Technical
Information
TI 287F/00/en

Capacitive Limit Detection
minicap FTC 260, FTC 262

Compact switch for limit detection with active build-up compensation
No calibration necessary
Version available for dust explosion areas









FTC 260

FTC 262

Applications
Minicap is designed for limit detection of light bulk solids,
e.g. grain products, flour, milk powder, animal feed, cement, chalk or gypsum.

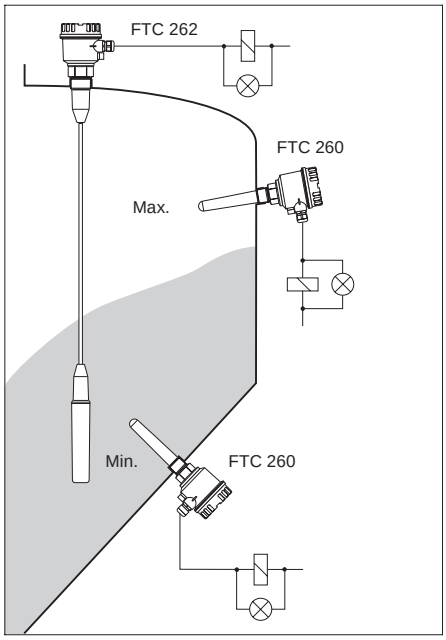
Versions:
- Minicap FTC 260
  with 140 mm rod probe;
  for bulk solids and liquids
- Minicap FTC 262
  with max. 6 m rope probe;
  for bulk solids
- Relay output (potential-free change-over contact / SPDT) with AC or DC power
- PNP output with three-wire DC power

Features and Benefits
- Complete unit consisting of the probe and electronic insert:
  – simple mounting
  – no calibration on start-up
- Active build-up compensation
  – accurate switch point even with heavy build-up on the probe
  – high operational safety
- Mechanically rugged
  – no wearing parts
  – long operating life
  – no maintenance
- The rope probe of the Minicap FTC 262 can be shortened
  – optimum matching to the measuring point in the silo
  – less stocks required

Endress+Hauser
The Power of Know How

Measuring System

Minicap is an electronic switch.
The complete measuring system consists of:
- the Minicap FTC 260 or FTC 262
- a power supply and
- controllers, switching devices, signal transmitters (e.g. lamps, horns, PCS, PLC, etc.)

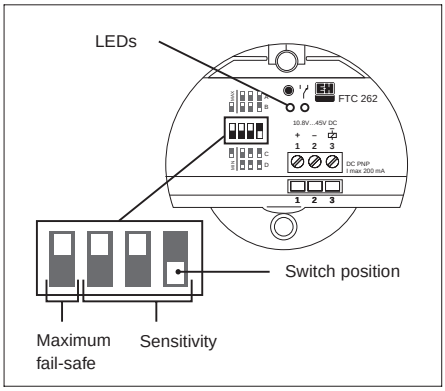


Limit detection in silos containing solids

Measuring Principle

Limit Detection

A metal plate at the end of the probe, within the insulation, and the integrated counter-electrode together with the surroundings combine to form the two electrodes of a capacitor.
If the probe is covered or free of material, then the capacitance changes and the Minicap switches.



Factory setting on switches

Active Build-up Compensation

The Minicap detects build-up on the probe and compensates for its effects so that the switch point is always accurate. The effects of build-up compensation depend on:
- the thickness of the build-up on the probe,
- conductivity of the material,
- the sensitivity setting on the electronic insert.

Setting the Sensitivity

The Minicap is so calibrated at the factory that it correctly switches in most cases.
Greater sensitivity can be set using a multi-pole switch on the electronic insert. This is only necessary, however, if there is very strong build-up on the probe, or if the dielectric constant of the material ε_r is very small.

Function Range

There is a loose relationship between the dielectric constant ε_r and density ρ of the material. However, this depends on the solid.
The table on the left indicates whether the Minicap can be used or if application limits are exceeded.

Table of application examples

Grey background: Application limits of Minicap exceeded. Recommendation: Soliphant FTM to be used.

In general:
If the dielectric constant of the solid is not known, then the density (apparent weight) of the solid is a deciding factor. Under normal conditions the Minicap functions in foodstuffs with a density of 250 g/l and above or in plastic or mineral materials with a density of 600 g/l and above.

