

LEVIFLOW® Ultrasonic Technology Clamp-On Flowmeters for Flexible Tubing



LFSC-iX Clamp-On Flowmeters

LFSC-i06X: 1/8x1/4", 1 l/min

LFSC-i10X: 1/4x3/8", 4 l/min

LFSC-i16X: 3/8x5/8", 20 l/min

LFSC-i19X: 1/2x3/4", 50 l/min

LFSC-i25X: 3/4x1", 80 l/min

LFSC-i35X: 1x1 3/8", 160 l/min

Ultraclean Non-Invasive Flow Measurement

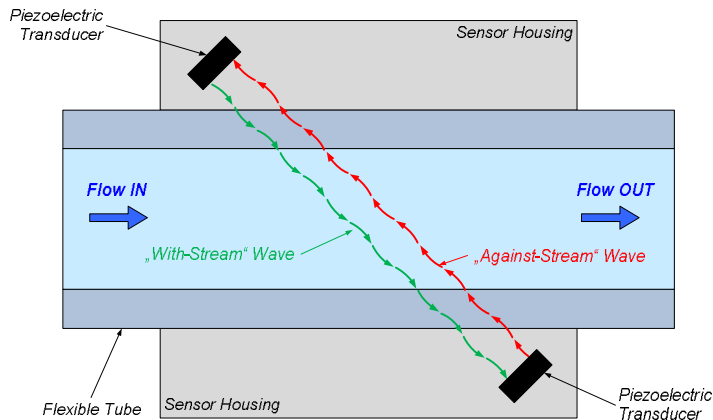


Figure 1: Operating principle of ultrasonic clamp-on flow sensor.

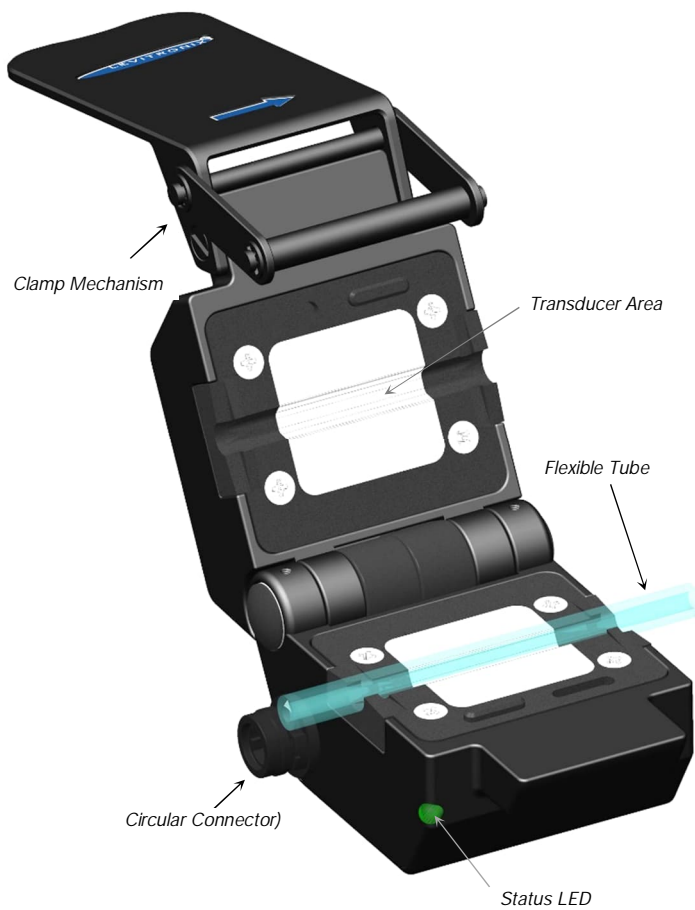


Figure 2: Clamp-on flowmeter

INTRODUCTION

The *LEVIFLOW*[®] clamp-on flowmeter *LFSC-iX* series with integrated converter electronics are designed for high precision and robust non-invasive flow measurements of high purity fluids with flexible tubing.

Figure 1 illustrates the operating principle of a two piezo-electric transducer channel, with the principle of transit time difference of two ultrasonic waves. The *LFSC-iX* series works with a proprietary multiple arrangement of this concept hence achieving a high precision and robust measurement with low dependency on parameters like fluid temperature and pressure. Furthermore, a proprietary hexagonal clamp shape geometry and clamp mechanism allows to achieve high clamping repeatability with very low dependency on pressure.

