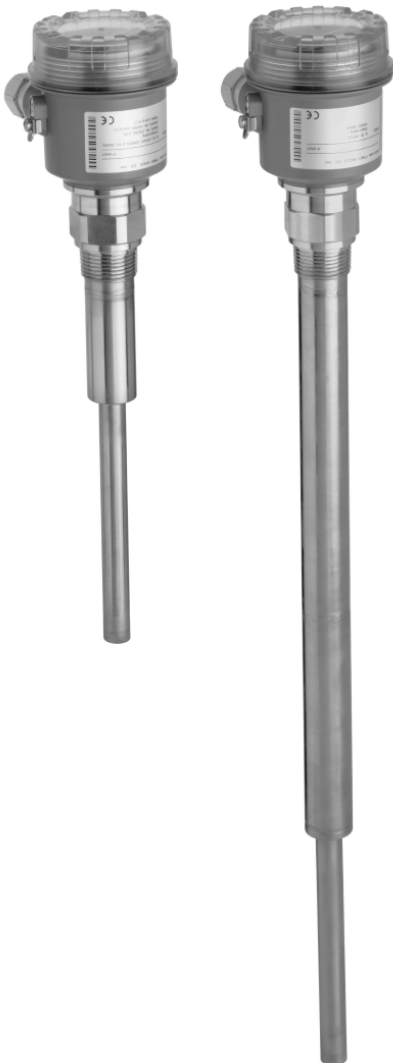


## Technical Information

# Soliphant T FTM20, FTM21

## Vibronic



Robust point level switch for bulk solids,  
also for dust incensive hazard areas

### Application

Soliphant T is a robust point level switch for silos with fine-grained or coarse-grained, non-fluidised bulk solids.

The various designs means the device has a wide range of applications. Certificates are also available for use in dust incensive hazard areas.

**FTM20** compact design 250 mm (10 in) as vibrating rod for installation in any direction

**FTM21** vibrating rod with extension pipe 500 mm, 1000 mm, 1500 mm (20 in, 40 in, 60 in) for installation in any direction

Typical applications: cereals, coffee beans, sugar, animal feed, rice, detergents, dye powder, chalk, gypsum, cement, sand, plastic granules

### Your benefits

- No calibration: easy commissioning (plug and play)
- Insensitive to build-up: maintenance-free operation
- No mechanically moving parts: no wear, long operating life
- Sensor material 316L: hardly any abrasion even with building materials
- F16 plastic housing with cover with sight glass: switch status visible from outside
- F18 aluminium housing also available
- Insensitive to external vibration and flow noises
- Also available with explosion protection ATEX II 1/3 D, FM or CSA approval

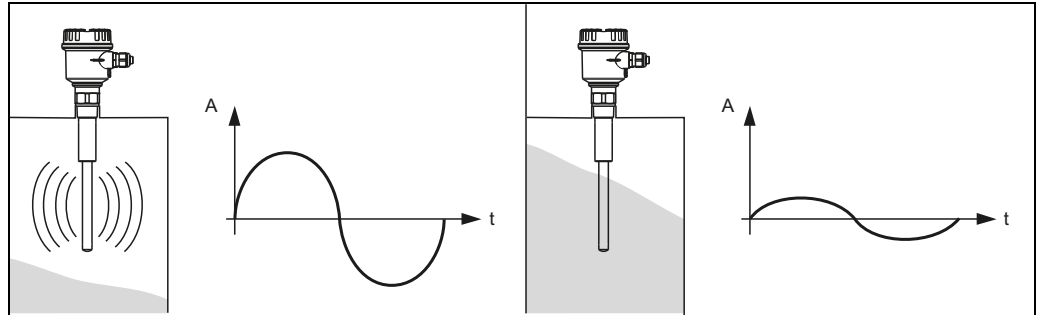
## Table of contents

<b>Function and system design</b> .....	<b>3</b>	Lateral load .....	8
Measuring principle .....	3	<b>Mechanical construction</b> .....	<b>9</b>
Measuring system .....	3	Design, dimensions .....	9
<b>Cable specifications</b> .....	<b>4</b>	Weight .....	10
Temperature resistance .....	4	Material .....	10
Cable entries .....	4	<b>Operability</b> .....	<b>10</b>
<b>Input</b> .....	<b>4</b>	Display elements .....	10
Measured variable .....	4	Operating elements of electronic inserts FEM22 and FEM24 ...	11
Measuring range (application) .....	4	Sediment detection .....	11
Input signal .....	4	<b>Certificates and approvals</b> .....	<b>12</b>
Measuring frequency .....	4	CE mark, declaration of conformity .....	12
<b>Output</b> .....	<b>4</b>	Ex approval .....	12
Galvanic isolation .....	4	Type of protection .....	12
Switch behaviour .....	4	Other standards and guidelines .....	12
Power-on behaviour .....	4	Pressure Equipment Directive 2014/68/EU (PED) .....	12
Fail-safe mode .....	4	RCM-tick mark .....	12
Switching delay .....	4	EAC conformity .....	12
Ex specifications .....	4	RoHS .....	12
<b>FEM22 electronic insert (DC PNP)</b> .....	<b>5</b>	<b>Ordering information</b> .....	<b>13</b>
Power supply .....	5	Soliphant T FTM20 .....	13
Electrical connection .....	5	Soliphant T FTM21 .....	14
Output signal .....	5	<b>Accessories</b> .....	<b>15</b>
Signal on alarm .....	5	Sliding sleeve .....	15
Connectable load .....	5	Spare parts .....	15
<b>FEM24 electronic insert (AC/DC with relay output)</b> ..	<b>6</b>	<b>Supplementary documentation</b> .....	<b>15</b>
Power supply .....	6	Operating Instructions .....	15
Electrical connection .....	6	Certificates .....	15
Output signal .....	6		
Signal on alarm .....	6		
Connectable load .....	6		
<b>Operating conditions</b> .....	<b>7</b>		
Installation instructions .....	7		
<b>Environment</b> .....	<b>7</b>		
Ambient temperature range .....	7		
Storage temperature .....	7		
Climate class .....	7		
Degree of protection .....	7		
Vibration resistance .....	7		
Electrical safety .....	7		
Electromagnetic compatibility .....	7		
Installation height as per IEC61010-1 Ed.3 .....	7		
<b>Process</b> .....	<b>8</b>		
Environment .....	8		
Thermal shock resistance .....	8		
Limiting medium pressure range .....	8		
State of aggregation .....	8		
Grain size .....	8		
Bulk density .....	8		

