Technical
Information
TI 253F/00/en

Microwave Level Measurement *micropilot FMR 130*

Smart-Transmitter for non-contact measurement in storage, buffer and process tanks Suitable for use in explosion hazardous areas

Micropilot with
DN 150 horn antenna

Antenna extension
FAR 10 with DN 150
horn

Application

The Micropilot FMR 130 is designed for continuous, non-contact level measurement of liquids, pastes and slurries. It is particularly suitable for applications in which products often change, and temperature gradients, inert gas blankets or vapour are present.

The Micropilot uses the microwave pulsed time-of-flight measurement method and operates in a frequency band approved for industrial use. Its low beam power allows safe installation in metallic and non-metallic vessels, with no risk to humans or the environment.

Features and Benefits

- Suitable for pressures from vacuum to 64 bar and and temperatures from –40°C to +250°C
- Measuring range up to 35 m, no blocking distance: full use of tank
- Analogue output can be wired to EEx e or EEx ia: flexible wiring
- Pressure and gas-tight process connections: safe measurement of toxic products
- Simple calibration: zero and span can be taken from tank drawings

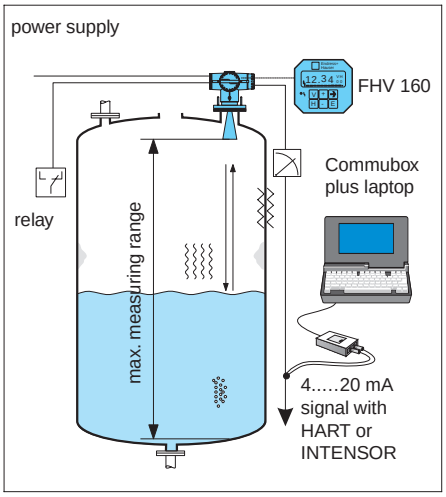
Functions

- Linearisation for volume measurement
- Suppression of interference echoes by fuzzy logic algorithms
- Self-monitoring

Endress+Hauser

Nothing beats know-how

Measuring System

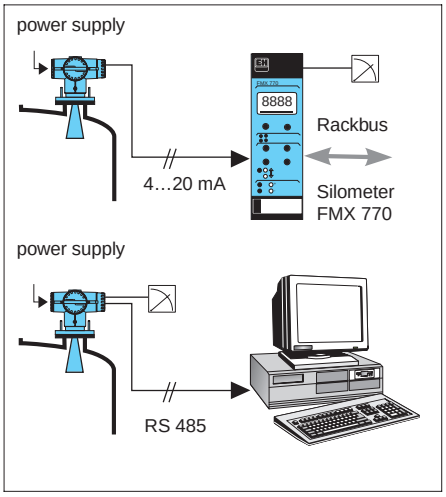


Micropilot FMR 130 measuring system: a handheld terminal or Commubox and laptop allows remote operation

Compact transmitter
Used as a compact transmitter, the Micropilot FMR 130 is equipped with:

- FHV 160 operating and display module as well as INTENSOR or HART protocol
- Remote operation is possible by handheld terminal or Commubox plus laptop.

The 4…20 mA output can be supplied *active* for powering follow-up devices or *passive* for connection to powered lines. A relay with potential-free changeover contact signals transmitter faults or level limits.



Single measuring point with Silometer FMX 770 (passive INTENSOR) or direct connection to PC via Rackbus RS-485

Silometer FMX 770 (Option)
A Silometer FMX 770 transmitter mounted in a Monorack housing or 19" rack connected to a Micropilot with *passive INTENSOR* output provides:

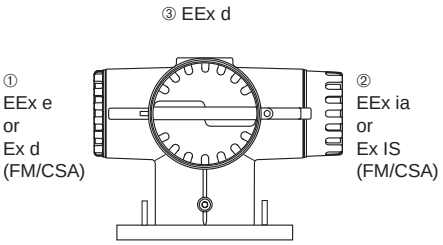
- a single measuring point *and/or*
- Rackbus connection to a ZA gateway and process control system

