



Level



Pressure



Flow



Temperature



Liquid  
Analysis



Registration



Systems  
Components



Services

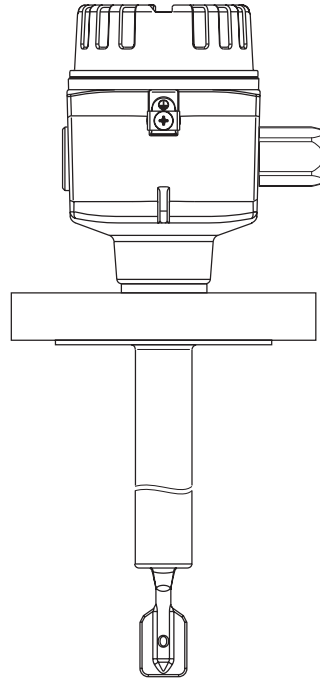
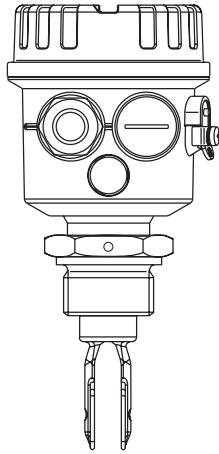


Solutions

## Operating Instructions

# Liquiphant M FTL50, FTL51

## Level Limit Switch



## **Table of Contents**

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# 1 Safety Instructions

Safe and secure operation of the unit can only be guaranteed if the operating instructions and all safety notes are read, understood and followed.

## 1.1 Approved usage

The Liquiphant M FTL50 and FTL51 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 FTL50 and 51 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 pictograms and symbols

Safe and reliable operation of this unit can only be guaranteed if the safety hints and warnings in these operating instructions are followed. The safety hints in these instructions are highlighted using the following symbols:



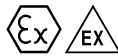
**Caution!**

This symbol indicates activities and actions that, if followed incorrectly, could lead to faulty operation or even damage to the unit.



**Note!**

This symbol indicates activities and actions that, if followed incorrectly, could have an indirect influence on the unit operation or could lead to an unforeseen unit reaction.



**Hazardous area, certified equipment!**

If this character is shown on the unit, then it may be operated in hazardous areas.

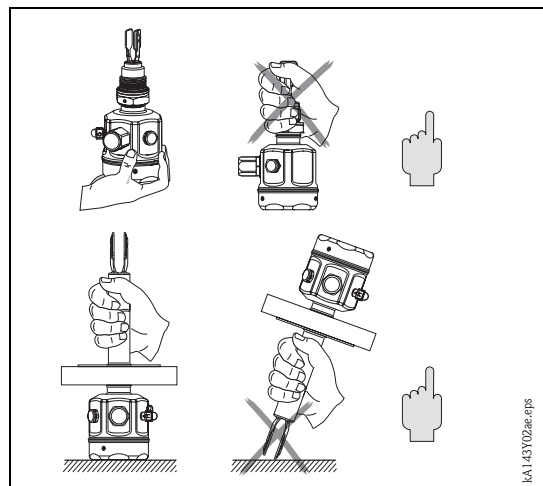


**Non-hazardous area!**

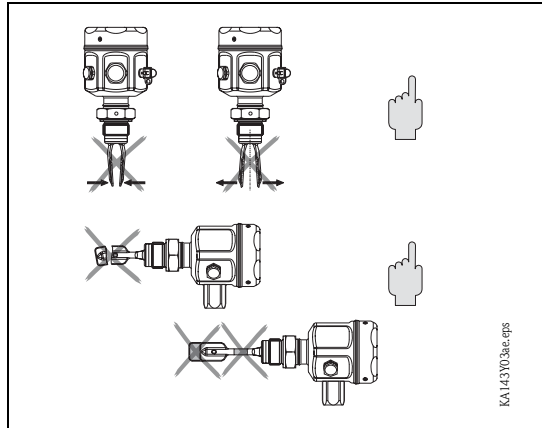
This symbol identifies the non-hazardous areas in these instructions. Units that operate in the non-hazardous areas but that are connected to the hazardous areas must also be certified.

## 1.3 Handling

**Hold by housing, flange or extension tube**



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



## 2 Order Codes

### Product structure

Design		Basic weight			
FTL50	Compact	1.3 lb	0.6 kg		
FTL51	With extension pipe	1.3 lb	0.6 kg		
<b>10</b>	<b>Certificates, applications</b>				
A	Version for non-hazardous area				
P	FM	IS, Class I, II, III	Division 1, Group A-G		
Q	FM	XP, Class I, II, III	Division 1, Group B-G, for E5 housing Group A-G		
R	FM	NI, Class I	Division 2, Group A-D		
S	CSA	IS, Class I, II, III	Division 1, Group A-G		
T	CSA	XP, Class I, II, III	Division 1, Group A-G		
U	CSA	General Purpose			
Y	Special version				
ATEX and TIIS certified units available on request					
<b>20</b>	<b>Process connection, material</b>		<b>Additional weight</b>		
Note: For 1450 psi (100 bar) process pressure, please select the appropriate option under "Additional option"					
Installation in welding neck accessory					
GM2	3/4" NPT	Thread ANSI	316L		
GM5	3/4" NPT	Thread ANSI	Alloy C4		
GN2	1" NPT	Thread ANSI	316L	0.4 lb	0.2 kg
GN5	1" NPT	Thread ANSI	Alloy C4	0.4 lb	0.2 kg
A82	1" 150 lb	RF Flange ANSI B16.5	316/316L	2.2 lb	1.0 kg
AA2	1-1/4" 150 lb	RF Flange ANSI B16.5	316/316L	2.6 lb	1.2 kg
AB2	1-1/4" 300 lb	RF Flange ANSI B16.5	316/316L (FTL 51)	4.4 lb	2.0 kg
AC2	1-1/2" 150 lb	RF Flange ANSI B16.5	316/316L	3.3 lb	1.5 kg
AD2	1-1/2" 300 lb	RF Flange ANSI B16.5	316/316L (FTL 51)	6.0 lb	2.7 kg
AE2	2" 150 lb	RF Flange ANSI B16.5	316/316L	5.3 lb	2.4 kg
AE5	2" 150 lb	RF Flange ANSI B16.5	Alloy C4 >316/316L	5.3 lb	2.4 kg
AF2	2" 300 lb	RF Flange ANSI B16.5	316/316L	7.1 lb	3.2 kg
AG2	2" 600 lb	RF Flange ANSI B16.5	316/316L (FTL 51)	9.3 lb	4.2 kg
AJ2	2-1/2" 300 lb	RF Flange ANSI B16.5	316/316L (FTL 51)	10.6 lb	4.8 kg
AL2	3" 150 lb	RF Flange ANSI B16.5	316/316L	10.8 lb	4.9 kg
AM2	3" 300 lb	RF Flange ANSI B16.5	316/316L (FTL 51)	15 lb	6.8 kg
AN2	3" 600 lb	RF Flange ANSI B16.5	316/316L (FTL 51)		
AP2	4" 150 lb	RF Flange ANSI B16.5	316/316L	15.4 lb	7.0 kg
AQ2	4" 300 lb	RF Flange ANSI B16.5	316/316L (FTL 51)	25.4 lb	11.5 kg
AR2	4" 600 lb	RF Flange ANSI B16.5	316/316L (FTL 51)	38.1 lb	17.3 kg
TC2	DN 25-38 (1 to 1-1/2")	ISO 2852 Tri-Clamp	316L	0.2 lb	0.1 kg
TE2	DN 40-51 (2")	ISO 2852 Tri-Clamp	316L	0.7 lb	0.3 kg
YY9	Special version				
Other process connections available, contact Endress+Hauser					

30 Length, spacer, pressure tight bushing				
FTL50				
AA	Compact	Ra <3.2 µm/80 grit		
IA	66 mm / 2.6" + temperature spacer		1.3 lb	0.6 kg
QA	66 mm / 2.6" + pressure tight bushing		1.5 lb	0.7 kg
FTL51				
CB	..... in (6 in to 115 in)	Ra 3.2 µm	316L**	
CE	..... in (6 in to 115 in)	Ra 3.2 µm	Alloy C4**	5 lb (2.3 kg)/100 in
DB	Length II*	Ra 3.2 µm	316L	0.2 lb 0.1 kg
DE	Length II*	Ra 3.2 µm	Alloy C4	0.2 lb 0.1 kg
KB	..... in (6 in to 115 in) + temperature spacer		316L**	5 lb (2.3 kg)/100 in +1.3 lb (+0.6 kg)
KE	..... in (6 in to 115 in) + temperature spacer		316L**	5 lb (2.3 kg)/100 in +1.3 lb (+0.6 kg)
LB	Length II* + temperature spacer		316L	0.2 lb 0.1 kg +1.3 lb +0.6 kg
LE	Length II* + temperature spacer		Alloy C4	0.2 lb 0.1 kg +1.3 lb +0.6 kg
SB	..... in (6 in to 115 in) + pressure tight bushing		316L**	5 lb (2.3 kg)/100 in +1.5 lb +0.7 kg
SE	..... in (6 in to 115 in) + pressure tight bushing		Alloy C4**	5 lb (2.3 kg)/100 in +1.5 lb +0.7 kg
TB	Length II* + pressure tight bushing		316L	0.2 lb 0.1 kg +1.5 lb +0.7 kg
TE	Length II* + pressure tight bushing		Alloy C4	0.2 lb 0.1 kg +1.5 lb +0.7 kg
YY	Special version			
*) Replacing instruments: when vertically mounting a Liquiphant M FTL51 with length II, the switch point is at the same height as for the Liquiphant II FTL360, FTL365, FDL30, FDL35				
**) order 3001 to 6000 mm (116 to 235 in) via yy				

