

Technical Information

Liquiphant M FTL51C

Vibronic

Point level switch for all kinds of liquids
with high corrosion-resistant coating



Application

The Liquiphant M is a point level switch for use in all liquids.

- for temperatures of $-50\text{ }^{\circ}\text{C}$ to $150\text{ }^{\circ}\text{C}$ (-58 to $302\text{ }^{\circ}\text{F}$)
- for pressure up to 40 bar (580 psi)
- for viscosities up to $10000\text{ mm}^2/\text{s}$ (cSt)
- for densities of $\geq 0.5\text{ g/cm}^3$ (SGU) or $\geq 0.7\text{ g/cm}^3$ (SGU)

The device functions reliably regardless of flow, turbulence, bubbles, foam, vibration, solids content or buildup, making the Liquiphant an ideal substitute for float switches.

All the wetted parts of the sensor (process connection, extension pipe and tuning fork) are coated in enamel or various synthetic materials, making the point level switch suitable for applications in very aggressive liquids.

International approvals certify use in hazardous areas.

Your benefits

- Use in safety systems requiring functional safety to SIL2/SIL3 in accordance with IEC 61508/IEC 61511-1
- Optimally adapted to the process with a wide range of materials for corrosion-resistant coating
- Large number of process connections to choose from
 - Flanges for various standards
 - Universal usage
- No adjustment: quick, low-cost startup
- No mechanically moving parts: no maintenance, no wear, long operating life
- FDA-approved material (PFA Edlon)

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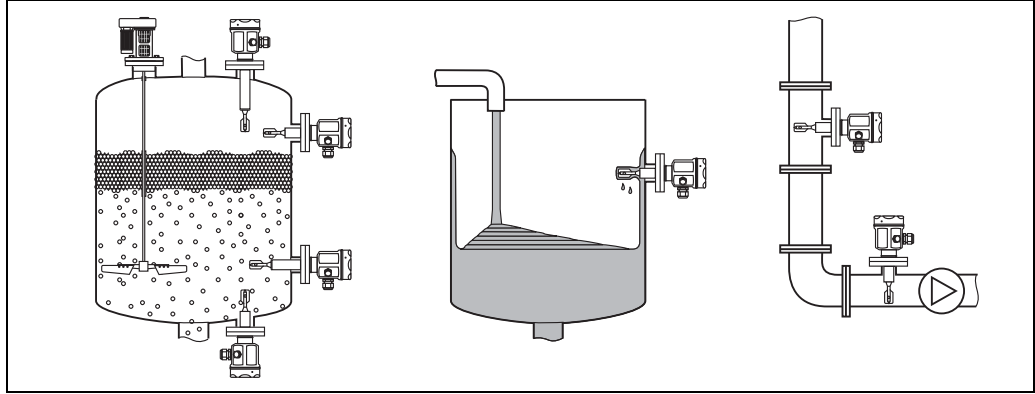
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Application

Point level detection

Maximum or minimum detection in tanks or pipes containing all kinds of liquids, including use in hazardous areas. Particularly suitable for very aggressive liquids that to high level of corrosion protection.



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Function and system design

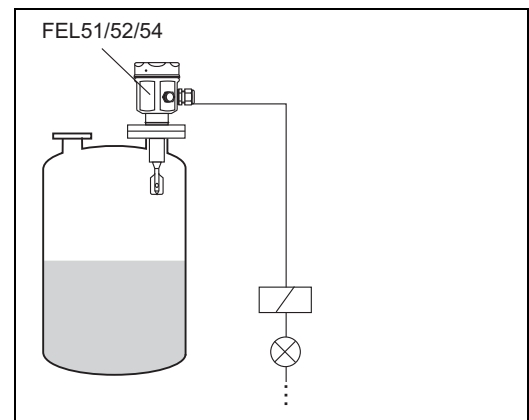
Measuring principle

The sensor's fork vibrates at its intrinsic frequency. This frequency is reduced when covered with liquid. This change in frequency causes the point level switch to switch.

Modularity

Point level switch

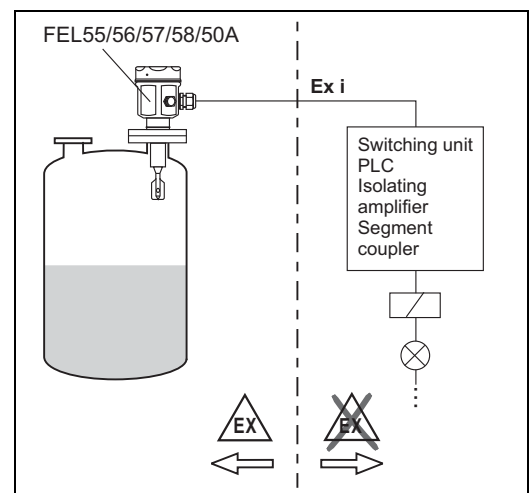
Liquiphant M FTL with electronic versions FEL51, FEL52, FEL54



L00-FTL51Cxx-15-05-xx-xx-000

Point level switch

Liquiphant M FTL with electronic versions FEL55, FEL56, FEL57, FEL58 for connecting to a separate switching unit or an isolating amplifier FEL50A for connecting to a PROFIBUS PA segment



L00-FTL51Cxx-15-05-xx-en-000

Electronic versions	<p>FEL51: Two-wire AC version; Switches the load directly into the power supply circuit via an electronic switch.</p> <p>FEL52: Three-wire DC version; Switches the load via the transistor (PNP) and separate connection e.g. in conjunction with programmable logic controllers (PLCs), DI modules as per EN 61131-2.</p> <p>FEL54: Universal current version with relay output; Switches the loads via 2 floating change-over contacts.</p> <p>FEL55: Signal transmission 16/8 mA on two-wire cabling e.g. in conjunction with programmable logic controllers (PLCs), AI modules 4 to 20 mA as per EN 61131-2.</p> <p>FEL56: For separate switching unit; signal transmission L-H edge 0.6 to 1.0 / 2.2 to 2.8 mA to EN 50227 (NAMUR) on two-wire cabling.</p> <p>FEL58: For separate switching unit; signal transmission H-L edge 2.2 to 3.5 / 0.6 to 1.0 mA to EN 50227 (NAMUR) on two-wire cabling. Checking of connecting cabling and other devices by pressing a key on the electronic insert.</p> <p>FEL57: For separate switching unit; PFM signal transmission; Current pulses superposed on the power supply along the two-wire cabling. Cyclical checking from the switching unit without changing levels.</p> <p>FEL50A: For connecting to PROFIBUS PA; Cyclic and acyclic data exchange acc. to PROFIBUS-PA Profile 3.0; Discrete Input.</p>
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Electronic version for density measurement	FEL50D: For connecting to Density Computer FML621
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Galvanic isolation	<p>FEL51, FEL52, FEL50A: between sensor and power supply</p> <p>FEL54: between sensor and power supply and load</p> <p>FEL55, FEL56, FEL57, FEL58, FEL50D: see connected switching unit</p>
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Design	FTL51C: Flange, extension pipe and tuning fork are coated.
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Input

Measured variable	Level (limit value)
Measuring range (detection range)	Depends on the mounting point or the length of the sensor with extension pipe. Up to 3000 mm (118 in) for synthetic coating, up to 1200 mm (47.2 in) for enamel coating
Density	Adjustment on the electronic insert > 0.5 g/cm ³ or > 0.7 g/cm ³ (other on request)

Electronic insert FEL51 (AC 2-wire)

Power supply

Supply voltage: AC 19 to 253 V
 Power consumption: < 0.83 W
 Residual current consumption: < 3.8 mA
 Short-circuit protection
 Overvoltage protection FEL51: overvoltage category III

Electrical connection

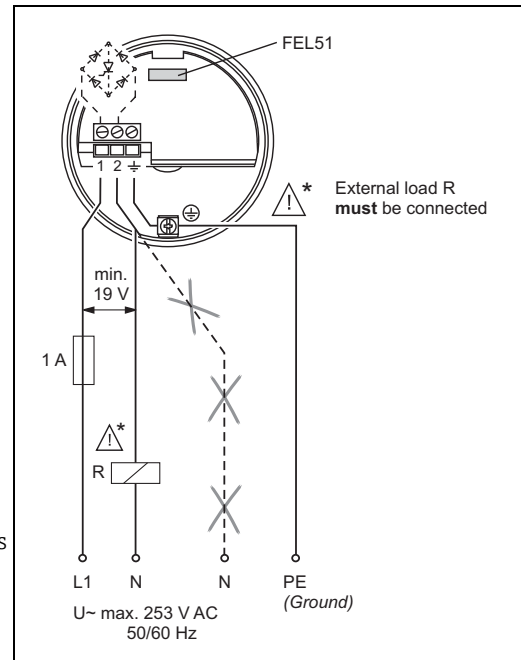
Two-wire AC connection

Switches the load directly into the power supply circuit via an electronic switch.

Always connect in series with a load!

Check the following:

- The residual current in blocked state (up to 3.8 mA)
- That for low voltage
 - the voltage drop across the load is such that the minimum terminal voltage at the electronic insert (19 V) when blocked is not undershot.
 - the voltage drop across the electronics when switched through is observed (up to 12 V)
- That a relay cannot de-energize with holding power below 3.8 mA.
 If this is the case, a resistor should be connected parallel to the relay. An RC module is available under the part number: 71107226
- When selecting the relay, pay attention to the holding power / rated power (see "Connectable load")



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Output signal

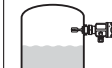


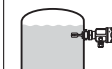





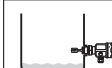


I_L = load current (switched through)

< 3.8 mA = residual current (blocked)

 = lit

 = unlit

L00-FTL2xxxx-07-05-xx-xx-000

Safety mode	Level	Output signal	LEDs	
			green	red
MAX		1 $\xrightarrow{I_L}$ 2		
		1 $\xrightarrow{< 3.8 \text{ mA}}$ 2		
MIN		1 $\xrightarrow{I_L}$ 2		
		1 $\xrightarrow{< 3.8 \text{ mA}}$ 2		

L00-FTL5xxxx-04-05-xx-xx-007

Signal on alarm

Output signal on power failure or in the event of damaged sensor: < 3.8 mA

Connectable load

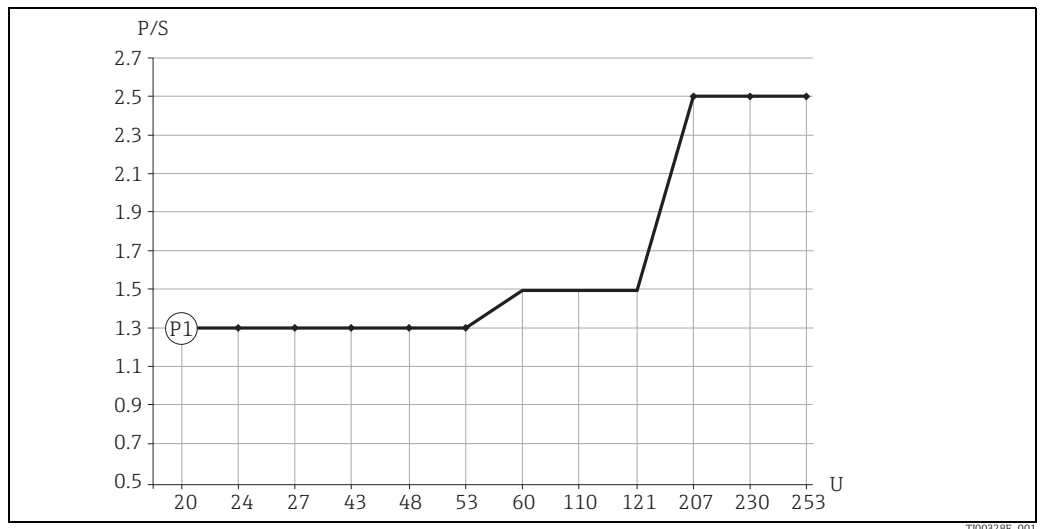
- Voltage drop via FEL51 ≤ 12 V
- Residual current if electrical switch is blocked: ≤ 3.8 mA
- Load switched directly into the power supply circuit via the thyristor.
 Transient (40 ms) ≤ 1.5 A, ≤ 375 VA at 253 V or ≤ 36 VA at 24 V (not short-circuit-proof)

The load is switched via an electronic switch directly in the power circuit.

Always connect in series with a load!

Not suitable for connection to low-voltage PLC inputs!

Selection guide for relays



Minimum nominal power of load
P/S nominal power in [W] / [VA]
U operating voltage in [V]

Position	Operating voltage	Nominal power	
		min.	max.
P1	24 V	> 1.3 VA	< 8.4 VA
AC operation	110 V	> 1.5 VA	< 38.5 VA
	230 V	> 2.5 VA	< 80.5 VA

Relays with less nominal power can be operated via an RC module connected in parallel (optional).

Electronic insert FEL52 (DC PNP)

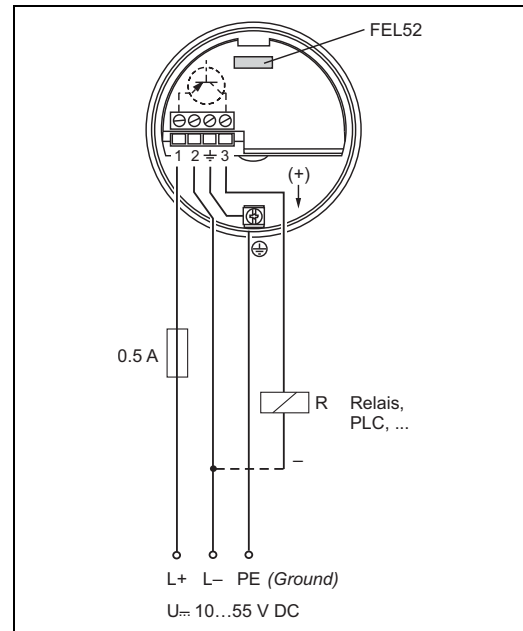
Power supply

Supply voltage: DC 10 to 55 V
 Ripple: ≤ 1.7 V, 0 to 400 Hz
 Current consumption: ≤ 15 mA
 Power consumption: ≤ 0.83 W
 Reverse polarity protection
 Overvoltage protection FEL52: overvoltage category III

Electrical connection

Three-wire DC connection

Switches the load via the transistor (PNP) and separate connection.
 Preferably used with programmable logic controllers (PLC), DI modules as per EN 61131-2.
 Positive signal at switching output of the electronics (PNP); Output blocked on reaching point level.



