

# Ultrasonic Measurement *prosonic FDU 80...86*

**Sensors for non-contact, continuous measurement of level and flow. Suitable for use in explosion hazardous areas.**



## Application

Prosonic FDU is a series of nine ultrasonic sensors with different measuring ranges for continuous, non-contact measurement of level and flow.

- FDU 80, 80 F  
Liquids: 5 m (16 ft)  
Solids: 2 m (6.5 ft)
- FDU 81, 81 F  
Liquids: 10 m (32 ft)  
Solids: 5 m (16 ft)
- FDU 82  
Liquids: 20 m (65 ft)  
Solids: 10 m (32 ft)
- FDU 83  
Liquids: 25 m (82 ft)  
Solids: 15 m (49 ft)
- FDU 84  
Solids: 25 m (82 ft)
- FDU 85  
Solids: 45 m (147 ft)
- FDU 86  
Solids: 70 m (230 ft)

The material to be measured can be aggressive liquids such as alkali or acid, or powdery and clumpy solids such as grain, coal, ore and gravel.

## Features and Benefits

- Complete sensor programme for non-contact, continuous measurement of level and flow
- For use in flumes, weirs, tanks and silos
- Insensitive to dirt and build-up
- Optional integrated heating to protect against a build up of ice on the sensor
- Wide range of mountings using flange or thread (with slip-on flange for flush mounting of the sensor)
- Weather resistant and safe against submersion (IP 68)
- Integrated temperature sensor

Please note:  
From January 2008, the sensors FDU80...86 are only available as spare part.

**Endress + Hauser**

The Power of Know How



# Measuring System

## Measuring System

The complete measuring system consists of

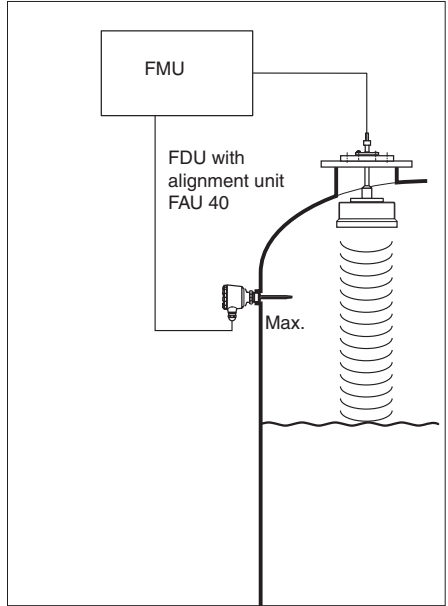
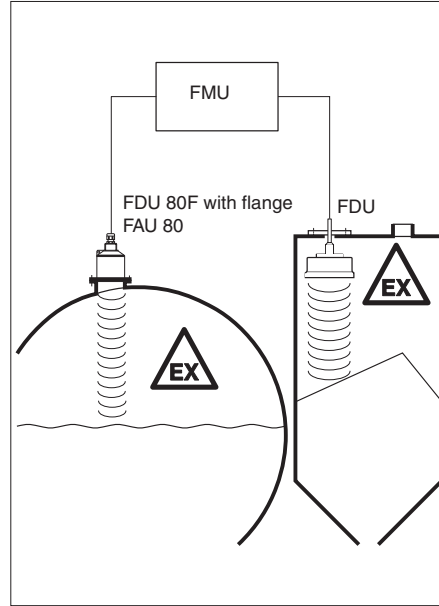
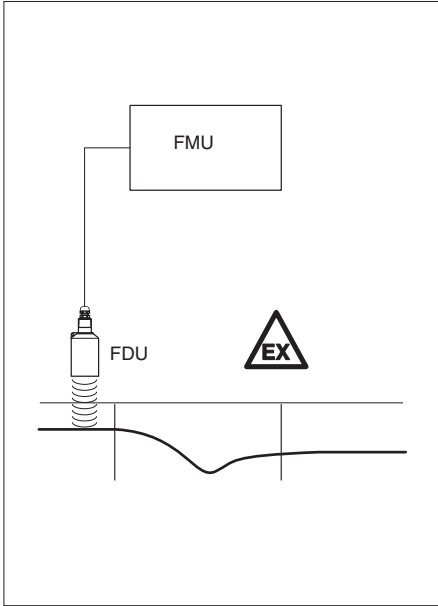
- the Prosonic FDU 80, 80 F, 81, 81 F, 82, 83, 84, 85 or 86 ultrasonic sensor
- the transmitter
  - Prosonic FMU 860: 1-channel version for level measurement or
  - Prosonic FMU 861: 1-channel version for flow measurement or level measurement or
  - Prosonic FMU 862: 2-channel version.

Sensor FDU 86 can be selected and operated by FMU 86x transmitters with software version 2.2 upwards.

## Sensor Accessories

The accessories (see pages 9 and 10) ensure that the sensors can be adapted to special process conditions:

- Alignment unit FAU 40 for the sensor
- All-weather protective cover
- Mounting frame
- Wall bracket
- Sensor flanges (e.g. FAU 80)
- External temperature sensor FMT 131
- A separate power supply unit is available for heated sensors.



The Prosonic transmitters have an input for the connection of a separate limit switch.

## Function

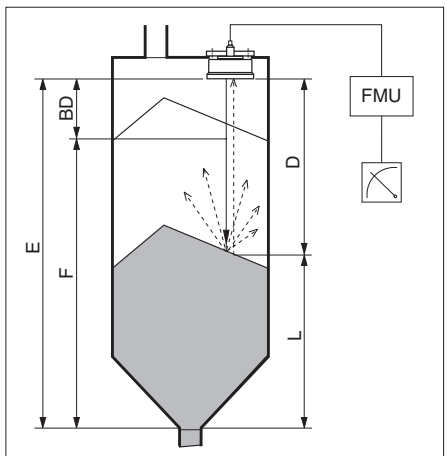
The emitter in the sensor is excited electrically and sends an ultrasonic pulse in the direction of the surface of the product which partially reflects the pulse. This echo is detected by the same sensor, now acting as a directional microphone, and then converted back into an electrical signal. The time between transmission and reception of the pulse (the sonic run time) is directly proportional to the distance between the sensor and the product surface. This distance is determined by the velocity of sound  $c$  and the run time  $t$  using the formula:

$$D = \frac{c \cdot t}{2}$$

- Operating principle of FDU ultrasonic sensors
- BD Blocking distance
  - D Distance from sensor to surface of material
  - L Height in silo (Level)
  - F Maximum level (100%, Full)
  - E Zero point of measurement (0%, Empty)

## Blocking Distance

Due to the ringing time of the sensor, there is a zone immediately below the sensor in which returning echoes cannot be detected. This so-called blocking distance BD determines the minimum distance between the sensor diaphragm and the maximum level in the silo. If the minimum distance is not maintained, the level will not be measured correctly.



# Planning Recommendations

## Maximum Measuring Range

The correct sensor for your particular application depends on the process and ambient conditions. When selecting the sensor, take into account that the maximum measuring range of the individual sensor is determined by the attenuation of the ultrasonic pulse by the air as well as by the reflecting characteristics of the product surface. Both the level of background noise (e.g. when filling) and the mounting point also can affect measurement.

## Application Requirements

Optimum conditions in tanks or silos are achieved if

- the lower edge of the sensor is below the silo roof
- the detection zone does not include any internal fixtures or the filling curtain
- the surface of the solid is hard and coarse-grained
- the surface of the liquid is calm and no vapour is formed
- operation is under normal atmospheric pressure
- the vessel is not being filled during measurement.

