Level | Pressure | Flow | Temperature | Liquid Analysis | Registration | Systems Components | Services | Solutions

Technical Information

Prosonic S
FDU90/91/91F/92/93/95/96

Ultrasonic sensors for non-contact continuous level and flow measurement, for connection to the transmitters FMU90 and FMU95



Application

- Continuous, non-contact level measurement of fluids, pastes, sludges and powdery to coarse bulk materials
- Flow measurement in open channels and measuring weirs
- Maximum measuring range
  - FDU90: 3 m (9.8 ft) in fluids
    1.2 m 3.9 ft) in bulk materials
  - FDU91/FDU91F: 10 m (33 ft) in fluids
    5 m (16 ft) in bulk materials
  - FDU92: 20 m (66 ft) in fluids
    10 m (33 ft) in bulk materials
  - FDU93: 25 m (82 ft) in fluids
    15 m (49 ft) in bulk materials
  - FDU95: 45 m (148 ft) in bulk materials
  - FDU96: 70 m (230 ft) in bulk materials
- Suited for explosion hazardous areas

Your benefits

- Non-contact measurement method; minimizes service requirements
- Integrated temperature sensor for time-of-flight correction. Accurate measurements are possible, even if temperature changes are present
- Hermetically welded PVDF sensors FDU91/92 for fluid measurement, for highest chemical resistance
- Integrated automatical sensor detection for transmitters FMU90, simple commissioning
- Can be installed up to 300 m (984 ft) from the transmitter
- Suited for rough ambient conditions thanks to separate installation from the transmitter
- Reduced build-up formation because of the self-cleaning effect
- Integrated heating against a build-up of ice at the sensor (optional), ensures reliable measurement
- Weather resistant and flood-proof (IP68)
- Dust-Ex and Gas-Ex certificats available (ATEX, FM, CSA)

TI00396F/00/EN/13.11
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Endress+Hauser
People for Process Automation

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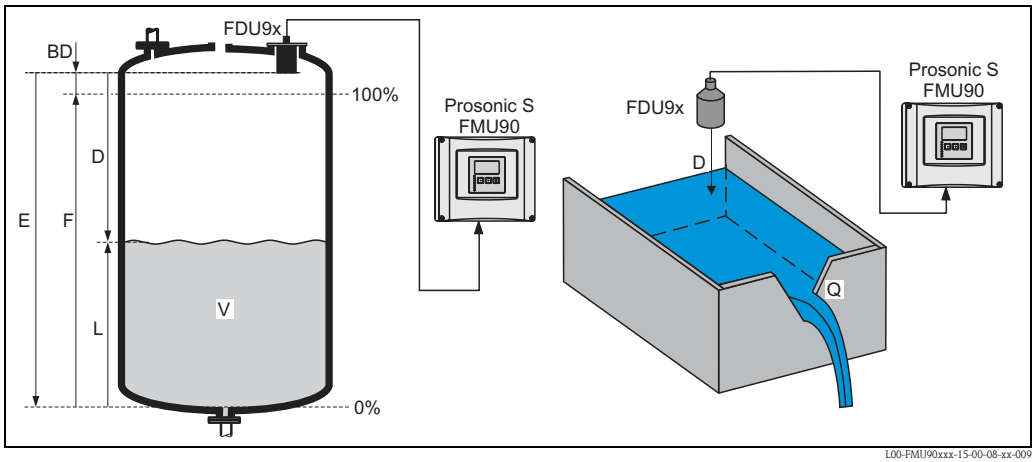
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Function and system design

Measuring principle



BD: *blocking distance,* **D:** *distance from sensor membrane to fluid surface,* **E:** *empty distance* **F:** *span (full distance),* **L:** *level,* **V:** *volume (or mass),* **Q:** *flow*

The sensor transmits ultrasonic pulses in the direction of the product surface. There, they are reflected back and received by the sensor. The transmitter Prosonic S measures the time t between pulse transmission and reception. From t (and the velocity of sound c) it calculates the distance D from the reference point (see the figure → 4) to the product surface:

$D = c \cdot t/2$

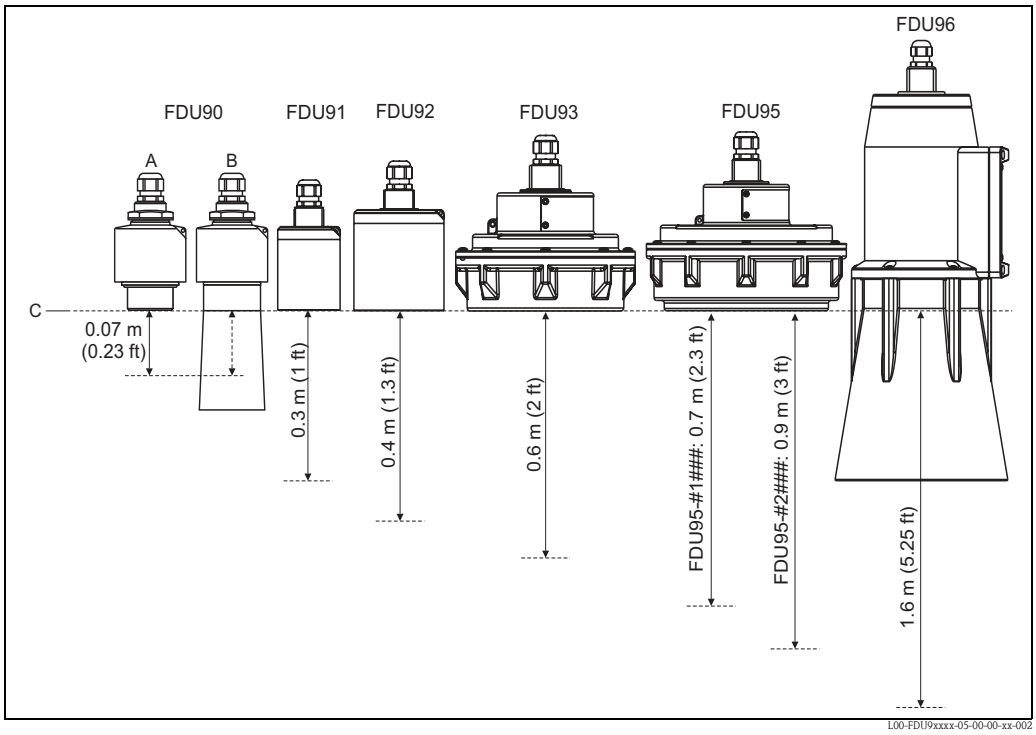
From D results the desired measuring value:
- level L
- volume V
- flow Q across measuring weirs or open channels

Time-of-flight correction

In order to compensate for temperature dependent time-of-flight changes, a temperature sensor is integrated in the ultrasonic sensors.

Blocking distance

The level L may not extend into the blocking distance BD. Level echoes within the blocking distance can not be evaluated due to the transient characteristics of the sensor and thus a reliable measurement is not possible. The blocking distance BD is dependent on the type of sensor:



A: *without flooding protection tube,* **B:** *with flooding protection tube,* **C:** *reference point*

Transmitter

The sensors can be connected to the transmitter FMU90 and FMU95. The transmitter recognizes the type of sensor automatically.

Input

Measuring range

The effective range of the sensors is dependent on the operating conditions. To estimate the range, proceed as follows (see also the example):

1. Determine which of the influences shown in the following table are appropriate for your process.
2. Add the corresponding attenuation values.
3. From the total attenuation, use the diagram to calculate the range.

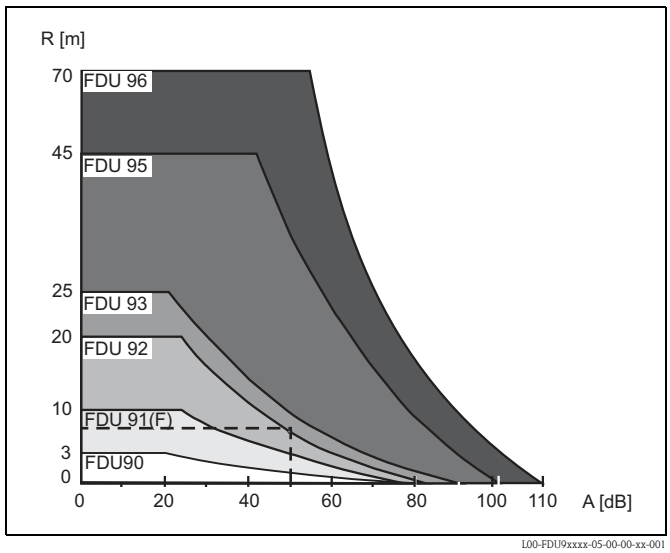
Fluid surface	**Attenuation**
calm	0 dB
waves	5 to 10 dB
strong turbulence (e.g. stirrers)	10 to 20 dB
foaming	Please contact your Endress+Hauser sales representative.

Bulk material surface	**Attenuation**
hard, rough (e.g. rubble)	40 dB
soft (e.g. peat, dust-covered clinker)	40 to 60 dB

Dust	**Attenuation**
no dust formation	0 dB
little dust formation	5 dB
heavy dust formation	5 to 20 dB

Filling curtain in detection range	**Attenuation**
none	0 dB
small quantities	5 dB
large quantities	5 to 20 dB

Temperature difference between sensor and product surface	**Attenuation**
to 20 °C (68 °F)	0 dB
to 40 °C (104 °F)	5 to 10 dB
to 80 °C (176 °F)	10 to 20 dB



A: *Attenuation (dB),* **R:** *Range (m)*

Example for FDU92

- Silo with rubble: ~ 40dB
- small quantities of filling curtain: ~ 5dB
- little dust: ~ 5dB

total: ~ 50dB

=> Range approx. 8 m (26 ft)

Operating frequency

Sensor	Operating frequency
FDU90	90 kHz
FDU91	43 kHz
FDU91F	42 kHz
FDU92	30 kHz
FDU93	27 kHz
FDU95 - *1*** (low temperature version)	17 kHz
FDU95 - *2*** (high temperature version)	18 kHz
FDU96	11 kHz

Output

Signal transmission

analogue voltages

Auxiliary energy

Power supply

supplied by the transmitter FMU90

Sensor heater (for FDU91)

The FDU90 and FDU91 sensors are available in a version with heater. The power for this heater must be provided by an external power supply unit. The supply voltage is connected to the brown (BN) and blue (BU) strands of the sensor cable.

