

Level Limit Switch *liquiphant FTL 360 / FTL 361*

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



Liquiphant level limit switch:

- FTL 360, compact version
- FTL 361, with extension tube
- with various process connections
- with aluminium, plastic or stainless steel housing

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

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.

Endress+Hauser

Nothing beats know-how



Measurement Principle

Operating principle of the Liquiphant

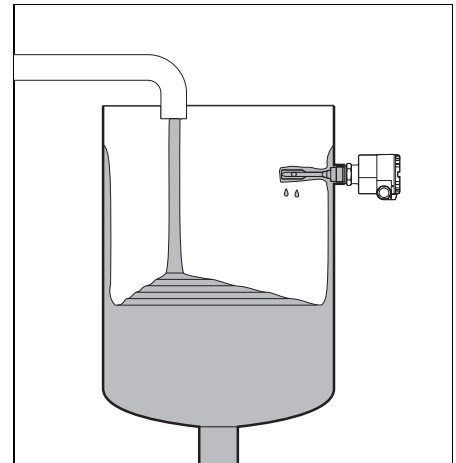
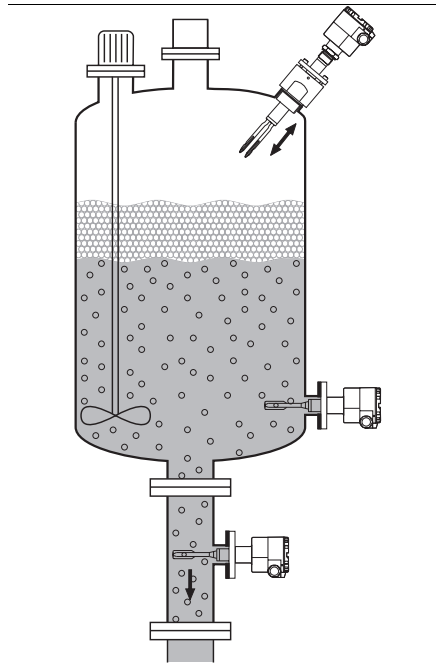
The sensor in the form of tuning fork is made to vibrate at its resonant frequency. When the sensor is immersed in the liquid, the resonant frequency changes. The frequency change is detected and then converted into a switching signal. The built-in switch for minimum or maximum detection enables the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



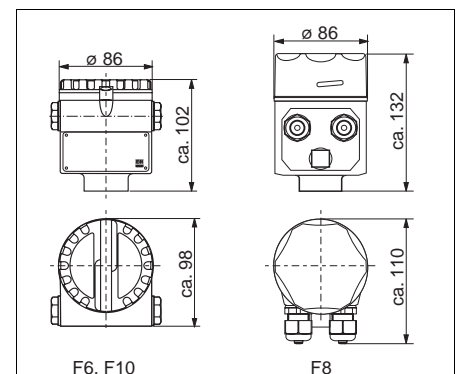
The limit switch with greater operational safety, even for liquids which are adhesive, causing build-up, corrosive, agitated, sparking or foaming.

Measuring System



Housing
F8

- 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

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.

