F / C) or (rapid flashing = programming)
Electrical connection	for round plug connector M12x1, 4-pole
Ingress protection	IP 67
Weight	see table "Dimensions and weights"
Conformity	CE

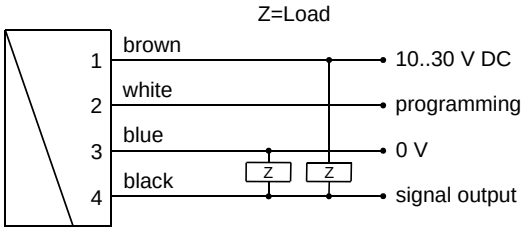
Ranges

Nominal width		Range l/min H_2O	Q_{max} recommended
DN 8..25	❍	0.4.. 6.0	120
DN 8..25	●	1.0.. 15.0	
DN 10..25	●	1.0.. 25.0	
DN 15..25	●	1.0.. 50.0	
DN 20..25	●	1.0.. 80.0	
DN 25 *	❍	1.0..100.0	

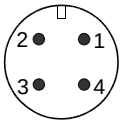
* Inner pipe diameter ≥ Ø22.5

Special ranges are available.

Connection diagram



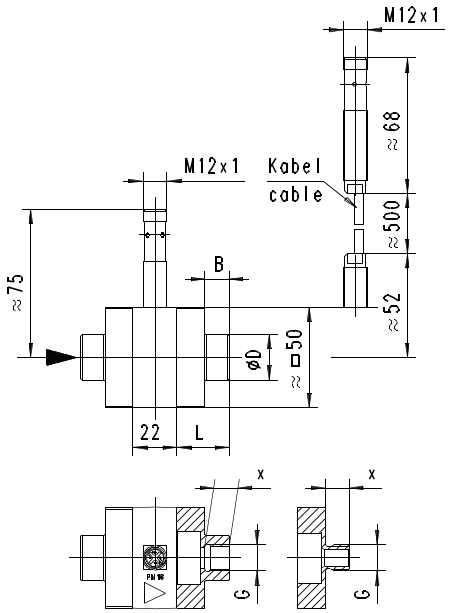
Connection example: PNP NPN



Before the electrical installation, it must be ensured that the supply voltage corresponds to the data sheet.
It is recommended to use screened wiring.

The push-pull-output) of the frequency output version can as desired be switched as a PNP or an NPN output.

Dimensions and weights



Connection pieces

G	DN	L	B	X	ØD Metal / Plastic	Weight* kg Metal / plastic
G 1/4	DN 8	26	12	12	22.5 / 33	0.245 / 0.055
G 3/8	DN 10					0.240 / 0.050
G 1/2	DN 15	28	14	14	28.0 / 37	0.250 / 0.055
G 3/4	DN 20	30	16	16	35.0 / 42	0.270 / 0.060
G 1	DN 25		-	18	-	0.400 / 0.085
G 1/4 A	DN 8	26	-	12	-	0.230 / 0.045
G 3/8 A	DN 10		-		-	0.230 / 0.045
G 1/2 A	DN 15	28	-	14	-	0.240 / 0.050
G 3/4 A	DN 20	30	-	16	-	0.235 / 0.050
G 1 A	DN 25	32	-	18	-	0.235 / 0.050

*Weights per connection, excluding bolts
Other interfaces on request

Body

Construction	Weight* kg
Plastic	ca. 0.100
Metal	ca. 0.400

*Weights incl. internal parts, sensor and bolts for connection pieces

Options

Through a range of options, the XF system is flexibly adaptable to very varied requirements:

Full metal construction
The standard model has a plastic body with a pressure resistance of 16 bar. A metalled body (nickelled brassor stainless steel) with a pressure resistance of 100 bar is optionally available. The higher operating pressure requires a combination with metal connection pieces.

Measurements in the range 1..100 l/min are possible.

High temperature
If the full metal model with high temperature sensors is fitted, operation at media temperatures up to 150 °C is possible. Here, the primary sensor element is located in the casing of the measurement unit, while the evaluation electronics are located away from casing via a 50 cm long heat-resistant cable.

Resistance to backflows
With forward flows, the diaphragm pushes against an arched end stop, and is undamaged by flow rates which are significantly higher than the intended measurement range, or by water hammer. For flows or pressure surges in the reverse direction, in the standard model the diaphragm pushes against a circumferential plastic support ring, and almost completely closes the flow cross-section. This causes pressure to build up which can damage the diaphragm. In applications where such conditions can arise (e.g. from elastic hoses to the rear of the measuring equipment) the use of the "resistance to backflows" option is recommended. Here, the plastic support ring is replaced by another arched end stop made of stainless steel, so that the diaphragm is provided with the same overload and pressure surge resistance in the reverse direction as in the forward direction. However, a measurement in the reverse direction is not possible.

The "resistance to backflows" option is mandatory for bodies made of metal.

Minimum value measurement
For measurement ranges up to 6 l/min, the sensitivity of the measuring system can be increased, and so measurements even less than 1 l/min, i.e. from 0.4 l/min become possible. For this, the sensor is installed on the opposite side of the casing. This option is not available for metal casings and models with resistance to backflows.

Handling and operation

Installation

The device is supplied with connection pieces mounted. These may be removed for the installation in the pipework.
The sensor can be operated in any location. However, the lowest tendency to contamination occurs when the diaphragm swings from bottom to top. If possible. installation should therefore be made either with flow from bottom to top, or horizontal. In the latter case, the sensor in the minimum value range model (max. 6 l/min, see options) should point downwards; for all other versions it should point upwards. Factory adjustment is made with flow horizontal. It should be ensured that the device is installed in the direction of the flow arrow. In spite of its low bulk, the diaphragm is very robust; nevertheless it should not be buckled or compressed through force during installation or removal.

The bolts in the casing pass all the way through it, and must be completely removed if the sensor body is replaced. Afterwards, as normal with a flanged part, the body can be pulled out without loosening the screw connections.

Note

The measurement range end value can be programmed by the user via "teaching". Requirement for programmability must be stated when ordering, otherwise the device cannot be programmed. The ECI-1 device configurator with associated software is available as a convenient option for programming all parameters by PC, and for adjustment. The teaching option is not available for the pulse output version.

Operation and programming

The teaching process can be carried out by the user as follows:

- The flow rate to be set is applied to the device.
- Apply an impulse of at least 0.5 seconds and max. 2 seconds duration to pin 2 (e.g. via a bridge to the supply voltage or a pulse from the PLC), in order to accept the measured value.
- When the teaching is complete, pin 2 should be connected to 0 V, so as to prevent unintended programming.

The devices have a yellow LED which flashes during the programming pulse. During operation, the LED serves as an indicator of operating voltage (for analog output) or of switching status (for frequency or pulse output).

To avoid the need to transit to an undesired operating status for the purpose of teaching, the device can be provided ex-works with a teach-offset. The teach-offset value is added to the currently measured value before saving. The offset value can be positive or negative.

Example: The end of the measurement range should be set to 80 l/min. However, it is possible only to reach 60 l/min without problems. In this case, the device would be set using a teach-offset of +20 l/min. At a flow rate of 60 l/min in the process, teaching would then store a value of 80 l/min.

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Ordering code

LABO - XF- [1.] [2.] [3.] [4.] [5.] [6.] [7.] [8.]

[9.] [10. **S**] [11.]