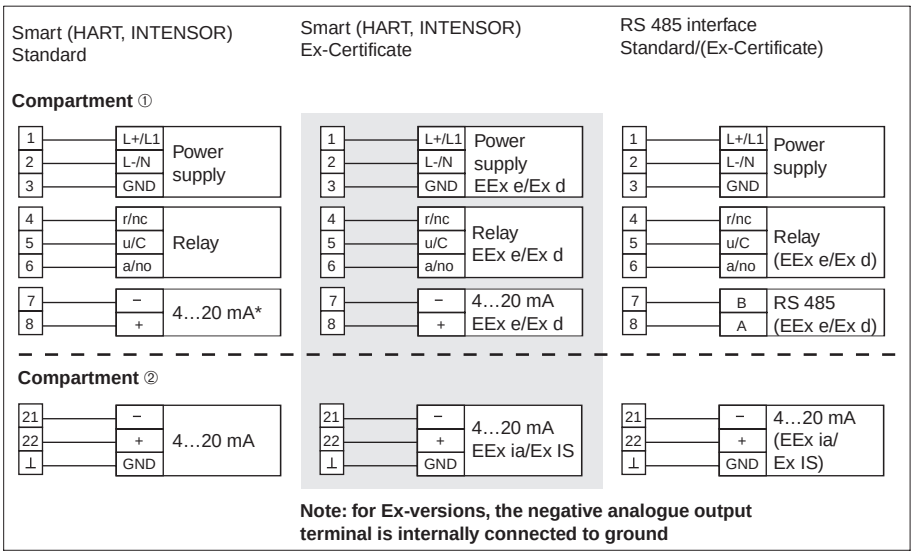
Rackbus RS-485 Interface (Option)
Using this option, several Micropilot transmitters can be connected together on a bus and operated directly from a personal computer. Alternatively, an FXA 675 card allows connection to a process control system via Rackbus.

Electrical Connection

The Micropilot FMR 130 housing has three separate compartments: ① and ② contain the terminals, ③ the electronics.

- For the Ex-version, the 4...20 mA connections can be made to EEx ia/ Ex IS or EEx e/Ex d (selected by jumper).
- The 4...20 mA output is passive or active to order (Product Structure 40)
- The transmitter housing can be turned through 85° for easy wiring.





Terminal assignment
*jumper selection in preparation
HART is a registered trademark of the HART Communication Foundation
INTENSOR is a registered trademark of Endress+Hauser

