



Level



Pressure



Flow



Temperature



Liquid
Analysis



Registration



Systems
Components



Services

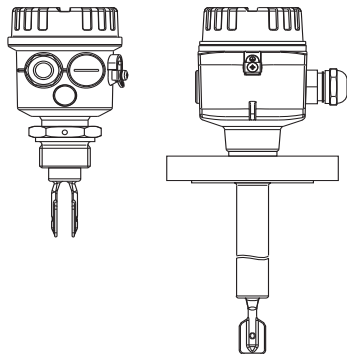


Solutions

简明操作指南

Liquiphant M FTL50, FTL51

限位开关



KA00143F/28/ZH/07.10

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小心!

= 禁止;

导致不正确操作或损坏。

安全指南

Liquiphant M FTL50、FTL51 设计用于液位的限位检测。

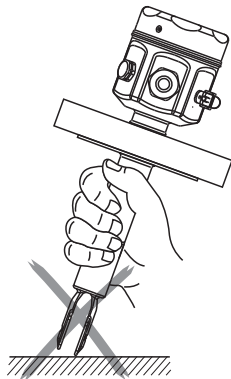
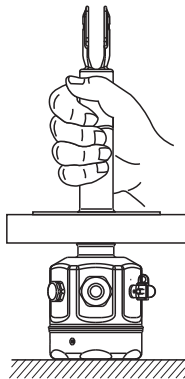
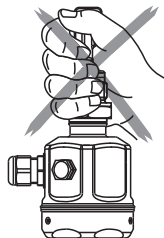
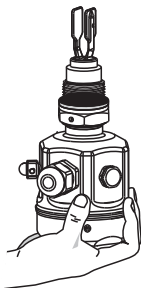
使用不当可能会导致应用危险。

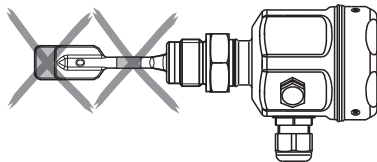
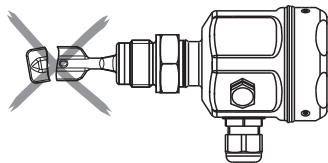
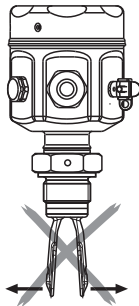
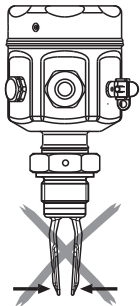
仅允许经授权的合格专业人员进行

Liquiphant M FTL50、FTL51 的安装、电气连接、调试、操作和维护，必须严格遵守《操作手册》、相关标准、法律要求和证书 (取决于实际应用) 中的要求。在设备附近安装易于操作的电源开关。标识电源开关方便设备通断。

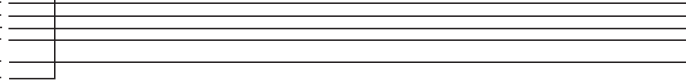
操作

握住外壳、法兰或延长管。





禁止弯曲
禁止截短
禁止拉伸



Endress+Hauser



max. 100 bar, 150 °C

max. 100 bar, 150 °C



-max. 25 bar, 150 °C
max. 40 bar, 100 °C

max. 16 bar, 120 °C
max. 2 bar, 150 °C

TC2	DN25-38 (1...1 1/2"), ISO 2852, 316L Tri-Clamp卡箍
TE2	DN40-51 (2"), ISO 2852, 316L Tri-Clamp卡箍

yy9 2*

¹ 无 2^* 其他

不适用于PBT认证³*

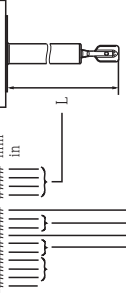


ENDRESS+HAUSER
LIQUIPHANT M

订货号

FTL5#-##### mm

in



FTL51

²

AA mm, 316L,
BB mm, AlloyC4合金,
BE mm, 316L,
CB in, 316L,
CE in, AlloyC4合金,
DB in, 316L,
DE "L II", AlloyC4合金,

²

IA mm, 316L
JB mm, AlloyC4合金
JE in, 316L
KB in, 316L
KE in, AlloyC4合金
LB "L II", 316L
LE "L II", AlloyC4合金

²

QA mm, 316L
RB mm, AlloyC4合金
RE in, 316L
SB in, AlloyC4合金
SE in, 316L
TB "L II", AlloyC4合金
TE "L II", AlloyC4合金
YY ²

Ra < 3.2 µm/80 grit (FTL50)

Ra < 3.2 µm/80 grit

Ra < 3.2 µm/80 grit

Ra < 3.2 µm/80 grit

Ra < 3.2 µm/80 grit

Ra < 3.2 µm/80 grit

Ra < 3.2 µm/80 grit

+ "T" (FTL50)

+ "T"

+ "T"

+ "T"

+ "T"

+ "T"

+ "T"

+ "p" (FTL50)

+ "p"

+ "p"

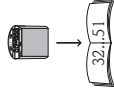
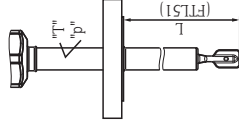
+ "p"

+ "p"

+ "p"

+ "p"

A FEL50A, PROFIBUS PA
1 FEL51, 19...253 V AC
2 FEL52, 10... 55 V DC, PNP
4 FEL54, 19...253 V AC, 19...55 V DC, DPDT
5 FEL55, 11... 36 V DC, 8/16mA
6 FEL56, NAMUR, L-H
7 FEL57, PFM
8 FEL58, NAMUR, H-L
9 ²



E1	F27	NEMA6P, NPT ¾	
E4	F16, F13/17, IP66,	NEMA4X, NPT ½	
E5	F16, F13/17, IP66,	NEMA4X, NPT ¾	
E6	F15, F27, IP68,	NEMA4X, NPT ½	
F1	F16, IP66,	G ½	
F4	F16, IP66,	G ½	
F5	F13/17, IP66,	G ½	
F6	F15, IP66,	G ½	
G1	F27, IP68,	M20	
G4	F16, IP66,	M20	
G5	F13/17, IP66,	M20	
G6	F15, IP66,	M20	
N4	F16, IP66,	M12	
N5	F13/17, IP66,	M12	
N6	F15, IP66,	M12	
Y9	²		
#3	一体式外壳		
#7	铝/分离型外壳		
A	¹		
B	免PVIS		
C	EN 10204 - 3.1, 316L		
K	特殊密度调节H20		
L	特殊密度调节H20, EN10204-3.1		
N	EN 10204 - 3.1, NACE MR0175, 316L		
P	100 bar (FTL51)		
R	100 bar, EN 10204 - 3.1, NACE MR0175, 316L (FTL51)		
S	GL/ABS船级认证(FTL51: max. 1600 mm)		
Y	²		

	F16 (PBT)	
	F13/17 (铝) F27 (316L)	
		
		



F16 (PBT)



F13/17 (铝)
F27 (316L)



F15 (316L)



¹ 无

² 其他

“L II” 开关点

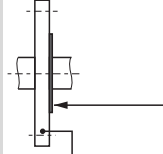
Liquiphant II FTL360/365, FDL 30/35

“T” 隔温管

“p” 压力密封馈通

ANSI B 16.5

AA2	1½"	150 lbs,	RF,	316/316L
AB2	1¼"	300 lbs,	RF,	316/316L (FTL51)
AC2	1½"	150 lbs,	RF,	316/316L
AD2	1½"	300 lbs,	RF,	316/316L (FTL51)
AE2	2"	150 lbs,	RF,	316/316L
AE5	2"	150 lbs,	RF,	Alloy C4 >316/316L
AE6	2"	300 lbs,	RF,	Alloy C22 >316/316L
AF2	2"	300 lbs,	RF,	316/316L
AG2	2"	600 lbs,	RF,	316/316L (FTL51)
AI2	2½"	300 lbs,	RF,	316/316L (FTL51)
AL2	3"	150 lbs,	RF,	316/316L
AM2	3"	300 lbs,	RF,	316/316L (FTL51)
AN2	3"	600 lbs,	RF,	316/316L (FTL51)
AP2	4"	150 lbs,	RF,	316/316L
AQ2	4"	300 lbs,	RF,	316/316L (FTL51)
AR2	4"	600 lbs,	RF,	316/316L (FTL51)
AS2	1"	150 lbs,	RF,	316/316L



