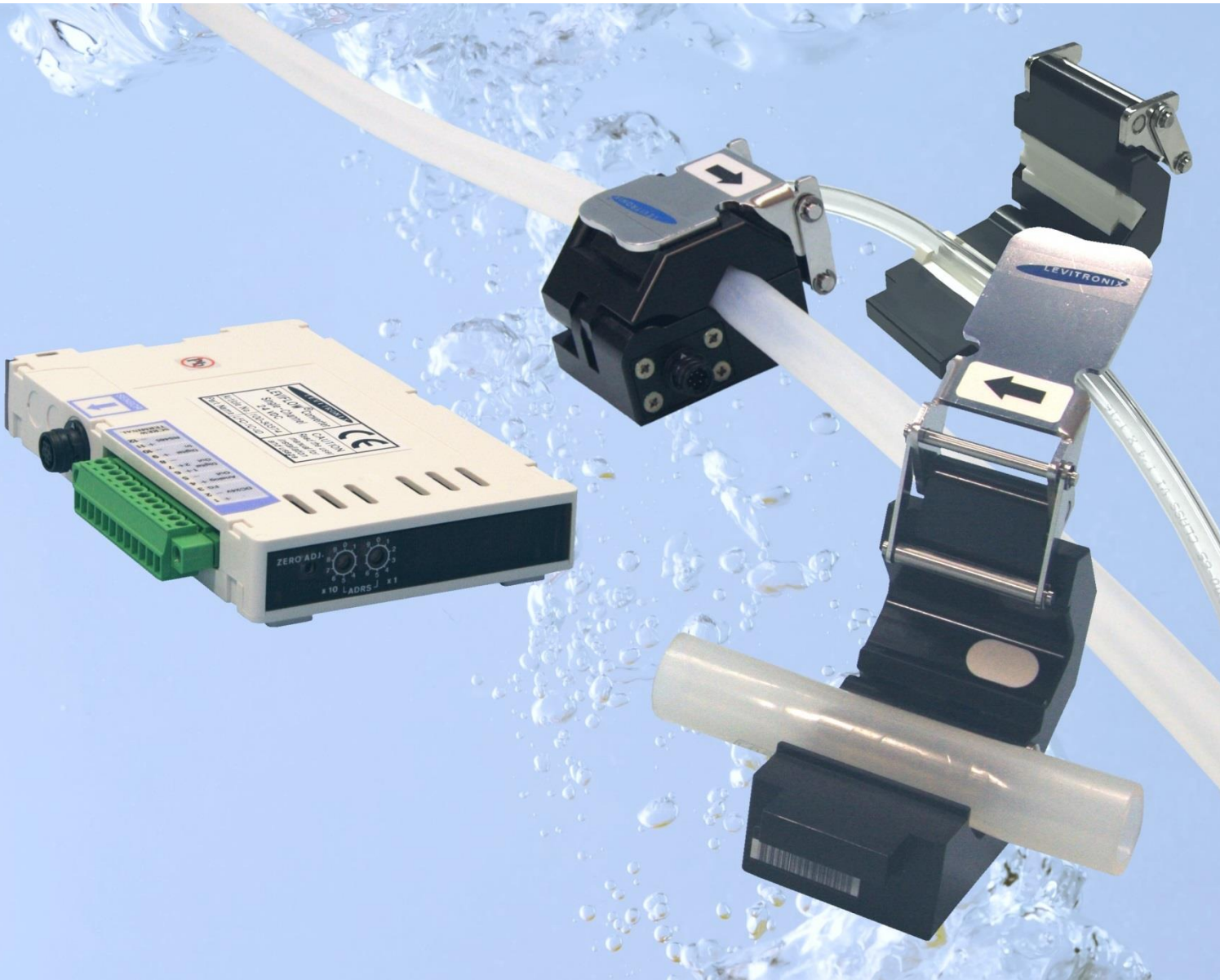


LEVIFLOW® Ultrasonic Technology Clamp-On Flowmeter D-Series for Flexible Tubing



LFSC-D Clamp-On Flowmeters

LFSC-08D: 4 l/min

LFSC-12D: 20 l/min

LFSC-22D: 80 l/min

Ultraclean Non-Invasive Flow Measurement

INTRODUCTION

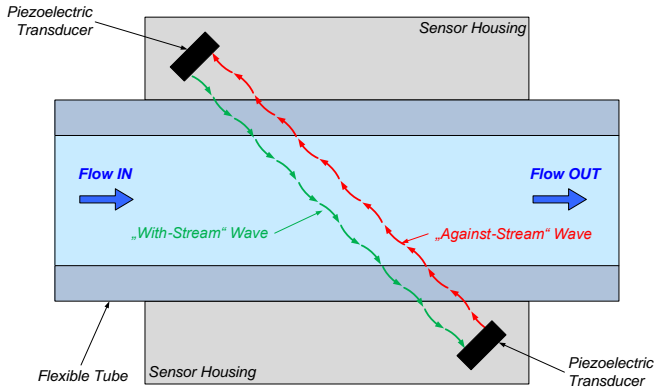


Figure 1: Operating principle of ultrasonic clamp-on flow sensor (D-series)

INTRODUCTION

The LEVIFLOW® clamp-on flowmeters are designed for non-invasive flow measurements of high purity fluids with flexible tubing. Figure 1 illustrates the operating principle. Two piezoelectric transducers, mounted in the sensor housing, generate and receive an ultrasonic wave. The wave going in direction of the flow (with-stream wave) is accelerated and the wave going against the flow direction (against-stream wave) is slowed down. The two waves are processed by a signal converter. The difference of the transit time of both waves is proportional to the velocity of the fluid.

The standard configuration of the LEVIFLOW® clamp-on flowmeters (Figure 2) consists of a flow sensor and a converter with a digital signal processor (DSP) for processing the sensor