

LEVIFLOW® Ultrasonic Technology Single-Use High Precision Flowmeters



LFS-SU Single-Use Flowmeters

LFS-03SU: 0 – 0.8 l/min

LFS-06SU: 0 – 8 l/min

LFS-10SU: 0 – 20 l/min

LFS-20SU: 0 – 80 l/min

Ultraclean Non-Invasive Flow Measurement

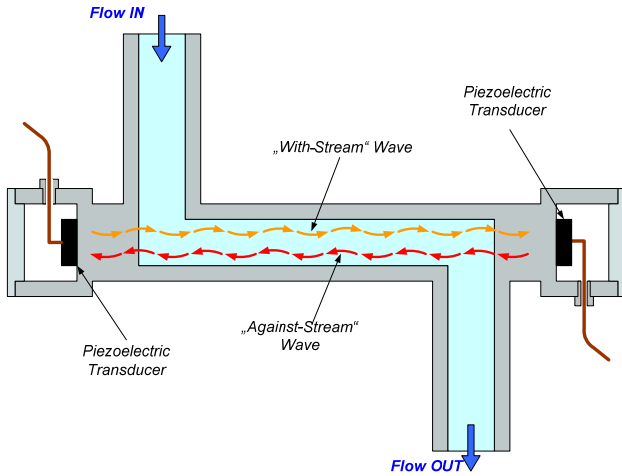


Figure 1: Operating principle of ultrasonic single-use sensor

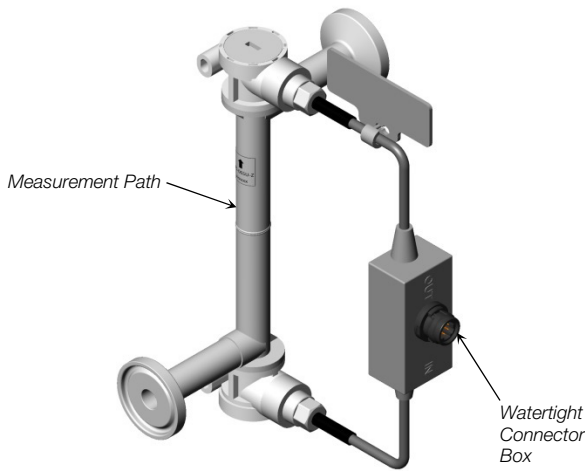


Figure 2: Single-use flowsensor

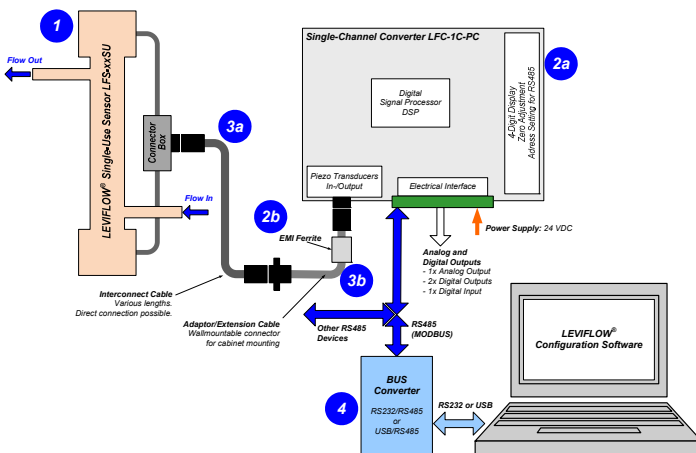


Figure 3: System configuration for usage with LEVIFLOW® configuration software

INTRODUCTION

The LEVIFLOW® single-use 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 wet materials of the single-use sensors fabricated from biocompatible (FDA, USP-VI, BSE/TSE and Animal free) gamma sterilizable polypropylene (PP).

The standard configuration of the LEVIFLOW® single-use flowmeters (Figure 3) consists of a flow sensor and a converter with a digital signal processor (DSP) for processing the sensor signals. 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).