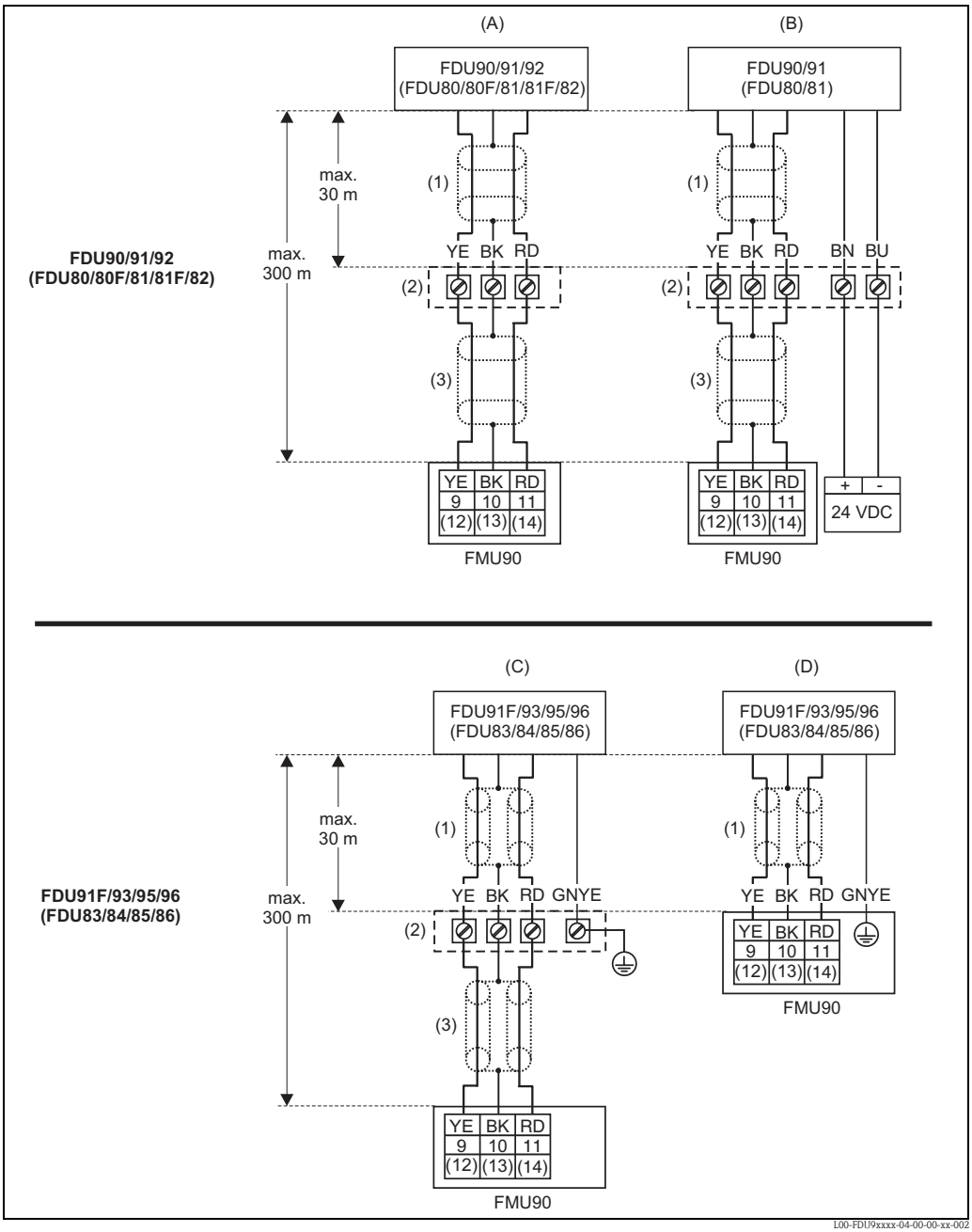
Technical data

- 24 VDC ±10 %; residual ripple < 100 mV
- 250 mA per sensor

Note!
- If the sensor heater is applied, the integrated temperature sensor can not be used. Instead, an external temperature sensor (Pt100 or FMT131 from Endress+Hauser) must be used. The transmitter FMU90 is available in a version with an input for the external temperature sensor. For details refer to Technical Information TI00397F.
- The power for the sensor heater can be supplied by the power supply RNB130 from Endress+Hauser (→ 30 "Accessories").

Electrical connection

Connection diagram



(A): *without sensor heater*
(B): *with sensor heater*
(C): *grounding at the terminal box*
(D): *grounding at the transmitter FMU90*
(1): *Screen of the sensor cable*
(2): *Terminal box*
(3): *Screen of the extension cable*
Colours of the strands: YE = yellow; BK = black; RD = red; BU = blue; BN = brown; GNYE = green-yellow

Connection hints

Caution!
- In order to avoid interference signals, the sensor cables should not be laid parallel to high voltage electric power lines. The cables may not be laid in the proximity to frequency converters.
- The cable screen serves as a return cable and must be connected to the transmitter without any electrical break. With the pre-assembled cables, the screen ends in a black strand (BK). With the extension cable, the screen must be twisted together and connected to the "BK" terminal.

Warning!
- The sensors FDU83, FDU84, FDU85 and FDU86 with an ATEX, FM or CSA certificate are not certified for connection to the FMU90 transmitter.
- for the sensors FDU91F/93/95/96 and FDU83/84/85/86:
  The ground lead (GNYE) must be connected to the local potential equalization **after a maximum distance of 30 m (98 ft)**. This can be done either
  – at the terminal box or
  – at the transmitter FMU90 or in the cabinet (if the distance to the sensor does not exceed 30 m (98 ft)).

Note!
For easier mounting it is advisable to use the sensors FDU90/91/92 and FDU80/80F/81/81F/82 with a maximum cable length of 30 m (98 ft) as well. For longer distances an extension cable with a terminal box should be used.

Connection of the sensor heater (for FDU90/FDU91)

The FDU90 and FDU91 sensors are available in a version with heater. The power for this heater must be provided by an external power supply unit. The supply voltage is connected to the brown (BN) and blue (BU) strands of the sensor cable.

Technical Data
- 24 VDC ± 10 %; residual ripple < 100 mV
- 250 mA per sensor

Note!
When using the sensor heater, the temperature compensation of the ultrasonic measurement must be performed with an external temperature probe, which is connecte to the additional temperature input of the FMU90 transmitter (see Technical Information TI00397F).

Extension cables for the sensors

For distances up to 30 m (98 ft) the sensor can be directly connected by the sensor cable. For longer distances, it is recommended to use an extension cable. The extension cable is connected via a terminal box. The total length (sensor cable + extension cable) may be up to 300 m (984 ft).

Caution!
If the terminal box is installed in explosion hazardous areas, all applicable national guidelines must be observed.
Suitable extension cables can be obtained from Endress+Hauser (→ 🖹 30 "Accessories")
Alternatively, cables with the following properties can be used:

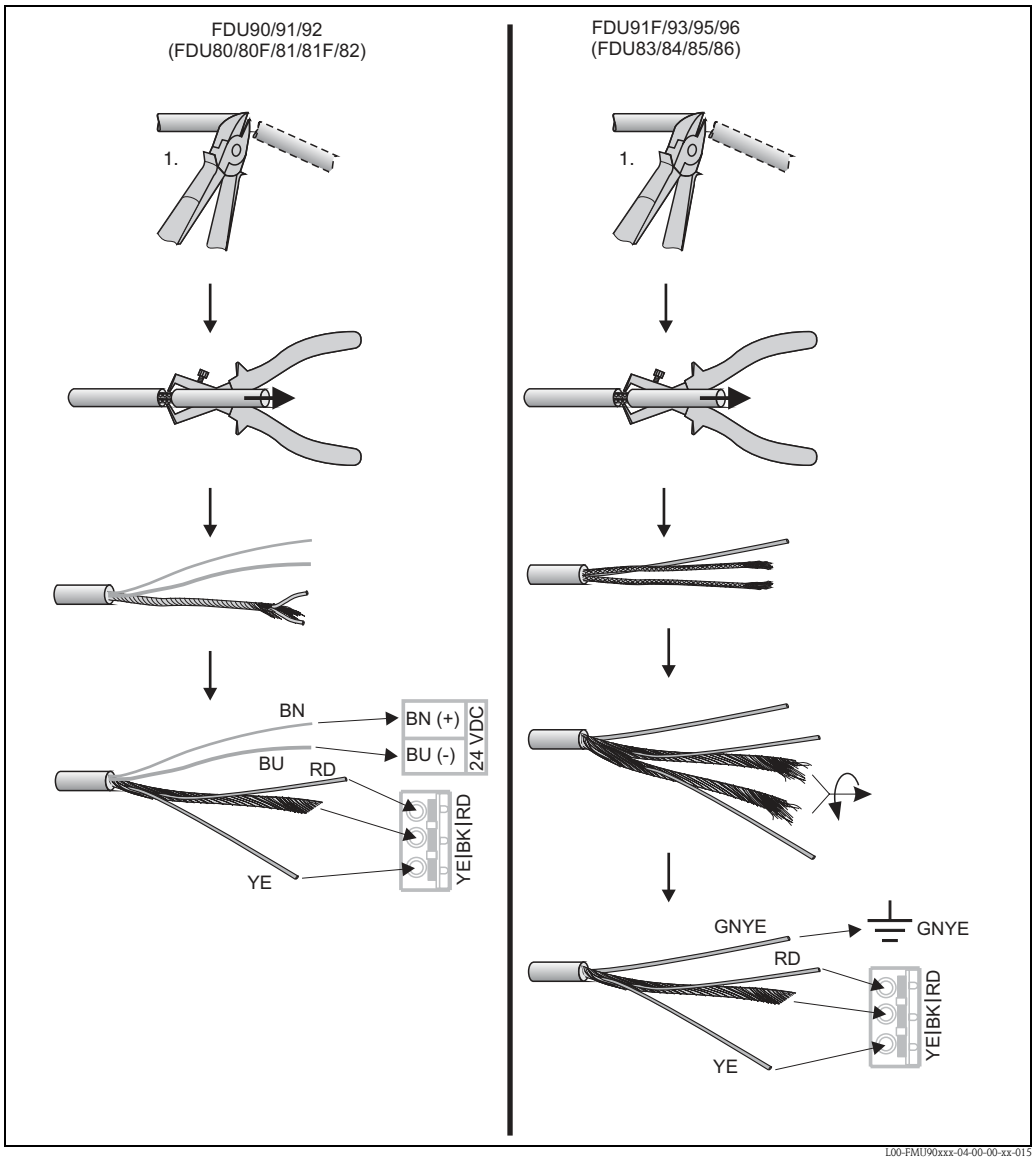
- Number of cores according to the connection diagram (→ 🖹 7 "Connection diagram")
- braided wire screen for the yellow (YE) and red (RD) core (no foil screen)
- Length: up to 300 m (984 ft), sensor cable + extension cable
- Cross section: 0.75 mm^2 to 2.5 mm^2 (18 to 14 AWG)
- up to 6 Ω per core
- max. 60 nF
- for FDU91F/93/95/96 and FDU 83/84/85/86: The earth lead must not be within the screening.

Shortening the sensor cable

If required, the sensor cable can be shortened. Please note:

- Do not damage the cores when removing the insulation.
- The cable is shielded by a metallic braiding. This shielding serves as a return cable and corresponds to the black (BK) strand of the unshortened cable. After shortening the cable, loosen the metallic braiding, twist it together securely and connect it to the "BK" terminal.