L00-FTL5xxxx-04-05-xx-xx-030

Output signal

I_L = load current (switched through)

$< 100 \mu A$ = residual current (blocked)

= lit

= unlit

L00-FTL2xxxx-07-05-xx-xx-000

Safety mode	Level	Output signal	LEDs	
			green	red
MAX		$L+ \xrightarrow{I_L} +$ 1 → 3		
		$1 \xrightarrow{< 100 \mu A} 3$		
MIN		$L+ \xrightarrow{I_L} +$ 1 → 3		
		$1 \xrightarrow{< 100 \mu A} 3$		

L00-FTL5xxxx-04-05-xx-xx-004

Signal on alarm

Output signal on power failure or in the event of damaged sensor: $< 100 \mu A$

Connectable load

- Load switched via the transistor and separate PNP connection, \leq DC 55 V
- Load current ≤ 350 mA (pulsed overload and short-circuit protection)
- Residual current $< 100 \mu A$ (with transistor blocked)
- Capacitance load $\leq 0.5 \mu F$ at 55 V, $\leq 1.0 \mu F$ at 24 V
- Residual voltage < 3 V (with transistor switched through);

Electronic insert FEL54 (AC/DC with relay output)

Power supply

Supply voltage: AC 19 to 253 V, 50/60 Hz or DC 19 to 55 V
 Power consumption: ≤ 1.3 W
 Reverse polarity protection
 Overvoltage protection FEL54: overvoltage category III

Electrical connection

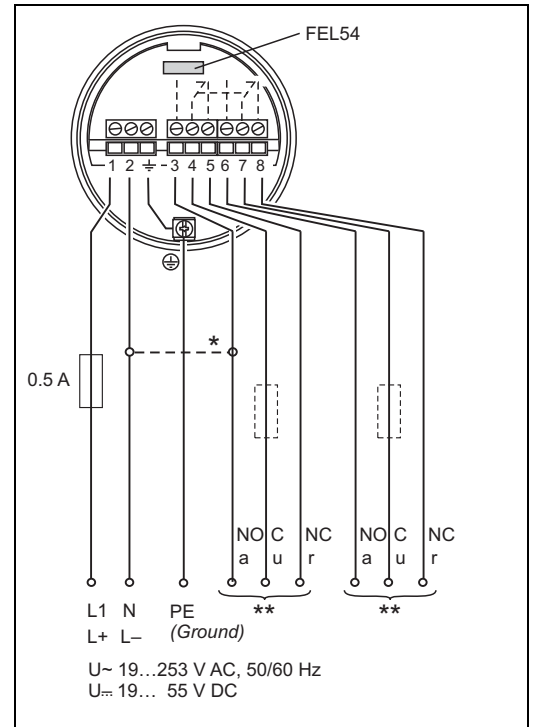
Universal current connection with relay output

Power supply:
 Please note the different voltage ranges for AC and DC.

Output:
 When connecting an instrument with high inductance, provide a spark arrester to protect the relay contact.
 A fine-wire fuse (depending on the load connected) protects the relay on short-circuiting.
 Both relay contacts switch simultaneously.

* When jumpered, the relay output works with NPN logic.

** See "Connectable load"



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Output signal

- = relay energized
- = relay de-energized
- = lit
- = unlit

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Safety mode	Level	Output signal	LEDs	
			green	red
MAX		 3 4 5 6 7 8		
		 3 4 5 6 7 8		
MIN		 3 4 5 6 7 8		
		 3 4 5 6 7 8		

L00-FTL5xxxx-04-05-xx-xx-002

Signal on alarm

Output signal on power failure or in the event of damaged sensor: relay de-energized

Connectable load

- Loads switched via 2 floating change-over contacts (DPDT)
- $I_{\sim} \leq 6$ A (Ex de 4 A), $U_{\sim} \leq$ AC 253 V; $P_{\sim} \leq 1500$ VA, $\cos \varphi = 1$, $P_{\sim} \leq 750$ VA, $\cos \varphi > 0.7$
- $I_{=}$ ≤ 6 A (Ex de 4 A) to DC 30 V, $I_{=} \leq 0.2$ A to 125 V
- When connecting a low-voltage circuit with double insulation according to IEC 1010, the following applies: the sum of the voltages of the relay output and power supply is ≤ 300 V
- The electronic insert FEL52 DC-PNP is preferred for low DC load currents (e.g. when connecting to a PLC)
- Relay contact material: silver/nickel AgNi 90/10

Electronic insert FEL55 (8/16 mA)

Power supply

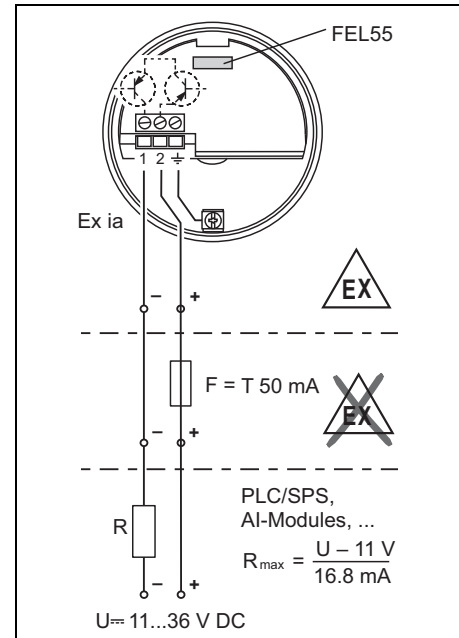
Supply voltage: DC 11 to 36 V
 Power consumption: < 600 mW
 Reverse polarity protection
 Overvoltage protection FEL55: overvoltage category III

Electrical connection

Two-wire connection for separate switching unit

For separate switching unit.
 Signal transmission 16/8 mA on two-wire cabling.
 For connection to programmable logic controllers (PLC) for example, AI modules 4 to 20 mA to EN 61131-2.
 Output signal jump from high to low current on point level.


Fuse required for non-Ex applications!
 Only use power units with safe galvanic isolation (e.g. SELV).



Output signal

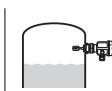


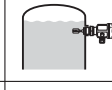


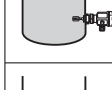


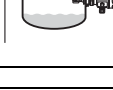


$$\sim 16 \text{ mA} = 16 \text{ mA} \pm 5 \%$$

$$\sim 8 \text{ mA} = 8 \text{ mA} \pm 6 \%$$

 = lit

 = unlit

L00-FTL2xxxx-07-05-xx-xx-000

Safety mode	Level	Output signal	LEDs	
			green	red
MAX		+ ~16 mA → 1		
		+ ~8 mA → 1		
MIN		+ ~16 mA → 1		
		+ ~8 mA → 1		

L00-FTL5xxxx-04-05-xx-xx-000

Signal on alarm

Output signal on power failure or in the event of damaged sensor: < 3.6 mA

Connectable load

- $R = (U - 11 \text{ V}) : 16.8 \text{ mA}$
- $U =$ connection voltage: DC 11 to 36 V (in wet environments DC 11 to 35 V)

Example: PLC with 250 Ω with 2-wire version

$$250 \Omega = (U - 11 \text{ V}) / 16.8 \text{ mA}$$

$$4.2 [\Omega / \text{A}] = U - 11 \text{ V}$$

$$U = 15.2 \text{ V}$$

Electronic insert FEL56 (NAMUR L-H edge)

Power supply

Supply voltage: DC 8.2 V \pm 20 %
 Power consumption: < 6 mW at I < 1 mA; < 38 mW at I = 2.8 mA
 Connection data interface: IEC 60947-5-6

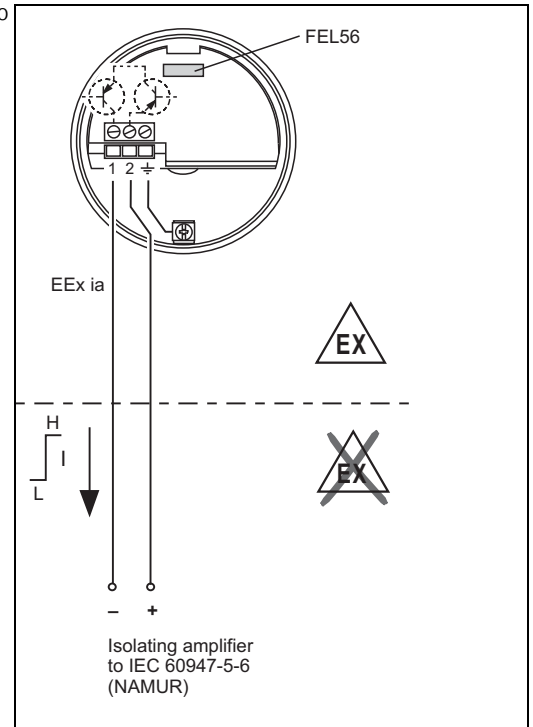
Electrical connection

Two-wire connection for separate switching unit

For connecting to isolating amplifiers according to NAMUR (IEC 60947-5-6), e.g. FTL325N from Endress+Hauser.
 Output signal jump from low to high current on point level.

(L-H edge)

Connecting to multiplexer:
 Set clock time to min. 2 s.



L00-FTL5xxxx-04-05-xx-en-004

Output signal

☀ = lit
 ⚡ = flashes
 ● = unlit

L00-FTL5xxxx-07-05-xx-xx-002

Safety mode	Level	Output signal	LEDs	
			green	red
MAX		+ 0.6 ... 1.0 mA 2 → 1	⚡	●
		+ 2.2 ... 2.8 mA 2 → 1	☀	☀
MIN		+ 0.6 ... 1.0 mA 2 → 1	⚡	●
		+ 2.2 ... 2.8 mA 2 → 1	⚡	☀

L00-FTL5xxxx-04-05-xx-xx-003

Signal on alarm

Output signal in the event of damaged sensor: > 2.2 mA

Connectable load

- See Technical Data of the isolating amplifier connected according to IEC 60947-5-6 (NAMUR)

Electronic insert FEL58 (NAMUR H-L edge)

Power supply

Supply voltage: DC 8.2 V \pm 20 %
 Power consumption: < 6 mW at I < 1 mA; < 38 mW at I = 3.5 mA
 Connection data interface: IEC 60947-5-6


Electrical connection

Two-wire connection for separate switching unit

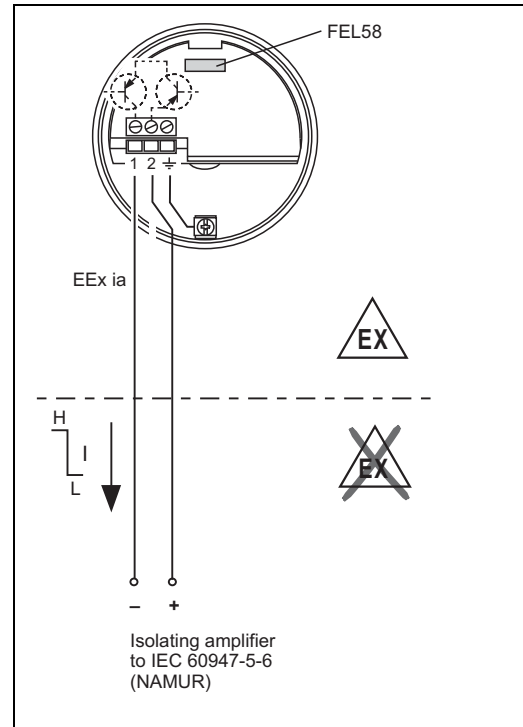
For connecting to isolating amplifiers as per NAMUR (IEC 60947-5-6), e.g. FTL325N, FTL375N from Endress+Hauser. Output signal jump from high to low current on point level.

(H-L edge)

Additional function:
 Test key on the electronic insert.
 Pressing the key breaks the connection to the isolating amplifier.

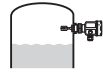


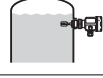


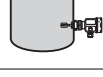





 **Note!**
 In Ex-d applications, the additional function can only be used if the housing is not exposed to an explosive atmosphere.




Connecting to multiplexer:
 Set clock time to min. 2 s.



L00-FTL5xxxx-04-05-xx-en-002

Output signal

Safety mode	Level	Output signal	LEDs green yellow
MAX		+ 2.2 ... 3.5 mA → 1	 
		+ 0.6 ... 1.0 mA → 1	 
MIN		+ 2.2 ... 3.5 mA → 1	 
		+ 0.6 ... 1.0 mA → 1	 

 = lit
 = flashes
 = unlit

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L00-FTL5xxxx-04-05-xx-xx-007

Signal on alarm

Output signal in the event of damaged sensor: < 1.0 mA

Connectable load

- See Technical Data of the isolating amplifier connected according to IEC 60947-5-6 (NAMUR)
- Connection also to isolating amplifiers which have special safety circuits (I > 3.0 mA)

Electronic insert FEL57 (PFM)

Power supply

Supply voltage: DC 9.5 to 12.5 V
 Current consumption: 10 to 13 mA
 Power consumption: < 150 mW
 Reverse polarity protection

Electrical connection

Two-wire connection for separate switching unit

For connecting to Endress+Hauser switching units Nivotester FTL320, FTL325P, FTL370, FTL372, FTL375P (also with proof test).

Output signal jump of the PFM signal from high to low frequency when sensor is covered. Switching between minimum/maximum safety in the Nivotester.

Additional function "cyclical checking":
 After interruption of the power supply, a test cycle is activated which checks the sensor and electronics without any change in level.

Approved for overfill protection acc. to WHG (German Water Resources Act).

