

# 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

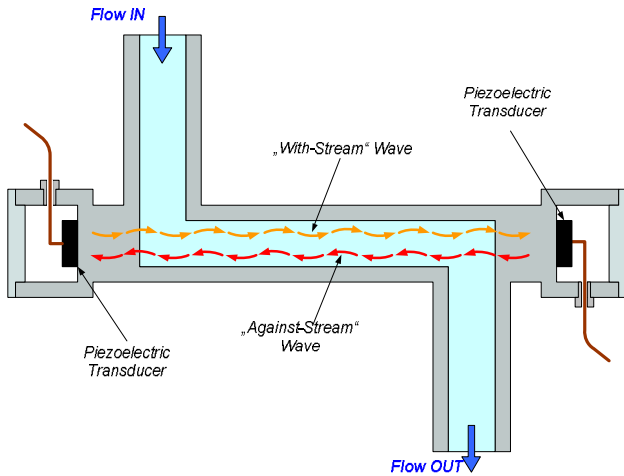


Figure 1: Operating principle of ultrasonic single-use sensor

## INTRODUCTION

The *LEVIFLOW*<sup>®</sup> 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*<sup>®</sup> 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*<sup>®</sup> Service Software is available at *Levitronix*<sup>®</sup> 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%) measurement with high turn-down ratio
- 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*<sup>®</sup> MagLev Pumps
- Easy integration into OEM equipment
- Easy configurable flow sensor parameters (PC software)
- Integrated and configurable totalizer function
- ATEX/IECEx flow sensor versions available.

## APPLICATIONS

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

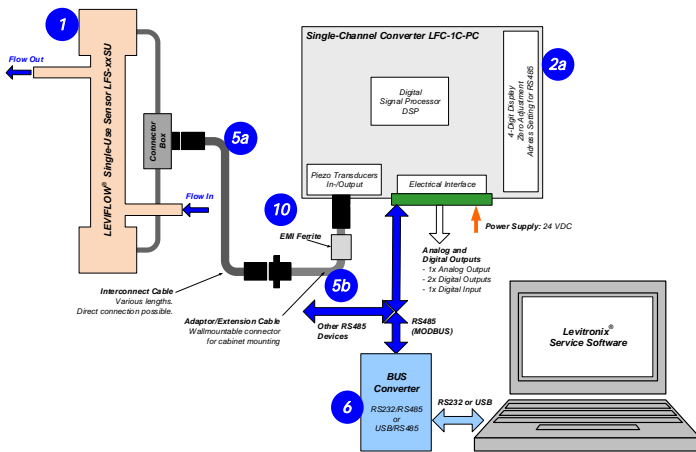


Figure 2: System configuration with single-channel converter for usage with *Levitronix*<sup>®</sup> Service Software.

