



Level



Pressure



Flow



Temperature

Liquid  
Analysis

Registration

Systems  
Components

Services



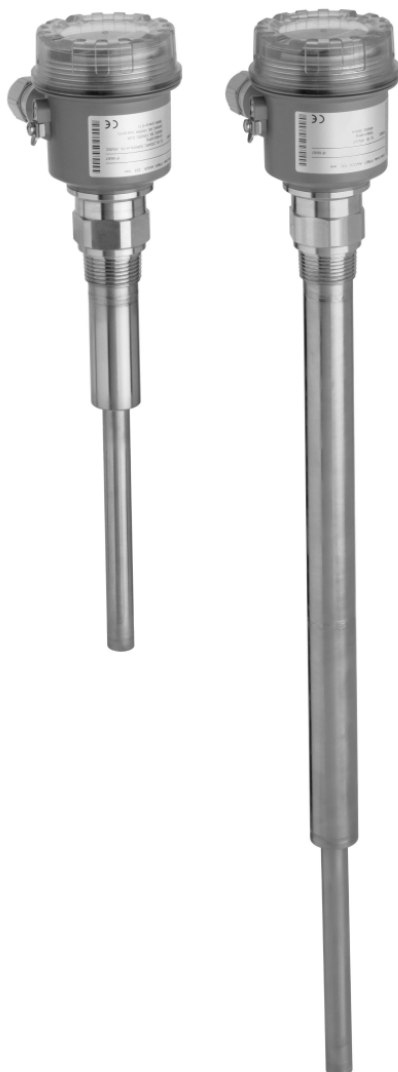
Solutions

## Technical Information

# Soliphant T FTM20, FTM21

Level limit switch

Robust vibration limit switch for bulk solids,  
also for dust incendive hazard areas



### Application

Soliphant T is a robust level limit 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 incendive hazard areas.

**FTM20** compact design (250 mm) 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

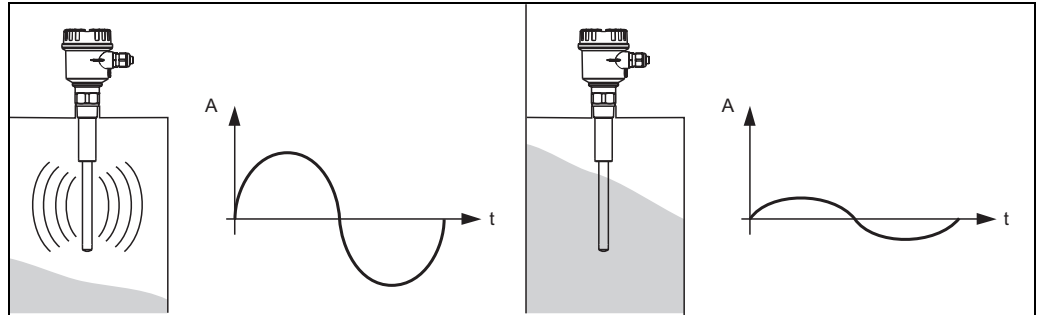
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## Function and system design

