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
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
- Wall bracket
- Sensor flanges (e.g. FAU 80)
- External temperature sensor FMT 131
- A separate power supply unit is available for heated sensors.

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.

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.

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.

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

Example for calculating range:
• Silo with grit approx. 40 dB
• Little content approx. 5 dB
• Little dust approx. 5 dB
Gives an attenuation of 50 dB.
The FDU 82 sensor measures up to 8 m under these conditions.

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.

<table>
<thead>
<tr>
<th></th>
<th>α  (°)</th>
<th>L  (m)</th>
<th>r</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Liquids</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>FDU 80, 80 F</td>
<td>8°</td>
<td>5 m</td>
<td>0.35 m</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(16 ft)</td>
<td>(1.1 ft)</td>
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<td>FDU 81, 81 F</td>
<td>8°</td>
<td>10 m</td>
<td>0.69 m</td>
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<tr>
<td></td>
<td></td>
<td>(32 ft)</td>
<td>(2.3 ft)</td>
</tr>
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<td>FDU 82</td>
<td>8°</td>
<td>20 m</td>
<td>1.4 m</td>
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<tr>
<td></td>
<td></td>
<td>(65 ft)</td>
<td>(4.6 ft)</td>
</tr>
<tr>
<td>FDU 83</td>
<td>4°</td>
<td>25 m</td>
<td>0.87 m</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(82 ft)</td>
<td>(2.8 ft)</td>
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<tr>
<td><strong>Solids</strong></td>
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<td>(0.46 ft)</td>
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<td></td>
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<td>(32 ft)</td>
<td>(2.3 ft)</td>
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<tr>
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<td></td>
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<td>(147 ft)</td>
<td>(6.2 ft)</td>
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<td>6°</td>
<td>70 m</td>
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<td></td>
<td></td>
<td>(230 ft)</td>
<td>(11.8 ft)</td>
</tr>
</tbody>
</table>

- α: 3 dB beam angle
- L: length of beam (calculated from max. measuring range of sensor)
- r: radius of beam

#### 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.
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.

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.
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$_{abs}$, flanges in 1.4435 also above.

### 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
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

<table>
<thead>
<tr>
<th>1 mm = 0.039 in</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 in = 25.4 mm</td>
</tr>
</tbody>
</table>

### Example:
Flow measurement with Khafagi-Venturi flumes

<table>
<thead>
<tr>
<th>Typ</th>
<th>bg mm</th>
<th>b9 mm</th>
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<tbody>
<tr>
<td>QV 308</td>
<td>800</td>
<td>320</td>
</tr>
</tbody>
</table>

### Typ QV 308 800 320

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.
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 mm² (AWG 18)). They can be connected:

• directly in the FMU connection compartment; the connecting terminals are designed for cross sections up to 2.5 mm² (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 VDC (10%)
  - 0.5 A
  - max. length m (ft)
  - Ø mm² (AWG 20)
  - 0.75 (AWG 18)
  - 1 (AWG 17)

<table>
<thead>
<tr>
<th>Ø mm² (AWG)</th>
<th>0.5 (AWG 20)</th>
<th>0.75 (AWG 18)</th>
<th>1 (AWG 17)</th>
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</thead>
<tbody>
<tr>
<td>max. length</td>
<td>150 (490.5)</td>
<td>250 (817.5)</td>
<td>300 (981)</td>
</tr>
</tbody>
</table>

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. 938278-0121
- 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 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

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
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

Dimensions
1 mm = 0.039 in
1 in = 25.4 mm

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.

