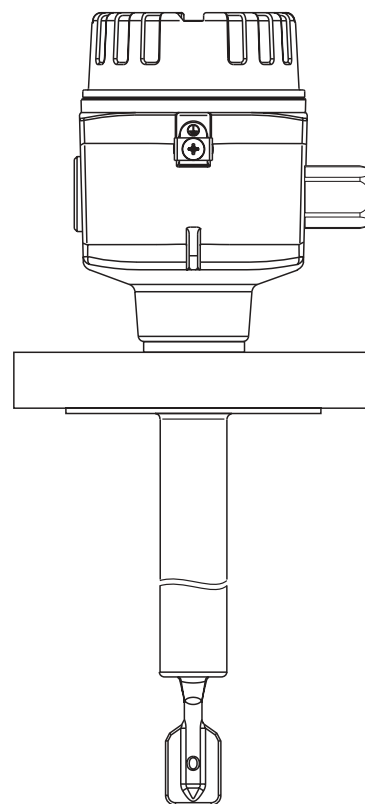
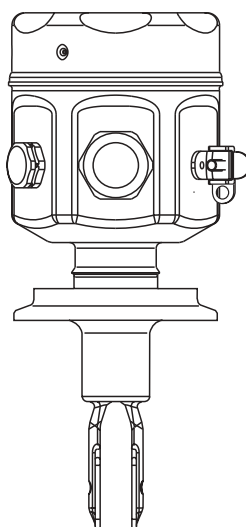


# *liquiphant M* FTL 50 H, FTL 51 H

## Level Limit Switch



## IMPORTANT NOTICE RETURN AUTHORIZATION POLICY

Endress+Hauser must pre-approve and assign a Return Authorization number to any instrument you plan to return. Please identify the Return Authorization number clearly on all shipping cartons and paperwork.

Please note that the issuance of a Return Authorization number does not automatically mean that credit will be issued, or that the return is covered by our warranty. An Endress+Hauser associate will contact you regarding the disposition of your returned equipment.

In order to serve you better, and to protect our employees from any potentially hazardous contaminants, Endress+Hauser must return unopened, at the sender's expense, all items that do not have a Return Authorization number.

To get a Return Authorization number for **credit**, call **888-ENDRESS**

To get a Return Authorization number for **calibration or repair**, call **800-642-8737**

To get a Return Authorization number **in Canada**, call **800-668-3199**

Please be sure to include the following information when requesting a Return Authorization number. This information will help us speed up the repair and return process.

Customer name:

Customer address:

Customer phone number:

Customer contact:

Equipment type:

Original sales order or purchase order number:

Reason for return:

Failure description, if applicable:

Process material(s) to which the equipment has been exposed:

OSHA Hazard Communication Standard 29CFR 1910.1200 mandates that we take specific steps to protect our employees from exposure to potentially hazardous materials. Therefore, all equipment so exposed must be accompanied by a letter certifying that the equipment has been decontaminated prior to its acceptance by Endress+Hauser.

The employees of Endress+Hauser sincerely appreciate your cooperation in following this policy.

Address your equipment to:

Endress+Hauser

2350 Endress Place

Greenwood, IN 46143

Return Authorization number:

In Canada:

Endress+Hauser

1440 Graham's Lane, #1, Burlington

Ont. Canada L7S 1W3

Return Authorization number:

Effective November 1987

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# 1 Safety Instructions

## 1.1 Approved Usage

The Liquiphant M FTL 50 H and FTL 51 H is designed for level limit detection in liquids. If used incorrectly, it is possible that application-related dangers may arise. The level limit switch Liquiphant M FTL 50 H and 51 H may be installed, connected, commissioned, operated and maintained **by qualified and authorized personnel only**, under strict observance of these operating instructions, any relevant standards, legal requirements, and, where appropriate, the certificate.

## 1.2 Safety Conventions and Symbols

In order to highlight safety-relevant or alternative operating procedures in the manual, the following conventions have been used, each indicated by a corresponding icon.

### Safety Conventions

#### Note!

A note highlights actions or procedures which, if not performed correctly, may indirectly affect operation or may lead to an instrument response which is not planned.



Note!

#### Caution!

Caution highlights actions or procedures which, if not performed correctly, may lead to personal injury or incorrect functioning of the instrument.



Caution!

#### Warning!

A warning highlights actions or procedures which, if not performed correctly, will lead to personal injury, a safety hazard or destruction of the instrument.



Warning!

### Explosion Protection



Device certified for use in explosion hazardous area



If the Liquiphant M has this symbol embossed on its nameplate, it can be installed in an explosion hazardous area.



Explosion hazardous area

Symbol used in drawings to indicate explosion hazardous areas.

Devices located in and wiring entering areas with the designation “explosion hazardous areas” must conform with the stated type of protection.



Safe area (non-explosion hazardous area)

Symbol used in drawings to indicate, if necessary, non-explosion hazardous areas. Devices located in safe areas still require a certificate if their outputs run into explosion hazardous areas.

#### Warning! (For Intrinsically Safe Units)

Installation shall be in accordance with the National Electrical Code (ANSI/NFPA 70) and ANSI/ISA RP 12.6, “Wiring Practices for Hazardous (Classified) Locations, Instrumentation Part I: Intrinsic Safety”.



Warning!



Liquiphant M has been tested for pharmaceutical, food and dairy processing, earning EHEDG certificates, and meeting 3-A Sanitary Standards.



### 1.3 Handling

Hold by housing, flange or extension tube.

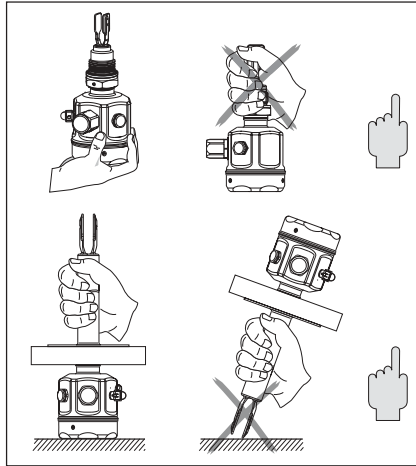


Figure 1.1

Do **not** bend.  
Do **not** shorten.  
Do **not** lengthen.

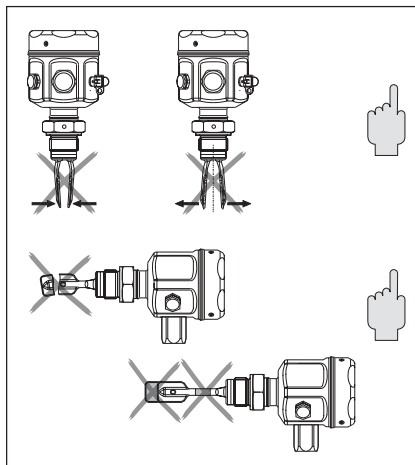


Figure 1.2

### 1.4 Repairs, Dangerous Chemicals

See Return Authorization Policy on page 2.

### 1.5 Technical Improvements

The manufacturer reserves the right to modify technical data without prior notice.

## 2 System Description

### 2.1 Introduction

The Liquiphant M is a level limit switch for use in all liquids

- with a temperature between  $-40^{\circ}\text{F}$  and  $300^{\circ}\text{F}$  ( $-40^{\circ}\text{C}$  and  $150^{\circ}\text{C}$ )
- with a pressure up to 580 psig (40 bar) depending on process connection
- with a viscosity up to 10,000 cP
- with a density from 0.5 SGU

This function is not affected by density, dielectric, flow (max. 16 ft/s), turbulence, bubbles, foam, vibration, bulk solids content or build-up. The Liquiphant is thus the ideal replacement for float switches.

### 2.2 Measurement Principle

The forks vibrate at their resonant frequency. This frequency is reduced when covered with liquid. The change in frequency then activates a limit switch.

### 2.3 Measuring System

- For direct connection

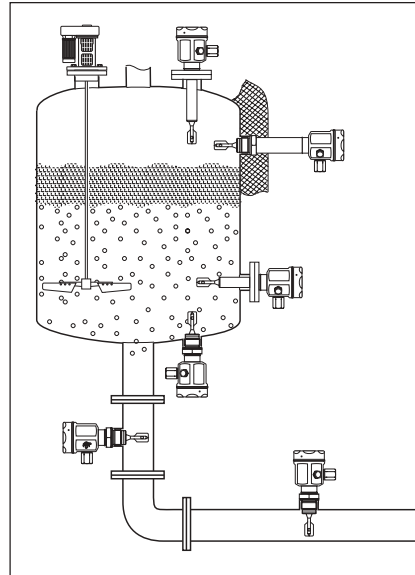
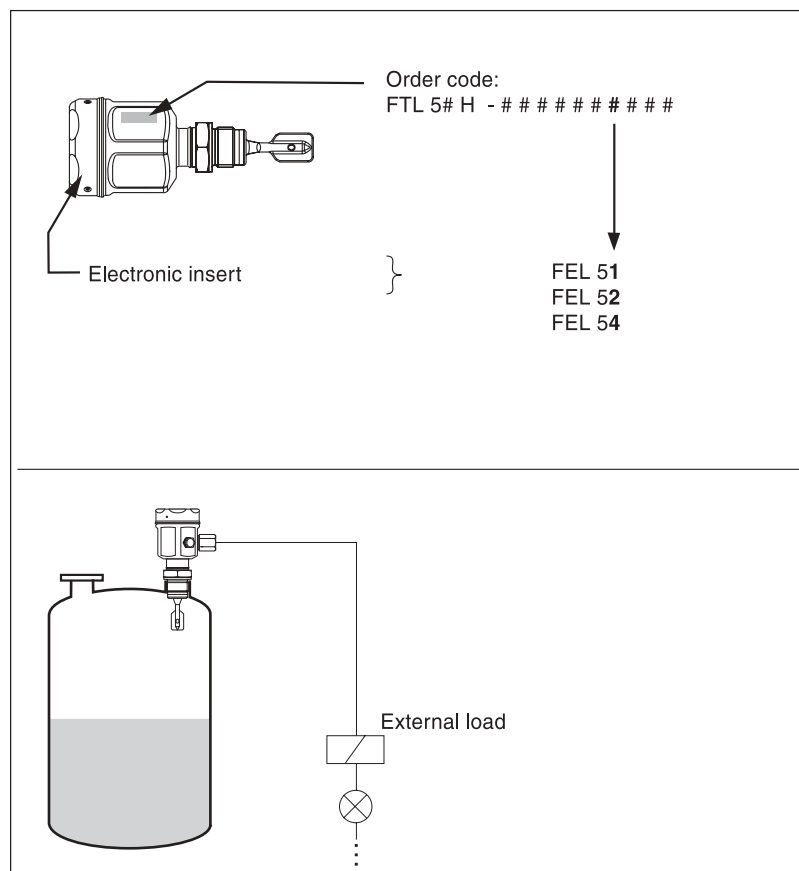
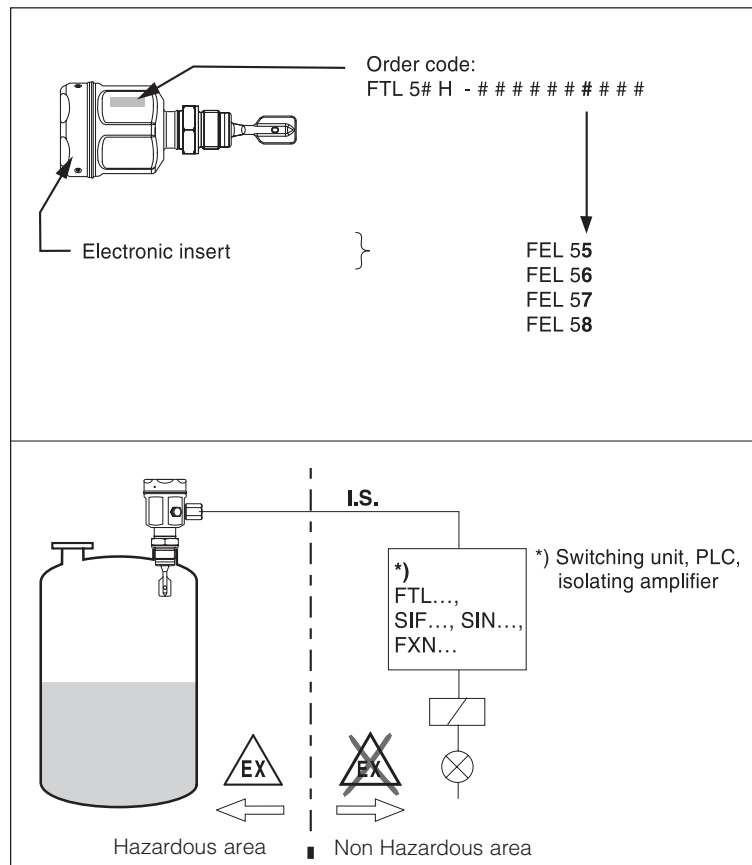


Figure 2.1  
Level limit detection in liquids

- For connection via switching unit



### 3 Mounting and Installation

Switchpoints on the sensor depend on the mounting position with reference to water, density 1 SGU, 73.4°F (23°C), pressure 0 psia (0 bar).