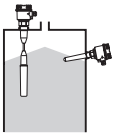
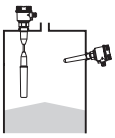
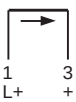
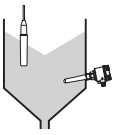
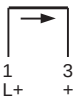
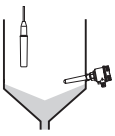
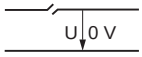
Grain, seed, legumes and their products			
Examples	ρ in g/l (approx.)	ε_r (approx.)	Function
Rice	770	3,0	yes
Cornstarch (packed)	680	2,6	yes
Flour (wheat)	580	2,4	yes
Corn grist	500	2,1	yes
Sunflower seeds	380	1,9	yes
Noodles	370	1,9	yes
Bran (wheat)	250	1,7	yes
Popcorn	30	1,1	no
Minerals, inorganic materials			
Cement	1050	2,2	yes
Plaster	730	1,8	yes
Chalk (packed)	540	1,6	(yes)
Chalk (loose)	360	1,4	no
Plastics			
ABS granulate	630	1,7	yes
PA granulate	620	1,7	yes
PE granulate	560	1,5	no
PVC powder	550	1,4	no
PU dust	80	1,1	no

Minimum/Maximum Fail-Safe Mode
The Minicap FTC 260 can be set to minimum or maximum fail-safe mode (see following table).

AC or DC version with relay output (potential-free change-over contact):
- Maximum fail-safe mode:
  The relay is de-energised when the probe is covered or the power supply fails.
- Minimum fail-safe mode:
  The relay is de-energised when the probe is free or the power supply fails.

DC version with PNP output:
- Maximum fail-safe mode:
  The switch output is blocked when the probe is covered or the power supply fails.
- Minimum fail-safe mode:
  The switch output is blocked when the probe is free or the power supply fails.

Selecting the switch position and function

Switch position	Level	Relay output SPDT	Transistor output PNP	Red LED for switching status	Green LED for stand-by
 **Maximum fail-safe mode**	 Probe covered	 3 4 5 Relay de-energised	 1 3 L+ blocked	☼	☼
	 Probe free	 3 4 5 Relay energised	 1 3 L+ + connected	●	☼
 **Minimum fail-safe mode**	 Probe covered	 3 4 5 Relay energised	 1 3 L+ + connected	●	☼
	 Probe free	 3 4 5 Relay de-energised	 1 3 L+ blocked	☼	☼
 **Power failure**		 3 4 5 Relay de-energised	 1 3 L+ blocked	●	●

Installation Hints

Silo Material
The Minicap can be installed in a wide range of silos made of different materials (e.g. metal, plastic, concrete).

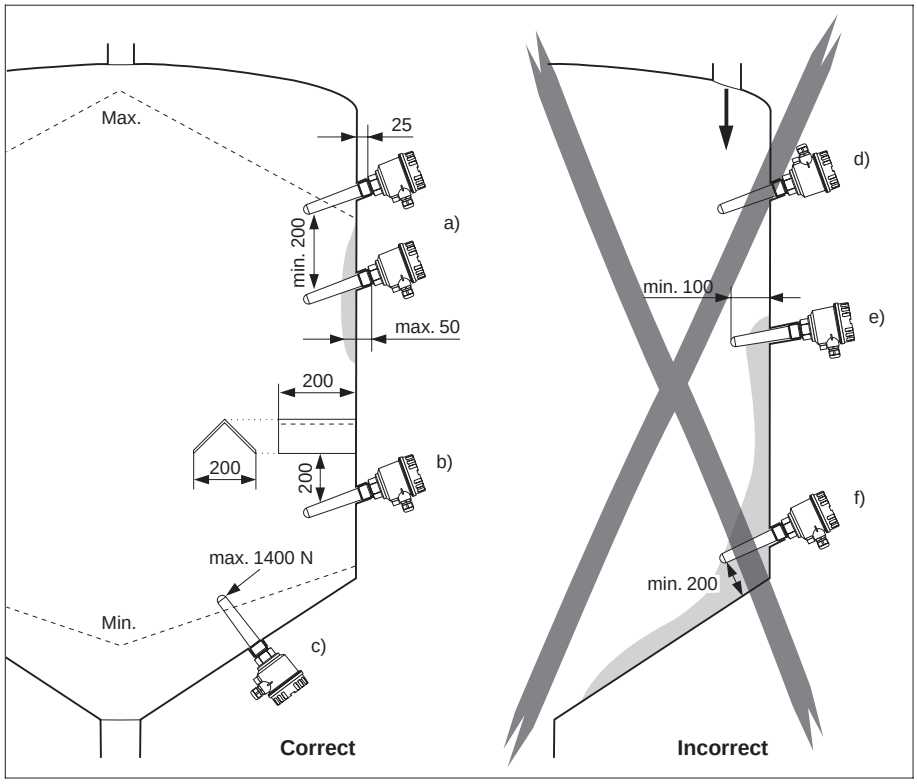
Mounting Point
Note the angle of the material mounds and the outlet funnel when determining the mounting point or probe length of the FTC 262.