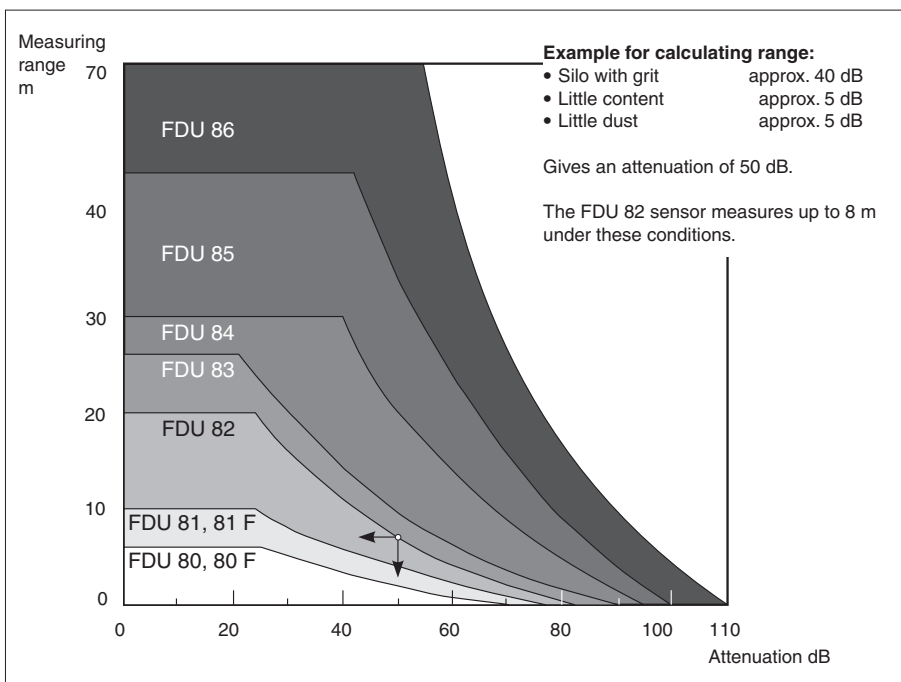
Less than optimum conditions reduce the measuring range of the sensors.

## Calculating the Range

The diagram shows ideal attenuation curves for the FDU 80...86 sensors:

- Check the factors affecting your measurement in the table right.
- Add up their attenuation values.
- Take this sum and find the point where it intersects with the range limit line of the sensor you are using

Factors	Attenuation (dB)
Temperature layering air temperature difference between sensor and surface of material up to 20°C (68°F) up to 40°C (104°F) up to 80°C (176°F) up to 150°C (302°F)	0 5...10 10...20 20...30
Filling curtain outside detection zone small amounts in detection zone large amounts in detection zone	0 5...10 10...40
Dust none low amounts high amounts	0 5 5...20
Surface of solid hard, coarse (e.g. grit) soft (e.g. peat, dust-covered clinker)	40 40...60
Surface of liquid calm ripples strong turbulence (e.g. agitator blades)	0 5...10 10...20
Foam please contact Endress+Hauser	
Sensor installation lower edge free in silo on collar, lower edge slanted depending on diameter/length ratio on collar, lower edge horizontal depending on diameter/length ratio	0 10...20 20...40



## Dimensions

1 m = 3.28 ft  
1 ft = 0.305 m

Echo attenuation as a function of range for various sensors (ideal reflection and atmospheric conditions)

# Installation

## Detection Limits and Interference Signals

If internal fixtures are present in the tank, then careful alignment of the sensor is critical in order to keep the interference echoes as low as possible. The ultrasonic pulse should travel unimpeded to the surface of the material. The signal leaves the sensor as a narrow beam which widens as the distance increases. Every object within this beam gives rise to an echo which is then received by the sensor. The radius of the beam can be easily estimated by using the 3 dB beam angle.

## Operating Limits

- The sensors may not be used to measure aliphatic hydrocarbons (not applicable to FDU 80 F / FDU 81 F).

## Estimation of the Detection Limits of the Detector

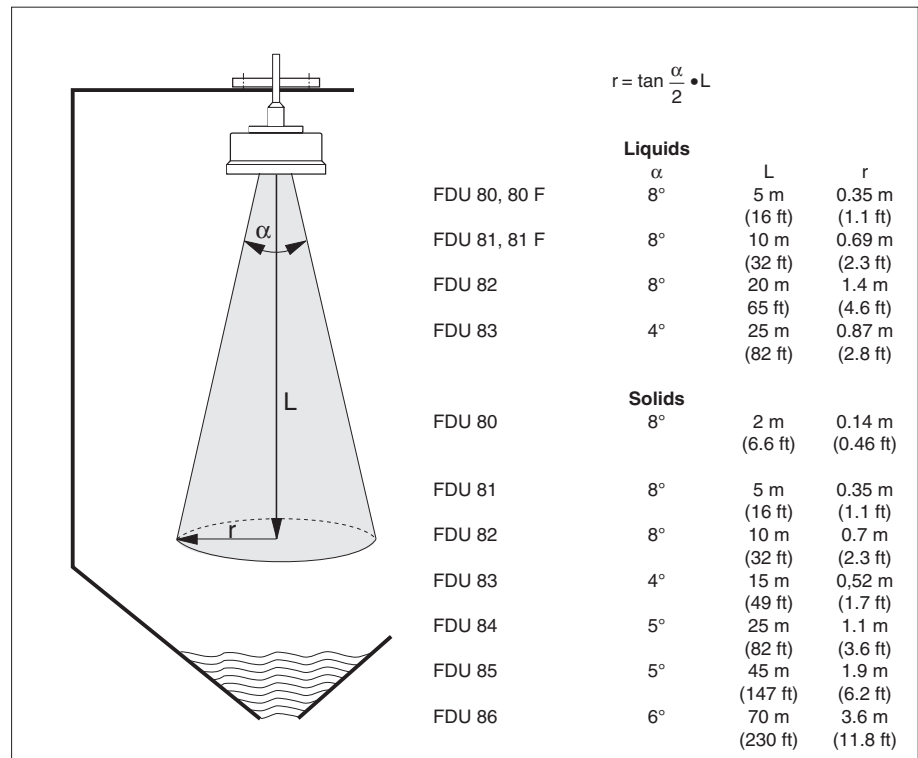
Please note:

- Edges, internal fixtures, etc. within the sound cone are of greatest importance in the first third of the range as the energy of the beam is highly concentrated.
- The energy in the last third of the range is distributed over a larger area, so that internal structures and edges are not as critical.

## Accuracy

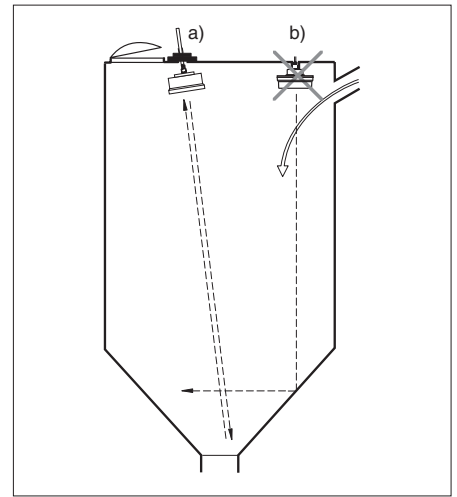
- A constant temperature and sound velocity within the measuring path enable a high degree of accuracy to be achieved. The effects of large temperature variations within the measuring path and changing gas mixtures must be calculated and the Prosonic programmed accordingly.
- With liquids having a high partial pressure, the gas composition must be determined to see if it remains constant.

$\alpha$  3 dB beam angle  
 L length of beam  
 (calculated from max.  
 measuring range of  
 sensor)  
 r radius of beam



### Guidelines when Mounting

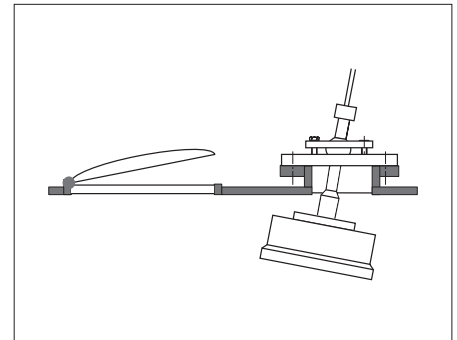
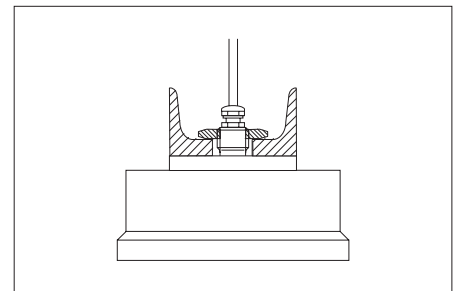
- Check that the maximum level height does not come within the blocking distance of the sensor (see page 11, »Technical Data«).
- If possible, the face of the sensor should lie parallel to the surface of the product.
- The PE or PTFE coating on the diaphragm of the FDU 84, 85 and 86 is an integral part of the measuring system and must not be damaged during installation.
- Do not damage the funnel of the FDU 86 when mounting.
- The connecting cable of the FDU sensor is not designed as a supporting cable. Do not use it as a suspension wire.
- For dust explosion areas: The connecting cable of the FDU must be laid in piping. Local regulations for explosive atmospheres caused by dust must be observed.
- All national guidelines applicable must be observed in explosion hazardous areas.