SYSTEM BENEFITS

- High precision (1%) flow measurement
- No contamination due to non-invasive flow measurement
- No moving parts -> no particle generation
- 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)
- Integrated and configurable totalizer function

APPLICATIONS

- High purity and high precision 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

Sensor Type	LFS-03SU	LFS-06SU LFS-06SU-SC1	LFS-10SU	LFS-20SU
Characteristics				
Flow Range [lpm]	0 – 0.8	0 – 8	0 – 20	0 – 80
Triclamp Fitting Size	3/8" (ID = 6.4 mm)	3/8" (ID = 6.4 mm)	1/2" (ID = 9.4 mm)	1" (ID = 22.2 mm)
Measurement Path ID in [mm]	2.5	6	10	20
Accuracy of Reading <i>Note: Repeatability < Accuracy/2</i>	see Figure 4	LFS-06SU: > 1.7 l/min: ±1% < 1.7 l/min: ±17 ml/min LFS-06SU-SC1: > 0.08 l/min: ±1% < 0.08 l/min: 0.8 ml/min	> 4.7 l/min: ±1% < 4.7 l/min: ±47 ml/min	>18.8 l/min: ±1 % <18.8 l/min: ±188 ml/min
Wetted Surface Area [cm ²]	29.5	32.2	53.2	173.5
Wetted Surface Area [ml]	4	4.8	12.3	95.8
Weight [g]	42	43	61	125
Pressure Drop Coefficient C at 20°C $\Delta P = C \times Q^2$, Q = Flow [lpm], ΔP = Press. Drop [kPa]	16.8	0.88	0.075	0.0035
Fluid Temperature	Normal range: 10 – 60 °C (50 – 140 °F)			
Ambient Temperature	0 – 40 °C (32 – 104 °F)			
Maximum Fluid Pressure	0 – 0.5 MPa (0 – 5 bar, 0 – 72.5 psi)			
Kinematic Viscosity	0.8 – 40 mm ² /s (0.8 – 40 cSt)			
Sound Speed	1000 – 2200 m/s			
Wet Materials	Polypropylene (FDA, USP VI, ADI free), Gamma robust for up to 40 kGy			
Sensor Enclosure Classification	IP-65 (for connected sensor)			
Cable Jacket Material	PVC			
Cable Length	Various extension cables available.			
Electrical Connectors	Circular type (IP-67), lock-release mounting			

