XA02396F-A/00/EN/
01.21
71532683
2021-06-28

Safety Instructions
Micropilot FMR56/57

PROFIBUS PA, FOUNDATION Fieldbus

II 1 D Ex ta IIIC T_{500} xx°C Da
II 1/2 D Ex ta/tb IIIC T85°C Da/Db

Endress+Hauser
People for Process Automation

Micropilot FMR56/57

PROFIBUS PA, FOUNDATION Fieldbus

Table of contents

Associated documentation

This document is an integral part of the following Operating Instructions:

PROFIBUS PA
BA01127F/00 (FMR56, FMR57)

FOUNDATION Fieldbus
BA01123F/00 (FMR56, FMR57)

Supplementary documentation

Explosion-protection brochure: CP00021Z/11

The Explosion-protection brochure is available:
- In the download area of the Endress+Hauser website: www.endress.com -> Downloads -> Brochures and Catalogs -> Text Search: CP00021Z
- On the CD for devices with CD-based documentation

Manufacturer's certificates

UK Declaration of Conformity

Declaration Number:
EC00881

The UK Declaration of Conformity is available:
In the download area of the Endress+Hauser website:
www.endress.com -> Downloads -> Declaration -> Type: EU Declaration -> Product Code: ...

UKCA type-examination certificate

Certificate number:
CML 21UKEX2141X

List of applied standards: See UK Declaration of Conformity.

Manufacturer address

Endress+Hauser SE+Co. KG
Hauptstraße 1
79689 Maulburg, Germany

Address of the manufacturing plant: See nameplate.

Other standards

Among other things, the following standards shall be observed in their current version for proper installation:
- IEC/EN 60079-14: "Explosive atmospheres - Part 14: Electrical installations design, selection and erection"
- EN 1127-1: "Explosive atmospheres - Explosion prevention and protection - Part 1: Basic concepts and methodology"

Extended order code

The extended order code is indicated on the nameplate, which is affixed to the device in such a way that it is clearly visible. Additional information about the nameplate is provided in the associated Operating Instructions.

Structure of the extended order code

FMR5x	–	**********	+	A*B*C*D*E*F*G*..
(Device type)		*(Basic specifications)*		*(Optional specifications)*

* = Placeholder
At this position, an option (number or letter) selected from the specification is displayed instead of the placeholders.

Basic specifications

The features that are absolutely essential for the device (mandatory features) are specified in the basic specifications. The number of positions depends on the number of features available.
The selected option of a feature can consist of several positions.

Optional specifications

The optional specifications describe additional features for the device (optional features). The number of positions depends on the number of features available. The features have a 2-digit structure to aid identification (e.g. JA). The first digit (ID) stands for the feature group and consists of a number or a letter (e.g. J = Test, Certificate). The second digit constitutes the value that stands for the feature within the group (e.g. A = 3.1 material (wetted parts), inspection certificate).

More detailed information about the device is provided in the following tables. These tables describe the individual positions and IDs in the extended order code which are relevant to hazardous locations.

Extended order code: Micropilot

The following specifications reproduce an extract from the product structure and are used to assign:
- This documentation to the device (using the extended order code on the nameplate).
- The device options cited in the document.

Device type

FMR56, FMR57

Basic specifications

Position 1, 2 (Approval)		
Selected option		**Description**
FMR5x	UE [1]	UK Ex II 1 D Ex ta IIIC T_{500} xx°C Da
	UF [2]	UK Ex II 1/2 D Ex ta/tb IIIC T85°C Da/Db

1) The designation changes in connection with Position 4 = L, M, N:
II 1 D Ex ta [ia Da] IIIC T_{500} xx°C Da
2) The designation changes in connection with Position 4 = L, M, N:
II 1/2 D Ex ta/tb [ia Da] IIIC T85°C Da/Db

Position 3 (Power Supply, Output)		
Selected option		**Description**
FMR5x	E	2-wire, FOUNDATION Fieldbus, switch output (PFS)
	G	2-wire, PROFIBUS PA, switch output (PFS)

Position 4 (Display, Operation)		
Selected option		**Description**
FMR5x	A	Without, via communication
	C	SD02, 4-line, push buttons + data backup function
	E	SD03, 4-line, illum., touch control + data backup function
	L [1]	Prepared for display FHX50 + M12 connection
	M [1]	Prepared for display FHX50 + custom connection
	N [1]	Prepared for display FHX50 + NPT1/2"