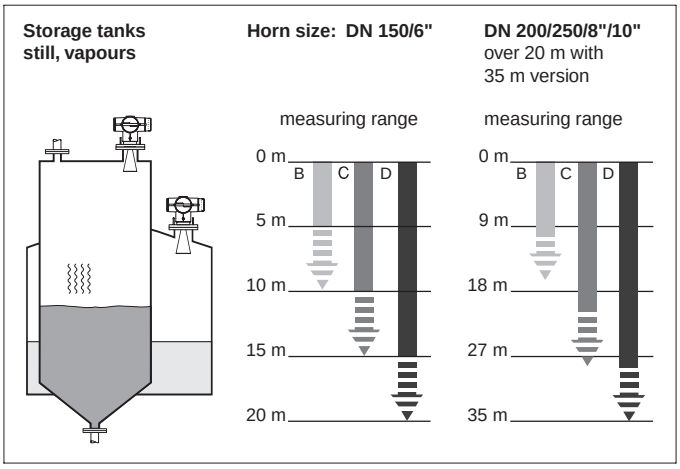
Operating Conditions

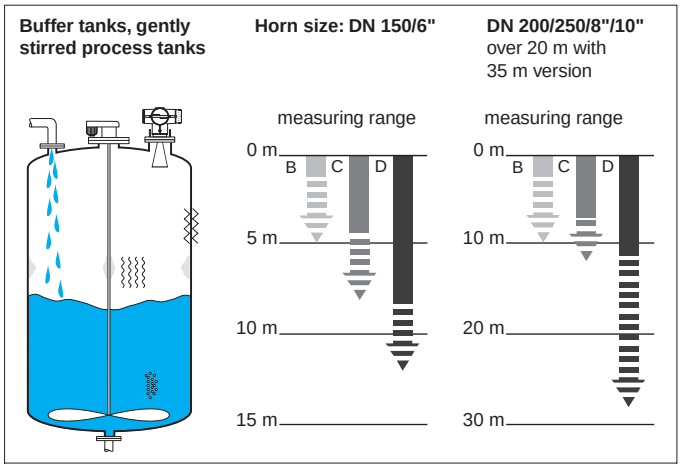
Measuring Range

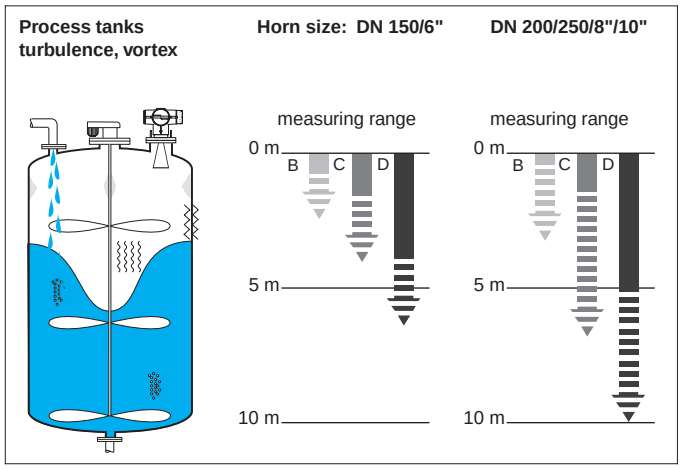
The measuring range is dependent upon antenna size, the conditions in the tank and the medium to be measured, see Table and diagrams below.

- If the liquid properties are unknown or the product changes take Class B.
- For Class A the DN 250/10" antenna typically measures up to 6 m.
- For larger ranges than indicated use a by-pass or stilling pipe.

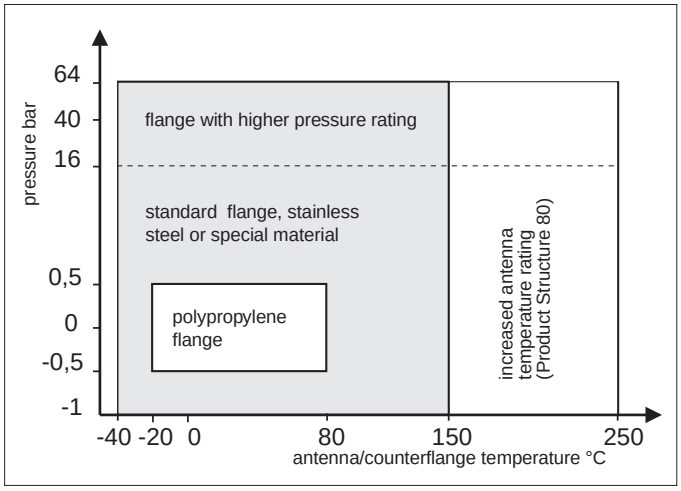
Class	Examples
A	Liquefied gases dielectric constant ε_r approx. 1.4...1.9
B	non-conducting liquids, e.g. petrochemicals, benzine, oil, toluol, dielectric constant ε_r approx. 1.9...4
C	e.g. conc. acids, organic solvents, analine, esters, alcohols, acetone, oil/water mixtures, ε_r approx. 4...10
D	conducting liquids, e.g. aqueous solutions, dilute acids and alkalis, ε_r > 10 or σ > 10 mS/cm







Typical measuring ranges as a function of antenna size (Product Structure 20), tank conditions and medium properties — the solid part of the range lies well within the performance limits, see Technical Data