**Note!**

The swtichpoints of the Liquiphant **M** are at different positions than those of the previous version Liquiphant **II**.

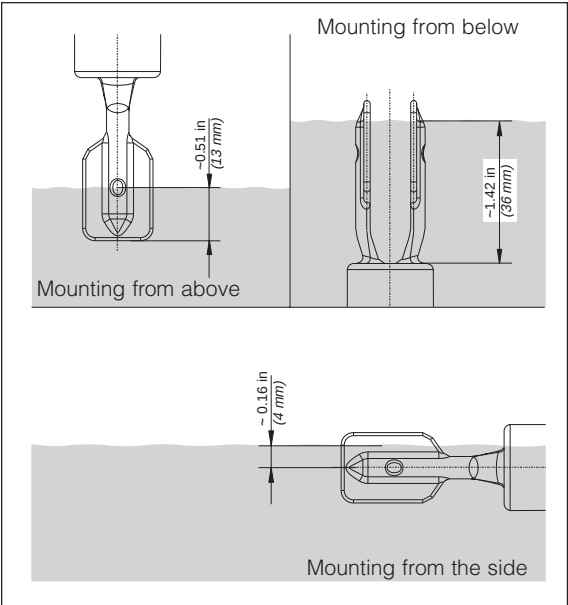


Figure 3.1  
Mounting positions

Below are examples of mounting with regard to the viscosity  $\nu$  of the liquid and the amount of build-up.

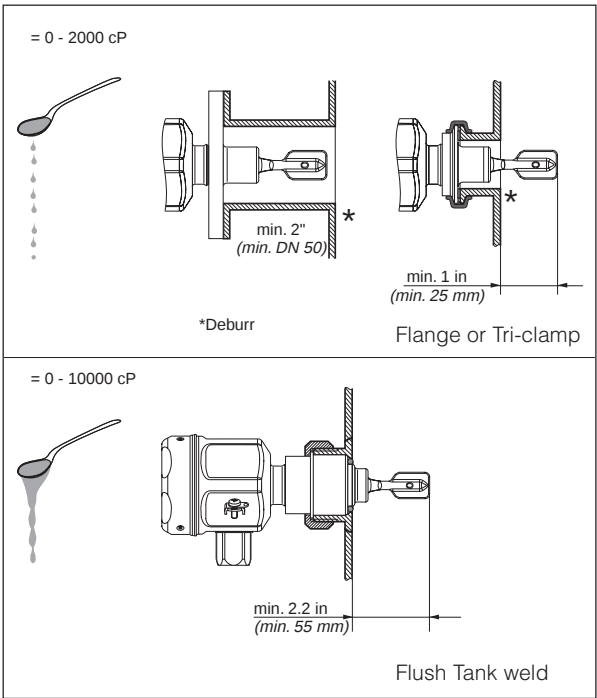


Figure 3.2  
Mounting examples with  
regard to liquid viscosity

Consider build-up. Fork may not contact the build-up. Ensure that there is sufficient distance between the build-up expected on the tank wall and the fork.

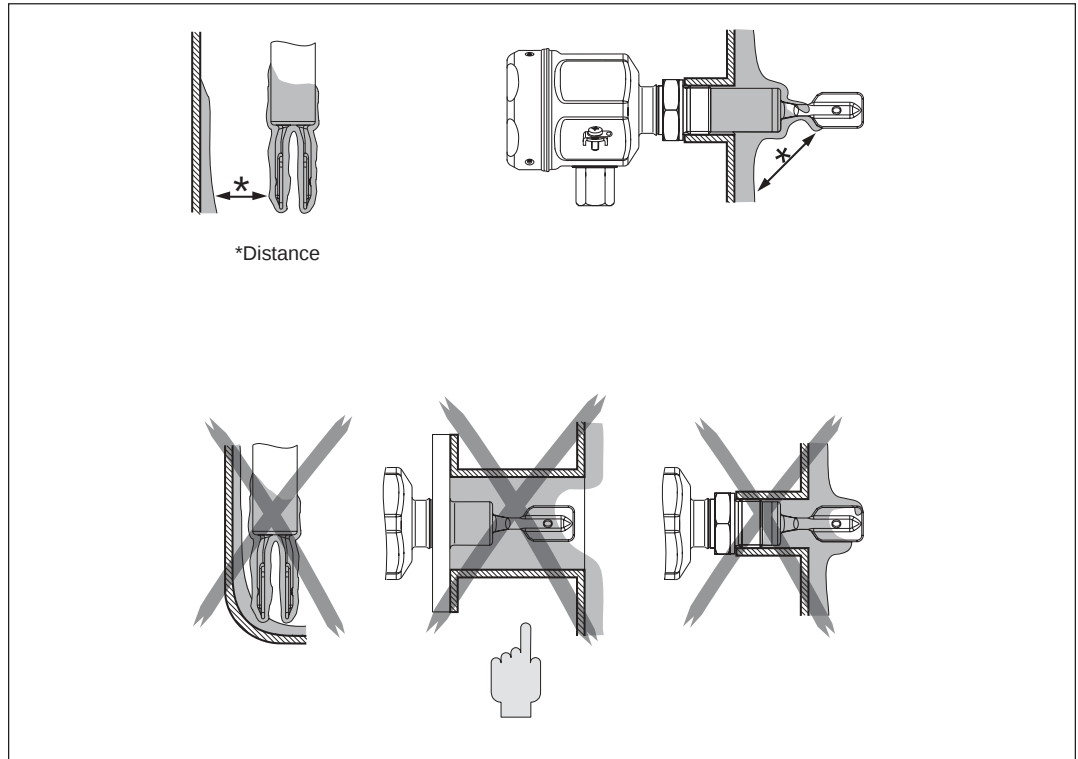
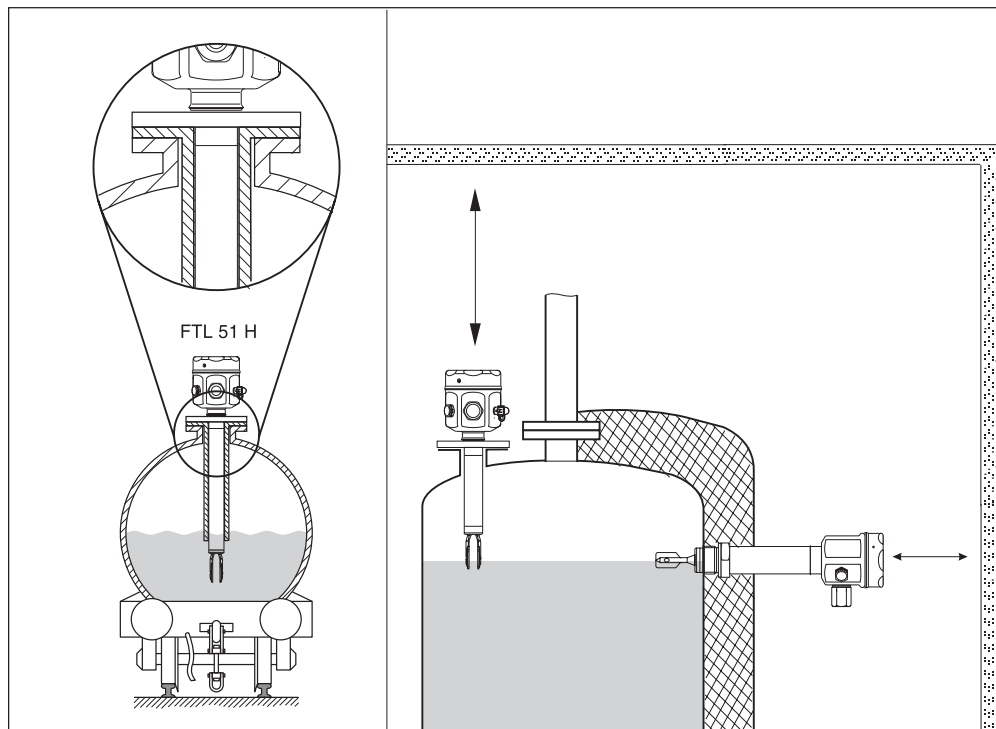


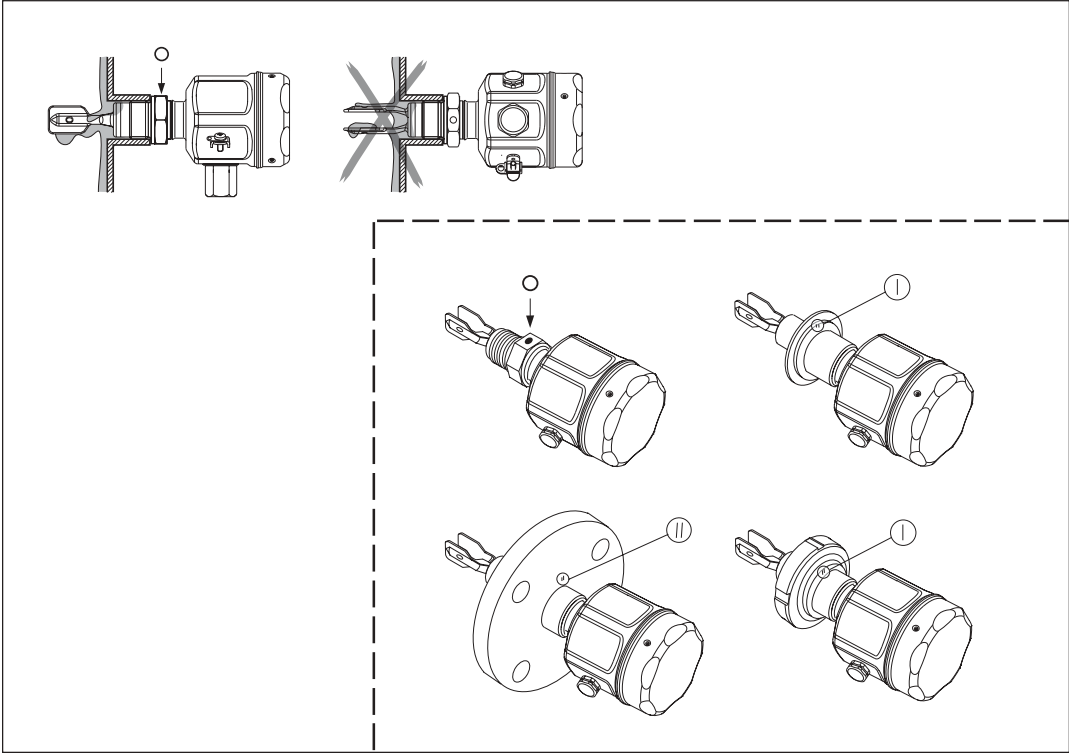
Figure 3.3  
Fork may not contact the  
build-up

