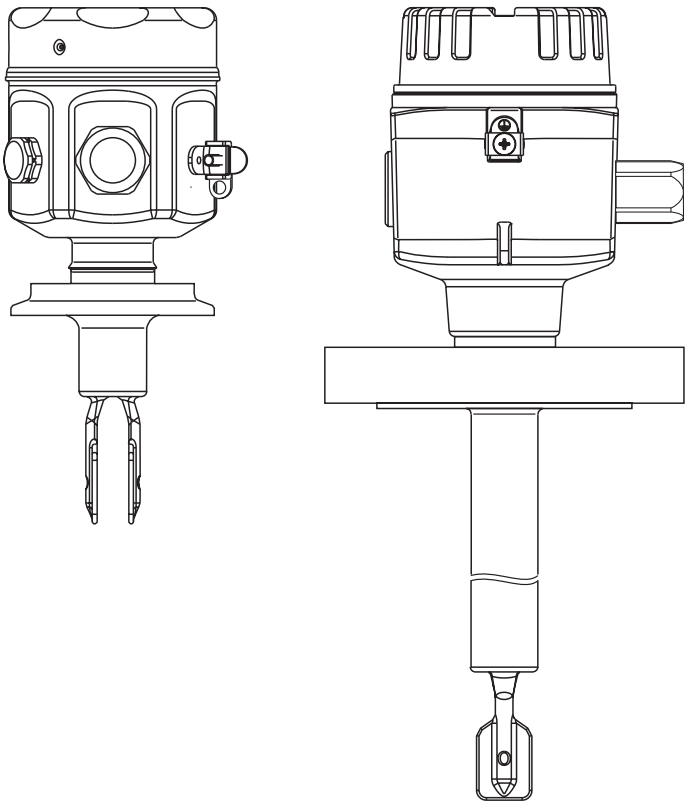
BA 214F/24/ae/04.02
52005009

liquiphant M
FTL 50 H, FTL 51 H

Level Limit Switch



Endress+Hauser

The Power of Know How

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

Table of Contents

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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.

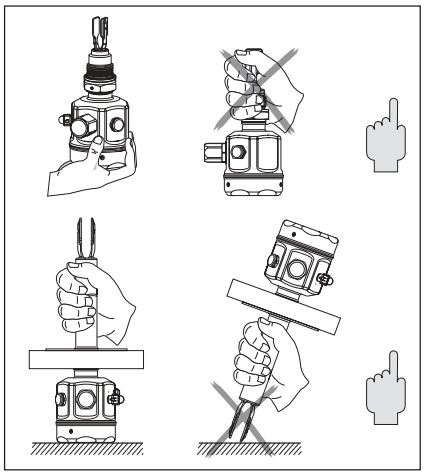


Figure 1.1

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

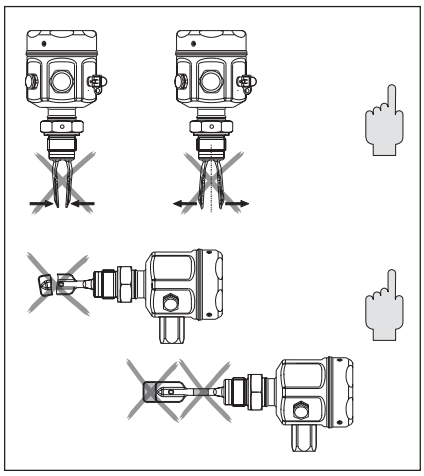


Figure 1.2

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°F and 300°F (–40°C and 150°C)
- with a pressure up to 580 psig (40 bar) depending on process connection

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.

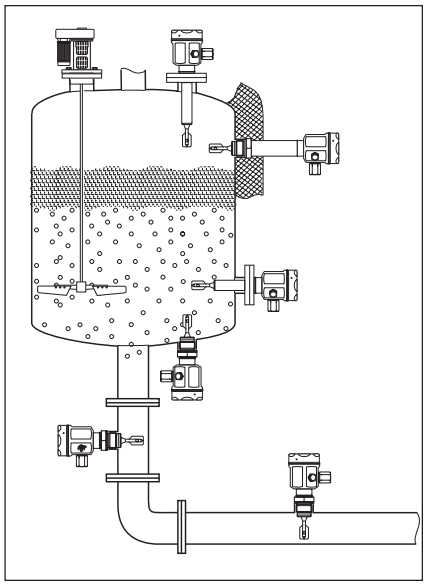


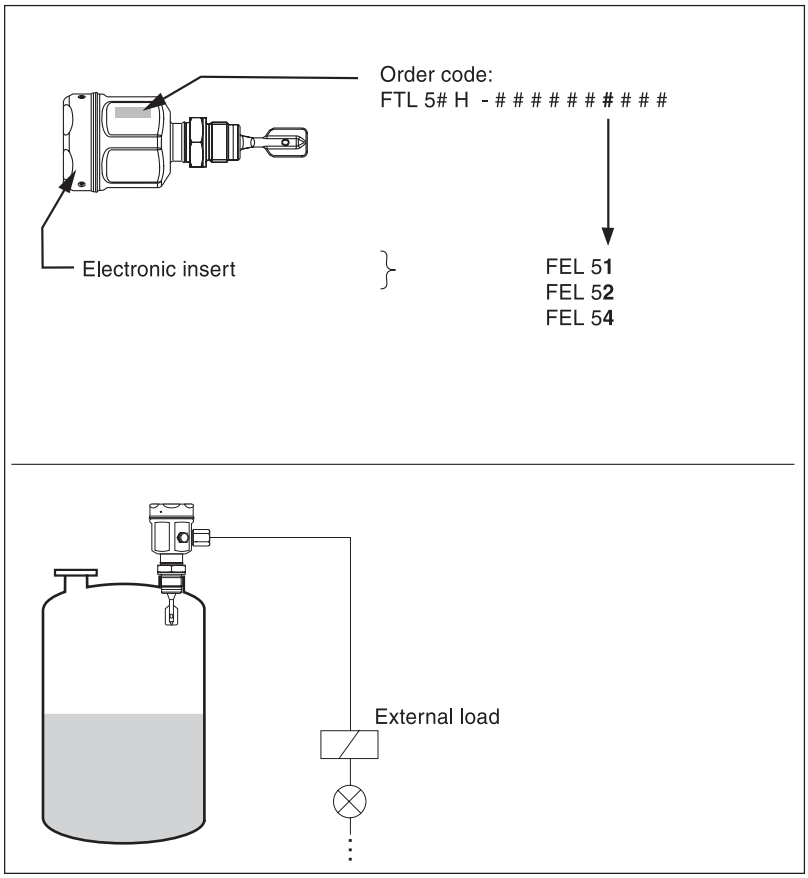
Figure 2.1
Level limit detection in liquids

2.2 Measurement Principle

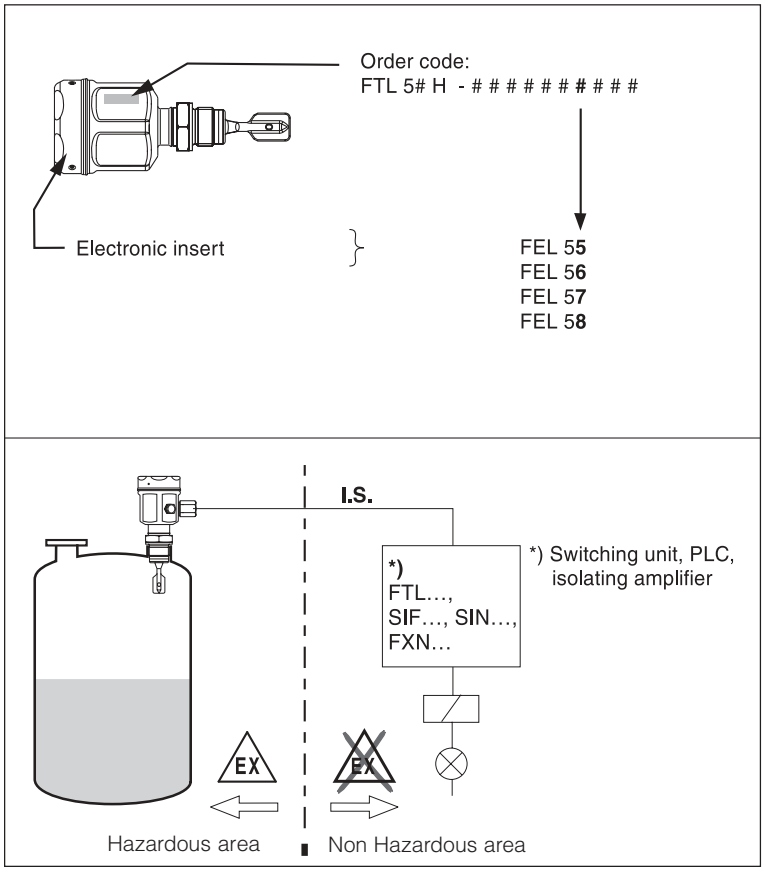
The forks vibrate at their resonant frequency. This frequency is reduced when covered with liquid. The change in frequency then activates a limit switch.

2.3 Measuring System

- For direct connection



- 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**.

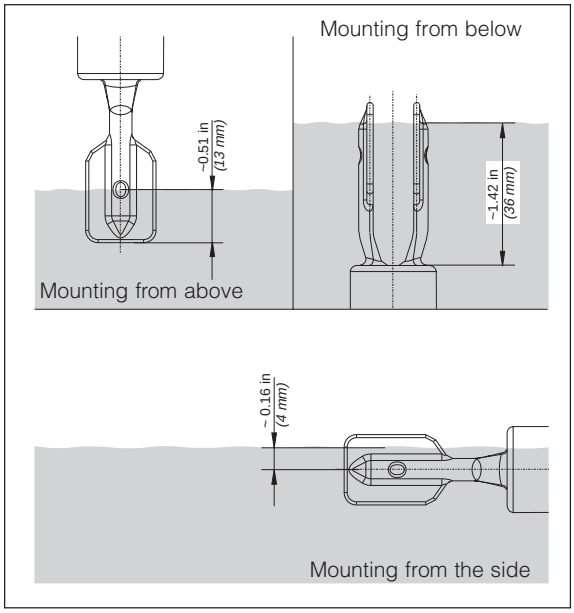


Figure 3.1
Mounting positions

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

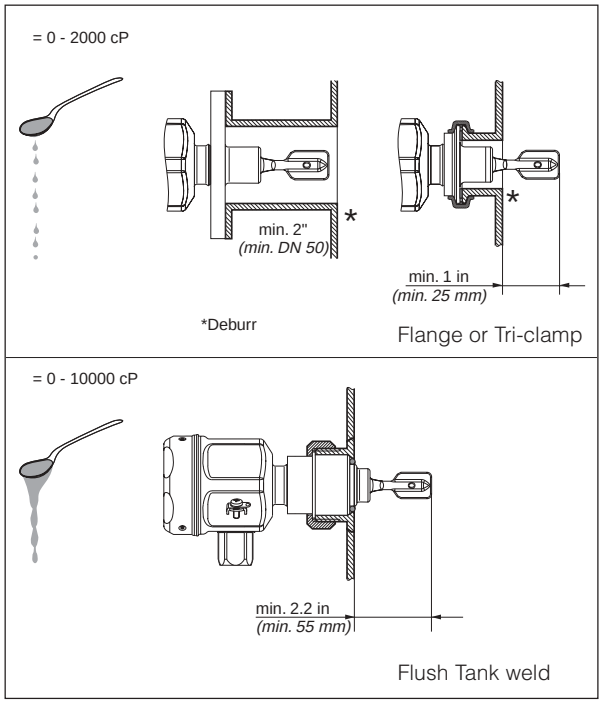


Figure 3.2
Mounting examples with regard to liquid viscosity

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.