EN 1092-1

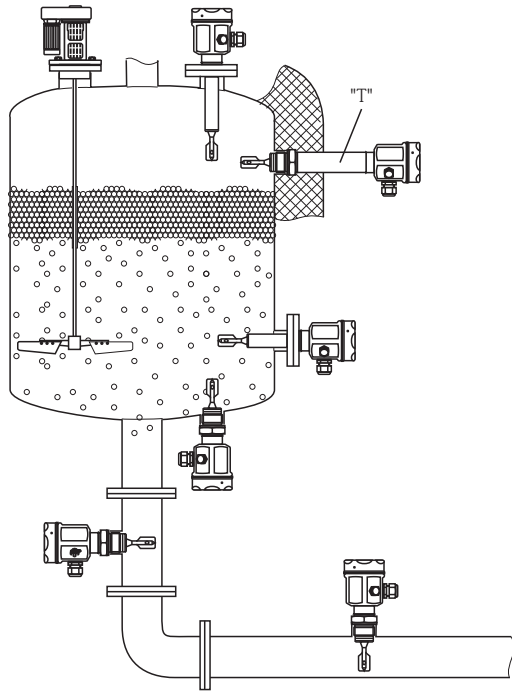
BA2	DN32,	PN6 A,	316L
BB2	DN32,	PN25/40 A,	316L
BC2	DN40,	PN6 A,	316L
BD2	DN40,	PN25/40 A,	316L
BE2	DN50,	PN6 A,	316L
BG2	DN50,	PN25/40 A,	316L
BH2	DN65,	PN6 A,	316L
BI2	DN50,	PN100 A,	316L (FTL51)
BK2	DN65,	PN25/40 A,	316L
BM2	DN80,	PN10/16 A,	316L
BN2	DN80,	PN25/40 A,	316L
BQ2	DN100,	PN10/16 A,	316L
BR2	DN100,	PN25/40 A,	316L

B12	DN80,	PN100 A,	316L (FTL51)
B82	DN25,	PN25/40 A,	316L
CA2	DN32,	PN6 B1,	316L
CA5	DN32,	PN6,	AlloyC4合金> 316L
CA6	DN32,	PN6,	AlloyC22合金> 316L
CE2	DN50,	PN6 B1,	316L
CE5	DN50,	PN6,	AlloyC4合金> 316L
CE6	DN50,	PN6,	AlloyC22合金> 316L
CG2	DN50,	PN25/40 B1,	316L
CG5	DN50,	PN25/40,	AlloyC4合金> 316L
CG6	DN50,	PN25/40,	AlloyC22合金> 316L
CI2	DN50,	PN100 B2,	316L (FTL51)
CN2	DN80,	PN25/40 B1,	316L
CN5	DN80,	PN25/40,	AlloyC4合金> 316L
CN6	DN80,	PN25/40,	AlloyC22合金> 316L
CQ2	DN100,	PN10/16 B1,	316L
CQ5	DN100,	PN10/16,	AlloyC4合金> 316L
CQ6	DN100,	PN10/16,	AlloyC22合金> 316L
C12	DN80,	PN100 B2,	316L (FTL51)
C82	DN25,	PN25/40 B1,	316L
C85	DN25,	PN25/40,	AlloyC4合金> 316L
C86	DN25,	PN25/40,	316L
DG2	DN50,	PN40 B1,	316L
DN2	DN80,	PN40 B1,	316L
D82	DN25,	PN40 B1,	316L
FG2	DN50,	PN40 C,	316L
NG2	DN50,	PN40 D,	316L

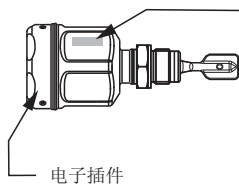
JIS B2220

KA2	10K 25,	RF,	316L
KC2	10K 40,	RF,	316L
KE2	10K 50,	RF,	316L
KE5	10K 50,	RF,	AlloyC4合金> 316L
KE6	10K 50,	RF,	AlloyC22合金> 316L
KL2	10K 80,	RF,	316L
KP2	10K 100,	RF,	316L

液体的限位检测

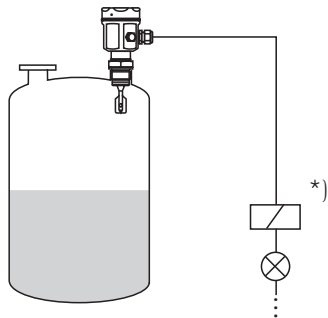


测量系统 直接连接



订货号:
FTLS# - # ### ## # ## #

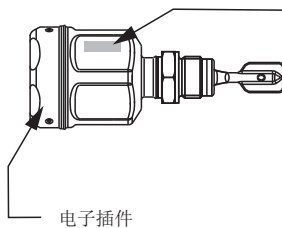
FEL51
FEL52
FEL54



*) 外部负载

测量系统

通过开关单元连接

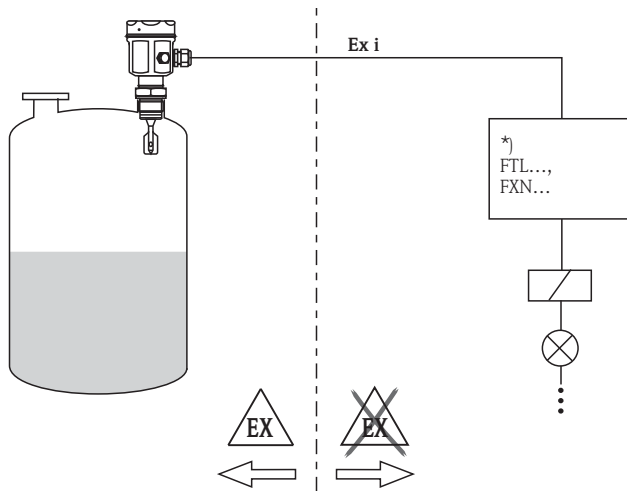


电子插件

订货号:

FTL5# - # ### ## # ## #

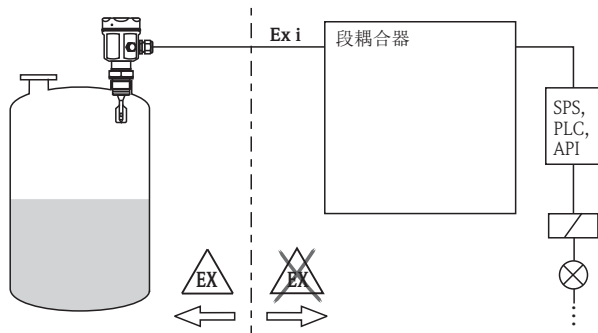
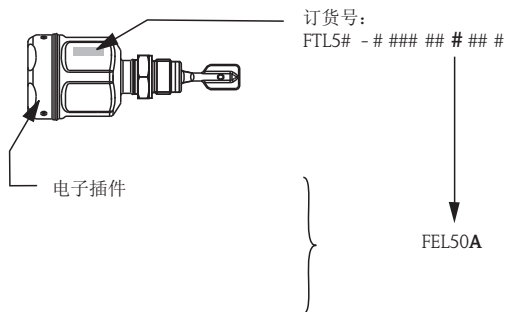
FEL55
FEL56
FEL57
FEL58



* 开关单元、PLC、隔离放大器

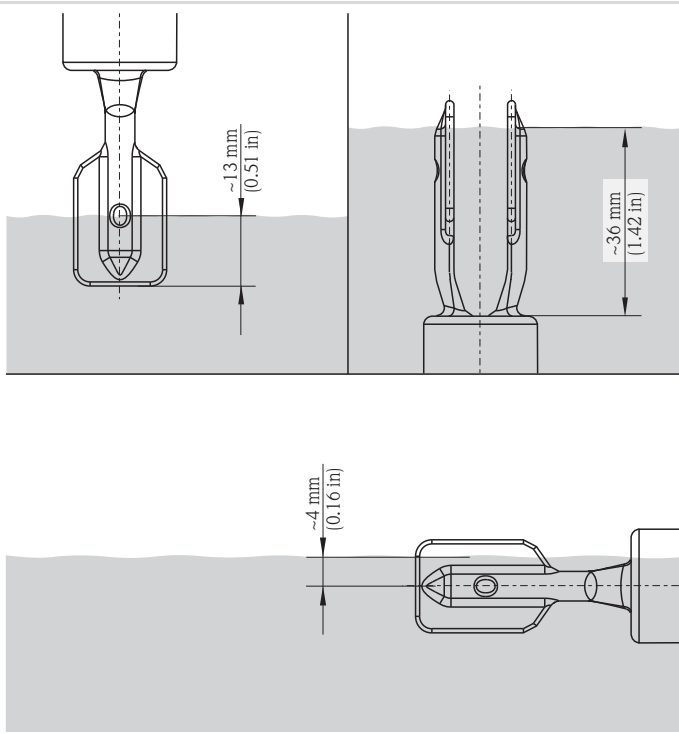
测量系统

连接至 PROFIBUS PA



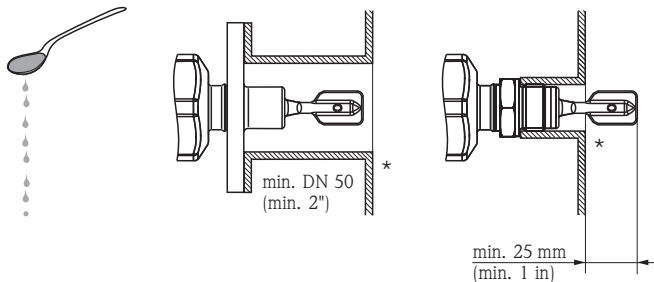
安装

开关点取决于安装位置



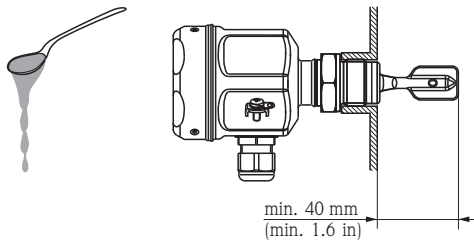
安装实例 取决于液体粘度 ν

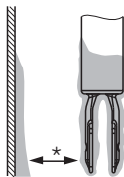
$\nu = 0 \dots 2000 \text{ mm}^2/\text{s}$
($\nu = 0 \dots 2000 \text{ cSt}$)



