Датчики уровня
Soliphant II FTM30/31/32 DR

Техническая информация

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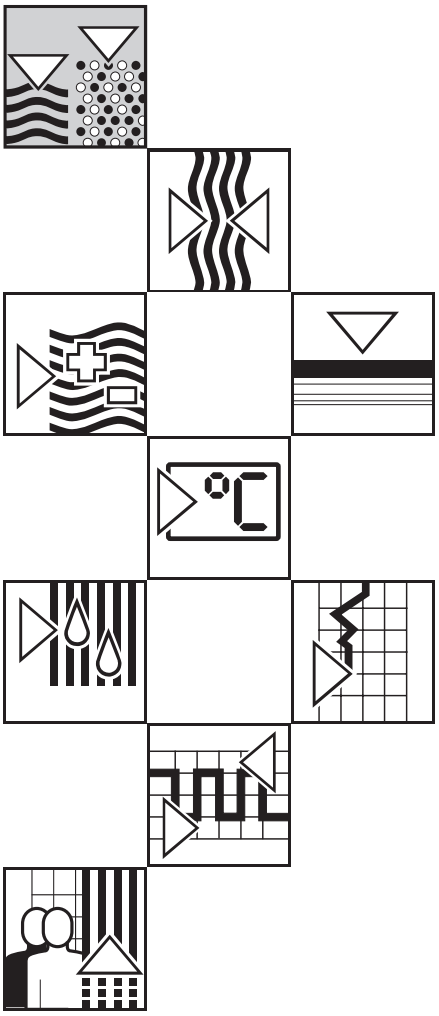
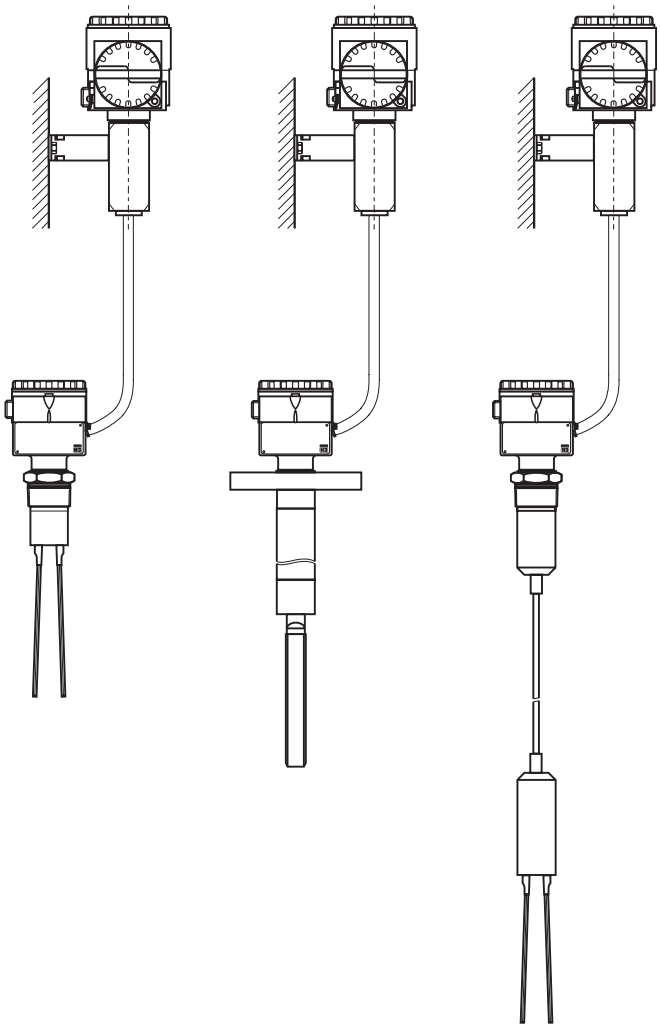
soliphant II
FTM 30/31/32 DR
Level Limit Switch

Operating Instructions





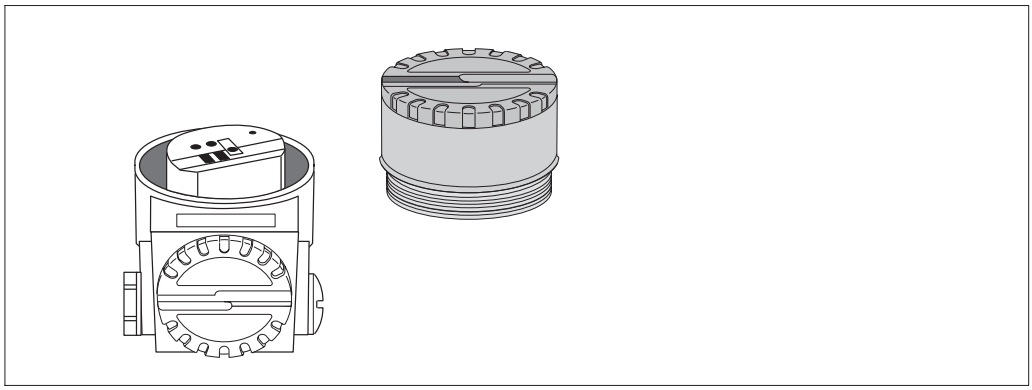
Quick guide

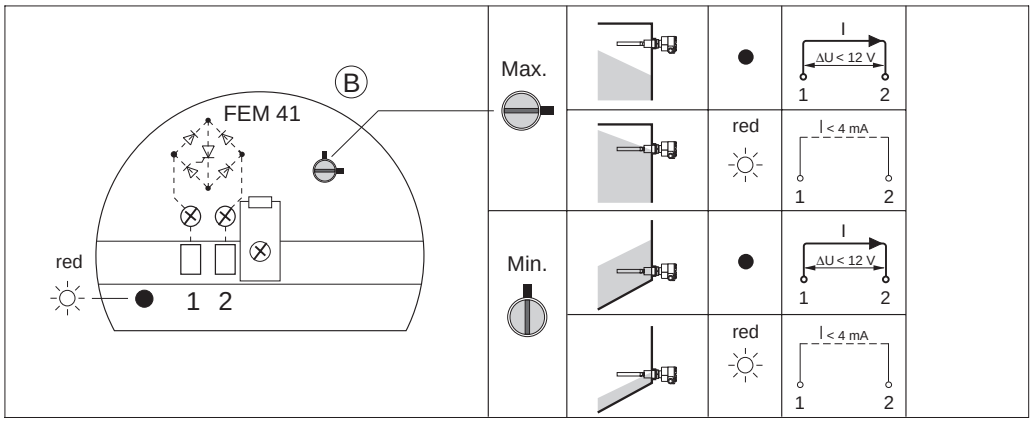
Quick Start Adjusters and LEDs are on the electronic insert in the separate housing T3.

Adjustment and function

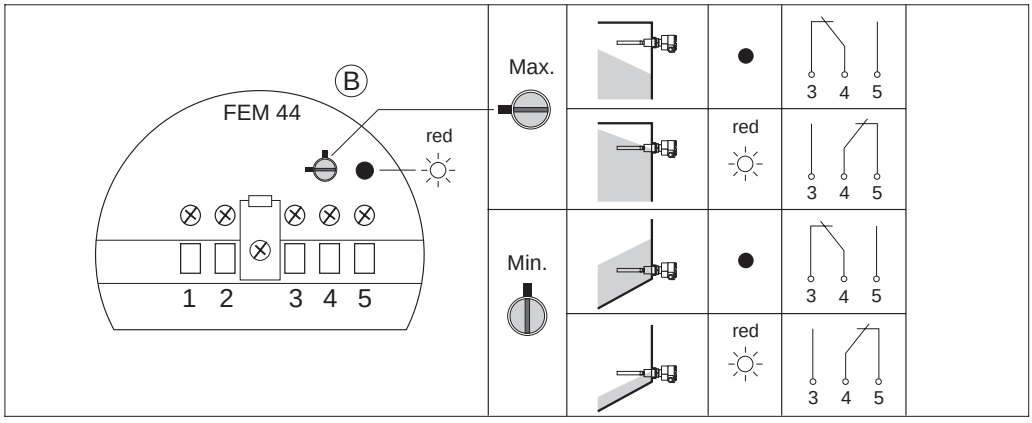
Max. = Maximum fail-safe
Min. = Minimum fail-safe

☼ = LED on
● = LED off

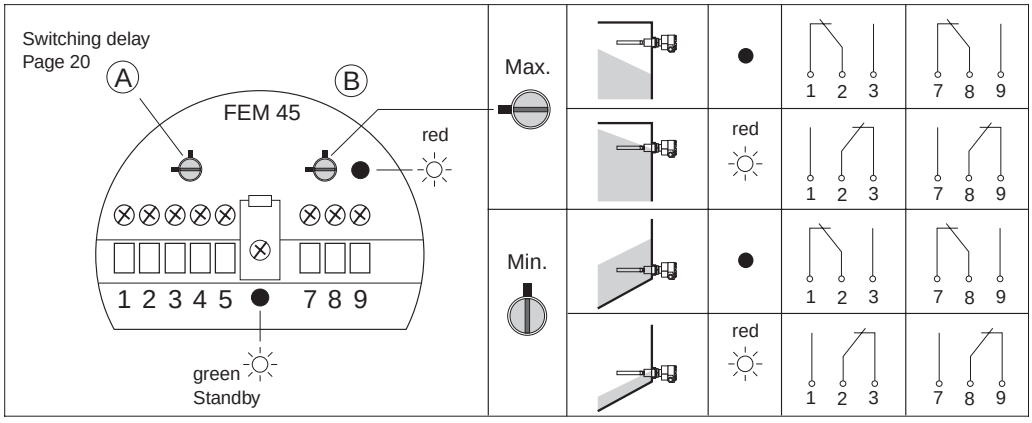




Electronic insert **FEM 41**
for two-wire
AC power supply.
Electronic switch



Electronic insert **FEM 44**
for universal power supply.
Relay output
with **one** potential-free
changeover contact (SPDT)



Electronic insert **FEM 45**
for universal power supply.
Relay output
with **two** potential-free
changeover contacts (DPDT)

Table of Contents

1 Notes on Safety

1.1 Special Notes on Safety

Approved usage

The Soliphant FTM .. DR is used for limit detection with powdered or fine-grained solids. See Technical Data for temperature, pressure, mechanical loads and bulk solids characteristics.

Installation, Commisioning, Operation

The Soliphant has been designed to operate safely in accordance with current technical, safety and EU standards. If installed incorrectly or used for applications for which it is not intended, however, it is possible that application-related dangers may arise, e.g. product overflow or explosion in a flammable atmosphere.
For this reason the instrument must be installed, connected, operated and maintained according to the instructions in this manual; personnel must be authorized and suitably qualified. The manual must have been read and understood, and the instructions followed. Modifications and repairs to the device are permissible only when they are expressly approved in the manual.

Explosion hazardous areas

If the Soliphant is to be installed in an explosion hazardous area, then the specifications in the certificate as well as all national regulations must be observed. Classes, Divisions and Groups are different according to FM or CSA approval, see Product Structure.

- Ensure that all personnel are suitably qualified.
- Observe the regulations concerning measurement and safety at the measuring point.

1.2 Safety Conventions and Symbols

In order to highlight safety-relevant operating procedures in the manual, the following conventions have been used, each indicated by a corresponding icon.

Safety conventions

Symbol	Meaning
 Note!	**Note!** A note highlights actions or procedures which, if not performed correctly, may indirectly affect operation or may lead to an instrument response which is not planned.
 Caution!	**Caution!** Caution highlights actions or procedures which, if not performed correctly, may lead to personal injury or incorrect functioning of the instrument.
 Warning!	**Warning!** A warning highlights actions or procedures which, if not performed correctly, may lead to personal injury, a safety hazard or destruction of the instrument.

Explosion protection

	**Device certified for use in explosion hazardous area** If the device has this symbol embossed on its name plate it can be installed or its cabling laid in an explosion hazardous area
	**Explosion hazardous area** Symbol used in drawings to indicate explosion hazardous areas. – Devices located in and wiring entering areas with the designation "explosion hazardous areas" must conform with the stated type of protection.
	**Safe area (non-explosion hazardous area)** Symbol used in drawings to indicate, if necessary, non-explosion hazardous areas. – Devices located in safe areas still require a certificate if their outputs run into explosion hazardous areas.

Electrical symbols

	Direct voltage A terminal to which or from which a direct current or voltage may be applied or supplied.
	**Alternating voltage** A terminal to which or from which an alternating (sine-wave) current or voltage may be applied or supplied.
	**Grounded terminal (earth connection)** A grounded terminal, which as far as the operator is concerned, is already grounded by means of an earth grounding system.
	**Protective grounding (earth) terminal** A terminal which must be connected to earth ground prior to making any other connection to the equipment.
	**Equipotential connection (earth bonding)** A connection made to the plant grounding system which may be of type e.g. neutral star or equipotential line according to national or company practice.

2 Usage

2.1 Application

Soliphant is a rugged limit switch for silos containing powdered or fine-grained solids, including those with very low bulk densities.
The material must be pourable, i.e. it must not stick or bake on.
The various versions ensure it can be used in a wide range of applications, including explosion-hazardous areas and foodstuffs.
The instruments are designed for use in industrial applications.

