LENNTECH
WATER TREATMENT SOLUTIONS

Technical Information

# Liquiphant S FTL70, FTL71

Vibronic



## High-temperature point level switch for all types of liquids

**Application**

The Liquiphant S is a point level switch for use in all types of liquids
- for process temperatures between −60 °C and 280 °C (−76 °F to 540 °F) (300 °C (572 °C) for max. 50 cumulative hours; without thermal shock restriction)
- for pressures up to 100 bar (1450 psi)
- for viscosities up to 10,000 mPa*s (cSt)
- for density ≥ 0.5 g/cm³ (SGU) or ≥ 0.7 g/cm³ (SGU), other configurations on request
- Foam detection on request

The function is not affected by flow, turbulence, bubbles, foam, vibration, solids content or buildup, making the Liquiphant an ideal substitute for float switches.

FTL70: Compact design, for pipes also
FTL71: Extension pipe up to 3 m (9.8 ft) and up to 6 m (20 ft) on request

For use in very aggressive liquids, the fork and process connection are available in the highly corrosion-resistant material AlloyC22 (2.4602).

EEx ia, EEx de and EEx d protection enable it to be used in hazardous areas.

**Your benefits**

- Use in safety systems requiring functional safety to SIL2 in accordance with IEC 61508/IEC 61511-1
- Welded, gas-tight feed-through ensures maximum safety, even in the event of damage to sensor
- With process connections from ¾" and small fork dimensions, it is also suitable where space is tight.
- A wide range of process connections allows for universal application.
- The right connection for every process control system: e.g. NAMUR, relay, DC-PMP,
- PROFIBUS PA interface
- No adjustment: quick, low-cost startup
- No mechanical moving parts: maintenance-free

Endress+Hauser
People for Process Automation

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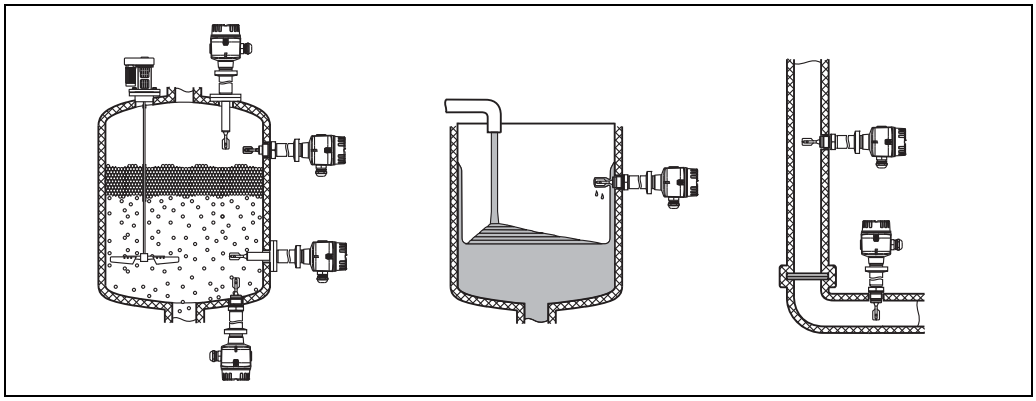
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# Application

**Point level detection**

Maximum or minimum detection in tanks or pipes with all types of cold to very hot liquids. The devices are also suitable for use in hazardous areas and for applications involving high pressure.



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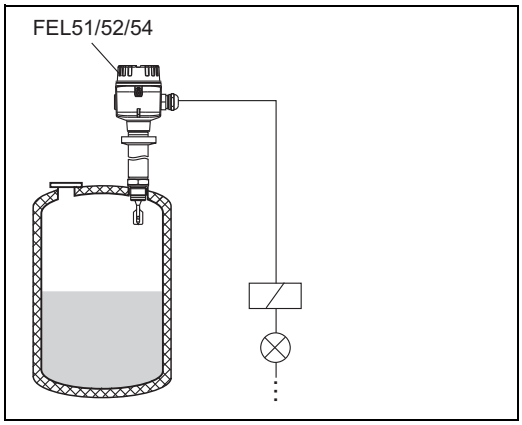
# Function and system design

**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.

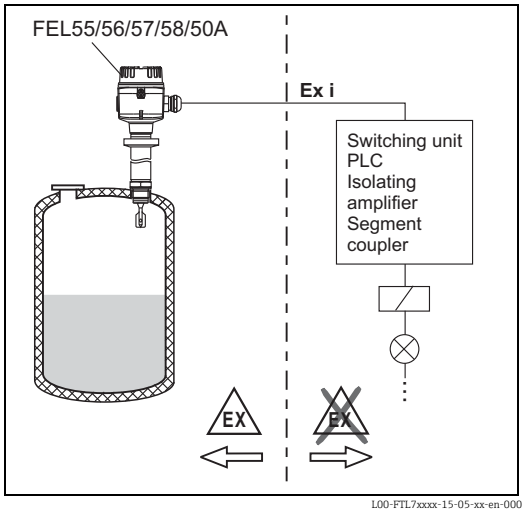
**Modularity**

**Point level switch**
Liquiphant S FTL7x with electronic inserts
FEL51, FEL52, FEL54




L00-FTL7xxxx-15-05-xx-xx-000

**Point level switch**
Liquiphant S FTL7x with electronic inserts
FEL55, FEL56, FEL57, FEL58, FEL50A
for connecting to a separate switching unit, an isolating amplifier or for connecting to a PROFIBUS PA segment coupler




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| | |
|---|---|
| **Electronic versions** | FEL51:<br>Two-wire AC version;<br>Switches the load directly into the power supply circuit via an electronic switch.<br><br>FEL52:<br>Three-wire DC version;<br>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.<br><br>FEL54:<br>Universal current version with relay output;<br>Switches the loads via 2 floating change-over contacts.<br><br>FEL55:<br>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.<br><br>FEL56:<br>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.<br><br>FEL58:<br>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.<br>Checking of connecting cabling and other devices by pressing a key on the electronic insert.<br><br>FEL57:<br>For separate switching unit; PFM signal transmission;<br>Current pulses superposed on the power supply along the two-wire cabling.<br>Proof test from the switching unit without changing levels.<br><br>FEL50A:<br>For connecting to PROFIBUS PA;<br>Cyclic and acyclic data exchange acc. to PROFIBUS-PA Profile 3.0<br>Discrete Input |
| **Galvanic isolation** | FEL51, FEL52, FEL50A: between sensor and power supply<br><br>FEL54: between sensor and power supply and load<br><br>FEL55, FEL56, FEL57, FEL58, FEL50D: see connected switching unit |
| **Design** | FTL70: Compact<br><br>FTL71: With extension pipe |

# Input

| | |
|---|---|
| **Measured variable** | Level (limit value) |
| **Measuring range (detection range)** | FTL70: dependent on mounting point<br><br>FTL71: dependent on mounting point and the extension pipe ordered.<br>Standard extension pipe up to 3 m (9.8 ft) and up to 6 m (20 ft) on request. |
| **Process density** | Setting on the electronic insert > 0.5 g/cm$^3$ (SGU) or > 0.7 g/cm$^3$ (SGU) (others 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

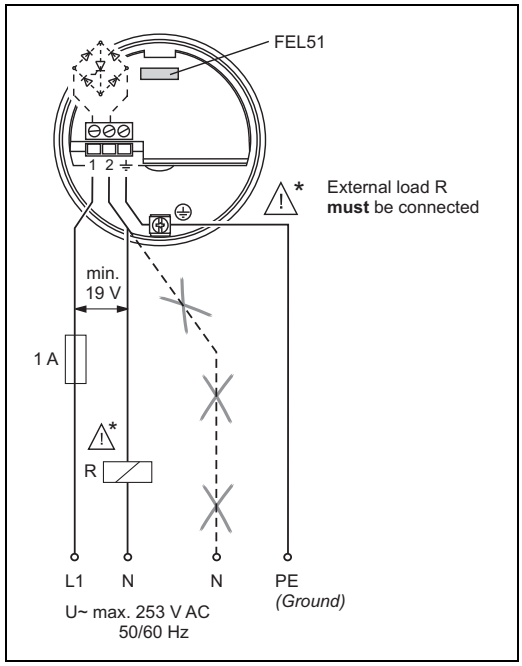
**Electrical connection**

**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 | LEDs red |
|---|---|---|---|---|
| MAX | | 1 —$I_L$→ 2 | ☼ | ● |
| | | 1 --< 3.8 mA--> 2 | ☼ | ☼ |
| MIN | | 1 —$I_L$→ 2 | ☼ | ● |
| | | 1 --< 3.8 mA--> 2 | ☼ | ☼ |

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**Signal on alarm**

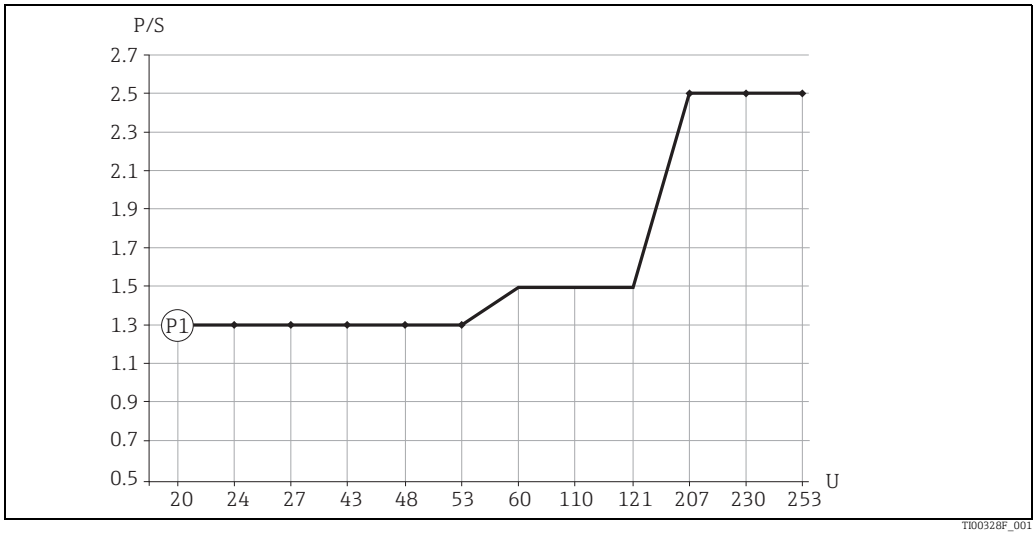
Output signal on power failure or in the event of damaged sensor: < 3.8 mA

**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)

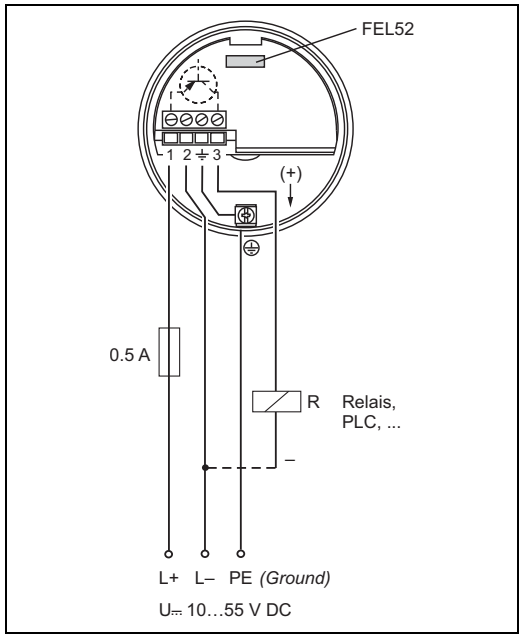
**Power supply**

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.




