Technical
Information
TI 251F/00/en

Capacitive Limit Detection
Electronic Insert FEC 22

Compact limit switch electronics for Multicap and Multicap T probes With active build-up compensation and automatically optimised switchpoint

Application
The FEC 22 electronic insert is designed for use with a Multicap or Multicap T probe as a compact limit switch for detecting material levels. The FEC 22 electronic insert contains all the (microprocessor-controlled) electronics necessary for limit detection and does not require an external switching unit.

The FEC 22 electronic insert is available in two versions:

- ❑ AC version
  with two changeover contacts (DPDT)
- ❑ DC version
  with PNP output

These two versions ensure it can be used in a wide variety of applications.

Features and Benefits
- Simple on-site operation and calibration using rotary switches and pushbuttons
- Simple adjustment using pushbuttons
- Consistent and accurate switchpoint using active build-up compensation even with strong material build-up on the probe
- Automatic (microprocessor-controlled) switchpoint optimisation
- Certified for explosion-hazardous areas

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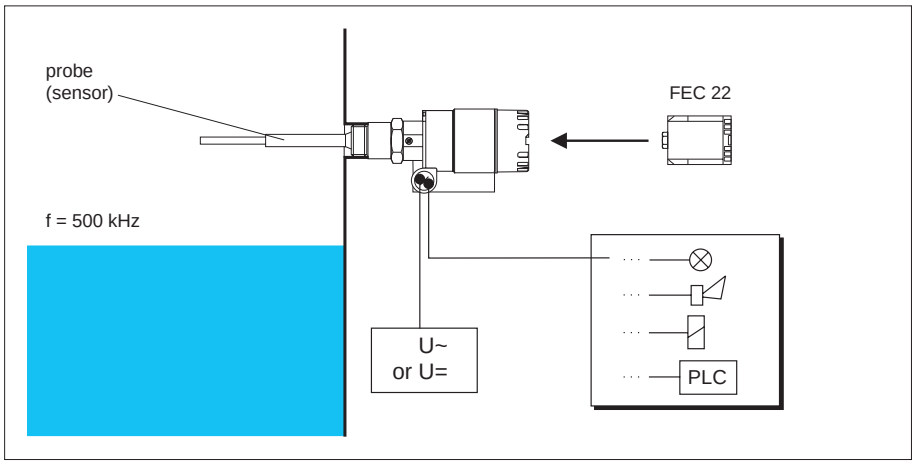
Measuring System

The FEC 22 electronic insert is a compact switching unit. A complete measuring system comprises:
- FEC 22 electronic insert
- Multicap or Multicap T probe
- power supply and
- any additional signal transmitters, switching units, control systems (e.g. lamps, horns, relays, PLC, process control systems, etc.)



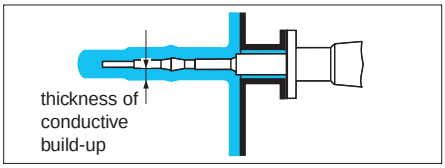
Measuring system

Operating Principle

FEC 22 Electronic Insert
The microprocessor in the FEC 22 electronic insert evaluates the high frequency impedance measurement (f = 500 kHz). A switching signal is given if the impedance value exceeds a preset range of limit values.

Calibration
The unit is calibrated by simply pressing a button on the control panel when the vessel is empty or full. The resulting measurement provides the FEC 22 electronic insert with an accurate switchpoint.

Active Build-Up Compensation
The Multicap probe with active build-up compensation and the FEC 22 electronic insert identifies material build-up on the probe. A compensation feature ensures that the switchpoint always stays the same. Build-up compensation is dependent upon:
- thickness of the material on the probe,
- conductivity of the build-up,
- switchpoint setting ΔC on the FEC 22 (see table below)



Minimum/Maximum Fail-Safe Mode
The FEC 22 electronic insert can be operated in either minimum or maximum fail-safe mode.

AC Version
The relays are de-energised if:
- the probe is free or the power supply fails (minimum fail-safe mode),
- the probe is covered or the power supply fails (maximum fail-safe mode).

DC Version
The switching output is blocked if:
- the probe is free or the power supply fails (minimum fail-safe mode),
- the probe is covered or the power supply fails (maximum fail-safe mode).

A red LED on the electronic insert indicates the switching status.

Optimised Switchpoint
The FEC 22 also has a microprocessor-controlled routine which automatically optimises the switchpoint when the probe is mounted horizontally.