Typical applications:
grain, flour, milk powder, cocoa, sugar, animal feed,
washing powders, dyes, chalk, plaster, cement, plastic granules

2.2 Measuring System

The components of the measuring system are:
- Soliphant II
  - – FTM 30 DR compact sensor
  - – FTM 31 DR with extension tube
  - – FTM 32 DR with rope
- Separate housing with electronic insert
  - – FEM 41 for two-wire alternating power supply
  - – FEM 44 for universal power supply and relay output with one potential-free switchover contact (SPDT)
  - – FEM 45 for universal power supply and relay output with two potential-free switchover contacts (DPDT)
- Control systems or signal devices that may be connected such as miniature contactors, alarm transmitters or programmable logic controllers

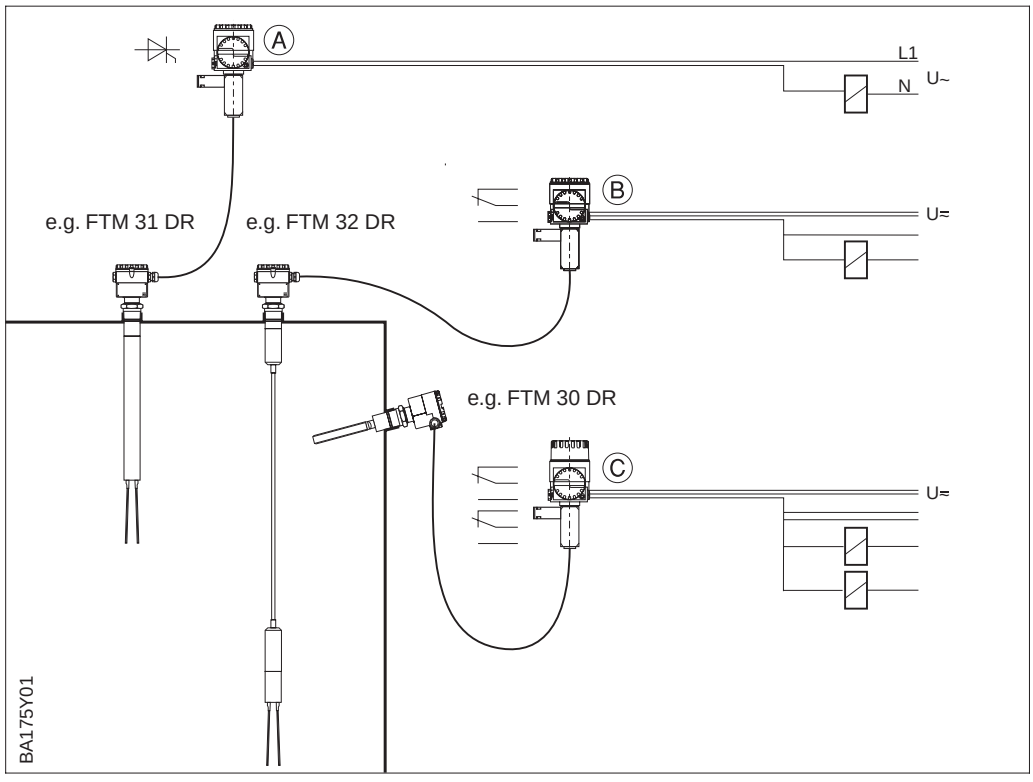


Fig. 1
A Limit switch for two-wire AC power supply

B Limit switch for universal power supply with **one** changeover contact

C Limit switch for universal power supply with **two** changeover contacts

2.3 Function

The symmetrical vibrating fork is excited to its resonant frequency. When the fork is covered by material, the vibrations are damped.
The tip of the fork is especially sensitive and makes it ideal for the limit detection of materials that have a very low bulk density.
In contrast, the base of the fork is very insensitive and is therefore unaffected by material build-up on the vessel walls.
The signal of the sensor is converted into a switching signal by the electronic insert in the separate housing.
Soliphant can be operated in both minimum or maximum fail-safe mode, i.e. the electronic switch opens or the relay de-energises when the minimum or maximum level is reached, on fault or on power failure.

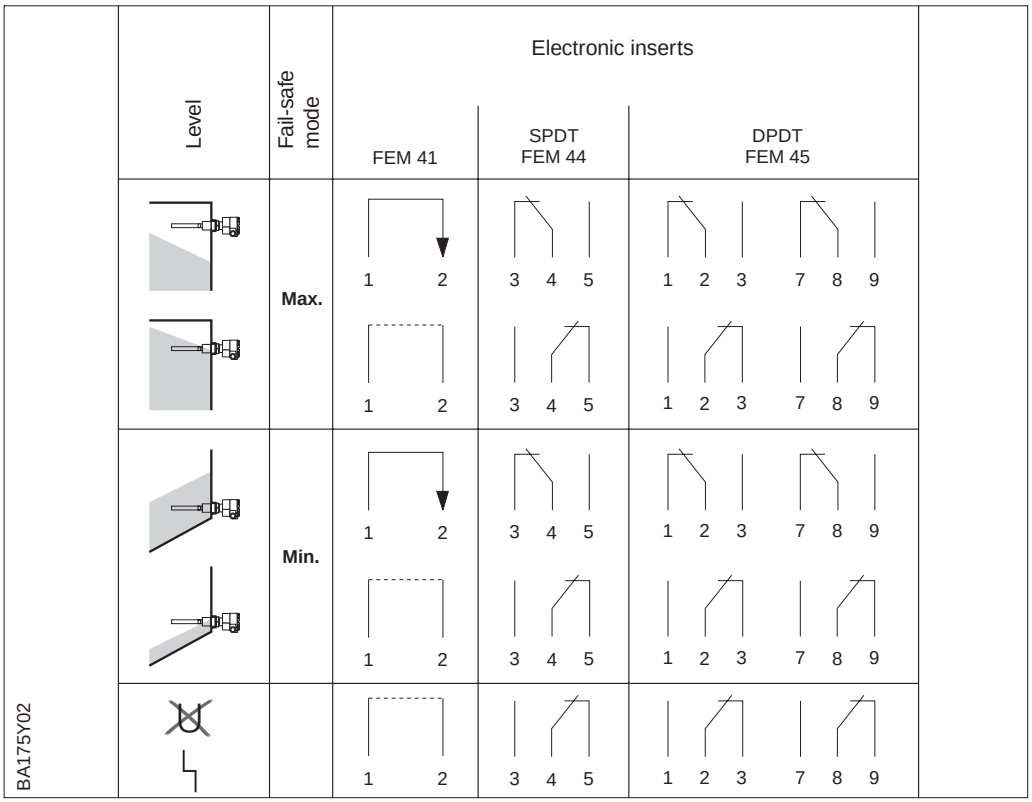


Fig. 2
The function of the electronic switch or relay depends on the level and fail-safe mode

3 Installation

3.1 Design planning

General information

Height of the switch point at the device:
Switching will occur
– if the tip of the fork is covered by high-density material to several millimetres,
– if the tip of the fork is covered by low-density and loosely-packed material to several centimetres.

Pneumatic conveying systems:
Turbulence can cause error switching. The Soliphant should thus be mounted away from air and material flows or is protected from strong air currents.

Inspecting or cleaning the silo:
Install the oscillating fork in a protected area.

Mounting in the open:
Install a protective hood for the Soliphant.
It protects the field-mounted Soliphant from condensation in the sensor housing F6 due to extreme temperature variations.

Soliphant FTM 30 DR

The compact Soliphant FTM 30 DR can be mounted in any position in a bulk solids vessel. See Fig. 3 for types of installation.

Take into account the angle of the mound or outflow funnel when determining the height of the installation point.

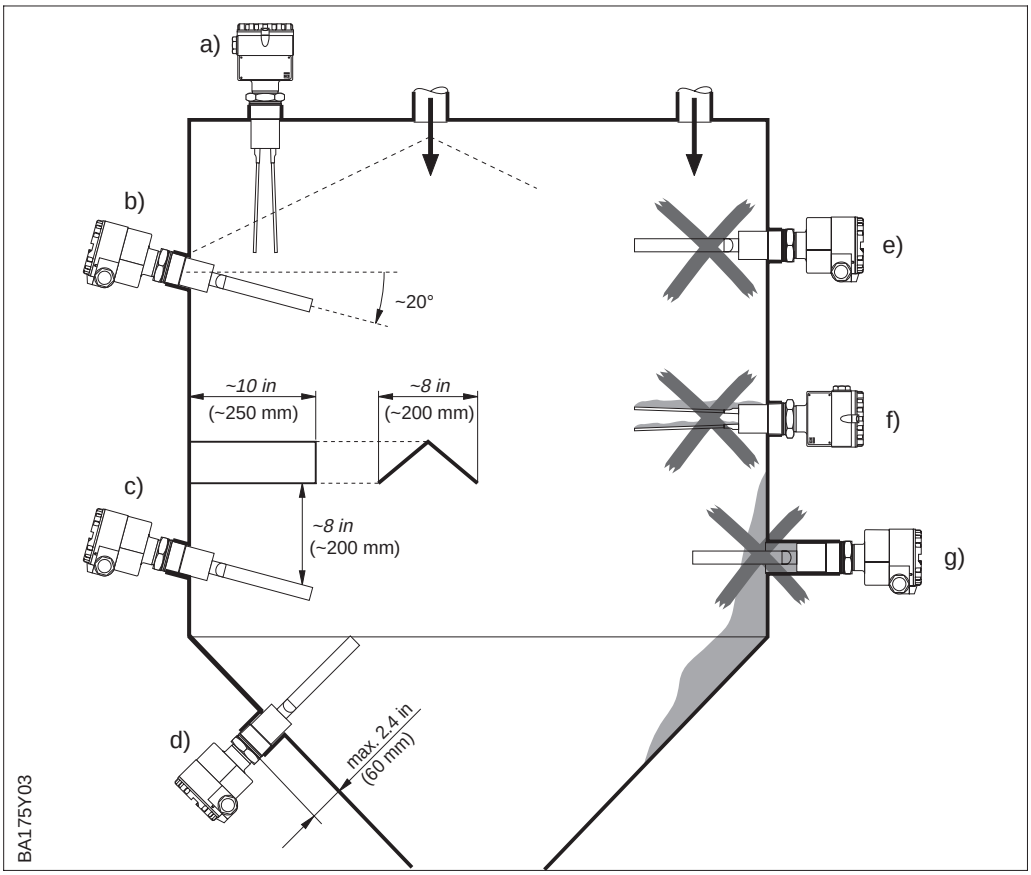


Fig. 3
Left:
correct mounting
a) top-mounted;
fork vertical but at any orientation
b) laterally mounted,
fork angled slightly downwards so that material can slide off more easily
c) with shield,
length approx. 10 in (250 mm), width approx. 8 in (200 mm), to protect against collapsing mounds
d) in discharge hopper;
max. nozzle length 2.4 in (60 mm), so that no build-up occurs which prevents the fork from oscillating

Right:
incorrect mounting
e) in filling curtain
f) fork orientation incorrect
(broad tine surface is subjected to high load caused by discharging material; malfunction due to residual material)
g) mounting nozzle too long

Soliphant FTM 31 DR

The Soliphant FTM 31 DR with extension tube e.g.
– if mounting is only possible from above
– if the switch point is to be altered using the sliding sleeve (accessory)
– with heavy build-up on the silo wall (mounting from above or from the side)

Take into account the angle of the mound or outflow funnel:
– for calculating the required length of the sensor when ordering a Soliphant FTM 31 DR
– for calculating the length of the mounting nozzle and mounting point, if you have an instrument with a specific length.

The Soliphant FTM 31 DR may not be shortened!

Mounting from above:
Mount in the centre of the discharge hopper order to keep the lateral load caused by discharging material to a minimum; or close to the vessel wall with an extra fastening near to the fork.

Mounting from the side:
Only order the length of extension tube required as very strong forces can affect the Soliphant due to outflowing material or when homogenising the material.
Fasten a very long Soliphant extension tube by using a tight-fitting nozzle or fastener.

Maximum length of a mounting nozzle:
Length of the Soliphant from process connection to the tip of the fork minus 7 in (170 mm).

Check that there is enough space outside the silo for mounting.

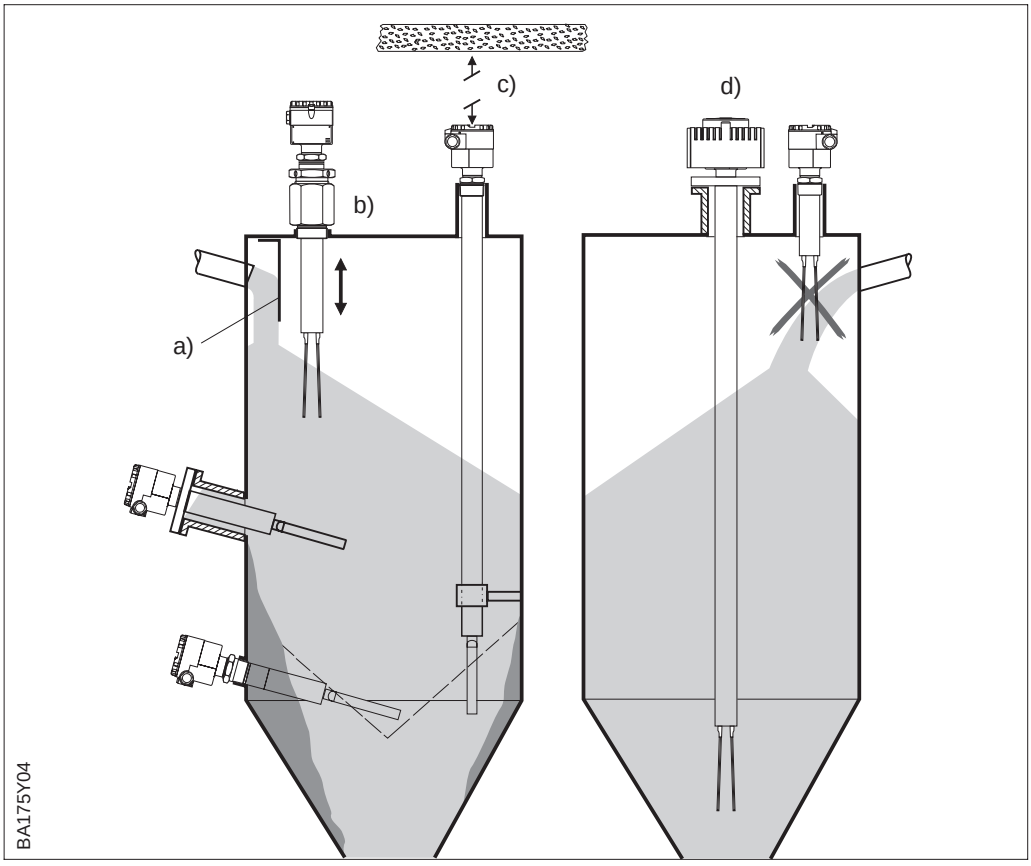


Fig. 4
a) Plate to protect against inflowing material
b) Sliding sleeve for infinite adjustment of the switch point
c) sufficient space for mounting
d) Protective hood against condensation in the housing

Soliphant FTM 32 DR

The Soliphant FTM 32 DR with rope if e.g.
– only top-mounting is possible
– there is strong build-up on the silo wall
– there is strong vibration of the silo

Take into account the angle of the mound or outflow funnel:
– for calculating the required length of the sensor when ordering a Soliphant FTM 32 DR
– for calculating the length of mounting nozzle required and mounting point, if you have an instrument with a specific length.