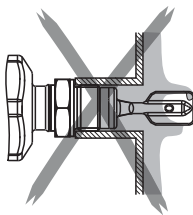
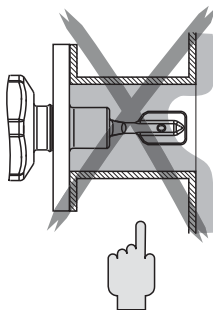
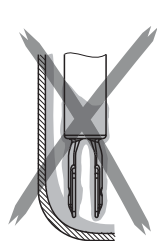
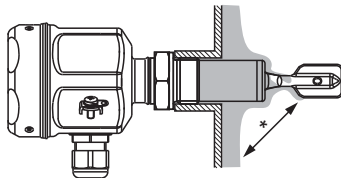
* 去毛刺

$\nu = 0 \dots 10000 \text{ mm}^2/\text{s}$
($\nu = 0 \dots 10000 \text{ cSt}$)

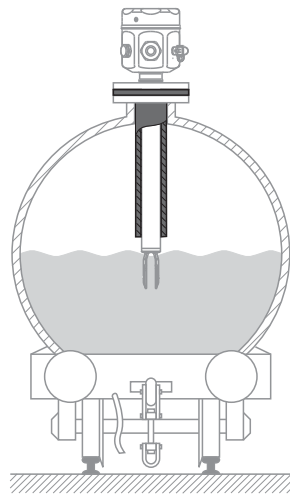
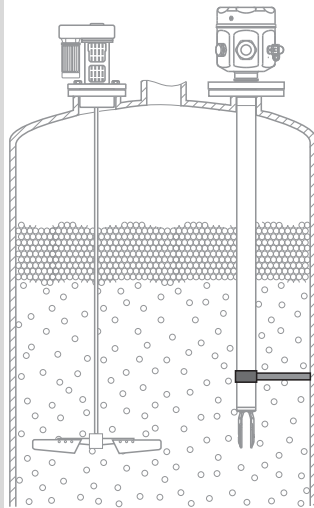




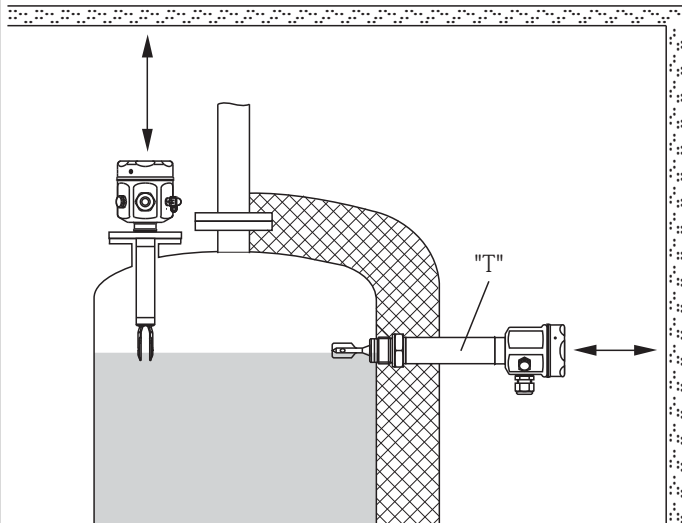
* 安装间距！



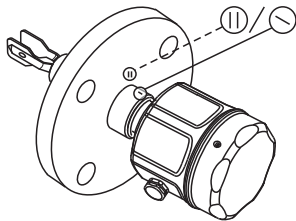
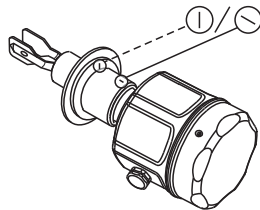
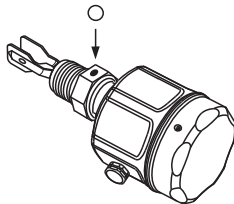
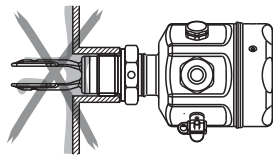
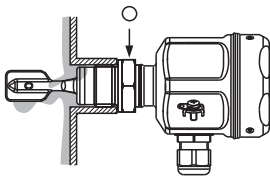
考虑粘附
保持距离，叉体不接触粘附物



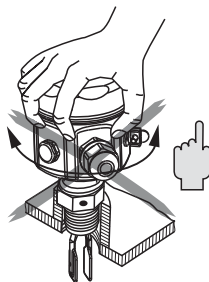
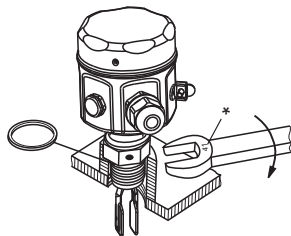
"T" = 绝缘罐体带保温层



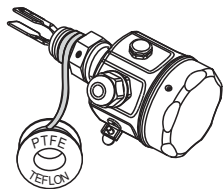
叉体的安装方向：
标记朝上或朝下



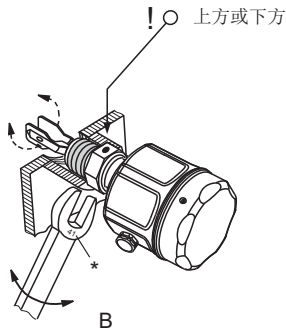
G $\frac{3}{4}$, 32 mm (1 $\frac{1}{4}$ ")*
G 1, 41 mm (1 $\frac{5}{8}$ ")*



NPT $\frac{3}{4}$, R $\frac{3}{4}$, G $\frac{3}{4}$, 32 mm (1 $\frac{1}{4}$ ")*
NPT 1, R 1, G 1, 41 mm (1 $\frac{5}{8}$ ")*



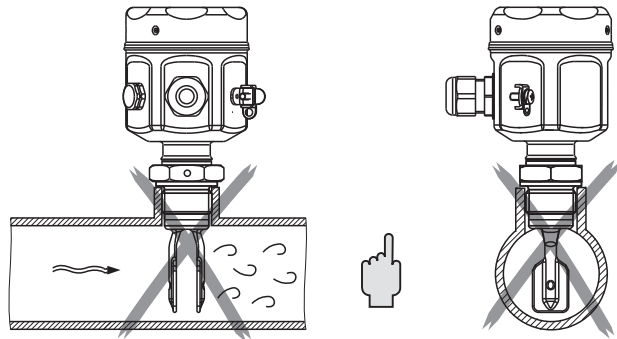
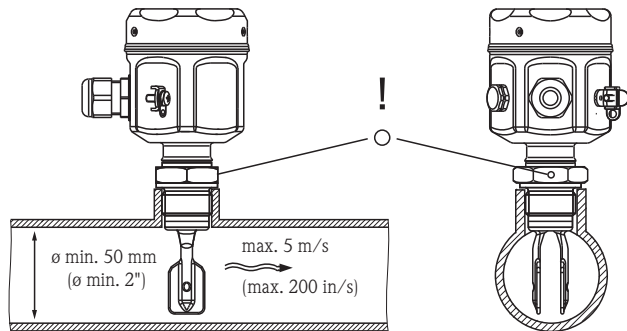
A



