LEVITRONIX®

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-15SU:** 0 – 50 l/min **LFS-20SU:** 0 – 80 l/min

Ultraclean Non-Invasive Flow Measurement

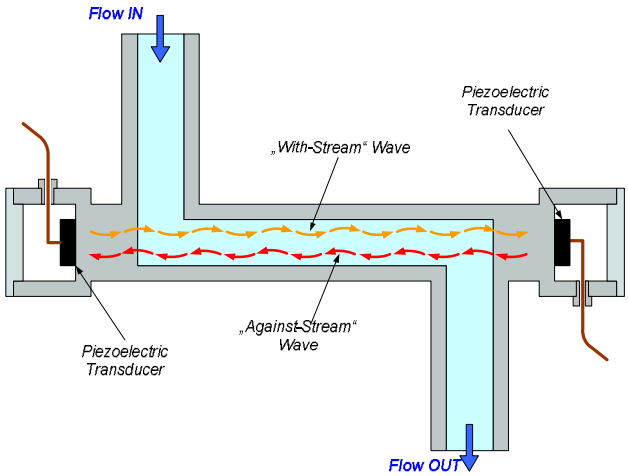


Figure 1: *Operating principle of ultrasonic single-use sensor*

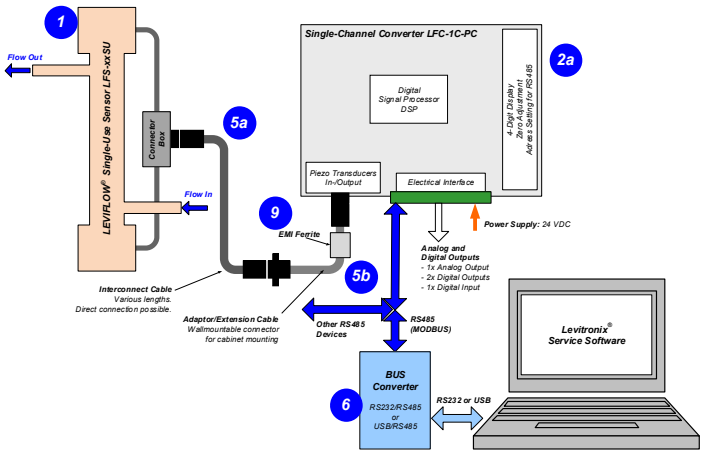


Figure 2: *System configuration with single-channel converter for usage with Levitronix® Service Software.*

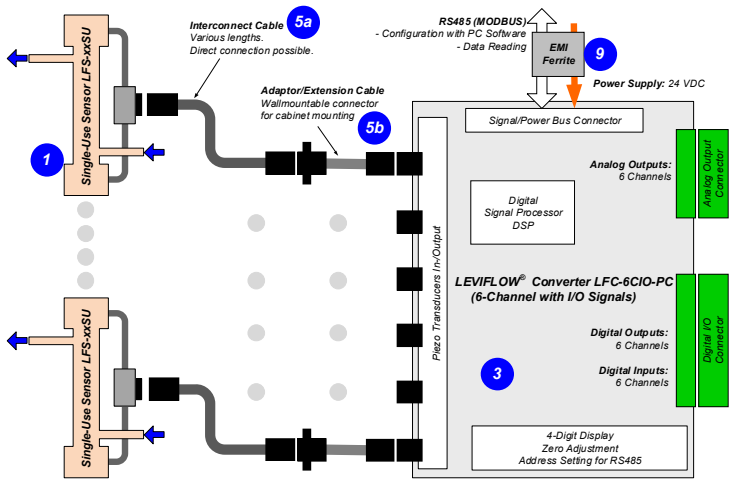


Figure 3: *System configuration with multi-channel converter.*

INTRODUCTION

The *LEVIFLOW®* single-use flowmeters are designed for non-invasive flow measurements of high purity fluids. *Figure 1* illustrates the operating principle. Two piezo-electric transducers, mounted in the sensor housing, generate and receive an ultrasonic wave. 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 2*) consists of a flow sensor and a converter for processing the sensor signals. Various signals (analog output, digital input/output) are provided and can be configured with a PC software. A RS485 bus allows arrays of multiple flowmeters. The sensor value is shown on a 4-digit display. For debugging, data collection and configuration with a PC the *Levitronix® Service Software* is available at *Levitronix®* together with a USB to RS485 adaptor. A stackable 6-channel converter (see *Figure 3*), with almost the same size as the single-channel converter, is available for high volume applications with reduced cabling effort and space need.

