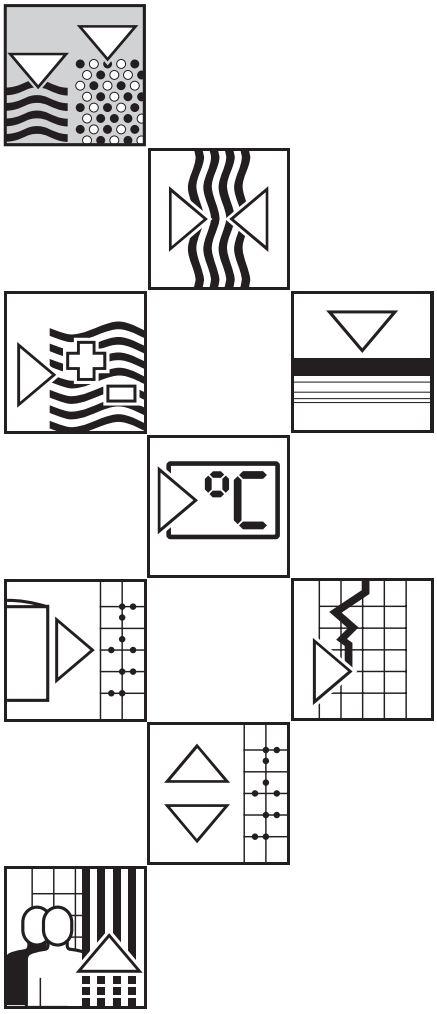
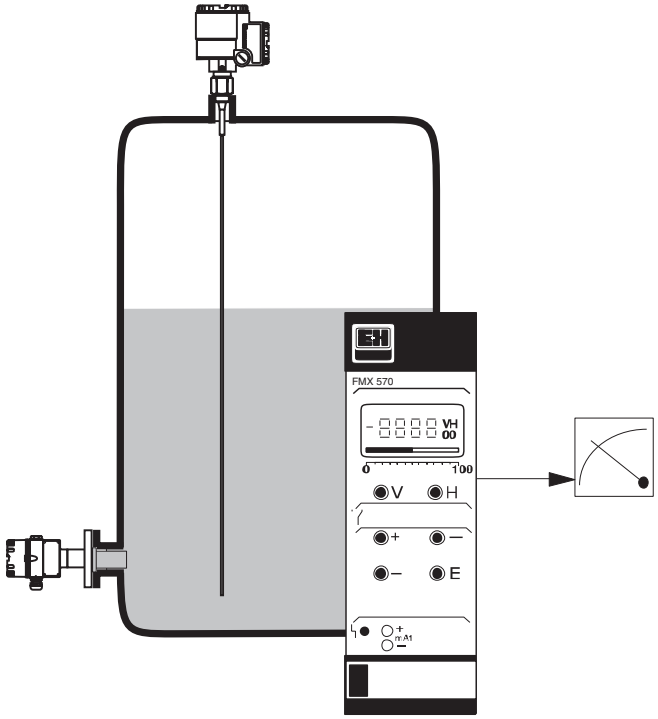
BA 119F/00/en/06.03
016338-1000
Software Version 1.x

silometer
FMX 570
Level Measurement

Operating Instructions

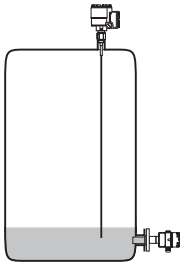
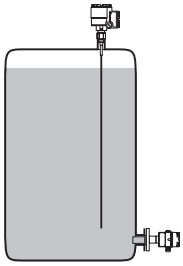
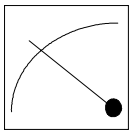




Endress+Hauser

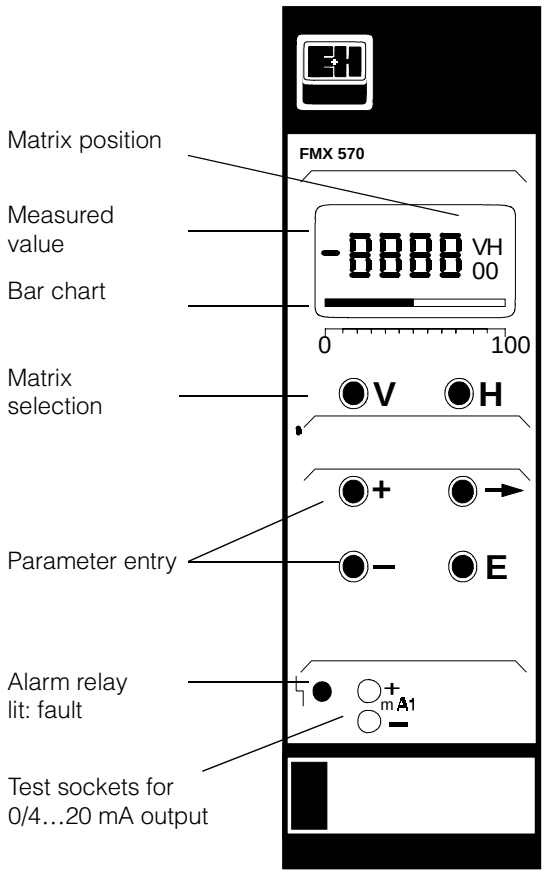
The Power of Know How

Level Measurement at a Glance

Function	Matrix	Action
1 Reset transmitter	**V9H5**	● Enter 671: »+« and »-« keys, ⇒ changes digit Press »E« to register entry - Omit if commissioned as in Section 4.1
2 »Empty« calibration* 	**V0H1**	● Fill vessel 0…40% full (probe covered) Enter level in %, m, ft, etc. Press »E« to register entry
3 »Full« calibration* 	**V0H2**	● Fill vessel 60…100% full Enter level in %, m, ft, etc. Press »E« to register entry
4 0/4 mA signal 	**V0H3** **V0H5** **V0H6**	● Enter 0 for 0…20 mA signal, 1 for 4…20 mA signal Press »E« to register entry ● Enter level for 0/4 mA signal (if not 0) Press »E« to register entry ● Enter level for 20 mA signal (if not 100) Press »E« to register entry

*Can be performed in reverse order

Silometer FMX 570



V Selects vertical matrix position

H Selects horizontal matrix position

V + H Select position V0H0

→ Selects next digit

→ + + Move decimal point

\+ Increases value of digit

– Decreases value of digit

E Registers entry

See also »Controls«, Chapter 3

Table of Contents

Notes on Safety

The Silometer FMX 570 is a level measurement transmitter which can be used with a variety of probes and sensors. It must be installed by qualified personnel according to the instructions in this manual.

Certificates

The Silometer FMX 570 transmitter is available with certificate. The Table below indicates the combinations available and conditions for installation. Full details can be taken from the certificates. Please note that where quoted technical data differs from that listed in Section 2.5, that in the certificate applies.

Certificate	Instruments	Notes
TÜV 00 ATEX 1640	Silometer FMC 671 Z/676 Z	CE Ex II (1) GD, [EEx ia] IIC/IIB, install outside Ex-area
PTB 98 ATEX 2215 X	DC 12 TE, DC .. TE ., DC .. E ., DC .. Capacitance probes 11500 Z(M), 11961 (Z), 21561 (Z) with electronic insert EC 16/17/27/37/47 Z, FEC 12, HTC 16/17/27 Z, HTC 10 E, HMC 37/47 Z	CE Ex II 1/2 G, II 2 G, EEx ia IIC/IIB T6
PTB 98 ATEX 2215 X	DC 12 TE, DC .. TE ., DC .. E ., DC .. Capacitance probes 11500 Z(M), 11961 Z, 21561 Z with electronic insert EC 17/37/47 Z, FEC 12	CE Ex II 1 G, EEx ia IIC/IIB T6
PTB 98 ATEX 2094	DB 50, DB 50 L, DB 51, DB 52, DB 53	CE Ex II 1/2 G, II 2 G, EEx ia IIC T4…T6
DIBt No. Z-65.11-29	Silometer FMX 570, DB 50…52 with electronic insert FEB 17 / FEB (17) P	Continuous level measurement for overspill protection in stationary vessels (for storage of non-combustible, water-polluting liquids)

Safety conventions

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

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 indicates actions or procedures which, if not performed correctly, may lead to personal injury or incorrect functioning of the instrument.

Warning!
- A warning indicates actions or procedures which, if not performed correctly, will lead to personal injury, a safety hazard or destruction of the instrument.

1 Introduction

Quick Operating Guides

The front cover contains short instructions for continuous level measurement with the default parameters.

In this manual

Users unfamiliar with the Silometer FMX 570 must read the operating instructions, which are structured as follows:

- Chapter 1: Introduction;
  contains general information including application, measurement principle and functional description.
- Chapter 2: Installation;
  contains hardware configuration, installation instructions.
  connection diagrams and technical data for the plug-in card.
- Chapter 3: Controls;
  describes the front panel keys and operating matrix.
- Chapter 4: Calibration and Operation;
  tells you how to commission the Silometer for level measurement.
- Chapter 5: Linearization;
  tells you how to calibrate the Silometer to measure volume in a horizontal cylindrical tank or a tank with a conical outlet.
- Chapter 6: Analogue Outputs;
  describes in detail the setting of the 0/4…20 mA signal line.
- Chapter 7: Trouble-Shooting;
  contains a description of the self-checking system with error messages, the simulation feature as well as instructions for configuration on replacement of the transmitter, probe or electronic insert.
- Chapter 8: Short Operating Guide
  contains a flowcharts for level and volume measurements
- Chapter 9: Index;
  lists key words to help you find information quickly.
- Chapter 10: Operating Matrix
  contains the operating matrix, the default parameters and a table to enter your operating parameters,

Further documentation

Installation of the probes, electronic inserts and accessories are described in the documentation accompanying these articles - see text for references. When installing probes in explosion hazardous areas the instructions included in the accompanying probe certification must also be observed.

1.1 Application

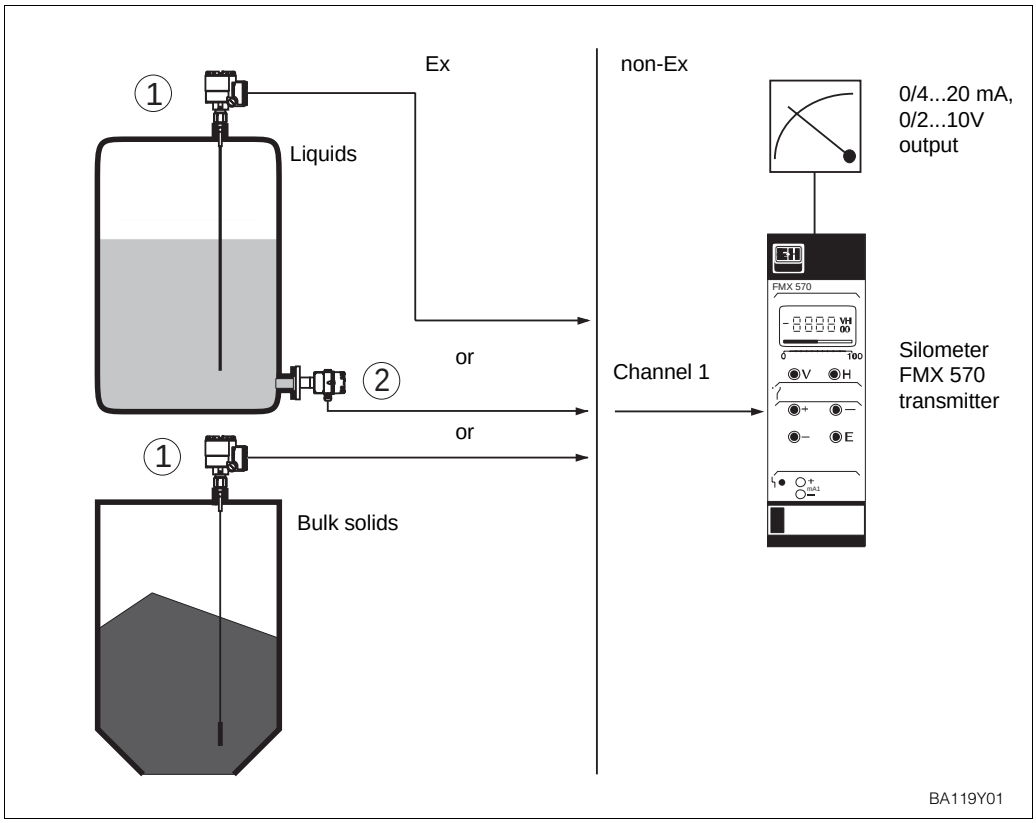


Fig. 1.1: Standard application showing Silometer FMX 570 controlling level measurement
① Capacitance probe
② Deltapilot

The Silometer FMX 570 is designed for level measurement with a capacitance or hydrostatic pressure probe in safe or explosion hazardous areas. It possesses an intrinsically-safe sensor circuit conforming to EEx ia IIC and IIB. A list of certificated combinations is to be found in »Notes on Safety« preceding this chapter. A working system for level measurement comprises:

- Silometer FMX 570 transmitter,
- Capacitance, Multicap or Deltapilot S probe
- Electronic insert

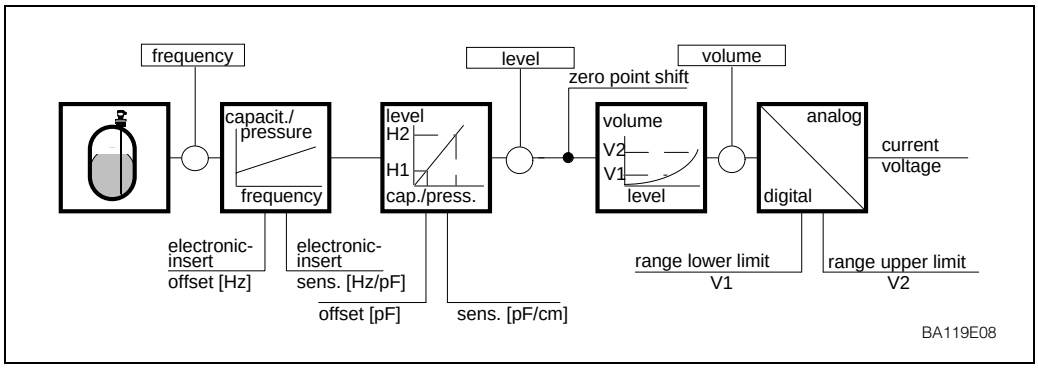


Fig. 1.2 Signal processing in the Silometer FMX 570

Silometer function

The capacitance or pressure measured by the sensor is converted into a frequency signal by the electronic insert located in its head. The Silometer FMX 570 supplies the power and receives a level-proportional frequency signal over a two-core cable. The signal is then processed to provide a level or volume measurement.