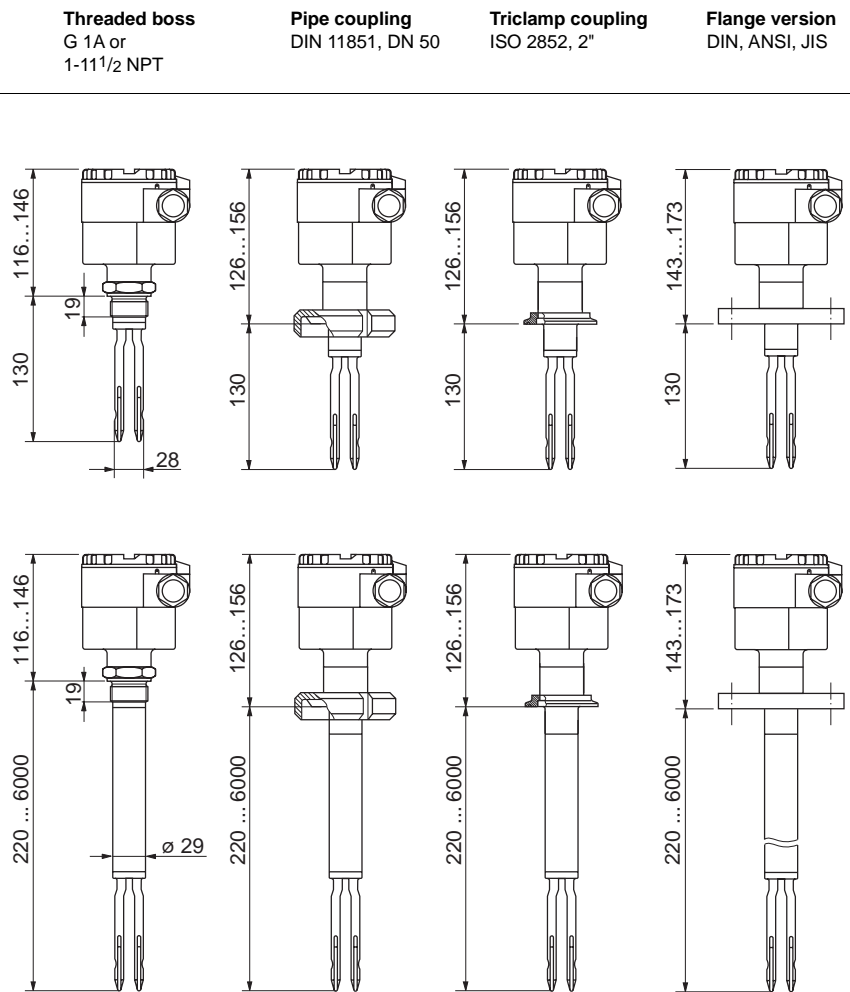
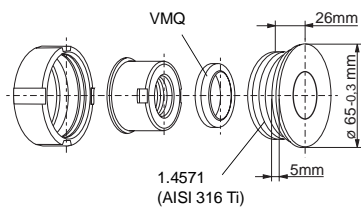
Process connection materials:

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

FTL 360
Compact version

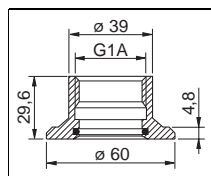
FTL 361
Extension tube version

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

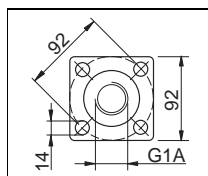


Above:
Weld-in socket
with fork orientation
for FTL 360 with G1A
thread for flush mounting
(moulded seal)
Order No. 215 159-0000

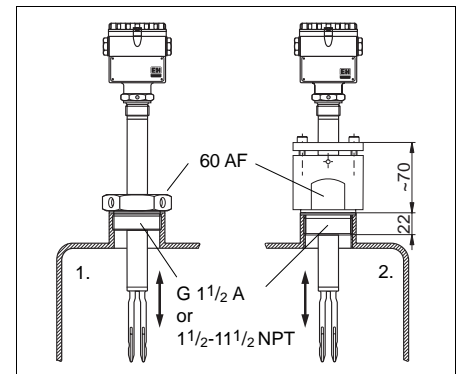
Below:
Weld-in socket
without fork orientation
for FTL 360 with G1A
thread for flush mounting;
material: AISI 304 (1.4301)
with FPM O-Ring seal.
Order No. 917 969-1000



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)



Installation

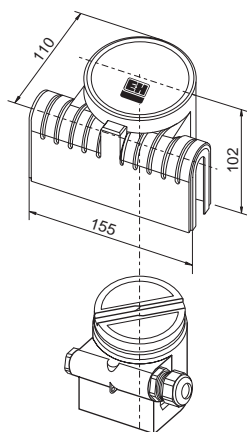
Please note when mounting the Liquiphant:

- 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 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



All-Weather Hood for housing F6, F10;
Made of polyamide.
The all-weather hood protects the sensor from excessive temperature and from condensation forming in the housing which can occur with wide temperature variations.