The Minicap switches when the probe tip is covered by a few centimeters of material or when it is free.

Material flow should not be directed at the probe.

Installation Hints FTC 260

General information and recommendations for installing the Minicap FTC 260 limit switch



Correct Installation

a) Minimum distance:
To prevent mutual interference with the FTC 260, the probes must be at least 200 mm from each other.

b) Mounting point:
The tip of the probes must point slightly downwards so that the material can slide off more easily. The protective cover protects the probe rod from collapsing mounds or mechanical strain at the outflow when the Minicap FTC 260 is set to minimum detection.

c) Mechanical load:
The maximum lateral load on the probe rod must be taken into account when used for minimum detection. It should therefore only be used for minimum detection with loose materials that have good flow characteristics.

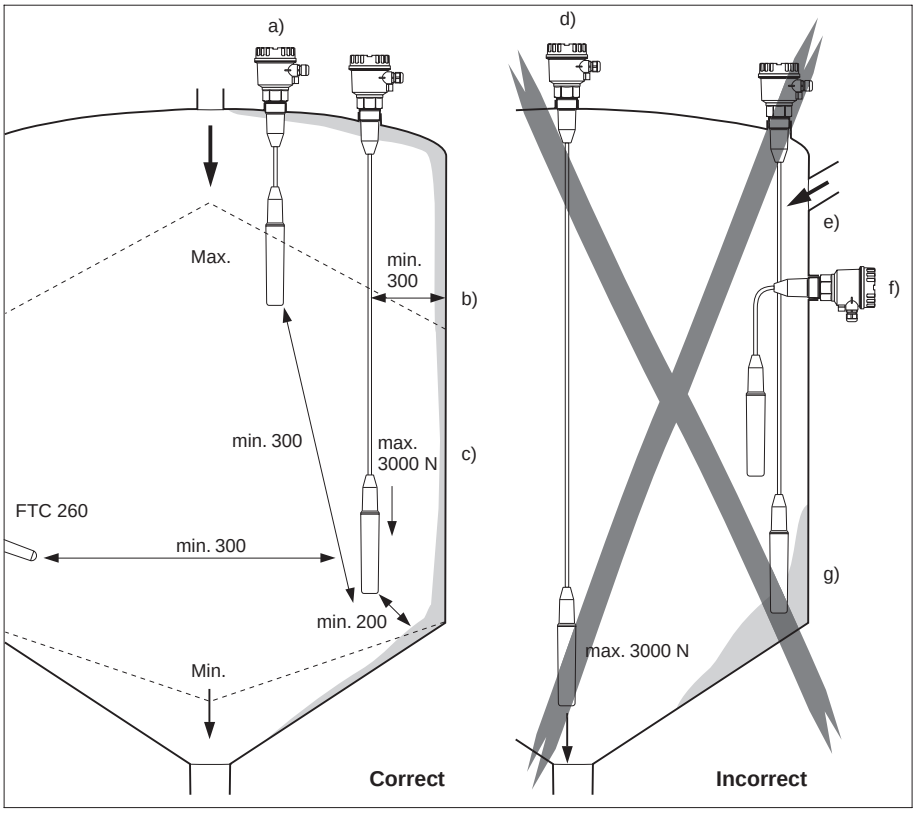
Incorrect Installation

d) The probe can be damaged by the inflowing material and cause faulty switching.
Cable gland pointed upwards can allow moisture to enter.

e) Threaded socket too long with material build-up on the silo wall. (less than the minimum mounting depth of 100 mm).

f) Mounted near build-up in the silo. The probe tip is too near to a silo wall (less than a minimum distance of 200 mm).

Installation Hints
FTC 262



Correct Mounting

a) Minimum distances:
Sufficent distance from the material filling curtain and the other probe.

b) Mounting point:
Do not install in the centre of the outlet cone. Ensure there is sufficient distance from the silo wall and from material build-up on the wall.

c) Mechanical load:
Note the tensile strain on the probe rope and the strength of the silo roof when used for minimum detection. Very high tensile forces may occur at the material outlet especially with heavy, powdery bulk materials which tend to form build-up.
These forces are significantly greater over the outlet than at the silo wall.

