

# 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 temperatures from  $-40^{\circ}\text{C}$  to  $+250^{\circ}\text{C}$
- 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

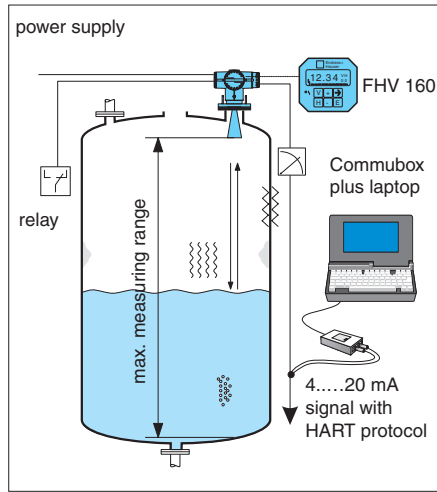
**Endress + Hauser**

The Power of Know How



# Measuring System

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

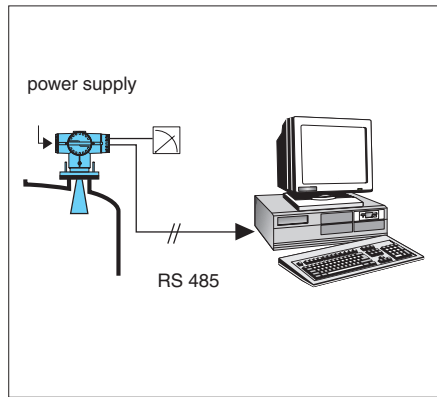


## Compact transmitter

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

- FHV 160 operating and display module as well as 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 direct connection to PC via Rackbus RS-485

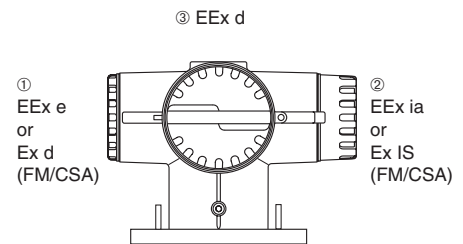
## Rackbus RS-485 Interface (Option)

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.



Smart (HART) Standard	Smart (HART) Ex-Certificate	RS 485 interface Standard/(Ex-Certificate)																																																									
<b>Compartment ①</b>																																																											
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**Note: for Ex-versions, the negative analogue output terminal is internally connected to ground**

HART is a registered trademark of the HART Communication Foundation

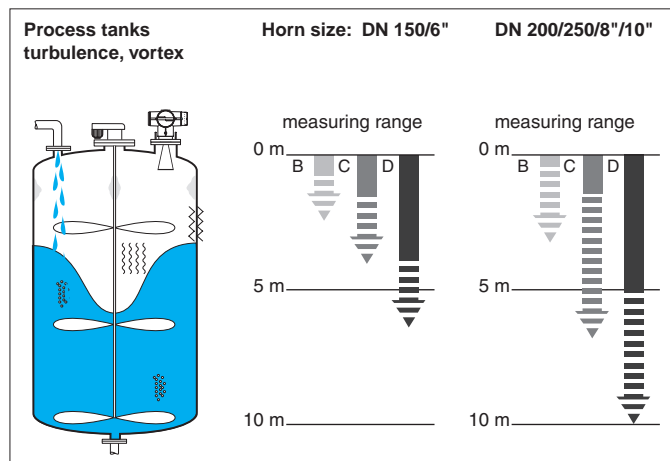
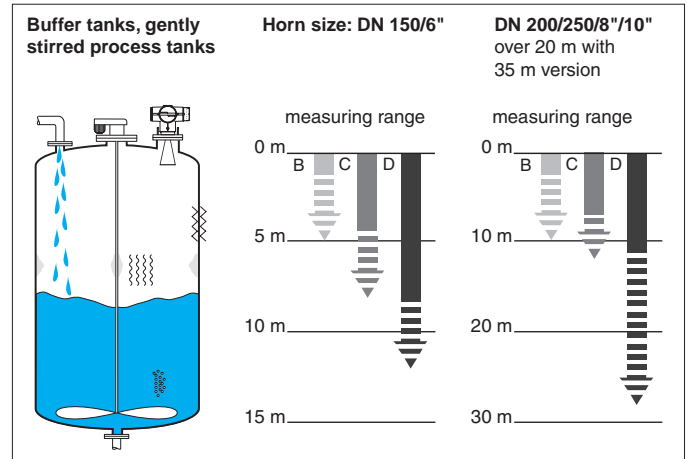
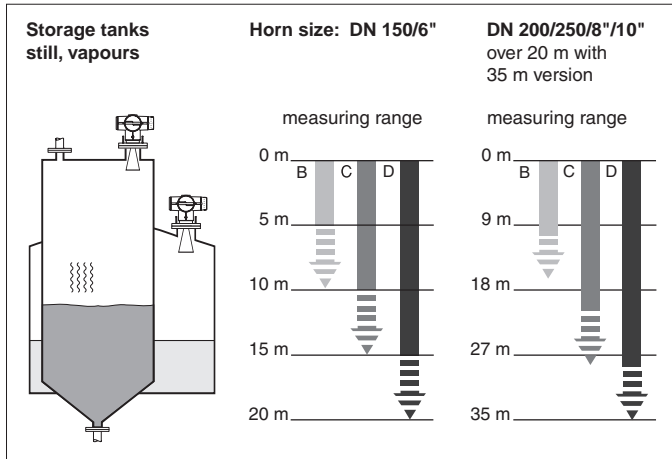
# Operating Conditions