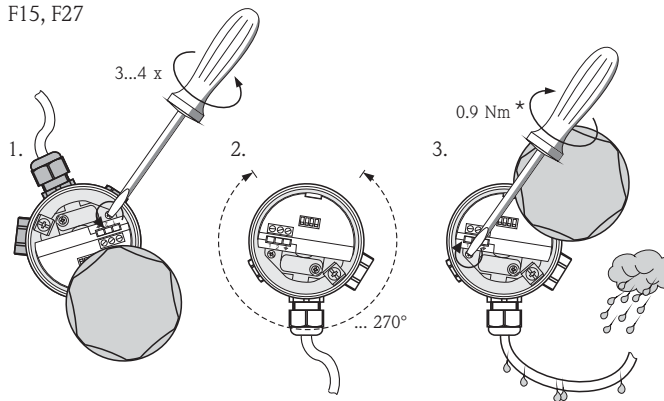
B

将 Liquiphant 拧入至过程连接中。
禁止通过外壳旋转拧紧！

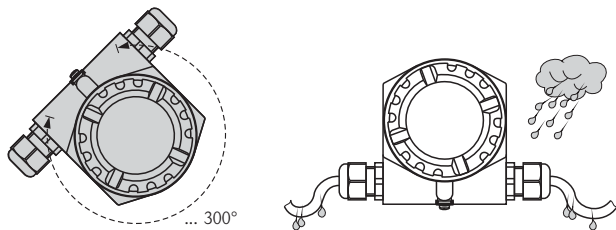
在管道中安装：
标记与流向一致



F15, F27



F16, F13, F17



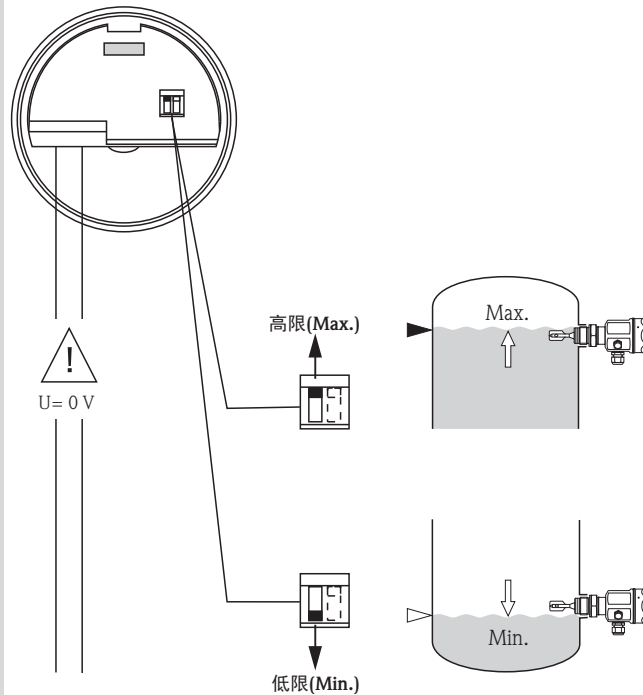
缆塞的安装位置

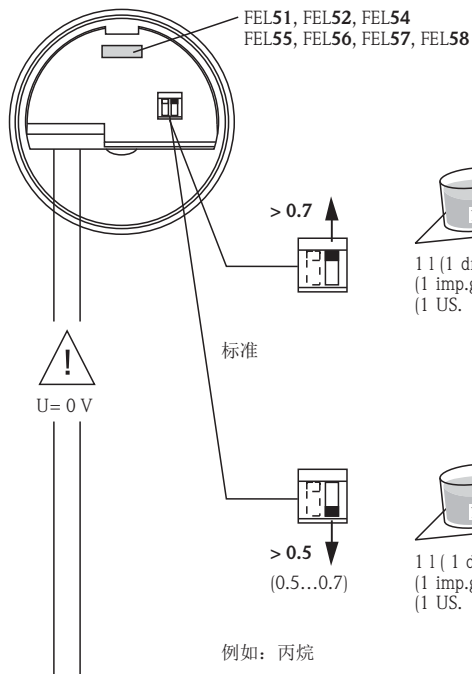
* 扭矩

设置

低限 (MIN) / 高限 (MAX)

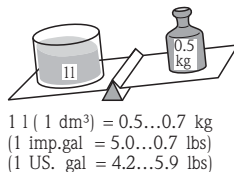
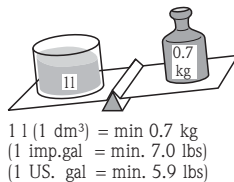
失效安全模式



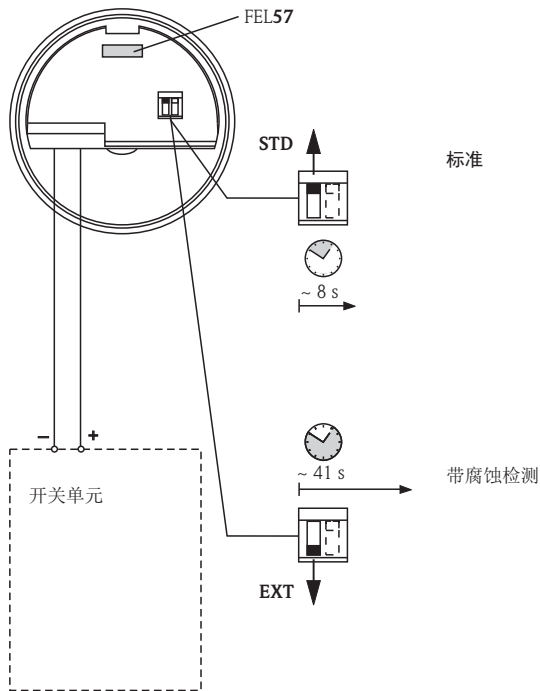


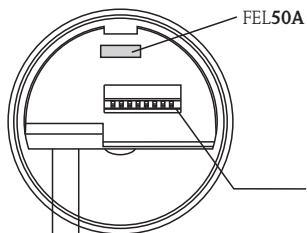
液体密度。

密度 ρ 的测量单位: g/cm^3 或 kg/l



FEL57 的自检功能
(参考第 44、45 页和
开关单元的动作顺序)





ON
OFF

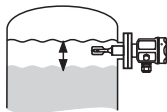
1	2	4	8	16	32	64	SW
0	0	0	0	0	0	0	HW
1	2	3	4	5	6	7	8

实例:

$2 + 8 = 10 = \text{地址}$

设置设备地址
(设置参数请参考 BA00141F)

指示灯信号



液位变化

LED指示灯



待机



开关状态



FEL57、FEL50A: 被覆盖



亮起



闪烁



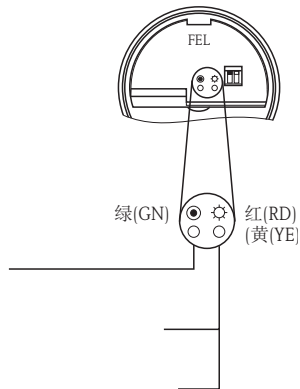
熄灭



输出信号

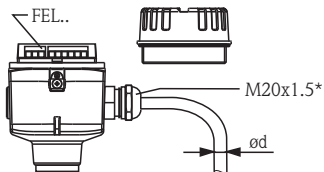


故障



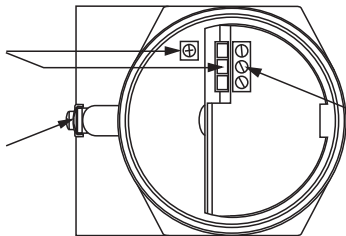


遵守国家法规！

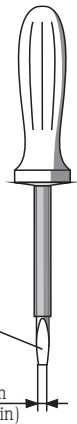


max. 2.5 mm²
(max. AWG 14)

max. 4 mm²
(max. AWG 12)



3 mm
(1/8 in)



电气连接

* 电缆缆塞

镀镍黄铜:

Ød = 7...10.5 mm (0.28...0.41 in)

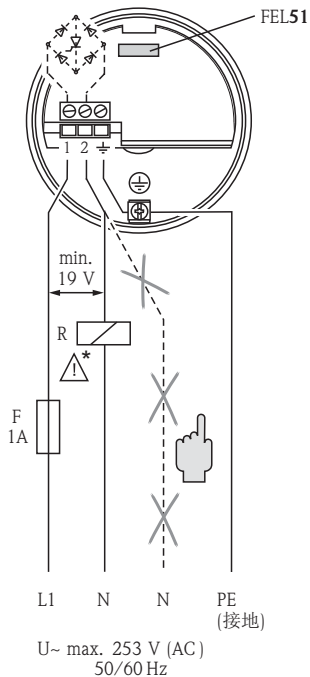
塑料:

Ød = 5...10 mm (0.2...0.38 in)

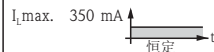
不锈钢:

Ød = 7...12 mm (0.28...0.47 in)