### 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.



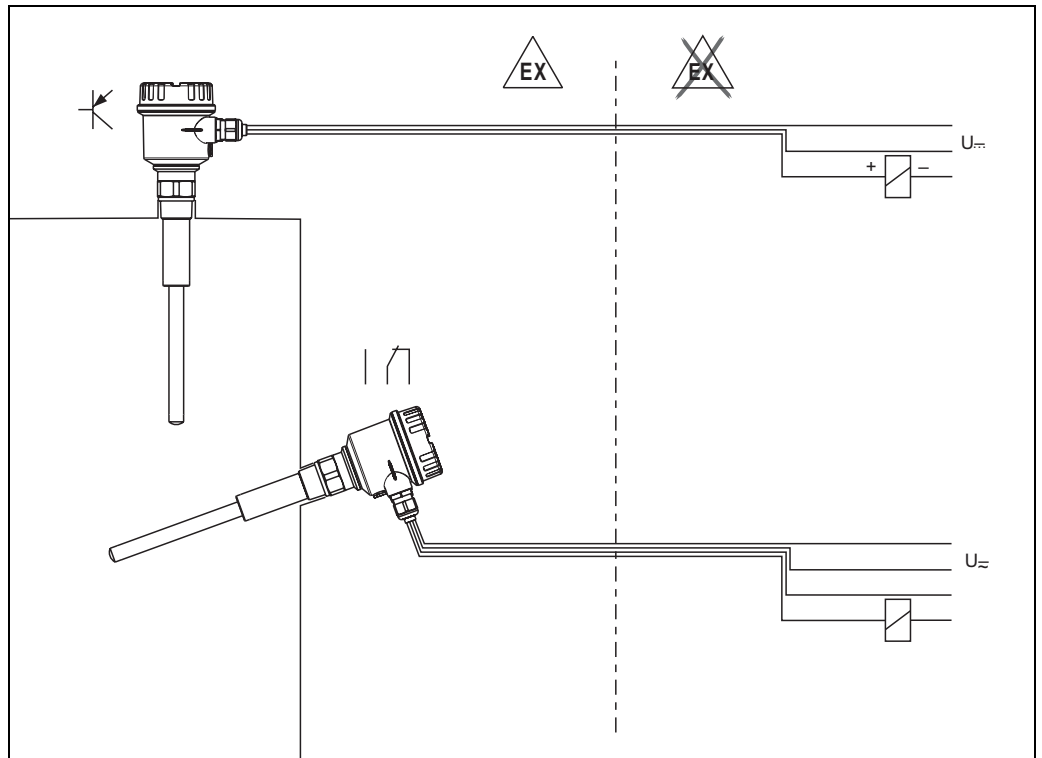
$A = \text{amplitude}$

### 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.)



## Cable specifications

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

### Immunity to temperature change of connecting cable

The connecting cables must withstand the ambient temperature +15 K.

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<b>Cable entries</b>	M20x1.5 (cable gland); NPT ½; G ½
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## Input

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<b>Measured variable</b>	Level (according to the mounting location and the overall length)
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<b>Measuring range (application)</b>	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.
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<b>Input signal</b>	Probes covered => small amplitude Probe not covered => large amplitude
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<b>Measuring frequency</b>	700...800 Hz
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## Output

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<b>Galvanic isolation</b>	FEM22: Between sensor and power supply  FEM24: Between sensor, power supply and load
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<b>Switch behaviour</b>	Binary
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<b>Power-on behaviour</b>	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.
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<b>Fail-safe mode</b>	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
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<b>Switching delay</b>	0.5 s when the sensor is covered 1 s when the sensor is exposed
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<b>Ex specifications</b>	FEM22, FEM24:  – Explosion protection for explosive dust-air mixtures: Dust-Ex, DIP
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## FEM22 electronic insert (DC PNP)

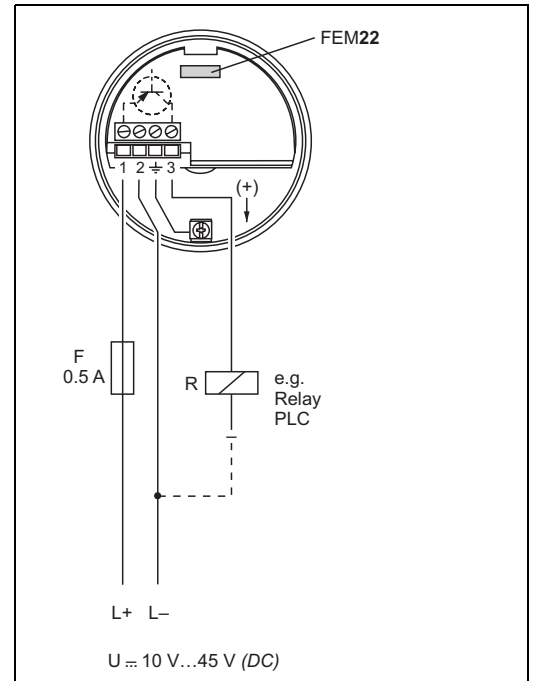
### Power supply

DC voltage 10 V...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 III

### Electrical connection

#### Three-wire direct current connection

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 level limit.