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

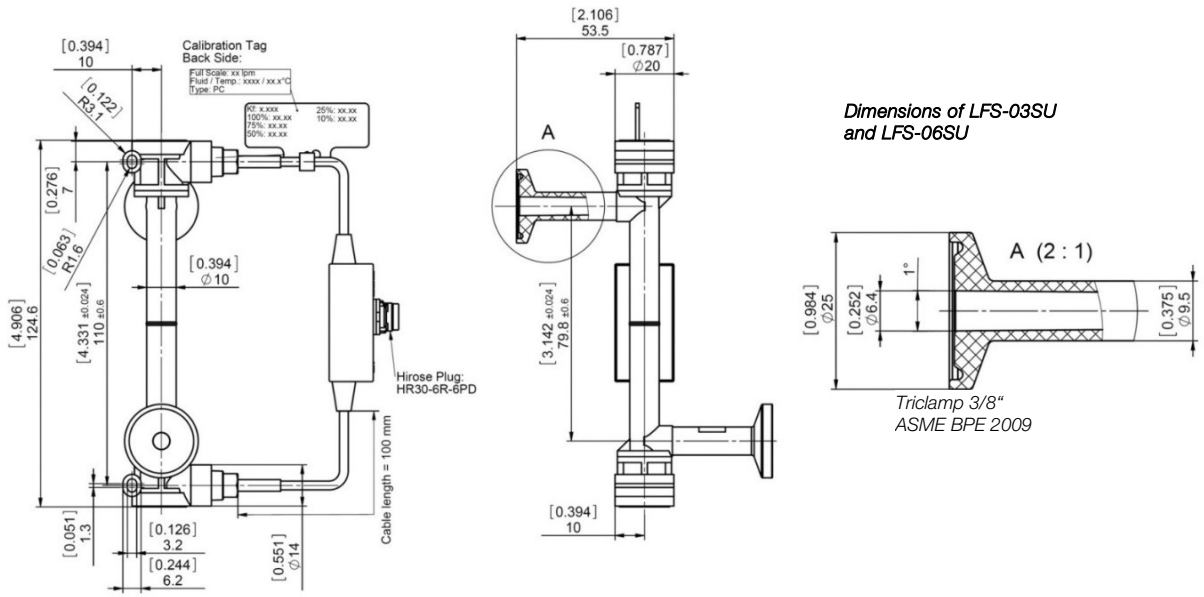
APPLICATIONS

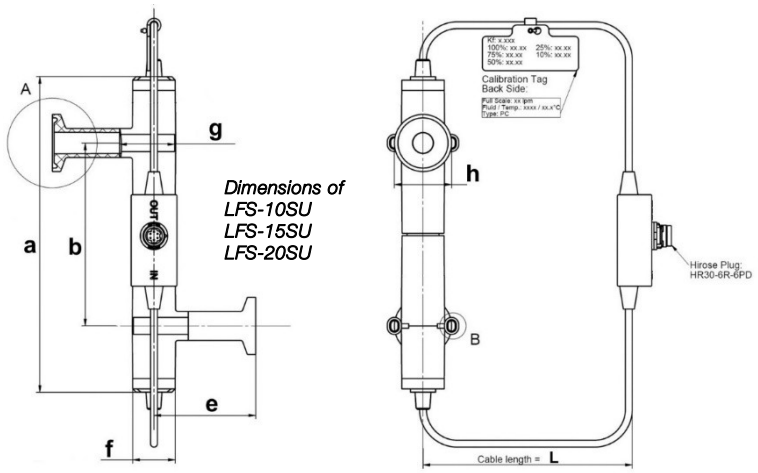
- High purity and high precision liquid processes
- Sterile non-invasive flow measurement in Pharmaceutical manufacturing
- Biotech processes
- Flow control in combination with *Levitronix®* MagLev pump systems
- Single-use disposable applications