Support the Liquiphant M FTL 51 H with high dynamic loads

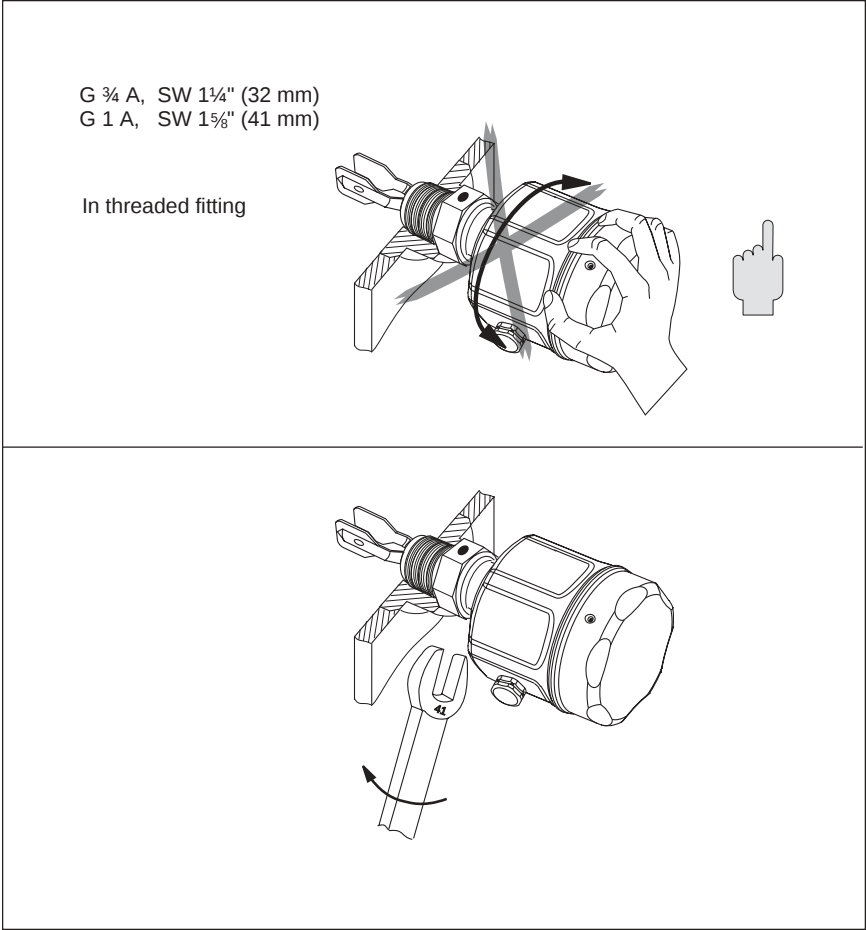


Allow adequate clearance outside the tank for mounting, electrical connection and adjustment.

For optimum mounting, without problem, even with high viscosity: position the fork so that the narrow edge of the tines is vertical. This ensures that the liquid can run off easily.



Screw Liquiphant into process connection. **DO NOT** use housing to turn.



Orientation in pipes: Marking in direction of flow.

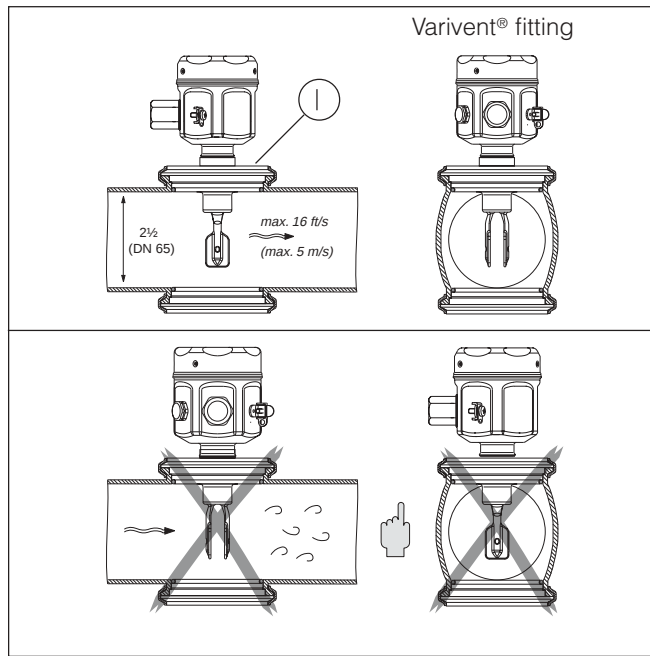


Figure 3.4  
Orientation in pipes

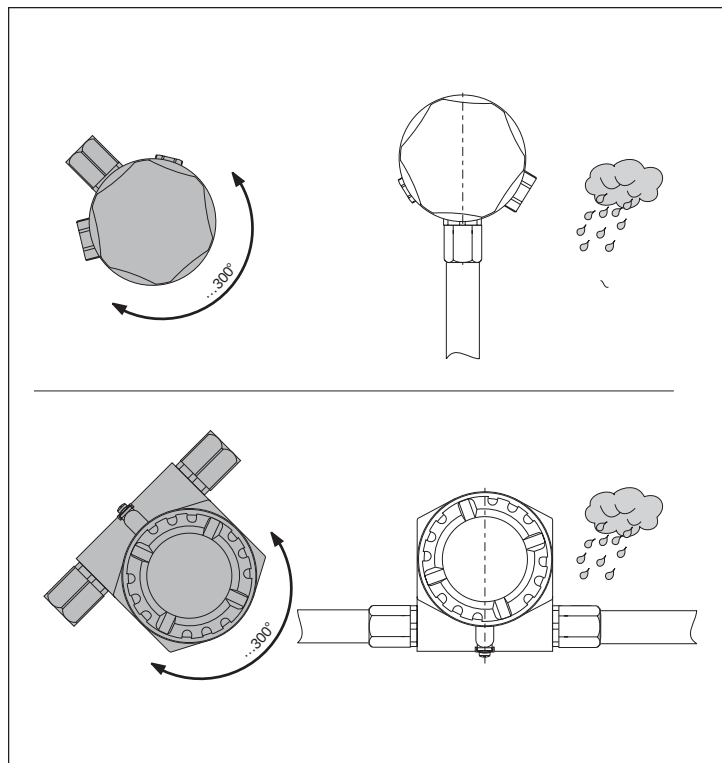


Figure 3.5  
Cable entry orientation

# 4 Setup and Connections

## 4.1 Setup

Minimum/maximum fail-safe mode

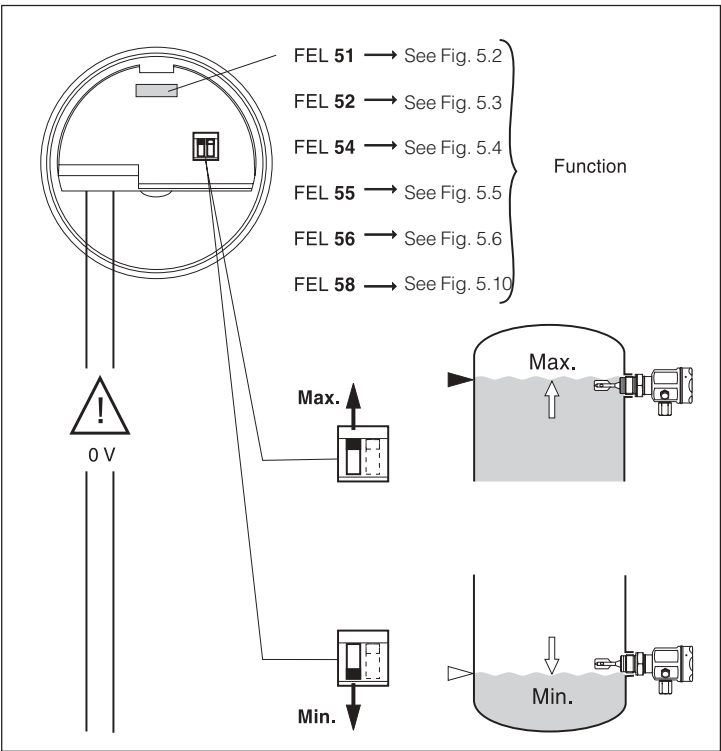


Figure 4.1  
Minimum/Maximum fail-safe mode

Liquid density: Density  $\rho$  measured in  $\text{g}/\text{cm}^3$  (SGU) or in  $\text{kg}/\text{l}$ .

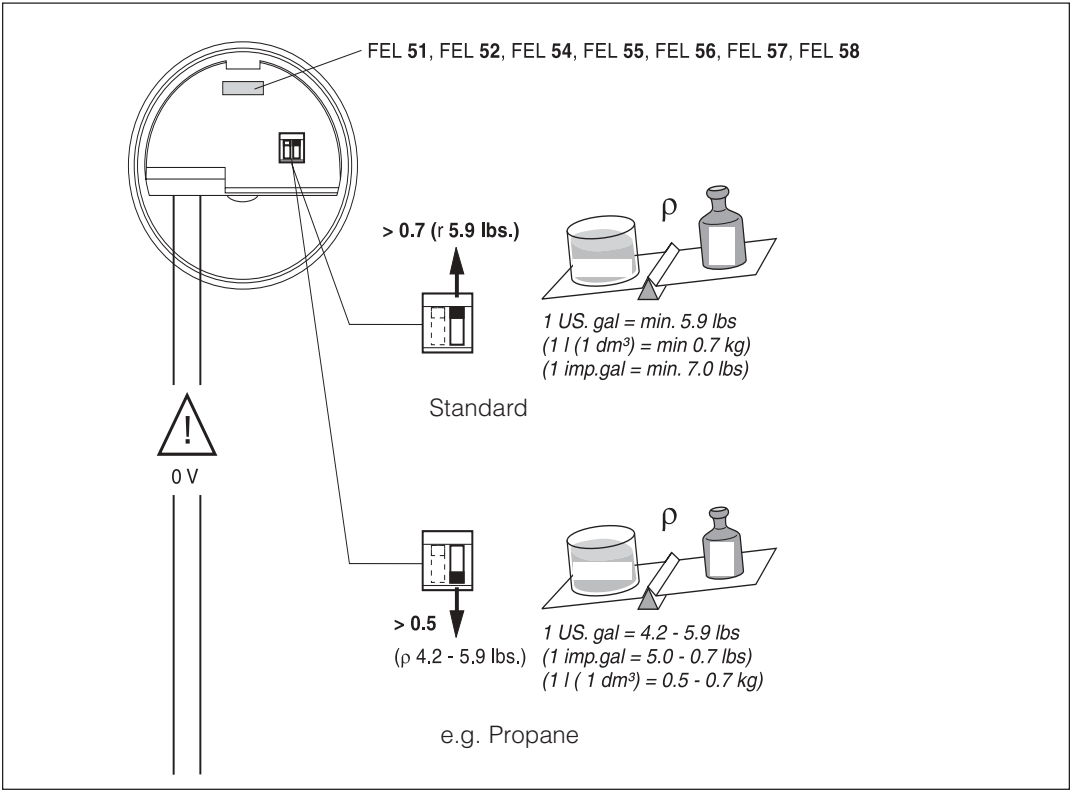


Figure 4.2  
Liquid density

## FEL 57

Functional test:

Test phase on switch-on (see figures 5.8 and 5.9 and switching unit for sequence).