## Function and system design

### Measuring principle

A piezoelectric drive excites the vibrating rod of Soliphant T FTM20, FTM21 to its resonance frequency. If medium covers the vibrating rod, the rod's vibrating amplitude changes (the vibration is damped). Soliphant's electronics compare the actual amplitude with a target value and indicates whether the vibrating rod is vibrating freely or whether it is covered by medium.



*A = amplitude*

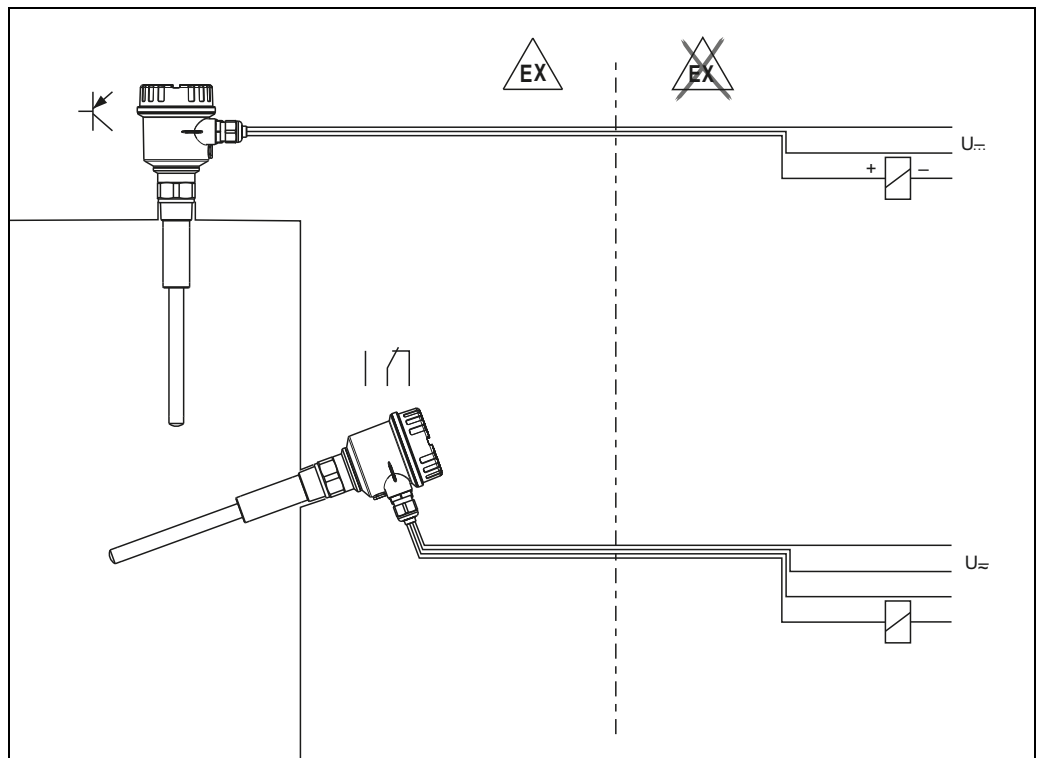
L00-FTM2xxxx-15-06-xx-xx-001

### Measuring system

#### Soliphant T is a compact electronic switch.

Thus, the entire measuring system only consists of:

- Soliphant T FTM20 or FTM21 with FEM22 or FEM24 electronic insert
- a supply point and
- the connected control systems, switching units, signalling systems (e.g. lamps, horns, PCS, PLC, etc.)



L00-FTM2xxxx-14-06-xx-xx-001

## Cable specifications

Use a shielded cable in the event of strong electromagnetic radiation.

---

**Temperature resistance** The connecting cables must withstand an ambient temperature of +20 K.

---

**Cable entries** M20x1.5 (cable gland); NPT ½; G ½

## Input

---

**Measured variable** Level (according to the mounting location and the overall length)

---

**Measuring range (application)** The measuring range depends on the mounting location of Soliphant T and the length of the pipe extension selected. The pipe extension is available in the following lengths: 500 mm, 1000 mm, 1500 mm (20 in, 40 in, 60 in).

---

**Input signal** Probes covered => small amplitude  
Probe not covered => large amplitude

---

**Measuring frequency** 700...800 Hz

## Output

---

**Galvanic isolation** FEM22:  
Between sensor and power supply  
  
FEM24:  
Between sensor, power supply and load

---

**Switch behaviour** Binary

---

**Power-on behaviour** When switching on the power supply the output is set to "signal on alarm".  
After a maximum of 3 s it switches to the correct output signal.