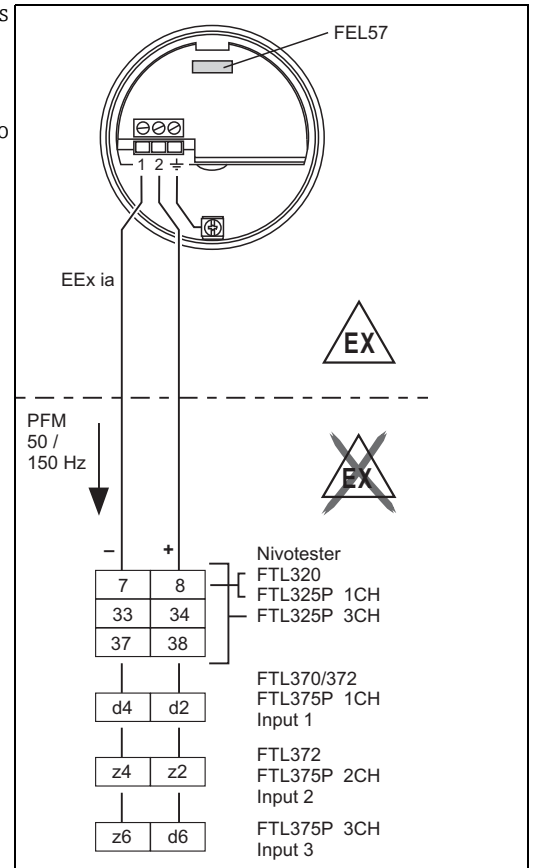
The following can be switched at the electronic insert:

– **Standard (STD):**

simulation approx. 8 s
 tuning fork exposed – covered – exposed.
 For proof testing, the Nivotester tests the sensor's level notification function.

– **Extended (EXT):**

Simulation approx. 41 s: tuning fork exposed – covered – alarm – exposed.
 For proof testing, the Nivotester tests the sensor's level notification function and fault notification (alarm) function.



L00-FTL5xxxx-04-05-xx-en-003

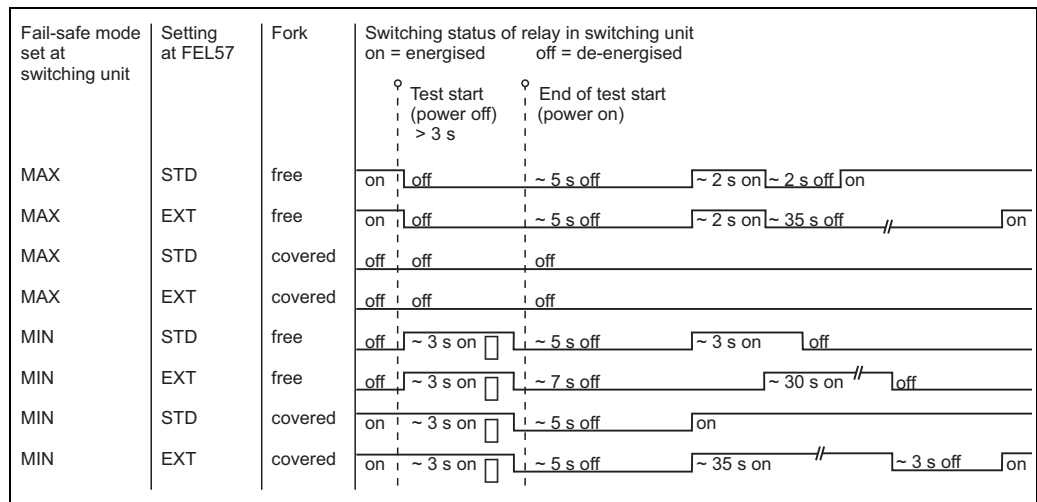
The check is activated and monitored at the switching unit.

The twin-core connecting cable (instrument cable) with a cable resistance of $\leq 25 \Omega$ per core is connected to the screw terminals (conductor cross-sections 0.5 to 2.5 mm / 0.02 to 0.1 in) in the connection compartment. Protective circuits against reverse polarity, HF influences and overvoltage peaks are installed.

Maximum cable length up to 1000 m (3281 ft).

A shielded connecting cable is recommended in the event of strong electromagnetic interference. Here the shielding must be connected to the sensor and the power supply.

Switching behavior of the connected device:



L00-FTL5xxxx-05-05-xx-en-000

* De-energized on power supply failure

Please note this switching response and function of the plant especially when replacing a Liquiphant incorporating electronic insert EL17Z or FEL37 with a Liquiphant M incorporating electronic insert FEL57.

Output signal

☀ = lit
● = unlit
L00-FTL2xxxx-07-05-xx-xx-000

Safety mode	Level	Output signal (PFM)	LEDs	
			green	yellow
		150 Hz	☀	☀
		50 Hz	☀	●

L00-FTL5xxxx-04-05-xx-xx-000

Signal on alarm

Output signal on power failure or in the event of damaged sensor: 0 Hz

Connectable load

- Floating relay contacts in the connected switching unit Nivotester FTL325P, FTL375P
- For contact load, see the Technical Data of the switching unit.

Electronic insert FEL50A (PROFIBUS PA)

Power supply

Bus voltage: DC 9 to 32 V

Bus current:

- 12.5 mA +/- 1.0 mA (software version: 01.03.00, hardware version: 02.00)
- 10.5 mA +/- 1.0 mA (software version: 01.03.00, hardware version: 01.00)

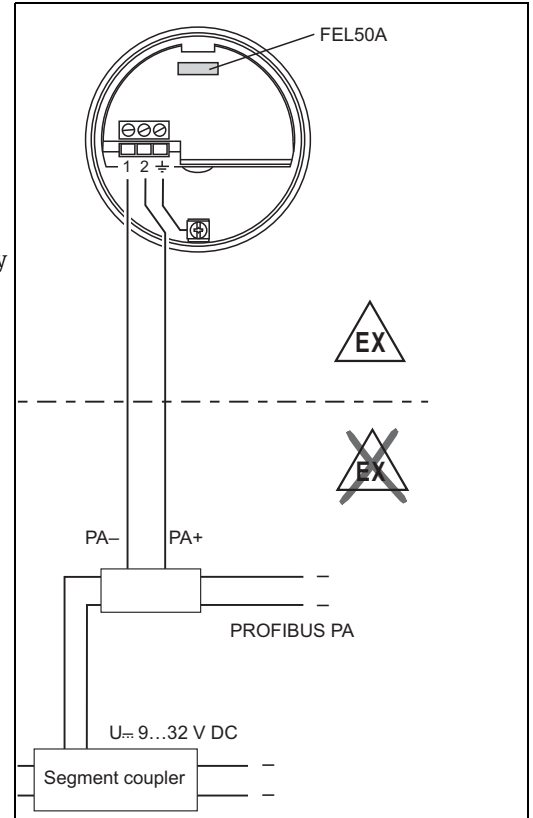
Electrical connection

Two-wire connection for power supply and data transfer

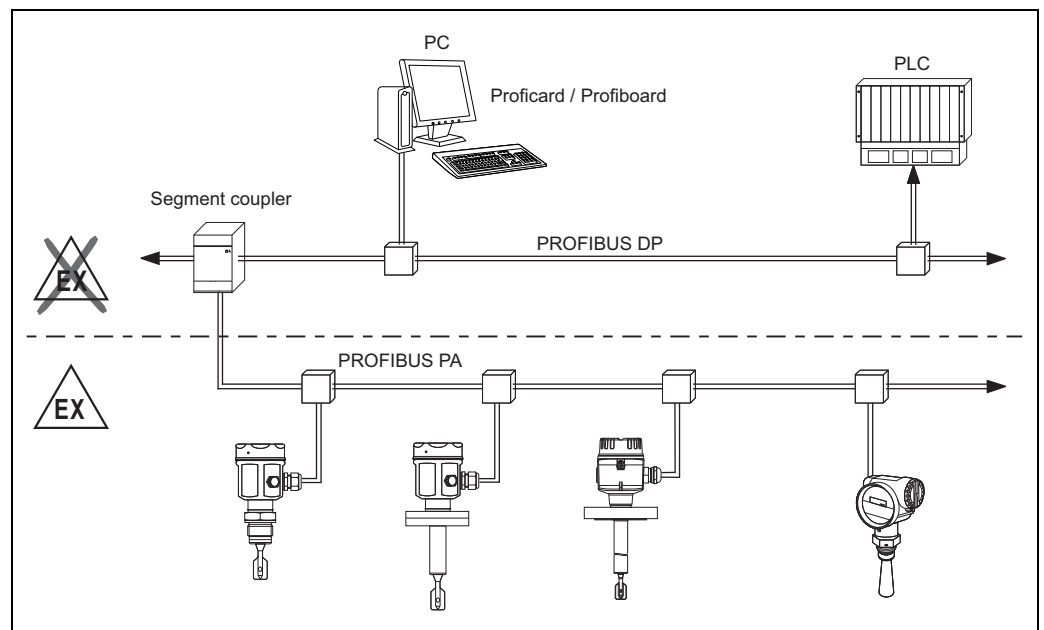
For connecting to PROFIBUS PA

Additional functions:

- Digital communication enables the representation, reading and editing of the following parameters:
Fork frequency, switch-on frequency, switch-off frequency, switch-on time and switch-off time, status, measured value, density change
- Matrix locking possible
- Switch to WHG mode possible (WHG approval)
- For a detailed description, see BA00198F



L00-FTL5xxxx-04-05-xx-en-005

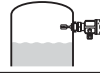
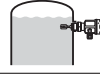
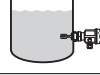
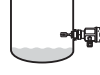


L00-FTL5xxxx-04-05-xx-xx-100

Output signal

☀ = lit
● = unlit

L00-FTL2xxxx-07-05-
xx-xx-000

Setting	Level	LEDs		FEL50A
		green	yellow	
not inverted		☀	●	OUT_D = 0 PA bus signal
		☀	☀	OUT_D = 1 PA bus signal
inverted		☀	☀	OUT_D = 0 PA bus signal
		☀	●	OUT_D = 1 PA bus signal

L00-FTL5xxxx-04-05-xx-xx-000

Signal on alarm

- Failure information can be opened using the following interfaces:
Yellow LED flashing, status code, diagnostic code; see BA00198F

Electronic insert FEL50D (density)

Power supply


Frequency range: 300 to 1500 Hz
 Signal level: 4 mA
 Pulse height: 16 mA
 Pulse width: 20 μ S

Electrical connection

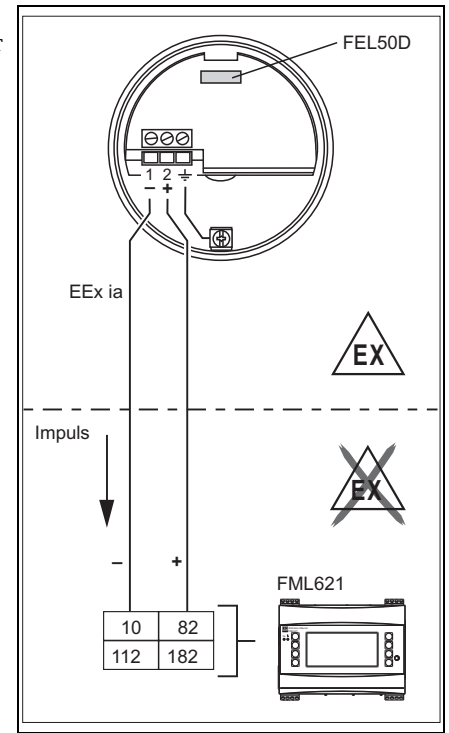
Two-wire connection at Density Computer FML621

For connecting to the density and concentration computer FML621.

The output signal is based on pulse technology. With the aid of this signal, the fork frequency is constantly forwarded to the switching unit.

 **Caution!**
 Operation with other switching units, such as FTL325P, is not permitted.

This electronic insert cannot be installed in devices that were originally used as a point level switch.



Signal on alarm

Output signal on power failure or in the event of damaged sensor: 0 Hz

Adjustment

In the Liquiphant M modular system, the option of an adjustment is also provided in addition to the electronics (see feature 60: "Accessories").

There are three types of adjustment:

Standard adjustment (see ordering information for additional options, basic version A)

- Here, two fork parameters are determined to describe the sensor characteristics, indicated in the adjustment report and provided with the product. These parameters must be transmitted to the Density Computer FML621.

Special adjustment (see ordering information for additional options, special adjustment, density H₂O (K) or special adjustment, density H₂O with 3.1 certificate (L))

- Here, three fork parameters are determined to describe the sensor characteristics, indicated in the adjustment report and provided with the product. These parameters must be transmitted to the Density Computer FML621. Greater accuracy is achieved with this type of adjustment (see also "Performance characteristics").

Field adjustment

- During field adjustment, a density value actually determined by the customer is entered and the system is automatically adjusted to this value (wet adjustment).