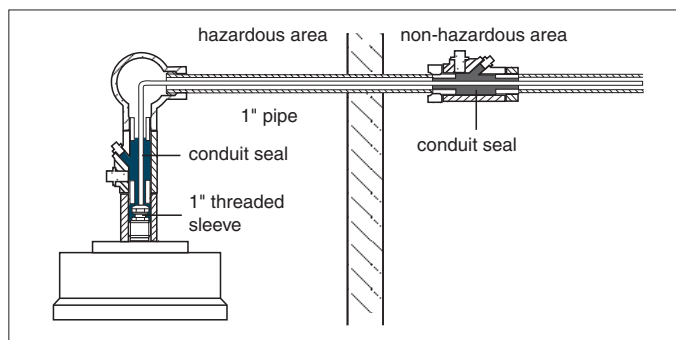
- a) Correct installation
- As far as possible from the silo wall, the material inflow and internal fixtures.
  - The centre of the outflow funnel reflects an echo which is received by the sensor even when the silo is empty.
- b) Incorrect installation
- The detection zone includes the filling curtain.
  - The echo is reflected to one side when the silo is empty.

### Mounting in Vessels

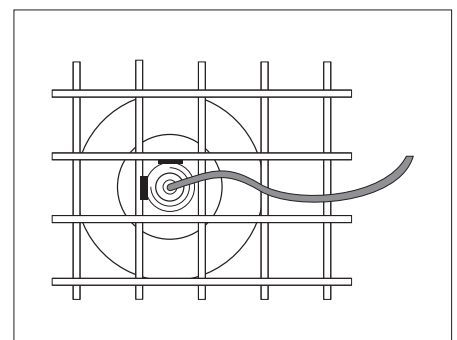
- Install the sensor so that its lower edge projects into the vessel.
- Position the sensor so that neither the filling curtain nor any internal fittings, e.g. an additional limit switch, are within the detection zone.
- The sensor must be positioned at the centre of the outflow funnel so that an echo is received when the silo is empty.
- Accurate positioning of the sensor can be simplified using the FAU 40 alignment unit.
- The cable of the prosonic sensor is not designed as a supporting cable. Do not use it as a suspension wire.
- If the sensor is to be installed in tanks containing very aggressive media, check that the chemical and corrosion resistance of the sensor materials meet these requirements.



- Mounting:
- above: FDU 84 on girder or angle bracket
  - centre: FDU 84 with alignment unit FAU 40 near to a service access
  - below: FDU 84 with a 1" sleeve welded to a grating



Sensor on a 1" pipe in combustible dust area (for FM, Class II)



## Flush Mounting with Slip-on Flange FAU 80

The FDU 80 F and FDU 81 F sensors can be flush mounted using an FAU 80 slip-on flange.

Flanges in polypropylene (PPs) should only be used with pressures up to 1.5 bar<sub>abs</sub>, flanges in 1.4435 also above.

### Note for 3A applications!

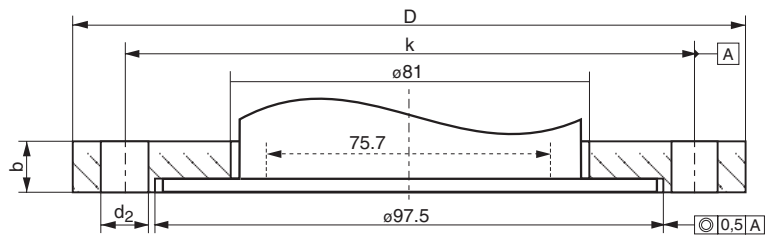
The internal diameter of the nozzle should be selected according to the valid allowable limits for 3A applications.

Usually, the internal diameter of the nozzle should be larger than or equal to the internal diameter of the sensor.

### Dimensions

1 mm = 0.039 in

1 in = 25.4 mm

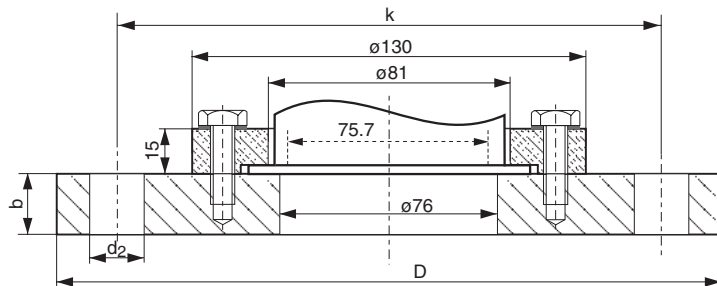


Order No.	b	Ø D	Ø d <sub>2</sub>	k	No. d <sub>2</sub>	Standard for
FAU 80 - CAP	20	200	18	160	8	DN 80 PN 16 (DIN EN 1092-1-E)
FAU 80 - CAJ						
FAU 80 - AAP	23.9	190.5	19.1	152.4	4	ANSI 3" 150 psi (ANSI B 16.5)
FAU 80 - AAJ						
FAU 80 - KAP	18	185	19	150	8	JIS 10 K 80 (JIS B 2210)
FAU 80 - KAJ						

### Note for 3A applications!

The internal diameter of the nozzle should be selected according to the valid allowable limits for 3A applications.

Usually, the internal diameter of the nozzle should be larger than or equal to the internal diameter of the sensor.



Order No.	b	Ø D	Ø d <sub>2</sub>	k	No. d <sub>2</sub>	Standard for
FAU 80 - CHP	20	220	18	180	8	DN 100 PN 16 (DIN 2527)
FAU 80 - CHJ						
FAU 80 - AHP	23.9	228.6	19.1	190.5	4	ANSI 4" 150 psi (ANSI B 16.5)
FAU 80 - AHJ						
FAU 80 - KHP	18	210	19	175	8	JIS 10 K 100 (JIS B 2210)
FAU 80 - KHJ						

## Mounting on a Mounting Pipe

The sensor should be mounted on a pipe only when the maximum level comes within the blocking distance.

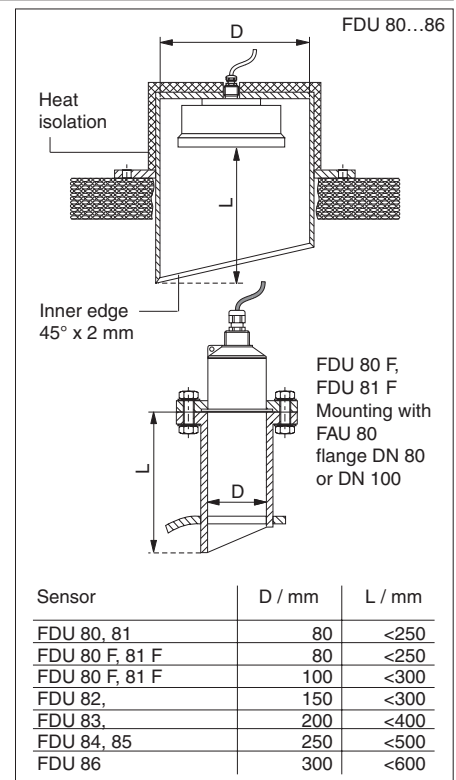
Please note:

- No build-up of material should form in the pipe.
- Select a pipe with a diameter as large as possible (see figures and table). If there is a possibility of build-up in the pipe the diameter should be significantly larger.
- The inner surface of the pipe should be as smooth as possible (no edges or welding seams). When mounting in the open, the pipe should be insulated as the temperature within the pipe can differ significantly from that in the vessel.
- For other nozzles, fixed target suppression must be used.

