Technical Information

**Liquiphant M**

**FTL50, FTL51, FTL50H, FTL51H**

Vibronic

*Point level switch for all kinds of liquids*

**Application**

- Process temperatures from −50 °C to 150 °C (-58 to 302 °F)
- Pressures up to 100 bar (1450 psi)
- Viscosities up to 10,000 mm²/s (cSt)
- For liquids with densities ≥ 0.5 g/cm³ (SGU)

FTL50: Compact design

FTL51: Extension pipe up to 3 m (9.8 ft) and up to 6 m (20 ft) on request

FTL50H, FTL51H: Certified for the food and pharmaceutical industries

Ideal substitute for float switches, as reliable function not affected by flow, turbulence, bubbles, foam, vibration, solids content or buildup.

**Your benefits**

- Recommended for safety systems requiring functional safety to SIL2/SIL3 as per IEC 61508/IEC 61511-1
- Design in accordance with ASME B31.3
- Recommended for use in sterile applications in the life science industry (design in accordance with ASME BPE)
- No adjustment: quick, low-cost startup
- No mechanically moving parts: no maintenance, no wear, long operating life
- Functional safety: Monitoring of tuning fork for damage
- Compact stainless steel housing (optional): the IP69 protection rating guarantees that the unit remains impermeable, even in the event of intensive cleaning or flooding for several hours
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Endress+Hauser
Application

Point level detection

Maximum or minimum detection in tanks or pipes containing all kinds of liquids, including use in hazardous areas, food and pharmaceuticals.

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

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
Electronic versions

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 e.g. in conjunction with programmable logic controllers (PLCs), DI modules as per EN 61131-2.

FEL54:
Universal current version with relay output;
Switches the loads via 2 floating change-over contacts.

FEL55:
Signal transmission 16/8 mA on two-wire cabling e.g. in conjunction with programmable logic controllers (PLCs), AI modules 4 to 20 mA as per EN 61131-2.

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.
Proof test 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

Electronics for continuous density measurement

FEL50D:
For connecting to Density Computer FML621

Galvanic isolation

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

Design

FTL50: Compact
FTL51: With extension pipe
FTL50H: Compact, with polished tuning fork and hygienic process connections
FTL51H: With extension pipe, polished tuning fork and hygienic process connections

Input

Measured variable
Level (limit value)

Measuring range (detection range)
FTL50: dependent on mounting point
FTL51: dependent on mounting point and the extension pipe ordered.
Standard extension pipe up to 3 m (9.8 ft) and up to 6 m (20 ft) on request.

Density
Setting on the electronic insert > 0.5 g/cm³ (SGU) or > 0.7 g/cm³ (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")

Output signal
<table>
<thead>
<tr>
<th>Safety mode</th>
<th>Level</th>
<th>Output signal</th>
<th>LEDs</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAX</td>
<td></td>
<td>MAX</td>
<td>green</td>
</tr>
<tr>
<td>MIN</td>
<td></td>
<td>MIN</td>
<td>green</td>
</tr>
</tbody>
</table>

$$I_L = \text{load current (switched through)}$$
$$< 3.8 \text{ mA} = \text{residual current (blocked)}$$
$$\blacklozenge = \text{lit}$$
$$\bullet = \text{unlit}$$

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

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<th>Position</th>
<th>Operating voltage</th>
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<tr>
<td></td>
<td>AC operation</td>
<td>min.</td>
</tr>
<tr>
<td>P1</td>
<td>24 V</td>
<td>&gt; 1.3 VA</td>
</tr>
<tr>
<td></td>
<td>110 V</td>
<td>&gt; 1.5 VA</td>
</tr>
<tr>
<td></td>
<td>230 V</td>
<td>&gt; 2.5 VA</td>
</tr>
</tbody>
</table>

Relays with less nominal power can be operated via an RC module connected in parallel (optional).
Electronics FEL51 (AC, in compact housing)

**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 connection 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 (e.g., RC module: part number 71107226).
- When using in conjunction with a cable end (FTL5#(H)- # # # # # C3#), the compact housing should only be used in enclosed areas.

**Output signal**

- \( I_L \) = load current (switched through)
- \( < 3.8 \text{ mA} \) = residual current (blocked)
- = lit
- = unlit

**Safety mode**

<table>
<thead>
<tr>
<th>Safety mode</th>
<th>Level</th>
<th>Output signal</th>
<th>LEDs</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAX</td>
<td>1</td>
<td>( I_L \rightarrow 3 )</td>
<td>green</td>
</tr>
<tr>
<td>MIN</td>
<td>1</td>
<td>( &lt; 3.8 \text{ mA} \rightarrow 2 )</td>
<td>green</td>
</tr>
</tbody>
</table>

**Signal on alarm**
Output signal on power failure or in the event of damaged sensor: \( < 3.8 \text{ mA} \)
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

<table>
<thead>
<tr>
<th>Position</th>
<th>Operating voltage</th>
<th>Nominal power</th>
<th>min.</th>
<th>max.</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>24 V</td>
<td>&gt; 1.3 VA</td>
<td>&lt; 8.4 VA</td>
<td></td>
</tr>
<tr>
<td>AC operation</td>
<td>110 V</td>
<td>&gt; 1.5 VA</td>
<td>&lt; 38.5 VA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>230 V</td>
<td>&gt; 2.5 VA</td>
<td>&lt; 80.5 VA</td>
<td></td>
</tr>
</tbody>
</table>

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.

**Output signal**
- **Safety mode**
  - MAX
  - MIN

<table>
<thead>
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<th>Safety mode</th>
<th>Level</th>
<th>Output signal</th>
<th>LEDs green</th>
<th>red</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAX</td>
<td></td>
<td>L+ L–</td>
<td>green</td>
<td>red</td>
</tr>
<tr>
<td>MIN</td>
<td></td>
<td>L+ L–</td>
<td>green</td>
<td>red</td>
</tr>
</tbody>
</table>

- **LEDs**
  - = lit
  - = unlit

- Load switched via the 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)

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

**Connectable load**
- Load switched via the 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)
Electronics FEL52 (DC PNP, in compact housing)

**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

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 point level.

Note! When using in conjunction with a cable end (FTL5#(H)-#######C3#), the compact housing should only be used in enclosed areas.

**Output signal**
With valve connector or cable tail

<table>
<thead>
<tr>
<th>Safety mode</th>
<th>Level</th>
<th>Output signal</th>
<th>LEDs</th>
<th>green</th>
<th>red</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MAX</strong></td>
<td><img src="image" alt="MAX" /></td>
<td><img src="image" alt="MAX" /></td>
<td><img src="image" alt="MAX" /></td>
<td><img src="image" alt="MAX" /></td>
<td><img src="image" alt="MAX" /></td>
</tr>
<tr>
<td><strong>MIN</strong></td>
<td><img src="image" alt="MIN" /></td>
<td><img src="image" alt="MIN" /></td>
<td><img src="image" alt="MIN" /></td>
<td><img src="image" alt="MIN" /></td>
<td><img src="image" alt="MIN" /></td>
</tr>
</tbody>
</table>

I_L = load current (switched through)  
< 100 μA = residual current (blocked)  
= lit  
= unlit
With M12x1 connector 52010285 / 52024216 (without LEDs)

<table>
<thead>
<tr>
<th>Safety mode</th>
<th>Level</th>
<th>Output signal</th>
<th>LEDs</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAX</td>
<td>L+</td>
<td>L1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>L&lt; 100 μA</td>
<td>1</td>
<td>●</td>
</tr>
</tbody>
</table>

With M12x1 connector 52018763 (with LEDs)

<table>
<thead>
<tr>
<th>Safety mode</th>
<th>Level</th>
<th>Output signal</th>
<th>LEDs</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAX</td>
<td>L+</td>
<td>L1</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>L&lt; 100 μA</td>
<td>1</td>
<td>●</td>
</tr>
</tbody>
</table>