40 Electronic insert				
1	FEL51*	Contact-free two-wire, 19 to 253 V AC		
2	FEL52*	PNP three-wire, 10 to 55 V DC		
4	FEL54	Floating change-over contacts, DPDT, 19 to 253 V AC, 19 to 55 V DC		
5	FEL55	8/16 mA, 11 to 36 V DC		
6	FEL56	NAMUR		
7	FEL57	Two-wire PFM		
8	FEL58*	NAMUR with push button (disconnects wire)		
9	Special version			
*) Also available in compact housing				

50 Housing, cable entry				
C3	Compact housing 316L IP66/68 5m cable			
D3	Compact housing 316L IP65 Pg11 connector			
E3	Compact housing 316L NEMA4x NPT1/2" connector			
N3	Compact housing 316L IP66/68 M12 connector			
E4	Polyester housing Nema 4x, NPT 1/2"			
E5	Aluminum housing Nema 4x, NPT 3/8"			1.1 lb/0.5 kg
E6	316L housing Nema 4x, NPT 1/2"			0.2 lb/0.1 kg
E7	Aluminum housing IP66 NPT 3/8", with separate connection compartment			2.0 lb/0.9 kg
Y9	Special version			

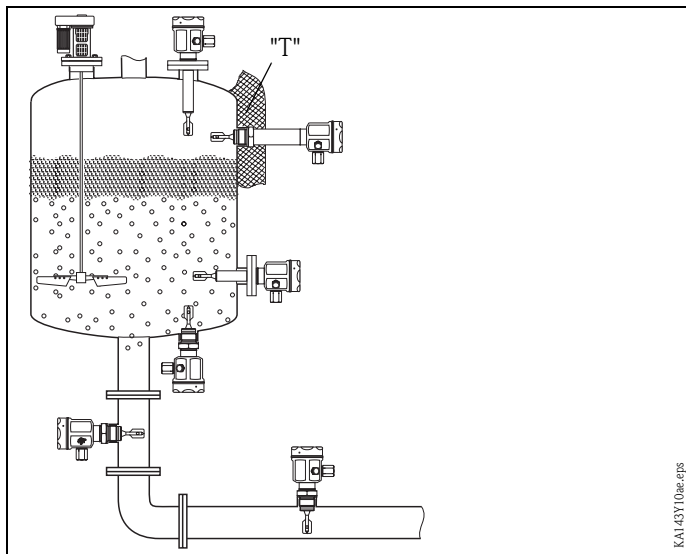
60 Additional fittings				
A	No additional fittings			
C	3.1.B material, wetted parts 316L, Inspection certificate to EN 10204, in accordance with Specification 52005759			
N	NACE 3.1.B			
P	1450 psi (100 bar) process pressure (FTL51)			
R	1450 psi (100 bar) process pressure, EN 10204 - 3.1 material, NACE MR0175 (316L wetted parts) (FTL51) Inspection certificate			
S	GL marine approval (FTL 51: max. length 63"/1600 mm)			
Y	Special version			

FTL 5# -					Complete product designation
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### 3 Installation

