Technical
Information
TI 271F/00/en

Operating Instructions
017182-1000

Capacitance Level Measurement
Electronic Inserts EC 37 Z, EC 47 Z

Transmitters for capacitance probes

Application
The electronic inserts EC 37 Z and EC 47 Z are transmitters for continuous capacitance level measurement in conjunction with the level measuring instruments Silometer FMX 570, FMC 671 Z, FMC 672 Z, and Prolevel FMC 661, FMC 662.

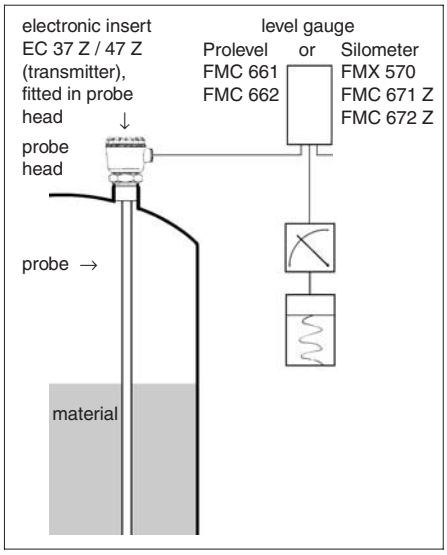
Features and Benefits
- Also for use in explosion-hazardous areas
- European and North American approvals
- Applicable over a wide temperature range
- Separate protection housing available.

Endress+Hauser
The Power of Know How

Measuring System

The complete measuring system comprises:

- a Silometer FMC…Z, FMX... or Prolevel FMC… level gauge
- a fully insulated rod or rope probe, which is fitted vertically in the vessel
- an electronic insert EC 37 Z or EC 47 Z, which is normally fitted in the probe head.



Measuring system for capacitance level measurement

Measuring Principle

The basis of this technique lies in the physical properties of a capacitor.
The capacitance C of a capacitor is derived from the distance d between the electrodes, the surface area A of the electrodes and the dielectric constant ε of the intermediate dielectric:

$$C = \varepsilon \frac{A}{d} .$$

The capacitor used in level measurement generally takes the form of the vessel itself and a probe that extends into the vessel. The vessel wall and the probe form the two electrodes. If the vessel is made from non-conductive material, then a counter electrode must be fitted (e. g. an earth tube, second probe or metal plate). This can also be the second rod of a double rod probe.
The distance between the electrodes and surface area remain constant. The only variable is the depth of material being measured, which represents the dielectric between the two electrodes. Air and vacuum have a relative dielectric constant $\varepsilon_r = 1$, for liquids and solids $\varepsilon_r > 1$ is valid.
The capacitance of the capacitor therefore depends on how much material lies between the probe and the vessel wall, i. e., how high the vessel is. This capacitance is measured by feeding a high frequency voltage at a constant frequency to the electrodes (vessel and probe). The higher the capacitance of the capacitor (and therefore the level), the greater the high frequency current flowing through the capacitor. The electronic insert converts the high frequency current into a frequency proportional to level, which is then used by the Silometer or Prolevel to indicate the level.