signals. The clamp on flowmeters can measure a flow up to 80 l/min. Various signals (analog output, digital input/output) are provided and can be configured with a PC software. A two wire RS485 bus allows arrays of multiple flowmeters. In addition, the sensor value is shown on a 4-digit display. For debugging, data collection and configuration with a PC the LEVIFLOW® Configuration Software is available at Levitronix® together with a USB to RS485 adaptor (see Figure 3).

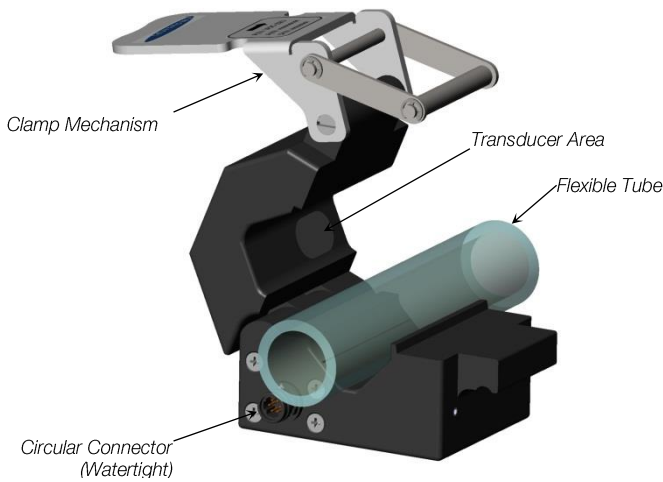


Figure 2: Clamp-on flowsensor

SYSTEM BENEFITS

- No contamination due to non-invasive flow measurement
- No moving parts -> no particle generation
- Low disposable cost (tubing cost only) with reusable sensor
- Improved bubble robustness due to DSP technology
- Flow control together with Levitronix® MagLev Pumps
- Easy integration into OEM equipment
- Easy configurable flow sensor parameters (PC software)
- Low pressure loss
- Integrated and configurable totalizer function

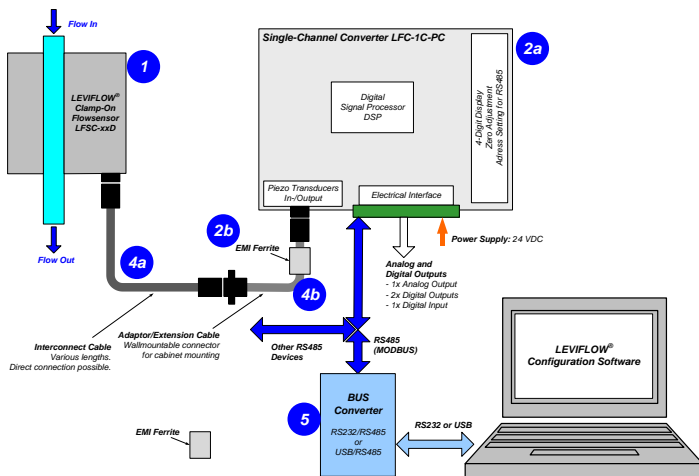


Figure 3: System configuration for usage with LEVIFLOW® configuration software (see order info. for position description)