Signal on alarm

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

Connectable load

- Load switched via the 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

Output signal

<table>
<thead>
<tr>
<th>Safety mode</th>
<th>Level</th>
<th>Output signal</th>
<th>LEDs green</th>
<th>red</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAX</td>
<td></td>
<td>3 4 5 6 7 8</td>
<td>☀</td>
<td></td>
</tr>
<tr>
<td>MIN</td>
<td></td>
<td>3 4 5 6 7 8</td>
<td>☀</td>
<td></td>
</tr>
</tbody>
</table>

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~ ≤ 750 VA, cos φ = 1, P~ ≤ 750 VA, cos φ ≥ 0.7
- I~ ≤ 6 A (Ex de 4 A) to DC 30 V, P~ ≤ 0.2 A to 125 V
- When connecting a low-voltage circuit with double insulation according to IEC 1010, the following applies: the sum of the voltages of the relay output and power supply is ≤ 300 V
- The electronic insert FEL52 DC-PNP is preferred for low DC load currents (e.g. when connecting to a PLC)
- Relay contact material: silver/nickel AgNi 90/10
Electronic insert FEL55 (8/16 mA)

Power supply

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

Electrical connection

Two-wire connection for separate switching unit

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

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

Output signal

<table>
<thead>
<tr>
<th>Safety mode</th>
<th>Level</th>
<th>Output signal</th>
<th>LEDs green</th>
<th>red</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAX</td>
<td>+ 2</td>
<td>~16 mA</td>
<td>lit</td>
<td>●</td>
</tr>
<tr>
<td>MIN</td>
<td>+ 2</td>
<td>~8 mA</td>
<td>lit</td>
<td>●</td>
</tr>
</tbody>
</table>

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 acc. to NAMUR (IEC 60947-5-6), e.g. FTL325N, FTL375N 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.

Output signal

<table>
<thead>
<tr>
<th>Safety mode</th>
<th>Level</th>
<th>Output signal</th>
<th>LEDs</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAX</td>
<td>+ 2</td>
<td>0.6…1.0 mA</td>
<td>green = lit</td>
</tr>
<tr>
<td></td>
<td>+ 2</td>
<td>2.2…2.8 mA</td>
<td>green = lit</td>
</tr>
<tr>
<td>MIN</td>
<td>+ 2</td>
<td>0.6…1.0 mA</td>
<td>green = lit</td>
</tr>
<tr>
<td></td>
<td>+ 2</td>
<td>2.2…2.8 mA</td>
<td>green = lit</td>
</tr>
</tbody>
</table>

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.

![Diagram](image.png)

---

**Output signal**

<table>
<thead>
<tr>
<th>Safety mode</th>
<th>Level</th>
<th>Output signal</th>
<th>LEDs green yellow</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAX</td>
<td>+</td>
<td>2.2 ... 3.5 mA</td>
<td>= lit</td>
</tr>
<tr>
<td>MIN</td>
<td>+</td>
<td>0.6 ... 1.0 mA</td>
<td>= flashes</td>
</tr>
<tr>
<td></td>
<td>+</td>
<td>2.2 ... 3.5 mA</td>
<td>= unlit</td>
</tr>
<tr>
<td></td>
<td>+</td>
<td>0.6 ... 1.0 mA</td>
<td></td>
</tr>
</tbody>
</table>

**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)
Electronics FEL58 (NAMUR H-L edge, compact housing)

### 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 acc. to 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: If the test magnet is held against the marking on the nameplate, the output signal is inverted.

Connecting to multiplexer:
Set clock time to min. 3 s.

The NAMUR interface has a defined power consumption rate. Thus, it is not possible to use the M12 connector with an integrated LED (52018763).

### Output signal

#### Safety mode

<table>
<thead>
<tr>
<th>Level</th>
<th>Output signal</th>
<th>LEDs green yellow</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAX</td>
<td>+ 2.2... 3.5 mA</td>
<td>☀ ☀ ☀ ☀ ☀</td>
</tr>
<tr>
<td>MIN</td>
<td>+ 0.6... 1.0 mA</td>
<td>☀ ☀ ☀ ☀ ☀</td>
</tr>
</tbody>
</table>

Note!
The light emitting diodes are not readable on the version FTL5x(H)-### C 3# (compact IP66/68 316L with a 5 m cable).

#### Signal on alarm
Output signal in the event of damaged sensor: < 1.0 mA

#### Connectable load
- See Technical Data of the isolating amplifier 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 ≤ 25 Ω 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:

<table>
<thead>
<tr>
<th>Fail-safe mode set at switching unit</th>
<th>Setting at FEL57</th>
<th>Fork</th>
<th>Switching status of relay in switching unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>MAX STD free</td>
<td>OFF</td>
<td>0 Hz</td>
<td>TEST start (power off) &gt; 3 s OFF 2' on 2' off</td>
</tr>
<tr>
<td>MAX EXT free</td>
<td>OFF</td>
<td>0 Hz</td>
<td>Test start (power on) 3 s OFF 2' on 2' off</td>
</tr>
<tr>
<td>MAX STD covered</td>
<td>OFF</td>
<td>0 Hz</td>
<td>End of test start 3 s OFF 2' on 2' off</td>
</tr>
<tr>
<td>MIN STD free</td>
<td>OFF</td>
<td>0 Hz</td>
<td>3 s on 5 s off 3 s on OFF</td>
</tr>
<tr>
<td>MIN EXT free</td>
<td>OFF</td>
<td>0 Hz</td>
<td>3 s on 5 s off 3 s on OFF</td>
</tr>
<tr>
<td>MIN STD covered</td>
<td>ON</td>
<td>150 Hz</td>
<td>3 s on 5 s off 3 s on ON</td>
</tr>
<tr>
<td>MIN EXT covered</td>
<td>ON</td>
<td>150 Hz</td>
<td>3 s on 5 s off 3 s on ON</td>
</tr>
</tbody>
</table>

* 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

<table>
<thead>
<tr>
<th>Safety mode</th>
<th>Level</th>
<th>Output signal (PFM)</th>
<th>LEDs green yellow</th>
</tr>
</thead>
</table>

- **Sun** = lit
- **Dot** = unlit

### 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 switch.
- Matrix locking possible
- Switch to WHG mode possible (WHG approval)
- For a detailed description, see BA00198F
### Output signal

<table>
<thead>
<tr>
<th>Setting</th>
<th>Level</th>
<th>LEDs</th>
<th>FEL50A</th>
</tr>
</thead>
<tbody>
<tr>
<td>not inverted</td>
<td></td>
<td><img src="logo.png" alt="Green LED lit" /></td>
<td><img src="logo.png" alt="Yellow LED unlit" /></td>
</tr>
<tr>
<td></td>
<td></td>
<td><img src="logo.png" alt="Green LED unlit" /></td>
<td><img src="logo.png" alt="Yellow LED lit" /></td>
</tr>
<tr>
<td>inverted</td>
<td></td>
<td><img src="logo.png" alt="Green LED unlit" /></td>
<td><img src="logo.png" alt="Yellow LED lit" /></td>
</tr>
<tr>
<td></td>
<td></td>
<td><img src="logo.png" alt="Green LED lit" /></td>
<td><img src="logo.png" alt="Yellow LED unlit" /></td>
</tr>
</tbody>
</table>

- ![Yellow LED flashing](logo.png) = lit
- ![Yellow LED unlit](logo.png) = unlit

### Signal on alarm

Failure information can be opened using the following interfaces:

Yellow LED flashing, status code, diagnostic code; see BA00198F
Electronic insert FEL50D (density)

**Power supply**
- Frequency range: 300 to 1500 Hz
- Signal level: 4 mA
- Pulse height: 16 mA
- Pulse width: 20 μS

**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

**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 option, 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 option, special adjustment, density H₂O (K) or special adjustment, density H₂O with 3.1 certificate (L))
    - Here, three fork parameters are determined to describe the sensor characteristics, indicated in the adjustment report and provided with the product.
    - These parameters must be transmitted to the Density Computer FML621.
    - Greater accuracy is achieved with this type of adjustment (see also "Performance characteristics").
  - **Field Adjustment**
    - During field adjustment, a density value actually determined by the customer is entered and the system is automatically adjusted to this value (wet adjustment).