For *minimum* detection
Minicap FTC 262 should *only* be used for light, easily flowing solids, and that do not tend to form build-up.

Incorrect Mounting

d) In the centre of the material outflow; the high tensile forces at this point may tear off the probe or damage the silo roof.

e) The probe may be damaged by inflowing material.

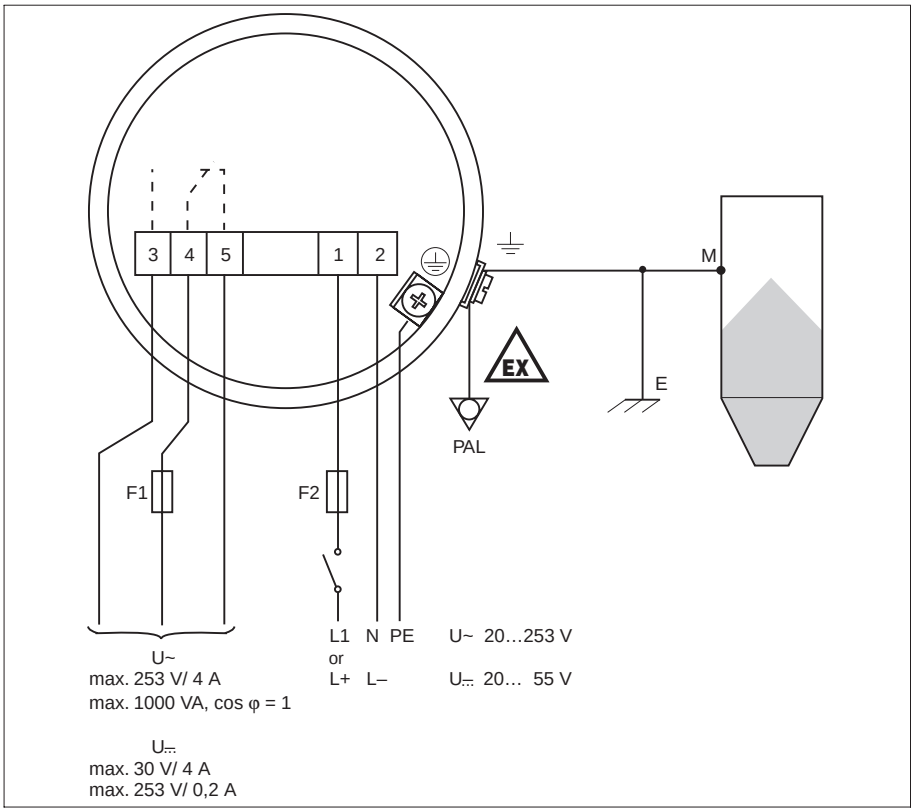
f) Mounted laterally

g) Too near silo wall;
when swinging gently the probe can hit the wall or touch any build-up which may have formed.
This can result in error switching

Electrical Connection

To ensure that the Minicap operates safely and without electrical interference, it must be connected to an earthed silo with metal or reinforced concrete walls.
For silos made of non-conductive materials, the external earth wire of the Minicap must be connected to a conductive and earthed component which is earthed near to the silo.
The protective earth can be connected to the internal earth terminal of the Minicap.

