

Capacitance Level Measurement *Electronic Inserts EC 11 Z, EC 72 Z*

Transmitters for capacitance probes



Application

The electronic inserts EC 11 Z and EC 72 Z are transmitters for continuous capacitance level measurement in not explosion-hazardous areas in conjunction with the level measuring instruments Silometer FMC 420, FMC 423 and FMC 425.

Features and Benefits

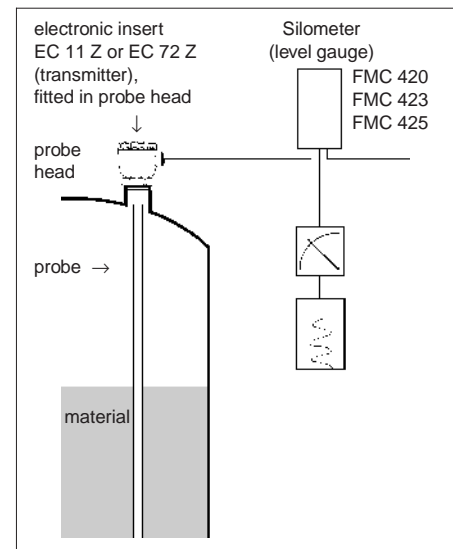
- Applicable over a wide temperature range
- Separate protection housing available
- Application on ships in accordance with the regulations of German Lloyd unlimited possible.

Measuring System

The complete measuring system comprises:

- a Silometer FMC... level gauge
- a fully insulated rod or rope probe, which is fitted vertically in the vessel
- an electronic insert EC 11 Z or EC 72 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:

$$C = \epsilon \frac{A}{d}$$

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 $\epsilon_r = 1$, for liquids and solids $\epsilon_r > 1$ 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 to indicate the level.

Installation

Normally the red electronic insert EC 11 Z or EC 72 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 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).

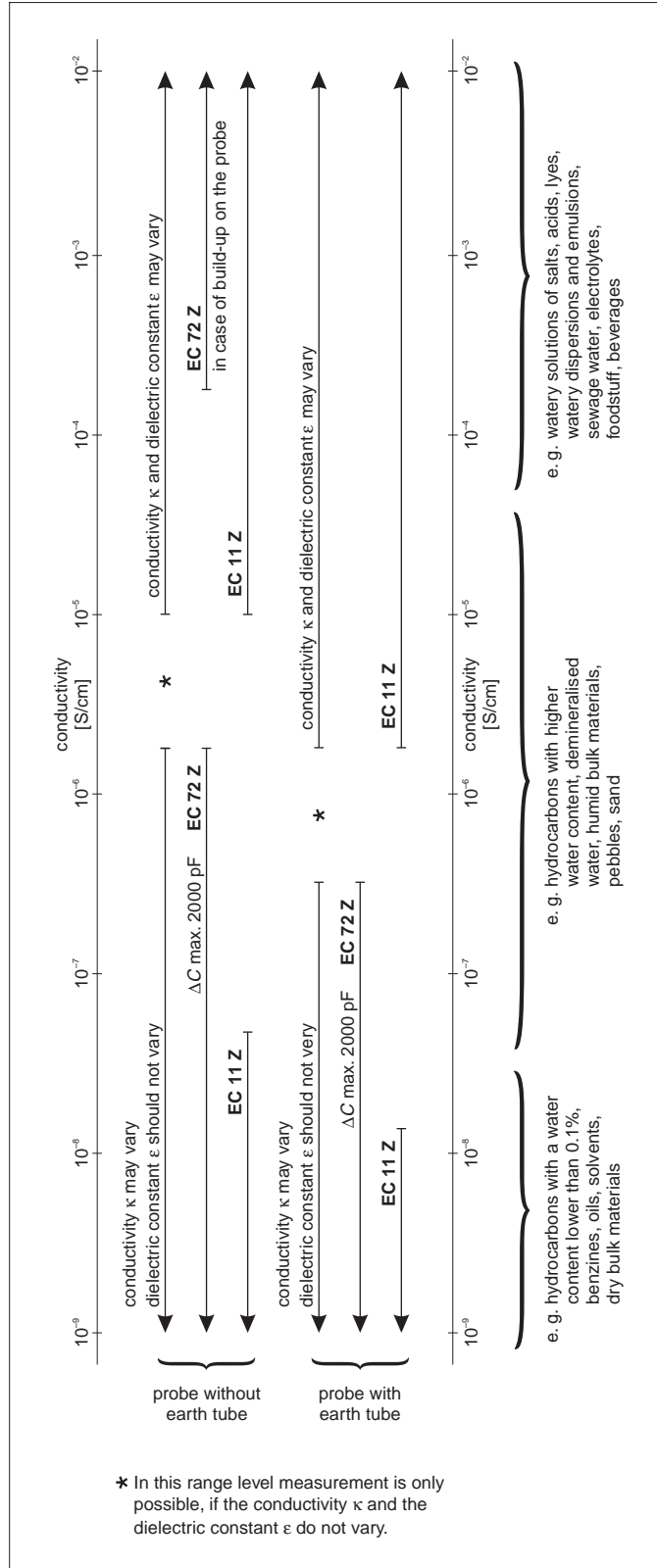
See Sect. "Dimensions" for the drilling template for wall mounting of the separate housing.