  - **Note!**
    - More information on Liquiphant M Density is available in Technical Information TI00420F. This can be downloaded from 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.

Light signals

<table>
<thead>
<tr>
<th>LED</th>
<th>Symbol</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yellow</td>
<td><img src="image" alt="Yellow symbol" /></td>
<td>Measurement valid</td>
</tr>
<tr>
<td></td>
<td><img src="image" alt="Yellow symbol" /></td>
<td>Unstable process situation</td>
</tr>
<tr>
<td></td>
<td><img src="image" alt="Yellow symbol" /></td>
<td>Maintenance required</td>
</tr>
<tr>
<td>Green</td>
<td><img src="image" alt="Green symbol" /></td>
<td>Power on</td>
</tr>
<tr>
<td></td>
<td><img src="image" alt="Green symbol" /></td>
<td>Power off</td>
</tr>
<tr>
<td>Red</td>
<td><img src="image" alt="Red symbol" /></td>
<td>No fault</td>
</tr>
<tr>
<td></td>
<td><img src="image" alt="Red symbol" /></td>
<td>Maintenance required</td>
</tr>
<tr>
<td></td>
<td><img src="image" alt="Red symbol" /></td>
<td>Device failure</td>
</tr>
</tbody>
</table>

* 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.
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:
0.5-60 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)

Performance characteristics

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 p₀: 0 bar (0 psi)
Sensor mounting: vertical from above
Density switch: to > 0.7 g/cm³ (SGU)

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 medium temperature

max. +1.8 to −2.8 mm (−50 to +150 °C / −58 to 302 °F)

Influence of medium density

max. +4.8 to −3.5 mm ([0.5 to 1.5 g/cm³ (SGU)])
max. +0.19 to −0.14 in

Influence of medium pressure

max. 0 to −2.5 mm (−1 to 64 bar (−14.5 to 928 psi))
max. 0 to −0.1 in

Switching delay

- When fork is covered: 0.5 s
- When fork is exposed: 1.0 s
- Available on request: 0.2 s; 1.5 s or 5 s (when the tuning fork is covered or exposed)
Operating conditions

Installation

Installation instructions

Switch points \( L \) on the sensor depend on the mounting position, with reference to water, Density 1 g/cm\(^3\) (SGU), 23 °C (73 °F), \( p_0 \) 0 bar (0 psi).

![Diagram of mounting options](image)

Mounting from above  Mounting from below  Mounting from the side

Note!

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

Examples of mounting

Examples of mounting with regard to the viscosity \( \nu \) 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.

![Diagram of mounting options](image)

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

* Deburr the nozzle surfaces

Mounting in piping from 2"

Flow velocities up to 5 m/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 M FTL51(H) in the event of a severe dynamic load.
Ensure adequate space outside the tank for mounting, connection and configuration.

Orientation
- FTL50(H) and FTL51(H) with short pipe up to approx. 500 mm (19.7 in): any position
- FTL51(H) 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 feedthrough.
** Maximum ambient temperature with FEL50D/FEL50A in hazardous areas.
*** The following applies for devices with a compact housing according to version D3, E3: $-30 ^\circ C \leq T_a \leq +70 ^\circ C$
**** The following applies for the F16 housing: $-40 ^\circ C \leq T_a \leq +70 ^\circ C$

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

<table>
<thead>
<tr>
<th>Types of housing</th>
<th>IP65</th>
<th>IP66*</th>
<th>IP67*</th>
<th>IP68*</th>
<th>IP69</th>
<th>NEMA type**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compact housing with valve connector Pg11/NPT ½</td>
<td>X</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Compact housing with 5 m (16 ft) cable tail</td>
<td>-</td>
<td>X</td>
<td>-</td>
<td>X</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Compact housing with M12x1 connector (52010285) 316L (metal)</td>
<td>-</td>
<td>X</td>
<td>-</td>
<td>X</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Compact housing with elbowed connector (52024216) / L= 5 m (16 ft), without integrated LEDs</td>
<td>-</td>
<td>X</td>
<td>-</td>
<td>X</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Compact housing with elbowed connector (52018763) / L= 5 m (16 ft), with integrated LEDs</td>
<td>-</td>
<td>X</td>
<td>-</td>
<td>X</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Polyester housing F16</td>
<td>-</td>
<td>X</td>
<td>X</td>
<td>-</td>
<td>-</td>
<td>4X</td>
</tr>
<tr>
<td>Stainless steel housing F15</td>
<td>-</td>
<td>X</td>
<td>X</td>
<td>-</td>
<td>-</td>
<td>4X</td>
</tr>
<tr>
<td>Aluminum housing F17</td>
<td>-</td>
<td>X</td>
<td>X</td>
<td>-</td>
<td>-</td>
<td>4X</td>
</tr>
<tr>
<td>Aluminum housing F13****</td>
<td>-</td>
<td>X</td>
<td>-</td>
<td>X***</td>
<td>-</td>
<td>4X/6P</td>
</tr>
<tr>
<td>Stainless steel housing F27</td>
<td>-</td>
<td>X</td>
<td>-</td>
<td>X</td>
<td>-</td>
<td>4X/6P</td>
</tr>
<tr>
<td>Aluminum housing T13 with separate connection compartment (Ex d)</td>
<td>-</td>
<td>X</td>
<td>-</td>
<td>X***</td>
<td>-</td>
<td>4X/6P</td>
</tr>
</tbody>
</table>

* 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)  
In the event of increased vibrations, the following additional option is recommended: feature "060" version "P" 100 bar (1450 psi) process pressure.

### Electromagnetic compatibility

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

**Medium temperature**
-50 to +150 °C (-58 to 302 °F); for exceptions, see 'Process connections'

**Thermal shock**
≤ 120 °C/s (248 °F/s)

**Medium pressure** $p_e$

![Graph showing medium pressure $p_e$]

* Permitted pressure rating when the "100 bar (1450 psi)" option is selected (see 'Product structure FTL51', feature 060, from  44). See 'Process connections' 33 for exceptions.

Canadian CRN approval: Details about the maximum pressure values are available in the download area at 'www.endress.com/download'.

Please refer to the standards listed for the permitted pressure values of the flanges at higher temperatures:
- EN 1092-1: 2005
  With regard to their stability-temperature property, the materials 1.4435 and 1.4404 are identical and are grouped together in EN 1092-1 Tab. 18 under 13E0. The chemical composition of the two materials can be identical.
- ASME B 16.5 - 2013 Tab. 2-2.2 F316
- ASME B 16.5 - 2013 Tab. 2-3.8 N10276
- JIS B 2220

The lowest value from the derating curves of the device and selected flange applies in each case.

**Test pressure**

- $p_e = 64$ bar (928 psi):
  - $≤ 100$ bar (1450 psi) or 1.5 times the medium pressure $p_e$
  - Sensor burst pressure at 200 bar (2900 psi)
- $p_e = 100$ bar (1450 psi):
  - $≤ 150$ bar (2175 psi) or 1.5 times the medium pressure $p_e$
  - Sensor burst pressure at 400 bar (5800 psi)

* Note!
  The device function is restricted during pressure testing.

**State of aggregation**
Liquid

**Density**
0.7 g/cm³ (SGU) = delivery status
0.5 g/cm³* (SGU) can be adjusted via switches

* Density settings for the compact housing on request

**Viscosity**
$≤ 10,000$ mm²/s (cSt)

**Solids content**
$≤ ø5$ mm (0.2 in)

**Lateral loading capacity**
$≤ 75$ Nm
Mechanical construction

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

Design

Summary of all electrical and mechanical versions

**Housing**

<table>
<thead>
<tr>
<th>Compact</th>
<th>F16</th>
<th>F15</th>
<th>F17</th>
<th>F27</th>
<th>T13</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipeline housing (316L)</td>
<td>Pipe housing (316L)</td>
<td>Stainless steel (316L)</td>
<td>Aluminum Housing coated</td>
<td>Stainless steel (316L)</td>
<td>Housing coated</td>
</tr>
<tr>
<td>Polyester (PBT)</td>
<td>Polyether</td>
<td>F13</td>
<td>Aluminum</td>
<td>(also for Ex d/XP), housing coated</td>
<td></td>
</tr>
<tr>
<td>Stainless steel (316L)</td>
<td></td>
<td>F17</td>
<td>Aluminum</td>
<td>Housing coated</td>
<td></td>
</tr>
<tr>
<td>Aluminum</td>
<td></td>
<td>F18</td>
<td>Aluminum with separate connection compartment (also Ex de and Ex d), housing coated</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Plug-in electronic inserts to mount in the housing

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

* Electronics also available as compact housing. The electronics cannot be exchanged!
  