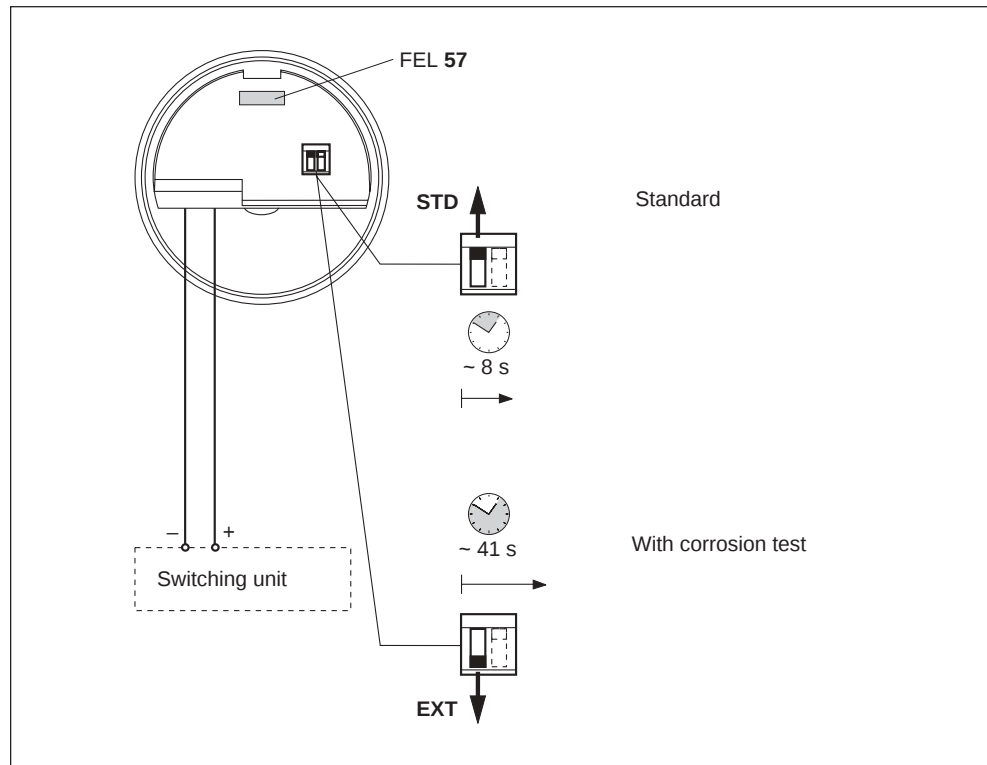
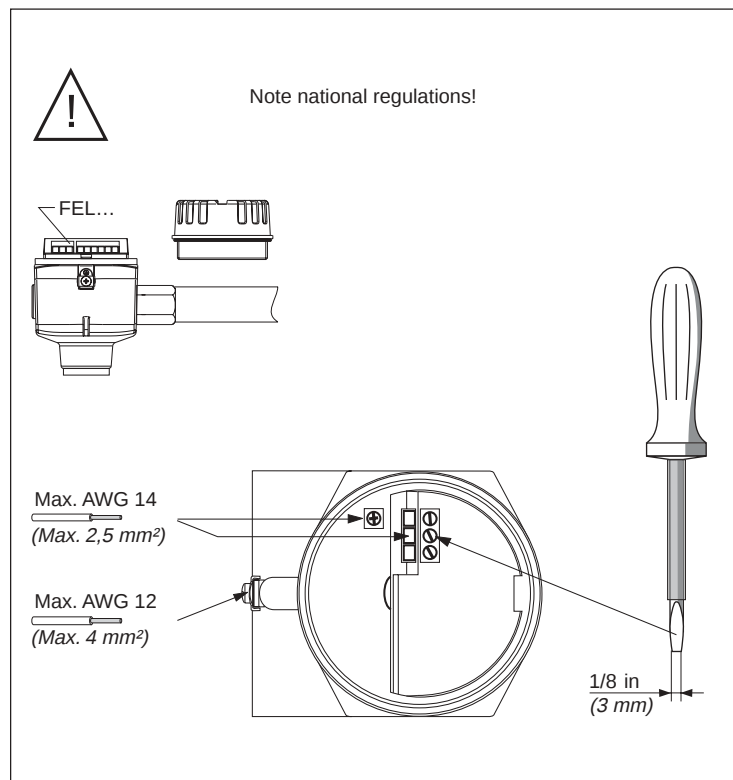


Figure 4.3  
FEL 57  
Functional Test

## 4.2 Connections

Note National Electrical Codes.



**Connections FEL 51**  
Two-wire AC connection

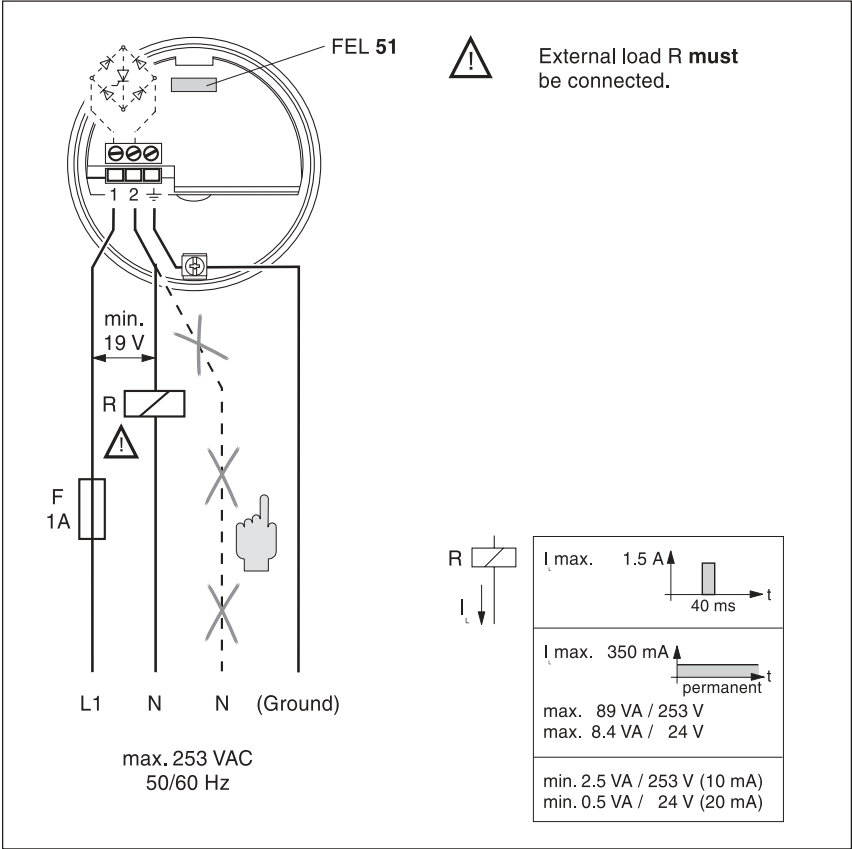


Figure 4.4  
FEL 51  
Two-wire AC connection

**Connections FEL 52**  
DC connection (PNP transistor)

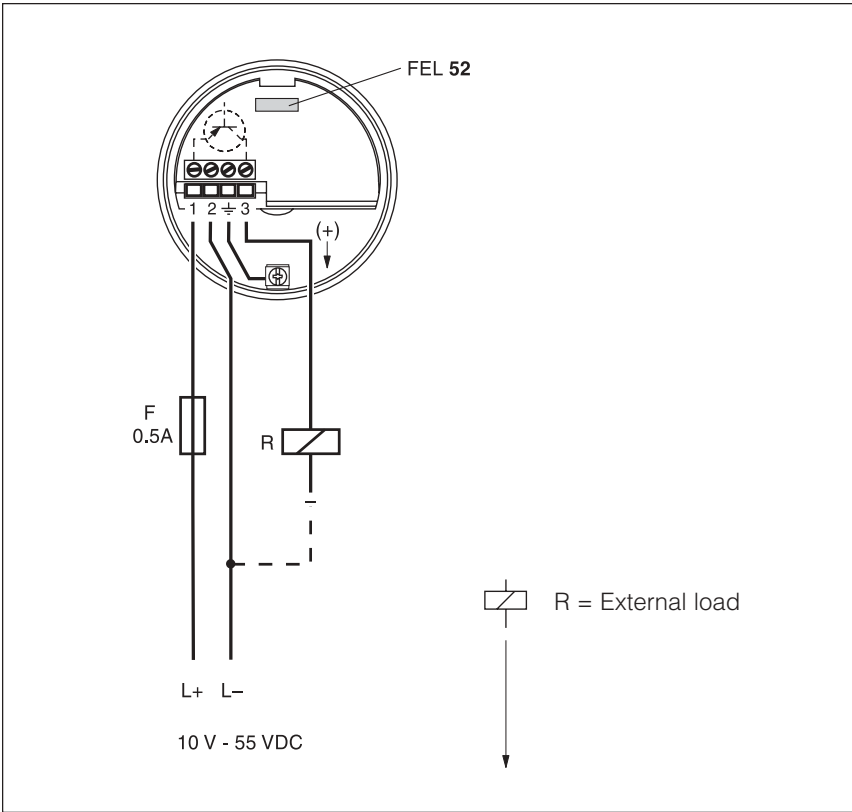


Figure 4.5  
FEL 52  
DC Connection (PNP)

## Connections FEL 54

Universal connection

Relay output

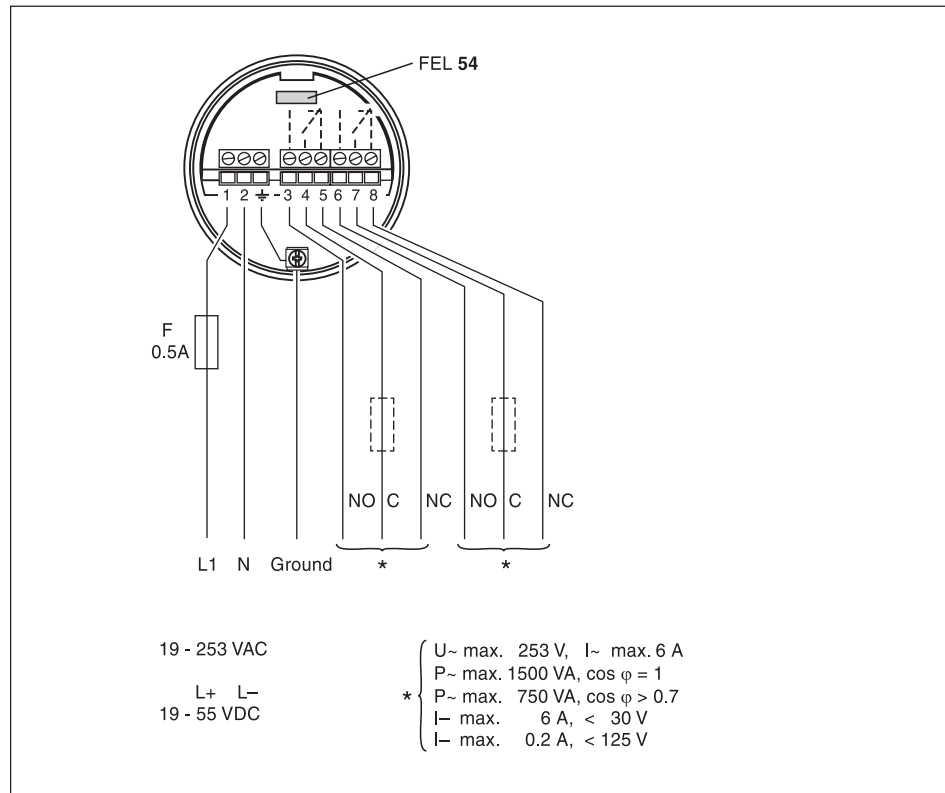


Figure 4.6  
FEL 54  
Universal connection  
Relay output

## Connections FEL 55

Output

16 / 8 mA (4-20)

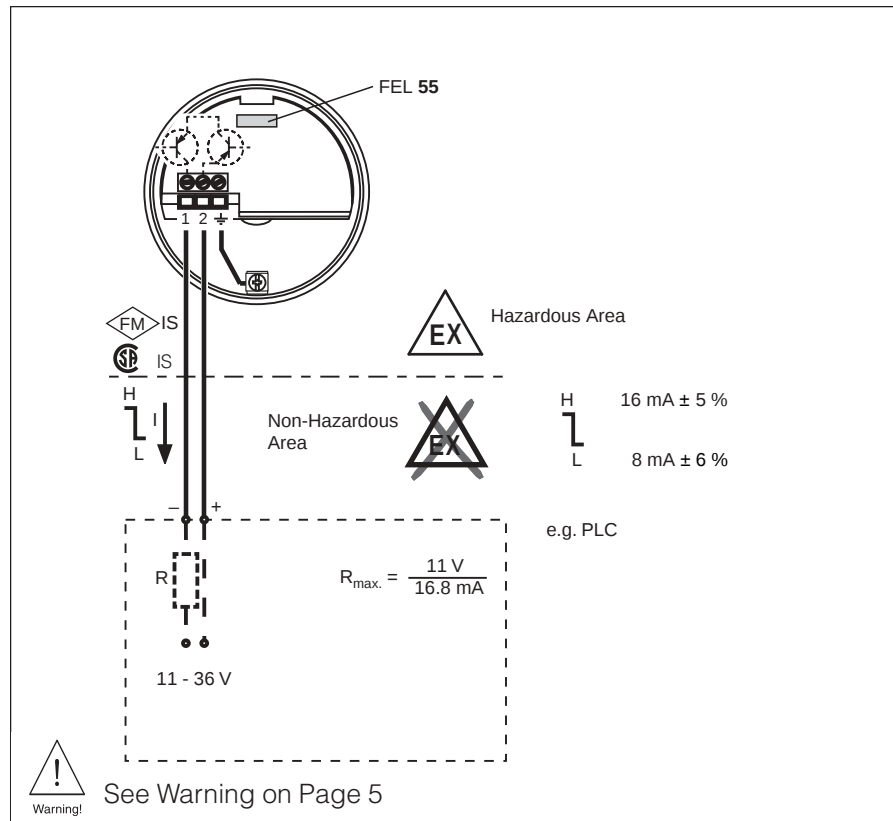


Figure 4.7  
FEL 55  
Output  
16 / 8 mA (4-20)