These clamp on flowmeters can measure flows from the ml range up to 160 l/min. The flowmeters can be operated in various configurations like Stand-Alone operation with a user panel (see *Figure 3*), operation with a PC and the *Levitronix*[®] *Service Software* (see *Figure 4*) for debugging, data collection and parameter configuration or operation with an OEM setup (see *Figure 5*) for easy integration into processing equipment with PLC or fieldbus (RS485 modbus) interface.

SYSTEM BENEFITS

- No contamination due to non-invasive flow measurement
- Low disposable cost (tubing cost only) with reusable sensor
- Low dependency on fluid temperature and pressure.
- Improved bubble robustness.
- Flow control together with *Levitronix*[®] MagLev Pumps
- Easy integration into OEM equipment with low cabling effort due to integrated converter electronics.
- Low pressure loss.
- Integrated and configurable totalizer function.
- Measure positive and negative flow.

APPLICATIONS

- High purity liquid processes
- Sterile non-invasive flow measurement in Pharmaceutical manufacturing
- Biotech processes
- Flow control in combination with *Levitronix*[®] MagLev pump systems
- Single-use disposable applications

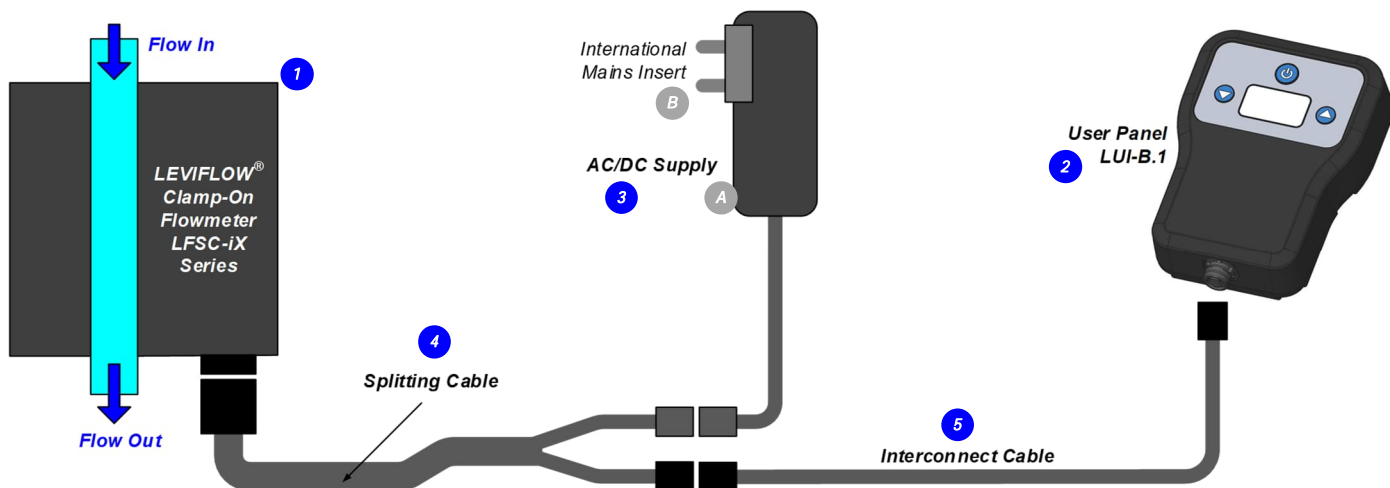


Figure 3: Stand-Alone system configuration
(See section "Order Information" for details to numbered components and other options)