Caution!
The protective earth conductor (GNYE), which is present in some of the sensor cables, may not be electrically connected to the cable shield.

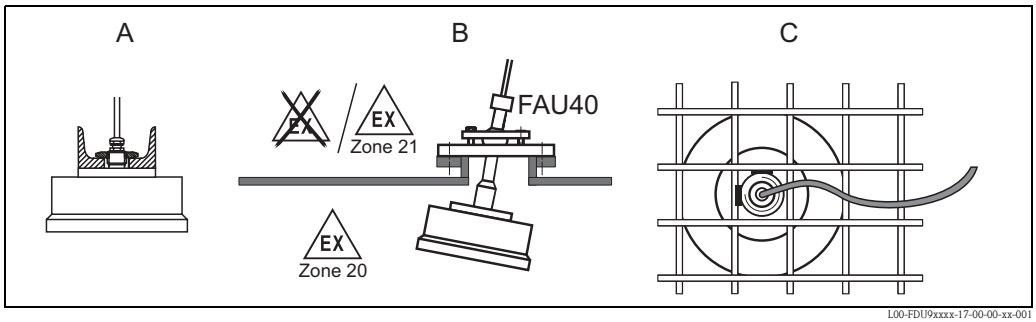


Colours of the strands: YE = yellow; BK = black; RD = red; BU = blue; BN = brown; GNYE = green-yellow

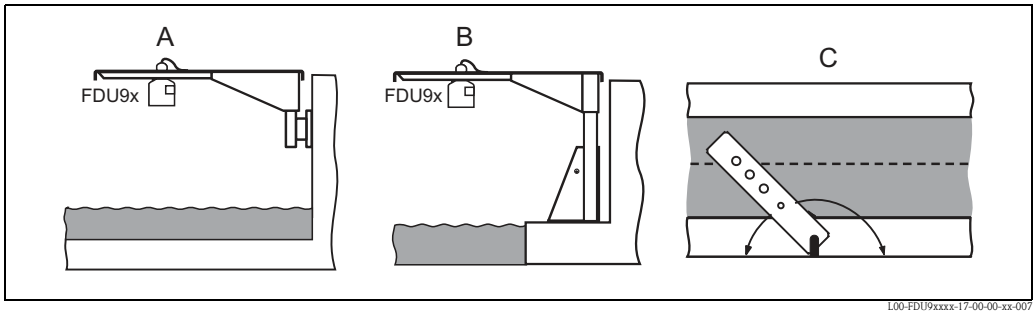
Note!
The blue (BU) and brown (BN) strands is only present for sensors with heater.

Installation conditions

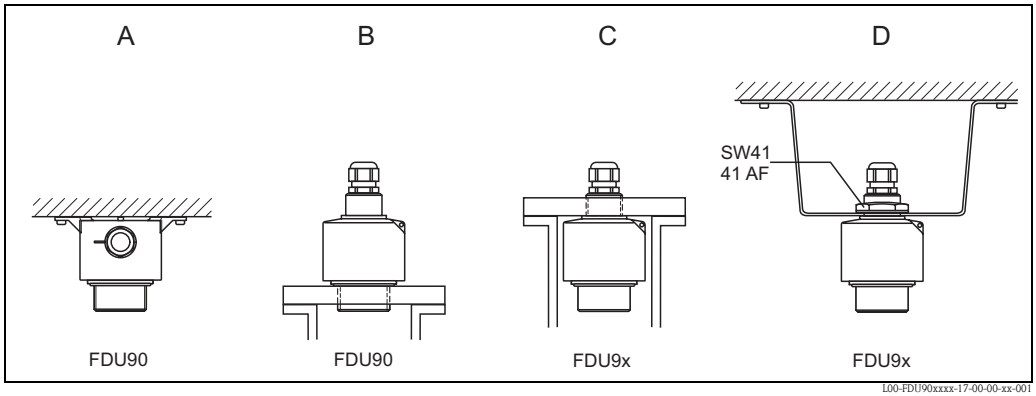
Installation options (Examples)



A: *at girder or angle bracket,* **B:** *with alignment unit FAU40, in ATEX Zone 20 the alignment unit can be used for zone separation,* **C:** *with a 1" sleeve welded to a grating*



A: *Installation with cantilever and wall bracket,* **B:** *Installation with cantilever and mounting frame,* **C:** *The cantilever can be turned in order to position the sensor over the centre of the flume.*
Cantilever, wall bracket and mounting frame are available as accessories (→ 🖹 30).

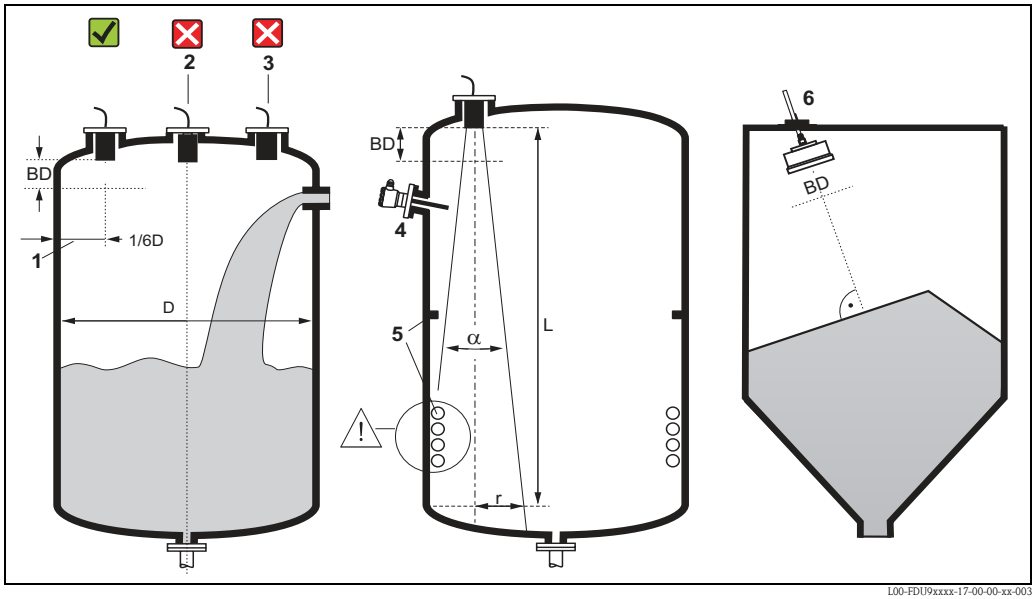


A: *FDU90: Ceiling mounting*
B: *FDU90: Mounted at front thread (G1-1/2 or NPT1-1/2)*
C: *FDU9x: Mounted at rear thread (G1 or NPT1)*
D: *FDU90, FDU91, FDU92: Mounting with G1 counter nut[1]; 42AF*

Caution!
- The cable of the sensors is not designed as a supporting cable. Do not use it as a suspension wire.
- The sensor membrane is part of the measuring system and must not be damaged during installation.

1) The counter nut with gasket is supplied for the sensors FDU90, FDU91 and FDU92 with a metric thread G1 at the process connection.

Installation conditions for level measurements



L00-FDU9xxxx-17-00-00-xx-003

- If possible, install the sensor so that its lower edge projects into the vessel.
- Make sure, that the maximum level does not reach into the blocking distance (BD, see table).
- Do not install the sensor in the middle of the tank (2). We recommend leaving a distance (1) between the sensor and the tank wall measuring 1/6 of the tank diameter.
- Avoid measurements through the filling curtain (3).
- Make sure that equipment (4) such as limit switches, temperature sensors, baffles etc. are not located within the emitting angle α. Emitting angles of the individual sensors are given in the table below. In particular, symmetrical equipment (5) such as heating coils etc. can influence the measurement.
- Align the sensor vertically to the product surface (6). An alignment unit (FAU40) is available as an accessory (→ 🖹 30).
- If the two-channel version of the transmitter FMU90 or the multi-channel version of the transmitter FMU90 is used, both sensors can be mounted in one vessel.
- To estimate the detection range, use the 3 dB emitting angle α:

Sensor	α (typically)	L (max)	r (max)
FDU90	12°	3 (9.8)	0.31 (1.0)
FDU91	9°	10 (33)	0.79 (2.6)
FDU91F	12°	10 (33)	1.05 (3.4)
FDU92	11°	20 (66)	1.92 (6.3)
FDU93	4°	25 (82)	0.87 (2.9)
FDU95	5°	45 (148)	1.96 (6.4)
FDU96	6°	70 (230)	3.6 (12)

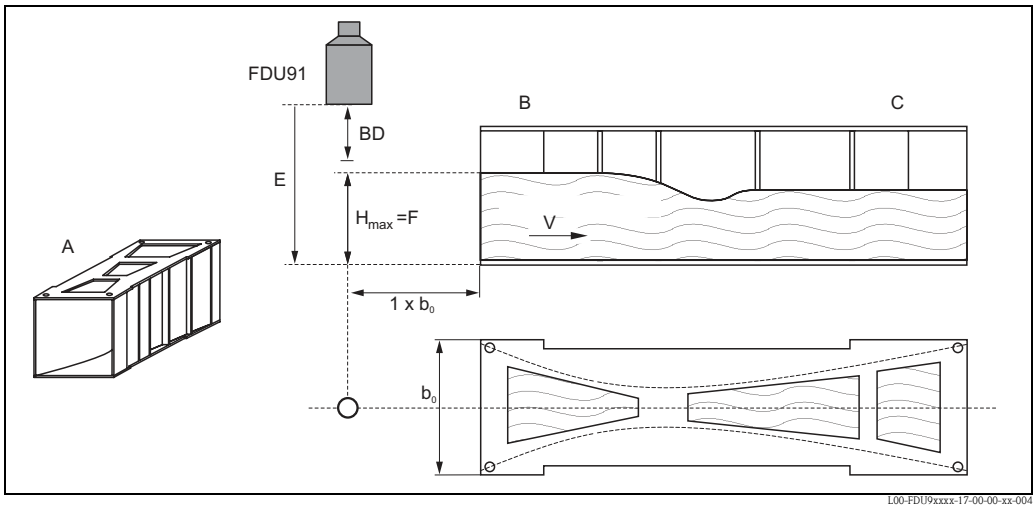
m (ft)

Warning!
All national guidelines applicable must be observed in explosion hazardous areas.

