Level Limit Switch

liquiphant FTL 360 / FTL 361

Level limit switch Liquiphant II with vibrating probe.
For all types of liquid.

Application
The Liquiphant is a level limit switch for all liquids.
It can monitor the upper and lower level limits in tanks and vessels and is suitable for all liquids:
• with temperatures lying between –40 °C and +150 °C
  (–40 °F and +300 °F)
• with a viscosity up to 10,000 mm²/s (cSt)
• with a density greater than 0.5 g/cm³
For particularly corrosive liquids the plastic-coated versions or the Hastelloy–version are suitable.
The Liquiphant is used wherever float switches were previously installed.
It is also used in those applications where float switches are not suitable.
(due to build-up, turbulence, flow, air bubbles).

Features at a glance
• Maintenance free:
  Operates completely reliably even with heavy build-up.
• Cost-effective: An economical standard Liquiphant can be used in all applications. It operates safely in all types of liquids and under all process conditions, independent of turbulence, electrical properties, solids or gas content, foam, or tank vibrations.
• Accurate switching: A constant switchpoint with millimetre accuracy without need for calibration.
• Operational safety: Thanks to its improved and patented system with intelligent drive electronics, the Liquiphant is unequalled in its tolerance to external vibrations. The tines are monitored electronically for corrosion.
• Proven in practice: The reliability you need is the experience we offer with 1 000 000 measuring points already installed.
Operating principle of the Liquiphant

The sensor in the form of a tuning fork is made to vibrate at its resonant frequency. When the sensor is immersed in the liquid, the resonant frequency changes. The frequency change is detected and then converted into a switching signal. The built-in switch for minimum or maximum detection enables the Liquiphant to be used for each application in the required fail-safe mode.

Installation possibilities

A wide range of application-specific designs, process connections and high corrosion-resistant materials allows limit detection of all kinds of liquids in tanks and pipes.

A few examples:

☐ Top mounting to monitor the maximum level. Optionally with a sliding sleeve to vary the switchpoint.
☐ Side mounting to monitor the minimum level.
☐ Mounted in a pipe as dry-run protection for the pump.

The limit switch with greater operational safety, even for liquids which are adhesive, causing build-up, corrosive, agitated, sparkling or foaming.

Measuring System

- Liquiphant as compact version or with extension tube
- Process connection: Threaded boss, flange or hygienic coupling
- Electronic insert for alternating or direct current, with electronic switching or a relay contact
- Housing
  - F6 Aluminium housing
  - F8 Stainless steel housing
  - F10 Polyester housing (PTB)

Housing versions

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The limit switch with greater operational safety, even for liquids which are adhesive, causing build-up, corrosive, agitated, sparkling or foaming.
**Process connections**

Application-specific process connections and designs ensure an ideal adaptability to the mounting requirements.

- Threaded boss G 1 A or 1" NPT
- Flanges according to various standards: DIN, ANSI, JIS

For particularly hygienic requirements, e.g. food processing:
- Milk pipe coupling
- Triclamp® coupling
- Weld-in socket for flush mounting

Fork and extension tube are polished.

**Process connection materials:**
- Stainless steel 316 Ti (1.4571) or Hastelloy C (2.4610),
- flange version additionally available with ECTFE (Halar®) or PFA coating.

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![Diagram of FTL 360 and FTL 361](image-url)

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**Threaded boss**
- G 1 A or 1-11/2" NPT

**Pipe coupling**
- DIN 11851, DN 50
- ISO 2852, 2"

**Triclamp coupling**
- DIN 11851, 2"

**Flange version**
- DIN, ANSI, JIS

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**FTL 360**
- Compact version

**FTL 361**
- Extension tube version

Dimensions in mm:
- 100 mm = 3.94 in
- 1 in = 25.4 mm

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**Above:**
- Weld-in socket with fork orientation for FTL 360 with G1A thread for flush mounting (moulded seal)
- Order No. 215 159-0000

**Below:**
- Weld-in socket without fork orientation for FTL 360 with G1A thread for flush mounting: material: AISI 304 (1.4301) with FPM O-Ring seal.
- Order No. 917 969-1000

**Separate flange**
- for FTL 360 / 361 with G1A threaded boss

**Sliding sleeve**
- for FTL 361 for variable switchpoint setting
- 1. Atmospheric pressure sliding sleeve
- 2. High pressure sliding sleeve for pressure up to 40 bar (600 psi)
Please note when mounting the Liquiphant:
- The vibration of the tines must not be blocked, e.g. due to adhering material.
- If build-up occurs then sufficient distance to the tank or pipe wall must be maintained.