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**Output signal**

$I_L$ = load current (switched through)

< 100 µA = residual current (blocked)

☼ = lit

● = unlit

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

| Safety mode | Level | Output signal | LEDs green | LEDs red |
|---|---|---|---|---|
| MAX |  | L+ 1 $I_L$ + 3 | ☼ | ● |
| |  | 1 < 100 µA 3 | ☼ | ☼ |
| MIN |  | L+ 1 $I_L$ + 3 | ☼ | ● |
| |  | 1 < 100 µA 3 | ☼ | ☼ |

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

**Signal on alarm**

Output signal on power failure or in the event of damaged sensor: < 100 µA

**Connectable load**

- Load switched via transistor and separate PNP connection, ≤ DC 55 V
- Load current ≤ 350 mA (pulsed overload and short-circuit protection)
- Residual current < 100 µA (with transistor blocked)
- Capacitance load ≤ 0.5 µF at 55 V, 1.0 µF 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**

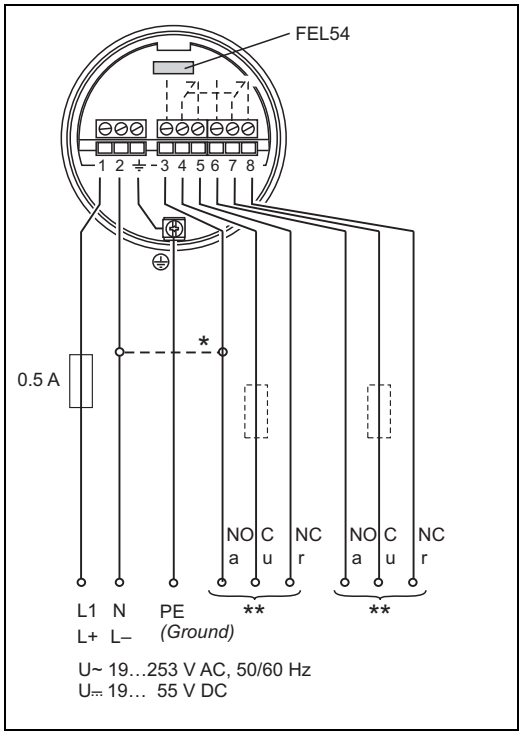
**Universal current connection with relay output**

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

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

** See "Connectable load"

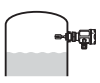
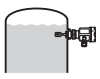
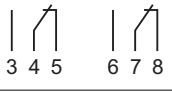
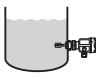
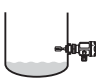



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**Output signal**

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

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

| Safety mode | Level | Output signal | LEDs green | LEDs 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-005

**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~ ≤ 6 A (Ex de 4 A), U~ ≤ AC 253 V; P~ ≤ 1500 VA, cos φ = 1, P~ ≤ 750 VA, cos φ > 0.7
- I⎓ ≤ 6 A (Ex de 4 A) to DC 30 V , I⎓ ≤ 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**

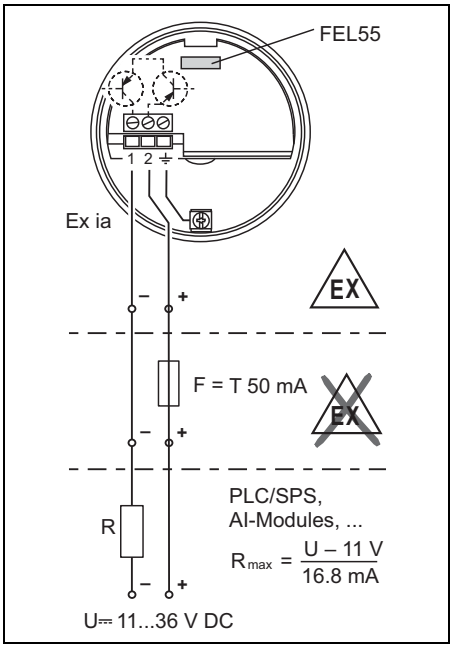
Supply voltage: DC 11 to 36 V
Power consumption: < 600 mW
Reverse polarity protection
Overvoltage protection FEL55: overvoltage category III

**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).




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

**Output signal**

~ 16 mA = 16 mA ± 5 %

~ 8 mA = 8 mA ± 6 %

☼ = lit

● = unlit

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

| Safety mode | Level | Output signal | LEDs green | LEDs red |
|---|---|---|---|---|
| MAX | | + 2 ~16 mA 1 | ☼ | ● |
| | | + 2 ~8 mA 1 | ☼ | ☼ |
| MIN | | + 2 ~16 mA 1 | ☼ | ● |
| | | + 2 ~8 mA 1 | ☼ | ☼ |

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

**Signal on alarm**

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

**Connectable load**

- R = (U - 11 V) : 16.8 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 Ω = (U – 11V) / 16.8 mA
4.2 [Ω /A] = U – 11 V
U = 15.2 V

# Electronic insert FEL56 (NAMUR L-H edge)

**Power supply**

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

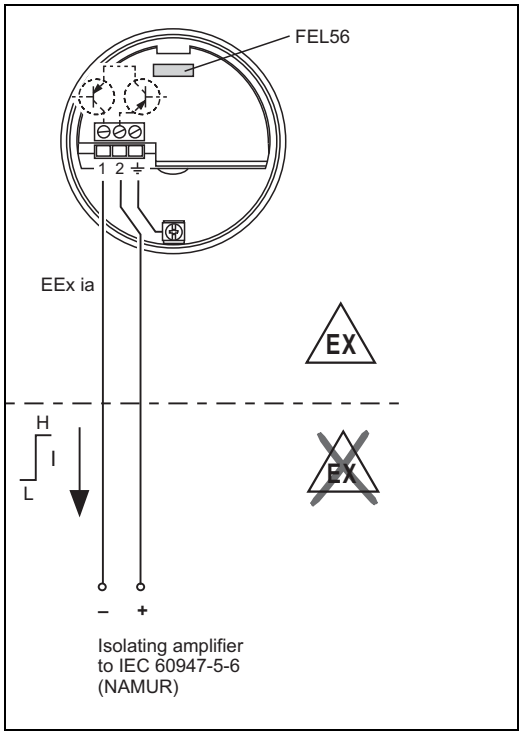
**Electrical connection**

**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.

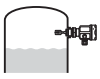
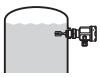
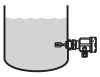
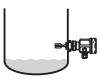



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**Output signal**

= lit
= flashes
= unlit

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

| Safety mode | Level | Output signal | LEDs green | LEDs red |
|---|---|---|---|---|
| MAX |  | + 2 → 1 : 0.6 … 1.0 mA | ☼ | ● |
| |  | + 2 → 1 : 2.2 … 2.8 mA | ☼ | ☀ |
| MIN |  | + 2 → 1 : 0.6 … 1.0 mA | ☼ | ● |
| |  | + 2 → 1 : 2.2 … 2.8 mA | ☼ | ☀ |

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 ±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**

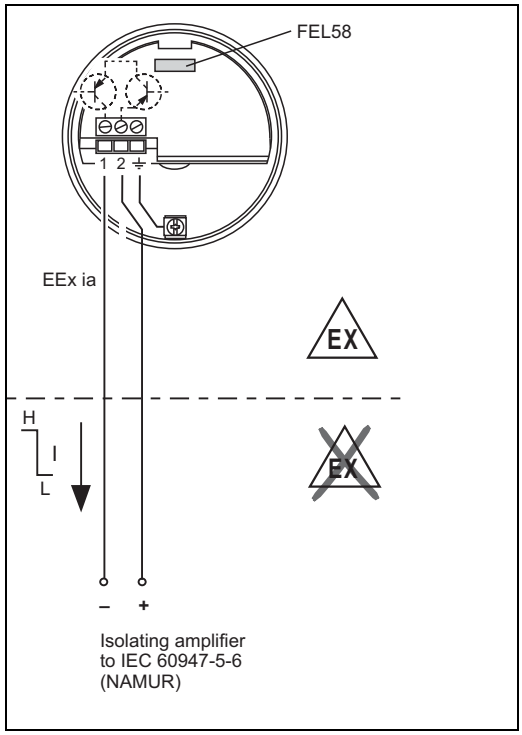
For connecting to isolating amplifiers as per NAMUR (IEC 60947-5-6), e.g. FTL325N, FTL375N from Endress+Hauser.
Output signal jump from high to low current on point level.

**(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**

= lit
= flashes
= unlit

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

| Safety mode | Level | Output signal | LEDs green | LEDs yellow |
|---|---|---|---|---|
| MAX |  | + 2 → 1 2.2 … 3.5 mA | ☼ | ☼ |
| |  | + 2 → 1 0.6 … 1.0 mA | ◪ | ● |
| MIN |  | + 2 → 1 2.2 … 3.5 mA | ☼ | ☼ |
| |  | + 2 → 1 0.6 … 1.0 mA | ◪ | ● |

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**

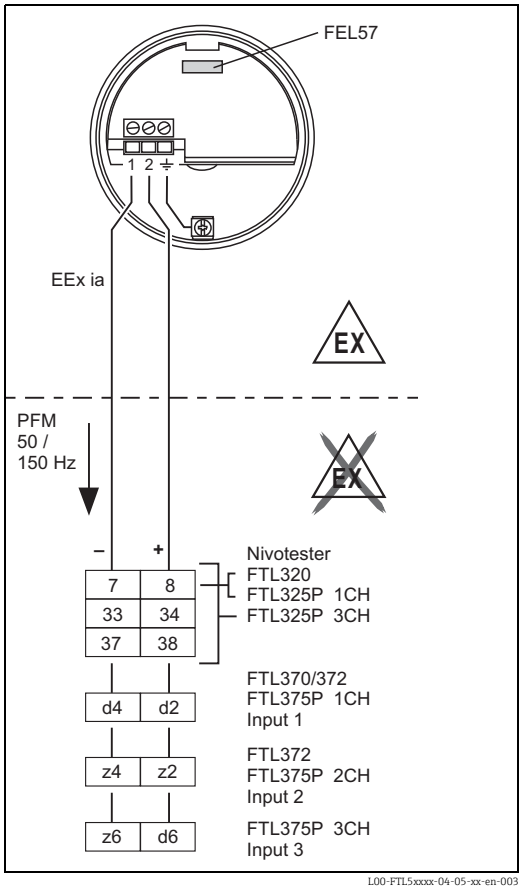
**Two-wire connection for separate switching unit**

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 “proof test”:
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.
  For proof testing, the Nivotester tests the sensor's level notification function.
- **Extended (EXT)**:
  Corrosion of the fork possible;
  Simulation approx. 41 s: tuning fork exposed – covered – corroded – exposed.
  For proof testing, the Nivotester tests the sensor's level notification function and fault notification (alarm) function.

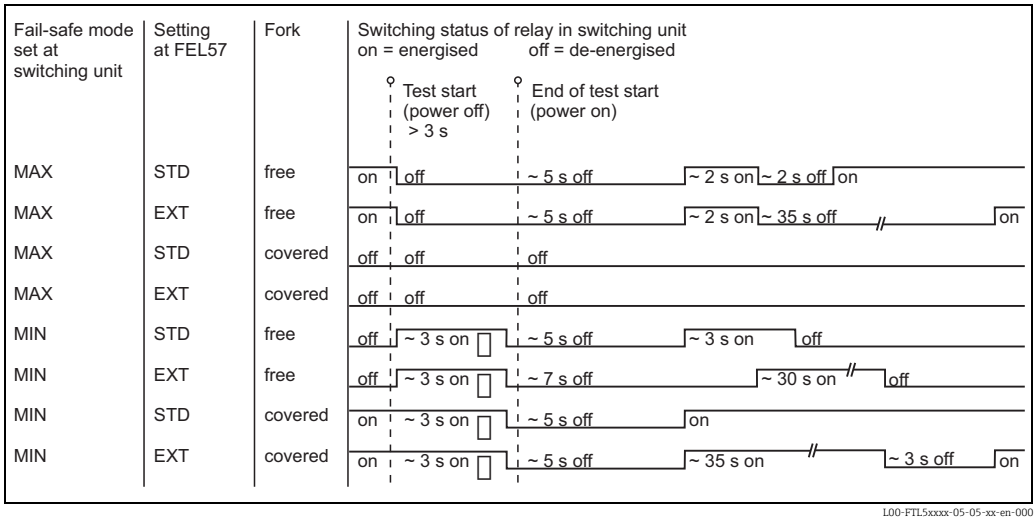



The check is activated and monitored at the switching unit.

The twin-core connecting cable (instrument cable) with a cable resistance of ≤25Ω 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.