Installation conditions for flow measurements

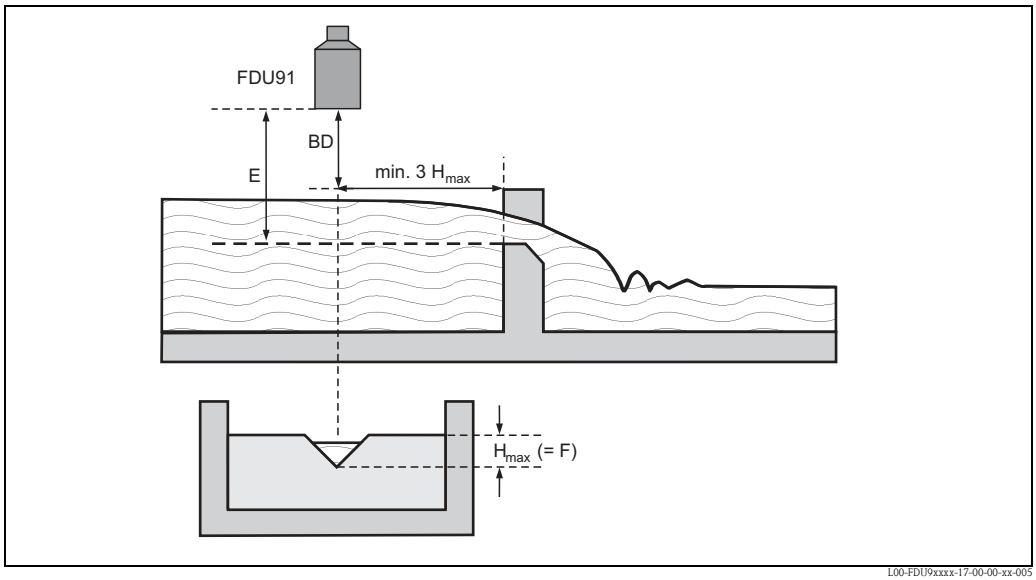
- Install the sensor at the inflow side (B), above the maximum water level H_{max} (=F) plus the blocking distance BD.
- Position the sensor in the middle of the channel or weir.
- Align the sensor vertically to the water surface.
- Comply to the installation distance of the channel or weir.[2)]
- Use a protective cover, in order to protect the sensor from direct sun or rain. A protective cover is available for the sensors FDU90 and FDU91 (→ 30).

Example: Khafagi-Venturi flume



A: *Khafagi-Venturi flume,* **B:** *inflow,* **C:** *outflow,* **BD:** *blocking distance,* **E:** *empty calibration,* **F:** *full calibration,* **V:** *direction of flow*

Example: V-notch weir

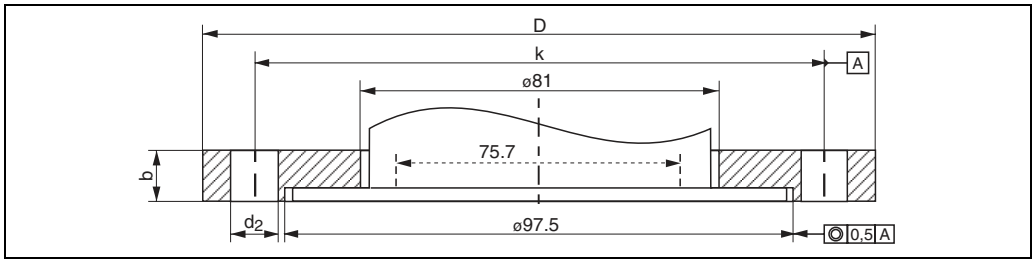


BD: *blocking distance,* **E:** *empty calibration*, **F:** *full calibration*

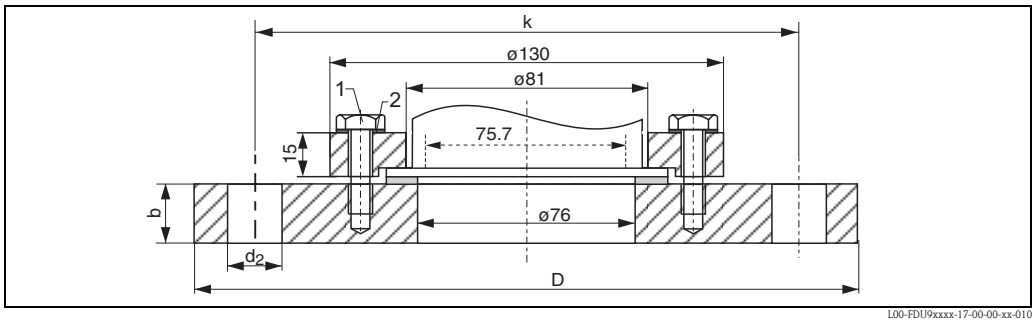
2) The installation distances of important flumes and weirs are specified in the Operating Instructions BA00289F (FMU90 with HART) and BA00293F (FMU90 with PROFIBUS).

Flush mounting with slip-on flange FAU80

The FDU91F sensor can be flush mounted using a FAU80 slip-on flange. Flanges in polypropylene (PP-FR) should only be used with pressures up to 1.5 bar_{abs} (22 psi abs), flanges in 316L also above.



Order code	Material	b [mm (in)]	øD [mm (in)]	ød2 [mm (in)]	k [mm (in)]	No. d2	Standard
FAU80 - CAP	PP-FR	20 (0.79)	200 (7.87)	18 (0.71)	160 (6.3)	8	DN80 PN16 A (DIN EN 1092-1 (DIN2527 B))
FAU80 - CAJ	316L (1.4435)						
FAU80 - AAP	PP-FR	23.9 (0.94)	190.5 (7.5)	19.1 (0.75)	152.4 (6.0)	4	ANSI 3" 150 lbs FF (ANSI B 16.5)
FAU80 - AAJ	316L (1.4435)						
FAU80 - KAP	PP-FR	18 (0.71)	185 (7.28)	19 (0.75)	150 (5.9)	8	JIS 10K 80A FF (JIS B 2220)
FAU80 - KAJ	316L (1.4435)						



The adapter flange is included in the delivery

Position	Part	Material
1	Screws	V2A
2	Washer	PP-FR or 316/316L (1.4435)

Order code	Material	b [mm]	øD [mm]	ød2 [mm]	k [mm]	No. d2	Standard
FAU80 - CHP	PP-FR	20 (0.79)	220 (8.66)	18 (0.71)	180 (7.09)	8	DN100 PN16 A (DIN EN 1092-1 (DIN2527 B))
FAU80 - CHJ	316L (1.4435)						
FAU80 - AHP	PP-FR	23.9 (0.94)	228.6 (9.0)	19.1 (0.75)	190.5 (7.5)	4	ANSI 4" 150 lbs FF (ANSI B 16.5)
FAU80 - AHJ	316L (1.4435)						
FAU80 - KHP	PP-FR	18 (0.71)	210 (8.27)	19 (0.75)	175 (6.89)	8	JIS 10K 100A FF (JIS B 2220)
FAU80 - KHJ	316L (1.4435)						

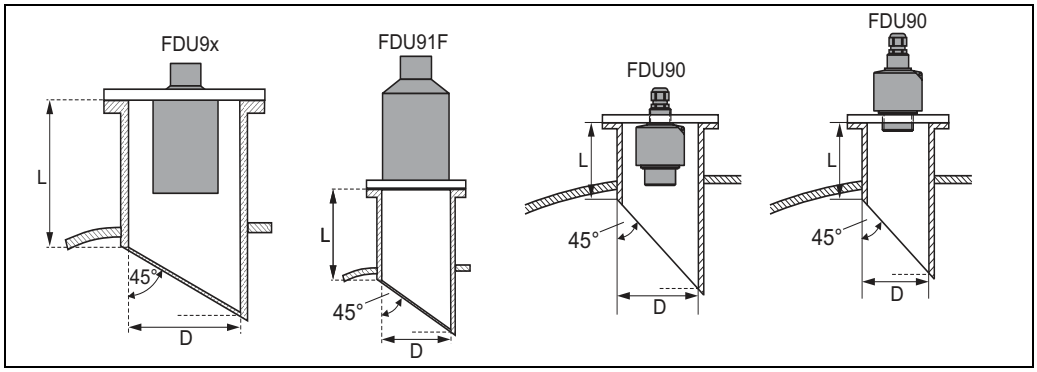
Note!
- The process seal is not included in the delivery.

- Endress+Hauser supplies DIN/EN flanges made of stainless steel AISI 316L with the material number 1.4404 or 1.4435. With regard to their temperature stability properties, the materials 1.4404 and 1.4435 are grouped under 13E0 in EN 1092-1 Tab. 18. The chemical composition of the two materials can be identical.

Caution!
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.

Nozzle installation

Install the sensor at a height so that the blocking distance BD is not undershot, even at maximum fill level. Use a pipe nozzle if you cannot maintain the blocking distance in any other way. The interior of the nozzle must be smooth and may not contain any edges or welded joints. In particular, there should be no burr on the inside of the tank side nozzle end. Note the specified limits for nozzle diameter and length. To minimise disturbing factors, we recommend an angled socket edge (ideally 45°).



	Maximum nozzle length [mm (in)]							
Nozzle diameter	**FDU90[1)]**	**FDU90[2)]**	**FDU91**	**FDU91F**	**FDU92**	**FDU93**	**FDU95**	**FDU96**
DN50/2"		50 (1.97)						
DN80/3"	340 (13.4)	250 (9.84)	340 (13.4)	250 (9.84)[3)]				
DN100/4"	390 (15.4)	300 (11.8)	390 (15.4)	300 (11.8)[3]				
DN150/6"	400 (15.7)	300 (11.8)	400 (15.7)	300(11.8)[3]	400 (15.7)			
DN200/8"	400 (15.7)	300 (11.8)	400 (15.7)	300(11.8)[3]	400 (15.7)	520 (20.5)		
DN250/10"	400 (15.7)	300 (11.8)	400 (15.7)	300(11.8)[3]	400 (15.7)	520 (20.5)	630 (24.8)	
DN300/12"	400 (15.7)	300 (11.8)	400 (15.7)	300(11.8)[3]	400 (15.7)	520 (20.5)	630 (24.8)	800 (31.5)
Sensor characteristics								
Emission angle α	12°	12°	9°	12°	11°	4°	5°	6°
Blocking distance [m (ft)]	0.07 (0.2)	0.07 (0.2)	0.3 (1)	0.3 (1)	0.4 (1.3)	0.6 (2)	0.7 (2.3)	1.6 (5.2)
Max. measuring range [m (ft)) in liquids	3 (9.8)	3 (9.8)	10 (33)	10 (33)	20 (66)	25 (82)		
Max. measuring range [m] in solids	1.2 (3.9)	1.2 (3.9)	5 (16)	5 (16)	10 (33)	15 (49)	45 (148)	70 (230)

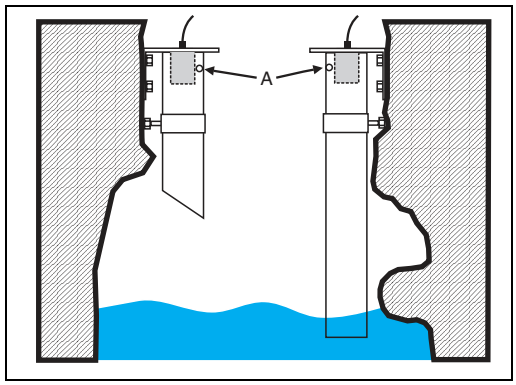
1) mounted at the rear side thread

2) mounted at the front side thread (flush mounting)

3) Valid for flush mounting; for mounting with G/NPT1" and DN100 or higher see FDU91F.