### Dimensions

1 mm = 0.039 in

1 in = 25.4 mm



Sensor	D / mm	L / mm
FDU 80, 81	80	<250
FDU 80 F, 81 F	80	<250
FDU 80 F, 81 F	100	<300
FDU 82,	150	<300
FDU 83,	200	<400
FDU 84, 85	250	<500
FDU 86	300	<600

## Mounting above Flumes

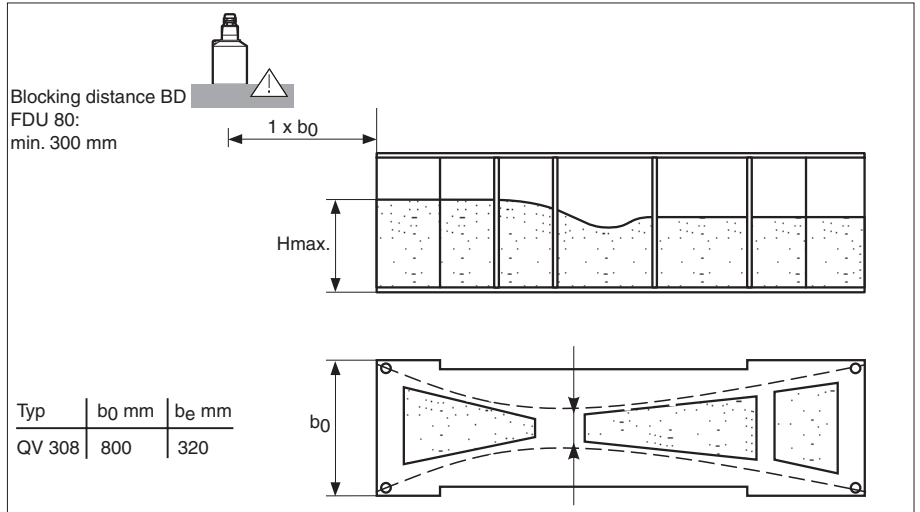
To achieve the highest accuracy, the sensor should be situated immediately above the high water level (100%) plus the blocking distance BD (see page 11, »Technical Data«).

The sensor must always be mounted perpendicular to the surface of the water and be above the centre of the flume.

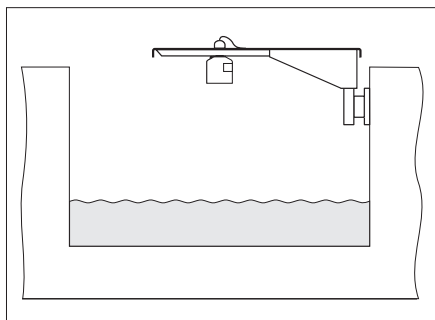
The appropriate mounting distances with respect to the flume are to be maintained (see operating manual »Prosonic«, BA 100F/00/en). When mounted in the open, the sensor must be protected against the sun by a protective cover, so that temperature compensation works correctly. We recommend an all weather protection cover (see page 9, »Accessories«).

### Dimensions

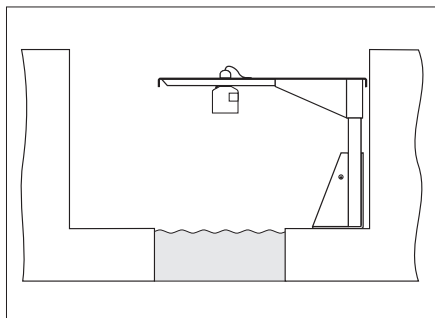
1 mm = 0.039 in  
1 in = 25.4 mm



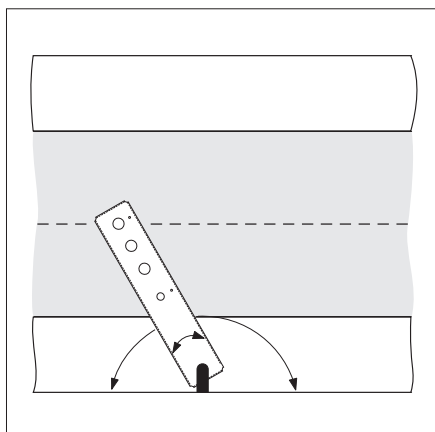
Example:  
Flow measurement with  
Khafagi-Venturi flumes



Mounting unit with wall bracket and cantilever (see page 9, »Accessories«)



Mounting unit with mounting frame and cantilever (see page 9, »Accessories«)



The mounting unit can be swivelled so that the sensor can be positioned over the centre of the flume.

# Electrical Connection

## Connecting the FDU

The sensors are supplied with a fixed cable of 5 m (16.35 ft) in length as standard (30 m (98.1 ft) if required, cross section 0.75 mm<sup>2</sup> (AWG 18)).

They can be connected:

- directly in the FMU connection compartment; the connecting terminals are designed for cross sections up to 2.5 mm<sup>2</sup> (AWG 13).
- via a terminal box; an additional cable is then required which may be up to 300 m (981 ft) in length, up to 6 Ω per core, maximum 60 nF (terminal box and cable not included in delivery). A two-wire, screened cable must be used (screening: metal braiding max. 6 Ω). The screening serves as a return cable. Do not ground the screening and lay to the transmitter without any electrical break.

If the terminal box is to be installed in explosion hazardous areas, then all national guidelines applicable must be observed.

These measures ensure that the sensors correspond to industrial (NAMUR) and European EMC Standards EN 50 081-1 for interference emission and EN 50 082-2 for interference immunity. For general information on EMC (test methods, installation hints) see TI 241F/00/en.

## Ultrasonic Sensor with Heating

The sensors FDU 80 and FDU 81 can be supplied with heating units. For heated sensors:

The connecting terminals for the heating unit are delivered with the sensor. They are to be mounted in the connection compartment of the transmitter.

- Technical data for an external power supply for heating the sensor  
– 24 V<sub>DC</sub> ( 10%)  
for each heated sensor, 250 mA, 8 W

∅ mm <sup>2</sup>	0.5 (AWG 20)	0.75 (AWG 18)	1 (AWG 17)
max. length m (ft)	150 (490.5)	250 (817.5)	300 (981)

### Wire coding

BK	black
RD	red
YE	yellow
GNYE	green/yellow
BN	brown
BU	blue

### Sensor extension cable:

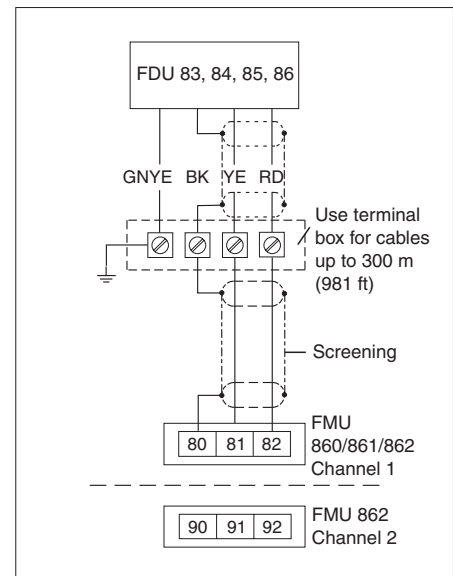
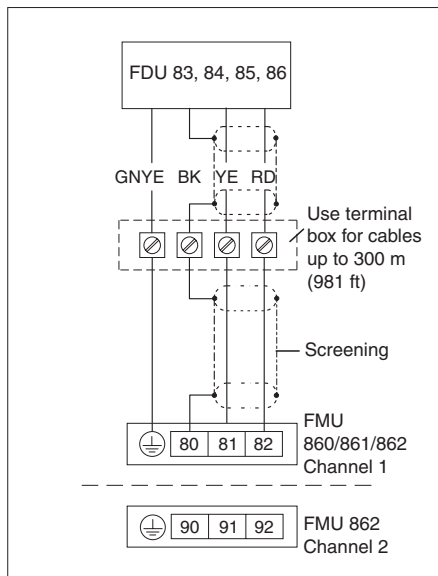
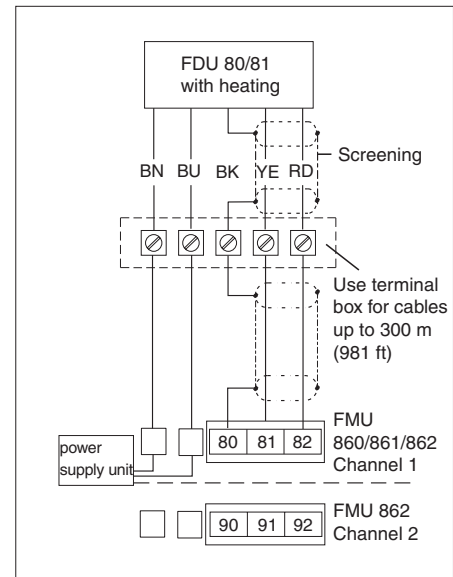
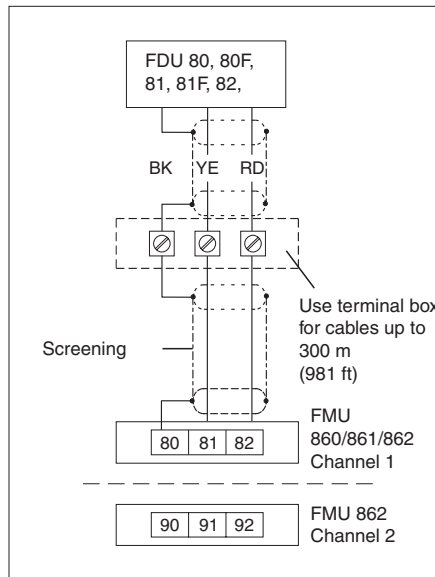
- FDU 80, 80F, 81, 81F, 82:  
Ord. No. 938278-0120
- FDU 83, 84, 85  
Ord. No. 938278-1021
- FDU 86  
Ord. No. 52000261