---

**Fail-safe mode** Minimum/maximum quiescent current safety can be switched at electronic insert  
  
MAX = maximum safety:  
When the vibrating rod is covered, the output switches in the direction of the signal on alarm  
Used for overflow protection for example  
  
MIN = minimum safety:  
When the vibrating rod becomes exposed, the output switches in the direction of the signal on alarm  
Used for empty running protection for example

---

**Switching delay** 0.5 s when the sensor is covered  
1 s when the sensor is exposed

---

**Ex specifications** FEM22, FEM24:  
  
– Explosion protection for explosive dust-air mixtures:  
Dust-Ex, DIP

## FEM22 electronic insert (DC PNP)

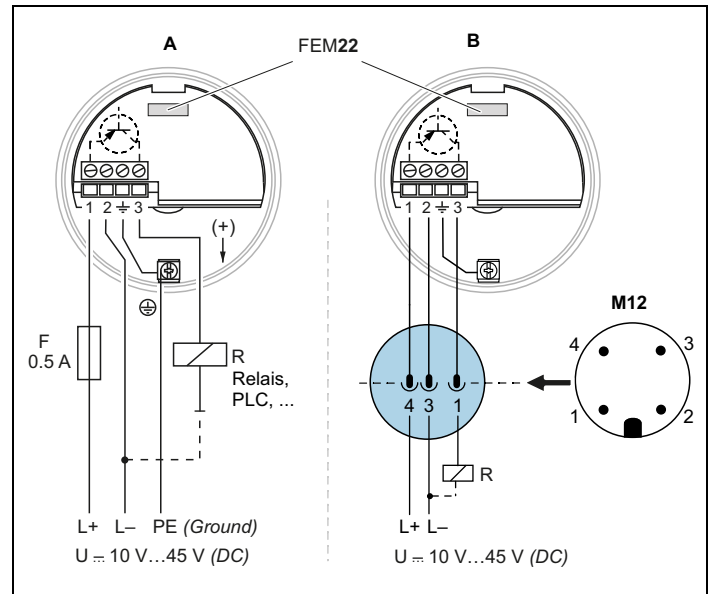
### Power supply

Voltage DC: 10...45 V  
 Ripple max. 5 V, 0...400 Hz  
 Current consumption max. 18 mA  
 Power consumption max. 0.81 W  
 Reverse polarity protection  
 Separation voltage: 2.2 kV  
 FEM22 overvoltage protection: overvoltage category II

### Electrical connection

#### Three-wire DC connection with cable entry / M12 plug

- Preferred in conjunction with programmable logic controllers (PLC), DI modules as per EN 61131-2
- Positive signal at electronics switch output (PNP)
- Output blocked at point level



A: With cable entry wired by customer (Ordering feature 40, options 2, 3, 4, 5, 6, 7)  
 B: With M12 plug wired at the factory (Ordering feature 40, options 1, 8)

### Output signal

IL = Load current (switched through)

< 100  $\mu$ A = Residual current (blocked)

☀ = Lit

● = Not lit

L00-FTL2xxxx-07-05-xx-xx-000

Fail-safe mode	Level	Output signal	LEDs	
			green	yellow
MAX		L+ $\xrightarrow{I_L}$ + 1 $\xrightarrow{I_L}$ 3	☀	☀
		1 $\xrightarrow{< 100 \mu A}$ 3	☀	●
MIN		L+ $\xrightarrow{I_L}$ + 1 $\xrightarrow{I_L}$ 3	☀	☀
		1 $\xrightarrow{< 100 \mu A}$ 3	☀	●

L00-FTM2xxxx-04-05-xx-xx-003

### Signal on alarm

Output signal on power failure or in the event of device failure: < 100  $\mu$ A

### Connectable load

- Load switched via transistor and separate PNP connection
- Load current: max. 45 V (cyclical overload and short-circuit protection), continuous max. 350 mA
- Residual current: < 100  $\mu$ A (for blocked transistor)
- Capacitive load: max. 0.5  $\mu$ F for 45 V, max. 1.0  $\mu$ F for 24 V
- Residual voltage: < 3 V (for transistor switched through)

## FEM24 electronic insert (AC/DC with relay output)

### Power supply

Alternating voltage AC: 19...253 V, 50/60 Hz or DC voltage 19...55 V  
 Power consumption max. 1.3 W  
 Reverse polarity protection  
 Separation voltage: 2.2 kV  
 FEM24 overvoltage protection: overvoltage category II

### Electrical connection

#### Universal current connection with relay output

Power supply:  
 Please note the different voltage ranges for AC and DC.

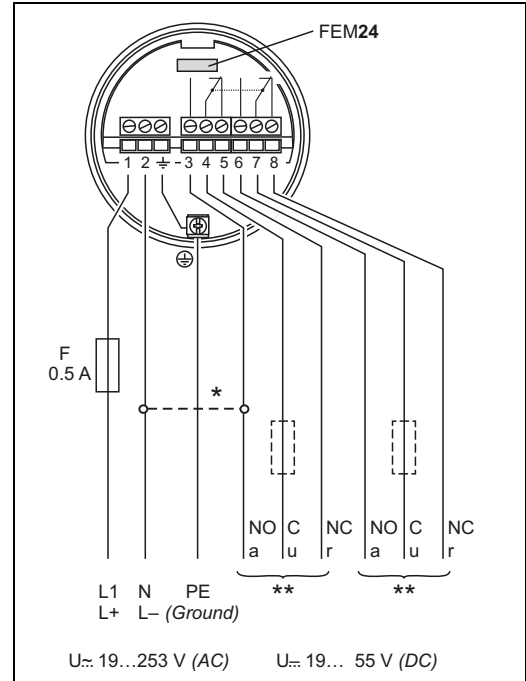
Output:  
 When connecting a device with high inductance, provide a spark arrester to protect the relay contact.  
 A fine-wire fuse (depending on the load connected) protects the relay contact in the event of a short-circuit.