Fail-safe operation

If a fault condition is detected, e.g. a break in sensor - transmitter cable, the analogue signal switches to -10 % or +110 % level or holds the last measured value. In addition, the alarm relay de-energises.

1.2 Measuring principle

The Silometer FMX 570 measures level on the basis of the capacitance and hydrostatic measurement principles. In both cases the measured value is processed by the electronic insert and passed on as a frequency signal.

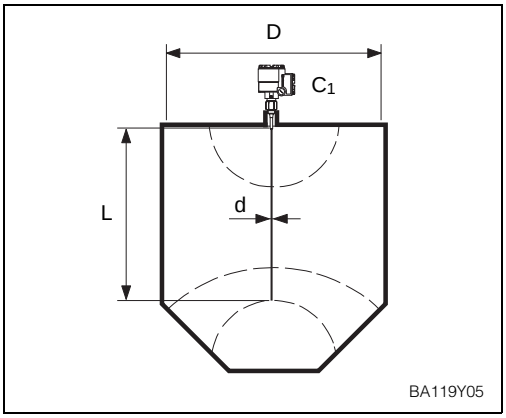


Fig. 1.3
Capacitance measurement principle

Capacitance measurement

The probe and vessel form the two plates of a capacitor, the total capacitance of which can then be calculated from the formula:

$$C_{tot} = C_1 + \frac{2\pi\varepsilon_0\varepsilon_r \times L}{\ln (D/d)} \quad pF \quad (1)$$

whereby
C_{tot} = total capacitance
C_1= capacitance or feed through
ε_0= dielectric constant of air
ε_r= rel. dielectric constant of product
D= diameter of vessel
d= diameter of probe
L= length of probe immersed in product in meters

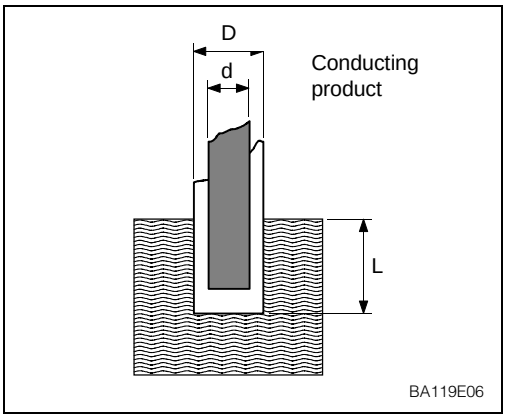


Fig. 1.4
Measurement in conducting media

Measurement in conducting media

If the product conducts, the capacitance is determined by the thickness and properties of the insulating material surrounding the probe. Equation (1) applies, whereby the variable D is now the diameter of the probe with insulation. In this case the capacitance varies by approx. 300 pF/m.

Measurement is independent of dielectric constant and not affected by changes in this variable.

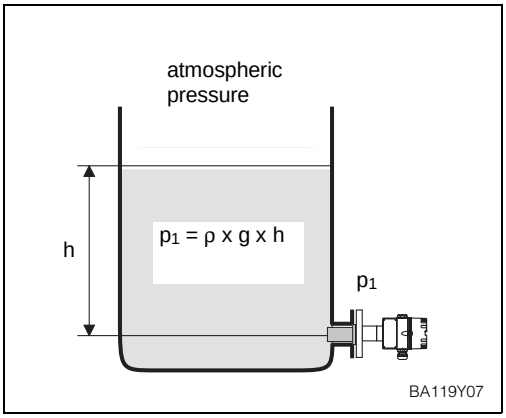


Fig. 1.5
Hydrostatic measurement principle

Hydrostatic measurement

In an open vessel, the level is derived from the hydrostatic pressure exerted by a column of liquid on a probe placed at its foot. The pressure exerted is:

$$p_1 = \rho \times g \times h \quad (2)$$

whereby
p_1 = hydrostatic pressure
ρ = density of the liquid
g = acceleration due to gravity
h = height of the liquid column.

Assuming a constant density, the level of the liquid can be calculated from the pressure measured by the Deltapilot.

2 Installation

This Chapter describes:

- The probes for use with the Silometer FMX 570
- Silometer installation in a rack or Monorack housing
- Transmitter wiring
- Sensor connection.
- Technical data.

Warning!

Warning!
- The Silometer FMX 570 transmitter must be installed outside explosion hazardous areas.

2.1 Probes and sensors

Table 2.1 lists the probes most frequently used with the Silometer FMX 570 transmitter. In addition to those listed, all probes which can be used with an EC 37 Z or EC 47 Z electronic insert can be connected to the transmitter. Installation hints can be taken from the appropriate Technical Information Sheet.

Table 2.1: Selection of probes suitable for use with the Silometer FMX 570

Principle	Probe	TI sheet	Insert
Capacitance, Multicap	11 500 Z	TI 161F	EC 37 Z
	Multicap DC 11	TI 169F	EC 47 Z
	Multicap DC 16	TI 096F	FEC 12
	Multicap DC 21	TI 208F	
	Multicap DC 26	TI 209F	
	Multicap TA	TI 239F	
	Multicap TE	TI 240F	
	Multicap E	TI 242F	
	Multicap A	TI 243F	
Hydrostatic pressure	Deltapilot S DB 50...53	TI 031F TI 257P	FEB 17 (P)

Sensor constants

Deltapilot S sensors and EC 37 Z/47 Z inserts for capacitance probes are supplied with the sensor constants zero frequency »fo« and sensitivity »Δf« or »S«. For Deltapilot S sensors the constants are printed on a label stuck inside the sensor head, for inserts they are printed on the name plate, see Fig. 7.1, Section 7.3.

Note these constants and enter them into fields V3H5 and V3H6 during commissioning, Section 4.1. This dispenses with the need for a recalibration of the transmitter on replacement of the sensor or insert.

Table 2.2: Measuring ranges and sensor constants of the Deltapilot S DB 5x

Cell type	Electronic insert FEB 17/FEB 17 P							
	Range		f_0	Δf	Range		f_0	Δf
0.1 bar	BA	0…100 mbar	200	10	DA	-100…100 mbar	200	5
0.4 bar	BB	0…400 mbar	200	2.5	DB	-400…400 mbar	200	1.25
1.2 bar	BC	0…1200 mbar	200	0.833	DC	-900…1200 mbar	200	0.476
4.0 bar	BD	0…4000 mbar	200	0.25	DD	-900…4000 mbar	200	0.204

2.2 Silometer installation

There are three possibilities for installing Silometer transmitters:

- Standard 19" rack with space for 12 7HP cards,
- Field housing with space for up to 6 7HP cards,
- Monorack housings for single transmitters.

Rack installation

A Racksyst system can be ordered fully wired, in which case the sensors and the external power supply only need to be wired. Planning hints can be found in Publication SD 041/00/e, »Racksyst Assembly Racks« .

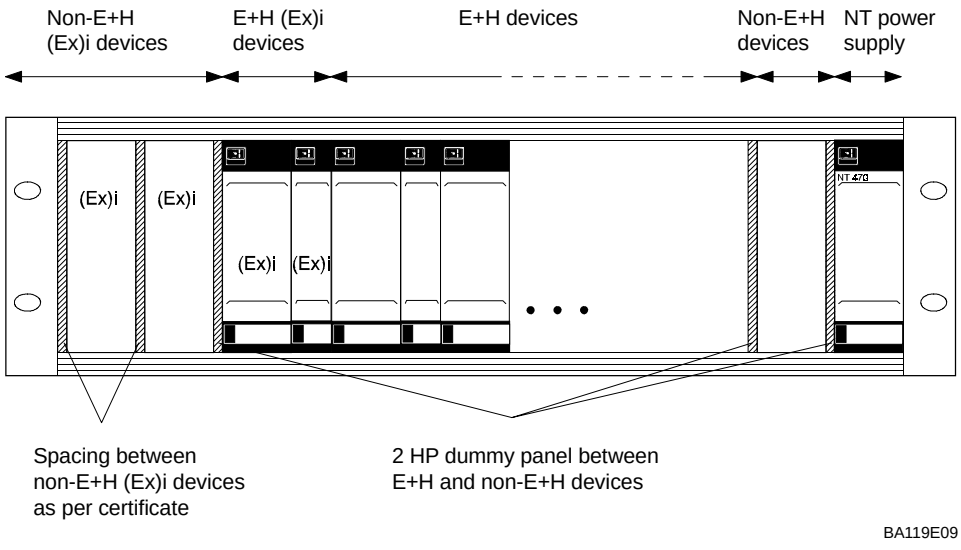


Fig. 2.1: Recommended arrangement for Racksyst rack assemblies

For non-Racksyst installations and for installations including non-Racksyst cards, fill the rack as follows (see also Fig. 2.1):

Rack arrangement

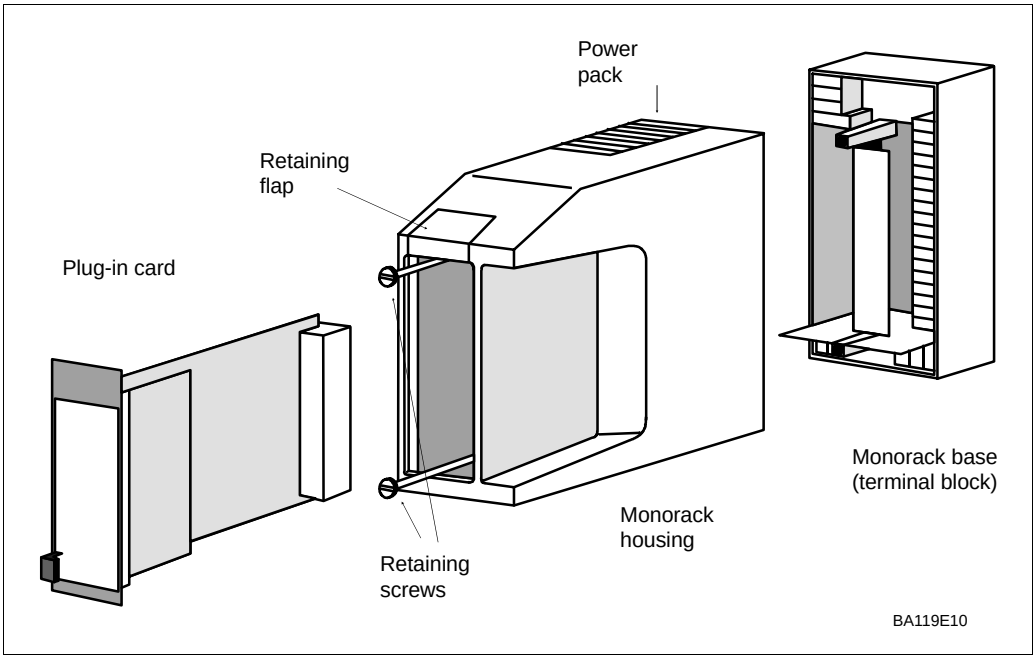
Step	Procedure
1	Allocate the power supply (NT 470) at the rightmost position. - If two NT 470s are used, install a 2 HP dummy panel between them.
2	Install non-intrinsically safe transmitters next to the power supply. - Install a 2 HP dummy panel between all foreign transmitters and between Racksyst cards and foreign transmitters
3	Install intrinsically safe transmitters to the left of the rack. - Install foreign cards first. - Install dummy panels between all foreign transmitters and between Racksyst cards and foreign transmitters in accordance with the instructions on the Ex-Certificate. - No spacer is required between Racksyst cards.

Racksyst field housing

Instructions for installing Commutec transmitters in the Racksyst field housing with half 19" rack are to be found in Publication PI 003.

- Check that the field housing is not installed in direct sunlight.
  - If appropriate fit a protective sun cover.
- The maximum permissible ambient temperature for the field housing varies between +50…+60 °C according to the power consumption of the cards (0…20 W)

Fig. 2.2:
Assembly and disassembly of the Monorack housing



Monorack housing

The Silometer FMX 570 transmitter and Monorack housing are supplied separately. The system must be assembled as shown in Fig. 2.2 before use.

