



Level



Pressure



Flow



Temperature

Liquid  
Analysis

Registration

Systems  
Components

Services



Solutions

## 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 which can be used in all liquids

- for temperatures from  $-50\text{ °C}$  to  $150\text{ °C}$   
(up to  $230\text{ °C}$  on request)
- for pressures up to 40 bar
- for viscosity up to  $10,000\text{ mm}^2/\text{s}$
- for densities  $\geq 0.5\text{ g/cm}^3$  or  $\geq 0.7\text{ g/cm}^3$ ,  
other settings available on request
- foam detection on request

The reliable function is not affected by flow, turbulence, bubbles, foam, vibration, solids content or buildup. The Liquiphant is thus the 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
- Wide range of electronics, e.g. NAMUR, relay, thyristor, PFM signal output: suitable connection for every process control system
- PROFIBUS PA protocol: for commissioning and maintenance
- No adjustment: quick, low-cost startup
- No mechanically moving parts: no maintenance  
no wear, long operating life
- Monitoring of fork for damage: guaranteed function
- FDA-approved material (PFA Edlon)

## Table of contents

<b>Application</b> .....	<b>4</b>	Connectable load .....	11
Point level detection .....	4		
<b>Function and system design</b> .....	<b>4</b>	<b>Electronic insert FEL57 (PFM)</b> .....	<b>12</b>
Measuring principle .....	4	Power supply .....	12
Modularity .....	4	Electrical connection .....	12
Electronic versions .....	5	Output signal .....	13
Electronic version for density measurement .....	5	Signal on alarm .....	13
Galvanic isolation .....	5	Connectable load .....	13
Design .....	5		
<b>Input</b> .....	<b>5</b>	<b>Electronic insert FEL50A (PROFIBUS PA)</b> .....	<b>14</b>
Measured variable .....	5	Power supply .....	14
Measuring range (detection range) .....	5	Electrical connection .....	14
Density .....	5	Output signal .....	15
		Signal on alarm .....	15
<b>Electronic insert FEL51 (AC 2-wire)</b> .....	<b>6</b>	<b>Electronic insert FEL50D (density)</b> .....	<b>16</b>
Power supply .....	6	Power supply .....	16
Electrical connection .....	6	Electrical connection .....	16
Output signal .....	6	Signal on alarm .....	16
Signal on alarm .....	6	Adjustment .....	16
Connectable load .....	6	Operating principle .....	17
		Light signals .....	17
<b>Electronic insert FEL52 (DC PNP)</b> .....	<b>7</b>	<b>Connection and function</b> .....	<b>18</b>
Power supply .....	7	Connecting cables .....	18
Electrical connection .....	7	Safety mode .....	18
Output signal .....	7	Switching time .....	18
Signal on alarm .....	7	Switch-on behavior .....	18
Connectable load .....	7		
<b>Electronic insert FEL54 (AC/DC with relay output)</b> ..	<b>8</b>	<b>Performance characteristics</b> .....	<b>18</b>
Power supply .....	8	Reference operating conditions .....	18
Electrical connection .....	8	Maximum measured error .....	18
Output signal .....	8	Repeatability .....	18
Signal on alarm .....	8	Hysteresis .....	18
Connectable load .....	8	Influence of medium temperature .....	18
		Influence of medium density .....	18
<b>Electronic insert FEL55 (8/16 mA)</b> .....	<b>9</b>	Influence of medium pressure .....	18
Power supply .....	9		
Electrical connection .....	9	<b>Operating conditions</b> .....	<b>19</b>
Output signal .....	9		
Signal on alarm .....	9	<b>Installation</b> .....	<b>19</b>
Connectable load .....	9	Installation instructions .....	19
		Examples of mounting .....	20
<b>Electronic insert FEL56 (NAMUR L-H edge)</b> .....	<b>10</b>	Orientation .....	21
Power supply .....	10		
Electrical connection .....	10	<b>Environment</b> .....	<b>22</b>
Output signal .....	10	Ambient temperature range .....	22
Signal on alarm .....	10	Ambient temperature limits .....	22
Connectable load .....	10	Storage temperature .....	22
		Climate class .....	22
<b>Electronic insert FEL58 (NAMUR H-L edge)</b> .....	<b>11</b>	Degree of protection .....	22
Power supply .....	11	Vibration resistance .....	22
Electrical connection .....	11	Electromagnetic compatibility .....	22
Output signal .....	11		
Signal on alarm .....	11		

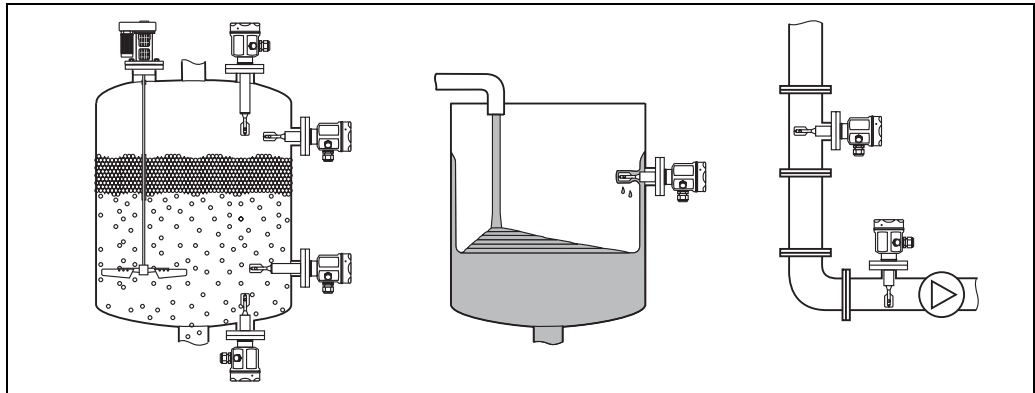
---

<b>Medium conditions</b> .....	<b>23</b>
Medium temperature .....	23
Thermal shock .....	23
Medium pressure pe .....	23
Test pressure .....	23
Pressure shock .....	23
State of aggregation .....	23
Density .....	23
Viscosity .....	23
Solids content .....	23
<b>Mechanical construction</b> .....	<b>24</b>
Design .....	24
Dimensions (in mm) .....	25
Weights .....	26
Material .....	27
Process connections .....	27
<b>Human interface</b> .....	<b>28</b>
Electronic inserts .....	28
Operating concept .....	28
<b>Certificates and approvals</b> .....	<b>29</b>
Certificates .....	29
Combinations of coatings, housings and electronic inserts .....	29
<b>Ordering information</b> .....	<b>31</b>
Liquiphant M FTL51C product structure .....	31
<b>Accessories</b> .....	<b>34</b>
Transparent cover .....	34
Cover with sight glass .....	34
<b>Documentation</b> .....	<b>34</b>
Operating Instructions .....	34
Technical Information .....	34
Functional safety (SIL) .....	35
Safety Instructions (ATEX) .....	35
Safety Instructions (NEPSI) .....	36
Control Drawings .....	36
System information .....	36

## 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.



L00-FTL51Cxx-11-05-xx-xx-001

## Function and system design

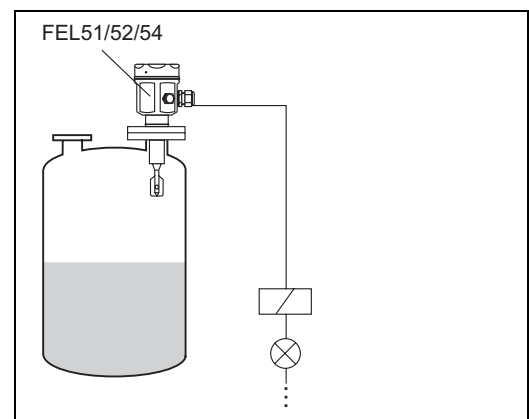
### Measuring principle

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

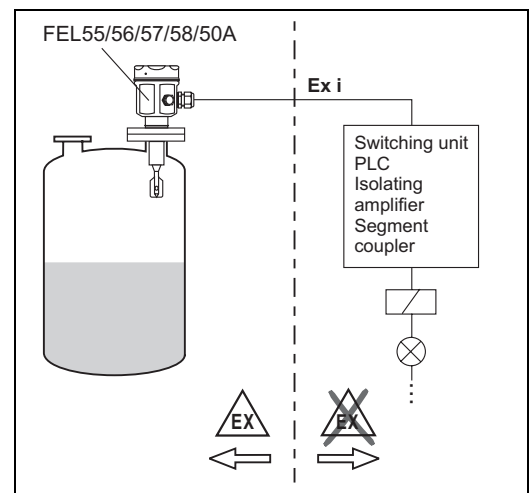
Liquiphant M FTL with electronic versions FEL51, FEL52, FEL54



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

<b>Electronic versions</b>	FEL51: Two-wire AC version; Switches the load directly into the power supply circuit via an electronic switch.
	FEL52: Three-wire DC version; Switches the load via the transistor (PNP) and separate connection.
	FEL54: Universal current version with relay output; Switches the loads via 2 floating change-over contacts.
	FEL55: For separate switching unit; signal transmission 16/8 mA on two-wire cabling.
	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.
	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.
	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.
FEL50A: For connecting to PROFIBUS PA; Cyclic and acyclic data exchange acc. to PROFIBUS-PA Profile 3.0 Discrete Input	