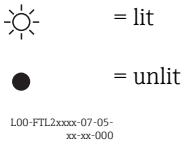
**Switching behavior of the connected device:**

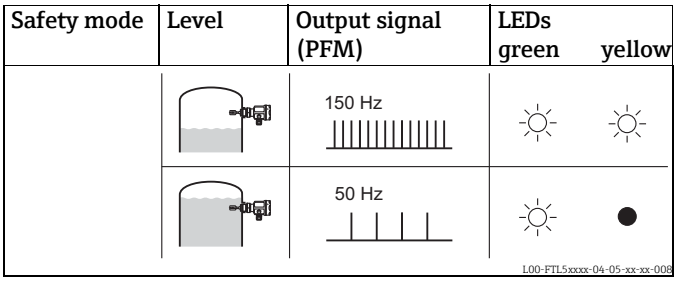



* De-energized on power supply failure

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**




**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)

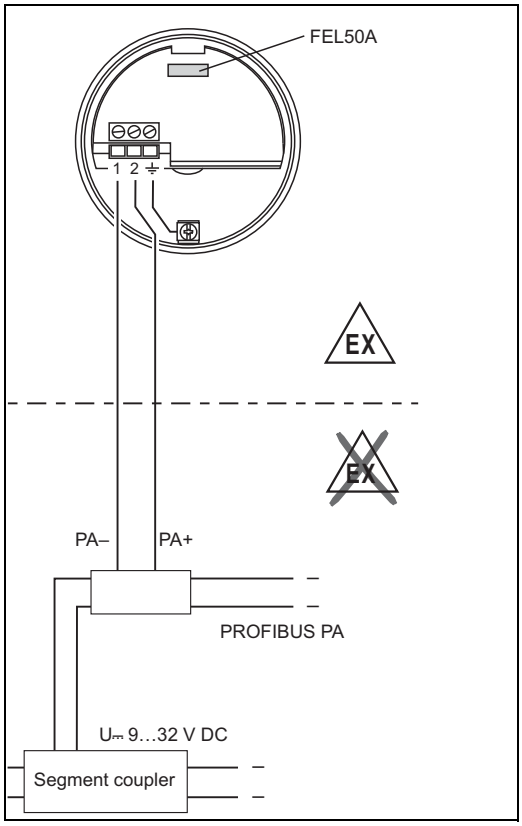
**Electrical connection**

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

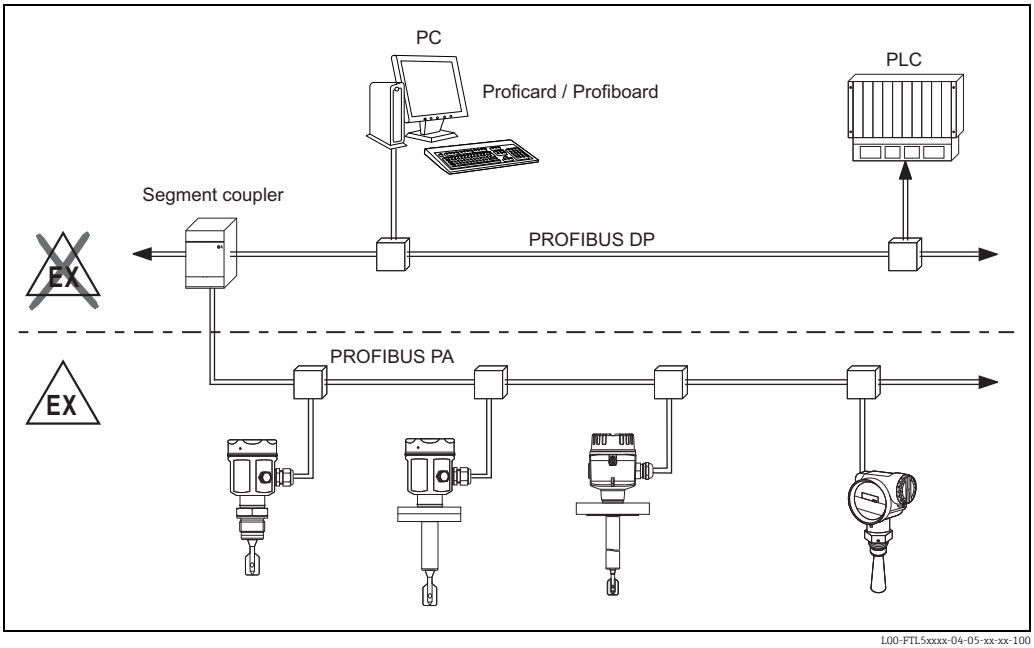
For connecting to PROFIBUS PA

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



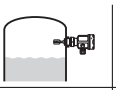
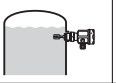
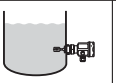

L00-FTL5xxxx-04-05-xx-xx-100

**Output signal**

☼ = lit

● = unlit

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

| Setting | Level | LEDs green | LEDs yellow | FEL50A |
|---|---|---|---|---|
| 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-009

**Signal on alarm**

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

# Connection and function

**Connecting cables**

- Electronic inserts: cross-section ≤ 2.5 mm² (14 AWG); strand in ferrule as per DIN 46228
- Protective ground in housing: cross-section ≤ 2.5 mm² (14 AWG)
- External equipotential bonding connection on housing: cross-section ≤ 4 mm² (12 AWG)

**Safety mode**

Minimum/maximum residual current safety selectable on electronic insert
(with FEL57 on Nivotester only)

MAX = maximum safety:
The output switches to the power fail response when the fork is covered
For use with overfill protection for example

MIN = minimum safety:
The output switches to the power fail response when the fork is exposed
For use with dry running protection for example

**Switching time**

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

Other switching times available on request.

**Switch-on behavior**

When switching on the power supply, the output assumes the alarm signal.
After ≤ 3 s it assumes the correct switching mode (exception: FEL57)

# Accuracy

**Reference operating conditions**

Ambient temperature: 23 °C (73 °F)

Medium temperature: 23 °C (73 °F)

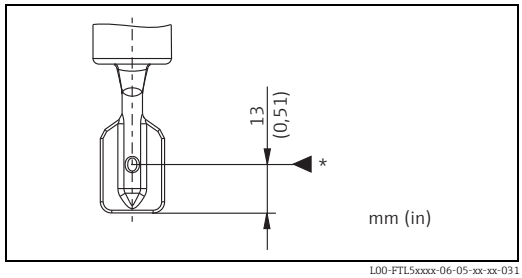
Medium density (water): 1 g/cm³ (SGU)

Medium viscosity: 1 mm²/s (cSt)

Medium pressure $p_e$: 0 bar (0 psi)

Sensor mounting: vertical from above

Density switch: to > 0.7 g/cm³ (SGU)




L00-FTL5xxxx-06-05-xx-xx-031

** 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** | approx. 2 mm (0.08 in) |
| **Influence of process temperature** | max. +1.4 to −5.5 mm (−60 to +280 °C)<br>max. +0.06 to -0.22 in |
| **Influence of process density** | max. +4.8 to −3.5 mm ((0.5 to 1.5 g/cm³ (SGU))<br>max. +0.19 to -0.14 in |
| **Influence of process pressure** | max. 0 to −3.9 mm (−1 to 100 bar (-14.5 to 1450 psi))<br>max. 0 to -0.15 in |
| **Switching delay** | ▪ When fork is covered: 0.5 s<br>▪ When fork is exposed: 1.0 s<br>▪ Available on request: 0.2 s; 1.5 s or 5 s (when the tuning fork is covered or exposed) |

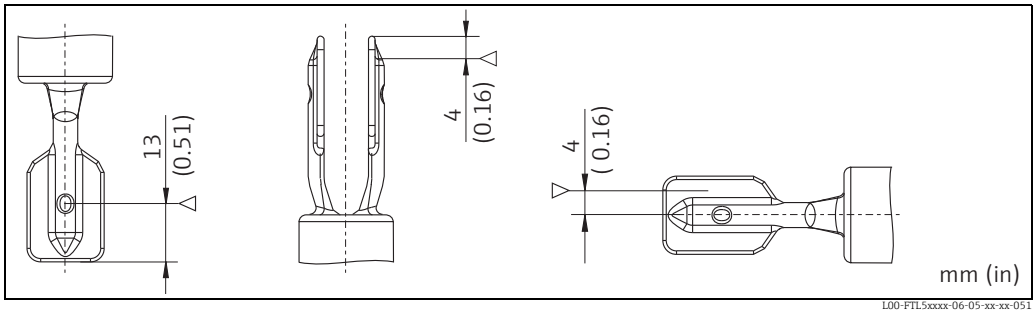
# Operating conditions

**Installation**

**Installation instructions**

Switch points ⊩ on the sensor depend on the mounting position, with reference to water,

Density 1 g/cm³ (SGU), 23 °C (73 °F), $p_e$ 0 bar (0 psi).



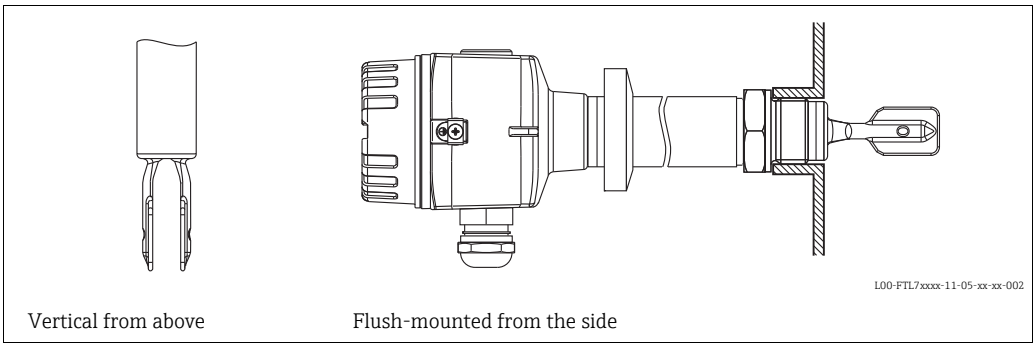

*Mounting from above* *Mounting from below* *Mounting from the side*

**Examples of mounting**

Depending on the viscosity ν of the liquid and the tendency to form buildup

**Optimum mounting, without problem even with high viscosity:**

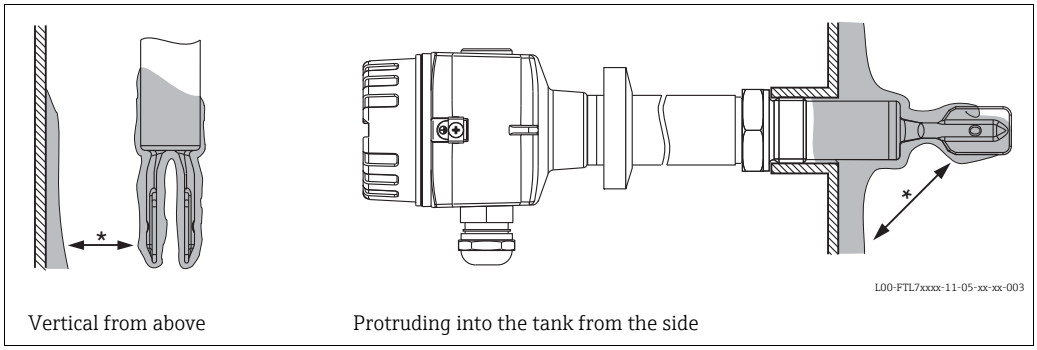
Position the fork so that the narrow edge of the tines is vertical to ensure that the liquid can run off easily.




Vertical from above Flush-mounted from the side

**With buildup on the tank walls:**

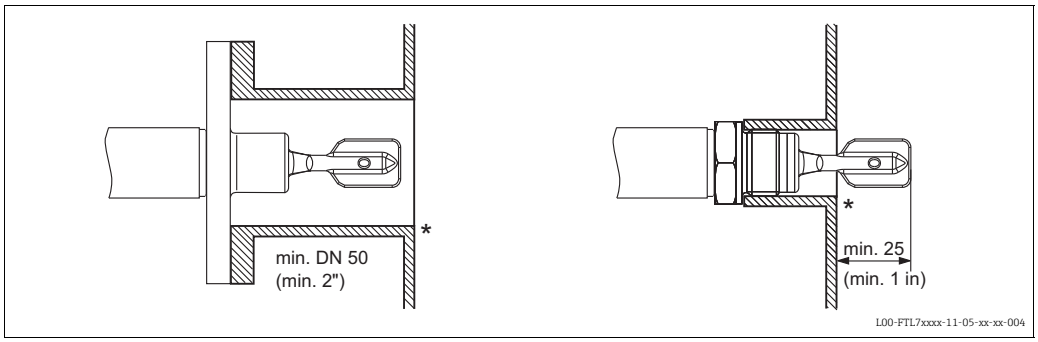
* Ensure that there is sufficient distance between the buildup expected on the tank wall and the fork.