SENSOR SPECIFICATIONS

Characteristics \ Sensor Type	LFS-03SU LFS-03SU-SC1	LFS-06SU LFS-06SU-SC1	LFS-10SU LFS-10SU-SC1	LFS-15SU LFS-15SU-SC1	LFS-20SU LFS-20SU-SC1
Flow Range [lpm]	0 – 0.8	0 – 8	0 – 20	0 – 50	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)	1" (ID = 22.2 mm)
Accuracy of Reading *Note: Repeatability < Accuracy/2*	LFS-03SU > 35 ml/min: ±1% 1 ml/min: ±10% LFS-03SU-SC1 > 6 ml/min: ±1% < 6 ml/min: ±0.06 ml/min	LFS-06SU: > 1.7 l/min: ±1% < 1.7 l/min: ±17 ml/min LFS-06SU-SC1: > 0.075 l/min: ±1% < 0.075 l/min: ±0.75 ml/min	LFS-10SU: > 4.7 l/min: ±1% < 4.7 l/min: ±47 ml/min LFS-10SU-SC1: > 0.75 l/min: ±1% < 0.75 l/min: ±7.5 ml/min	LFS-15SU: > 10.6 l/min: ±1% < 10.6 l/min: ±106 ml/min LFS-15SU-SC1: > 2 l/min: ±1% < 2 l/min: ±20 ml/min	LFS-20SU: >18.8 l/min: ±1 % <18.8 l/min: ±188 ml/min LFS-20SU-SC1: > 3.2 l/min: ±1% < 3.2 l/min: ±32 ml/min
Wetted Surface [cm²] / Vol. [ml] / Weight [g]	29.5 / 4 / 42	32.2 / 4.8 / 42	53.2 / 12.3 / 61	141.2 / 61.7 / 96	173.5 / 125 / 125
Pressure Drop Coefficient C at 20°C ΔP=C x Q², Q=Flow [lpm], ΔP=Press. Drop [kPa]	16.8	0.880	0.0750	0.0101	0.00350
Fluid Temperature / Ambient Temp.	Normal range: 2 – 60 °C (35.6 – 140 °F) / 0 – 40 °C (32 – 104 °F)				
Maximum Fluid Pressure	0 – 0.5 MPa (0 – 5 bar, 0 – 72.5 psi)				
Kinematic Viscosity / Sound Speed	0.3 – 40 mm²/s (0.3 – 40 cSt) / 1000 – 2200 m/s				
Wet Materials / Enclosure Classification	Polypropylene (FDA, USP VI, ADI free), Gamma robust for up to 40 kGy / IP-65 (for connected sensor)				
Cable Jacket / Length / Connector	PVC / Various extension cables available. / Circular type (IP-67), lock-release mounting				

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





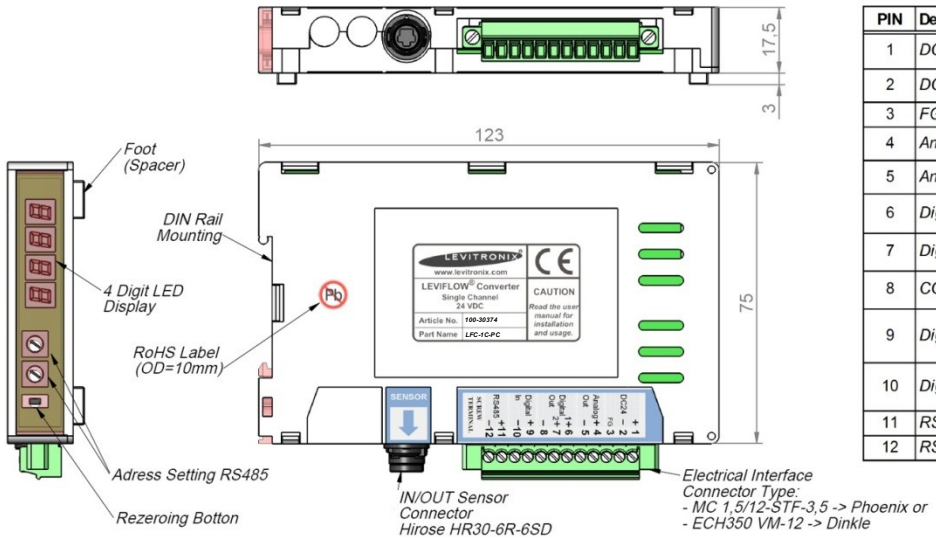
LFS-	-10-SU	-15SU	-20SU
Fitting Size Triclamp (ASME 2009)	1/2"	1"	1"
a	138	164.8	231.2
b	80	100	161.2
c	Ø 12.7	Ø 25.4	Ø 25.4
D	Ø 25	Ø 50.5	Ø 50.5
d	Ø 9.4	Ø 22.2	Ø 22.2
e	44.4	79.4	82.5
f	18.6	23	28
g	24	26	34
h	25	30	35
L	110	160	160