<b>Electronic version for density measurement</b>	FEL50D: For connecting to Density Computer FML621
---	--

<b>Galvanic isolation</b>	FEL51, FEL52, FEL50A: Between sensor and power supply
	FEL54: Between sensor and power supply and load
	FEL55, FEL56, FEL57, FEL58, FEL50D: See connected switching unit

<b>Design</b>	FTL51C: The flange, extension pipe and tuning fork are coated.
---------------	---

## Input

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

## Electronic insert FEL51 (AC 2-wire)

### Power supply

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

### Electrical connection

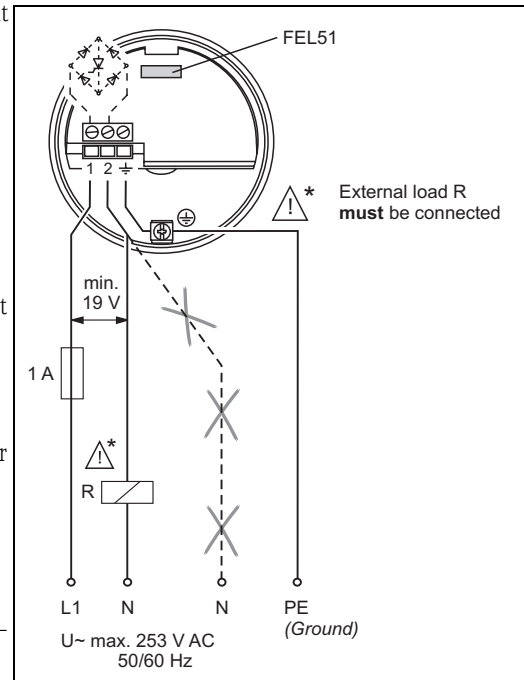
#### Two-wire AC connection

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 modification number MVT2Y1278.
- When selecting the relay, pay attention to the holding power / rated power (see "Connectable load")



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

### 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 $I_L$ → 2	☀	●
		1 < 3.8 mA → 2	☀	☀
Min.		1 $I_L$ → 2	☀	●
		1 < 3.8 mA → 2	☀	☀

L00-FTL5xxxx-04-05-xx-xx-001

### Signal on alarm

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

### Connectable load

- For relays with a minimum holding power/rated power > 2.5 VA at 253 V AC (10 mA) or > 0.5 VA at 24 V AC (20 mA)
- Relays with a lower holding power/rated power can be operated by means of an RC module connected in parallel.
- For relays with a maximum holding power/rated power < 89 VA at 253 AC or < 8.4 VA at 24 V AC
- Voltage drop across FEL51 max. 12V
- Residual current with blocked electrical switch: max. 3.8 mA.
- Load switched directly into the power supply circuit via the thyristor.

Transient (40 ms) max. 1.5 A, max. 375 VA at 253 V or max. 36 VA at 24 V (not short-circuit proof)

## Electronic insert FEL52 (DC PNP)

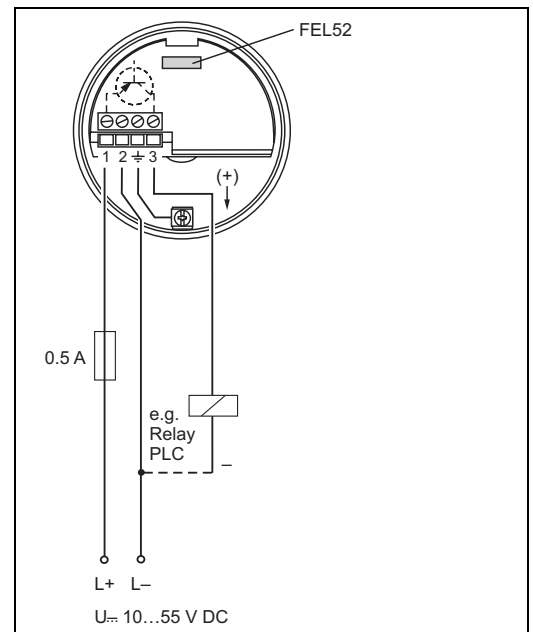
### Power supply

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

### Electrical connection

#### Three-wire DC connection

Preferably used with programmable logic controllers (PLC).  
 DI module as per EN 61131-2.  
 Positive signal at switching output of the electronics (PNP);  
 Output blocked on reaching limit.



L00-FTL5xxxx-04-05-xx-en-001

### Output signal

$I_L$  = load current (switched through)  
 $< 100 \mu\text{A}$  = 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	☀	●
		$1 \xrightarrow{< 100 \mu\text{A}} 3$	☀	☀
Min.		$L+ \xrightarrow{I_L} +$ 1 → 3	☀	●
		$1 \xrightarrow{< 100 \mu\text{A}} 3$	☀	☀

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

### Signal on alarm

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

### Connectable load

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

## Electronic insert FEL54 (AC/DC with relay output)

### Power supply

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

### Electrical connection

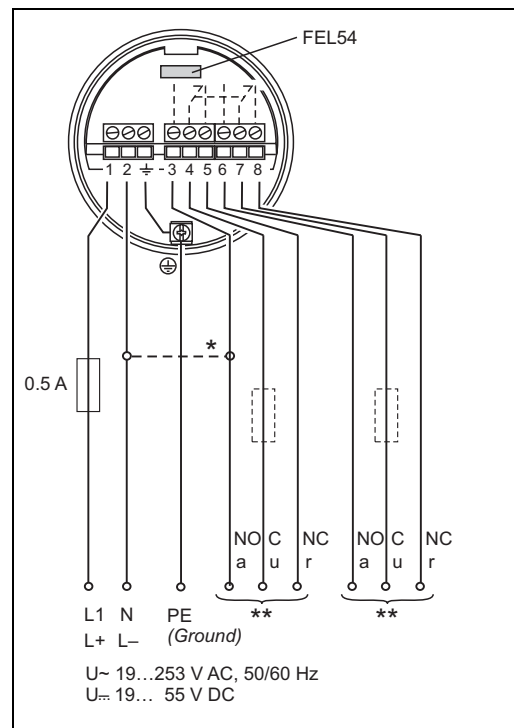
#### Universal current connection with relay output

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 contact on short-circuiting.  
 Both relay contacts switch simultaneously.

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

\*\* See "Connectable load"



### Output signal

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

L00-FTL2xxxx-07-05-xx-xx-001

Safety mode	Level	Output signal	LEDs	
			green	red
Max.				
Min.				

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

### 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~ max. 6 A (Ex de 4 A), U~ max. 253 V AC; P~ max. 1500 VA, cos φ = 1, P~ max. 750 VA, cos φ > 0.7
- I= max. 6 A (Ex de 4 A) bis 30 V DC, I= max. 0.2 A to 125 V
- When connecting a low-voltage circuit with double isolation according to IEC 1010, the following applies: total of voltages of relay output and power supply max. 300 V.



## Electronic insert FEL55 (8/16 mA)

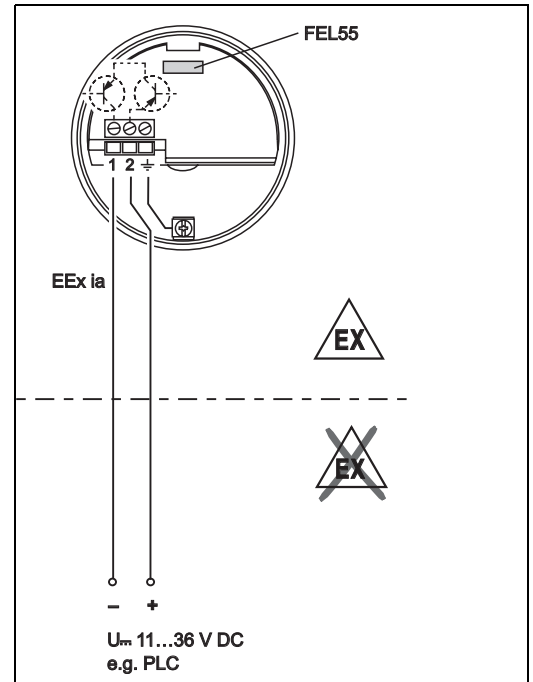
**Power supply**

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

**Electrical connection**

**Two-wire connection for separate switching unit**

For connecting to programmable logic controllers (PLCs) for example, AI module 4 to 20 mA to EN 61131-2. Output signal jump from high to low current on limit.