Vertical from above | Protruding into the tank from the side

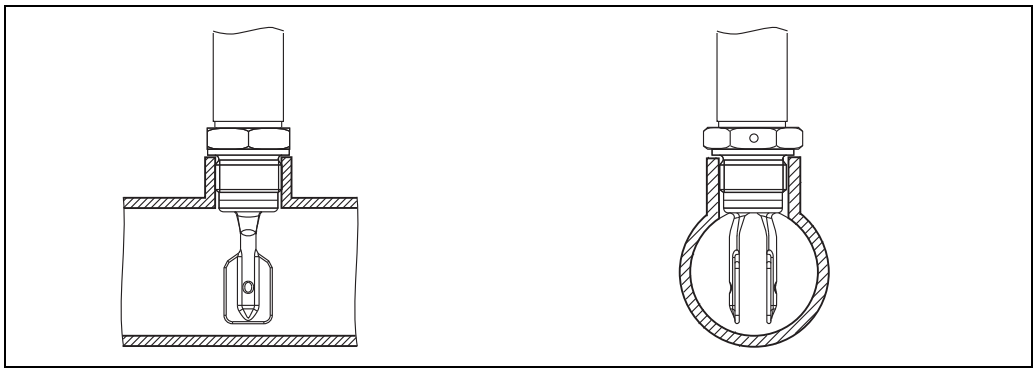
**Mounting positions in the case of low viscosity (up to 2000 mm²/s (cSt)):**

* Deburr the nozzle surfaces



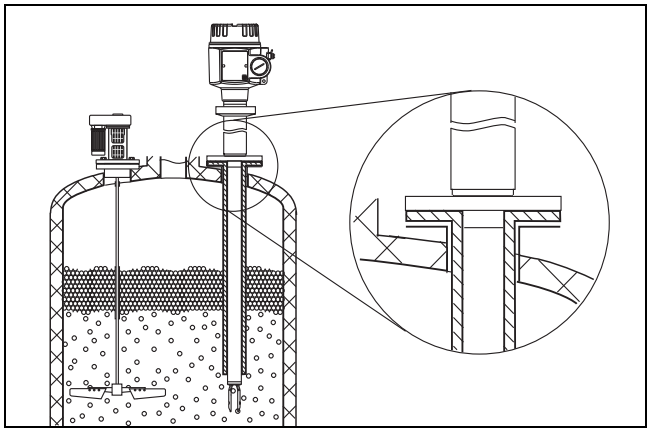

**Installation in pipes from 2":**

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



**Dynamic load**

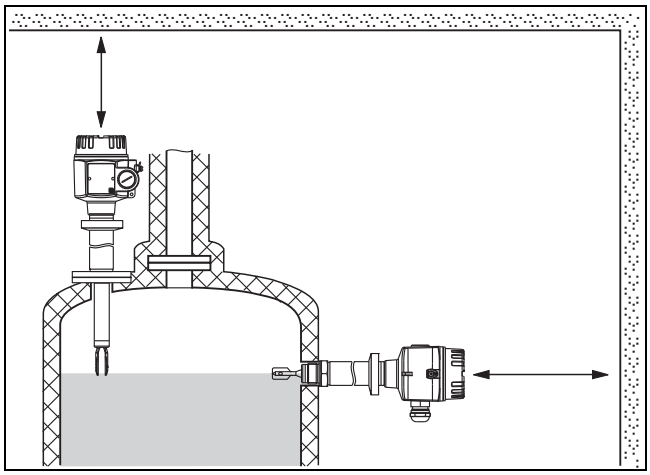
Support the Liquiphant S FTL71 in the event of a severe dynamic load.



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**Space outside the tank**

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



L00-FTL7xxxx-11-05-xx-xx-007

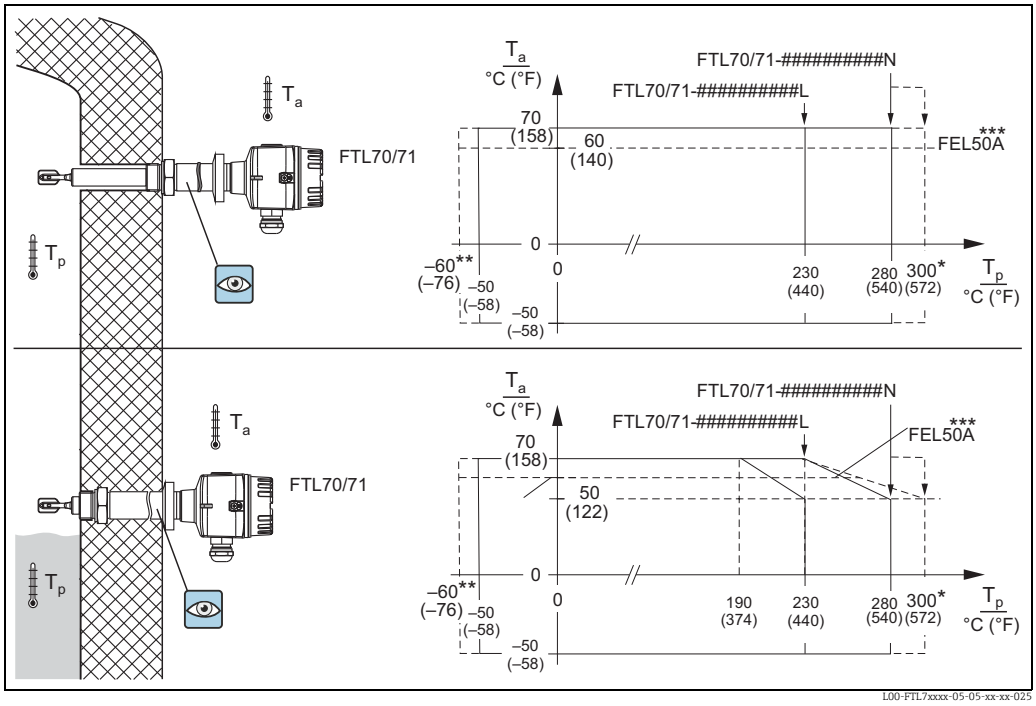
**Orientation**

FTL70, and FTL71 with short pipe up to approx. 500 mm (19.7 in): in any position,
FTL71 with long pipe: vertical

# Environment

**Ambient temperature range**

Permitted ambient temperature $T_a$ at the housing depending on the process temperature $T_p$ in the vessel:




L00-FTL7xxxx-05-05-xx-xx-025

* *Maximum of 50 cumulative hours*
** *–60 °C for ATEX and CSA certificates only*
*** *FEL50A maximum +60 °C ambient temperature ($T_a$) in hazardous areas*

**Ambient temperature limits**

–50 to +70 °C (-58 to 158 °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 | 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 |

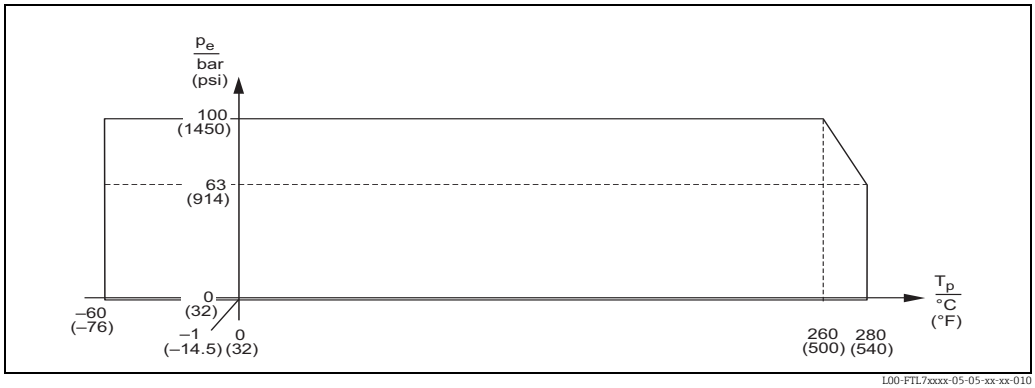
* As per EN60529
** As per NEMA 250
*** Only with M20 cable entry or G1/2 thread
**** F13 housing only in conjunction with XP or Ex d approval

**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<br>Interference immunity to EN 61326; Annex A (Industrial) and NAMUR Recommendation NE 21 (EMC) |

# Process conditions

| | |
|---|---|
| **Process temperature** | −60 to +280 °C (-76 to 536 °F) and 300 °C (572 °C) for max. 50 cumulative hours |
| **Thermal shock** | Without restriction within the process temperature range. |
| **Process pressure $p_e$** | <br>L00-FTL7xxxx-05-05-xx-xx-010<br><br>For the pressure values permitted for the flanges in the case of higher temperatures, please refer to the following standards:<br>▪ pR EN 1092-1: 2005<br>With regard to their stability-temperature property, the materials 1.4435 and 1.4404 are identical and are grouped together in EN1092-1 Tab. 18 under 13E0. The chemical composition of the two materials can be identical.<br>▪ ASME B 16.5a - 1998 Tab. 2-2.2 F316<br>▪ ASME B 16.5a - 1998 Tab. 2.3.8 N10276<br>▪ JIS B 2220<br><br>The lowest value from the derating curves of the device and selected flange applies in each case. |
| **Test pressure** | max. 150 bar (2175 psi) at 20 °C (68 °F). The function is not available during test pressure.<br>Burst pressure of diaphragm 400 bar (5800 psi) |
| **State of aggregation** | Liquid |
| **Density** | ≥ 0.7 g/cm³ (SGU) = delivery status<br>≥ 0.5 g/cm³ (SGU) can be adjusted via switches |
| **Viscosity** | ≤ 10,000 mm2/s (cSt) |
| **Solids content** | ≤ ø5 mm (0.2 in) |
| **Lateral loading** | ≤ 75 Nm |
| **Medium conditions** | The service life of the device can be affected in applications involving an increased h level of hydrogen diffusion through the metal process isolating diaphragm of the sensor.<br>Typical conditions: temperature >180 °C (>356 °F) and pressure >64 bar (>928 psi) |

# 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 FTL7x at www.endress.com.

## Design

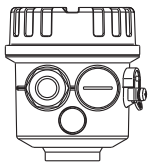
### Summary of all electrical and mechanical versions

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

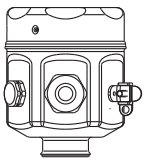

L00-FTL5xxxx-03-05-xx-xx-000

| | |
|---|---|
| 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 |

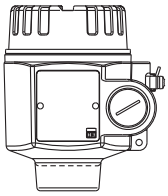
*Housing*


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

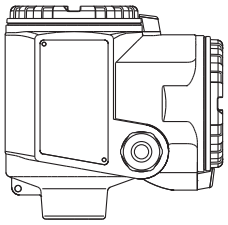
**F16**
Polyester (PBT)


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

**F15**
Stainless steel (316L)


L00-FTL5xxxx-03-05-xx-xx-003

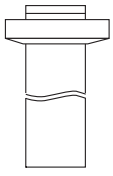
**F13**
Aluminum, coated (also for Ex d)
**F17**
Aluminum, coated
**F27**
Stainless steel (316L), (also for Ex d)


L00-FTL5xxxx-03-05-xx-xx-004

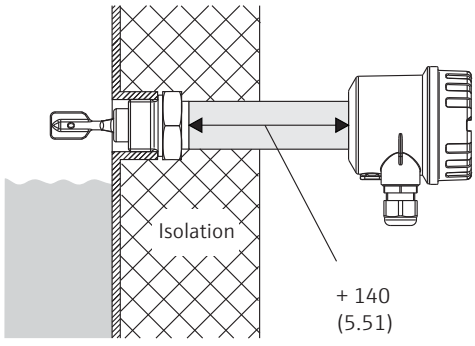
**T13**
Aluminum with separate connection compartment (also Ex de and Ex d), coated

*Temperature spacer and pressure-tight feedthrough*

**Temperature spacer** with gas-tight, welded feed-through (standard version)
approx. 160 mm (6.3 in) to 230 °C (446 °F)
Order code ("L")
approx. 200 mm (7.87 in) to 280 °C (536 °F)
Order code ("N")

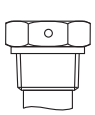

L00-FTL7xxxx-03-05-xx-xx-002

**Pressure-tight feedthrough** (optional)
Protects the housing from pressures up to 100 bar (1450 psi) if the sensor is damaged. Provides sealed insulation for the vessel and normal ambient temperatures for the housing.