The Soliphant FTM32 DR may be shortened (with rope shortening set accessory). The rope length cannot be increased.

The instrument should not be installed at the centre of the hopper but as near to the vessel wall as possible in order to keep tension caused by discharging material to a minimum. It should not, however, be so close that it touches the wall when it swings. Check the stability of the roof and the tension acting on the rope. The tension caused by material outflow is usually much higher with powders than with granular materials.

The Soliphant must be mounted outside the material stream when using pneumatic conveying systems.

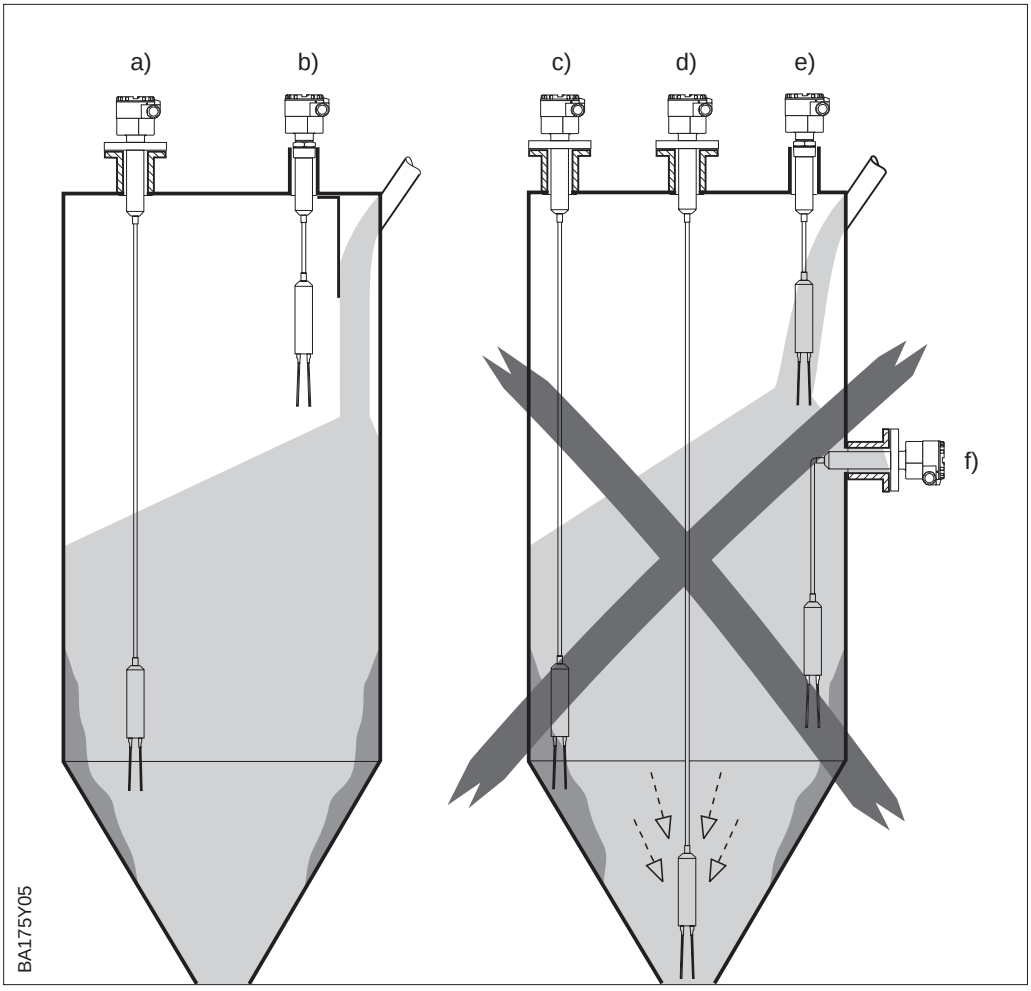


Fig. 5
Left:
correct mounting
a) next to the silo wall, but with enough distance from it and from material build-ups
b) protected against material flow

Right:
incorrect mounting
c) too near to the wall and material build-up
d) in the centre of the discharge hopper
e) in filling curtain
f) laterally mounted

Separate housing for the electronic insert

The mounting accessory enables the separate housing to be fixed to a wall or to a horizontal or vertical 2" pipe.

Select a mounting point which is protected from vibration and heat radiation and where there is sufficient clearance for connecting and calibrating the instrument.

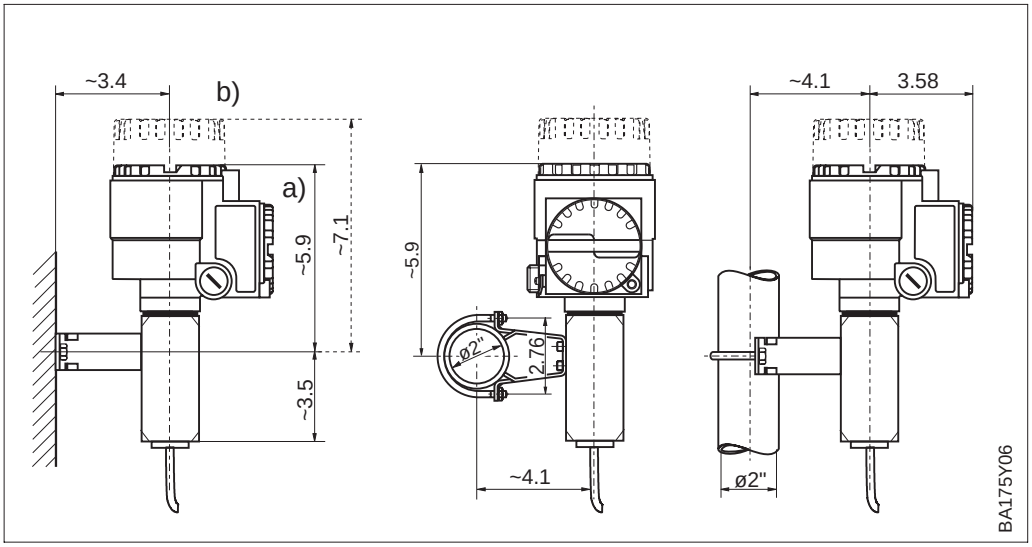


Fig. 6
Separate housing T3
a) Terminal connection area
b) Electronics area for electronic insert with adjusters

3.2 Mounting

Unpacking

The fork of the Soliphant is packed in a cardboard tube for transportation. To prevent the fork from being damaged, do not remove this until immediately before mounting.

See Section 8.6 "Disposal" for disposing of the packaging.

Instrument identification

Before installing, check to see if you have the correct instrument:
Compare the product designation on the nameplate with that given in the product structure on the next page.

Tools

- Soliphant with thread: open-end spanner 1.97 in ~$1^{31}/_{32}$" (50 AF)
- Soliphant with flange: open-end spanner to fit mounting bolts
- Cover lock: Allen key for Allen screws 0.12 in ~$^{1}/_{8}$" (3 AF)
- Clamp for separate housing: Allen key for Allen screws 0.16 in ~$^{5}/_{32}$" (4 AF)
- Dummy plugs for cable glands: Allen key for Allen screws ~$^{3}/_{8}$" (10 AF) and 0.55 in ~$^{35}/_{64}$" (14 AF)
- Flexible metallic protective tubing for connecting cable: open-end spanner $1^{1}/_{16}$" (~27 AF)
- Screwdriver, blade width approx. 0.2 in (approx. 5 ... 6 mm)

Product structure

Construction

FTM 30 DR compact version
FTM 31 DR with extension tube
FTM 32 DR with rope

Certificates, Applications

Q FM XP, Cl. I,II,III, Div. 1, Groups C, D, E, F, G
L CSA XP, Cl. I,II,III, Div. 1, Groups B, C, D, G and coal dust

Electronic Insert in Separate Housing

1 FEM 41, Two-wire AC, U~ 19 … 253 V
4 FEM 44, Universal power supply, U~ 19 … 253 V, U– 19 … 200 V
1 potential-free changeover contact
5 FEM 45, Universal power supply, U~ 19 … 253 V, U– 19 … 200 V
2 potential-free changeover contacts

Connecting Cable for Soliphant - Separate Housing

A 200 in (5 m)
B 400 in (10 m)
C ..... in *)
F 200 in (5 m) with flexible metal tubing
G 400 in (10 m) with flexible metal tubing
H ..... in *) with flexible metal tubing

*) min. 20 in (0,5 m)
max. 785 in (20 m), length **includes**
extension tube or rope of the Soliphant

Process Connection and Material

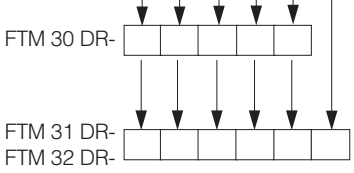
A Thread R 1½ ISO 7/1 (BSP), AISI 304
B Thread 1½ - 11½ NPT, ANSI B 1.20.1, AISI 304
H Flange DN 50, PN 40, DIN 2527, Form B, AISI 316
J Flange DN 80, PN 16, DIN 2527, Form B, AISI 316
K Flange DN 100, PN 16, DIN 2527, Form B, AISI 316
M Flange RF 2", 150 psi, ANSI B 16.5, AISI 316
P Flange RF 3", 150 psi, ANSI B 16.5, AISI 316
N Flange RF 4", 150 psi, ANSI B 16.5, AISI 316
Y Other process connections

Other Versions

1 Standard features
9 Others

Sensor Length

For FTM **31** DR:
A ..... in - 16 … 155 in
(400 … 4000 mm)
For FTM **32** DR:
B ..... in - 30 … 765 in
(750 … 19500 mm)
can be shortened with set (accessory)
Y Others



FTM 30 DR- full product designation

FTM 31 DR- full product designation
FTM 32 DR-

Cable length and sensor length in inches

Warning!
Errors can occur if the fork is damaged.
An explosion can occur if the diaphragm at the base of the fork is split.

When mounting, protect the fork against mechanical tension and shock.
Do not bend the fork!

If the Soliphant is too long when mounting then the fork must **not be shortened**!

If the Soliphant is too short when mounting then the fork must **not be lengthened**!

In such cases the mounting nozzle should be adjusted.

Handling

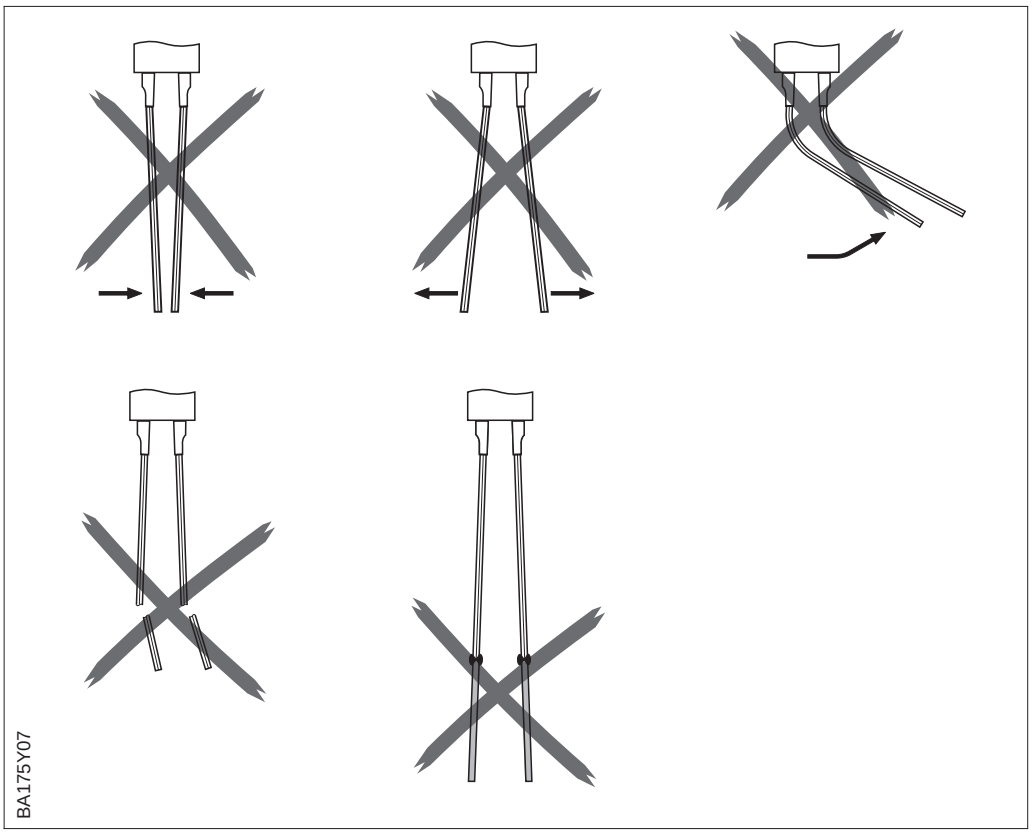


Fig. 7
Do not
damage the fork,
bend the fork,
shorten the fork,
lengthen the fork

Do not carry the separate housing hanging by its connecting cable!

Tightening the Soliphant

Before mounting:
Wrap suitable material around the thread so that it does not eat into the hole when tightening and that the fork can still be positioned correctly.

Screwing in:


Caution!

Caution!
When screwing into the threaded sleeve the instrument can be damaged if
– it presses against a vessel wall,
– bores into the material or into any build-up
– it is turned by its housing.

It is necessary therefore:
– to check before screwing in that there is enough free space in the silo.
– to turn the instrument only by the hex nut using an open-ended spanner (with 1.97 in = 50 AF).