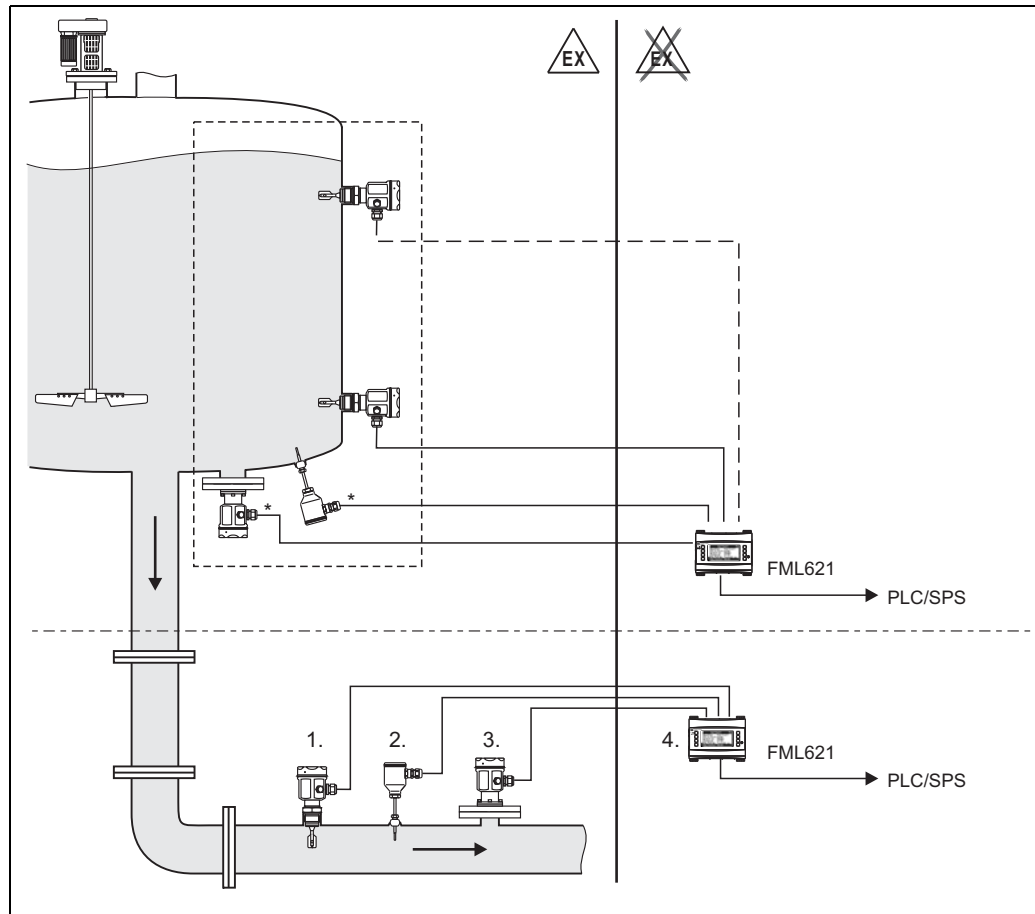


Note!

More information on Liquiphant M Density is available in Technical Information TI00420F. This document is available for download at www.endress.com => Download.

Operating principle

Measuring the density of a liquid medium in pipes and tanks. Also suitable for use in hazardous areas, and preferably for applications in the chemical and food industry.



* Pressure and temperature information required depending on the application.

1. Liquiphant M sensor with electronic insert FEL50D (pulse output);

2. Temperature sensor (e.g. 4 to 20 mA output);

3. Pressure transmitter (4 to 20 mA output);

4. Liquiphant density and concentration computer FML621 with display and operating unit

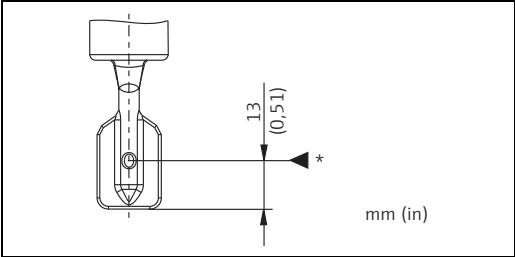
Light signals

LED	Symbol	Information
Yellow		Measurement valid
		Unstable process situation
		Maintenance required
Green		Power on
		Power off
Red		No fault
		Maintenance required
		Device failure

Connection and function

Connecting cables	<ul style="list-style-type: none"> Electronic inserts: cross-section $\leq 2.5 \text{ mm}^2$ (14 AWG); strand in ferrule as per DIN 46228 Protective ground in housing: cross-section $\leq 2.5 \text{ mm}^2$ (14 AWG) External equipotential bonding connection on housing: cross-section $\leq 4 \text{ mm}^2$ (12 AWG)
Safety mode	<p>Minimum/maximum residual current safety selectable on electronic insert (with FEL57 on Nivotester only)</p> <p>MAX = maximum safety: The output switches to the power fail response when the fork is covered For use with overflow protection for example</p> <p>MIN = minimum safety: The output switches to the power fail response when the fork is exposed For use with dry running protection for example</p>
Switching time	<p>When fork is covered: approx. 0.5 s When fork is exposed: approx. 1.0 s Additionally configurable for PROFIBUS PA: 0.5 to 60 s</p> <p>Other switching times available on request.</p>
Switch-on behavior	<p>When switching on the power supply, the output assumes the alarm signal. After ≤ 3 s it assumes the correct switching mode (exception: FEL57)</p>

Performance characteristics

Reference operating conditions	<p>Ambient temperature: 23 °C (73 °F) Medium temperature: 23 °C (73 °F) Medium density (water): 1 g/cm³ (SGU) Medium viscosity: 1 mm²/s (cSt) Medium pressure p_e: 0 bar (0 psi) Sensor mounting: vertical from above Density switch: to $> 0.7 \text{ g/cm}^3$ (SGU)</p>	 <p style="text-align: right; font-size: small;">L00-FTL5xxxx-06-05-xx-xx-031</p>
		* Switch point under reference operating conditions
Maximum measured error	Under reference operating conditions: max. +/-1 mm (0.04 in)	
Repeatability	0.1 mm (0.004 in)	
Hysteresis	<p>ECTFE and PFA: approx. 2 mm (0.08 in) Enamel: approx. 2.5 mm (0.1 in)</p>	
Influence of medium temperature	<p>ECTFE and PFA: max. +1.4 mm to -2.8 mm (-50 to +120 °C / -58 to 248 °F) Enamel: max. +0.6 mm to -1.5 mm (-50 to +150 °C / -58 to 302 °F)</p>	
Influence of medium density	<p>max. +4.8 mm to -3.5 mm ((0.5 to 1.5 g/cm³ (SGU)) max. +0.19 in to -0.14 in</p>	
Influence of medium pressure	<p>ECTFE and PFA: max. 0 mm to -2.0 mm (0 bar to 40 bar) max. 0 in to -0.08 in (0 psi to 580 psi) Enamel: max. 0 mm to -1.0 mm (0 bar to 25 bar) max. 0 in to -0.04 in (0 psi to 363 psi)</p>	
Switching delay	<ul style="list-style-type: none"> When fork is covered: 0.5 s 	

- When fork is exposed: 1.0 s
- Available on request: 0.2 s; 1.5 s or 5 s (when the tuning fork is covered or exposed)

Operating conditions

Installation instructions

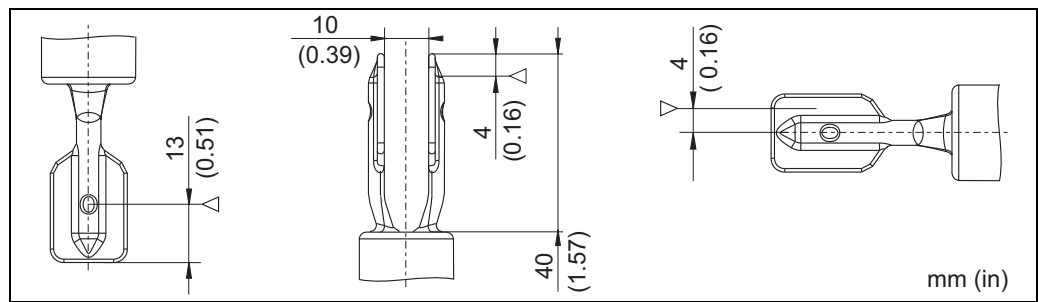
Switch points \triangleright on the sensor depend on the mounting position, with reference to water, Density 1 g/cm^3 (SGU), $23 \text{ }^\circ\text{C}$ ($73 \text{ }^\circ\text{F}$), p_e 0 bar (0 psi).



Note!

- The switch points of the Liquiphant **M** are at other positions to those of the previous version Liquiphant **II**.
- Minimum distance between the tip of the fork and the tank wall or pipe wall: 10 mm

Synthetic coating:

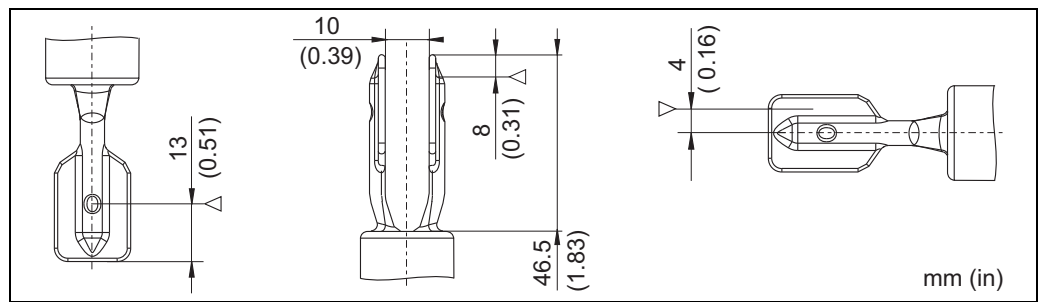


Mounting from above

Mounting from below

Mounting from the side

Enamel coating:



Mounting from above

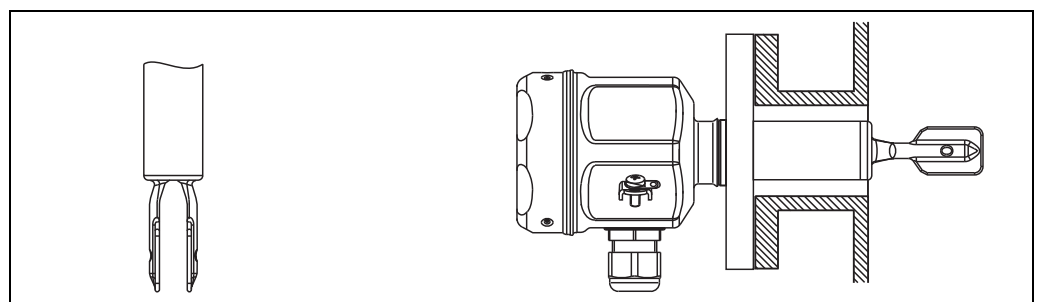
Mounting from below

Mounting from the side

Examples of mounting

Examples of mounting with regard to the viscosity ν of the liquid and the tendency to form buildup

Optimum mounting, without problem even with high viscosity:



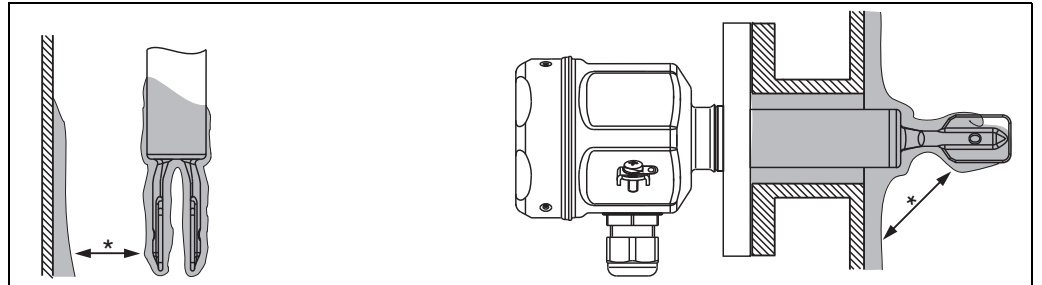
Vertical from above

Flush-mounted from the side

Position the fork so that the narrow edge of the tines is vertical to ensure that the liquid can run off easily.

With buildup on the tank walls:

* Ensure that there is sufficient distance between the buildup expected on the tank wall and the fork.

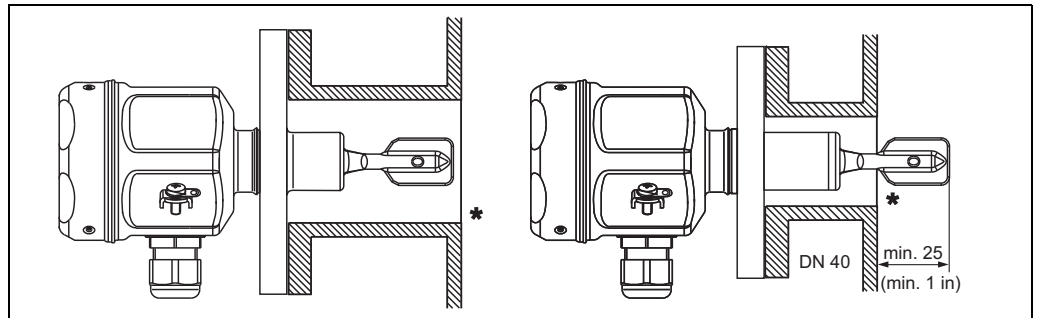


Vertical from above

Protruding into the tank from the side

L00-FTL51Cxx-11-05-xx-xx-003

Mounting positions with low viscosity (up to 2000 mm²/s):

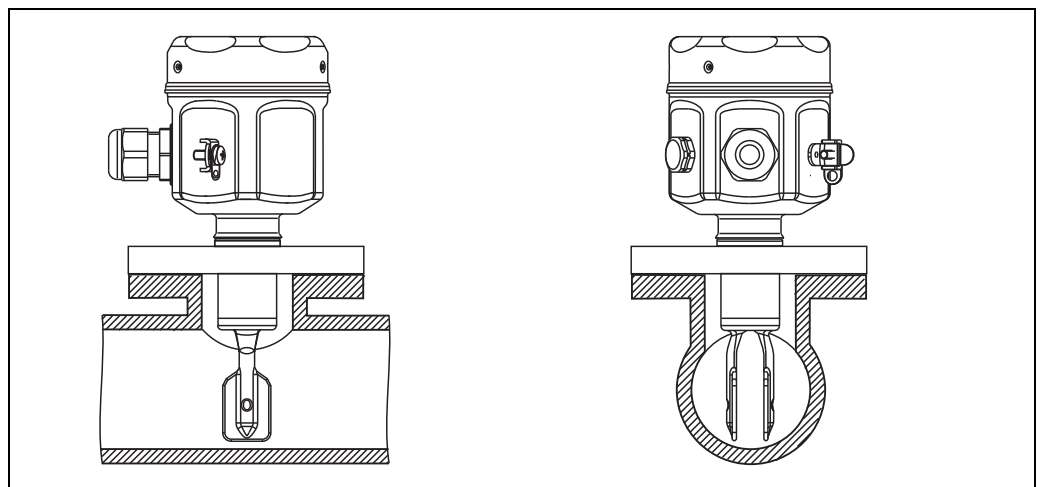


* Deburr the nozzle surfaces

L00-FTL51Cxx-11-05-xx-xx-004

Mounting in piping from 2"

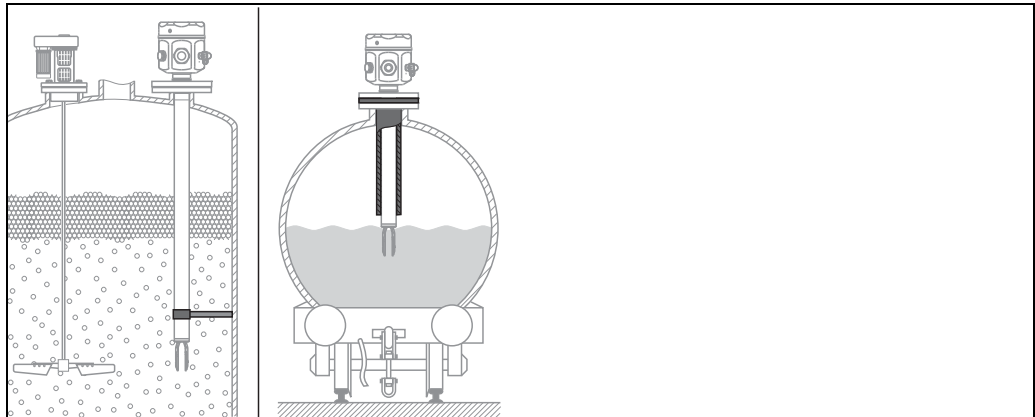
Flow velocities up to 5 m/s at a viscosity of 1 mm²/s (16.4 ft/s) and density of 1 g/cm³. (Check function for other medium conditions.)