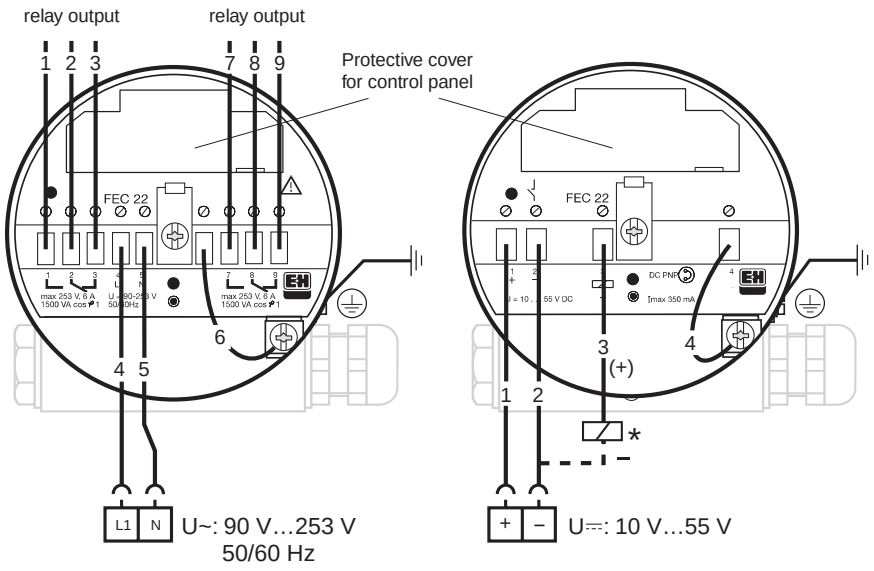
		Permitted thickness of build-up in mm			
Conductivity of build-up	**Typical build-up**	**For normal calibration on the FEC 22, ΔC = 4 pF**		**For coarse calibration on the FEC 22, ΔC = 32 pF**	
		Multicap	***Multicap T***	***Multicap***	***Multicap T***
0.2 mS/cm	water moist solids	ca. 25 mm	ca. 17.5 mm	> 25 mm	> 17.5 mm
1 mS/cm	wastewater	ca. 7 mm	ca. 5 mm	> 25 mm	> 17.5 mm
3 mS/cm	aqueous solutions alcohol	ca. 2 mm	ca. 1.5 mm	ca. 17 mm	ca. 12 mm
10 mS/cm		ca. 1 mm	ca. 0.7 mm	ca. 7.5 mm	ca. 5 mm
100 mS/cm	highly concentrated acids, electrolytes	ca. 0.2 mm	ca. 0.1 mm	ca. 2 mm	ca. 1.5 mm

Permitted thickness for build-up compensation

Electrical Connection

Standard installation cable may be used for the electrical connections.

For general Information on EMC (test procedures, recommendations on installation) see TI 241F/00/en.

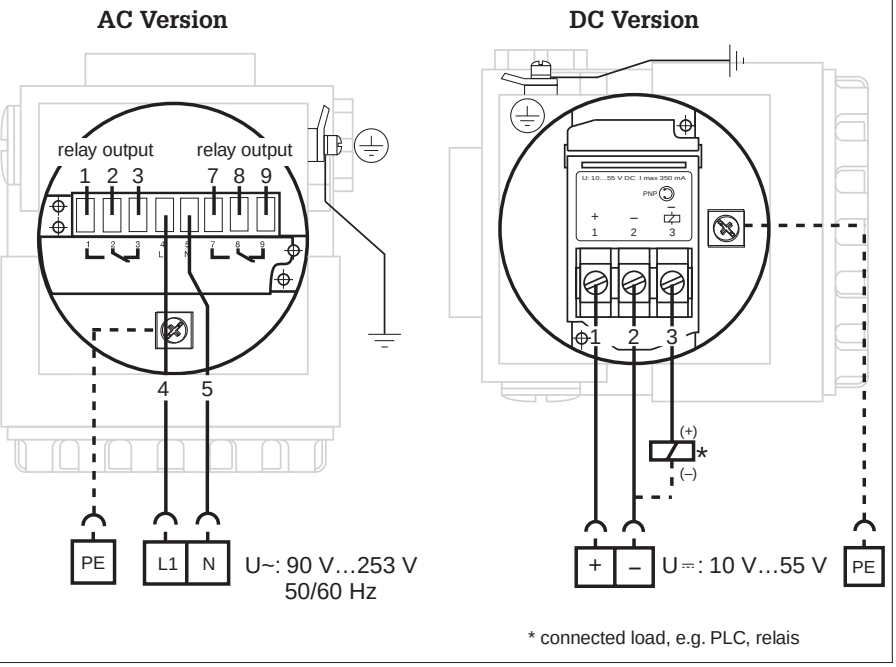


Connection of FEC 22 when mounted in an aluminium (F6) or plastic (F10) probe housing