Derating curves for horn antenna
O-ring:
EPDM: –40...+150°C
Viton: –20...+150°C
Kalrez: 0...+250°C
(Product Structure 20)

Process Connections

- Standards: DIN, ANSI or JIS
- Size: DN 150/6", DN 200/8", DN 250/10" each with corresponding antenna
  –for smaller nozzles (> DN 80/3") antenna extensions FAR 10 required
- Pressure: from vacuum to 64 bar, depending on flange
- Material: stainless steel 1.4571; polypropylene flange for DN 250/10"; special materials e.g. Hastelloy C4 or Tantalum cladding also available
- O-rings in Viton, Kalrez or EDPM
- For applications with superheated steam > 150°C, please enquire.

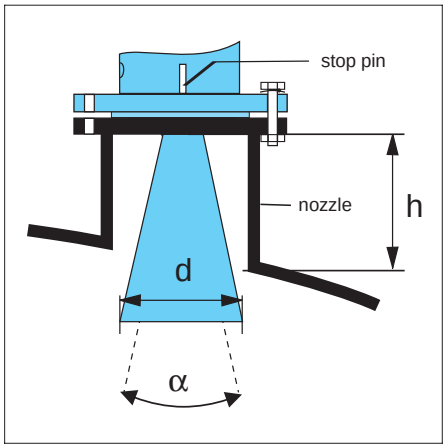
Installation

Standard Mounting

The *ideal* mounting position is:

- with horn perpendicular, stop pins parallel to tank wall
- off-centre in the tank, where possible with 30 cm clearance from tank walls
- where possible with no fittings within the beam angle α
- not above the filling curtain, baffles, or at the centre of any vortex

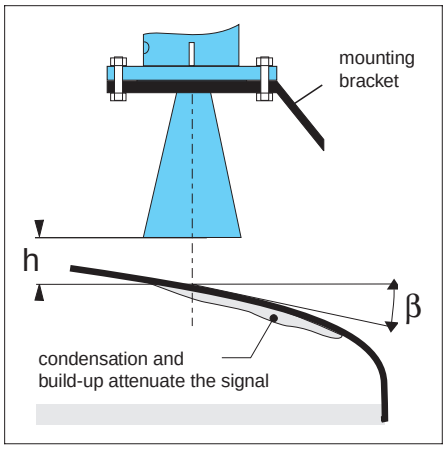
Size	d mm	h mm	α
DN 150/6"	146	max. 205	23°
DN 200/8"	191	max. 290	19°
DN 250/10"	241	max. 380	15°



External Mounting for Non-Invasive Measurement in Plastic Tanks

The conditions for standard mounting are valid, in addition:

- distance h must be greater than 100 mm
- angle β 10°...15°
- small dielectric constant ε_r for tank material, e.g. polypropylene, PVC, glass-fibre
- if possible, avoid positions with condensation or build-up.



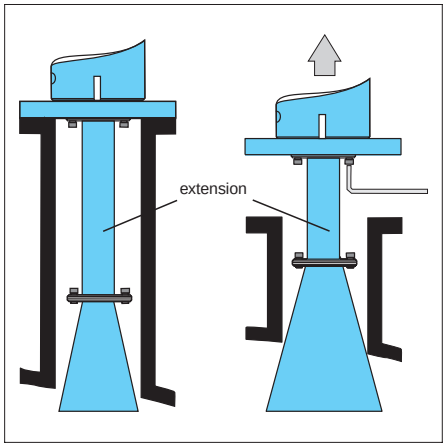
Antenna Extensions FAR 10

Case 1: Horn fits into the nozzle

- The extension tube length must be chosen such that the front of the antenna protrudes into the tank.
- The Micropilot is mounted from above.