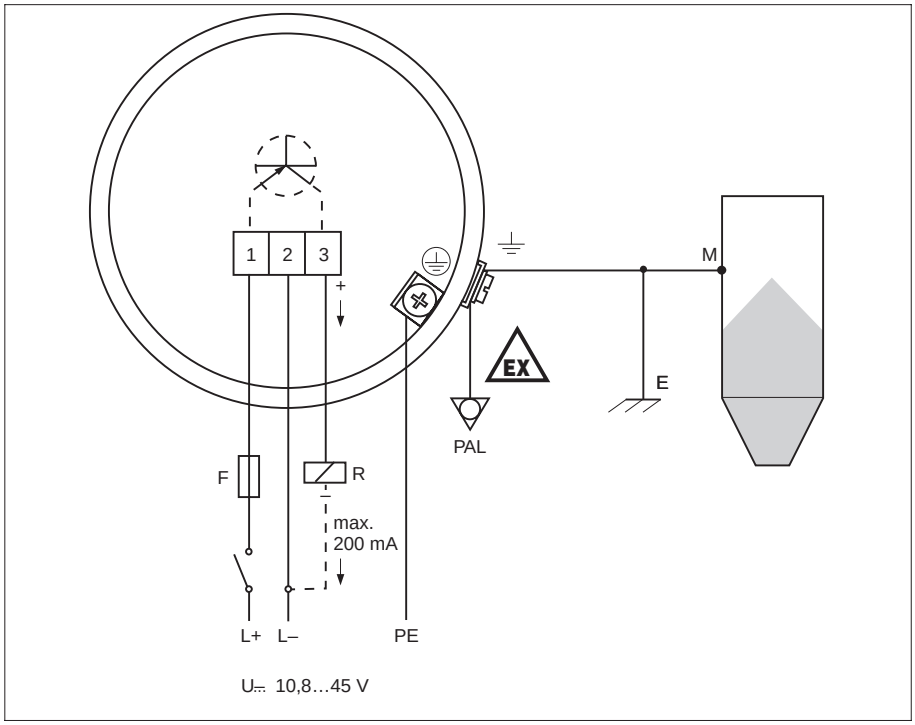
Connections can be made with standard instrument cabling.
See TI 241F/00/en for information on EMC (testing procedures, installation).
Connect the potential matching lead (PAL) when using in dust explosion hazardous areas.
Note national regulations!



Minicap AC or DC connection and relay output.

F1: Fine-wire fuse to protect the relay contact, dependent on the connected load
F2: Fine-wire fuse, 500 mA
M: Earth connection to silo or metal components on silo
E: Earth

No ground lines (PE) or potential matching lines (PAL) are required with Minicap FTC 260.



Minicap with three-cable DC connection;
Transistor output PNP.

F: Fine-wire fuse, 500 mA
R: Connected load, e.g. PLC, PCS, relay
M: Earth connection to silo or metal components on silo
E: Earth

Minicap is protected against reverse polarity. The green LED for standby goes out if the connections are reversed.

No ground lines (PE) or potential matching lines (PAL) are required with Minicap FTC 260.

Technical Data

General Information

Manufacturer	Endress+Hauser
Instrument	Limit switch
Instrument designation	Minicap FTC 260, FTC 262
Technical documentation Version	TI 287F/00/en 04.00
Technical specifications	DIN 19259

Application

Material	Solids, grain size max. 30 mm, dielectric constant $\varepsilon_r \geq 1{,}6$

Function and System Design

Measurement principle	Capacitive
Measuring system	Compact instrument
Design	With rod probe (FTC 260) or rope probe (FTC 262)
Signal transmission	Binary

Input

Measured variable	Limit detection
Measuring range	FTC 260: $\varepsilon_r \geq 1.6$, FTC 262: $\varepsilon_r \geq 1.5$

Output

Electronic insert	DC, PNP transistor output	AC / DC Relay output
Output signal	Switching: PNP I_{max} 200 mA – overload and short circuit protection – residual voltage at transistor at I_{max} < 2.9 V	Contact: change-over, potential-free $U\sim_{max}$ 253 V, $I\sim_{max}$ 4 A (AC) $P\sim_{max}$ 1000 VA, cos φ = 1 $P\sim_{max}$ 500 VA, cos φ > 0,7 $I{\overline{\underline{\ldots}}}_{max}$ 4 A bis $U{\overline{\underline{\ldots}}}$ 30 V (DC) $I{\overline{\underline{\ldots}}}_{max}$ 0,2 A bis $U{\overline{\underline{\ldots}}}$ 253 V (DC)
Switching delay when free or covered	FTC 260: 0.5 s FTC 262: 0,8 s	FTC 260: 0.5 s FTC 262: 0,8 s
Power fail signal	< 100 µA	relay de-energised
Overvoltage category	Category III (EN 61010)	
Protection class to EN 61010-1	FTC 260: Class II, FTC 262: Class I	

Accuracy

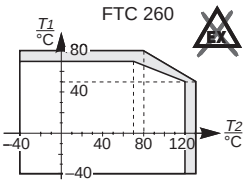
Reference conditions (for plastic vessels)	Ambient temperature 23 °C, operating temperature 23 °C, operating pressure p_e = 0 bar, material: dielectric constant ε_r = 2.6, conductivity < 1 µS, sensitivity setting: C	
	FTC 260	FTC 262
Hysteresis	Horizontal 4 mm, Vertical 7 mm	Vertical 5 mm
Switch point	Horizontal: centre of probe –5 mm Vertical: 40 mm above probe tip	Vertical: 35 mm above probe tip
Power up response	Correct switching after max. 1.5 s	Correct switching after max. 2 s
Long-term drift	Horizontal 3 mm, Vertical 6 mm	Vertical 6 mm
Effect of material temperature	Depending on material to be measured	Depending on material to be measured