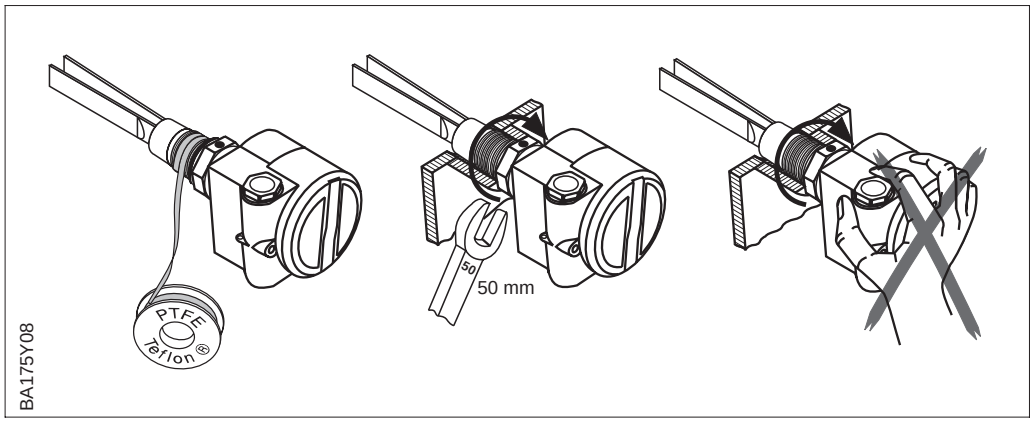


Fig. 8
Screw in the Soliphant with an open-ended spanner

Positioning the fork:
This is only necessary with a laterally mounted Soliphant.


Note!

Note!
The function can be affected if material remains lying on the broad side of the fork. With an instrument mounted for minimum detection outflowing material can damage the fork if the broad side of the fork is uppermost.

It is necessary therefore:
To turn the hex nut so that the mark is at the top.
This indicates that the narrow side of the fork is upwards and that the material can flow unhindered and does not remain on the fork.

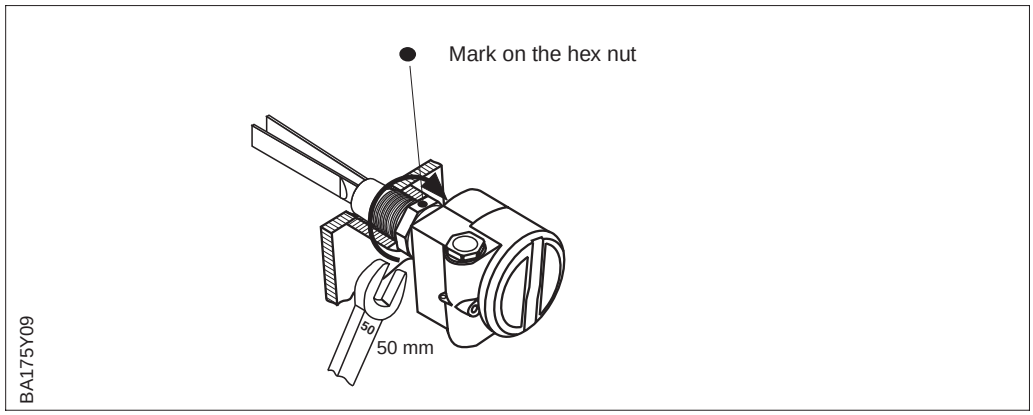


Fig. 9
Position the fork with the mark at the top!

Flange connection of the Soliphant

Advance work:
Important for mounting a narrow nozzle:
– Weld the flange exactly at right angles to the pipe.
– The internal diameter of the pipe should be a min. 1.73 in (44 mm) throughout its length.
Select a flange gasket suitable for the operating pressure and temperature.

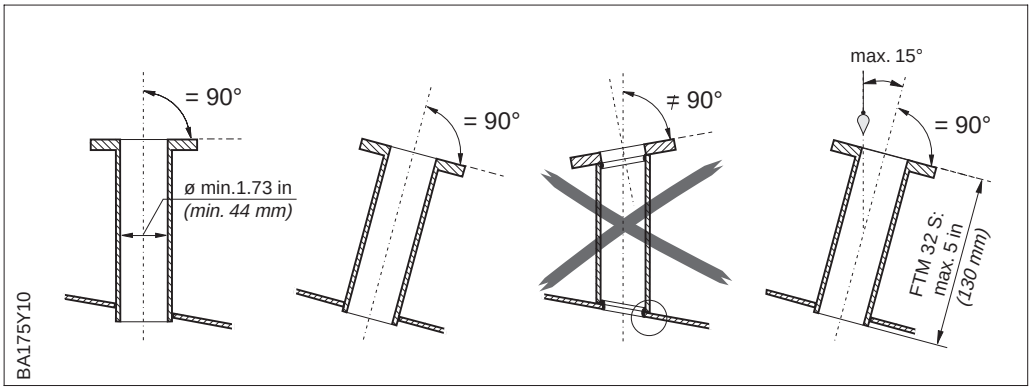


Fig. 10
Mounting nozzle and counter flange welded exactly together

Figure on the extreme right for FTM 32 DR only

Positioning the fork:
This is only necessary with a laterally mounted Soliphant.

Note!
The function can be affected if material remains lying on the broad side of the fork. When using the instrument for minimum detection, outflowing material can damage the fork if the broad side of the fork is uppermost.

Note!

It is necessary therefore:
To turn the flange so that the marks are at the top.
This indicates that the narrow side of the fork is upwards and that the material can flow unhindered and does not remain on the tines.

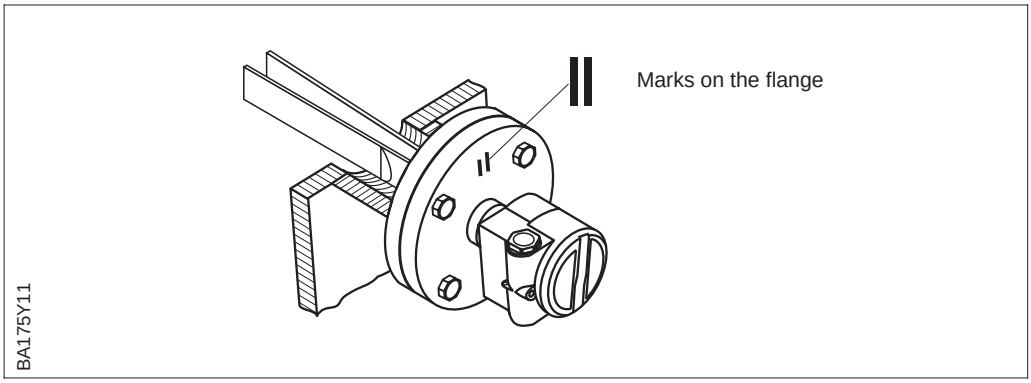


Fig. 11
Position the fork with the marks at the top!

Mounting a Soliphant FTM 31 DR with sliding sleeve

Warning!
Risk of injury: The Soliphant can be ejected at high speed from the sliding sleeve if it is not mounted according to instructions.


Warning!

It is necessary therefore:
To observe the operating manual enclosed with the sliding sleeve.

Soliphant- Positioning the cable entry

If the cable entry is not in the correct position after mounting the Soliphant, then it can be positioned by turning the housing.
(The cable entry is sealed during shipment by a yellow plastic plug for protection.):
– Open housing cover
– Do not wipe away the lubricant on the thread of the cover or the gasket!
– Place the cover on a clean surface only.
– Loosen the screw in the clamping ring in front of the terminal block by 3 or 4 turns
– Turn the housing until the cable entry is correctly positioned;
when the Soliphant is mounted laterally then the cable entry should point downwards;
the housing can be turned through approx. 270°
– Retighten the screw in the clamping ring on the front of the terminal block
– Close the housing cover

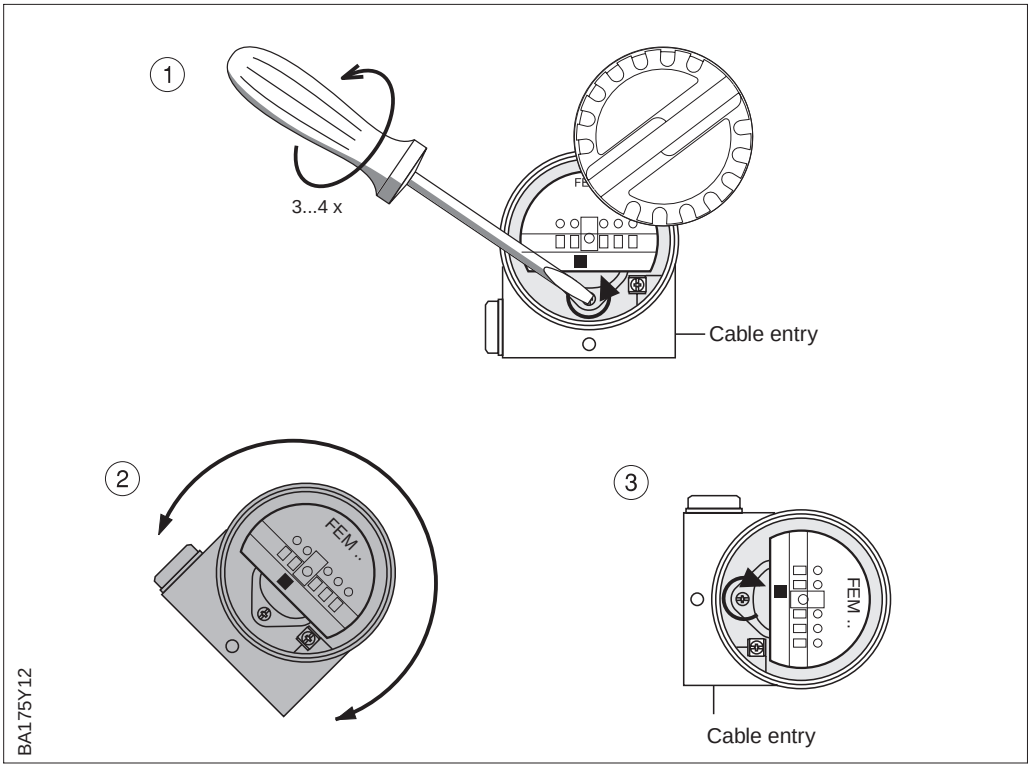


Fig. 12
Position cable entry

Mounting the T3 separate housing

See Fig. 13, 14 for examples on how to fix to a wall or 2" pipe.
There should be enough clearance for connecting and calibrating the instrument.
Do not attach to components of the plant which vibrate strongly.
Cover the housing to protect it from direct heat.

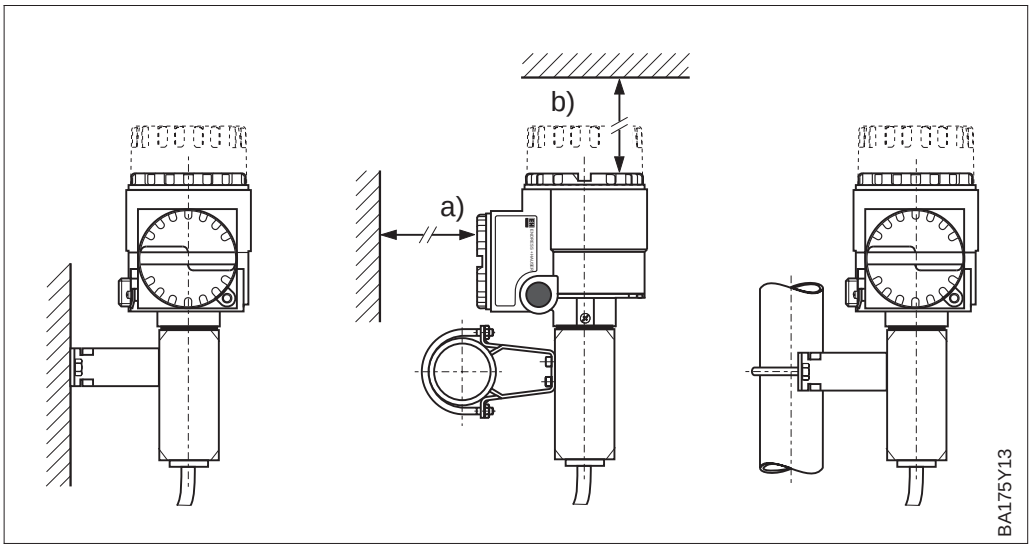


Fig. 13
Separate housing T3
a) Terminal connection area
b) Electronics area
Ensure there is sufficient space for connecting and adjusting!

If, after mounting, the connection area or cable entry (the cable entry is sealed during shipment by a yellow plastic plug for protection) is wrongly positioned, then the housing can be rotated.

Positioning the separate housing:
– Loosen the screw at the base of the housing by 3 to 4 turns
– Turn the housing in the direction required;
(the housing can be turned through approx. 270°)
– Retighten the screw at the collar of the housing

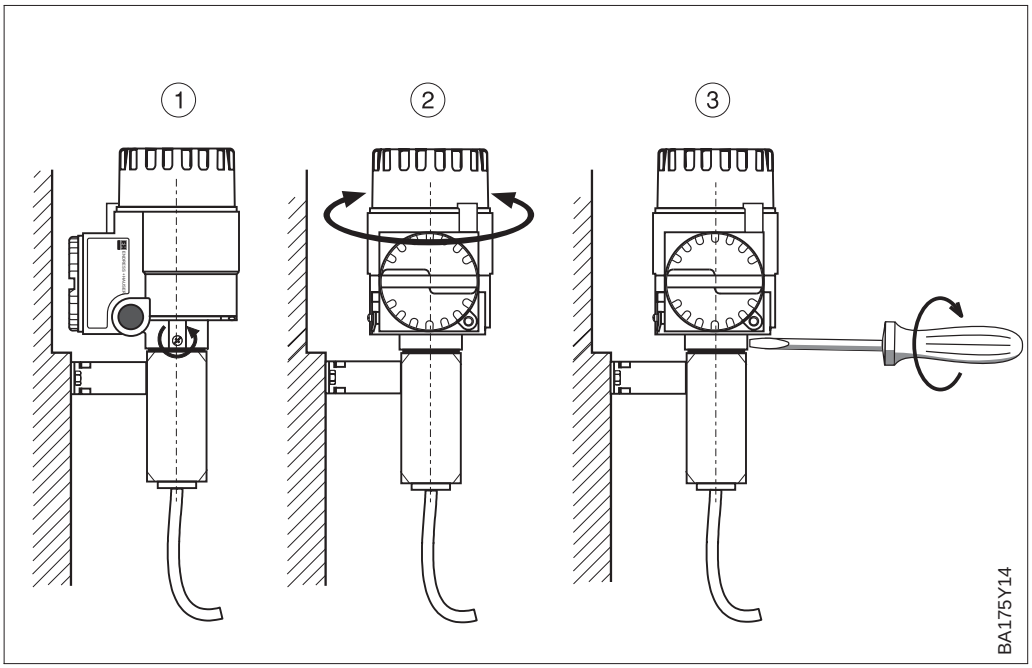


Fig. 14
Positioning the separate housing

4 Settings

Before connecting:
Carry out the settings on the electronic insert in the separate housing.