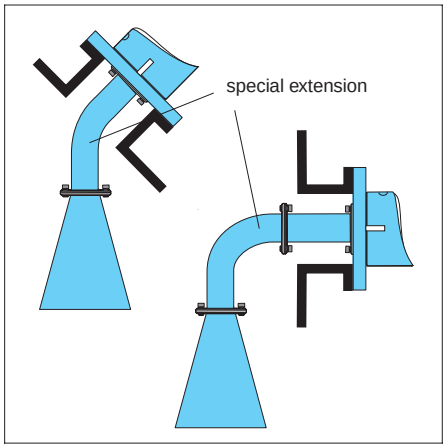
Case 2: Horn is larger than the nozzle

- The horn must be mounted from inside the tank, but the screws must be tightened from above by lifting the flange.
- Select an extension tube length which allows free access to the screws when the flange is lifted

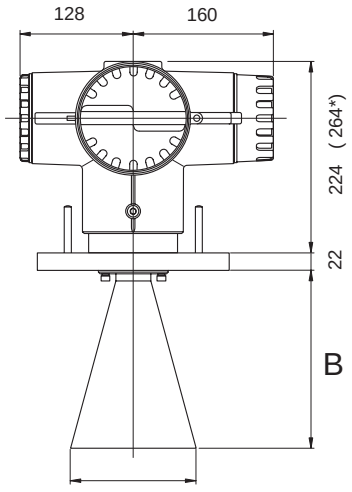


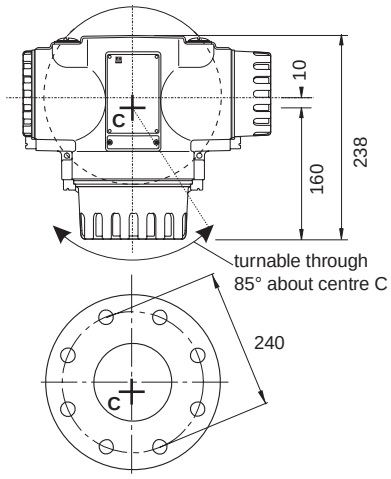
Special Extensions

In order to allow the Micropilot to be laterally mounted in e.g. distillation columns, curved extensions with angle 45° and 90° are available as special products. For more information contact Endress+Hauser.



Technical Data





Dimensions in mm of Micropilot FMR 130 with flange type DN 150, PN 16

1" = 25.4 mm

*for version with increased temperature rating 250°C

Horn	A	B
150/6"	146 mm	205 mm
200/8"	191 mm	290 mm
250/10"	241 mm	380 mm

General Specifications

Manufacturer	Endress+Hauser GmbH+Co., D 79689 Maulburg, Germany
Designation	Micropilot FMR 130
Function	Smart transmitter for level measurement by the pulsed time-of-flight (PTOF) microwave method
Operating frequency	Standard 5.8 GHz (ISM band); 6.3 GHz with FCC approval
Beam angle	DN 150/6" 23°; DN 200/8" 19°; DN 250/10" 15°
Pulse power	1 µW ERP
Reference conditions	To IEC 770 (T_U = 25°C) or as specified
Other	CE Mark

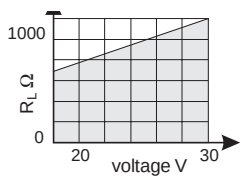
Input characteristics

Signal	Time-of-flight of microwave pulse from antenna to medium and back again.
Evaluation	Sampled envelope curve, 44 curves/s, with interference echo suppression by floating average curve and/or fixed target suppression
Update time	≥ 0.3 s, depending upon software evaluation mode
Measuring range	20 m (67 ft), option 35 m (115 ft) – see page 3 Accuracy, see measuring range diagrams page 3: solid range typically ±1 cm; dashed range typically ±2 cm; Digital resolution: 1 mm, see also analogue output Reproducibility: ± 3 mm Temperature coefficient: negligible Process pressure: 1 bar 16 bar 64 bar (physical) 20°C 0% –0.4% –1.7% of value 200°C 0% –0.2% –1.0% of value