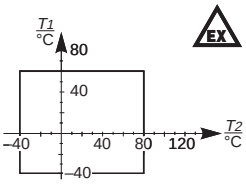
Operating conditions

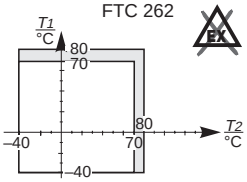
Installation

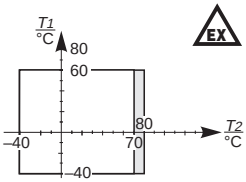
Orientation	See section ”Installation Hints”.

Environment









Operating temperature range T_1	–40…+70 °C (0…+160 °F) […+60 °C, Dust-Ex version]
Operating temperature limits ☐	–40…+80 °C (–40…+180 °F) […+60 °C, Dust-Ex version]
Storage temperature	–40…+80 °C (–40…+180 °F)
Climate class	IEC 68 part 2-38
Ingress protection	IP 66
Shock resistance	Probe: 7 J
Vibrational resistance	EN 60068-2-64 (IEC 68-2-64), 20…2000 Hz, spectral rate of velocity 0,5, 100 min per axis
Electromagnetic compatibility	Interference Emission to EN 61326, Electrical Equipment Class B Interference Immunity to EN 61326, Annex A (Industrial) and NAMUR Recommendation NE 21 (EMC) See TI 241F/00/en for general instructions regarding the EMC test conditions for E+H instruments.

Medium

	FTC 260	FTC 262
Process temperature range T_2	–40…+120 °C (–40…+250 °F) (…+80 °C, Dust-Ex version)	–40…+70 °C (0…+160 °F)
Process temperature limits	–40…+130 °C (–40…+270 °F) (…+80 °C, Dust-Ex version)	–40…+80 °C (–40…+180 °F)
Process pressure range p_e	–1…+25 bar (–14,5…+360 psi)	–1…+6 bar (–14,5…+90 psi)

Mechanical construction

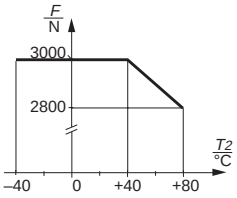
Housing

Housing F 14	Polyester PBT-FR, IP 66

Process connections

	FTC 260	FTC 262
Threaded boss	1 BSPT (R 1, ISO 7/1); Adapter for 1½ BSPT and 1½ BSP (G 1½) see accessories	1½ BSPT (R 1½, ISO 7/1)
	1 NPT, ANSI B 1.20.1, Adapter; for 1¼ NPT see accessories	1½ NPT, ANSI B 1.20.1

Material for wetted parts



Probe rod FTC 260	PPS = Polyphenylene sulphide (glass fibre content approx. 40%)
Probe length	FTC 260: 140 mm (5.5 in), FTC 262: min. 500 mm (20 in), max. 6000 mm (236 in)
Flexural strength FTC 260	1400 N (at probe tip)
Probe rope FTC 262	Surface in High Density PE over steel coating
Other probe parts FTC 262	PPS = Polyphenylene sulphide (glass fibre content approx. 40 %)
Tensile strength *F* of FTC 262	Max. 3000 N up to 40 °C, max 2800 N at 80 °C

User interface

Display	Green LED: stand-by Red LED: switch status
Operation	Switch on electronic insert: – switching between minimum and maximum fail-safe mode – sensitivity setting (depends on the dielectric constant ε_r and build-up). A sensitivity adjustment is normally not required (see section ”Operating Principle”)

Power supply

Electronic insert	DC, PNP transistor output	AC / DC Relay output
Supply voltage	U⎓ 10,8…45 V (DC), transient pulses to 55 V, current consumption max. 30 mA, reverse polarity protected	U~ 20…253 V (AC) or U⎓ 20…55 V (DC), current consumption max. 130 mA
Electrical connection	Terminals: wires max. 1.5 mm² in end sleeves, wire max. 2.5 mm²	

Certificates and approvals

ATEX, FM, CSA	See section ”Product Structure”
Overspill protection FTC 260	DIBt, General design approval
CE Mark	In attaching the CE Mark, Endress+Hauser confirms that the device conforms to all relevant EU directives.