- The Monorack is prepared for wall-mounting, degree of protection IP 40.
- The site must be chosen such that the operating temperature of -20°C…+60°C for one Monorack and -20°C…+50°C for Monorack banks is not exceeded.

Full details of the Monorack installation procedure can be taken from the manual supplied with it.

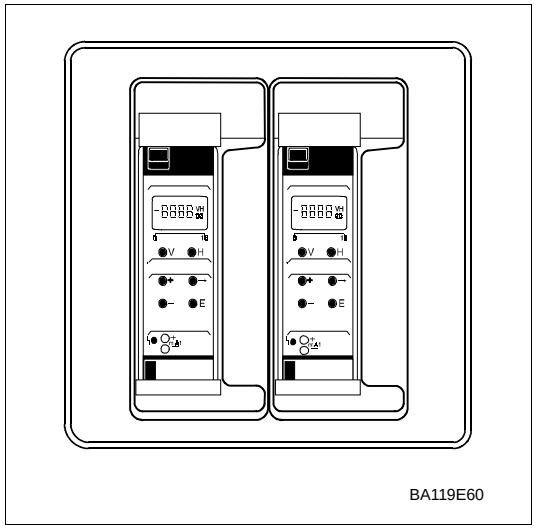
Monorack protective housing

If the Silometer FMX 570 transmitter and Monorack housing are to be mounted at an exposed site, then it is recommended that they be installed in the protective housing, degree of protection IP 55, which is available as an accessory.

- The protective housing accomodates two Silometer FMX 570 transmitters.
- The permissible ambient temperature is -20°C…+50°C for one Monorack and -20°C…+40°C for two.

Dimensions and instructions for installation are to be found in the Technical Information sheet TI 099/00/e.

Fig. 2.3:
Monorack protective housing



2.3 Transmitter wiring

Warning!
- Make electrical connections with the power supply switched off!
- When wiring up probes and sensors in explosion hazardous areas, observe the instructions on the certificate and other appropriate regulations.

Warning!

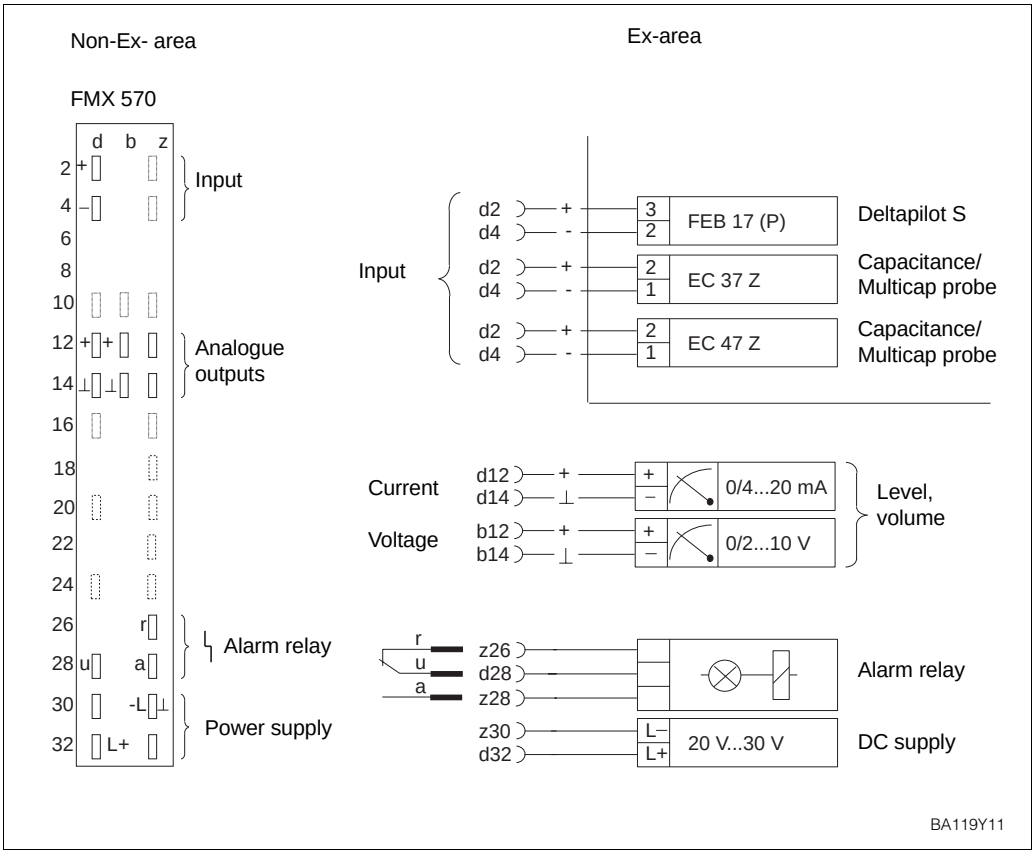


Fig. 2.4:
Pin assignment diagram for Silometer FMX 570

Fig. 2.4 is a pin assignment diagram for the Silometer FMX 570.

Rack wiring

- Terminals z 30, b 14 and d 14 are connected internally
- Inputs d2, d4 are electrically isolated from the circuit and each other.
- The circuit zero of the unit (⊥) is connected to the negative terminal of the supply voltage.

Note!
- Two indexing pins, at positions 2 and 9 in the rack connector ensure that Silometer FMX 570 transmitters only can be inserted at these points. The pins must be inserted if the rack is not custom built by Endress+Hauser.

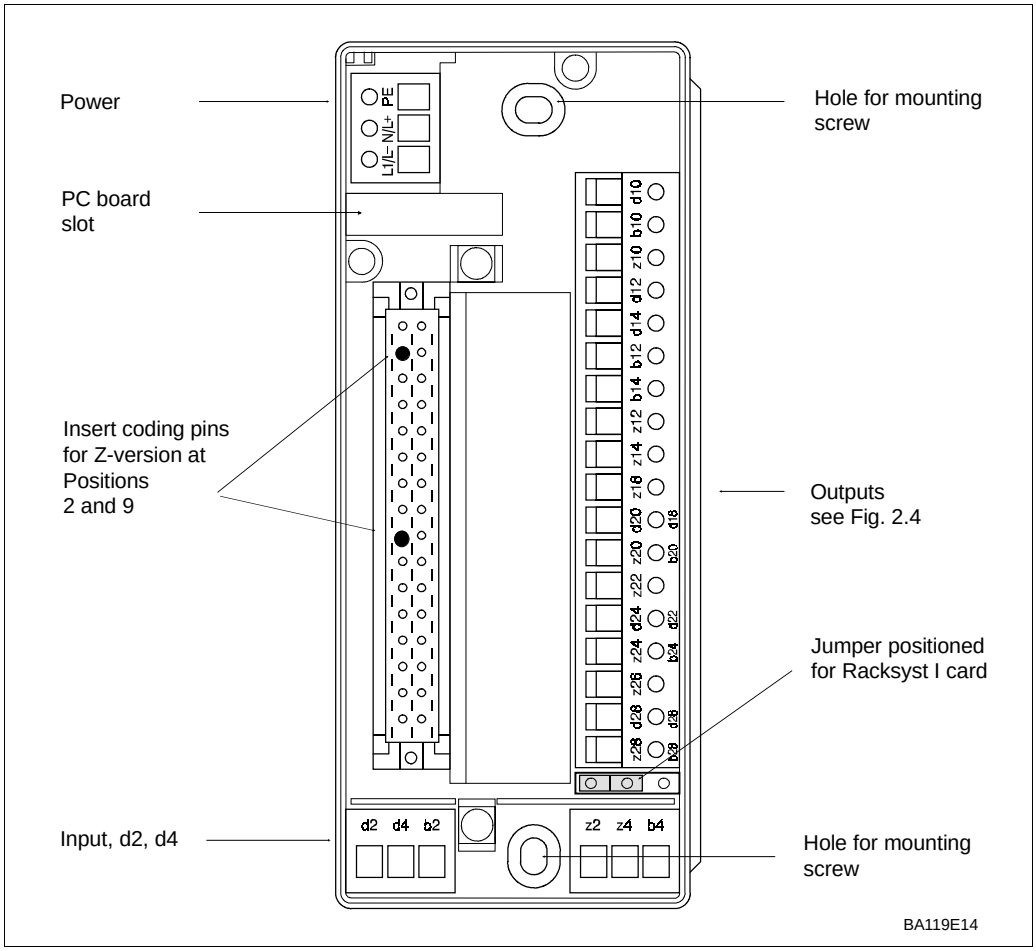
Note!

Analogue outputs

The negative terminal of the current output, of the voltage output and of the supply voltage are connected to the circuit zero of the Silometer FMX 570 module.

- Any number of measurement and control units can be connected in parallel to the voltage output, provided that all potentials are related to negative terminal of the 24 V supply ($R_L \geq 10$ kOhm).
  - There is no limit to the number of floating devices, apart from that imposed by considerations of maximum or minimum load.
- Only one non-floating device can be connected to each of the current outputs.

Fig. 2.5: Layout of Monorack terminal blocks



Monorack wiring

Fig. 2.5 shows the layout in the base of the Monorack II housing, the pin assignments correspond to those in Fig. 2.4. When connecting together several Monoracks, follow the instructions supplied with the housing.

- Set the jumper to position "Racksyst I"
- Insert the coding pins supplied at positions 2 and 9 in the female connector at the base of the housing.
- The pin assignments printed in black are valid for the Silometer FMX 570.

Note!

Note!
If you are installing the Silometer FMX in a Monorack I housing, please note that there is no jumper switch. In addition, for the 24 VDC version, the dummy card in the power control slot must be replaced by the 24 V card supplied.

2.4 Sensor connection

The Silometer FMX 570 can be operated with a variety of sensor types, each requiring a different electronic insert, e.g.:

- EC 37 Z or EC 47 Z for capacitance and Multicap probes
- EB 17 Z or EB 27 Z for Deltapilots

Sensor cable

Use commercial 2-core installation cable, max. line resistance 25 Ω/core, for the sensor/transmitter cable. If electromagnetic interference is to be expected, we recommend

- that the PFM negative line be grounded at the sensor (check Ex-regulations)
- in case of heavy interference, that shielded cable be used, grounded at both ends.

EC 37 Z and EC 47 Z

The electronic inserts EC 37 Z and EC 47 Z have two measuring ranges which can be selected by inserting a bridge between terminals 4 and 5 of the insert, see Fig 2.6. Full instructions on the selection of the insert are to be found in Publication E 07.80.06/1c.

- Note the zero frequency f_o____ and sensitivity S_____on the insert.

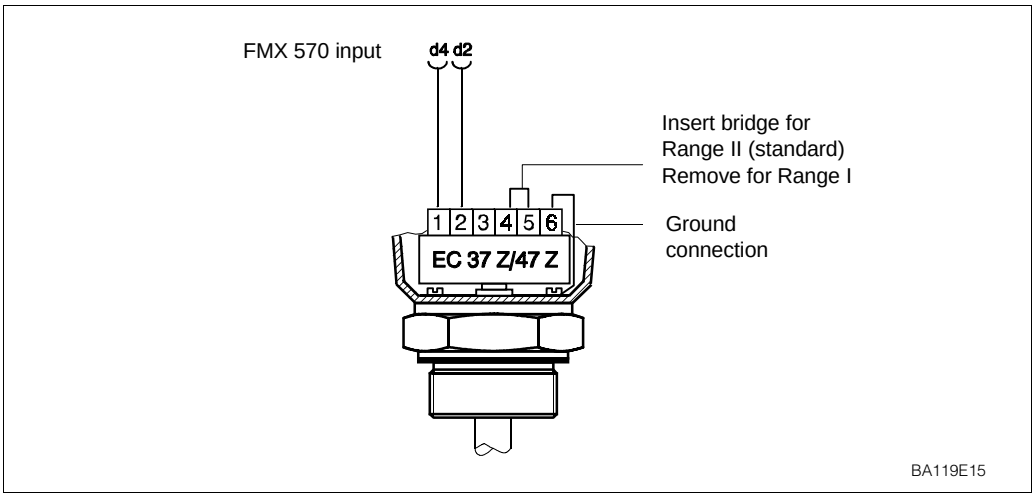


Fig. 2.6:
Connection diagram for electronic inserts EC 37 Z/EC 47 Z

FEB 17 (P)

The FEB 17 (P) electronic insert can be used with Deltapilot S sensors to measure level and volume in open vessels.