Figure 4: Basic dimensions for LFS-SU sensors

CONVERTER AND CABLE SPECIFICATIONS

Characteristics	Description or Values
Power Supply Current / Inrush (Start-Up) Current	24 VDC ± 10% 150 mA / Peak of 3.8 A within 210 µs
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 5 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 5* for details)
Mounting	DIN rail

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



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

Figure 5: *Dimensions and layout of interfaces of single channel converter LFC-1C-PC*

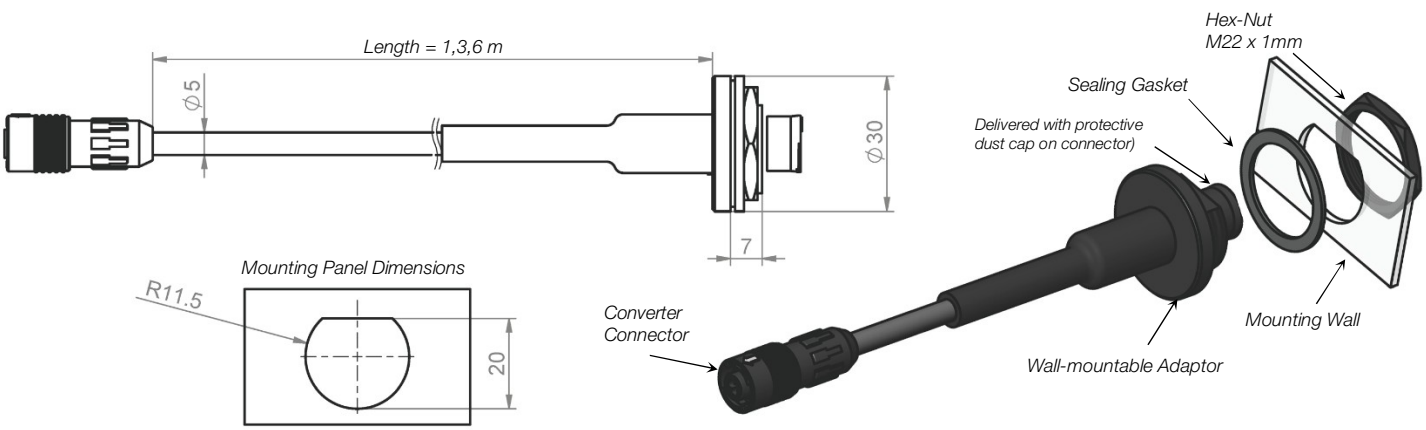


Figure 6: *Dimensions of wall mountable extension cables LFE-C.2*

Characteristics	6-Channel Converter Type LFC-6CIO-PC
Power Supply / Current / In-Rush (Start) Current	24 VDC ± 10% / 270 mA / Peak 4.9 within 210 µs
Ambient Temp / Humidity Range	0 – 50 °C (32 – 122 °F) / 30 - 85% R.H. (no condensation)
Enclosure Classification and Material	IP-20 (indoor use), ABS
Interfaces	- RS485 -> MODBUS protocol -> max. array of 99 ch. - Stacking of max. 16 converters -> 5 ms DSP process/time per channel - 4 Digit display (flow rate, error codes), re-zero button - Address potentiometers for RS485 address setting - 6x Analog Outputs: 4 – 20mA (0 – 20mA configurable) - 6x Digital Outputs: Flow Alarm, Measurement Error, Volume Counter Pulse, Volume Counter Alarm, Flow as Frequency or Bubble Detection (default: normally open) - 6x Digital Input: Volume Counter Reset or Zero Adjust
Configuration Parameters (Available and configurable with RS485/USB converter and service software)	- Viscosity - Low Cutoff - Dampening constant (filter) - Full scale setting - Linearization (15 points) - Alarm Outputs (High and Low Alarm) - Volume Counter and Volume Counter Alarm Settings
Weight / Dimensions / Mounting	215 g / 140 x 77.3 x 20.5 mm / DIN rail

