

# Level Limit Switch *liquiphant FTL 365 / FTL 366*

**Level limit switch Liquiphant II  
with vibrating probe. For all types of liquid.  
With explosionproof housing for use  
in hazardous areas.**



Level limit switch  
Liquiphant II.  
Limit switch with  
T3 housing  
with separate  
terminal chamber:

- Liquiphant FTL 365  
Compact version
- Liquiphant FTL 366  
Extended version

## 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  $-40^{\circ}\text{C}$  and  $+150^{\circ}\text{C}$  ( $-40^{\circ}\text{F}$  and  $+300^{\circ}\text{F}$ )
- with a viscosity up to  $10.000\text{ mm}^2/\text{s}$  (cSt)
- and a density greater than  $0.5\text{ g/cm}^3$ .

For particularly corrosive liquids the ECTFE-coated version or the Hastelloy-version are suitable.

Because of its flameproof housing (Ex d / EEx de) the Liquiphant can be used in hazardous location.

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 and Benefits

- 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 more than 1 000 000 measuring points already installed.

Endress + Hauser

The Power of Know How



# Measurement Principle

## Operating Principle of the Liquiphant

The sensor in the form of tuning fork is made to vibrate at its resonant frequency.

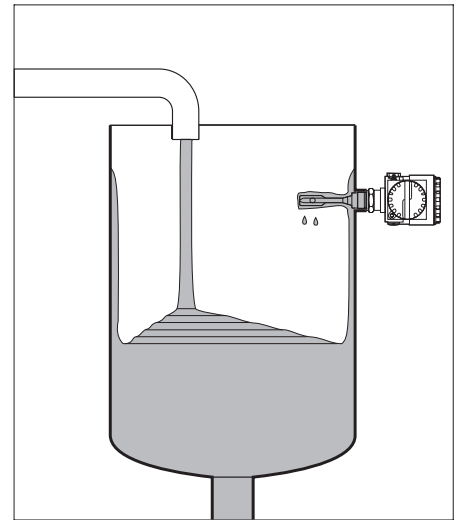
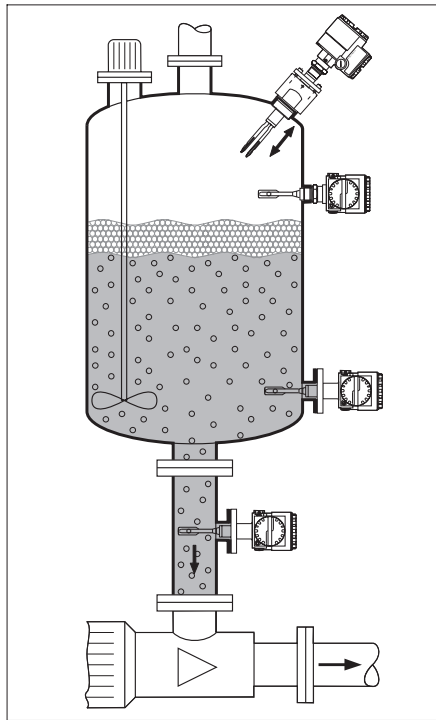
When the sensor is immersed in the liquid, the resonant frequency changes. The frequency change is detected and then converted into a switching signal. The built-in switch for minimum or maximum detection enables the Liquiphant to be used for each application in the required fail-safe mode.

## 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, sparking or foaming

# Measuring System

The complete measuring system consists of:

- 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

A clear description of Liquiphant and its options can be found on page 7 in the product structure.

## T3 Housing

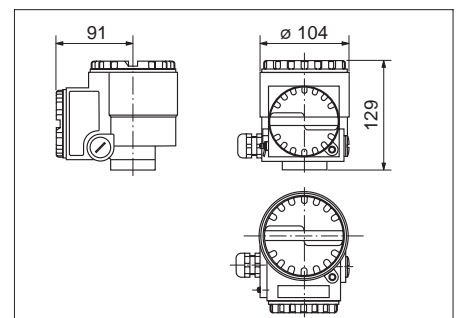
- Aluminium housing with epoxy coating
- Electronics chamber and terminal chamber are completely separated from one another to ensure operation under extremely rugged conditions.

Protection: IP 66

Housing can be rotated 300°

Electronics chamber

Terminal chamber



## 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), the flange version additionally available with ECTFE- (Halar®-) coating.

