Technical
Information
TI 258F/00/en

Microwave Level Measurement *micropilot FMR 130*

Smart transmitter for non-contact measurement in metallic by-pass pipes and stilling wells Suitable for use in explosion hazardous areas

Micropilot with antenna DN 80/3" on by-pass pipe

Application

The Micropilot FMR 130 microwave transmitter is designed for continuous, non-contact level measurement of liquids. It is used on by-pass pipes and stilling wells as a maintenance-free substitute for mechanical systems, or to provide reliable measurement under difficult conditions, e.g., when the dielectric constant of the medium is less than 1.9 or vortices are present.

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

Features and Benefits

- For pressures from vacuum to 64 bar, temperatures from –40°C to +250°C
- Non-contact measurement, also through ball valve; wear- and maintenance-free
- Precise measurement independent of medium and process conditions, no blocking distance
- Analogue output can be wired to EEx e or EEx ia: flexible wiring
- Pressure and gas-tight process connection: safe measurement of toxic products

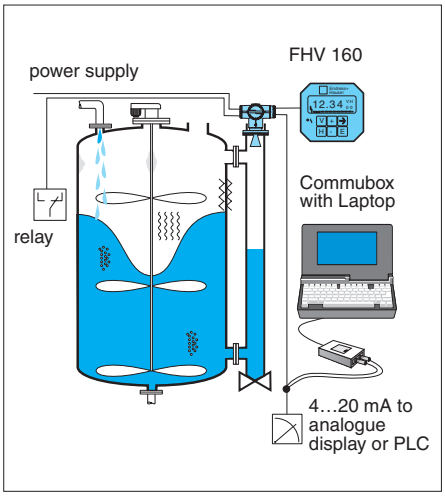
Functions

- Simple calibration using tank drawings, i.e. without medium
- Interference echo suppression with fuzzy logic algorithm
- Self-monitoring

Endress+Hauser

The Power of Know How

Measuring System

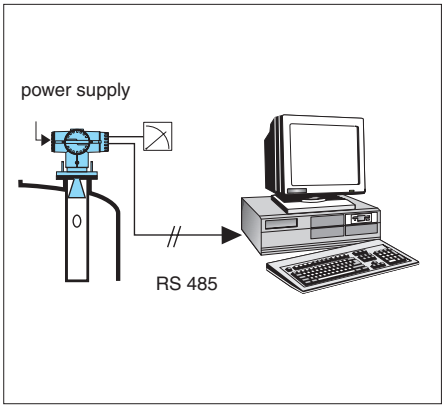


Measuring system Micropilot FMR 130: Remote operation is possible with handheld terminal or Commubox with laptop

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

- FHV 160 operating and display module as well as 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.



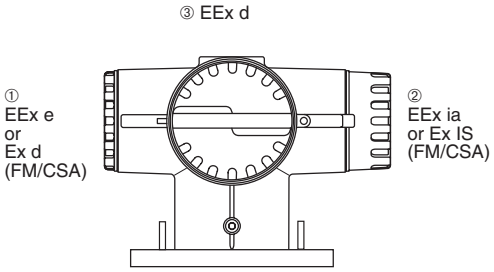
Individual measuring point with direct connection to PC via Rackbus RS 485

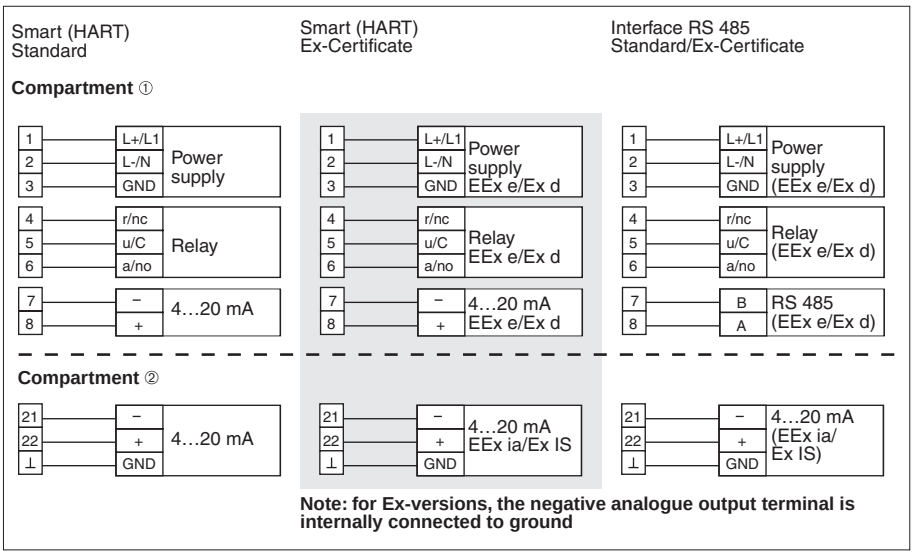
Rackbus RS 485 (Option)
Using this option, several Micropilots can be connected together on a bus and operated directly from a personal computer. Alternatively, an FXA 675 card allows connection to a process control system via Rackbus.