Warning!

Warning!
There is a risk of explosion if the settings are carried out after connecting the instrument.
If the Soliphant is already connected then, before making the settings:
– Switch off all power to the instrument
– Secure against switching on
– Check that no power is switched on to the instrument
– Ground and short-circuit all cabling
– Wait 15 minutes before opening the separate housing

Opening the electronics area

Protect the separate housing from dripping water.
Loosen the lock on the cover to the electronics area.
Unscrew cover.
Do not wipe away the lubricant on the thread of the cover or the gasket!
Place the cover on a clean surface only.

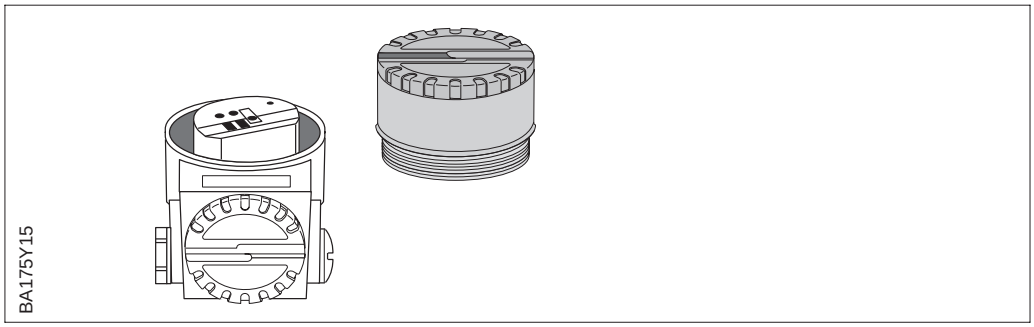


Fig. 15
Opened electronics area with electronic insert FEM

4.1 Selecting the fail-safe mode

Electronic insert FEM 41 FEM 44 FEM 45

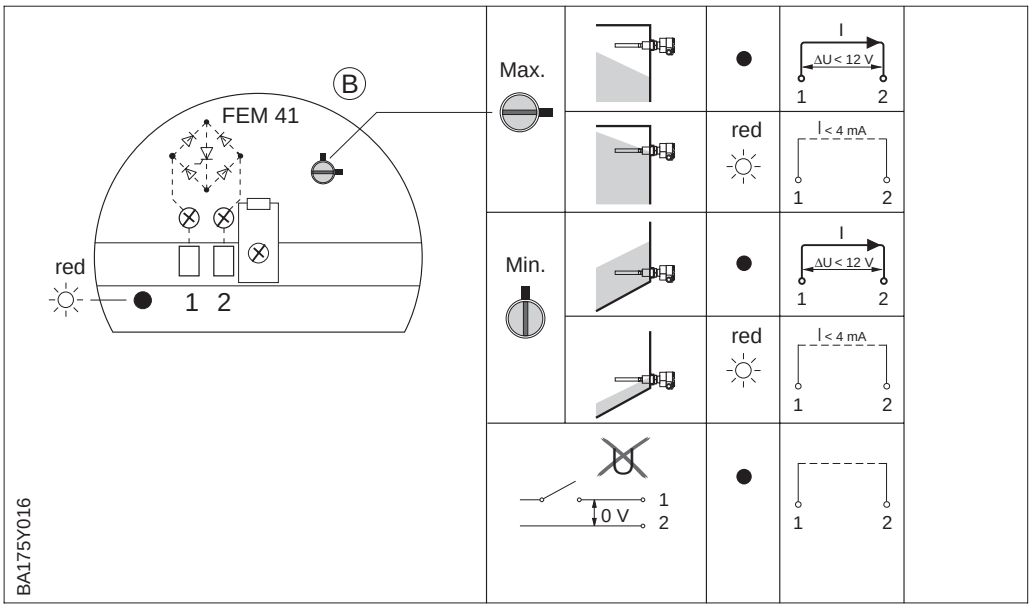
Maximum fail-safe: The circuit is open when the fork is covered or on power failure.

Minimum fail-safe: The circuit is open when the fork is free or on power failure.

Select the fail-safe mode required for your application using rotary switch B.
The switch can be turned in both directions; it then clicks in after 90°.

LEDs

Function indicator.
The LEDs can only be seen when the separate housing is **not** in the explosion hazardous area and when the cover of the electronics area can then be opened during operation or testing.



Adjustment and function

Max. = Maximum fail-safe
Min. = Minimum fail-safe

☼ = LED on
● = LED off

Fig. 16
Electronic insert **FEM 41**
Two-wire AC version.
Electronic switch

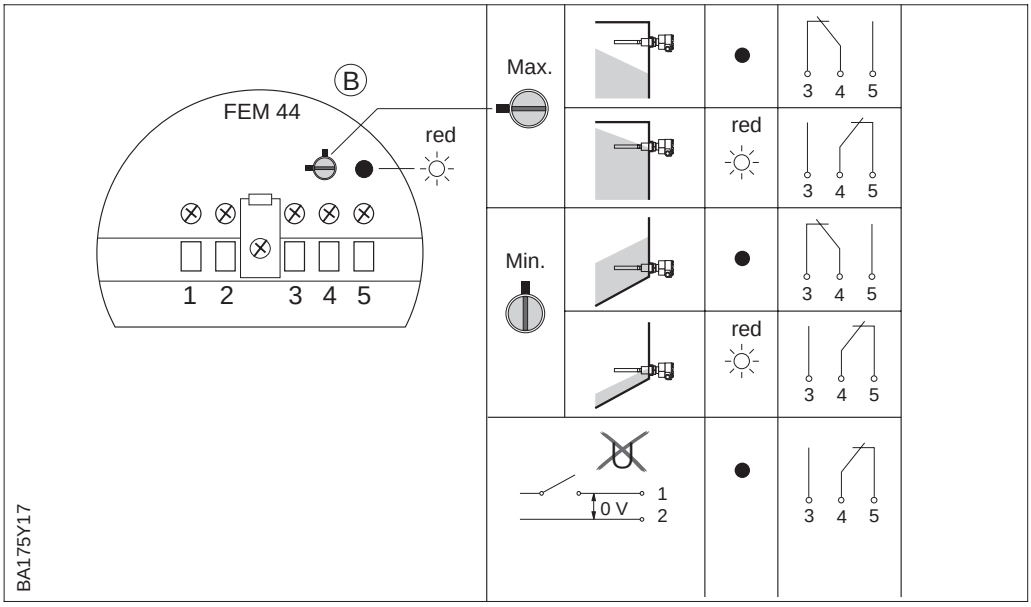


Fig. 17
Electronic insert **FEM 44**
Universal power version.
Relay output with **one** potential-free changeover contact (SPDT)

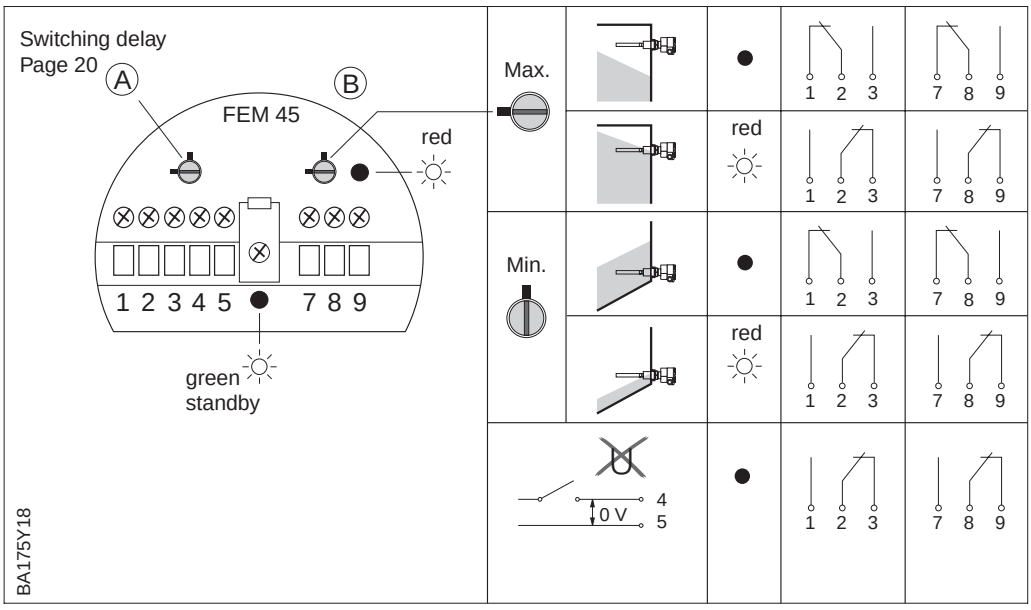


Fig. 18
Electronic insert **FEM 45**
Universal power version.
Relay output with **two** potential-free changeover contacts (DPDT)

4.2 Selecting switching delay (FEM 45)

Electronic insert FEM 45 only

Short switching delay: Switching delay Δt is 0.5 s when the fork is covered and 1.5 s when the fork is free.

Long switching delay: Switching delay Δt is approx. 2.5 s when the fork is covered and approx. 7.5 s when the fork is free.

Select the switching delay required for your application using rotary switch A.
The switch can be turned in both directions; it then clicks in after 90°.

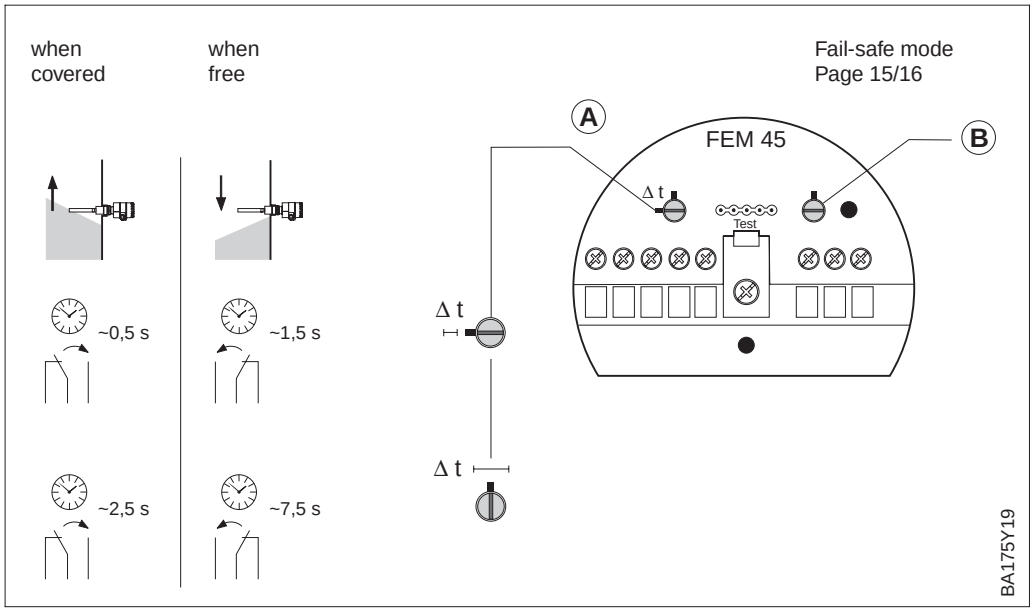


Fig. 19
Adjusting and operating the switching delay Δt with the electronic insert **FEM 45**

Closing the electronics area

Screw down the cover of the electronics area
Tighten the lock of the cover

5 Electrical Connection

5.1 Wiring

Two-wire AC version

Soliphant with electronic insert FEM 41

Serial connection with load:
Always connect the electronic insert in series with a load (relay, miniature contact) to the power supply!
Direct connection without a load will destroy the electronic insert (short circuit!).

Power supply:
Alternating current 19 V* ... 250 V, 50/60 Hz.
Connect an isolating switch and (quick-acting) 1.0 A fine-wire fuse next to the separate housing. The fine-wire fuse does not protect the electronic insert from short circuit (no-load connection).

*Power voltage:
When calculating the minimum required voltage ensure:
- The voltage across Terminals 1 and 2 of the electronic insert must be at least 19 V.
- The voltage drop across the electronic insert can be a maximum of 12 V when closed.
- The maximum voltage is 250 V.

Switching off a load:
The load connected in series is not completely isolated from the power mains if the electronic switch is in the "switched off" (closed) position for a level alarm.
Due to current consumption of the electronics there is still a small residual current of up to 4 mA flowing through the load.
If the load is a relay with a very low holding current then the relay may not de-energise. An extra load should then be connected in parallel, e.g. a resistor.