Ultrasound guide pipe

In narrow shafts with strong interference echoes, we recommend using an ultrasound guide pipe (e.g. PE or PVC wastewater pipe) with a minimum diameter of 100 mm (3.94 in), for FDU91. Make sure that the pipe is not soiled by accumulated dirt. If necessary, clean the pipe at regular intervals.



A: *venting hole*

Operating conditions: Environment

Ingress protection	tested according to IP68/NEMA6P (24 h at 6 ft under water surface)
Vibration resistance	DIN EN 600068-2-64; 20 to 2000 Hz; 1 $(m/s^2)^2$/Hz; 3x100 min.
Storage temperature	identical to process temperature, see below
Thermal shock resistance	according to DIN EN 60068-2-14; examination to min/max process temperature; 0.5 K/min; 1000 h
Electromagnetic compatibility	Electromagnetic compatibility according to all relevant requirements of the EN 61326- series and NAMUR recommendation EMC (NE21). For details see declaration of conformity. With respect to interference emission the devices meet the requirements of class A and are only provided for use in an "industrial environment"!

Operating conditions: Process

Process temperature
Process pressure

Sensor	Process temperature	Process pressure (abs.)
FDU90	-40 to +80 °C (-40 to +176 °F)[1]	0.7 to 4 bar (10.15 to 58 psi)
FDU91	-40 to +80 °C (-40 to +176 °F)[1)]	0.7 to 4 bar (10.15 to 58 psi)
FDU91F	-40 to +105 °C (-40 to +221 °F) (30 min/135 °C (275 °F))[2)] for Ex instruments: -40 to +80 °C (-40 to +176 °F)	0.7 to 4 bar (10.15 to 58 psi)
FDU92	-40 to +95 °C (-40 to+203 °F) for Ex instruments: -40 to +80 °C (-40 to +176 °F)	0.7 to 4 bar (10.15 to 58 psi)
FDU93	-40 to +95 °C (-40 to +203 °F) for Ex instruments: -40 to +80 °C (-40 to +176 °F)	0.7 to 3 bar (10.15 to 43.5 psi)
FDU95 - *1*** (low temperature version)	-40 to +80 °C (-40 to +176 °F)	0.7 to 1.5 bar (10.15 to 22 psi)
FDU95 - *2*** (high temperature version)	-40 to +150 °C (-40 to +302 °F) for Dust-Ex versions: -40 to +130 °C	0.7 to 1.5 bar (10.15 to 22 psi)
FDU96	-40 to +150 °C (-40 to +302 °F) for Dust-Ex or Gas-Ex versions: -40 to 140 °C (-40 to +284 °F)	0.7 to 3 bar (10.15 to 43.5 psi)

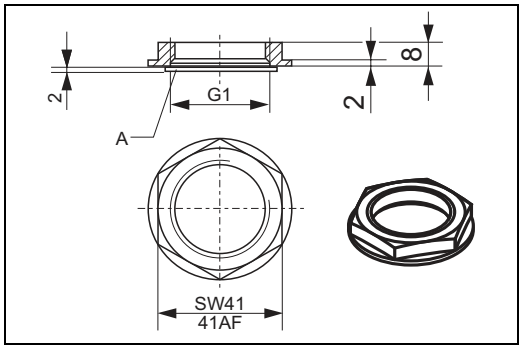
1) In order to avoid ice build-up, the sensors FDU90 and FDU91 are available in a version with integrated sensor heater (see page 6). If this heater is used, an external temperature sensor has to be applied for time-of-flight correction. The transmitter FMU90 is available in a version with an input for the external temperature sensor. For details refer to Technical Information TI00397F.

2) only valid for Tri-clamp and flush mounting

Mechanical construction

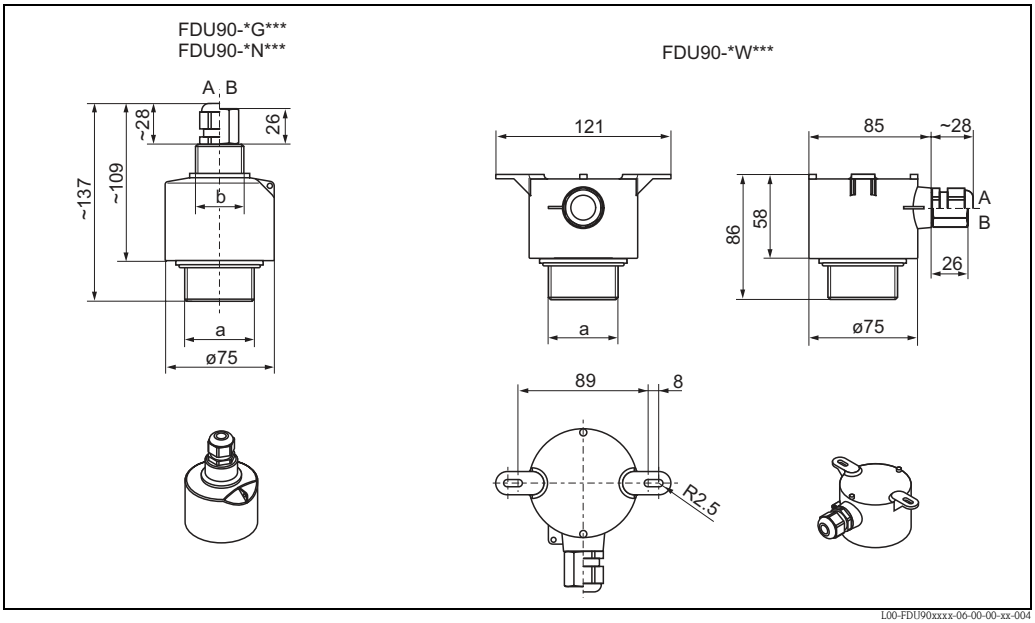
Counter nut G1

- Is supplied for the sensor FDU90, FDU91 and FDU92 with a metric G1 thread.
- Material: PA6.6
- Gasket (EPDM) is supplied



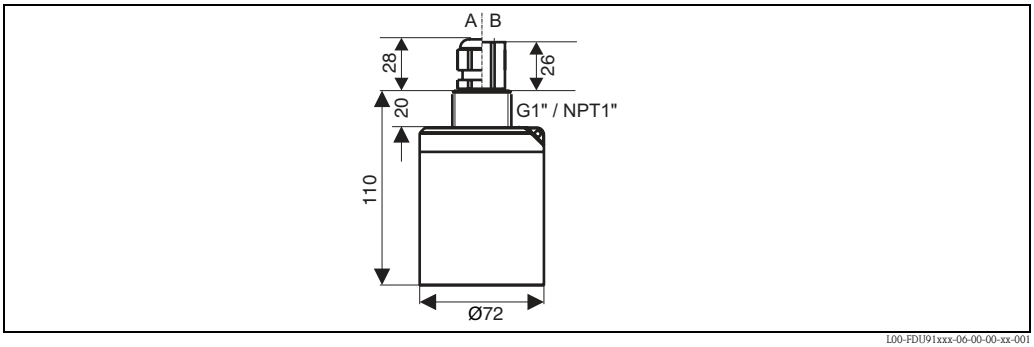
A: *Gasket*

Dimensions FDU90



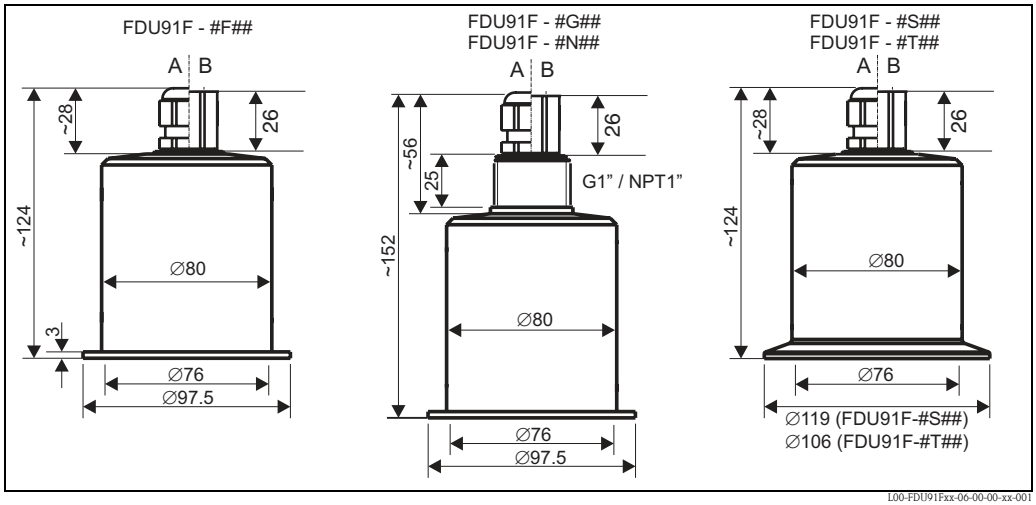
Dimensions in mm
A: *Cable gland for approval versions FDU90-C/D/E/G/H/J/R/U/V/1*
B: *Conduit connection NPT 1/2" for approval versions FDU90-Q/S*
The conduit connection is partly potted (half-filled)
a: *G1-1/2 or NPT1-1/2 (see product structure: 020 "Process connection"* → 🖹 *23)*
b: *G1 or NPT1 (see product structure: 020 "Process connection"* → 🖹 *23)*

Dimensions FDU91



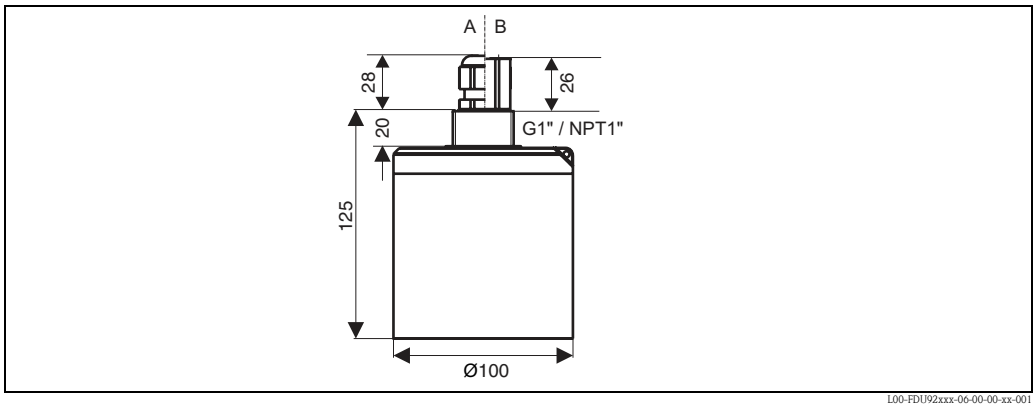
Dimensions in mm
A: *Cable gland for approval versions FDU91-C/D/E/G/H/J/R/U/V/1*
B: *Conduit connection NPT 1/2" for approval versions FDU91-Q/S*
The conduit connection is partly potted (half-filled).