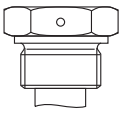
L00-FTL5xxxx-06-05-xx-xx-091

*Process connections*



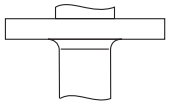
L00-FTL5xxxx-03-05-xx-xx-006

G ¾, DIN ISO 228/I
R ¾, DIN 2999
NPT ¾, ANSI B 1.20.1
(AF 32)



L00-FTL5xxxx-03-05-xx-xx-007

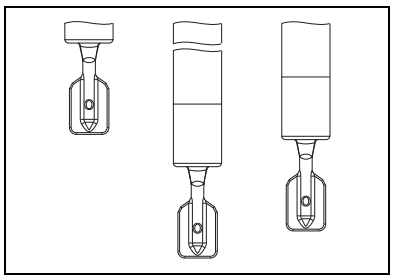
G 1, DIN ISO 228/I
R 1, DIN 2999
NPT 1, ANSI B 1.20.1
(AF 41)



L00-FTL5xxxx-03-05-xx-xx-009

Flanges according to DIN, ANSI, JIS
from DN 25 / 1"

*Sensors*
Compact or with extension pipe up to 3 m (9.8 in)
(6 m (20 in) on request)



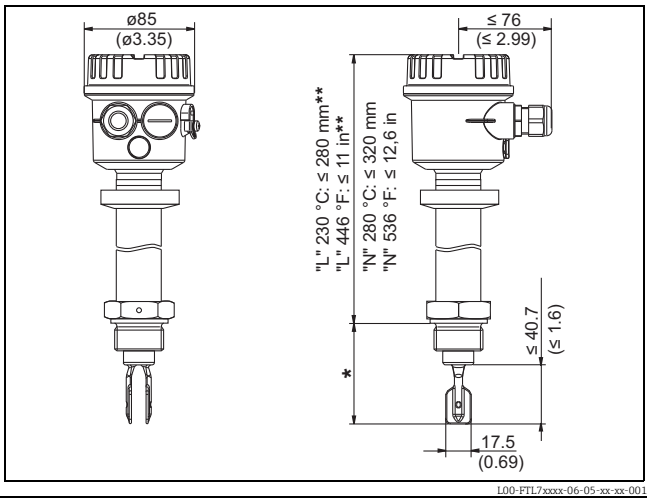
L00-FTL5xxxx-03-05-xx-xx-018

**Dimensions**

**Dimensions in mm (in)!**

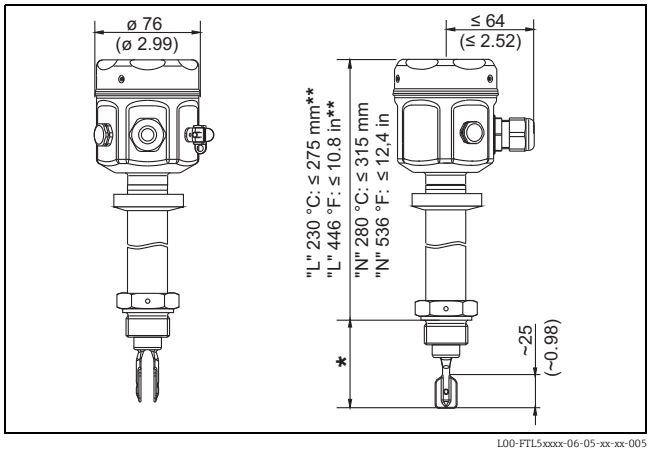
Housing and sensor FTL70/71

*Polyester housing F16*




L00-FTL7xxxx-06-05-xx-xx-001

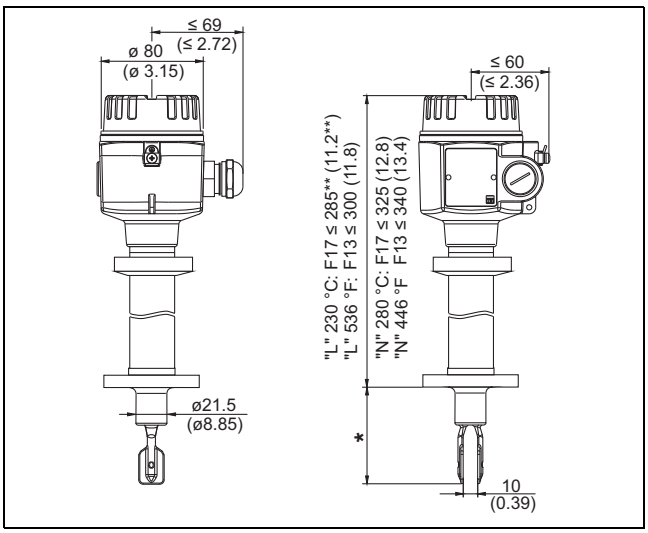
*Stainless steel housing F15*



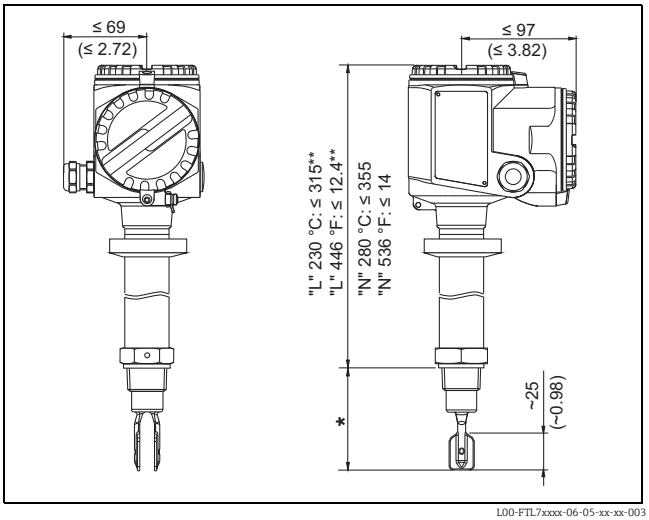

L00-FTL5xxxx-06-05-xx-xx-005

* See process connections
** "L" = version FTL70/71 - # # # # # # # # # # L for 230 °C (446 °F)
"N" = version FTL70/71 - # # # # # # # # # # N for 280 °C (536 °F)

*Aluminum housing F17/F13*
*Stainless steel housing (316L) F27*
*(F13 also for Ex d)*



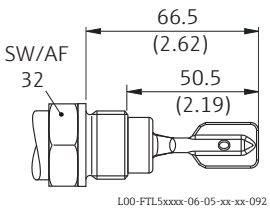
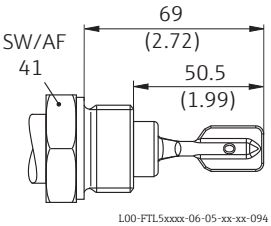

Aluminum housing T13
with separate connection
compartment

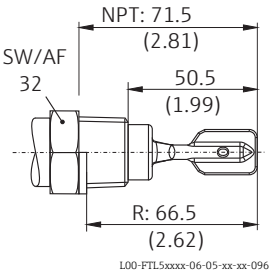
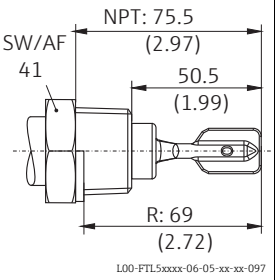
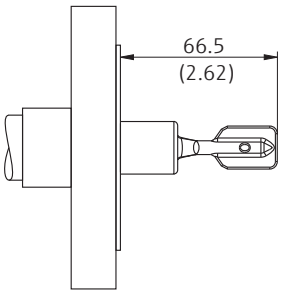



* See process connections
** "L" = version FTL70/71 - # # # # # # # # # # L for 230 °C (446 °F)
"N" = version FTL70/71 - # # # # # # # # # # N for 280 °C (536 °F)

The dimensions apply to process connections with G, R, NPT threads;
for versions with flanges, the dimensions may be up to 30 mm (1.18 in) greater.

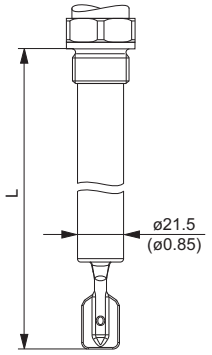
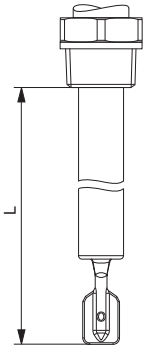
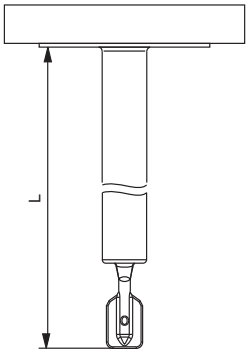
**Process connections**

| Process connection | | Dimensions | Accessories | Pressure<br>Temperature |
|---|---|---|---|---|
| **G ¾**<br>DIN ISO 228/I | GQ2<br>GQ6 |  | Flat seal as per<br>DIN 7603;<br>installed on site | ≤ 100 bar<br>(≤ 1450 psi)<br><br>≤ 280 °C<br>(≤ 536 °F) |
| **G 1**<br>DIN ISO 228/I | GR2<br>GR6 |  | Flat seal as per<br>DIN 7603;<br>installed on site | ≤ 100 bar<br>(≤ 1450 psi)<br><br>≤ 280 °C<br>(≤ 536 °F) |

| Process connection | | Dimensions | Accessories | Pressure Temperature |
|---|---|---|---|---|
| **NPT ¾**<br>ANSI B 1.20.1<br><br>or<br><br>**R ¾**<br>DIN 2999 | GM2<br>GM6<br><br><br><br>GE2<br>GE6 |  | | ≤ 100 bar<br>(≤ 1450 psi)<br><br>≤ 280 °C<br>(≤ 536 °F) |
| **NPT1**<br>ANSI B 1.20.1<br><br>or<br><br>**R 1**<br>DIN 2999 | GN2<br>GN6<br><br><br><br>GF2<br>GF6 |  | | ≤ 100 bar<br>(≤ 1450 psi)<br><br>≤ 280 °C<br>(≤ 536 °F) |
| **Flanges**<br>ANSI B 16.5<br>EN 1092-1<br>(DIN 2527 B)<br>JIS B2220 | A##<br>B##<br>C##<br>K## |  | Seal depending on design;<br>installed on site | See nominal pressure of flange, however<br>≤ 100 bar<br>(≤ 1450 psi)<br><br>≤ 280 °C<br>(≤ 536 °F)<br><br>At high temperatures, note pressure loading capacity of flange depending on temperature! |
| | For higher chemical-resistance, AlloyC22-plated flanges are available. The flange carrier material is made of 316L and is welded with a 2 to 3 mm (0.08 to 0.12 in) thick AlloyC22 disk. | | | |

**Sensor length L for FTL71**

The sensor length L depends on the process connection.

| Thread: G ¾ G 1 | Thread: NPT ¾ NPT1 R ¾ R 1 | Flanges and flange-like process connections |
|---|---|---|
|  |  |  |
| From seal surface of thread | From lower edge of thread | |

Any length L:
148 mm to 3000 mm (6 to 115 in); special version (TSP) on request up to 6000 mm (235 in)

**Weights**

See ordering information: → 31

**Materials**

Material specifications as per AISI and DIN-EN.

**Parts in contact with process**

- Process connection and extension pipe: 316L (1.4435) optional 2.4602 (AlloyC22)
- Tuning fork: S31803 (1.4462) optional 2.4602 (AlloyC22)
- Flanges: 316L (1.4404)
- Flange plating: AlloyC22

**Parts with no process contact**

- Tuning fork/housing seal: EPDM
- Temperature spacer: 316 L (1.4435)
- Pressure-tight feedthrough: 316L (1.4435)
- Ground terminals at housing (external): 304 (1.4301)
- Nameplate on housing (external): 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 (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,
  - 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-AlSi10Mg, plastic-coated,
  - Cover seal: EPDM
  - Safety claw: nickel-plated brass

**Process connections**

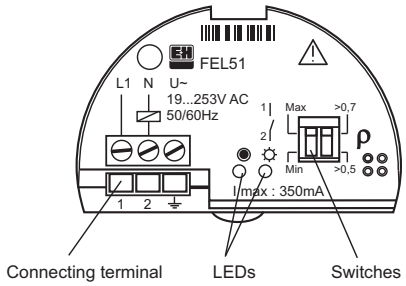
- Parallel thread G ¾, G 1 as per DIN ISO 228/I, flat seal as per DIN 7603, installed on site
- Tapered thread R ¾, R 1 as per DIN 2999 Part 1
- Tapered thread ¾ -14 NPT, 1 - 11½ NPT as per ANSI B 1.20.1
- Flanges (for standards, see also Ordering information → 31+):
  - as per EN/DIN from DN 25
  - as per ANSI B16.5 from 1"
  - as per JIS B2220 (RF)

# Operability

**Electronic inserts**

With FEL51, FEL52, FEL54, FEL55:

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




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With FEL56:

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



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

With FEL57:

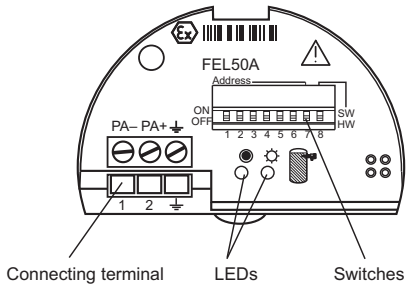
- 2 switches for density change and proof testing,
- green LED to indicate operational status,
- yellow LED to indicate covered status, flashes in the event of corrosion damage on sensor or if the electronics are defective

With FEL58:

- 2 switches for fail-safe circuit 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 switching status, test key
  - breaks cable connection

With FEL50A:

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




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**Operating concept**

Onsite configuration

# Certificates and approvals

**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

**Other certificates**

- See Ordering informationLiquiphant S FTL70 FTL71 → 🖹 31
- Leak-detection system in conjunction with WHG approval
  Approval number: Z–65.40–446
  (See also "Ordering information" → 🖹 31)
- TSE Certificate of Suitability
  The following applies to wetted device components:
  – They do not contain any materials derived from animals.
  – No additives or operating materials derived from animals are used in production or processing.