❍ = Option

1.	**Signal output**									
	I	current output 4..20 mA								
	U	voltage output 0..10 V								
	F	frequency output (see "Ordering information")								
	C	pulse output (see "Ordering information")								
2.	**nominal width**									
	008	DN 8 - G 1/4								
	010	DN 10 - G 3/8								
	015	DN 15 - G 1/2								
	020	DN 20 - G 3/4								
	025	DN 25 - G 1								
3.	**Connection type**									
	G	internal thread								
	A ❍	external thread								
	T ❍	hose nozzle								
4.	**Connection material**									
	M	CW614N nickelled								
	P ❍	POM								
	K ❍	stainless steel								
5.	**Body material**									
	Q	PPS								
	M ❍	CW614N nickelled								
	K ❍	stainless steel								
6.	**Measurement range**									
	006 ❍	Minimum value 0.4.. 6.0 l/min	●	●	●	●	●			●
	015	1.0.. 15.0 l/min	●	●	●	●	●	●	●	●
	025	1.0.. 25.0 l/min	●	●	●	●		●	●	●
	050	1.0.. 50.0 l/min	●	●	●			●	●	●
	080	1.0.. 80.0 l/min	●	●				●	●	●
	100 ❍	1.0..100.0 l/min	●					●	●	●
7.	**Seal material**									
	V	fluorocarbon rubber								
	E ❍	EPDM								
	N ❍	NBR								
8.	**Resistance to backflows**									
	O	without resistance to backflows								●
	R ❍	with resistance to backflows						●	●	●
9.	**Programming**									
	N	cannot be programmed (no teaching)								
	P ❍	programmable (teaching possible)								
10.	**Electrical connection**									
	S	for round plug connector M12x1, 4-pole								
11.	**Optional**									
	H ❍	150 °C Version (with 300 mm cable, only for metal casing)						●	●	

Required ordering information

For LABO-XF-F:
Output frequency at full scale [ ][ ][ ][ ] Hz
Maximum value: 2.000 Hz

For LABO-XF-C:
For the pulse output version, the volume (with numerical value and unit) which will correspond to one pulse must be stated.

Volume per pulse (numerical value) [ ][ ][ ][ ]

Volume per pulse (unit) [ ][ ][ ][ ][ ][ ][ ][ ]

Options

Special range for analog output: [ ][ ][ ] l/min
<= Measurement range (standard=measurement range)

Special range for frequency output: [ ][ ][ ] l/min
<= Measurement range (standard=measurement range)

Power-On-Delay period (0..99 s) [ ][ ] s
(time after applying power during which the outputs are not activated or set to defined values)

Further options available on request.

Accessories

- Round plug connector/cable
- Evaluation electronics OMNI-TA
- Device configurator ECI-1

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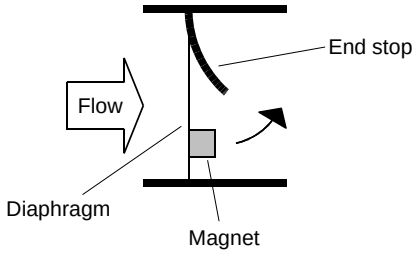
Flow Transmitter / Switch FLEX-XF

- **Universal flow sensor with rapid dynamic diaphragm**
- **Switching output and/or analog output (4..20 mA or 0..10 V)**
- **Wide measuring range**
- **Ingress protection IP 67**
- **Cable outlet infinitely rotatable**
- **Robust stainless steel housing**

Characteristics

A thin elastic diaphragm made of stainless steel, which covers the entire flow cross-section, is deflected by the flowing fluid, and thereby pushes against an arched end stop.



There is a plastic-coated magnet on the diaphragm. When there is a deflection, its magnetic field changes, and this is detected by a sensor outside the area of flow.

Flexible diaphragm made of stainless steel, with plastic-coated magnet.

Because the diaphragm only bends, and functions without a bearing, there is almost no frictional effect. The movement therefore occurs practically free of hysteresis, and the test results have very good reproducibility. The diaphragm's low bulk results in a rapid response time.

The almost complete covering of the flow cross-section in the neutral position allows very high initial sensitivity. As soon as the slightest flow exists, the diaphragm is of necessity deflected. The evaluation of the entire flow cross-section means that there are no problems when routing pipes. Run-in and run-out sections are not necessary.

The shaped end stop and the elastic properties of the diaphragm mean that even severe water hammer causes no damage.

The low number of media contact parts guarantees reliable operation and a low tendency to contamination.

The connection pieces for both sides can be freely selected, and are flanged on. Various nominal widths and materials are available. By removing the four bolts of the flange connection, it is simple to remove the measurement unit for servicing, while the connections remain in the pipework.

The integrated FLEX-XF converter / counter have an analog output (4..20 mA or 0..10 V) and a transistor output (push-pull). The transistor output can be used as a limit switch for monitoring of minima or maxima, but also as a frequency output.

Technical data

Sensor	dynamic diaphragm	
nominal width	DN 8.0.25	
Process connection	female thread G $^1/_4$..G 1, optionally male thread or hose nozzle	
Metering ranges	1..100 l/min (water) for standard ranges, see table "Ranges", minimum value range 0.4..6 l/min optionally available	
Accuracy	standard ranges: ±3 % of the measured value, minimum 0.25 l/min minimum value range: ±3 % of the measured value, minimum 0.1 l/min	
Pressure loss	max. 0.5 bar at the end of the metering range	
Pressure	plastic construction: PN 16 full metal construction: PN 100	
Media temperature	0..70 °C with high temperature option 0..150 °C	
Ambient temperature	0..70 °C	
Storage temperature	-20..+80 °C	
Materials medium-contact	Body: Connections: Seals: Diaphragm: Magnet holder: Adhesive:	PPS, CW614N nickelled or stainless steel 1.4404 POM, CW614N nickelled or stainless steel 1.4404 FKM stainless steel 1.4031k PPS epoxy resin
Materials, non-medium-contact	Electronic housing: Plug: Clip: Flange bolts:	1.4305 / CW614N nickelled PA6.6 PA6.6 stainless steel full metal construction: steel
Supply voltage	18..30 V DC	
Power consumption	< 1 W (for no-load outputs)	
Analog output	4..20 mA / load 500 Ohm max. or 0..10 V / load min. 1 kOhm	

Switching output	transistor output "push-pull" (resistant to short circuits and polarity reversal) I_{out} = 100 mA max.
Hysteresis	2 % F.S., for min.-switch, position of the hysteresis above the limit value, and for max.-switch, below the limit value
Display	yellow LED (On = Normal / Off = Alarm / rapid flashing = Programming)
Electrical connection	for round plug connector M12x1, 4-pole
Ingress protection	IP 67
Weight	see table "Dimensions and weights"
Conformity	CE

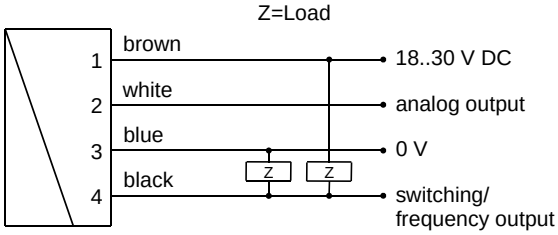
Ranges

Nominal width		Switching range l/min H_2O	Q_{max} recommended
DN 8..25	❍	0.4.. 6.0	120
DN 8..25	●	1.0.. 15.0	
DN 10..25	●	1.0.. 25.0	
DN 15..25	●	1.0.. 50.0	
DN 20..25	●	1.0.. 80.0	
DN 25 *	❍	1.0..100.0	

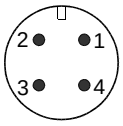
* Inner pipe diameter ≥ Ø22.5

Special ranges are available.

Wiring



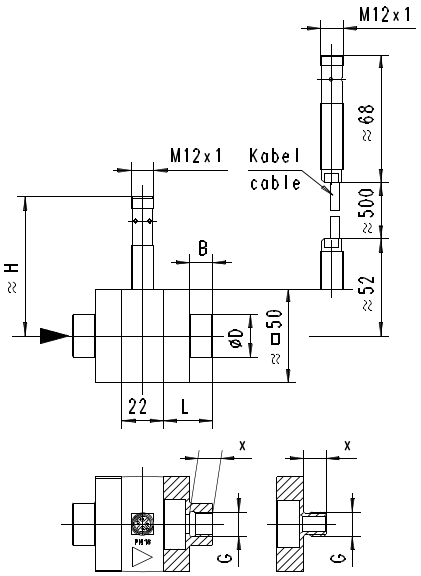
Connection example: PNP NPN



Before the electrical installation, it must be ensured that the supply voltage corresponds with the data sheet.

It is recommended to use shielded wiring.