Both relay contacts switch simultaneously.  
 DPDT (double pole double throw)

\* When jumpered, the relay output works with NPN logic.

\*\* See below "Connectable load"

Note!  
 Please note the different voltage ranges for direct and alternating current.



L00-FTM2xxxx-04-05-xx-xx-004

### Output signal

= Relay energised  
 = Relay de-energised  
 = Lit  
 = Not lit

L00-FTL2xxxx-07-05-xx-xx-001

Fail-safe mode	Level	Output signal	LEDs	
			green	yellow
MAX				
MIN				

L00-FTM2xxxx-04-05-xx-xx-005

### Signal on alarm

Output signal in event of power failure: relay de-energised

### Connectable load

- Loads switched via 2 floating change-over contacts.
- I~ max. 6 A, U~ max. 253 V; P~ max. 1500 VA, cos φ = 1, P~ max. 750 VA, cos φ > 0.7;
- I- max. 6 A to 30 V, I- max. 0.2 A to 125 V.
- The following applies when connecting a functional extra-low voltage circuit with double insulation as per IEC 1010: Sum of voltages of relay output and power supply max. 300 V

## Operating conditions

### Installation instructions

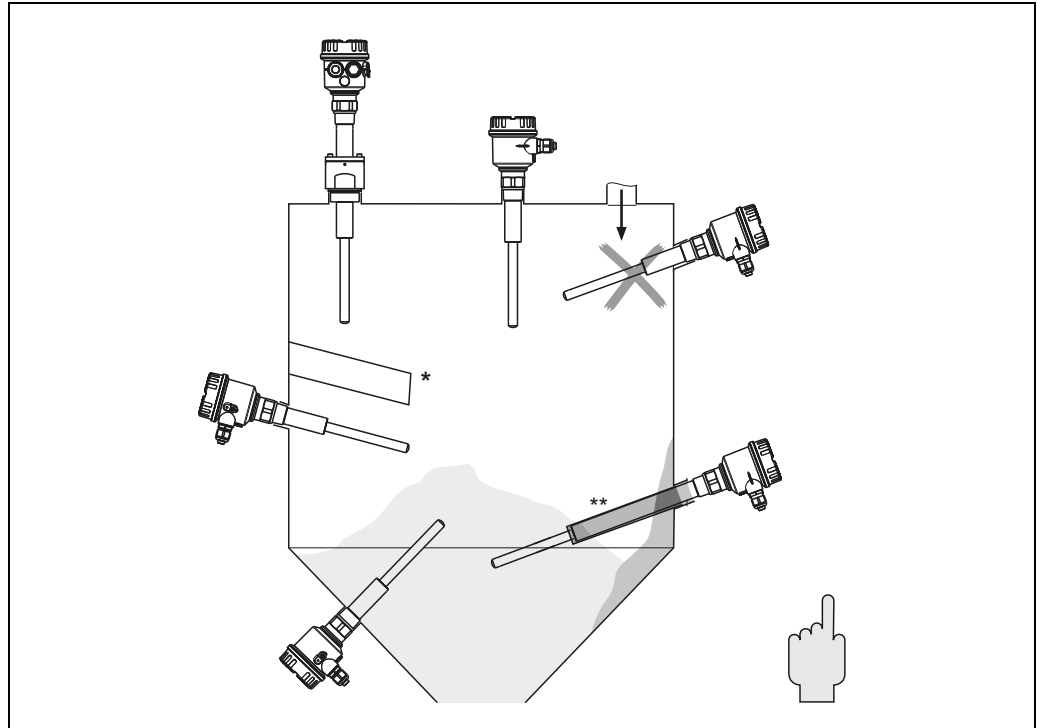
#### Mounting location

e.g. vessels, silos, storage or buffer container

Note!

Installation must ensure friction-locked mechanical connection between sensor and vessel/silo.

#### Orientation



L00-FTM20xxx-11-05-xx-xx-000

Horizontal installation/vertical installation

\* With protective cover (to be provided by customer)

\*\* With protecting tube (to be provided by customer)