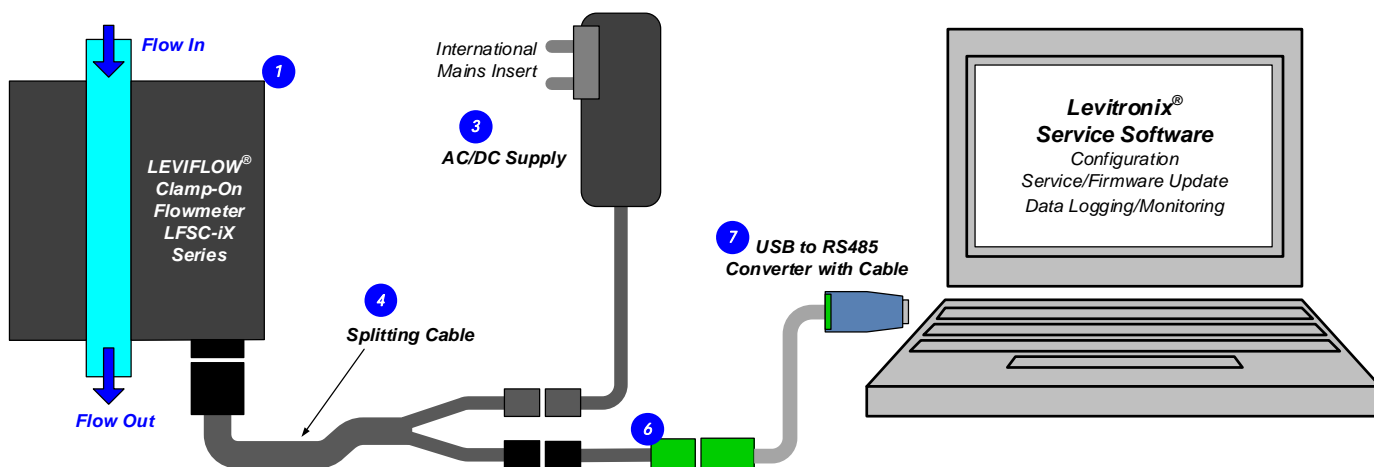


Figure 4: Configuration for PC with Levitronix® Service Software (parameter configuration, Data logging and monitoring)
(See section "Order Information" for details to numbered components and other options)

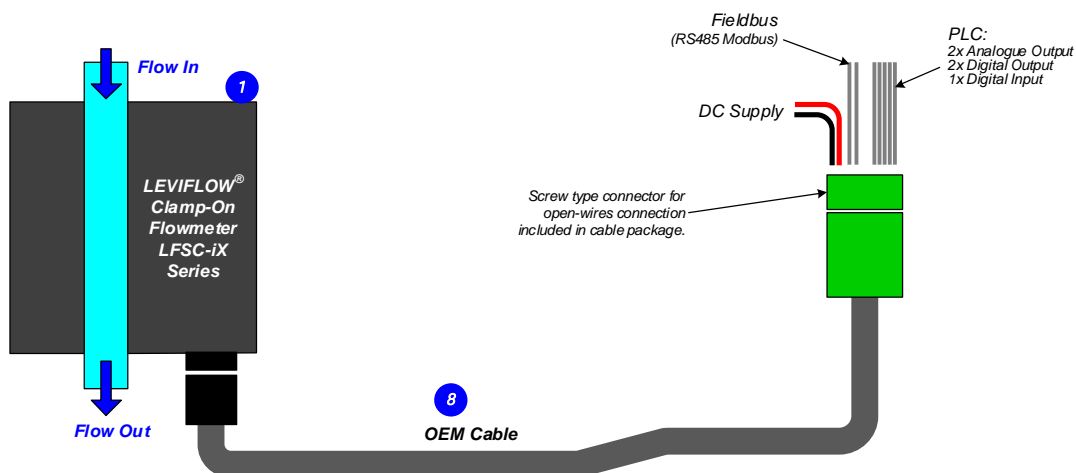


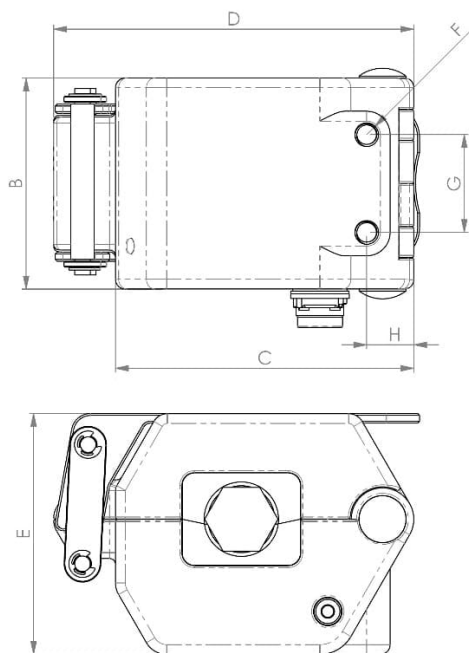
Figure 5: OEM system configuration
(See section "Order Information" for details to numbered components and other options)