If the housing is ordered with a cable gland: the cable gland is ready-mounted upon delivery. A second cable gland is included in conjunction with FEL54.

**Temperature spacer and pressure-tight feedthrough**

**Temperature spacer** (optional)
Provides sealed insulation for the vessel and normal ambient temperatures for the housing.

**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.
**Process connections**

![Diagram of process connections]

- G ¾, DIN ISO 228/I
- R ¾, EN10226
- NPT ¾, ASME B 1.20.1 (AF 32)
- G 1, DIN ISO 228/I
- R 1, EN10226
- NPT 1, ASME B 1.20.1 (AF 41)

**Sensors**

Compact, with extension pipe up to 3 m (up to 6 m on request) or special "length L II" (see → l 33ff.)

- Flanges as per DIN, ASME, JIS from DN 25 / 1"

**Dimensions**

Dimensions in mm (in)!

**Housing FTL50(H), FTL51(H) with sensor FTL50(H)**

*Compact housing, primarily for hygiene applications*

![Dimensions diagram]

1. 5 m cable
2. M12 connector
3. Pg 1/2 connector

**Polyester housing F16**

![Polyester housing diagram]
**Liquiphant M FTL50(H), FTL51(H)**

**F15 stainless steel housing primarily for hygiene applications**

**Aluminum housing F17**

**Stainless steel housing (316L) F27**

**Aluminum housing F13**

**Aluminum housing F13**

with separate connection compartment

* See "Process connections"
Note!
The switch points of the Liquiphant M are at other positions to those of the previous version Liquiphant II.

### Process connections for FTL50(H) and FTL51(H)

<table>
<thead>
<tr>
<th>Process connection</th>
<th>Dimensions</th>
<th>Accessories</th>
<th>Pressure Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>G ¾</strong> DIN ISO 228/l with defined thread start; Flat seal to DIN 7603: supplied</td>
<td>GQ2 GQ6</td>
<td></td>
<td>≤ 100 bar / only FTL51 (≤ 1450 psi) ≤ 150 °C (302 °F)</td>
</tr>
<tr>
<td><strong>G ¾</strong> DIN ISO 228/l with defined thread start for flush-mounted installation in weld-in adapter</td>
<td>GQ2 GQ6</td>
<td>Weld-in adapter (with defined thread start) with silicone O-ring only FTL50, FTL50H</td>
<td>≤ 25 bar (363 psi) ≤ 150 °C (302 °F) ≤ 40 bar (580 psi) ≤ 100 °C (212 °F)</td>
</tr>
<tr>
<td><strong>G 1</strong> DIN ISO 228/l Flat seal to DIN 7603: supplied</td>
<td>GR2 GR6</td>
<td></td>
<td>≤ 100 bar / only FTL51 (1450 psi) ≤ 150 °C (302 °F)</td>
</tr>
<tr>
<td><strong>G 1</strong> DIN ISO 228/l with defined thread start With seal surface for flush-mounted installation in weld-in adapter</td>
<td>GW2</td>
<td>Weld-in adapter (with defined thread start) with silicone O-ring</td>
<td>≤ 25 bar (363 psi) ≤ 150 °C (302 °F) ≤ 40 bar (580 psi) ≤ 100 °C (212 °F)</td>
</tr>
<tr>
<td><strong>NPT ¾</strong> ASME B 1.20.1 or <strong>R ¾</strong> DIN/EN 10226</td>
<td>GM2 GM6</td>
<td></td>
<td>≤ 100 bar / only FTL51 (1450 psi) ≤ 150 °C (302 °F)</td>
</tr>
<tr>
<td><strong>NPT1</strong> ASME B 1.20.1 or <strong>R 1</strong> DIN/EN 10226</td>
<td>GN2 GN6</td>
<td></td>
<td>≤ 100 bar / only FTL51 (1450 psi) ≤ 150 °C (302 °F)</td>
</tr>
</tbody>
</table>

* FDA-compliant material in accordance with 21 CFR Part 177.2600 (silicone)
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.

**TE2: Mounting with NA connector only in conjunction with housing T13, F13 and compact housing.**

**TC2: Mounting with NA connector only in conjunction with compact housing.**

<table>
<thead>
<tr>
<th>Process connection</th>
<th>Dimensions</th>
<th>Accessories</th>
<th>Pressure Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flanges ASME B 16.5, EN 1092-1, (DIN 2527 B), JIS B2220</td>
<td><img src="image1" alt="Diagram" /></td>
<td>Seal depending on design installed on site</td>
<td>See nominal pressure of flange, however ≤ 100 bar (1450 psi) (only FTL51) ≤ 150 °C (302 °F)</td>
</tr>
<tr>
<td>Tri-Clamp ISO 2852 DN25-38 (1 to 1 ½”) DIN 32676 DN25-40 ø D = 50.5 mm (1.99 in) ISO 2852 DN40-51 (2”) DIN 32676 DN50 ø D = 64.0 mm (2.52 in)</td>
<td><img src="image2" alt="Diagram" /></td>
<td>Clamping ring and front seal installed on site**</td>
<td>≤ 25 bar (363 psi) ≤ 150 °C (302 °F)</td>
</tr>
<tr>
<td>Tri-Clamp NA Connect only for FTL50H, FTL51H ISO 2852 DN25-38 (1 to 1 ½”) DIN 32676 DN25-40 ø D = 50.5 mm (1.99 in) ISO 2852 DN40-51 (2”) DIN 32676 DN50 ø D = 64.0 mm (2.52 in)</td>
<td><img src="image3" alt="Diagram" /></td>
<td>Clamping ring and front seal installed on site**</td>
<td>≤ 25 bar (363 psi) ≤ 150 °C (302 °F)</td>
</tr>
<tr>
<td>Threaded pipe joint DIN 32 DIN 40 DIN 50 DIN 11851</td>
<td><img src="image4" alt="Diagram" /></td>
<td>Sealing ring with collar, installed on site**</td>
<td>DN 32, DN 40: ≤ 40 bar (580 psi) up to 100 °C (212 °F) ≤ 25 bar (363 psi) up to 140 °C (284 °F) DN 50: ≤ 25 bar (363 psi) ≤ 140 °C (284 °F)</td>
</tr>
<tr>
<td>Flush-mounted for weld-in adapter Factory standard Endress+Hauser with silicone seal and thread adapter nut: supplied</td>
<td><img src="image5" alt="Diagram" /></td>
<td>Weld-in adapter (fork can be positioned)</td>
<td>≤ 40 bar (580 psi) ≤ 100 °C (212 °F) ≤ 25 bar (363 psi) ≤ 150 °C (302 °F)</td>
</tr>
<tr>
<td>Process connection</td>
<td>Dimensions</td>
<td>Accessories</td>
<td>Pressure Temperature</td>
</tr>
<tr>
<td>-------------------</td>
<td>------------</td>
<td>-------------</td>
<td>---------------------</td>
</tr>
</tbody>
</table>
| **Aseptic**<br>DN 50<br>DIN 11864-1<br>Form A for pipe DIN 11850 with thread adapter nut | HE2<br>66.5 (2.62)<br>≤ 25 bar (363 psi)<br>≤ 140 °C (284 °F) | sealing ring installed on site** | **