Dimensions FDU91F



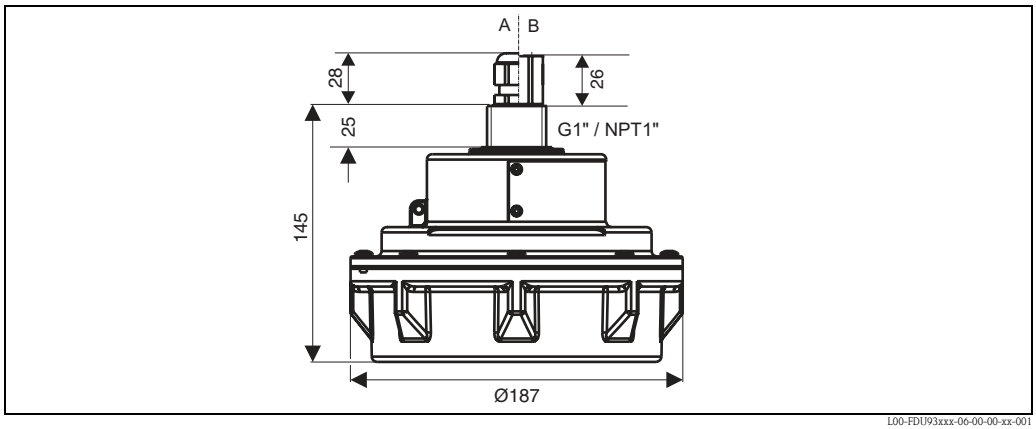
Dimensions in mm
A: *Cable gland for approval versions FDU91F-C/D/E/G/H/J/R/U/V*
B: *Conduit connection NPT 1/2" for approval versions FDU91F-Q/S*
The conduit connection is partly potted (half-filled).

Dimensions FDU92



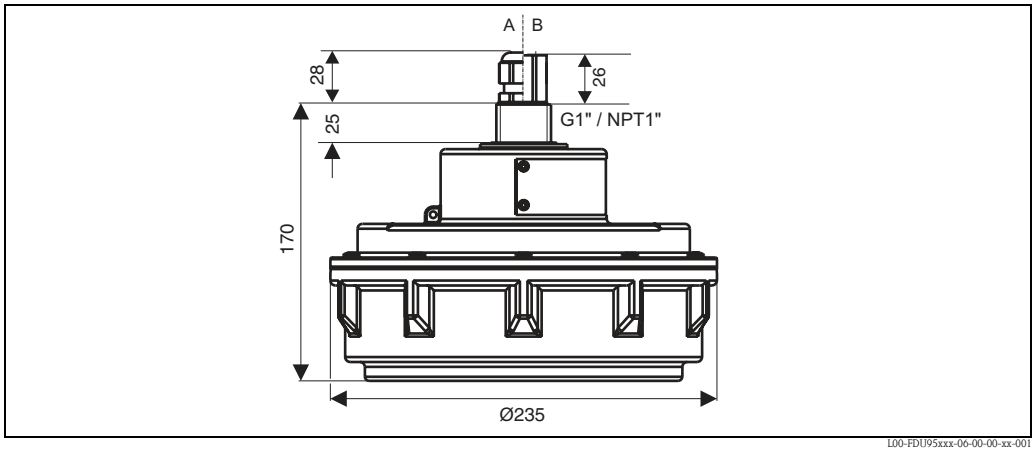
Dimensions in mm
A: *Cable gland for approval versions FDU92-C/D/E/G/H/J/R/U/V/1*
B: *Conduit connection NPT 1/2" for approval versions FDU92-Q/S*
The conduit connection is partly potted (half-filled).

Dimensions FDU93



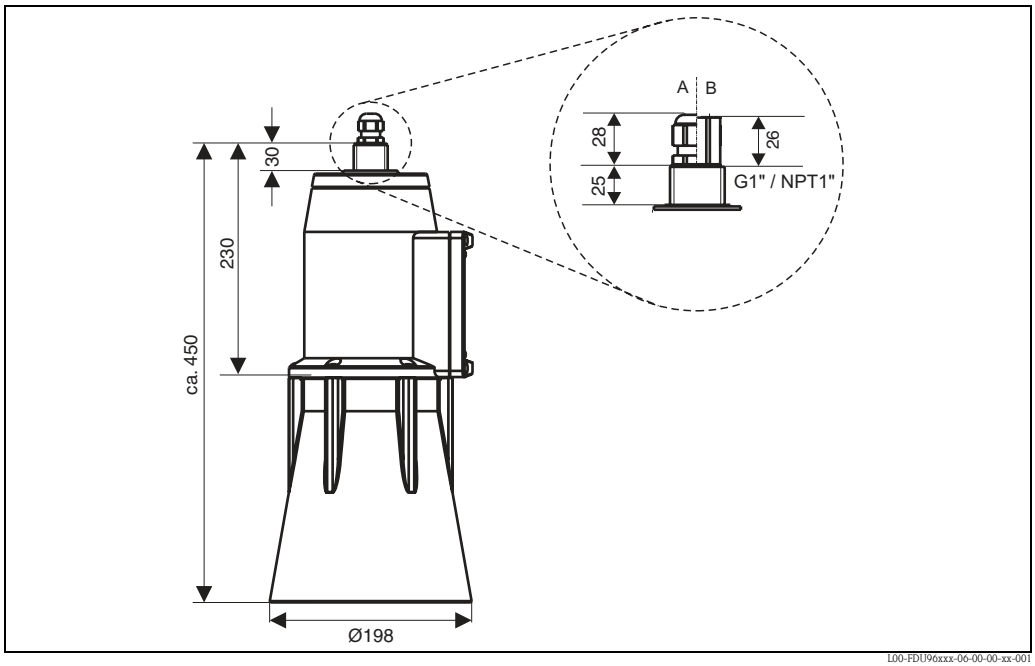
Dimensions in mm
A: *Cable gland for approval version FDU93-C/D/E/G/H/J/R/U/W/1*
B: *Conduit connection NPT 1/2" for approval versions FDU93-P/T*
The conduit connection is partly potted (half-filled).

Dimensions FDU95



Dimensions in mm
A: *Cable gland for approval versions FDU95-C/D/E/H/J/R/U/W/1*
B: *Conduit connection NPT 1/2" for approval versions FDU95-P/T*
The conduit connection is partly potted (half-filled).

Dimensions FDU96

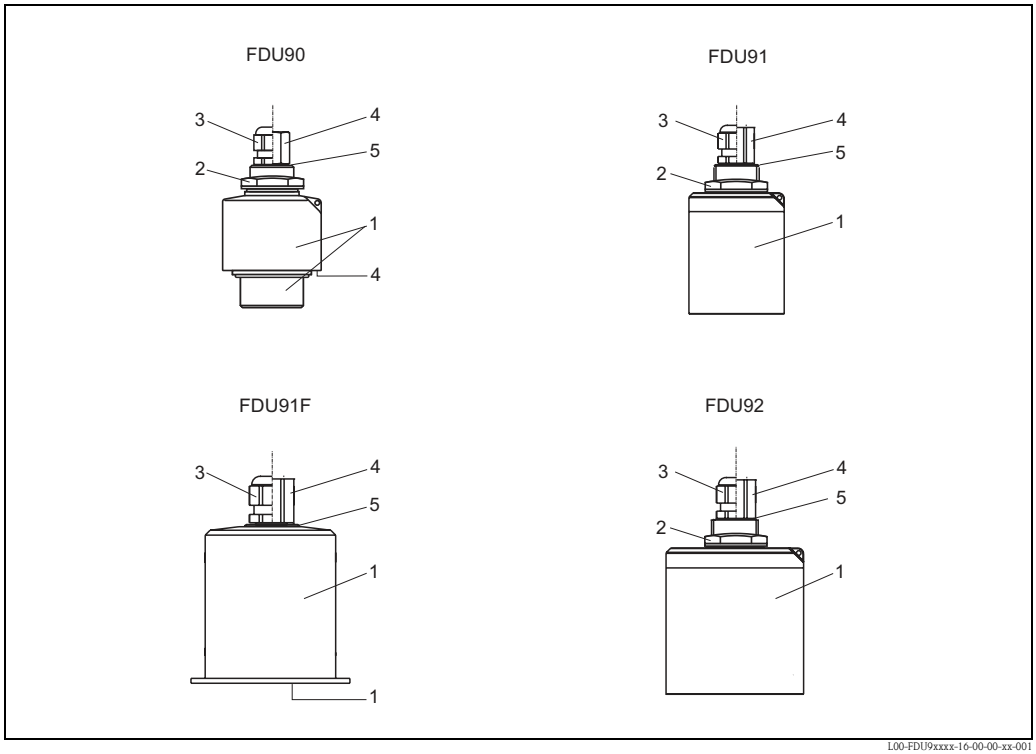


Dimensions in mm
A: *Cable gland for approval versions FDU96-C/D/E/F/H/J/R/W/1*
B: *Conduit connection NPT 1/2" for approval versions FDU96-K/L/P/T*
The conduit connection is partly potted (half filled).

Weight

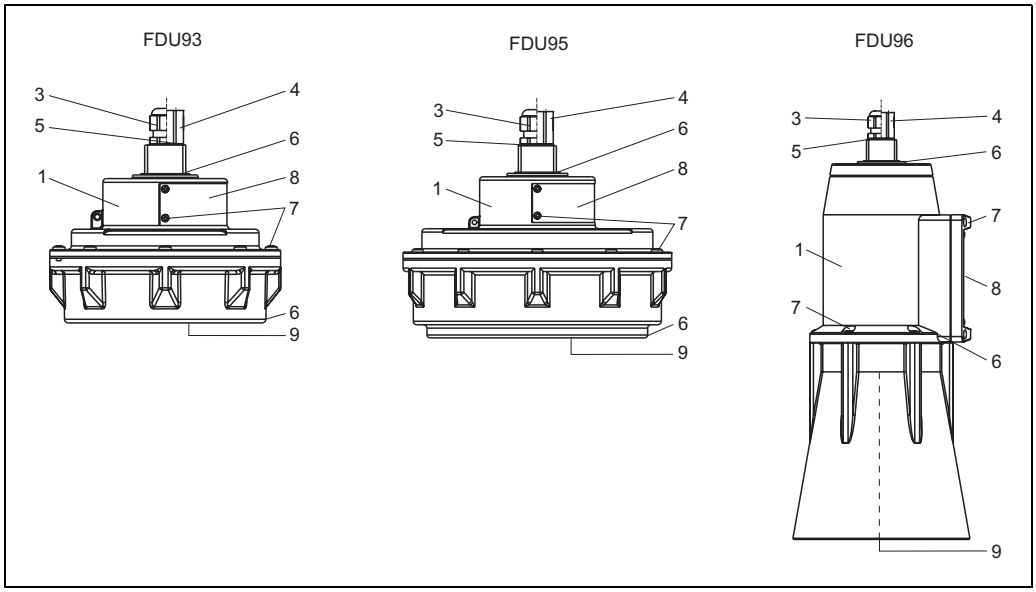
Sensor	Weight (including 5 m (16 ft) cable)
FDU90	▪ approx. 0.9 kg (1.98 lbs) without flooding protection tube ▪ approx. 1.0 kg (2.21 lbs) with flooding protection tube
FDU91	approx. 1.1 kg (2.43 lbs)
FDU91F	approx. 1.6 kg (3.53 lbs)
FDU92	approx. 2 kg (4.41 lbs)
FDU93	approx. 2.9 kg (6.39 lbs)
FDU95	approx. 4.5 kg (9.92 lbs)
FDU96	approx. 5 kg (11.03 lbs)

Materials



Pos.	Part	FDU90	FDU91	FDU91F	FDU92
1	Sensor	PVDF		316 L (1.4404/1.4435)	PVDF
2	Counter nut	PA6.6		–	PA6.6
3	Cable gland	PA			
4	Adpater	CuZn nickel-plated			
5	O-ring	EPDM			
6	Sealing				

Note!
The chemical compatibility of the sensors must be checked before installation with compatibility charts.