Table 3: *Specifications for multi-channel converter LFC-6CIO-PC*

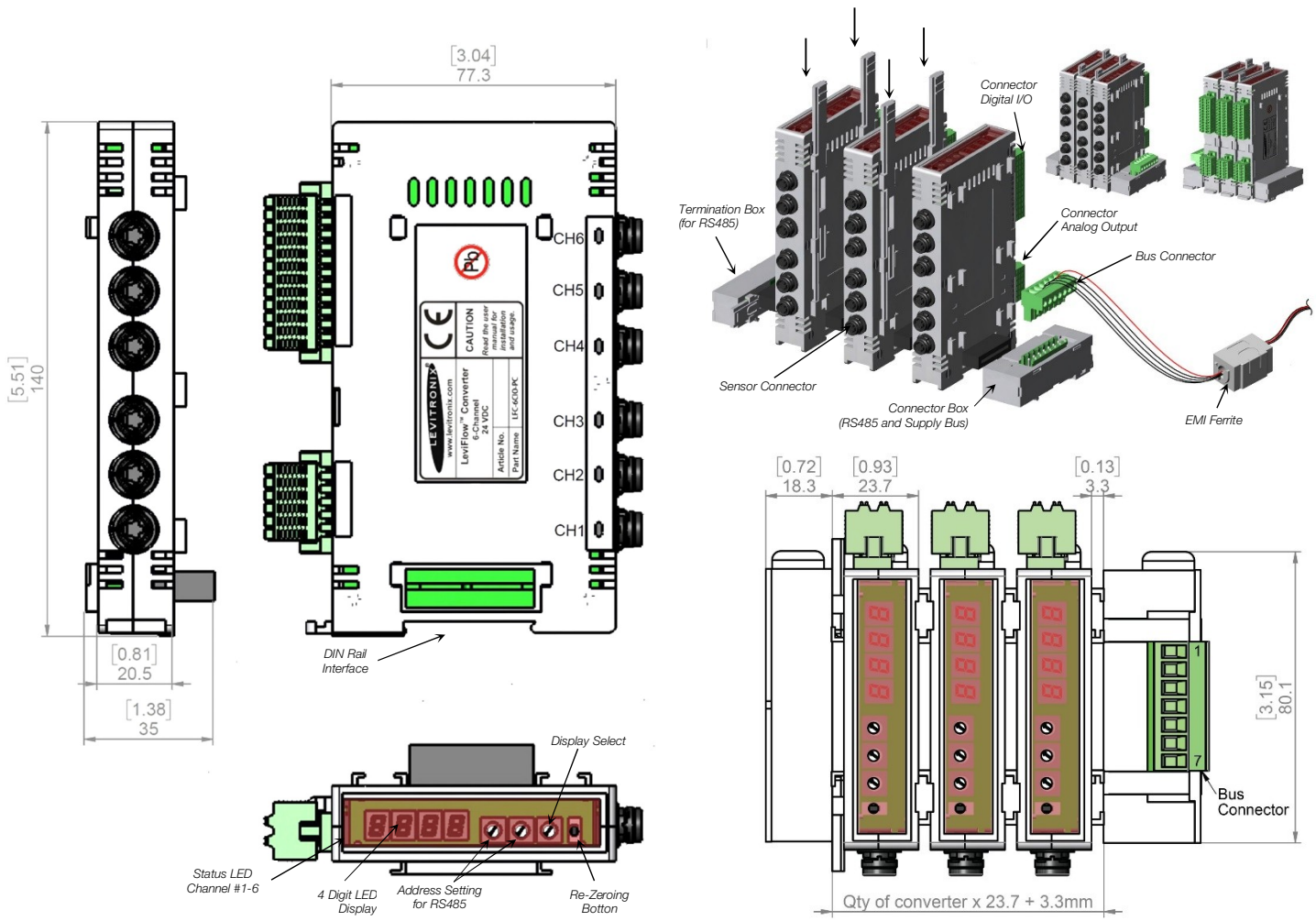


Figure 7: *Dimensions, mounting and stacking concept of LFC-6CIO-PC*

ORDER INFORMATION

Pos.	Part Name	Article #	1% Accuracy Flow Range	Fitting	Connector	Note
1a	LFS-03SU-Z LFS-03SU-Z-G25 [1] LFS-03SU-Z-SC1 LFS-03SU-Z-SC1-G25 [1]	100-30375 100-30399 100-30418 100-30419	35 – 800 ml/min 6 – 800 ml/min 	Triclamp 3/8”	Circular Hirose type with IP67.	--
1b	LFS-06SU-Z LFS-06SU-Z-G25 [1] LFS-06SU-Z-SC1 LFS-06SU-Z-SC1-G25 [1]	100-30377 100-30400 100-30394 100-30406	1.7 – 8 l/min 0.075 – 8 l/min 			
1c	LFS-10SU-Z LFS-10SU-Z-G25 [1] LFS-10SU-Z-SC1 LFS-10SU-Z-SC1-G25 [1]	100-30397 100-30405 100-30408 100-30416	4.7 – 20 l/min 0.75 – 20 l/min 	Triclamp 1/2”		
1d	LFS-15SU-Z LFS-15SU-Z-G25 [1] LFS-15SU-Z-SC1 LFS-15SU-Z-SC1-G25 [1]	100-30412 100-30111 100-30431 100-30432	10.6 – 50 l/min 2 – 50 l/min 	Triclamp 1”		
1e	LFS-20SU.1-Z LFS-20SU.1-Z-G25 [1] LFS-20SU-Z-SC1 LFS-20SU-Z-SC1-G25 [1]	100-30483 100-30484 100-30464 100-30465	18.8 – 80 l/min 3.2 – 80 l/min 	Triclamp 1”		*Firmware revision requirements for converters:* *LFC-1C-PC -> Rev24 or higher* *LFC-6CIO-PC -> Rev07 or higher*

Table 4: *Standard flow sensor configurations*

Note 1: Gamma irradiated with dosage > 25 kGy.

Pos.	Part Name	Part #	Description	Interfaces
2	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 (9) for flow sensor cable included in converter package.*
3 (A+B)	LFC-6CIO-PC	100-30446	6-Channel Converter with I/O Interfaces (Digital I/O connector 3a and analog output connector 3b included)	RS485 (MODBUS) protocol 6 analog outputs (4 – 20 mA), 6 digital inputs, 6 digital outputs Order Bus Conn. (8a) and Termination Box (8b) as separate article. *Note 1: EMI ferrite (9) for bus connection to be ordered as separate article. When stacking multiple converters every sensor cable needs the same EMI ferrite (9).*
4 (A-H)	LFC-1C-PC-SK	100-91072	Converter Starter Kit	Flow converter LFC-1C-PC (A) with Ferrite (B), AC/DC desktop supply (C) with international AC mains inserts, sensor cable LFI-C.1-30 (D), converter connection cable LFI-D.1 (E), RS485/USB cable YN-485I-TR (F), USB stick with Levitronix Service Software and product Literature (G).