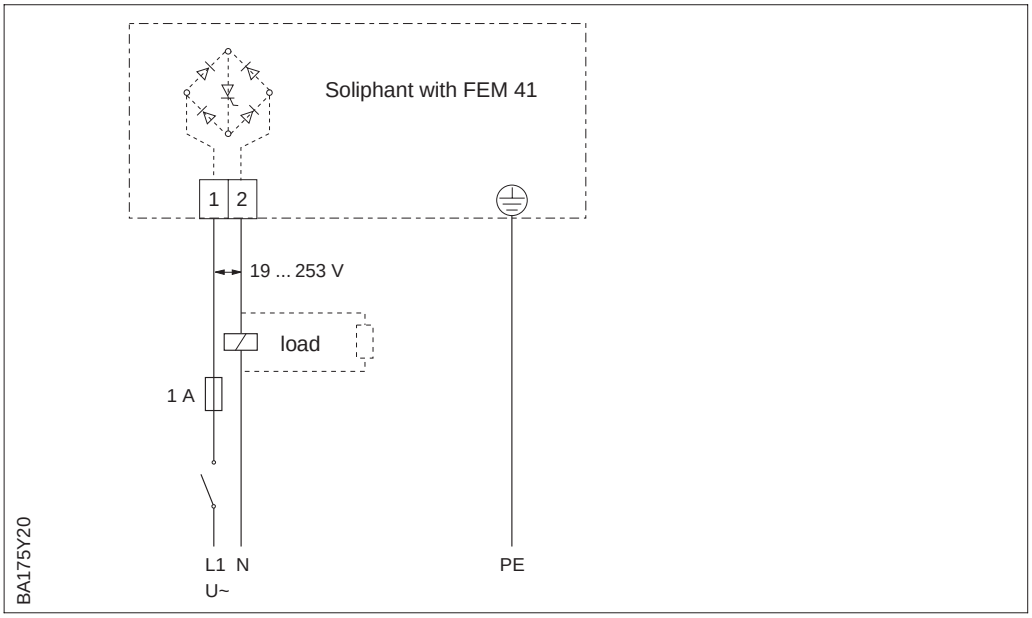


Fig. 20
Wiring

Electronic insert **FEM 41** for two wire AC power supply, electronic switch

Technical data for calculating the power required and the load see Page 31

Soliphant with electronic insert FEM 44

Universal power version with one relay output

Power supply:
Alternating current 19 V ... 250 V, 16 Hz ... 60 Hz, or direct current 19 V ... 200 V.
Connect an isolating switch and (quick-acting) 0.2 A fuse next to the separate housing.

Relay output:
1 potential-free changeover contact (SPDT).
For load on contact see Technical Data on Page 31.
On alarm and power failure:
– The relay contact breaks the connection between Terminal 4 and Terminal 3,
– The relay contact closes the connection between Terminal 4 and Terminal 5.
Protecting the relay contact:
– Connect a spark arrester when connecting a device with high inductivity
– Fine-wire fuse (dependent on the load connected)

Note!

Note:
For connecting an extra-low voltage circuit with reliable separation:
Total voltage for power supply and relay output max. 300 V.

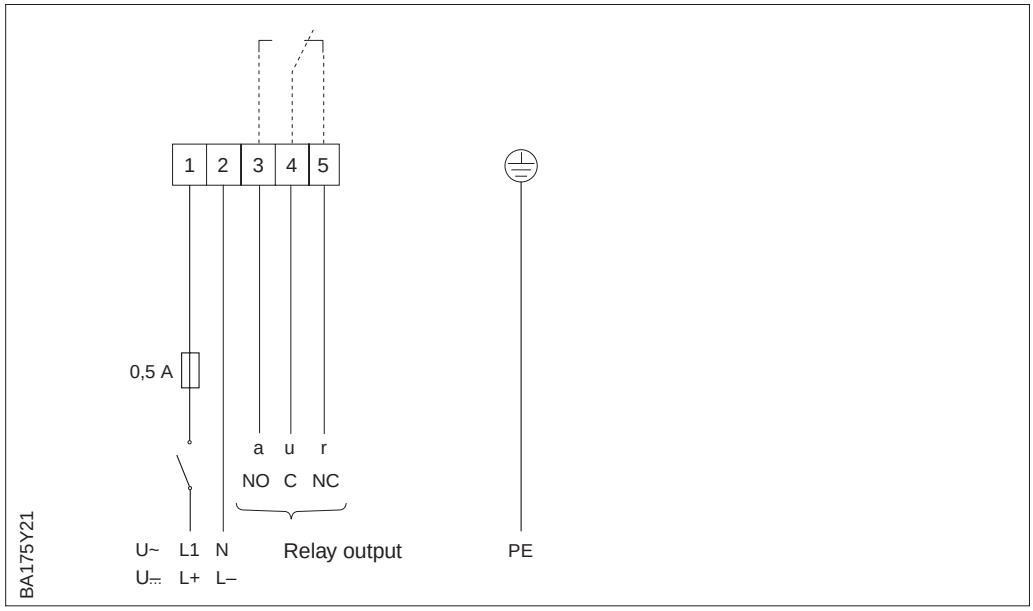


Fig. 21
Wiring

Electronic insert **FEM 44** for universal power supply; relay output with **one** potential-free changeover contact (SPDT)

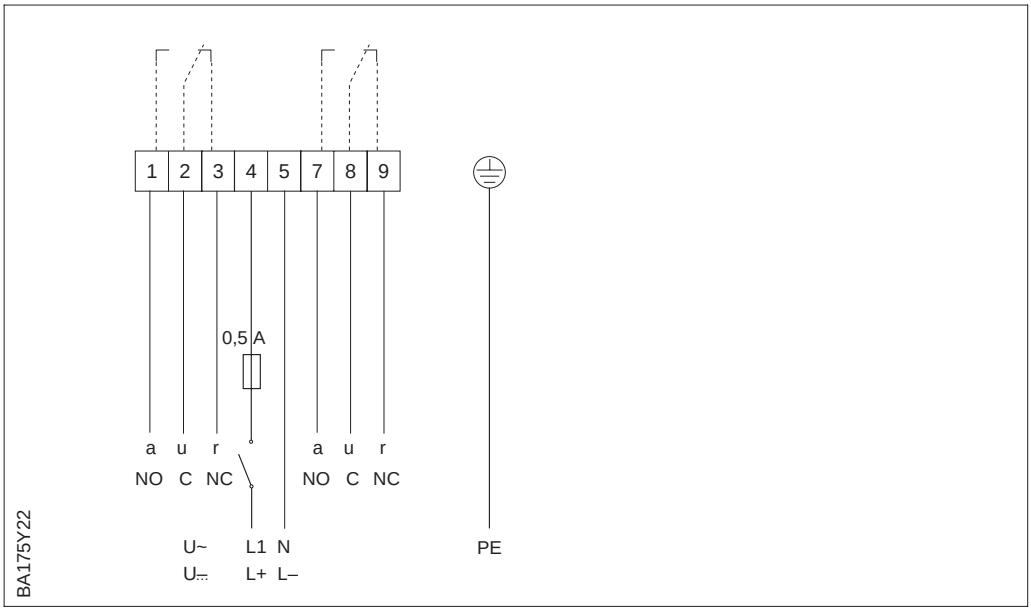
Universal power version with two relay outputs

Soliphant with electronic insert FEM 45

Power supply:
Alternating current 19 V ... 250 V, 16 Hz ... 60 Hz, or direct current 19 V ... 200 V.
Connect an isolating switch and (quick-acting) 0.2 A fine-wire fuse next to the separate housing.

Relay outputs:
2 potential-free changeover contacts (DPDT).
For load on contact see Technical Data on Page 31.
On alarm and power failure:
– Relay contact 1 breaks the connection between Terminal 2 and Terminal 1,
– Relay contact 1 closes the connection between Terminal 2 and Terminal 3.
– Relay contact 2 breaks the connection between Terminal 8 and Terminal 7,
– Relay contact 2 closes the connection between Terminal 8 and Terminal 9.
To protect the relay contacts:
– Connect a spark arrester when connecting a device with high inductivity
– Fine-wire fuse (dependent on the load connected)

Note:
For connecting an extra-low voltage circuit with reliable separation:
Total voltage for power supply and relay output max. 300 V.



Note!

Fig. 22
Wiring

Electronic insert **FEM 45** for universal power supply; relay output with **two** potential-free changeover contacts (DPDT)

5.2 Connection on site

Note!

Note:
- All national regulations concerning installation are to be observed!
- All national regulations concerning explosion protection are to be observed if the Soliphant is to be mounted in an explosion hazardous area.

Tools

- Usual tools for connecting measuring instruments.
- Cover lock: Allen key for Allen screws 0.12 in ~ $^{1}/_{8}$" (3 AF)
- Dummy plugs for cable entries: key for Allen screws $^{3}/_{8}$" (~10 AF) and 0.55 in ~ $^{35}/_{64}$" (14 AF)
- Flexible metallic protective tubing for connecting cable: open-end spanner $1^{1}/_{16}$" (27 AF)

Connecting the Soliphant to the separate housing

- Protect the Soliphant housing from dripping water
- Unscrew the housing cover of the Soliphant
  Do not wipe away the lubrication from around the thread of the cover or the gasket!
- Place the cover on a clean surface only.
- Unscrew the protective packing (yellow plastic plug) from the cable entry
- Insert the connecting cable in the pipe or in the flexible metallic protective tubing and make watertight according to national regulations
- Connect the 6 wires of the connecting cable to the terminal block according to their colour coding
- Connect the green/yellow protective earth to the ground connection in the Soliphant housing

If the connecting cable is to be shortened:
– Free wires to a length of approx. 4 in (approx. 100 mm)
– Strip the insulation of the wires 0.2 in (5 mm) and attach end sleeves
– Strip the insulation of the green/yellow protective earth 0.4 in (10 mm) and attach end sleeves
– Remove the screen braiding cleanly and insulate

- Screw down the housing cover of the Soliphant

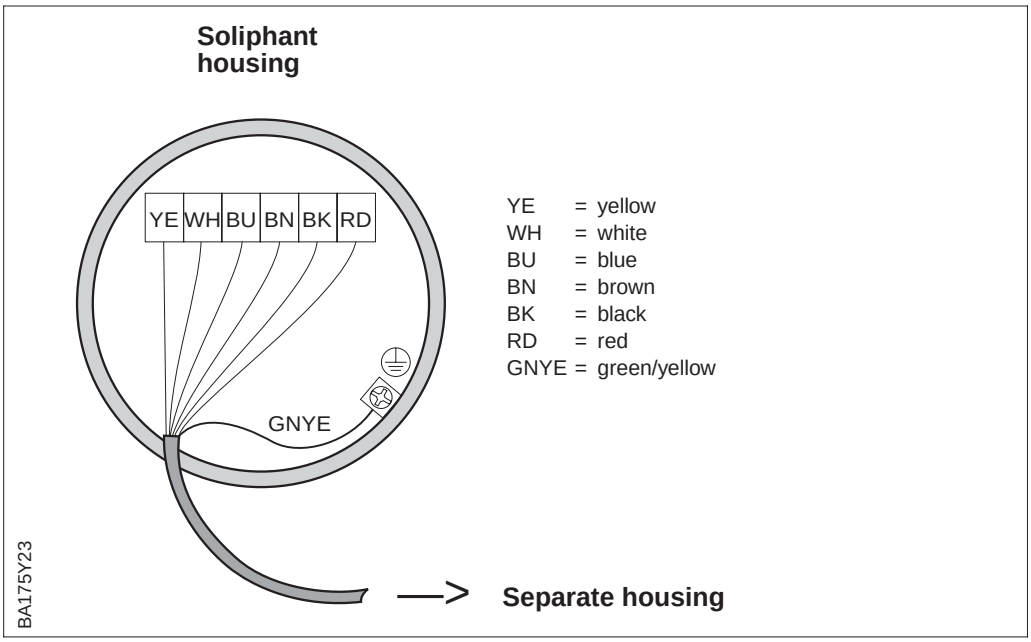
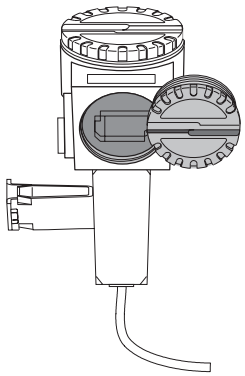


Fig. 23
Connecting wires between the separate housing and Soliphant, connection in the Soliphant housing

Warning!
Cables for connecting the electronic insert can be live with hazardous voltages when touched (cable for power supply and cabling to the switching devices).
Before connecting:
– Switch off all voltages
– Secure against switching on
– Check that no power is switched on to the instrument
– Ground and short-circuit all cabling

Connecting the electronic insert in the separate housing

- Check before connecting that the correct electronic insert is present in the separate housing:
  Check the product designation on the nameplate agrees with the product structure on Page 12
- Protect the separate housing from dripping water
- Loosen the cover lock to the connecting area
- Unscrew the cover to the connecting area
  Do not wipe away the lubrication around the thread of the cover or the gasket!
- Place the cover on a clean surface only.
- Unscrew the protective packing (yellow plastic plug) from the cable entry
  (The metallic dummy plug may only be removed if a second connecting cable is required.)
- Insert the connecting cable in the pipe or in the flexible metallic protective tubing and make watertight according to national regulations
- Strip the insulation of the wires 0.4 in (10 mm) and - if wire strands - attach end sleeves
- Connect the wires to the terminal block.
  See Fig. 24 for FEM 41 or Abb. 25 for FEM 44 and FEM 45.
- Connect the green/yellow protective earth to the ground connection in the Soliphant housing
- Screw down the cover of the connection area
- Tightly screw down the cover lock



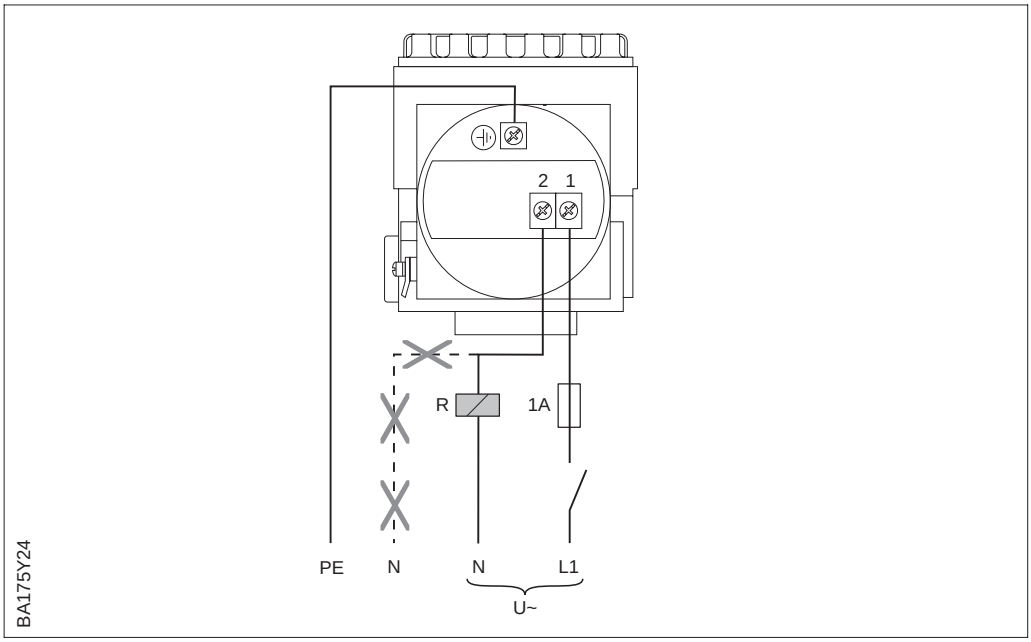


Fig. 24
Connecting the electronic insert **FEM 41** for two-wire AC power supply

Important:
Always connect Terminal 2 to an external load R.
Do not short out load R!
(Connecting Terminal 2 directly to N will destroy the electronic insert.)