Electrical Connection

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

- For the Smart 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.





Note: for Ex-versions, the negative analogue output terminal is internally connected to ground

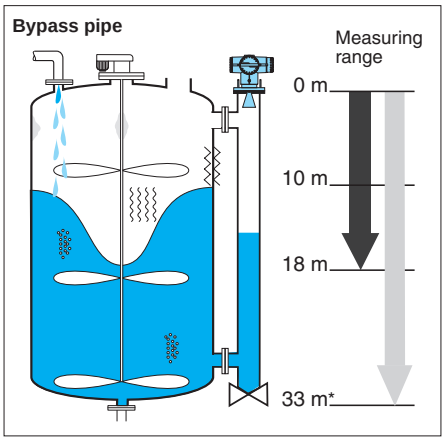
HART = registered trademark of the HART Communication Foundation

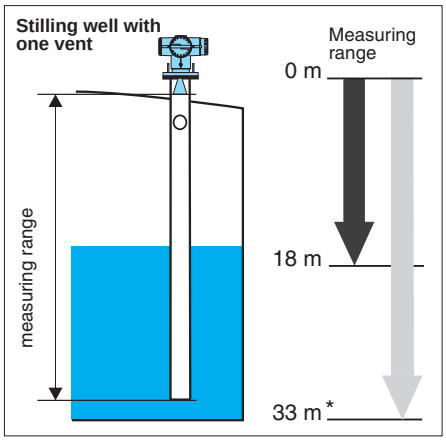
Operating Conditions

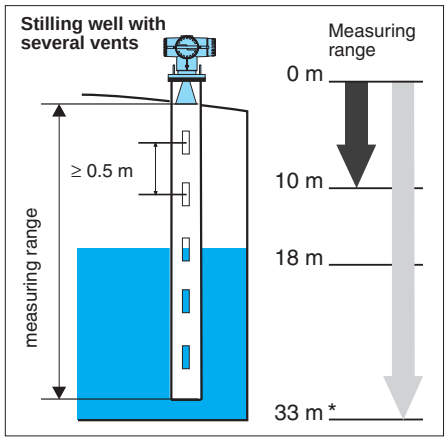
Measuring Range

In contrast to measurements with a free radiating antenna, the measuring range in by-pass pipes and stilling wells is independent of the medium properties ($\varepsilon_r \geq 1.4$) and process conditions.

The maximum measuring range is dependent upon the nominal diameter of the pipe or well and the presence of vents, see figures below.







Typical measuring range as a function of antenna and application

DN 80/3"

≥ DN 100/4"

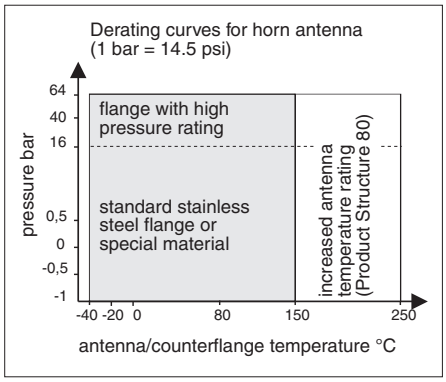
< DN 80/3" on request

*Version with extended range required above 18 m

Max. vent diameter DN 80/3": 20 mm
≥ DN 100/4": 25 mm

Process Connections

- Standards: DIN, ANSI or JIS
- Sizes: DN 80/3", DN 100/4", DN 150/6" and larger
- Pressure: from vacuum to 64 bar, depending upon version - see diagram
- Material: standard stainless steel 1.4571, special materials such as Hastelloy C4 are also available
- Seals (O-ring) in Viton, Kalrez (D4079) or EDPM
- For applications with superheated steam hotter than 150°C or other O-ring properties, please enquire.