Liquiphant with plastic coating (ECTFE or PFA)

Pipe mounting

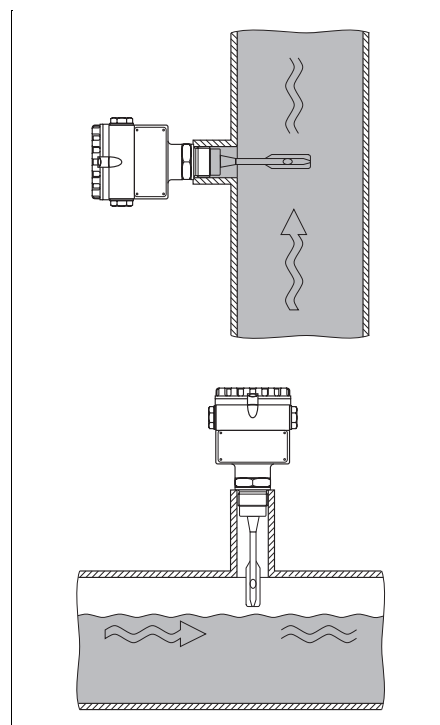
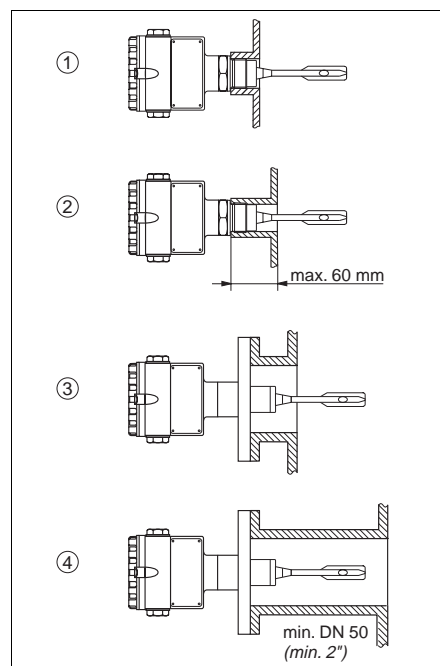
- For use as dry-run protection for pumps preferably mount the Liquiphant in a vertical pipe.
- When determining the length of the nozzle take the pipe diameter into account
- If mounted in a horizontal pipe, partial pipe filling can be detected if the correct nozzle length is chosen.