Dimensions and weights



For high temperatures with extended electronic

Connection pieces

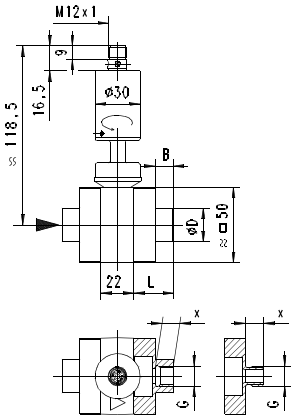
G	DN	L	B	X	ØD Metal / Plastic	Weight* kg Metal / plastic
G 1/4	DN 8	26	12	12	22.5 / 33	0.245 / 0.055
G 3/8	DN 10					0.240 / 0.050
G 1/2	DN 15	28	14	14	28.0 / 37	0.250 / 0.055
G 3/4	DN 20	30	16	16	35.0 / 42	0.270 / 0.060
G 1	DN 25		-	18	-	0.400 / 0.085
G 1/4 A	DN 8	26	-	12	-	0.230 / 0.045
G 3/8 A	DN 10		-		-	0.230 / 0.045
G 1/2 A	DN 15	28	-	14	-	0.240 / 0.050
G 3/4 A	DN 20	30	-	16	-	0.235 / 0.050
G 1 A	DN 25	32	-	18	-	0.235 / 0.050

*weights per connection, excluding bolts
Other interfaces on request

Body

Construction	Weight* kg
Plastic	ca. 0.210
Metal	ca. 0.490
Metal (with spacer)	ca. 0.560

*Weights incl. internal parts, sensor and bolts for connection pieces



Options

Through a range of options, the XF system is flexibly adaptable to very varied requirements:

Full metal construction
The standard version has a plastic body with a pressure resistance of 16 bar. A metalled body (nickelled brass) with a pressure resistance of 100 bar is optionally available. The higher operating pressure requires a combination with metal connection pieces. Measurements and switching value settings in the range 1..80 l/min are possible.

High temperature
If the full metal model is fitted with high temperature sensors and a gooseneck, operation at media temperatures up to 150 °C is possible.
Note: Operation using the plastic body is also possible at temperatures greater than 70 °C. However, it should be noted that this reduces the stability to pressure .

Resistance to backflows
With forward flows, the diaphragm pushes against an arched end stop, and is undamaged by flow rates which are significantly higher than the intended metering range, or by water hammer. For flows or pressure surges in the reverse direction, in the standard version the diaphragm pushes against a circumferential plastic support ring, and almost completely closes the flow cross-section. This causes pressure to build up which can damage the diaphragm. In applications where such conditions can arise (e.g. from elastic hoses to the rear of the measuring equipment) the use of the "resistance to backflows" option is recommended.

Here, the plastic support ring is replaced by another arched end stop made of stainless steel, so that the diaphragm is provided with the same overload and pressure surge resistance in the reverse direction as in the forward direction. However, a measurement or setting of switching value in the reverse direction is not possible.
The "resistance to backflows" option is mandatory for bodies made of metal.

Minimum value measurement
For metering ranges up to 6 l/min, the sensitivity of the measuring system can be increased, and so measurements even less than 1 l/min, i.e. from 0.4 l/min become possible. For this, the sensor is installed on the opposite side of the housing. This option is not available for metal housings and models with resistance to backflows.

Handling and operation

Installation

The device is supplied with connection pieces mounted. These may be removed for the installation in the pipework.
The sensor can be operated in any location. However, the lowest tendency to contamination occurs when the diaphragm swings from bottom to top (see "Principles Drawing"). If possible. installation should therefore be made either with flow from bottom to top, or horizontal. Factory adjustment is made with flow horizontal.

It should be ensured that the sensor is installed in the direction of the flow arrow. In spite of its low bulk, the diaphragm is very robust; nevertheless it should not be buckled or compressed through force during installation or removal.

The bolts in the housing pass all the way through it, and must be completely removed if the sensor body is replaced. Afterwards, as normal with a flanged part, the body can be pulled out without loosening the screw connections.

The electronics housing is connected to the primary sensor, and cannot be removed by the user. After installation, the electronic head can be turned to align the cable outlet.

Programming

The electronics contain a magnetic contact, with the aid of which different parameters can be programmed. Programming takes place when a magnet clip is applied for a period between 0.5 and 2 seconds to the marking located on the label. If the contact time is longer or shorter than this, no programming takes place (protection against external magnetic fields).

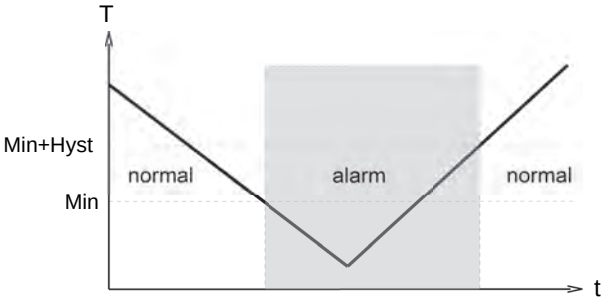
After the programming ("teaching"), the clip can either be left on the device, or removed to protect data.
The device has a yellow LED which flashes during the programming pulse. During operation, the LED serves as a status display for the switching output.
In order to avoid the need to transit to an undesired operating status during "teaching", the device can be provided ex-works with a "teach-offset". The "teach-offset" value is added to the currently measured value before saving (or is subtracted if a negative value is entered).

Example: The switching value is to be set to 70 % of the metering range, because at this flow rate a critical process status is to be notified. However, only 50% can be achieved without danger. In this case, the device would be ordered with a "teach-offset" of +20 %. At 50 % in the process, a switching value of 70 % would then be stored during "teaching".

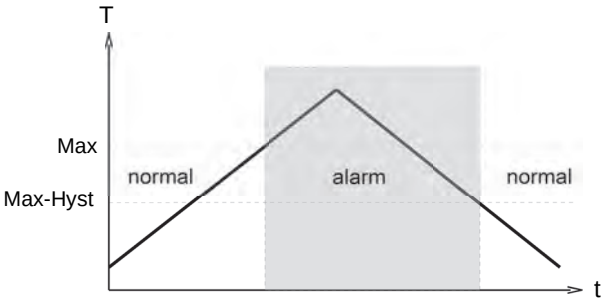
Normally, programming is used to set the limit switch. However, if desired, other parameters such as the end value of the analog or frequency output may also be set.

The limit switch can be used to monitor minima or maxima.

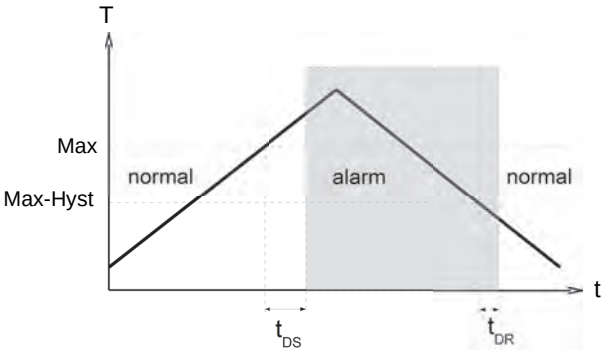
With a minimum-switch, falling below the limit value causes a switchover to the alarm state. Return to the normal state occurs when the limit value plus the set hysteresis is again exceeded.



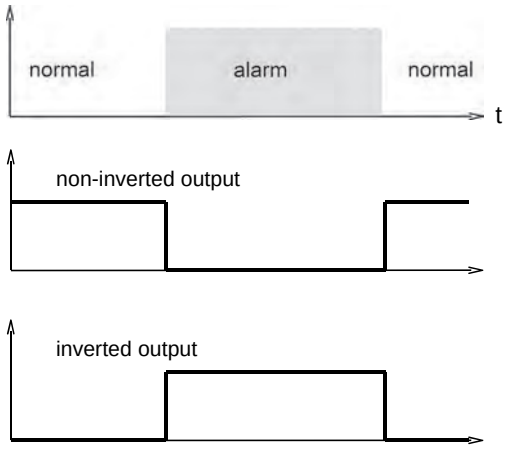
With a maximum-switch, exceeding the limit value causes a switchover to the alarm state. Return to the normal state occurs when the measured value once more falls below the limit value minus the set hysteresis.



A switchover delay time (t_{DS}) can be applied to the switchover to the alarm state. Equally, one switch-back delay time (t_{DR}) of several can be applied to switching back to the normal state.