## Accessories

- ❑ High pressure sliding sleeve for variable switch point setting (when commissioning)
- ❑ Separate flanges
- ❑ Weld-in socket

Dimensions in mm  
100 mm = 3.94 in

**Threaded boss**  
G1A or  
1 - 11½ NPT

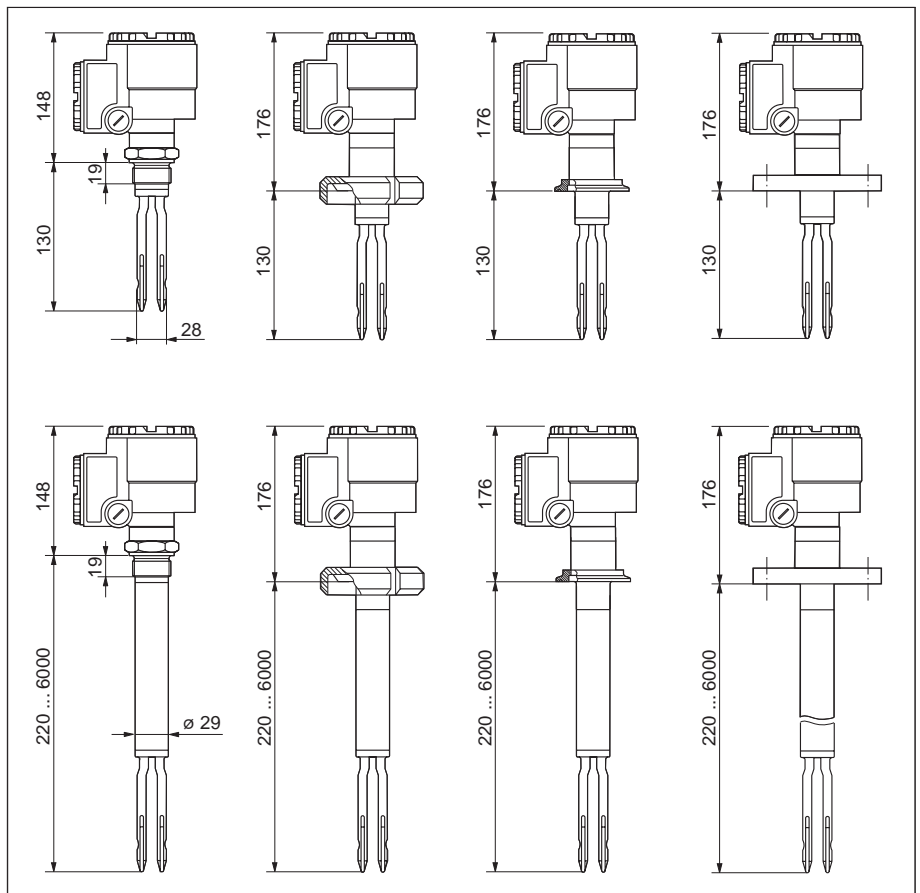
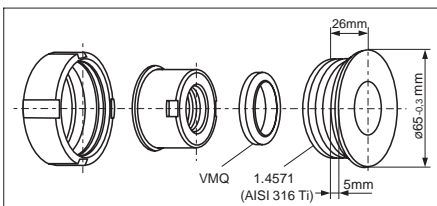
**Pipe coupling**  
DIN 11851, DN 50

**Triclamp coupling**  
ISO 2852, 2"

**Flange version**  
DIN, ANSI, JIS

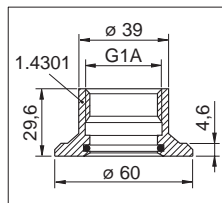
FTL 365  
Compact version

FTL 366  
Extension tube version

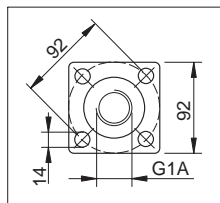


**Above:**  
**Weld-in socket\***  
with fork orientation  
for FTL 365 with  
G1A thread for flush  
mounting  
Order No. 215159-0000

**Below:**  
**Weld-in socket\***  
without fork orientation  
for FTL 365 with  
G1A thread for flush  
mounting  
(with FPM-O-Ring)  
Order No. 917969-1000

