Technical Information
Liquiphant FTL64

Vibronic
HART

Point level switch for liquids in high-temperature applications

Application
- Point level switch for all liquids, for minimum or maximum detection in tanks, vessels and piping, even in hazardous areas
- Particularly suitable for high-temperature applications with up to 280 °C (536 °F)
- Tuning fork and process connection with highly corrosion-resistant Alloy C22 (2.4602) material and PFA-coated (conductive) version available for very aggressive media
- Process temperature range: –60 to +280 °C (–76 to +536 °F)
- Pressures up to 100 bar (1 450 psi)
- Viscosities up to 10,000 mPa⋅s
- Ideal substitute for float switches; reliable function is not affected by flow, turbulence, air bubbles, foam, vibration, solids content or buildup.

Advantages
- Approved for safety systems with functional safety requirements up to SIL2/SIL3 in accordance with IEC 61508
- Maximum safety thanks to welded gas-tight feedthrough, even if sensor is damaged
- Functional safety: monitoring of the vibration frequency of the tuning fork
- Heartbeat Technology via Fieldcare/DTM and the free iOS/Android SmartBlue app
- With Bluetooth® wireless technology
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About this document

Symbols

### Safety symbols

![DANGER]

This symbol alerts you to a dangerous situation. Failure to avoid this situation will result in serious or fatal injury.

![WARNING]

This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in serious or fatal injury.

![CAUTION]

This symbol alerts you to a dangerous situation. Failure to avoid this situation can result in minor or medium injury.

![NOTICE]

This symbol contains information on procedures and other facts which do not result in personal injury.

### Electrical symbols

- Ground connection
  Grounded clamp, which is grounded via a grounding system.
- Protective earth (PE)
  Ground terminals, which must be grounded prior to establishing any other connections. The ground terminals are located on the inside and outside of the device.

### Symbols for certain types of information

- ☑ Permitted
  Procedures, processes or actions that are permitted.
- ✗ Forbidden
  Procedures, processes or actions that are forbidden.
- Tip
  Indicates additional information
- Reference to documentation
- Reference to another section
- Series of steps

### Symbols in graphics

- View
- 1, 2, 3 ... Item numbers
- Hazardous area
- Safe area (non-hazardous area)

### Communication-specific symbols

- Bluetooth
  Wireless data transmission between devices over a short distance.
Function and system design

### point level detection

Maximum or minimum detection for liquids in tanks or pipes in all industries. Suitable for leakage monitoring, pump dry-running protection or overfill prevention, for example.

Specific versions are suitable for use in hazardous areas.

The point level switch differentiates between the "covered" and "not covered" conditions.

Depending on the MIN (minimum detection) or MAX (maximum detection) modes, there are two possibilities in each case: OK status and demand mode.

**OK status**
- In MIN mode, the fork is covered, e.g. Pump dry running protection
- In MAX mode, the fork is not covered e.g. overfill prevention

**Demand mode**
- In MIN mode, the fork is not covered e.g. pump dry running protection
- In MAX mode, the fork is covered e.g. overfill prevention

### Measuring principle

The sensor's tuning fork vibrates at its intrinsic frequency. As soon as the liquid covers the tuning fork, the vibration frequency decreases. The change in frequency causes the point level switch to switch.

### Measuring system

![Diagram of a measuring system](image)

1. Example of a measuring system

### Dependability for measuring devices with HART or Bluetooth

**IT security**

Endress+Hauser can only provide a warranty if the device is installed and used as described in the Operating Instructions. The device is equipped with security mechanisms to protect it against any inadvertent changes to the device settings. IT security measures in line with operators' security standards and designed to provide additional protection for the device and device data transfer must be implemented by the operators themselves.

**Device-specific IT security**

The device offers specific functions to support protective measures by the operator. These functions can be configured by the user and guarantee greater in-operation safety if used correctly. An overview of the most important functions is provided in the following section:

- Write protection via hardware write protection switch
- Access code (applies for operation via display, Bluetooth, FieldCare, DeviceCare, AMS, PDM ...)

### Input

**Measured variable**

Level (point level), MAX or MIN safety
Measuring range

Depends on the installation location and the pipe extension ordered
Standard pipe extension up to 3 m (9.8 ft) and up to 6 m (20 ft) on request.

Output

Output signal

SIO (FEL60H electronic insert)
8/16 mA (SIO) with superimposed digital communication protocol HART, 2-wire

Continuous operation (FEL60H electronic insert)
4 to 20 mA proportional to the oscillation frequency with superimposed digital communication protocol HART, 2-wire
For continuous current output, one of the following modes of operation can be selected:
- 4.0 to 20.5 mA
- NAMUR NE 43: 3.8 to 20.5 mA (factory setting)
- US mode: 3.9 to 20.8 mA

Signal on alarm

Signal on alarm in accordance with NAMUR recommendation NE 43.
4 to 20 mA HART:
- Max. alarm: can be set from 21.5 to 23 mA
- Min. alarm: < 3.6 mA (factory setting)

Load

![Load diagram]

1 Power supply 10.5 to 30 V
2 Power supply 10.5 to 35 V for other types of protection and for non-certified device versions
3 $R_{L\ max}$ maximum load resistance
U Supply voltage

Operation via handheld terminal or PC with operating program: take minimum communication resistance of 250 Ω into consideration.

Damping

Damping affects all the outputs (output signal, display) and is only available in the continuous 4 to 20 mA mode.

Damping has no effect on the SIO.

Activating damping:
Via local display, Bluetooth, handheld terminal or PC with operating program, continuous from 0 to 999 s
Factory setting: 1 s
Switch output

Preset switching delay times can be ordered:
- 0.5 s when the tuning fork is covered and 1.0 s when the tuning fork is uncovered (factory setting)
- 0.25 s when the tuning fork is covered and 0.25 s when the tuning fork is uncovered
- 1.5 s when the tuning fork is covered and 1.5 s when the tuning fork is uncovered
- 5.0 s when the tuning fork is covered and 5.0 s when the tuning fork is uncovered

The user can also set the switching delays for when the fork is covered and uncovered in the range from 1 to 60 seconds independently of one another.

(Operation via display, Bluetooth or FieldCare, DeviceCare, AMS, PDM)

Ex connection data

See safety instructions (XA): All data relating to explosion protection are provided in separate Ex documentation and are available from the Downloads area of the Endress+Hauser website. The Ex documentation is supplied as standard with all devices approved for use in explosion hazardous areas.

Protocol-specific data

HART

- Manufacturer ID: 17 (0x11)
- Device type code: 0x11C4
- Device revision: 1
- HART specification: 7
- DD revision: 1
- Device description files (DTM, DD) information and files at:
  - www.endress.com
  - www.fieldcommgroup.org
- HART load: min. 250 Ω

HART device variables (preset at the factory)

The following measured values are assigned to the device variables at the factory:

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1) The PV is always applied to the current output.
2) Point level detection is the initial state depending on the fork state (uncovered/covered) and the safety function (MIN/MAX)
3) Sensor frequency is the oscillation frequency of the fork
4) Fork state is the fork state (Fork covered option/Fork uncovered option)

Choice of HART device variables

- Level limit detection
- Sensor frequency
- Fork state
- Sensor temperature
- Terminal current
  - The terminal current is the read-back current on terminal block. Visibility depends on order options or device settings
- Terminal voltage
  - Visibility depends on order options or device settings

Supported functions

- Burst mode
- Additional transmitter status
- Device locking
**Wireless HART data**

- Minimum start-up voltage: 10.5 V
- Start-up current: > 3.6 mA
- Start-up time: < 8 s
- Minimum operating voltage: 10.5 V
- Multidrop current: 4 mA

**Heartbeat Technology**

Heartbeat Technology module

The software package consists of 3 modules. These three modules combined check, evaluate and monitor device functionality and process conditions.