**DRD**<br>With clamped flange | PE2<br>66.5 (2.62)<br>≤ 40 bar (580 psi)<br>≤ 100 °C (212 °F) | Welding flange with PTFE flat seal (fork can be positioned) See 'Accessories' (or installed on site)** | In conformity with FDA* |

**SMS**<br>2" (DN 51) with thread adapter nut | UE2<br>66.5 (2.62)<br>≤ 25 bar (363 psi)<br>≤ 140 °C (284 °F) | sealing ring installed on site** | **

**Varivent**<br>for piping ≥ DN 65 ≥ O.D. 3" ≥ I.P.S. 3" | WE2<br>56.5 (2.22)<br>≤ 25 bar (363 psi)<br>≤ 150 °C (302 °F) | Clamping ring and O-ring seal, installed on site** | However, see specification as per Tuchenhagen VARIVENT-Inline housing: ≤ 25 bar (363 psi) ≤ 150 °C (302 °F) |

**Ingold fitting**<br>DN 25<br>Fitting length 46 mm (2.52 in)<br>Thread adapter nut G 1 ¼ with O-ring seal, EPDM (FDA-compliant, USP Class VI*) | TT2<br>46 (1.81)<br>51.5 (2.03)<br>≤ 16 bar (232 psi)<br>≤ 150 °C (302 °F) | **

* FDA-compliant material in accordance with 21 CFR Part 177/2600 (silicone), 21 CFR Part 177.1550 (PTFE) ** The maximum temperature and the maximum pressure are dependent on the clamping ring used and the seal used. The lowest value applies in each case.
Sensor length L for FTL51 and FTL51H, depending on process connection

<table>
<thead>
<tr>
<th>Thread:</th>
<th>G ¾</th>
<th>G 1</th>
<th>Thread:</th>
<th>NPT ¾</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NPT1</td>
<td>R ¾</td>
<td></td>
<td>R 1</td>
</tr>
</tbody>
</table>

Flanges and flange-like process connections

<table>
<thead>
<tr>
<th>Flange connection</th>
<th>ASME: 316/316L</th>
<th>EN: 316L (1.4404)</th>
<th>JIS: 316L (1.4404)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tuning fork</td>
<td>316L (1.4435)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Optional 2.4602 (AlloyC22)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note!
The switch points of Liquiphant M are at other positions to those of the previous version Liquiphant II. Special length "L II".

With vertical mounting from above approximately the same switch point as for the Liquiphant II FTL360, FTL365, FDL30, FDL35.

*L II" depends on process connection:

- L = 115 mm (4.53 in) for flanges and flange-like process connections such as Clamp, DRD...
- L = 99 mm (3.9 in) for threads NPT and R (BSPT)
- L = 118 mm (4.65 in) for threads G1 (BSP 1)
- L = 115 mm (4.53 in) for threads G ¾ (BSP ¾)
- L = 104 mm (4.09 in) for flush-mounted 1" (G1" Endress+Hauser welding bosses)

Weights

See 'Ordering information' → 44ff

Materials and surfaces

Material specifications as per AISI and DIN-EN.

Parts in contact with process

- Process connection and extension pipe:
  - FTL5x → 316L (1.4404 or 1.4435) optional 2.4602 (AlloyC22)
  - FTL5xH → 316L (1.4435)
- Tuning fork: 316L (1.4435) optional 2.4602 (AlloyC22)
- Flanges:
  - ASME: 316/316L
  - EN: 316L (1.4404)
  - JIS: 316L (1.4404)
- Flange plating: AlloyC22 (2.4602)
- Flat seal for process connection G ¾ or G 1: elastomer fiber, asbestos-free

Surface roughness

Choice of mechanically polished surface roughness (version → probe length → type):

- Ra < 1.5 μm (59.1 μin)
- Ra < 0.3 μm (11.8 μin), 3-A and EHEDG approval and CoC-ASME-BPE
Note!
The surface is electropolished if the additional option 'B' or 'E' (CoC - ASME BPE) is selected in addition to surface roughness quality $Ra < 0.3 \mu m$ (11.8 $\mu in$). The surface roughness is then: $Ra < 0.38 \mu m$ (15.0 $\mu in$).
With this combination, the wetted parts are made of 316L (1.4435) in accordance with BN2 (delta-ferrite content < 1 %).

Parts with no process contact
- Tuning fork/housing seal: EPDM
- Temperature spacer: 316 L (1.4435)
- Pressure-tight feedthrough: 316L (1.4435)
- Ground terminal on housing (external): 316L (1.4404)
- Cable glands
  - Housing F13, F15, F16, F17: polyamide (PA)
  - With B or C approval (→ 44 ordering information): nickel-plated brass
  - Housing F27: polyamide PA, with approval 'B' or 'C' 316L (1.4435)
  - Housing T13: nickel-plated brass
- Polyester housing F16: PBT-FR with PBT-FR cover or with PA12 transparent cover
  - Cover seal: EPDM
  - Nameplate glued: polyester film (PET)
  - Pressure compensation filter: PBT-GF20
- Stainless steel housing F15: 316L (1.4404)
  - Cover seal: silicone
  - Safety claw: 304 (1.4301)
  - Pressure compensation filter: PBT-GF20, PA
- Aluminum housing F17/F13: EN-AC-AlSi10Mg, plastic-coated
  - Nameplate: aluminum, anodized
  - Cover seal: EPDM
  - Safety claw: nickel-plated brass
  - Pressure compensation filter: silicone
- Stainless steel housing F27: 316L
  - Nameplate: 316L (1.4404)
  - Cover seal: FVMQ (optional: EPDM seal available as spare part)
  - Safety claw: 316L (1.4435)
- Aluminum housing T13: EN-AC-AlSi10Mg, plastic-coated,
  - Nameplate: aluminum, anodized
  - Cover seal: EPDM
  - Safety claw: nickel-plated brass
  - Pressure compensation filter: silicone
- Compact housing (valve connector or M12 connector): 316L (1.4435)

Process connections
- Parallel thread G ¾, G 1 to DIN ISO 228/I with flat seal to DIN 7603
- Tapered thread R ¾, R 1 to EN10226
- Tapered thread ¾ - 14 NPT, 1 - 11½ NPT as per ASME B 1.20.1
- Flush-mounted installation with weld-in adapter to factory standard Endress+Hauser (G ¾, G 1)
- Flush-mounted installation with weld-in adapter to factory standard Endress+Hauser (1"), sensor can be positioned
- Tri-Clamp 1½", 2" to ISO 2852
- Threaded pipe joint DN 32, 40, 50 to DIN 11851
- Aseptic connection DN 50 to DIN 11864-1
  - Form A for pipe DIN 11850
  - SMS connection 2" (DN 51)
  - DRD flange
- Varivent® DN 50 (50/40) to factory standard Tuchenhagen
- Flanges: as per EN/DIN 1092-1 from DN 25, as per ASME B 16.5 from 1", as per JIS B2220 (RF)
- Ingold DN25 fitting length 46 mm (1.81 in) with thread adapter nut G1 ¼

Further details at Ordering information → 44.
Human interface

Electronic inserts

With FEL51, FEL52, FEL54, FEL55:
- 2 switches for safety mode and density change
- green LED to indicate operational status
- red LED to indicate the switching status, flashes in the event of corrosion damage on sensor or if the electronics are defective

With FEL56:
- 2 switches for safety mode and density change
- green LED flashes to indicate operational status
- red LED to indicate the switching status, flashes in the event of corrosion damage on sensor or if the electronics are defective

With FEL57:
- 2 switches for density change and Testing
- green LED to indicate operational status
- yellow LED to indicate the covered status, flashes in the event of corrosion damage on sensor or if the electronics are defective

With FEL58:
- 2 switches for safety mode and density change
- green LED – flashes quickly to indicate operational status,
  – flashes slowly in the event of corrosion damage to the sensor 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, pulsed 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

Compact housing

Function test with test magnet

Versions AC, DC-PNP and NAMUR:
During the test, the current state of the electronic switch is reversed.