L00-FTM2xxxx-04-05-xx-en-002

### 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 → 3	☀	☀
		$1 \xrightarrow{< 100 \mu A} 3$	☀	●
Min.		$L+ \xrightarrow{I_L} +$ 1 → 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 19 V...253 V, 50/60 Hz or DC voltage 19 V...55 V  
 Power consumption max. 1.3 W  
 Reverse polarity protection  
 Separation voltage: 2.2 kV  
 FEM24 overvoltage protection: overvoltage category III

### 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.

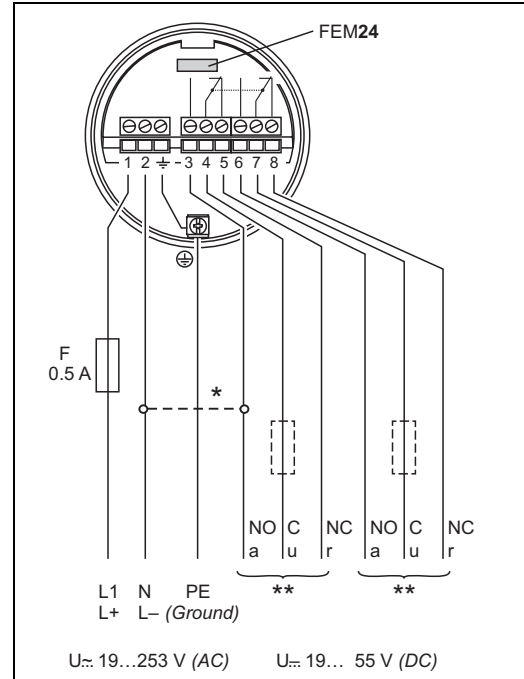
Both relay contacts switch simultaneously.  
 DPDT (double pole double throw)

\* 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,  $\cos \varphi = 1$ , P~ max. 750 VA,  $\cos \varphi > 0.7$ ;
- 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