- Heartbeat Diagnostics
- Heartbeat Verification
- Heartbeat Monitoring

**Power supply**

**Terminal assignment**

Single compartment housing

3 Connection terminals and ground terminal in the connection compartment

1 Positive terminal
2 Negative terminal
3 Internal ground terminal
Dual compartment housing, L-form

4 Connection terminals and ground terminal in the connection compartment

1 Positive terminal
2 Negative terminal
3 Internal ground terminal

Available device plugs

In the case of devices with a plug, it is not necessary to open the housing for connection purposes.

M12 plug

5 M12 plug, pin assignment

1 Signal +
2 Not assigned
3 Signal –
4 Ground

For more details, see the 'Accessories' section.

Supply voltage

- $U = 10.5$ to $35 \text{ V}_{\text{DC}}$ (Ex d, Ex e, non-Ex)
- $U = 10.5$ to $30 \text{ V}_{\text{DC}}$ (Ex i)
- Rated current: 4 to 20 mA HART

- The power unit must be tested to ensure it meets safety requirements (e.g. PELV, SELV, Class 2) and must comply with the relevant protocol specifications.
- Comply with the following according to IEC/EN61010-1: provide a suitable circuit breaker for the device.

Potential equalization

WARNING

Explosion Hazard!

- Please refer to the separate documentation on applications in hazardous areas for the safety instructions.

Endress+Hauser
Ground terminal for connecting the potential matching line

If necessary, the potential matching line can be connected to the external ground terminal of the transmitter before the device is connected.

For optimum electromagnetic compatibility:
- Potential matching line as short as possible
- Observe a cross-section of at least 2.5 mm² (14 AWG)

Terminals
- Supply voltage and internal ground terminal: 0.5 to 2.5 mm² (20 to 14 AWG)
- External ground terminal: 0.5 to 4 mm² (20 to 12 AWG)

Cable entries
- Cable entry
- Dummy plug

The type of cable entry depends on the device version ordered.

Cable specification
- The cable outer diameter depends on the cable entry used
- Cable outer diameter
  - Plastic: Ø5 to 10 mm (0.2 to 0.38 in)
  - Nickel-plated brass: Ø7 to 10.5 mm (0.28 to 0.41 in)
  - Stainless steel: Ø7 to 12 mm (0.28 to 0.47 in)

Overvoltage protection

Devices without optional overvoltage protection
Equipment from Endress+Hauser fulfills the requirements of the product standard IEC/DIN EN 61326-1 (Table 2 Industrial Environment).

Depending on the type of port (DC supply, input/output port) different test levels according to IEC/DIN EN 61326-1 against transient overvoltages (Surge) are applied (IEC/DIN EN 61000-4-5):
Test level on DC power ports and input/output ports is 1 000 V line to earth

Devices with optional overvoltage protection
- Spark-over voltage: min. 400 V
- Tested: According to IEC/DIN EN 60079-14 sub chapter 12.3
  (IEC/DIN EN 60060-1 chapter 7)
- Nominal discharge current: 10 kA

Overvoltage category
Overvoltage category II

Pollution degree
Pollution degree 2
Performance characteristics

Reference operating conditions
- Ambient temperature: +23 °C (+73 °F)
- Process temperature: +23 °C (+73 °F) ± 5 °C (9 °F)
- Density (water): 1 g/cm³ (62.4 lb/ft³)
- Medium viscosity: 1 mPa⋅s
- Process pressure: unpressurized
- Sensor installation: vertically from above
- Density selection switch: > 0.7 g/cm³ (43.7 lb/ft³) (SGU)
- Switch direction of sensor: uncovered to covered

Take switch point into consideration
The following are typical switch points, depending on the orientation of the point level switch
Water +23 °C (+73 °F)

Minimum distance between the tuning fork and the tank wall or pipe wall: 10 mm (0.39 in)

Maximum measured error
At reference operating conditions: max. ±1 mm (0.04 in)

Resolution
Current output: < 1 µA

Dead time, time constant, settling time
Presentation of the dead time, time constant and settling time as per DIN EN 61298-2

Dynamic behavior, current output
- Dead time (t₁): 100 ms
- Time constant T63 (t₂): can be set from 0 to 999 s
- Settling time (t₃): minimum 250 ms
Liquiphant FTL64 HART

Dynamic behavior, digital output
- Dead time ($t_1$):
  - Minimum: 200 ms
  - Maximum: 800 ms
- Time constant $T_63$ ($t_2$): can be set from 0 to 999 s
- Settling time ($t_3$): minimum 200 ms

Reading cycle
- Acyclic: maximum 3/s, typically 1/s (depending on command # and number of preambles)
- Cyclic (burst): maximum 3/s, typically 2/s
The device offers the BURST MODE function for cyclic value transmission via the HART communication protocol.

Cycle time (update time)
Cyclic (burst): at least 300 ms

Hysteresis
At reference operating conditions: 2.5 mm (0.1 in)

Non-repeatability
0.5 mm (0.02 in)

Influence of the process temperature
The switch point moves from +1.4 to −5.5 mm (+0.06 to −0.22 in) in the temperature range of −60 to +280 °C (−76 to +536 °F)

Influence of the process pressure
The switch point moves from 0 to −3.9 mm (0 to −0.15 in) in the pressure range of −1 to +100 bar (−14.5 to +1450 psi)

Mounting

Mounting location, orientation
Mounting instructions
- Any orientation for version with a pipe length of up to 500 mm (19.7 in) approx.
- Vertical orientation from above for device with long pipe
- Minimum distance between the tuning fork and the tank wall or pipe wall: 10 mm (0.39 in)

Installation examples for a vessel, tank or pipe
Installation instructions

Take viscosity into consideration

Viscosity values
- Low viscosity: < 2,000 mPa⋅s
- High viscosity: > 2,000 to 10,000 mPa⋅s

Low viscosity
- Low viscosity, e.g. water: < 2,000 mPa⋅s
  It is permitted to position the tuning fork within the installation socket.

High viscosity
- Highly viscous liquids may cause switching delays.
  - Make sure that the liquid can run off the tuning fork easily.
  - Deburr the socket surface.
- High viscosity, e.g. viscous oils: ≤ 10,000 mPa⋅s
  The tuning fork must be located outside the installation socket!

Avoid buildup
- Use short installation sockets to ensure that the tuning fork projects freely into the vessel
- Leave sufficient distance between the buildup expected on the tank wall and the tuning fork
10  Installation examples for a highly viscous process medium

Take clearance into consideration
Allow sufficient space outside the tank for mounting, connection and settings involving the electronic insert.

11  Take clearance into consideration

Aligning the tuning fork using the marking
The tuning fork can be aligned using the marking in such a way that the medium drains off easily and buildup is avoided.

Markings are identified on the process connection by:
Material specification, thread designation, circle, line or double line
12 Position of the tuning fork when installed horizontally in the vessel using the marking

Installing the device in piping

- Flow velocity up to 5 m/s with a viscosity of 1 mPa⋅s and density of 1 g/cm³ (62.4 lb/ft³) (SGU).
- Check for correct functioning in the event of other process medium conditions.
- The flow will not be significantly impeded if the tuning fork is correctly aligned and the marking is pointing in the direction of flow.
- The marking is visible when installed

13 Installation in pipes (take fork position and marking into consideration)

Aligning the cable entry

Housings with locking screw:
- The housing can be turned and the cable aligned by turning the locking screw.
- The locking screw is not tightened when the device is delivered.