Electronic Inserts

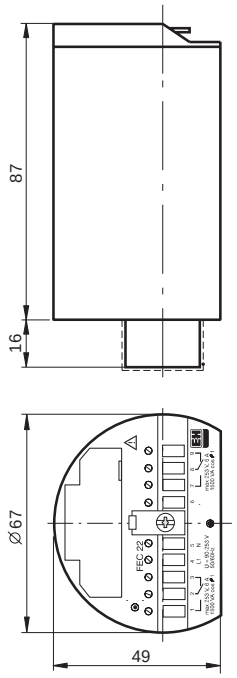
FEC 22 (AC version)
AC voltage 90 V…253 V, 50/60 Hz.
Current consumption approx. 10 mA at 230 V.
Potential-free relay contacts, with switching capacity
- alternating current: 253 V, max. 6 A max. approx. 1500 VA at cos φ = 1
- direct current: 30 V: 6 A max.
  125 V: 0.2 A max.

FEC 22 (DC version)
Three-wire DC connection PNP
DC voltage 10 V…55 V
Current consumption approx. 18 mA at 24 V
- Load current up to 350 mA continuous, max. 55 V, with overload and polarity protection
- Residual current in blocked status smaller than 100 µA



Connection of FEC 22 when mounted in an aluminium housing (T3) with separate connection compartment for EEx d/EEx ia

Technical Data



Dimensions in mm
of the FEC 22
electronic insert

1" = 25.4 mm

General specifications	Manufacturer	Endress+Hauser
	Instrument family	Electronic insert
	Instrument type	FEC 22
	CE mark	By attaching the CE Mark, Endress+Hauser confirms that the electronic insert FEC 22 fulfils all legal requirements of the relevant EC directives
Application	Limit detection	In liquids and solids
Operation and system design	Measuring principle	Capacitive
	Signal processing	AC version: 2 relays connected in parallel (DPDT)
		DC version: Load switching via transistor
	Electrical Isolation	Between measuring loop and power supply loop
Input	Measured variable	Level (limit)
	Operating frequency	500 kHz
	Range of capacitance	For empty indication (free probe) 10 pF…350 pF
Output	AC version	Two change-over contacts (DPDT)
	DC version	PNP output
Operating conditions	Nominal temperature range	-40°C…+70°C
	Limiting temperature range	-40°C…+80°C
	Storage temperature range	-40°C…+85°C
	Climatic class	Climatic protection to IEC 68, Part 2…38, Fig. 2a
	Ingress protection	IP 20
	Vibration resistance	To IEC 68 Part 2-6, 10…55 Hz, 0.15 mm, x,y,z
	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)
Mechanical construction	Design	Compact instrument
	Dimensions	See dimensional sketch
	Weight	0.3 kg
	Material	Plastic
	Electrical connection	Terminal connection, wires 2.5 mm^2
Control and display elements	Outside the protective cover:	
	Green LED	Standby
	Red LED	Switching status: AC version (relays de-energised), DC version (switching output blocked)
	Under the protective cover:	
	5 LEDs	Display of gradations with values
	2 keys	Calibration / assigning values
	Rotary switch	For selecting 8 different settings
Power supply	AC/DC version	See “Electrical Connection”
Certificates and approvals	Certificate of conformity	KEMA No. Ex-95.D.4452 X ZE 158F/00/a3
Ordering	Order No.: 942299-0000	FEC 22 in AC version
	Order No.: 942299-1000	FEC 22 in DC version
External standards, guidelines	Supplementary Documentation	Multicap T DC…TE probe, TI 240F/00/en
		Multicap T DC…TA probe, TI 239 F/00/en
		Multicap DC…E probe, TI 242 F/00/en
		Multicap DC…A probe, TI 243 F/00/en

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