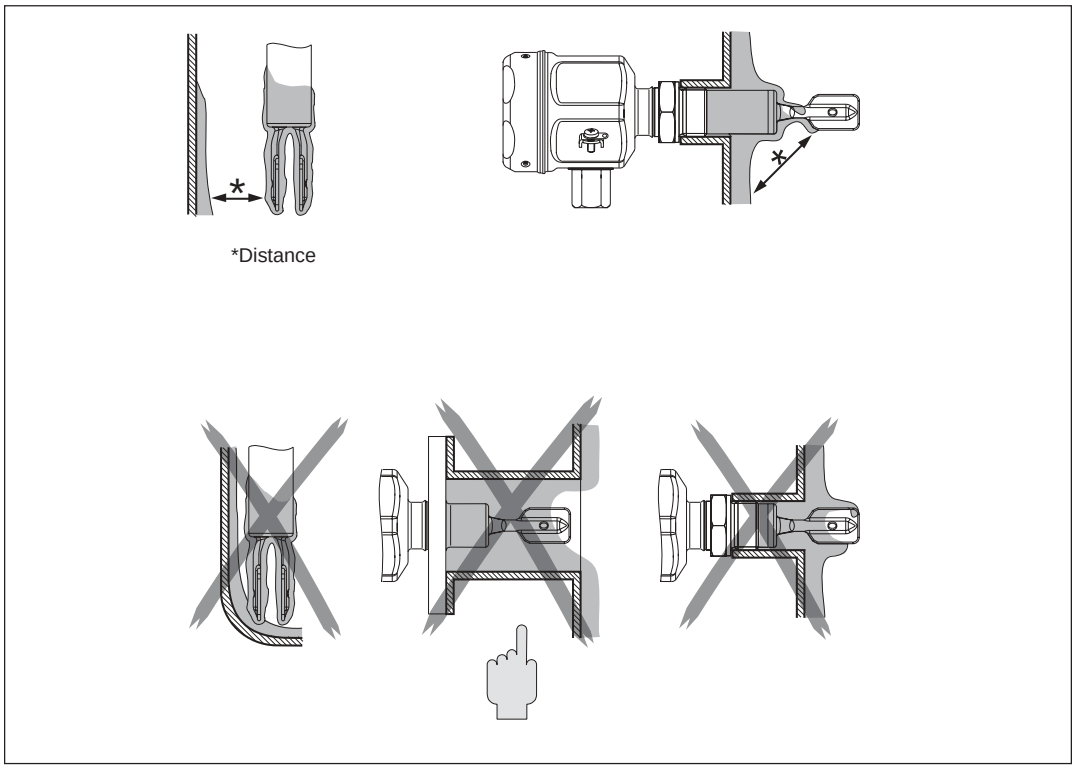
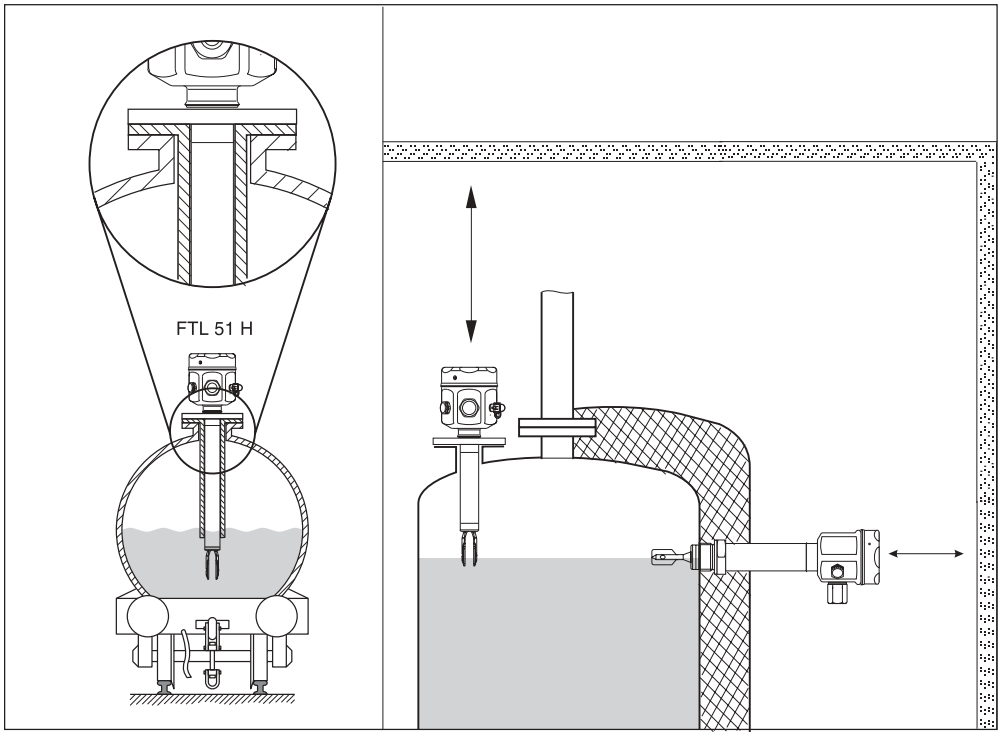


Figure 3.3
Fork may not contact the build-up

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.

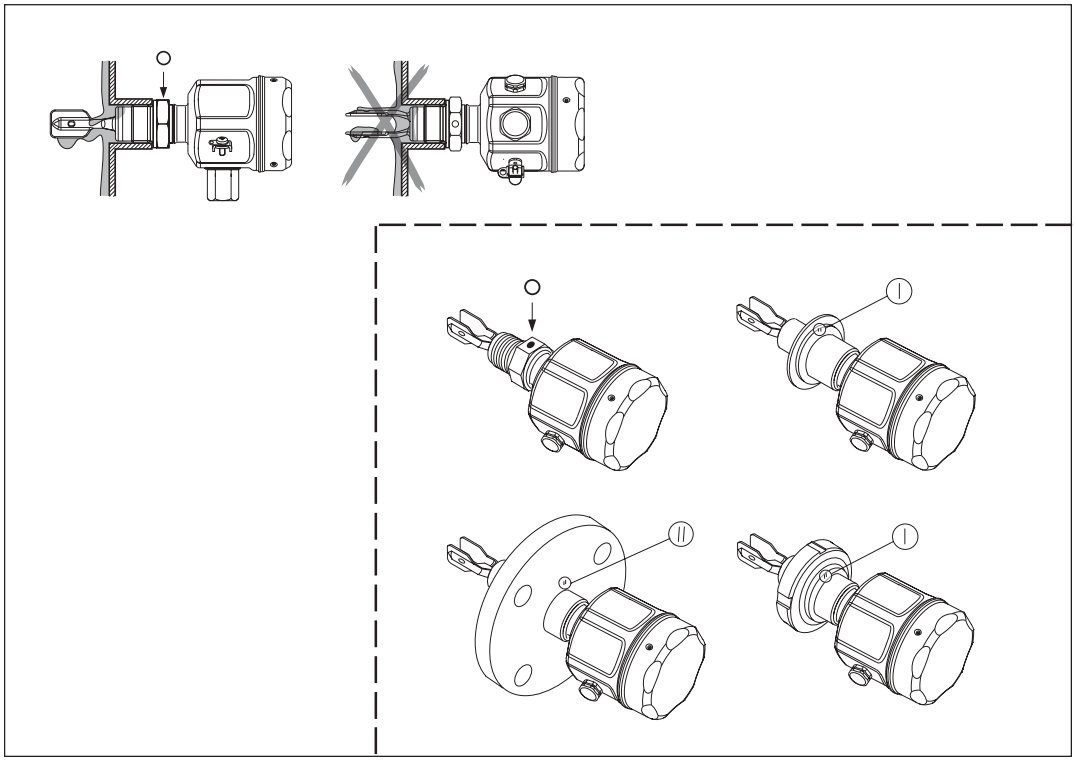
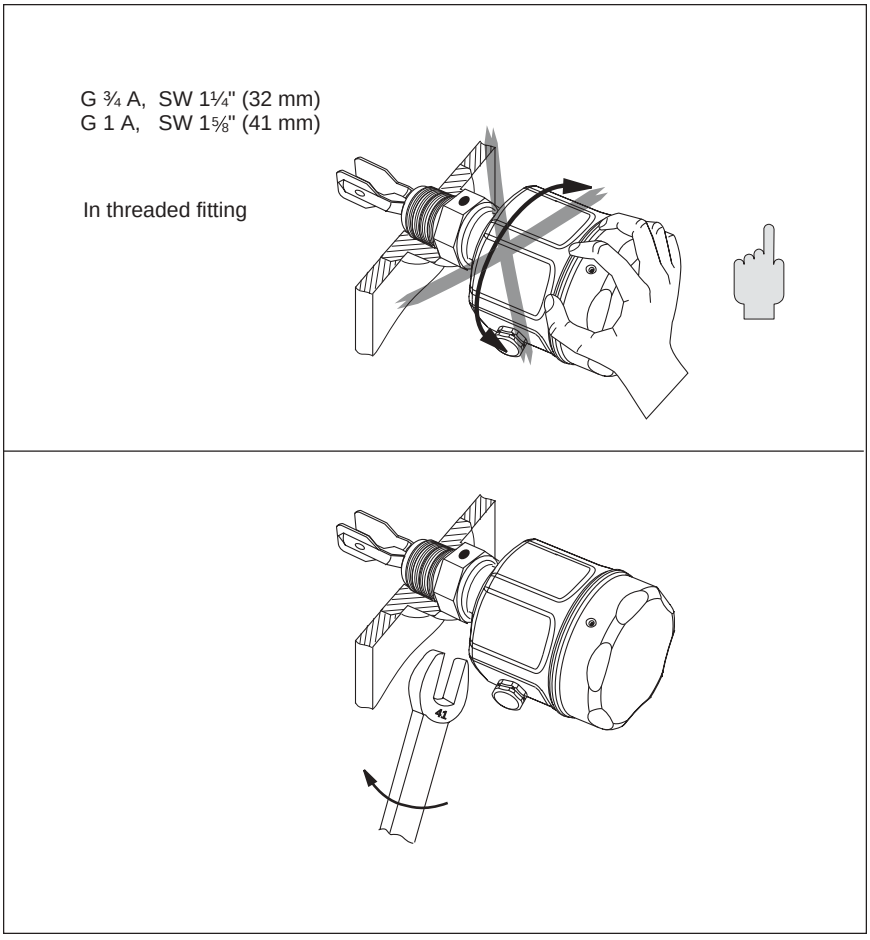


Figure 3.4
Orientation of fork tines: Marking above or below

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



Orientation in pipes: Marking in direction of flow.