Housing with locking screw: The housing can be turned and the cable aligned by turning the locking screw.

14 Housing with external locking screw and drip loop
Special mounting instructions

Vessel with heat insulation

If process temperatures are high, the device should be incorporated in the usual vessel insulation system to prevent the electronics from heating as a result of thermal radiation or convection. The insulation in this case should not be higher than the neck of the device.

![Diagram of Vessel with Heat Insulation](image)

15  **Vessel with heat insulation**

1  Vessel insulation

2  Insulation up to the housing neck max.

Support the device

**NOTICE**

If the device is supported incorrectly, shocks and vibrations can damage the coated surface.

- Use suitable supports only.

Support the device in the event of severe dynamic load. Maximum lateral loading capacity of the pipe extensions and sensors: 75 Nm (55 lbf ft).

![Diagram of Support in the Event of Dynamic Load](image)

16  **Examples of support in the event of dynamic load**

**Marine approval:** In the case of pipe extensions or sensors longer than 1600 mm (63 in), a support is needed at least every 1600 mm (63 in).

**Sliding sleeves**

For more details, see the "Accessories" section.
Environment

**Ambient temperature range**

The following values apply up to a process temperature of +90 °C (+194 °F). At higher process temperatures, the permitted ambient temperature is reduced (see diagram).

- Without LCD display: –40 to +70 °C (–40 to +158 °F)
- With LCD display: –40 to +70 °C (–40 to +158 °F) with limitations in optical properties, such as display speed and contrast
  Can be used without limitations: –20 to +60 °C (–4 to +140 °F)

Optionally available:

- –50 °C (–58 °F) with restricted operating life and performance
- –60 °C (–76 °F) with restricted operating life and performance,

3. Below –50 °C (–58 °F): measuring devices can be permanently damaged

**Storage temperature**

-40 to +80 °C (–40 to +176 °F)
Optional –50 °C (–58 °F) or –60 °C (–76 °F)

**Humidity**

Operation up to 100 %. Do not open in a condensing atmosphere.

**Operating height**

Up to 5000 m (16 404 ft) above sea level.

**Climate class**

As per IEC 60068-2-38 test Z/AD
Degree of protection
Test as per IEC 60529 and NEMA 250
IP68 test condition: 1.83 m H₂O for 24 h

Housing
See cable entries

Cable entries
- M20 threaded joint, plastic, IP66/68 NEMA Type 4X/6P
- M20 threaded joint, nickel-plated brass, IP66/68 NEMA Type 4X/6P
- M20 threaded joint, 316L, IP66/68 NEMA Type 4X/6P
- M20 thread, IP66/68 NEMA Type 4X/6P
- Thread G ½, NPT ½, IP66/68 NEMA Type 4XX

Degree of protection for M12 plug
- When housing is closed and connecting cable is plugged in: IP66/67 NEMA Type 4X
- When housing is open or connecting cable is not plugged in: IP20, NEMA Type 1

NOTICE
M12 plug: Loss of IP protection class due to incorrect installation!
- The degree of protection only applies if the connecting cable used is plugged in and screwed tight.
- The degree of protection only applies if the connecting cable used is specified according to IP67 NEMA Type 4X.

If the "M12 plug" option is selected as the electrical connection, IP66/67 NEMA Type 4X applies for all housing types.

Vibration resistance
As per IEC60068-2-64-2008
a(RMS) = 50 m/s², f = 5 to 2 000 Hz, t = 3 axes x 2 h

Shock resistance
In accordance with IEC60068-2-27-2008: 300 m/s² = 90 gₙ + 18 ms

Mechanical load
Support the device in the event of severe dynamic load. Maximum lateral loading capacity of the pipe extensions and sensors: 75 Nm (55 lbf ft).

For more details, see the "Supporting the device" section.

Pollution degree
Pollution level 2

Electromagnetic compatibility (EMC)
- Electromagnetic compatibility as per EN 61326 series and NAMUR recommendation EMC (NE21)
- With regard to the safety function (SIL), the requirements of EN 61326-3-x are satisfied
- Maximum deviation under disturbance: < 0.5% of span

For more details, refer to the EU Declaration of Conformity.

Process

Process temperature range
- –60 to +230 °C (–76 to +446 °F)
- –60 to +280 °C (–76 to +536 °F)/to 300 °C (572 °F) for max. 50 h on cumulative basis
- –50 to +230 °C (–58 to +446 °F) with PFA coating (conductive)

The device can be ordered for use in very aggressive media with a highly corrosion-resistant PFA coating. At medium temperatures up to ≥ 150 °C (302 °F), pay attention to the chemical durability and the increasing risk of damage to the coating from diffusion.

Observe pressure and temperature dependency. See the "Process pressure range of the sensors" section.

Medium conditions
The service life of the device can be impacted in applications where increased hydrogen diffusion through the metallic membrane can be expected.
Typical conditions from which hydrogen diffusion is relevant:
- Temperature: > 180 °C (356 °F)
- Increasing process pressures accelerate hydrogen diffusion
Thermal shock

Without restrictions within the process temperature range.

- With PFA coating (conductive): ≤ 120 K/s

Process pressure range

⚠️ **WARNING**

The maximum pressure for the device depends on the lowest-rated element, with regard to pressure, of the selected component. This means that it is necessary to pay attention to the process connection as well as the sensor.

- Pressure specifications, Technical Information, "Mechanical construction" section.
- Only operate the device within the specified limits!
- The Pressure Equipment Directive (2014/68/EU) uses the abbreviation "PS". The abbreviation "PS" corresponds to the MWP (maximum working pressure) of the device.

Refer to the following standards for the permitted pressure values of the flanges at higher temperatures:

- pR EN 1092-1: With regard to its stability-temperature property, the material 1.4435 is identical to 1.4404, which is classed as 13E0 in EN 1092-1 Tab. 18. The chemical composition of the two materials can be identical.
- ASME B 16.5
- JIS B 2220

In each case, the lowest value from the derating curves of the device and the selected flange applies.

- Devices with CRN approval: maximum 90 bar (1305 psi) for devices with a pipe extension

### Process pressure range of the sensors

<table>
<thead>
<tr>
<th>°C</th>
<th>bar</th>
<th>psi</th>
</tr>
</thead>
<tbody>
<tr>
<td>-14.5</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>32</td>
<td>63</td>
<td>914</td>
</tr>
<tr>
<td>260</td>
<td>280</td>
<td>500 540</td>
</tr>
</tbody>
</table>

Ordering information: Product Configurator, feature "Application":

- PN: max. 100 bar (1450 psi) max. 230 °C (446 °F)
- PN: max. 100 bar (1450 psi) max. 280 °C (536 °F)
- With PFA coating (conductive): max. 40 bar (580 psi) max. 230 °C (446 °F)

### Overpressure limit

- Overpressure limit = 1.5 · PN
  - Maximum 100 bar (1450 psi) at 230 °C (446 °F) and 280 °C (536 °F)
  - Membrane burst pressure at 200 bar (2900 psi)

The device function is limited during the pressure test.

Mechanical integrity is guaranteed up to 1.5 times the process nominal pressure PN.