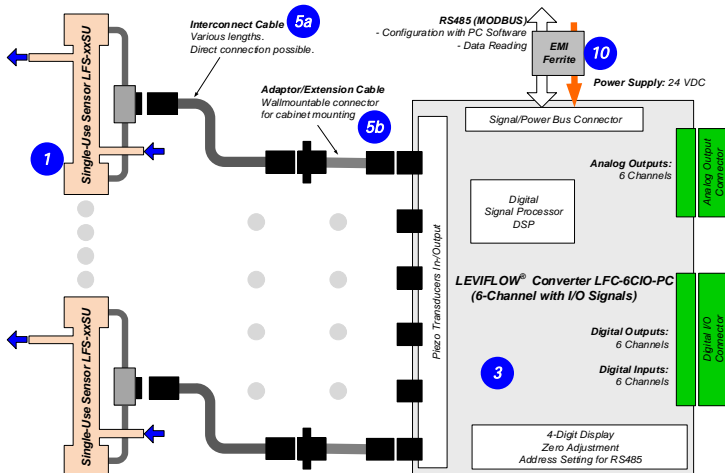
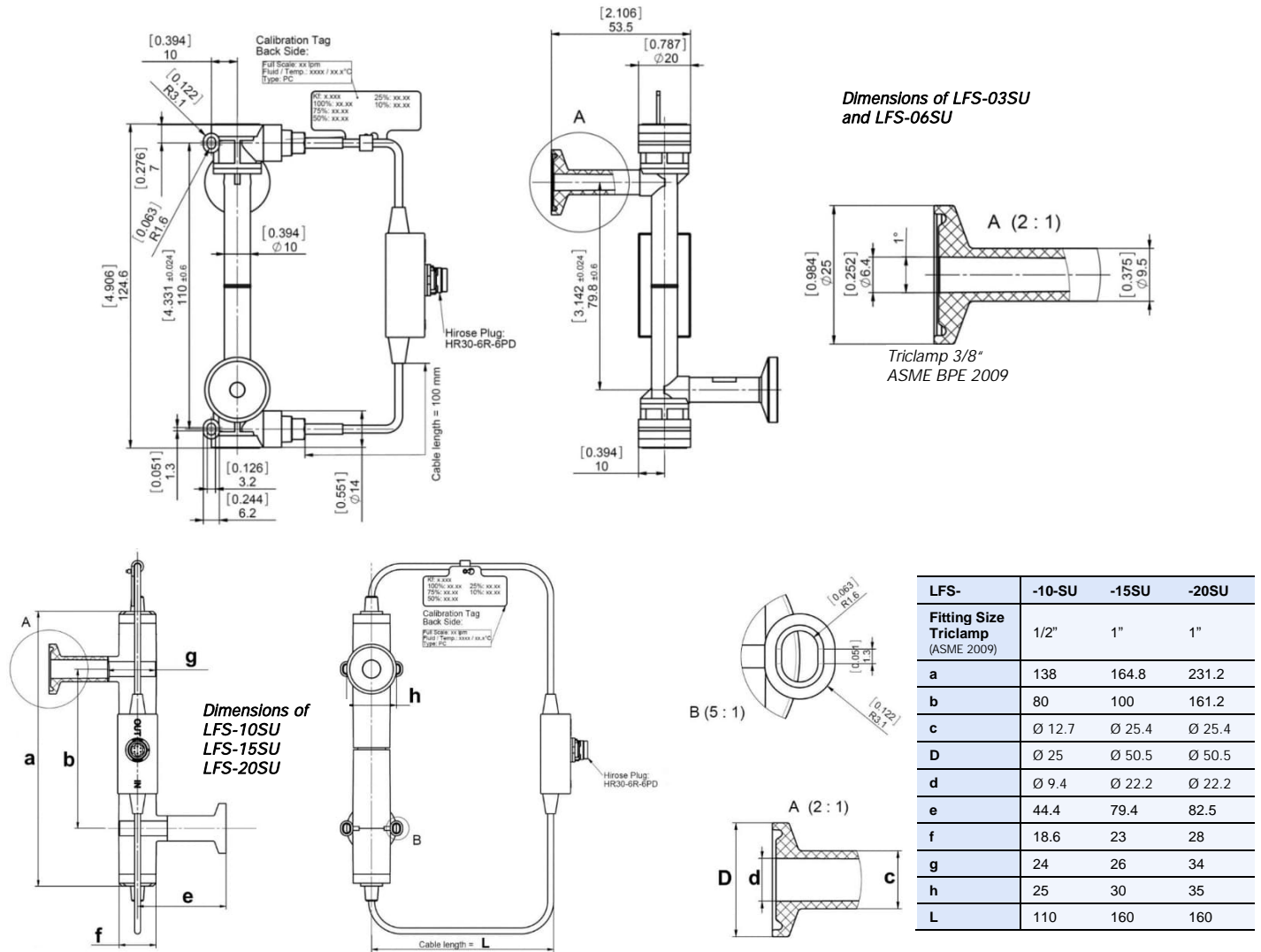


Figure 3: System configuration with multi-channel converter.