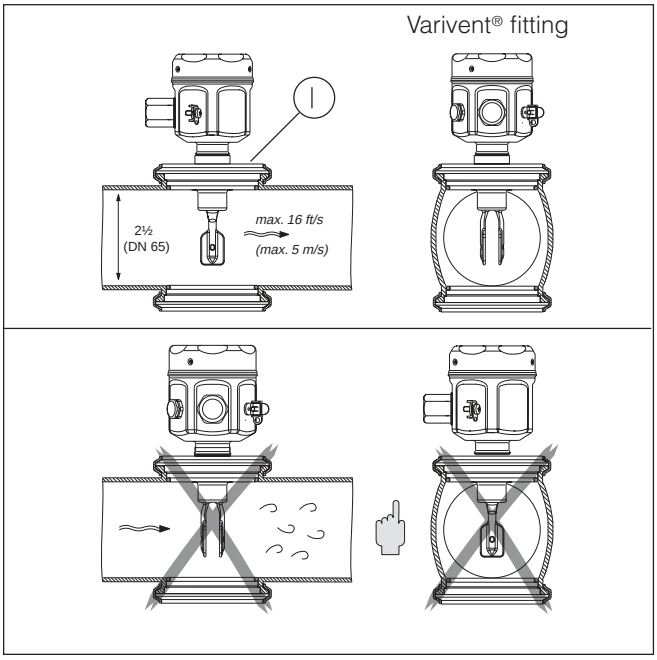


Figure 3.4
Orientation in pipes

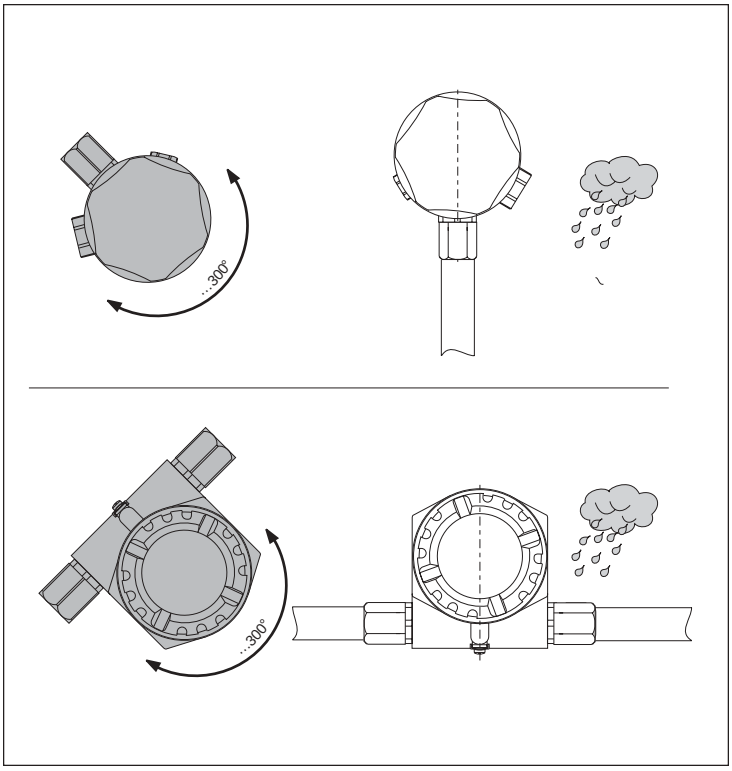


Figure 3.5
Cable entry orientation

4 Setup and Connections

4.1 Setup

Minimum/maximum fail-safe mode

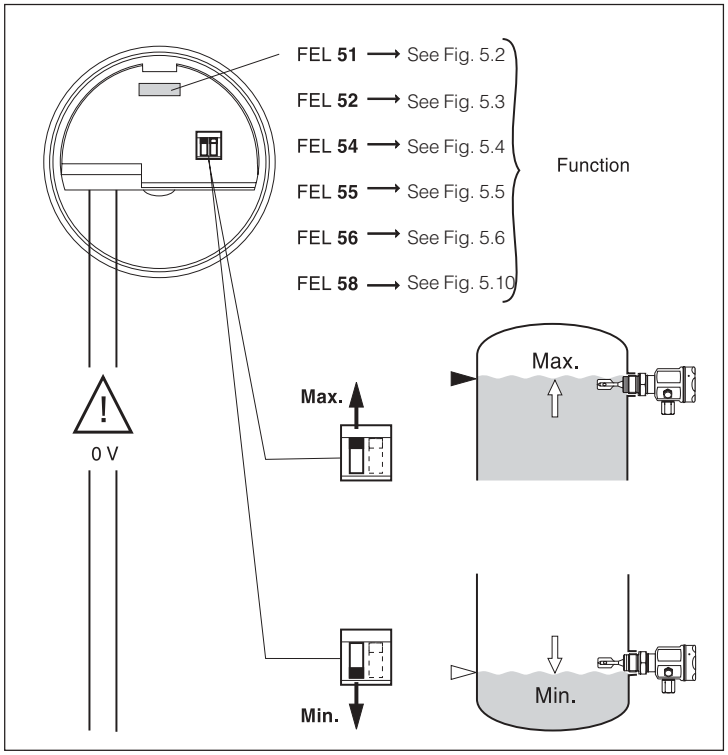


Figure 4.1
Minimum/Maximum fail-safe mode

Liquid density: Density ρ measured in g/cm³ (SGU) or in kg/l.

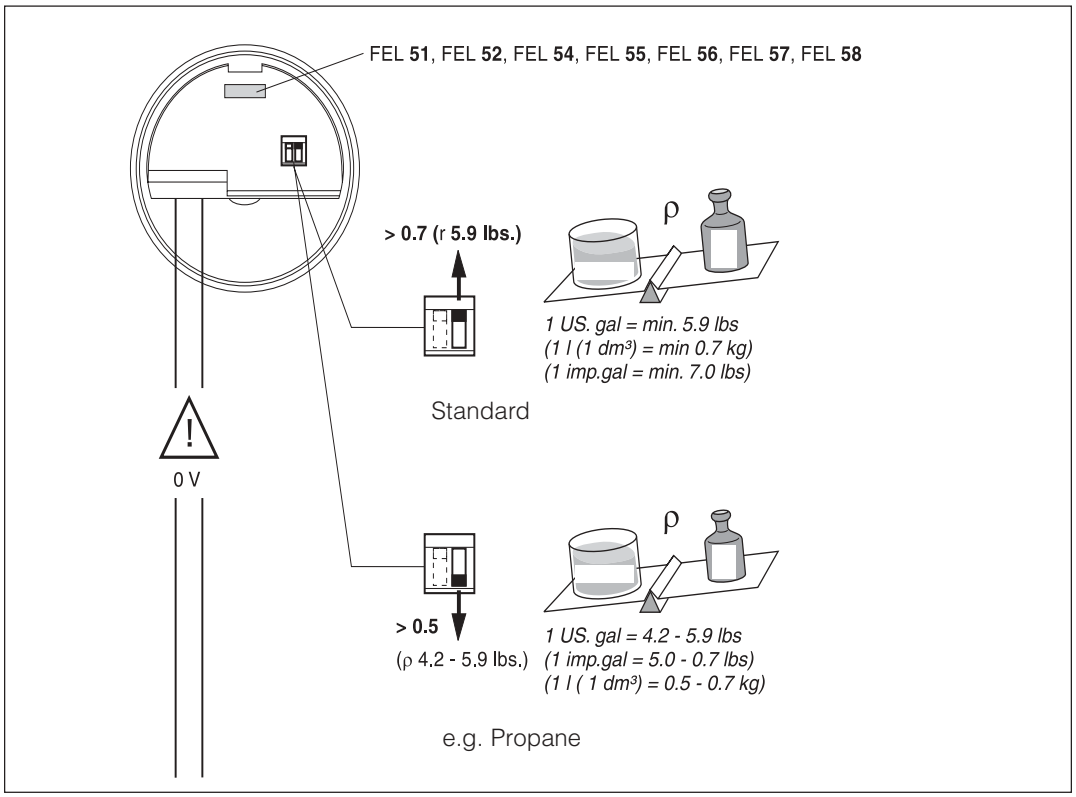


Figure 4.2
Liquid density

FEL 57
Functional test:
Test phase on switch-on (see figures 5.8 and 5.9 and switching unit for sequence).

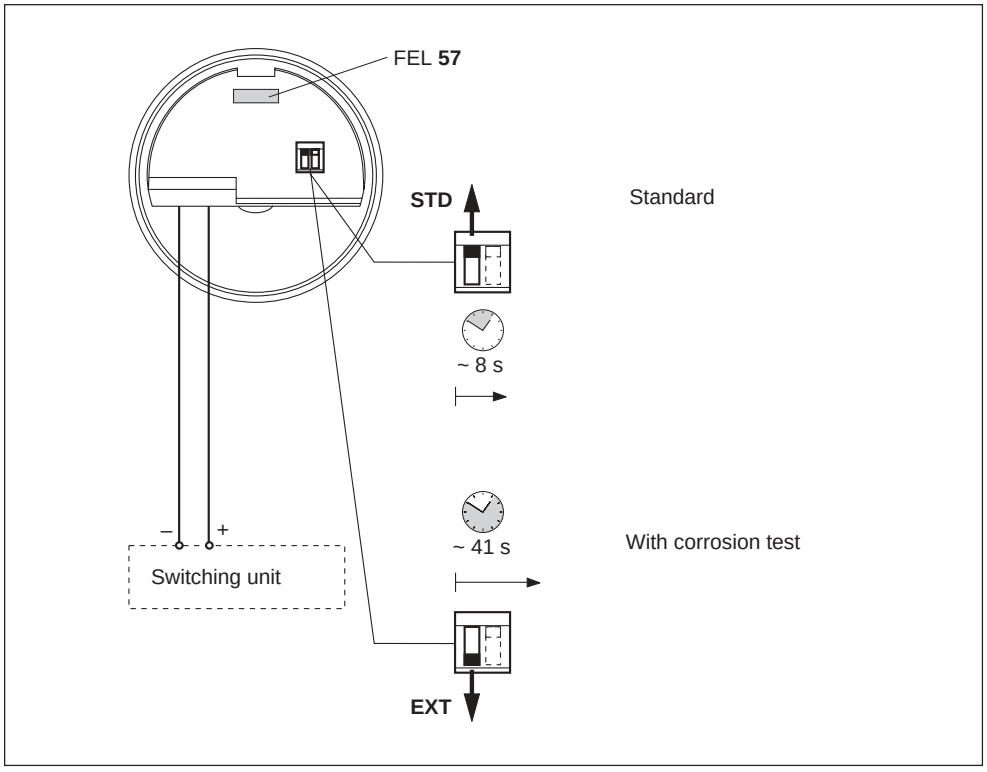
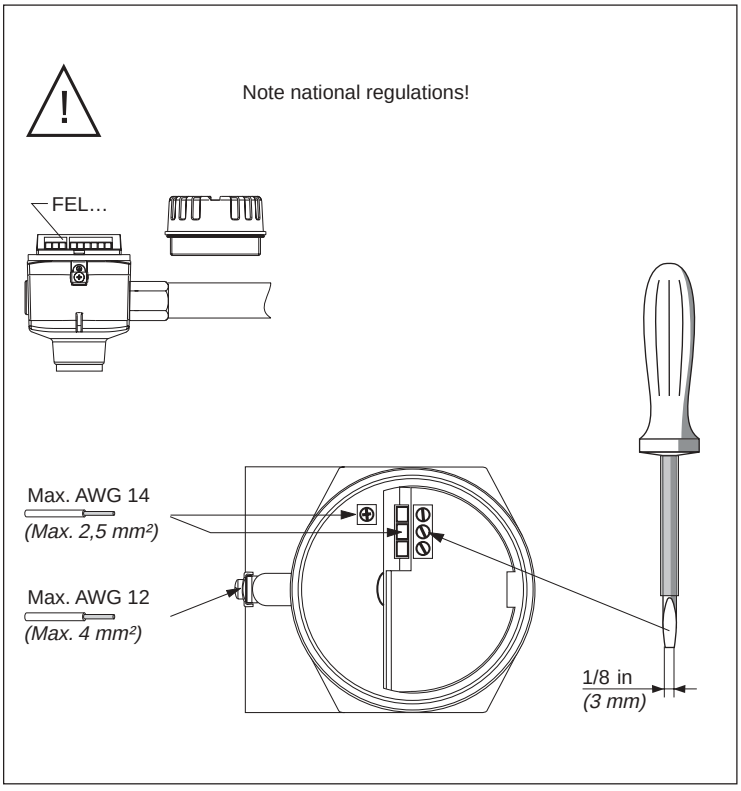