Ordering

Limit switch

Minicap FTC 260, FTC 262 see ”Product Structure”

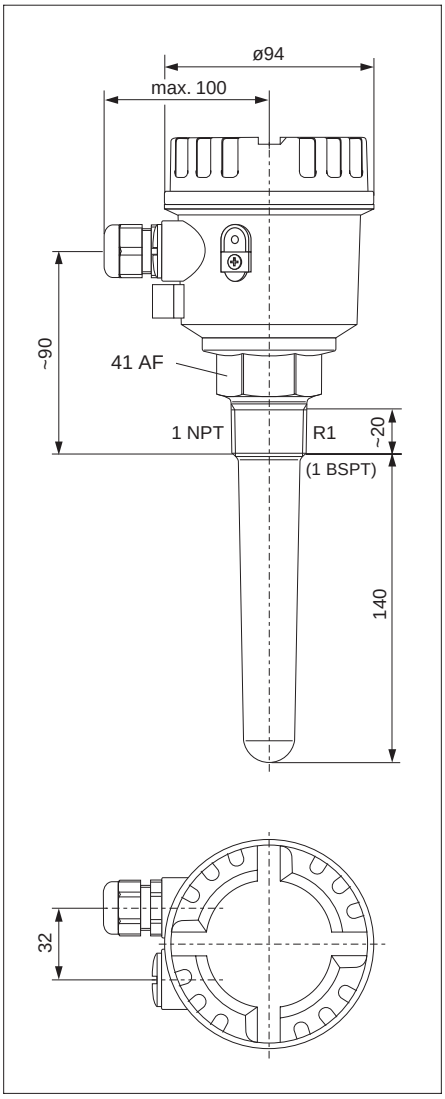
Accessories

Adapter for FTC 260: 1 BSPT female (R_c1) ISO 7/1 (see dimensional sketch)	For 1½ BSPT (R 1½ ISO 7/1, PPS) For 1½ BSP (G 1½ DIN ISO 228, PPS	Part No.: 943215-1001 Part No.: 943215-1021
Adapter for FTC 260: 1 NPT female	For 1¼ NPT, steel For 1¼ NPT, AISI 316 Ti (1.4571)	Part No.: 943215-0042 Part No.: 943215-0043
Transparent cover for FTC 260/262	Part No.: 943201-1001 (not for Dust-Ex)	
Rope shortening set for FTC 262	Part No.: 52005918 (not for CSA)	

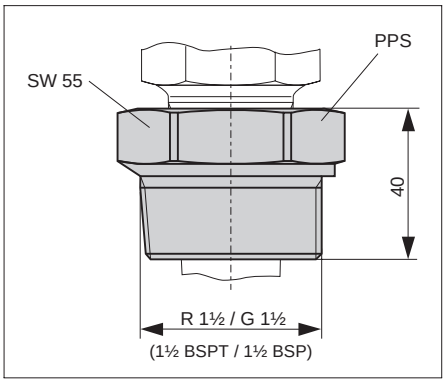
Supplementary documentation

Operating manual for FTC 260	KA 093F/00/a6 Part No.: 017476-0000
Operating manual for FTC 262	KA 155F/00/a6 Part No.: 52005985
Operating manual for rope shortening set for FTC 262	KA 157F/00/a6 Part No.: 52005986
Safety instructions (ATEX) for FTC 260	XA 011F/00/a6 CE ⟨Ex⟩ II 1/3 D Part No.: 52000928
Safety instructions (ATEX) for FTC 262	XA 092F/00/a3 CE ⟨Ex⟩ II 1/3 D Part No.: 52005988