Hold the test magnet against the marking on the nameplate: The switching status is changed.
Light signals

Versions AC and DC-PNP with valve connector or cable tail

**Green light (gn) lights up (AC/DC):**
Liquiphant M is connected to the power supply and is operational.

**Green light (gn) flashing (NAMUR):**
Liquiphant M is connected to the power supply and is operational.

**Red light (rd) lights up (AC/DC):**
MAX application mode (overfill protection): sensor is immersed in liquid.
MIN application mode (dry running protection): sensor is not immersed in liquid.

**Yellow light (ye) lights up (NAMUR):**
MAX application mode (overfill protection): sensor is not immersed in liquid.
MIN application mode (dry running protection): sensor is immersed in liquid.

**Red light (rd) flashing (AC/DC):**
Liquiphant M has detected a fault.
**Version NAMUR and DC-PNP with M12x1 round connector 316L.**

Green light (gn) lights up (DC-PNP):
Liquiphant M is connected to the power supply and is operational.

Green light (gn) flashing with 1 Hz (NAMUR):
Liquiphant M is connected to the power supply and is operational.

Yellow light (ye) lights up (DC-PNP):
Sensor is immersed in liquid.

Yellow light (ye) lights up (NAMUR):
MAX application mode (overfill protection): sensor is not immersed in liquid.
MIN application mode (dry running protection): sensor is immersed in liquid.

Red light (rd) flashing (DC-PNP):
Liquiphant M has detected a fault.

Green light (gn) flashing with 0.3 Hz (NAMUR):
Liquiphant M has detected a fault.

**Version DC-PNP with M12x1 round connector 316L.**
Green light (gn) lights up:
Liquiphant M is connected to the power supply and is operational.

Yellow light (ye 1) lights up:
MAX application mode (overfill protection): sensor is not immersed in liquid.
MIN application mode (dry running protection): sensor is not immersed in liquid.

Yellow light (ye 2) lights up:
MAX application mode (overfill protection): sensor is immersed in liquid.
MIN application mode (dry running protection): sensor is immersed in liquid.

Green light (gn) lights up, both yellow lights (ye 1+2) do not light up:
Liquiphant M has detected a fault.

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.

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
The approved process connections are listed in the CRN-approval (Canadian Registration Number). Details about the maximum pressure values are available in the download area at ‘www.endress.com/download’. CRN-approved devices are marked on the name plate with the registration number CRN: 0F15899.2C.

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

Endress+Hauser
**Note:**
A separate analysis must be performed for pressure instruments that are part of safety equipment designed to protect a pipe or vessel from exceeding allowable limits (safety accessory in accordance with Pressure Equipment Directive 2014/68/EU, Article 2, point 4).

**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 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 → 51 ff.

**General approvals**

The following approvals are available for Liquiphant M FTL50H, FTL51H:

- EHEDG: certificate
- 3A: 3A certificate (USA), Authorization no. 459: 74-xx Sensors and Sensor Fittings and Connections
- Certificate of Compliance as per ASME BPE-2012. (Order code: additional option = "B" or "E")

<table>
<thead>
<tr>
<th>Product</th>
<th>Type</th>
<th>Max. process pressure</th>
<th>Marking</th>
<th>Listing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liquiphant M</td>
<td>FTL50-S/T##...</td>
<td>64 bar (928 psi)</td>
<td>Single Seal</td>
<td>CSA/FM</td>
</tr>
<tr>
<td></td>
<td>FTL50-P/Q/R##...</td>
<td>(928/1450 psi)</td>
<td>Single Seal</td>
<td>CSA/FM</td>
</tr>
<tr>
<td></td>
<td>FTL51-S/T##...</td>
<td>64 bar (928 psi)</td>
<td>Single Seal</td>
<td>CSA/FM</td>
</tr>
<tr>
<td></td>
<td>FTL51-P/Q/R##...</td>
<td>(928/1450 psi)</td>
<td>Single Seal</td>
<td>CSA/FM</td>
</tr>
</tbody>
</table>

**Process connections**

<table>
<thead>
<tr>
<th>Order code</th>
<th>Ra (μm)</th>
<th>ASME BPE + CoC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt;0.3</td>
<td>&lt; 0.38</td>
</tr>
</tbody>
</table>

- Suitable fittings and seals must be used to ensure hygiene-compliant design according ASME BPE etc.
- Surfaces with ASME-BPE option: Ra < 0.38 μm (< 15 μin) electropolished and passivated or Ra < 1.5 μm (59 μin) mechanically polished.
- To avoid risk of contamination, install according to the “Hygienic Equipment Design Criteria (HDC)” as stated in the Subgroup Design Principles of the EHEDG, Doc. 8.
Suitable fittings and seals must be used to ensure hygiene-compliant design according to the specifications of 3-A SSI and EHEDG Position Paper in its most actual version.

The leak-tight connections can be cleaned with the cleaning methods (CIP and SIP) usually used in this industry. For CIP (Clean in Place) and SIP (Sterilize in Place) processes the pressure and temperature specifications of the sensor and the process connections must be observed.

The device has been developed for use in hygienic processes. The wetted materials meet the requirements of FDA and 3-A-Sanitary Standard No. 74-XX. Endress+Hauser confirms this by affixing the 3-A sign to the device!

For T-piece installation of the sensor in combination with EHEDG certificate, note:
The T-piece must be smaller with \( L / (D - d) \leq 1 \).

Certificate of current Good Manufacturing Practises (cGMP)

The declaration is available in English only

Materials of construction of product wetted parts

TSE compliance

Polishing and surface finish

Material/compound compliance table (USP Class VI, FDA conformity)

Other certificates

Material certificate as per EN 10204/3.1 for all wetted parts NACE MR0175/MR0103, AD2000

Leak detection system in conjunction with WHG approval

Approval number: Z-65.40-446 (see also "Ordering information" → 44)

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" (→ 30 ff.) and "Ordering information" (→ 44) sections.

Manufacturer declarations

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

- FDA conformity
- TSE-free: Materials not derived from animals
- Regulation (EC) no. 2023/2006 (GMP)
- Regulation (EC) No. 1935/2004 materials in contact with food

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

Regulation (EU) No. 10/2011: The regulation on plastic materials does not apply to the Liquiphant FTL5x, as the wetted materials are made exclusively of stainless steel.

The silicone seals supplied comply with BFR recommendation XV (commodities based on silicones from the Federal Institute for Risk Assessment - BFR), and the EPDM seals provided comply with BFR recommendation XXI (commodities based on natural and synthetic rubber).

Use in hazardous zones

Pay particular attention to the information provided in the documentation: Safety Instructions, Control Drawings etc. → 51
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.

Pressure equipment directive  The Pressure Equipment Directive 97/23/EC does not apply to the Liquiphant FTL5x, as it does not have a pressurized housing in accordance with Article 1, Paragraph 2.1.4 of the directive.

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

Note!
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

Accessories
Note!
- All dimensions in mm (in)!
- For additional information on weld-in adapters, refer to TI00426F.
- The tolerance of the thread start between the weld-in adapter and sensor is ± 15°.

<table>
<thead>
<tr>
<th>Weld-in adapter</th>
<th>Overview</th>
</tr>
</thead>
<tbody>
<tr>
<td>G 3/4, d=29 (1.14) without flange</td>
<td>G 3/4, d=50 (1.97) with flange</td>
</tr>
<tr>
<td>Material roughness μm (μin)</td>
<td>316L 1.5 (59.1)</td>
</tr>
<tr>
<td>Without inspection certificate EN10204-3.1 material</td>
<td>71258357</td>
</tr>
<tr>
<td>With inspection certificate EN10204-3.1 material</td>
<td>52028295(3)</td>
</tr>
<tr>
<td>Seal (replacement part: set of 5)</td>
<td>Silicone O-ring 52021717</td>
</tr>
</tbody>
</table>
1) This weld-in adapter replaces the weld-in adapter with the order number 917969-1000.
2) This weld-in adapter replaces the weld-in adapter with the order number 215159-0000.
3) A seal is included in the delivery.