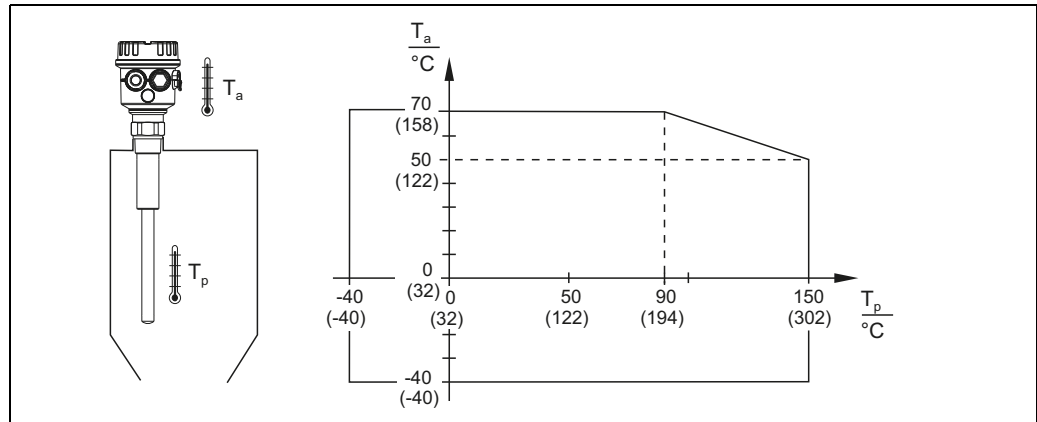
## Environment

<b>Ambient temperature range</b>	-40...70 °C (-40...158 °F)
<b>Storage temperature</b>	-40...85 °C (-40...185 °F)
<b>Climate class</b>	Climatic protection as per DIN IEC 68 Part 2-38, Fig. 2a
<b>Degree of protection</b>	IP66/IP67, NEMA4X
<b>Vibration resistance</b>	DIN 60068-2-27 / IEC 68-2-27: shock 30 g; vibration 0.01 g <sup>2</sup> /Hz
<b>Electrical safety</b>	IEC 61010, CSA 1010.1-92, FM3600
<b>Electromagnetic compatibility</b>	Interference emission to EN 61326, Electrical Equipment Class B Interference immunity to EN 61326, Annex A (Industrial)
<b>Installation height as per IEC61010-1 Ed.3</b>	Up to 2000 m (6600 ft) above sea level.

## Process

### Environment

Permitted ambient temperature  $T_a$  at housing depending on the medium temperature  $T_p$  in the container:



L00-FTM20xxx-05-06-xx-xx-001

### Thermal shock resistance

Maximum 120 K

### Limiting medium pressure range

-1...25 bar (-14.5...362.5 psi)

#### Maximum Working Pressure (MWP)

25 bar (362.5 psi)

#### Burst pressure

100 bar (1450 psi)

### State of aggregation

Solids

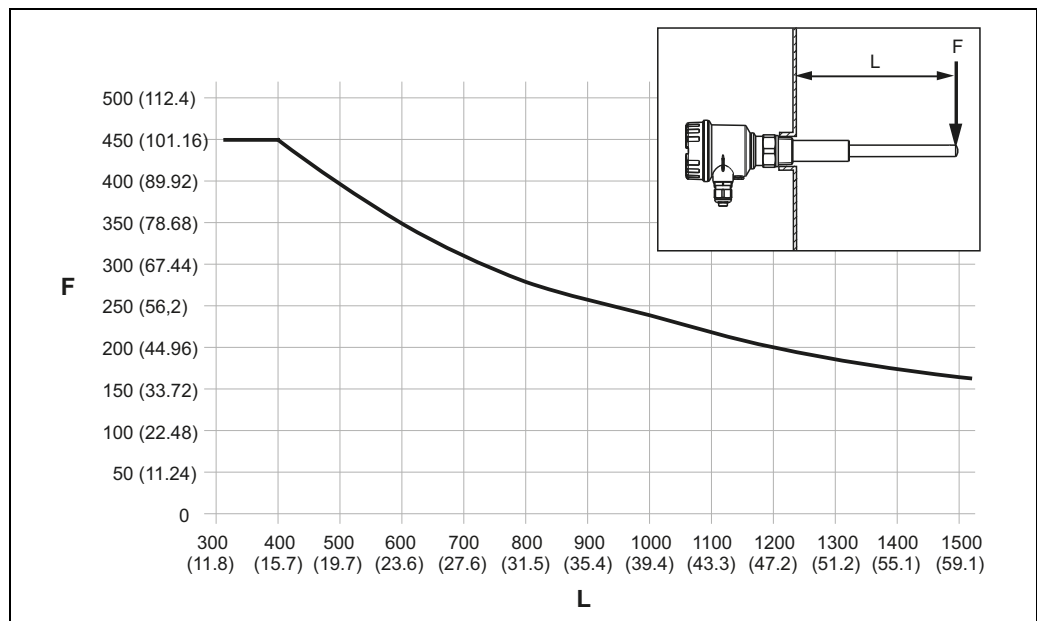
### Grain size

≤ 25 mm (< 0,98 in)

### Bulk density

≥ 200 g/l (26.7 oz/gal US), not fluidised

### Lateral load



L00-FTM20xxx-05-06-xx-xx-002

$F$ : Maximum permissible lateral load in Nm (lbf)

$L$ : Length in mm (in)

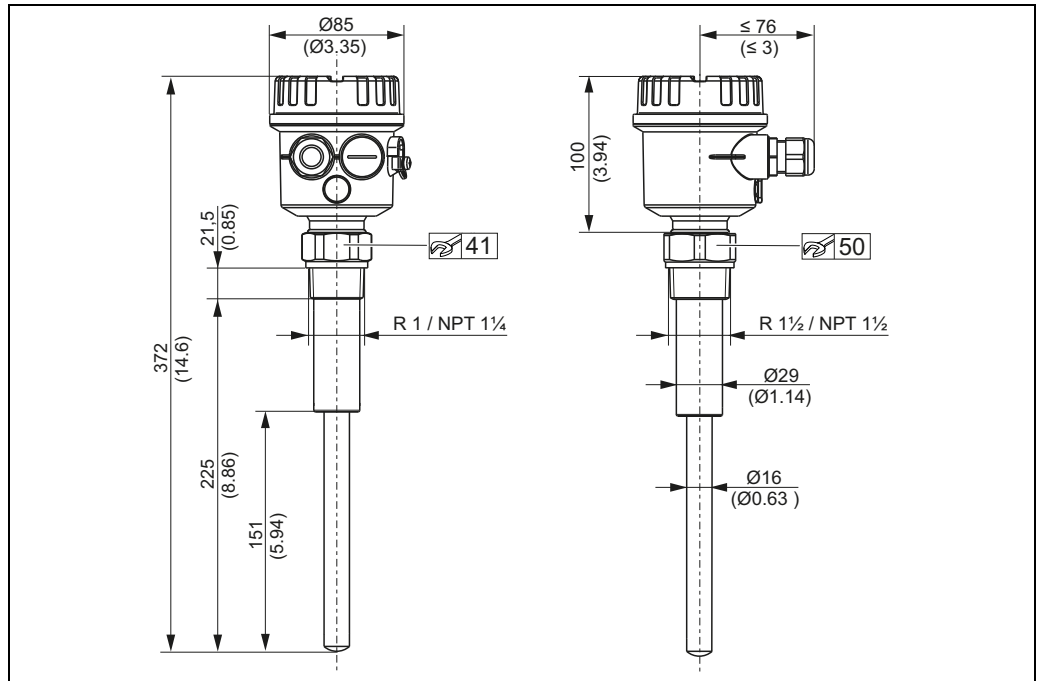


## Mechanical construction

Note!  
All dimensions in mm!