L00-FTL51Cxx-11-05-xx-xx-005

Support the device in the event of a severe dynamic load.

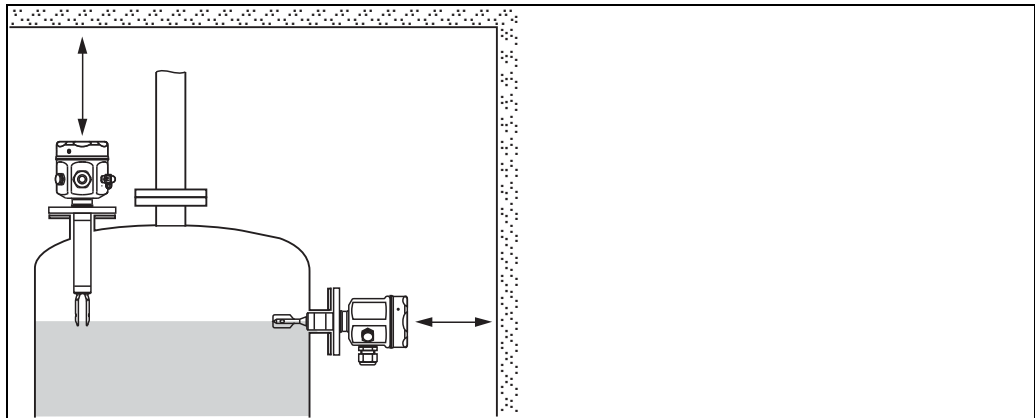
Support is possible only in conjunction with **ECTFE or PFA** synthetic coating.



L00-FTL5xxxx-11-05-xx-xx-005

Installation location

Ensure that there is adequate space outside the tank for mounting, connection and configuration.



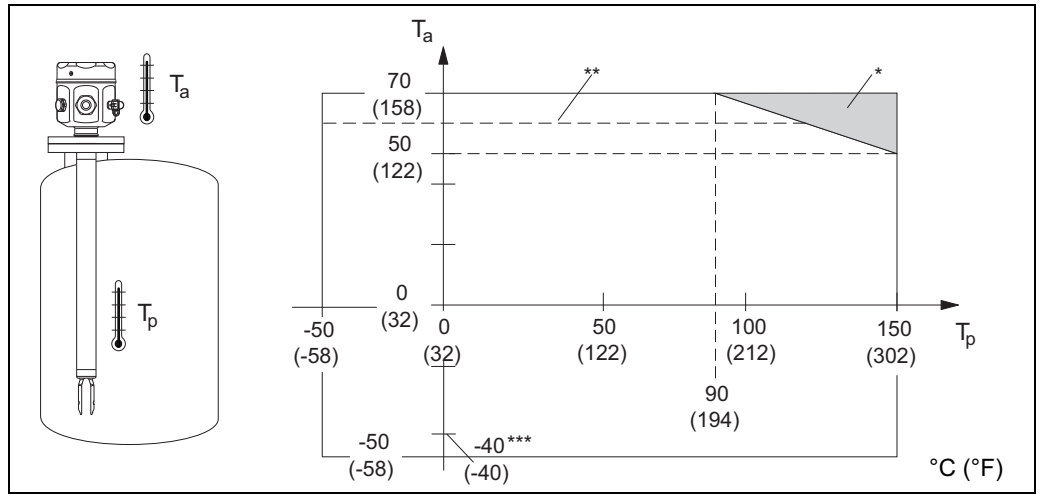
L00-FTL51Cxx-11-05-xx-xx-006

Orientation

FTL51C with short pipe up to approx. 500 (19.7 mm): any position
 FTL51C with long pipe, vertical

Environment

Ambient temperature range Permitted ambient temperature T_a at the housing depending on the medium temperature T_p in the tank:



- * Additional temperature range for devices with a temperature spacer or pressure tight feed-through.
- ** Maximum ambient temperature with FEL50D/FEL50A in hazardous areas.
- *** For F16 housing, the following applies: $-40\text{ °C} \leq T_a \leq +70\text{ °C}$ ($-40\text{ °F} \leq T_a \leq +158\text{ °F}$)

Storage temperature -50 to +80 °C (-58 to 176 °F)

Installation height as per IEC61010-1 Ed.3 Up to 2000 m (6600 ft) above sea level.
Can be extended up to 3000 m (9800 ft) above sea level if overvoltage protection is used, for example HAW562 or HAW569.

Climate class Climate protection to IEC 68, Part 2-38, Fig. 2a

Degree of protection


Types of housing	IP65	IP66*	IP67*	IP68*	IP69	NEMA type**
Polyester housing F16	-	X	X	-	-	4X
Stainless steel housing F15	-	X	X	-	-	4X
Aluminum housing F17	-	X	X	-	-	4X
Aluminum housing F13****	-	X	-	X***	-	4X/6P
Stainless steel housing F27	-	X	-	X	-	4X/6P
Aluminum housing T13 with separate connection compartment (Ex d)	-	X	-	X***	-	4X/6P

- * As per EN60529
- ** As per NEMA 250
- *** only with M20 cable entry or G1/2 thread
- **** F13 housing only in conjunction with XP or Ex d approval

Vibration resistance As per IEC 68, parts 2-6 (10 to 55 Hz, 0.15 mm (0.01 in), 100 cycles)

Electromagnetic compatibility Interference emission to EN 61326, Electrical Equipment Class B
Interference immunity to EN 61326; Annex A (Industrial) and NAMUR Recommendation NE 21 (EMC)

Medium conditions

Medium temperature	ECTFE: -50 °C to +120 °C (-58 °F to +248 °F) PFA: -50 °C to +150 °C (-58 °F to +302 °F) up to 230 °C (446 °F) special product on request Enamel: max. -50 °C to +150 °C (-58 °F to +302 °F) up to 200 °C (392 °F) special product on request
Thermal shock	≤ 120 °C/s (248 °F/s)
Medium pressure p_e	<p>The following values apply over the entire temperature range. Pay attention to exceptions for flange process connections!</p> <ul style="list-style-type: none"> ▪ ECTFE and PFA: -1 to +40 bar (-14.5 to 580 psi) ▪ Enamel: max. -1 to +25 bar (-14.5 to 363 psi) <p>Please refer to the standards listed for the permitted pressure values of the flanges at higher temperatures:</p> <ul style="list-style-type: none"> ▪ pR EN 1092-1: 2005 With regard to their stability-temperature property, the materials 1.4435 and 1.4404 are identical and are grouped together under 13E0 in EN 1092-1 Tab. 18. The chemical composition of the two materials can be identical. ▪ ASME B 16.5a - 1998 Tab. 2-2.2 F316 ▪ ASME B 16.5a - 1998 Tab. 2.3.8 N10276 ▪ JIS B 2220 <p>The lowest value from the derating curves of the device and selected flange applies in each case. Canadian CRN approval: Additional details on maximum pressure values are available in the download area of the product page at "www.endress.com".</p>
Test pressure	<p>$p_e = 100$ bar (1450 psi):</p> <ul style="list-style-type: none"> ▪ ≤ 150 bar (2175 psi) or 1.5 times the medium pressure p_e) ▪ Sensor burst pressure at 200 bar (2900 psi) <p> Note! Device function is not available during pressure testing.</p>
Pressure shock	≤ 20 bar/s (≤ 290 psi)
State of aggregation	Liquid
Density	0.7 g/cm ³ (SGU) = delivery status 0.5 g/cm ³ (SGU) can be adjusted via switches
Viscosity	≤ 10,000 mm ² /s (cSt)
Solids content	≤ ø5 mm (0.2 in)
Lateral loading capacity	≤ 75 Nm

Mechanical construction



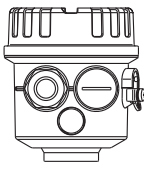
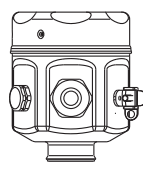
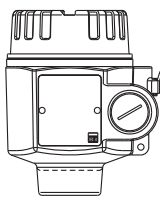
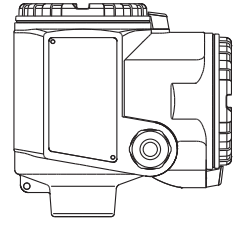
Note!

2D and 3D drawings containing individual dimensions can be generated and downloaded in the Configurator on the product pages of the Liquiphant FTL5x at www.endress.com.


Design

Summary of all electrical and mechanical versions

Housing

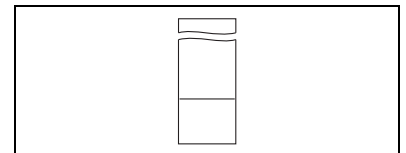
			
L00-FTL5xxxx-03-05-xx-xx-001	L00-FTL5xxxx-03-05-xx-xx-002	L00-FTL5xxxx-03-05-xx-xx-003	L00-FTL5xxxx-03-05-xx-xx-004
F16 Polyester (PBT)	F15 Stainless steel (316L)	F17/F13 Aluminum (also for EEx d), coated F27 Stainless steel (316L)	T13 Aluminum with separate connection compartment (also EEx de and EEx d), coated

Plug-in electronic inserts to mount in the housing

	<p>L00-FTL5xxxx-03-05-xx-xx-000</p> <p>FEL51: Two-wire AC connection FEL52: Three-wire DC connection PNP FEL54: Universal current connection, 2 relay outputs FEL55: Output 16/8 mA for separate switching unit FEL56: Output 0.6 to 1.0 / 2.2 to 2.8 mA for separate switching unit (NAMUR) FEL58: Output 2.2 to 3.5 / 0.6 to 1.0 mA for separate switching unit (NAMUR) FEL57: Output 150/50 Hz, PFM, for separate switching unit (Nivotester) FEL50A: Digital communication PROFIBUS PA FEL50D: Pulse output for Density Computer FML621</p>
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Bushings

Temperature spacer and pressure tight feed-through



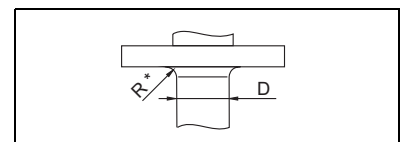
Process connections

Flanges* according to DIN/EN, ANSI, JIS from DN 40 / 1½"

* The following applies for DN 25/ANSI 1":

Pipe diameter (D) ≤ 24.2 mm, radius (R) ≤ 4 mm.

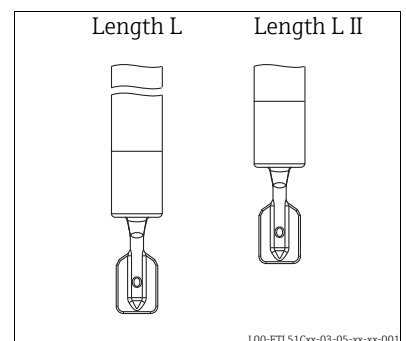
Take into account for counterflange!