Figure 4.3
FEL 57
Functional Test

4.2 Connections

Note National Electrical Codes.



Connections FEL 51

Two-wire AC connection

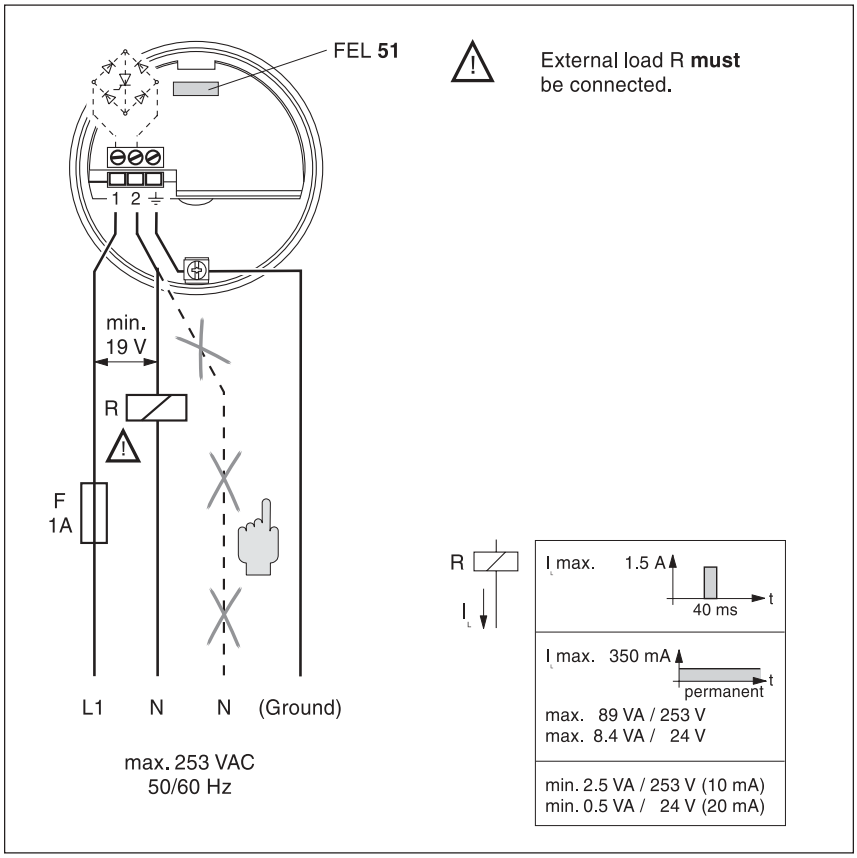


Figure 4.4
FEL 51
Two-wire AC connection

Connections FEL 52

DC connection (PNP transistor)

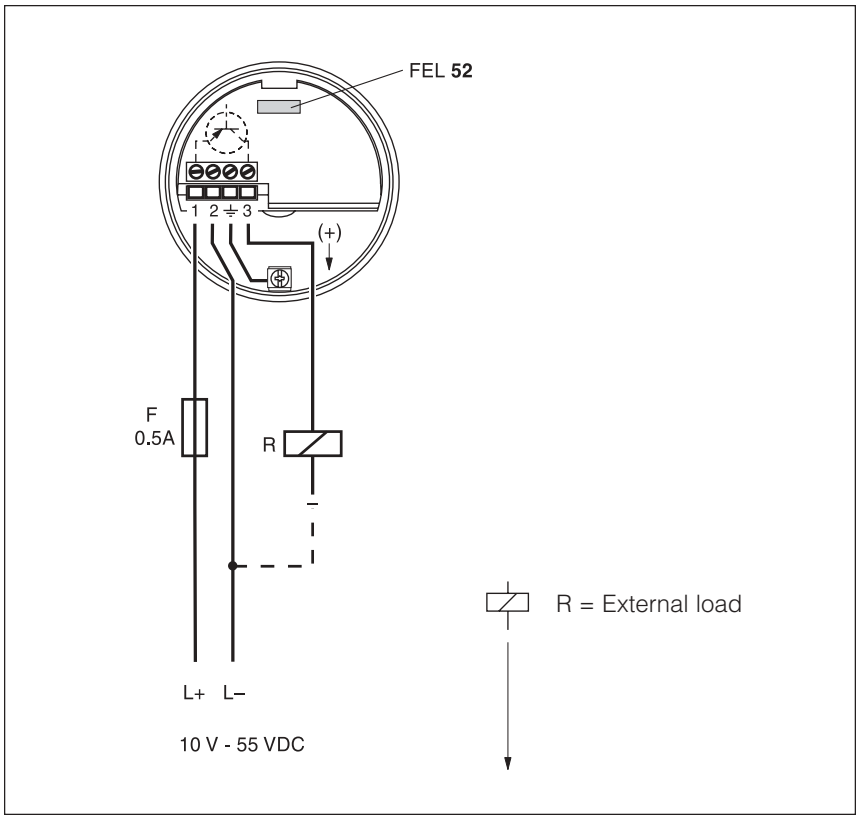


Figure 4.5
FEL 52
DC Connection (PNP)

Connections FEL 54
Universal connection
Relay output

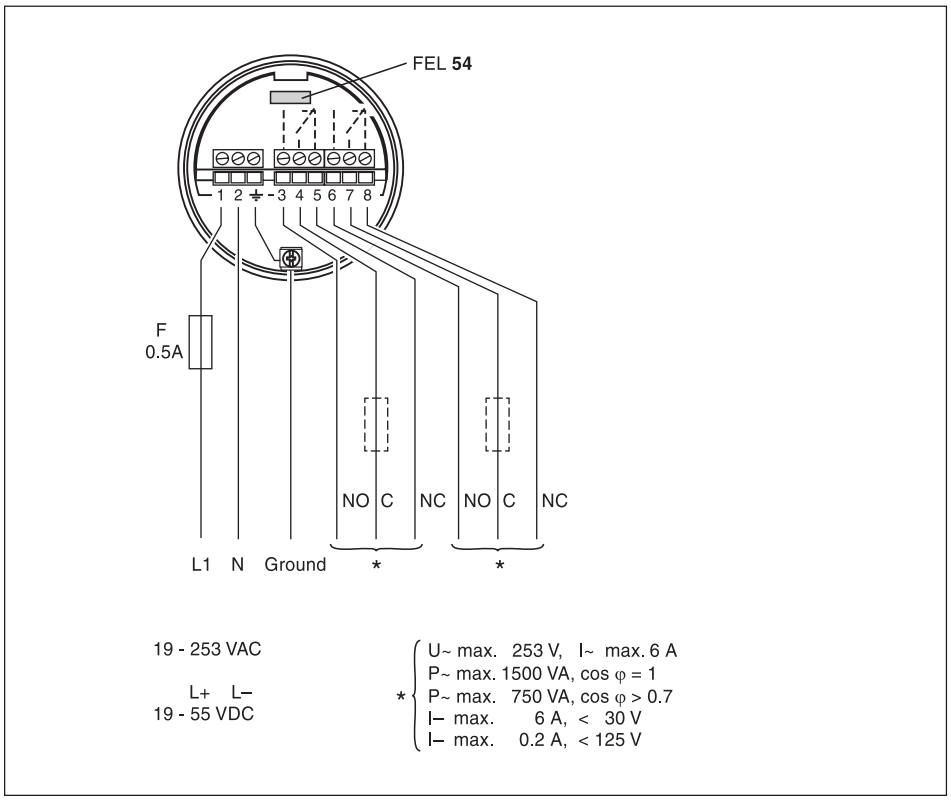


Figure 4.6
FEL 54
Universal connection
Relay output

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

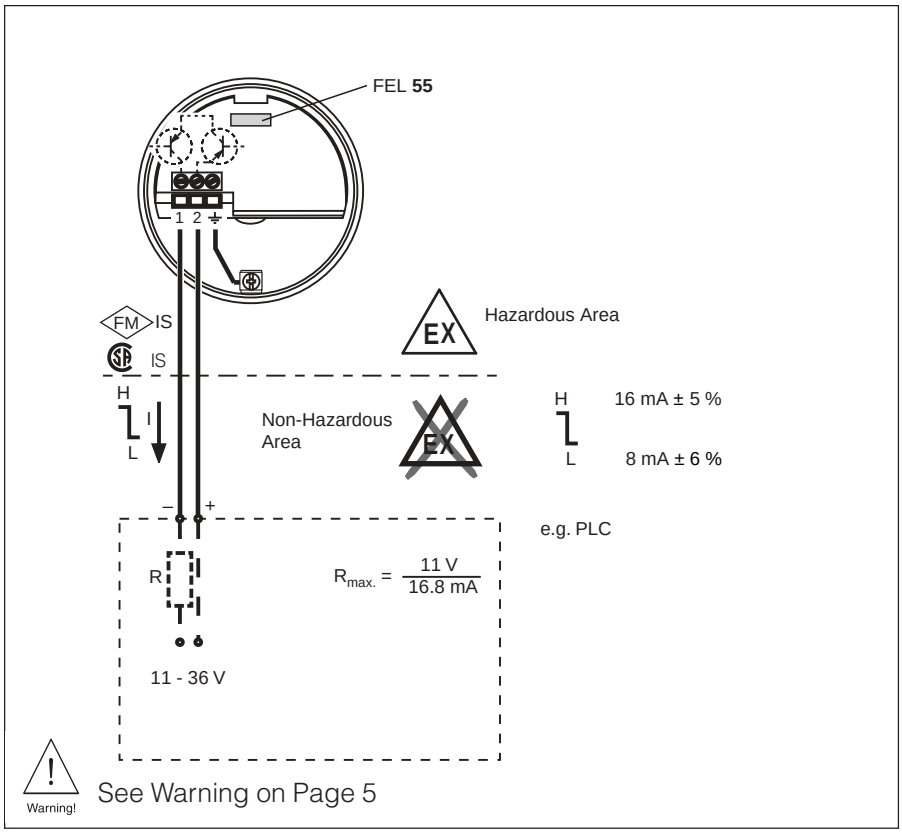


Figure 4.7
FEL 55
Output
16 / 8 mA (4-20)