Installation

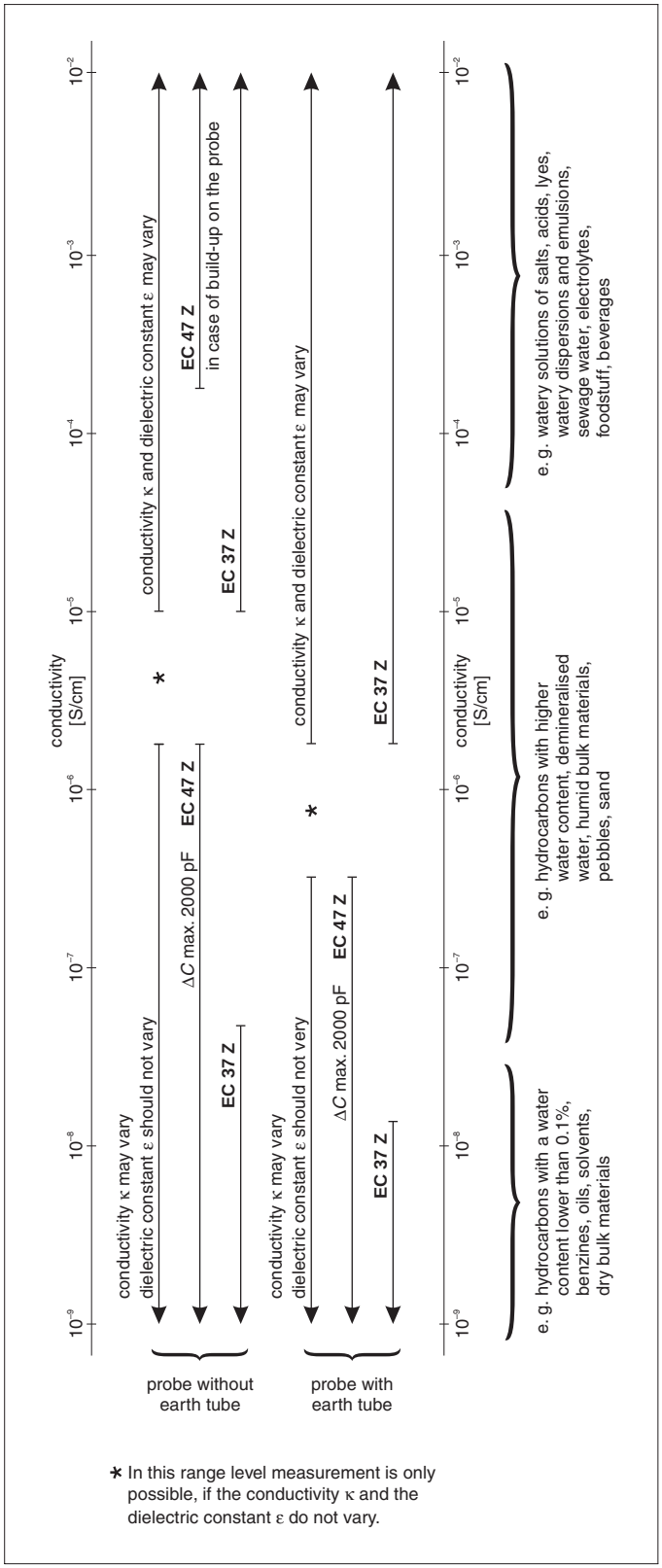
Normally the violet electronic insert EC 37 Z or EC 47 Z is screwed in the probe head.
Before fitting, connect the earth connection between terminal 6 and the probe head housing.
The operating temperature within the vessel should not exceed 100 °C, provided the ambient temperature of the probe head housing is not higher than 60 °C.

If the ambient temperature at the probe head is higher, then an electronic insert in a separate protection housing HMC 37 Z or HMC 47 Z should be used with coaxial cable to the probe head (max. +200 °C). The initial capacitance C_A will then be increased by the capacitance of the coaxial cable (approx. 50 pF/m).
See Sect. “Dimensions” for the drilling template for wall mounting of the electronic insert in a separate housing HMC 37 Z or HMC 47 Z.

Selection of the Electronic Insert

The selection of the measuring frequency and thus the electronic insert depends on the conductivity, dielectric constant and build-up of the material, as well as the probe construction and the vessel wall material. Recommended application ranges are shown in the following figure.
If the electronic insert EC 47 Z is used, then the counter electrode should be carefully selected:

- In metal vessels ensure that there is a perfect earth connection from the probe head housing to the vessel.
- In concrete, plastic or wood containers fit the counter electrode in the container or outside on the vessel wall and connect it with the probe head housing.
- If liquid is being measured, then it is advisable to use a probe with earth tube.