**Connections FEL 56**

NAMUR output  
<1.0 mA / > 2.1 mA

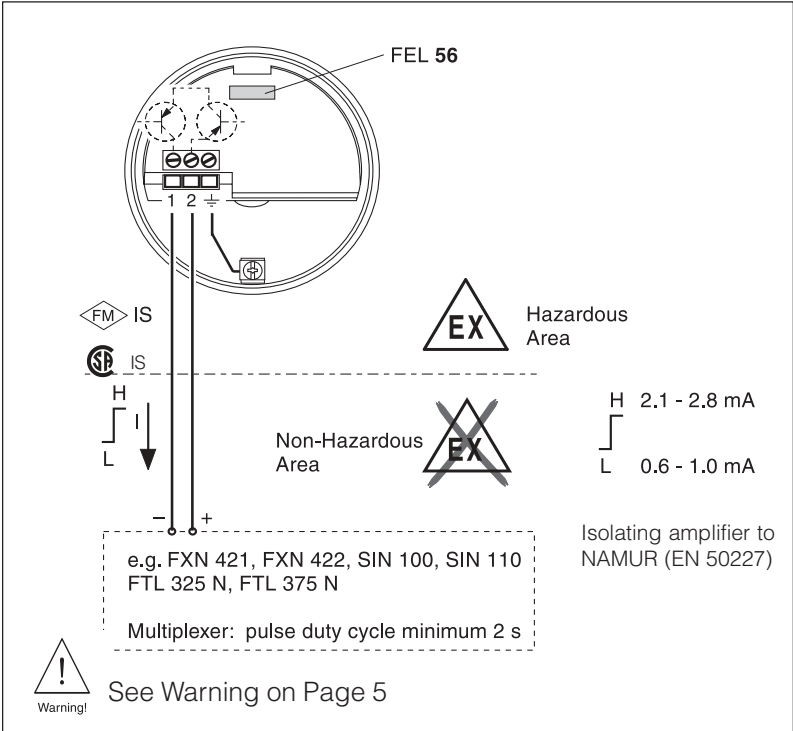


Figure 4.8  
FEL 56  
NAMUR output  
<1.0 mA / > 2.1 mA

**Connections FEL 57**

PFM output  
150 Hz / 50 Hz

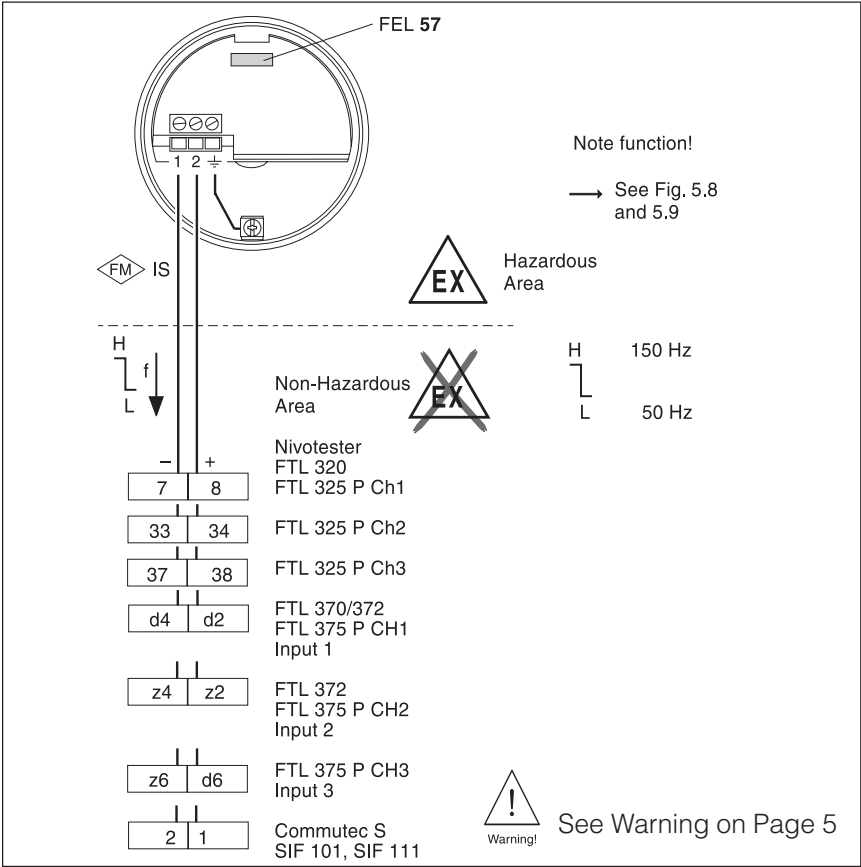


Figure 4.9  
FEL 57  
PFM output  
150 Hz / 50 Hz

### Connections FEL 58

NAMUR output H-L

>2.1 mA / <1.0 mA

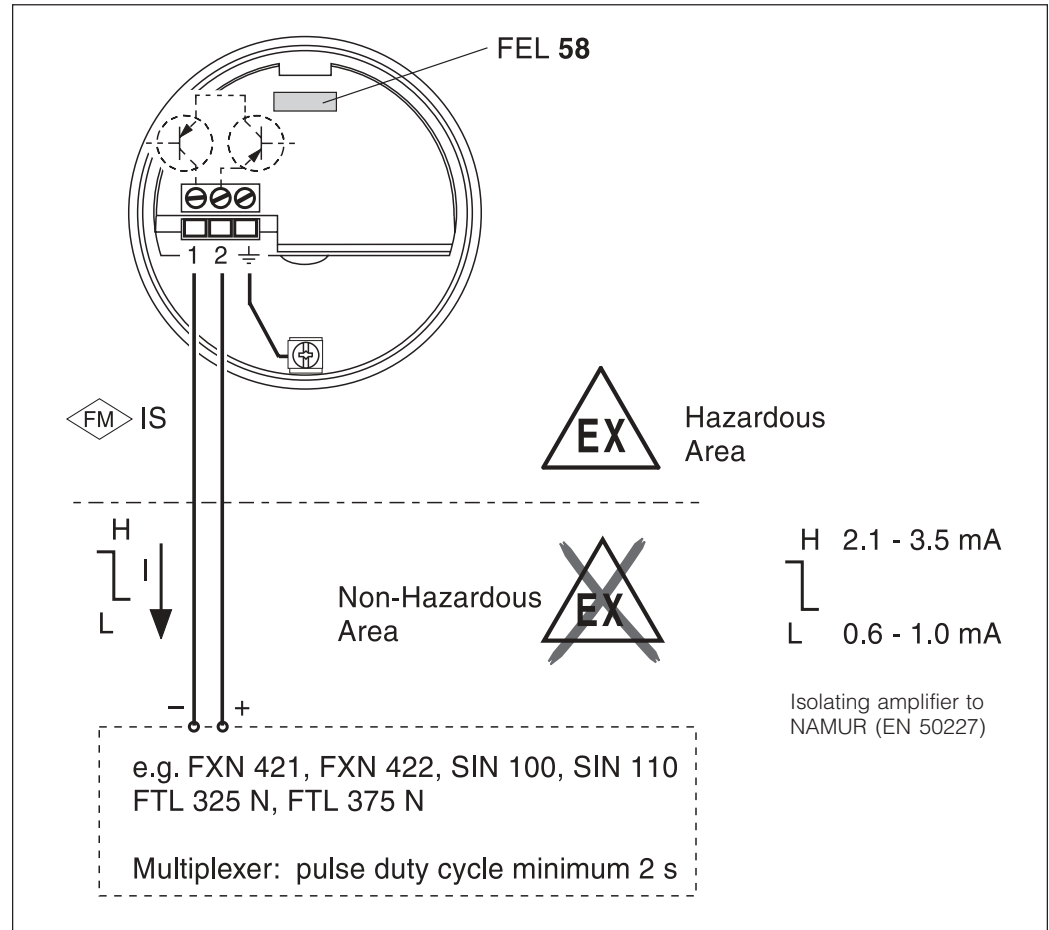


Figure 4.10  
FEL 58  
NAMUR output H-L  
>2.1 mA / <1.0 mA

# 5 Function

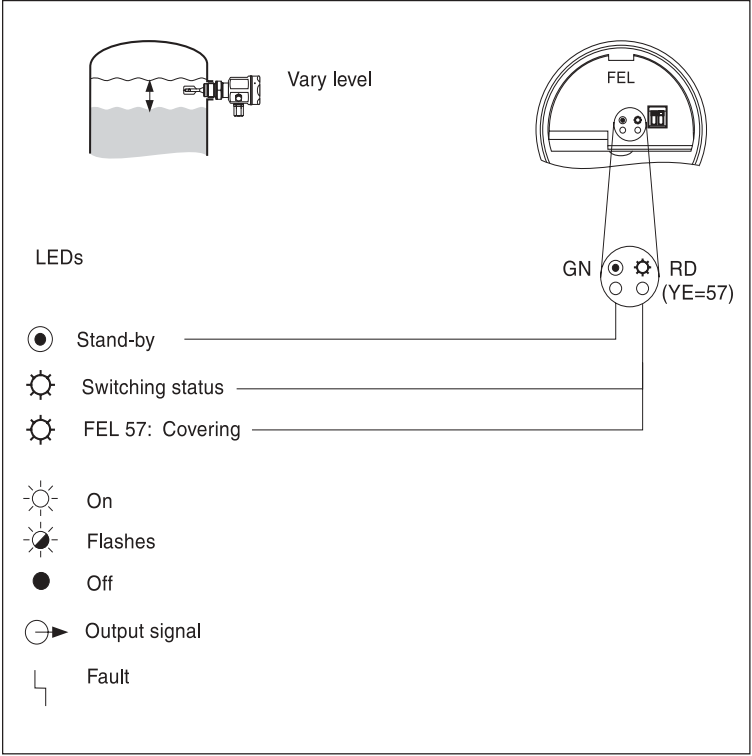


Figure 5.1  
Display elements

## Function FEL 51

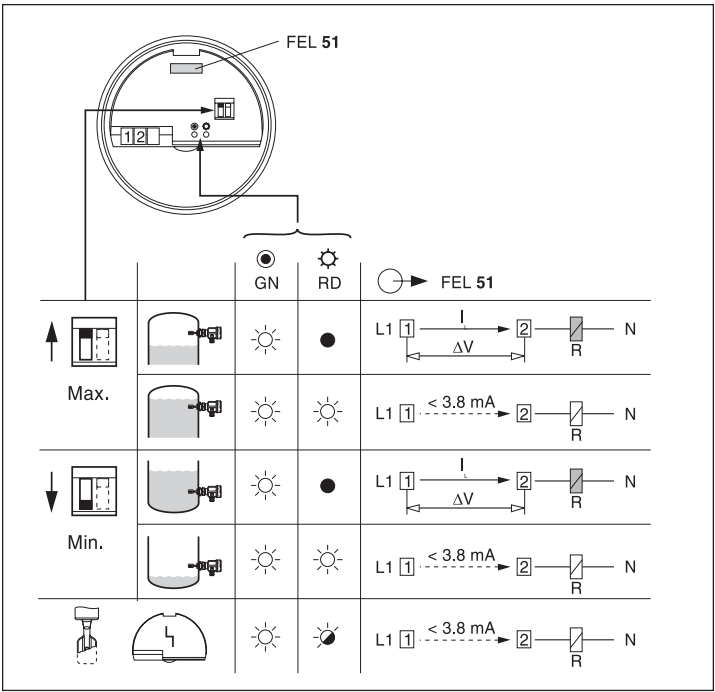