**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 3/4 A
Two-core screened cabling, max. 25 Ω per core.

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

**Certificates**
J  Cenelec EEx m II T5
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)

**Dimensions**
1 m = 3.28 ft
1 ft = 0.305 m

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

**Alignment Unit FAU 40**
For easy mounting and positioning of the FDU sensor (see Technical Information TI 179F/00/en).

**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

* for use in Dust-Ex: Insert the seal which is supplied with the sensor here.
## Technical Data

### General Information

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Endress+Hauser GmbH+Co.</th>
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<tbody>
<tr>
<td>Instrument</td>
<td>Ultrasonic sensor</td>
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<tr>
<td>Designation</td>
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<td>TI 189F/00/en 06.99</td>
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<td>Technical data</td>
<td>according to DIN 19259</td>
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### 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 to the surface of the product

#### Measuring ranges
<table>
<thead>
<tr>
<th>FDU</th>
<th>Measuring ranges in liquids</th>
<th>Measuring ranges in solids</th>
</tr>
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<tbody>
<tr>
<td>80</td>
<td>5 m (16 ft)</td>
<td>2 m (6.5 ft)</td>
</tr>
<tr>
<td>80F</td>
<td>5 m (16 ft)</td>
<td></td>
</tr>
<tr>
<td>81</td>
<td>10 m (32 ft)</td>
<td>5 m (16 ft)</td>
</tr>
<tr>
<td>81F</td>
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<td></td>
</tr>
<tr>
<td>82</td>
<td>20 m (65 ft)</td>
<td>10 m (32 ft)</td>
</tr>
<tr>
<td>83</td>
<td>25 m (82 ft)</td>
<td>15 m (49 ft)</td>
</tr>
<tr>
<td>84</td>
<td></td>
<td>25 m (82 ft)</td>
</tr>
<tr>
<td>85</td>
<td></td>
<td>45 m (147 ft)</td>
</tr>
<tr>
<td>86</td>
<td></td>
<td>70 m (230 ft)</td>
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#### Blocking distance
<table>
<thead>
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<th>FDU</th>
<th>Blocking distance in liquids</th>
<th>Blocking distance in solids</th>
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<tr>
<td>80, 80F</td>
<td>0.3 m (1.0 ft)</td>
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<tr>
<td>81, 81F</td>
<td>0.5 m (1.6 ft)</td>
<td></td>
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<tr>
<td>82</td>
<td>0.8 m (2.6 ft)</td>
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<tr>
<td>83</td>
<td>1.0 m (3.3 ft)</td>
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<tr>
<td>84, 85</td>
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</tr>
<tr>
<td>86</td>
<td>1.6 m (5.2 ft)</td>
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#### Operating frequency (at 23°C)
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<td>80, 80F</td>
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<td>81, 81F</td>
<td>44 kHz</td>
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<td>82</td>
<td>29 kHz</td>
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<tr>
<td>83</td>
<td>30 kHz</td>
</tr>
<tr>
<td>84</td>
<td>21 kHz</td>
</tr>
<tr>
<td>85</td>
<td>17 kHz</td>
</tr>
<tr>
<td>86</td>
<td>11 kHz</td>
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#### Pulse frequency
Dependent on measuring range 1 Hz...10 Hz

#### Attenuation due to conditions
Determining the detection limits with a 3 dB beam angle

\[
 r = \tan \frac{\alpha \cdot L}{2}
\]

<table>
<thead>
<tr>
<th>( \alpha ) = 3 dB beam angle</th>
<th>( r )</th>
<th>( L )</th>
<th>( \alpha )</th>
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<td>Liquids</td>
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<tr>
<td>FDU 80, 80F</td>
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<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>

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

Ambient 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, 86: –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
Interference emission to EN 50081-1, Interference resistance to EN 50082-2 and industrial standard NAMUR: 10 V/m

General operating conditions

Temperature at sensor
* May be used at high temperatures but only after first contacting Endress+Hauser
** Limits apply as stated in Certificates E, J (see page 15)
*** Limits apply as stated in Certificates P, Q, S, T (see page 15)
**** with heating –20…+60°C
***** CIP cleaning at 95°C
Sterilisation 30 min at 135°C

Process pressure
* May be used at high pressures but only after first contacting Endress+Hauser