### Connecting the sensors

- above left :  
FDU 80, 80F, 81, 81F, 82
- above right:  
FDU 80, 81 with heating system
- below right:  
FDU 83, 84, 85 (ground via the terminal box)
- below left:  
FDU 83, 84, 85, 86 (ground to FMU)

### Screening

The screening acts as feedback and must be exhibit electrical continuity between sensor and transmitter.

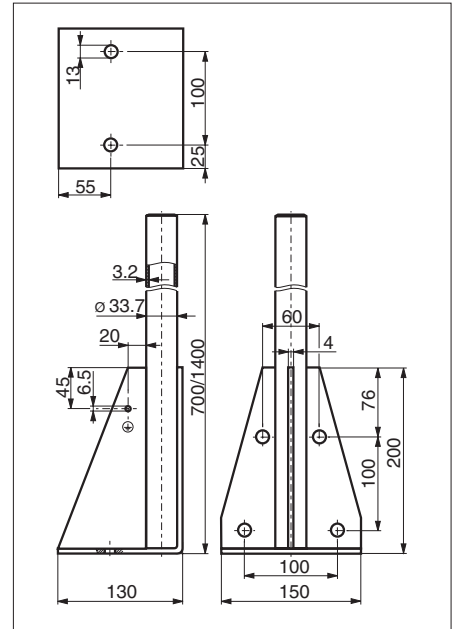




# Accessories

## Mounting Frame

Material: Order  
 number:  
 700 mm, galvanised steel 919791-0000  
 700 mm, 1.4301 (AISI 304) 919791-0001  
 1400 mm, galv. steel 919791-0002  
 1400 mm, 1.4301 (AISI 304) 919791-0003



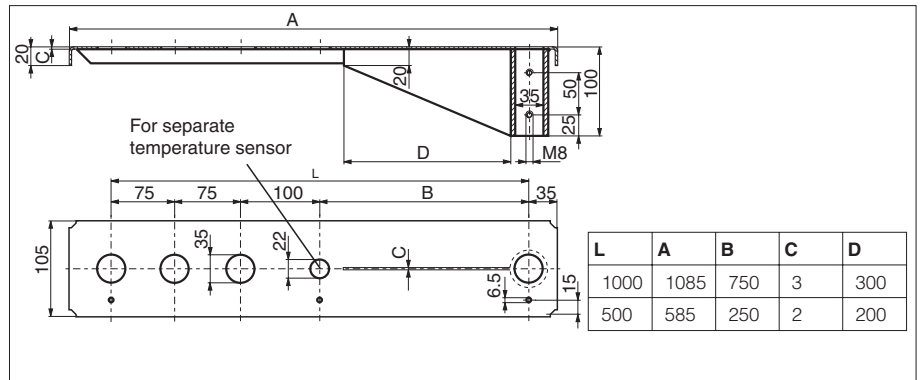
Mounting frame with 1" pipe for cantilever and Prosonic FMU

## Cantilever for Mounting Frame

For mounting Prosonic sensors FDU 80 and 81 over open channels

Material/version: Order  
 number:  
 500 mm, galv. steel 919790-0000  
 500 mm, 1.4301 (AISI 304) 919790-0001  
 1000 mm, galv. steel 919790-0002

**Dimensions**  
 1 mm = 0.039 in  
 1 in = 25.4 mm



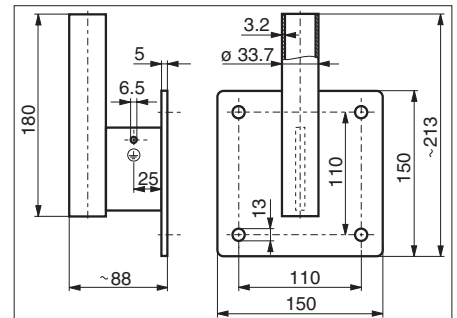
Cantilever for mounting frame

1000 mm,  
 1.4301 (AISI 304)  
 919790-0003

## Wall Bracket

- Material: galvanised steel  
 Order number: 919792-0000
- Material: 1.4301 (AISI 304)  
 Order number: 919792-0001

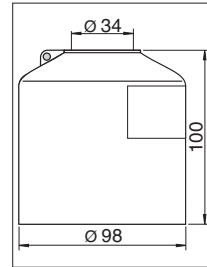
Wall bracket for cantilever



# Accessories

## All-Weather Protective Cover

For Prosonic sensors FDU 80 and 81  
 Material: PP-GF  
 Order number: 919793-0000  
 The measurement point designation is fixed to the protective cover.  
 Break off the fixing eyes on the sensor at the preformed positions – *beforehand*.



All-weather protective cover for FDU 80 and FDU 81

## Flanges

Version, similar to: Order number:  
 DN 80 PN 16 in PPs 919789-0000  
 DN 100 PN 16 in PPs 919789-0002  
 DN 150 PN 16 in PPs 919789-0004  
 DN 200 PN 16 in PPs 919789-0006  
 The maximum operating pressure of the sensor applies.  
 Other flanges on request.

## Power Supply Unit for Sensor Heating of FDU 80 and FDU 81

Power unit (24 V DC) for sensor heating with IP 66 protective housing.  
 Material: PT/ABS  
 Order No.: 215095-0002

## External Temperature Sensor FMT 131

Application: for heated sensor and when temperature is not to be measured in the sensor.  
 Housing: POM, IP 65  
 Sensor (NTC): 1.4571 stainless steel  
 Thread: G 1/2 A  
 Two-core screened cabling, max. 25 Ω per core.

Order code:  
 • Standard version:  
 FMT 131-R7: not certified, always without cable

### Dimensions

1 m = 3.28 ft  
 1 ft = 0.305 m

Certificates	
J	ATEX II 2 G EEx m T6
Q	FM Class I Div.1 Groups A...D
R	Standard

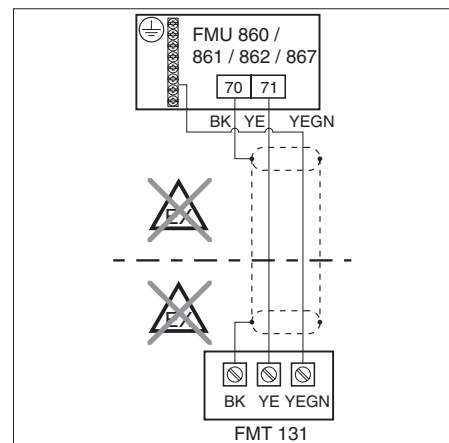
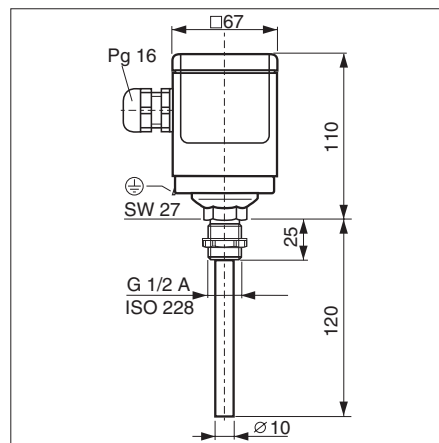
Cable Length	
1	5 m
*	other on request
8	...m variable length (6...30 m)