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

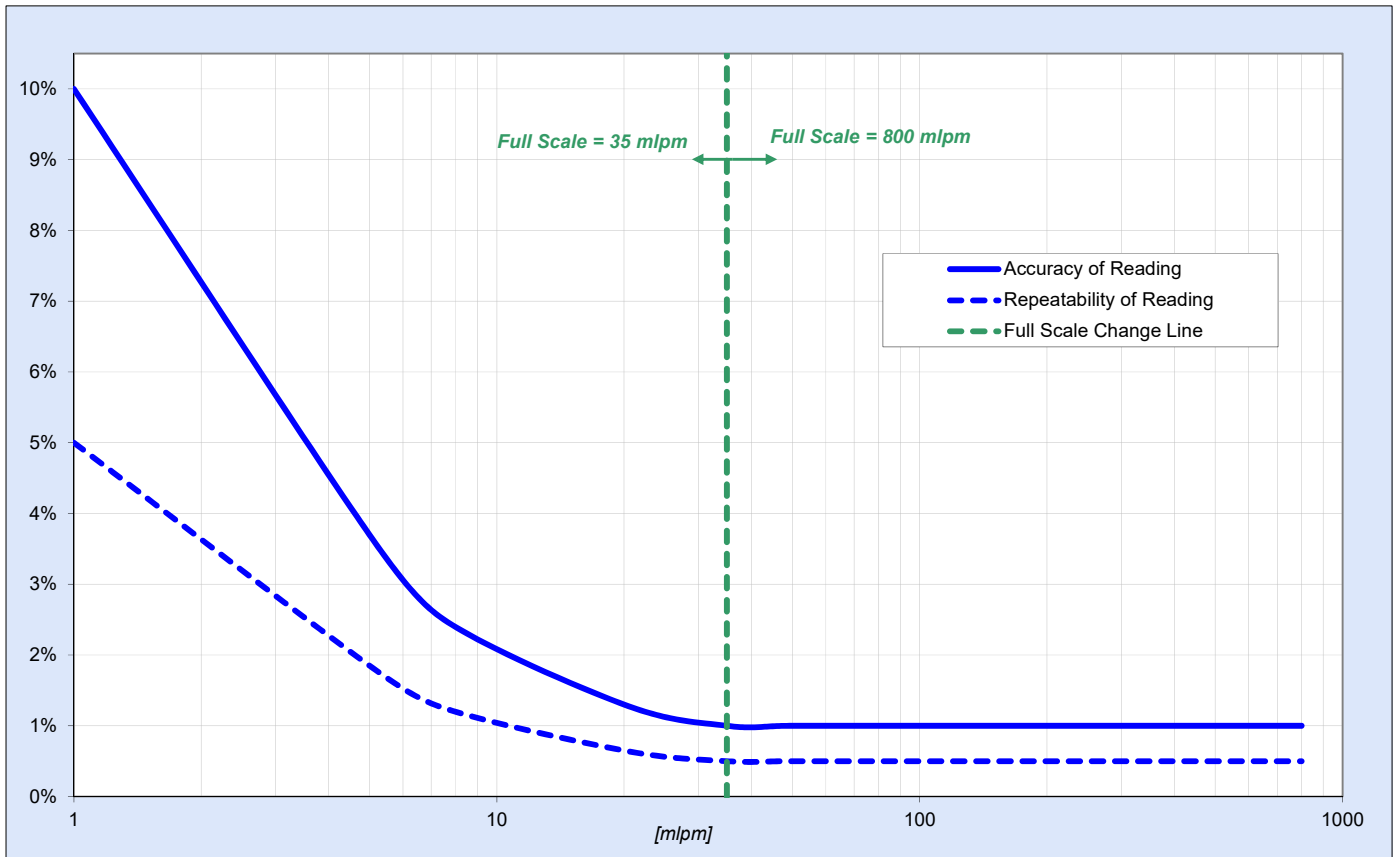


Figure 4: Accuracy and repeatability