Liquiphant with plastic coating

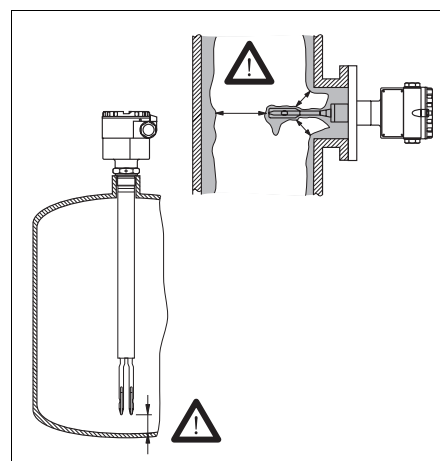
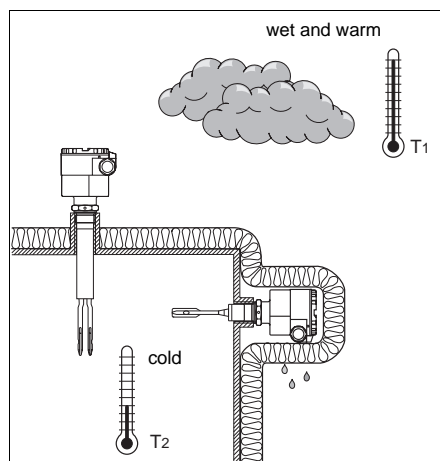
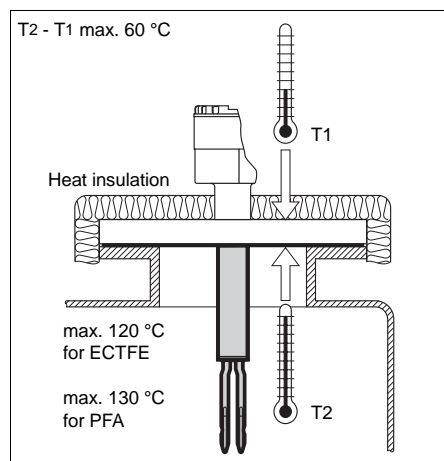
- Maximum operating temperature for ECTFE: 120 °C (250 °F), for PFA: 130 °C (270 °F)
- The temperature difference T2 - T1 between the inner and outer surfaces of the flange must not exceed 60 °C (140 °F). If necessary, insulate the outer surface of the flange.

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



Electrical Connection

CE MARK

The device fulfils 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. Emission to EN 50081-1.

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

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 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 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.

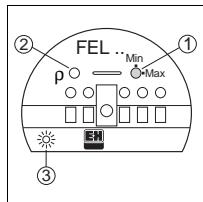
Current consumption max. 7 mA.
Potential free relay contact.

Load capacity:

- With AC max. 250 V, max. 6 A
P ~ max. 1500 VA, $\cos \varphi = 1$
P ~ max. 750 VA, $\cos \varphi > 0,7$
- With DC 20 V to 200 V,
P = max. 200 W

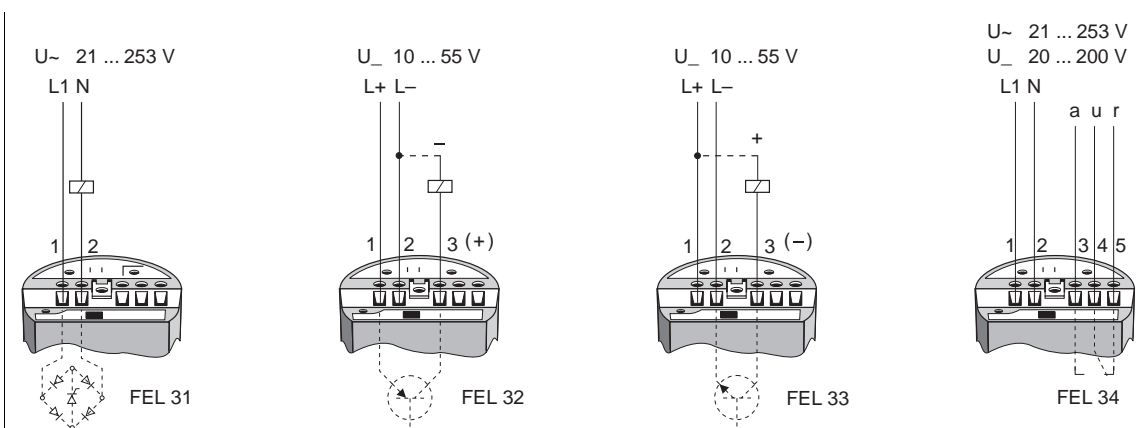


1. Maximum/Minimum fail-safe can be switched on the electronic insert
2. Switch for liquid density:
 $\rho > 0.5$
e.g. for liquefied gas;
 $\rho > 0.7$
standard setting
3. The LED indicates the switching status