SPECIFICATIONS

Characteristics		LFSC-I06X	LFSC-I10X	LFSC-I16X	LFSC-I19X	LFSC-I25X	LFSC-I35X
Flow Range [l/min]		0 – 1 l/min	0 – 4 l/min	0 – 20 l/min	0 – 50 l/min	0 – 80 l/min	0 – 160 l/min
Accuracy of Reading ³ (for fully developed flow profile)	> 10% FS < 10% FS	±2 % ±2 ml/min	±1.5 % ±6 ml/min	±1.5 % ±30 ml/min	±1.5 % ±75 ml/min	±1.5 % ±120 ml/min	±1.5 % ±240 ml/min
Weight		390 g	390 g	480 g	480 g	1090 g	1090 g
Maximum Fluid Pressure (max. pressure of tube might limit this value)		6.5 bar	6.5 bar	5 bar	5 bar	5 bar	5 bar
Pressure Drop Coefficient C ² ΔP = C x Q ² , (for water), Q = Flow [l/min] ΔP = Press. Drop [kPa = 10 mbar]		4.48 at 20°C 4.45 at 37°C	0.0797 at 20°C 0.0793 at 37°C	0.0099 at 20°C 0.0098 at 37°C	0.00185 at 20°C 0.00185 at 37°C	0.000347 at 20°C 0.000345 at 37°C	0.0000948 at 20°C 0.0000943 at 37°C
Usable	ID	1/8" = 3.2 mm	1/4" = 6.4 mm	3/8" = 9.5 mm	1/2" = 12.7 mm	3/4" = 19.1 mm	1" = 25.4 mm
Flexible Tubing	OD	1/4" = 6.4 mm	3/8" = 9.5 mm	5/8" = 15.9 mm	3/4" = 19.1 mm	1" = 25.4 mm	1 3/8" = 34.9 mm
Dimensions	Wall thickness	1/16" = 1.6 mm	1/16" = 1.6 mm	1/8" = 3.2 mm	1/8" = 3.2 mm	1/8" = 3.2 mm	3/16" = 4.8 mm
Standard Calibrated Tubes ⁶	a: Liveo™ Pharma Silicone ⁵ , compatible with AdvantaSil® APHP (High Pressure) ⁴ b: Saint Gobain C-Flex® (374) ¹ c: AdvantaFlex® TPE ⁴ All calibration sets stored in flowmeter and calibrated at 20°C and 37°C water temperature. Default parameter setting is Liveo™ Pharma Silicone at 37°C.						
Fluid / Ambient Temperature		Normal range: 10 – 60 °C (50 – 140 °F)		/	0 – 40 °C (32 – 104 °F)		
Measurable Kin. Viscosity / Sound Speed		0.5 – 100 mm²/s (0.5 – 100 cSt)		/	1000 – 2000 m/s (others on request)		
Housing: Rating / Main Materials / Cleaning		IP-65		/	PPS/PTFE-like coating/PP		/ Wiping with IPA or water
Ambient Temp / Humidity Range		0 – 40 °C (32 – 104 °F)		/	15 – 95% (non condensing)		
Electrical Connector / Cables		Circular type (IP-67, lock-release mounting)		/	Various extension/adaptor cables available.		
Supply Voltage / Current / Inrush		12 - 24 VDC ± 10%	/	70 or 120 mA @ 12 or 24 VDC,	/	0.3 or 0.2 A at 12 and 24 VDC during start-up < 3 ms	
Interfaces		RS485 -> MODBUS protocol 1x Digital Input: Volume Counter Reset or Zero Adjust 2x Digital Outputs: Flow Alarm, Measurement Error, Volume Counter Pulse, Counter Alarm, Flow as Frequency.			1x Analog Output 4 – 20mA (0 – 20mA configurable) Status LED		
Configuration Parameters		Low Cutoff, Dampening constant (filter), Full scale setting, Linearization, Alarm Outputs (High and Low Alarm), Volume Counter Settings <i>Note: Available and configurable with RS485/USB converter and service software.</i>					

Table 1: Specifications of flowmeters

Note 1: C-Flex® is a registered trademark of Saint Gobain Performance Plastics, 2015. All rights reserved. Note 2: Pressure coefficient is calculated and accounts for the clamp length only.
Note 3: Accuracy is based on 1x standard deviation for calibration at 20 or 37°C ±3°C liquid temperature and 20°C±5°C ambient temperature with zeroing after clamping. Accuracy does not include tubing variation effects.
Note 4: AdvantaSil® and AdvantaFlex® are registered trademarks of NewAge Industries.
Note 5: All sensors are calibrated with Liveo™ Pharma 65. LFSC-I25X/35X are compatible with Liveo™ Pharma 80. Liveo™ is a trademark of DuPont de Nemours.
Note 6: Contact Levitronix® for custom tubing calibration.