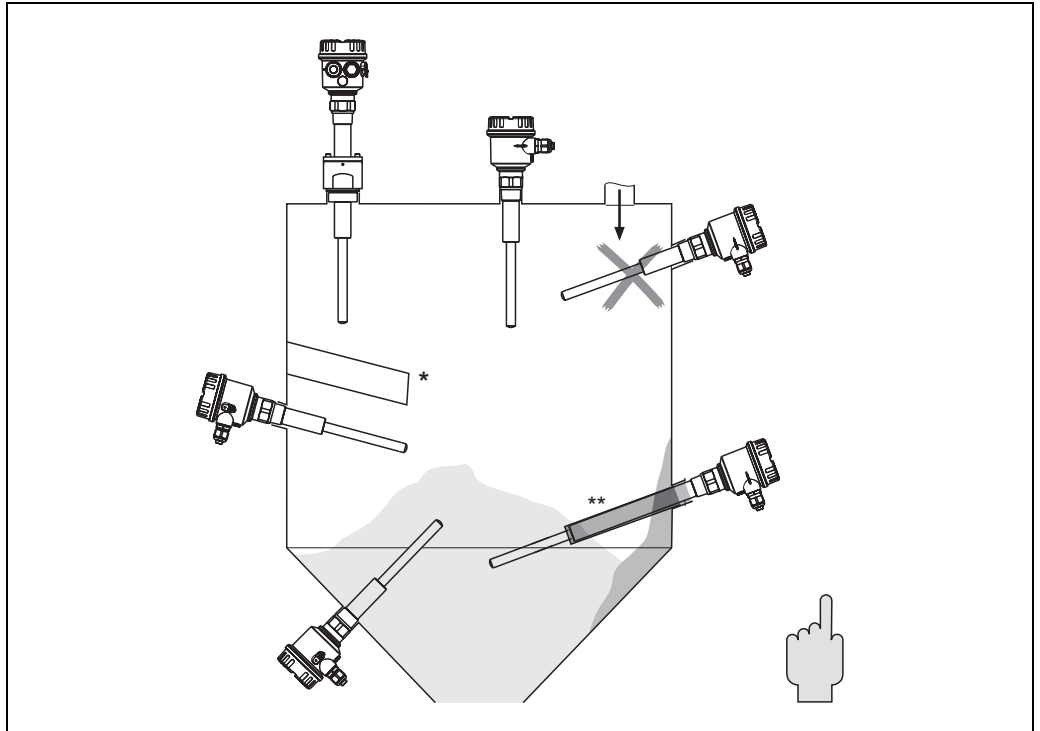
## Operating conditions

### Installation instructions

#### Mounting location

e.g. storage or buffer container

#### Orientation



*Horizontal installation/vertical installation*

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

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

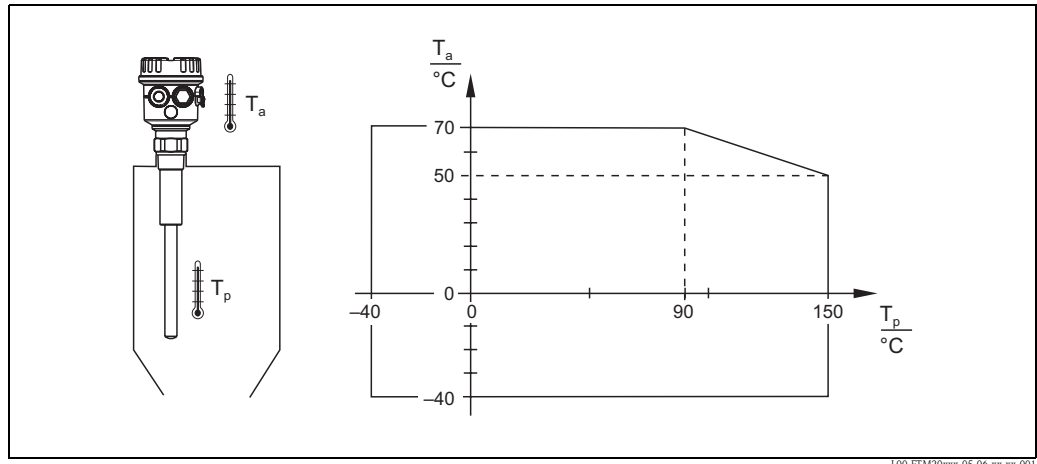
## Environment

<b>Ambient temperature range</b>	-40...70 °C
<b>Storage temperature</b>	-40...85 °C
<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)