FMT 131 -

**Dimensions**  
 1 mm = 0.039 in  
 1 in = 25.4 mm

left:  
 dimensions of temperature sensor FMT 131

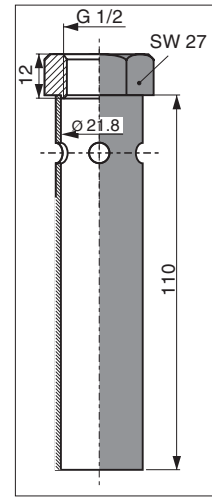
right:  
 electrical connection of standard temperature sensor FMT 131-R7 (FMT 131-J is delivered with cable connected)



# Accessories

## Protective Sleeve for Temperature Sensor FMT 131

Material: 1.4571 stainless steel  
(AISI 316 Ti)  
Order No.: 942046-0000

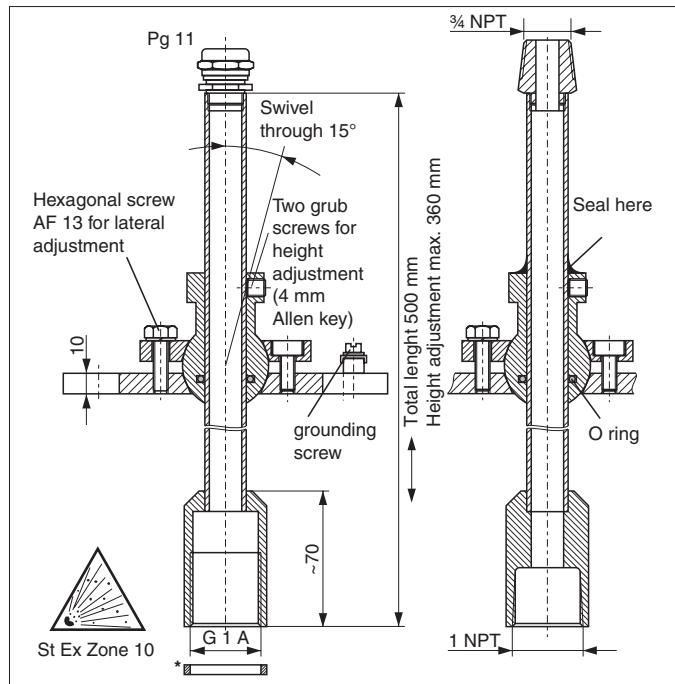


**Dimensions**  
1 mm = 0.039 in  
1 in = 25.4 mm

## Alignment Unit FAU 40

For easy mounting and positioning of the FDU sensor (see Technical Information TI 179F/00/en).

Dimension of protective sleeve for temperature sensor



Dimensions of alignment unit FAU 40

left:  
with G 1 thread and Pg 11 cable gland

right:  
with 1 NPT thread and 3/4" cable gland for pipe connection

\* for use in Dust-Ex:  
Insert the seal which is supplied with the sensor here

## Spare Parts for Sensor FDU 86

The following spare parts are available for the FDU 86 (Type FDU 86-R # #):

- Funnel with accessories  
Order number: 52002963
- Seals with accessories  
Order number: 52002964
- Cable with accessories  
Length                      Order number:  
5 m (16 ft)                      52002957  
10 m (32 ft)                      52002958  
15 m (49 ft)                      52002959  
20 m (65 ft)                      52002960  
25 m (82 ft)                      52002961  
30 m (98 ft)                      52002962

# Technical Data

## General Information

Manufacturer	Endress+Hauser GmbH+Co.
Instrument	Ultrasonic sensor
Designation	Prosonic FDU 80, 80F, 81, 81F, 82, 83, 84, 85, 86
Technical documentation Version Technical data	TI 189F/00/en 06.99 according to DIN 19259

## Application

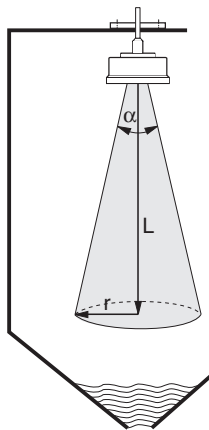
Non-contact continuous level measurement in liquids and solids
--

## Operation and System Design

Measuring principle	Ultrasonic echo level measurement, time-of-flight
Modularity	Ultrasonic sensor for various measuring ranges for connecting to the transmitters 860...862, as standard with integrated temperature sensor and mounting accessories, FDU 80/81 with optional heating. Sensor FDU 86 can be selected and operated by FMX 86x transmitters with software version 2.2 upwards.
Construction	FDU 80...86: Sensors with connecting cable, mounting via threaded boss on collar, FDU 80F/81F: Flush-mounted sensor with connecting cable, mounting via slip-on flange
Signal transmission	Analogue voltages

## Input

Measured variables	Level or flow, determined by the distance from the ultrasonic sensor (membrane) to the surface of the product																																																										
Measuring ranges		in liquids	in solids																																																								
	FDU 80	5 m (16 ft)	2 m (6.5 ft)																																																								
	FDU 80F	5 m (16 ft)	–																																																								
	FDU 81	10 m (32 ft)	5 m (16 ft)																																																								
	FDU 81F	10 m (32 ft)	–																																																								
	FDU 82	20 m (65 ft)	10 m (32 ft)																																																								
	FDU 83	25 m (82 ft)	15 m (49 ft)																																																								
	FDU 84	–	25 m (82 ft)																																																								
	FDU 85	–	45 m (147 ft)																																																								
	FDU 86	–	70 m (230 ft)																																																								
Blocking distance	FDU 80, 80F	0.3 m (1.0 ft)																																																									
	FDU 81, 81F	0.5 m (1.6 ft)																																																									
	FDU 82	0.8 m (2.6 ft)																																																									
	FDU 83	1.0 m (3.3 ft)																																																									
	FDU 84, 85	0.8 m (2.6 ft)																																																									
	FDU 86	1.6 m (5.2 ft)																																																									
Operating frequency (at 23°C)	FDU 80, 80F	58 kHz																																																									
	FDU 81, 81F	44 kHz																																																									
	FDU 82	29 kHz																																																									
	FDU 83	30 kHz																																																									
	FDU 84	21 kHz																																																									
	FDU 85	17 kHz																																																									
	FDU 86	11 kHz																																																									
Pulse frequency	Dependent on measuring range 1 Hz...10 Hz																																																										
Attenuation due to conditions	Determining the detection limits with a 3 dB beam angle																																																										
$\alpha$ = 3 dB beam angle L = length of beam (calculated from max. measuring range of sensor) r = radius of beam	$r = \tan \frac{\alpha}{2} \cdot L$ <table border="1"> <thead> <tr> <th></th> <th><math>\alpha</math></th> <th>L</th> <th>r</th> </tr> </thead> <tbody> <tr> <td colspan="4"><b>Liquids</b></td> </tr> <tr> <td>FDU 80, 80F</td> <td>8°</td> <td>5 m</td> <td>0.35 m</td> </tr> <tr> <td>FDU 81, 81F</td> <td>8°</td> <td>10 m</td> <td>0.69 m</td> </tr> <tr> <td>FDU 82</td> <td>8°</td> <td>20 m</td> <td>1.4 m</td> </tr> <tr> <td>FDU 83</td> <td>4°</td> <td>25 m</td> <td>0.87 m</td> </tr> <tr> <td colspan="4"><b>Solids</b></td> </tr> <tr> <td>FDU 80</td> <td>8°</td> <td>2 m</td> <td>0.14 m</td> </tr> <tr> <td>FDU 81</td> <td>8°</td> <td>5 m</td> <td>0.35 m</td> </tr> <tr> <td>FDU 82</td> <td>8°</td> <td>10 m</td> <td>0.7 m</td> </tr> <tr> <td>FDU 83</td> <td>4°</td> <td>15 m</td> <td>0.52 m</td> </tr> <tr> <td>FDU 84</td> <td>5°</td> <td>25 m</td> <td>1.1 m</td> </tr> <tr> <td>FDU 85</td> <td>5°</td> <td>45 m</td> <td>1.9 m</td> </tr> <tr> <td>FDU 86</td> <td>6°</td> <td>70 m</td> <td>3.6 m</td> </tr> </tbody> </table>				$\alpha$	L	r	<b>Liquids</b>				FDU 80, 80F	8°	5 m	0.35 m	FDU 81, 81F	8°	10 m	0.69 m	FDU 82	8°	20 m	1.4 m	FDU 83	4°	25 m	0.87 m	<b>Solids</b>				FDU 80	8°	2 m	0.14 m	FDU 81	8°	5 m	0.35 m	FDU 82	8°	10 m	0.7 m	FDU 83	4°	15 m	0.52 m	FDU 84	5°	25 m	1.1 m	FDU 85	5°	45 m	1.9 m	FDU 86	6°	70 m	3.6 m
	$\alpha$	L	r																																																								
<b>Liquids</b>																																																											
FDU 80, 80F	8°	5 m	0.35 m																																																								
FDU 81, 81F	8°	10 m	0.69 m																																																								
FDU 82	8°	20 m	1.4 m																																																								
FDU 83	4°	25 m	0.87 m																																																								
<b>Solids</b>																																																											
FDU 80	8°	2 m	0.14 m																																																								
FDU 81	8°	5 m	0.35 m																																																								
FDU 82	8°	10 m	0.7 m																																																								
FDU 83	4°	15 m	0.52 m																																																								
FDU 84	5°	25 m	1.1 m																																																								
FDU 85	5°	45 m	1.9 m																																																								
FDU 86	6°	70 m	3.6 m																																																								
For feet see page 4																																																											