FEL51 的连接 两线制交流 (AC) 连接



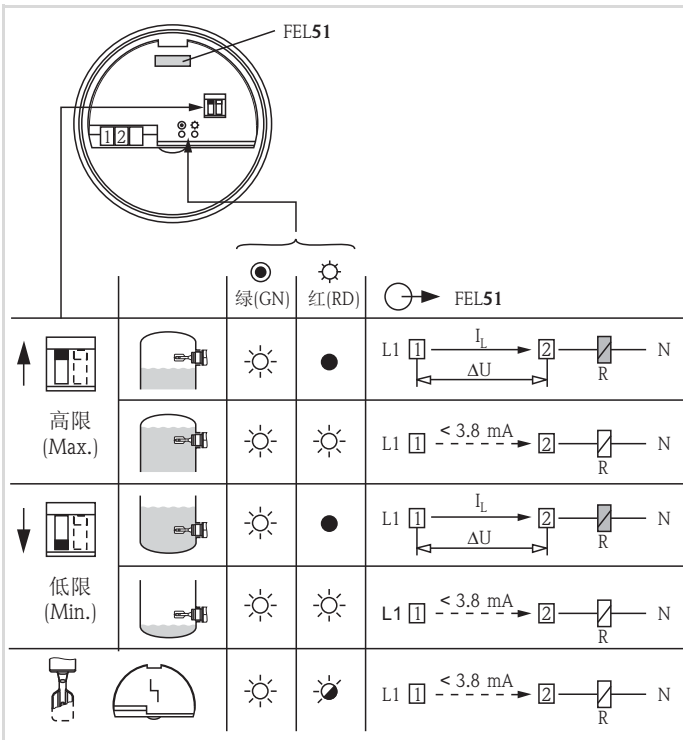
* 必须连接外部负载R



max. 89 VA / 253 V
max. 8.4 VA / 24 V

min. 2.5 VA / 253 V (10 mA)
min. 0.5 VA / 24 V (20 mA)

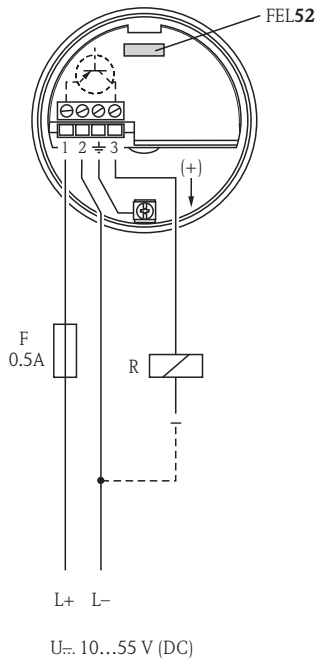
FEL51 的功能



$\Delta U_{FEL51} \text{ max. } 12 \text{ V}$

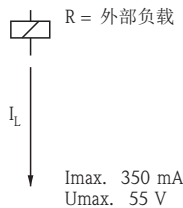
FEL52 的连接

直流 (DC) 连接 (PNP)

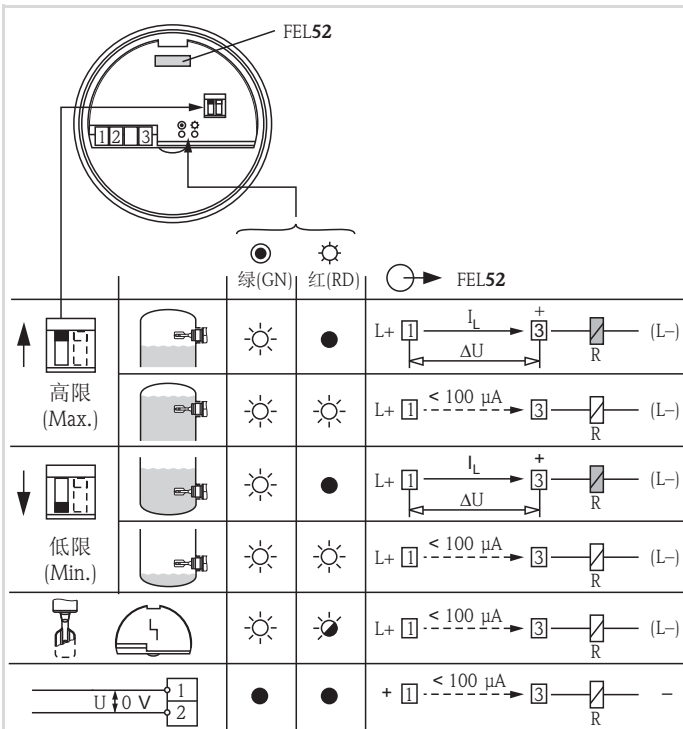


同样适用于DI模块

EN 61131-2

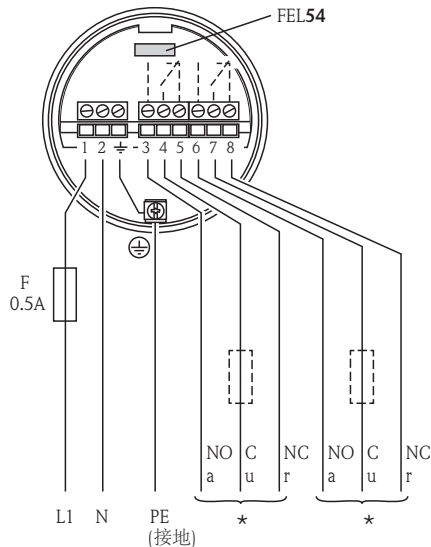


FEL52 的功能



$\Delta U_{FEL52} \text{ max. } 3 V$

FEL54 的连接 通用连接 继电器输出

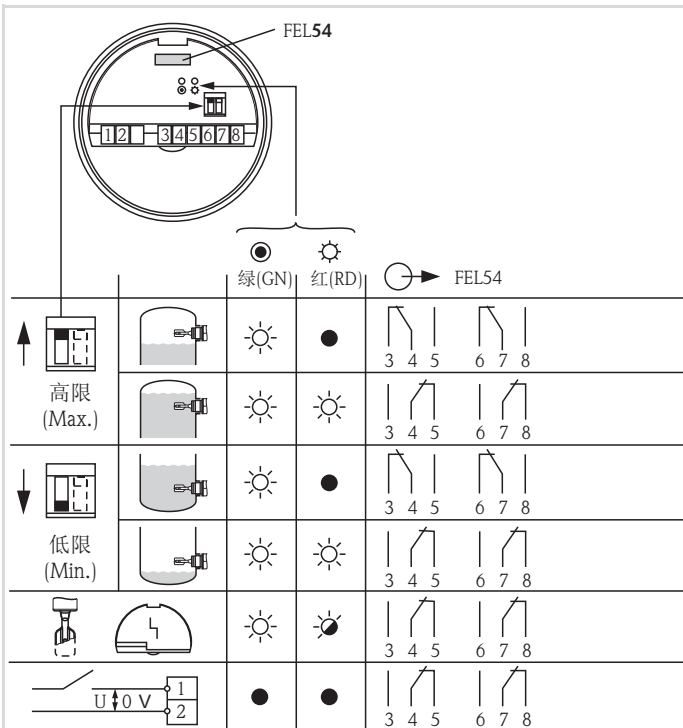


$U \sim 19 \dots 253 \text{ V (AC)}$

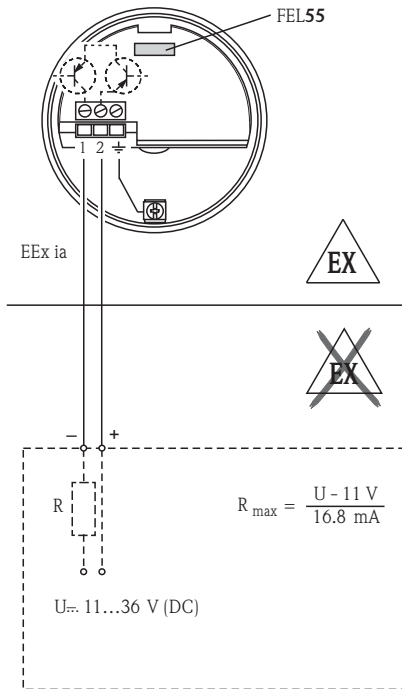
$L+ \quad L-$
 $U_{\dots} 19 \dots 55 \text{ V (DC)}$

$I \sim \text{max. } 6 \text{ A (EEx de: } 4 \text{ A)}$
 $U \sim \text{max. } 253 \text{ VAC}$
 $P \sim \text{max. } 1500 \text{ VA, } \cos \varphi = 1$
 $\star \begin{cases} P \sim \text{max. } 750 \text{ VA, } \cos \varphi > 0.7 \\ I_{\dots} \text{ max. } 6 \text{ A (EEx de: } 4 \text{ A), } U_{\dots} < 30 \text{ V} \\ I_{\dots} \text{ max. } 0.2 \text{ A, } U_{\dots} < 125 \text{ V} \end{cases}$