- Note the zero frequency f_o_____ and sensitivity Δf _____ of the probe (see Table 2.2 on page 8)

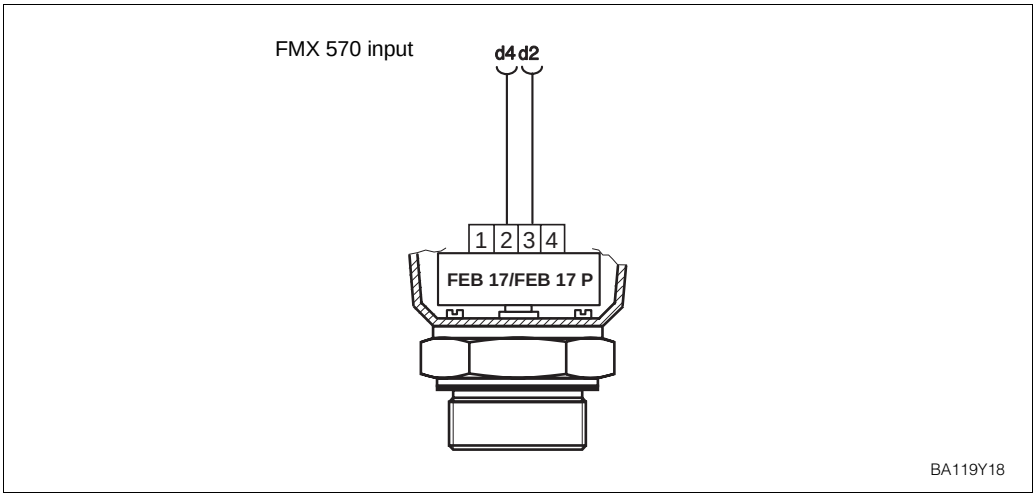
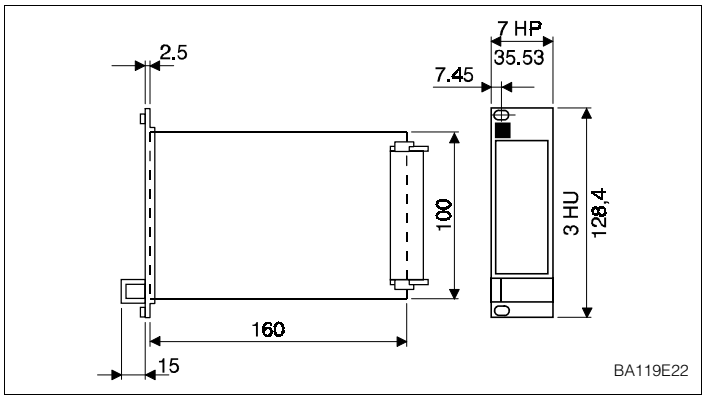


Fig. 2.7:
Connection diagram for electronic insert FEB 17 (P)

2.5 Technical data: Silometer FMX 570 transmitter

Fig. 2.8
Silometer FMX 570 plug-in card



Construction

- Design: 19", 7 HP, plug-in card
- Front panel: black synthetic with blue field inlay, grip and markings, Protection: IP 20 (DIN 40050)
- Dimensions: see diagram
- Weight: approx. 0.3 kg/11 oz
- Operating temperature: -0 °C...+70 °C/+32 °F..158 °F
  Storage temperature: -20 °C...+85 °C/-4 °F...185 °F

Electrical connection

- Multipoint plug: conforming to DIN 41612, Part 3, Type F (28-pole) Coding pins in positions 2 and 9
- Power supply: 24 V DC (+6 V…-4 V); residual ripple 2 V, within tolerance
- Supply current: approx. 90 mA, max. 125 mA
- Signal inputs: Electrically isolated from the rest of the circuitry. Protection [EEx ia] IIC or IIB
- Probes: Capitance probes, impedance probes with EC 37 Z or EC 47 Z electronic insert
  Deltapilot S with electronic insert FEB 17 / FEB 17 P
- Electromagnetic compatibility: Interference Emission to EN 61326, Electrical Equipment Class A
  Interference Immunity to EN 61326

Outputs

- Analogue output: 0...20 mA/4...20 mA selectable, R_L max. 500 Ω
  0...10 V/2...10 V selectable, R_L min. 10 k Ω
- Alarm relay relay with a potential-free change-over contact
  Max. switching capacity:
  2.5 A, 250 VAC, 300 VA at cos φ > 0.7 *or*
  100 VDC, 90 W

Certificates

- Silometer FMX 570 Intrinsically safe circuit to [EEx ia] IIC and IIB
  (PTB certification in preparation)
  see also »Safety Notes«.

3 Controls

This Chapter describes how the Silometer FMX 570 transmitters are operated. It is divided into the following sections:

- Commutec operating matrix
- Configuration and display: Silometer FMX 570

3.1 Commutec operating matrix

All functions, including the analogue outputs and relay switch points are configured via the operating matrix, see Fig. 3.1:

- Each field in the matrix is accessed by a vertical (V) and horizontal (H) position which can be entered at the front panel of the FMX 570 with the V and H keys
- The parameters are entered with the plus, minus, arrow and enter keys.

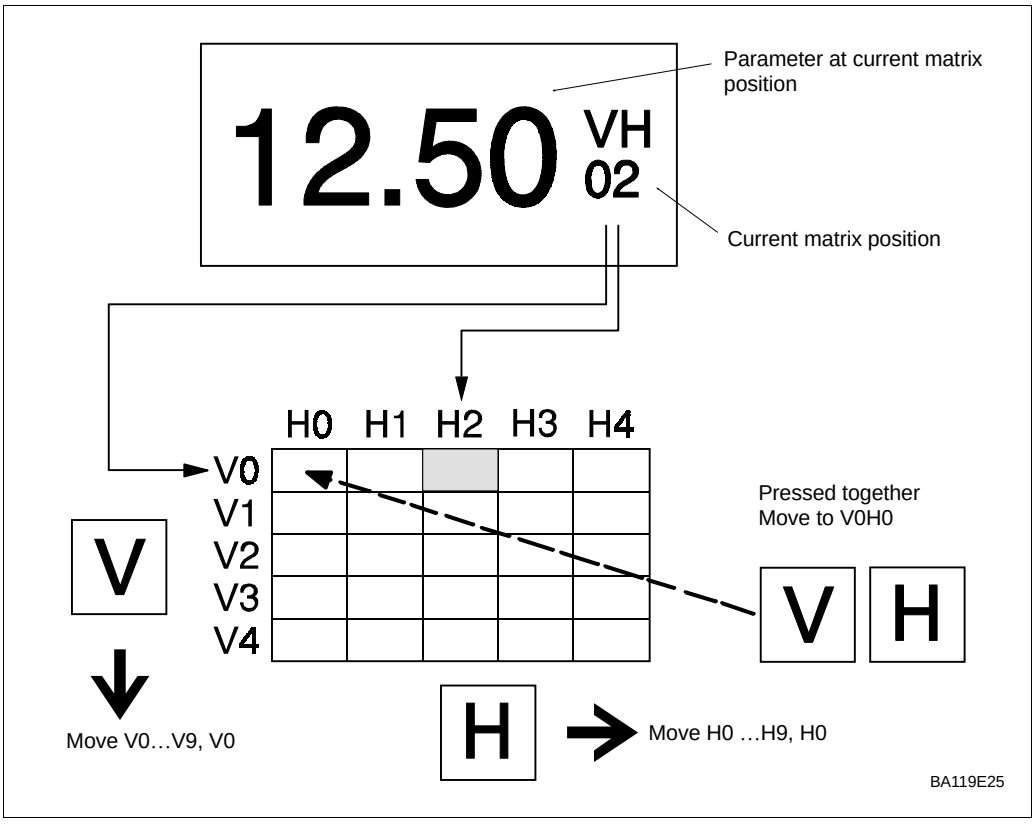


Fig. 3.1:
Silometer FMX 570 display
Parameter matrix operation with function of V and H keys.
The complete matrix has 10 x 10 fields, although not all are used

3.2 Configuration and display

Fig. 3.2: Front panel of the Silometer FMX 570 transmitter

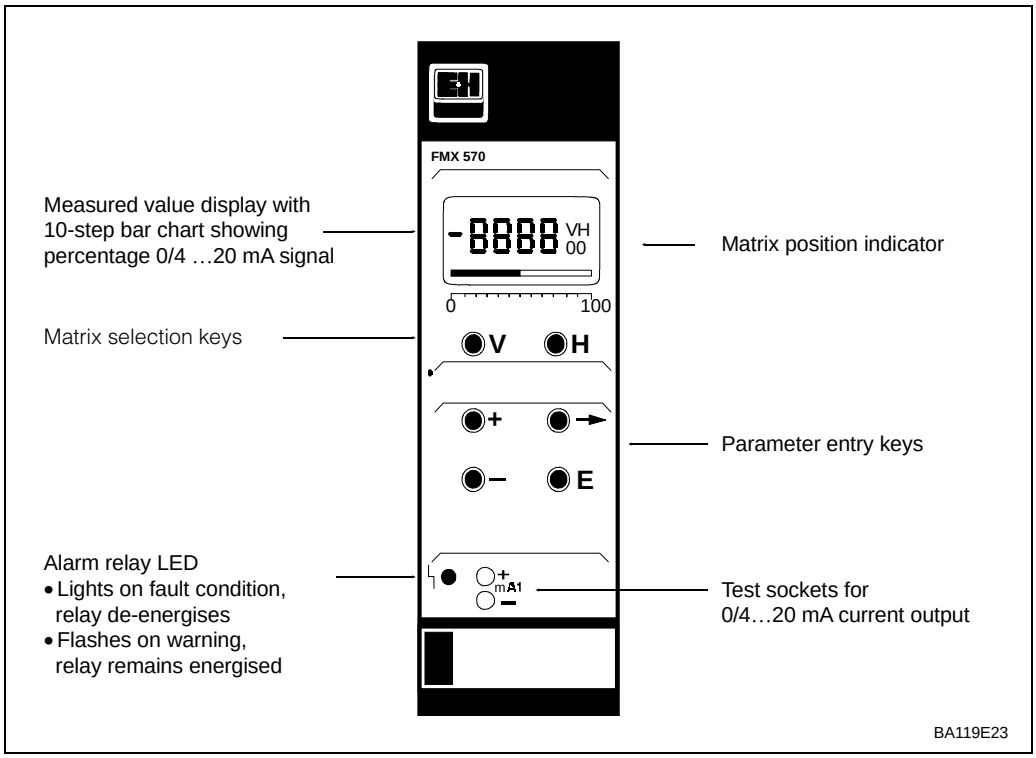


Fig. 3.1 shows the LC-display with matrix of the Silometer FMX 570, Fig. 3.2 its front panel. Table 3.1 below describes the function of the operating keys.

- Changes are not possible if the matrix has been locked (Section 4.7).
- Non-flashing parameters are either read-only indications or locked entry fields.

Table 3.1: Silometer FMX 570 Parameter entry and display keys

Keys	Function
Matrix selection	
V	• Press V to select the vertical position.
H	• Press H to select the horizontal position
V + H	• Press simultaneously to select the measured value field, V0H0
Parameter entry	
→	• Select the digit to be changed. The digit at the extreme left is selected and flashes. • Move to the next digit by pressing »⇒« again. When the last digit is reached »⇒« selects the leftmost digit again.
+ + →	• To change the position of the *decimal point*, press down both »⇒« and »+«. The decimal point moves 1 space to the right.
+	• Increases the value of the flashing digit
–	• Decreases the value of the flashing digit • To enter a *negative number* decrease the leftmost digit until a minus sign appears in front of it
E	• Press »E« to register entry. • Unregistered entries remain ineffective and the instrument will operate with the old value.

4 Calibration and Operation

This chapter is concerned with the basic settings of the Silometer FMX 570 which allow it to operate for continuous level measurement. The principle sections describe:

- Commissioning
- Calibration for level measurement
- Calibration for linear volume or weight measurement
- Dry calibration for Deltapilot probes
- Level offset
- Display of measured values
- Locking the parameter matrix.

The linearization for volume or weight measurements is described in Chapter 5, the setting of the analogue outputs in Chapter 6 and the controls in Chapter 3.

Note your settings!

When configuring, note your parameters in the Table in the rear cover.

- If the transmitter is ever replaced, these parameters can be entered at the front panel. The transmitter will then measure correctly without the need for another calibration.

4.1 Commissioning

If programming the module for the first time, reset the module to the factory based parameters, see Table in back cover. Then enter the probe constants fo and S (Δf). This ensures that the EC 37 Z/EC 47 Z electronic insert or Deltapilot can be replaced without the need for recalibration, see Section 7.3.

Step	Matrix	Entry	Significance
1	V9H5	e.g. 672	Enter any number 670…679 to reset transmitter
2	-	»E«	Register change
3	V3H5	e.g. 475.3	Enter zero frequency f_o (offset) of electronic insert or sensor
4	-	»E«	Register change
5	V3H6	e.g. 0.652	Enter sensitivity, S or Δf, of electronic insert or sensor
6	-	»E«	Register change

Operating mode

The operating mode is set at V8H0. Since the default value corresponds to level measurement, this step can be omitted if the transmitter has been reset.

For a recalibration without reset check that mode 1, is on display:

- 1 = continuous level measurement, Sections 4.2, 4.3, 4.4.
- 6 = simulation, see Chapter 7, Section 7.2.

Step	Matrix	Entry	Significance
1	V8H0	e.g. 1	Mode 1, continuous level measurement
2	-	»E«	Register entry

4.2 Calibration for level measurement

This calibration requires the determination of two parameters,

- an »empty« level at V0H1,
- a »full« level at V0H2.

After calibration

If the level is entered in %, after the calibration:

- % level is displayed at V0H0
- the 0/4…20 mA signal range corresponds to 0…100% level
- the parameters »offset« and »sensitivity« are calculated and stored at V3H1/V3H2.

If the level is entered in m, ft. etc. the analogue outputs must be set in the same units, see Chapter 6.