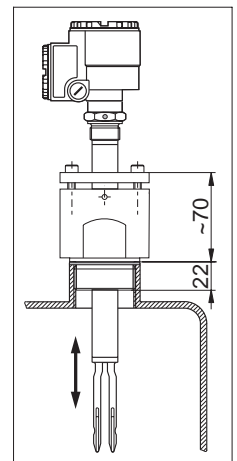


**Separate flange\***  
for FTL 365 / 366 with  
G1A threaded boss



\* These accessories  
have no FM or CSA  
approval  
\*\* No CSA approval

**Sliding sleeve\*\***  
High pressure sliding  
sleeve for Liquiphant  
FTL 366 for variable  
switchpoint setting.  
Operating pressure  
up to 40 bar.  
(FM: up to 300 psi)  
Thread G1½A  
or 1½ - 11½ NPT



# Installation

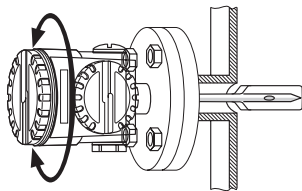
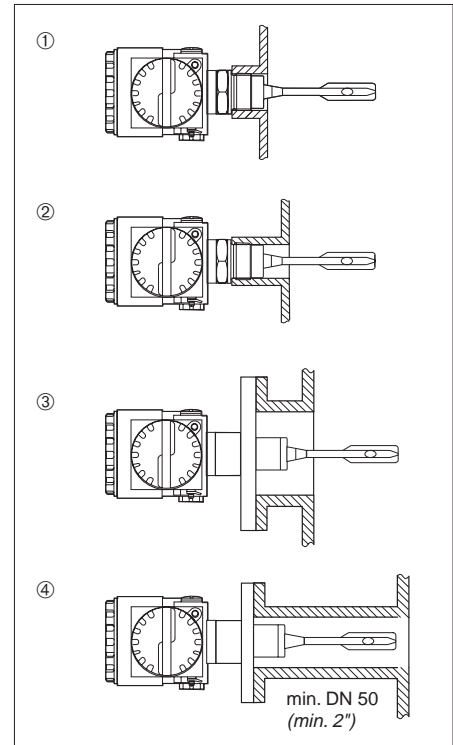
Please note when mounting the Liquiphant:

- 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:

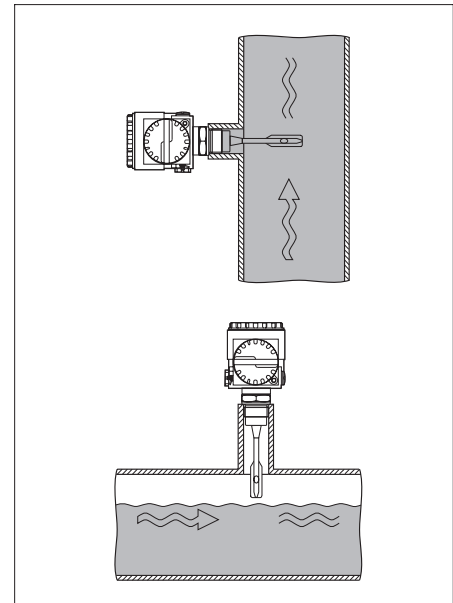
- ① Generally:  
The process connection preferably flush with the tank wall
- ② With low viscosity liquids:  
mount the sensor so that the liquid can flow out of the nozzle and uncover the tines.
- ③ With high viscosity liquids:  
nozzle length max. 60 mm (with a 1"-nozzle).  
Better: Use a nozzle with a larger diameter.
- ④ Nozzle diameter min. DN 50 (min. 2")



The housing can be turned through 300°

## 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.



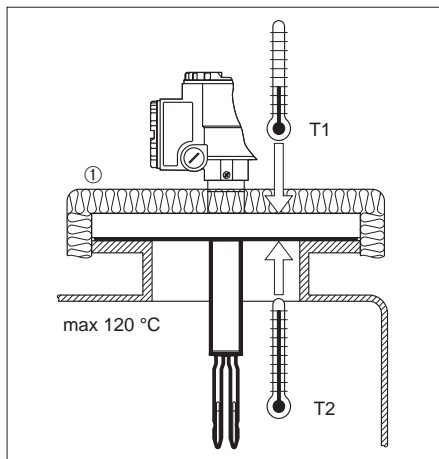
## Liquiphant with Halar Coating

With ECTFE (Halar®) coated versions please note:

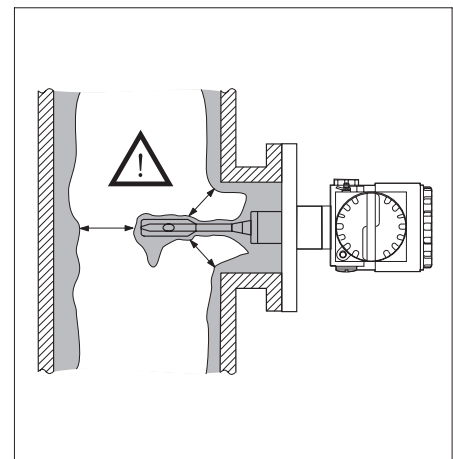
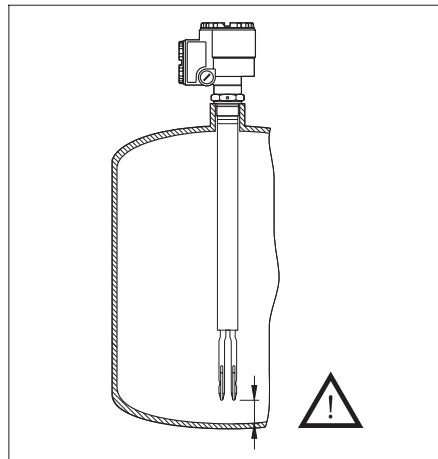
- Maximum operating temperature 120°C (250°F)
- The temperature difference T1 - T2 between the inner and outer surfaces of the flange must not exceed 60°C (140°F). If necessary, insulate the outer surface of the flange.

Liquiphant with Halar coating

- ① Insulation



The tines must not touch the tank or pipe wall nor the sediment



# Electrical Connection

## 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:

- Ex d applications  
 $U \cong \text{max. } 250 \text{ V}$ ,  $I \cong \text{max. } 6 \text{ A}$   
 $P \sim \text{max. } 1500 \text{ VA}$ ,  $\cos \phi = 1$
- EEx de applications  
 $U \cong \text{max. } 250 \text{ V}$ ,  $I \cong \text{max. } 4 \text{ A}$   
 $P \sim \text{max. } 1000 \text{ VA}$ ,  $\cos \phi = 1$

$P \sim \text{max. } 750 \text{ VA}$ ,  $\cos \phi \geq 0,7$

$P - \text{max. } 200 \text{ W}$

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)

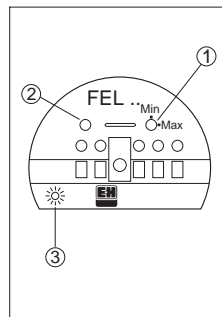
For general information on EMC  
 (test procedures, installation hints)  
 see TI 241F/00/en.

## FEL 31

Two-wire AC connection  
 21 V ... 253 V, 50 / 60 Hz

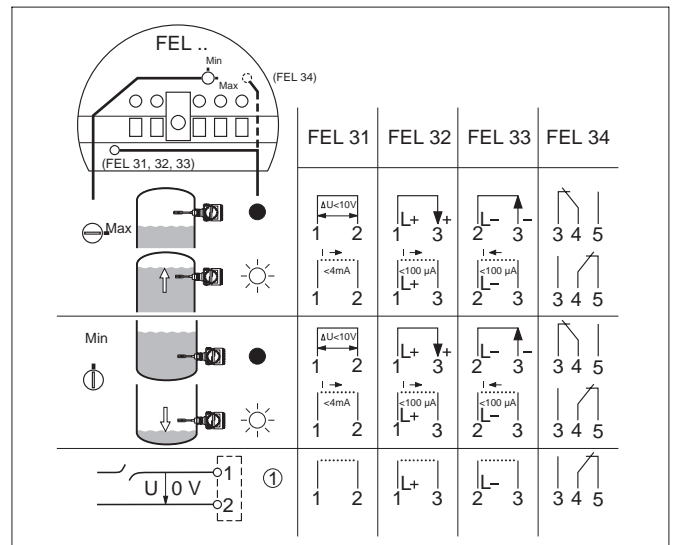
- Load for short periods  
 max. 1.5 A / 40 ms  
 max. 375 VA / 250 V  
 max. 36 VA / 24 V
- Continuous load max. 350 mA  
 max. 87 VA / 250 V  
 max. 8.4 VA / 24 V
- Minimum load  
 min. 2.5 VA / 250 V (10 mA)  
 min. 0.5 VA / 24 V (20 mA)
- Residual current when open 4 mA
- Voltage drop across the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