### Medium density

- Liquids with density > 0.7 g/cm³ (43.7 lb/ft³)
  - Setting > 0.7 g/cm³ (43.7 lb/ft³), as supplied to the customer

- Liquids with density 0.5 g/cm³ (31.2 lb/ft³)
  - Setting > 0.5 g/cm³ (31.2 lb/ft³), can be ordered as preset value or configurable
**Liquaphant FTL64 HART**

Liquids with density > 0.4 g/cm³ (25.0 lb/ft³)
- Setting > 0.4 g/cm³ (25.0 lb/ft³), can be ordered as preset value or configurable
- SIL for defined media and process parameters on request

For information on medium differentiation/density detection: Documentation Liquaphant density (FEL60D) with density computer FML621 (Endress+Hauser website [www.endress.com](http://www.endress.com) → Downloads)

<table>
<thead>
<tr>
<th>Property</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Viscosity</td>
<td>≤ 10000 mPa·s</td>
</tr>
<tr>
<td>Pressure tightness</td>
<td>Up to vacuum</td>
</tr>
<tr>
<td>Solids contents</td>
<td>Ø ≤ 5 mm (0.2 in)</td>
</tr>
</tbody>
</table>

**Mechanical construction**

**Design, dimensions**

**Device height**

The device height consists of the following components:
- Housing including cover
- Temperature spacer with gas-tight glass feedthrough (second line of defense)
- Compact version or pipe extension
- Process connection

The individual heights of the components can be found in the following sections:
- Determine the height of the device and add the individual heights
- Take the installation clearance into consideration (space that is needed to install the device)

---

**Diagram**

![Diagram](image)

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Housing including cover</td>
</tr>
<tr>
<td>B</td>
<td>Temperature spacer with gas-tight glass feedthrough, 2 lengths available, depending on the process temperature</td>
</tr>
<tr>
<td>C</td>
<td>Process connection</td>
</tr>
<tr>
<td>D</td>
<td>Probe design: compact version with tuning fork</td>
</tr>
<tr>
<td>E</td>
<td>Probe design: pipe extension with tuning fork</td>
</tr>
</tbody>
</table>

18 Components to determine the device height
Dimensions Housing and cover

All housings can be aligned. The housing alignment can be secured in place on housings with a locking screw.

Single compartment housing, aluminum

1  Height with cover comprising glass sight glass (devices for Ex d/XP, dust Ex)
2  Height with cover comprising plastic sight glass
3  Height with cover without sight glass
Dual compartment housing, L-shaped, aluminum or 316 L

Dimensions of L-shaped dual compartment housing. Unit of measurement mm (in)

1. Height with cover comprising glass sight glass (devices for Ex d/XP, dust Ex)
2. Height with cover comprising plastic sight glass
3. Cover without sight glass

Temperature spacer

- Provides sealed insulation for the vessel and a normal ambient temperature for the housing.
- If the sensor is damaged, protects the housing from vessel pressures up to 100 bar (1450 psi)

Temperature spacer with gas-tight glass feedthrough

1. Temperature spacer with pressure-tight glass feedthrough with maximum insulation length

2. 2 lengths available depending on the process temperature

Product Configurator, ‘Application’ feature:

- 230 °C (446 °F): approx. 160 mm (6.3 in)
- 280 °C (536 °F): approx. 200 mm (7.87 in)
- PFA (conductive) 230 °C (446 °F): approx. 160 mm (6.3 in)

Probe design

Compact version

Sensor length L: depends on process connection

For further details, see the “Process connections” section.
Probe design: compact version, sensor length L

Pipe extension
- Material: 316L, sensor length L: 148 to 3000 mm (5.83 to 118.11 in)
- Material: Alloy C22, sensor lengths L: 148 to 3000 mm (5.83 to 118.11 in)
- Material: 316L substrate material coated with PFA (conductive), sensor lengths L: 148 to 3000 mm (5.83 to 118.11 in)
- Only available with flange as a process connection.
- Length tolerances L: < 1 m (3.3 ft) = –5 mm (–0.2 in), 1 to 3 m (3.3 to 9.8 ft) = (–10 mm (–0.39 in)

Pipe extension (sensor length L). Unit of measurement mm (in)
A  G ¾, G 1
B  NPT ¾, NPT 1, R ¾, R 1
C  Flange

Tuning fork

Process connections

Process connection, sealing surface
- Thread ISO228, G
- Thread ASME B1.20.1, NPT
- Thread EN10226, R
- Flange ASME B16.5, RF (Raised Face)
- Flange ASME B16.5, FF (Flat Face)
- Flange ASME B16.5, RTJ (Ring Type Joint)
- Flange EN1092-1, Form A
- Flange EN1092-1, Form B1
- Flange EN1092-1, Form C
- Flange EN1092-1, Form D
- Flange EN1092-1, Form E
- Flange JIS B2220, RF (Raised Face)
- Flange HG/T20592, RF (Raised Face)
- Flange HG/T20615, RF (Raised Face)
- Flange HG/T20615, RJ (Ring Joint)

**Height of process connection**

![Diagram of process connection](image)

18 (0.71) 57 (2.24)

**25** Maximum height specification for the process connections

A  Process connection with threaded connection
B  Process connection with flange

**Thread ISO228 G**

G ¾, G 1
- Material: 316L
- Pressure rating: ≤ 100 bar (1450 psi)
- Temperature: ≤ 280 °C (536 °F)
- Weight G ¾: 0.2 kg (0.44 lb)
- Weight G 1: 0.33 kg (0.73 lb)

![Diagram of ISO228 G thread](image)

66.5 (2.62) 50.5 (1.99)

**26** Thread ISO228 G ¾. Unit of measurement mm (in)

**Thread ASME B1.20.3, MNPT**

- Material: 316L
- Pressure rating: ≤ 100 bar (1450 psi)
- Temperature: ≤ 280 °C (536 °F)
- Weight: 0.3 kg (0.66 lb)

![Diagram of ASME B1.20.3 thread](image)

69 (2.72) 50.5 (1.99)
Thread EN10226, R
- Material: 316L
- Pressure rating: ≤ 100 bar (1450 psi)
- Temperature: ≤ 280 °C (536 °F)
- Weight: 0.3 kg (0.66 lb)

Flanges
AlloyC22-plated flanges are available for higher chemical resistance.
The flange carrier material is made of 1.4462 and is welded to an AlloyC22 disk.

In the event of high temperatures: pay attention to the pressure loading capacity of the flange depending on the temperature!

ASME B16.5 flanges, RF

<table>
<thead>
<tr>
<th>Pressure rating</th>
<th>Type</th>
<th>Material</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cl.150</td>
<td>NPS 1&quot;</td>
<td>316/316L</td>
<td>1.0 kg (2.21 lb)</td>
</tr>
<tr>
<td>Cl.150</td>
<td>NPS 1-½&quot;</td>
<td>316/316L</td>
<td>1.5 kg (3.31 lb)</td>
</tr>
<tr>
<td>Cl.150</td>
<td>NPS 2&quot;</td>
<td>316/316L</td>
<td>2.4 kg (5.29 lb)</td>
</tr>
<tr>
<td>Cl.150</td>
<td>NPS 2½&quot;</td>
<td>316/316L</td>
<td>2.4 kg (5.29 lb)</td>
</tr>
<tr>
<td>Cl.150</td>
<td>NPS 3&quot;</td>
<td>316/316L</td>
<td>4.9 kg (10.8 lb)</td>
</tr>
</tbody>
</table>
### Liquiphant FTL64 HART