## Process

### Environment

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



$$x \text{ } ^\circ\text{C} = (1.8 x + 32) \text{ } ^\circ\text{F}$$

### Thermal shock resistance

Maximum 120 K

### Limiting medium pressure range

-1...25 bar

#### Maximum Working Pressure (MWP)

25 bar

#### Burst pressure

100 bar

### State of aggregation

Solids

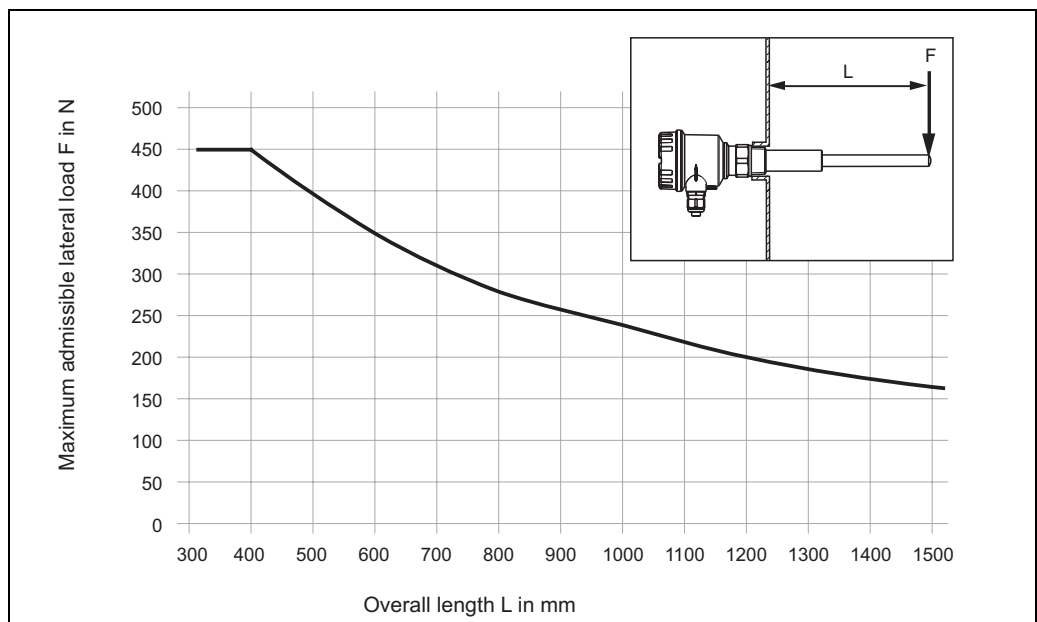
### Grain size

$\leq 25 \text{ mm}$

### Bulk density

$\geq 200 \text{ g/l}$ , not fluidised

### Lateral load



$$100 \text{ mm} = 3.94 \text{ in}$$



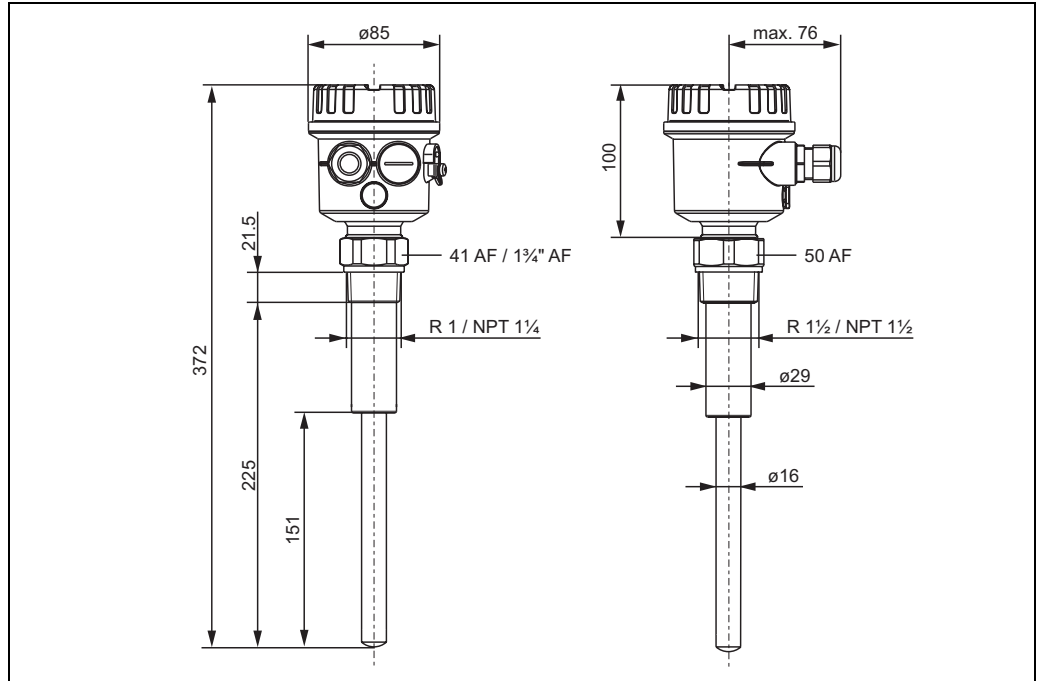
## Mechanical construction



Note!  
All dimensions in mm! (100 mm = 3.94 in)