# SPECIFICATIONS

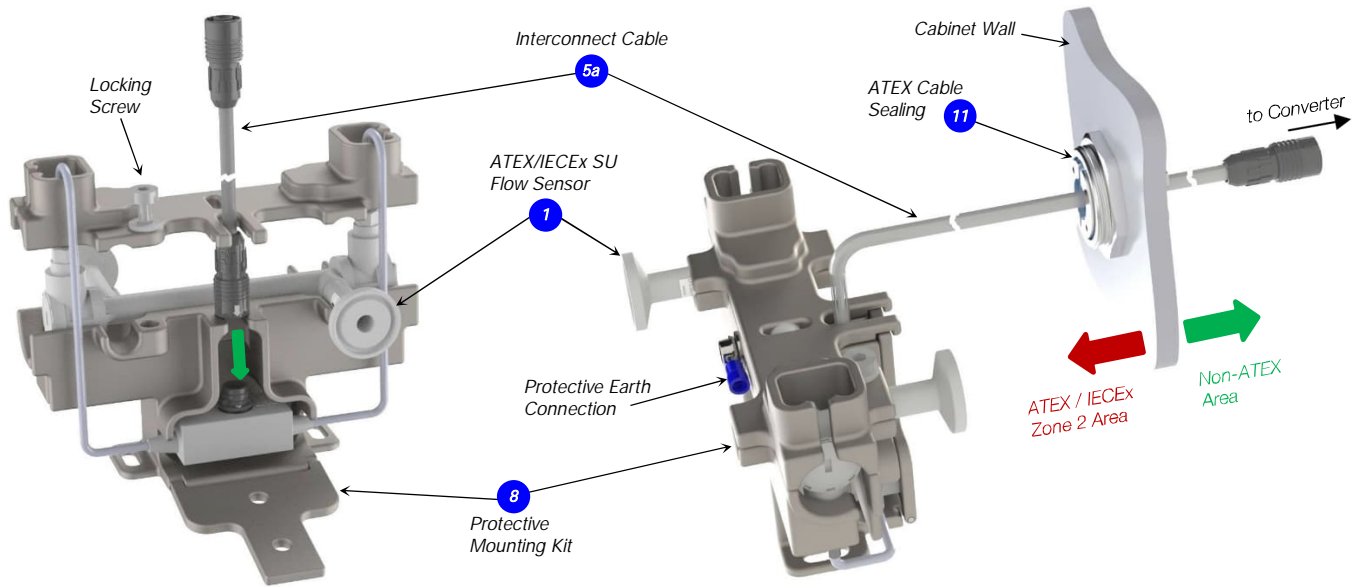
Sensor Type	LFS-03SU LFS-03SU-SC1	LFS-06SU LFS-06SU-SC1	LFS-10SU LFS-10SU-SC1	LFS-15SU LFS-15SU-SC1	LFS-20SU LFS-20SU-SC1
Characteristics					
Flow Range [lpm]	0 – 0.8	0 – 8	0 – 20	0 – 50	0 – 80
Triclamp Fitting Size	3/8" (ID = 6.4 mm)	3/8" (ID = 6.4 mm)	1/2" (ID = 9.4 mm)	1" (ID = 22.2 mm)	1" (ID = 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)



**Figure 4:** Basic dimensions for LFS-SU sensors

## SPECIFICATIONS

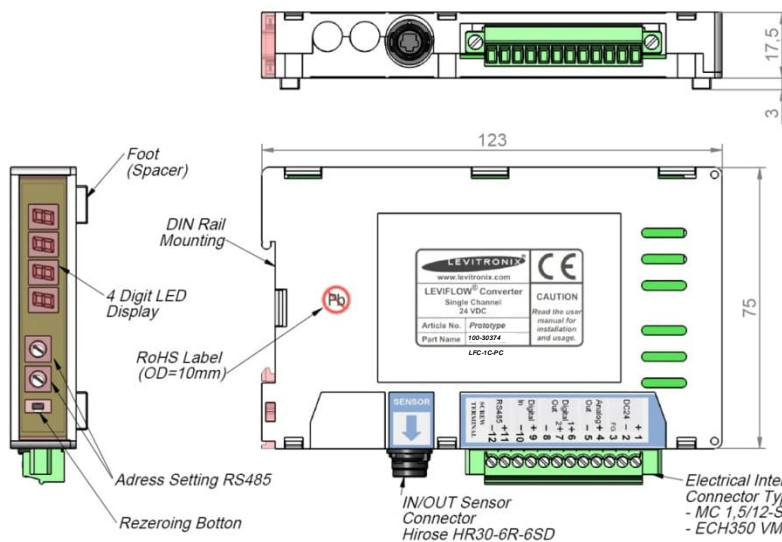


**Figure 5: ATEX/IECEx flow sensor configuration and components**

Note 1: Pictures shows LFS-03/06SU with LKM-1.3 mounting kit. Other sizes are similar. Detailed drawings with IFU can be requested at Levitronix®.