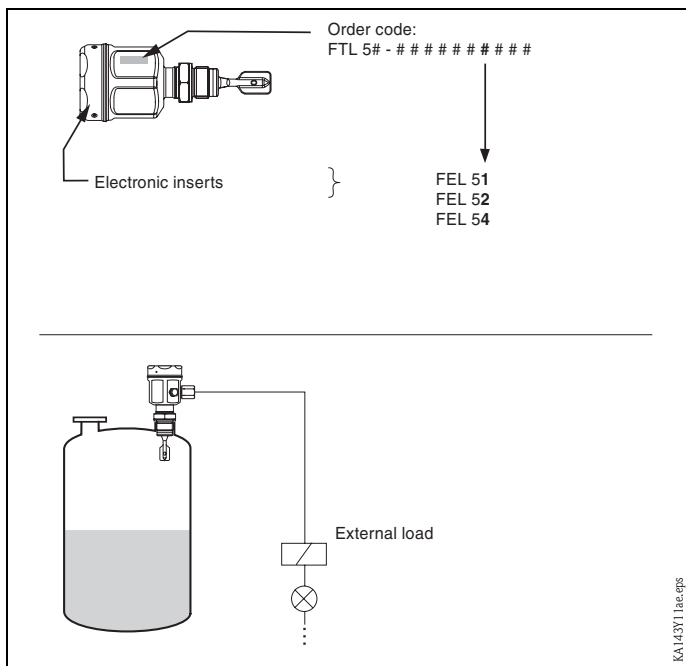
#### 3.1 Application

Level limit detection in liquids



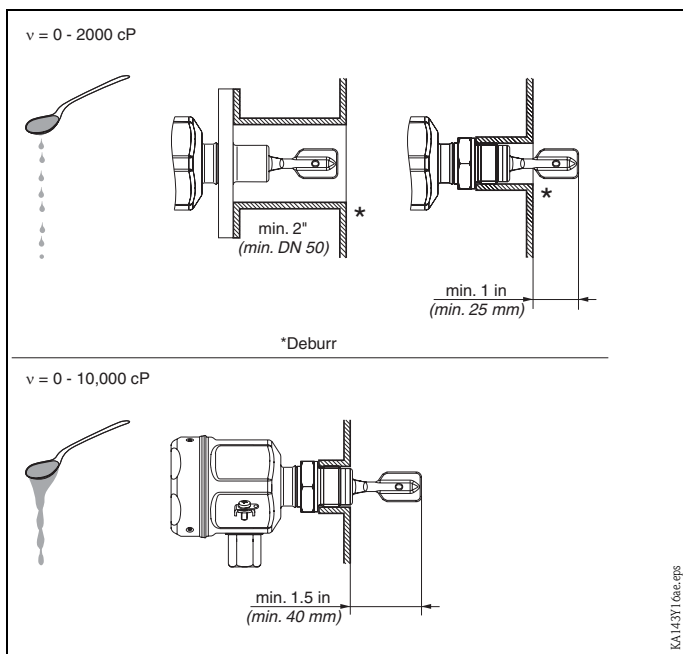
#### 3.2 Measuring System

For direct connection

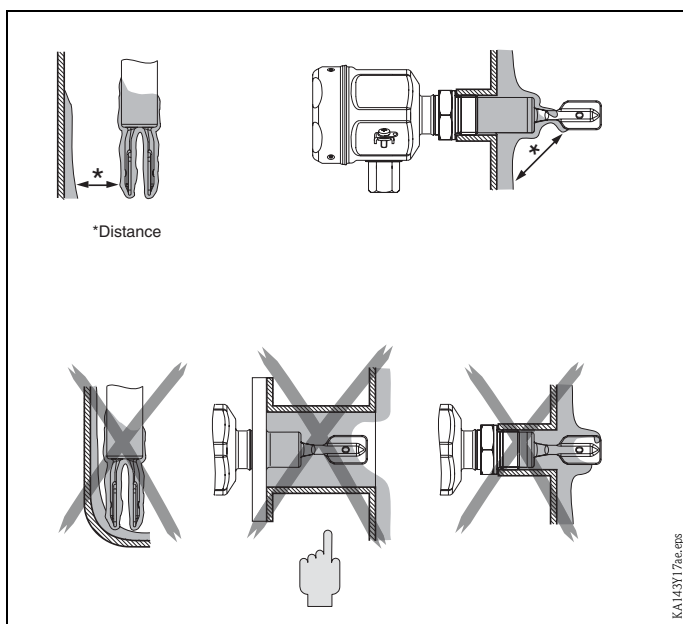




**Mounting examples as a function of liquid viscosity**

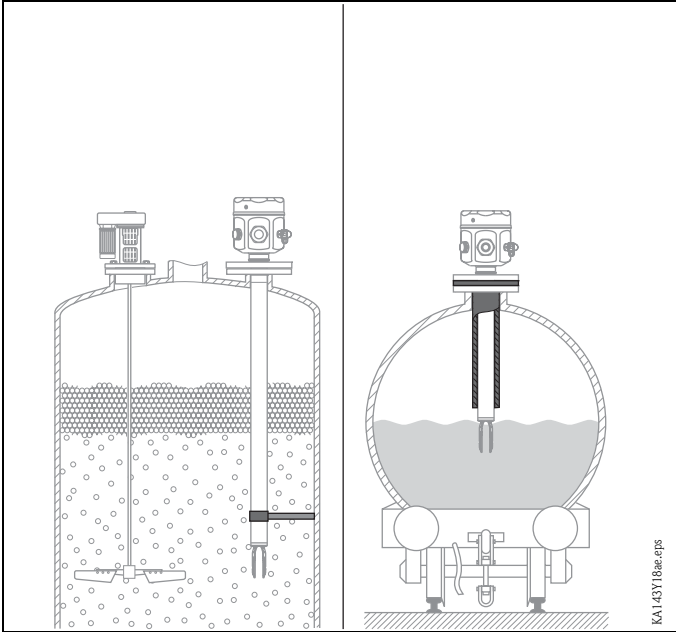


**Consider buildup.  
Fork may not contact the buildup**

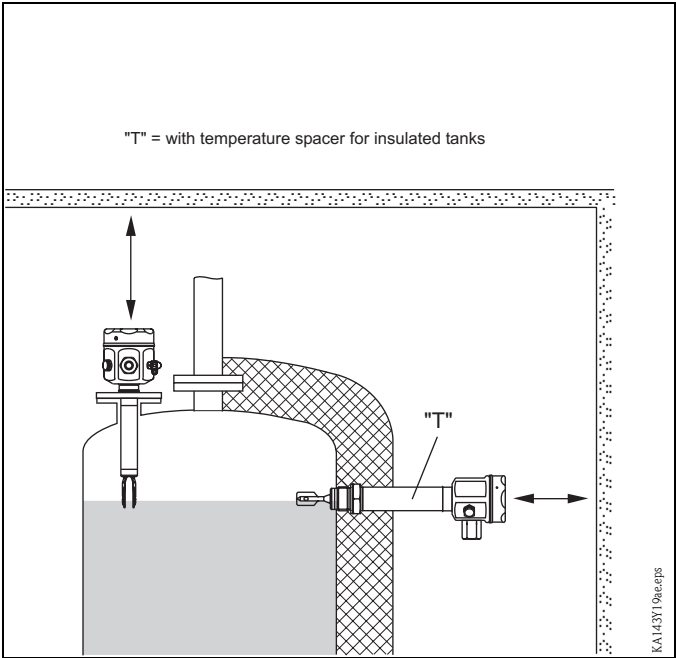




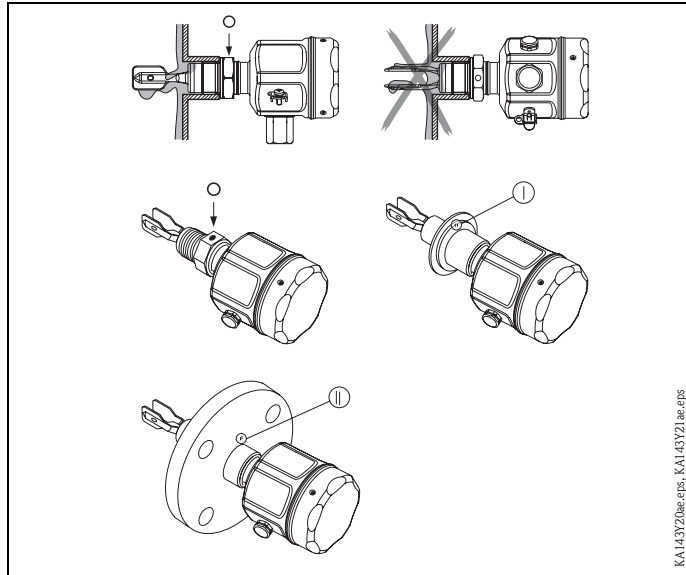
**In cases of dynamic forces support**



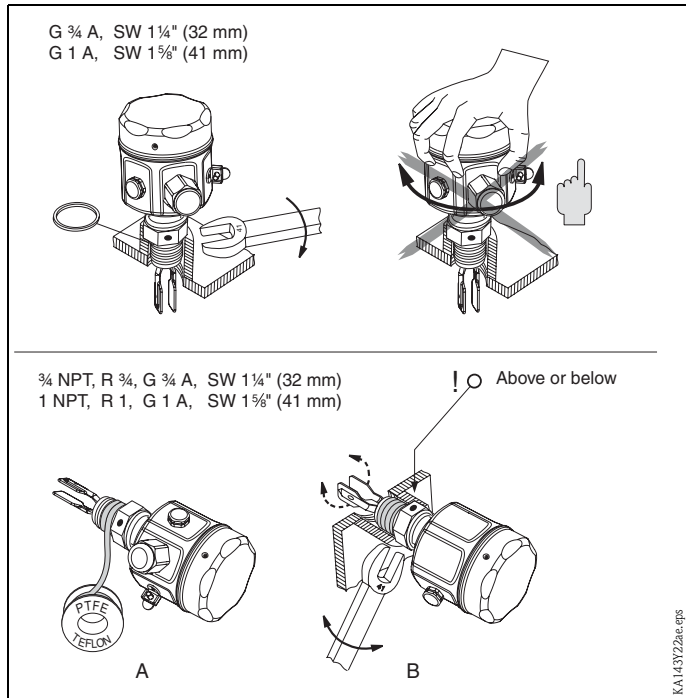
**Allow clearance**



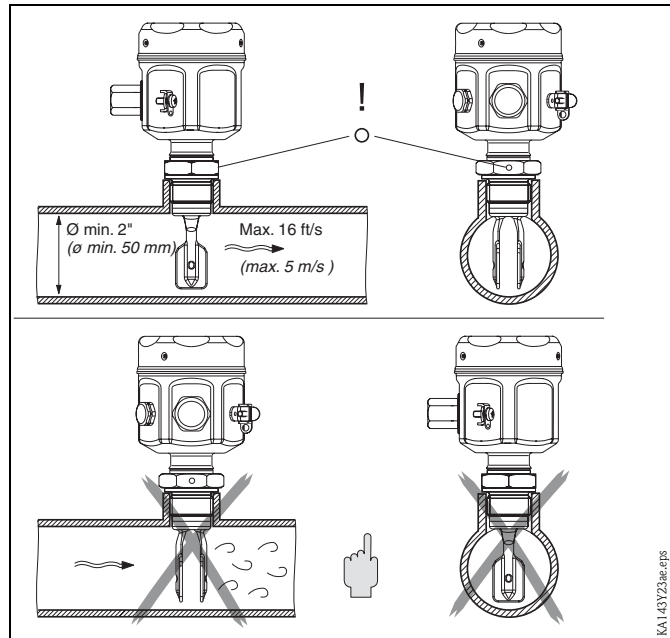
**Orientation of fork tines:  
marking above or below**



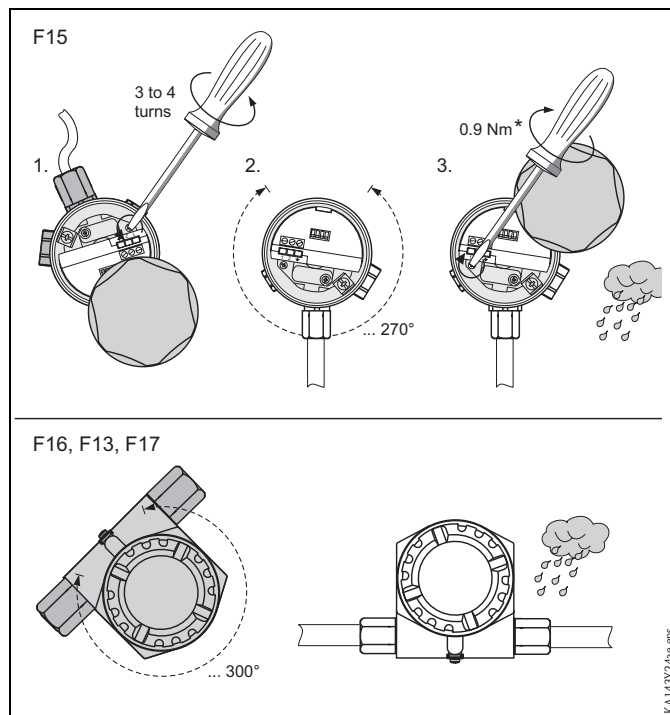
**Screw Liquiphant into  
process connection.  
DON'T use housing to turn.**