FEL54 的功能

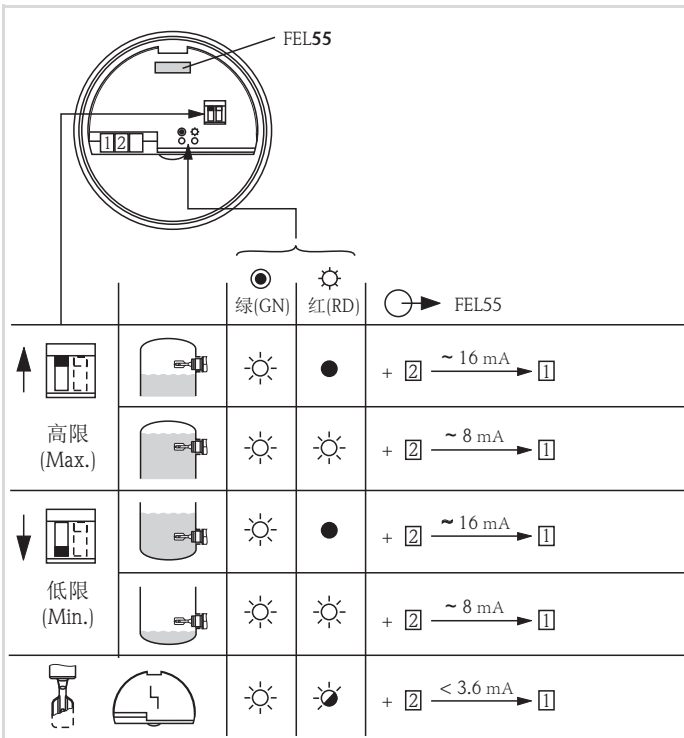


FEL55 的连接 8/16 mA 输出

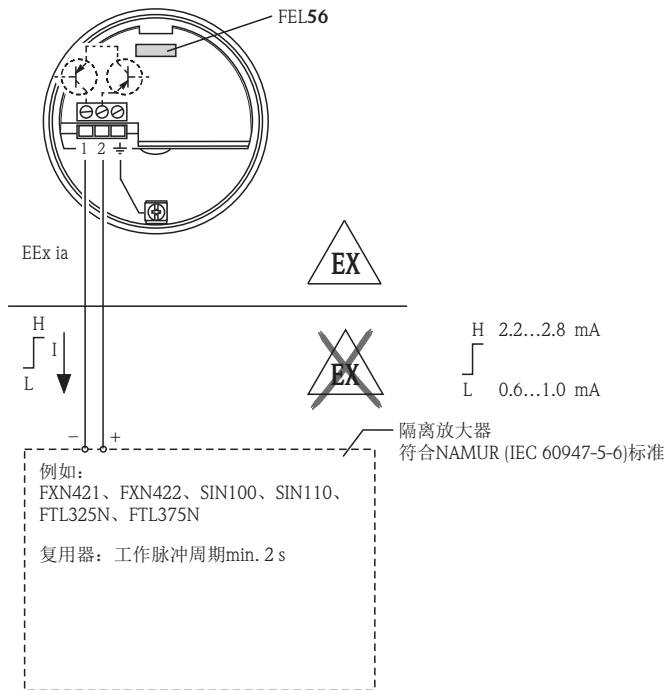


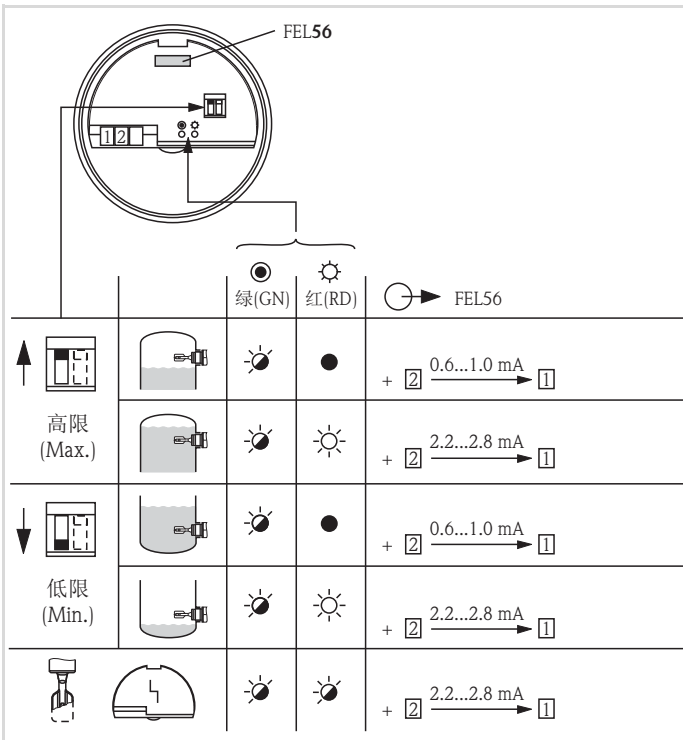
例如：PLC、AI模块

4...20 mA
EN 61131-2

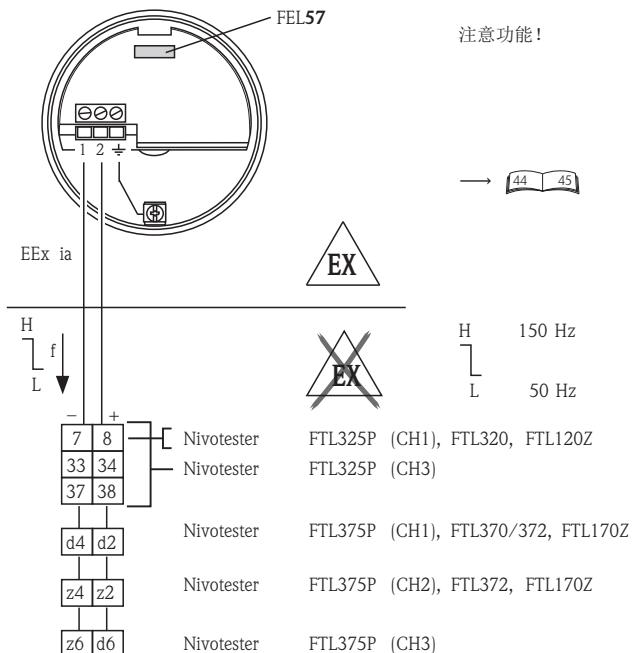


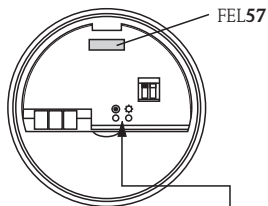
FEL56 的连接
NAMUR 输出 L-H
< 1.0 mA / > 2.2 mA

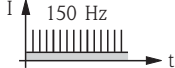
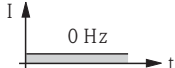
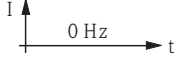




FEL 57 的连接 PFM 输出 150 Hz / 50 Hz



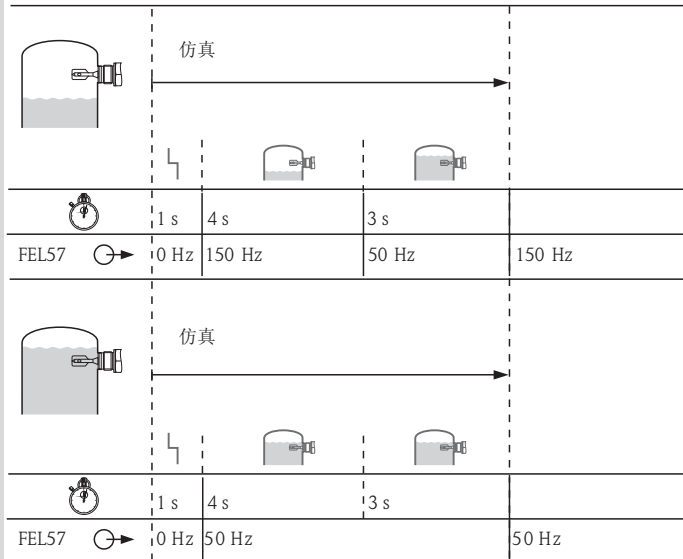
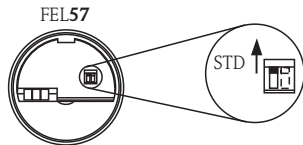


	 绿(GN)	 黄(YE)	 FEL57
			
			
 			
 $U \updownarrow 0 \text{ V}$ 			

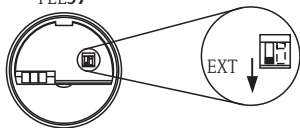
* 开关响应



开关响应 自检 (STD)

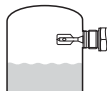


FEL57



开关响应
自检 (EXT)