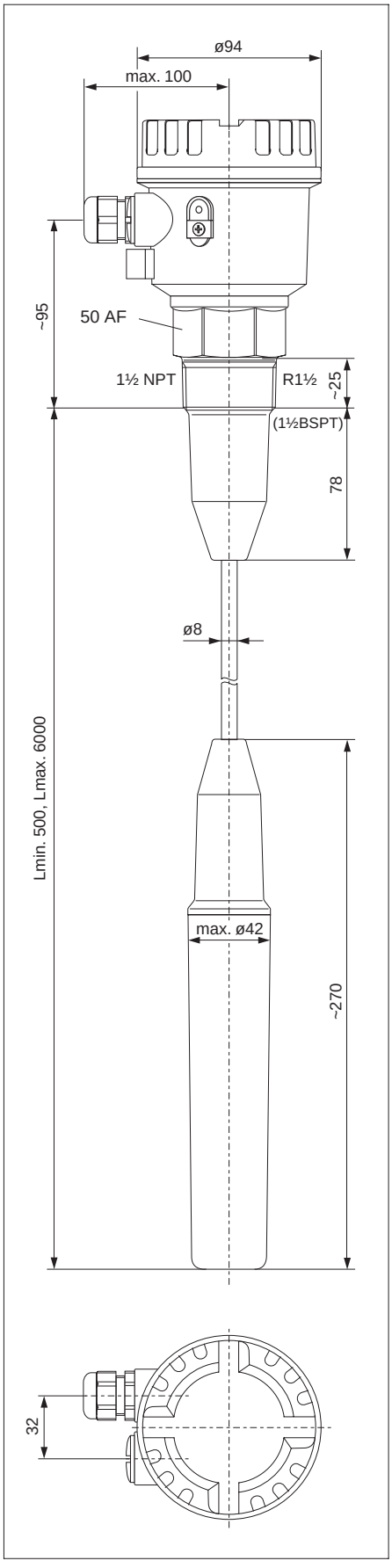
Dimensions



Minicap FTC 260



Adapter for FTC 260



Minicap FTC 262

Probe length tolerances:

Probe length L	Tolerance
Max. 1000 mm	+0, –10 mm
Max. 3000 mm	+0, –20 mm
Max. 6000 mm	+0, –30 mm

Dimensions in mm
100 mm = 3.94 in

Product Structure

Minicap FTC 260 Limit switch with rod probe

Certificates and Approvals

A Versions for non-Ex areas
B BVS, Zone 10, ATEX II 1/3 D
D Overspill protection to WHG
J FM DIP, Cl. II, III, Groups E-G, T5
S CSA DIP, Cl. II, Groups E-G, Cl. III
U CSA General Purpose
Y Special version

Process Connection

A 1 BSPT threaded boss, (R 1, ISO 7/1)
B 1 NPT threaded boss, ANSI B 1.20.1
Y Other

Electronic Insert

2 DC connection 10.8…45 V,
Transistor output PNP
4 Universal connection, U~: 20…253 V (AC), U–: 20…55 V (DC)
Relay output, potential-free change-over contact (SPDT)
9 Other

Housing and Cable Entry

A Polyester F14, IP 66, Pg 13.5
B Polyester F14, IP 66, ½ NPT
C Polyester F14, IP 66, G ½
D Polyester F14, IP 66, M 20x1.5
Y Other

Additional Equipment

1 None
2 Transparent cover
9 Other

FTC260– | | | | | | Product designation Weight 0.56 kg (1.23 lbs)

Minicap FTC 260

Minicap FTC 262 Limit switch with robe probe

Certificates and Approvals

A Versions for non-Ex areas
B ATEX II 1/3 D
J FM DIP, Cl. II, III, Groups E-G
S CSA DIP, Cl. II, Group G and coal dust, Cl. III
U CSA General Purpose
Y Special version

Process Connection **Weight**

A 1½ BSPT threaded boss, (R 1½, ISO 7/1) Basic weight 1.23 kg
B 1½ NPT threaded boss, ANSI B 1.20.1 Basic weight 1.23 kg
Y Other

Probe Length L (Rope shortening not allowed for CSA)

1 Variable in mm (500 mm…6000 mm) Additional weight 0.07 kg/1000 mm
2 Variable in inch (20 in…236 in) Additional weight 0.18 kg/ 100 in
3 1500 mm (59 in) Total weight 1.30 kg
4 2500 mm (98 in) Total weight 1.37 kg
5 4000 mm (157 in) Total weight 1.48 kg
6 6000 mm (236 in) Total weight 1.62 kg

Electronic Insert

2 DC connection 10.8…45 V,
Transistor output PNP
4 Universal connection, U~: 20…253 V (AC), U–: 20…55 V (DC)
Relay output, potential-free change-over contact
9 Other

Housing and Cable Entry

A Polyester F14, IP 66, Pg 13,5
B Polyester F14, IP 66, ½ NPT
C Polyester F14, IP 66, G ½
D Polyester F14, IP 66, M 20x1.5
Y Other

Additional Equipment

1 None
2 Transparent cover
9 Other

FTC262– | | | | | | | Product designation Total weight kg
(1 kg = 2.2 lbs)

Minicap FTC 262

Basic weight:
For probe lengths
500 mm (20 in)

Please state probe length required in millimeters or inches

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