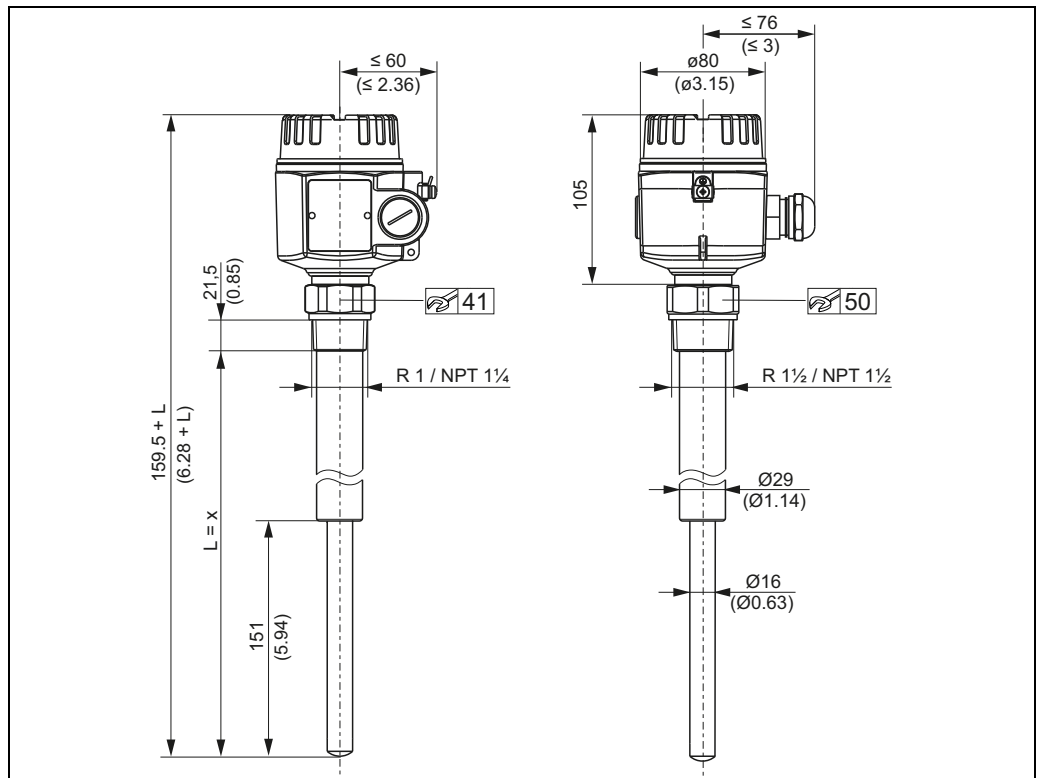
### Design, dimensions

#### Compact version



L00-FTM20xxx-06-05-xx-xx-001

#### Pipe extension



L00-FTM20xxx-06-05-xx-xx-000

x = 500 mm, 1000 mm, 1500 mm (20 in, 40 in, 60 in)

<b>Weight</b>	FTM20/FTM21 with F16 housing, FEM24 and R 1 thread:	
	Compact	= approx. 1.0 kg (2.21 lbs)
	500 mm (20 in)	= approx. 1.3 kg (2.87 lbs)
	1000 mm (40 in)	= approx. 2.0 kg (4.41 lbs)
	1500 mm (60 in)	= approx. 2.6 kg (5.73 lbs)

**Material** **F16 housing:**  
PTB-FR, cover with sight glass made of PA12, EPDM cover seal

**F18 housing:**  
Aluminium EN-AC-ALSi10Mg, plastic-coated  
EPDM cover seal

**Process connections:**

- R1; R1½ (316L, DIN 2999)
- NPT 1¼ - 1½; NPT 1½ - 1½ (316L, ANSI B 1.20.1)

**Sensor:**

316L

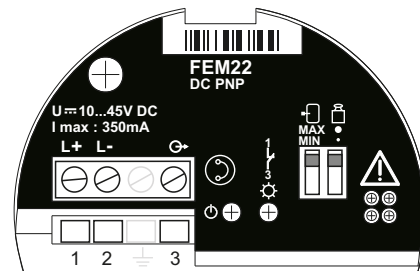
## Operability

**Display elements** Note!  
The switch settings in the following graphics are in the as-delivered state.

### FEM22

One green LED: operation

One yellow LED: electronic switch closed

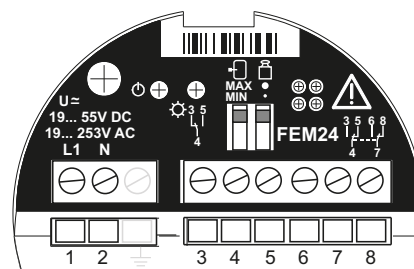


L00-FEM22xxx-07-05-xx-xx-001

### FEM24

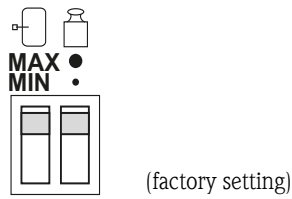
One green LED: operation

One yellow LED: contact closed  
(relay energised or fed with current)