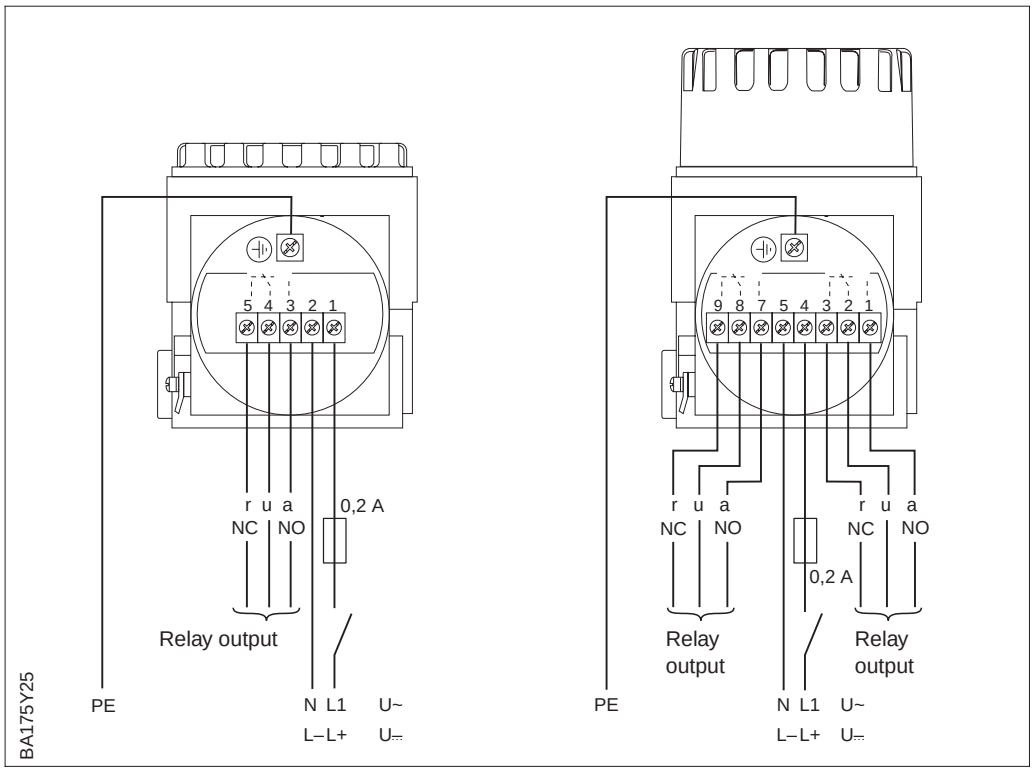


Fig. 25
Left:
Connecting
the electronic insert **FEM 44**
for universal power supply

Relay output
with **one** potential-free
changeover contact (SPDT)

Right:
Connecting
the electronic insert **FEM 45**
for universal power supply

Relay output
with **two** potential-free
changeover contacts (DPDT)

External Ground connections

The separate housing and the Soliphant as well as the vessel with material must be connected to the potential compensation line.
The ground connections for this are on the outside of the housing.

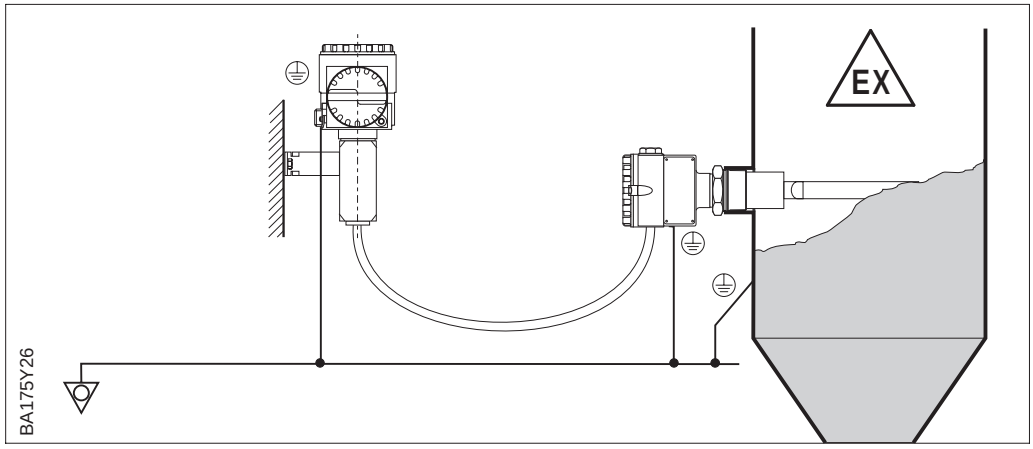


Fig. 26
Connecting to the potential compensation line

6 Commissioning

6.1 Preparations

Check wiring for correct connections
– to power supply (mains)
– to on-line devices

Switch on the power supply
– to the electronic insert of the Soliphant
– to the on-line devices

6.2 Function test

Check to ensure proper limit detection when filling and emptying the silo across the point where the fork is mounted. This check is especially important with very light or loose materials.

If the separate housing of the Soliphant is mounted in the explosion hazardous area then the housing cover may not be opened during operation. Test only by checking the response of on-line devices.
When mounted in a non-hazardous area, then the function can be controlled with the LED on the electronic insert. See Page 19.

If the Soliphant does not switch, then refer to the section "Troubleshooting".

7 Maintenance

When used correctly under normal conditions and when mounted correctly, the Soliphant limit switch requires no maintenance.

When cleaning and checking the silo:
– Remove build-up
– Check the fork for damage
– FTM 32 DR: Check the rope for damage

Shorten the time between control checks if the fork is subjected to high mechanical loads.

8 Troubleshooting and Repair

Warning!
An explosion may occur if the regulations governing explosion protection are not observed when carrying out troubleshooting and repairs.

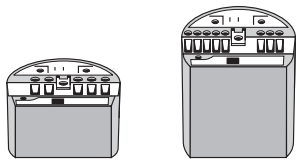
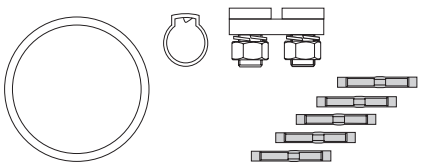
Troubleshooting and repairs may therefore be carried out **by authorised and trained personnel only**.

8.1 Sources of error

If an error is shown, then first see if
– the fail-safe switch is correctly set
– the Soliphant is connected correctly
– there is a power supply to terminals
– the power voltage is large enough
– the on-line devices are operating correctly
– with the FEM 41 electronic insert there is a sufficient current flowing through the other on-line devices

Other sources of error:
– the fork touches internals in the vessel
– there is strong build-up on the fork
– the fork is damaged
– material has formed cavities
– the density of the material is too low
– there is strong vibration of the vessel wall
– FTM 32 DR swings and touches the silo wall
– the rope of the FTM 32 DR is damaged or broken

8.2 Spare parts

Diagram	Description	Order number
	***Separate housing:***	
	Electronic insert FEM 41	942288-0000
	Electronic insert FEM 44	942289-0000
	Electronic insert FEM 45	943032-0000
	***Soliphant:***	
	Rope shortening set for FTM 32 DR	935622-0001

8.3 Replacing spare parts

Spare parts may only be replaced by authorised and trained personnel!

Warning!
The cables to the separate housing may have voltages which are dangerous when touched (cables for power supply and cables to switching devices).
Before replacing it is therefore necessary to:
– Switch off all power to the instrument
– Secure against switching on
– Check that no power is switched on to the instrument
– Ground and short-circuit all cabling
– Wait 15 minutes before opening the separate housing

8.4 Checking

After replacing spare parts the instrument must then undergo an individual test **by authorised personnel**.

8.5 Returning the unit for repair

Should an instrument need to be sent to , please note the following:

Cleaning

Remove all traces of product.
This is particularly important if the product can impair health, e.g. is corrosive, poisonous, carcinogenic, radioactive, etc.
If the last traces of dangerous products cannot be removed, e.g. product has penetrated into fissures or diffused into plastic parts, we kindly ask you not to send the transmitter for repair.

Information of material and defect

Please enclose with the instrument:
– an exact description of the application for which it was used
– a description of the properties of the material
– a short description of the fault.
This information helps us to diagnose the error and therefore reduce your costs.

Thank you for your co-operation.

8.6 Disposal

Packaging

All sales and transportation packaging used by complies with the German packaging regulations covering its re-use and recycling.

Instruments

For a small charge, will accept all instruments originally produced by its product centers for recycling as specified by German regulations on the disposal of electronic waste.
Before returning, please carefully remove any residue from the sensors if the material is dangerous to health. Delivery, carriage paid, to EHauptstraße 1, 79689 Maulburg, Germany.

9 Technical Data

9.1 Table to DIN 19259

General Specifications

Manufacturer	
Instrument family	Soliphant II
Instrument types	FTM 30 DR, FTM 31 DR, FTM 32 DR
Instrument function	Level limit switch

Application

Limit detection	Maximum or minimum detection in silos with powdery and fine-grained solids, max. grain size 0.4 in (10 mm)

Operation and System Design

Measuring principle	Damping of the oscillation of a fork vibrating at its resonant frequency
Modularity	Complete limit switch, consisting of the sensor and separate housing and integrated electronic insert FEM… (switching unit)
Signal processing	– Two-wire AC version (with FEM 41): load switched directly via a thyristor in the power supply; – Universal power supply with relay output (with FEM 44, 45): load switched via a potential-free changeover contact
Electrical isolation	FEM 41 : between sensor and power supply; FEM 44, 45: between sensor, power supply and load

Input

Measured variable	Height (limit value, binary)
Measuring range (detection range)	FTM 30 DR: determined by installation point FTM 31 DR: determined by sensor length (tube) approx. 16 in …155 in (approx. 400 mm …4000 mm) from above FTM 31 DR with sliding sleeve: adjustable, ca. 8 in …150 in (approx. 200 mm …3900 mm) from above FTM 32 DR: determined by sensor length (rope) approx. 30 in …765 in (approx. 750 mm …19500 mm) from above

Output

Output signal	Binary, output blocked when reaching limit
Signal failure	Output blocked
Load (connectable) to FEM 41	Transient (40 ms) max. 1.5 A, max. 375 VA at 250 V or max. 36 VA at 24 V (no short-circuit protection) continuous max. 87 VA at 250 V, max. 8.4 VA at 24 V min. 2.5 VA at 250 V (10 mA), min. 0.5 VA at 24 V (20 mA) Voltage drop across FEM 41 max. 12 V Residual current max. 4 mA with blocked thyristor
Load (connectable) to FEM 44, 45	FEM 44: 1 changeover contact, FEM 45: 2 changeover contacts I~ max. 6 A, U~ max. 250 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; additional switching delay 0.3 s Voltage difference between relay output and power supply max. 300 V

Output, General information

Fail-safe switching	Minimum or maximum fail-safe mode, switchable
Switching time	FEM 41, 44: approx. 0.5 s when covered, approx. 1.5 s when free FEM 45 : approx. 0.5 s when covered, approx. 1.5 s when free, switchable to approx. 2.5 s when covered, approx. 7.5 s when free

Accuracy

Reference conditions	Temperature T = 70 °F (20 °C), operating pressure p_e = 14.5 psi (1 bar) Density of material > 62.4 lbs/ft³ (> 1 kg/l), grain size < 0.08 in (< 2 mm)
Measured error	approx. 0.4 in (approx. 10 mm) for vertical mounting, approx. 0.2 in (approx. 5 mm) for lateral mounting of the sensor
Setting time	The output remains open approx. 2.5 s after switching on the power supply
Switching time error	+/– 25 % when covered or free
Effects of temperature and operating pressure	negligible

Operating Conditions

Mounting

Orientation	Any position for FTM 30 DR and FTM 31 DR with short tube Vertical FTM 31 DR with long tube and FTM 32 DR
Lateral load on fork for FTM 30 DR	130 lbs (600 N) on narrow edge of tines, static

Continued overleaf

Operating Conditions (Continued)

Mounting

Lateral load on tube for FTM 31 DR	Max. 40 in (to 1 m): approx. 220 ft lbs (300 Nm)
Tensile strength of rope for FTM 32 DR	550 lbs (2500 N)

Environment

Operating temperature range	Separate housing T3 with electronic insert: –40 °F…+160 °F (–40 °C…+70 °C) Soliphant housing F6: –40 °F…+250 °F (–40 °C…+120 °C)
Storage temperature range	–40 °F…+160 °F (–40 °C…+70 °C)
Climatic class	Climatic protection to IEC 68, Part 2-38, Fig. 2a
Ingress protection (housing)	NEMA 4 X
Electromagnetic compatibility	By attaching the CE mark, r confirms that the Soliphant FTM.... fulfils all legal requirements of the relevant EC directives. Interference immunity to EN 50082-2 (field strength 10 V/m), Interference emission to EN 50081-2 (industrial environment)