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

SENSOR SPECIFICATIONS

Characteristics	LFSC-08D	LFSC-12D	LFSC-22D
Flow Range [l/min]	0 – 4 l/min	0 – 20 l/min	0 – 80 l/min
Clamp Shape Length	8 mm	12 mm	22 mm
Accuracy of Reading	> 15% of FS < 15% of FS ±3 % ±18 ml/min	±3 % ±90 ml/min	±3 % ±360 ml/min
Weight	211 g	208 g	327 g
Maximum Fluid Pressure (max. pressure of tube might limit this value)	6.5 bar	6.5 bar	4 bar
Pressure Drop Coefficient C ²	0.0754 at 20°C 0.0688 at 37°C	0.00750 at 20°C 0.00697 at 37°C	0.000158 at 20°C 0.000147 at 37°C
Usable Flexible Tubing Dimensions	ID 1/4" = 6.4 mm OD 3/8" = 9.6 mm Wall thickness 1/16" = 1.6 mm	3/8" = 9.5mm 9/16" = 14.3mm 3/32" = 2.4 mm	3/4" = 19.05 mm 1" = 25.4 mm 1/8" = 3.2 mm

Characteristics	Specification (all Sensors)
Standard Tube Material	Saint Gobain C-Flex® 1 (374, 072 and 082) and Silicone (Pharma 50, 65 and 80)
Fluid Temperature	Normal range: 10 – 60 °C (50 – 140 °F)
Ambient Temperature	0 – 40 °C (32 - 104 °F)
Kinematic Viscosity	0.7 – 10 mm ² /s (0.7 – 10 cSt)
Sound Speed	1300 – 1700 m/s (others on request)
IP Classification	IP-65
Allowed Cleaning	Wiping with IPA or water
Electrical Connector	Circular type (IP-67), lock-release mounting
Cables	Various extension cables available.

Table 1: Specifications of flow sensors (all data based on calibration with water at 20 or 37 °C with zeroing after clamping)

1: C-Flex® is a registered trademark of Saint Gobain Performance Plastics, 2015. All rights reserved.

2: Pressure coefficient accounts for the clamp length only.

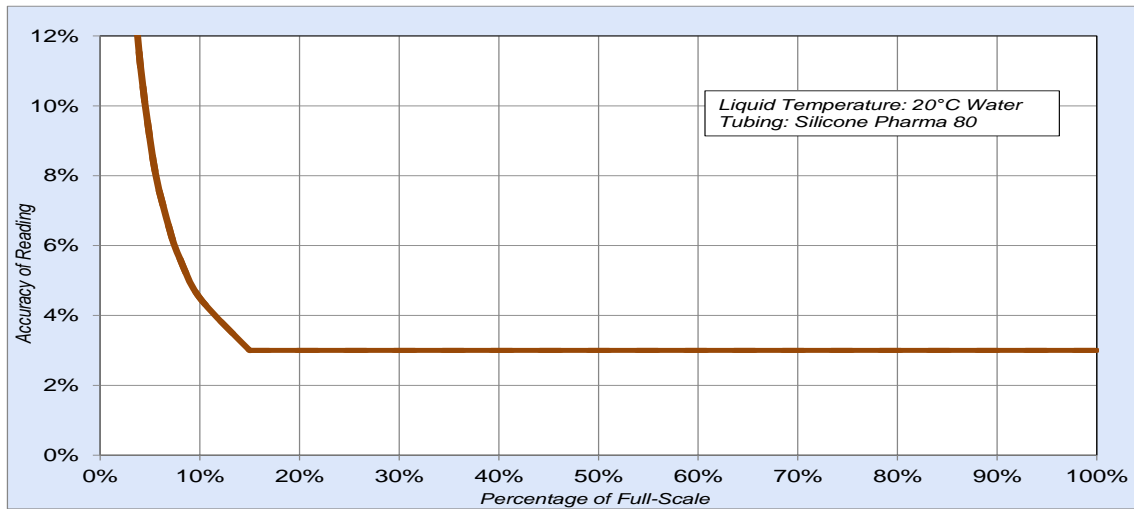
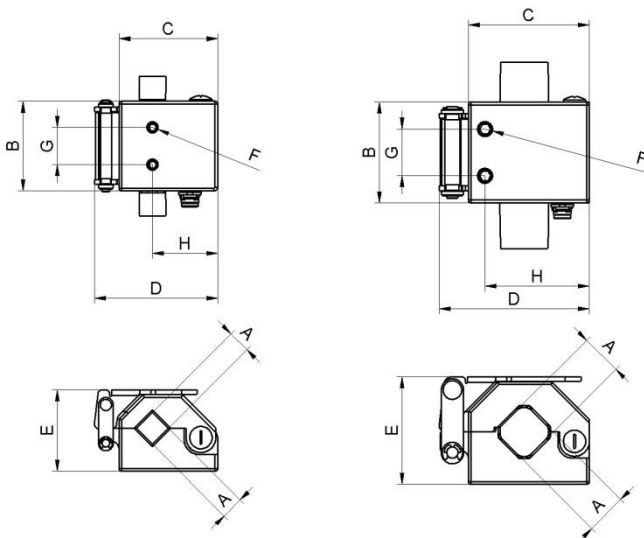