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

**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.		+ 2 $\xrightarrow{\sim 16 \text{ mA}}$ 1		
		+ 2 $\xrightarrow{\sim 8 \text{ mA}}$ 1		
Min.		+ 2 $\xrightarrow{\sim 16 \text{ mA}}$ 1		
		+ 2 $\xrightarrow{\sim 8 \text{ mA}}$ 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**

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

Example:  
 PLC with 250  $\Omega$  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

Power consumption: < 6 mW at I < 1 mA; < 38 mW at I = 2.8 mA  
 Connection data interface: IEC 60947-5-6

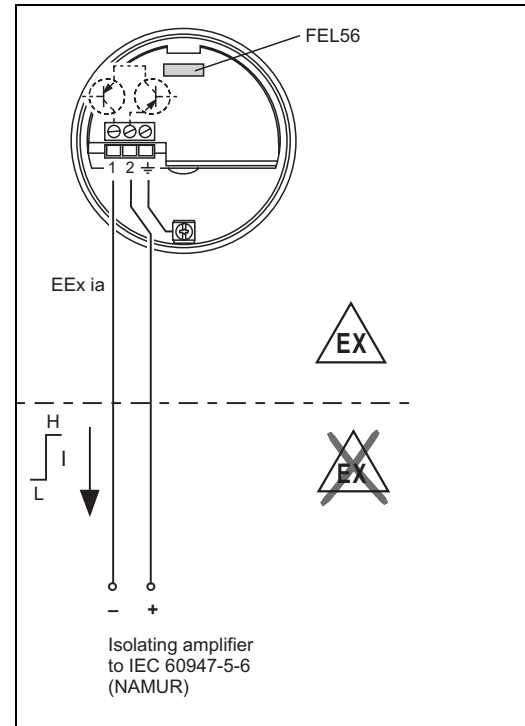
### Electrical connection

#### Two-wire connection for separate switching unit

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

#### (L-H edge)

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



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

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 acc. to NAMUR (IEC 60947-5-6), e.g. FTL325N, FTL375N from Endress+Hauser. Output signal jump from high to low current on limit.

#### (H-L edge)

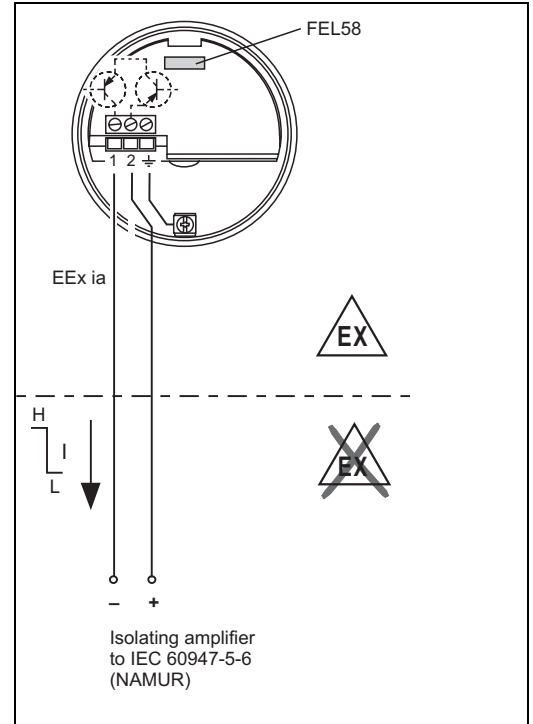
Additional function:  
 Test key on the electronic insert.  
 Pressing the key breaks the connection to the isolating amplifier.



#### 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 2 → 1	
		+ 0.6 ... 1.0 mA 2 → 1	
Min.		+ 2.2 ... 3.5 mA 2 → 1	
		+ 0.6 ... 1.0 mA 2 → 1	

= lit  
 = flashes  
 = unlit

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

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

### 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: 9.5 to 12.5 V DC  
 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 Nivotester switching units FTL320, FTL325P, FTL370, FTL372, FTL375P (also with cyclical checking) from Endress+Hauser. Output signal jump of the PFM signal from high to low frequency when sensor is covered. Switching between minimum/maximum safety in the Nivotester.

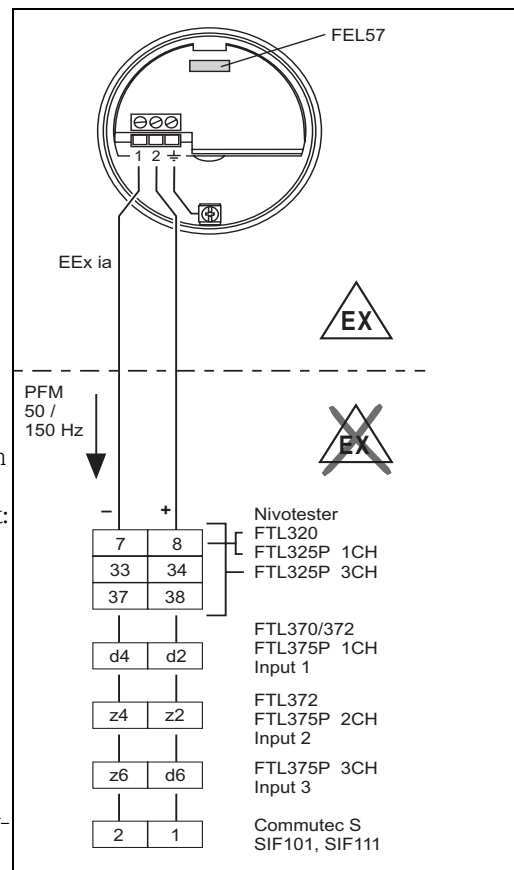
Additional function “cyclical checking”:  
 After interruption of the power supply, a test cycle is activated which checks the sensor and electronics without any change in level. Approved for overfill protection acc. to WHG (German Water Resources Act). The following can be switched at the electronic insert:

#### – Standard (STD):

Corrosion of the fork unlikely;  
 simulation approx. 8 s  
 tuning fork exposed – covered – exposed.  
 This setting tests level reporting in the Nivotester during cyclical checking.

#### – Extended (EXT):

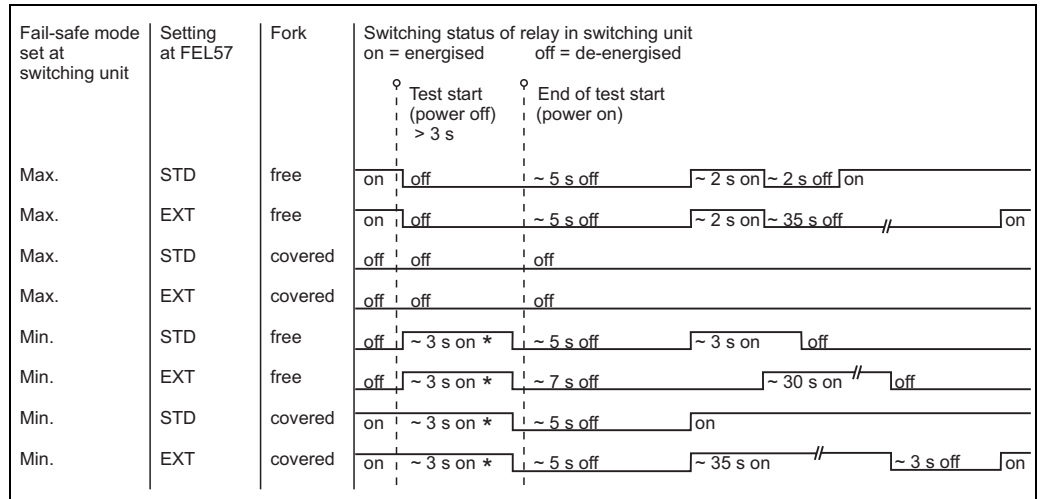
Corrosion of the fork possible;  
 Simulation approx. 41 s: tuning fork exposed – covered – corroded – exposed.  
 This setting tests level reporting and alarm notification in the Nivotester during cyclical checking.



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

The check is activated and monitored at the switching unit.

**Switching behavior of the connected device:**

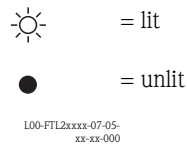


L00-FTL5xxxx-05-05-xx-en-000

\* De-energized on power supply failure

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

**Output signal**



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

L00-FTL5xxxx-04-05-xx-xx-008

**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 device Nivotester FTL320, FTL325P, FTL370, FTL372, FTL375P
- For contact load, see the Technical Data of the switching unit.

## Electronic insert FEL50A (PROFIBUS PA)

### Power supply

Bus voltage: 9 to 32 V DC

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)