Characteristics	Description or Values
Power Supply / Current / Inrush (Start-Up) Current	24 VDC $\pm$ 10% / 150 mA / Peak of 3.8 A within 210 $\mu$ 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)	<ul style="list-style-type: none"> <li>- RS485 -&gt; MODBUS protocol -&gt; max. array of 99 channels</li> <li>- 1x Analog Output 4 – 20mA (0 – 20mA configurable)</li> <li>- 2x Digital Outputs: Flow Alarm, Measurement Error, Volume Counter Pulse, Volume Counter Alarm, Flow as Frequency or Bubble Detection (default: normally open)</li> <li>- 1x Digital Input: Volume Counter Reset or Zero Adjust</li> <li>- 4 Digit display (flow rate, error codes), re-zero button</li> <li>- Address potentiometers for RS485 address setting</li> </ul>
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 / Dimensions	130 g / 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%
2	DC24V-	Current: 150 mA
3	FG	Starting: 4.4 A, 2ms
4	Analog Out +	Field Ground
5	Analog Out -	4 - 20 mA
6	Digital Out1 +	(0 - 20 mA configurable)
7	Digital Out2 +	Load Resistance < 600 Ohm
8	COM	Max. rating: DC30V, 20mA (open collector)
9	Digital In+	Various configurable options available depending on firmware
10	Digital In-	No-voltage contact or transistor open collector
11	RS485 +	Various configurable options available depending on firmware
12	RS485 -	RS485 with MODBUS Protocol

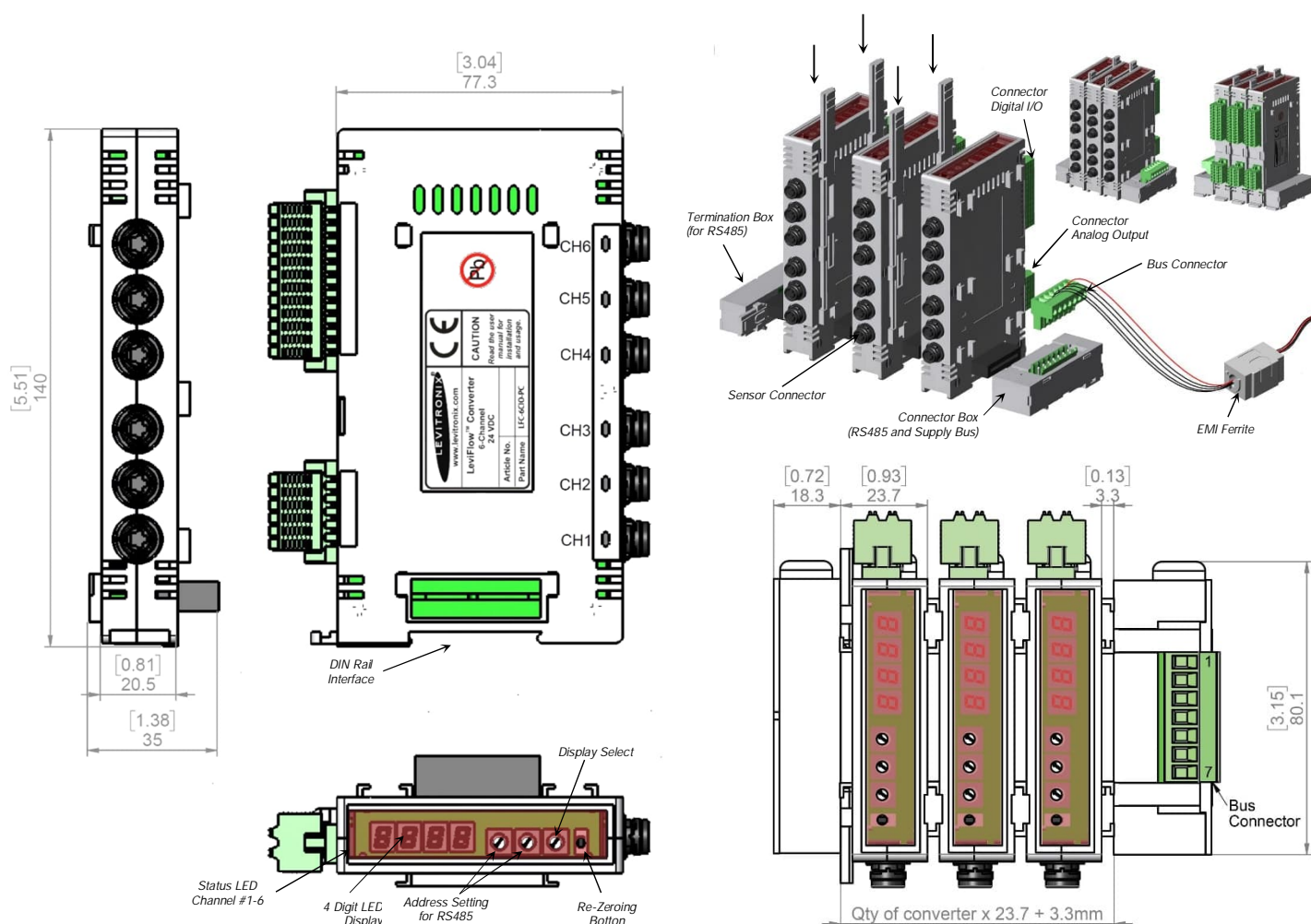
**Figure 6: Dimensions and layout of interfaces of single channel converter LFC-1C-PC**