Nozzle mounting
When mounting the sensor in a nozzle, the viscosity of the liquid should be taken into account:
1. Generally:
   - The process connection preferably flush with the tank wall
2. With low viscosity liquids
   - mount the sensor so that the liquid can flow out of the nozzle and uncover the tines.
3. With high viscosity liquids nozzle max. 60 mm (with a 1”-nozzle).
   - Better: Use a nozzle with a larger diameter.
4. Tuning fork in pipe:
   - min. DN 50 with low viscosity liquids

Pipe mounting
- For use as dry-run protection for pumps preferably mount the Liquiphant in a vertical pipe.
- When determining the length of the nozzle take the pipe diameter into account
- If mounted in a horizontal pipe, partial pipe filling can be detected if the correct nozzle length is chosen.

Liquiphant with plastic coating
- Maximum operating temperature for ECTFE: 120 °C (250 °F),
  for PFA: 130 °C (270 °F)
- The temperature difference T2 - T1 between the inner and outer surfaces of the flange must not exceed 60 °C (140 °F). If necessary, insulate the outer surface of the flange.

For humid environments or cold media, to avoid condensate forming within the housing:
install a FTL 361, min. length 220 mm, or insulate the housing.

The fork tines may not touch the tank or pipe wall or any build-up.
**Electronic inserts**

Electronic switch with:
- Two-wire AC connection
- Three-wire DC connection PNP
- Three-wire DC connection NPN
- Universal connection with potential free relay contact

The electronic inserts are exchangeable without requiring a recalibration!

**FEL 32**
Three-wire DC connection PNP
- Continuous load max. 350 mA for short periods 1 A, max. 1 s
- Operating voltage 10 V ... 55 V
- Overload and reverse polarity protected
- Residual current when open <100 µA
- Current consumption max. 15 mA

**FEL 33**
Three-wire DC connection NPN
- Continuous load max. 350 mA for short periods 1 A, max. 1 s
- Operating voltage 10 V ... 55 V
- Overload and reverse polarity protected
- Residual current when open <100 µA
- Current consumption max. 15 mA

**FEL 34**
Universal connection for AC 21 V ... 253 V, 50 / 60 Hz or DC 20 V ... 200 V.
- Current consumption max. 7 mA.
- Potential free relay contact.
- Load capacity:
  - With AC max. 250 V, max. 6 A
    - \( P \sim \text{max. 1500 VA}, \cos \varphi = 1 \)
    - \( P \sim \text{max. 750 VA}, \cos \varphi > 0.7 \)
  - With DC 20 V to 200 V,
    - \( P = \text{max. 200 W} \)

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**CE MARK**

The device fulfills the legal requirements of the following EC Guidelines:
- Guideline 89/336/EC (Electromagnetic compatibility)
- Guidelines 73/23/EC and 93/68/EC (Low Voltage Appliances)

Electromagnetic compatibility (EMC): Immunity to EN 50082-2 and industrial standard NAMUR, at a field strength of 10 V/m.

For general information on electromagnetic compatibility (test methods, installation hints) see TI 241F/00/en.

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1. Maximum-/Minimum fail-safe can be switched on the electronic insert
2. Switch for liquid density:
   - \( \rho > 0.5 \) e.g. for liquefied gas;
   - \( \rho > 0.7 \) standard setting
3. The LED indicates the switching status

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**Function and switching of the electronic inserts**

- Electrical Connection

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**FEL 31**
Two-wire AC connection 21 V ... 253 V, 50 / 60 Hz
- Load for short periods max. 1.5 A / 40 ms
- max. 375 VA / 250 V
- max. 36 VA / 24 V
- Continuous load max, 350 mA max. 87 VA / 250 V max. 8.4 VA / 24 V
- Minimum load
  - min. 2.5 VA / 250 V (10 mA)
  - min 0.5 BA / 24 V (20 mA)
- Residual current when open 4 mA
- Voltage drop across the electronic switch when closed, 10 V
- Do not use the FEL 31 without an external load!

**FEL 32**
Three-wire DC connection PNP
- Continuous load max. 350 mA
- Operating voltage 10 V ... 55 V
- Overload and reverse polarity protected
- Residual current when open <100 µA
- Current consumption max. 15 mA

**FEL 33**
Three-wire DC connection NPN
- Continuous load max. 350 mA
- Operating voltage 10 V ... 55 V
- Overload and reverse polarity protected
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Universal connection for AC 21 V ... 253 V, 50 / 60 Hz or DC 20 V ... 200 V.
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- Overload and reverse polarity protected
- Residual current when open <100 µA
- Current consumption max. 15 mA

---

**U~** 21 V ... 253 V
**U_** 10 V ... 55 V
**U_** 10 V ... 55 V
**U~** 21 V ... 253 V

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Setting the switchpoint
If a switchpoint with millimetre accuracy is required please note the diagram opposite.
1. Top mounting
2. Side mounting with the tines next to each other or above one another
3. Bottom mounting

Switchpoint data are related to water (Density 1 g/cm³). For use in extremely light liquids (liquified gas - LPG) the switch on the Liquiphant should be set to "Density 0.5".