Pos.	Part	FDU93	FDU95	FDU96
1	Sensor	UP		
2	Counter nut	PA6.6		
3	Cable gland	PA or CuZn nickel-plated		
4	Adpater	CuZn nickel-plated		
5	O-ring	EPDM		
6	Sealing	VMQ		
7	Screws	V2A		
8	Nameplate	304 (1.4301)		
9	Membrane	ALU or PFA coated	FDU95 - *1*** (low temperature version): 316 L (1.4404) FDU95 - *2*** (high temperature version): 316 L (1.4404) and PE	ALU or PFA coated

Note!
The chemical compatibility of the sensors must be checked before installation with compatibility charts.

Connecting cable

5 to 300 m (16 to 984 ft)
for cable length > 30 m (> 98 ft), an extension cable is recommended.
In this case, the total length (sensor cable + extension cable) must not exceed 300 m (984 ft).

Cable	Material
for FDU90/91/91F/92/93	PVC
for FDU95/96	VMQ

Certificates and Approvals

CE mark

The measuring system meets the legal requirements of the EC-guidelines. Endress+Hauser confirms the instrument passing the required tests by attaching the CE-mark.

Ex approval

The available certificates are listed in the ordering information. Note the associated safety instructions (XA) and control or installation drawings (ZD).

Warning!
- Measuring systems for use in hazardous environments are accompanied by separate "Ex documentation", which is an integral part of this Operating Manual. Strict compliance with the installation instructions and ratings as stated in this supplementary documentation is mandatory.
  – Ensure that all personnel are suitably qualified.
  – Observe the specifications in the certificate as well as national and local standards and regulations.

- The transmitter may only be installed in suitable areas.
- Sensors with a certificate for hazardous areas may be connected to a transmitter without a certificate.
- For FM approvals:
  Unauthorized substitution of components may impair the suitability for Division 1 or Division 2.
- Do not disconnect equipment unless the area is known to be non-hazardous.

Note!
The sensor must be installed and used in a way that eliminates any danger. Possible installation positions: in tanks, vessels, silos, over stockpiles, open channels, weirs or other bins.

External standards and guidelines

EN 60529

Protection class of housing (IP code)

EN 61326 series

EMC product family standard for electrical equipment for measurement, control and laboratory use

NAMUR

User association for automation technology in process industries

Ordering information

Product structure FDU90

010	Approval
C	IEC Ex ta/tb IIIC Da/Db, IEC Ex ma IIC T5 Gb
D	IEC Ex ma IIC T5 Gb
E	ATEX II 1/2D Ex ta/tb IIIC, ATEX II 2G Ex ma IIC T5
G	ATEX II 3G Ex nA II T6 (in preparation)
H	ATEX II 3D (in preparation)
J	ATEX II 2G Ex ma IIC T5
Q	FM Cl.I,II,III Div.1+2 Gr.A-G, zone 1,2,21,22 (in preparation)
R	Non-hazardous area
S	CSA C/US Cl.I,II,III Div.1+2 Gr.A-G, zone 1,2 (in preparation)
U	CSA General Purpose (in preparation)
V	TIIS Ex is IIC T6 (in preparation)
1	NEPSI DIP (in preparation)

020	Process connection (threaded boss)
G	Thread ISO228, PVDF; rear side G1, front side G1-1/2
N	Thread ANSI, PVDF; rear side NPT1, front side NPT1-1/2
W	Ceiling mounting; front side G1-1/2

030	Cable length
1	5 m/16 ft
2	10 m/32 ft
3	15 m/49 ft
4	20 m/65 ft
5	25 m/82 ft
6	30 m/98 ft
8	... m (variable length, up to 300 m)
A	... ft (variable length, up to 985 ft)

035	Heater
A	W/o
B	Connection to 24 VDC Note Technical Information FMU90! (Temperature compensation)

040	Additional option
A	Basic version
B	Flooding protection tube
L	5-point linearity protocol (only to order with FMU9x transmitter + 5-point linearity protocol (in preparation)

895	Marking
Z1	Tagging (TAG)

FDU90 -	product designation

Product structure FDU91

010	Approval
C	IEC Ex ta/tb IIIC Da/Db, IEC Ex ma IIC T6 Gb
D	IEC Ex ma IIC T6 Gb
E	ATEX II 1/2 D Ex ta/tb IIIC, ATEX II 2 G Ex ma IIC T6
G	ATEX II 3G EEx nA II T6 (in preparation)
H	ATEX II 3D (in preparation)
J	ATEX II 2 G Ex ma IIC T6
Q	FM Cl.I,II,III Div. 1+2 Gr.A-G, zone 1,2,21,22
R	Non-hazardous area
S	CSA Cl.I,II,III Div.1+2 Gr.A-G, zone 1,2
U	CSA General Purpose
V	TIIS Ex is IIC T6
1	NEPSI DIP (in preparation)

020	Process connection (threaded boss)
G	Thread ISO228 G1, PVDF
N	Thread ANSI NPT1, PVDF

030	Cable length
1	5 m/16 ft
2	10 m/32 ft
3	15 m/49 ft
4	20 m/65 ft
5	25 m/82 ft
6	30 m/98 ft
8	... m (variable length, up to 300 m)
A	... ft (variable length, up to 985 ft)

035	Heater
A	w/o
B	Connection to 24 VDC Note Technical Information FMU90! (Temperature compensation)

040	Additional option
A	Basic version
L	5-point linearity protocol only to order with FMU9x transmitter + 5-point linearity protocol (in preparation)

995	Marking
1	Tagging (TAG)

FDU91 -							product designation

Product structure FDU91F

010	Approval
C	IEC Ex ta/tb IIIC Da/Db, IEC Ex ma IIC T6 Gb
D	IEC Ex ma IIC T6 Gb
E	ATEX II 1/2 D Ex ta/tb IIIC, ATEX II 2 G Ex ma IIC T6
G	ATEX II 3G EEx nA II T6 (in preparation)
H	ATEX II 3D (in preparation)
J	ATEX II 2G Ex ma II T6
Q	FM Cl.I,II,III Div. 1+2 Gr.A-G, zone 1,2,21,22
R	Non-hazardous area
S	CSA Cl.I,II,III Div.1+2 Gr.A-G, zone 1,2
U	CSA General Purpose
V	TIIS Ex is IIC T6 (in preparation)

020	Process connection
F	for slip-on flange, 316L, accessory FAU80A
G	Thread ISO228 G1, 316L
N	Thread ANSI NPT1, 316L
S	Tri-Clamp ISO2852 DN101,6 (4"), 316L, 3A
T	Tri-Clamp ISO2852 DN88,6 (3½"), 316L, 3A

030	Cable length
1	5 m/16 ft
2	10 m/32 ft
3	15 m/49 ft
4	20 m/65 ft
5	25 m/82 ft
6	30 m/98 ft
8	... m (variable length, up to 300 m)
A	... ft (variable length, up to 985 ft)

040	Additional option
A	Basic version
B	EN10204-3.1 material, wetted parts, (316L wetted parts); inspection certificate
L	5-point linearity protocol (only to order with FMU9x transmitter + 5-point linearity protocol, (in preparation))

995	Marking
1	Tagging (TAG)

FDU91F -	product designation

Product structure FDU92

010	Approval
C	IIEC Ex ta/tb IIIC Da/Db, IEC Ex ma IIC T6 Gb
D	IEC Ex ma IIC T6 Gb
E	ATEX II 1/2 D Ex ta/tb IIIC, ATEX II 2 G Ex ma IIC T6
G	ATEX II 3G EEx nA II T6 (in preparation)
H	ATEX II 3D (in preparation)
J	ATEX II 2G Ex m II T6
Q	FM Cl.I,II,III Div. 1+2 Gr.A-G, zone 1,2,21,22
R	Non-hazardous area
S	CSA Cl.I,II,III Div.1+2 Gr.A-G, zone 1,2
U	CSA General Purpose
V	TIIS Ex is IIC T6
1	NEPSI DIP (in preparation)

020	Process connection (threaded boss)
G	Thread ISO228 G1, PVDF
N	Thread ANSI NPT1, PVDF

030	Cable length
1	5 m/16 ft
2	10 m/32 ft
3	15 m/49 ft
4	20 m/65 ft
5	25 m/82 ft
6	30 m/98 ft
8	... m (variable length, up to 300 m)
A	... ft (variable length, up to 985 ft)

040	Additional option
A	Basic version
L	5-point linearity protocol (only to order with FMU9x transmitter + 5-point linearity protocol, (in preparation))

995	Marking
1	Tagging (TAG)

FDU92 –	product designation

Product structure FDU93

010	Approval
C	IEC Ex ta/tb IIIC Da/Db
D	IEC Ex ma IIC T6 Gb, IEC Ex ta/tb IIIC Da/Db
E	ATEX II 1/2 D Ex ta/tb IIIC
G	ATEX II 3G EEx nA II T6 (in preparation)
H	ATEX II 3D (in preparation)
J	ATEX II 1/2 D Ex ta/tb IIIC, ATEX II 2 G Ex ma IIC T6
P	FM Cl.I,II,III Div. 1+2 Gr.A-G, zone 2,21,22
R	Non-hazardous area
T	CSA Cl.II,III Div.1 Gr.E-G, zone 2
U	CSA General Purpose
W	TIIS dust-Ex DP12 (in preparation)
1	NEPSI DIP (in preparation)