**Orientation in pipes:  
marking in direction of  
flow**

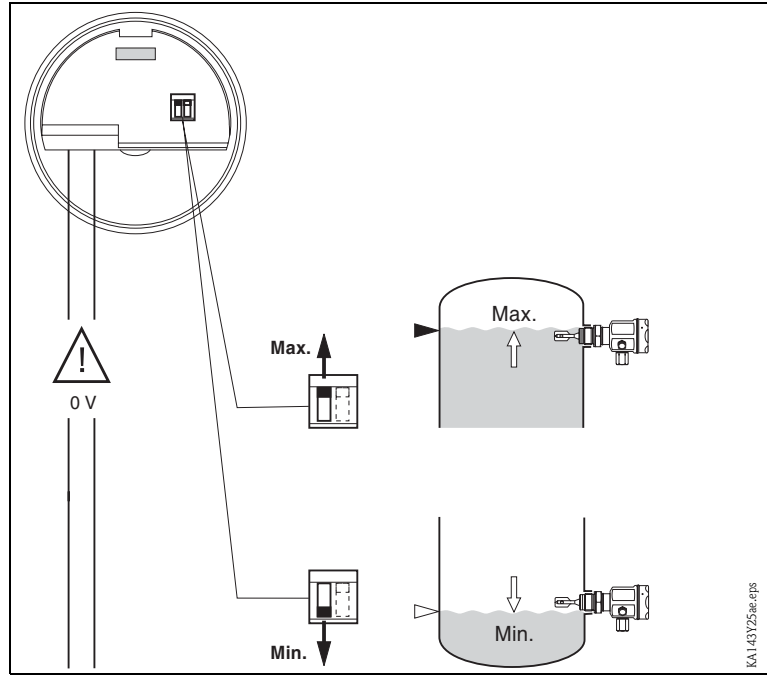


**Cable entry orientation**

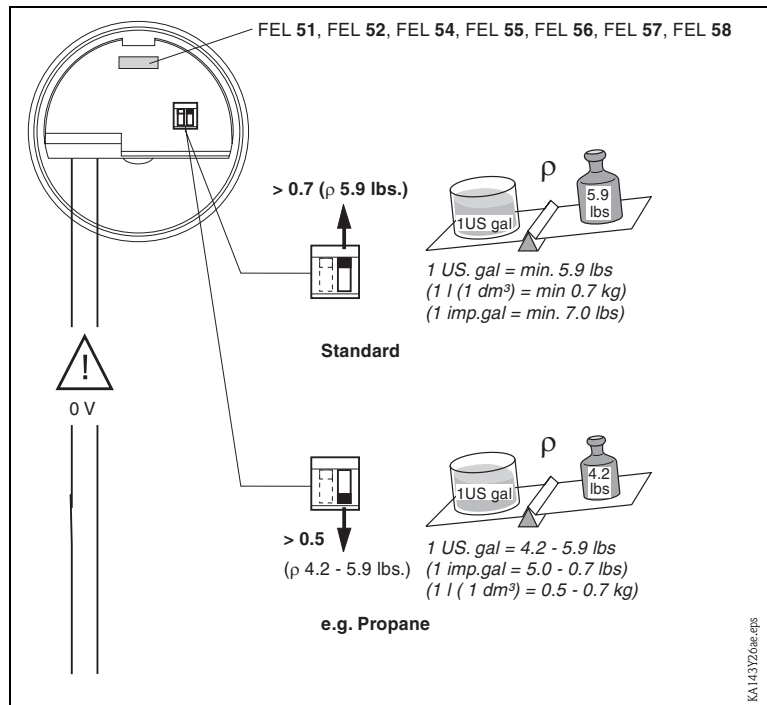


## 4 Setup

### Minimum/maximum fail-safe mode

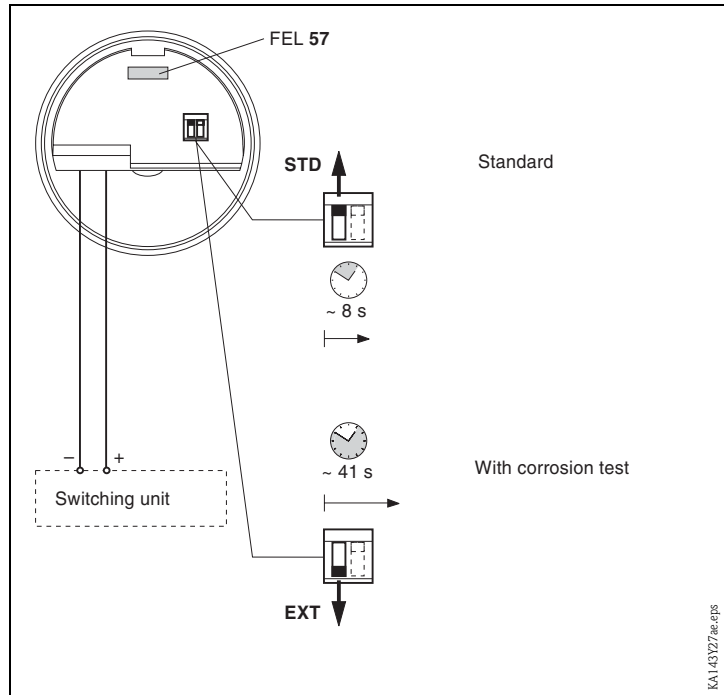


### Liquid density. Density $\rho$ measured in $\text{g}/\text{cm}^3$ (SGU) or in $\text{kg}/\text{l}$

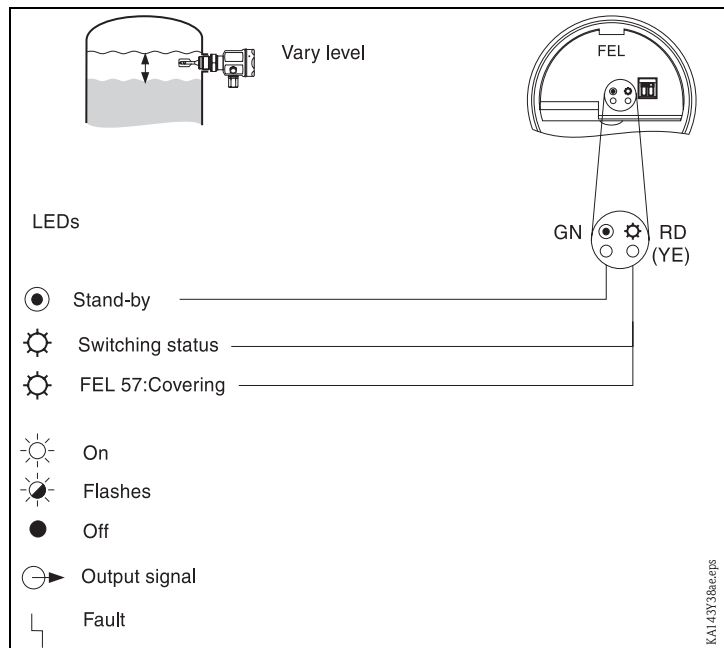


**Self test FEL57**

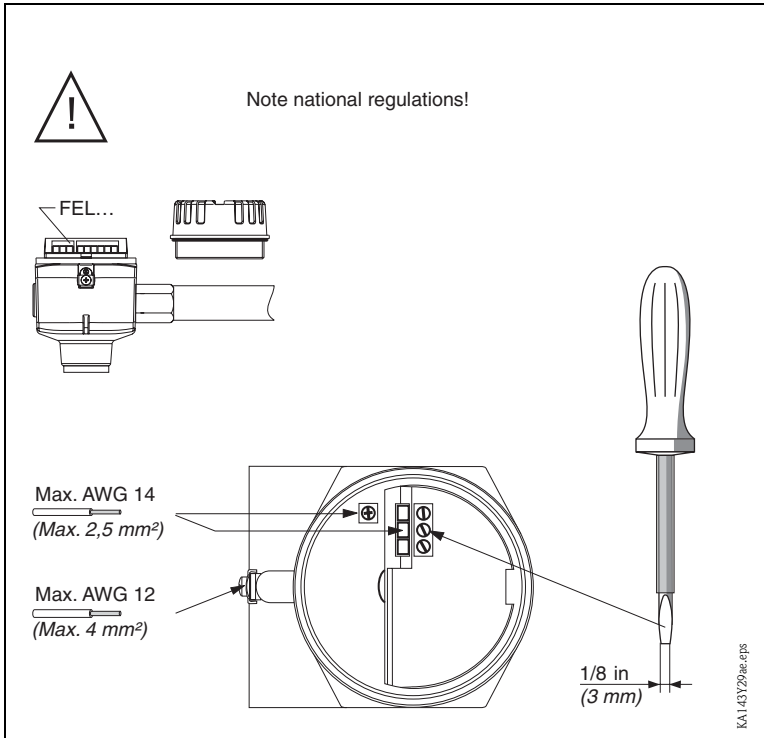
(See page 21 and switching unit for sequence)