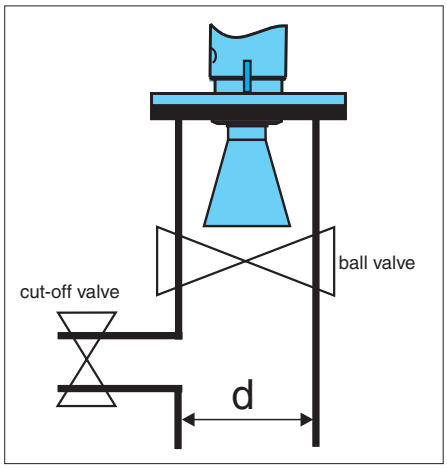
O-ring (Product Structure 20):
EPDM: –40...+150°C
Viton: –20...+150°C
Kalrez: 0...+250°C

Installation

Standard Installation

- Min. pipe diameter, see table below
- Horn perpendicular and centred in pipe
- Slight unevenness of the pipe surface or light build-up do not influence the measurement
- Measurements also possible through ball valves
- When planning new stilling wells:
  - a single vent close to the antenna is sufficient for low-viscosity liquids
  - attach approx. 10 mm wide metal bar to bottom of pipe to exactly define the zero-point.

Antenna	d mm
DN 80/6"	78
DN 100/8"	96



Product Structure

Micropilot FMR 130

10 Certificates

	Type	Protection/Approval	Communication Approval
R	Standard	for non-hazardous areas	with BZT postal approval
A	ATEX II 1/2 G	EEx de [ia] IIC T4/T6	with BZT postal approval
5	Standard	for non-hazardous areas	with FCC approval
O	FM	Class I, Div. 1&2, Group A, B, C, D	with FCC approval
P	FM	Class I, Div. 1&2, Group A, B, C, D	with BZT postal approval
S	CSA	Class I, Div. 1&2, Group A, B, C, D	with Canadian approval
Y	Special certificate		

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	Antenna Type	Size	O-ring	Antenna/Counterflange Temperature
M	Horn antenna	DN 80/3"	Viton	–20...+150°C
N	Horn antenna	DN 80/3"	EPDM	–40...+150°C
P	Horn antenna	DN 80/3"	Kalrez	0...+250°C
I	Horn antenna	DN 100/4"	Viton	–20...+150°C
J	Horn antenna	DN 100/4"	EPDM	–40...+150°C
K	Horn antenna	DN 100/4"	Kalrez	0...+250°C
Y	Special antenne/seal			

30 Process Connection

	Dia./Pressure	*Standard*	*Flange Material*
CA2	DN80/PN16	DIN 2526, raised face, Form C	Stainless steel 1.4571**
CE2	DN80/PN40	DIN 2526, raised face, Form C	Stainless steel 1.4571**
CH2	DN100/PN16	DIN 2526, raised face, Form C	Stainless steel 1.4571**
CL2	DN100/PN40	DIN 2526, raised face, Form C	Stainless steel 1.4571**
CO2	DN150/PN16	DIN 2526, raised face, Form C	Stainless steel 1.4571**
AA2	ANSI 3"/150 psi	ANSI 16.5 raised face	Stainless steel 1.4571**
AE2	ANSI 3"/300 psi	ANSI 16.5 raised face	Stainless steel 1.4571**
AH2	ANSI 4"/150 psi	ANSI 16.5 raised face	Stainless steel 1.4571**
AL2	ANSI 4"/300 psi	ANSI 16.5 raised face	Stainless steel 1.4571**
AO2	ANSI 6"/150 psi	ANSI 16.5 raised face	Stainless steel 1.4571**
YY9	Special process connection		

YY9 Special process connection (please state)
- Equivalent JIS flange
- Pressure: PN 40, PN 64, 300 psi, 900 psi
- Material: Stainless steel or with cladding Hastelloy B2 or C4, Tantalum; other special materials, please enquire

40 4...20mA Analogue Output/Communication

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

50 Cable Entry

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

60 Version

A Measuring range max. 18 m, any span
B Measuring range max. 33 m, any span (antenna DN 100/4" only)
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

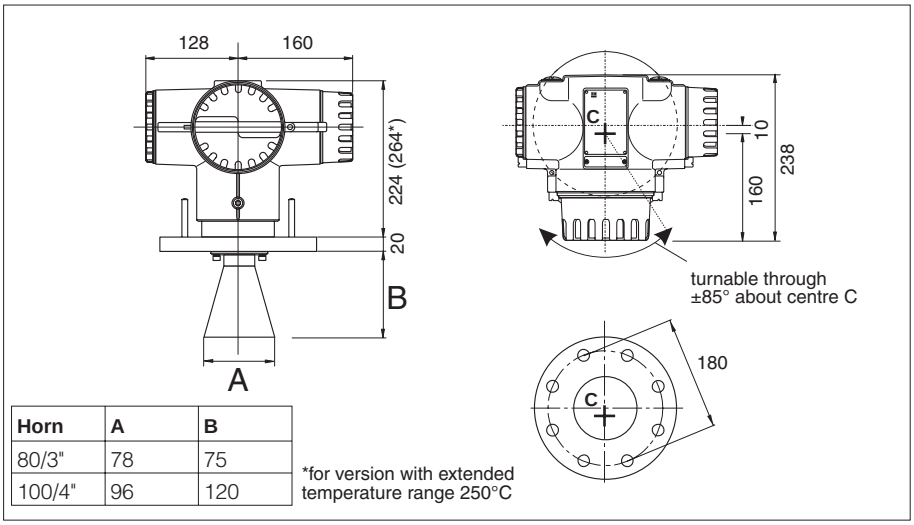
A None
B With built-in heating (ambient temperature (–40°C)
D With increased antenna temperature rating (+250°C)
E With built-in heating and increased temperature rating
Y Special equipment