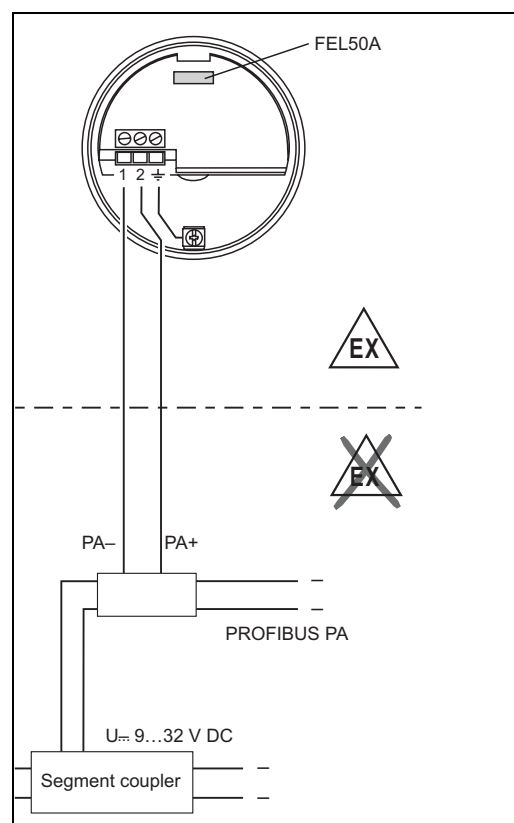
### Electrical connection

#### Two-wire connection for power supply and data transfer

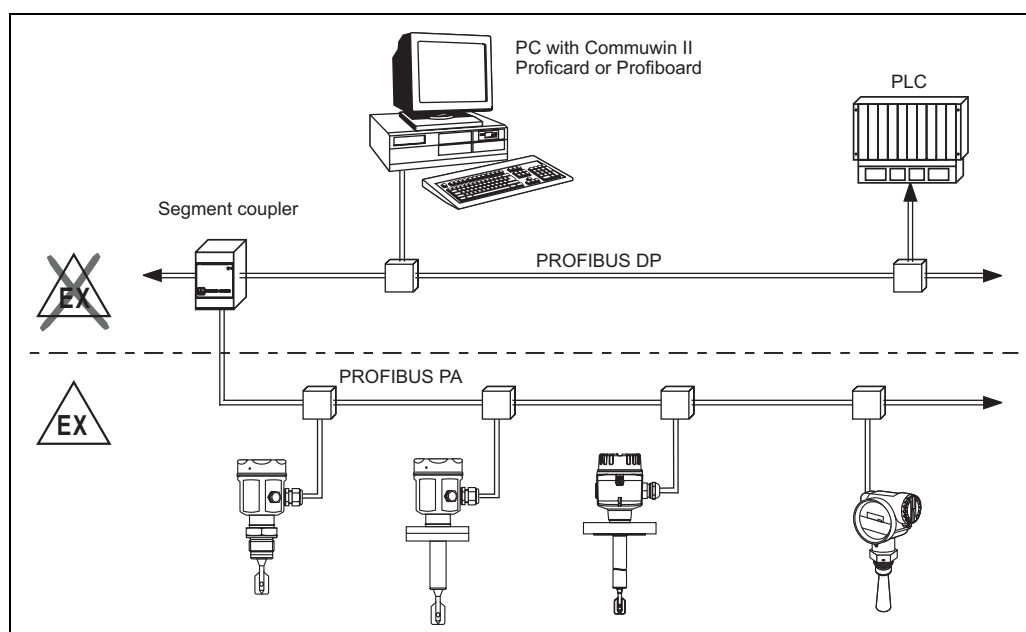
For connecting to PROFIBUS PA

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 switch.
- Matrix locking possible
- Switch to WHG mode possible (WHG approval).
- For a detailed description, see BA198F
- You can also visit [www.profibus.com](http://www.profibus.com) for more information



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

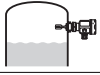
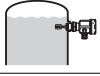
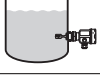
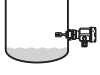


L00-FTL5xxxx-04-05-xx-en-006

**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 = 1 PA bus signal
		☀	●	OUT_D = 0 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 BA198F

## Electronic insert FEL50D (density)

### Power supply

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

### Electrical connection

#### Two-wire connection at Density Computer FML621

For connecting to the density and concentration computer FML621.

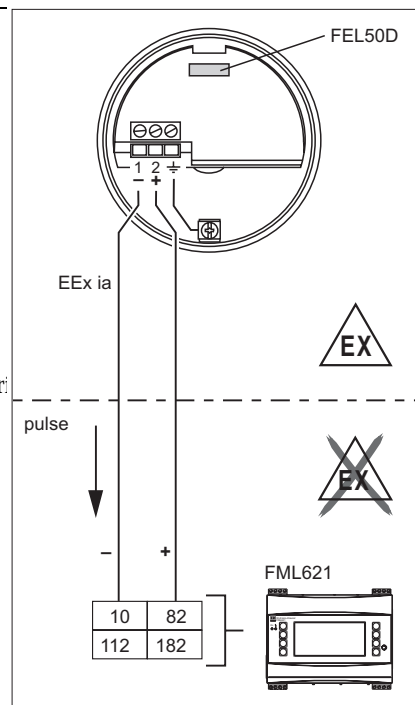
The output signal is based on pulse technology.  
 With the aid of this signal, the fork frequency is constantly forwarded to the switching unit.



#### Caution!

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

This electronic insert cannot be installed in devices that were ori



TI420Fen004

### 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 H<sub>2</sub>O (K) or special adjustment, density H<sub>2</sub>O 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).



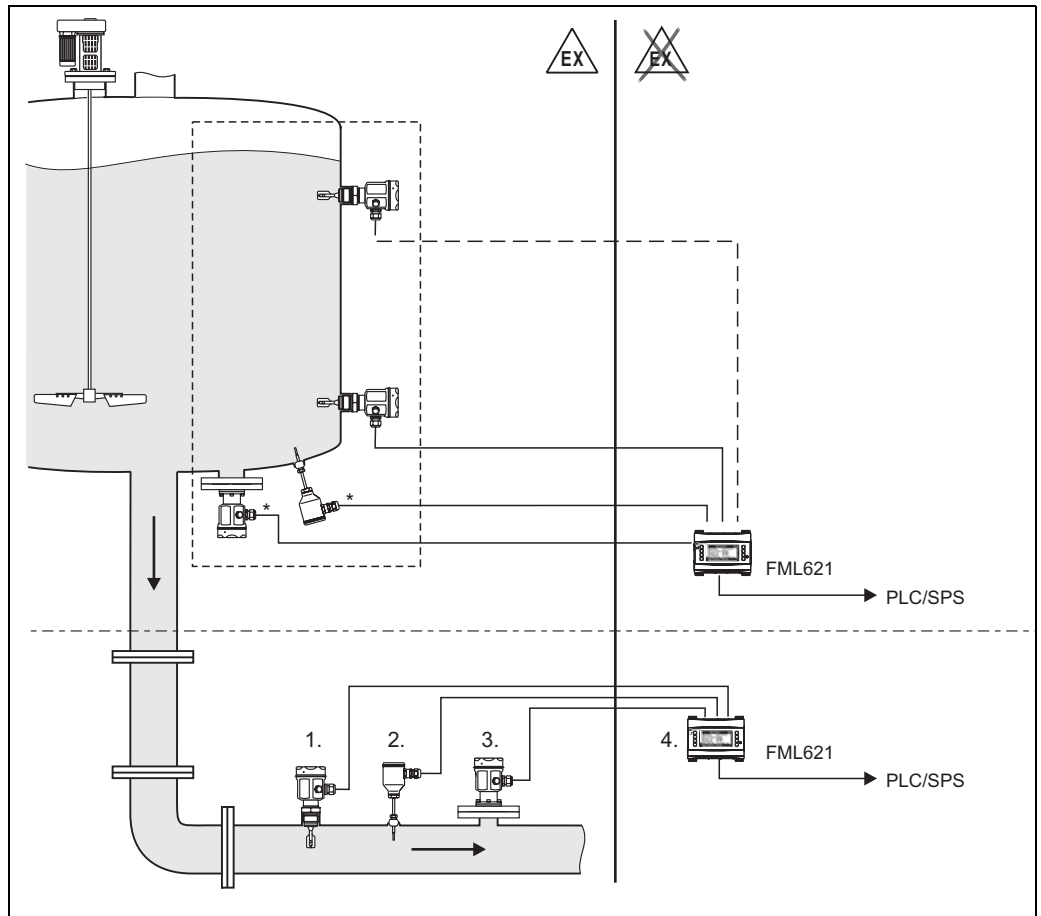
#### Note!

Further information on Liquiphant M Density is available in Technical Information TI420F. This document is available for download at [www.endress.com](http://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 w		Measurement valid
		Unstable process situation
		Maintenance required
Green		Power on
		Power off
Red		No fault
		Maintenance required
		Device failure

## Connection and function

<b>Connecting cables</b>	<ul style="list-style-type: none"> <li>■ Electronic inserts: cross-section max. 2.5 mm<sup>2</sup>; strand in ferrule to DIN 46228</li> <li>■ Protective earth in housing: cross-section max. 2.5 mm<sup>2</sup></li> <li>■ External equipotential bonding connection on housing: cross-section max. 4 mm<sup>2</sup></li> </ul>
--------------------------	--

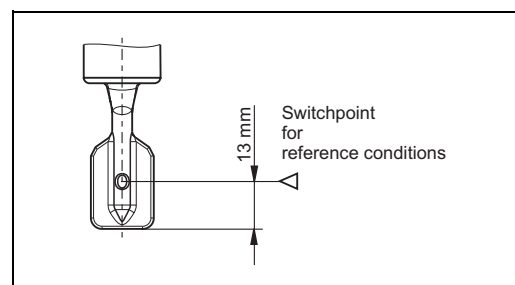
<b>Safety mode</b>	<p>Minimum/maximum residual current safety selectable on electronic insert. (with FEL57 on Nivotester only)</p> <p>Max. = maximum safety: The output switches to the power fail response when the fork is covered For use with overflow protection for example</p> <p>Min. = minimum safety: The output switches to the power fail response when the fork is exposed For use with dry running protection for example</p>
--------------------	--

<b>Switching time</b>	<p>When fork is covered: approx. 0.5 s When fork is exposed: approx. 1.0 s (Other switching times on request.)</p> <p>Additionally configurable for PROFIBUS PA: 0.5-60 s</p>
-----------------------	---