## 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.

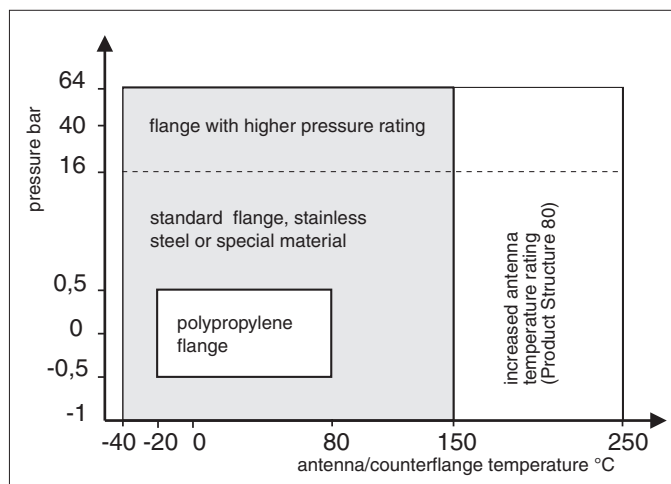
- If the liquid properties are unknown or the product changes take Class B.
- For Class A the DN 250/10" antenna typically measures up to 6 m.
- For larger ranges than indicated use a by-pass or stilling pipe.

Class	Examples
A	Liquefied gases dielectric constant $\epsilon_r$ approx. 1.4...1.9
B	non-conducting liquids, e.g. petrochemicals, benzine, oil, toluol, dielectric constant $\epsilon_r$ approx. 1.9...4
C	e.g. conc. acids, organic solvents, analine, esters, alcohols, acetone, oil/water mixtures, $\epsilon_r$ approx. 4...10
D	conducting liquids, e.g. aqueous solutions, dilute acids and alkalis, $\epsilon_r > 10$ or $\sigma > 10$ 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 EPDM
- For applications with superheated steam > 150°C, please enquire.

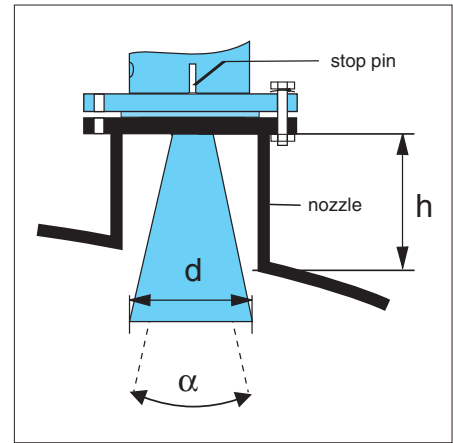
# Installation

## 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  $\alpha$
- not above the filling curtain, baffles, or at the centre of any vortex

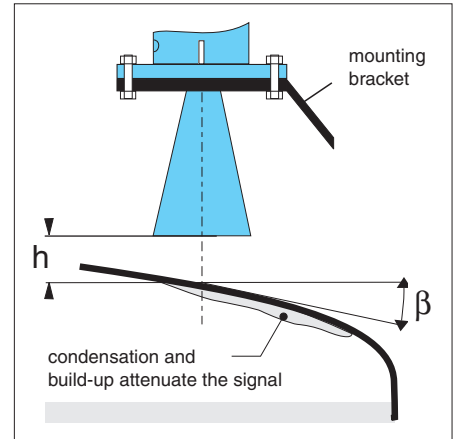
Size	d mm	h mm	$\alpha$
DN 150/6"	146	max. 205	23°
DN 200/8"	191	max. 290	19°
DN 250/10"	241	max. 380	15°



## 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  $\beta$  10°...15°
- small dielectric constant  $\epsilon_r$  for tank material, e.g. polypropylene, PVC, glass-fibre
- if possible, avoid positions with condensation or build-up.