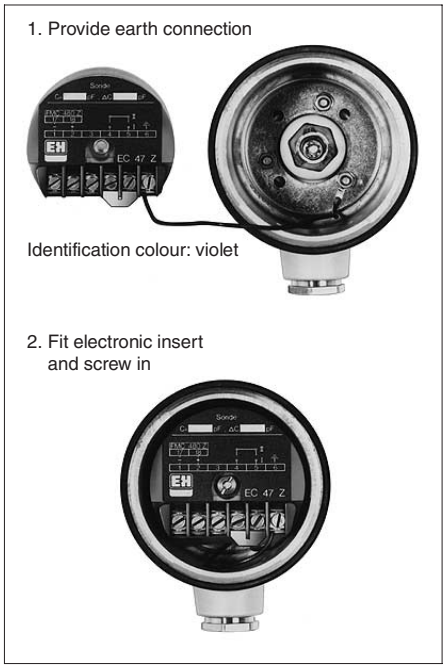
Recommended application ranges of EC 37 Z and EC 47 Z

Electrical Connection

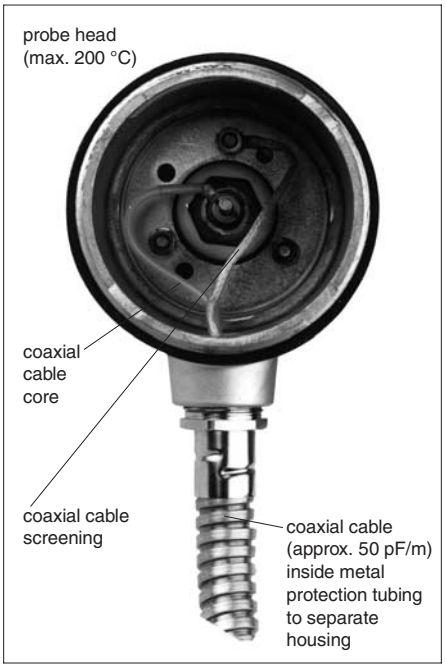
For the standard measuring range II, bridge 4–5 on the electronic insert EC…Z is closed.
Range I is only used with materials of a very low dielectric constant (e. g. hydrocarbons or dry solids) in small vessels with sensors without an earth tube. For measuring range I, bridge 4–5 is removed.
Use a screened, two-core instrument cable to connect to the Silometer or Prolevel.
Earth the screening on both sides; if this is not possible, earth it on one side in the probe housing.
Observe explosion regulations!

Further details are given in the instruction manual of the used Silometer FMC…Z, FMX... or Prolevel FMC…

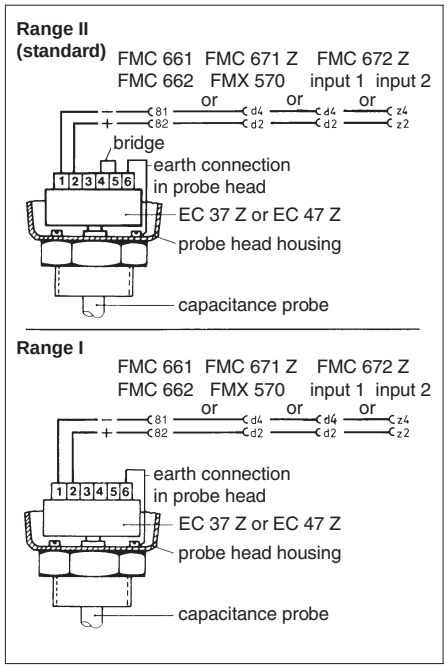
For the greatest possible accuracy, recalibrate after replacing the electronic insert.