Operating data
Operating pressure in tank
max. 40 bar (600 psi), see the illustration below for permissible temperature
Test pressure: max. 60 bar (900 psi)
Operating temperature in tank:
−40 ºC...+150 ºC (−40 ºF...+300 ºF)
Ambient housing temperature:
−20 ºC...+70 ºC (0 ºF...+160 ºF)
Liquid viscosity: max. 10000 mm²/s (cSt)
Minimum density of the liquid: 0.5 g/cm³
Switching hysteresis: approx. 5 mm
Switching delay:
when covered approx. 0.4 s,
when exposed approx. 1 s
Fail-safe mode: Min./Max. selectable
Switching display:
LED on the electronic insert

Sensor materials
• Stainless steel 1.4581 (~AISI 316 Ti) optionally polished
• Stainless steel 1.4581 (~AISI 316 Ti) with ECTFE or PFA coating, together with coated flanges
• Hastelloy C 2.4610

Accessories
☐ Sliding sleeve for variable switchpoint setting
(when commissioning)
- Atmospheric pressure sliding sleeve
- High pressure sliding sleeve
☐ Separate flanges
☐ Transparent housing cover: allows the LED status to be seen

Technical Data
The maximum permissible temperature
T₁ at the housing depends on the operating temperature
T₂ in the tank.
x ºC = (1.8x + 32) ºF

The maximum permissible pressure pₑ in the vessel depends on the temperature T₂ in the vessel.
1 bar = 14.5 psi
## Product structure

### FTL 360

**Certificate**
- R Standard, no particular approval
- U CSA, General Purpose

**Process connection / Material**
- GR2 Threaded boss G1 A, AISI 316 Ti
- GN2 Threaded boss 1" NPT, AISI 316 Ti
- ME2 Pipe coupling DIN 11851 DN 50, AISI 316 Ti
- TE2 Triclamp (ISO 2852) 2", AISI 316 Ti

Fork surface finish
- A Standard fork (Material same as process connection)
- B Polished fork, only with process connection GR2, GN2, TE2
- Y Special fork finish

Electronic
1. FEL 31, AC-2-wire, 21...253 V
2. FEL 32, DC-PNP, 10...55 V
3. FEL 34, AC/DC with relay contact
   - 21 V...253 V AC, 20 V...200 V DC
9. Special electronic

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- ME2 Pipe coupling DIN 11851 DN 50, AISI 316 Ti
- TE2 Triclamp (ISO 2852) 2", AISI 316 Ti

Fork surface finish
- A Standard fork, material same as process connection, not available for process connections ME2, TE2
- B Polished fork, only with process connection ME2, TE2, GR2, GN2 and with extension tube «G» or «4»

Sensor length, extension tube material
Plastic coating with flanges only
Min. length 220 mm, max. length 6000 mm

<table>
<thead>
<tr>
<th>mm/ in</th>
<th>Material</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>AISI 316 Ti</td>
<td>(1.4571)</td>
</tr>
<tr>
<td>B</td>
<td>AISI 316 Ti / ECTFE coated</td>
<td>(up to 6 m / 236 in)</td>
</tr>
<tr>
<td>C</td>
<td>Hastelloy C</td>
<td></td>
</tr>
<tr>
<td>G</td>
<td>AISI 316 Ti, polished</td>
<td></td>
</tr>
<tr>
<td>Y</td>
<td>Special length, special material (e.g. PFA coated up to 1 m / 40 in)</td>
<td></td>
</tr>
</tbody>
</table>

Electronic
1. FEL 31, AC-2-Wire, 21...253 V
2. FEL 32, DC-PNP, 10...55 V
3. FEL 34, AC/DC with relay contact
   - 21 V...253 V AC, 20 V...200 V DC
9. Special electronic

Housing, cable entry
- K Polyester housing F10, IP 66, Pg 16 (IP 66)
- O Polyester housing F10, IP 66, M 20x1.5
- R Aluminium housing F6, IP 66, G 1/2 NPT
- T Aluminium housing F6, IP 66, M 20x1.5
- V Aluminium housing F6, IP 66, M 20x1.5
1. Stainless steel housing F8, IP 66, Pg 13.5
2. Stainless steel housing F8, IP 66, G 1/2
3. Stainless steel housing F8, IP 66, M 20x1.5
4. Stainless steel housing F8, IP 66, 1/2 NPT
Y Special housing