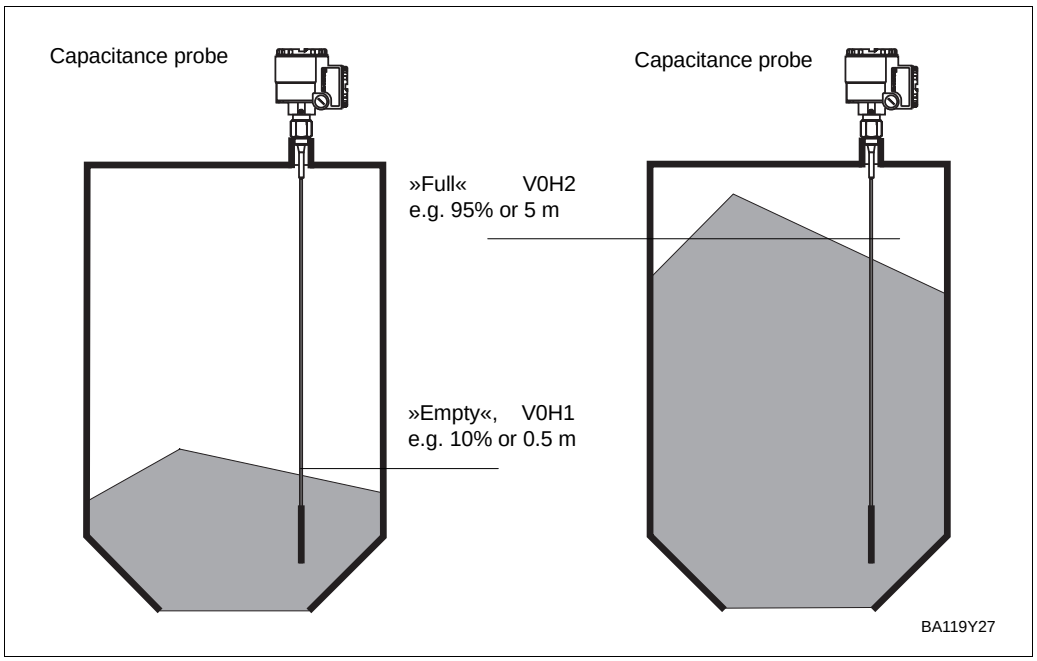


Fig. 4.1: Parameters required for calibration of the Silometer FMX 570 for level measurement shown for bulk solid measurement. Any filling mound or outflow depression can be accounted for by the parameters entered.

Procedure

Step	Matrix	Entry	Significance
1	V0H1	e.g. 10%	Fill the vessel until the probe is covered (ca. 0…40%) and enter the level you wish to have displayed.
2	-	»E«	Register entry
3	V0H2	e.g. 95%	Fill the vessel as far as possible (ca. 60…100%) and enter the level you wish to have displayed.
4	-	»E«	Register entry
5	V0H0		The measured value is shown in the units selected.

Note!

Note!
- The calibration can be performed in reverse order
- For bulk solids, the probe measures the depth of emersion in the product only. Account for any filling mound or outflow depression by the entered levels.
- For the Deltapilot S (liquids only), a »dry calibration« can be made see Section 4.4.
- If appropriate, a linearization can now be carried out, see Chapter 5.

4.3 Calibration for linear volume or weight measurement

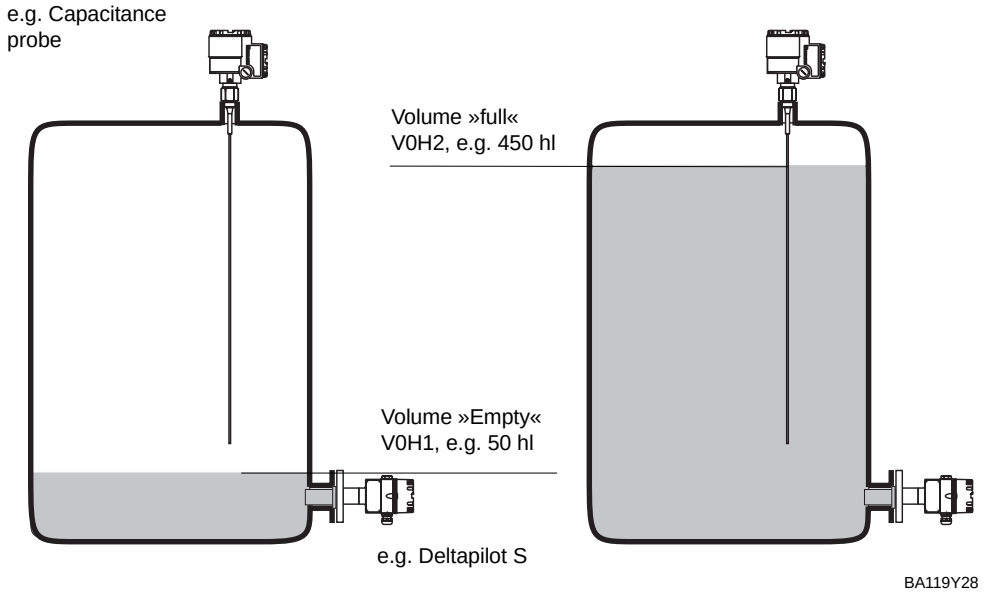


Fig. 4.2: Parameters required for calibration of the Silometer FMX 570. Example for volume measurement of liquids with capacitance probe or hydrostatic pressure sensor

The Silometer FMX 570 can also be calibrated in volume or weight units, e.g. in litres, hectolitres, gallons, %vol, tonnes or kg. After calibration volume (or weight) is displayed at V0H0. The analogue output must be set in the same units, as described in Chapter 6.

If the level/volume relationship is not linear, i.e. the tank is a horizontal cylinder or has a conical outlet, the volume calibration is performed as part of the linearization procedure. In this case, before proceding further, turn to Chapter 5, Section 5.1 or 5.2 to determine the correct order of parameter entry.

Procedure

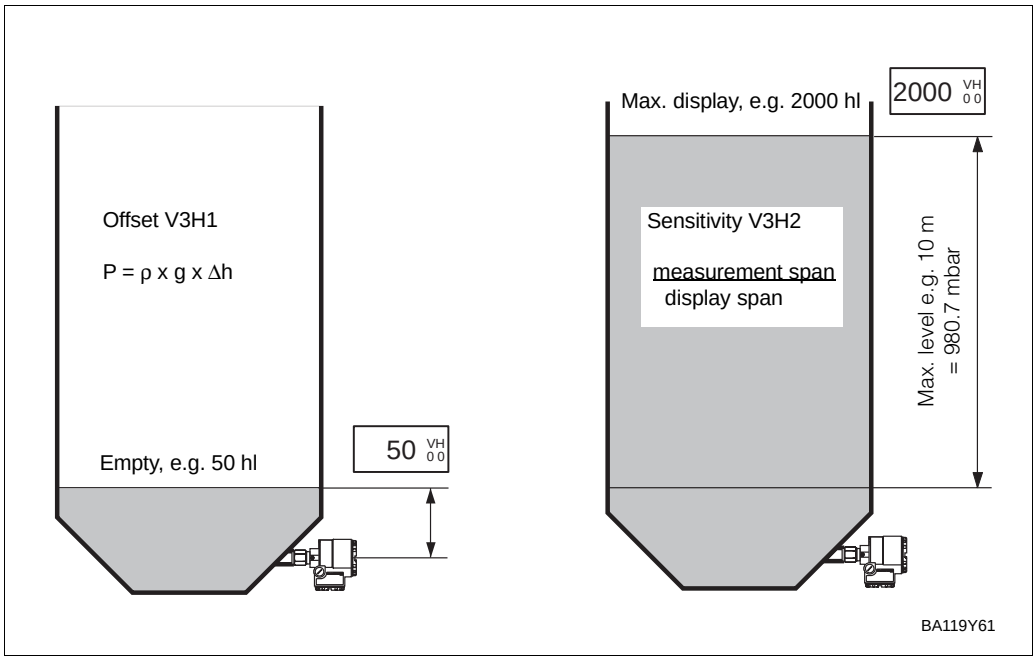
Step	Matrix	Entry	Significance
1	V0H1	e.g. 50 hl	Fill the vessel until the probe is covered (ca. 0…40%) and enter the volume (or weight) you wish to have displayed.
2	-	»E«	Register entry
3	V0H2	e.g. 450 hl	Fill the vessel as far as possible (ca. 60…100%) and enter the volume (or weight) you wish to have displayed.
4	-	»E«	Register entry
5	V0H0		The measured value is shown in the units selected.

Note!
- The calibration can be performed in the reverse order.
- If the level/volume relationship for the vessel is not linear, first see Chapter 5.

Note!

4.4 »Dry calibration« for open vessels (Deltapilot)

Fig. 4.3: Parameters for dry calibration with Deltapilot probes



It may not always be possible to fill and empty the vessel for the calibrations as described in Sections 4.2 and 4.3. To cover this eventuality the Silometer FMX 570 can be calibrated »dry« by using the sensor constants. For this alternative calibration you need:

- the »zero frequency« and »sensitivity« of the sensors,
- the »empty« level or offset at which the measurement should start
- the maximum height of the liquid column and
- the density of the liquid.

Caution!

Caution!
- Check the calibration during the first filling of the tank! If your calculations are incorrect the levels measured will be incorrect also!

Sensor constants f_o, Δf V3H5/V3H6

The sensor constants »f_o« and »Δf«, see Section 2.1, are to be found in Table 2.2 on page 9. For the theoretical calibration, however, it is recommended that the zero frequency of the installed Deltapilot S at atmospheric pressure is read from V0H8.

Step	Matrix	Entry	Significance
1	V3H5	e.g. 99.5	Enter »f_o« value (read from V0H8)
2	-	»E«	Register entry
3	V3H6	e.g. 1.02	Enter »Δf« value
4	-	»E«	Register entry

Note!

Note!
- The zero frequency of the sensor is in fact dependent upon the sensor orientation, so that there may be a slight difference between the value read from Table 2.2 and that of the factory calibration which is printed in the sensor housing. This effect is compensated during the standard calibration, where the factory values are used.

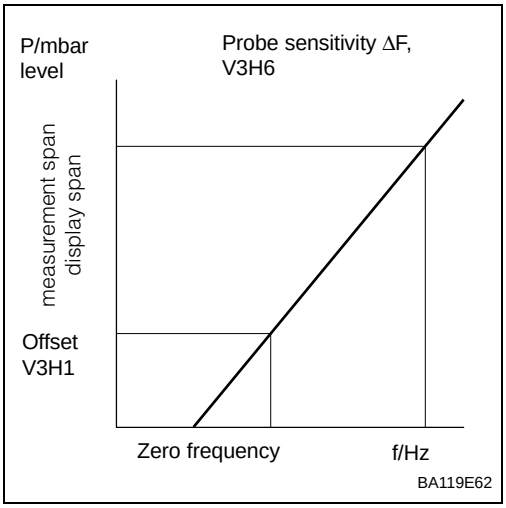


Fig. 4.4:
Parameters for dry calibration with Deltapilot probe

Offset and sensitivity of the display, V3H1/V3H2

The entry of values in V3H5/V3H6 adapts the Silometer to the application. It now knows which pressure is associated with a particular frequency. The next step is to adapt the display, i.e. the measuring range is fixed. This requires the entry of:

- the offset in *mbar* in V3H1
  The offset is the pressure in mbar which acts on the sensor when the display reads »0«, i.e.

  $V3H1 = p_{zero}$

- the sensitivity in *mbar/digit* in V3H2
  The sensitivity determines the change in the measured value Δh in V0H0 per mbar change at the sensor, i.e.