<b>Switch-on behavior</b>	<p>When switching on the power supply, the output assumes the alarm signal. After max. 3 s it assumes the correct switching mode (exception: FEL57)</p>
---------------------------	---

## Performance characteristics

<b>Reference operating conditions</b>	<p>Ambient temperature: 23 °C Medium temperature: 23 °C Medium density: 1 g/cm<sup>3</sup> (water) Viscosity: 1 mm<sup>2</sup>/s Medium pressure <math>p_e</math>: 0 bar Sensor mounting: vertical from above Density switch: to &gt; 0.7</p>
---------------------------------------	---



L00-FTL5xxxx-06-05-xx-en-000

<b>Maximum measured error</b>	Max. +/- 1 mm (at reference operating conditions)
-------------------------------	---

<b>Repeatability</b>	0.1 mm
----------------------	--------

<b>Hysteresis</b>	<p>ECTFE: approx. 2 mm PFA: approx. 2 mm Enamel: approx. 2.5 mm</p>
-------------------	---

<b>Influence of medium temperature</b>	<p>ECTFE: max. +1.4 mm to -2.8 mm (-50 °C to +120 °C) PFA: max. +1.4 mm to -2.8 mm (-50 °C to +150 °C) Enamel: max. +0.6 mm to -1.5 mm (-50 °C to +150 °C)</p>
--	--

<b>Influence of medium density</b>	Max. +4.8 mm to -3.5 mm (0.5 g/cm <sup>3</sup> to 1.5 g/cm <sup>3</sup> )
------------------------------------	---

<b>Influence of medium pressure</b>	<p>ECTFE: max. 0 mm to -2.0 mm (0 bar to 40 bar) PFA: max. 0 mm to -2.0 mm (0 bar to 40 bar) Enamel: max. 0 mm to -1.0 mm (0 bar to 25 bar)</p>
-------------------------------------	---

## Operating conditions

### Installation

#### Installation instructions

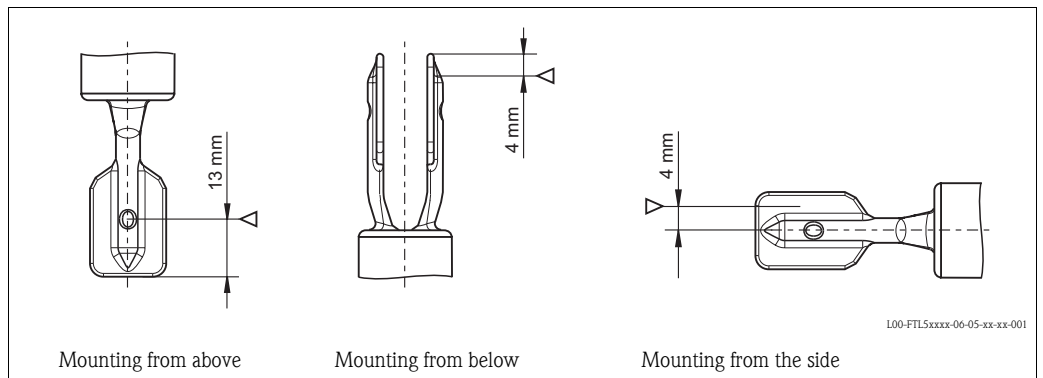
Switch points  $\triangleright$  on the sensor depend on the mounting position, with reference to water, Density 1 g/cm<sup>3</sup>, 23 °C, p<sub>e</sub> 0 bar.



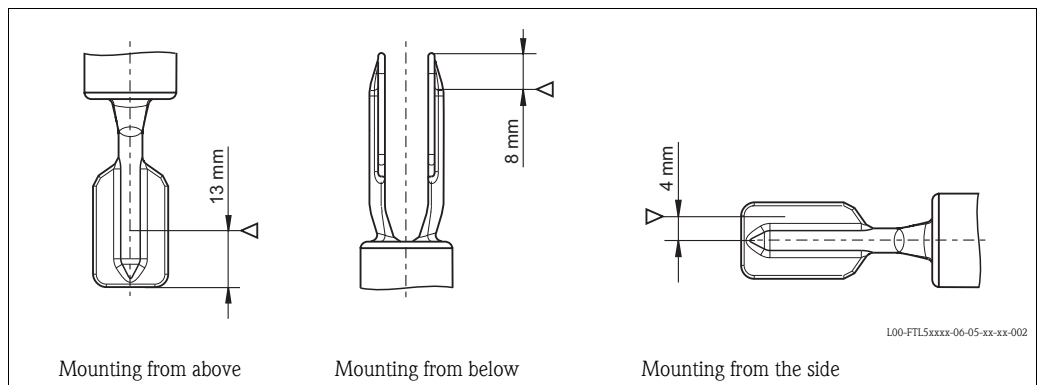
Note!

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

#### Synthetic coating:

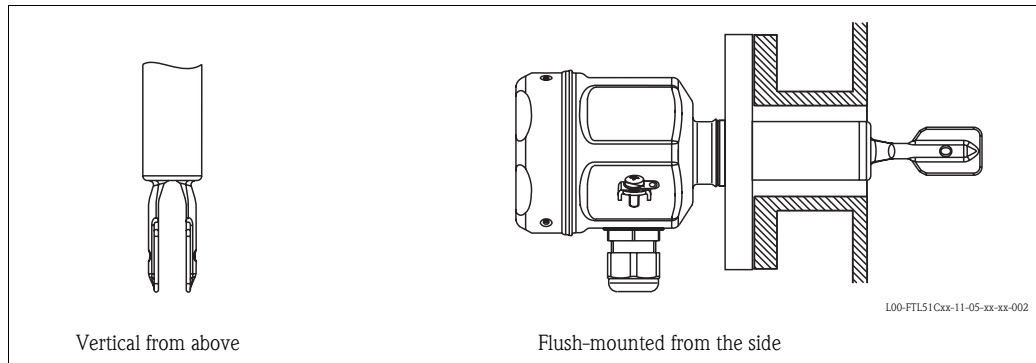


#### Enamel coating:



Examples of mounting

Optimum mounting, without problem even with high viscosity:

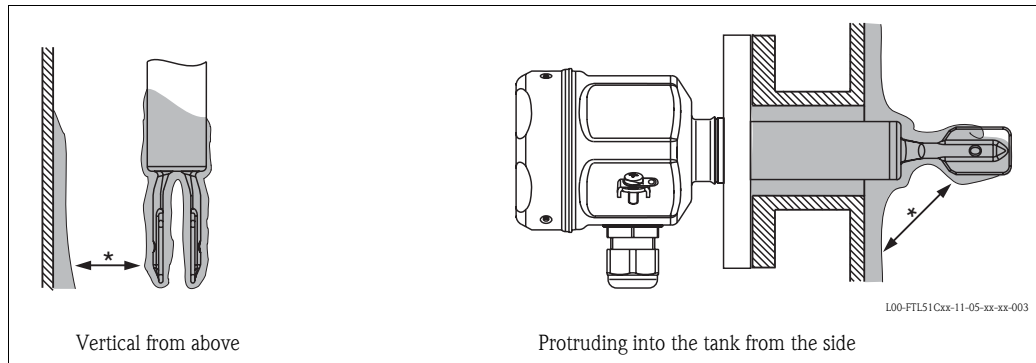


Note!

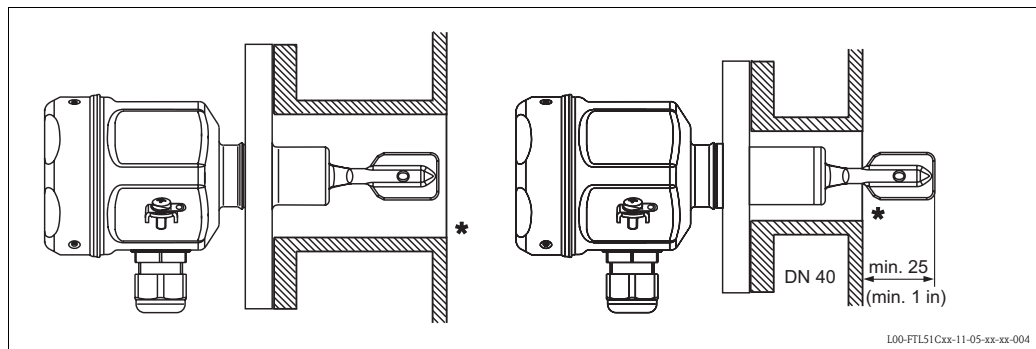
Position the fork so that the narrow edge of the tines is vertical to ensure that the liquid can run off easily.