Product

Temperature of product	FTM 30 DR: –40 °F … +300 °F (–40 °C … +150 °C) FTM 31 DR: –40 °F … +300 °F (–40 °C … +150 °C) FTM 32 DR: –40 °F … +180 °F (–40 °C … + 80 °C)
Pressure (operating pressure) p_e	FTM 30 DR, FTM 31 DR: –14.5 psi … +230 psi (–1 bar … +16 bar) FTM 32 DR: –14.5 psi … + 30 psi (–1 bar … + 2 bar)
Pressure limit	FTM 30 DR, FTM 31 DR: Burst pressure min. 1500 psi (100 bar) FTM 32 DR: Burst pressure min. 45 psi (3 bar)
Density of product	Min. 1.3 lbs/ft³ (min. 20 g/l)
Grain size of product	Max. 0.4 in (max. 10 mm)

Construction

Design	FTM 30 DR: compact unit FTM 31 DR: with extension tube max. 155 in (4 m) FTM 32 DR: with rope max. 765 in (19.5 m) each with separate housing T3 for the electronic insert FEM
Dimensions	See dimensioned drawings on Page 33
Weight	See Product Structure on Page 12
Materials	Process connections (thread): stainless steel AISI 304; Flanges: AISI 316 , Tube: AISI 304, rope insulation: PUR; Vibrating fork: stainless steel AISI 316; Housing F6, T3: aluminium GD-Al Si 12, DIN 1725, with plastic coating; Seal for housing cover F6, T3: EPDM (elastomer); Base for separate housing T3: aluminium with plastic coating, Cable gland: brass, nickel-plated; Mounting bracket and clamp: AISI 304 Connecting cable: PUR insulation Flexible metal tubing for connecting cable: galvanised steel with UV-resistant thermoplastic covering, galvanised steel threads
Process connections	Tapered thread R 1½ to ISO 7/1 (BSP); Tapered thread 1½ - 11½ NPT to ANSI B 1.20.1 Flanges to DIN, ANSI see Product Structure
Electrical connection	Terminal screws in separate connection compartment of housing T3: for max. AWG 14 (max. 2.5 mm²) wires in sleeves

Display and User Interface

On electronic insert FEM 41, 44, 45	Rotary switch for minimum/maximum fail-safe; red LED showing switching status

Power Supply

Electronic insert FEM 41	Voltage at Terminal 1 and 2: 19 …250 V, 50 / 60 Hz; Current consumption (stand-by) max. 4 mA
Electronic insert FEM 44, 45	AC voltage 19 …250 V, 16 …60 Hz or DC voltage 19 …200 V; Current consumption FEM 44: max. 7 mA, FEM 45: max. 10 mA

Certificates and Approvals

FM, CSA	See Product Structure on Page 12

Ordering

Product designation	See Product Structure on Page 12
Accessories	See Page 34
Supplementary documentation	General information on EMV - TI 241F/00/en
Certificates	On request

9.2 Dimensions

Fig. 27

A **FTM 30** DR compact version, with thread R 1½ (ISO 7/1) or 1½ - 11½ NPT

B **FTM 30** DR compact version, with flange to DIN 2527 Form B or ANSI B 16.5

C **FTM 31** DR with extension tube, with thread R 1½ (ISO 7/1) or 1½ - 11½ NPT

D **FTM 31** DR with extension tube, with flange to DIN 2527 Form B, or ANSI B 16.5

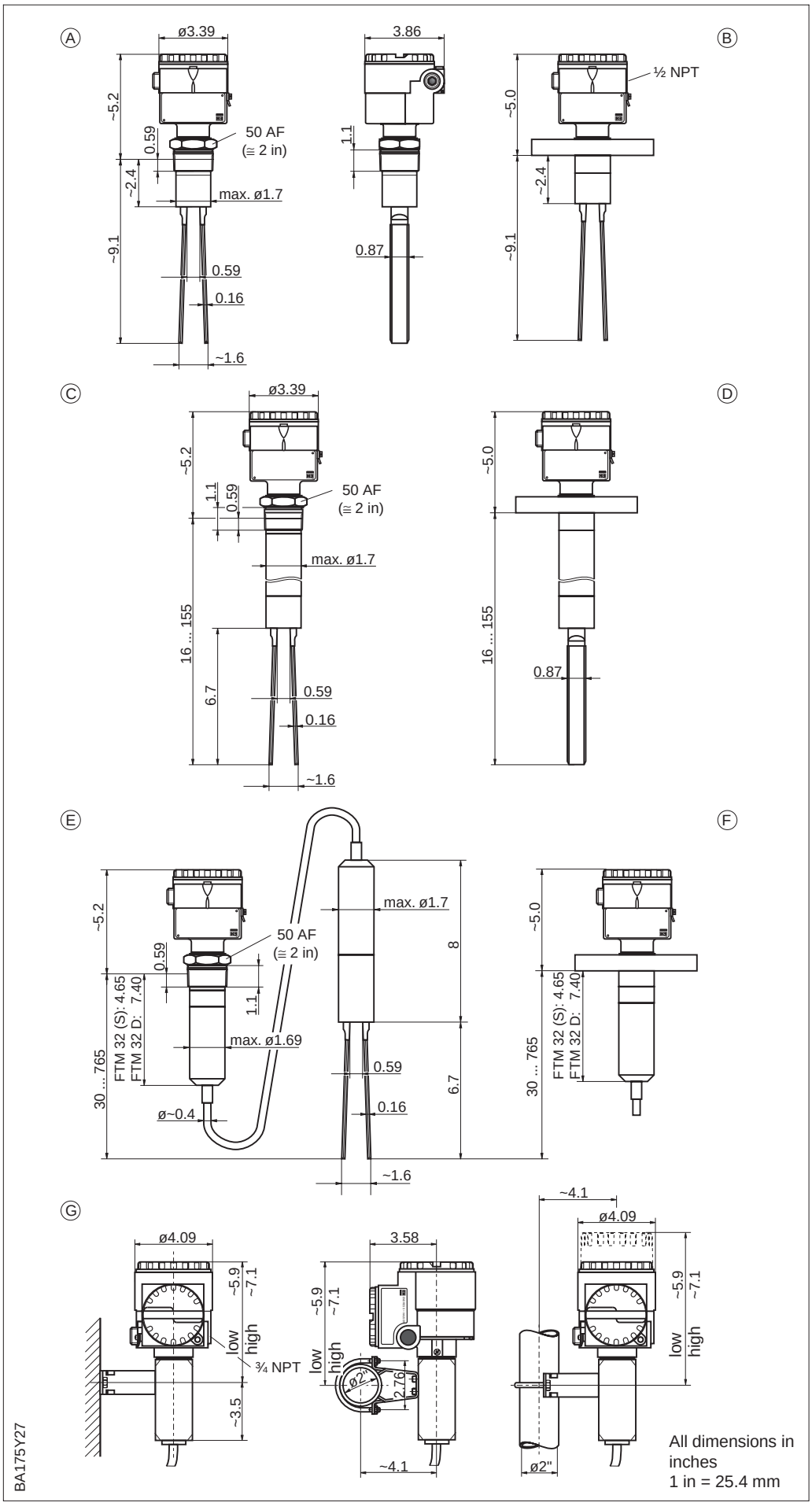
E **FTM 32** DR with rope, with thread R 1½ (ISO 7/1) or 1½ - 11½ NPT

F **FTM 32** DR with rope, with flange to DIN 2527 Form B, or ANSI B 16.5

G **Separate housing T 3** for electronic insert; mounting accessories see Page 34; left: wall mounting right: pipe mounting

Flanges see Page 12, Product Structure, Process Connection, Material.

See standard data sheets for flange dimensions



All dimensions in inches
1 in = 25.4 mm

Length tolerances for FTM 31 DR
Sensor length
[a]) max. 40 in (1 m)
[b]) max. 120 in (3 m)
[c]) max. 155 in (4 m)

Tolerance
[a]) +0 in (0 mm), –0.2 in (– 5 mm)
[b]) +0 in (0 mm), –0.4 in (–10 mm)
[c]) +0 in (0 mm), –0.8 in (–20 mm)

Length tolerances for FTM 32 DR
Sensor length
[d]) max. 120 in (3 m)
[e]) max. 765 in (19,5 m)

Tolerance
[d]) +0.1 in (+2.5 mm), –0.6 in (–15 mm)
[e]) +0.1 in (+2.5 mm), –0.8 in (–20 mm)

Length tolerances for connecting cable

Cable length	Tolerance
max. 200 in (5 m)	+ 4 in (100 mm)
max. 400 in (10 m)	+ 8 in (200 mm)
max. 785 in (20 m)	+16 in (400 mm)

9.3 Accessories

Mounting accessories for separate housing T3
Mounting accessories: 1 bracket, 1 clamp, 2 screws, 2 nuts are also supplied.
This enables the separate housing to be easily mounted on a wall or 2" pipe.

Dimensions in inches
1 in = 25.4 mm

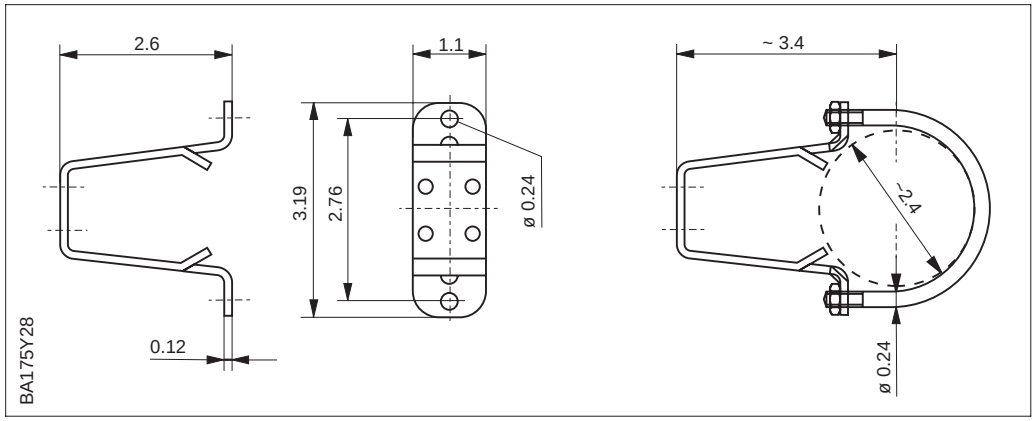
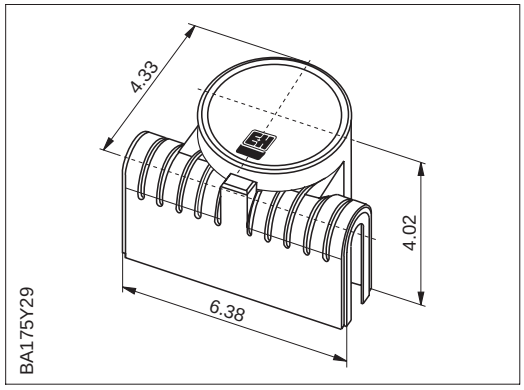


Fig. 28
Mouting accessories for separate housing T3

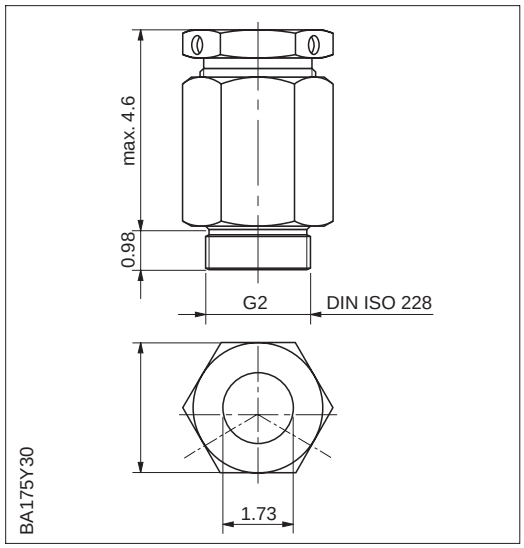
Left:
Bracket for wall mounting

Right:
Clamp for mounting on a 2" pipe



Protective Hood
Protects the field-mounted Soliphant from condensation in the sensor housing F6 which can occur due to extreme temperature variations.

Fig. 29
Protective hood
For sensor housing F6
Material: polyamide
Weight: 0.29 lbs (0.13 kg)
Order No.: 942262-0000

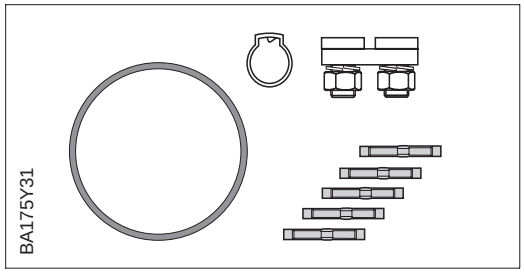


Sliding Sleeve
When mounting the FTM 31 DR sensor in the silo from above, the sliding sleeve allows the switch point to be infinitely adjusted.

Fig. 30
Sliding sleeve
Maximum permissible operating pressure:
150 psi (10 bar);
Max. operating temperature:
180 °F (80 °C);
Packing for threaded gland:
PTFE glass fabric;
Weight: 5.7 lbs (2.6 kg)

Material: steel
Order No.: 916538-0000

Material:
stainless steel AISI 316 Ti
Order No.: 916538-0001



Rope Shortening Set
This is for use with the FTM 32 DR sensor
It consists of a number of accessories, which enable the rope to be shortened and to make a permanent water-tight connection with the sensor.
Instructions for mounting are included.

Fig. 31
Rope shortening set
Order No.: 935622-0001

По вопросам продаж и поддержки обращайтесь:

Алматы (7273)495-231
Ангарск (3955)60-70-56
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Астрахань (8512)99-46-04
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Ноябрьск (3496)41-32-12
Новосибирск (383)227-86-73
Омск (3812)21-46-40
Орел (4862)44-53-42
Оренбург (3532)37-68-04
Пенза (8412)22-31-16
Петрозаводск (8142)55-98-37
Псков (8112)59-10-37
Пермь (342)205-81-47
Ростов-на-Дону (863)308-18-15
Рязань (4912)46-61-64
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Санкт-Петербург (812)309-46-40
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Симферополь (3652)67-13-56
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Сочи (862)225-72-31
Ставрополь (8652)20-65-13
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