product designation

FMR 130 - | | | | | | | | |

**Stainless steel 1.4571 ≅ BS 316 Ti

Technical Data



Horn	A	B
80/3"	78	75
100/4"	96	120

*for version with extended temperature range 250°C

Dimensions in mm of Micropilot FMR 130 (with flange type DN 100 PN 16)

1" = 25.4 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	approx 6 GHz utra wide band system
Beam power	Average 1 µW ERP
Reference conditions	To IEC 770 (T_U = 25°C) or as specified
Other	CE Mark

Input characteristics

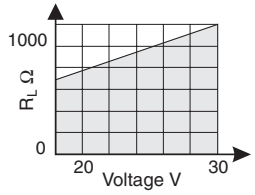
Signal	Time-of-flight of microwave pulse from antenna to medium and back again.
Evaluation	Sampled envelope curve, 44 curves/s, with interferance echo suppression by floating average curve and/or fixed target suppression
Update time	≥ 0.3 s, depending upon software evaluation mode
Measuring range	Max. 18 m (60 ft), option 33 m (108 ft), see page 3 Accuracy: typically ±5 mm, max. ±10 mm Digital resolution: 1 mm, see also analogue output Reproducibility: ± 3 mm Temperature coefficient: negligible

Process pressure:

(physical)		1 bar	16 bar	40 bar	
	20°C	0%	–0.4%	–1.0%	of value
	200°C	0%	–0.2%	–0.7%	of value

Output characteristics

Analogue output *(Product Structure 40)*

Output	4...20 mA (3.8...21.6 mA), active or passive
Isolation	Electrically isolated from rest of circuitry For Ex-versions: the negative analogue output terminal is internally connected to ground
Signal on alarm	–10%, +110% or hold last value, switchable
Accuracy	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	

	HART	RS-485
active	250*...600 Ω	0...600 Ω
active, EEx [ia]	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 = HART = 250 Ω; RS-485 = 0 Ω and R_L = load, see diagram,
R_{ISB} = impedance of any safety barrier
*If smart communciation not used = 0 Ω

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)	HART: with DXR 275 handheld terminal, or Commubox/laptop RS-485 interface: with adapter/PC card

Technical Data (Cont.)

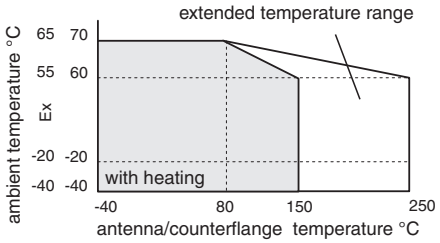
Output characteristics (continued)

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
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	Interference Emission to EN 61326, Electrical Equipment Class B Interference Immunity to EN 61326, Annex A (Industrial) and NAMUR Recommendation NE 21 (EMC) A standard installation cable is sufficient if only the analogue signal is used. Use a screened cable when working with a superimposed communications signal (HART).
Postal approval *(Product Structure 10)*	R&TTE, FCC No. LCG FMR 13x
Explosion protection *(Product Structure 10)*	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
Climatic class	Housing: Class C, DIN 400 40; IEC 68
Ingress protection	Housing and antenna: IP 68, DIN 400 50 for Pg16 version Housing: Salt spray test: 504h as per DIN 50 021
Vibration resistance	IEC 68 2-6/6.1990

Mechanical construction
(for dimensions see page 5)

Antenna	Material: stainless steel or special material, e.g. Hastelloy C4 (2.4610), Tantalum etc.
Housing	Material: Al, sea-water resistant, chromated, powder coated Weight: ca. 6 kg + flange
Flange	Standards: see Product Structure 30 Material: stainless steel or special cladding material as antenna Helium leak test: 10^{-7} mbar.l/s Tested to 1.5 PN

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