Sensors

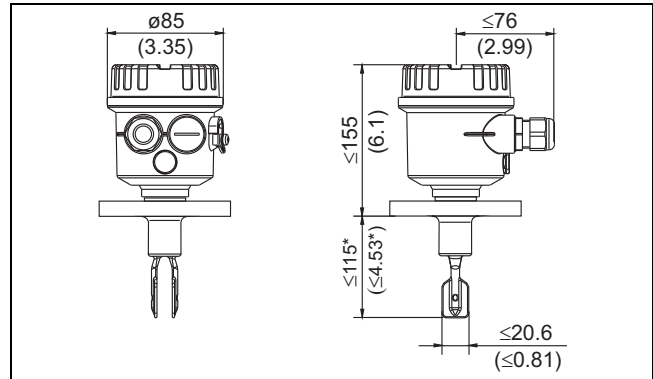
With extension pipe up to 3 m

or special "length L II" (see also Page 24)



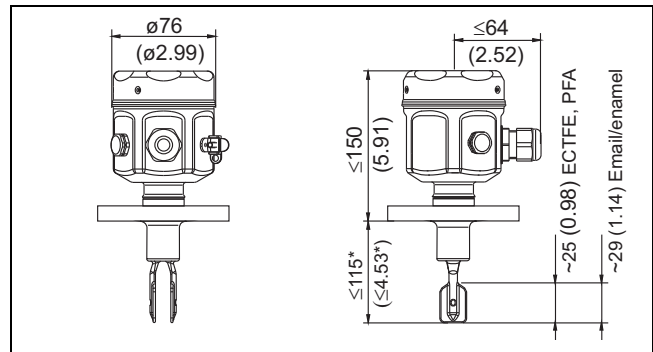
Dimensions (in mm)

Housing and sensor FTL51C
Polyester housing F16



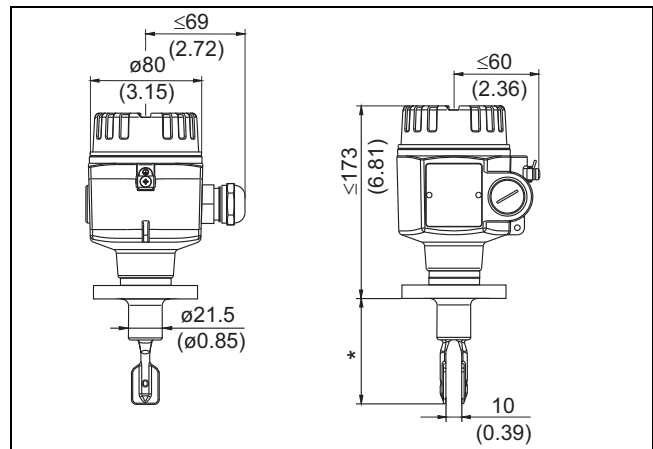
L00-FTL51Cxx-06-05-xx-xx-025

Stainless steel housing F15



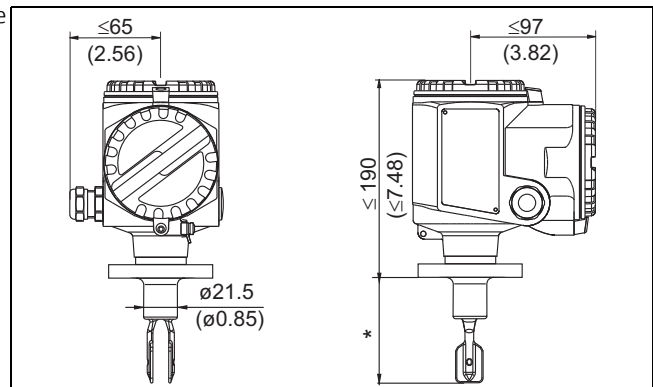
L00-FTL51Cxx-06-05-xx-xx-126

Aluminum housing F17/F13
Stainless steel housing (316L) F27



L00-FTL5xxxx-06-05-xx-xx-006

Aluminum housing T13 with separate connection compartment



L00-FTL5xxxx-06-05-xx-xx-007

* This length is customer-specific.



Note!

The switch points of the Liquiphant **M** are at other positions to those of the previous version Liquiphant **II**.

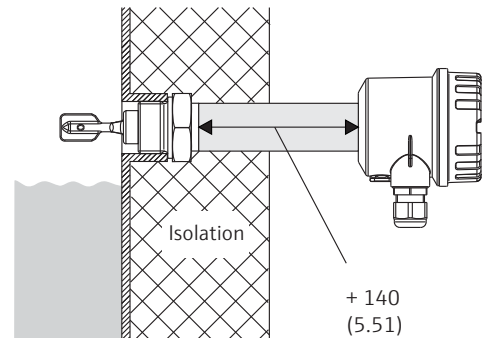
Bushings: temperature spacer, pressure tight feed-through

Temperature spacer

Provides sealed insulation for the vessel and normal ambient temperatures for the housing.

Pressure tight feed-through

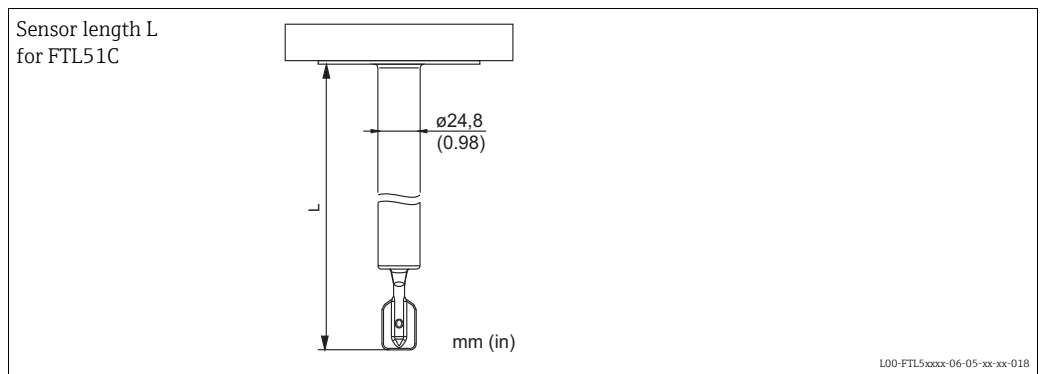
Protects the housing from vessel pressures up to 40 bar (580 psi) if the sensor is damaged. Provides sealed insulation for the vessel and normal ambient temperatures for the housing.



L00-FTL5xxxx-06-05-xx-xx-091

Process connections

Process connection	Dimensions	Accessories	Pressure Temperature
<p>Flanges:</p> <p>Synthetic coating ANSI B16.5 (RF) EN 1092-1 (Form A) JIS B 2220 (RF)</p> <p>Enamel coating ANSI B16.5 (RF) EN 1092-1 (Form B) JIS B 2220 (RF)</p>	<p>mm (in)</p> <p>L00-FTL51Cxx-06-05-xx-xx-024</p>	<p>For synthetic coating: seal made of PTFE supplied</p> <p>In event of enamel coating: Seal provided by the customer</p>	<p>See nominal pressure of flange, however</p> <p>For ECTFE: ≤ 40 bar ≤ 120 °C</p> <p>For PFA (Edlon*): ≤ 40 bar ≤ 150 °C</p> <p>For enamel: ≤ 25 bar ≤ 150 °C</p>
<p>*) FDA-compliant material in accordance with 21 CFR Part 177.1550/2600</p>			



L00-FTL5xxxx-06-05-xx-xx-018

Any length L:
148 mm to 3000 mm (6 in to 115 in) for synthetic coating
148 mm to 1200 mm (6 in to 48 in) for enamel coating



Note!

The switch points of the Liquiphant **M** are at other positions to those of the previous version Liquiphant **II**.

Special length "L II": 115 mm (4.5 in)

If vertically mounted from above, the same switch point as for the Liquiphant II FTL360, FTL365, FDL30, FDL35

Weights

See Ordering information → 33.

Material Material specifications as per AISI and DIN-EN.

Parts in contact with process

- Extension pipe substrate Alloy C4 in the case of enamel coating: 316L (1.4435 oder 1.4404) in the case of synthetic coating
- Fork substrate Alloy C4 in the case of enamel coating: 316L (1.4435) in the case of synthetic coating
- Flanges, coated:

Layer thickness	ECTFE	PFA* (Edlon™)	PFA (RubyRed)	PFA (conductive)	Enamel
Lower limit	0.5 mm	0.45 mm	0.45 mm	0.45 mm	0.4 mm
Upper limit	1.6 mm	1.6 mm	1.6 mm	1.6 mm	0.8 mm
Substrate	316L (1.4404)	316L (1.4404)	316L (1.4404)	316L (1.4404)	1.0487
* FDA-compliant in accordance with 21 CFR Part 177.1550					

Parts with no process contact

- Tuning fork/housing seal: EPDM
- Temperature spacer: 316 L (1.4435)
- Pressure-tight feedthrough: 316L (1.4435)
- Ground terminal on housing (external): 316L (1.4404)
- Cable glands
 - Housing F13, F15, F16, F17: polyamide (PA)
 - In the case of approval B or C (→ 33 Ordering information): nickel-plated brass
 - Housing F27: polyamide PA, with approval "B" or "C" 316L (1.4435)
 - Housing T13: nickel-plated brass
- Polyester housing F16: PBT-FR with PBT-FR cover or with PA12 transparent cover
 - Cover seal: EPDM
 - Nameplate glued: polyester film (PET)
 - Pressure compensation filter: PBT-GF20
- Stainless steel housing F15: 316L (1.4404)
 - Cover seal: silicone
 - Safety claw: 304 (1.4301)
 - Pressure compensation filter: PBT-GF20, PA
- Aluminum housing F17/F13: EN-AC-ALSi10Mg, plastic-coated
 - Nameplate: aluminum, anodized
 - Cover seal: EPDM
 - Safety claw: nickel-plated brass
 - Pressure compensation filter: silicone
- Stainless steel housing F27: 316L
 - Nameplate: 316L (1.4404)
 - Cover seal: FVMQ (optional: EPDM seal available as spare part)
 - Safety claw: 316L (1.4435)
- Aluminum housing T13: EN-AC-ALSi10Mg, plastic-coated,
 - Nameplate: aluminum, anodized
 - Cover seal: EPDM
 - Safety claw: nickel-plated brass

Process connections

- Flanges made of 316L (1.4404) - synthetic coating; flanges made of 1.0487 (ASTMA 529) - enamel coating
- Flanges as per EN/DIN 1092-1 from DN 25, as per ASME B16.5 from 1", as per JIS B 2220 (RF) from 10K50

Human interface

Electronic inserts

With FEL51, FEL52, FEL54, FEL55:

- 2 switches for safety mode and density change
- green LED to indicate operational status
- red LED to indicate the switching status, flashes in the event of corrosion damage on sensor or if the electronics are defective

With FEL56:

- 2 switches for safety mode and density change
- green LED flashes to indicate operational status
- red LED to indicate the switching status, flashes in the event of corrosion damage on sensor or if the electronics are defective

With FEL57:

- 2 switches for density change and Testing
- green LED to indicate operational status
- yellow LED to indicate the covered status, flashes in the event of corrosion damage on sensor or if the electronics are defective

With FEL58:

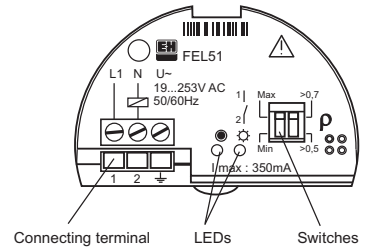
- 2 switches for safety mode and density change
- green LED
 - flashes quickly to indicate operational status,
 - flashes slowly in the event of corrosion damage to the sensor or if the electronics are defective
- yellow LED to indicate the switching status, Test key – breaks the cable connection

With FEL50A:

- 8 switches for configuring the device address
- green LED to indicate operational status, pulsing to indicate communication;
- yellow LED to indicate the switching status, flashes in the event of corrosion damage on sensor or if the electronics are defective

With FEL50D:

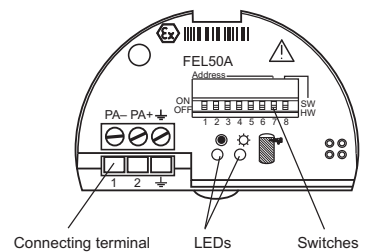
- yellow LED: to indicate the validation of the measurement
- green LED: to indicate the operational status
- red LED: to indicate faults



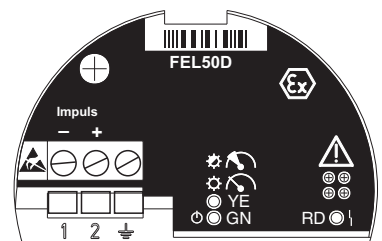
L00-FTL5xxxx-03-05-xx-en-001



L00-FTL5xxxx-03-05-xx-xx-013



L00-FTL5xxxx-03-05-xx-en-002




TT328Fxx004

Operating concept

Onsite configuration

Certificates and approvals


Certificates	See Ordering information →  33.
CE mark	The measuring system meets the legal requirements of the applicable EC Directives. These are listed in the corresponding EC Declaration of Conformity along with the standards applied. Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.
RoHS	The measuring system complies with the substance restrictions of the EU Directive on the restriction of the use of certain hazardous substances 2011/65/EU (RoHS 2).
RCM-tick mark	The product or measuring system supplied complies with the regulations of the Australian Communications and Media Authority (ACMA) for network integrity, performance characteristics and health and safety requirements. The specifications for electromagnetic compatibility, in particular, are observed. The products bear the RCM-tick mark on their nameplate.



A0029561

EAC conformity	The measuring system meets the legal requirements of the applicable EAC Directives. These are listed in the corresponding EAC Declaration of Conformity along with the standards applied. Endress+Hauser confirms successful testing of the device by affixing to it the EAC mark.
CRN approval	Versions with a CRN approval (Canadian Registration Number) are marked with a "*" in ordering information feature 20 "process connection" (s. Seite 33 ff.). CRN-approved devices are assigned the registration number CRN: 0F10904.5CADD1 on the nameplate. Further details are available in the Downloads area on www.endress.com.

Pressure Equipment Directive 2014/68/EU (PED)	<p>Pressure instruments with permitted pressure ≤ 200 bar (2 900 psi)</p> <p>Pressure instruments with permitted pressure ≤ 200 bar (2 900 psi) Pressure instruments with a flange and threaded boss that do not have a pressure-bearing housing do not fall within the scope of the Pressure Equipment Directive, irrespective of the maximum permitted pressure.</p> <p>Reason:</p> <p>According to Article 2, point 5 of EU Directive 2014/68/EU, pressure accessories are defined as "devices with an operational function and having pressure-bearing housings". If a pressure instrument does not have a pressure-bearing housing (no identifiable pressure chamber of its own), there is no pressure accessory present within the meaning of the Directive.</p>
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Process seal according to ANSI/ISA 12.27.01	<p>Practice in North America for the installation of process seals</p> <p>Endress+Hauser devices are designed as either single seal or dual seal devices with an alarm in accordance with ANSI/ISA 12.27.01. This means that the user does need to install for an external secondary process seal in the thermowell which is required in ANSI/NFPA 70 (NEC) and CSA 22.1 (CEC). These devices comply with installation practice in North America and enable very safe, low-cost installation in pressurized applications with hazardous media.</p> <p>Further information on the specific device can be found in the following section: Safety Instructions (ATEX) →  38 ff.</p>
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Product	Type	Max. process pressure	Marking	Listing
Liquiphant M	FTL51-S/T##... FTL51-P/Q/R##...	64/100 bar (928/1450 psi)	Single Seal	CSA FM

Other certificates	<ul style="list-style-type: none"> Material certificate as per EN 10204/3.1 for all wetted parts NACE MR0175/MR0103, AD2000 Leak detection system in conjunction with WHG approval Approval number: Z-65.40-446 (see also "Ordering information" s. Seite 33 ff.)
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**Note!**

Device components in contact with the process are listed in the sections "Mechanical construction" (→ 25 ff.) and "Ordering information" (→ 33 ff.).