Function and switching of the electronic inserts

	FEL 31	FEL 32	FEL 33	FEL 34
Max				
Min				
U = 0 V				

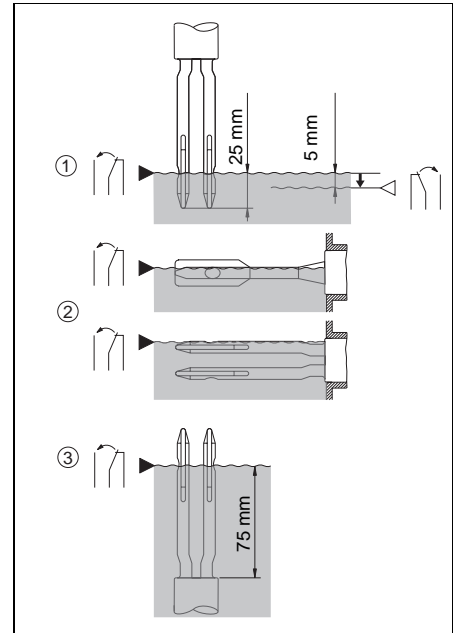


Setting the switchpoint

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 °C...+150 °C (-40 °F...+300 °F)
Ambient housing temperature:
-20 °C...+70 °C (0 °F...+160 °F)
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

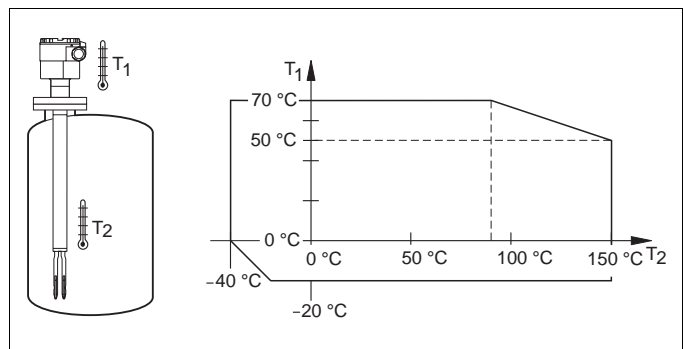
Sensor materials

- 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

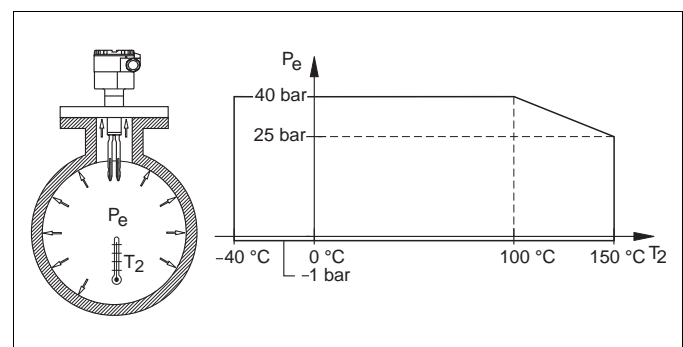
Accessories

- ☐ 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

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 vessel depends on the temperature T_2 in the vessel.
 1 bar = 14.5 psi



Technical Data

Product structure

Other
process connections,
materials,
electronic inserts,
 housings
on request

Liquiphant FTL 360
compact version

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 For flanges see separate table YY9 Special process connection									
Fork surface finish A Standard fork (Material same as process connection) B Polished fork, only with process connection GR2, GN2, ME2, TE2 Y Special fork finish									
Electronic 1 FEL 31, AC-2-wire, 21...253 V 2 FEL 32, DC-PNP, 10...55 V 4 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, Pg 16 (IP 66) T Aluminium housing F6, IP 66, 1/2 NPT U Aluminium housing F6, IP 66, G 1/2 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									
FTL 360 – <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>									
Product designation									