Conversion factors
• 1 mm = 0.039 in
• 1 in = 25.4 mm
• 1 bar = 14.5 psi
• 1 psi = 0.069 bar
• 1 kg = 2.2 lbs
• 1 lb = 0.45 kg
• x °C = (1.8 • x + 32) °F

Mechanical Construction

Housings

FDU 80F, FDU 81F (flush-mounted)
Weight: FDU 80F: 0.5 kg (1.1 lbs)
FDU 81F: 0.55 kg (1.2 lbs)

FDU 80, FDU 81
Weight: FDU 80: 0.55 kg (1.2 lbs)
FDU 81: 0.6 kg (1.3 lbs)

FDU 82
Weight: 1.2 kg (2.6 lbs)

FDU 83
Weight: 3.1 kg (6.8 lbs)

FDU 84
Weight: 4.7 kg (10.3 lbs)

FDU 85
Weight: 5.0 kg (10.9 lbs)

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 Zone 10
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: PP-GF
FDU 80F, 81F: ETFE
FDU 83: PA*
FDU 84: PA*
FDU 85: UP
FDU 86: UP

Thread
FDU 80, 81, 82: PP-GF
FDU 80F, 81F: ETFE
FDU 83: 1.4301 (AISI 304) or aluminium
FDU 84: 1.4301 (AISI 304) or aluminium
FDU 85: UP
FDU 86: 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: 1.4571 (AISI 316 Ti)
FDU 84: 1.4571 (AISI 316 Ti)/PE*
FDU 85: Al/PE**
FDU 86: Al/PTFE***

Diaphragm seal
FDU 83, 84, 85: EPDM
FDU 86: silicone

Connecting cable
FDU 80, 80F, 81, 81F, 82: PVC
FDU 83, 84, 85: PUR
FDU 86: 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/00en Prosonic FMU 860…862
Operating Instructions BA 100F/00en Prosonic FMU 860…862
Product Structure

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

Certificates
- R Standard (not certified)
- J CENELEC EEx m II T5 (Zone 1); only for FDU 80: EEx m II T6 (Zone 1)
- U CSA General Purpose
- Q FM Class I, Div. 1, Groups A…D, FM Class II / III, Div. 2, Groups F and G
- S CSA Class I, Div. 1, Groups A, B, C, D

Process Connection / Material
- G Thread G 1 A / PP-GF
- N Thread 1 NPT / PP-GF
- F Thread 1 NPT / PP-GF (3A certification)

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 (6…30 m)

Heating (FDU 80 and 81 only)
- A none
- B with heating, 24 V DC

FDU 83, 84, 85 Prosonic Sensors

Certificates
- R Standard (not certified)
- E BVS/DMT (Dust-Ex) Zone 10/ATEX II 1/2 D
- U CSA General Purpose
- P FM Class II, Div. 1, Groups E, F, G
- T CSA Class II, Div. 1, Groups E, F, G

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 (6…30 m)

Conversion factors
- 1 m = 3.28 ft
- 1 ft = 0.305 m
Product Structure

Certificates

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<th>Letter</th>
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* in preparation

Process Connection / Material

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<td>G</td>
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<tr>
<td>N</td>
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<tr>
<td>S</td>
<td>Threaded connection G 1, 1.4301 (AISI 304)</td>
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<tr>
<td>V</td>
<td>Threaded connection 1 NPT, 1.4301 (AISI 304)</td>
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Cable Length

<table>
<thead>
<tr>
<th>Number</th>
<th>Description</th>
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<tr>
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</tr>
<tr>
<td>6</td>
<td>with 30 m (98 ft) connecting cable</td>
</tr>
<tr>
<td>8</td>
<td>… m variable length (6…30 m)</td>
</tr>
</tbody>
</table>

Conversion factors

- 1 m = 3.28 ft
- 1 ft = 0.305 m
- °C = (1.8 • °C + 32) °F

FDU 86 – Prosonic Sensor

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