仿真



1 s

4 s

30 s

//

6 s

FEL57 →

0 Hz

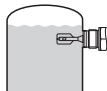
150 Hz

50 Hz

0 Hz

150 Hz

仿真



1 s

4 s

30 s

//

6 s

FEL57 →

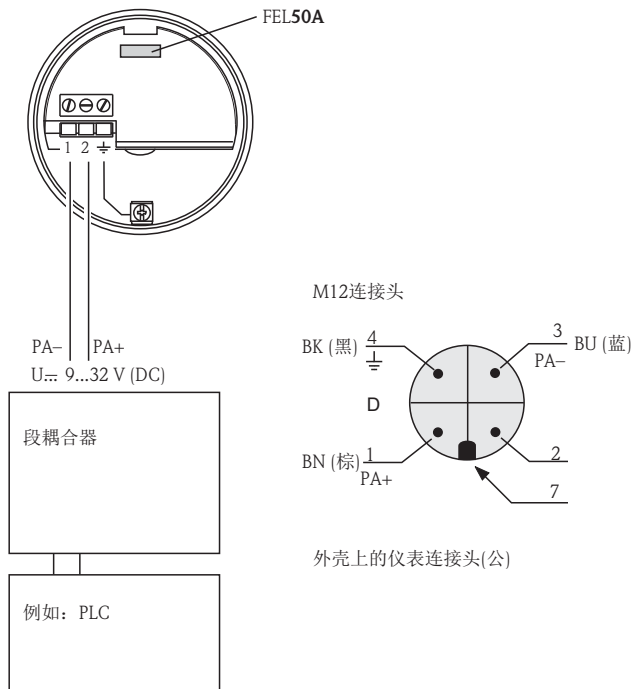
0 Hz

50 Hz

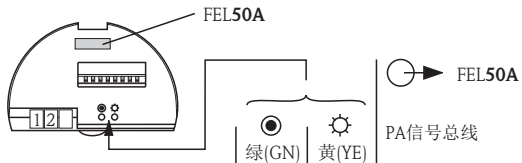
0 Hz

50 Hz

FEL50A 的连接

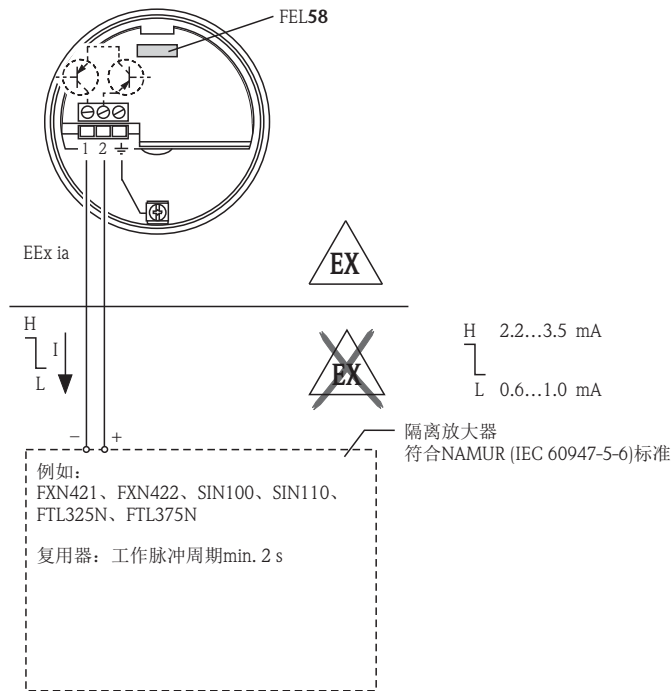


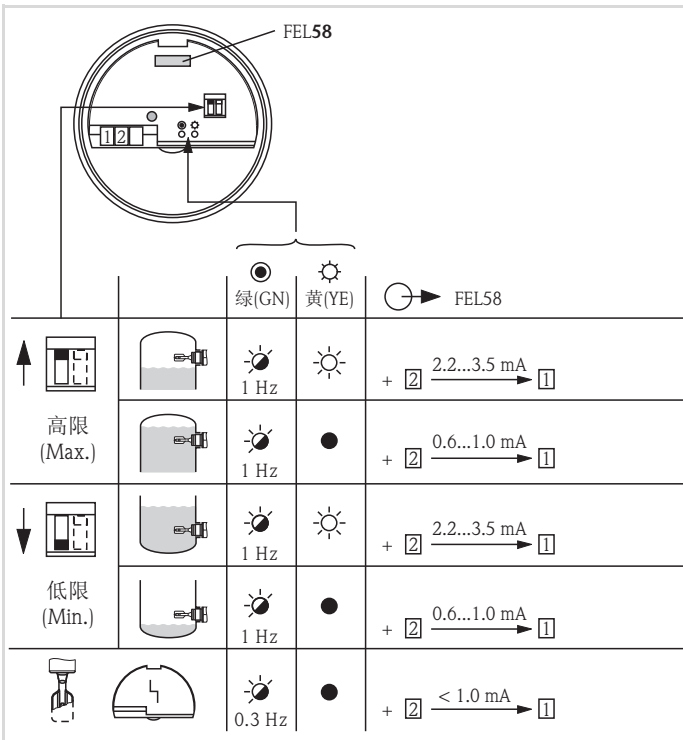
FEL50A 的功能



不翻转				OUT_D = 0
				OUT_D = 1
翻转				OUT_D = 0
				OUT_D = 1
SPS Commuwin II			-	通信
		-		状态, 参考BA00141F
				../..

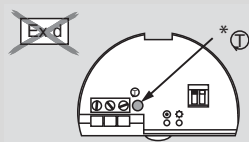
FEL58 的连接
NAMUR 输出 H-L
> 2.2 mA / < 1.0 mA





FEL58 的功能测试按钮

高限 (MAX) 失效安全模式



高限 (MAX)  + 		
1. 正常操作	绿(GN) 黄(YE)   1 Hz $+ \frac{2.2 \dots 3.5}{2} \text{ mA} \rightarrow 1$	绿(GN) 黄(YE)   1 Hz $+ \frac{0.6 \dots 1.0}{2} \text{ mA} \rightarrow 1$
2. 按下测试按钮 	绿(GN) 黄(YE)   $+ \frac{0}{2} \text{ mA} \rightarrow 1$	绿(GN) 黄(YE)   $+ \frac{0}{2} \text{ mA} \rightarrow 1$
3. 松开测试按钮， 约2 s后正常操作 	绿(GN) 黄(YE)   1 Hz $+ \frac{2.2 \dots 3.5}{2} \text{ mA} \rightarrow 1$	绿(GN) 黄(YE)   1 Hz $+ \frac{0.6 \dots 1.0}{2} \text{ mA} \rightarrow 1$

低限
(MIN)



1. 正常操作

绿(GN) 黄(YE)



1 Hz

+ 2.2...3.5
2 mA → 1

绿(GN) 黄(YE)



1 Hz

+ 0.6...1.0
2 mA → 1

2. 按下测试按钮



绿(GN) 黄(YE)



+ 0 mA
2 → 1

绿(GN) 黄(YE)



+ 0 mA
2 → 1

3. 松开测试按钮，
约2 s后正常操作



绿(GN) 黄(YE)



1 Hz

+ 2.2...3.5
2 mA → 1

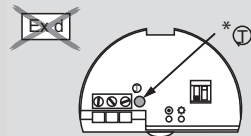
绿(GN) 黄(YE)



1 Hz

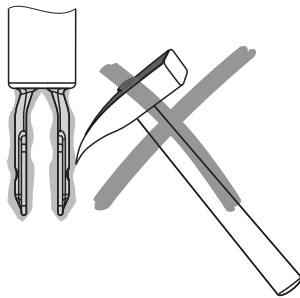
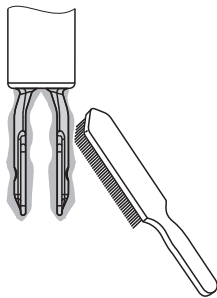
+ 0.6...1.0
2 mA → 1

FEL58 的功能测试按钮
低限 (MIN) 失效安全模式

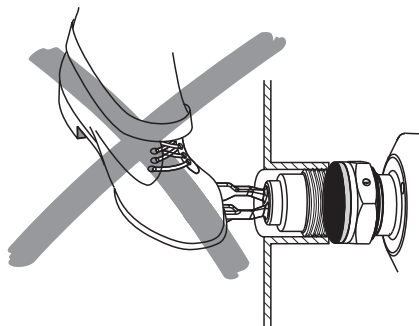


维护和清洁

除垢



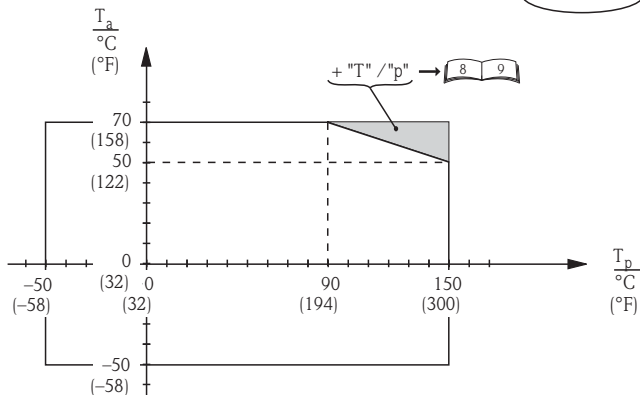
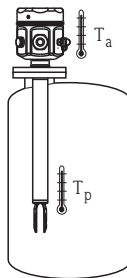
禁止踩踏！