<table>
<thead>
<tr>
<th>Pressure rating</th>
<th>Type</th>
<th>Material</th>
<th>Weight</th>
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</thead>
<tbody>
<tr>
<td>Cl.150</td>
<td>NPS 4&quot;</td>
<td>316/316L</td>
<td>7.0 kg (15.44 lb)</td>
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<tr>
<td>Cl.300</td>
<td>NPS 1-½&quot;</td>
<td>316/316L</td>
<td>2.7 kg (5.95 lb)</td>
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<tr>
<td>Cl.300</td>
<td>NPS 2&quot;</td>
<td>316/316L</td>
<td>3.2 kg (7.06 lb)</td>
</tr>
<tr>
<td>Cl.300</td>
<td>NPS 3&quot;</td>
<td>316/316L</td>
<td>6.8 kg (14.99 lb)</td>
</tr>
<tr>
<td>Cl.300</td>
<td>NPS 4&quot;</td>
<td>316/316L</td>
<td>11.5 kg (25.6 lb)</td>
</tr>
<tr>
<td>Cl.600</td>
<td>NPS 2&quot;</td>
<td>316/316L</td>
<td>6.8 kg (14.99 lb)</td>
</tr>
<tr>
<td>Cl.600</td>
<td>NPS 3&quot;</td>
<td>316/316L</td>
<td>6.8 kg (14.99 lb)</td>
</tr>
<tr>
<td>Cl.600</td>
<td>NPS 4&quot;</td>
<td>316/316L</td>
<td>17.3 kg (38.15 lb)</td>
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</table>

### ASME B16.5 flanges, FF

<table>
<thead>
<tr>
<th>Pressure rating</th>
<th>Type</th>
<th>Material</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cl.150</td>
<td>NPS 1&quot;</td>
<td>316/316L</td>
<td>1.0 kg (2.21 lb)</td>
</tr>
<tr>
<td>Cl.150</td>
<td>NPS 2&quot;</td>
<td>316/316L</td>
<td>2.4 kg (5.29 lb)</td>
</tr>
<tr>
<td>Cl.300</td>
<td>NPS 1-½&quot;</td>
<td>316/316L</td>
<td>2.7 kg (5.95 lb)</td>
</tr>
<tr>
<td>Cl.300</td>
<td>NPS 2&quot;</td>
<td>316/316L</td>
<td>3.2 kg (7.06 lb)</td>
</tr>
<tr>
<td>Cl.300</td>
<td>NPS 4&quot;</td>
<td>316/316L</td>
<td>11.5 kg (25.36 lb)</td>
</tr>
<tr>
<td>Cl.600</td>
<td>NPS 2&quot;</td>
<td>316/316L</td>
<td>4.2 kg (9.26 lb)</td>
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<tr>
<td>Cl.600</td>
<td>NPS 3&quot;</td>
<td>316/316L</td>
<td>6.8 kg (14.99 lb)</td>
</tr>
<tr>
<td>Cl.600</td>
<td>NPS 4&quot;</td>
<td>316/316L</td>
<td>17.3 kg (38.15 lb)</td>
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</table>

### ASME B16.5 flanges, RTJ

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<tr>
<th>Pressure rating</th>
<th>Type</th>
<th>Material</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cl.300</td>
<td>NPS 2&quot;</td>
<td>316/316L</td>
<td>3.2 kg (7.06 lb)</td>
</tr>
<tr>
<td>Cl.300</td>
<td>NPS 3&quot;</td>
<td>316/316L</td>
<td>6.8 kg (14.99 lb)</td>
</tr>
<tr>
<td>Cl.300</td>
<td>NPS 4&quot;</td>
<td>316/316L</td>
<td>11.5 kg (25.36 lb)</td>
</tr>
<tr>
<td>Cl.600</td>
<td>NPS 2&quot;</td>
<td>316/316L</td>
<td>17.3 kg (38.15 lb)</td>
</tr>
</tbody>
</table>

### EN flanges EN 1092-1, A

<table>
<thead>
<tr>
<th>Pressure rating</th>
<th>Type</th>
<th>Material</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>PN25/40</td>
<td>DN25</td>
<td>316L (1.4404)</td>
<td>1.3 kg (2.87 lb)</td>
</tr>
<tr>
<td>PN25/40</td>
<td>DN32</td>
<td>316L (1.4404)</td>
<td>2.0 kg (4.41 lb)</td>
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<tr>
<td>PN25/40</td>
<td>DN40</td>
<td>316L (1.4404)</td>
<td>2.6 kg (5.29 lb)</td>
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<tr>
<td>PN25/40</td>
<td>DN50</td>
<td>316L (1.4404)</td>
<td>3.2 kg (7.06 lb)</td>
</tr>
<tr>
<td>PN25/40</td>
<td>DN65</td>
<td>316L (1.4404)</td>
<td>4.3 kg (9.48 lb)</td>
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<tr>
<td>PN25/40</td>
<td>DN80</td>
<td>316L (1.4404)</td>
<td>5.9 kg (13.01 lb)</td>
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<tr>
<td>PN25/40</td>
<td>DN100</td>
<td>316L (1.4404)</td>
<td>7.5 kg (16.54 lb)</td>
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<tr>
<td>PN100</td>
<td>DN50</td>
<td>316L (1.4404)</td>
<td>5.5 kg (12.13 lb)</td>
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<tr>
<td>Pressure rating</td>
<td>Type</td>
<td>Material</td>
<td>Weight</td>
</tr>
<tr>
<td>----------------</td>
<td>------</td>
<td>----------------</td>
<td>---------</td>
</tr>
<tr>
<td>PN10/16</td>
<td>DN50</td>
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<td>2.5 kg (5.51 lb)</td>
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<tr>
<td>PN10/16</td>
<td>DN80</td>
<td>316L (1.4404)</td>
<td>4.8 kg (10.58 lb)</td>
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<tr>
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<td>DN100</td>
<td>316L (1.4404)</td>
<td>5.2 kg (11.47 lb)</td>
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<tr>
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<td>DN25</td>
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</tr>
<tr>
<td>PN25/40</td>
<td>DN50</td>
<td>316L (1.4404)</td>
<td>1.4 kg (3.09 lb)</td>
</tr>
<tr>
<td>PN25/40</td>
<td>DN50</td>
<td>Alloy C22&gt;1.4462</td>
<td>3.2 kg (7.06 lb)</td>
</tr>
<tr>
<td>PN25/40</td>
<td>DN80</td>
<td>316L (1.4404)</td>
<td>3.2 kg (7.06 lb)</td>
</tr>
<tr>
<td>PN25/40</td>
<td>DN80</td>
<td>Alloy C22&gt;316L</td>
<td>5.9 kg (13.01 lb)</td>
</tr>
<tr>
<td>PN63</td>
<td>DN50</td>
<td>316L (1.4404)</td>
<td>4.5 kg (9.92 lb)</td>
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</table>

**EN flanges EN 1092-1, E**

<table>
<thead>
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<th>Type</th>
<th>Material</th>
<th>Pressure rating</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>DN50</td>
<td>316L (1.4404)</td>
<td>PN25/40</td>
<td>3.2 kg (7.06 lb)</td>
</tr>
</tbody>
</table>

**JIS flanges B2220**

<table>
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<th>Pressure rating</th>
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<th>Material</th>
<th>Weight</th>
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</thead>
<tbody>
<tr>
<td>20K</td>
<td>20K 50A</td>
<td>316L (1.4404)</td>
<td>1.9 kg (4.19 lb)</td>
</tr>
</tbody>
</table>

**Weight**

**Housing**
Weight including electronics and display (graphic display):

- **Single compartment housing**
  - Aluminum: 1.1 kg (2.43 lb)

- **Dual compartment housing, L-form**
  - Aluminum: 1.7 kg (3.75 lb)
  - 316L: 4.3 kg (9.48 lb)

- **Gas-tight feedthrough**
  0.2 kg (0.44 lb)