for single-use sensor LFS-03SU

SENSOR SPECIFICATIONS

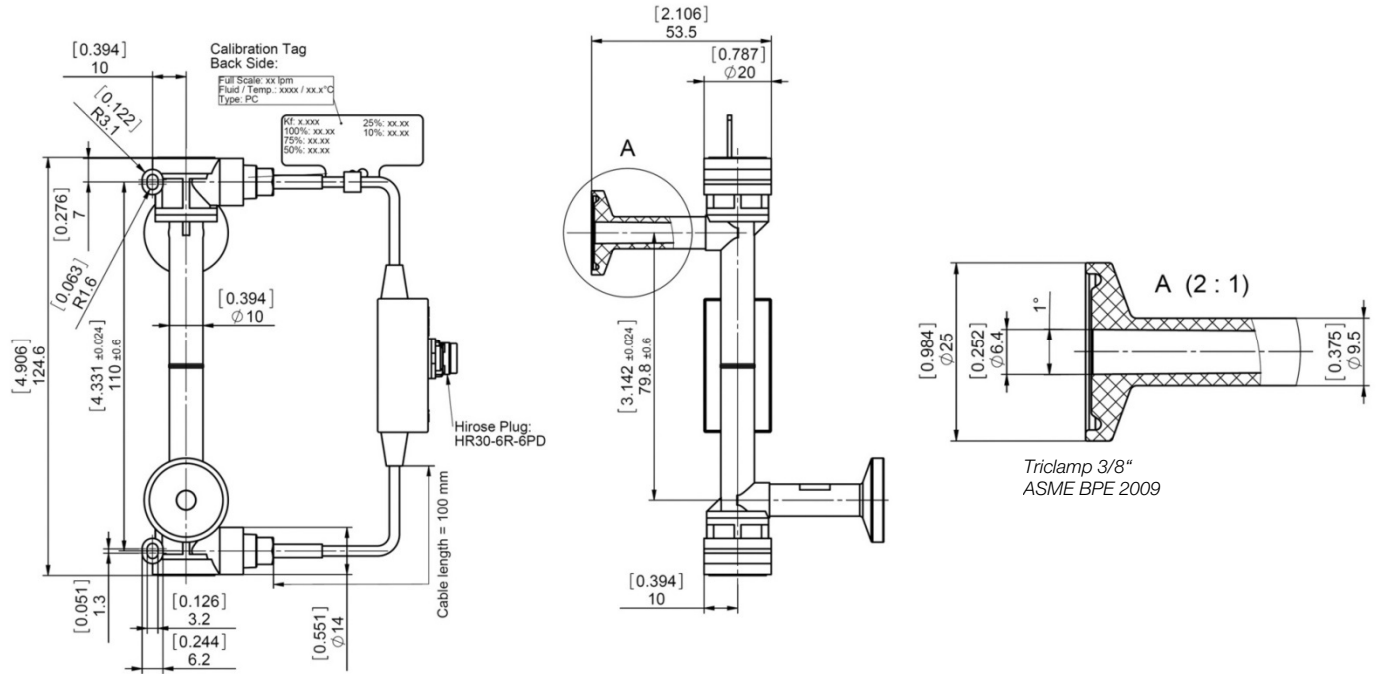
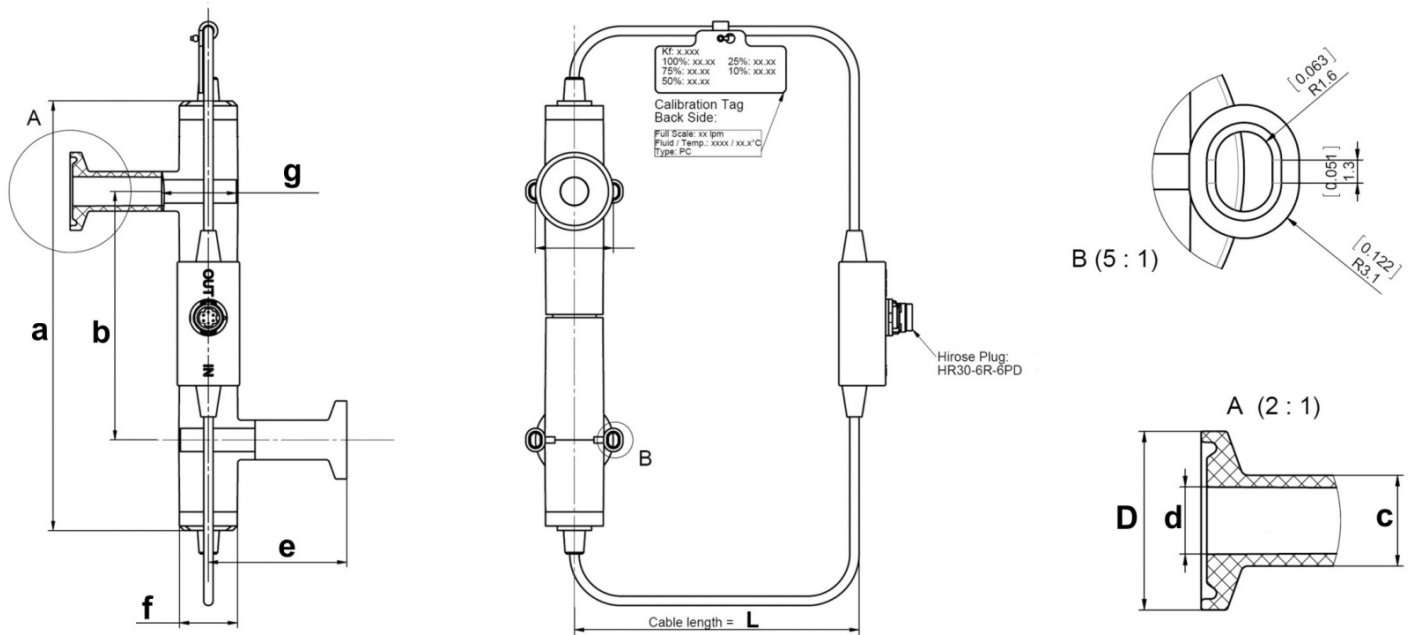