Connections FEL 56
NAMUR output
<1.0 mA / > 2.1 mA

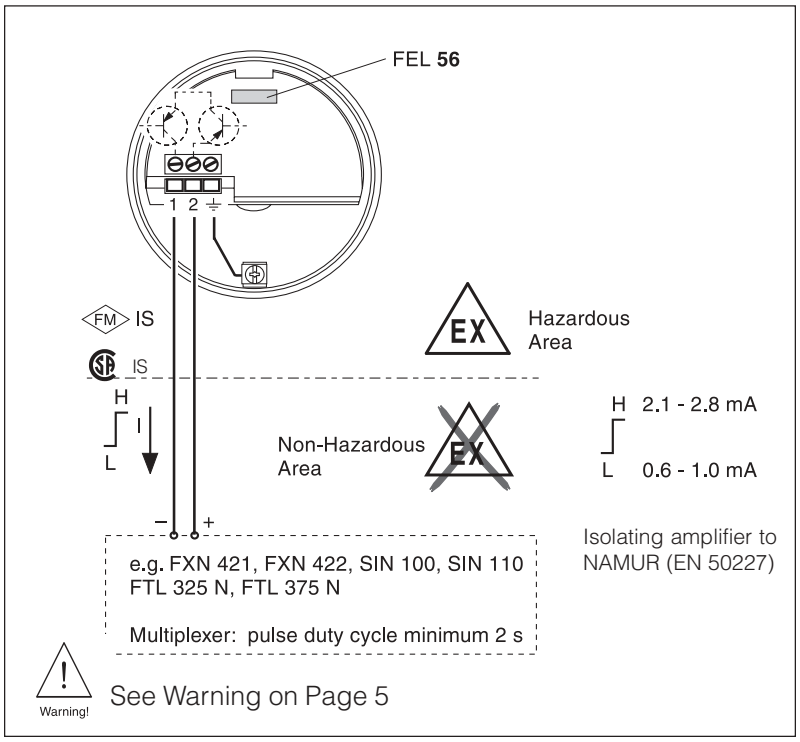


Figure 4.8
FEL 56
NAMUR output
<1.0 mA / > 2.1 mA

Connections FEL 57
PFM output
150 Hz / 50 Hz

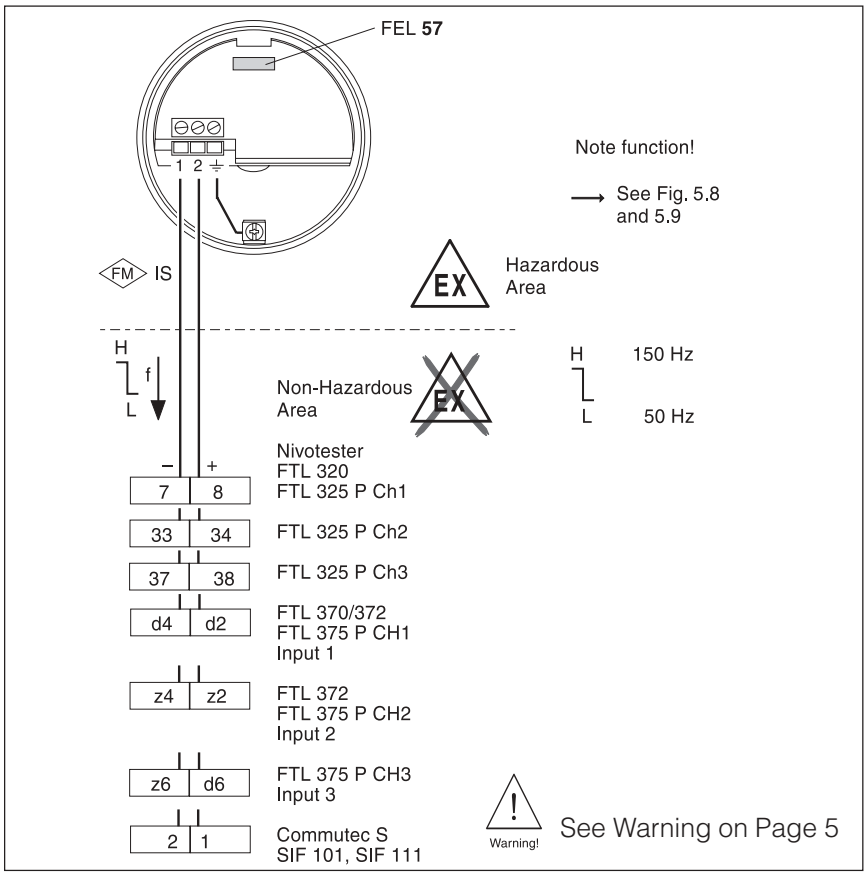


Figure 4.9
FEL 57
PFM output
150 Hz / 50 Hz

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

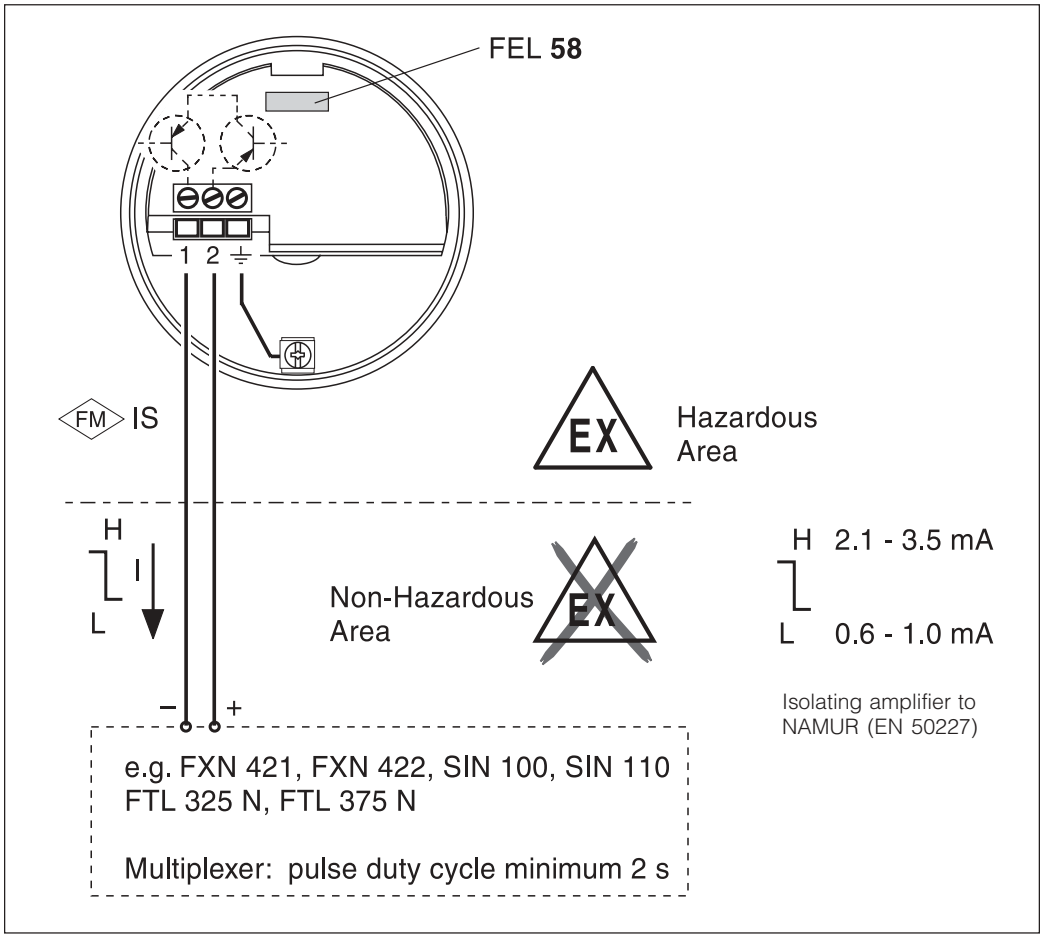


Figure 4.10
FEL 58
NAMUR output H-L
>2.1 mA / <1.0 mA

5 Function

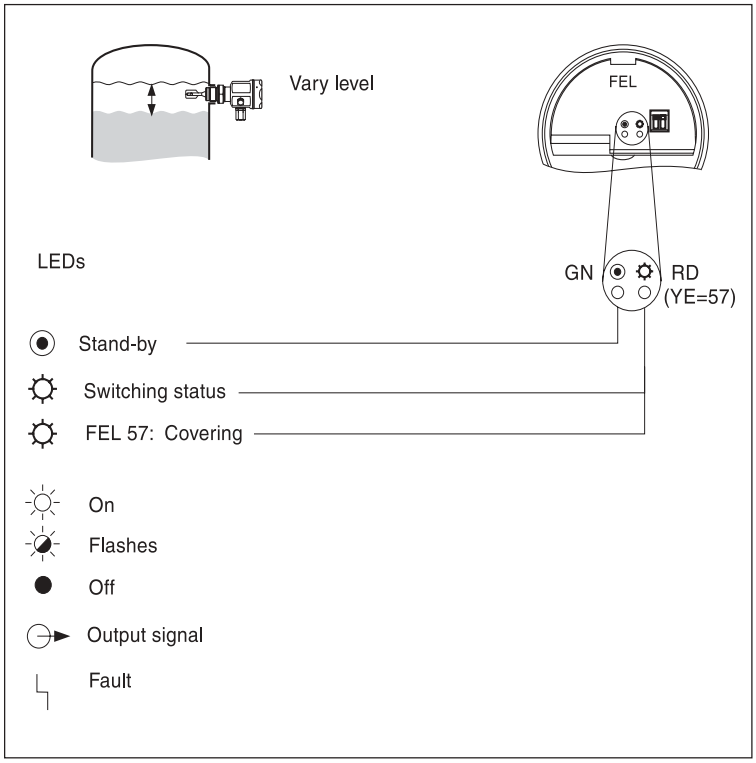
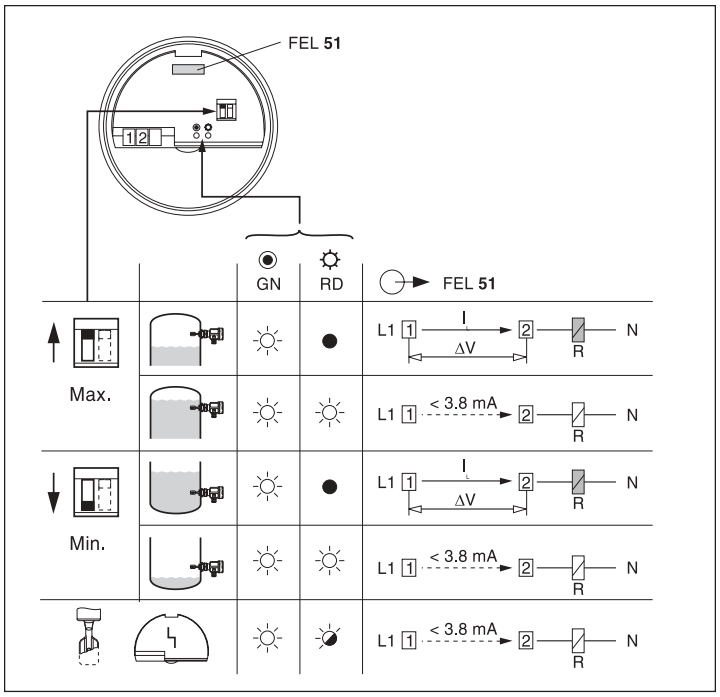