- **Probe length (Ra < 3.2 µm/126 µin)**
  - 1000 mm: 0.9 kg (1.98 lb)
  - 100 in: 2.3 kg (5.07 lb)

- **Pipe extension**
  - 1000 mm: 0.9 kg (1.98 lb)
  - 50 in: 1.15 kg (2.54 lb)

- **Process connection**
  See 'Process connections' section

- **Protective cover, plastic**
  0.2 kg (0.44 lb)

- **Protective cover, 316L**
  0.93 kg (2.05 lb)

**Materials**

**Materials in contact with process**

- **Process connection and pipe extension**
  - 316L (1.4435 or 1.4404)
  - Optional Alloy C22 (2.4602)
  - Optional PFA coating (conductive)
• G ¾, G 1 according to DIN ISO 228/1, flat seal according to DIN 7603, at installation location
• R ¾, R 1 according to DIN 2999 Part 1
• ¾ -14 NPT, 1 - 11½ NPT according to ANSI B 1.20.1

Tuning fork
S31803 (1.4462)
• Optional Alloy C22 (2.4602)
• Optional PFA coating (conductive)

Flanges
• 316L (1.4404)
  • Optional PFA coating (conductive)
  • Flange plating: Alloy C22
• Flanges (standard specifications → Product Configurator)
  • according to EN/DIN from DN 25
  • according to ANSI B16.5 from 1"
  • according to JIS B 2220 (RF)

Materials not in contact with process

Aluminum housing, coated
• Housing: aluminum EN AC 43400
  Polyester powder coating on aluminum as per EN1706 43400 (reduced copper content ≤ 0.1 % to prevent corrosion)
• Coating: Polyester
• Dummy cover: aluminum EN AC 43400
• Cover with sight glass: EN AC 43400 aluminum, PC Lexan 943A synthetic glass
  • Cover with polycarbonate sight glass optionally available
  • For Ex d applications, the sight glass is made from borosilicate.
• Cover sealing materials: HNBR
• Cover sealing materials: FVMQ (in low-temperature version only)
• Stopper: aluminum
  Plastic (PBT-GF30-FR) in non-hazardous, Ex i or IS combination with plastic cable gland, M20 thread or G ¾ thread
• Nameplate: plastic foil
• TAG plate: plastic foil, stainless steel or provided by the customer
• M20 cable glands: select material (stainless steel, nickel-plated brass, polyamide)

L-shaped aluminum housing, coated
• Polyester powder coating on aluminum as per EN1706 AC43400 (reduced copper content ≤ 0.1 % to prevent corrosion)
• Stainless steel (ASTM A351 : CF3M (cast equivalent to material AISI 316L)/DIN EN 10213 : 1.4409)

Stainless steel housing, 316L
• Housing: stainless steel AISI 316L (1.4409)
  Stainless steel (ASTM A351 : CF3M (cast equivalent to material AISI 316L)/DIN EN 10213 : 1.4409)
• Dummy cover: stainless steel AISI 316L (1.4409)
• Cover with sight glass: borosilicate
• Stopper: stainless steel
• Cover sealing materials: FVMQ (in low-temperature version only)
• Cover sealing materials: HNBR
• Nameplate: stainless steel housing, labeled directly
• TAG plate: plastic foil, stainless steel or provided by the customer
• M20 cable glands: select material (stainless steel, nickel-plated brass, polyamide)

Aluminum housing nameplate
Adhesive plastic film label

Nameplate of stainless steel housing
Stainless steel housing, labeled directly
### Wired-on nameplate
- Stainless steel
- Plastic film
- Provided by customer
- RFID tag: polyurethane potting compound

### Cable entries
- M20 gland:
  - Plastic, brass nickel plated or 316L (depends on version ordered)
  - Dummy plug made of plastic, aluminum or 316L (depends on version ordered)
- Thread M20:
  - Dummy plug made of aluminum or 316L (depends on version ordered)
- Thread G ½:
  - Adapter made of aluminum or 316L (depends on version ordered)
  - If the G ½ thread is selected, the device is provided with an M20 thread as standard and an adapter to G ½ is included, along with the associated documentation
- Thread NPT ½:
  - Dummy plug made of aluminum or 316L (depends on version ordered)
- M12 plug:
  - CuZn nickel-plated or 316L (depends on version ordered)
  - Dummy plug made of aluminum or 316L (depends on version ordered)

### Surface roughness
The surface roughness of the surface in contact with the process is Ra ≤3.2 µm (126 µin).

### User interface

#### Operating concept
- Operator-oriented menu structure for user-specific tasks
  - Guidance
  - Diagnostics
  - Application
  - System

#### Fast and safe commissioning
- Interactive wizard with graphical user interface for guided commissioning in FieldCare, DeviceCare or DTM, AMS and PDM-based third-party tools or SmartBlue
- Menu guidance with short explanations of the individual parameter functions
- Standardized operation at the device and in the operating tools

#### Integrated Historm data memory
- Adoption of data configuration when electronics modules are replaced
- Up to 100 event messages recorded in the device

#### Efficient diagnostic behavior increases measurement availability
- Remedial measures are integrated in plain text
- Diverse simulation options

#### Bluetooth (optionally integrated in local display)
- Quick and easy setup with SmartBlue app or PC with DeviceCare, version 1.07.05 and higher, or FieldXpert SMT70
- No additional tools or adapters required
- Encrypted single point-to-point data transmission (tested by Fraunhofer Institute) and password-protected communication via Bluetooth® wireless technology

### Languages
- Operating languages
  - English option (English option is set at the factory if no other language is ordered)
  - Deutsch
  - Français
  - Español
  - Italiano
  - Nederlands
  - Portuguesa
  - Polski
  - русский язык (Russian)
Onsite operation  

FEL60H electronic insert

- Minimum/maximum quiescent current safety can be switched at the electronic insert
- MAX = maximum safety: when the tuning fork is covered the output switches to demand mode, e.g. use for overfill protection
- MIN = minimum safety: when the tuning fork is uncovered, the output switches to demand mode, e.g. use to prevent pumps from running dry

Local display

Device display (optional)

Functions:
- Display of measured values and fault and notice messages
- Background lighting, which switches from green to red in the event of an error
- The device display can be removed for easier operation
Remote operation

Via HART protocol

Via service interface (CDI)

Operation via Bluetooth® wireless technology (optional)

Prerequisite

- Measuring device with display including Bluetooth
- Smartphone or tablet with Endress+Hauser SmartBlue app or PC with DeviceCare from version 1.07.05 or FieldXpert SMT70

The connection has a range of up to 25 m (82 ft). The range can vary depending on environmental conditions such as attachments, walls or ceilings.

The operating keys on the display are locked as soon as the device is connected via Bluetooth.

System integration

HART

Version 7

Supported operating tools

Smartphone or tablet with Endress+Hauser SmartBlue app, DeviceCare from version 1.07.05, FieldCare, DTM, AMS and PDM

HistoROM data management

When replacing the electronic insert, the stored data is transferred by reconnecting the HistoROM. The device serial number is saved in the HistoROM. The electronics serial number is saved in the electronics.

Certificates and approvals

Current certificates and approvals for the product are available at www.endress.com on the relevant product page:

1. Select the product using the filters and search field.
2. Open the product page.
3. Select Downloads.

CE mark

The measuring system meets the legal requirements of the applicable EU Directives. These are listed in the corresponding EU Declaration of Conformity together with the standards applied. Endress+Hauser confirms successful testing of the device by affixing it the CE mark.