With buildup on the tank walls:

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



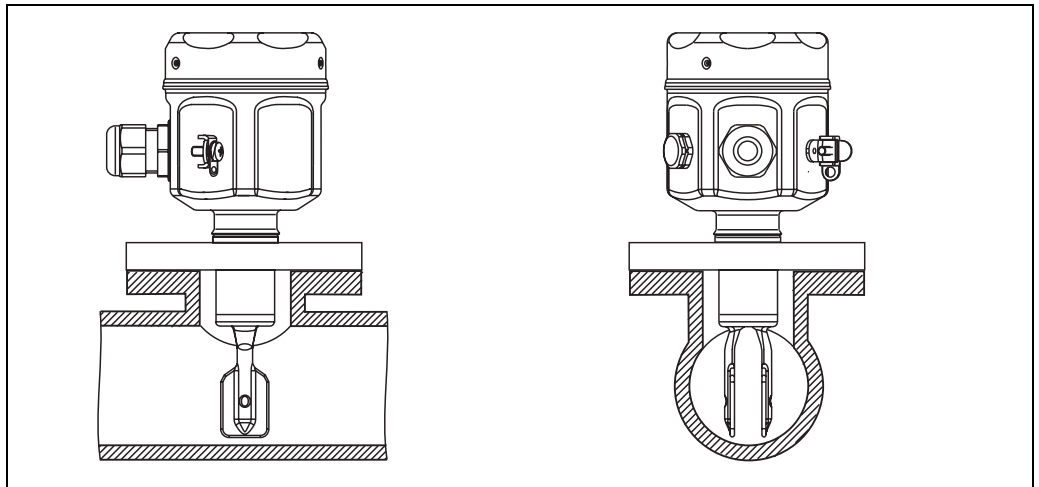
Mounting positions with low viscosity (up to 2000 mm<sup>2</sup>/s):



\* Deburr the nozzle surfaces

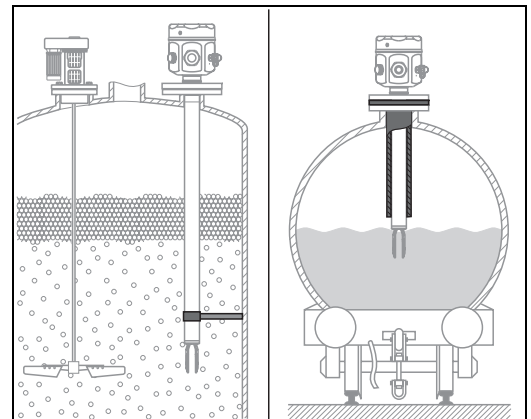
**Mounting in piping from 2"**

Flow velocities up to 5 m/s for viscosity 1 mm<sup>2</sup>/s and density 1 g/cm<sup>3</sup>.  
 (Check the function for other medium conditions.)



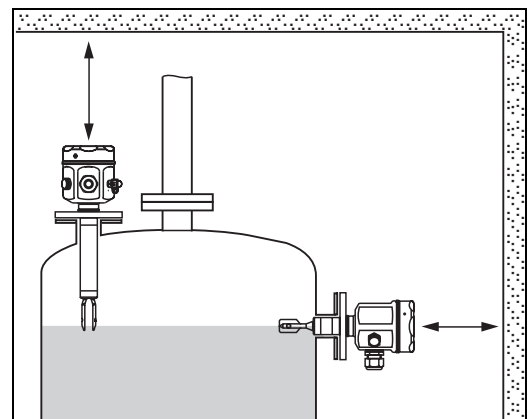
L00-FTL51Cxxx-11-05-xx-xx-005

Liquiphant M FTL51C  
 in the event of severe dynamic load.



L00-FTL5xxx-11-05-xx-xx-005

Ensure adequate space outside the tank for mounting, connection and configuration



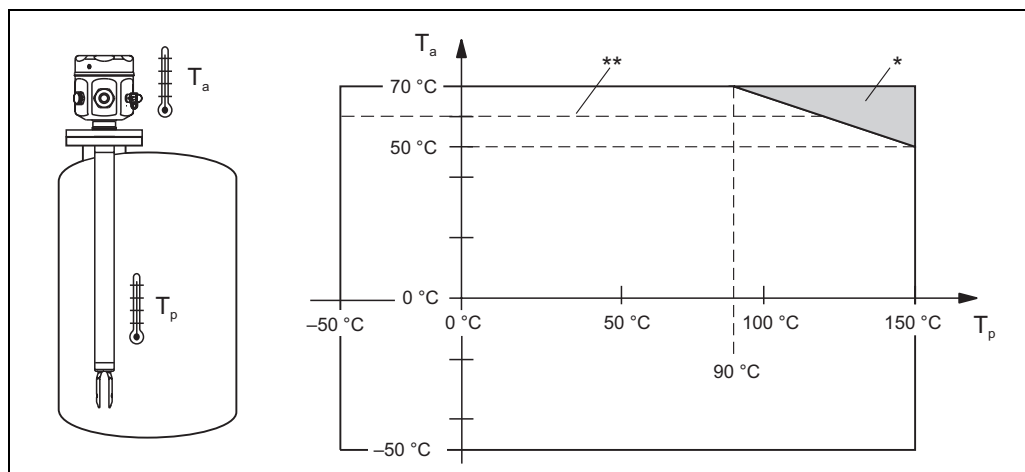
L00-FTL51Cxxx-11-05-xx-xx-005

**Orientation**

FTL51C with short pipe (up to approx. 500 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.

\*\*

Medium temperatures up to 230 °C on request!

The difference in temperature between the process and ambient side ( $T_p - T_a$ ) of the flange with ECTFE and PFA may not exceed 60 °C. For this reason, the flange might have to be included in the tank insulation where necessary.

**Ambient temperature limits** -50 °C to +70 °C (function with restricted data)

**Storage temperature** -50 °C to +80 °C

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

**Degree of protection**

Types of housing	IP65	IP66*	IP67*	IP68*	IP69k	NEMA4X**
Polyester housing F16	-	X	X	-	-	X
Stainless steel housing F15	-	X	X	-	-	X
Aluminum housing F17	X	X	X	-	-	X
Aluminum housing F13	X	X	-	X***	-	X
Stainless steel housing F27	-	X	-	X	-	4x / 6P
Aluminum housing T13 with separate connection compartment (EEx d)	X	X	-	X***	-	4x / 6P

\* As per EN60529

\*\* As per NEMA 250

\*\*\* Only with M20 cable entry or G1/2 thread

**Vibration resistance** To IEC 68, Part 2-6 (10 to 55 Hz, 0.15 mm, 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

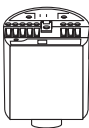
<b>Medium temperature</b>	ECTFE: -50 °C to +120 °C PFA: -50 °C to +150 °C/up to 230 °C on request Enamel: max. -50 °C to +150 °C/up to 200 °C on request
<b>Thermal shock</b>	Max. 120 °C/s
<b>Medium pressure <math>p_e</math></b>	The following values apply over the entire temperature range. Pay attention to exceptions for flange process connections! <ul style="list-style-type: none"> <li>■ ECTFE: -1 to +40 bar</li> <li>■ PFA: -1 to +40 bar</li> <li>■ Enamel: max. -1 to +25 bar</li> </ul> Please refer to the standards listed for the permitted pressure values of the flanges at higher temperatures: <ul style="list-style-type: none"> <li>■ 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.</li> <li>■ ASME B 16.5a - 1998 Tab. 2-2.2 F316</li> <li>■ ASME B 16.5a - 1998 Tab. 2.3.8 N10276</li> <li>■ JIS B 2220</li> </ul> The lowest value from the derating curves of the device and selected flange applies in each case.
<b>Test pressure</b>	Max. 100 bar (1.5 times the medium pressure $p_e$ ); no function during test pressure Sensor burst pressure 200 bar
<b>Pressure shock</b>	Max. 20 bar/s
<b>State of aggregation</b>	Liquid
<b>Density</b>	$\geq 0.7 \text{ g/cm}^3$ = delivery status $\geq 0.5 \text{ g/cm}^3$ * can be adjusted via switches
<b>Viscosity</b>	Max. 10000 mm <sup>2</sup> /s
<b>Solids content</b>	Max. $\varnothing 5 \text{ mm}$

## Mechanical construction

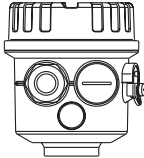
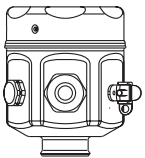
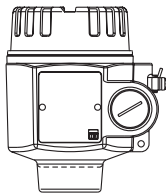
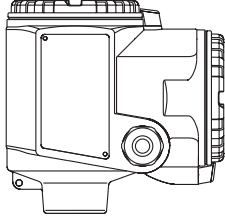
### Design

Summary of all electrical and mechanical versions

*Plug-in electronic inserts to mount in the housing*

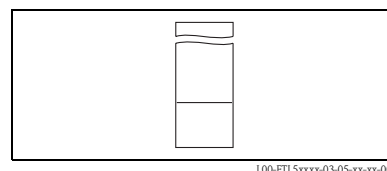
 <p>L00-FTL5xxxx-03-05-xx-xx-000</p>	FEL51:	Two-wire AC connection
	FEL52:	Three-wire DC connection PNP
	FEL54:	Universal current connection, 2 relay outputs
	FEL55:	Output 16/8 mA for separate switching unit
	FEL56:	Output 0.6 to 1.0 / 2.2 to 2.8 mA for separate switching unit (NAMUR)
	FEL58:	Output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

*Housing*

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

*Bushings*

Temperature spacer and pressure tight feed-through



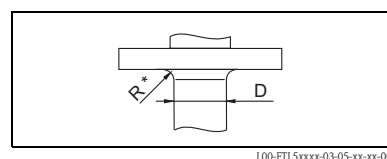
*Process connections*

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

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

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

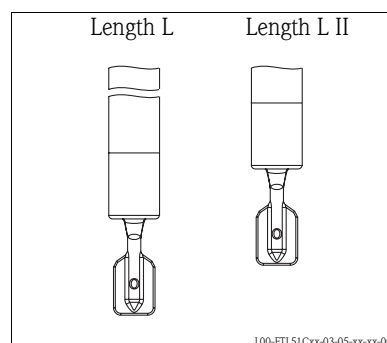
Take into account for counterflange!