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 72 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 11 Z and EC 72 Z

Electrical Connection

If there is a capacitance variation $\Delta C > 1000 \text{ pF}$ for empty and full vessel, then with the electronic insert EC 72 Z the linearity error may be compensated by connecting earth to terminal 5 instead of terminal 6.

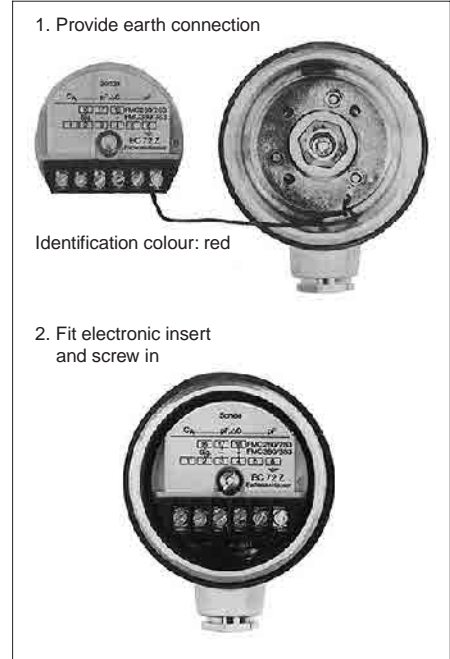
Attention!

The whole measuring system including the indicating instruments lies then on the potential of the vessel.

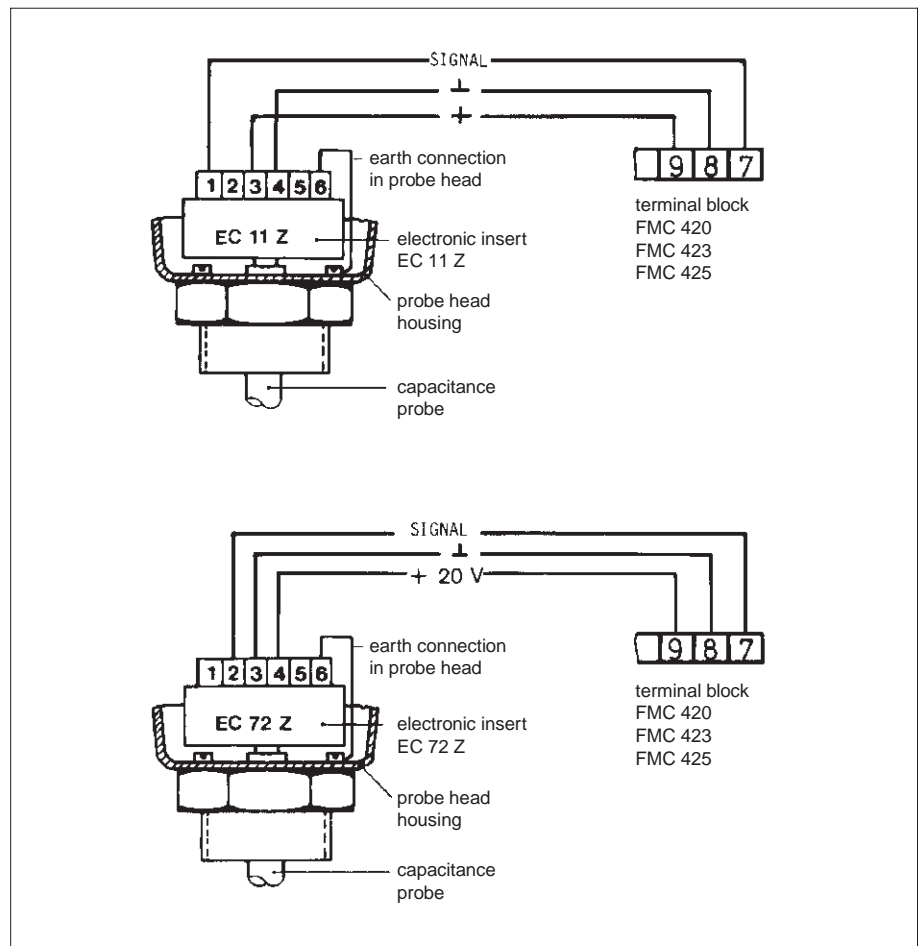
Connect screened 3-core instrument cable to Silometer.
Ground screen at both ends; if this is not possible, ground at one end in the probe housing.