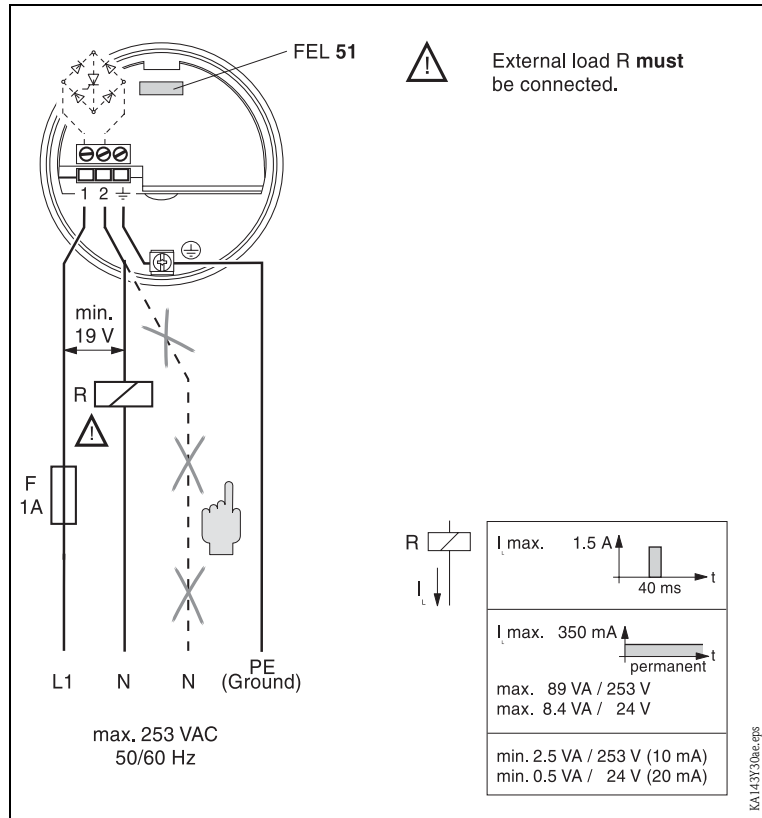
**4.1 Display elements**



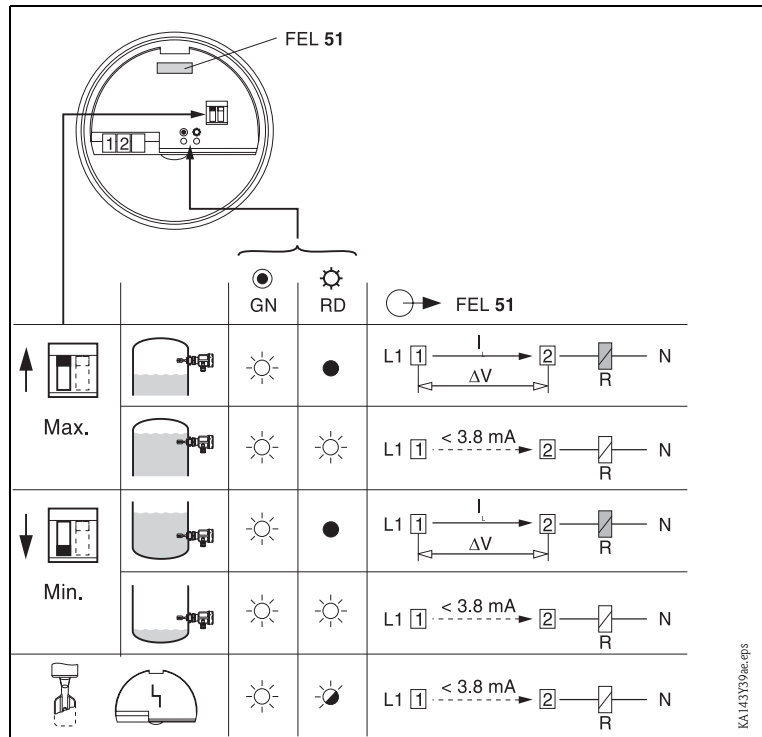
### 4.2 Connections, Function



**Connections FEL51**  
**Two-wire AC connection**

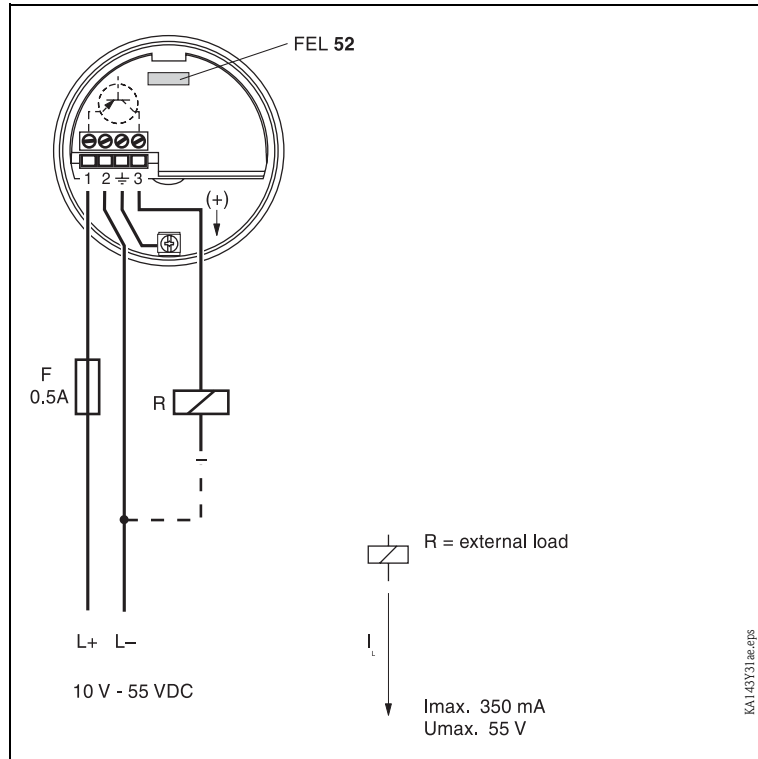


**Function FEL51**

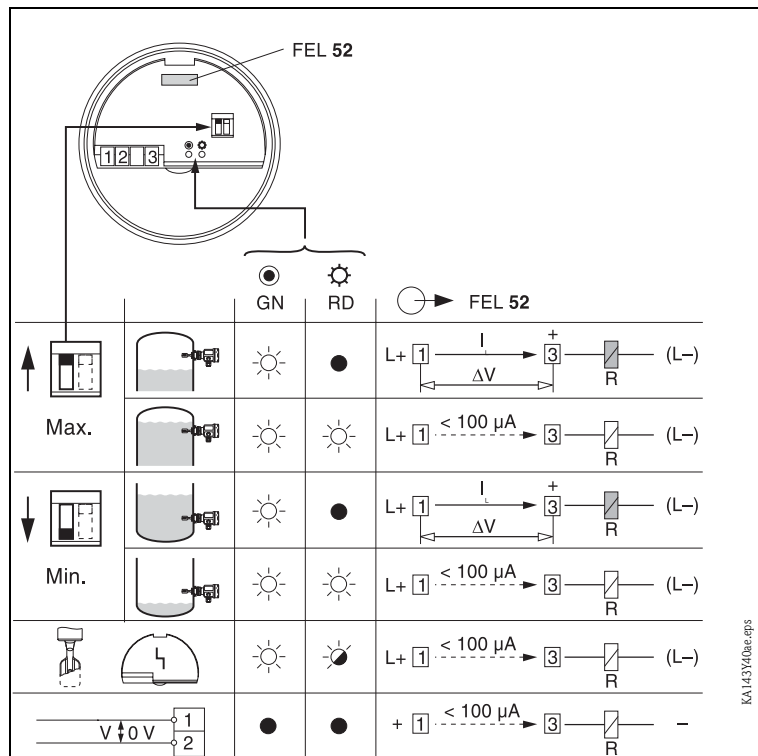


$\Delta V_{FEL51} \text{ max. } 3V$

**Connections FEL52**  
**DC connection (PNP)**

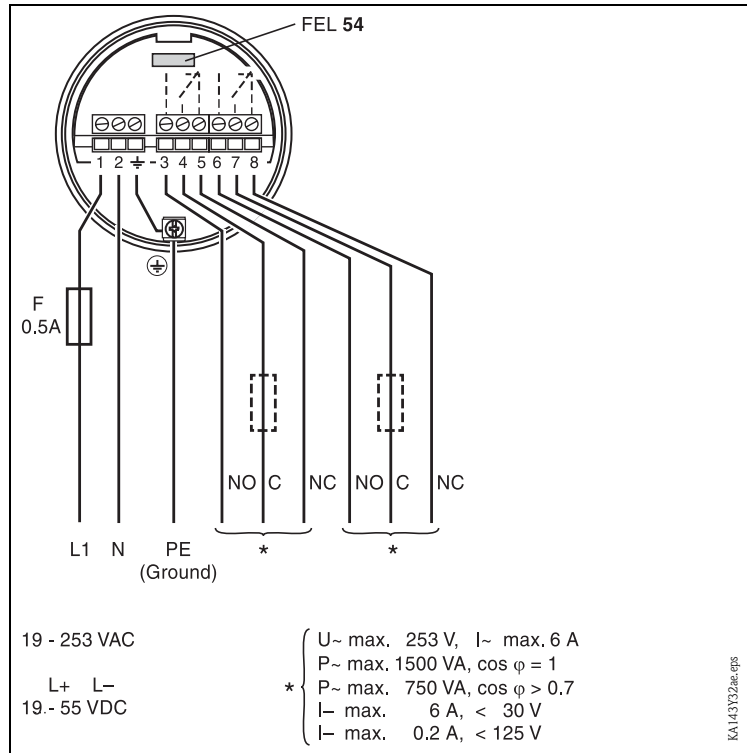


**Function FEL52**

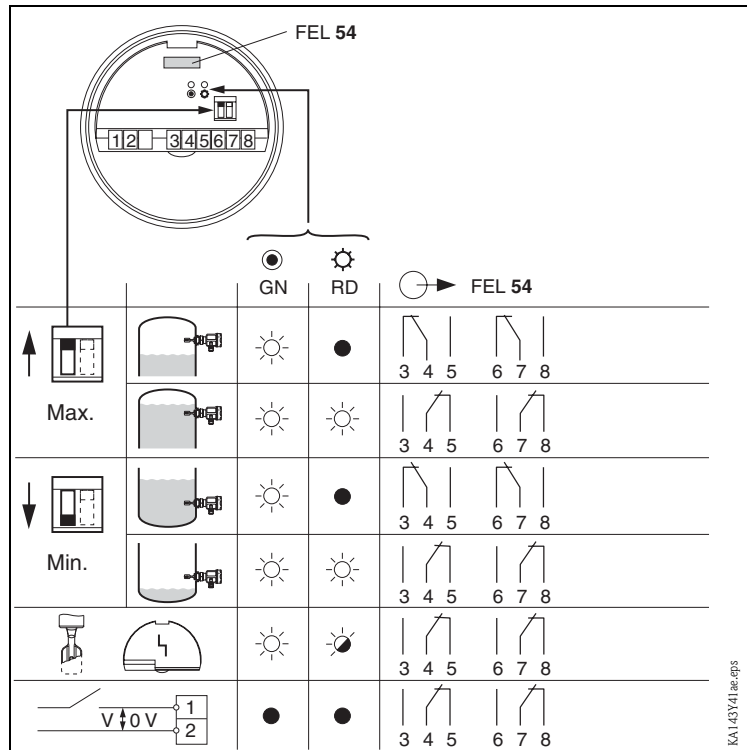




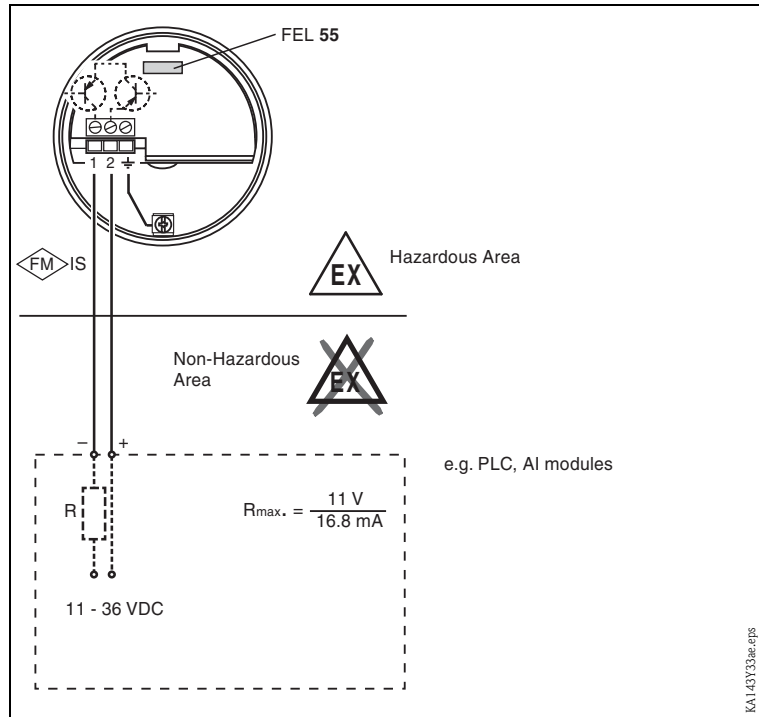
**Connections FEL54**  
**Universal connection**  
**Relay output**