Figure 5.1
Display elements

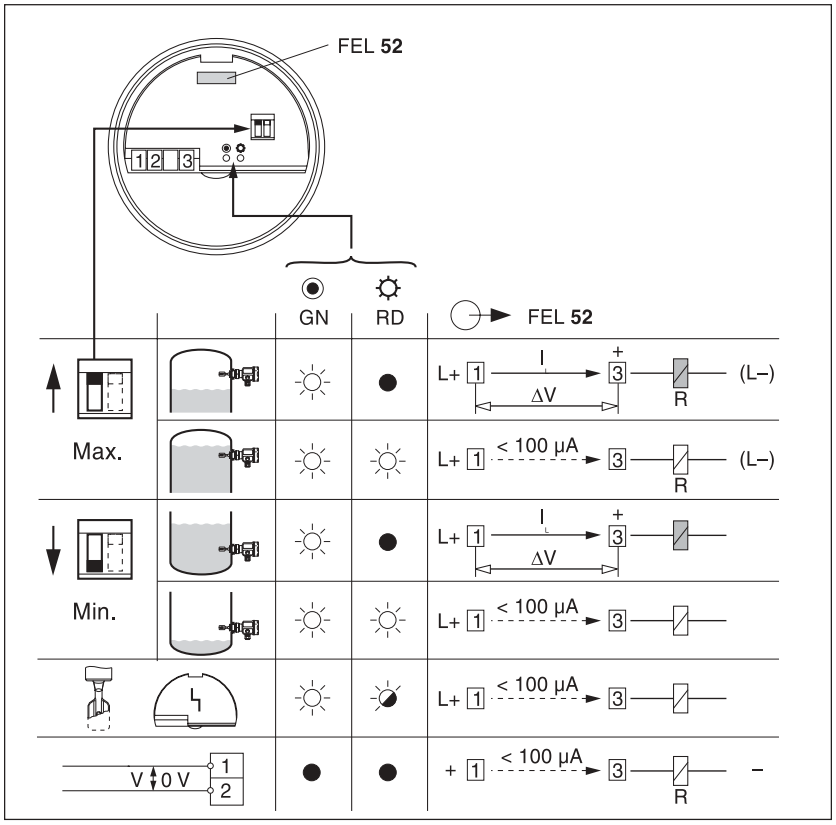
Function FEL 51



$\Delta V_{FEL\ 51}$ max. 12V

Figure 5.2
FEL 51

Function FEL 52



$\Delta V_{FEL\ 52}$ max. 3V

Figure 5.3
FEL 52

Function FEL 54

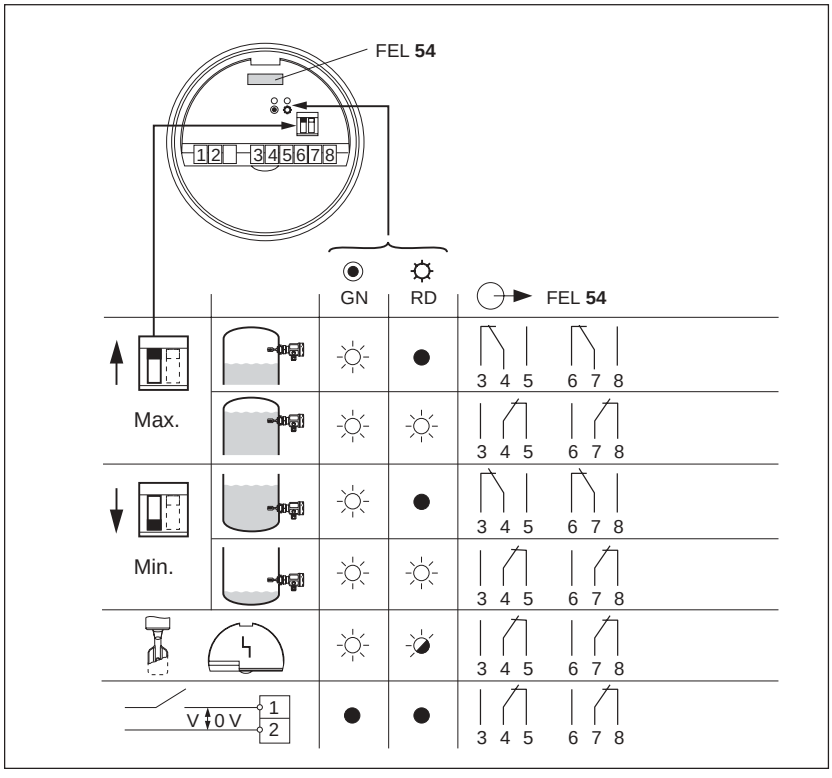


Figure 5.4
FEL 54

Function FEL 55

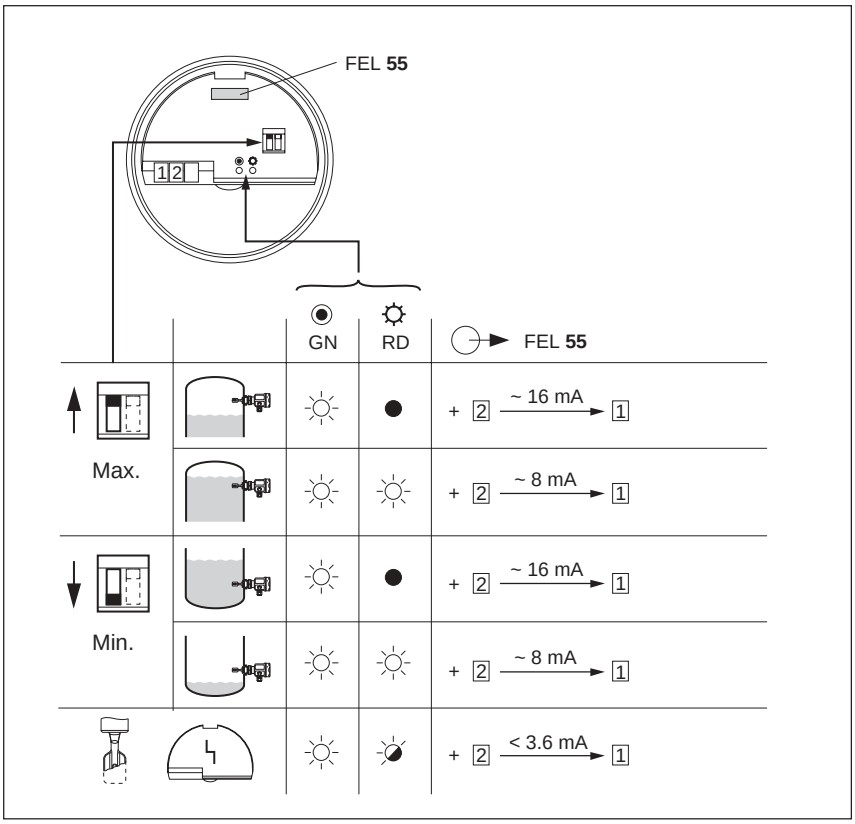


Figure 5.5
FEL 55

Function FEL 56

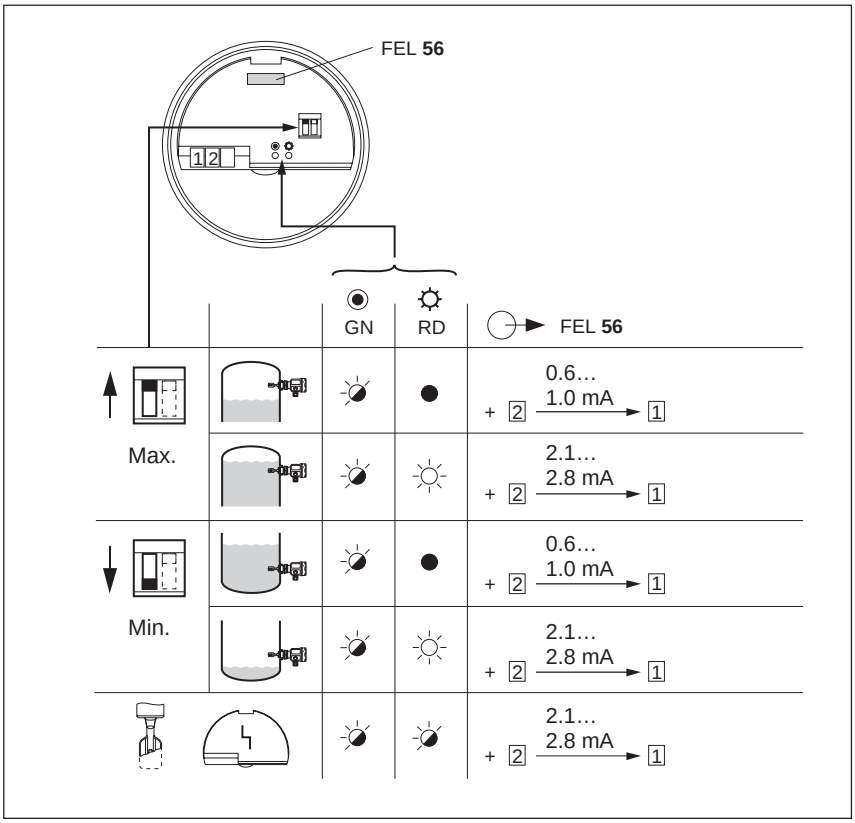


Figure 5.6
FEL 56

Function FEL 57

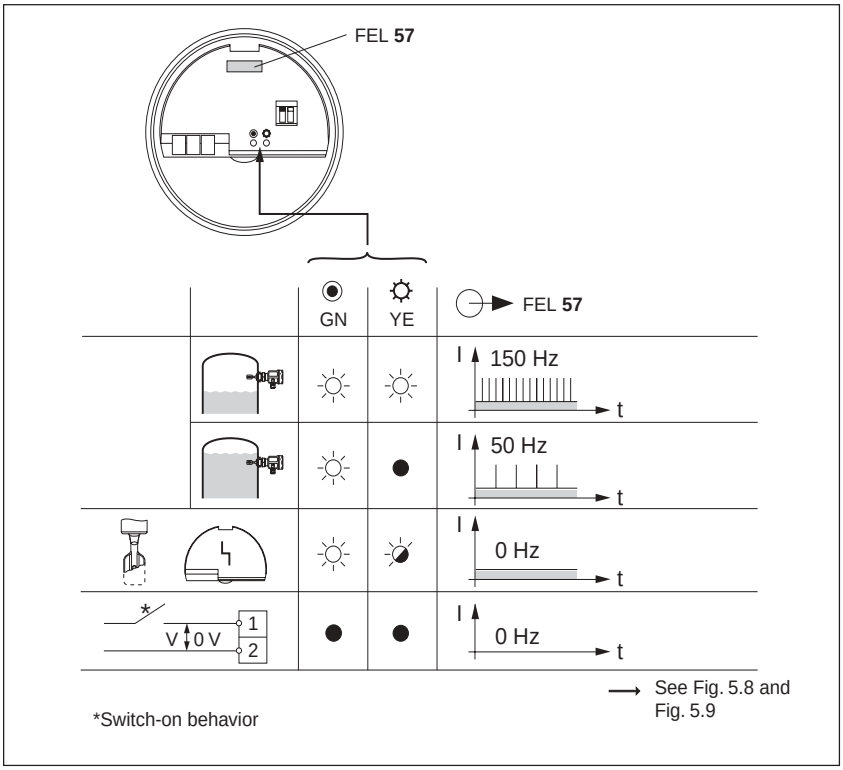