Figure 4: Accuracy (±) of reading is representative for the described configuration. Other configurations may result in different accuracies.



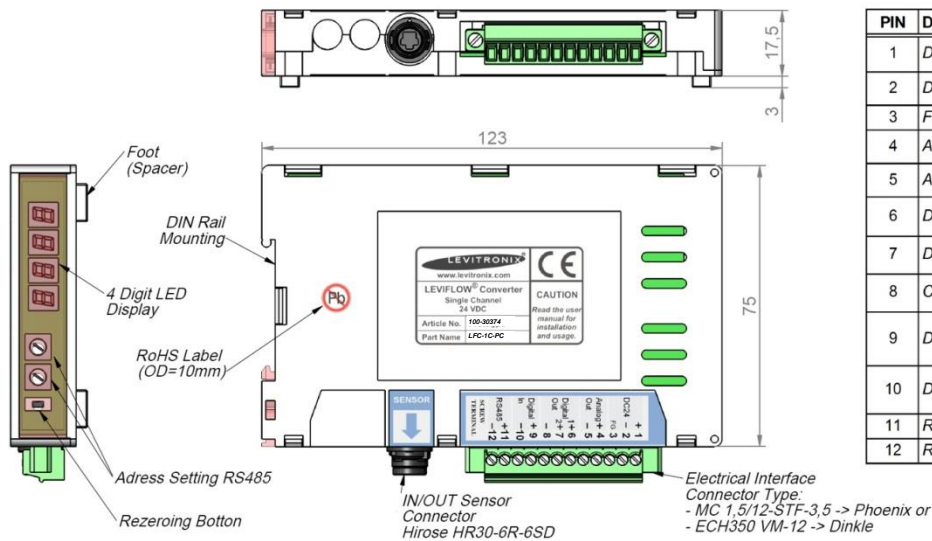
Sensor Type	Dimensions in [mm]							
	A	B	C	D	E	F	G	H
LFSC-08D	8	48	53	66.2	43.5	M6 x 6	20	35
LFSC-12D	12	48	53	66.2	43.5	M6 x 6	20	35
LFSC-22D	22	54	65	80.7	57.5	M8 x 10	25	56

Figure 5: Dimensions for LFSC-D clamp-on flow sensors

CONVERTER AND CABLE SPECIFICATIONS

Characteristics	Single Channel Converter Type LFC-1C-PC
Power Supply Current / Inrush (Start-Up) Current	24 VDC \pm 10% 150 mA / 3.8 A during < 210 μ s
Ambient Temp Humidity Range	0 – 40 °C (32 – 104 °F) 30 - 85% R.H. (no condensation)
Enclosure Classification and Material	IP-20 (indoor use), ABS
Interfaces (See Figure 6 for detailed PIN designation and electrical specification)	- RS485 -> MODBUS protocol -> max. array of 99 channels - 1x Analog Output 4 – 20mA (0 – 20mA configurable) - 2x Digital Outputs: Flow Alarm, Measurement Error, Volume Counter Pulse, Volume Counter Alarm, Flow as Frequency or Bubble Detection (default: normally open) - 1x Digital Input: Volume Counter Reset or Zero Adjust - 4 Digit display (flow rate, error codes), re-zero button - Address potentiometers for RS485 address setting
Configuration Parameters (Available and configurable with RS485/USB converter and configuration software)	Viscosity, Low Cutoff, Dampening constant (filter) Full scale setting, Linearization (15 points), Alarm Outputs (High and Low Alarm) Volume Counter Settings
Weight	130 g
Dimensions	123 x 75 x 17.5 mm (see Figure 6 for details)
Mounting	DIN rail