1) UK Ex approved version of FHX50

Position 5 (Housing)		
Selected option		**Description**
FMR57	B	GT18 dual compartment, 316L
FMR5x	C	GT20 dual compartment, Alu coated

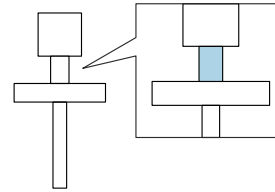
Position 6 (Electrical Connection)		
Selected option		**Description**
FMR5x	A [1]	Gland M20, IP66/68 NEMA4X/6P
	B	Thread M20, IP66/68 NEMA4X/6P
	C	Thread G1/2, IP66/68 NEMA4X/6P
	D	Thread NPT1/2, IP66/68 NEMA4X/6P

1) Only in connection with Position 1, 2 = UF

Position 7, 8 (Antenna)		
Selected option		**Description**
FMR56	BN	Horn 80 mm/3", PP cladded, -40...80°C
	BR	Horn 100 mm/4", PP cladded, -40...80°C
FMR57	Bx	Horn (different sizes)
	Fx	Parabolic (different sizes)

Position 9, 10 (Seal)		
Selected option		**Description**
FMR57	A6	Viton GLT, -40...200°C
	D4	Graphite, -40...400°C (HT)

Shown in the temperature tables exemplary as follows:



Position 11-13 (Process Connection)		
Selected option		**Description**
FMR56	UAE	Mounting bracket
	XR0	Connection, without flange/mounting bracket
	XxG	Slip on flange (different sizes)
FMR57	Axx Cxx Kxx	Flange (different sizes)
	RxJ	Thread, 316L
	XxJ	Align. device (different sizes)

Position 14 (Air Purge Connection)		
Selected option		**Description**
FMR57	1	G1/4
	2	NPT1/4

Optional specifications

ID Nx, Ox (Accessory Mounted)		
Selected option		**Description**
FMR57	OP OT	Antenna extension (different sizes)
	OW	Horn protection, PTFE, no airpurge possible

Safety instructions: General

- Staff must meet the following conditions for mounting, electrical installation, commissioning and maintenance of the device:
  - Be suitably qualified for their role and the tasks they perform
  - Be trained in explosion protection
  - Be familiar with national regulations
- Install the device according to the manufacturer's instructions and national regulations.
- Do not operate the device outside the specified electrical, thermal and mechanical parameters.
- Only use the device in media to which the wetted materials have sufficient durability.

- Avoid electrostatic charging:
  - Of plastic surfaces (e.g. enclosure, sensor element, special varnishing, attached additional plates, ..)
  - Of isolated capacities (e.g. isolated metallic plates)
- Modifications to the device can affect the explosion protection and must be carried out by staff authorized to perform such work by Endress+Hauser.
- Refer to the temperature tables for the relationship between the permitted ambient temperature for the sensor and/or transmitter, depending on the range of application and the temperature class.

Safety instructions: Special conditions

Permitted ambient temperature range at the electronics enclosure:
$-40\ °C \leq T_a \leq +80\ °C$

- Observe the information in the temperature tables.
- In the case of process connections made of polymeric material or with polymeric coatings, avoid electrostatic charging of the plastic surfaces.
- To avoid electrostatic charging: Do not rub surfaces with a dry cloth.
- In the event of additional or alternative special varnishing on the enclosure or other metal parts or for adhesive plates:
  - Observe the danger of electrostatic charging and discharge.
  - Do not install in the vicinity of processes (≤ 0.5 m) generating strong electrostatic charges.

Device type FMR54 (planar, enamel), FMR56
An antenna coated with non-conductive material can be used if avoiding electrostatic charging (e.g. through friction, cleaning, maintenance, strong medium flow).

Device type FMR57 and Optional specification, ID Nx, Ox = OW
An antenna coated with non-conductive material can be used if avoiding electrostatic charging (e.g. through friction, cleaning, maintenance, strong medium flow).