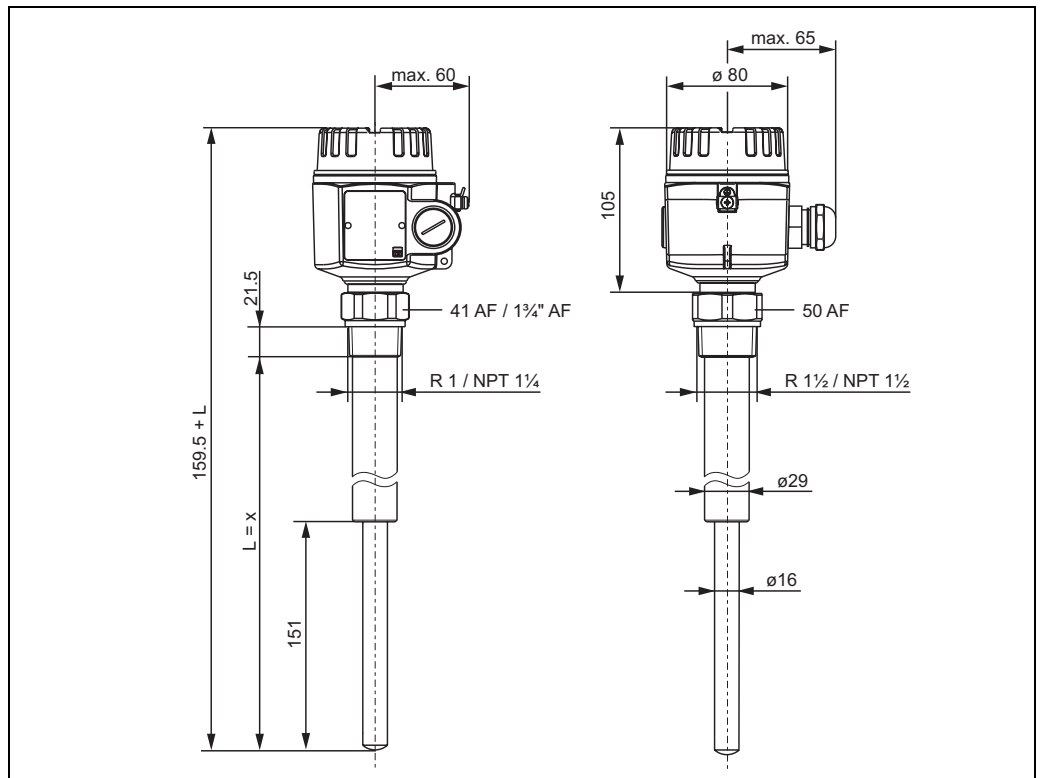
### Design, dimensions

#### Compact version



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

#### Pipe extension



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

$x = 500 \text{ mm}; 1000 \text{ mm}; 1500 \text{ mm}; 20 \text{ in}; 40 \text{ in}; 60 \text{ in}$

<b>Weight</b>	FTM20/FTM21 with F16 housing, FEM24 and R 1 thread:	
	Compact	= approx. 1.0 kg
	500 mm	= approx. 1.3 kg
	1000 mm	= approx. 2.0 kg
	1500 mm	= approx. 2.6 kg

<b>Material</b>	<b>F16 housing:</b>
	PTB-FR, cover with sight glass made of PA12, EPDM cover seal
	<b>F18 housing:</b>
	Aluminium EN-AC-ALSi10Mg, plastic-coated EPDM cover seal
	<b>Process connections:</b>
	<ul style="list-style-type: none"> <li>■ R1; R1½ (316L, DIN 2999)</li> <li>■ NPT 1¼ - 11½; NPT 1½ - 11½ (316L, ANSI B 1.20.1)</li> </ul>
	<b>Sensor:</b>
	316L

## Human interface

### Display elements

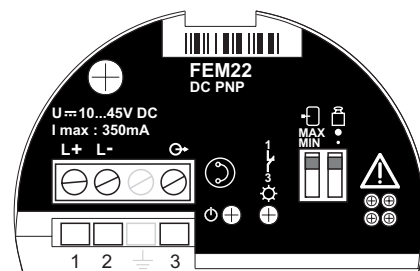


Note!  
The switch settings in the following graphics are in the as-delivered state.

#### FEM22

One green LED: operation

One yellow LED: electronic switch closed

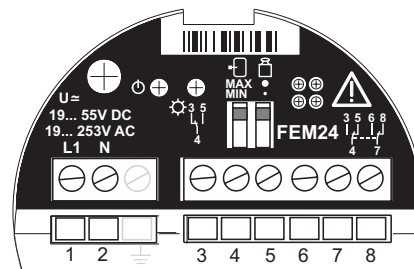


L00-FEM22xxx-07-05-xx-xx-001

#### FEM24

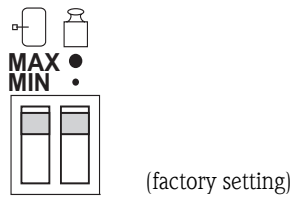
One green LED: operation

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

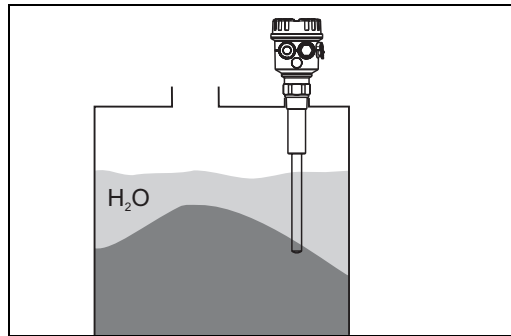
- 400 g/l (high bulk density)

- 200 g/l (low bulk density)

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**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.