RCM marking

The supplied product or measuring system meets the ACMA (Australian Communications and Media Authority) requirements for network integrity, interoperability, performance characteristics as well as health and safety regulations. Here, especially the regulatory arrangements for electromagnetic compatibility are met. The products bear the RCM marking on the nameplate.

Ex-approval

All data relating to explosion protection are provided in separate Ex documentation and are available from the Downloads Area. The Ex documentation is supplied as standard with all devices approved for use in explosion hazardous areas.

Explosion-protected smartphones and tablets

If used in hazardous areas, mobile end devices with an Ex approval must be used.

Overfill protection

Before mounting the device, observe the documentation from the WHG approvals (German Federal Water Act).
Approved for overfill protection and leakage detection.

Product Configurator: feature “Additional approval”

**Additional information**

- **Difference in wetted materials between the tuning fork and pipe extension:**
  - Tuning fork: S31803 (1.4462)
  - Pipe extension: 316L (1.4435)

  With regard to the different materials of the tuning fork and pipe extension, the corrosion test is based on the material of the pipe extension 316L (1.4435).

**General material compliance**

Endress+Hauser guarantees compliance with all relevant laws and regulations, including the current guidelines for materials and substances.

Examples:
- RoHS
- China RoHS
- REACH
- POP VO (Stockholm Convention)

For further information and general declarations of compliance, see the Endress+Hauser website [www.endress.com](http://www.endress.com).

**Functional safety**

The Liquiphant has been developed according to the IEC 61508 standard. The device is suitable for overfill protection and dry-running protection up to SIL 2 (SIL 3 with homogeneous redundancy). A detailed description of the safety functions with Liquiphant, settings and functional safety data are provided in the "Functional Safety Manual" on the Endress+Hauser website: [www.endress.com](http://www.endress.com) → Downloads.

Product Configurator: feature “Additional approval”

Subsequent confirmation of usability according to IEC 61508 is not possible.

**Radio approval**

Further information and currently available documentation can be found on the Endress+Hauser website: [www.endress.com](http://www.endress.com) → Downloads.

**CRN approval**

Versions with a CRN approval (Canadian Registration Number) are listed in the corresponding registration documents. CRN-approved devices are marked with a registration number.

Any restrictions regarding the maximum process pressure values are listed on the CRN certificate.

Product Configurator: feature “Additional approval”

**Service**

- Cleaned of oil+grease (wetted)
- ANSI safety red coating (housing cover)
- Switching delay setting to be spec.
- Setting for MIN safety mode
- Setting for HART burst mode PV
- Setting for max. alarm current
- Preset density > 0.4 g/cm³ (25.0 lb/ft³)
- Preset density > 0.5 g/cm³ (31.2 lb/ft³)
- Bluetooth communication is disabled on delivery

**Test, certificate, declaration**

- Inspection certificate 3.1, EN10204 (material certificate, wetted parts)
- NACE MR0175/ISO 15156 (wetted parts), declaration
- NACE MR0103/ISO 17945 (wetted parts), declaration
- AD 2000 (wetted parts), declaration, excluding cast parts
- ASME B31.3 process piping, declaration
- ASME B31.1 process piping, declaration
- Pressure test, internal procedure, test report
- Helium leak test, internal procedure, test report
- PMI test, internal procedure (wetted parts), test report
- Penetrant testing AD2000-HP5-3 (PT), wetted/pressurized metallic parts, test report
- Penetrant testing ISO23277-1 (PT), wetted/pressurized metallic parts, test report
- Penetrant testing ASME VIII-1 (PT), wetted/pressurized metallic parts, test report
- Welding documentation, wetted/pressurized seams, declaration/ISO/ASME
  Welding documentation consisting of:
  - Welding drawings
  - WPQR (Welding Procedure Qualification Record) according to ISO 14613/ISO14614 or ASME Sect. IX
  - WPS (Welding Procedure Specifications)
  - WQR (Welder Qualification Record)

Documentation currently available on the Endress+Hauser website: [www.endress.com](http://www.endress.com) → Downloads or with the serial number of the device under Online Tools in the Device Viewer.

### Pressure Equipment Directive
Pressure equipment with permitted pressure ≤ 200 bar (2900 psi)
Pressure instruments with a process connection that does not have a pressurized housing do not fall within the scope of the Pressure Equipment Directive, irrespective of the maximum allowable pressure.

**Reasons:**
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.

### Process seal as per ANSI/ISA 12.27.01
North American practice for the installation of process seals. In accordance with ANSI/ISA 12.27.01, Endress+Hauser devices are designed as either single seal or dual seal devices with a warning message. This allows the user to waive the use of - and save the cost of installing - an external secondary process seal in the protective conduit as required in ANSI/NFPA 70 (NEC) and CSA 22.1 (CEC). These instruments comply with North American installation practice and allow very safe and cost-effective installation for pressurized applications with hazardous fluids. More information is provided in the Safety Instructions (XA) for the relevant device.

The following housings are approved as single seal devices:
- single compartment, aluminum

### EAC conformity
The measuring system meets the legal requirements of the applicable EAC guidelines. These are listed in the corresponding EAC Declaration of Conformity along with the standards applied.

The manufacturer confirms successful testing of the device by affixing to it the EAC mark.

### ASME B 31.3/31.1
Design and materials in accordance with ASME B31.3/31.1. The welds are through-penetration welded and meet the requirements of the ASME Boiler and Pressure Vessel Code, Section IX and EN ISO 15614-1.

### Ordering information
Detailed ordering information is available from your nearest sales organization [www.addresses.endress.com](http://www.addresses.endress.com) or in the Product Configurator at [www.endress.com](http://www.endress.com):

1. Select the product using the filters and search field.
2. Open the product page.
3. Select **Configuration**.

**Product Configurator - the tool for individual product configuration**
- Up-to-the-minute configuration data
- Depending on the device: Direct input of measuring point-specific information 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 in the Endress+Hauser Online Shop
The device can be ordered with a tag name.

**Location of tag name**
In the additional specification, select:
- Stainless steel wired-on tag plate
- Paper adhesive label
- Tag provided by the customer
- RFID TAG
- RFID TAG + stainless steel wired-on tag plate
- RFID TAG + paper adhesive label
- RFID TAG + TAG provided by the customer
- IEC61406 stainless steel TAG
- IEC61406 stainless steel TAG + NFC TAG
- IEC61406 stainless steel TAG, stainless steel TAG
- IEC61406 stainless steel TAG + NFC, stainless steel TAG
- IEC61406 stainless steel TAG, plate provided
- IEC61406 stainless steel TAG + NFC, plate provided

**Definition of tag name**
In the additional specification, specify:
3 lines of maximum 18 characters each
The specified tag name appears on the selected plate and/or on the RFID TAG.

**Visualization in SmartBlue app**
The first 32 characters of the tag name
The tag name can always be changed specifically for the measuring point via Bluetooth.

**Display in electronic nameplate (ENP)**
The first 32 characters of the tag name

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**Test reports, declarations and inspection certificates**
All test reports, declarations and inspection certificates are provided electronically in the Device Viewer:
Enter the serial number from the nameplate (www.endress.com/deviceviewer)

**Product documentation on paper**
Test reports, declarations and inspection certificates in hard copy can optionally be ordered with feature 570 "Service", Version I7 "Product documentation on paper". The documents are then provided with the device upon delivery.

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**Application packages**

**Heartbeat Technology module**

**Heartbeat Diagnostics**
Continuously monitors and assesses the device condition and process conditions. Generates diagnostic messages when certain events occur and provides troubleshooting measures in accordance with NAMUR NE 107.