## SPECIFICATIONS



Characteristics	6-Channel Converter Type LFC-6CIO-PC
Power Supply / Current / In-Rush (Start) Current	24 VDC $\pm$ 10% / 270 mA / Peak 4.9 within 210 $\mu$ s
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	<ul style="list-style-type: none"> <li>- RS485 -&gt; MODBUS protocol -&gt; max. array of 99 ch.</li> <li>- Stacking of max. 16 converters -&gt; 5 ms DSP process/time per channel</li> <li>- 4 Digit display (flow rate, error codes), re-zero button</li> <li>- Address potentiometers for RS485 address setting</li> <li>- 6x Analog Outputs: 4 – 20mA (0 – 20mA configurable)</li> <li>- 6x Digital Outputs: Flow Alarm, Measurement Error, Volume Counter Pulse, Volume Counter Alarm, Flow as Frequency or Bubble Detection (default: normally open)</li> <li>- 6x Digital Input: Volume Counter Reset or Zero Adjust</li> </ul>
Configuration Parameters (Available and configurable with RS485/USB converter and service software)	<ul style="list-style-type: none"> <li>- Viscosity</li> <li>- Low Cutoff</li> <li>- Dampening constant (filter)</li> <li>- Full scale setting</li> <li>- Linearization (15 points)</li> <li>- Alarm Outputs (High and Low Alarm)</li> <li>- Volume Counter and Volume Counter Alarm Settings</li> </ul>
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 converter LFC-6CIO-PC