*Sensors*

With extension pipe up to 3 m

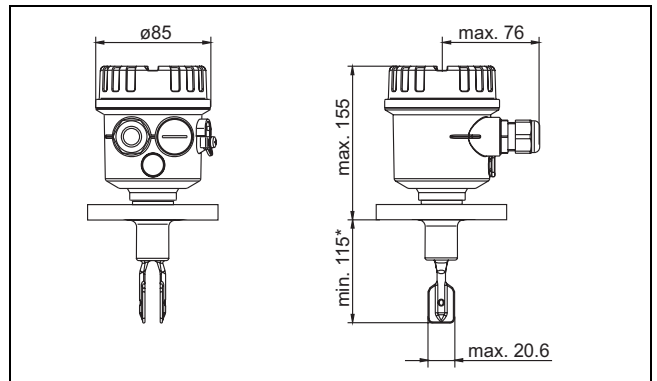
or special "length L II" (see also Page 24)





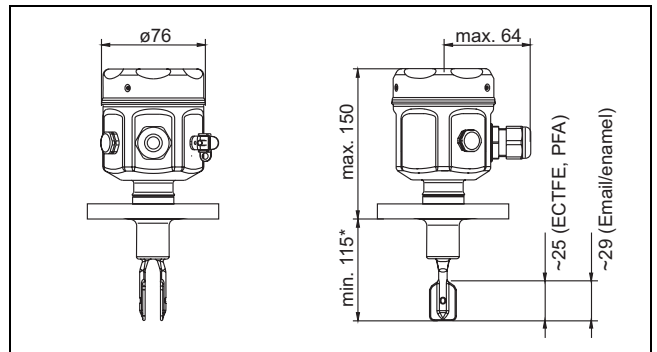
**Dimensions (in mm)**

Housing and sensor FTL51C  
Polyester housing F16



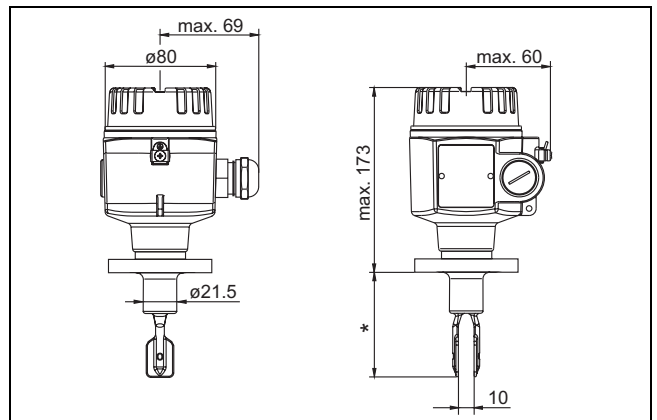
L00-FTL51Cxx-06-05-xx-xx-025

Stainless steel housing F15



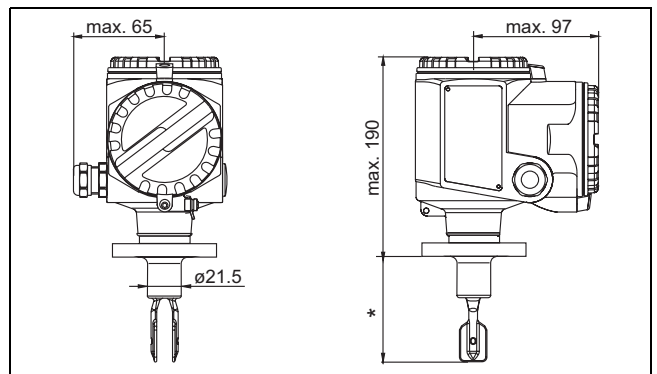
L00-FTL51Cxx-06-05-xx-xx-126

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**.

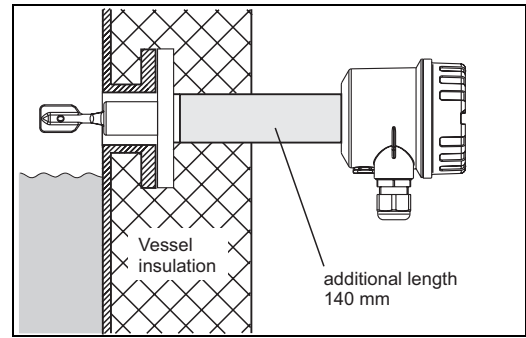
Bushings: temperature spacer, pressure tight feed-through

**Temperature spacer**

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

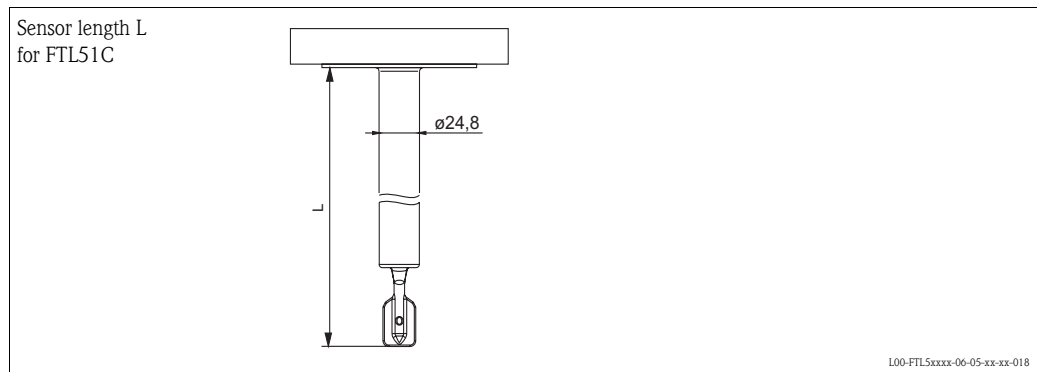
**Pressure tight feed-through**

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



Process connections

Process connection		Dimensions	Accessories	Pressure Temperature
<p><b>Flanges:</b></p> <p><b>Synthetic coating</b> ANSI B16.5 (FF) EN 1092-1 (Form A) JIS B 2238 (FF)</p> <p><b>Enamel coating</b> ANSI B16.5 (RF) EN 1092-1 (Form B) JIS B 2238 (RF)</p>	<p>A## B## C## K##</p>		<p>In event of synthetic coating: PTFE seal 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:      Max. 40 bar                           Max. 120 °C</p> <p>For PFA (Edlon*): Max. 40 bar                           Max. 150 °C</p> <p>For enamel:        Max. 25 bar                           Max. 150 °C</p>
<p>*) FDA-compliant material in accordance with 21 CFR Part 177.1550/2600</p>				



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)

With vertical mounting from above the same switchpoint as for the Liquiphant II  
FTL360, FTL365, FDL30, FDL35

**Weights**

See product structure

**Material**

Material specifications as per AISI and DIN-EN.

**Parts in contact with process**

- Process connection and extension pipe: 316L (1.4435) coated
- Tuning fork: 316L (1.4435) coated
- 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
Carrier material	316L (1.4404)	316L (1.4404)	316L (1.4404)	316L (1.4404)	1.0487

**Parts with no process contact**

- Tuning fork/housing seal: EPDM
- Temperature spacer: 316 L (1.4435)
- Pressure tight feed through: 316L (1.4435)
- Grounding at housing (outside): 304 (1.4301)
- Nameplate at housing (outside): 304 (1.4301)
- Cable glands
  - Housing F13, F15, F16, F17: polyamide (PA)
  - With B or C approval (→ 31 ordering information): nickel-plated brass
  - Housing F27: 316L
  - 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-AISi10Mg, plastic-coated
  - Cover seal: EPDM
  - Safety claw: nickel-plated brass
  - Pressure compensation filter: silicone
- Stainless steel housing F27: 316L (1.4435)
  - Cover seal: FVMQ (optional: EPDM seal available as spare part)
  - Safety claw: 316L (1.4435)
- Aluminum housing T13: EN-AC-AISi10Mg, plastic-coated
  - 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 to EN/DIN from DN 25, for standards see "Product structure," to ANSI B16.5 from 1", to JIS B 2238 (RF) from DN 50

## 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  
cyclical checking,  
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 on sensor  
or if the electronics are defective

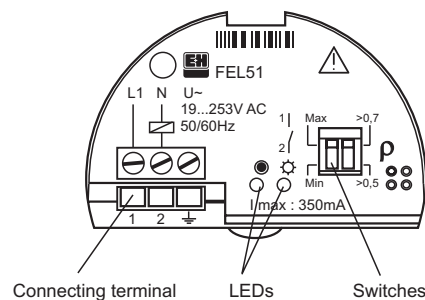
yellow LED to indicate the switching status,  
Test key – breaks the cable connection