In the normal state the integrated LED is on, in the alarm state it is off, and this corresponds to its status when there is no supply voltage.
In the non-inverted (standard) model, while in the normal state the switching output is at the level of the supply voltage; in the alarm state it is at 0 V, so that a wire break would also display as an alarm state at the signal receiver. Optionally, an inverted switching output can also be provided, i.e. in the normal state the output is at
0 V,and in the alarm state it is at the level of the supply voltage.



A Power-On delay function (ordered as a separate option) makes it possible to maintain the switching output in the normal state for a defined period after application of the supply voltage.

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Ordering code

FLEX - XF- 1. 2. 3. 4. 5. 6. 7. 8.

9. 10. 11.

❍ = Option

1.	**Nominal width**									
	008	DN 8 - G 1/4								
	010	DN 10 - G 3/8								
	015	DN 15 - G 1/2								
	020	DN 20 - G 3/4								
	025	DN 25 - G 1								
2.	**Process connection**									
	G	female thread								
	A ❍	male thread								
	T ❍	hose nozzle								
3.	**Connection material**									
	M	CW614N nickelled								
	P ❍	POM								
	K ❍	stainless steel								
4.	**Body material**									
	Q	PPS								
	M ❍	CW614N nickelled								
	K ❍	stainless steel								
5.	**Metering range**									
	006 ❍	minimum value 0.4.. 6.0 l/min	●	●	●	●	●			●
	015	1.0.. 15.0 l/min	●	●	●	●	●	●	●	●
	025	1.0.. 25.0 l/min	●	●	●	●		●	●	●
	050	1.0.. 50.0 l/min	●	●	●			●	●	●
	080	1.0.. 80.0 l/min	●	●				●	●	●
	100 ❍	1.0..100.0 l/min	●					●	●	●
6.	**Seal material**									
	V	FKM								
	E ❍	EPDM								
	N ❍	NBR								
7.	**Resistance to backflows**									
	O	without resistance to backflows								●
	R ❍	with resistance to backflows						●	●	●
8.	**Analog output**									
	I	current output 0/4..20 mA								
	U ❍	voltage output 0/2..10 V								
9.	**Switching function**									
	L	minimum-switch								
	H	maximum-switch								
	R	frequency output								
10.	**Switching signal**									
	O	standard								
	I ❍	inverted								
11.	**Optional**									
	D ❍	150 °C version (with spacer, only for metal housing)						●	●	

Options

Special range for analog output: ☐☐☐ l/min
<= Metering range
(Standard = Metering range)

Special range for frequency output: ☐☐☐ l/min
<= Metering range
(Standard = Metering range)

End frequency (max. 2000 Hz) ☐☐☐☐ Hz

Switching delay ☐☐.☐ s
(from normal to alarm)

Switchback delay ☐☐.☐ s
(from alarm to normal)

Power-On-Delay period (0..99 s) ☐☐ s
(time after power on, during which the outputs are not actuated)

Switching output fixed ☐☐☐ l/min

Special hysteresis ☐☐ %
(standard = 2 % of end value)

If the field is not completed, the standard setting is selected automatically.

Accessories

- Cable/round plug connector (KB...)
  see additional information “Accessories”
- Device configurator ECI-1

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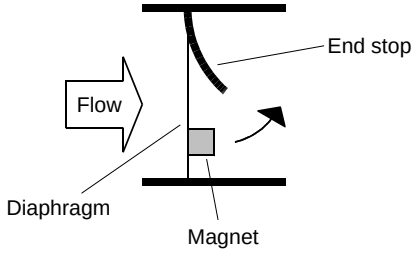
Pressure Transmitter / Switch OMNI-XF

- **Universal flow rate sensor with dynamic diaphragm**
- **Analog output, two switching outputs**
- **Clear, easily legible, illuminated LCD display**
- **Modifiable units in the display**
- **Designed for industrial use**
- **Small, compact construction**
- **Simple installation**

Characteristics

A thin elastic diaphragm made of stainless steel, which covers the entire flow cross-section, is deflected by the flowing fluid, and thereby pushes against an arched end stop.



There is a plastic-coated magnet on the diaphragm. When there is a deflection, its magnetic field changes, and this is detected by a sensor outside the area of flow.

Flexible diaphragm made of stainless steel, with plastic-coated magnet.

Because the diaphragm only bends, and functions without a swivel, there is almost no frictional effect. The movement therefore occurs practically free of hysteresis, and the test results have very good reproducibility.

The diaphragm's low bulk results in a short response time. The almost complete covering of the flow cross-section in the rest position produces very high start-up sensitivity. As soon as the slightest flow exists, the diaphragm is of necessity deflected. The evaluation of the entire flow cross-section means that there are no problems when routing pipes. Run-in and run-out sections are not necessary. The shaped end stop and the elastic properties of the diaphragm mean that even severe water hammer causes no damage. The low number of media contact parts guarantees reliable operation and a low tendency to contamination.

There are flanged connection pieces on the inlet and outlet; these are available in various nominal widths and materials. By removing the four bolts of the flange connection, it is simple to remove the measurement unit for servicing, while the connections remain in the pipework.

The OMNI measuring transducer located on the sensor has a backlit graphics LCD display which is very easy to read, both in the dark and in bright sunlight. The graphics display allows the presentation of measured values and parameters in a clearly understandable form.

The measured values are displayed to 4 places, together with their physical unit, which may also be modified by the user. The electronics have an analog output (4..20 mA or 0..10 V) and two switching outputs, which can be used as limit value switches for monitoring minima or maxima, or as two-point controllers. The switching outputs are designed as push-pull drivers, and can therefore be used both as PNP and NPN outputs. Exceeding limit values is signalled by a red LED which is visible over a long distance, and by a message in text in the display.

The stainless steel case has a hardened non-scratch mineral glass pane. It is operated by a programming ring fitted with a magnet, so there is no need to open the operating controls casing, and its leakproofness is permanently ensured.

By turning the ring to right or left, it is simple to modify the parameters (e.g. switching point, hysteresis...). To protect from unintended programming, it can be removed, turned through 180 ° and replaced, or completely removed, thus acting as a key.

Technical data

Sensor	dynamic diaphragm
Nominal width	DN 8.0.25
Connection type	internal thread G $^{1}/_{4}$..G 1, optionally external thread or hose nozzle
Measurement ranges	1..100 l/min (water) for standard ranges, see table "Ranges", minimum value range 0.4..6 l/min optionally available
Accuracy	standard ranges: ±3 % of the measured value, minimum 0.25 l/min Minimum value range: ±3 % of the measured value, minimum 0.1 l/min
Pressure loss	max. 0.5 bar at the end of the measurement range
Pressure	plastic construction: PN 16 full metal construction: PN 100
Media temperature	0..70 °C with high temperature option 0..150 °C
Ambient temperature	0..70 °C

Storage temperature	-20..+80 °C	
Materials media-contact	body:	PPS, CW614N nickelled or stainless steel 1.4404
	connections:	POM, CW614N nickelled or stainless steel 1.4404
	seals:	fluorocarbon rubber
	diaphragm:	stainless steel 1.4031k
	magnet holder:	PPS
	adhesive:	epoxy resin
Materials non-media-contact	casing	stainless steel 1.4305
	glass	mineral glass, hardened
	magnet	Samarium-Cobalt
	ring	POM
	flange bolts	stainless steel Full metal construction: steel
Supply voltage	18..30 V DC	
Power consumption	< 1 W	
Signal output	4/0..20 mA / max. load 500 Ohm (0/2..10 V available on request)	
Switching output	transistor output "push-pull" (resistant to short circuits and polarity reversal) I_{out} = 100 mA max.	
Hysteresis	adjustable, position of the hysteresis depends on minimum or maximum	
Display	extendable graphic LCD display temperature range -20..+70 °C, 32 x 16 pixels, backlit, displays value and unit, flashing LED signal lamp with simultaneous message on the display.	
Electrical connection	for round plug connector M12x1, 5-pole	
Ingress protection	IP 67 / (IP 68 when oil-filled)	
Weight	see table "Dimensions and weights"	
Conformity	CE	

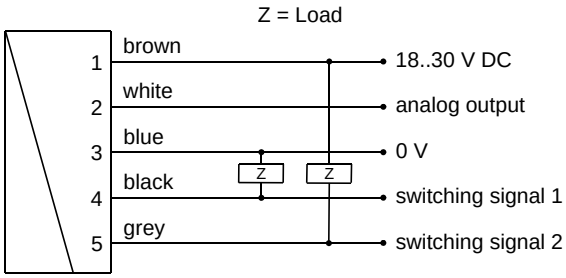
Ranges

Nominal width		Switching range l/min H_2O	Q_{max} recommended
DN 8..25	❍	0.4.. 6.0	120
DN 8..25	●	1.0.. 15.0	
DN 10..25	●	1.0.. 25.0	
DN 15..25	●	1.0.. 50.0	
DN 20..25	●	1.0.. 80.0	
DN 25 *	❍	1.0..100.0	

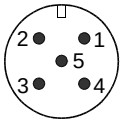
* Inner pipe diameter ≥ Ø22.5

Special ranges are available.