Device type FMR57 and Basic specification, Position 11-13 = XxJ
- Changing the position of the alignment device must be impossible:
  - After the alignment of the antenna via the pivot bracket
  - After tightening of the clamping flange
  - After setting the damping ring (torque 15 Nm)
- Degree of protection IP67 must be fulfilled.

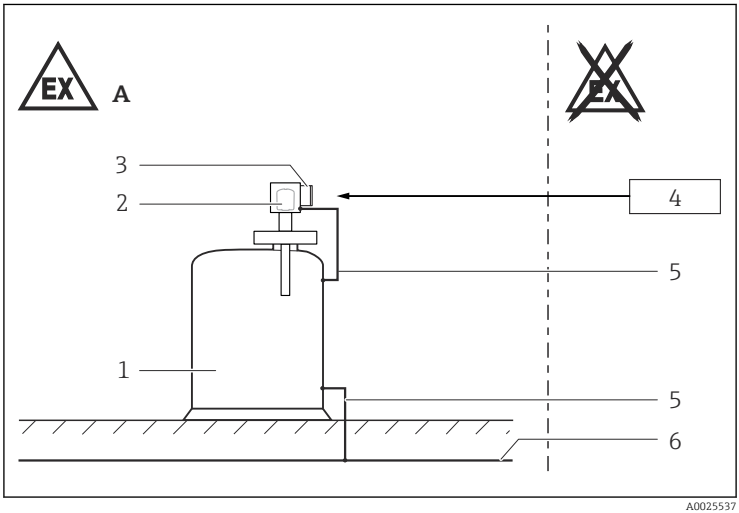
Device type FMR57 and Basic specification, Position 14 = 1, 2

- If equipment with Ga/Gb or Da/Db is required: In the closed state the minimum degree of protection of the installation must be IP67.
- After removing the air purge connection: Lock the opening with a suitable plug.
  - Torque: 6-7 Nm
  - For Da/Db: thread engagement > 5 turns
- Degree of protection IP67 must be fulfilled.

Device type FMR54, FMR57 and Optional specification, ID Nx, Ox = OM, ON, OR, OS, OP, OT

Avoid contact between sensor and tank wall. Take into account tank fittings and flow conditions (avoid sparks caused by impact and friction).

Safety instructions: Installation



1

A Zone 20, Zone 21
1 Tank; Zone 20, Zone 21
2 Electronics compartment Ex ia; Electronic insert
3 Connection compartment Ex tb
4 Power supply
5 Potential equalization line
6 Potential equalization

- After aligning (rotating) the enclosure, retighten the fixing screw (see Operating Instructions).
- Install the device to exclude any mechanical damage or friction during the application. Pay particular attention to flow conditions and tank fittings.
- Only use certified cable entries or sealing plugs. The metal sealing plugs supplied meet this requirement.
- Before operation:
  - Screw in the cover all the way.
  - Tighten the securing clamp on the cover.
- After mounting and connecting the antenna, ingress protection of the enclosure must be at least IP65.
- Perform the following to achieve the degree of protection:
  - Screw the cover tight.
  - Mount the cable entry correctly.
- Continuous service temperature of the connecting cable: −40 °C to ≥ +85 °C; in accordance with the range of service temperature taking into account additional influences of the process conditions ($T_{a,min}$), ($T_{a,max}$ +20 K).

Basic specification, Position 4 = N
Observe the requirements according to IEC/EN 60079-14 for conduit systems and the wiring- and installation instructions of the suitable Safety Instructions (XA). In addition, observe national regulations and standards for conduit systems.

Intrinsic safety

The device can be connected to the Endress+Hauser FXA291 service tool: refer to the Operating Instructions.

Temperature tables

→ Safety Instructions: XA02412F/00

The Safety Instructions for temperature tables are available:
In the download area of the Endress+Hauser website:
www.endress.com -> Downloads ->
Manuals and Datasheets ->
Type: Ex Safety Instructions (XA) -> Text Search: ...

Basic specification, Position 1, 2 = UF in connection with Basic specification, Position 3 = E, G
Deratings are based on a power consumption of 1 W (PFS);
→ 16.

Explanation of how to use the temperature tables

Unless otherwise indicated, the positions always refer to the basic specification.

Basic specification, Position 1, 2 = UE

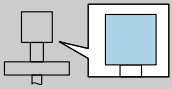
1st column: Position 5 = A, B, ...