Liquiphant FTL 361
with extension tube

FTL 361									
Certificate R Standard, no particular approval U CSA, General Purpose									
Process connection / Material GR2 Threaded boss G1A, 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 For flanges see separate table YY9 Special process connection									
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 mm/ in A / 1 AISI 316 Ti (1.4571) B / 2 AISI 316 Ti / ECTFE coated (up to 6 m / 236 in) C / 3 Hastelloy C G / 4 AISI 316 Ti, polished Y Special length, special material (e.g. PFA coated up to 1 m / 40 in)									
Electronic 1 FEL 31, AC-2-Wire, 21...253 V 2 FEL 32, DC-PNP, 10...55 V 4 FEL 34, AC/DC with relay contact 21 V...253 V AC, 20 V...200 V DC 9 Special electronic									
Housing, cable entry as FTL 360 - see above									
FTL 361 – <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>									
Product designation									
State length in mm or inch									

How to Order Flanges

Flanges for Liquiphant
FTL 360 and FTL 361

DIN-Flanges to DIN 2527 Form B (Hastelloy clad in Form C)		ANSI-Flanges to B 16.5 (RF)	
BA2	DN 32, PN 6, AISI 316 Ti	AA2	1 1/4", 150 psi, AISI 316 Ti
CA5	DN 32, PN 6, Hastelloy clad	AC2	1 1/2", 150 psi, AISI 316 Ti
BB2	DN 32, PN 40, AISI 316 Ti	AC7	1 1/2", 150 psi, AISI 316 Ti/ECTFE
BC2	DN 40, PN 6, AISI 316 Ti	AE2	2", 150 psi, AISI 316 Ti
BD2	DN 40, PN 40, AISI 316 Ti	AE7	2", 150 psi, AISI 316 Ti/ECTFE
BD7	DN 40, PN 40, AISI 316 Ti/ECTFE	AE5	2", 150 psi, Hastelloy clad
BE2	DN 50, PN 6, AISI 316 Ti	AG2	2", 300 psi, AISI 316 Ti
BE7	DN 50, PN 6, AISI 316 Ti/ECTFE	AG7	2", 300 psi, AISI 316 Ti/ECTFE
CE5	DN 50, PN 6, Hastelloy clad	AG5	2", 300 psi, Hastelloy clad
BG2	DN 50, PN 40, AISI 316 Ti	AK2	2 1/2", 300 psi, AISI 316 Ti
BG7	DN 50, PN 40, AISI 316 Ti/ECTFE	AL2	3", 150 psi, AISI 316 Ti
CG5	DN 50, PN 40, Hastelloy clad	AL7	3", 150 psi, AISI 316 Ti/ECTFE
CG2	DN 50, PN 40, AISI 316 Ti with raised face	AN2	3", 300 psi, AISI 316 Ti
NG2	DN 50, PN 40, AISI 316 Ti with groove	AP2	4", 150 psi, AISI 316 Ti
FG2	DN 50, PN 40, AISI 316 Ti with tongue	AR2	4", 300 psi, AISI 316 Ti
BK2	DN 65, PN 40, AISI 316 Ti	AV2	6", 150 psi, AISI 316 Ti
BM2	DN 80, PN 16, AISI 316 Ti	A12	6", 150 psi, AISI 316 Ti
BN2	DN 80, PN 40, AISI 316 Ti	JIS-Flanges to JIS B 2210	
BN7	DN 80, PN 40, AISI 316 Ti/ECTFE	KE2	10 K, 50, AISI 316 Ti
CN5	DN 80, PN 40, Hastelloy clad	KE7	10 K, 50, AISI 316 Ti/ECTFE
CN2	DN 80, PN 40, AISI 316 Ti with raised face	KE5	10 K, 50, Hastelloy clad
BQ2	DN 100, PN 16, AISI 316 Ti	YY9	other Flanges, other material on request
BQ7	DN 100, PN 16, AISI 316 Ti/ECTFE		
CQ5	DN 100, PN 16, Hastelloy clad		
CQ2	DN 100, PN 16, AISI 316 Ti with raised face		
BR2	DN 100, PN 40, AISI 316 Ti		

Supplementary Documentation

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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