  ✎ Note!
  Wetted device components are listed in the "Mechanical construction“ (→ 🖹 22+) and “Ordering information“ (→ 🖹 31) sections.

**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**

Device versions available with CRN approval: 0F10904.5C (Canadian Registration Number) are marked with a "*" in feature 20 "Process connection" under Ordering information( → 🖹 31+).
Further details on maximum pressure values are available in the Download area of the product pages under www.endress.com.

**Process seal according to ANSI/ISA 12.27.01**

Practice in North America for the installation of process seals
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.
Further information is provided in the Safety Instructions (XA) for the specific device → 39 ff.

| Product | Listing | Type | Max. process pressure | Marking |
|---|---|---|---|---|
| Liquiphant M | CSA<br>FM | FTL70-S/T##...<br>FTL70-P/Q/R##... | 64/100 bar<br>(928/1450 psi) | Single Seal |
| | CSA<br>FM | FTL71-S/T##...<br>FTL71-P/Q/R##... | 64/100 bar<br>(928/1450 psi) | Single Seal |

**Pressure Equipment Directive 2014/68/EU (PED)**

**Pressure instruments with permitted pressure ≤ 200 bar (2 900 psi)**

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.

**Reason:**

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.

**Use in hazardous zones**

Pay particular attention to the information provided in the documentation: Safety Instructions, Control Drawings etc. → 39

**ASME B 31.3**

Design and materials in accordance with ASME B31.3 The welding seals are through-penetration welded and comply with ASME Boiler and Pressure Vessel Code Section IX and EN ISO 15614-1.

**Combinations of housing and electronic inserts**

For permitted combinations of housing versions and electronic inserts, see the safety instructions for ATEX, NEPSI etc.. A list of available documents can be found on → 39+. The actual documents are available on the product pages at www.endress.com.

Abbreviations used:

| Housing | Electronic inserts |
|---|---|
| Polyester housing F16<br>Aluminum housing F17 (plug-in)<br>Aluminum housing F13 (thread)<br>Aluminum housing T13 (separate connection compartment)<br>Stainless steel housing F15 (for hygiene applications)<br>Stainless steel housing F27 (precision casting) | FEL50A Profibus PA<br>FEL51 SIL 2-wire 19-253VDC<br>FEL52 3-wire PNP<br>FEL54 relay DPDT 19-253VAC/19-55VDC<br>FEL55 8/16mA, 11-36VDC<br>FEL56 NAMUR (L-H signal)<br>FEL57 2-wire PFM<br>FEL58 NAMUR+test key (H-L signal) |

| | | | |
|---|---|---|---|
| A: | Non-hazardous area | F16, F17, F13, T13, F15, F27 | FEL51/52/54 FEL50A/55/56/57/58 |
| B: | ATEX/NEPSI II 3G EEx nC II T6, WHG | F16, F17, F13, T13, F15, F27 | FEL54 |
| C: | ATEX/NEPSI II 3G EEx nA II T6, WHG | F16, F17, F13, T13, F15, F27 | FEL51/52 FEL50A/55/56/57/58 |
| D: | Non-hazardous area, WHG | F16, F17, F13, T13, F15, F27 | FEL51/52/54 FEL50A/55/56/57/58 |
| E: | ATEX II 1/2G EEx de IIC T6, WHG/ IEC Zone 0/1 | T13 | FEL51/52/54 FEL50A/55/56/57/58 |
| F: | ATEX II 1/2GD Ex ia IIC T6, WHG/ IEC | F17, F13, T13, F15, F27 | FEL50A/55/56/57/58 |
| L: | ATEX II 1/2G EEx d IIC T6, WHG/ IECE Zone 0/1 | F13, T13, F27 | FEL51/52/54 FEL50A/55/56/57/58 |
| M: | NEPSI Ex ia IIC T6 | F16, F17, F13, T13, F15, F27 | FEL50A/55/56/57/58 |
| N: | NEPSI Ex d IIC T6 | F13, T13, F27 | FEL51/52/54 FEL50A/55/56/57/58 |
| P: | FM IS Cl.I, II ,III Div.1 Gr.A-G, Zone 0, 1, 2, 20, 21, 22 | F16, F17, F13, T13, F15, F27 (with NPT cable entry) | FEL50A/55/56/57/58 |
| Q: | FM XP Cl.I, II, III Div.1 Gr.A-G, Zone 1, 2, 21, 22 | F13, T13, F27 | FEL51/52/54 FEL50A/55/56/57/58 |
| R: | FM NI Cl.I Div.2 Gr.A-D, Zone 2 | F16, F17, F13, T13, F15, F27 | FEL51/52/54 FEL50A/55/56/57/58 |
| S: | CSA IS Cl I, II, III Div.1 Gr.A-G, Zone 0, 1, 2 | F16, F17, F13, T13, F15, F27 (with NPT cable entry) | FEL50A/55/56/57/58 |
| T: | CSA XP Cl I, II, III Div.1 Gr.A-G, Zone 1, 2 | F13, T13, F27 | FEL51/52/54 FEL50A/55/56/57/58 |
| U: | CSA General Purpose | F16, F17, F13, T13, F15, F27 | FEL51/52/54 FEL50A/55/56/57/58 |
| V: | TIIS Ex ia IIC T2 | F16, F17, F13, T13, F15, F27 | FEL50A/55/56/57/58 |
| W: | TIIS Ex d IIC T2 | F13, T13, F27 | FEL51/52/54 FEL50A/55/56/57/58 |
| Y: | Other certificate (for non-hazardous areas) | | |

Note! **Polyester housing F16 (PBT)**
Electrical connecting cables run in pipes:
- Do not screw cable entries firmly to the piping. Use flexible connections (e.g. with armored hose).
- If piping is used for grounding, ensure that there is a continuous electrical connection.

# Ordering information

Detailed ordering information is available from the following sources:
- In the Product Configurator on the Endress+Hauser website: www.endress.com → Click "Corporate" → Select your country → Click "Products" → Select the product using the filters and search mask → Open the product page → The "Configuration" button to the right of the product image opens the Product Configurator.
- From your Endress+Hauser Sales Center: www.addresses.endress.com

Product Configurator - the tool for individual product configuration

- Up-to-the-minute configuration data
- Depending on the device: direct input of information specific to measuring point, such as measuring range or operating language
- Automatic verification of exclusion criteria
- Automatic creation of the order code and its breakdown in PDF or Excel output format
- Ability to order directly from the Endress+Hauser online shop

Versions that are mutually exclusive are not indicated in this table.

**Ordering information**
**Liquiphant S**
**FTL70**
**FTL71**

| **Design:** | | *Basic weight* |
|---|---|---|
| FTL70 | Compact | 0.7 kg |
| FTL71 | With extension pipe | 0.7 kg |

| **10** | **Approval:** | | |
|---|---|---|---|
| A | Non-hazardous area | | |
| B | ATEX/NEPSI II 3 G | EEx nC II T6 | Overfill protection as per WHG |
| C | ATEX/NEPSI II 3 G | EEx nA II T6 | Overfill protection as per WHG |
| D | Non-hazardous area | | Overfill protection as per WHG |
| E | ATEX II 1/2 G | EEx de IIC T6 | Overfill protection as per WHG, IEC Ex Zone 0/1 |
| F | ATEX II 1/2 G | EEx ia IIC T6 | Overfill protection as per WHG, IEC Ex Zone 0/1 |
| | ATEX II 1/2 D | T 80°C* | |
| L | ATEX II 1/2 G | EEx d IIC T6 | Overfill protection as per WHG, IEC Ex Zone 0/1 |
| 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 T2 | |
| W | TIIS | Ex d IIC T2 | |
| Y | Special version | | |

*) not for PBT

| **20** | | **Process connection:** | | | *Additional weight* |
|---|---|---|---|---|---|
| | Threaded connection | | | | |
| | GQ2 | G ¾ | 316L | Thread ISO 228 | |
| | GQ6 | G ¾ | AlloyC22 | Thread ISO 228 | |
| | GR2 | G 1 | 316L | Thread ISO 228 | 0.2 kg |
| | GR6 | G 1 | AlloyC22 | Thread ISO 228 | 0.2 kg |
| | GE2 | R ¾ | 316L | Thread DIN 2999 | |
| | GE6 | R ¾ | AlloyC22 | Thread DIN 2999 | |
| | GF2 | R 1 | 316L | Thread DIN 2999 | 0.2 kg |
| | GF6 | R 1 | AlloyC22 | Thread DIN 2999 | 0.2 kg |
| | GM2* | NPT ¾ | 316L | Thread ANSI | |
| | GM6 | NPT ¾ | AlloyC22 | Thread ANSI | |
| | GN2* | NPT1 | 316L | Thread ANSI | 0.2 kg |
| | GN6 | NPT1 | AlloyC22 | Thread ANSI | 0.2 kg |
| | EN flanges | | | | |
| | B82 | DN25 PN25/40 A | 316L | Flange EN 1092-1 (DIN 2527 B) | 1.4 kg |
| | C82 | DN25 PN25/40 B1 | 316L | Flange EN 1092-1 (DIN 2527 C) | 1.3 kg |

| 20 | | Process connection: | | | | | | *Additional weight* |
|---|---|---|---|---|---|---|---|---|
| | | C86 | DN25 | PN25/40 B1 | | AlloyC22 >1.4462 | Flange EN 1092-1 (DIN 2527) | 1.3 kg |
| | | D82 | DN25 | PN40 B1 | | 316L | Flange EN 1092-1 (DIN 2526 D) | 1.4 kg |
| | | BB2 | DN32 | PN25/40 A | | 316L | Flange EN 1092-1 (DIN 2527 B) | 2.0 kg |
| | | BD2 | DN40 | PN25/40 A | | 316L | Flange EN 1092-1 (DIN 2527 B) | 2.4 kg |
| | | CF2 | DN50 | PN10/16 B1 | | 316L | Flange EN 1092-1 (DIN 2527 C) | 2.5 kg |
| | | BG2 | DN50 | PN25/40 A | | 316L | Flange EN 1092-1 (DIN 2527 B) | 3.2 kg |
| | | CG2 | DN50 | PN25/40 B1 | | 316L | Flange EN 1092-1 (DIN 2527 C) | 2.9 kg |
| | | DG2 | DN50 | PN40 B1 | | 316L | Flange EN 1092-1 (DIN 2526 D) | 2.9 kg |
| | | CG6 | DN50 | PN25/40 B1 | | AlloyC22 >1.4462 | Flange EN 1092-1 (DIN 2527) | 2.9 kg |
| | | BI2 | DN50 | PN63 A | | 316L | Flange EN 1092-1 (DIN 2527 B) | 4.5 kg |
| | | CI2 | DN50 | PN63 B2 | | 316L | Flange EN 1092-1 (DIN 2527 E) | 4.5 kg |
| | | CI6 | DN50 | PN63 B1 | | AlloyC22 >1.4462 | Flange EN 1092-1 (DIN 2527) | 4.5 kg |
| | | BJ2 | DN50 | PN100 A | | 316L | Flange EN 1092-1 | 5.5 kg |
| | | CJ2 | DN50 | PN100 B2 | | 316L | Flange EN 1092-1 | 5.5 kg |
| | | BK2 | DN65 | PN25/40 A | | 316L | Flange EN 1092-1 (DIN 2527 B) | 4.3 kg |
| | | CM2 | DN80 | PN10/16 B1 | | 316L | Flange EN 1092-1 (DIN 2527 C) | 4.8 kg |
| | | BN2 | DN80 | PN25/40 A | | 316L | Flange EN 1092-1 (DIN 2527 B) | 5.9 kg |
| | | CN2 | DN80 | PN25/40 B1 | | 316L | Flange EN 1092-1 (DIN 2527 C) | 5.2 kg |
| | | DN2 | DN80 | PN40 B1 | | 316L | Flange EN 1092-1 (DIN 2526 D) | 5.2 kg |
| | | CN6 | DN80 | PN25/40 B1 | | AlloyC22 >1.4462 | Flange EN 1092-1 (DIN 2527) | 5.2 kg |
| | | B02 | DN80 | PN63 A | | 316Ti | Flange EN 1092-1 (DIN 2527 B) | 6.9 kg |
| | | C02 | DN80 | PN63 B2 | | 316L | Flange EN 1092-1 (DIN 2527 E) | 6.9 kg |
| | | C06 | DN80 | PN63 B1 | | AlloyC22 >1.4462 | Flange EN 1092-1 (DIN 2527) | 6.9 kg |
| | | B12 | DN80 | PN100 A | | 316L | Flange EN 1092-1 | 8.0 kg |
| | | C12 | DN80 | PN100 B2 | | 316L | Flange EN 1092-1 | 8.0 kg |
| | | CQ2 | DN100 | PN10/16 B1 | | 316L | Flange EN 1092-1 (DIN 2527 C) | 5.3 kg |
| | | BR2 | DN100 | PN25/40 A | | 316L | Flange EN 1092-1 (DIN 2527 B) | 7.5 kg |
| | | BU2 | DN100 | PN63 A | | 316L | Flange EN 1092-1 (DIN 2527 B) | 10.1 kg |
| | | CU2 | DN100 | PN63 B2 | | 316L | Flange EN 1092-1 (DIN 2527 E) | 10.1 kg |
| | | CU6 | DN100 | PN63 B1 | | AlloyC22 >1.4462 | Flange EN 1092-1 (DIN 2527) | 10.1 kg |
| | | | ANSI flanges | | | | | |
| | | A82* | 1" | 150 lbs | RF | 316/316L | Flange ANSI B16.5 | 1.0 kg |
| | | AB2* | 1¼" | 300 lbs | RF | 316/316L | Flange ANSI B16.5 | 2.0 kg |
| | | AC2* | 1½" | 150 lbs | RF | 316/316L | Flange ANSI B16.5 | 1.5 kg |
| | | AD2* | 1½" | 300 lbs | RF | 316/316L | Flange ANSI B16.5 | 2.7 kg |
| | | AE2* | 2" | 150 lbs | RF | 316/316L | Flange ANSI B16.5 | 2.4 kg |
| | | AE6 | 2" | 150 lbs | RF | AlloyC22 >1.4462 | Flange ANSI B16.5 | 2.4 kg |
| | | AF2* | 2" | 300 lbs | RF | 316/316L | Flange ANSI B16.5 | 3.2 kg |
| | | AF6 | 2" | 300 lbs | RF | AlloyC22 >1.4462 | Flange ANSI B16.5 | 3.2 kg |
| | | AG2* | 2" | 600 lbs | RF | 316/316L | Flange ANSI B16.5 | 4.2 kg |
| | | AG6 | 2" | 600 lbs | RF | AlloyC22 >1.4462 | Flange ANSI B16.5 | 4.2 kg |
| | | AL2* | 3" | 150 lbs | RF | 316/316L | Flange ANSI B16.5 | 4.9 kg |
| | | AM2* | 3" | 300 lbs | RF | 316/316L | Flange ANSI B16.5 | 6.8 kg |
| | | AN2* | 3" | 600 lbs | RF | 316/316L | Flange ANSI B16.5 | 8.5 kg |
| | | AN6 | 3" | 600 lbs | RF | AlloyC22 >1.4462 | Flange ANSI B16.5 | 8.5 kg |
| | | AP2* | 4" | 150 lbs | RF | 316/316L | Flange ANSI B16.5 | 7.0 kg |