Figure 5.2  
FEL 51

## Function FEL 52

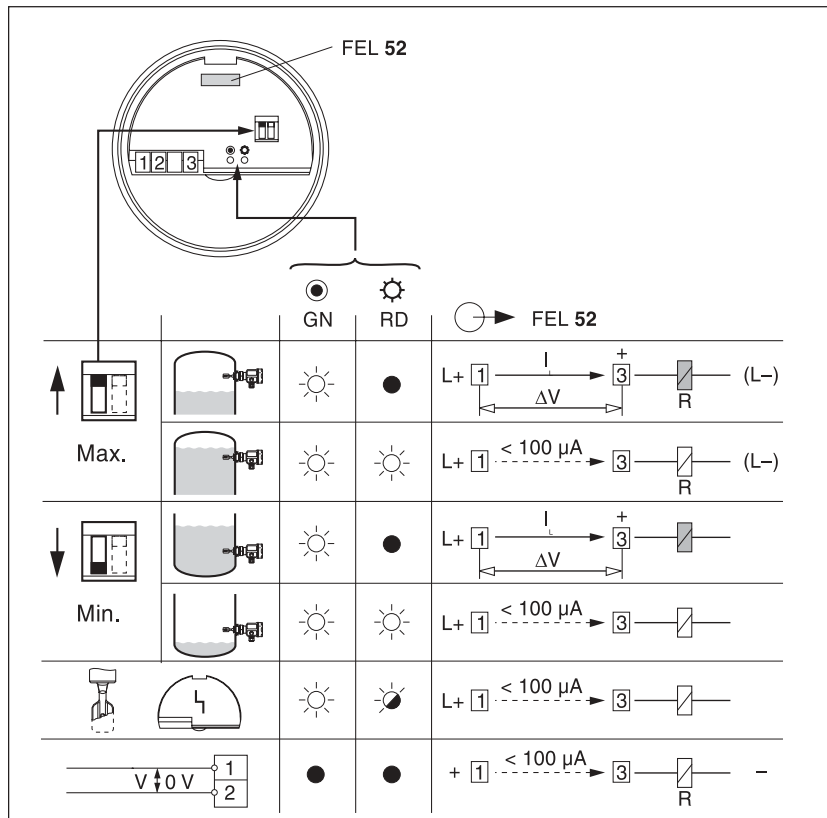


Figure 5.3  
FEL 52

## Function FEL 54

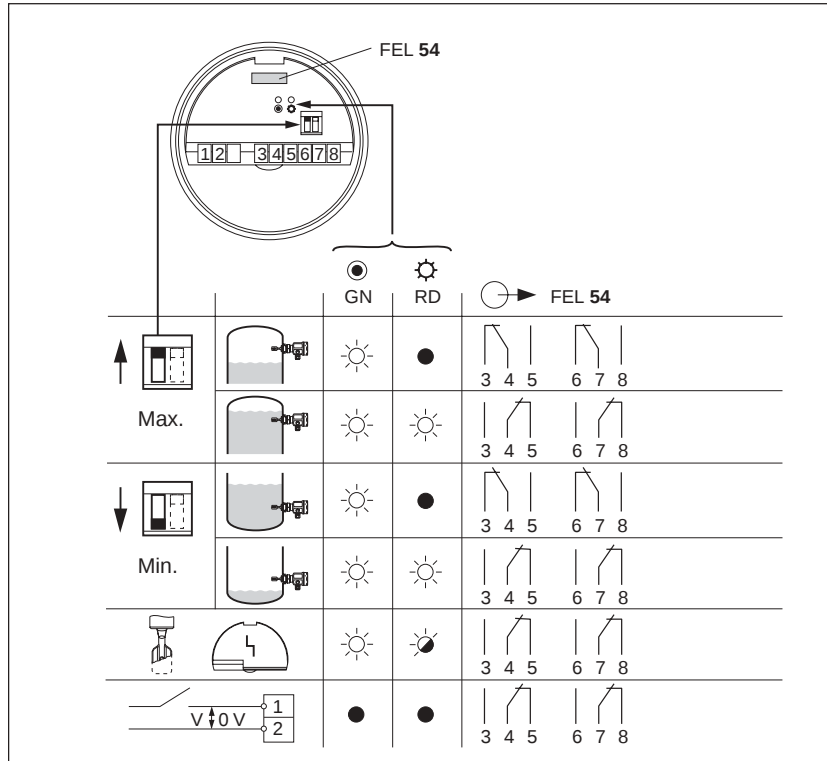


Figure 5.4  
FEL 54

Function FEL 55

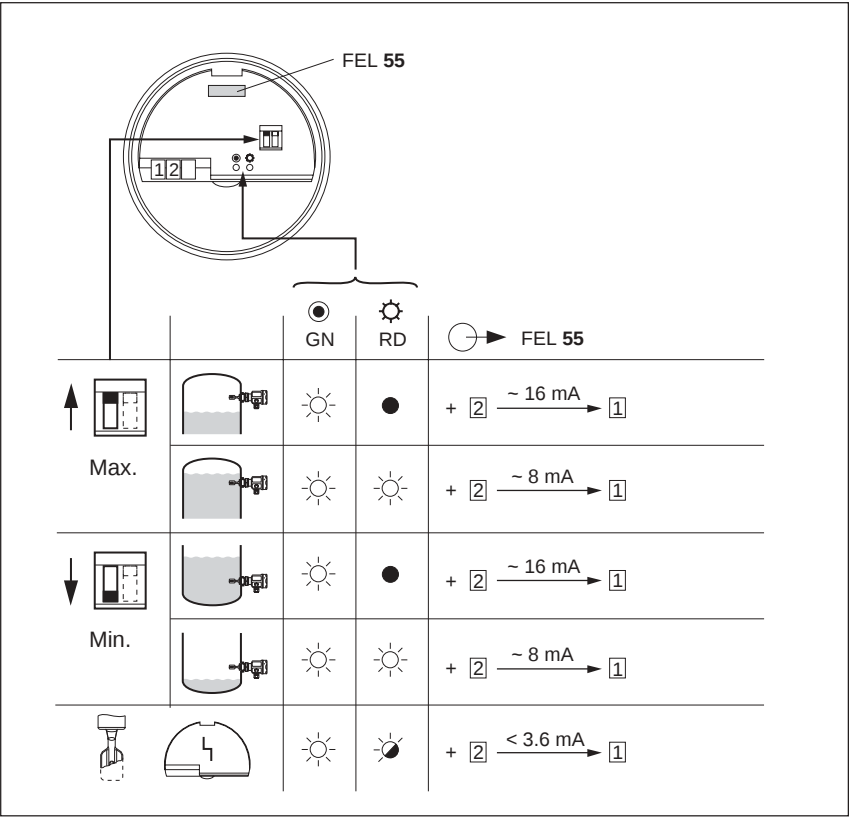


Figure 5.5  
FEL 55

Function FEL 56

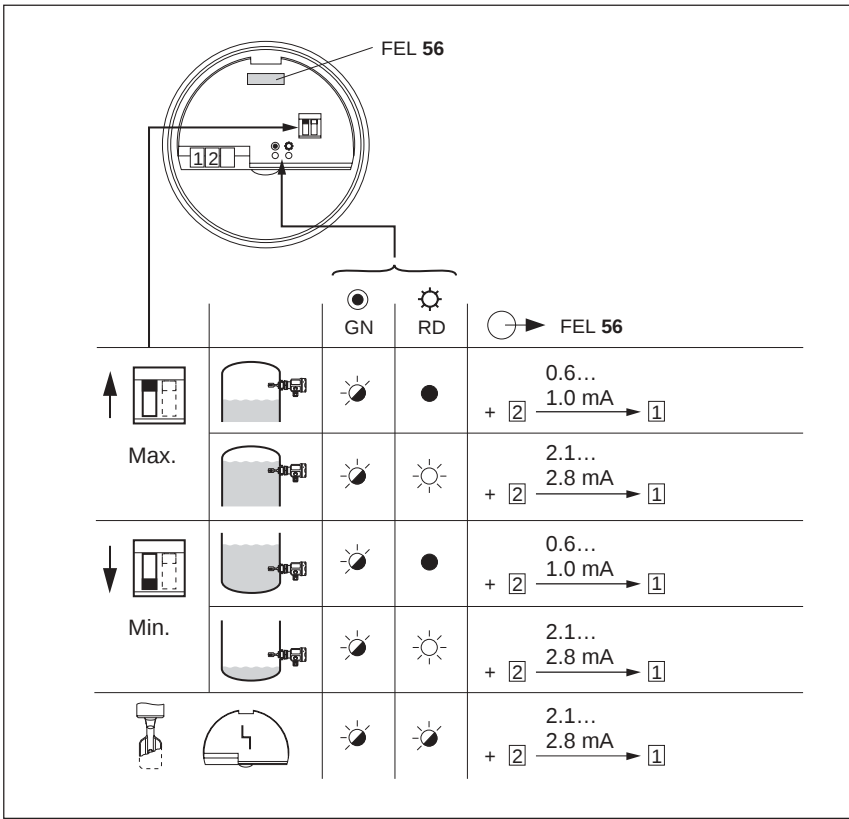


Figure 5.6  
FEL 56

## Function FEL 57

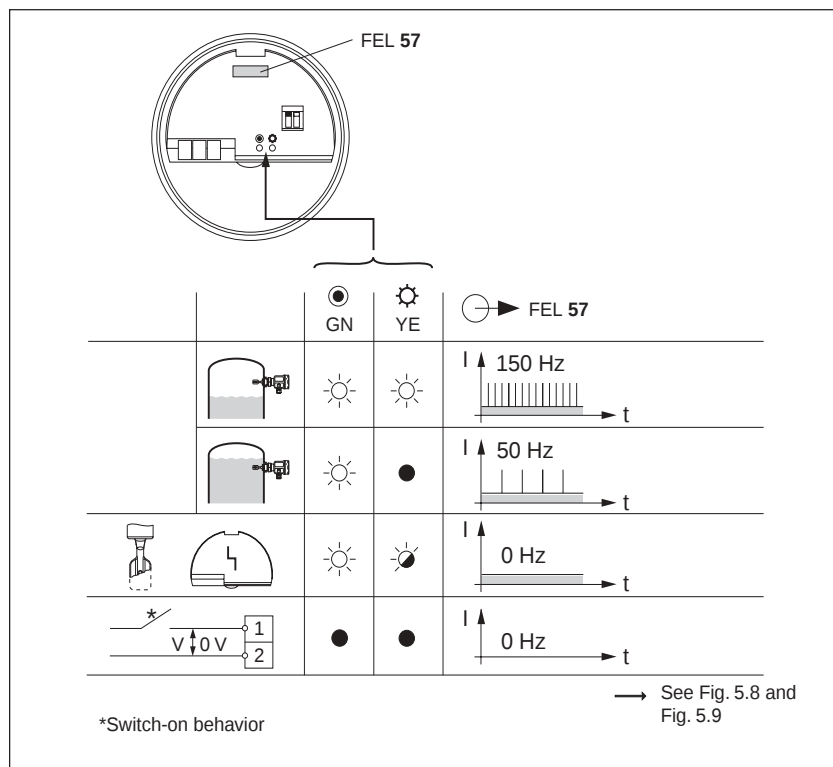


Figure 5.7  
FEL 57

Function FEL 57 Switch-on behavior STD (Test phase\*)

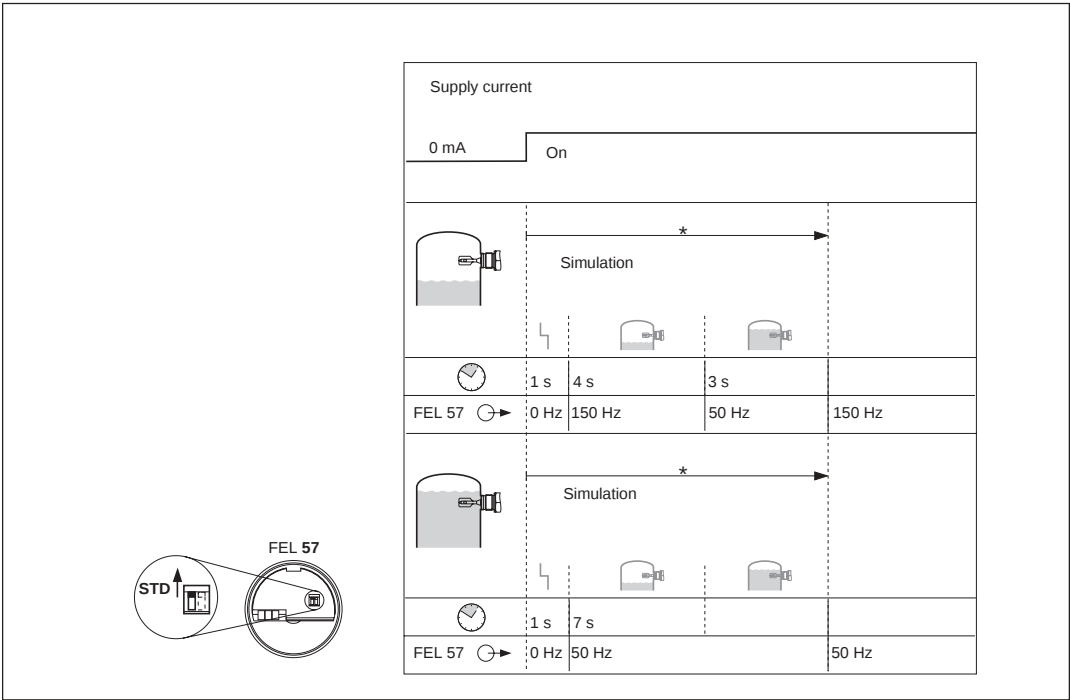


Figure 5.8  
FEL 57  
Switch-on behavior STD

Function FEL 57 Switch-on behavior EXT (Test phase\*)