2nd column: Position 3 = A, B, ..
- (1): 1 channel used
- (2): 2 channels used

3rd column: Calculation of temperature values and maximum permissible ambient temperature in °C

4th column: Maximum surface temperature in °C

Example table

 = C	(1)		
	E, G	$T = T_a + 5$ K $T_{500} = T_a + 21$ K	$T_a = 80$ $T_a = 64$	128

T_a: Ambient temperature in °C

T_{500}: Deposited material with a layer of 500 mm

Basic specification, Position 1, 2 = UF

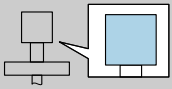
1st column: Position 5 = A, B, ...

2nd column: Position 3 = A, B, ..
- (1): 1 channel used
- (2): 2 channels used

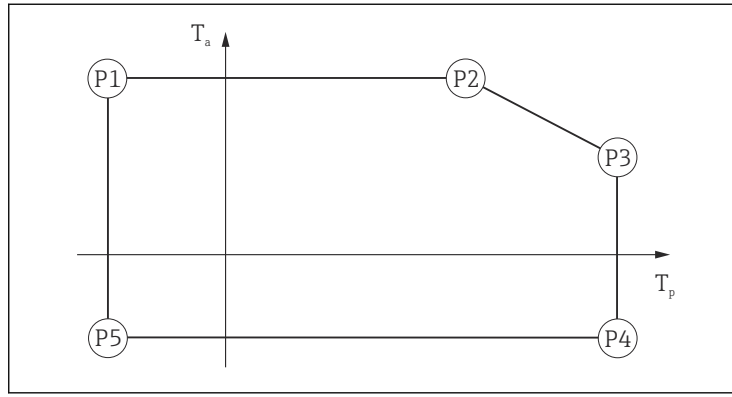
3rd column: Process temperature

Column P1 to P5: Position (temperature value) on the axes of the derating
- T_a: Ambient temperature in °C
- T_p: Process temperature in °C

Example table

 = C	(1)		P1		P2		P3		P4		P5	
			T_p	T_a	T_p	T_a	T_p	T_a	T_p	T_a	T_p	T_a
	E, G	135	–40	80	80	80	135	67	135	–40	–40	–40
		200	–40	80	80	80	200	51	200	–40	–40	–40

Example diagrams of possible deratings



Connection data

Cable entry: Connection compartment

Ex ta

Basic specification, Position 1, 2 = UE

Cable gland: No cable gland available.

Ex tb

Basic specification, Position 1, 2 = UF

Cable gland: *Basic specification, Position 6 = A*

Basic specification, Position 5 = B, C

preferably for Position 5 = B

Thread	Clamping range	Material	Sealing insert	O-ring
M20x1,5	ø 7 to 12 mm	1.4404	NBR	EPDM (ø 17x2)

preferably for Position 5 = C

Thread	Clamping range	Material	Sealing insert	O-ring
M20x1,5	ø 8 to 10.5 mm [1] (ø 6.5 to 13 mm) [2]	Ms, nickel-plated	Silicone	EPDM (ø 17x2)

1) Standard
2) Separate clamping inserts available

- The tightening torque refers to cable glands installed by the manufacturer:
  - Recommended: 3.5 Nm
  - Maximum: 10 Nm
  - This value may be different depending on the type of cable. However, the maximum value must not be exceeded.
- Only suitable for fixed installation. The operator must pay attention to a suitable strain relief of the cable.
- The cable glands are suitable for a low risk of mechanical danger (4 Joule) and must be mounted in a protected position if larger impact energy levels are expected.
- To maintain the ingress protection of the enclosure: Install the enclosure cover, cable glands and blind plugs correctly.

Cable entry: Electronics compartment

Cable gland: *Basic specification, Position 4 = M*

Basic specification, Position 5 = B, C

preferably for Position 5 = B

Thread	Clamping range	Material	Sealing insert	O-ring
M16x1,5	ø 5 to 10 mm	1.4404	PA/NBR	NBR (ø 13x2)

preferably for Position 5 = C

Thread	Clamping range	Material	Sealing insert	O-ring
M16x1,5	ø 5 to 10 mm	Ms, nickel-plated	PA/NBR	NBR (ø 13x2)

- The tightening torque refers to cable glands installed by the manufacturer:
  - Recommended: 3.5 Nm
  - Maximum: 5 Nm
  - This value may be different depending on the type of cable. However, the maximum value must not be exceeded.
- Only suitable for fixed installation. The operator must pay attention to a suitable strain relief of the cable.
- The cable glands are suitable for a low risk of mechanical danger (4 Joule) and must be mounted in a protected position if larger impact energy levels are expected.
- To maintain the ingress protection of the enclosure: Install the enclosure cover, cable glands and blind plugs correctly.