Figure 5: Dimensions for LFS-03SU-Z and LFS-06SU-Z flow sensors



Sensor Type	Triclamp Fitting Size (ASME BPE 2009)	Dimensions in [mm]								
		a	b	c	D	d	e	f	g	L
LFS-10SU-Z	1/2"	80	138	Ø 12.7 (= 1/2")	Ø 25	Ø 9.4	44.4	18.6	24	110
LFS-20SU-Z	1"	161.2	231.2	Ø 25.4 (= 1")	Ø 50.5	Ø 22.2	82.5	28	34	160

Figure 6: Dimensions for LFS-10SU-Z and LFS-20SU-Z flow sensors

CONVERTER AND CABLE SPECIFICATIONS

Characteristics	Description or Values
Power Supply	24 VDC \pm 10%
Current / Inrush (Start-Up) Current	150 mA / Peak of 3.8 A within 210 μ s
Ambient Temp	0 – 40 °C (32 – 104 °F)
Humidity Range	30 - 85% R.H. (no condensation)
Enclosure Classification and Material	IP-20 (indoor use), ABS
Interfaces (See Figure 7 for detailed PIN designation and electrical specification)	<ul style="list-style-type: none"> - 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 7 for details)
Mounting	DIN rail

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

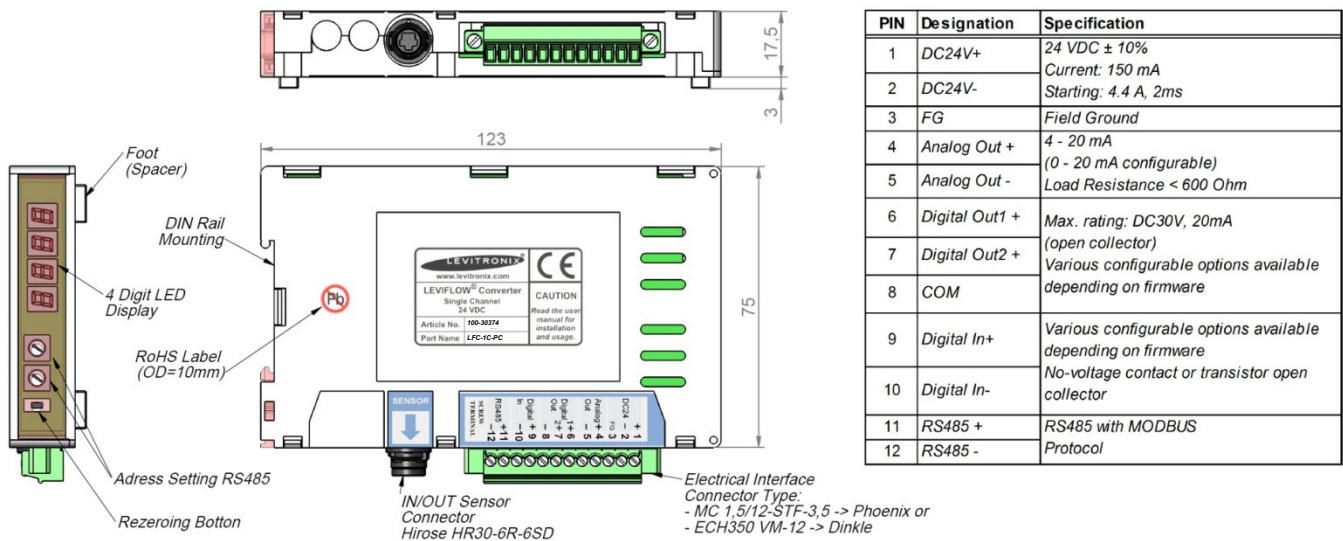


Figure 7: Dimensions and layout of interfaces of single channel converter LFC-1C-PC

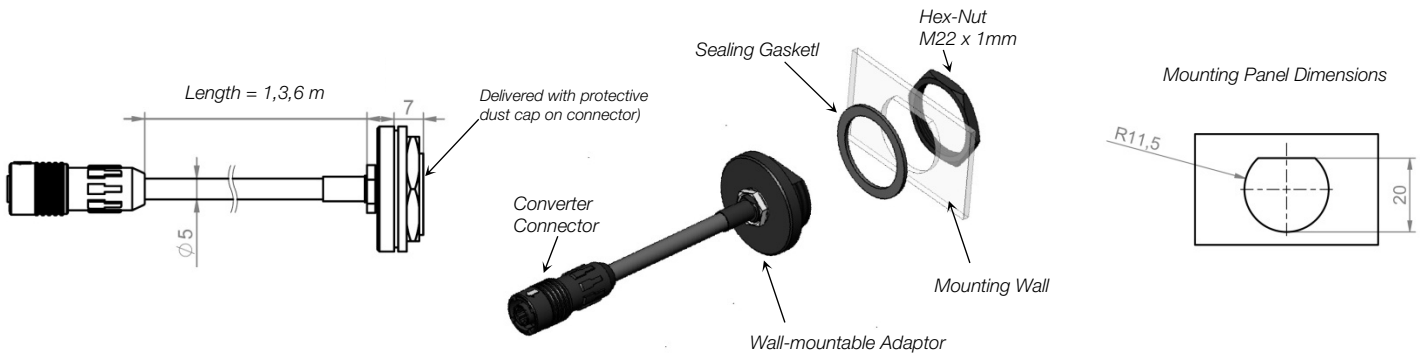


Figure 8: Dimensions of wall mountable extension cables LFE-C.2

ORDER INFORMATION



Figure 9: LEVIFLOW® flowmeter components

Pos.	Part Name	Article #	1% Accuracy Flow Range	Fitting	Connector	Note
1a	LFS-03SU-Z LFS-03SU-Z-G25 †	100-30375 100-30399	35 – 800 mlpm			
1b	LFS-06SU-Z LFS-06SU-Z-G25 † LFS-06SU-Z-SC1 LFS-06SU-Z-SC1-G25 †	100-30377 100-30400 100-30394 100-30406	1.7 – 8 l/min 0.08 – 8 l/min	Triclamp 3/8"	Circular Hirose type with IP67.	--
1c	LFS-10SU-Z LFS-10SU-Z-G25 †	100-30397 100-30405	4.7 – 20 l/min	Triclamp 1/2"		
1d	LFS-20SU-Z LFS-20SU-Z-G25 †	100-30379 100-30404	18.8 – 80 l/min	Triclamp 1"		

Table 3: Standard flow sensor configurations
Note 1: Gamma irradiated with dosage > 25 kGy.

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

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

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 Life Science 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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