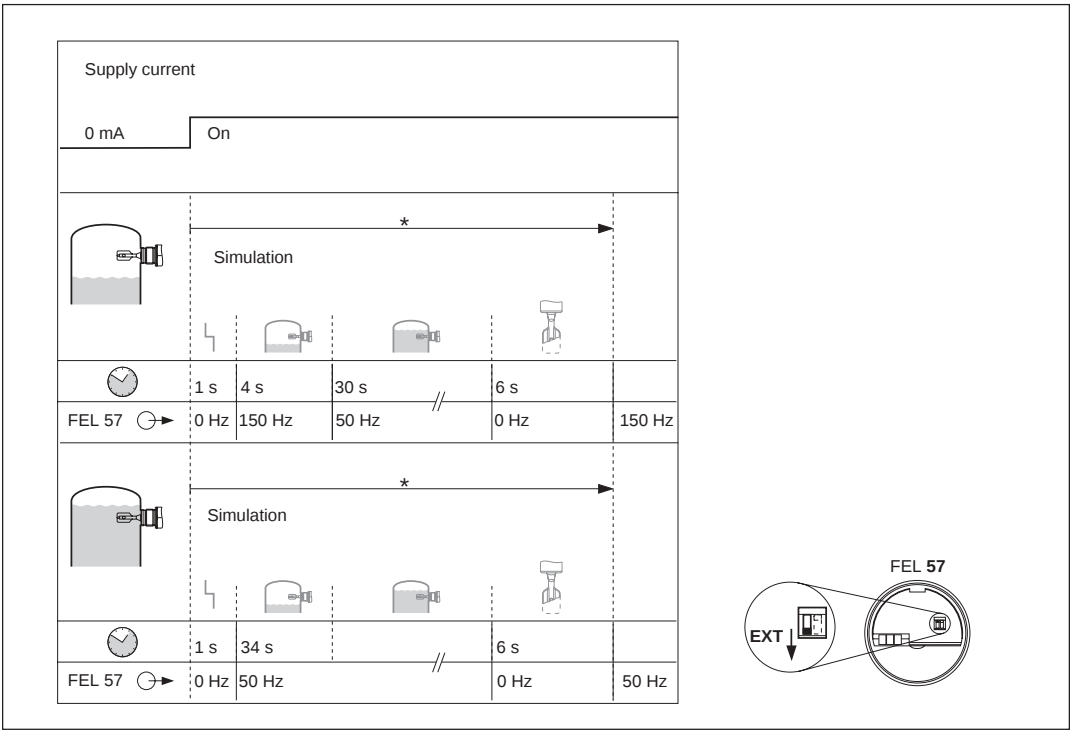


Figure 5.9  
FEL 57  
Switch-on behavior EXT

## Function FEL 58

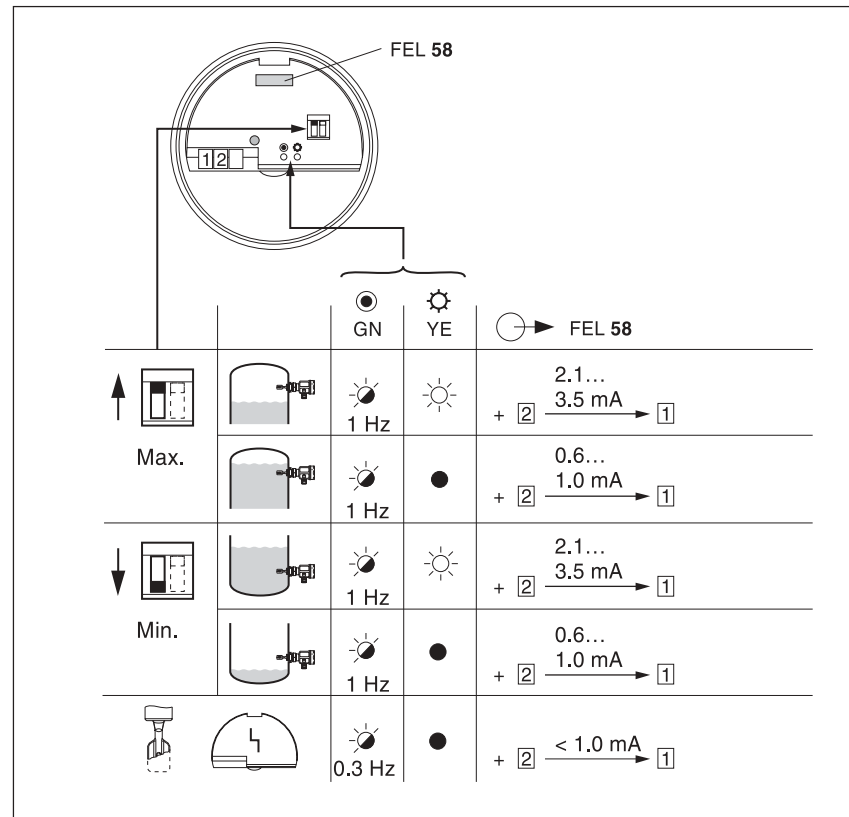
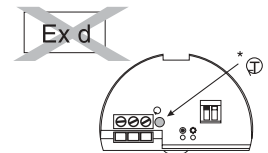


Figure 5.10  
FEL 58

| Normal operation | Test button |                 | Operation   |
|------------------|-------------|-----------------|-------------|
| Max.<br>Min.     | GN<br>YE    | ① min. 3 s<br>② | ~ 2 s later |
| Max.<br>Min.     | GN<br>YE    | GN<br>YE        | GN<br>YE    |
| Max.<br>Min.     | GN<br>YE    | GN<br>YE        | GN<br>YE    |
| Max.<br>Min.     | GN<br>YE    | GN<br>YE        | GN<br>YE    |
| Max.<br>Min.     | GN<br>YE    | GN<br>YE        | GN<br>YE    |

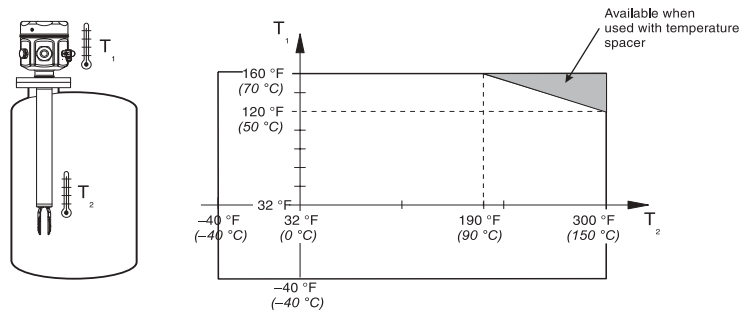
Figure 5.11  
FEL 58 Test Button\*



## 6 Technical Data

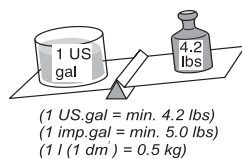
Ambient temperature T<sub>1</sub>

Process temperature T<sub>2</sub>

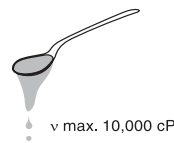


Process pressure  
p = max. 580 psig (40 bar)  
Depending on process connection

Density  $\rho$



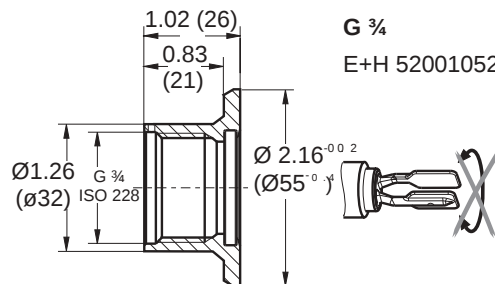
Viscosity  $\nu$



### 6.1 Accessories

Weld-in sockets

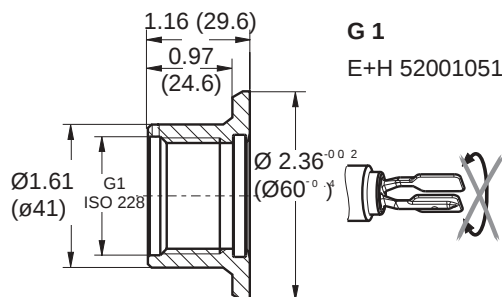
AISI 316 L  
(1.4435)



**G 3/4**  
E+H 52001052

max. 360 psi/300°F  
(max. 25 bar/150°C)

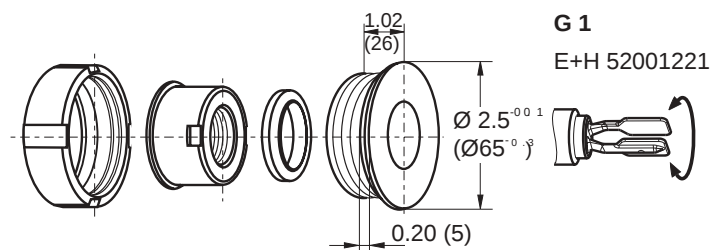
max. 580 psi/210°F  
(max. 40 bar/100°C)



**G 1**  
E+H 52001051

max. 360 psi/300°F  
(max. 25 bar/150°C)

max. 580 psi/210°F  
(max. 40 bar/100°C)

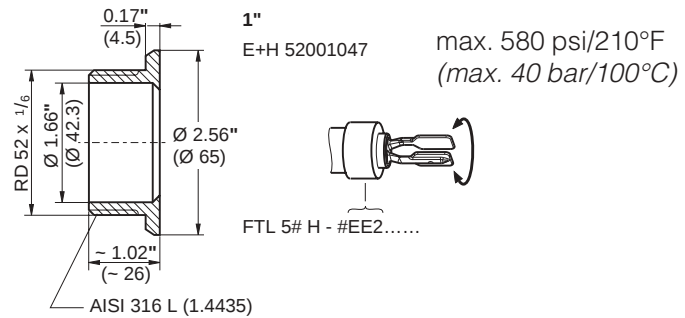


**G 1**  
E+H 52001221

max. 580 psi/210°F  
(max. 40 bar/100°C)

Dimensions are in inches (mm)

Weld-in adapter



## 6.2 Spare Parts

### Electronic inserts



Warning!

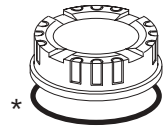


|        |              |
|--------|--------------|
| FEL 51 | E+H 52002304 |
| FEL 52 | E+H 52002305 |
| FEL 54 | E+H 52002306 |
| FEL 55 | E+H 52002307 |
| FEL 56 | E+H 52002308 |
| FEL 57 | E+H 52002309 |
| FEL 58 | E+H 52006454 |

#### Warning!

FEL 55, FEL 56 and FEL 57 that have been used in **non-explosion hazardous areas may not** be re-used in explosion hazardous areas.