| 20 | Process connection: | | | | | | *Additional weight* |
|---|---|---|---|---|---|---|---|
| | AQ2* | 4" | 300 lbs | RF | 316/316L | Flange ANSI B16.5 | 11.5 kg |
| | AR2* | 4" | 600 lbs | RF | 316/316L | Flange ANSI B16.5 | 17.3 kg |
| | | JIS flanges | | | | | |
| | KF2 | 20 K 50 | | RF | 316L | Flange JIS B2220 | 1.9 kg |
| | KF6 | 20 K 50 | | RF | AlloyC22 >316L | Flange JIS B2220 | 1.9 kg |
| | YY9 | Special version | | | | | |
| | * With CRN approval. | | | | | | |

| 30 | Probe length: | | | | |
|---|---|---|---|---|---|
| | FTL70 | | | | |
| | AB | Compact version | Ra < 3.2 µm/80 grit, | 316L | |
| | | Fork: 318L | | | |
| | AE | Compact version | Ra < 3.2 µm/80 grit, | Alloy | |
| | FTL71 | | | | |
| | BB | ..... mm L | Ra < 3.2 µm/80 grit, | 316L | |
| | | Fork: 318L | | | 0.9 kg/m |
| | BE | ..... mm L | Ra < 3.2 µm/80 grit, | Alloy | 0.9 kg/m |
| | CB | ..... inch L | Ra < 3.2 µm/80 grit, | 316L | |
| | | Fork: 318L | | | 2.3 kg/100 in |
| | CE | ..... inch L | Ra < 3.2 µm/80 grit, | Alloy | 2.3 kg/100 in |
| | YY | Special version | | | |

| 40 | Electronics; output: | | | |
|---|---|---|---|---|
| | A | FEL50A; | PROFIBUS PA | |
| | 1 | FEL51; | SIL 2–wire | 19 to 253 V AC |
| | 2 | FEL52; | SIL 3–wire PNP | 10 to 55 V DC |
| | 4 | FEL54; | SIL relay DPDT | 19 to 253 V AC/19 to 55 V DC |
| | 5 | FEL55; | SIL 8/16 mA | 11 to 36 V DC |
| | 6 | FEL56; | SIL NAMUR (L-H signal) | |
| | 7 | FEL57; | SIL 2-wire PFM | |
| | 8 | FEL58; | SIL NAMUR + test keys (H-L signal) | |
| | 9 | Special version | | |

| 50 | Housing; cable entry: | | | | |
|---|---|---|---|---|---|
| | E1* | F27 316L | NEMA6P; | Thread NPT ¾ | |
| | E4 | F16 Polyester | NEMA4X; | Thread NPT ½ | |
| | E5 | F17 Alu | NEMA4X; | Thread NPT ¾ | 0.5 kg |
| | E7 | T13 Alu | coated IP66; | Thread NPT ¾ | |
| | | Separate connection compartment | | | 1.1 kg |
| | E8 | F13 Alu | NEMA4X; | Thread NPT ¾ | |
| | | suitable for EEx d/XP | | | 0.5 kg |
| | F1* | F27 316L | IP68 | Thread G1/2 | |
| | F4 | F16 Polyester | IP66; | Thread G ½ | |
| | F5 | F17 Alu | IP66; | Thread G ½ | 0.5 kg |
| | F7 | T13 Alu | coated IP66; | Thread G ½ | |
| | | Separate connection compartment | | | 1.1 kg |
| | F8 | F13 Alu | IP68; | Thread G ½ | |
| | | suitable for EEx d/XP | | | 0.5 kg |
| | G1* | F27 316L | IP68; | M20 threaded joint | |
| | G4 | F16 Polyester | IP66; | M20 threaded joint | |
| | G5 | F17 Alu | IP66; | M20 threaded joint | 0.5 kg |
| | G7 | T13 Alu | coated IP66; | M20 threaded joint | |
| | | separate connection compartment (EEx d > M20 thread) | | | 1.1 kg |
| | G8 | F13 Alu | IP68; | M20 threaded joint | |
| | | suitable for EEx d/XP | | | 0.5 kg |
| | N4 | F16 Polyester | IP66; | M12 connector | |
| | N4 | F16 Polyester | IP66; | M12 connector | |
| | N5 | F17 Alu | IP66; | M12 connector | |
| | Y9 | Special version | | | |
| | | * F27 housing under development. | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **60** | | | | | | | **Additional option:** | | |
| | | | | | | | A | Basic version | |
| | | | | | | | C | EN 10204 - 3.1 material (316L/318L wetted)<br>Inspection certificate | |
| | | | | | | | N | EN 10204 - 3.1 material, NACE MR0175 (316L wetted)<br>inspection certificate | |
| | | | | | | | S | GL/ABS marine certificate | |
| | | | | | | | Y | Special version | |
| **70** | | | | | | | **Application:** | | |
| | | | | | | | L | 230 °C, gas-tight feed-through | |
| | | | | | | | N | 280 °C, gas-tight feed-through | 0.2 kg |
| | | | | | | | Y | Special version | |
| FTL7x- | | | | | | | | Complete product designation | |

Note!
The basic weight comprises:
- Sensor (compact)
- Thread G ¾
- Electronic insert
- Polyester housing

# Accessories

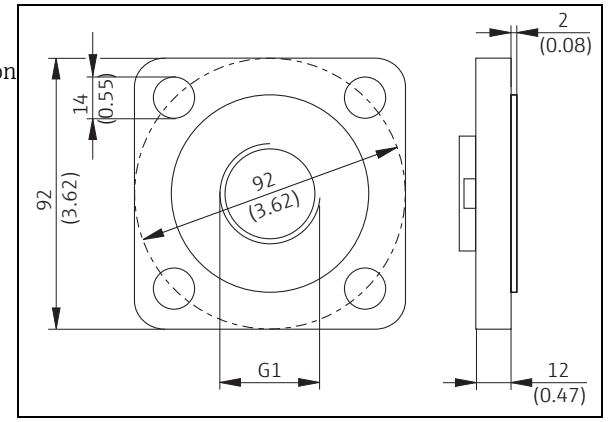
**Lap joint flange**

Order number: 918158-0000
with G 1 thread for mounting a
Liquiphant 51 with GR2 process connection

Pressure up to 40 bar (580 psi)

Material: corrosion-resistant steel
1.4301 (AISI 304)

Weight: 0.54 kg (1.19 lbs)



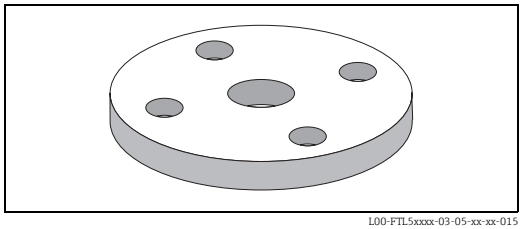
L00-FTL5xxxx-06-05-xx-xx-108

**Lap joint flanges**

With G 1 thread for mounting
a Liquiphant S FTL70/71
with GR2 process connection.

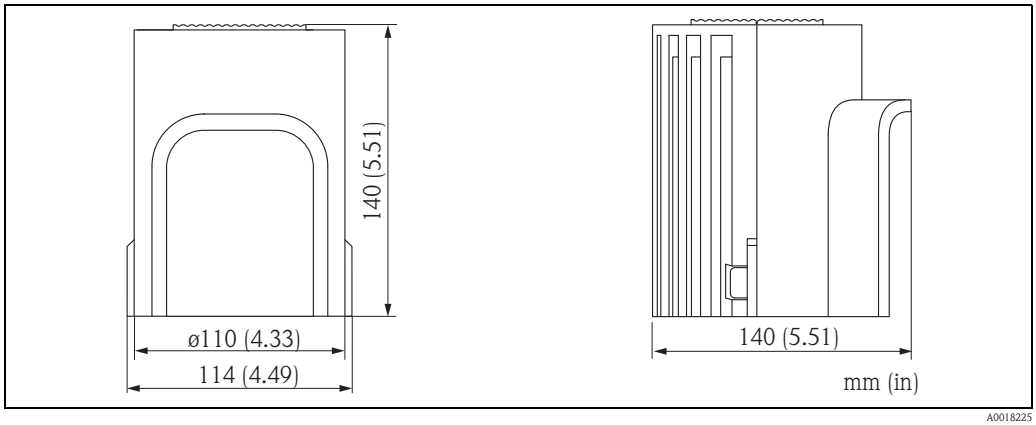
Material: corrosion-resistant steel
1.4571 (AISI 113Ti)

– Order number: 918143-0000
  Flange DN50 PN40, EN 1092-1
  Weight: 3.11 kg (6.86 lbs)
– Order number: 918144-0000
  Flange ASME 2", 150 psi, RF
  Weight: 2.38 kg (5.25 lbs)


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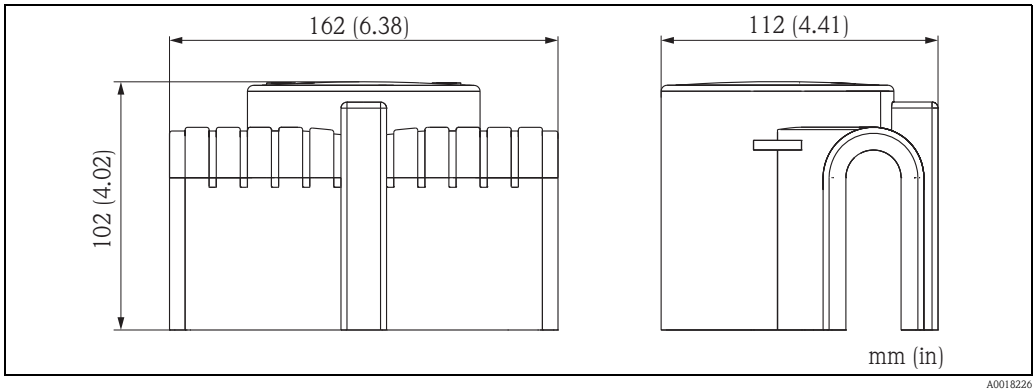
**Weather protection cover**