## ORDER INFORMATION

Pos.	Part Name	Article #	1% Accuracy Flow Range	Fitting	Note
1a	LFS-03SU-Z	100-30375	35 – 800 ml/min	Triclamp 3/8"	<p>The LFS-xxSU-Z-Ex sensors are ATEX/IECEx certified and can be placed in Zone 2 explosive atmosphere. Specific mounting kits (see Table 6 Pos 8) are needed for sensor protection. An ATEX/IECEx certified cable sealing system (see Table 6 Pos. 11) is necessary for the sensor cable to leave the Zone 2 area. The sensors have the following marking:</p> <p>CE  II 3G Ex ec mc IIC T6 Gc</p> <p>CE  II 3D Ex mc tc IIIC T80°C Dc</p>
	LFS-03SU-Z-G25 <sup>1</sup>	100-30399			
	LFS-03SU-Z-SC1	100-30418	6 – 800 ml/min		
	LFS-03SU-Z-SC1-G25 <sup>1</sup>	100-30419			
	LFS-03SU-Z-SC1-Ex	100-30514			
1b	LFS-06SU-Z	100-30377	1.7 – 8 l/min	Triclamp 1/2"	
	LFS-06SU-Z-G25 <sup>1</sup>	100-30400			
	LFS-06SU-Z-SC1	100-30394	0.075 – 8 l/min		
	LFS-06SU-Z-SC1-G25 <sup>1</sup>	100-30406			
	LFS-06SU-Z-SC1-Ex	100-30515			
1c	LFS-10SU-Z	100-30397	4.7 – 20 l/min	Triclamp 1/2"	
	LFS-10SU-Z-G25 <sup>1</sup>	100-30405			
	LFS-10SU-Z-SC1	100-30408	0.75 – 20 l/min		
	LFS-10SU-Z-SC1-G25 <sup>1</sup>	100-30416			
	LFS-10SU-Z-SC1-Ex	100-30516			
1d	LFS-15SU-Z	100-30412	10.6 – 50 l/min	Triclamp 1"	
	LFS-15SU-Z-G25 <sup>1</sup>	100-30111			
	LFS-15SU-Z-SC1	100-30431	2 – 50 l/min		
	LFS-15SU-Z-SC1-G25 <sup>1</sup>	100-30432			
	LFS-15SU-Z-SC1-Ex	100-30517			
1e	LFS-20SU.1-Z	100-30483	18.8 – 80 l/min	Triclamp 1"	
	LFS-20SU.1-Z-G25 <sup>1</sup>	100-30484			
	LFS-20SU-Z-SC1	100-30464	3.2 – 80 l/min		
	LFS-20SU-Z-SC1-G25 <sup>1</sup>	100-30465			
	LFS-20SU-Z-SC1-Ex	100-30518			

**Table 4: Standard flow sensor configurations**

Note 1: Gamma irradiated with dosage > 25 kGy.

Pos.	Part Name	Part #	Description	Note / Interfaces
2	LFC-1C-PC	100-30374	Single Channel Converter	Analog Output (4 – 20 mA), 2x Digital Output, 1x Digital Input, RS485 (MODBUS) 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), 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-4851-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- <b>10/30/60</b>	190-1030 <b>7/8/9</b>	Cable length: <b>1/3/6</b> m	Interconnect cable for connection between sensor and converter, PVC jacket
5b	LFE-C.2- <b>10/30/60</b>	190-1031 <b>0/1/2</b>	Cable length: <b>1/3/6</b> m	Extension cable with wall-mountable connector for cabinet mounting, PVC jacket. Delivered with protective dust cap on wall-mountable connector side.
6	YN-4851-TR, USB to RS485 Adaptor-TR Isolated	100-30392	Structure/Design	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).
7a	Mounting Bracket LMK-1.2	100-91478	Sensor compatibility	For LFS-03SU and LFS-06SU.
7b	Mounting Bracket LMK-2.2	100-91479		For LFS-10SU
7c	Mounting Bracket LMK-3.2	100-91480		For LFS-15SU
7d	Mounting Bracket LMK-4.2	100-91481		For LFS-20SU
			Material / Sensor Fixation	Anodized Aluminum / Screw type
8a	Mounting Bracket LMK-1.3	100-91624	Sensor compatibility	For LFS-03SU and LFS-06SU
8b	Mounting Bracket LMK-2.3	100-91625		For LFS-10SU
8c	Mounting Bracket LMK-3.3	100-91626		For LFS-15SU
8d	Mounting Bracket LMK-4.3	100-91627		For LFS-20SU
			Material / Sensor Fixation	Stainless Steel / Screw type
9a	Connector Box for LFC-6CIO-PC	100-30447	COMBICON connector	For wiring RS485 and supply of stacks of LFC-6CIO-PC converter.
9b	Termination Box for LFC-6C	100-30317	--	For termination of RS485 bus of LFC-6CIO-PC.
10	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.
11 (A-E)	ATEX Cable Sealing System ACS-A.2 (Roxtec)	100-91628	Sleeve/Nut (A), Gasket (B) Frame (C)	Stainless Steel and EPDM Roxylon (EPDM rubber) Note: Lubricant (D), measurement plates (E) and IFU are included.