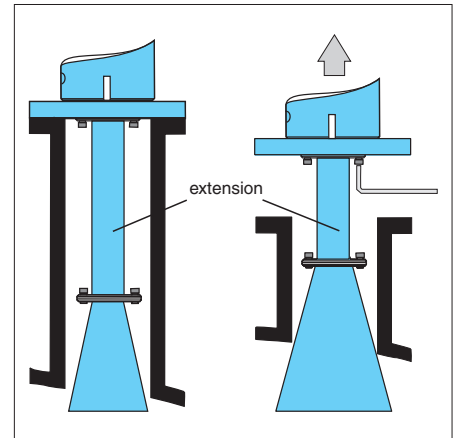
## Antenna Extensions FAR 10

### 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.

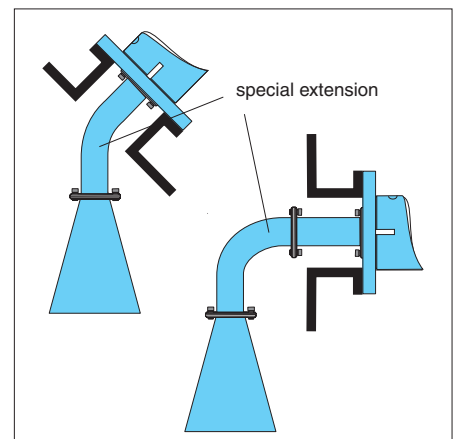
### Case 2: Horn is larger than the nozzle

- 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

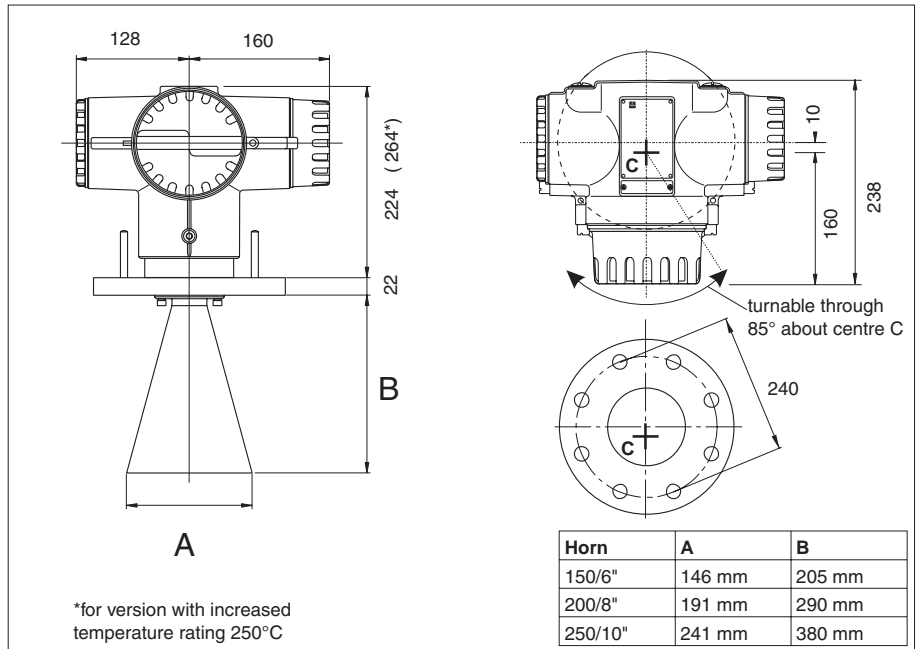
In order to allow the Micropilot to be laterally mounted in e.g. distillation columns, curved extensions with angle 45° and 90° are available as special products. For more information contact Endress+Hauser.



# Technical Data

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

1" = 25.4 mm



## 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 ultra wide band system
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 <sub>U</sub> = 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	<p>HART RS-485 active 250*...600 Ω 0...600 Ω active, EEx [ia] 250*...400 Ω 0...400 Ω passive R<sub>K</sub>*... (R<sub>L</sub> - R<sub>K</sub>*) passive, EEx ia R<sub>K</sub>*... (R<sub>L</sub> - R<sub>K</sub>* - R<sub>ISB</sub>) R<sub>K</sub> = HART = 250 Ω; RS-485 = 0 Ω R<sub>L</sub> = load, see diagram, R<sub>ISB</sub> = impedance of any safety barrier *If smart communication not used = 0 Ω</p>