Table 5: *LEVIFLOW® converters*

Pos.	Part Name	Part #	Features	Special Feature / Description
5a	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.
5b	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.
6	YN-485I-TR, USB to RS485 Adaptor-TR Isolated	100-30392	Structure/Design Purpose	USB connector (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 converter with PC.
7a 7b 7c 7d	Mounting Bracket LMK-1.2 Mounting Bracket LMK-2.2 Mounting Bracket LMK-3.2 Mounting Bracket LMK-4.2	100-91478 100-91479 100-91480 100-91481	Sensor compatibility Material / Sensor Fixation	For LFS-03SU and LFS-06SU. For LFS-10SU. For LFS-15SU For LFS-20SU. Anodized Aluminum / Locking pin concept
8a	Connector Box for LFC-6CIO-PC	100-30447	COMBICON connector	For wiring RS485 and supply of stacks of LFC-6CIO-PC converter.
8b	Termination Box for LFC-6C	100-30317	--	For termination of RS485 bus of LFC-6CIO-PC.
9	LeviFlow Splitting Ferrite	100-30353	EMI filtering of DC supply	For LFC-6CIO-PC supply and bus needed. On flow sensor cables needed in case of stacking of multiple converters.

Table 6: *Accessories*

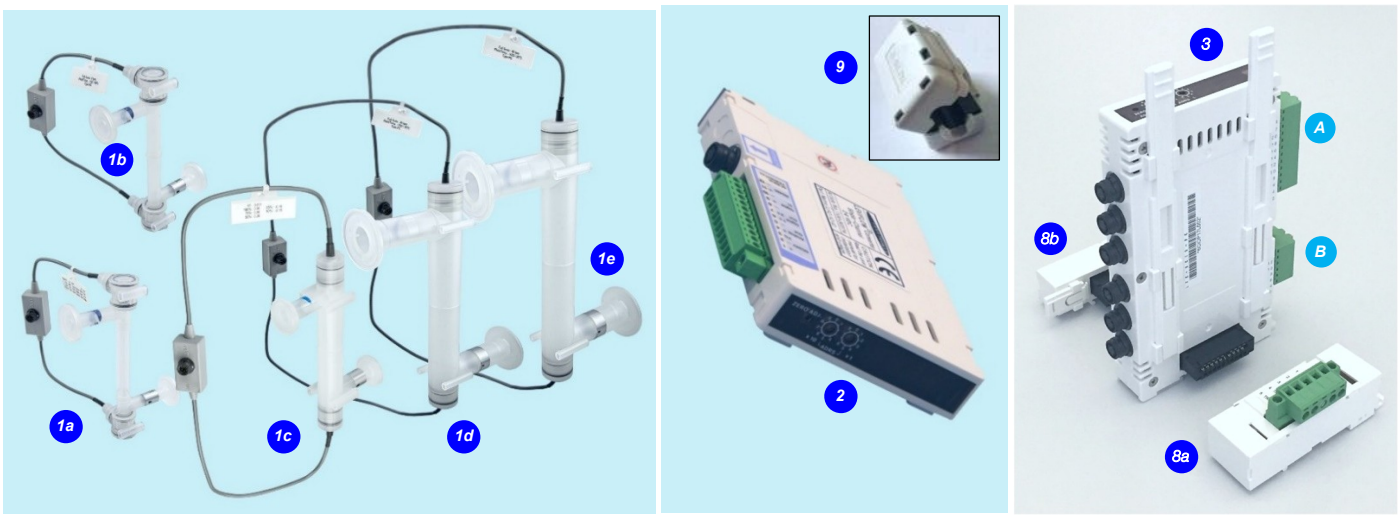


Figure 8: LEVIFLOW® flow sensors and converter

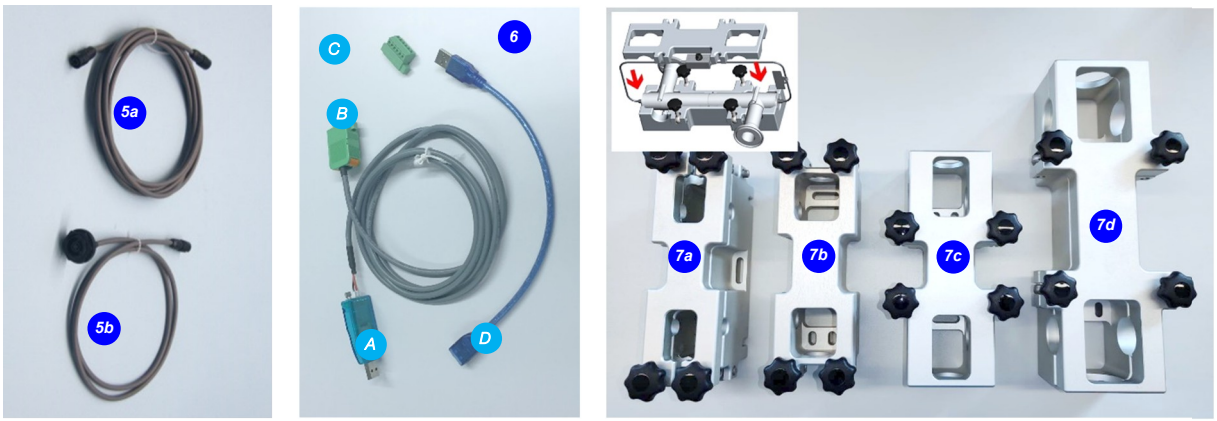


Figure 9: Accessories

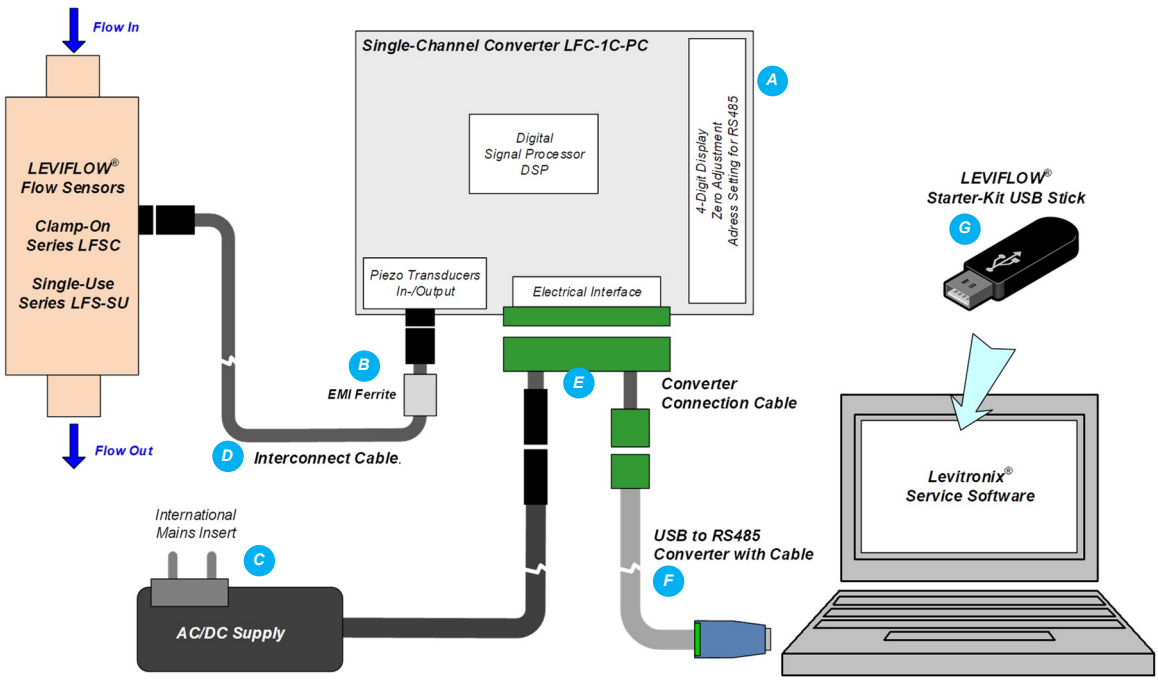


Figure 10: Converter starter kit (see Table 2 Position 4) with components

LEVITRONIX® THE COMPANY

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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