Connection diagram

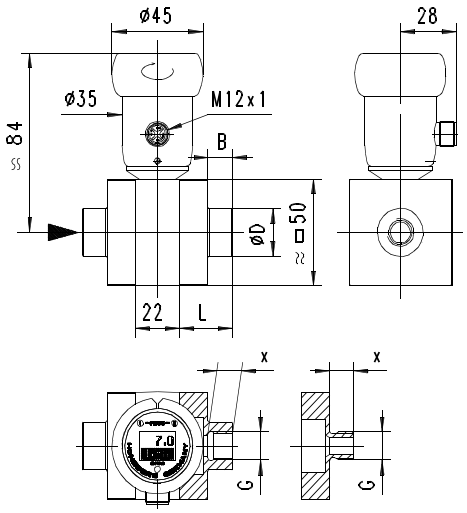


Connection example: PNP NPN



Before the electrical installation, it must be ensured that the supply voltage corresponds to the data sheet.
The use of screened cabling is recommended.

Dimensions and weights



Connection pieces

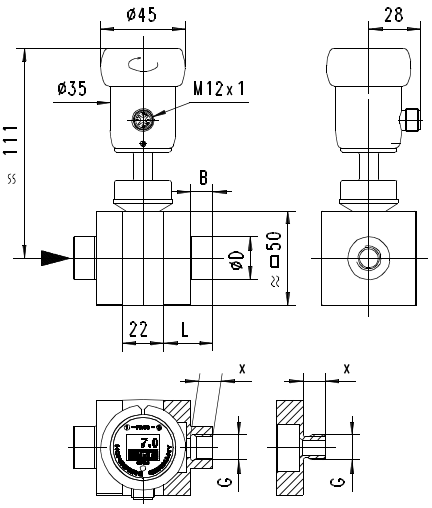
G	DN	L	B	X	ØD Metal / Plastic	Weight* kg Metal / plastic
G 1/4	DN 8	26	12	12	22.5 / 33	0.245 / 0.055
G 3/8	DN 10				22.5 / 33	0.240 / 0.050
G 1/2	DN 15	28	14	14	28.0 / 37	0.250 / 0.055
G 3/4	DN 20	30	16	16	35.0 / 42	0.270 / 0.060
G 1	DN 25		-	18	-	0.400 / 0.085
G 1/4 A	DN 8	26	-	12	-	0.230 / 0.045
G 3/8 A	DN 10		-		-	0.230 / 0.045
G 1/2 A	DN 15	28	-	14	-	0.240 / 0.050
G 3/4 A	DN 20	30	-	16	-	0.235 / 0.050
G 1 A	DN 25	32	-	18	-	0.235 / 0.050

*Weights per connection, excluding bolts

Body

Construction	Weight* kg
Plastic	ca. 0.265
Metal	ca. 0.550
Metal (with spacer)	ca. 0.625
Metal (with gooseneck)	ca. 0.720

*Weights incl. internal parts, sensor and bolts for connection pieces



Options

Through a range of options, the XF system is flexibly adaptable to very varied requirements.

Full metal construction
The standard model has a plastic body with a pressure resistance of 16 bar. A metalled body (nickelled brass) with a pressure resistance of 100 bar is optionally available. The higher operating pressure requires a combination with metal connection pieces.

Measurements and switching value settings in the range 1..80 l/min are possible.

High temperature
If the full metal model is fitted with high temperature sensors and a gooseneck, operation at media temperatures up to 150 °C is possible.

Note:Operation using the plastic body is also possible at temperatures greater than 70 °C. However, it should be noted that this reduces the stability to pressure .

Resistance to backflows
With forward flows, the diaphragm pushes against an arched end stop, and is undamaged by flow rates which are significantly higher than the intended measurement range, or by water hammer. For flows or pressure surges in the reverse direction, in the standard model the diaphragm pushes against a circumferential plastic support ring, and almost completely closes the flow cross-section. This causes pressure to build up which can damage the diaphragm. In applications where such conditions can arise (e.g. from elastic hoses to the rear of the measuring equipment) the use of the "resistance to backflows" option is recommended. Here, the plastic support ring is replaced by another arched end stop made of stainless steel, so that the diaphragm is provided with the same overload and pressure surge resistance in the reverse direction as in the forward direction. However, a measurement or setting of switching value in the reverse direction is not possible.

The "resistance to backflows" option is mandatory for bodies made of metal.

Minimum value measurement
For measurement ranges up to 6 l/min, the sensitivity of the measuring system can be increased, and so measurements even less than 1 l/min, i.e. from 0.4 l/min become possible. For this, the sensor is installed on the opposite side of the casing. This option is not available for metal casings and models with resistance to backflows.

Handling and operation

Installation

The device is supplied with connection pieces mounted. These may be removed for the installation in the pipework.
The sensor can be operated in any location. However, the lowest tendency to contamination occurs when the diaphragm swings from bottom to top. If possible. installation should therefore be made either with flow from bottom to top, or horizontal. In the latter case, the sensor in the minimum value range model (max. 6 l/min, see options) should point downwards; for all other versions it should point upwards. Factory adjustment is made with flow horizontal.

It should be ensured that the sensor is installed in the direction of the flow arrow. In spite of its low bulk, the diaphragm is very robust; nevertheless it should not be buckled or compressed through force during installation or removal.

The bolts in the casing pass all the way through it, and must be completely removed if the sensor body is replaced. Afterwards, as normal with a flanged part, the body can be pulled out without loosening the screw connections.

The electronics casing is permanently connected to the primary sensor, and cannot be removed by the user. After installation, the electronic head can be turned to the best position for reading.

Programming

The annular gap of the programming ring can be turned to positions 1 and 2. The following actions are possible:

Set to 1 = continue (STEP)
Set to 2 = modify (PROG)

Rest position between 1 and 2

The ring can be removed to act as a key, or turned through 180 ° and replaced to create a programming protector.
Operation is by dialog with the display messages, which makes its use very simple.
Starting from the normal display (present value and unit), if 1 (STEP) is repeatedly selected, then the display shows the following information in this order:

Display of parameters, using position 1

- Switching value S 1 (switching point 1 in the selected unit)
- Switching characteristic of S 1
  MIN = Monitoring of minimum value
  MAX = Monitoring of maximum value
- Hysteresis 1 (hysteresis value of S 1 in the set unit)
- Switching value S 2
- Switching characteristic of S 2
- Hysteresis 2
- Code
  After entering the **code 111**, further parameters can be defined:
- Filter (settling time of the display and output)
- Physical unit (Units)
- Output: 0..20 mA or 4..20 mA
- 0/4 mA (measured value corresponding to 0/4 mA)
- 20 mA (measured value corresponding to 20 mA)

For models with a voltage output, replace 20 mA accordingly with 10 V.