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:

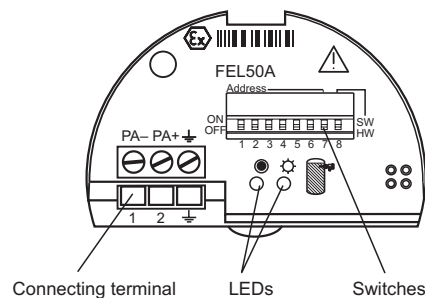
- yellow LED: to indicate the validation of the measurement
- green LED: to indicate the operational status
- red LED: to indicate faults



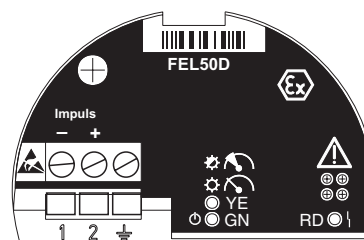
L00-FTL5xxxx-03-05-xx-en-001



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



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



TL328Fxx004

### Operating concept

Onsite configuration

## Certificates and approvals

### Certificates

See product structure

### 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.

<b>Coating: ECTFE, PFA, enamel</b>			
	<b>Certificate, applications</b>	<b>Housing</b>	<b>Electronic inserts</b>
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
<b>Coating: enamel or PFA (conductive)</b>			
	<b>Certificate, applications</b>	<b>Housing</b>	<b>Electronic inserts</b>
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***
<b>Coating: ECTFE, PFA (non-conductive)</b>			

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

**Liquiphant M FTL51C product structure**

Design							<i>Basic weight</i>
FTL51C	With extension pipe						0.6 kg
<b>10</b>	<b>Approval:</b>						
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						
<b>20</b>	<b>Process connection:</b>						<i>Additional weight</i>
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	
BDK	DN40	PN25/40	ECTFE	>316L	Flange EN 1092-1 (DIN 2527)	2.4 kg	
BDL	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	
BOU	DN100	PN10/16	PFA (RubyRed)	>316L	Flange EN 1092-1 (DIN 2527)	5.6 kg	
BOV	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						
**) Replacing devices: when vertically mounting a Liquiphant M FTL51C with length II, the switch point is at the same height 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					

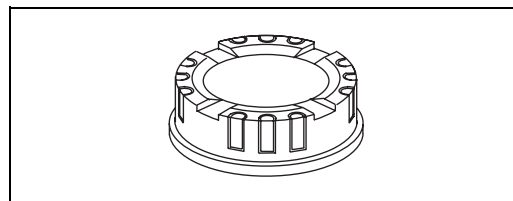


<b>40</b>									<b>Electronics; output:</b>
				8	FEL58	NAMUR + test keys (H-L signal)			
				9	Special version				
<b>50</b>									<b>Housing; cable entry:</b>
				E1*	F27 316L	NEMA6P;	Thread NPT 3/4		
				E4	F16 Polyester	NEMA4X;	Thread NPT 1/2		
				E5	F13/F17 Alu	NEMA4X;	Thread NPT 3/4		
				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.				
<b>60</b>									<b>Additional options 1:</b>
				A	Not selected				
				K	Special adjustment, density H20				
				L	Special adjustment, density H20, EN10204-3.1				
				S	GL/ABS marine approval (max. 1600 mm)				
				Y	Special version				
<b>70</b>									<b>Additional options 2:</b>
				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

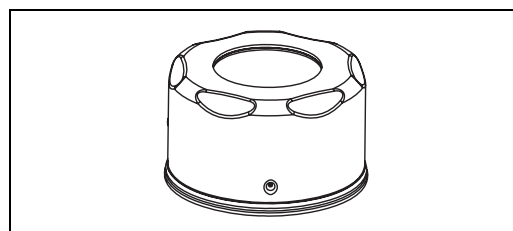
For polyester housing F16  
 Material: PA 12  
 Weight: 0.04 kg  
 Order number: 943461-0001



L00-FTL5xxx-03-05-xx-xx-010

### 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-FTL5xxx-03-05-xx-xx-017

## Documentation



Note!  
 You can find supplementary documentation on the product pages at [www.endress.com](http://www.endress.com)

### Operating Instructions

Electronic insert FEL50A for Liquiphant M/S  
 PROFIBUS PA  
 BA141F/00/en

Liquiphant M Density,  
 Density Computer FML621  
 BA335F/00/en

Liquiphant M FTL51C  
 KA162F/00/a6

Liquiphant M FTL51C-##### 7 ##  
 KA165F/00/a6

Liquiphant M Density FTL50, FTL51  
 Electronic insert: FEL50D  
 KA284F/00/a6

Liquiphant M Density FTL50H, FTL51H  
 Electronic insert: FEL50D  
 KA285F/00/a6

Liquiphant M Density FTL51C  
 Electronic insert: FEL50D  
 KA286F/00/a6

### Technical Information

Nivotester FTL370/372, switching units in Racksyst design  
 for Liquiphant M with electronic insert FEL57  
 TI198F/00/en

Nivotester FTL320, switching unit in Minipac design  
 for Liquiphant M with electronic insert FEL57  
 TI203F/00/en

General instructions for electromagnetic compatibility  
 (Test procedure, installation recommendation)  
 TI241F/00/en

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

TI328F/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

Isolating amplifier FTL375N,  
1 to 3-channel switching units for top-hat rail mounting  
For Liquiphant M/S with electronic insert FEL56, FEL58  
TI361F/00/en

Liquiphant M Density,  
Density Computer FML621  
TI420F/00/en

---

**Functional safety (SIL)**

Liquiphant M/S with electronic insert FEL51 (MAX)  
SD164F/00/en

Liquiphant M/S with electronic insert FEL51 (MIN)  
SD185F/00/en

Liquiphant M/S with electronic insert FEL52 (MAX)  
SD163F/00/en

Liquiphant M/S with electronic insert FEL52 (MIN)  
SD186F/00/en

Liquiphant M/S with electronic insert FEL54 (MAX)  
SD162F/00/en

Liquiphant M/S with electronic insert FEL54 (MIN)  
SD187F/00/en

Liquiphant M/S with electronic insert FEL55 (MAX)  
SD167F/00/en

Liquiphant M/S with electronic insert FEL55 (MIN)  
SD279F/00/en

Liquiphant M/S with electronic insert FEL57 + Nivotester FTL325P (MAX)  
SD111F/00/en

Liquiphant M/S with electronic insert FEL57 + Nivotester FTL325P (MIN)  
SD231F/00/en

Liquiphant M/S with electronic insert FEL57+ Nivotester FTL375P (MAX)  
SD113F/00/en

Liquiphant M/S with electronic insert FEL56 + Nivotester FTL325N (MAX)  
SD168F/00/en


Liquiphant M/S with electronic insert FEL56 + Nivotester FTL325N (MIN)  
SD188F/00/en

Liquiphant M/S with electronic insert FEL58 + Nivotester FTL325N (MAX)  
SD161F/00/en


Liquiphant M/S with electronic insert FEL58 + Nivotester FTL325N (MIN)  
SD170F/00/en


---


**Safety Instructions (ATEX)**


CE  II 1/2 G, EEx d IIC/B

(KEMA 99 ATEX 1157)  
XA031F/00/a3

**CE**  II 1/2 G, EEx ia/ib IIC/B  
(KEMA 99 ATEX 0523)  
XA063F/00/a3

**CE**  II 1 G, EEx ia IIC/B  
(KEMA 99 ATEX 5172 X)  
XA064F/00/a3

**CE**  II 1/2 G, EEx de IIC/B  
(KEMA 00 ATEX 2035)  
XA108F/00/a3

**CE**  II 3 G, EEx nA/nC II  
(EG 01 007-a)  
XA182F/00/a3

**Safety Instructions (NEPSI)**

Ex d IIC/IIB T3-T6 , Ex d IIC T2-T6  
(NEPSI GYJ06424)  
XA401F/00/B2

Ex ia IIC T2-T6, Ex ia IIB T3-T6  
(NEPSI GYJ05556, NEPSI GYJ06464),  
XC009F/00/b2

Ex nA II T3-T6, Ex nC/nL IIC T3-T6  
(NEPSI GYJ04360, NEPSI GYJ071414)  
XC010F/00/b2

**Control Drawings**

Liquiphant M/S (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  
ZD041F-I/00/EN

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  
ZD042F-G/00/EN

Liquiphant M/S (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  
ZD043F-C/00/EN

Liquiphant M, Liquiphant S (cCSAus / XP)  
Class I, Groups A, B, C, D  
Class II, Groups E, F, G  
Class III  
ZD240F/00/EN

Liquiphant M/S (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  
ZD244F/00/EN

**System information**

Liquiphant M  
SI040F/00/en







---

## Instruments International

Endress+Hauser  
Instruments International AG  
Kaegenstrasse 2  
4153 Reinach  
Switzerland

Tel. +41 61 715 81 00  
Fax +41 61 715 25 00  
[www.endress.com](http://www.endress.com)  
[info@ii.endress.com](mailto:info@ii.endress.com)

**Endress+Hauser**   
People for Process Automation