State length in mm or inch
# How to Order Flanges

<table>
<thead>
<tr>
<th>DIN-Flanges to DIN 2527 Form B</th>
<th>ANSI-Flanges to B 16.5 (RF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BA2 DN 32, PN 6, AISI 316 Ti</td>
<td>AA2 1 1/4&quot;, 150 psi, AISI 316 Ti</td>
</tr>
<tr>
<td>CA5 DN 32, PN 6, Hastelloy clad</td>
<td>AC2 1 1/2&quot;, 150 psi, AISI 316 Ti</td>
</tr>
<tr>
<td>BB2 DN 32, PN 40, AISI 316 Ti</td>
<td>AC7 1 1/2&quot;, 150 psi, AISI 316 Ti/EECTFE</td>
</tr>
<tr>
<td>BC2 DN 40, PN 6, AISI 316 Ti</td>
<td>AE2 2&quot;, 150 psi, AISI 316 Ti</td>
</tr>
<tr>
<td>BD2 DN 40, PN 40, AISI 316 Ti</td>
<td>AE7 2&quot;, 150 psi, AISI 316 Ti/EECTFE</td>
</tr>
<tr>
<td>BE2 DN 50, PN 6, AISI 316 Ti</td>
<td>AE5 2&quot;, 150 psi, Hastelloy clad</td>
</tr>
<tr>
<td>CE5 DN 50, PN 6, Hastelloy clad</td>
<td>AG2 2&quot;, 300 psi, AISI 316 Ti</td>
</tr>
<tr>
<td>BG2 DN 50, PN 40, AISI 316 Ti</td>
<td>AG7 2&quot;, 300 psi, AISI 316 Ti/EECTFE</td>
</tr>
<tr>
<td>BG7 DN 50, PN 40, AISI 316 Ti/EECTFE</td>
<td>AG5 2&quot;, 300 psi, Hastelloy clad</td>
</tr>
<tr>
<td>CG2 DN 50, PN 40, Hastelloy clad</td>
<td>AK2 2 1/2&quot;, 300 psi, AISI 316 Ti</td>
</tr>
<tr>
<td>CG7 DN 50, PN 40, AISI 316 Ti/EECTFE</td>
<td>AL2 3&quot;, 150 psi, AISI 316 Ti</td>
</tr>
<tr>
<td>CG2 DN 50, PN 40, AISI 316 Ti with raised face</td>
<td>AL7 3&quot;, 150 psi, AISI 316 Ti/EECTFE</td>
</tr>
<tr>
<td>NG2 DN 50, PN 40, AISI 316 Ti with groove</td>
<td>AN2 3&quot;, 300 psi, AISI 316 Ti</td>
</tr>
<tr>
<td>FG2 DN 50, PN 40, AISI 316 Ti with tongue</td>
<td>AP2 4&quot;, 150 psi, AISI 316 Ti</td>
</tr>
<tr>
<td>BK2 DN 65, PN 40, AISI 316 Ti</td>
<td>AR2 4&quot;, 300 psi, AISI 316 Ti</td>
</tr>
<tr>
<td>BM2 DN 80, PN 16, AISI 316 Ti</td>
<td>AV2 6&quot;, 150 psi, AISI 316 Ti</td>
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<tr>
<td>BN2 DN 80, PN 40, AISI 316 Ti</td>
<td>A12 6&quot;, 150 psi, AISI 316 Ti</td>
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<tr>
<td>BN7 DN 80, PN 40, AISI 316 Ti/EECTFE</td>
<td>KE2 10 K, 50, AISI 316 Ti</td>
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<tr>
<td>CN5 DN 80, PN 40, Hastelloy clad</td>
<td>KE7 10 K, 50, AISI 316 Ti/EECTFE</td>
</tr>
<tr>
<td>CN2 DN 80, PN 40, AISI 316 Ti with raised face</td>
<td>KE5 10 K, 50, Hastelloy clad</td>
</tr>
<tr>
<td>BG2 DN 100, PN 16, AISI 316 Ti</td>
<td>YY9 other Flanges, other material on request</td>
</tr>
<tr>
<td>BG7 DN 100, PN 16, AISI 316 Ti/EECTFE</td>
<td></td>
</tr>
<tr>
<td>CG2 DN 100, PN 16, Hastelloy clad</td>
<td></td>
</tr>
<tr>
<td>CG2 DN 100, PN 16, AISI 316 Ti with raised face</td>
<td></td>
</tr>
<tr>
<td>BR2 DN 100, PN 40, AISI 316 Ti</td>
<td></td>
</tr>
</tbody>
</table>

### Supplementary Documentation

**Flanges for Liquiphant FTL 360 and FTL 361**

**Separate housing HTL 10 E**

For electronic insert FEL:

higher ambient temperature range for the sensor housing and easier operation in tight spaces.

Technical Information TI 274F/00/en.

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