L00-FEM24xxx-07-05-xx-xx-002


**Operating elements of  
electronic inserts  
FEM22 and FEM24**



L00-FTM2xxxx-19-05-xx-xx-002

 One switch for safety mode

MAX Overfill protection  
MIN Dry running protection

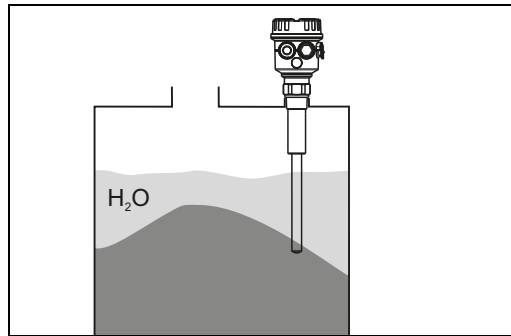
 One switch for bulk density/density setting

- 400 g/l (high bulk density)
- 200 g/l (low bulk density)

---

**Sediment detection**


**Detection of solids under water**



L00-FTM2xxxx-19-05-xx-xx-001

The system does not detect coverage by liquids similar to water.

## Certificates and approvals

<b>CE mark, declaration of conformity</b>	The measuring system meets the legal requirements of the applicable EC Directives. These are listed in the corresponding EC Declaration of Conformity along with the standards applied. Endress+Hauser confirms successful testing of the device by affixing to it the CE mark.
<b>Ex approval</b>	Your Endress+Hauser sales centre can provide you with information on the Ex versions which can currently be delivered. All explosion protection data are given in a separate documentation (see "Supplementary Documentation") which is available upon request. Copies of certificates available upon request.
<b>Type of protection</b>	See "Ordering information" as of Page 13 and "Supplementary documentation" on Page 15.
<b>Other standards and guidelines</b>	Other standards and guidelines that were taken into consideration in designing and developing Soliphant T FTM20, FTM21: <ul style="list-style-type: none"> <li>■ Low Voltage Directive (73/23/EEC)</li> <li>■ DIN EN 61010 Part 1, 2001 Protection Measures for Electrical Equipment for Measurement, Control, Regulation and Laboratory Procedures Part 1: General requirements</li> <li>■ EN 61326 Electrical Equipment for Measurement, Control and Laboratory Use EMC requirements</li> </ul>
<b>Pressure Equipment Directive 2014/68/EU (PED)</b>	<p><b>Pressure instruments with permitted pressure <math>\leq</math> 200 bar (2 900 psi)</b></p> <p>Pressure instruments with permitted pressure <math>\leq</math> 200 bar (2 900 psi) Pressure instruments with a flange and threaded boss that do not have a pressure-bearing housing do not fall within the scope of the Pressure Equipment Directive, irrespective of the maximum permitted pressure.</p> <p><b>Reason:</b></p> <p>According to Article 2, point 5 of EU Directive 2014/68/EU, pressure accessories are defined as "devices with an operational function and having pressure-bearing housings". If a pressure instrument does not have a pressure-bearing housing (no identifiable pressure chamber of its own), there is no pressure accessory present within the meaning of the Directive.</p> <p><b>Note:</b></p> <p>A separate analysis must be performed for pressure instruments that are part of safety equipment designed to protect a pipe or vessel from exceeding allowable limits (safety accessory in accordance with Pressure Equipment Directive 2014/68/EU, Article 2, point 4).</p>
<b>RCM-tick mark</b>	The product or measuring system supplied complies with the regulations of the Australian Communications and Media Authority (ACMA) for network integrity, performance characteristics and health and safety requirements. The specifications for electromagnetic compatibility, in particular, are observed. The products bear the RCM-tick mark on their nameplate.
	
<b>EAC conformity</b>	The measuring system meets the legal requirements of the applicable EAC Directives. These are listed in the corresponding EAC Declaration of Conformity along with the standards applied.  Endress+Hauser confirms successful testing of the device by affixing to it the EAC mark.
<b>RoHS</b>	The measuring system complies with the substance restrictions of the EU Directive on the restriction of the use of certain hazardous substances 2011/65/EU (RoHS 2).

A0029561

## Ordering information

### Soliphant T FTM20

10		Approval			
	A	Non-hazardous area			
	C	CSA General Purpose, CSA C US			
	D	CSA DIP+FM DIP			
	G	IEC Ex t III C			
	N	NEPSI DIP A20/A22			
	V	EAC Ex t III C			
	Y	Special version			
	4	ATEX II 1/3 D			
20		Process connection			
	A	Thread, DIN2999	R1,	316L	
	G	Thread, DIN2999	R1½,	316L	
	M	Thread, ANSI	NPT1¼,	316L	
	N	Thread, ANSI	NPT1½,	316L	
	Y	Special version			
30		Electronics; output			
	2	FEM22:	3-wire PNP,	10...45 V DC	
	4	FEM24:	Relay DPDT,	19...253 V AC / 55 V DC	
	8	FEM20B	ASI Bus		
	9	Special version			
40		Housing; cable entry			
	1	F16	Polyester	IP66/IP67, NEMA4X	M12 plug
	2	F16	Polyester	IP66/IP67, NEMA4X	M20 gland
	3	F16	Polyester	IP66/IP67, NEMA4X	Thread, NPT½
	4	F16	Polyester	IP66/IP67, NEMA4X	Thread, G½
	5	F18	Aluminium	IP66/IP67, NEMA4X	M20 gland
	6	F18	Aluminium	IP66/IP67, NEMA4X	Thread, NPT¾
	7	F18	Aluminium	IP66/IP67, NEMA4X	Thread, G½
	8	F18	Aluminium	IP66/IP67, NEMA4X	M12 plug
	9	Special version			
50		Additional fittings			
	A	Basic version			
	Y	Special version			
FTM20		Complete product designation			