Further details are given in the instruction manual of the used Silometer FMC...

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



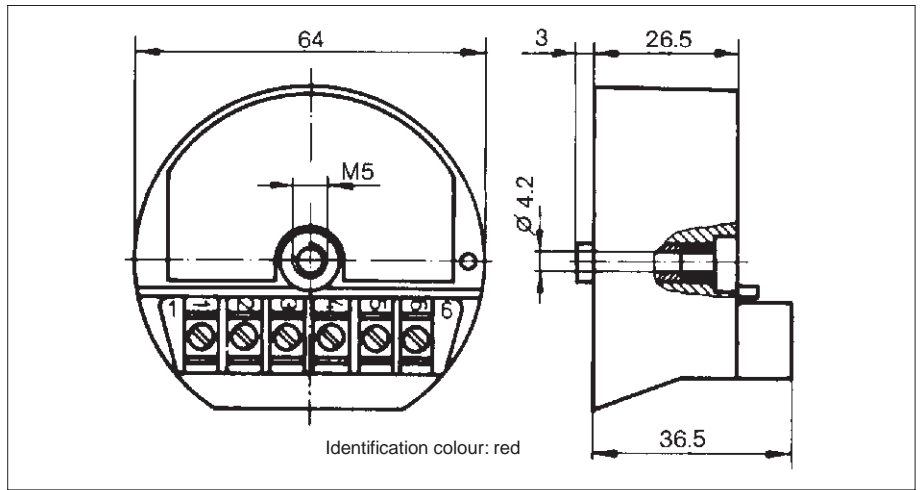
Connection to probe head



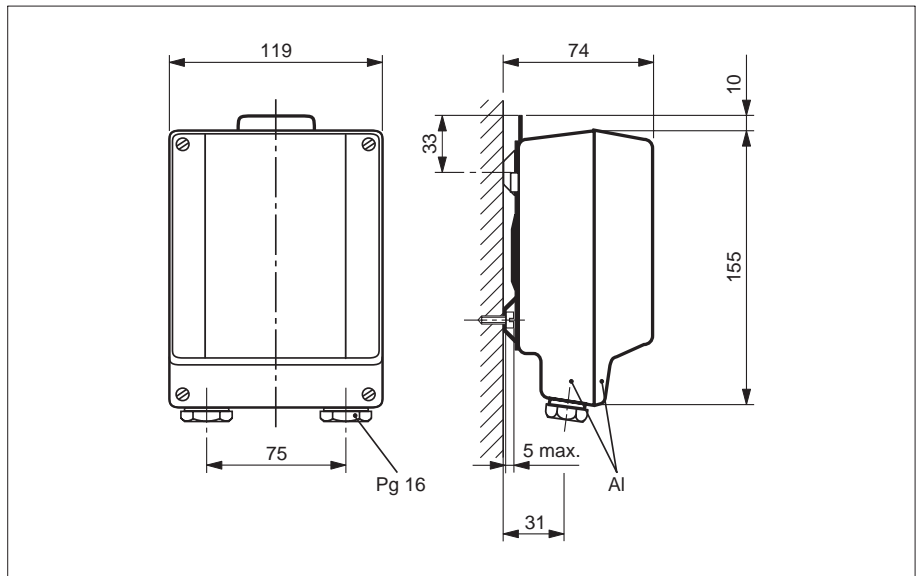
Connection to Silometer FMC... (Minipac)