Output characteristics

Analogue output *(Product Structure 40)*

Output	4...20 mA (3.8...21.6 mA), active or passive
On alarm	–10% (2.4 mA), +110% (22 mA) or hold last value, switchable
Isolation	Electrically isolated from rest of circuitry For Ex-versions: the negative analogue output terminal is internally connected to ground
Characteristics	Resolution: better than 0.1% (13 µA) Temperature drift: ± 0.1%/10 K of range end value (20 mA) Linearity: ≤ 0.1% of range end value (20 mA) Load dependency: ± 0.3%/100 Ω of range end value (20 mA)
Load for passive output	INTENSOR HART RS-485 active 150*...600 Ω 250*...600 Ω 0...600 Ω active, EEx [ia] 150*...400 Ω 250*...400 Ω 0...400 Ω passive R_{K*}..... (R_L – R_K*) passive, EEx ia R_{K*}..... (R_L– R_K* –R_{ISB}) R_K = INTENSOR = 150 Ω; HART = 250 Ω; RS-485 = 0 Ω R_L = load, see diagram, R_{ISB} = impedance of any safety barrier *If smart communication not used = 0 Ω



Technical Data (Cont.)

Output characteristics (continued)

Communication interfaces *(Product structure 40)*

Local operation	FHV 160 operating and display module Six keys. LC display, 4 1/2 digit with VH position and bar graph Polycarbonate housing, IP 44, EEx ia IIC T4
Remote operation (options)	INTENSOR: with Commulog VU 260 Z handheld terminal, Silometer FMX 770 transmitter, or Commubox/laptop HART: with DXR 275 handheld terminal, or Commubox/laptop RS-485 interface: with adapter/PC card or interface FXA 675

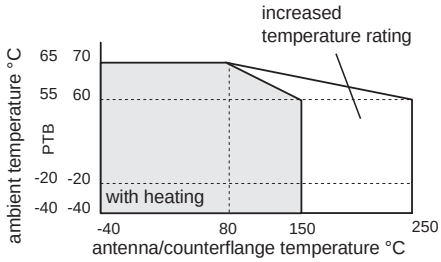
Relay

Type	1 relay with potential-free changeover contact
Function	Selectable, alarm relay or limit relay For limit relay, maximum or minimum fail-safe mode selectable through switch-on and switch-off points
On alarm	Alarm relay de-energises
Switching capacity	AC: 2.5 A, 250 V, 600 VA at cos φ = 1; 300 VA at cos φ ≥ 0.7 DC: 2.5 A, 100V, 100 W

Power supply

Versions *(Product Structure 70)*	230 V (184...250 V), 50/60 Hz; 115 V (90...138 V), 50/60 Hz: 48 V (38...58 V), 50/60 Hz; 24 V (19...29 V), 50/60 Hz 24 VDC (18...30 V), residual ripple 1 Vpp within tolerances
Power consumption	AC: ca. 10 VA, ca. 20 VA with heating DC: ca. 6 W, ca. 16 W with heating