Figure 5.7
FEL 57

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

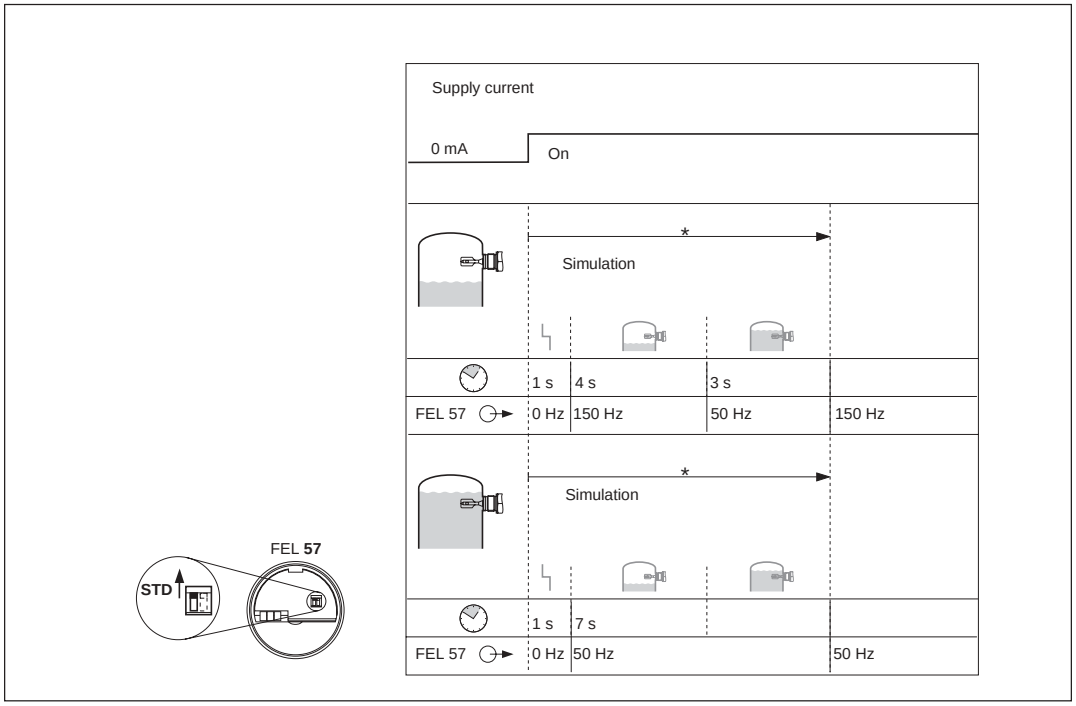


Figure 5.8
FEL 57
Switch-on behavior STD

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

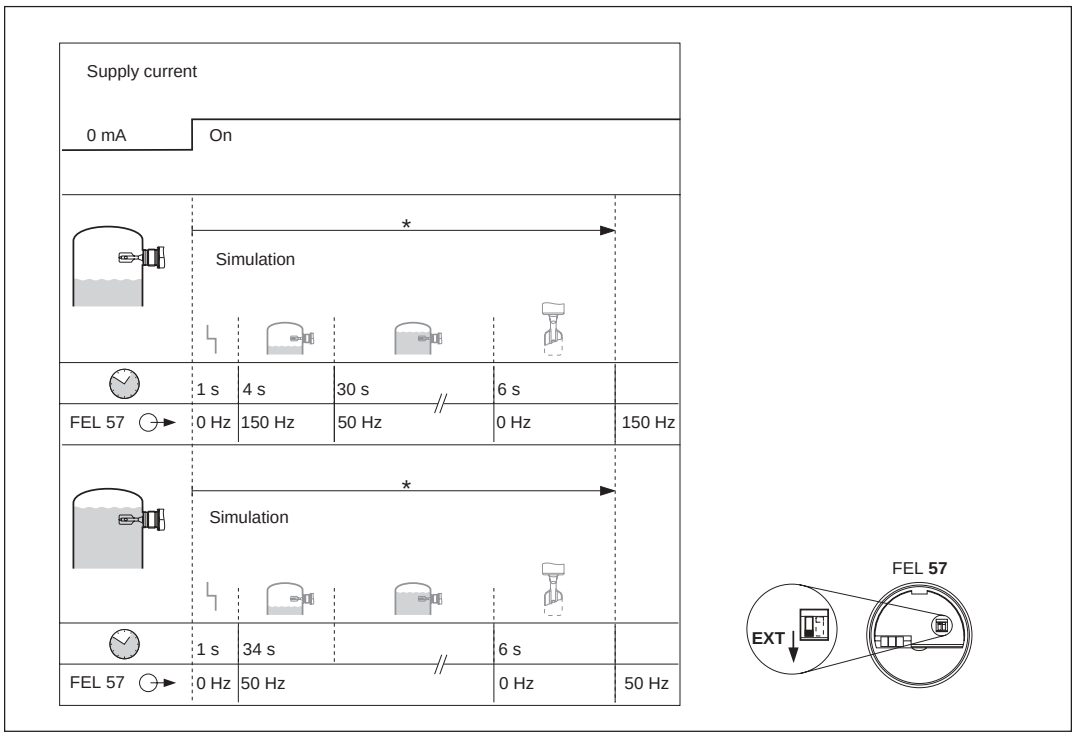


Figure 5.9
FEL 57
Switch-on behavior EXT

Function FEL 58

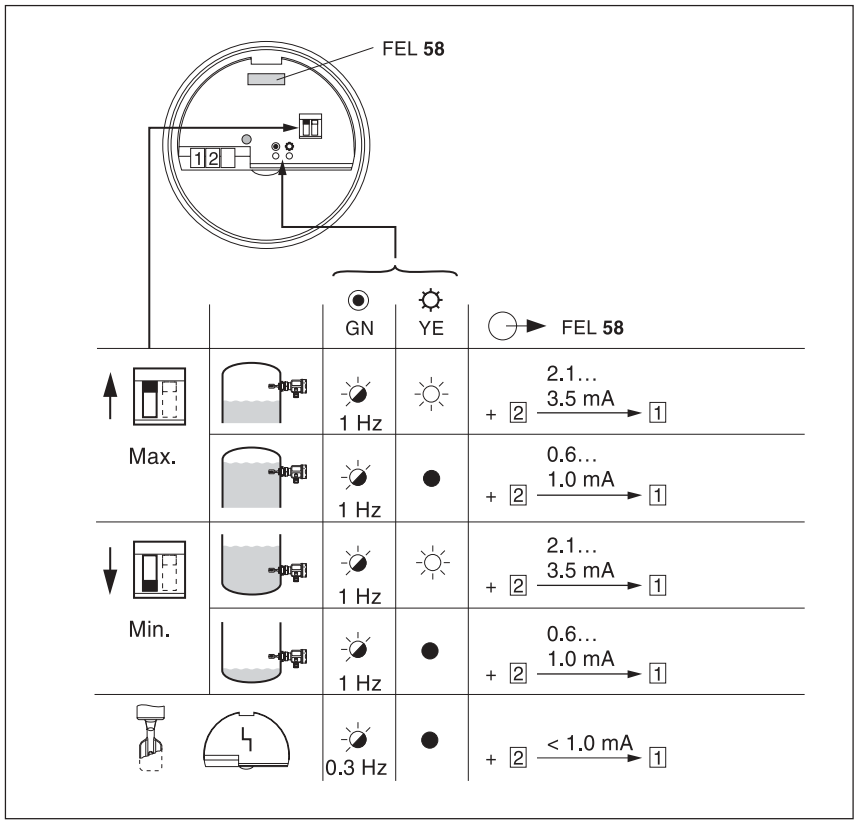


Figure 5.10
FEL 58

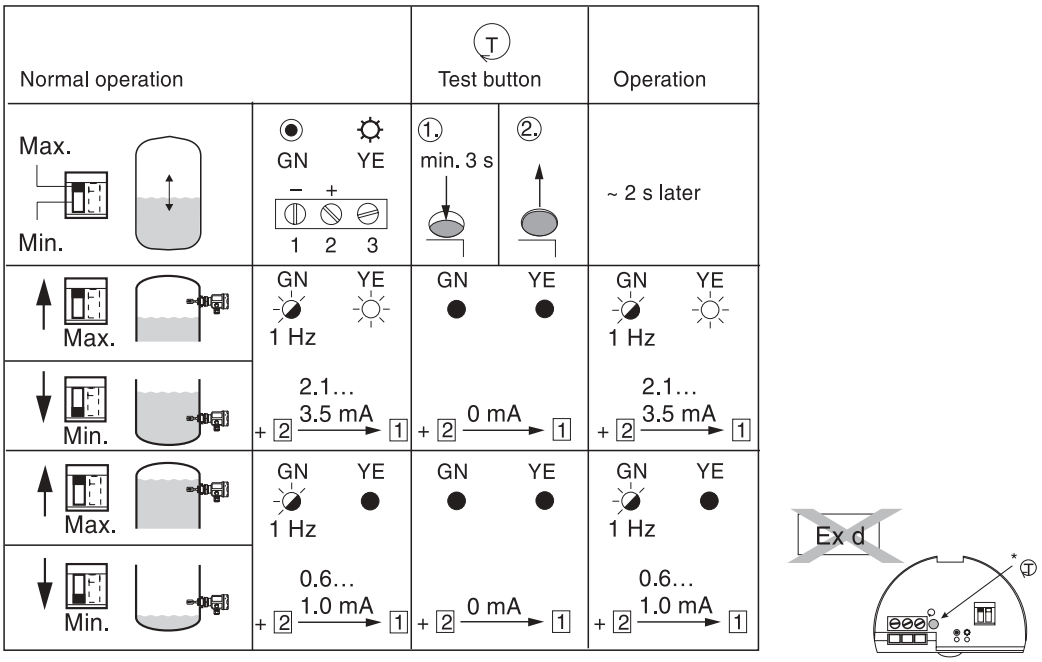
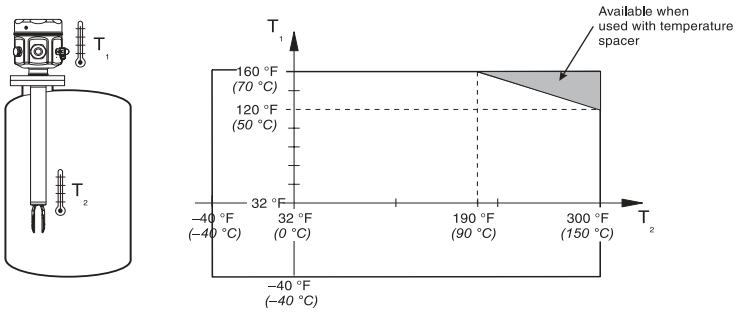