Dimensions

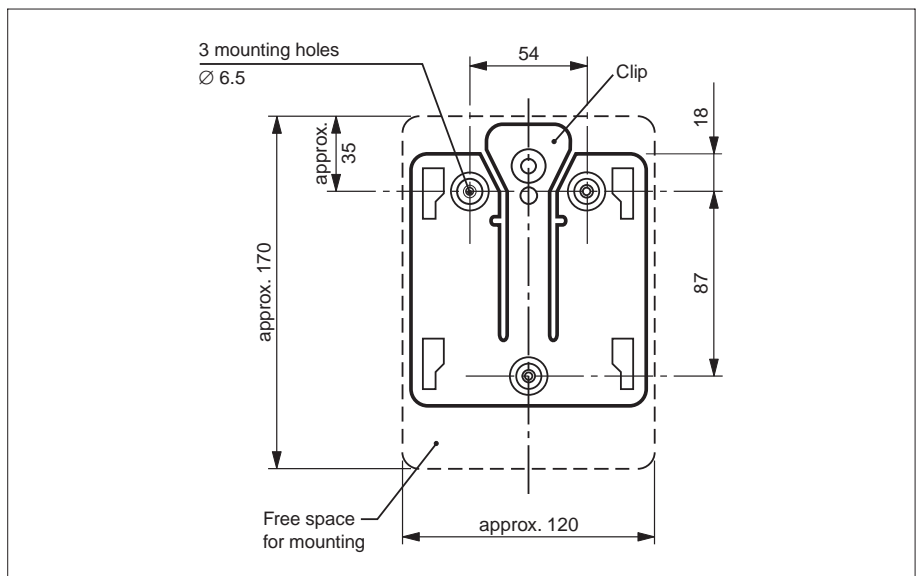
Dimensions in mm of the electronic inserts EC 11 Z and EC 72 Z



Dimensions in mm of the separate housing for EC 11 Z and EC 72 Z



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



Technical Data

Electronic insert EC 11 Z

Housing	plastic, potted electronics
Weight	130 g
Identification colour	red
Protection type to DIN 40050	electronics IP 55, terminals IP 00
Permissible ambient temperature	-20...+100 °C
Operating frequency	approx. 33 kHz
Supply voltage	20 V from Silometer FMC...
Output signal	0...4000 µA, equivalent to 0...4000 pF
Electromagnetic Compatibility	Interference Emission to EN 61326, Electrical Equipment Class B Interference Immunity to EN 61326

Electronic insert EC 72 Z

as EC 11 Z, but:

Permissible ambient temperature	-20...+80 °C
Operating frequency	approx. 1 MHz
Output signal	0...2000 µA, equivalent to 0...2000 pF

Separate housing for electronic insert EC 11 Z, EC 72 Z

Housing	cast aluminium
Weight without electronic insert	approx. 1.4 kg
Protection type to DIN 40050	IP 55
Cable glands	2 x Pg 16
Connection to probe	2 m coaxial cable, temperature resistant to +200 °C, in a flexible protection tubing of galvanised steel
Capacitance of the coaxial cable	approx. 50 pF/m
Permissible ambient temperature	-20...+80 °C

Supplementary Documentation

- Silometer FMC 420, FMC 423
Technical Information TI 077F/00/en
- Silometer FMC 425
Technical Information TI 143F/00/en
- Separate housing for electronic insert
Technical Information TI 228F/00/en
- General information on
electromagnetic compatibility
Technical Information TI 241F/00/en

Certificate

- Certificate for type testing by
German Lloyd

No. 94358 HH (GL)
12/79

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