  $V3H2 = \Delta p/\Delta h = (p_2 - p_1)/(h_2 - h_1)$

- the pressures: $p_{mbar} = 10 \times \rho\ (kg/dm^3) \times g\ (m/s^2) \times \Delta h\ (m)$

Example 1:

Example: For 0.45 m water display = 0%, for 10 m water, display = 100%

• Maximum display	= 100%
• Determine pressures	
p_{zero} = 10 x 1.0 x 9.807 x 0.45	= 44.13 mbar
$p_{100\%}$ = 19 x 1.0 x 9.807 x 10	= 980.7
• Sensitivity = Δp/Δh	
= (980.7 - 44.13)/(100 - 0) = 936.6/100	= 9.366 mbar/%
• Offset, V3H1	**= 44.13 mbar**
Sensitivity, V3H2	**= 9.366 mbar/%**

Example 2:

Example: For 0.45 m water display = 50 hl, for 10 m water, display = 2000 hl

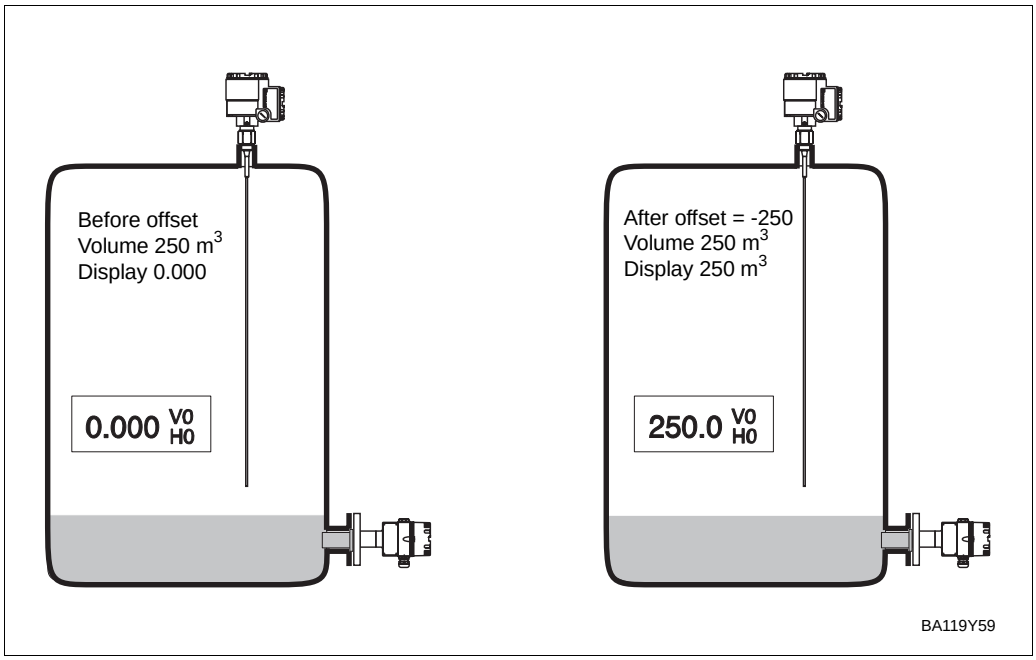
• Maximum display	= 2000 hl
• Determine pressures	
$p_{50\ hl}$ = 10 x 1.0 x 9.807 x 0.45	= 44.13 mbar
$p_{2000\ hl}$ = 19 x 1.0 x 9.807 x 10	= 980.7
• Sensitivity = Δp/Δh	
= (980.7 - 44.13)/(2000 - 50) = 936.6/1950	= 0.4803 mbar/hl
• Since 50 hl is displayed for 0.45 m water,	
p_{zero} has to be calculated	
p_{zero} = $p_{50\ hl}$ - h1 x sensitivity	
= 44.14 - 50 x 0.4803 = 44.13 - 24.01	= 20.12
• Offset, V3H1	**= 20.12 mbar**
Sensitivity, V3H2	**= 0.480 mbar/hl**

»Dry calibration«, Sensor adjustment

Step	Matrix	Entry	Significance
1	V3H1	e.g. 20.12	Enter offset (V0H0 displays 50 for 45 cm water)
2	-	»E«	Register entry
3	V3H2	e.g. 0.480	Enter sensitivity
4	-	»E«	Register entry
5	V0H0		The measured value is displayed in the units selected

4.5 Level offset value

Fig. 4.5: Effect of level offset on display at V0H0 for level measurement without linearization



The calibration determines the level displayed at V0H0 for a particular head of liquid. By entering a level offset at V3H4 the displayed value can be corrected by the value entered.

- The offset is *subtracted* from the true measured value
- It must be entered in the units you have used for calibration
- The analog output settings must be changed to follow the corrected measurement.

For example, the Silometer FMX has been calibrated to display 0.0 at the level shown in Fig. 4.5. Sometime later it is decided that the true volume measured from the bottom of the tank is to be measured, i.e. when the liquid reaches the calibrated zero level, the display must indicate say 250 m^3. The value -250 is entered:

Step	Matrix	Entry	Significance
1	V3H4	e.g -250	Enter amount by which the display is to be corrected in the units used for calibration
2	-	»E«	Register entry
3	V0H0	...	The corrected value is displayed (+250 instead of 0 at 0)

Note!

Note!

- The offset can also be used if a linearization has been performed. In this case, the offset is first subtracted from the »level« displayed at V0H9 and the result converted to the volume to be displayed at V0H0.

4.6 Measured value display

During normal operation the measured value can be read at V0H0 In addition to this, several other fields contain system information which might be needed, e.g., for trouble-shooting. Table 4.1 summarizes the measured value displays.

Table 4.1: Matrix positions of measured value displays

Channel 1	Measured value	Remarks
V0H0	Level or volume	Display in %, m, ft, hl, m^3, ft^3, t etc. according to calibration and/or linearization. The entries for the 0/4 mA and 20 mA value at V0H5 and V0H6 control the 10-step LCD bar diagram.
V0H8	Current measuring frequency	Displays the frequency which is actually measured by the probe. Can be used as a fault check (must change as level changes)
V0H9	Measured value before linearization	Indicates level in the units used for calibration or before linearization
V9H0	Current error code	Error code of fault with highest priority appears on fault condition, alarm LED lights or blinks
V9H1	Last error code	The previous (corrected) error code can be read and deleted here - press »E« to delete
V9H3	Software version with instrument code	The first two figures indicate the instrument, the last, the software version; 33 = Version 3.3

4.7 Locking the parameter matrix

When all parameter entries have been made (see also Chapters 5…6) the matrix can be locked by entering a code number.

Step	Matrix	Entry	Significance
1	V8H9	e.g. 888	Enter any code from 100 - 669 or from 680 - 999
2	-	»E«	Register entry

In this mode, all entries can be displayed but not changed.

- The lock is released when a number between 670 and 679, e.g. 672, is entered into the matrix at the same position.

5 Linearization

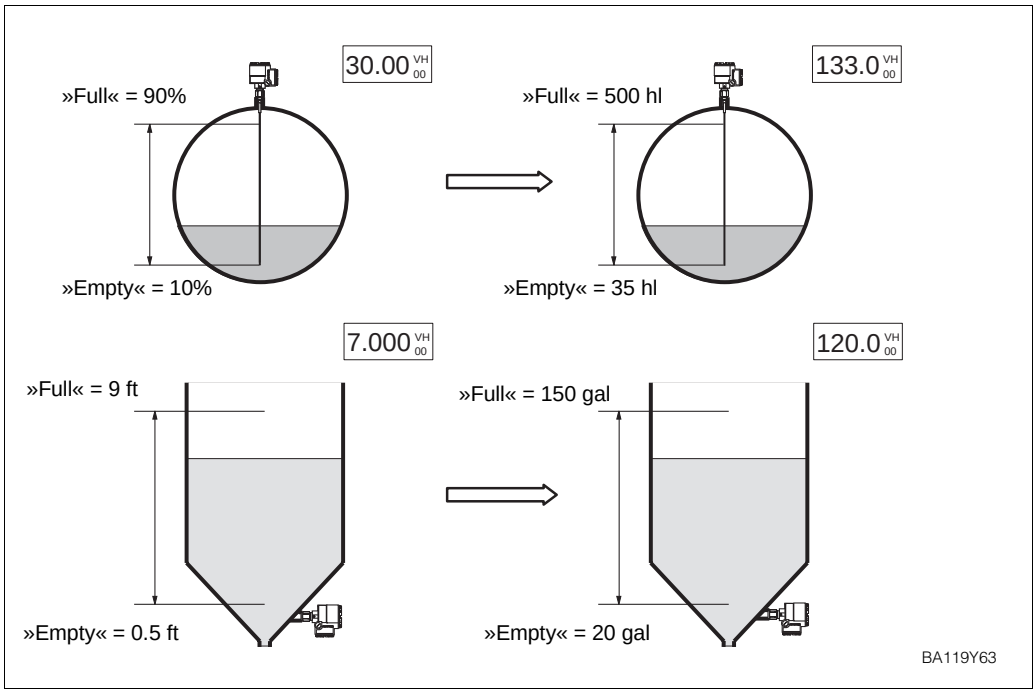


Fig. 5.1: Linearization for a vessel with a conical outlet

For tanks in which volume is not directly proportional to level, e.g. for horizontal cylinders or tanks with conical outlets, the linearization converts the level measurement into a measurement of capacity.

Parameters for linearization are selected and entered at fields V2H0…V2H8. In addition, the field V3H0 determines whether the associated calibration is to be performed in level or volume units (0 = level …default, 1 = volume). The following linearization modes can be entered at V2H0:

0 = linear, default value
1 = horizontal cylinder
3 = manual entry
4 = cancel current setting

The modes horizontal cylinder and manual entry for conical outlets are described in Sections 5.1 and 5.2, all others in Section 5.3.

Two important rules must be observed when performing a linearization:

- All level (or volume) entries must be made in the units you have chosen for calibration at V0H1 and V0H2.
- The levels for linearization and calibration must be referenced to the same datum point.

After linearization

After linearization:

- The volume of liquid currently in the tank can be read from V0H0.
- The level before linearization can be read from V0H9.
- The 0/4…20 mA signal range must be set in the volume units entered, see Chapter 6.

5.1 Linearization for a horizontal cylindrical tank

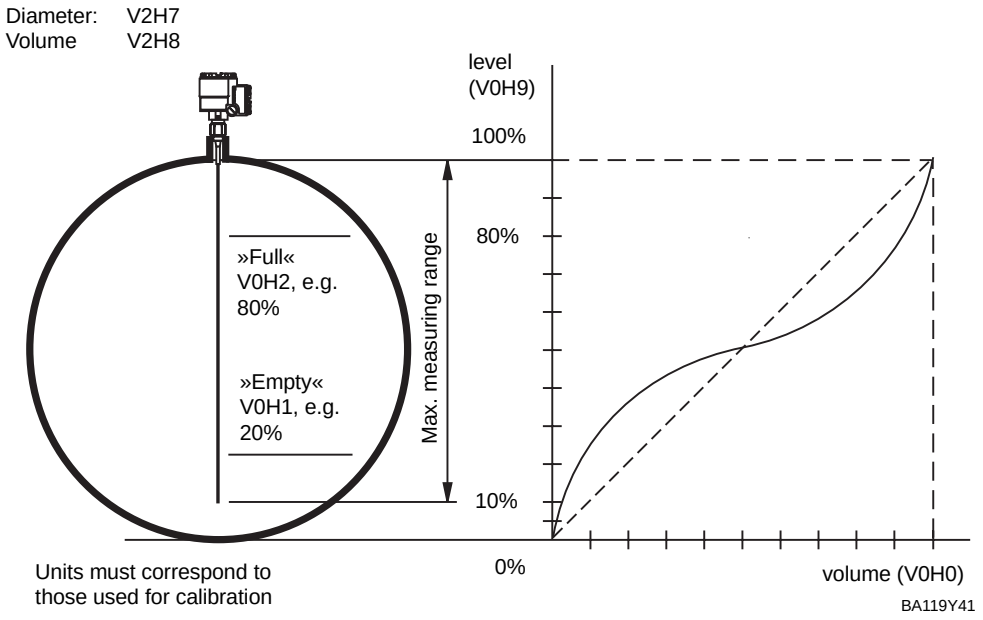


Fig. 5.2:
Parameters required for linearization of the Silometer FMX 570 for a horizontal cylinder

Use this mode if you have a cylindrical tank which lies horizontally. The Silometer FMX 570 transmitter uses a stored linearization table which requires the entry of the tank diameter, tank volume for its volume calculations.

Procedure

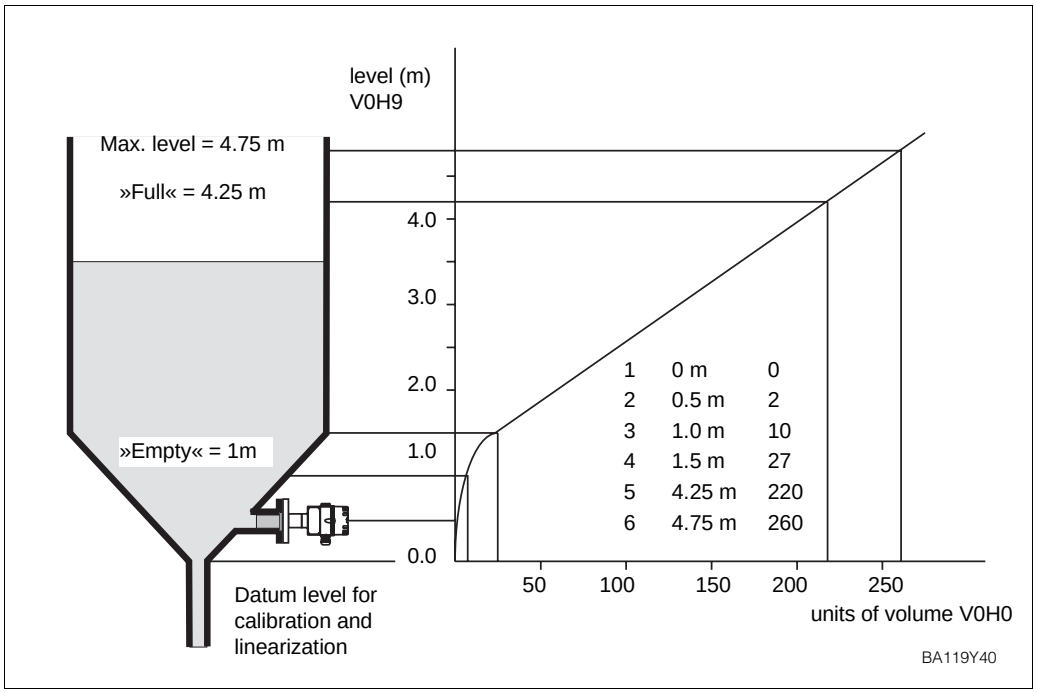
Step	Matrix	Entry	Significance
1	V9H5	e.g. 672	Reset, see Section 4.1 (default = operating mode 1) - Enter sensor constants at V3H5 and V3H6
2	-	»E«	Register entry
3	V3H0	e.g. 0	Select units to be used for calibration: 0 = level, 1 = volume
4	-	»E«	Register entry
5	V2H7	e.g. 10	Enter tank dia. (for level, in units to be used for calibration)
6	-	»E«	Register entry
7	V2H8	e.g. 200	Enter tank volume in the units you require - If 100 is entered, the system measures in % vol.
8	-	»E«	Register entry
9	V2H0	1	Select horizontal cylinder mode
10	-	»E«	Press »E« to activate linearization
11	V0H1/V0H2	-	Calibrate for level or volume , see Section 4.2 or 4.3.
12	V0H0/V0H9	-	V0H0 indicates volume, V0H9 level before linearization

Note!
- For capacitance or Multicap probes a ground tube is necessary or the liquid must be conducting.
- If a level calibration is made, V3H0 = 0, the calibration can preceed the linearization.
- If the calibration is to be in *volume units* (V3H0 = 1), *the sequence of steps must be exactly as shown above.*
- When V3H0 = 1, the entry at V2H7 fixes the end value for the level display at V0H9.