For F16 housing




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

For F13, F17 and F27 housing



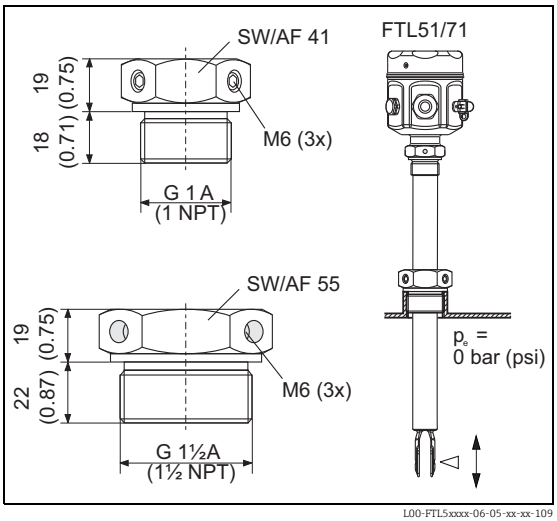

| Material | Order No. | Weight |
|---|---|---|
| PA6, gray | 71040497 | 300 g (10.58 oz) |

**Sliding sleeves for unpressurized operation**

Switch point infinitely variable for Liquiphant MFTL71

Material: corrosion-resistant steel 1.4435 (AISI 316 L)

Weight for G 1, NPT 1: 0.21 kg (0.46 lbs)
Weight for G 1½, NPT 1½: 0.54 kg (1.19 lbs)



| Thread | Standard | Material | Order number | Approval |
|---|---|---|---|---|
| G 1 | DIN ISO 228/I | 1.4435 (AISI 316 L) | 52003978 | |
| G 1 | DIN ISO 228/I | 1.4435 (AISI 316 L) | 52011888 | With inspection certificate EN 10204 - 3.1 material |
| NPT1 | ASME B 1.20.1 | 1.4435 (AISI 316 L) | 52003979 | |
| NPT1 | ASME B 1.20.1 | 1.4435 (AISI 316 L) | 52011889 | With inspection certificate EN 10204 - 3.1 material |
| G 1½ | DIN ISO 228/I | 1.4435 (AISI 316 L) | 52003980 | |
| G 1½ | DIN ISO 228/I | 1.4435 (AISI 316 L) | 52011890 | With inspection certificate EN 10204 - 3.1 material |
| NPT1½ | ASME B 1.20.1 | 1.4435 (AISI 316 L) | 52003981 | |
| NPT1½ | ASME B 1.20.1 | 1.4435 (AISI 316 L) | 52011891 | With inspection certificate EN 10204 - 3.1 material |

**High pressure sliding sleeves**

For continuous adjustment of the switch point of a Liquiphant M FTL71.
Also for use in hazardous areas. For further information → 39ff. (ATEX, NEPSI).

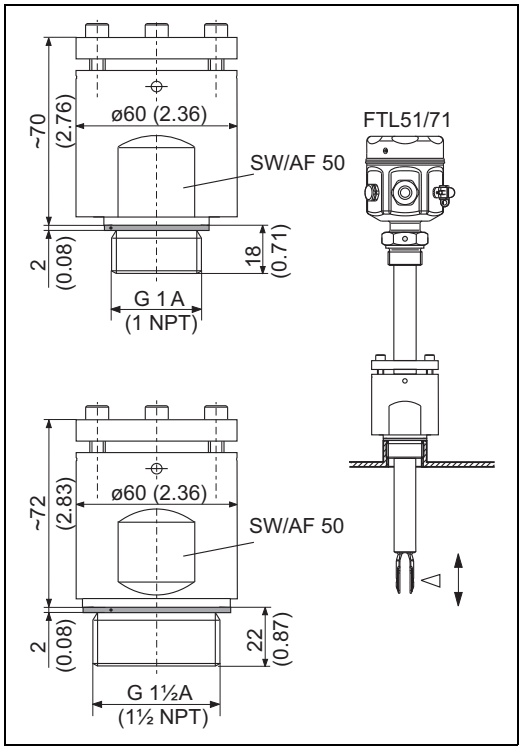
Material: corrosion-resistant steel 1.4435 (AISI 316L) or AlloyC22

Weight for G 1, NPT 1: 1.13 kg (2.49 lbs)
Weight for G 1½, NPT 1½: 1.32 kg (2.91 lbs)

Seal package made of graphite.

For G1, G 1½:
Seal is included in the delivery.

Note!
For process pressures up to 100 bar (1450 psi).

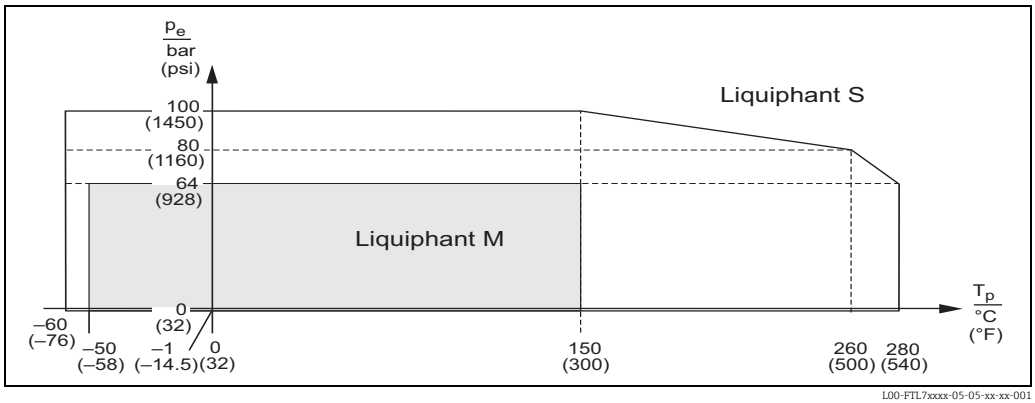


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| Thread | Standard | Material | Order number | Approval |
|---|---|---|---|---|
| G 1 | DIN ISO 228/1 | 1.4435 (AISI 316 L) | 52003663 | |
| G 1 | DIN ISO 228/1 | 1.4435 (AISI 316 L) | 52011880 | With inspection certificate EN 10204 - 3.1 material |
| G 1 | DIN ISO 228/1 | AlloyC22 | 71118691 | With inspection certificate EN 10204 - 3.1 material |
| NPT1 | ASME B 1.20.1 | 1.4435 (AISI 316 L) | 52003667 | |
| NPT1 | ASME B 1.20.1 | 1.4435 (AISI 316 L) | 52011881 | With inspection certificate EN 10204 - 3.1 material |
| NPT1 | ASME B 1.20.1 | AlloyC22 | 71118694 | With inspection certificate EN 10204 - 3.1 material |
| G 1½ | DIN ISO 228/1 | 1.4435 (AISI 316 L) | 52003665 | |

| Thread | Standard | Material | Order number | Approval |
|---|---|---|---|---|
| G 1½ | DIN ISO 228/1 | 1.4435 (AISI 316 L) | 52011882 | With inspection certificate EN 10204 - 3.1 material |
| G 1½ | DIN ISO 228/1 | AlloyC22 | 71118693 | With inspection certificate EN 10204 - 3.1 material |
| NPT1½ | ASME B 1.20.1 | 1.4435 (AISI 316 L) | 52003669 | |
| NPT1½ | ASME B 1.20.1 | 1.4435 (AISI 316 L) | 52011883 | With inspection certificate EN 10204 - 3.1 material |
| NPT1½ | ASME B 1.20.1 | AlloyC22 | 71118695 | With inspection certificate EN 10204 - 3.1 material |

**Pressure and temperature derating of high pressure sliding sleeves**



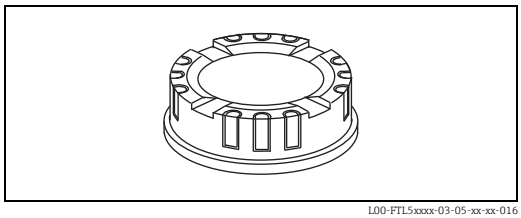
L00-FTL7xxxx-05-05-xx-xx-001

**Cover with sight glass**

Order number: 943461-0001
for polyester housing F16

Material: PA 12

Weight: 0.04 kg (0.09 lbs)


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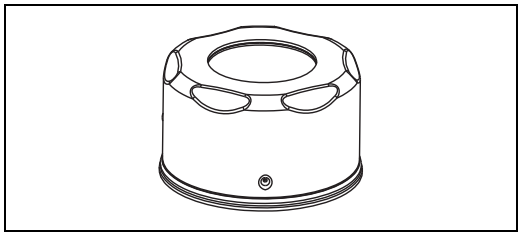
**Cover with sight glass**

For stainless steel housing F15

Material: AISI 316L

Weight: 0.16 kg (0.35 lbs)

- Order number: 52027002
  With glass sight glass
- Order number: 52028207
  With PC sight glass
  (Not for CSA, General Purpose)


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

# 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 S FTL70, FTL71

KA00172F/00/a6

Liquiphant S FTL70-######## # 7 #, FTL71-######## # 7 #
KA00173F/00/a6

Liquiphant M/S sliding sleeve for FTL51/71, G 1, NPT 1
KA00151F/00/a6

Liquiphant M/S sliding sleeve for FTL51/71, G 1½, NPT 1½
KA00152F/00/a6

Liquiphant M/S high-pressure sliding sleeve for FTL51/71, G 1, NPT 1
KA00153F/00/a6

Liquiphant M/S high-pressure sliding sleeve for FTL51/71, G 1½, NPT 1½
KA00154F/00/a6

**Technical Information**

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

Isolating amplifier FTL325P, 1- or 3-channel switching units for top-hat rail mounting
for Liquiphant M/S with electronic insert FEL57
TI00350F/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
TI00353F/00/en

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

Isolating amplifier FTL375P,
1 to 3-channel switching units for top-hat rail mounting
for Liquiphant M/S with electronic insert FEL57
TI00360F/00/en

**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 ⟨Ex⟩ II 1/2 G, Ex d IIC/B (KEMA 99 ATEX 1157)<br>XA00031F/00/a3<br><br>CE ⟨Ex⟩ II 1/2 G, Ex ia/ib IIC/B (KEMA 99 ATEX 0523)<br>XA00063F/00/a3<br><br>CE ⟨Ex⟩ II 1 G, Ex ia IIC/B (KEMA 99 ATEX 5172 X)<br>XA00064F/00/a3<br><br>CE ⟨Ex⟩ II 1/2 G, Ex de IIC/B (KEMA 00 ATEX 2035)<br>XA00108F/00/a3<br><br>CE ⟨Ex⟩ II 3 G, Ex nA/nC II (EG 01 007-a)<br>XA00182F/00/a3 |
| **Safety Instructions (NEPSI)** | Ex d IIC/IIB T3-T6 , Ex d IIC T2-T6<br>(NEPSI GYJ06424)<br>XA00401F/00/B2<br><br>Ex ia IIC T2-T6, Ex ia IIB T3-T6<br>(NEPSI GYJ05556, NEPSI GYJ06464),<br>XC00009F/00/b2<br><br>Ex nA II T3-T6, Ex nC/nL IIC T3-T6<br>(NEPSI GYJ04360, NEPSI GYJ071414)<br>XC00010F/00/b2 |
| **Control Drawings** | Liquiphant M (IS and NI) Current output PFM, NAMUR Entity installation<br>Class I, Div. 1, 2, Groups A, B, C, D<br>Class I, Zone 0<br>Class II, Div. 1, 2, Groups E, F, G<br>Class III<br>ZD00041F<br><br>Liquiphant M, Liquiphant S (cCSAus / IS)<br>Class I, Div. 1, Groups A, B, C, D Ex ia IIC T6<br>Class II, Div. 1, Groups E, F, G<br>Class III<br>ZD00042F<br><br>Liquiphant M (NI), FTL50(H), FTL51(H), FTL51C, FTL70, FTL71<br>Class I, Div. 2, Groups A, B, C, D<br>Class II, Div. 2, Groups F, G<br>Class III<br>ZD00043F<br><br>Liquiphant M, Liquiphant S (cCSAus / XP)<br>Class I, Groups A, B, C, D<br>Class II, Groups E, F, G<br>Class III<br>ZD00240F<br><br>Liquiphant M (IS and NI) PROFIBUS PA, FOUNDATION FieldbusClass I, Zone 0, IIC<br>Class I, Division 1, 2, Groups A, B, C, D<br>Class II, Division 1, 2, Groups E, F, G<br>Class III<br>ZD00244F |

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