Sensor Type	Size Type	Dimensions in [mm]						
		B	C	D	E	F	G	H
LFSC-i06X	1	54	66.3	82.2	51.3	M6 x 6	20	11.1
LFSC-i10X	1							
LFSC-i16X	2	54	76.3	92.2	61.7	M6 x 6	25	12.1
LFSC-i19X	2							
LFSC-i25X	3	80	104.6	120.4	87.1	M8 x 8	41	17.7
LFSC-i35X	3							

Figure 6: Basic dimensions for clamp-on flowmeters

COMPONENTS

Pos.	Part Name	Article #	Tube: ID x OD	Flow Range	Calibration Set and Note
1a	LFSC-i06X-002	100-30485	ID = 1/8"= 3.2 mm OD = 1/4"= 6.4 mm	1 lpm	Water @ 20°C and 37°C Liveo™ Pharma Silicone compatible with AdvantaSil® APHP High Pressure, C-Flex® and Advanta Flex TPE. Default activated calibration set is Liveo™ Pharma at 37°C water temperature. Other calibration sets can be chosen <i>with Levitronix® Service Software</i> or with the user panel <i>LUI-B.1</i>
1b	LFSC-i10X-001	100-30477	ID = 1/4"= 6.4 mm OD = 3/8"= 9.5 mm	4 lpm	
1c	LFSC-i16X-001	100-30482	ID = 3/8"=9.5 mm OD = 5/8"=15.9 mm	20 lpm	
1d	LFSC-i19X-001	100-30479	ID = 1/2"=12.7 mm OD = 3/4"=19.1 mm	50 lpm	
1e	LFSC-i25X-001	100-30480	ID = 3/4"=19.1 mm OD = 1"=25.4 mm	80 lpm	
1f	LFSC-i35X-001	100-30481	ID = 1"= 25.4 mm OD = 1 3/8"= 34.9 mm	160 lpm	

Table 2: Standard flow sensor configurations

Pos.	Component	Article Name	Article #	Features	Special Feature / Description
2	User Panel	LUI-B.1-02	100-30473	Description Standard Firmware	Monitoring flow, zeroing and tube set selection. IP65 rating. Basic dimensions: 70x93x23 mm A4.00
3	Desktop AC/DC Power Supply	SMI36-24-V HR30	100-40023	Voltage Output / Input Basic Dimensions Safety Approvals Note	24VDC, 36 W / 90 – 264 VAC, 47-63 Hz 78.5 x 66 x 35 mm, cable length = 1.4 m UL/cUL (60950-1, 62368-1), RCM, CCC, PSE Included are interchangeable AC blades (adaptors) for global usage (B).
4	Y-Split Cable	ICY-1.1-02 (0.2 m)	190-10448	Materials / Dimension Connection In / Out Main Purpose	PVC jacket with TPE split block / 0.2m for one cable side and 0.2m for the 0.2m split cables. Circular Hirose type / 2x Circular Hirose type Split signals to connect flow sensor to power supply and user panel or PC.
5	IPS Cable Signal 6 Wires	ICS-1.1-01 (0.1 m) ICS-1.1-10 (1 m) ICS-1.1-30 (3 m)	190-10343 190-10344 190-10345	Cable Material / Wires Connection In / Out Main Purpose	PVC jacket / 6x 0.08 mm ² and shielding Circular Hirose type / Circular Hirose type Interconnect cable for LUI-B.1 user panel.
6	IPS Cable Signal 6 Wires	ICS-1.3-50 (5 m)	190-10389	Cable Material / Wires Connection In / Out Main Purpose	PVC jacket / 6x 0.08 mm ² and shielding Connector with screw type plug for open wire connection / Circular Hirose type Interconnection cable from Fieldbus of Split-Cable to USB/RS485 adaptor.
7	USB to RS485 Adaptor-TR Isolated	YN-485I-TR	100-30392	Structure/Design Purpose	USB (A) with termination resistor and cable with connector pair (B and C) for external RS485 wire connection. Magnetically isolated. Cable length is 2m. Included is a USB space saver cable (D). Communication over fieldbus of flowmeter with PC
8	IPS Cable Signal 12 Wires	ICS-2.4-50 (5 m)	190-10475	Cable Material / Wires Connection In / Out Main Purpose	PVC jacket / 12x 0.14 mm ² and shielding Connector with screw type plug for open wire connection / Circular Hirose type Cable for OEM configurations with integrated DC source (A) for current output of analog out.

Table 3: Accessories



Figure 7: LEVIFLOW® flowmeter components



Figure 8: Accessories

Levitronix® is the world-wide leader in magnetically levitated bearingless motor technology. *Levitronix®* was the first company to introduce bearingless motor technology to the Semiconductor, Medical and Lifescience markets. The company is ISO 9001 certified. Production and quality control facilities are located in Switzerland. In addition, *Levitronix®* is committed to bring other highly innovative products like the *LEVIFLOW®* flowmeter series to the market.



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