# 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)	HART: with DXR 275 handheld terminal, or Commubox/laptop RS-485 interface: with adapter/PC card or interface FXA 675

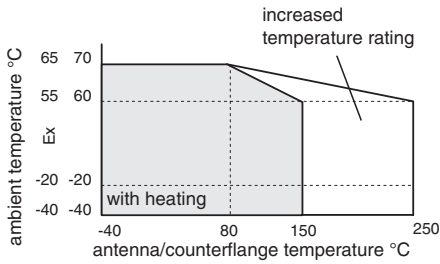
### Relay

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 $\cos \varphi = 1$ ; 300 VA at $\cos \varphi \geq 0.7$ 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 and NEMA 4X Housing: Salt spray test: 504h as per DIN 50 021
Vibration resistance	IEC 68 2-6/6.1990

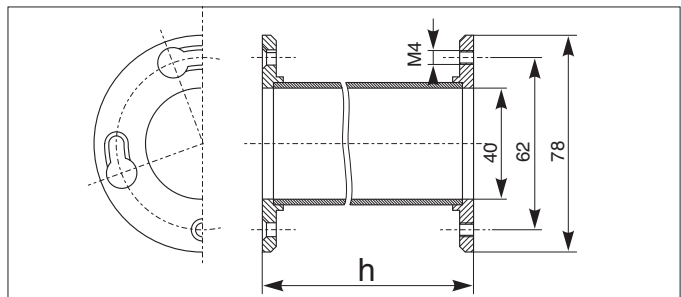
## Mechanical construction

Horn antenna	Dimensions: see diagram, page 5 Material: Stainless steel 1.4571 ( $\cong$ 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 mm and special lengths
Material	Available in stainless steel 1.4571 ( $\cong$ 316 Ti), 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

<b>10</b>	<b>Certificates Type</b>	<b>Explosion Protection</b>	<b>Communications Approval</b>	
	R Standard	None	BZT approval	
	A ATEX II 1/2 G	EEx de [ia] IIC T4/T6	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			
<b>20</b>	<b>Antenna Type</b>	<b>Flange</b>	<b>O-ring</b>	<b>Temperature of Antenna/Counterflange</b>
	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			
<b>30</b>	<b>Process Connection</b>	<b>Dia./Pressure</b>	<b>Standard</b>	<b>Flange Material</b>
	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		
	<b>40</b>	<b>4...20mA Analogue Output/Communication</b>	<b>Type</b>	<b>Digital Interface</b>
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		
<b>50</b>	<b>Cable Entry</b>			
	4	For M20 x 1.5		
	2	For NPT 1/2"		
	3	For NPT 3/4"		
	5	For G 1/2"		
9	Special cable entry			
<b>60</b>	<b>Version</b>			
	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			
<b>70</b>	<b>Power Supply</b>			
	1	230VAC	50/60Hz	
	2	115VAC	50/60Hz	
	3	48VAC	50/60Hz	
	4	24VAC	50/60Hz	
	5	24VDC		
9	Special voltage			
<b>80</b>	<b>Additional Equipment</b>			
	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		

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)

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

\*hole pattern only, for pressure range see diagram on page 3  
 \*\*Stainless steel 1.4571 ≡ 316 Ti

# Product Structure

Extension for Micropilot FMR 130 with Horn Antenna		
<b>Material</b>		
2	Stainless steel 1.4571 (≅ 316 Ti)	
4	2.4617/Hastelloy B2	
5	2.4610/Hastelloy C4	
9	Other material	
<b>Length</b>		
A	100 mm	
B	200 mm	
C	300 mm	
D	400 mm	
Y	Special length	
FAR10-	<input type="text"/>	<input type="text"/>
product designation		

## Supplementary Documentation

- Micropilot System Information SI 019F/00/en
- Micropilot FMR 131 With rod antenna Technical Information TI 252F/00/en
- Micropilot FMR 130 For stilling wells and bypass pipes Technical Information TI 258F/00/en
- Marine Certificate GL 96 695 – 95 HH ZE 135F/00/en
- Rackbus System Information SI 014F/00/en
- Silometer FMX 770 Technical Information TI 222F/00/en
- RS-485 Interface FXA 675 Technical Information TI 221F/00/en
- Commubox FXA 191 Technical Information TI 237/00/en
- Commuwin II Operating Programm System Information SI 018F/00/en

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Endress+Hauser  
GmbH+Co. KG  
Instruments  
International  
P.O. Box 2222  
D-79574 Weil am Rhein  
Germany  
Tel. (07621) 975-02  
Fax (07621) 975-345  
<http://www.endress.com>  
[info@ii.endress.com](mailto:info@ii.endress.com)

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