Figure 5.11
*FEL 58 Test Button**

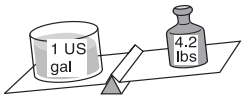
6 Technical Data

Ambient temperature T1
Process temperature T2



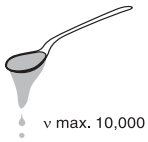
Process pressure
p = max. 580 psig (40 bar)
Depending on process connection

Density ρ



(1 US.gal = min. 4.2 lbs)
(1 imp.gal = min. 5.0 lbs)
(1 l (1 dm) = 0.5 kg)

Viscosity ν

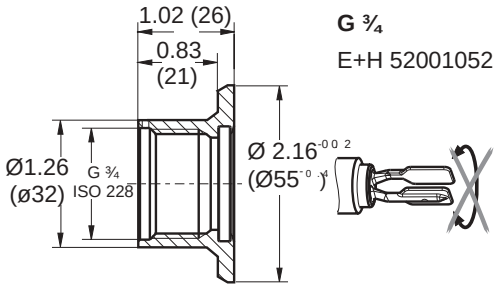


ν max. 10,000 cP

6.1 Accessories

Weld-in sockets

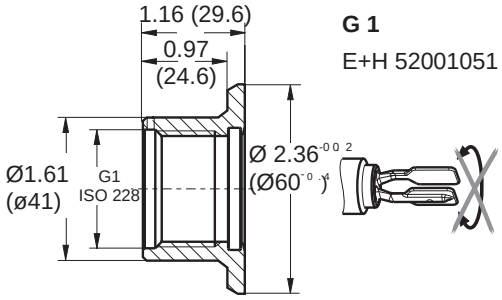
AISI 316 L
(1.4435)



G ¾
E+H 52001052

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

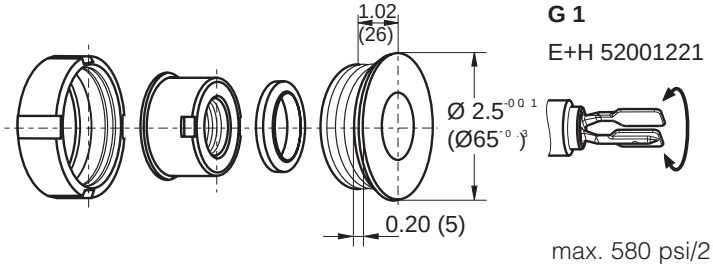
max. 580 psi/210°F
(max. 40 bar/100°C)



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)

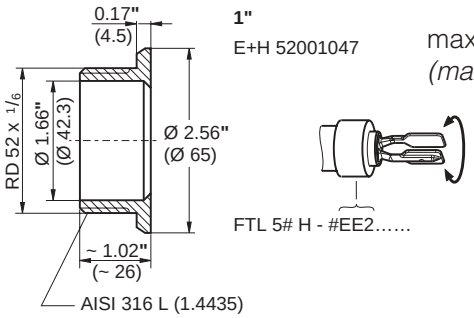


G 1
E+H 52001221

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

Dimensions are in inches (mm)

Weld-in adapter



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

6.2 Spare Parts

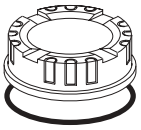
Electronic inserts

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

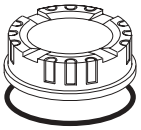
Warning!

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.

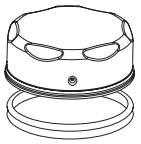
Housing covers, seals



	Alu w/EPDM O-ring	E+H 52002699
*	Alu EX w/EPDM O-ring	E+H 52002698

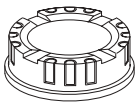


	PBT-FR (cover only)	E+H 943461-0000
*	EPDM O-ring	E+H 017717-0003



	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

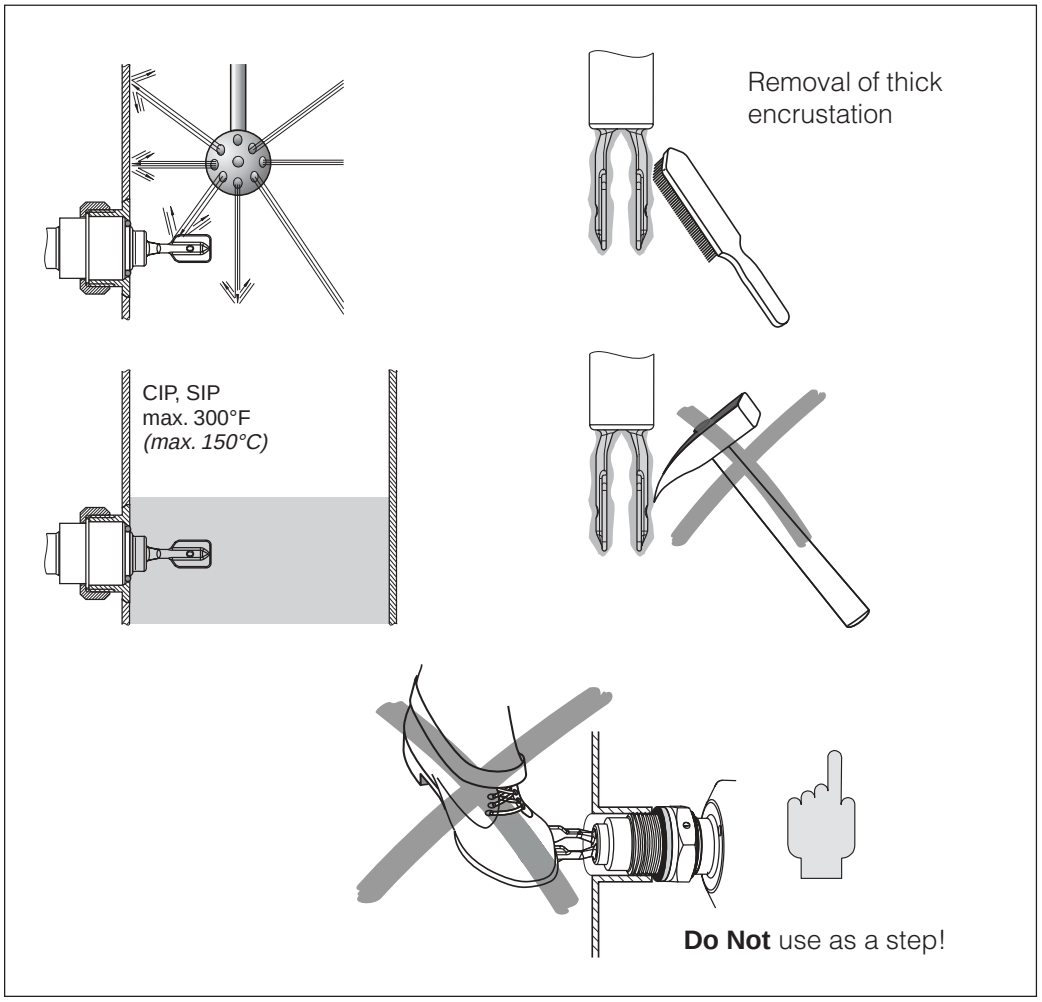
AISI 316L
(1.4435)

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

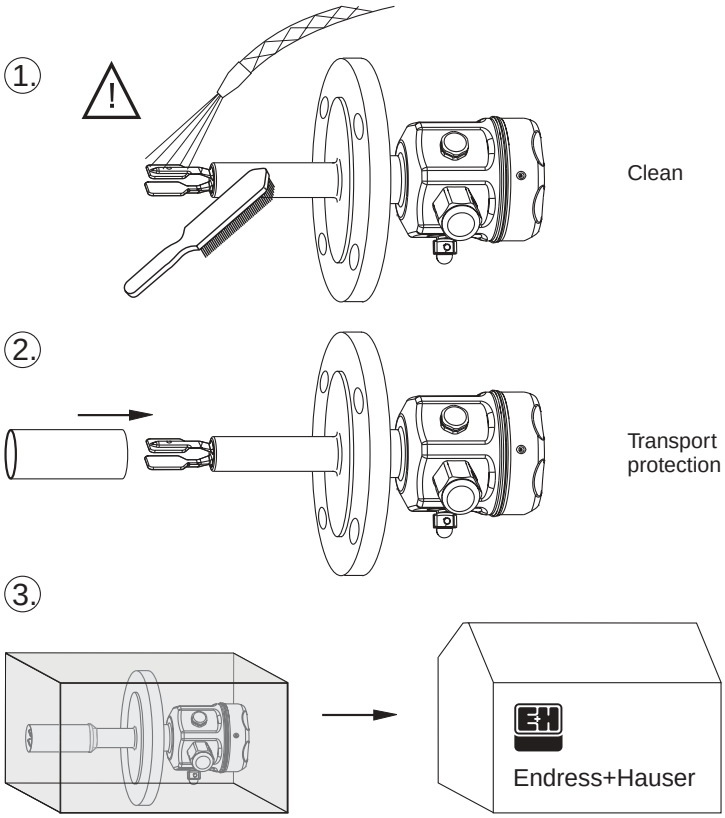


7.2 Troubleshooting

Fault	Reason	Remedy
Does not switch	No power	Check power
	Faulty signal line	Check signal line
	Faulty electronic insert – FEL 51 connected directly to L1 and N	Exchange –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 (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 |

Liquiphant M FTL 51 H – | 1 | 2 | 3 | 4 | 5 | 6 |

FTL 50 H: Compact
FTL 51 H: With extension pipe

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 application and selection assistance,
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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