Connection to probe head

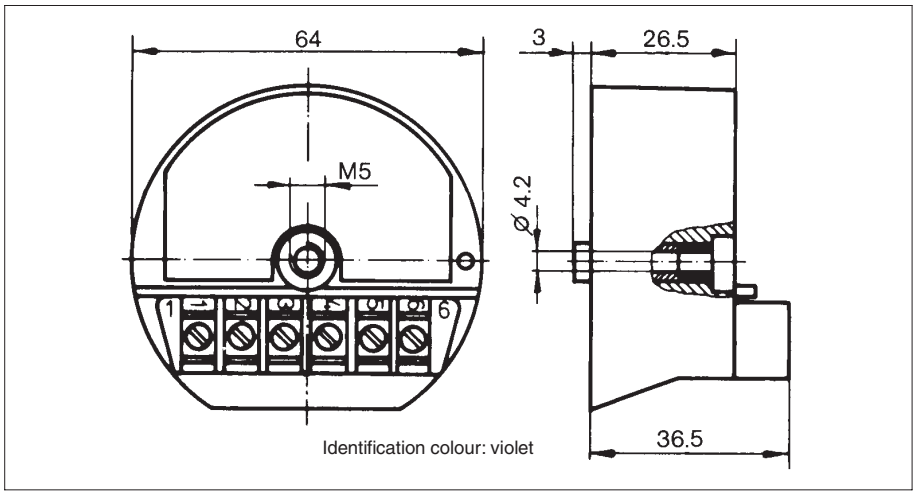


Connection of the coaxial cable from the HMC 37 Z and HMC 47 Z in the probe head

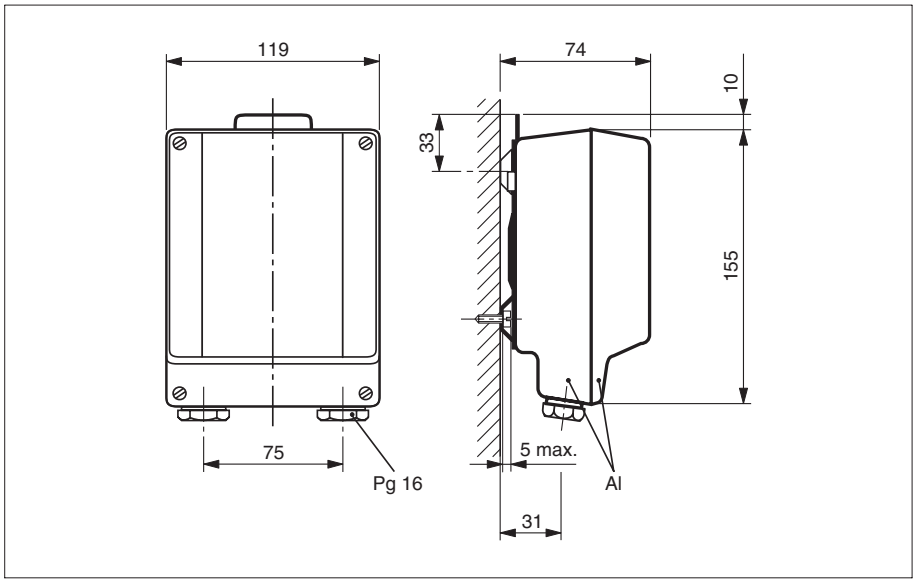


Connection to Silometer FMC…Z, FMX... or Prolevel FMC…

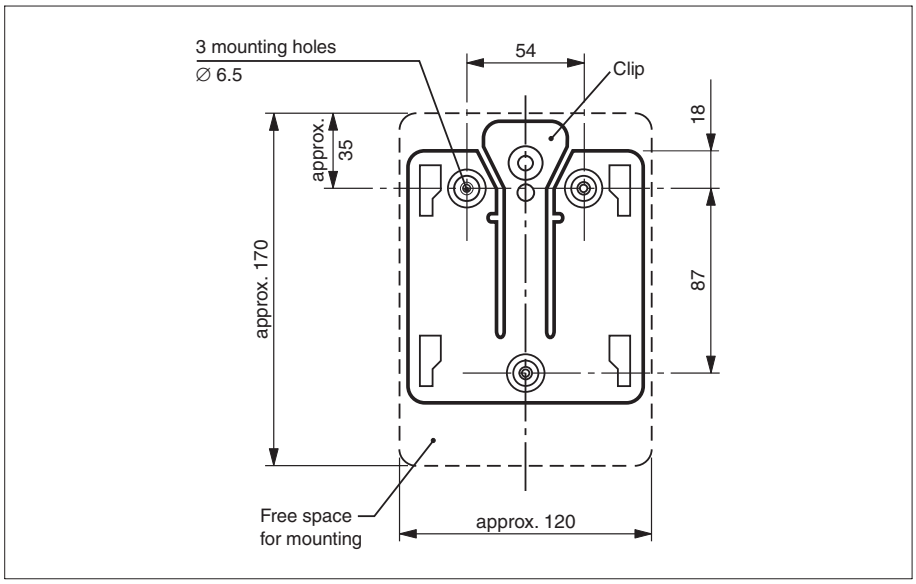
Dimensions



Dimensions in mm of the electronic inserts EC 37 Z and EC 47 Z



Dimensions in mm of the electronic inserts in a separate housing HMC 37 Z and HMC 47 Z