## Output

Transmitters	FMU 860: 1-channel instrument for level measurement FMU 861: 1-channel instrument for flow measurement FMU 862: 2-channel instrument for flow or level measurement
--------------	--

**Process Conditions**

**Mounting conditions**

Mounting position	Vertical to the surface of the material
-------------------	---

**Ambient conditions**

Storage temperature	FDU 80: -40...+60°C (-40...+140°F) FDU 80F: -40...+95°C (-40...+203°F) FDU 81: -40...+80°C (-40...+176°F) FDU 81F: -40...+95°C (-40...+203°F) FDU 82, 83, 84, 85: -40...+80°C (-40...+176°F) FDU 86: -40...+150°C (-40...+302°F)
Relative humidity	FDU 80, 80F, 81, 81F, 82, 83, 85, 86: 100% FDU 84: 100% (max. 60°C/140°F), 95% (max. 80°C/176°F)
Protection	IP 68 (tested by immersing to 1 m for 24 h)
Electromagnetic compatibility	Emitted interference to EN 61326, Class B equipment; immunity to interference resistance to EN 61326; Annex A (industry sector)

**Process temperature**

**FDU 80**

Certificate (Version)	Sensor heating	Temperature class	Ambient temperature
standard (R) CSA GP (U)			- 20 °C... + 60 °C [- 40 °C... + 60 °C for limited range]
ATEX II 2 G (J) FM (Q) CSA (S)	nein	T6	- 20 °C... + 60 °C
	ja	T6	- 20 °C... + 40 °C

**FDU 81**

Certificate (Version)	Sensor heating	Temperature class	Ambient temperature
standard (R) CSA GP (U)	nein		- 20 °C... + 80 °C [- 40 °C... + 80 °C for limited range]
	ja		- 20 °C... + 60 °C
ATEX II 2 G (J) FM (Q) CSA (S)	nein	T5	- 20 °C... + 80 °C
	ja	T5	- 20 °C... + 60 °C

**FDU 80F / 81F**

Certificate (Version)	Temperature class	Ambient temperature
standard (R) CSA GP (U)		- 40 °C... + 95 °C
ATEX II 2 G (J) FM (Q) CSA (S)	T5	- 20 °C... + 80 °C

**FDU 82**

Certificate (Version)	Temperature class	Ambient temperature
standard (R) CSA GP (U)		- 20 °C... + 80 °C [- 40 °C... + 80 °C for limited range]
ATEX II 2 G (J) FM (Q) CSA (S)	T5	- 20 °C... + 80 °C
	T6	- 20 °C... + 60 °C

**FDU 83 / 84 / 85**

Certificate (Version)	Ambient temperature
standard (R) CSA GP (U)	- 20 °C... + 80 °C [- 40 °C... + 80 °C for limited range]
ATEX II 1/2 D (E) FM (P) CSA (T)	- 20 °C... + 80 °C

**FDU 86**

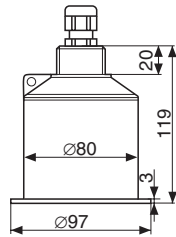
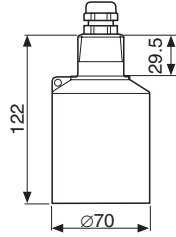
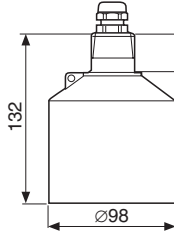
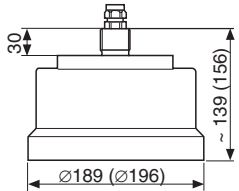
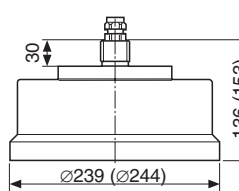
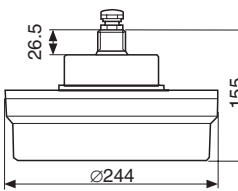
Certificate (Version)	Temperature class	Ambient temperature
standard (R) CSA GP (U)		- 40 °C... + 150 °C
ATEX 1/2 D (E) FM (P) CSA (S)	T3C	- 40 °C... + 140 °C
ATEX 1/2 D (F) FM (K) CSA (L)	T5	- 40 °C... + 80 °C
ATEX II 2 G	T5	- 40 °C... + 90 °C
	T6	- 40 °C... + 75 °C

**Process pressure**

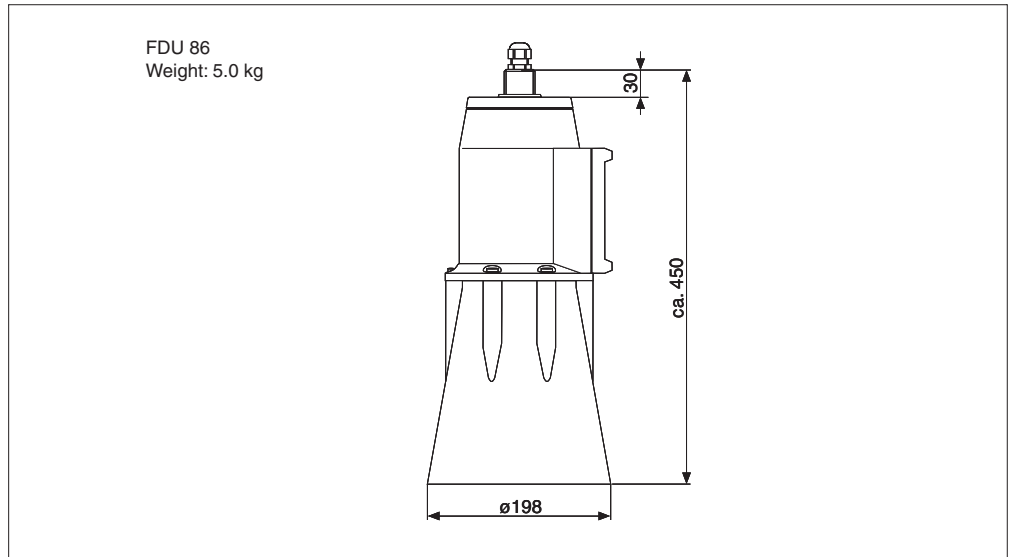
Process pressure P <sub>abs</sub>	FDU 80	FDU 80F	FDU 81	FDU 81F	FDU 82	FDU 83	FDU 84	FDU 85	FDU 86
* May be used at high pressures but only after first contacting Endress+Hauser	2 bar (29 psi)	4 bar (58 psi)	2 bar (29 psi)	4 bar (58 psi)	2 bar (29 psi)	1.5 bar (22 psi)	1.5 bar (22 psi)	1.5 bar (22 psi)	3 bar (44 psi)