Note!

5.2 Linearization for a tank with conical outlet

Fig. 5.3: Linearization for a vessel with a conical outlet



Manual entry
V2H0 = 3

This option allows you to enter your own characteristic, whereby two possibilities exist for entering the level values:

- By hand: in this case both level and volume/weight parameters should be calculated and entered in a table prior to configuration. A level calibration can always be performed.
- Automatically: the tank is filled or emptied in known volume increments and the measured level is written into V2H4 by the system. This method can be used when the level/volume relationship is not known.

The automatic mode can also be used if you can calibrate in volume units only: perform the volume calibration first, e.g. when filling the tank, followed by the linearization with »level registration« e.g. when emptying the tank. In this case, however, the »level« values displayed at V0H9 have no significance. The entry mode is selected at V2H1:

- 0 = manual,
- 1 = automatic.

At the end of the linearization the system measures in the volume/weight units selected, e.g. m^3, ft^3, t, %. Use the Table overleaf to enter your values.

Note!

Note!
- You must enter at least two points:
  - The first level point should be below or at the level of the sensor. If it is not and the level drops below the first point, the linearization will extrapolate back!
  - The last level point should be greater than or equal to the maximum level to be measured.
  - The maximum value is 9998; 9999 cancels the entry.
- The maximum number of points is 30
- When all points have been entered and the linearization is activated, the points are sorted in rising volume and subjected to a plausibility check!

Manual linearization with tabular values

No. V2H2	Volume V2H3	Level V2H4	No. V2H2	Volume V2H3	Level V2H4
1			16		
2			17		
3			18		
4			19		
5			20		
6			21		
7			22		
8			23		
9			24		
10			25		
11			26		
12			27		
13			28		
14			29		
15			30		

Procedure

Step	Matrix	Entry	Significance
1	V9H5	e.g. 672	Reset transmitter (default = operating mode 1) - Enter sensor constants at V3H5 and V3H6
2	-	»E«	Register entry
3	V0H1/V0H2	-	Calibrate as described in e.g. Section 4.2
4	V2H1	0	Select manual entry of values
5	-	»E«	Register entry
6	V2H2	1…30	Enter table entry number
7	-	»E«	Register entry
8	V2H3	e.g. 0	Enter volume in required units
9	-	»E«	Register entry
10	V2H4	00.00	Enter level in units used in calibration
11	-	»E«	Register entry
12	V2H5	2…30	Enter next table entry number
13	-	»E«	Register entry. - The system jumps to V2H3, V2H2 is incremented
14	V2H3		Repeat steps 8 to 13 until all points are entered
15	V2H0	3	Select manual linearization table
16	-	»E«	Press »E« to activate linearization

Note!
• Set analogue output in units used for linearization

Note!

Manual linearization with automatic level registration

Step	Matrix	Entry	Significance
1	V9H5	e.g. 672	Reset transmitter (default = operating mode 1)
		-	Enter sensor constants at V3H5 and V3H6
2	-	»E«	Register entry
3	V0H1/V0H2	-	Calibrate as described in e.g Section 4.2
4	V2H1	1	Select automatic entry of level
5	-	»E«	Register entry
6	V2H2	1…30	Enter table entry number
7	-	»E«	Register entry
8	V2H3	e.g. 0	Fill vessel, enter volume in required units
9	-	»E«	Register entry
10	V2H4	-	Select level entry field
11	-	»E«	Press »E« to write measured level in matrix
12	V2H5	2…30	Enter next table entry number
13	-	»E«	Register entry
		-	The system jumps to V2H3, V2H2 is incremented
14	V2H3		Repeat steps 8 to 13 until all points are entered
15	V2H0	3	Select manual linearization table
16	-	»E«	Press »E« to activate linearization

Note!

Note!
- For this procedure the tank can be filled for calibration then emptied for linearization.
- If a volume calibration is performed, Section 4.3, then the value displayed at field V2H4 is a »volume« not a level.
- Set analogue output in same units as used for linearization

Corrections to manual linearization

An incorrect entry can be overwritten by selecting the appropriate table number at V2H2 and entering the new value at V2H3 or V2H4.

- If 9999 is entered, the entire point is deleted from the characteristic.
- On activation the linearization is resorted and subjected to a plausibility check.

Step	Matrix	Entry	Significance
1	V2H2	1…30	Enter table entry number where correction is to be made
2	-	»E«	Register entry
3	V2H3/H4	e.g. 10	Correct volume or level
4	-	»E«	Register entry
5	-		Make further correction as in steps 1 to 4
6	V2H0	3	Select manual linearization table
7	-	»E«	Press »E« to activate linearization

5.3 Other modes

Linear
V2H0 = 0

This mode (default) is selected when the Silometer FMX 570 transmitter is to revert to measurement of level after being used for volume measurement.

- If the volume is proportional to level, e.g. standing cylinder, a volume measurement is obtained by entering the »empty« and »full« volumes at V0H1 and V0H2 respectively, see Section 4.3.

Step	Matrix	Entry	Significance
1	V2H0	0	Select linear characteristic
2	-	»E«	Press »E« to activate linearization

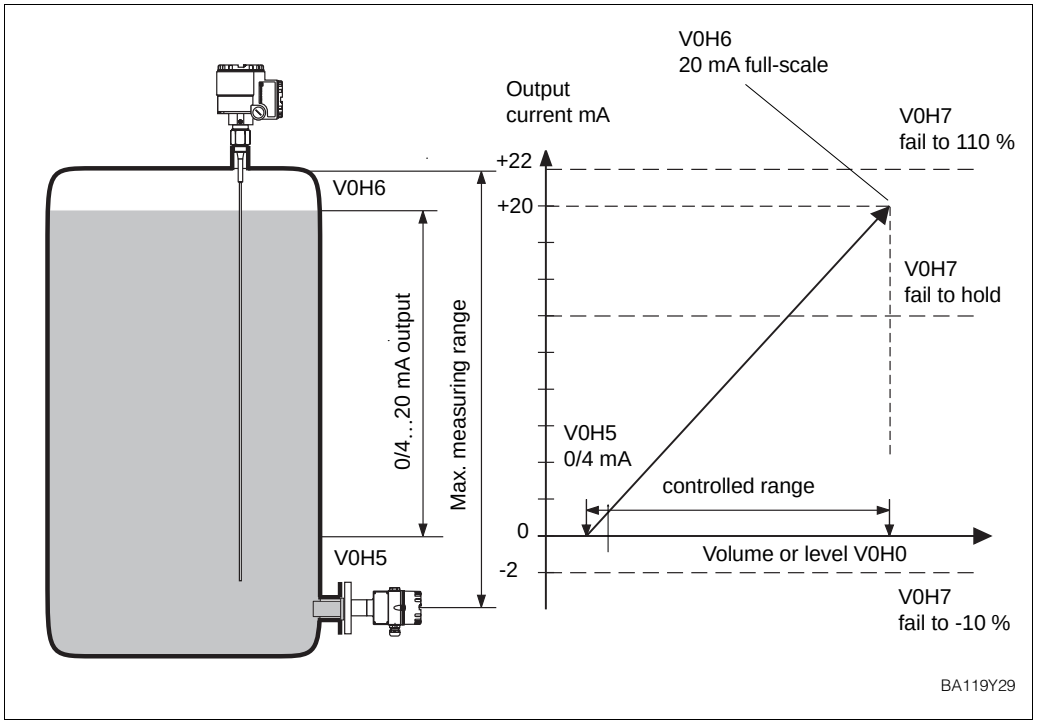
Cancel current setting
V2H0 = 4

Use this option if you wish to enter an entirely new manual characteristic without a transmitter reset. All values in the linearization table are cancelled and can be entered anew. The function does not affect the horizontal cylinder characteristic or any factory characteristic stored in the transmitter.

Step	Matrix	Entry	Significance
1	V2H0	4	Cancel all previous entries in the manual linearization table
2	-	»E«	Press E to register

6 Analogue Outputs

Fig. 6.1: Control parameters for analogue outputs (0…20 mA)



This Chapter deals with the analogue output settings. The FMX 570 transmitter is designed for continuous measurement with control of:

- one voltage output 0/2 ... 10 V
- one current output 0/4 ... 20 mA

by the level or volume indication at V0H0. Table 6.1 and Fig. 6.1 summarize the parameters which control the analogue outputs and 10-step LCD display.

Units

When defining the analogue range at V0H5/V0H6, the entries must be made in the units used for calibration or if performed, linearization.

Table 6.1: Control parameters for analogue outputs

Channel 1	Significance	Default value
V0H3	Analogue range 0 = 0...20 mA / 0...10 V 1 = 4...20 mA / 2...10 V	1
V0H4	Output damping in seconds	1
V0H5	0/4 mA value (in units used for calibration or linearization)	0.0
V0H6	20 mA value (in units used for calibration or linearization)	100.0
V0H7	Output on fault condition (safety alarm) 0 = -10 % 1 = +110 % 2 = hold last value	0

6.1 Analogue output settings

Analogue output range

One of two analogue ranges can be set at V0H3:

- 0 = 0 ... 20 mA/ 0...10 V
- 1 = 4 ... 20 mA/ 2...10 V (default setting.).

Current and voltage outputs are switched together.

Step	Matrix	Entry	Significance
1	V0H3	0	Selects 0... 20 mA/0 ...10 V range
2	-	»E«	Register entry

Output damping

A filter, set at V0H4, acts to smooth the analogue output. Using it results in a steady display and analogue output less affected by sudden changes in level e.g. due to turbulence. The effect may be modified by changing the integration factor for output damping between 0 ... 100s.

- 0 = without filter.
- 1…100 = with filter (default value = 1 s).

Step	Matrix	Entry	Significance
1	V0H4	e.g. 5	Sets output damping = 5s
2	-	»E«	Register entry

0/4…20 mA signal parameters

These parameters, entered in the units used for calibration or linearization, indicate the start and end of range values of the analogue signal output and also control the 10-step LCD display. The parameters to be entered are:

- 0/4 mA value: V0H5
- 20 mA value: V0H6.

Step	Matrix	Entry	Significance
1	V0H5	e.g. 100	Start-point level or volume for analogue output
2	-	»E«	Registers entry
3	V0H6	e.g. 1100	Full scale level or volume for analogue output
4	-	»E«	Register entry

Turn-down scale:
Practically any start or end value can be entered, allowing the 0/4…20 mA signal to be assigned to any section of the measuring range.

Reverse scale:
If V0H5> V0H6 a warning E 608 appears at V9H0 and the alarm LEDs blink, however, the instrument continues to operate. The warning and alarm can be eliminated by swapping the values contained in the fields V3H8 and V3H9, D/A calibration, which are normally used for service purposes only. The bar chart, however, still operates in the same direction

- Enter the smaller value in V0H5, the larger in V0H6
- Select operating mode 6 in field V8H0 (simulation). Note the parameters in V3H8 and V3H9
- Enter the V3H8 parameters in V3H9 and vica versa
- Select operating mode 1 in field V8H0.

Output at fault

The current and voltage outputs can be set to take on distinctive values if the self-monitoring circuit of the Silometer FMX 570 transmitter triggers on finding a fault. The choice is made at V0H7, whereby:

- 0 = -10% of full scale ≤ -2 mA, -1V (default value)
- 1 = +110% of full scale ≥ +22 mA, +11V
- 2 = hold = value at fault held

Proceed as follows:

Step	Matrix	Entry	Significance
1	V0H7	e.g. 0	Analogue output drops to -2 mA/-1V on fault
2	-	»E«	Registers entry

Caution!

Caution!

- Selecting option 2 effectively disables any fault recognition safeguards on the analogue lines. Although the self-checking system functions, the alarm relay trips and the red alarm LED lights on the transmitter, all analogue devices connected to the Silometer appear to indicate correct measurements.

7 Trouble-Shooting

When the instructions in the manual have been followed correctly, the system must now function. Should this not be the case, the Silometer FMX 570 transmitter provides a number of aids for setting up and operating the module correctly. This Chapter contains the following:

- Trouble-shooting tables, with error messages, meaning and response
- Description of simulation operating mode for service and commissioning purposes
- Instructions for commissioning replacement electronic inserts, probes and transmitters.
- Repairs

7.1 Trouble-shooting tables

Fault condition

When the FMX 570 transmitter recognizes a fault condition:

- the red fault LED lights and the alarm relay trips.
- the output current (with the exception of operating mode 2) reverts to the status selected in field V0H7, i.e. to -10%, +110% of the selected measuring range or last measured value (hold) - see Chapter 6.