- 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

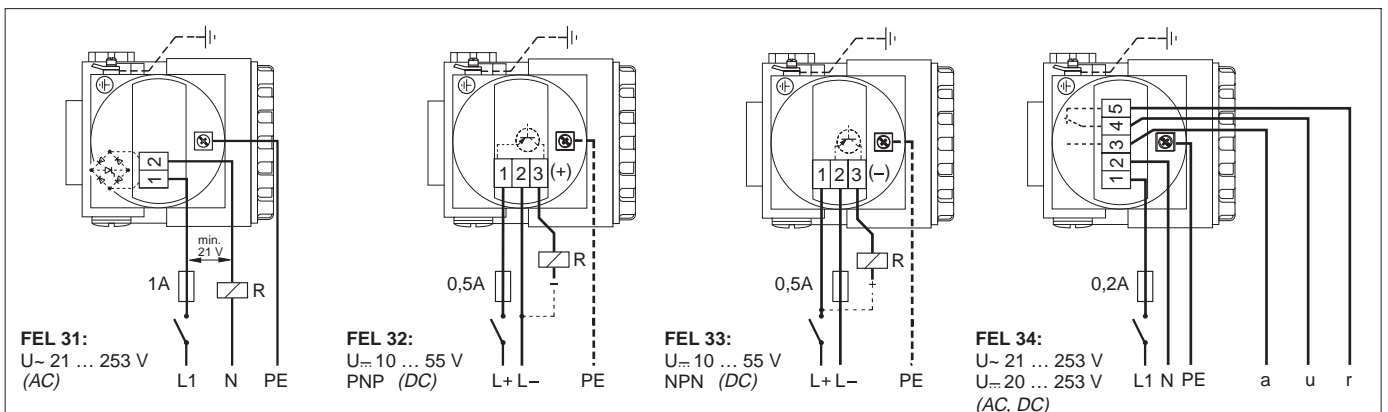


Function and switching of the electronic inserts

- ① by cable breakage or fork corrosion



## Electrical connection

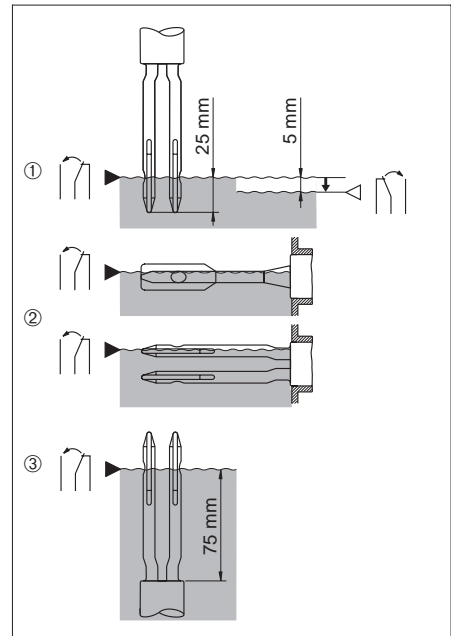


### Setting the Switchpoint

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/cm<sup>3</sup>). For use in extremely light liquids (liquified gas - LPG) the switch on the Liquiphant should be set to "Density 0.5".



## Technical Data

### 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°C...+150°C (-40°F...+300°F)  
 Ambient housing temperature: -40°C...+70°C (0°F...+160°F)  
 Liquid viscosity: max. 10000 mm<sup>2</sup>/s (cSt)  
 Minimum density of the liquid: 0.5 g/cm<sup>3</sup>  
 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

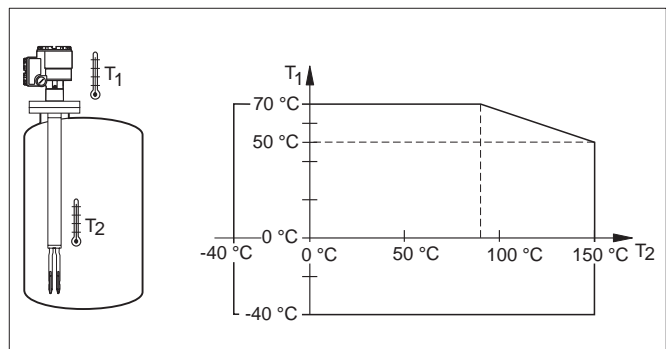
- Stainless steel 1.4581 (~AISI 316 Ti), optionally polished
- Stainless steel 1.4581 (~AISI 316 Ti) with ECTFE coating, together with ECTFE coated flanges
- Hastelloy C (2.4610)