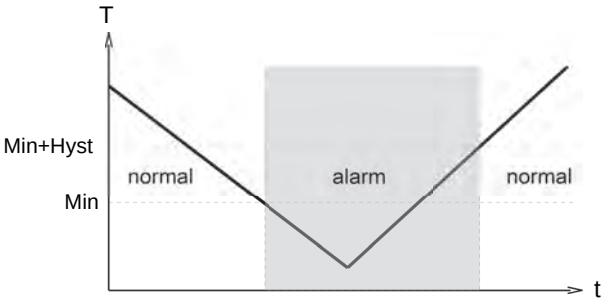
Edit, using position 2

If the currently visible parameter is to be modified:

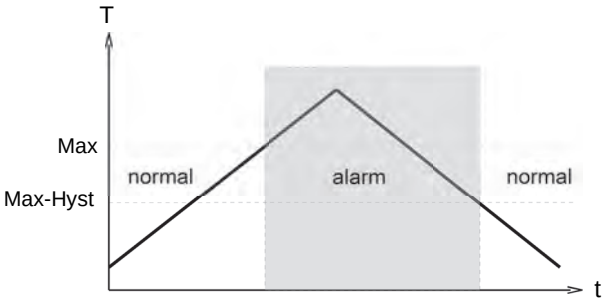
- Turn the annular gap to position 2, so that a flashing cursor appears which displays the position which can be modified.
- By repeatedly turning to position 2, values are increased; by turning to position 1, the cursor moves to the next digit.
- Leave the parameter by turning to position 1 (until the cursor leaves the row); this accepts the modification.
- If there is no action within 30 seconds, the device returns to the normal display range without accepting the modification.

The limit value switches S 1 and S 2 can be used to monitor minima or minima or maxima.

With a minimum-switch, falling below the limit value causes a switchover to the alarm state. Return to the normal state occurs when the limit value plus the set hysteresis is once more exceeded.



With a maximum-switch, exceeding the limit value causes a switchover to the alarm state. Return to the normal state occurs when the measured value once more falls below the limit value minus the set hysteresis.



The change to the alarm state is indicated by the integrated red LED and a message in text in the display.
While in the normal state the switching outputs are at the level of the supply voltage; in the alarm state they are at 0 V, so that a wire break would also display an alarm state at the signal receiver.

Overload display
Overload of a switching output is detected and indicated on the display ("Check S 1 / S 2"), and the switching output is switched off.

Simulation mode
To simplify commissioning, the sensor provides a simulation mode for the analog output. It is possible to create a programmable value in the range 0..26.0 mA at the output (without modifying the process variable). This allows the wiring run between the sensor and the downstream electronics to be tested during commissioning. This mode is accessed by means of code **311**.

Factory settings
After modifying the configuration parameters, it is possible to reset them to the factory settings at any time using **code 989**.

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Ordering code

	1.	2.	3.	4.	5.	6.	7.	8.	9.
OMNI - XF-									

❍ = Option

1.	**nominal width**									
	008	DN 8 - G 1/4								
	010	DN 10 - G 3/8								
	015	DN 15 - G 1/2								
	020	DN 20 - G 3/4								
	025	DN 25 - G 1								
2.	**Connection type**									
	G	internal thread								
	A ❍	external thread								
	T ❍	hose nozzle								
3.	**Connection material**									
	M	CW614N nickelled								
	P ❍	POM								
	K ❍	stainless steel								
4.	**Body material**									
	Q	PPS								
	M ❍	CW614N nickelled								
	K ❍	stainless steel								
5.	**Measurement range**									
	006 ❍	minimum value 0.4.. 6.0 l/min	●	●	●	●	●			●
	015	1.0.. 15.0 l/min	●	●	●	●	●	●	●	●
	025	1.0.. 25.0 l/min	●	●	●	●		●	●	●
	050	1.0.. 50.0 l/min	●	●	●			●	●	●
	080	1.0.. 80.0 l/min	●	●				●	●	●
	100 ❍	1.0..100.0 l/min	●					●	●	●
6.	**Seal material**									
	V	fluorocarbon rubber								
	E ❍	EPDM								
	N ❍	NBR								
7.	**Resistance to backflows**									
	O	without resistance to backflows								●
	R ❍	with resistance to backflows						●	●	●
8.	**Analog output**									
	I	current output 0/4..20 mA								
	U ❍	voltage output 0/2..10 V								
9.	**Optional**									
	D ❍	150 °C Version (with spacer, only for metal casing)						●	●	
	H ❍	150 °C version (with gooseneck, only for metal casing)						●	●	
	O ❍	tropical model oil-filled version for heavy duty or external use						●	●	●

Accessories

- Round plug connector/cable
- Device configurator ECI-1

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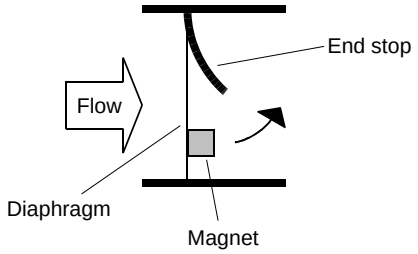
OMNI-C-XF Counter

- **Universal flow rate sensor with dynamic diaphragm**
- **Simple totalisation**
- **Simple filling counter with programmable end signal**
- **Control switchover at present value**
- **Automatic, dynamic change of display unit and decimal places in the graphics display**
- **Antivalent outputs**
- **Small, compact construction**
- **Simple installation**

Characteristics

A thin elastic diaphragm made of stainless steel, which covers the entire flow cross-section, is deflected by the flowing fluid, and thereby pushes against an arched end stop.



There is a plastic-coated magnet on the diaphragm. When there is a deflection, its magnetic field changes, and this is detected by a sensor outside the area of flow.

Flexible diaphragm made of stainless steel, with plastic-coated magnet.

Because the diaphragm only bends, and functions without a bearing, there is almost no frictional effect. The movement therefore occurs practically free of hysteresis, and the test results have very good reproducibility. The diaphragm's low bulk results in a short response time. The almost complete covering of the flow cross-section in the neutral position produces very high start-up sensitivity. As soon as the slightest flow exists, the diaphragm is of necessity deflected. The evaluation of the entire flow cross-section means that there are no problems when routing pipes. Run-in and run-out sections are not necessary. The shaped end stop and the elastic properties of the diaphragm mean that even severe water hammer causes no damage. The low number of media contact parts guarantees reliable operation and a low tendency to contamination.

There are flanged connection pieces on the inlet and outlet; these are available in various nominal widths and materials. By removing the four bolts of the flange connection, it is simple to remove the measurement unit for servicing, while the connections remain in the pipework.

The totaliser of the OMNI flow rate system enables a totalisation or measurement of consumption for all HONSBERG device families (for fluids and gases) with which the OMNI system is compatible; this is independent of the input signal, pulse or analog input, and of the measurement process.

Simple filling control is also possible. Here, the counter can be set to count upwards or downwards.
When the preset point is reached, a switching signal is emitted which is available in antivalent form to two outputs.
Resetting can be carried out by means of a signal input or also by a programming ring.

The state of the counter is indicated in an LCD display with only four digits. Here, the number of decimal places and the unit displayed is continuously matched to the current state of the counter. In this case, the smallest value which can be displayed is 0.001 ml (= 1 µl), and the largest is 9999 m³. The counter therefore has 13 places, of which the four most significant are displayed at any one time. The display resolution at all times is therefore at least 1 per thousand of the displayed value, or better, and this generally exceeds the accuracy of the connected flow transmitter. The non-displayed digits of the counter are in that case irrelevant to the accuracy of the measurement. The automatic dynamic changeover of units in the display in relation to the state of the counter makes the value easy to read in spite of a display with only four digits. In addition, user configuration of the counter is unnecessary.
In addition to the totalised value, the present flow rate can be displayed.

The stainless steel case has a hardened non-scratch mineral glass pane. It is operated by a programming ring fitted with a magnet, so there is no need to open the operating controls housing, and its leakproofness is permanently ensured.

By turning the ring to right or left, it is simple to modify the parameters (e.g. switching point, hysteresis...). To protect from unintended programming, it can be removed, turned through 180 ° and replaced, or completely removed, thus acting as a key.