Environmental conditions



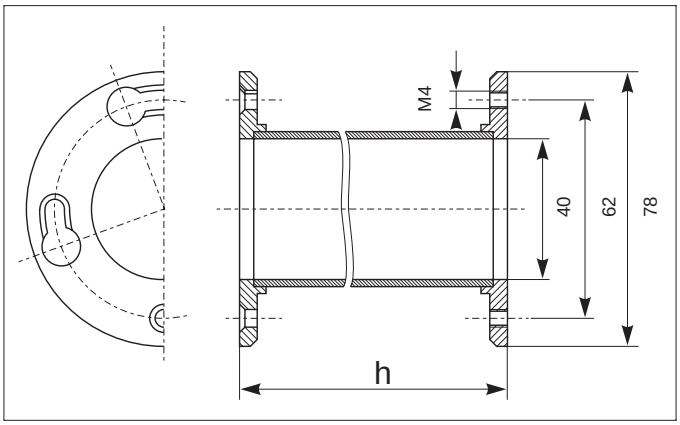
Temperature ratings *(Product structure 10, 80)*	Nominal range: -20…+70°C; with heating: -40…+70°C with certificate: -20…+65°C; with heating: -40…+65°C limit: -25 (-40)…+80°C; storage: -40…+85°C Max. temperature at antenna/counterflange: see diagram
Electromagnetic compatibility	Emission to EN 50 081-1, immunity to EN 50 082-2 and NAMUR industrial standard
Postal approval *(Product structure 10)*	BZT No. G 750 476 (5.8 GHz, ISM band) FCC No. LCG FMR 13x (6.3 GHz)
Explosion protection *(Product structure 10)*	PTB: EEx de [ia] IIC T2...T6/T2...T4 with FHV 160 FM/CSA: Class I, Div 1+2, Groups A-D
Marine approvals	GL 96 695 – 95 HH, Cat. G; ABS No. 95–ES 10070–X
Climatic class	Housing: Class C, DIN 400 40; IEC 68
Ingress protection	Housing and antenna: IP 68, DIN 400 50 and NEMA 4X Housing: Salt spray test: 504h as per DIN 50 021
Vibration resistance	IEC 68 2-6/6.1990

Mechanical construction

Horn antenna	Dimensions: see diagram, page 5 Material: Stainless steel 1.4571 (≙BS 316 L), special materials e.g. Hastelloy C4 cladding (2.4120), Tantalum cladding etc.
Housing	Dimensions: see diagram, page 5 Material: Al, sea-water resistant, chromated, powder coated Weight: ca. 6 kg + flange
Flange *(Product structure 30)*	Standards: DIN, ANSI and JIS; pressures to 64 bar (900 psi), tested to 1.5 PN, Helium leak test 10^{-7} mbar.l.s Material: Stainless steel 1.4571, polypropylene, special as horn

Antenna extension FAR 10

Dimensions	see diagram below, standard h = 100, 200, 300, 400 and special lengths
Material	Available in stainless steel 1.4571 (≙BS 316 L), special materials as horn antenna



Dimensions of antenna extension in mm, standard lengths:
h = 100 mm, 200 mm, 300 mm and 400 mm

Product Structure

Micropilot FMR 130

10 Certificates

	Type	Explosion Protection	Communications Approval
R	Standard	None	BZT approval
A	PTB	EEx de [ia] IIC T6; T4 with FHV 160	BZT approval
E	BVS	Dust-Ex, Zone 10	BZT approval
5	Standard	None	FCC approval
O	FM	Class I, Div. 1&2, Group A - D	FCC approval
P	FM	Class I, Div. 1&2, Group A - D	BZT approval
S	CSA	Class I, Div. 1&2, Group A - D	Canadian approval
Y	Special certificate		

20

	Antenna Type	Flange	O-ring	Temperature of Antenna/Counterflange
A	Horn antenna	DN 150/6"	Viton	–20...+150°C
B	Horn antenna	DN 150/6"	EPDM	–40...+150°C
C	Horn antenna	DN 150/6"	Kalrez	0...+250°C
U	Horn antenna	DN 200/8"	Viton	–20...+150°C
V	Horn antenna	DN 200/8"	EPDM	–40...+150°C
W	Horn antenna	DN 200/8"	Kalrez	0...+250°C
E	Horn antenna	DN 250/10"	Viton	–20...+150°C
F	Horn antenna	DN 250/10"	EPDM	–40...+150°C
G	Horn antenna	DN 250/10"	Kalrez	0...+250°C
Y	Special antenne/O-ring			

30 Process Connection

	Dia./Pressure	*Standard*	*Flange Material*
CO2	DN150/PN16	DIN 2526, raised face, Form C	Stainless steel 1.4571**
CD2	DN200/PN16	DIN 2526, raised face, Form C	Stainless steel 1.4571**
CU2	DN250/PN16	DIN 2526, raised face, Form C	Stainless steel 1.4571**
BU7	DN250/PN16*	DIN 2527, Form B	Polypropylene
AO2	ANSI 6"/150 psi	ANSI 16.5, raised face	Stainless steel 1.4571**
AD2	ANSI 8"/150 psi	ANSI 16.5, raised face	Stainless steel 1.4571**
AU2	ANSI 10"/150 psi	ANSI 16.5, raised face	Stainless steel 1.4571**
AD2	ANSI 10"/150 psi*	ANSI 16.5, raised face	Polypropylene
YY9	Special process connection, see left		