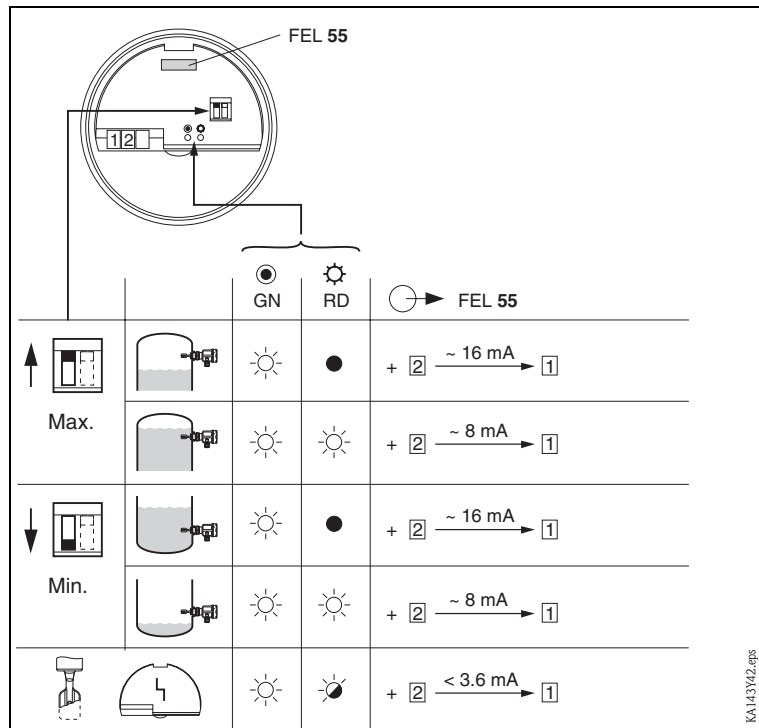
**Function FEL54**



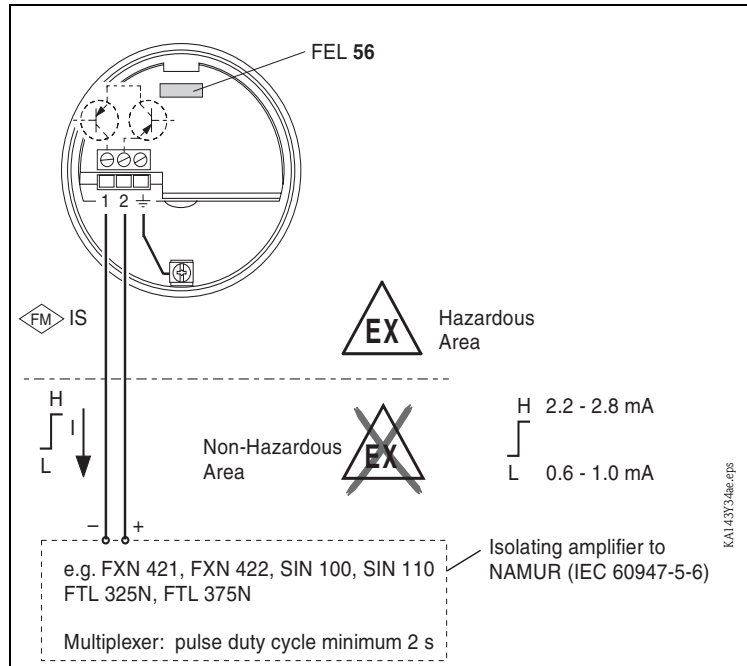
**Connections FEL55**  
**Output**  
**8/16 mA**



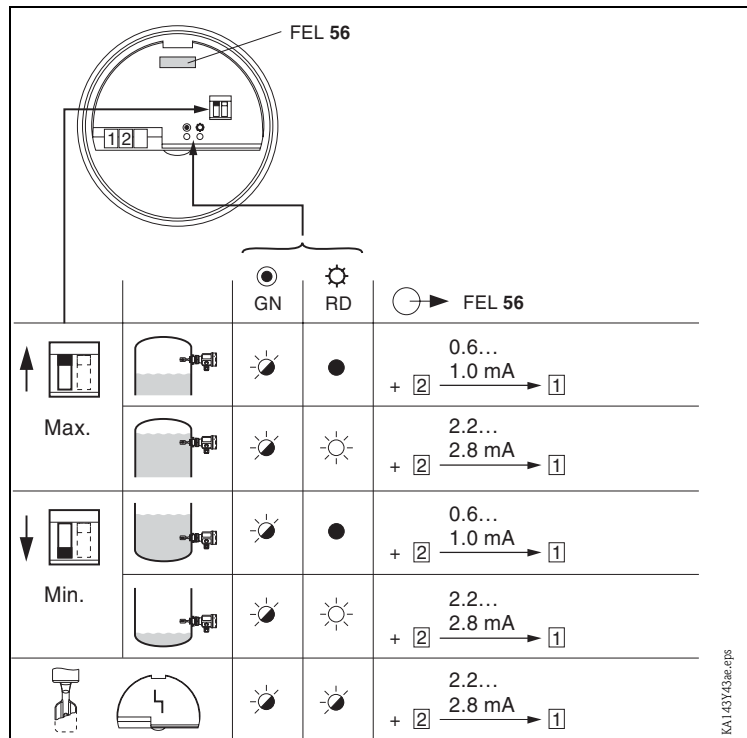
**Function FEL55**



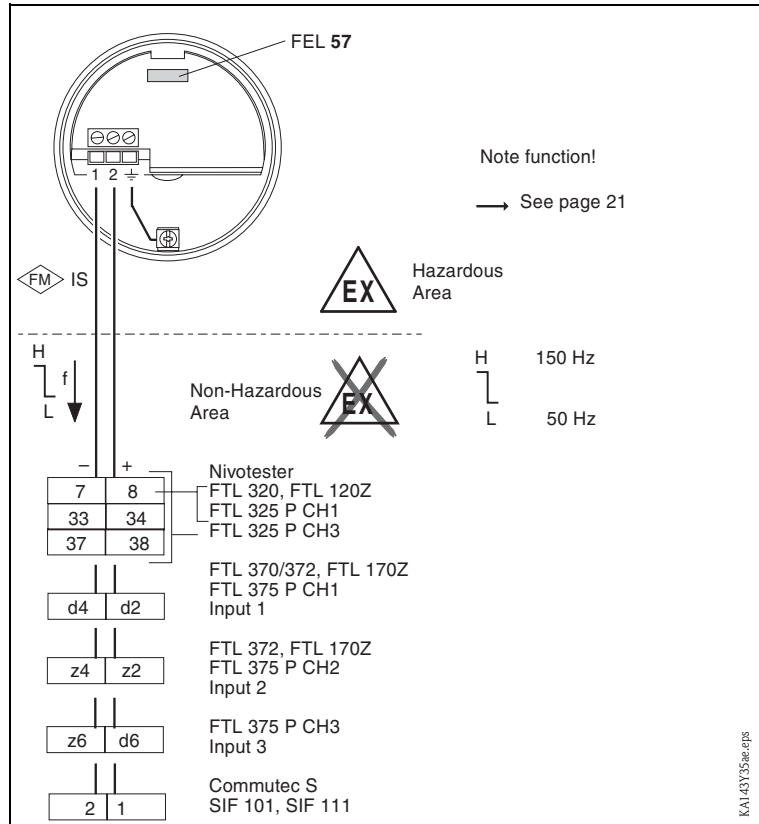
**Connections FEL56  
NAMUR output L-H  
<1.0 mA / >2.2 mA**



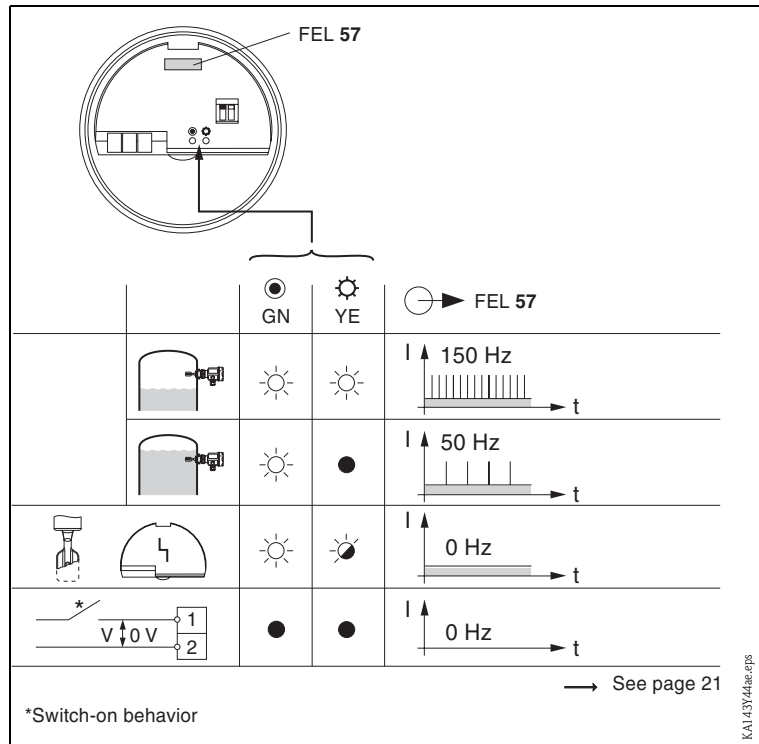
**Function FEL56**



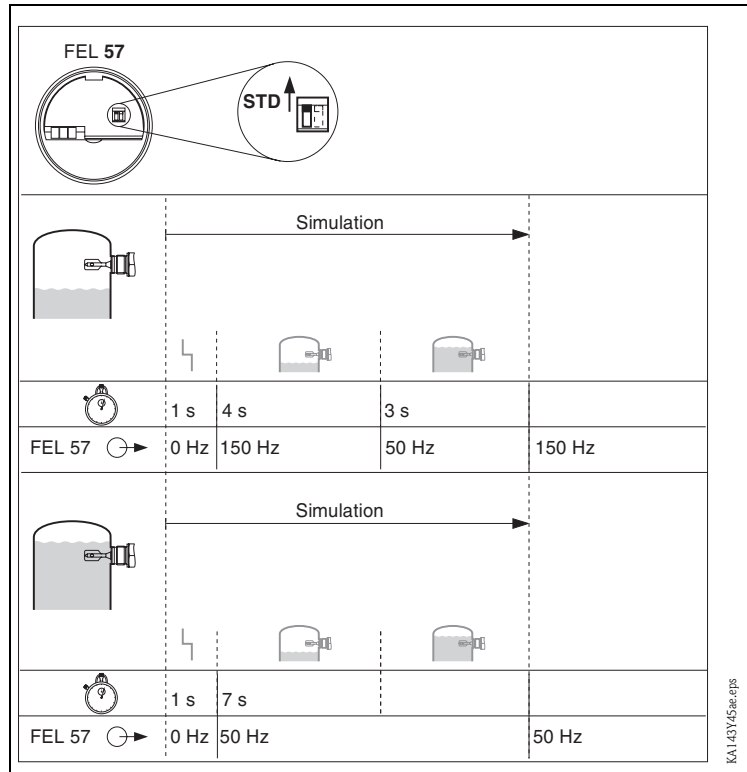
**Connections FEL57**  
**PFM output**  
**150 Hz/50 Hz**