Manufacturer declarations

The following documents can be ordered together with the document, depending on the desired device configuration:

- FDA conformity

The applicable European guidelines and standards can be found in the relevant EU Declarations of Conformity.

Use in hazardous zones

Pay particular attention to the information provided in the documentation: Safety Instructions, Control Drawings etc. → 38

Combinations of coatings, housings and electronic inserts

Based on the various certificates, permissible combinations of coatings, housings* and electronic inserts are given in the following table.

*) Abbreviations: Polyester = PBT, steel 1.4301/1.4435 = St., aluminum = Alu
Aluminum housing with separate connection compartment = Alu/sep.

Coating: ECTFE, PFA, enamel			
	Certificate, applications	Housing	Electronic inserts
A	Without any special certificate (for non-hazardous area)	PBT, St., Alu, Alu/sep.	FEL51/52/54, FEL55/56/57/58/50A/50D
D	Overfill protection to WHG (Germany)	PBT, St., Alu, Alu/sep.	FEL51/52/54, FEL55/56/57/58/50A
R	FM, NI, Cl. I, Div. 2, Gr. A–D	St., Alu, Alu/sep. with NPT cable entry	FEL51/52/54, FEL55/56/57/58/50D
		PBT with NPT cable entry	FEL51/52, FEL55/56/57/58/50D
U	CSA, General Purpose	St., Alu, Alu/sep. with NPT cable entry	FEL51/52/54, FEL55/56/57/58/50D***
		PBT with NPT cable entry	FEL51/52, FEL55/56/57/58/50D***
Y	Other certificate (for non-hazardous area)	PBT, St., Alu, Alu/sep.	FEL51/52/54, FEL55/56/57/58/50A/50D
Coating: enamel or PFA (conductive)			
	Certificate, applications	Housing	Electronic inserts
B	ATEX II 3G EEx nC IIC T6, WHG	PBT, St., Alu, Alu/sep.	FEL54
	ATEX II 3G EEx nC IIC T6, WHG ATEX II 3D T85°C, WHG	St., Alu, Alu/sep.	FEL54
C	ATEX II 3G EEx nA IIC T6, WHG	PBT, St., Alu, Alu/sep.	FEL51/52/54, FEL55/56/57/58/50A/ 50D***
	ATEX II 3G EEx nA IIC T6, WHG ATEX II 3D T85°C, WHG	St., Alu, Alu/sep.	FEL51/52/54, FEL55/56/57/58/50A/ 50D***
E	ATEX II 1/2 G, EEx de IIC T6, WHG	Alu/sep.	FEL51/52/54, FEL55/56/57/58/50A/50D
F	ATEX II 1/2 G, EEx ia IIC T6, WHG	PBT, St., Alu, Alu/sep.	FEL55/56/57/58/50A/50D
	ATEX II 1/2 G, EEx ia IIC T6, WHG ATEX II 1/2 D, T80°C	St., Alu, Alu/sep.	FEL51/52/54, FEL55/56/57/58/50A/50D
L	ATEX II 1/2 G, EEx d IIC T6, WHG	Alu	FEL51/52/54, FEL55/56/57/58/50A/50D
P	FM, IS, Cl. I, II, III, Div. 1, Gr. A–G	PBT, St., Alu, Alu/sep. with NPT cable entry	FEL55/56/57/58/50D/ 50D***

Q	FM, XP, Cl. I, II, III, Div. 1, Gr. A-G	Alu with NPT cable entry	FEL51/52/54, FEL55/56/57/58/50D
S	CSA, IS, Cl. I, II, III, Div. 1, Gr. A-G	PBT, St., Alu, Alu/sep. with NPT cable entry	FEL55/56/57/58/50D/ 50D***
T	CSA, XP, Cl. I, II, III, Div. 1, Gr. A-G	Alu with NPT cable entry	FEL51/52/54, FEL55/56/57/58/50D/ 50D***
Coating: ECTFE, PFA (non-conductive)			
Certificate, applications		Housing	Electronic inserts
1	ATEX II 1/2 G, EEx ia IIB T6, WHG	PBT, St., Alu, Alu/sep.	FEL55/56/57/58/50A/50D
2	ATEX II 1/2 G, EEx d IIB T6, WHG	Alu	FEL51/52/54, FEL55/56/57/58/50A/50D
3	ATEX II 1/2 G, EEx de IIB T6, WHG	Alu/sep.	FEL51/52/54, FEL55/56/57/58/50A/50D
4	ATEX II 1/2 G, EEx ia IIC** T6, WHG	PBT, St., Alu, Alu/sep.	FEL55/56/57/58/50A/50D
5	ATEX II 1/2 G, EEx d IIC** T6, WHG	Alu	FEL51/52/54, FEL55/56/57/58/50A/50D
6	ATEX II 1/2 G, EEx de IIC** T6, WHG	Alu/sep.	FEL51/52/54, FEL55/56/57/58/50A/50D
** With instruction: "Avoid electrostatic charge" *** In preparation!			

Ordering information

**Product structure Liquiphant
M FTL51C**

Design				Basic weight
FTL51C		With extension pipe		0.6 kg
10				
Approval:				
A	Non-hazardous area			
B	ATEX/NEPSI II 3 G	EEx nC II T6		Overfill protection to WHG (Germany)
	ATEX/NEPSI II 3 D	T 85 °C*		
C	ATEX/NEPSI II 3 G	EEx nA II T6		Overfill protection to WHG (Germany)
	ATEX/NEPSI II 3 D	T 85 °C*		
D	Non-hazardous area			Overfill protection to WHG (Germany)
E	ATEX II 1/2 G	EEx de IIC T6		Overfill protection to WHG (Germany)
F	ATEX II 1/2 G	EEx ia IIC T6		Overfill protection to WHG (Germany)
	ATEX II 1/2 D	T 80 °C*		
L	ATEX II 1/2 G	EEx d IIC T6		Overfill protection to WHG (Germany)
M	NEPSI	Ex ia IIC T6		
N	NEPSI	Ex d IIC T6		
P	FM	IS, Class I, II, III		Division 1, Group A–G
Q	FM	XP, Class I, II, III		Division 1, Group B–G, for E5 housing Group A–G
R	FM	NI, Class I		Division 2, Group A–D
S	CSA	IS, Class I, II, III		Division 1, Group A–G
T	CSA	XP, Class I, II, III		Division 1, Group A–G
U	CSA	General Purpose		
V	TIIS	Ex ia IIC T3		
W	TIIS	Ex d IIB T3		
X	TIIS	Ex ia IIC T6		
Y	Special version			
1	ATEX II 1/2 G	EEx ia IIB T6		Overfill protection to WHG (Germany)
2	ATEX II 1/2 G	EEx d IIB T6		Overfill protection to WHG (Germany)
3	ATEX II 1/2 G	EEx de IIB T6		Overfill protection to WHG (Germany)
4	ATEX II 1/2 G	EEx ia IIC T6		Overfill protection to WHG (Germany)
	Observe safety instructions (XA) (electrostatic charge)!			
5	ATEX II 1/2 G	EEx d IIC T6		Overfill protection to WHG (Germany)
	Observe safety instructions (XA) (electrostatic charge)!			
6	ATEX II 1/2 G	EEx de IIC T6		Overfill protection to WHG (Germany)
	Observe safety instructions (XA) (electrostatic charge)!			
7	TIIS	Ex d IIC T3		
8	TIIS	Ex d IIC T6		
	*) Not for PBT			
20				
Process connection:				
				Additional weight
ACK*	1½"	150 lbs	ECTFE > 316/316L	Flange ANSI B16.5 1.5 kg
ACL*	1½"	150 lbs	PFA (Edlon™) > 316/316L	Flange ANSI B16.5 1.5 kg
ACM*	1½"	150 lbs	PFA (RubyRed) > 316/316L	Flange ANSI B16.5 1.5 kg
ACN*	1½"	150 lbs	PFA (conductive) > 316/316L	Flange ANSI B16.5 1.5 kg
AEK*	2"	150 lbs	ECTFE > 316/316L	Flange ANSI B16.5 2.4 kg
AEL*	2"	150 lbs	PFA (Edlon™) > 316/316L	Flange ANSI B16.5 2.4 kg
AEM*	2"	150 lbs	PFA (RubyRed) > 316/316L	Flange ANSI B16.5 2.4 kg
AEN*	2"	150 lbs	PFA (conductive) > 316/316L	Flange ANSI B16.5 2.4 kg
AES*	2"	150 lbs	Enamel > 316/316L	Flange ANSI B16.5 2.4 kg
AFK*	2"	300 lbs	ECTFE > 316/316L	Flange ANSI B16.5 3.2 kg
AFL*	2"	300 lbs	PFA (Edlon™) > 316/316L	Flange ANSI B16.5 3.2 kg
AFM*	2"	300 lbs	PFA (RubyRed) > 316/316L	Flange ANSI B16.5 3.2 kg
AFN*	2"	300 lbs	PFA (conductive) > 316/316L	Flange ANSI B16.5 3.2 kg
AFS*	2"	300 lbs	Enamel > 316/316L	Flange ANSI B16.5 3.2 kg
ALK*	3"	150 lbs	ECTFE > 316/316L	Flange ANSI B16.5 4.9 kg
ALL*	3"	150 lbs	PFA (Edlon™) > 316/316L	Flange ANSI B16.5 4.9 kg
ALM*	3"	150 lbs	PFA (RubyRed) > 316/316L	Flange ANSI B16.5 4.9 kg
ALN*	3"	150 lbs	PFA (conductive) > 316/316L	Flange ANSI B16.5 4.9 kg
APK*	4"	150 lbs	ECTFE > 316/316L	Flange ANSI B16.5 7.0 kg
APL*	4"	150 lbs	PFA (Edlon™) > 316/316L	Flange ANSI B16.5 7.0 kg
APM*	4"	150 lbs	PFA (RubyRed) > 316/316L	Flange ANSI B16.5 7.0 kg
APN*	4"	150 lbs	PFA (conductive) > 316/316L	Flange ANSI B16.5 7.0 kg
A8K*	1"	150 lbs	ECTFE > 316/316L	Flange ANSI B16.5 1.0 kg
A8L*	1"	150 lbs	PFA (Edlon™) > 316/316L	Flange ANSI B16.5 1.0 kg
A8M*	1"	150 lbs	PFA (RubyRed) > 316/316L	Flange ANSI B16.5 1.0 kg

20	Process connection:					Additional weight
A8N*	1"	150 lbs	PFA (conductive)	> 316/316L	Flange ANSI B16.5	1.0 kg
BBK	DN32	PN25/40	ECTFE	>316L	Flange EN 1092-1 (DIN 2527)	2.0 kg
BBL	DN32	PN25/40	PFA (Edlon™)	>316L	Flange EN 1092-1 (DIN 2527)	2.0 kg
BBM	DN32	PN25/40	PFA (RubyRed)	>316L	Flange EN 1092-1 (DIN 2527)	2.0 kg
BBN	DN32	PN25/40	PFA (conductive)	>316L	Flange EN 1092-1 (DIN 2527)	2.0 kg
BBD	DN40	PN25/40	ECTFE	>316L	Flange EN 1092-1 (DIN 2527)	2.4 kg
BDK	DN40	PN25/40	PFA (Edlon™)	>316L	Flange EN 1092-1 (DIN 2527)	2.4 kg
BDM	DN40	PN25/40	PFA (RubyRed)	>316L	Flange EN 1092-1 (DIN 2527)	2.4 kg
BDN	DN40	PN25/40	PFA (conductive)	>316L	Flange EN 1092-1 (DIN 2527)	2.4 kg
BEK	DN50	PN6	ECTFE	>316L	Flange EN 1092-1 (DIN 2527)	1.6 kg
BEL	DN50	PN6	PFA (Edlon™)	>316L	Flange EN 1092-1 (DIN 2527)	1.6 kg
BEM	DN50	PN6	PFA (RubyRed)	>316L	Flange EN 1092-1 (DIN 2527)	1.6 kg
BEN	DN50	PN6	PFA (conductive)	>316L	Flange EN 1092-1 (DIN 2527)	1.6 kg
BGK	DN50	PN25/40	ECTFE	>316L	Flange EN 1092-1 (DIN 2527)	3.2 kg
BGL	DN50	PN25/40	PFA (Edlon™)	>316L	Flange EN 1092-1 (DIN 2527)	3.2 kg
BGM	DN50	PN25/40	PFA (RubyRed)	>316L	Flange EN 1092-1 (DIN 2527)	3.2 kg
BGN	DN50	PN25/40	PFA (conductive)	>316L	Flange EN 1092-1 (DIN 2527)	3.2 kg
BNK	DN80	PN25/40	ECTFE	>316L	Flange EN 1092-1 (DIN 2527)	5.9 kg
BNL	DN80	PN25/40	PFA (Edlon™)	>316L	Flange EN 1092-1 (DIN 2527)	5.9 kg
BNM	DN80	PN25/40	PFA (RubyRed)	>316L	Flange EN 1092-1 (DIN 2527)	5.9 kg
BNN	DN80	PN25/40	PFA (conductive)	>316L	Flange EN 1092-1 (DIN 2527)	5.9 kg
BOK	DN100	PN10/16	ECTFE	>316L	Flange EN 1092-1 (DIN 2527)	5.6 kg
BOL	DN100	PN10/16	PFA (Edlon™)	>316L	Flange EN 1092-1 (DIN 2527)	5.6 kg
BOM	DN100	PN10/16	PFA (RubyRed)	>316L	Flange EN 1092-1 (DIN 2527)	5.6 kg
BON	DN100	PN10/16	PFA (conductive)	>316L	Flange EN 1092-1 (DIN 2527)	5.6 kg
B8K	DN25	PN25/40	ECTFE	>316L	Flange EN 1092-1 (DIN 2527)	1.4 kg
B8L	DN25	PN25/40	PFA (Edlon™)	>316L	Flange EN 1092-1 (DIN 2527)	1.4 kg
B8M	DN25	PN25/40	PFA (RubyRed)	>316L	Flange EN 1092-1 (DIN 2527)	1.4 kg
B8N	DN25	PN25/40	PFA (conductive)	>316L	Flange EN 1092-1 (DIN 2527)	1.4 kg
CGS	DN50	PN25/40	Enamel	>1.0487	Flange EN 1092-1 (DIN 2527)	3.2 kg
CNS	DN80	PN25/40	Enamel	>1.0487	Flange EN 1092-1 (DIN 2527)	5.9 kg
KEK	10 K 50		ECTFE	>316L	Flange JIS B2238	1.7 kg
KEL	10 K 50		PFA (Edlon™)	>316L	Flange JIS B2238	1.7 kg
KEM	10 K 50		PFA (RubyRed)	>316L	Flange JIS B2238	1.7 kg
KEN	10 K 50		PFA (conductive)	>316L	Flange JIS B2238	1.7 kg
YY9*	Special version					