### Certificates

See product structure

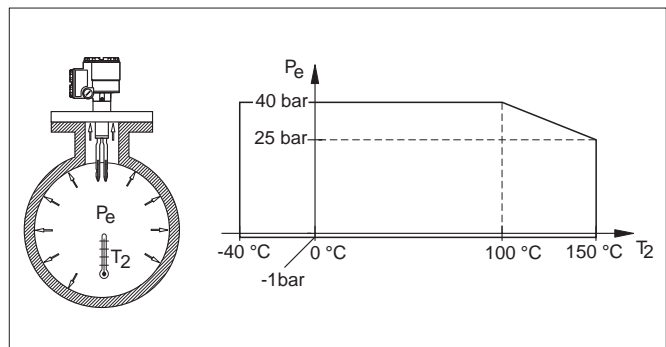
The maximum permissible temperature  $T_1$  at the housing depends on the operating temperature  $T_2$  in the tank

$$x^{\circ}\text{C} = (1.8x + 32)^{\circ}\text{F}$$



The maximum permissible pressure  $p_e$  in the vessels depends on the temperature  $T_2$  in the vessel.

$$1 \text{ bar} = 14.5 \text{ psi}$$





# Product Structure for Flanges

Flanges for Liquiphant  
FTL 365 and FTL 366

DIN-Flanges to DIN 2527 Form B (Hastelloy-clad in Form C)		ANSI-Flanges to B 16.5 (RF)	
BE2	DN 50, PN 6, AISI 316 Ti	AE2	2", 150 psi, AISI 316 Ti
BE7	DN 50, PN 6, AISI 316 Ti/ECTFE	AE7	2", 150 psi, AISI 316 Ti/ECTFE
CE5	DN 50, PN 6, Hastelloy-clad	AE5	2", 150 psi, Hastelloy-clad
BG2	DN 50, PN 40, AISI 316 Ti	AG2	2", 300 psi, AISI 316 Ti
BG7	DN 50, PN 40, AISI 316 Ti/ECTFE	AG7	2", 300 psi, AISI 316 Ti/ECTFE
CG5	DN 50, PN 40, Hastelloy-clad	AG5	2", 300 psi, Hastelloy-clad
CG2	DN 50, PN 40, AISI 316 Ti with raised face		
NG2	DN 50, PN 40, AISI 316 Ti with groove	AK2	2 1/2", 300 psi, AISI 316 Ti
FG2	DN 50, PN 40, AISI 316 Ti with tongue		
		AL2	3", 150 psi, AISI 316 Ti
BK2	DN 65, PN 40, AISI 316 Ti	AL7	3", 150 psi, AISI 316 Ti/ECTFE
BM2	DN 80, PN 16, AISI 316 Ti	AN2	3", 300 psi, AISI 316 Ti
BN2	DN 80, PN 40, AISI 316 Ti	AP2	4", 150 psi, AISI 316 Ti
BN7	DN 80, PN 40, AISI 316 Ti/ECTFE	AR2	4", 300 psi, AISI 316 Ti
CN5	DN 80, PN 40, Hastelloy-clad		
CN2	DN 80, PN 40, AISI 316 Ti with raised face	AV2	6", 150 psi, AISI 316 Ti
		A12	6", 300 psi, AISI 316 Ti
BQ2	DN 100, PN 16, AISI 316 Ti	<b>JIS-Flanges to JIS B 2210</b>	
BQ7	DN 100, PN 16, AISI 316 Ti/ECTFE	KE2	10 K, 50, AISI 316 Ti
CQ5	DN 100, PN 16, Hastelloy-clad	KE7	10 K, 50, AISI 316 Ti/ECTFE
CQ2	DN 100, PN 16, AISI 316 Ti with raised face	KE5	10 K, 50, Hastelloy-clad
BR2	DN 100, PN 40, AISI 316 Ti	YY9	other Flanges, other material on request

## Supplementary Documentation

Technical information (TI)  
for the other level limit switches  
of the Liquiphant II family:

- Liquiphant II Limit Switches  
Special Documentation  
SD 047F/00/en
- Certificate of Conformity  
KEMA No. Ex-93.C.7751  
Certificate ZE 092F/00/a3
- Safety Instructions (ATEX)  
CE II 1/2 G, EEx de IIC  
XA 059F/00/a3
- Liquiphant FTL 360 / FTL 361  
Level limit switch Liquiphant II with  
vibrating probe. For all types of liquid.  
Technical Information TI 184F/00/en
- Liquiphant FDL 30 / 31, FDL 35 / 36  
Intrinsically safe vibration sensor for  
use in hazardous locations.  
To connect to the switches Nivotester  
FTL 320, FTL 370 / 372  
Technical Information TI 185F/00/en

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