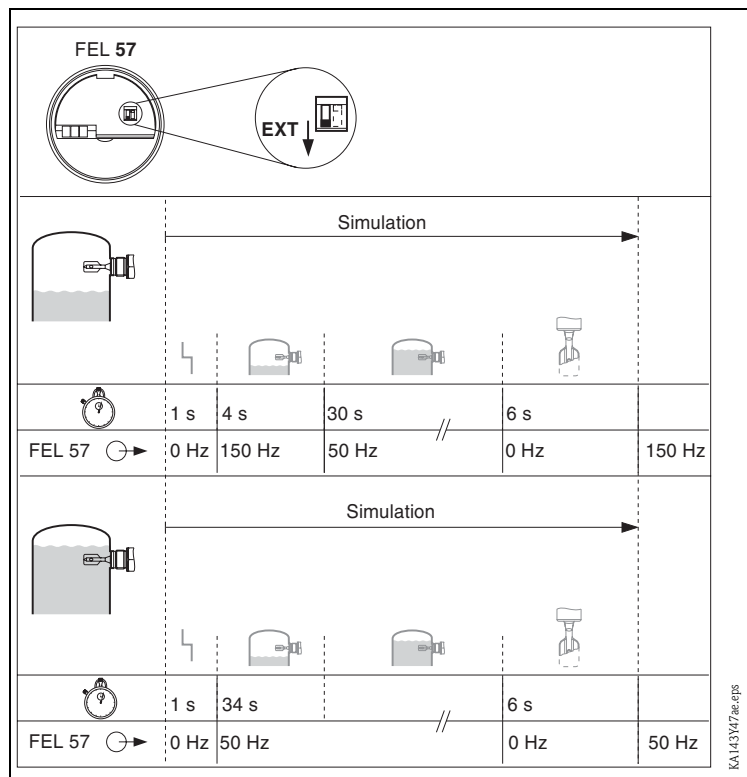
**Function FEL57**



**Switch-on behavior STD  
(Self test)**

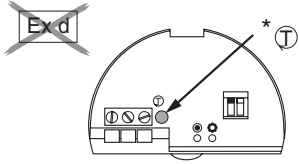


**Switch-on behavior EXT  
(Self test)**





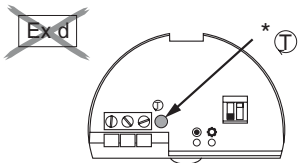
**Function test button FEL58**  
**Fail-safe mode MAX**



<b>MAX</b> +		
<b>1. Normal operation</b>	GN  YE 1 Hz 2.2... + 3.5 mA 2 → 1	GN  YE 1 Hz 0.6... + 1.0 mA 2 → 1
<b>2. Press test button</b> 	GN  YE + 0 mA 2 - - - - -> 1	GN  YE + 0 mA 2 - - - - -> 1
<b>3. Release the test button, after ~2 s normal operation</b> 	GN  YE 1 Hz 2.2... + 3.5 mA 2 → 1	GN  YE 1 Hz 0.6... + 1.0 mA 2 → 1

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**Function test button FEL58**  
**Fail-safe mode MIN**

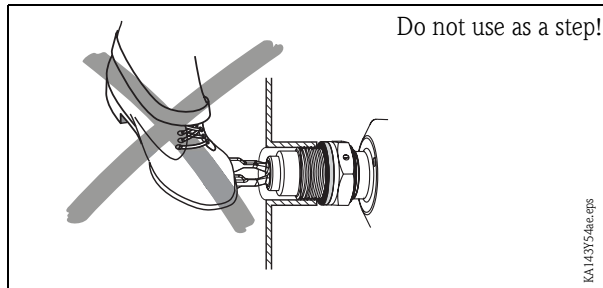
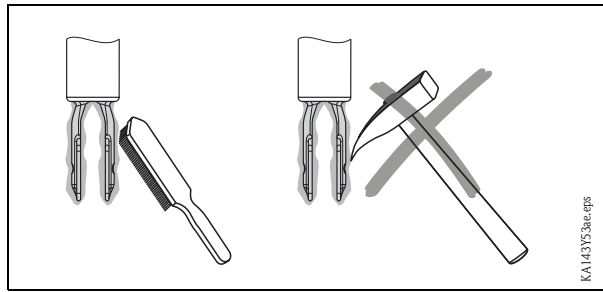


<b>MIN</b> +		
<b>1. Normal operation</b>	GN  YE 1 Hz 2.2... + 3.5 mA 2 → 1	GN  YE 1 Hz 0.6... + 1.0 mA 2 → 1
<b>2. Press test button</b> 	GN  YE + 0 mA 2 - - - - -> 1	GN  YE + 0 mA 2 - - - - -> 1
<b>3. Release the test button, after ~2 s normal operation</b> 	GN  YE 1 Hz 2.2... + 3.5 mA 2 → 1	GN  YE 1 Hz 0.6... + 1.0 mA 2 → 1

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## 5 Maintenance & Cleaning

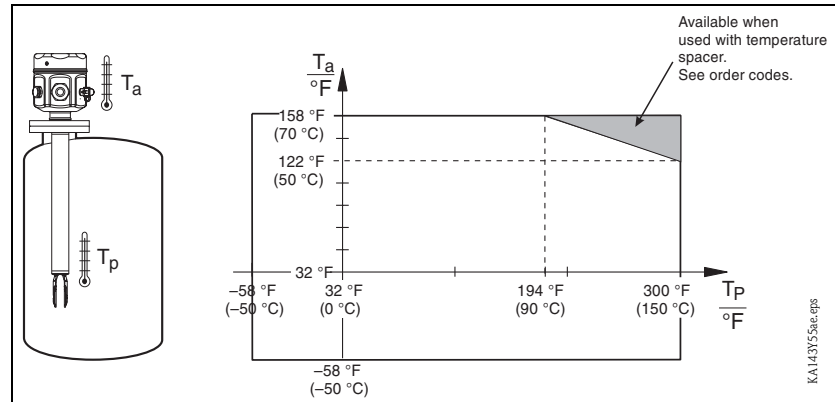
### Removal of encrustation



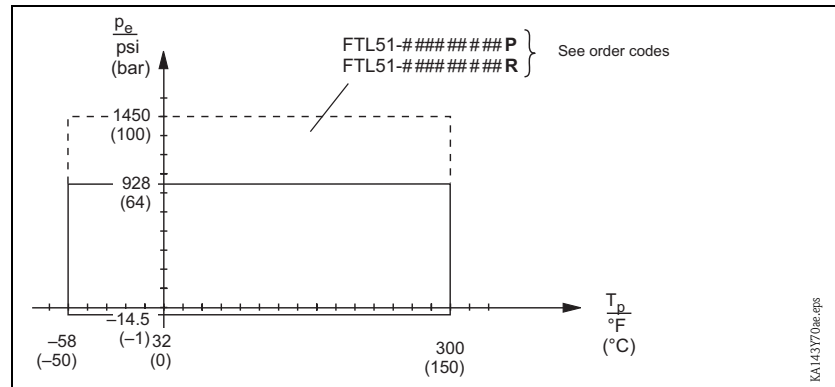


## 6 Technical Data

Ambient temperature  $T_a$   
 Process temperature  $T_p$

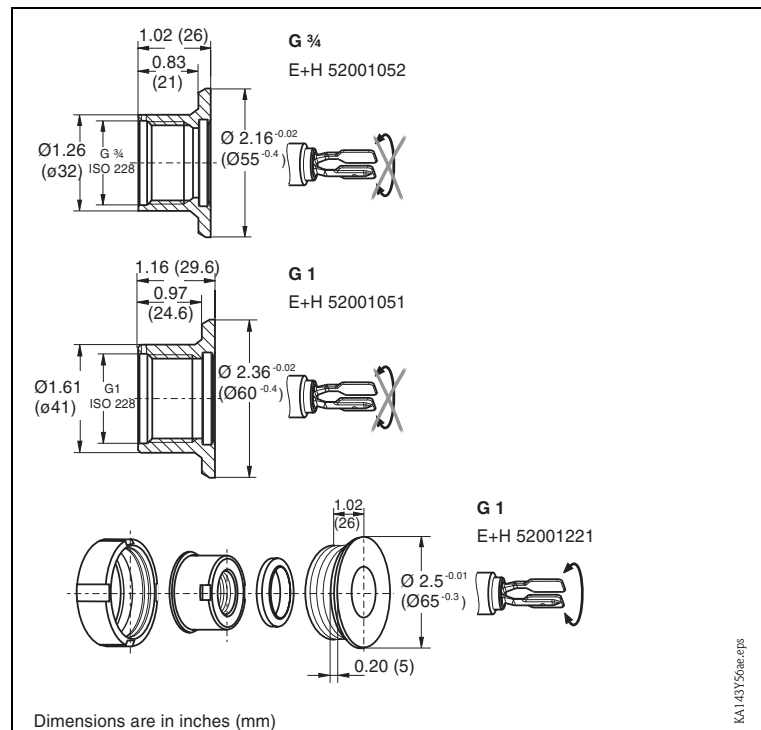


Process pressure  $p_e$   
 Process temperature  $T_p$



### 6.1 Accessories

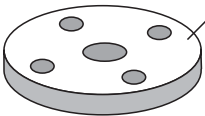

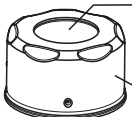
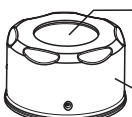
Weld-in sockets