**Mechanical Construction**

**Housings**

<p>FDU 80F, FDU 81F (flush-mounted) Weight: FDU 80F: 0.5 kg (1.1 lbs) FDU 81F: 0.55 kg (1.2 lbs)</p> 	<p>FDU 80, FDU 81 Weight: FDU 80: 0.55 kg (1.2 lbs) FDU 81: 0.6 kg (1.3 lbs)</p> 	<p>FDU 82 Weight: 1.2 kg (2.6 lbs)</p> 
<p>FDU 83 Weight: 3.1 kg (6.8 lbs)</p> 	<p>FDU 84 Weight: 4.7 kg (10.3 lbs)</p> 	<p>FDU 85 Weight: 5.0 kg (10.9 lbs)</p> 

Values in brackets apply to dust-Ex. A 1.4301/SS 304 stainless steel cover around the PA housing enables it to be used in ATEX Zone 20



### Materials

Housing * A 1.4301/SS 304 stainless steel cover around the PA housing enables it to be used in Zone 10.	FDU 80, 81, 82: FDU 80F, 81F: FDU 83 FDU 84 FDU 85 FDU 86	PP-GF ETFE PA* PA* UP UP
Thread	FDU 80, 81, 82: FDU 80F, 81F: FDU 83 FDU 84 FDU 85 FDU 86	PP-GF ETFE 1.4301 (AISI 304) or aluminium 1.4301 (AISI 304) or aluminium UP UP or 1.4301
Diaphragm * 0.5 mm stainless steel 1.4571/SS 316Ti with a 4 mm closed-pore PE cover facing the material  ** 1 mm aluminium with a 5 mm closed-pore PE cover facing the material  *** aluminium diaphragm coated with PTFE	FDU 83 FDU 84 FDU 85 FDU 86	1.4571 (AISI 316 Ti) 1.4571 (AISI 316 Ti)/PE* Al/PE** Al/PTFE***
Diaphragm seal	FDU 80...85: FDU 86:	EPDM silicone
Connecting cable	FDU 80, 80F, 81, 81F, 82: FDU 83, 84, 85: FDU 86:	PVC PUR silicone
Mounting accessories	Alignment unit: flange 1.4301 (AISI 304), pipe galvanised steel Slip-on flange: PP (max. 1.5 bar) or 1.4435 (AISI 304) (>1.5 bar)	

### Power Supply

Power supply	Via transmitters FMU 860...862
--------------	--------------------------------

### Certificates and Approvals

Ignition protection	see section »Product Structure«
CE mark	By attaching the CE mark, Endress+Hauser confirms that the instrument fulfils all the requirements of the relevant EC directives.

### Order Code

see section »Produkt Structure«
---------------------------------

### Supplementary Documentation

Technical Information TI 190F/00/en Prosonic FMU 860...862 Operating Instructions BA 100F/00/en Prosonic FMU 860...862
---

# Product Structure

## FDU 80, 80F, 81, 81F, 82 Prosonic Sensors

### Certificates

- G ATEX II 3 G EEx nA II T6
- H ATEX II 3 D
- J ATEX II 2 G EEx m II T5 (T6 for FDU 80)
- Q FM Class I, Div. 1, Groups A...D, FM Class II / III, Div. 2, Groups F and G
- R Standard (not certified)
- S CSA Class I, Div. 1, Groups A, B, C, D
- U CSA General Purpose
- V TIIS Ex is II T6 (not for FDU80F/81F)

### Process Connection / Material

- G Thread G 1 A / PP-GF for FDU 80F/81F: ETFE
- N Thread 1 NPT / PP-GF for FDU 80F/81F: ETFE
- F Thread 1 NPT / PP-GF (3A certification) for FDU 80F/81F: ETFE

### Cable Length

- 1 with 5 m (16 ft) connecting cable
- 2 with 10 m (32 ft) connecting cable
- 3 with 15 m (49 ft) connecting cable
- 4 with 20 m (65 ft) connecting cable
- 5 with 25 m (82 ft) connecting cable
- 6 with 30 m (98 ft) connecting cable
- 8 ... m (variable length, up to 300 m)

### Heating (FDU 80 and 81 only)

- A none
- B with heating, 24 V DC

FDU



Product designation

## FDU 83, 84, 85 Prosonic Sensors

### Certificates

- E ATEX II 1/2 D
- H ATEX II 3 D
- P FM Class II, Div. 1, Groups E, F, G
- R Standard (not certified)
- E BVS/DMT (Dust-Ex) Zone 10/ATEX II 1/2 D
- T CSA Class II, Div. 1, Groups E, F, G
- U CSA General Purpose
- W TIIS dust Ex DP12 (not for FDU84)

### Process Connection / Material

- G Thread G 1 A / Aluminium; for FDU 85: plastic
- N Thread 1 NPT / Aluminium; for FDU 85: plastic
- S Thread G 1 A / 1.4301 (AISI 304) (FDU 83, FDU 84 only)
- V Thread 1 NPT / 1.4301 (AISI 304) (FDU 83, FDU 84 only)

### Cable Length

- 1 with 5 m (16 ft) connecting cable
- 2 with 10 m (32 ft) connecting cable
- 3 with 15 m (49 ft) connecting cable
- 4 with 20 m (65 ft) connecting cable
- 5 with 25 m (82 ft) connecting cable
- 6 with 30 m (98 ft) connecting cable
- 8 ... m (variable length, up to 300 m)

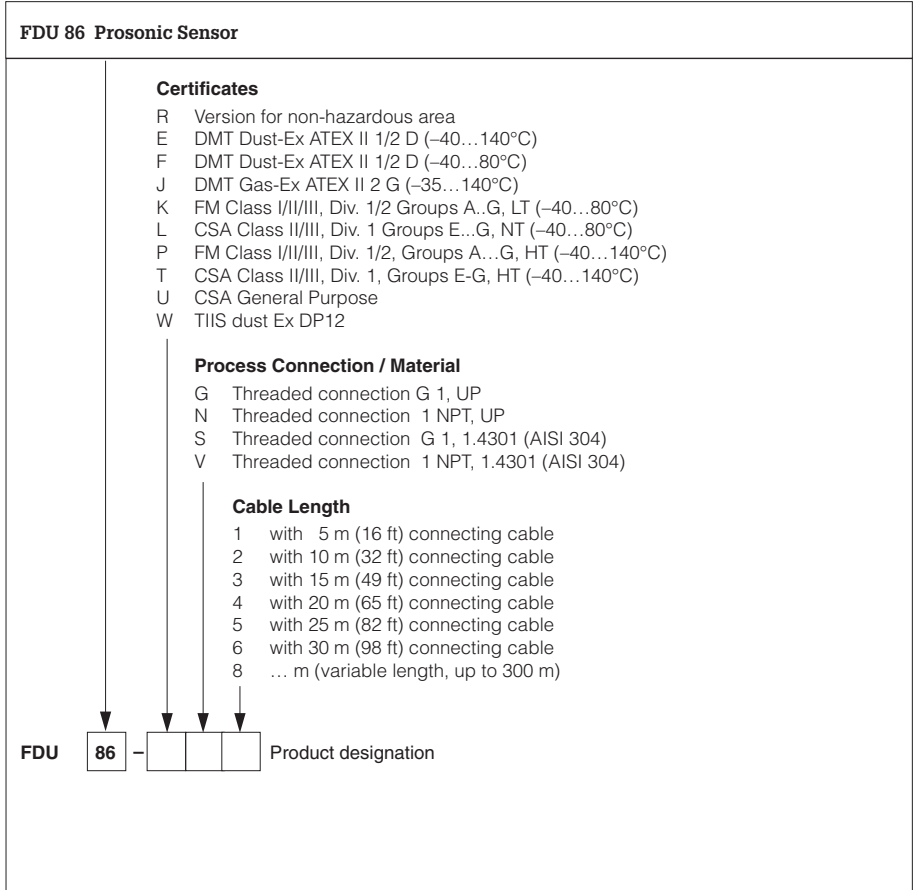
FDU



Product designation



# Product Structure







---

---

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)

**Endress + Hauser**  
The Power of Know How