30	Probe length; Type:			
BK	..... mm		ECTFE	0.9 kg/m
BL	..... mm		PFA (Edlon™)	0.9 kg/m
BM	..... mm		PFA (RubyRed)	0.9 kg/m
BN	..... mm		PFA (conductive)	0.9 kg/m
BS	..... mm		Enamel	0.9 kg/m
CK	..... inch		ECTFE	2.3 kg/100 in
CL	..... inch		PFA (Edlon™)	2.3 kg/100 in
CM	..... inch		PFA (RubyRed)	2.3 kg/100 in
CN	..... inch		PFA (conductive)	2.3 kg/100 in
CS	..... inch		Enamel	2.3 kg/100 in
DK	Length: type II**		ECTFE	
DL	Length: type II**		PFA (Edlon™)	
DM	Length: type II**		PFA (RubyRed)	
DN	Length: type II**		PFA (conductive)	
DS	Length: type II**		Enamel	
YY	Special version			
**) If replacing devices: When vertically mounting a Liquiphant M FTL51C with length II, the switch point is at the same level as for a Liquiphant II FTL360, FTL365, FDL30, FDL35				

40	Electronics; output:		
A	FEL50A	PROFIBUS PA	
D	FEL50D	Density/concentration	
1	FEL51	2-wire 19 to 253 V AC	
2	FEL52	3-wire PNP 10 to 55 V DC	
4	FEL54	Relay DPDT 19 to 253 V AC, 19 to 55 V DC	
5	FEL55	8/16 mA, 11 to 36 V DC	
6	FEL56	NAMUR (L-H signal)	
7	FEL57	2-wire PFM	

40									Electronics; output:
				8	FEL58	NAMUR + test keys (H-L signal)			
				9	Special version				
50									Housing; cable entry:
				E1*	F27 316L	NEMA6P;	Thread NPT 3/4		
				E4	F16 Polyester	NEMA4X;	Thread NPT 1/2		
				E5	F13/F17 Alu	NEMA4X;	Thread NPT 3/4		
				E6	F15 316L	NEMA4X;	Thread NPT 1/2		
				E7	T13 Alu	coated, IP66;	Thread NPT 3/4		
					Separate connection compartment				
				F1*	F27 316L	IP68	Thread G1/2		
				F4	F16 Polyester	IP66;	Thread G 1/2		
				F5	F13/F17 Alu	IP66;	Thread G 1/2		
				F6	F15 316L	IP66;	Thread G 1/2		
				F7	T13 Alu	coated, IP66;	Thread G 1/2		
					Separate connection compartment				
				G1*	F27 316L	IP68;	M20 threaded joint		
				G4	F16 Polyester	IP66;	M20 threaded joint		
				G5	F13/F17 Alu	IP66;	M20 threaded joint		
							(EEx d > M20 thread)		
				G6	F15 316L	IP66;	M20 threaded joint		
				G7	T13 Alu	coated, IP66;	M20 threaded joint		
					Separate connection compartment				
							(EEx d > M20 thread)		
				N4	F16 Polyester	IP66;	M12 connector		
				N5	F13/F17 Alu	IP66;	M12 connector		
				N6	F15 316L	IP66;	M12 connector		
				Y9	Special version				
					* F27 housing in preparation.				
60									Additional options 1:
				A	Not selected				
				K	Special adjustment, density H20				
				L	Special adjustment, density H20, EN10204-3.1				
				S	GL/ABS marine approval (≤ 1600 mm)				
				Y	Special version				
70									Additional options 2:
				A	Not selected				
				B	Temperature spacer				
				C	2nd line of defence > pressure tight feed-through				
				Y	Special version				
FTL51C -									Complete product designation
					Note! The basic weight includes the compact sensor, electronic insert and polyester housing				

Accessories

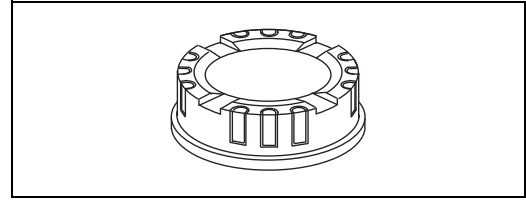
Transparent cover

For polyester housing F16

Material: PA 12

Weight: 0.04 kg

Order number: 943461-0001



L00-FTL5xxxx-03-05-xx-xx-016

Cover with sight glass

For stainless steel housing F15

Material: AISI 316L

Weight: 0.16 kg

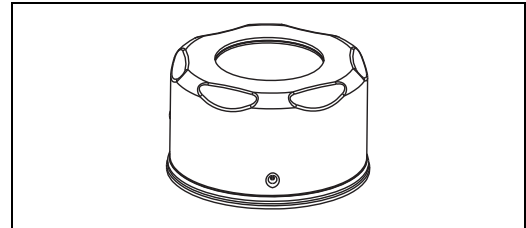
– With glass sight glass

Order number: 943301-1000

– With PC sight glass

Order number: 52001403

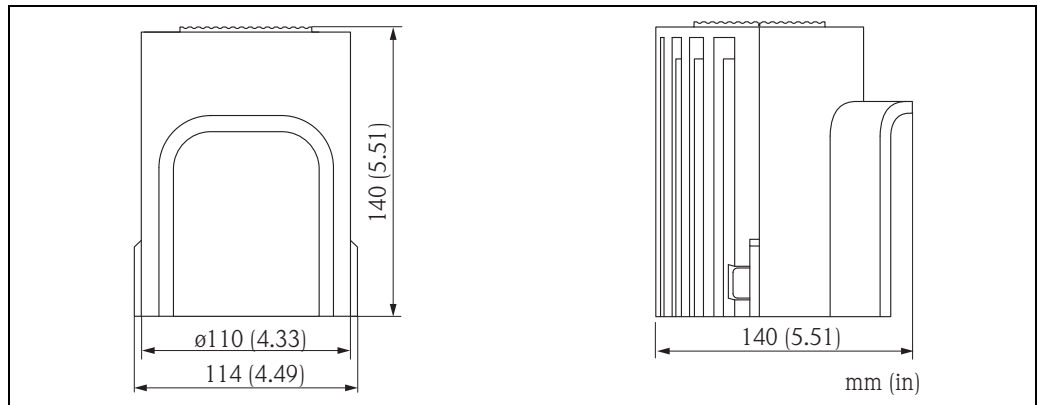
(Not for CSA, General Purpose)



L00-FTL5xxxx-03-05-xx-xx-017

Weather protection cover

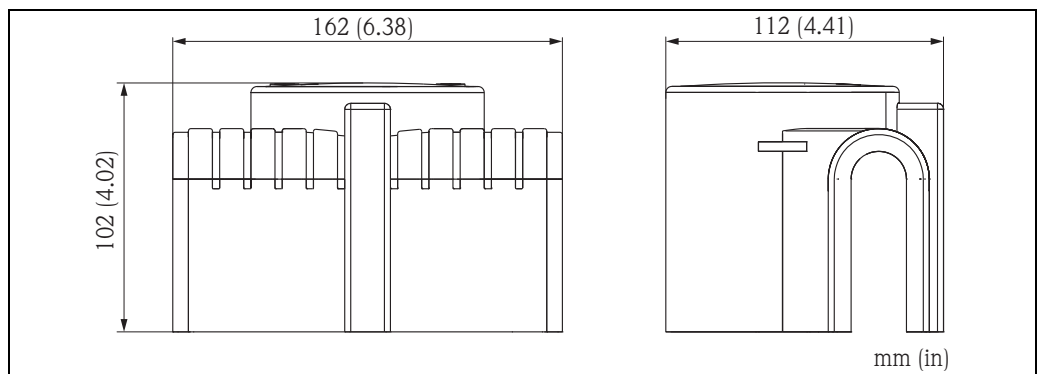
For F16 housing



A0018225

Material	Order No.	Weight
PBT, gray	71127760	240 g (8.46 oz)

For F13, F17 and F27 housing



A0018226

Material	Order No.	Weight
PA6, gray	71040497	300 g (10.58 oz)

Documentation



Note!

You can find supplementary documentation on the product pages at www.endress.com

Operating Instructions

Electronic insert FEL50A for Liquiphant M/S PROFIBUS PA
BA00141F/00/en

Liquiphant M density, density computer FML621
BA00335F/00/en

Liquiphant MFTL51C
KA00162F/00/a6

Liquiphant M FTL51C-##### 7 ##
KA00165F/00/a6

Liquiphant M density FTL50, FTL51
Electronic insert: FEL50D
KA00284F/00/a6

Liquiphant M density FTL50H, FTL51H
Electronic insert: FEL50D
KA00285F/00/a6

Liquiphant M density FTL51C
Electronic insert: FEL50D
KA00286F/00/a6

Technical Information

General instructions for electromagnetic compatibility
(Test procedure, installation recommendation)
TI00241F/00/en

Liquiphant M FTL50/51(H), for process temperatures up to 150 °C
TI00328F/00/en

Isolating amplifier FTL325P,
1 or 3-channel switching units for top-hat rail mounting
for Liquiphant M/S with electronic insert FEL57
TI350F/00/en

Isolating amplifier FTL325N,
1 or 3-channel switching units for top-hat rail mounting
for Liquiphant M/S with electronic insert FEL56, FEL58
TI353F/00/en

Liquiphant S FTL70/71, for medium temperatures up to 280 °C
TI354F/00/en

Isolating amplifier FTL375P,
1 to 3-channel switching units for top-hat rail mounting
for Liquiphant M/S with electronic insert FEL57
TI360F/00/en

Liquiphant M density, density computer FML621
TI420F/00/en

Weld-in adapter,
TI00426F

Functional safety (SIL)

Liquiphant M with electronic insert FEL51 (MAX)
SD00164F

Liquiphant M with electronic insert FEL51 (MIN)
SD00185F

Liquiphant M with electronic insert FEL52 (MAX)
SD00163F

Liquiphant M with electronic insert FEL52 (MIN)
SD00186F

Liquiphant M with electronic insert FEL54 (MAX)
SD00162F

Liquiphant M with electronic insert FEL54 (MIN)
SD00187F

Liquiphant M with electronic insert FEL55 (MAX)
SD00167F

Liquiphant M with electronic insert FEL55 (MIN)
SD00279F

Liquiphant M with electronic insert FEL57 + Nivotester FTL325P
SD01508F (MAX + MIN)

Liquiphant M with electronic insert FEL56 + Nivotester FTL325N
SD01521F (MAX + MIN)

Liquiphant M with electronic insert FEL58 + Nivotester FTL325N
SD01522F (MAX + MIN)

Safety Instructions (ATEX)

CE Ⓢ II 1/2 G, Ex d IIC/B (KEMA 99 ATEX 1157)
XA00031F/00/a3

CE Ⓢ II 1/2 G, Ex ia/ib IIC/B (KEMA 99 ATEX 0523)
XA00063F/00/a3

CE Ⓢ II 1 G, Ex ia IIC/B (KEMA 99 ATEX 5172 X)
XA00064F/00/a3

CE Ⓢ II 1/2 G, Ex de IIC/B (KEMA 00 ATEX 2035)
XA00108F/00/a3

CE Ⓢ II 3 G, Ex nA/nC II (EG 01 007-a)
XA00182F/00/a3

Safety Instructions (NEPSI)

Ex d IIC/IIB T3-T6, Ex d IIC T2-T6
(NEPSI GYJ06424)
XA00401F/00/B2

Ex ia IIC T2-T6, Ex ia IIB T3-T6
(NEPSI GYJ05556, NEPSI GYJ06464),
XC00009F/00/b2

Ex nA II T3-T6, Ex nC/nL IIC T3-T6
(NEPSI GYJ04360, NEPSI GYJ071414)
XC00010F/00/b2

Control Drawings

Liquiphant M (IS and NI) Current output PFM, NAMUR Entity installation
Class I, Div. 1, 2, Groups A, B, C, D
Class I, Zone 0
Class II, Div. 1, 2, Groups E, F, G
Class III
ZD00041F

Liquiphant M, Liquiphant S (cCSAus / IS)
Class I, Div. 1, Groups A, B, C, D Ex ia IIC T6
Class II, Div. 1, Groups E, F, G
Class III
ZD00042F

Liquiphant M (NI), FTL50(H), FTL51(H), FTL51C, FTL70, FTL71
Class I, Div. 2, Groups A, B, C, D
Class II, Div. 2, Groups F, G
Class III
ZD00043F

Liquiphant M, Liquiphant S (cCSAus / XP)
Class I, Groups A, B, C, D
Class II, Groups E, F, G
Class III
ZD00240F

Liquiphant M (IS and NI) PROFIBUS PA, FOUNDATION Fieldbus
Class I, Zone 0, IIC
Class I, Division 1, 2, Groups A, B, C, D
Class II, Division 1, 2, Groups E, F, G
Class III
ZD00244F



71310310

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