Drilling template for wall mounting of the mounting plate of the separate housing (dimensions in mm)

Technical Data

Electronic insert EC 37 Z

Housing	plastic, potted electronics
Weight	140 g
Identification colour	violet
Protection type to DIN 40050	electronics IP 55, terminals IP 00
Certificates	PTB (Germany), FM (USA), CSA (Canada), shipbuilding approvals by ABS, BV, and DNV
Explosion protection type	Europe: EEx ia IIC T6 (max. 60 °C) North America: IS / Cl. I, II, III / Div. 1 / Group A–G
Permissible ambient temperature	operating range: –20…+80 °C storage range: –40…+85 °C
Measuring frequency	approx. 33 kHz
Measuring voltage *U*~	approx. 5.3 V
Supply voltage	14.8 V from Silometer FMC…Z
Supply current	max. 22 mA
Output signal	pulse-shaped, superimposed on the supply current
Range II (standard)	60 Hz…2.8 kHz ± 15%, equivalent to 20…4350 pF
Range I	550 Hz…2.8 kHz ± 15%, equivalent to 20…335 pF

Electronic insert EC 47 Z

as EC 37 Z, but:

Measuring frequency	approx. 1 MHz
Measuring voltage	approx. 1.1 V
Range II (standard)	60 Hz…1.3 kHz ± 15%, equivalent to 20…2000 pF
Range I	550 Hz…2.8 kHz ± 15%, equivalent to 20…335 pF

Electronic insert in separate housing HMC 37 Z, HMC 47 Z

Housing	cast aluminium
Protection type to DIN 40050	IP 55
Cable entries	2 × Pg 16
Connection to probe	coaxial cable, temperature resistant to +200 °C, in a flexible protection tubing of galvanised steel, length as required, standard length 2 m
Capacitance of the coaxial cable	approx. 50 pF/m
Permissible ambient temperature	–20…+80 °C
Other technical data	HMC 37 Z as EC 37 Z HMC 47 Z as EC 47 Z

Electromagnetic compatibility	Interference Emission to EN 61326; Electrical Equipment Class B Interference Immunity to EN 61326

Supplementary Documentation

- ❏ Silometer FMX 570
  Technical Information TI 201F/00/en
- ❏ Silometer FMC 671 Z
  Technical Information TI 064F/00/en
- ❏ Silometer FMC 672 Z
  Technical Information TI 063F/00/en
- ❏ Prolevel FMC 661
  Technical Information TI 232F/00/en
- ❏ Prolevel FMC 662
  Technical Information TI 233F/00/en
- ❏ Separate housing for electronic insert
  Technical Information TI 228F/00/en
- ❏ Silometer FMX 570
  CE ⟨Ex⟩ II (1) GD, [EEx ia] IIC/IIB
  XA 109F/00/a3
- ❏ Silometer FMC 671 Z
  CE ⟨Ex⟩ II (1) GD, [EEx ia] IIC/IIB
  XA 110F/00/a3
- ❏ Silometer FMC 672 Z
  CE ⟨Ex⟩ II (1) GD, [EEx ia] IIC/IIB
  XA 185F/00/a3
- ❏ Prolevel FMC 661, FMC 662
  CE ⟨Ex⟩ II (1) GD, [EEx ia] IIC
  XA 036F/00/a3

Endress+Hauser
GmbH+Co. KG
Instruments International
P.O. Box 2222
D-79574 Weil am Rhein
Germany

Tel. (0 76 21) 9 75-02
Fax (0 76 21) 9 75-3 45
http://www.endress.com
info@ii.endress.com

Endress+Hauser
The Power of Know How

05.02/PT1

TI 271F/00/en/02.04
017182-1000
SL/CV5

017182- 1000