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Technical data

Sensor	dynamic diaphragm
Nominal width	DN 8..25
Process connection	female thread G $^1/_4$..G 1, optionally male thread or hose nozzle
Metering ranges	1..100 l/min (water) for standard ranges, see table "Ranges", minimum value range 0.4..6 l/min optionally available
Accuracy	Standard ranges: ±3 % of the measured value, minimum 0.25 l/min Minimum value range: ±3 % of the measured value, minimum 0.1 l/min
Pressure loss	max. 0.5 bar at the end of the metering range
Pressure	Plastic construction: PN 16 Full metal construction: PN 100
Media temperature	0..70 °C with high temperature option 0..150 °C
Ambient temperature	0..70 °C
Storage temperature	-20..+80 °C
Materials medium-contact	Body: PPS, CW614N nickelled or stainless steel 1.4404 Connections: POM, CW614N nickelled or stainless steel 1.4404 Seals: FKM Diaphragm: stainless steel 1.4031k Magnet holder: PPS Adhesive: epoxy resin
Materials non-medium-contact	Housing: stainless steel 1.4305 Glass: mineral glass, hardened Magnet: Samarium-Cobalt Ring: POM Flange bolts: stainless steel full metal construction: steel
Counter range	0.000 ml to 9999 m³ with automatic setting of the decimal places and of the applicable unit.
Switching signal outputs (Pin 4 + 5)	2 x push-pull output, max. 100 mA, resistant to short circuits and polarity reversal, antivalent states, configurable on the device as a wiper signal or edge signal
Counter reset signal (Pin 2)	input 18..30 V resistant to short circuits and polarity reversal PIN 2, wiper signal, positive or negative edge can be selected locally
Counting input	(normally not directly accessible from the device) frequency input 0..10 kHz analog input 0/4..20 mA analog input 0..10 V
Supply voltage	18..30 V DC
Power consumption	< 1 W
Display	backlit graphical LCD-Display (transreflective), extended temperature range -20..+70 °C, 32 x 16 pixels, background illumination, displays value and unit, flashing LED signal lamp with simultaneous message on the display.
Electrical connection	for round plug connector M 12x1, 5-pole
Ingress protection	IP 67 / (IP 68 when oil-filled)
Weight	see table "Dimensions and weights"
Conformity	CE

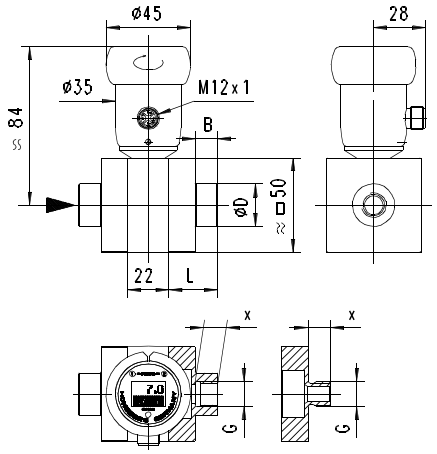
Ranges

Nominal width		Switching range l/min H_2O	Q_{max} recommended
DN 8..25	❍	0.4.. 6.0	120
DN 8..25	●	1.0.. 15.0	
DN 10.0.25	●	1.0.. 25.0	
DN 15.0.25	●	1.0.. 50.0	
DN 20.0.25	●	1.0.. 80.0	
DN 25 *	❍	1.0..100.0	

* Inner pipe diameter ≥ Ø22.5

Special ranges are available.

Dimensions and weights



Connection pieces

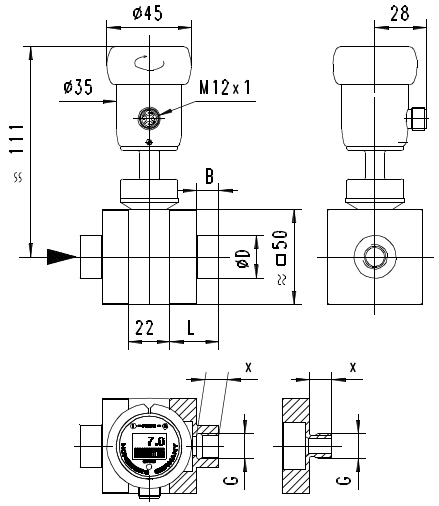
G	DN	L	B	X	ØD Metal / Plastic	Weight* kg Metal / plastic
G $^1/_4$	DN 8	26	12	12	22.5 / 33	0.245 / 0.055
G $^3/_8$	DN 10				22.5 / 33	0.240 / 0.050
G $^1/_2$	DN 15	28	14	14	28.0 / 37	0.250 / 0.055
G $^3/_4$	DN 20	30	16	16	35.0 / 42	0.270 / 0.060
G 1	DN 25		-	18	-	0.400 / 0.085
G $^1/_4$ A	DN 8	26	-	12	-	0.230 / 0.045
G $^3/_8$ A	DN 10		-		-	0.230 / 0.045
G $^1/_2$ A	DN 15	28	-	14	-	0.240 / 0.050
G $^3/_4$ A	DN 20	30	-	16	-	0.235 / 0.050
G 1 A	DN 25	32	-	18	-	0.235 / 0.050

*Weights per connection, excluding bolts

Body

Construction	Weight* kg
Plastic	ca. 0.265
Metal	ca. 0.550
Metal (with spacer)	ca. 0.625
Metal (with gooseneck)	ca. 0.720

*Weights incl. internal parts, sensor and bolts for connection pieces



Options

Through a range of options, the XF system is flexibly adaptable to very varied requirements.

Full metal construction
The standard version has a plastic body with a pressure resistance of 16 bar. A metalled body (nickelled brass) with a pressure resistance of 100 bar is optionally available. The higher operating pressure requires a combination with metal connection pieces. Measurements and switching value settings in the range 1..80 l/min are possible.

High temperature
If the full metal model is fitted with high temperature sensors and a gooseneck, operation at media temperatures up to 150 °C is possible.

Note:Operation using the plastic body is also possible at temperatures greater than 70 °C. However, it should be noted that this reduces the stability to pressure .

Resistance to backflows
With forward flows, the diaphragm pushes against an arched end stop, and is undamaged by flow rates which are significantly higher than the intended metering range, or by water hammer. For flows or pressure surges in the reverse direction, in the standard version the diaphragm pushes against a circumferential plastic support ring, and almost completely closes the flow cross-section. This causes pressure to build up which can damage the diaphragm.

In applications where such conditions can arise (e.g. from elastic hoses to the rear of the measuring equipment) the use of the "resistance to backflows" option is recommended. Here, the plastic support ring is replaced by another arched end stop made of stainless steel, so that the diaphragm is provided with the same overload and pressure surge resistance in the reverse direction as in the forward direction. However, a measurement or setting of switching value in the reverse direction is not possible. The "resistance to backflows" option is mandatory for bodies made of metal.

Minimum value measurement
For metering ranges up to 6 l/min, the sensitivity of the measuring system can be increased, and so measurements even less than 1 l/min, i.e. from 0.4 l/min become possible. For this, the sensor is installed on the opposite side of the housing. This option is not available for metal housings and models with resistance to backflows.

Handling and operation

Installation

The device is supplied with connection pieces mounted. These may be removed for the installation in the pipework.
The sensor can be operated in any location. However, the lowest tendency to contamination occurs when the diaphragm swings from bottom to top. If possible. installation should therefore be made either with flow from bottom to top, or horizontal. In the latter case, the sensor in the minimum value range model (max. 6 l/min, see options) should point downwards; for all other versions it should point upwards. Factory adjustment is made with flow horizontal.

It should be ensured that the sensor is installed in the direction of the flow arrow. In spite of its low bulk, the diaphragm is very robust; nevertheless it should not be buckled or compressed through force during installation or removal.

The bolts in the housing pass all the way through it, and must be completely removed if the sensor body is replaced. Afterwards, as normal with a flanged part, the body can be pulled out without loosening the screw connections.

The electronics housing is permanently connected to the primary sensor, and cannot be removed by the user. After installation, the electronic head can be turned to the best position for reading.

Programming

On the display, the counter indicates the state of the totaliser as a value and unit. The units ml, L, m³ are set automatically.

For operation as a totaliser, no configuration by the user is necessary.

To use the other functions, configuration may be required. This is carried out using the programming ring located on the device.

The annular gap of the programming ring can be turned to positions 1 and 2. The following actions are possible:

Set to 1 = continue (STEP)
Set to 2 = modify (PROG)

Neutral position between 1 and 2

The ring can be removed to act as a key, or turned through 180 ° and replaced to create a programming protector.
Operation is by dialog with the display messages, which makes its use very simple.

The control display of the present flow rate depends on the metering range of the selected flow transmitter, and has already

been set appropriately in the factory (ml/min, l/min, l/h, m³/h).
It is activated by turning the ring to position 1
After 10 seconds, the display automatically returns to the totaliser mode.