Terminals: Connection compartment

Ex ta

Basic specification, Position 3 = E, G

Terminal 1 (+), 2 (–)	Terminal 3 (+), 4 (–)
Power supply U_N = 20 V_{DC} U_m = 250 V	Switch output (PFS) [1] U_N = 35 V_{DC} U_m = 250 V

1) Observe "Power limitation Switch output (PFS)", → 15

Power limitation Switch output (PFS)

Basic specification, Position 3 = E, G

To limit the temperature rise it is necessary to limit the power consumption of the Switch output (PFS).

This is achieved by:
- using a supply voltage by consideration of Ri_{Fault} and terminal voltage U = 19.5 V.
- using a power supply with power limitation:
  - I_{max} = 51.3 mA and 19.5 V
  - *Basic specification, Position 3 = E, G:* U ≤ 35 V
- using an external resistor.
- reducing the maximum voltage at the terminals of the device depending on U_N and the channel used (by using a suitable power supply, a limiting resistor or both).

The limiting resistor is installed outside the device and may be a load/communication resistor or a relay coil. When using it, pay attention to correct load and temperature effects.

Table of external resistors depending on power load and supply voltage:

Power load	1.0 W
Terminal voltage U	19.5 V
I_{Fault}	0.0513 A
Ri_{Fault}	380.3 Ω

U_N [V]	R_V min
35	302 Ω
34	283 Ω
33	263 Ω
32	244 Ω
31	224 Ω
30	205 Ω
29	185 Ω
28	166 Ω
27	146 Ω
26	127 Ω
25	107 Ω
24	88 Ω
23	68 Ω
22	49 Ω
21	29 Ω
20	10 Ω
19	0 Ω

Ex tb

Basic specification, Position 3 = E, G

The power consumption of I/O modules with passive PFS output can be limited for certain applications.

- Recommended: Power consumption = 1 W. This is obtained for a supply voltage at the terminals of 27 V_{DC}.
- For higher supply voltages (U_{max}): Insert a serial resistance (R_V) in order to limit the power consumption, see table below.

Table for the PFS serial resitance (R_V):

Power consumption	1.0 W
Total power consumption	1.88 W
Internal resistance R_i	760 Ω

U_{max} [V]	R_V min
35	205 Ω
34	177 Ω
33	150 Ω
32	122 Ω
31	95 Ω
30	67 Ω
29	39 Ω
28	12 Ω
27	0 Ω

For values associated with a higher or lower internal power consumption please contact Endress+Hauser.

Terminal 1 (+), 2 (–)	Terminal 3 (+), 4 (–)
Power supply U_N = 32 V_{DC} U_m = 250 V	Switch output (PFS) U_N = 35 V_{DC} U_m = 250 V

Terminals: Electronics compartment

Ex ia

Service interface (CDI)

Taking the following values into consideration, the device can be connected to the certified Endress+Hauser FXA291 service tool or a similar interface:

Service interface													
U_i = 7.3 V effective inner inductance L_i = negligible effective inner capacitance C_i = negligible													
U_o = 7.3 V I_o = 100 mA P_o = 160 mW													
L_o (mH) =	5.00	2.00	1.00	0.50	0.20	0.15	0.10	0.05	0.02	0.01	0.005	0.002	0.001
C_o (µF) [1] =	0.73	1.20	1.60	2.00	2.60	-	3.20	4.00	5.50	7.30	10.00	12.70	12.70
C_o (µF) [2] =	-	0.49	0.90	1.40	-	2.00	-	-	-	-	-	-	-

1) Values according to PTB "ispark" program
2) Values according to IEC/EN 60079-25, Annex C

www.addresses.endress.com

Endress+Hauser

People for Process Automation