**Heartbeat Verification**
Performs a verification of the current device condition on demand and generates the Heartbeat Technology verification report showing the verification result.

**Heartbeat Monitoring**
Continuously provides device and/or process data for an external system. Analysis of this data provides a basis for process optimization and predictive maintenance.

**Heartbeat Diagnostics**
Diagnostic messages output to:
- the local display
- an asset management system (e.g. FieldCare or DeviceCare)
- an automation system (e.g. PLC)

**Heartbeat Verification**
- Device monitoring in installed state without interrupting the process, including report
- Clear measuring point assessment (Passed/Failed) with high total test coverage within the framework of manufacturer specifications
- Can be used to document normative requirements
The ‘Heartbeat Verification’ module contains the **Heartbeat Verification** wizard, which verifies the current instrument health and creates the Heartbeat Technology verification report:

- **Heartbeat Verification** wizard can be used via the SmartBlue app
- **Heartbeat Verification** wizard guides the user through the entire process for creating the verification report
- The operating hours counter, minimum/maximum temperature indicator and minimum/maximum frequency indicator are displayed.
- If the oscillation frequency of the fork increases, a corrosion warning appears.
- The order configuration of the oscillation frequency in air is indicated in the verification report.
  - A high oscillation frequency is an indicator of corrosion.
  - A lower oscillation frequency indicates buildup or a sensor covered by the medium.
  - Deviations in the oscillation frequency compared to the oscillation frequency on delivery may be caused by the process temperature and pressure.
- Frequency history: Last 16 sensor frequencies that were stored at the time of the Heartbeat Verification

### Heartbeat Monitoring

- **Loop diagnostics** wizard: Detection of elevated measuring circuit resistance values or declining power supply
- **Process window** wizard: Two frequency limits for monitoring the upper and lower range of the oscillation frequency (can be defined independently of one another). Changes in the process can be identified, e.g. corrosion or buildup.

### Proof testing

The proof test is only available for devices with SIL or WHG approval.

A proof test is required at appropriate intervals in the following applications: SIL (IEC61508/IEC61511), WHG (German Water Resources Act).

The **Proof test** wizard is available with the ordered SIL or WHG approval. The wizard guides the user through the entire process for creating the verification report. The verification report can be saved as a PDF file.

### Accessories

#### Device Viewer

All the spare parts for the device, along with the order code, are listed in the **Device Viewer** (www.endress.com/deviceviewer).

#### Protective cover for aluminum dual compartment housing

- Material: stainless steel 316L
- Order number: 71438303

![Diagram of protective cover](image.png)

35  **Protective cover for aluminum dual compartment housing. Unit of measurement mm (in)**

#### Protective cover for single compartment housing, aluminum or 316L

- Material: plastic
- Order number: 71438291
M12 socket

The M12 sockets listed are suitable for use in the temperature range –25 to +70 °C (–13 to +158 °F).

**M12 socket IP69**
- Terminated at one end
- Angled
- 5 m (16 ft) PVC cable (orange)
- Slotted nut 316L (1.4435)
- Body: PVC
- Order number: 52024216

**M12 socket IP67**
- Angled
- 5 m (16 ft) PVC cable (gray)
- Slotted nut Cu Sn/Ni
- Body: PUR
- Order number: 52010285

**Sliding sleeves for unpressurized operation**

Not suitable for devices with PFA (conductive) coating.

Not suitable for use in explosive atmospheres.

Switch point, infinitely adjustable.

G 1, DIN ISO 228/1
- Material: 1.4435 (AISI 316L)
- Weight: 0.21 kg (0.46 lb)
- Order number: 52003978
- Order number: 52011888, approval: with inspection certificate EN 10204 - 3.1 material
High pressure sliding sleeves

Suitable for use in explosive atmospheres.

- Switch point, infinitely adjustable
- Seal package made of graphite
- Graphite seal available as spare part 71078875
- For G 1, G 1½: seal is included in the delivery

G 1, DIN ISO 228/I
- Material: 1.4435 (AISI 316L)
- Weight: 1.13 kg (2.49 lb)
- Order number: 52003663
- Order number: 52011880, approval: with inspection certificate EN 10204 - 3.1 material

G 1, DIN ISO 228/I
- Material: AlloyC22
- Weight: 1.13 kg (2.49 lb)
- Approval: with inspection certificate EN 10204 - 3.1 material
- Order number: 71118691

NPT 1, ASME B 1.20.1
- Material: 1.4435 (AISI 316L)
- Weight: 1.13 kg (2.49 lb)
- Order number: 52003667
- Order number: 52011881, approval: with inspection certificate EN 10204 - 3.1 material

NPT 1, ASME B 1.20.1
- Material: 1.4435 (AISI 316L)
- Weight: 1.13 kg (2.49 lb)
- Approval: with inspection certificate EN 10204 - 3.1 material
- Order number: 71118691
NPT 1, ASME B 1.20.1
- Material: AlloyC22
- Weight: 1.13 kg (2.49 lb)
- Approval: with inspection certificate EN 10204 - 3.1 material
- Order number: 71118694

G 1½, DIN ISO 228/1
- Material: 1.4435 (AISI 316L)
- Weight: 1.32 kg (2.91 lb)
- Order number: 52003665
- Order number: 52011882, approval: with inspection certificate EN 10204 - 3.1 material

G 1½, DIN ISO 228/1
- Material: AlloyC22
- Weight: 1.32 kg (2.91 lb)
- Approval: with inspection certificate EN 10204 - 3.1 material

NPT 1½, ASME B 1.20.1
- Material: 1.4435 (AISI 316L)
- Weight: 1.32 kg (2.91 lb)
- Order number: 52003669
- Order number: 52011883, approval: with inspection certificate EN 10204 - 3.1 material

NPT 1½, ASME B 1.20.1
- Material: AlloyC22
- Weight: 1.32 kg (2.91 lb)
- Approval: with inspection certificate EN 10204 - 3.1 material
- Order number: 71118695

More detailed information and documentation are available:
- Product Configurator on the Endress+Hauser website www.endress.com
- Endress+Hauser Sales Organization www.addresses.endress.com

Documentation

For an overview of the scope of the associated Technical Documentation, refer to the following:
- Device Viewer (www.endress.com/deviceviewer): Enter the serial number from the nameplate
- Endress+Hauser Operations app: Enter serial number from nameplate or scan matrix code on nameplate.

**Standard documentation**

- **Document type: Operating Instructions (BA)**
  Installation and initial commissioning – contains all functions in the operating menu that are required for a typical measuring task. Functions beyond this scope are not included.

- **Document type: Description of Device Parameters (GP)**
  The document is part of the Operating Instructions and serves as a reference for parameters, providing a detailed explanation of each individual parameter of the operating menu.

- **Document type: Brief Operating Instructions (KA)**
  Quick guide to the first measured value – includes all essential information from incoming acceptance to electrical connection.

- **Document type: Safety Instructions, certificates**
  Depending on the approval, Safety Instructions are supplied with the device, e.g. XA. This documentation is an integral part of the Operating Instructions. The nameplate indicates which Safety Instructions (XA) apply to the device in question.

**Supplementary device-dependent documentation**

Additional documents are supplied depending on the device version ordered: Always comply strictly with the instructions in the supplementary documentation. The supplementary documentation is an integral part of the device documentation.
Special documentation

- SD02874F: Heartbeat Verification + Monitoring application package
- SD02530P: Graphic display with Bluetooth, radio approval
- SD02398F: Sliding sleeve for Liquiphant (installation instructions)
- TI00426F: Weld-in adapter, process adapter and flanges (overview)

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