Table 2: Specification of converter LFC-1C-PC



PIN	Designation	Specification
1	DC24V+	24 VDC \pm 10% Current: 150 mA
2	DC24V-	Starting: 4.4 A, 2ms
3	FG	Field Ground
4	Analog Out +	4 - 20 mA (0 - 20 mA configurable)
5	Analog Out -	Load Resistance < 600 Ohm
6	Digital Out1 +	Max. rating: DC30V, 20mA (open collector)
7	Digital Out2 +	Various configurable options available depending on firmware
8	COM	
9	Digital In+	Various configurable options available depending on firmware
10	Digital In-	No-voltage contact or transistor open collector
11	RS485 +	RS485 with MODBUS
12	RS485 -	Protocol

Figure 6: Dimensions and layout of interfaces of single channel converter LFC-1C-PC

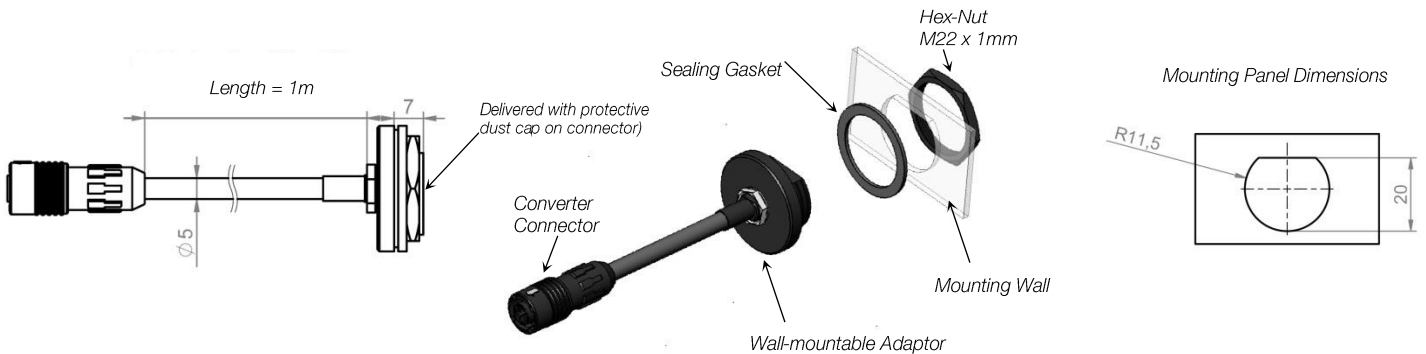


Figure 7: Dimensions of wall mountable extension cables LFE-C.2

ORDER INFORMATION

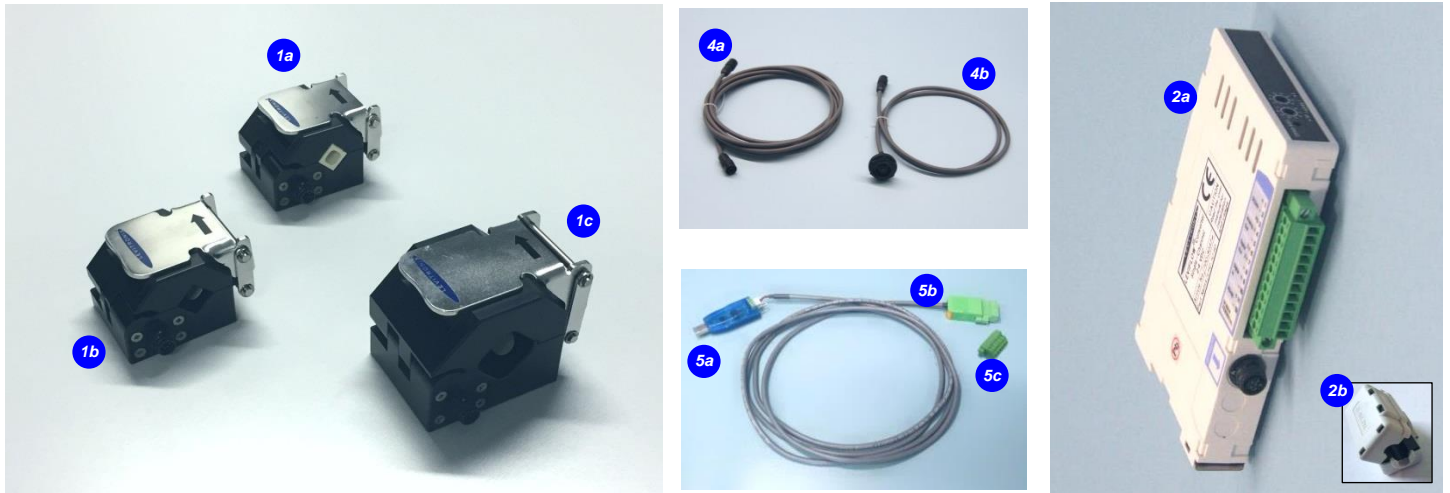


Figure 8: LEVIFLOW® flowmeter components

Pos.	Part Name	Article #	Tube: ID x OD	Flow Range	Connector	Calibration Set	Note
1a	LFSC-08D-001	100-30396	ID = 1/4"= 6.4 mm OD = 3/8"= 9.6 mm	4 lpm			Default activated calibration set is Silicone at 37°C water temperature. Other parameter sets can be chosen with Levitronix® Configurations Software.
1b	LFSC-12D-007	100-30390	ID = 3/8"=9.5 mm OD = 9/16"=14.7 mm	20 lpm	Circular Hirose	Water @ 20°C and 37°C Silicone and C-Flex®	
1c	LFSC-22D-005	100-30391	ID = 3/4"=19.05 mm OD = 1"=25.4 mm	80 lpm			

Table 3: Standard flow sensor configurations (others on request)

Pos.	Part Name	Part #	Description	Interfaces
2 (a+b)	LFC-1C-PC	100-30374	Single Channel Converter	Analog Output (4 – 20 mA), 2x Digital Output, 1x Digital Input, RS485 (MODBUS) protocol Note: EMI ferrite (2b) for flow sensor cable included in converter package.