## Soliphant T FTM21

<b>10</b>		<b>Approval</b>			
	A	Non-hazardous area			
	C	CSA General Purpose, CSA C US			
	D	CSA DIP+FM DIP			
	G	IEC Ex t III C			
	N	NEPSI DIP A20/A22			
	V	EAC Ex t III C			
	Y	Special version			
	4	ATEX II 1/3 D			
<b>20</b>		<b>Process connection</b>			
	A	Thread, DIN2999	R1,	316L	
	G	Thread, DIN2999	R1½,	316L	
	M	Thread, ANSI	NPT1¼,	316L	
	N	Thread, ANSI	NPT1½,	316L	
	Y	Special version			
<b>25</b>		<b>Sensor length</b>			
	2	500 mm			
	3	1000 mm			
	4	1500 mm			
	6	20 inch			
	7	40 inch			
	8	60 inch			
	9	Special version			
<b>30</b>		<b>Electronics; output</b>			
	2	FEM22:	3-wire PNP,	10...45 V DC	
	4	FEM24:	Relay DPDT,	19...253 V AC / 55 V DC	
	8	FEM20	ASI Bus		
	B				
	9	Special version			
<b>40</b>		<b>Housing; cable entry</b>			
	1	F16	Polyester	IP66/IP67, NEMA4X	M12 plug
	2	F16	Polyester	IP66/IP67, NEMA4X	M20 gland
	3	F16	Polyester	IP66/IP67, NEMA4X	Thread, NPT½
	4	F16	Polyester	IP66/IP67, NEMA4X	Thread, G½
	5	F18	Aluminium	IP66/IP67, NEMA4X	M20 gland
	6	F18	Aluminium	IP66/IP67, NEMA4X	Thread, NPT¾
	7	F18	Aluminium	IP66/IP67, NEMA4X	Thread, G½
	8	F18	Aluminium	IP66/IP67, NEMA4X	M12 plug
	9	Special version			
<b>50</b>		<b>Additional fittings</b>			
	A	Basic version			
	Y	Special version			
FTM21		Complete product designation			

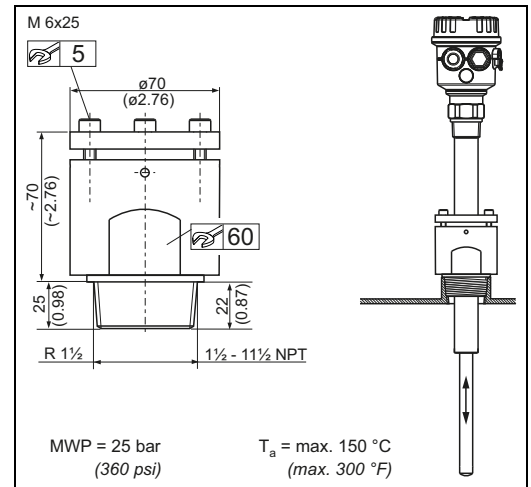
## Accessories

### Sliding sleeve

For pressurised container

- R 1½  
DIN 2999  
Material number: 52023312
- NPT 1½ - 11½  
ANSI B 1.20.1  
Material number: 52025090

Note!  
Suitable for multiple switch-point configurations!

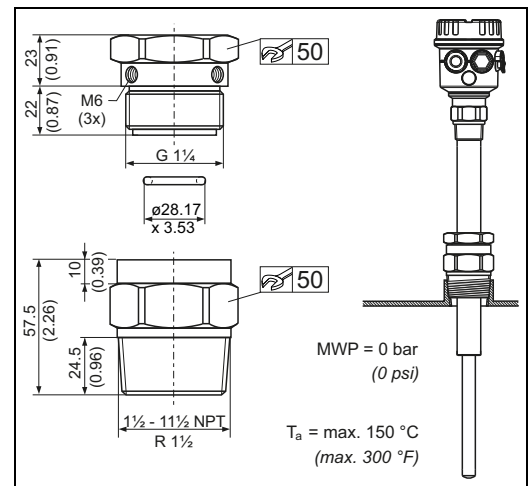


L00-FTM2xxxx-03-05-xx-xx-001

For unpressurised container, IP65

- R 1½  
DIN 2999  
Material number: 52023313
- NPT 1½ - 11½  
ANSI B 1.20.1  
Material number: 52024578

Note!  
Only suitable for one-time switch-point configuration!



L00-FTM2xxxx-03-05-xx-xx-002

### Spare parts

- FEM22 electronic insert: 52025688
- FEM24 electronic insert: 52025691
- Cover for polyester housing (F16), transparent plastic with seal: 52025790
- Cover for aluminium housing (F18), aluminium with seal: 52005910
- Cover for aluminium housing (F18), aluminium with glass insert and seal (not for EEx d): 52027693

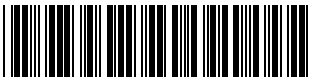
## Supplementary documentation

### Operating Instructions

- Soliphant T FTM20, FTM21  
KA00227F

### Certificates

- |           |      |       |          |
|-----------|------|-------|----------|
| ■ ATEX II | Ex t | 1/3D  | XA00300F |
| ■ IECEx   | Ex t | Ga/Gc | XA00424F |
| ■ NEPSI   | Ex t | ta/tb | XA00434F |



71415262

[www.addresses.endress.com](http://www.addresses.endress.com)

---