技术参数

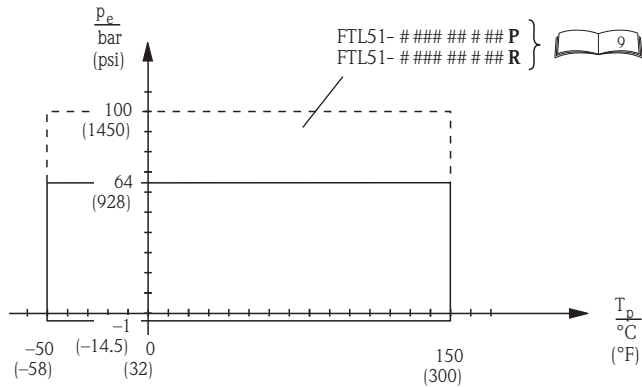
环境温度 T_a

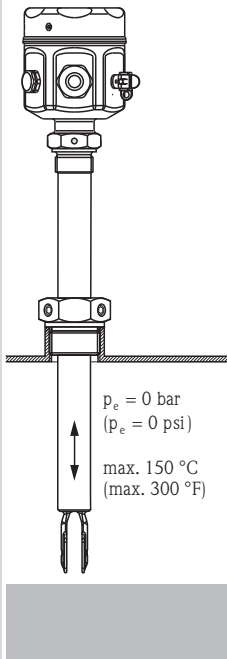
过程温度 T_p



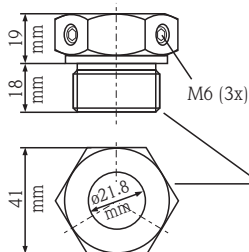
过程压力 p_e

过程温度 T_p

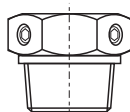




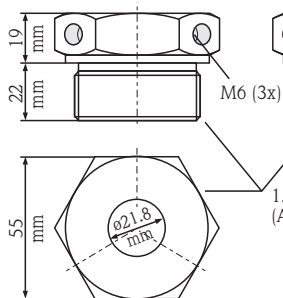
G 1
52003978



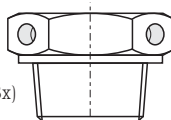
NPT 1 - 1½
52003979



G 1½
52003980



NPT 1½ - 1½
52003981



附件

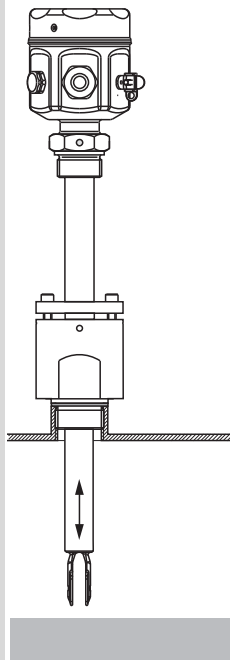
滑动套管，常压操作

参考：

KA00151F (G 1, NPT 1)

KA00152F (G 1½, PT 1½)

100 mm = 3.94 in



参考:

KA00153F (G 1, NPT 1)

KA00154F (G 1½, PT 1½)

100 mm = 3.94 in

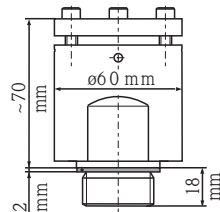
G 1

1.4435 (AISI 316L)

52003663

AlloyC4合金: 52003664

AlloyC22合金: 71118691



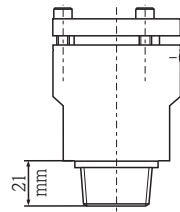
NPT 1 - 1½

1.4435 (AISI 316L)

52003667

AlloyC4合金: 52003668

AlloyC22合金: 71118699



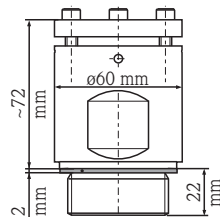
G 1½

1.4435 (AISI 316L)

52003665

AlloyC4合金: 52003666

AlloyC22合金: 71118693



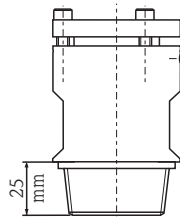
NPT 1½ - 1½

1.4435 (AISI 316L)

52003669

AlloyC4合金: 52003670

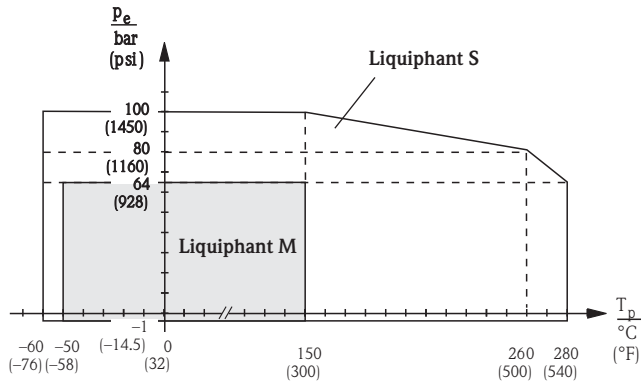
AlloyC22合金: 71118699



高压滑动套管:

过程压力 p_e

过程温度 T_p



故障排除

故障	原因	解决措施
开关不动作	无电源	检查电源
	信号线故障	检查信号线
	电子插件故障 - FEL51 直接连接至 L1 和 N	更换 - 始终通过外部负载连接 FEL51
	液体密度过低	在电子插件上设置密度 > 0.5
	叉体结垢	清洁叉体
	叉体被腐蚀 (FEL 上的指示信号: 红 / 黄闪烁 FEL58: 绿色闪烁, 0.3 Hz)	更换叉体和过程连接
	FEL51: 连接继电器的内阻抗过大	连接合适的继电器
	FEL51: 连接继电器的保持电流过低	串接继电器电阻
	FEL54: 触点焊接在一起 (短路后)	更换 FEL54; 回路中安装保险丝
开关不正确	下限 (MIN) / 上限 (MAX) 设置错误	在电子插件上设置正确测量模式
间断故障切换	厚泡沫层 强扰动条件 起泡液体	将 Liquiphant 安装在旁通管中
	强射频干扰 (RFI)	使用屏蔽电缆
	强振动	接耦, 阻尼时间, 叉体旋转 90°
	外壳进水	拧上外壳盖, 拧紧缆塞
	FEL52: 输出过载	减少负载, (电缆) 容抗
断电后, 开关错误	FEL57, 开关信号保持功能测试的状态	注意 FEL57 的开关响应; 断电后, 功能测试单元的开关信号最长保持 45 s

故障排除补充说明

叉体的开关响应异常时，诊断插槽的针脚 4 可以测量叉体的动作频率。

使用电子插件

FEL51/52/54/55/56/57/58 时，叉体为正弦波振动，通过幅值可以确定叉体状态。

使用电子插件 FEL50A 时，由于采用矩形脉冲信号，仅可测量叉体的振动频率。

备件

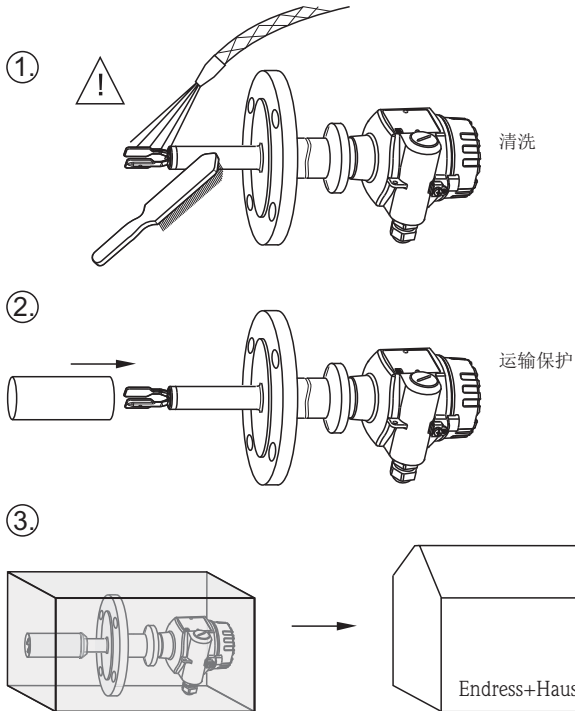
电子插件



FEL51	52002304
FEL52	52002305
FEL54	52002306
FEL55	52002307
FEL56	52002308
FEL57	52002309
FEL58	52006454
FEL50A	52010527

安装要求:

在安装过程中, 请注意由非本安回路供电的电源或电子插件
禁止与本安回路直接连接。



TI00328F
TI00426F

Liquiphant FTL50、FTL50H、FTL51、FTL51H
焊接底座，适用于物位和压力仪表

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