<table>
<thead>
<tr>
<th>Weld-in dummy</th>
<th>71168889</th>
<th>71166879</th>
<th>71166879</th>
<th>71181945</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liquiphant M</td>
<td>Feature</td>
<td>Version</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FTL50</td>
<td></td>
<td>GQ2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FTL5x</td>
<td></td>
<td>GW2</td>
<td>GW2</td>
<td>GW2</td>
</tr>
<tr>
<td>FTL50H</td>
<td></td>
<td>GQ2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FTL5xH</td>
<td></td>
<td>GW2</td>
<td>GW2</td>
<td>GW2</td>
</tr>
</tbody>
</table>

**Material roughness μm (μin), process side**

<table>
<thead>
<tr>
<th>RD52</th>
<th>DRD DN50</th>
</tr>
</thead>
<tbody>
<tr>
<td>65 (2.56) (welding flange)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Material</th>
<th>RD52</th>
<th>DRD DN50</th>
</tr>
</thead>
<tbody>
<tr>
<td>316L</td>
<td>316L</td>
<td>316L/304</td>
</tr>
<tr>
<td>0.8 (31.5)</td>
<td>0.8 (31.5)</td>
<td></td>
</tr>
</tbody>
</table>

**Without inspection certificate EN10204-3.1 material**

| | 52001047 | 52002041 |
| | 1), 2) | 2)/ | 916743-0000 |

**With inspection certificate EN10204-3.1 material**

| | 52006909 | 52011899 |
| | 1), 2) | 2)/ |

**Seal (replacement part: set of 5)**

<table>
<thead>
<tr>
<th>Silicone profile gasket</th>
<th>PTFE flat seal</th>
</tr>
</thead>
<tbody>
<tr>
<td>52014424</td>
<td>52024228</td>
</tr>
</tbody>
</table>

**Weld-in dummy M40167**

<table>
<thead>
<tr>
<th>Device</th>
<th>Feature</th>
<th>Version</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liquiphant M</td>
<td>FTL5xH</td>
<td>020 EE2 PE2</td>
</tr>
</tbody>
</table>

**Without inspection certificate**

<table>
<thead>
<tr>
<th>Material</th>
<th>RD52</th>
<th>DRD DN50</th>
</tr>
</thead>
<tbody>
<tr>
<td>316L/304</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.8 (31.5)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**With inspection certificate**

<table>
<thead>
<tr>
<th>Material</th>
<th>RD52</th>
<th>DRD DN50</th>
</tr>
</thead>
<tbody>
<tr>
<td>316L/304</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.8 (31.5)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Seal**

<table>
<thead>
<tr>
<th>Silicone profile gasket</th>
<th>PTFE flat seal</th>
</tr>
</thead>
<tbody>
<tr>
<td>43014424</td>
<td>52024228</td>
</tr>
</tbody>
</table>
1) This weld-in adapter replaces the weld-in adapter with the order number 942329-0001.
2) A seal is included in the delivery.

Note!
All the weld-in adapters available are described in document TI00426F. www.endress.com --> Download -->Advanced--> Documentation code --> TI00426F.

Weather protection cover
For F16 housing

<table>
<thead>
<tr>
<th>Material</th>
<th>Order No.</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>PBT, gray</td>
<td>71127760</td>
<td>240 g (8.46 oz)</td>
</tr>
</tbody>
</table>

For F13, F17 and F27 housing

<table>
<thead>
<tr>
<th>Material</th>
<th>Order No.</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>PA6, gray</td>
<td>71040497</td>
<td>300 g (10.58 oz)</td>
</tr>
</tbody>
</table>
Lap joint flange

Order number: 918158-0000
With G 1 thread for mounting a Liquiphant FTL50, FTL51 with process connection GR2
Pressure up to 40 bar (580 psi)
Material: corrosion-resistant steel 1.4301 (AISI 304)
Weight: 0.54 kg (1.19 lbs)

Lap joint flanges

With G 1 thread for mounting a Liquiphant FTL50, FTL51 with process connection GR2
Material: corrosion-resistant steel 1.4571 (AISI 316Ti)
- 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)

Sliding sleeves for unpressurized operation

Switch point infinitely variable for Liquiphant MFTL51
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)

<table>
<thead>
<tr>
<th>Thread</th>
<th>Standard</th>
<th>Material</th>
<th>Order number</th>
<th>Approval</th>
</tr>
</thead>
<tbody>
<tr>
<td>G 1</td>
<td>DIN ISO 228/I</td>
<td>1.4435 (AISI 316 L)</td>
<td>52003978</td>
<td></td>
</tr>
<tr>
<td>G 1</td>
<td>DIN ISO 228/I</td>
<td>1.4435 (AISI 316 L)</td>
<td>52011888</td>
<td>With inspection certificate EN 10204 - 3.1 material</td>
</tr>
<tr>
<td>NPT1</td>
<td>ASME B 1.20.1</td>
<td>1.4435 (AISI 316 L)</td>
<td>52003979</td>
<td></td>
</tr>
<tr>
<td>NPT1</td>
<td>ASME B 1.20.1</td>
<td>1.4435 (AISI 316 L)</td>
<td>52011889</td>
<td>With inspection certificate EN 10204 - 3.1 material</td>
</tr>
<tr>
<td>G 1½</td>
<td>DIN ISO 228/I</td>
<td>1.4435 (AISI 316 L)</td>
<td>52003980</td>
<td></td>
</tr>
<tr>
<td>G 1½</td>
<td>DIN ISO 228/I</td>
<td>1.4435 (AISI 316 L)</td>
<td>52011890</td>
<td>With inspection certificate EN 10204 - 3.1 material</td>
</tr>
</tbody>
</table>
### High pressure sliding sleeves

For continuous adjustment of the switch point of a Liquiphant M FTL51. Also for use in hazardous areas. Additional information → 51ff. (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.

---

<table>
<thead>
<tr>
<th>Thread</th>
<th>Standard</th>
<th>Material</th>
<th>Order number</th>
<th>Approval</th>
</tr>
</thead>
<tbody>
<tr>
<td>NPT1½</td>
<td>ASME B 1.20.1</td>
<td>1.4435 (AISI 316 L)</td>
<td>52003981</td>
<td></td>
</tr>
<tr>
<td>NPT1½</td>
<td>ASME B 1.20.1</td>
<td>1.4435 (AISI 316 L)</td>
<td>52011891</td>
<td>With inspection certificate EN 10204 - 3.1 material</td>
</tr>
</tbody>
</table>

---

<table>
<thead>
<tr>
<th>Thread</th>
<th>Standard</th>
<th>Material</th>
<th>Order number</th>
<th>Approval</th>
</tr>
</thead>
<tbody>
<tr>
<td>G 1</td>
<td>DIN ISO 228/1</td>
<td>1.4435 (AISI 316 L)</td>
<td>52003663</td>
<td></td>
</tr>
<tr>
<td>G 1</td>
<td>DIN ISO 228/1</td>
<td>1.4435 (AISI 316 L)</td>
<td>52011880</td>
<td>With inspection certificate EN 10204 - 3.1 material</td>
</tr>
<tr>
<td>G 1</td>
<td>DIN ISO 228/1</td>
<td>AlloyC22</td>
<td>71118691</td>
<td>With inspection certificate EN 10204 - 3.1 material</td>
</tr>
<tr>
<td>NPT1</td>
<td>ASME B 1.20.1</td>
<td>1.4435 (AISI 316 L)</td>
<td>52003667</td>
<td></td>
</tr>
<tr>
<td>NPT1</td>
<td>ASME B 1.20.1</td>
<td>1.4435 (AISI 316 L)</td>
<td>52011881</td>
<td>With inspection certificate EN 10204 - 3.1 material</td>
</tr>
<tr>
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<td>ASME B 1.20.1</td>
<td>AlloyC22</td>
<td>71118694</td>
<td>With inspection certificate EN 10204 - 3.1 material</td>
</tr>
<tr>
<td>G 1½</td>
<td>DIN ISO 228/1</td>
<td>1.4435 (AISI 316 L)</td>
<td>52003665</td>
<td></td>
</tr>
<tr>
<td>G 1½</td>
<td>DIN ISO 228/1</td>
<td>1.4435 (AISI 316 L)</td>
<td>52011882</td>
<td>With inspection certificate EN 10204 - 3.1 material</td>
</tr>
<tr>
<td>G 1½</td>
<td>DIN ISO 228/1</td>
<td>AlloyC22</td>
<td>71118693</td>
<td>With inspection certificate EN 10204 - 3.1 material</td>
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<tr>
<td>NPT1½</td>
<td>ASME B 1.20.1</td>
<td>1.4435 (AISI 316 L)</td>
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<tr>
<td>NPT1½</td>
<td>ASME B 1.20.1</td>
<td>1.4435 (AISI 316 L)</td>
<td>52011883</td>
<td>With inspection certificate EN 10204 - 3.1 material</td>
</tr>
<tr>
<td>NPT1½</td>
<td>ASME B 1.20.1</td>
<td>AlloyC22</td>
<td>71118695</td>
<td>With inspection certificate EN 10204 - 3.1 material</td>
</tr>
</tbody>
</table>
**Liquiphant M FTL50(H), FTL51(H)**