For operation as a preset counter, the following must be set:

1. The preset point
2. The type of output signal ("Preset has been reached"):
   Signal edge / wiper pulse
   width of the wiper pulse, if required
3. The unit of the preset point:
   (ml, litre, m³).

Starting from the normal display (total and unit), if 1 (STEP) is selected repeatedly, then the counter shows the following information:

- Normal display is total and unit (e.g. litre)
- Display of present value (e.g. l/min)
- Preset point incl. type of switching output.
- Code

The code gives access to various input levels into which parameters can be entered (so that this does not occur unintendedly, the code must be entered!)

Code 111:

- Gate time (available only for sensors which transmit frequency)
- Filter time
- Direction of count (pos. / neg.)
- Unit for switching value/reset point
- Decimal place for switching value/reset point
- Switching type for switching value (edge/wiper signal)
- Pulse duration (for wiper signal)
- Reset method (manual / via signal)

Code 100:

- Manual reset for totaliser

The detailed flow chart for operation is available in the "Operating instructions for OMNI-C".

Ordering code

	1.	2.	3.	4.	5.	6.	7.	8.	9.
OMNI-C - XF-								**A**	

❍ = Option

1.	**Nominal width**										
	008		DN 8 - G 1/4								
	010		DN 10 - G 3/8								
	015		DN 15 - G 1/2								
	020		DN 20 - G 3/4								
	025		DN 25 - G 1								
2.	**Process connection**										
	G		female thread								
	A	❍	male thread								
	T	❍	hose nozzle								
3.	**Connection material**										
	M		CW614N nickelled								
	P	❍	POM								
	K	❍	stainless steel								
4.	**Body material**										
	Q		PPS								
	M	❍	CW614N nickelled								
	K	❍	stainless steel								
5.	**Metering range**										
	006	❍	minimum value 0.4.. 6.0 l/min	●	●	●	●	●			●
	015		1.0.. 15.0 l/min	●	●	●	●	●	●	●	●
	025		1.0.. 25.0 l/min	●	●	●	●		●	●	●
	050		1.0.. 50.0 l/min	●	●	●			●	●	●
	080		1.0.. 80.0 l/min	●	●				●	●	●
	100	❍	1.0..100.0 l/min	●					●	●	●
6.	**Seal material**										
	V		FKM								
	E	❍	EPDM								
	N	❍	NBR								
7.	**Resistance to backflows**										
	O		without resistance to backflows								●
	R	❍	with resistance to backflows						●	●	●
8.	**Signal output**										
	A		antivalent switching signal (Counter state reached)								
9.	**Optional**										
	D	❍	150 °C Version (with spacer, only for metal housing)						●	●	
	H	❍	150 °C version (with gooseneck, only for metal housing)						●	●	
	O	❍	tropical model oil-filled version for heavy duty or external use						●	●	●

Accessories

- Cable/round plug connector (KB...)
  see additional information “Accessories”
- Device configurator ECI-1

Honsberg Instruments GmbH
Tenter Weg 2-8 ● 42897 Remscheid ● Germany
Fon +49 (0) 2191 - 9672 - 0 ● Fax - 40
www.honsberg.com ● info@honsberg.com

Device Configurator ECI-1

- **Can be used on site for:**
  - **parameter modification**
  - **firmware update**
  - **adjustment of inputs and outputs**
- **Can be connected via USB**

Characteristics

The device configurator ECI-1 is an interface which allows the connection of microcontroller-managed HONSBERG sensors to the USB port of a computer.
Together with the Windows software "HONSBERG Device Configurator" it enables

- the modification of all the sensor's configuration settings
- the reading of measured values
- the adjustment of inputs and outputs
- firmware updates

Technical data

Supply voltage	12..30 V DC (depending on the connected sensor) and via USB
Power consumption	< 1 W
Connection	
Sensor	cable bushing M12x1, 5-pole, straight length approx. 50 cm
Lead	device connector M12x1, 5-pole
USB	USB bushing type B
Operating temperature	0..50 °C
Storage temperature	-20..+80 °C
Dimensions of housing	98 mm (L) x 64 mm (W) x 38 mm (H)
Housing material	ABS
Ingress protection	IP 40

Handling and operation

Connection

The device configurator is intended for temporary connection to the application. It is connected between the the existing sensor lead and the sensor. Power supply is via the supply to the sensor and the computer's USB port. When inactive (no communication), the configurator behaves completely neutrally; all signals from the sensor remain available to the application. During communication between computer and sensor, the signal wirings are separated in the configurator, so that in this state the sensor's output signals are not available.

To connect 4-pole leads without a middle hole to the installed 5-pole device connector, adapter K04-05 is included. 4-pole leads with a middle hole can be used without an adapter.

Ordering code

Device configurator (for scope of delivery, see the diagram below)	**ECI-1**

Scope of delivery

1. Device configurator ECI-1
2. USB cable
3. Adapter K04-05
4. Plug KB05G
5. Cable K05PU-02SG
6. Carrying case

Incl. software

Accessories:

Mains connector 24 V DC (with fitted round plug connector, 5-pole, incl. international plug set)		**EPWR24-1**

Replacement parts:

M12x1 adapter 4- / 5-pole	**K04-05**
PUR cable, 5-pole, shielded with round plug connector M12x1	**K05PU-02SG**
Round plug connector M12x1, 5-pole (without cable)	**KB05G**

Options

LABO transmitter - Temperature up to 150 °C

All LABO transmitters can be used with electronics positioned in a separate area with media temperatures up to 150 °C.

OMNI - Tropical model

This OMNI electronic option should be used where temperatures change quickly, or for external installations (the device is filled with oil, and thus prevents condensate formation in the electronics housing, even under adverse circumstances)

Accessories

Filter

Type ZV

Type ZE

The HONSBERG filters are offered for the protection of the devices from dirt or as independent components for coarse and fine filtration of liquids.

For more information, see additional product information.

Round plug connector 4 / 5-pin

1	brown	1	brown
2	white	2	white
3	blue	3	blue
4	black	4	black
		5	grey

Ordering code

Self-assembly

	1.	2.
KB		

1.	**Number of pins**	
	04	4-pin
	05	5-pin
2.	**Connector output**	
	G	straight
	W	elbow 90 °

Packaged

1.	2.		3.	4.	5.	6.
	PU	-				

1.	**Number of pins**	
	K	4-pin
	K05	5-pin
2.	**Cable material**	
	PU	PUR
3.	**Cable length**	
	02	2 m
	05	5 m
	10	10 m
4.	**Shielding**	
	N	shielding not applied to coupling
	S	shielding applied to coupling
5.	**Connector output**	
	G	straight
	W	elbow 90 °
6.	**Shielding**	
	A	shielded

Panel meter OMNI-TA

External converter with the same data as the electronics; can be mounted directly on the primary sensor, but as an external panel-mounting variant with IP 67 housing.

GHM Messtechnik GmbH
Hans-Sachs-Str. 26 ● 93128 Regenstauf ● Germany
Fon +49 (0) 9402 - 9383 - 0 ● Fax - 33
www.ghm-messtechnik.de ● info@ghm-messtechnik.de

Panel counter OMNI-C-TA

External counter with the same data as the electronics; can be mounted directly on the primary sensor, but as an external panel-mounting variant with IP 67 housing.

OMNI - Remote

Function is identical to OMNI-suburb. Connection to the sensor is, however, made by wire, and so the measurement point and display location can be apart

EEZ-904

External universal counter

GHM Messtechnik GmbH
Hans-Sachs-Str. 26 ● 93128 Regenstauf ● Germany
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Product overview

„Industrial Sensors and Instrumentation“

Temperature
Flow
Level / Filling Height
Analysis
Humidity
Pressure
Weighing Instruments

„Process Instrumentation Hygienic Design“

GHM*adapt*
Temperature
Flow
Level / Filling Height
Analysis

“Laboratory Instrumentation”

„Industrial Electronics“

Displays / Controller
Transmitter / Signal conditioning
Isolating converters
Safety and Monitoring Devices
Power Electronics
Calibration and Testing

“Measuring Data Acquisition“

Data Logging and Monitoring
Test Bench Measurement Technology
Renewable Energies