### Housing covers, seals



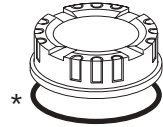
Alu w/EPDM O-ring

E+H 52002699



Alu EX w/EPDM O-ring

E+H 52002698



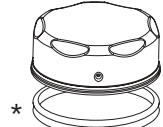
PBT-FR (cover only)

E+H 943461-0000



EPDM O-ring

E+H 017717-0003



AISI 304/316L (cover only)  
(1.4301/1.4435)

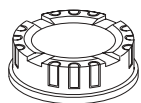
E+H 943301-0000



MVQ Silicone Seal

E+H 943304-0000

\* Lubricate with silicone grease or graphite



PA 12

Transparent cover for  
Plastic housing  
E+H 943461-0001



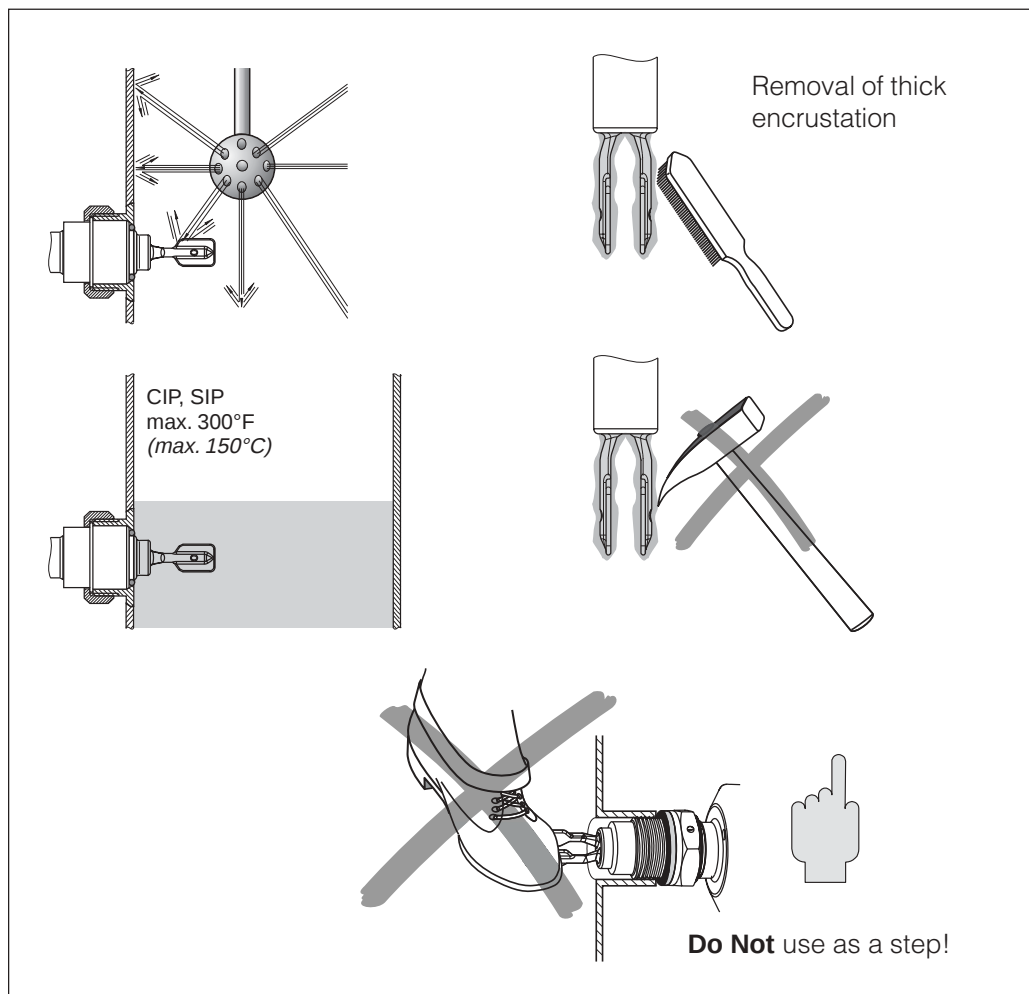
AISI 316L  
(1.4435)

Stainless Steel cover  
with glass window for SS housing  
E+H 943301-1000

with polycarbonate window  
E+H 52001403

## 7 Maintenance & Troubleshooting

### 7.1 Maintenance

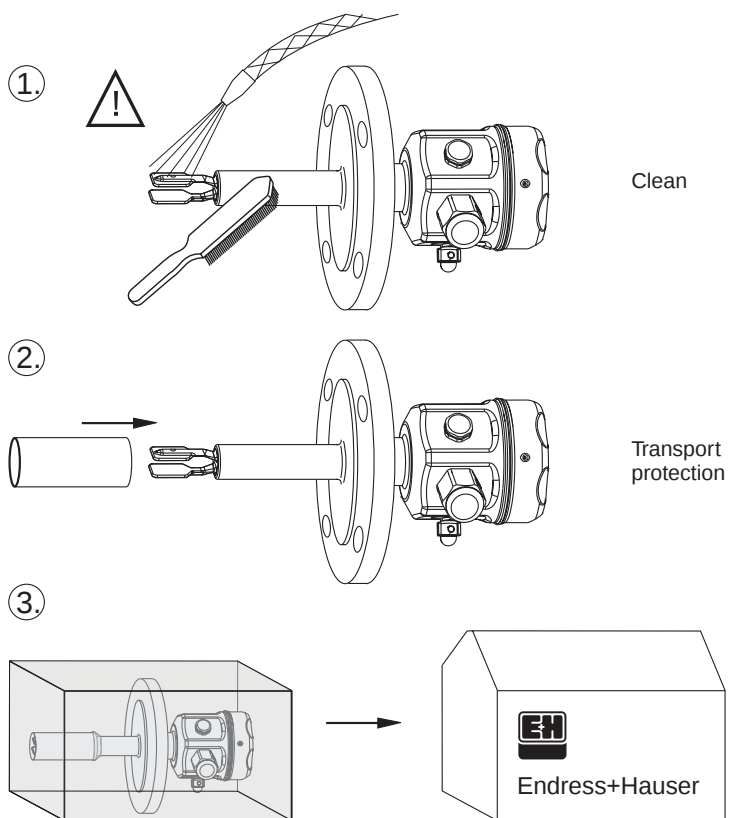


## 7.2 Troubleshooting

| Fault                                    | Reason                                                                                 | Remedy                                                                                        |
|------------------------------------------|----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
| Does not switch                          | No power                                                                               | Check power                                                                                   |
|                                          | Faulty signal line                                                                     | Check signal line                                                                             |
|                                          | Faulty electronic insert<br>– FEL 51 connected directly to L1 and N                    | Exchange<br>–always connect FEL 51 via external load                                          |
|                                          | Density of liquid too low                                                              | Set density to > 0.5 at electronic insert                                                     |
|                                          | Fork encrusted                                                                         | Clean fork                                                                                    |
|                                          | Fork corroded<br>(Indication on FEL: red/yellow flashes, FEL 58: green flashes 0.3 Hz) | Exchange fork and process connection                                                          |
|                                          | FEL 51: Internal resistance of connected relay too large                               | Connect suitable relay                                                                        |
|                                          | FEL 51: Holding current of connected relay too low                                     | Connected resistor in parallel with relay                                                     |
|                                          | FEL 54: Contacts welded together (after short-circuit)                                 | Exchange FEL 54; put fuse in contact circuit                                                  |
| Switches incorrectly                     | Min- / Max- fail-safe mode set wrong                                                   | Set correct mode at electronic insert                                                         |
| Sporadic faulty switching                | Thick heavy foam, very turbulent conditions, foaming liquid                            | Mount Liquiphant in bypass                                                                    |
|                                          | Extreme RFI                                                                            | Use shielded cable                                                                            |
|                                          | Extreme vibration                                                                      | Decouple, damp, turn fork 90°                                                                 |
|                                          | Water in housing                                                                       | Screw cover and cable gland tight                                                             |
|                                          | FEL 52: Output overloaded                                                              | Reduce load, (cable) capacitance                                                              |
| Switches incorrectly after power failure | FEL 57, Behavior during switch-on test (functional test)                               | Observe switching behavior of FEL 57; After power failure block plant control for up to 45 s. |

## 7.3 Repair

at Endress+Hauser



See page 2 (RA Policy)

## 7.4 Order Codes

Liquiphant M FTL 50 H – 

|   |   |   |   |   |   |
|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|

FTL 50 H: Compact

FTL 51 H: With extension pipe

Liquiphant M FTL 51 H – 

|   |   |   |   |   |   |
|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|

### 1 *Certificates and Approvals*

- A General Purpose, without any special certificate
- P FM approved, intrinsically safe, CL I, II, III; Div. 1, Gr. A-G (inserts 55, 56, 57, 58 only)  
FM approved, dust ignition proof, CL II, III; Div. 1, Gr. E-G
- Q FM approved, explosion proof, CL I, II, III; Div. 1, Gr. B-G (Aluminum housing E7)  
Groups A-G if E5 housing selection is used  
FM approved, dust ignition proof, CL II, III; Div. 1, Gr. E-G
- R FM approved, non-incendive, CL I, Div. 2, Grp. A-D  
FM approved, special protection, CL II, III; Div. 2, Gr. F-G
- U CSA, General purpose
- S CSA, intrinsically safe, CL I, Gr. A-D; CL II, Gr. E-G; CL III (inserts 55, 56, 57, 58 only)
- T CSA, explosion proof, CL I, Gr. A-D; CL II, Gr. E-G; CL III  
CSA, non-incendive, CL 1, Div. 2, Gr. A-D; CL II, Div. 2 Gr. E-G; CL III (Aluminum housing only)
- Y Others

### 2 *Process Connection, Material*

- TC2 1½" Tri-clamp® / 316L SS (same size as 1" Tri-clamp®)
- TE2 2" Tri-clamp® / 316L SS
- EE2 Flush-mounted for 1" welded adapter / 316L SS
- WE2 Varivent® / 316L SS
- YY9 Others

### 3 *Length "L" Temp. Separator, 2nd line of def.*

- AD Compact, Ra < 0.5 µm, > 240 grit, 3-A sanitary (FTL 50 H only)
- ID Compact, Ra < 0.5 µm/240 grit/3-A sanitary + Temperature separator (FTL 50 H only)
- QD Compact, Ra < 0.5 µm/240 grit/ 3-A + 2nd line of defense (pressure-tight feedthrough (FTL 50 H only)
- DD\* 4.7" (118 mm), Ra < 0.5µm/240 grit/3-A sanitary (FTL 51 H only)
- CD Length (6" to 115"), Ra < 0.5 µm, > 240 grit, 3-A sanitary (FTL 51 H only)
- KD Temperature separator, length (6" to 115") Ra < 0.5 µm/240 grit/3-A sanitary (FTL 51 H only)
- LD\* Length type II, temperature separator, Ra < 0.5 µm/240 grit/3-A sanitary (FTL 51 H only)
- SD 2nd line of defense, Length in inches (6" to 115"), Ra < 0.5 µm/240 grit/3-A sanitary (FTL 51 H only)
- TD\* 2nd line of defense, Length type II, Ra < 0.5 µm/240 grit/3-A sanitary (FTL 51 H only)
- YY Others

\*Length type II, for replacing Liquiphant II (FTL 360, FTL 365, FDL 30 or FDL 35)

When replacing Liquiphant II with a Liquiphant M FTL 51, the switchpoint is the same when mounted vertically.

### 4 *Output*

#### **Electronic Insert**

- 1 FEL 51, two-wire, AC, 19 - 253 V
- 2 FEL 52, three-wire DC, 10 - 55 V, PNP transistor output
- 4 FEL 54, universal, 19 - 253 VAC, 19 - 55 VDC, potential-free DPDT relay
- 5 FEL 55, two-wire DC 11 - 36 V, Output 8/16 mA, I.S.
- 6 FEL 56, two-wire acc. to NAMUR (EN 50227), I.S.
- 7 FEL 57, PFM signal transmission on two-wire cabling, I.S.
- 8 FEL 58, NAMUR with push button
- 9 Special version

### 5 *Housing, Cable Entry*

- E4 Polyester housing NEMA 4X, adapter ½" NPT
- E5 Aluminum housing NEMA 4X, ¾" NPT
- E6 Stainless Steel housing NEMA 4X, adapter ½" NPT
- E7 Aluminum housing, NEMA 4X, NPT with separate connection compartment (see separate instruction manual KA 164F)
- Y9 Others

### 6 *Additional Fittings*

- A Basic fittings
- C 3.1.B material certificate
- Y Other fittings



For more Endress+Hauser product please visit: [www.ainstru.com](http://www.ainstru.com)

Mail: [Sales@ainstru.com](mailto:Sales@ainstru.com)

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in the U.S. call 888-ENDRESS

For total support of your installed base, 24 hours a day,  
in the U.S. call 800-642-8737

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