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

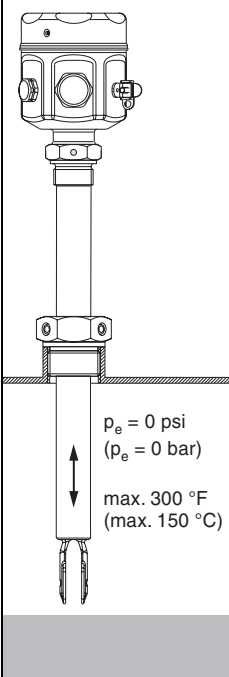
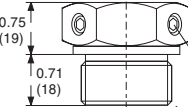
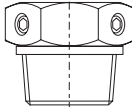
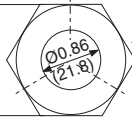
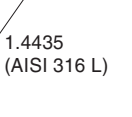
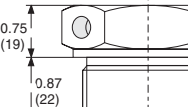
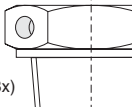
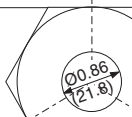
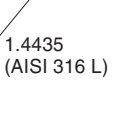
max. 580 psi/210°F  
 (max. 40 bar/100°C)

**Lap joint flanges with BSP 1 (G1) thread; Covers with window**

	Corrosion-resistant steel 1.4571 (AISI 316 Ti)	Lap joint flange with G1 thread 2", 150 psi, RF, ANSI B 16.5 E+H 918144-0000
	PA 12	Transparent cover For plastic housing E+H 943461-0001
	Glass AISI 316 L (1.4435)	Stainless steel cover with glass window For stainless steel housing E+H 943301-1000
	PC AISI 316 L (1.4435)	With polycarbonate window E+H 52001403

KA143Y58ae.eps

**Sliding sleeves for unpressurized operation**

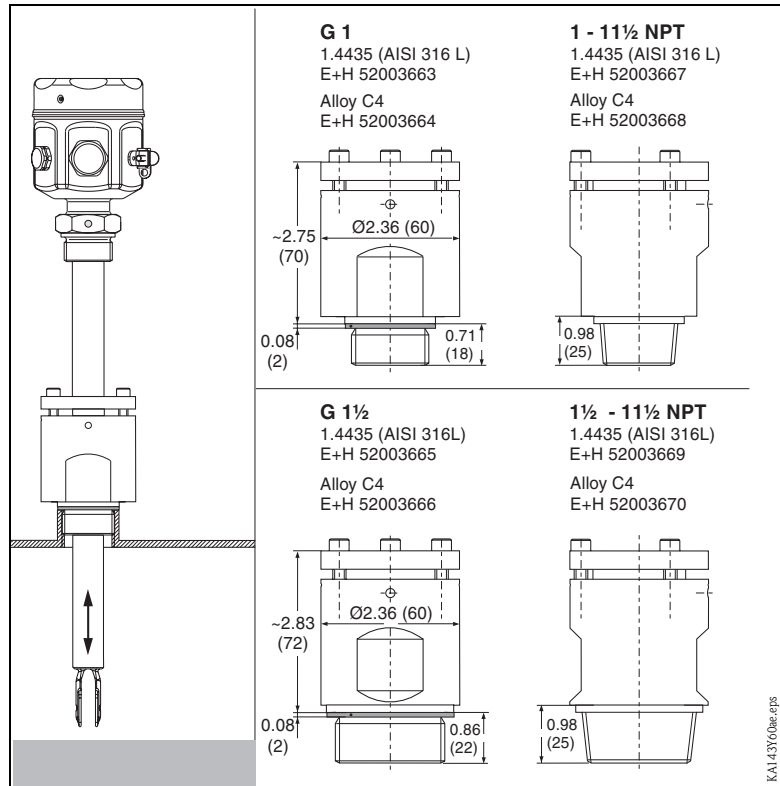
	<b>G 1</b> E+H 52003978	<b>1 - 1 1/2 NPT</b> E+H 52003979
		
	0.75 (19) 0.71 (18) 1.61 (41)	M6 (3x) 1.4435 (AISI 316 L)
		
	<b>G 1 1/2</b> E+H 52003980	<b>1 1/2 - 1 1/2 NPT</b> E+H 52003981
		
	0.75 (19) 0.87 (22) 2.16 (55)	M6 (3x) 1.4435 (AISI 316 L)
		

$p_e = 0 \text{ psi}$   
 $(p_e = 0 \text{ bar})$   
 max. 300 °F  
 (max. 150 °C)

KA143Y59ae.eps

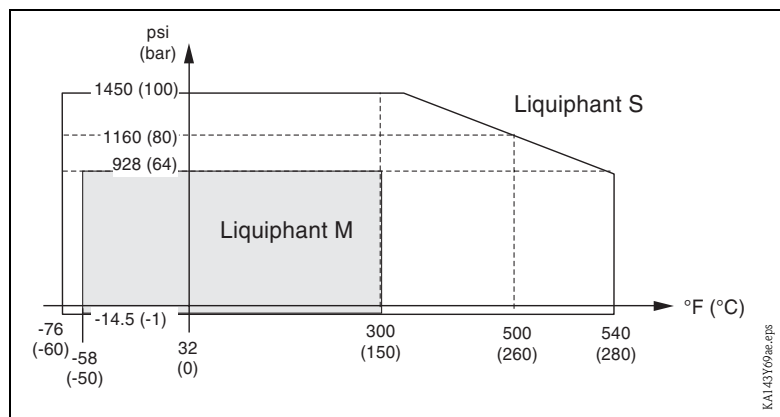
See KA151F  
(G 1, NPT 1)  
See KA152F  
(G 1 1/2, NPT 1 1/2)

**High pressure sliding sleeves**



See KA153F  
(G 1, NPT 1)  
See KA154F  
(G 1 1/2, NPT 1 1/2)

**High pressure sliding sleeves:  
Process pressure  $p_e$   
Process temperature  $T_p$**



## 7 Troubleshooting


Fault	Reason	Remedy
Does not switch	No power	Check power
	Faulty signal line	Check signal line
	Faulty electronic insert – FEL51 connected directly to L1 and N	Exchange – always connect FEL51 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, FEL58: green flashes (0.3 Hz))	Exchange fork and process connection
	FEL51: Internal resistance of connected relay too large	Connect suitable relay
	FEL51: Holding current of connected relay too low	Connected resistor in parallel with relay
	FEL54: Contacts welded together (after short-circuit)	Exchange FEL54; 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
	FEL52: Output overloaded	Reduce load, (cable) capacitance
Switches incorrectly after power failure	FEL57: behavior during switch-on test (functional test)	Observe switching behavior of FEL57; after power failure block plant control for up to 45 s

### Troubleshooting Supplement

If the switching behavior of the fork is abnormal, the fork frequency can be measured at PIN 4 of the diagnosis socket. With electronic inserts FEL 51/52/54/55/56/57/58, this is a sinusoidal vibration whose amplitude makes it possible to determine the condition of the fork.

## 8 Spare Parts

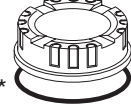
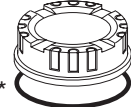
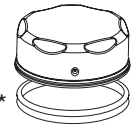
### Electronic inserts

	FEL51	52002304	KA143101ae.eps
	FEL52	52002305	
	FEL54	52002306	
	FEL55	52002307	
	FEL56	52002308	
	FEL57	52002309	
	FEL58	52006454	

### Installation specification:

During installation, please keep in mind that electrical resources (electronic inserts) which are powered by non-intrinsically-safe circuits may **no** longer be interconnected with intrinsically-safe circuits.

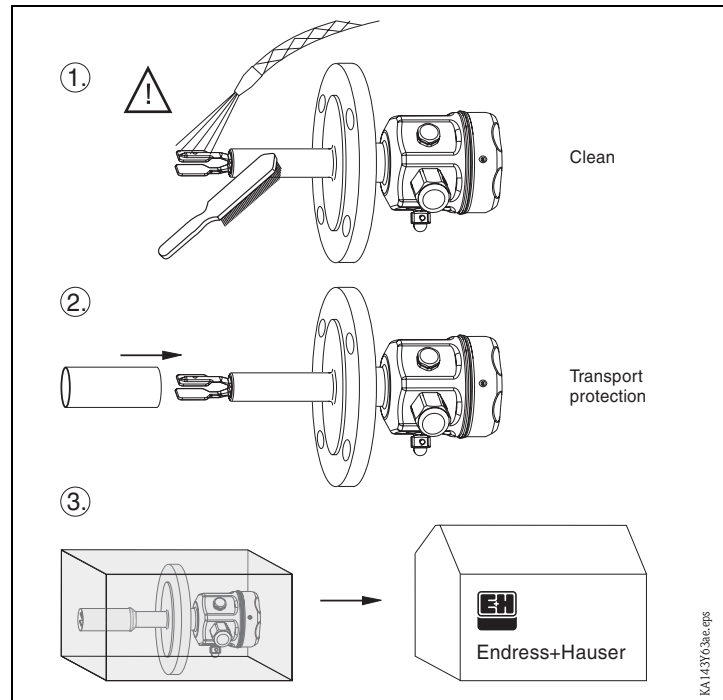
### Housing covers, seals

* 	Alu	} Alu w/EPDM O-ring E+H 52002699	E+H 52002699
	EPDM		
* 	PBT-FR (cover only)	E+H 943461-0000	E+H 017717-0003
	EPDM O-ring	E+H 017717-0003	
* 	AISI 304/316L (cover only) (1.4301/1.4435)	E+H 943301-0000	E+H 943304-0000
	MVQ Silicone Seal	E+H 943304-0000	

\* Lubricate with silicone grease or graphite.

## 9 Repair

Repair is done at Endress+Hauser



## 10 Supplemental Documentation

Technical Information

TI328F

Liquiphant FTL50, FTL50H, FTL51, FTL51H

Notes on Safety

XA031F	CE	II 1/2 G	EEx d	IIC/IIB
XA063F	CE	II 1/2 G, II 1/2 D	EEx ia/ib	IIC/IIB
XA064F	CE	II 1 G	EEx ia	IIC/IIB
XA108F	CE	II 1/2 G	EEx de	IIC/IIB
XA154F	CE	II 1/2 G, II 1/2 D	EEx ia/ib	IIC/IIB
XA159F	CE	II 1 G	EEx ia	IIC/IIB
XA182F	CE	II 3 G, II 3 D	EEx nA/nC	II



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