**Table 6: Accessories**

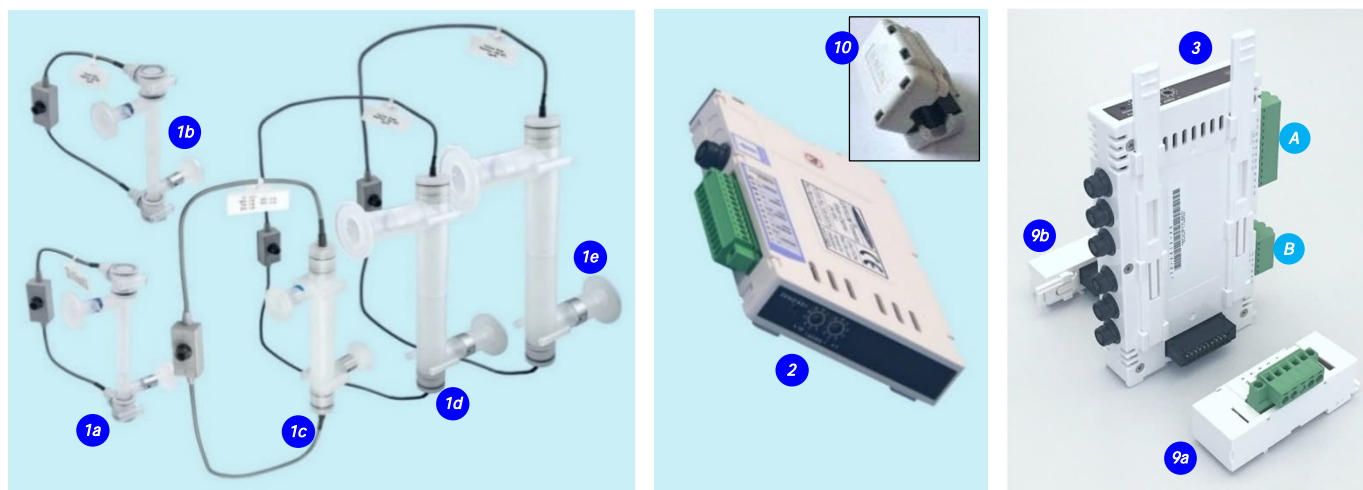


Figure 8: LEVIFLOW® flow sensors and converter



Figure 9: Accessories

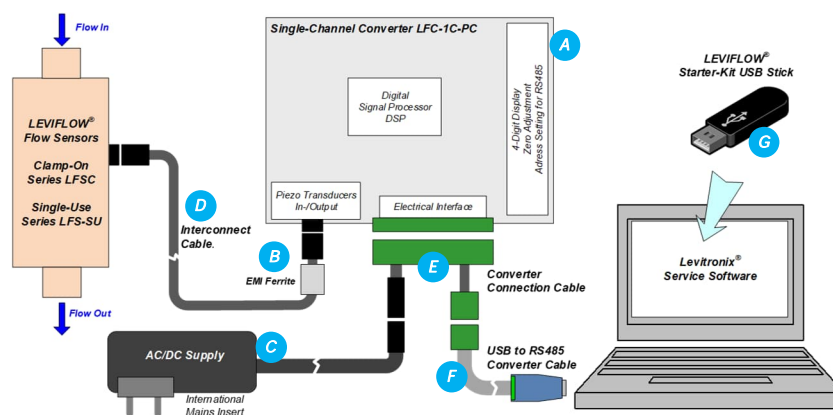


Figure 10: Converter starter kit (see Table 2 Position 4) with components

*Levitronix®* 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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