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## Certificates and approvals

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**CE mark,  
declaration of conformity**

The instrument is designed to meet state-of-the-art safety requirements, has been tested and left the factory in a condition in which it is safe to operate.

The instrument complies with the applicable standards and regulations as listed in the EC declaration of conformity and thus complies with the statutory requirements of the EG directives.

Endress+Hauser confirms the successful testing of the instrument by affixing to it the CE mark.

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**Ex approval**

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.

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**Type of protection**

See "Ordering information" as of Page 13 and "Supplementary documentation" on Page 16.

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**Other standards and  
guidelines**

Other standards and guidelines that were taken into consideration in designing and developing Soliphant T FTM20, FTM21:

- Low Voltage Directive (73/23/EEC)
- DIN EN 61010 Part 1, 2001  
Protection Measures for Electrical Equipment for Measurement, Control, Regulation and Laboratory Procedures  
Part 1: General requirements
- EN 61326  
Electrical Equipment for Measurement, Control and Laboratory Use  
EMC requirements

## Ordering information

### Soliphant T FTM20

10		Approval			
	A	Non-hazardous area			
	C	CSA General Purpose, CSA C US			
	D	CSA DIP+FM DIP			
	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			
	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
	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			
	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	FEM20B	ASI Bus		
	9	Special version			
<b>40</b>		<b>Housing; cable entry</b>			
	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
	9	Special version			
<b>50</b>		<b>Additional fittings</b>			
	A	Basic version			
	Y	Special version			
FTM21		Complete product designation			

## Accessories

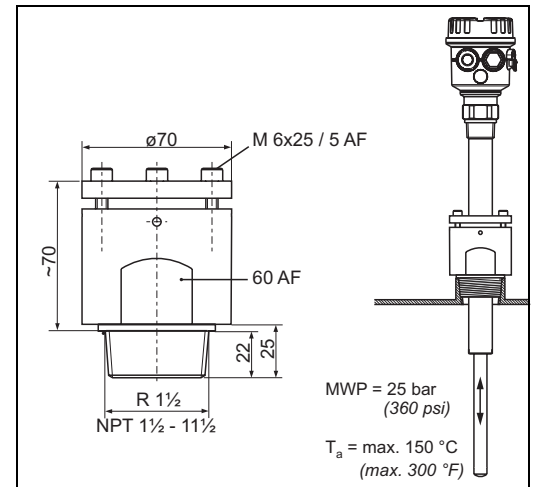
### Sliding sleeve

For pressurised container

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



Note!  
Suitable for multiple switch-point configurations!



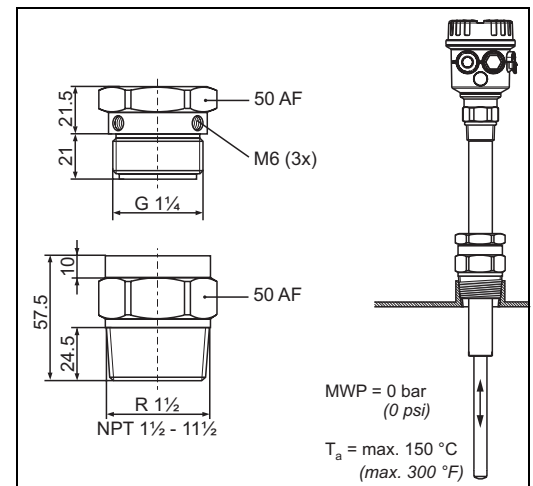
L00-FTM2xxxx-03-05-xx-en-001

For unpressurised container, IP65

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



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



L00-FTM2xxxx-03-05-xx-en-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

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## Supplementary documentation

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### Operating Instructions

- Soliphant T FTM20, FTM21  
KA227F/00/a6

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### Certificates

- ATEX II 1/3 D T +12 K  
XA300F/00/a3

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### Instruments International

Endress+Hauser  
Instruments International AG  
Kaegenstrasse 2  
4153 Reinach  
Switzerland

Tel. +41 61 715 81 00  
Fax +41 61 715 25 00  
[www.endress.com](http://www.endress.com)  
[info@ii.endress.com](mailto:info@ii.endress.com)

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