A diagnostic message is given in Field V9H0:

- If the cause of the fault has been rectified, the last diagnostic message is retained in V9H1.
- This message can be cleared by pressing the »E« key.

If the power fails, all relays de-energise.

Warnings

When the FMX 570 transmitter has detected a warning:

- the red fault LED flashes but the Silometer continues to measure
- the alarm relay remains energised
- the appropriate message is to be found in V9H0.

The error messages are listed in Table 7.1 in the order of their priority. If one fault is on display and a fault of higher priority occurs, the latter will appear at V9H0. The preceding message can be called by pressing the "plus" key.

Table 7.2, trouble-shooting, indicates possible configuration errors for the Silometer FMX 570.

Table 7.1: Error messages

Code	**Type**	**Cause and Remedy**
E 101-106	Alarm	Fault in instrument electronics - Call Endress+Hauser Service
E 107	Alarm	Battery voltage too low - Make back-up of entered parameters immediately - Have battery changed at once by trained personel or ring for service
E 201-202	Alarm	Fault in probe (f < 35 Hz; f > 3000 Hz) - Check probe and electronic insert
E 401	Alarm	Fault in probe or wiring - Check probe, electronic insert and wiring
E 601	Warning	PFM transmission internal code check - can be ignored if it appears only briefly
E 602	Warning	Linearization does not rise monotonously (volume does not increase with level) - Check and re-enter correct values, reactivate linearization
E 604	Warning	Linearization has less than two sets of values - Enter more values, reactivate linearization
E 608	Warning	Value in V0H5 greater than that in V0H6 - Check input
E 610	Warning	Calibration fault (»empty« level > »full« level) - Repeat calibration
E 613	Warning	Instrument in simulation mode - Switch back when finished

Table 7.2: Trouble shooting table for incorrect function without error message

Sensor/ channel	**Fault**	**Cause and remedy**
Capacitance	Measured value wrong	• Incorrect calibration? Check measured value before linearisation, V0H9 - if not correct, check whether full and empty calibration correct V0H1/V0H2 - if correct, check linearization parameters - check operating mode, V8H0 • Change in product - recalibrate for new product • Build-up on probe - wire electronic insert for build-up, see Section 2.4 - clean probe • Probe damaged, bent or pressed to side of vessel - check and remedy • Condensation in connection compartment
Deltapilot S	Measured value wrong	• Incorrect calibration? Check measured value before linearisation, V0H9 - if not correct, check whether full and empty calibration correct V0H1/V0H2 - If correct, check linearization parameters - check operating mode, V8H0 • Change in density of product - recalibrate -• Sensor damaged - check and remedy

7.2 Simulated operating mode

This function is intended primarily for checking the correct function of the system and is selected and terminated at V8H0:

- Enter 6 to simulate frequency, level, volume or current
- Enter an operating mode to terminate simulation and resume normal measurements.

Start and stop simulation

Step	Matrix	Entry	Significance
1	V8H0	e.g. 6	Selects simulation mode channel 1, entries can be made at fields V9H6…V9H9
			or
		e.g. 0	Selects two channel measurement and ends simulation
2	-	»E«	Registers entry

Four modes are possible:

- Simulation of frequency, V9H6
- Simulation of level, V9H7
- Simulation of volume, V9H8
- Simulation of current, V9H9.

When a value is entered at the appropriate matrix, the analog outputs are fed with the appropriate current and voltage and the other 3 simulation values are recalculated. Throughout the simulation the red alarm LED flashes to indicate that the instrument is no longer measuring, the alarm relay does not, however, trip.

Frequency simulation

Step	Matrix	Entry	Significance
1	V9H6	e.g. 100	Depending upon the calibration and linearization, a value corresponding to 100 Hz is displayed
2	-	»E«	Registers entry

Level simulation

Step	Matrix	Entry	Significance
1	V9H7	e.g. 10	Depending upon the calibration and linearization, the analogue output is fed with a current corresponding to e.g.10 m, 10 ft, 10% level.
2	-	»E«	Registers entry

Volume simulation

Step	Matrix	Entry	Significance
1	V9H8	e.g. 100	Depending upon the calibration and linearization, the analogue outputs are fed with the current corresponding to 100 hl, 100 gallons, 100%
2	-	»E«	Registers entry

Current simulation

Step	Matrix	Entry	Significance
1	V9H9	e.g. 16	The analogue output is fed with a current of 16 mA and the corresponding measured value displayed at V0H0
2	-	»E«	Registers entry

7.3 Exchanging transmitters, probes and electronic inserts

Transmitter

If the Silometer has to be exchanged, the replacement need not be recalibrated. Instead it is usually sufficient to enter all the matrix values from the old into the new transmitter. The replacement will then measure correctly.

- Where a special order has to be maintained, e.g. activation of linearization after entry of parameters, this should be accounted for during re-entry or the steps must be performed separately.

For probes and electronic inserts, the procedure to be followed depends upon the type used.

Capacitance probes with EC 37 Z/EC 47 Z

For level measurement, provided the sensor constants were entered before calibration, it is not necessary to recalibrate the instrument when the electronic insert is replaced by one of the same type. On replacement:

- the zero frequency (or offset) f_O and
- sensitivity S

for the range selected (default Range II) must be entered at V3H5 and V3H6 respectively. Fig. 7.1 shows where the information is to be found on the EC 37 Z and EC 47 Z inserts.

- If a different range is selected, the transmitter must be recalibrated.
- If the constants were not entered a recalibration is necessary.

Procedure

Step	Matrix	Entry	Significance
1	V3H5	e.g. 57.2	Enter zero frequency (offset)
2	-	»E«	Register entry
3	V3H6	e.g. 0.652	Enter sensitivity
4	-	»E«	Register entry

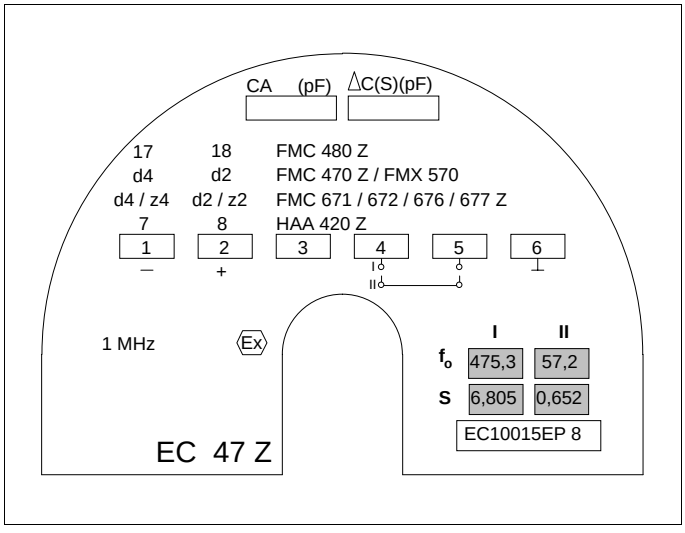


Fig. 7.1: Electronic insert EC 37 Z/ EC 47 Z showing location of probe constants

Deltapilot

Provided a »dry« calibration was made or the sensor constants were entered before calibration, it is not necessary to recalibrate the instrument when the electronic insert is replaced. The measurement can be taken up again as soon as the new constants have been entered in the matrix.

- If the old sensor constants were not entered, the system must be recalibrated.

For new sensor constants see table 2.2.

- f_0 is the zero frequency (or offset)
- Δf is the sensitivity

For the Deltapilot, the zero frequency may also be read from V0H8 when the probe is unpressurized. This value gives slightly better accuracy, since it accounts for the orientation of the probe.

Procedure

Step	Matrix	Entry	Significance
1	V3H5	e.g. 101	Enter zero frequency (from probe head or V0H8)
2	-	»E«	Register entry
3	V3H6	e.g. 1.052	Enter sensitivity
4	-	»E«	Register entry

7.4 Repairs

Check the condition of the probes during regular maintenance inspections. If necessary, free them of build-up. Remember that all probes are sensitive instruments and must be treated accordingly.

Should the Silometer FMX 570 transmitter or its probes need to be repaired by Endress+Hauser, please send it to your nearest Service Centre with a note containing the following information:

- An exact description of the application for which it was used.
- The physical and chemical properties of the product measured.
- A short description of the fault.

Caution!

- Special precautions must be observed when sending probes for repair:

Caution!

- Remove all visible traces of product from the probe.
- If the product can impair health, i.e. is corrosive, poisonous, carcinogenic, radioactive etc., please check that the probe is thoroughly decontaminated.
- 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 probe for repair.

8 Quick programming guide

8.1 Level measurement

Start
Chapter 4, Section 4.1
- Constants for EC 37 Z/EC 47 Z or FEB 17 / FEB 17 P
- level is displayed at V0H0

Reset parameters:	V9H5
Enter sensor constants	
- Zero frequency	V3H5
- Sensitivity	V3H6
Select mode	V8H0
1= Level measurement	

Calibration
Chapter 4, Section 4.2 or 4.3
- After calibration level/volume is displayed at V0H0

Level or volume	V3H0
»Empty« calibration	V0H1
»Full« calibration	V0H2

Set analogue output signal (optional)
Chapter 6
- Enter settings in the units selected during calibration or linearization

Select output range	V0H3
0 = 0…20 mA/0…10 V,	
1 = 4…20 mA/2…10V	
Set output damping	V0H4
Set 0/4 mA value	V0H5
Set 20 mA value	V0H6
Set output at fault	V0H7
0 = -10% (-2 mA/-1 V)	
1 = +110% (+22 mA/11V)	
2 = last measurement	

Lock parameter matrix (optional)
Chapter 4, Section 4.7

Lock parameter matrix	V8H9

8.2 Continuous volume measurement (linearization)

Start
Chapter 4, Section 4.1
- Constants for EC 37 Z/EC 47 Z or FEB 17 / FEB 17 P
- level is displayed at V0H0

Reset parameters: V9H5
Enter sensor constants
zero frequency V3H5
sensitivity V3H6
Select mode V8H0
1 = Level measurement

Calibration
Chapter 4, Section 4.3
- After calibration level is displayed at V0H0

»Empty« calibration V0H1
»Full« calibration V0H2

Linearization
Chapter 5
- V0H0 displays volume
- Analogue output must be set in volume units

For vessel linearization
Set linearization type V2H0
1 = horizontal cylinder*
3 = manual characteristic
For Option 1,
Enter tank diameter V2H7
Enter tank volume V2H8
For Option 3
Enter mode V2H1
0 = manual
1 = automatic level (E)
Enter volume V2H3
Enter level V2H4

* If you have calibrated in volume units, turn to Section 5.1 to check the correct order of entry of the paramters

Set analogue output signal (optional)
Chapter 6
- Enter settings in the units selected

Select output range V0H3
0 = 0…20 mA/0…10 V,
1 = 4…20 mA/2…10V
Set output damping V0H4
Set 0/4 mA value V0H5
Set 20 mA value V0H6
Set output at fault V0H7
0 = -10% (-2 mA/-1 V)
1 = +110% (+22 mA/11V)
2 = last measurement

Lock parameter matrix (optional)
Chapter 4, Section 4.6

Lock parameter matrix V8H9

Index

Operating Matrix

Operating and default parameters

Enter your operating parameters in the matrix below.

	H0	H1	H2	H3	H4	H5	H6	H7	H8	H9
V0										
V1										
V2										
V3										
V4										
V5										
V6										
V7										
V8										
V9										

Display field

The default parameters are as indicated below.

	H0	H1	H2	H3	H4	H5	H6	H7	H8	H9
V0		0.0	100.0	0	1	0.0	100.0	1		
V1										
V2	0	0	1	0.0	0.0	1		100	100	
V3	0	0.0	10.0		0.0	0.0	1.0			
V4										
V5										
V6										
V7										
V8	1									670
V9	E	E		1020		0	0.0	0.0	0.0	0.0

Display field

Parameter Matrix

	H0	H1	H2	H3	H4	H5	H6	H7	H8	H9
V0 Calibration Channel 1	Measured value	Empty calibration	Full calibration	Select current 0=0…20mA 1=4…20mA	Output damping (s)	Value for 0/4 mA	Value for 20 mA	Safety alarm 0 = -10% 1=+110% 2=Hold	Actual measuring frequency channel 1	Measured value before linearization
V1										
V2 Linearisation Channel 1	Linearization 0=linear 1= hor. cylinder 2=factory 3=manual 4=clear 3	Level input mode 0=manual 1=auto.	Table No. (1…30)	Input Volume	Input Level	Next Table No.		Diameter for horizontal cylinder	Volume for horizontal cylinder	
V3 Extended Calibration Channel 1	Calibration mode 0=level 1= volume	Offset	Sensitivity		Zero offset value	Offset of device (zero frequency)	Sensitivity of device		For Service only (0 mA D/A calibration)	For Service only 20 mA D/A calibration)
V4										
V5										
V6							.			
V7										
V8	Operating mode 1= level 6 = simulation									Security locking < 670 or > 679
V9 Service and Simulation	Current diagnostic code	Last diagnostic code E=clear		Instrument and Software version		Reset to default values 670…679	Simulation frequency	Simulation level	Simulation volume	Simulation current

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