*FTL51 with high-pressure sliding sleeve (100 bar (1450 psi)). See "Additional option" option "P" or "R".*

**Cover with sight glass**
- Order number: 943461-0001
  - for polyester housing F16
  - Material: PA 12
  - Weight: 0.04 kg (0.09 lbs)

**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)

**Circular connector**
- Order number: 52010285
  - 4x0.34 M12 socket
  - Cable: PVC (gray) 5 m (16 ft)
  - Body: PUR (blue)
  - Thread adapter nut: Cu Sn/Ni
  - Degree of protection: IP67
  - Temperature range with fixed cable:
    - -25 to +70 °C (-13 to +158 °F)
  - Temperature range with flexible cable:
    - -5 to +70 °C (23 to +158 °F)

- Order number: 52024216
  - 4x0.34 M12 socket
  - Cable: PVC (orange) 5 m (16 ft)
  - Body: PVC (orange)
  - Thread adapter nut: 316L
  - Degree of protection: IP69 (fully locked)
  - Temperature range: -25 to +70 °C (-13 to +158 °F)
Order number: 52018763
4x0.34 M12 socket with integrated LEDs
Cable: PVC (orange) 5 m (16 ft)
Body: PVC (transparent)
Thread adapter nut: 316L
Degree of protection: IP69/IP69 (fully locked)
Temperature range: −25 to +70 °C (-13 to +158 °F)

### Documentation

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

<table>
<thead>
<tr>
<th>Operating Instructions</th>
<th>BA00141F: Electronic insert FEL50A for Liquiphant M, PROFIBUS PA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BA00335F: Liquiphant M Density, density computer FML621</td>
</tr>
<tr>
<td></td>
<td>KA00143F: Liquiphant M FTL50, FTL51</td>
</tr>
<tr>
<td></td>
<td>KA00144F: Liquiphant M FTL50(H), FTL51(H)</td>
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<tr>
<td></td>
<td>KA00162F: Liquiphant M FTL51C</td>
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<tr>
<td></td>
<td>KA00163F: Liquiphant M FTL50-####### # 7 #, FTL51-####### # 7 #</td>
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<td>KA00164F: Liquiphant M FTL50H-####### # 7 #, FTL51H-####### # 7 #</td>
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<td>KA00165F: Liquiphant M FTL51C-####### # 7 #</td>
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<td>KA00220F: Liquiphant M FTL5#-# ### ## # #3 #, FTL5#H-# ### ## # #3 #</td>
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<td></td>
<td>KA00284F: Electronic insert FEL50D for Liquiphant M Density FTL50, FTL51</td>
</tr>
<tr>
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<td>KA00285F: Electronic insert FEL50D for Liquiphant M Density FTL50H, FTL51H</td>
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<td>KA00286F: Electronic insert: FEL50D for Liquiphant M Density FTL51C</td>
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<tr>
<td></td>
<td>KA00151F: Liquiphant M sliding sleeve for FTL51, G 1, NPT 1</td>
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<tr>
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<td>KA00152F: Liquiphant M sliding sleeve for FTL51, G 1½, NPT 1½</td>
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<td>KA00153F: Liquiphant M high-pressure sliding sleeve for FTL51, G 1, NPT 1</td>
</tr>
<tr>
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<td>KA00154F: Liquiphant M high-pressure sliding sleeve for FTL51, G 1½, NPT 1½</td>
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</table>

<table>
<thead>
<tr>
<th>Technical Information</th>
<th>TI00241F: General instructions for electromagnetic compatibility (Test procedure, installation recommendation)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TI00347F: Liquiphant M FTL51C, wetted parts with highly corrosion-resistant coating ECTFE, PFA or enamel coating</td>
</tr>
<tr>
<td></td>
<td>TI00350F: Isolating amplifier FTL325P, 1- or 3-channel switching units for top-hat rail mounting for Liquiphant M with electronic insert FEL57</td>
</tr>
<tr>
<td></td>
<td>TI00353F: Isolating amplifier FTL325N, 1- or 3-channel switching units for top-hat rail mounting for Liquiphant M with electronic insert FEL56, FEL58</td>
</tr>
<tr>
<td></td>
<td>TI00354F: Liquiphant M FTL70/71, for medium temperatures up to 280 °C (536 °F)</td>
</tr>
<tr>
<td></td>
<td>TI00360F: Isolating amplifier FTL375P, 1 to 3-channel switching units for top-hat rail mounting for Liquiphant M with electronic insert FEL57</td>
</tr>
<tr>
<td></td>
<td>TI00420F: Liquiphant M Density, density computer FML621</td>
</tr>
<tr>
<td></td>
<td>TI00426F: Weld-in adapter</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Functional safety (SIL)</th>
<th>SD00164F: Liquiphant M with electronic insert FEL51 (MAX)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SD00185F: Liquiphant M with electronic insert FEL51 (MIN)</td>
</tr>
<tr>
<td></td>
<td>SD00163F: Liquiphant M with electronic insert FEL52 (MAX)</td>
</tr>
<tr>
<td></td>
<td>SD00186F: Liquiphant M with electronic insert FEL52 (MIN)</td>
</tr>
</tbody>
</table>
### Safety Instructions

**ATEX**

- XA00115F, XA00114F, XA00108F, XA00031F: DEKRA 15 ATEX 0088
  - Ex d, Ex de
- XA00113F, XA000064F, XA00063F: KEMA 99 ATEX 0523 X
  - Ex d, Ex de
- XA00182F: EG 01 007 X
  - Ex nA

**IEC Ex**

- XA01371F, XA00114F, XA00108F, XA00031F: IECEx DEK 15.0060
  - Ex d, Ex de
- XA00113F, XA00064F, XA00063F: KEMA 99 ATEX 0523 X; IECEx DEK 15.0028X
  - Ex d, Ex de

### Safety Instructions (NEPSI)

- XA00401F/00/B2: Ex d IIc/IIB T3...T6 , Ex d IIc T2...T6
  (NEPSI GYJ06424)
- XC00009F/00/b2: Ex ia IIc T2...T6, Ex ia IIB T3...T6
  (NEPSI GYJ05556, NEPSI GYJ06464),
- XC00010F/00/b2: Ex nA II T3...T6, Ex nC/nL IIc T3...T6
  (NEPSI GYJ04360, NEPSI GYJ071414)

### Control Drawings

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

- ZD00042F: 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

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

- ZD000240F: Liquiphant M, Liquiphant S (cCSAus / XP)
  - Class I, Groups A, B, C, D
  - Class II, Groups E, F, G
  - Class III

- ZD000244F: Liquiphant M (IS and NI) PROFIBUS PA, FOUNDATION Fieldbus
  - Class I, Zone 0, IIc
  - Class I, Division 1, 2, Groups A, B, C, D
  - Class II, Division 1, 2, Groups E, F, G
  - Class III