YY9 Special process connection (please state)
- Equivalent JIS flange
- Flange sizes: from DN 80/3"
- Pressure: PN 40, PN 64, 300 psi, 900 psi
- Material: Stainless steel or with cladding
- Hastelloy B2 or C4, Tantalum, special material (please enquire)

40 4...20mA Analogue Output/Communication

	Type	*Digital Interface*	*Operation*
B	active	INTENSOR protocol	FHV160 (supplied) or as option "E"
C	active	HARTprotocol;	FHV160 (supplied) or as option "F"
D	active	RS-485 interface;	FHV160 (supplied) or as option "G"
E	active	INTENSOR protocol;	*VU260Z/FXA191 (accessory)*
F	active	HARTprotocol;	*DXR275/FXA191 (accessory)*
G	active	RS-485 interface;	*FXA675 /RS485 adapter (accessory)*
M	passive	INTENSOR protocol;	FHV160 (supplied) or as option "O"
N	passive	HARTprotocol;	FHV160 (supplied) or as option "P"
Q	passive	RS-485 interface;	FHV160 (supplied) or as option "R"
O	passive	INTENSOR protocol;	*VU260Z/FMX770/FXA191 (accessory)*
P	passive	HARTprotocol;	*DXR275/FXA191 (accessory)*
R	passive	RS-485 interface;	*FXA675 /RS485 adapter (accessory)*
Y	Special output		

50 Cable Entry

1	With WADI PG16
2	For NPT 1/2"
3	For NPT 3/4"
4	For M20 x 1.5
5	For G1/2"
9	Special cable entry

60 Version

A	Measuring range max. 20 m, any span
B	Measuring range max. 35 m, any span (not for DN 150/6" horn)
Y	Special version

70 Power Supply

1	230VAC	50/60Hz
2	115VAC	50/60Hz
3	48VAC	50/60Hz
4	24VAC	50/60Hz
5	24VDC	
9	Special voltage	

80 Additional Equipment

A	None
B	With built-in heating (ambient temperature –40°C)
D	With increased temperature rating (+250°C)
E	With built-in heating and increased temperature rating
Y	Special equipment

FMR 130 - [ ][ ][ ][ ][ ][ ][ ][ ] product designation

*hole pattern only, for pressure range see diagram on page 3
**Stainless steel 1.4571 ≅ BS 316 L

Product Structure

Extension for Micropilot FMR 130 with Horn Antenna

Material

2 Stainless steel 1.4571 (≙ BS 316 L)
4 2.4617/Hastelloy B2
5 2.4610/Hastelloy C4
9 Other material

Length

A 100 mm
B 200 mm
C 300 mm
D 400 mm
Y Special length

FAR10-			product designation

Supplementary Documentation

- ❏ Micropilot
  System Information SI 011F/00/e
- ❏ Micropilot FMR 131
  With rod antenna
  Technical Information TI 252F/00/e
- ❏ Micropilot FMR 130
  For stilling wells and bypass pipes
  Technical Information TI 258F/00/e
- ❏ Marine Certificate GL 96 695 – 95 HH
  ZE 135F/00/e
- ❏ Rackbus
  System Information SI 014F/00/e
- ❏ Silometer FMX 770
  Technical Information TI 222F/00/e
- ❏ RS-485 Interface FXA 675
  Technical Information TI 221F/00/e
- ❏ Commubox FXA 191
  Technical Information TI 237/00/e
- ❏ Commuwin II Operating Programm
  System Information SI 018F/00/e

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