3	LFC-1C-PC-SK	100-91072	Converter Starter Kit	Includes converter, AC/DC supply, plug-and-play cabling, configuration software.

Table 4: LEVIFLOW® converter for clamp-on sensor

Pos.	Part Name	Part #	Features	Special Feature / Description
4a	LFI-C.1-10 LFI-C.1-30 LFI-C.1-60	190-10307 190-10308 190-10309	Cable length: 1 m, PVC Cable length: 3 m, PVC Cable length: 6 m, PVC	Interconnect cable for connection between sensor and converter.
4b	LFE-C.2-10 LFE-C.2-30 LFE-C.2-60	190-10310 190-10311 190-10312	Cable length: 1 m, PVC Cable length: 3 m, PVC Cable length: 6 m, PVC	Extension cable with wall-mountable connector for cabinet mounting. Delivered with protective dust cap on wall-mountable connector side.
5	YN-485I-TR, USB to RS485 Adaptor-TR Isolated	100-30392	Structure/Design Purpose	USB connector (5a) with termination resistor and cable with connector pair (5b and 5c) for external RS485 wire connection. Magnetically isolated. Cable length is 2m. Communication over fieldbus of converter with PC.

Table 5: Accessories

Pos.	Part Name	Part #	Flow Range	Calibration Set	Note
6a	LFSC-08D-001+ LFC-1C-PC	100-91076	0 – 4 lpm	Water @ 20°C and 37°C Silicone and C-Flex®	Extension and interconnect cables to be ordered as separate article with specified length (see Table 5).
6b	LFSC-12D-007+ LFC-1C-PC	100-91012	0 – 20 lpm		
6c	LFSC-22D-005 + LFC-1C-PC	100-91013	0 – 80 lpm		Default activated calibration set is Silicone at 37°C water temperature.

Table 6: Standard flowmeter sets – flow sensor with converter

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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