020	Process connection (threaded boss)
G	Thread ISO228 G1, UP
N	Thread ANSI NPT1, UP

030	Cable length
1	5 m/16 ft
2	10 m/32 ft
3	15 m/49 ft
4	20 m/65 ft
5	25 m/82 ft
6	30 m/98 ft
8	... m (variable length, up to 300 m)
A	... ft (variable length, up to 985 ft)

040	Additional option
A	Basic version
L	5-point linearity protocol (only to order with FMU9x transmitter + 5-point linearity protocol, (in preparation))

995	Marking
1	Tagging (TAG)

FDU93 -	product designation

Product structure FDU95

010	Approval
C	IEC Ex ta/tb IIIC Da/Db
D	IEC Ex ma IIC T6 Gb, IEC Ex ta/tb IIIC Da/Db
E	ATEX II 1/2 D Ex ta/tb IIIC
H	ATEX II 3D (in preparation)
J	ATEX II 1/2 D Ex ta/tb IIIC, ATEX II 2G Ex ma IIC T6
P	FM Cl.II Div.1 Gr.E-G, zone 2,21,22
R	Non-hazardous area
T	CSA Cl.II Div.1 Gr.E-G, zone 2
U	CSA General Purpose
W	TIIS dust-Ex DP12 (in preparation)
1	NEPSI DIP (in preparation)

015	Temperature; blocking distance; material
1	-40 ... +80°C/176°F; 70 cm/2.3ft; membrane: 316L; PEcoated
2	-40 ... 150°C/302°F; 90 cm/2,9ft; membrane: 316L

020	Process connection (threaded boss)
G	Thread ISO228 G1, UP
N	Thread ANSI NPT1, UP

030	Cable length
1	5 m/16 ft
2	10 m/32 ft
3	15 m/49 ft
4	20 m/65 ft
5	25 m/82 ft
6	30 m/98 ft
8	... m (variable length, up to 300 m)
A	... ft (variable length, up to 985 ft)

040	Additional option
A	Basic version
L	5-point linearity protocol (only to order with FMU9x transmitter + 5-point linearity protocol, (in preparation))

995	Marking
1	Tagging (TAG)

FDU95 -							product designation

Product structure FDU96

010	Approval
C	IEC Ex ta/tb IIIC Da/Db
D	IEC Ex ma IIC T6 Gb, IEC Ex ta/tb IIIC Da/D
E	ATEX II 1/2 D Ex ta/tb IIIC, -40 ... +140 °C
F	ATEX II 1/2 D Ex ta/tb IIIC, -40 ... +80 °C
H	ATEX II 3D (in preparation)
J	ATEX II 1/2 D Ex ta/tb IIIC, ATEX II 2 G Ex ma IIC T6
K	FM Cl.I,II,III Div.1+2 Gr.A-G, LT; Ambient temperature: -40 ... +80 °C (176 °F), zone 2,21,22
L	CSA Cl.II,III Div.1 Gr.E-G, LT; Ambient temperature: -40 ... +80 °C (176 °F), zone 2
P	FM Cl.I,II,III Div.1+2 Gr.A-G, HT; Ambient temperature: -40 ... +140 °C (284 °F), zone 2,21,22
R	Non-hazardous area
T	CSA Cl.II,III Div.1 Gr.E-G, HT; Ambient temperature: -40 ... +140 °C (284 °F), zone 2
U	CSA General Purpose
W	TIIS dust-Ex DP12 (in preparation)
1	NEPSI DIP (in preparation)

020	Process connection (threaded boss)
G	Thread ISO228 G1, UP
S	Thread ISO228 G1, 304
N	Thread ANSI NPT1, UP
V	Thread ANSI NPT1, 304

030	Cable length
1	5 m/16 ft
2	10 m/32 ft
3	15 m/49 ft
4	20 m/65 ft
5	25 m/82 ft
6	30 m/98 ft
8	... m (variable length, up to 300 m)
A	... ft (variable length, up to 985 ft)

040	Additional options
A	Basic version
L	5-point linearity protocol (only to order with FMU9x transmitter + 5-point linearity protocol, (in preparation))

995	Marking
1	Tagging (TAG)

FDU96 -	product designation

Scope of delivery

- Instrument according to the version ordered
- This Technical Information TI00396F (serves as installation and operating instruction)
- For certified instrument versions: Safety Instructions (XA) or Control Drawings (ZD)
- For FDU90/91 with sensor heater: terminal module, to be mounted in the field housing of the transmitter FMU90
- For FDU90/91/92 with G1" process connection: counter nut (PA6.6) + seal (EPDM)
- For FDU 93/95/96 with Ex-certificate: process seal (VMQ)

Accessories

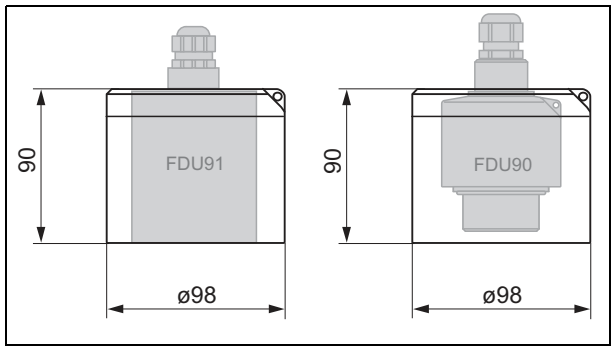
Extension cable for sensors

for Sensor	Material	Cable type	Order code
■ FDU90 ■ FDU91 ■ FDU92	PVC	LiYCY 2x(0.75)	71027742
■ FDU91F ■ FDU93 ■ FDU95	PVC (-40 to +105 °C) (-40 to +221 °F)	LiYY 2x(0.75)D+1x0.75	71027743
■ FDU95 ■ FDU96	Silicone (-40 to +150 °C) (-40 to +302 °F)	Li2G2G 2x(0.75)D+1x0.75	71027745
■ FDU90/FDU91 with heater	PVC	LiYY 2x(0.75)D+2x0.75	71027746

Total length (sensor cable + extension cable): up to 300 m (984 ft)

Protective cover for FDU91

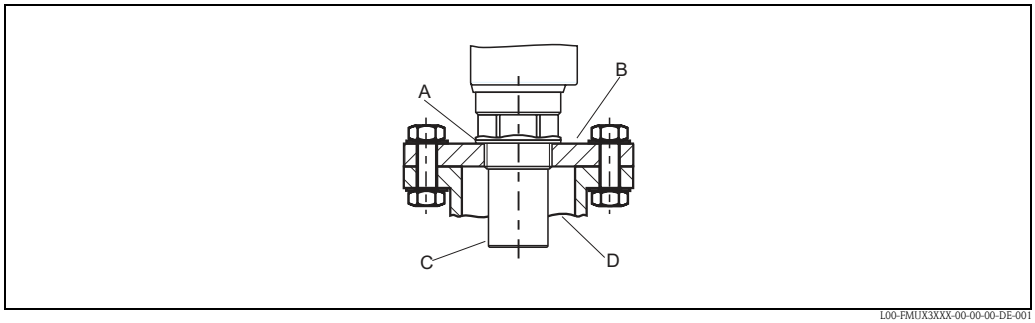
- Material: PVDF
- Order code: 52025686



L00-FDU9xxxx-06-00-00-xx-003

Dimensions in mm

Screw in flange



L00-FMUX3XXX-00-00-00-DE-001

A: *sealing ring EPDM (supplied),* **B:** *screw in flange,* **C:** *sensor,* **D:** *nozzle*

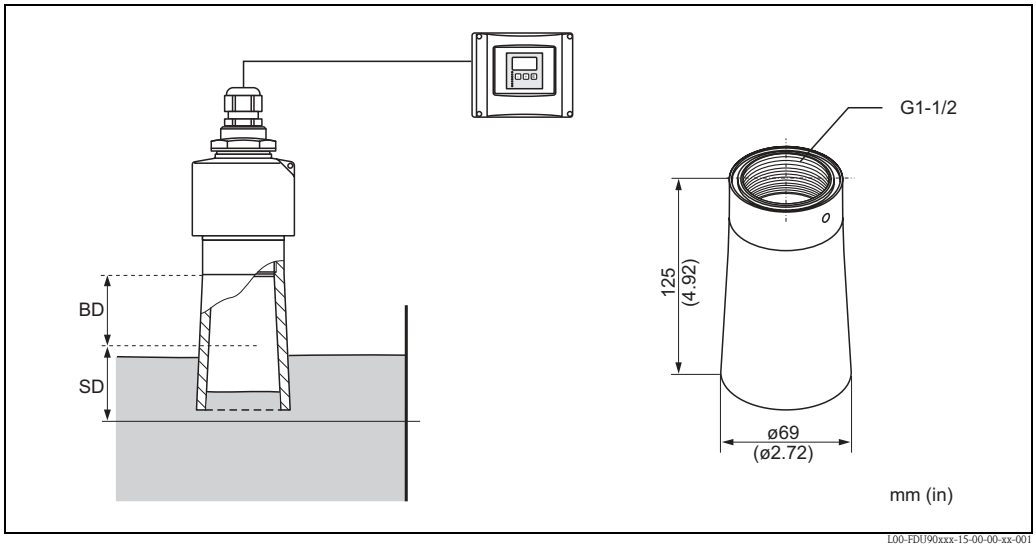
Screw in flange FAX50

015	Material:	
	BR1	DN50 PN10/16 A, steel flange EN1092-1
	BS1	DN80 PN10/16 A, steel flange EN1092-1
	BT1	DN100 PN10/16 A, steel flange EN1092-1
	JF1	2" 150lbs FF, steel flange ANSI B16.5
	JG1	3" 150lbs FF, steel flange ANSI B16.5
	JH1	4" 150lbs FF, steel flange ANSI B16.5
	JK2	8" 150lbs FF, PP max 3bar abs/44psia flange ANSI B16.5
	XIF	UNI flange 2"/DN50/50, PVDF max 4bar abs/58psia, suitable for 2" 150lbs/DN50 PN16/10K 50
	XIG	UNI flange 2"/DN50/50, PP max 4bar abs/58psia, suitable for 2" 150lbs/DN50 PN16/10K 50
	XIJ	UNI flange 2"/DN50/50, 316L max 4bar abs/58psia suitable for 2" 150lbs/DN50 PN16/10K 50
	XJF	UNI flange 3"/DN80/80, max 4bar abs/58psia, suitable for 3" 150lbs/DN80 PN16/10K 80
	XJG	UNI flange 3"/DN80/80, PP max 4bar abs/58psia, suitable for 3" 150lbs/DN80 PN16/10K 80
	XJJ	UNI flange 3"/DN80/80, 316L max 4bar abs/58psia, suitable for 3" 150lbs/DN80 PN16/10K 80
	XKF	UNI flange 4"/DN100/100, PVDF max 4bar abs/58psia, suitable for 4" 150lbs/DN100 PN16/10K 100
	XKG	UNI flange 4"/DN100/100, PP max 4bar abs/58psia, suitable for 4" 150lbs/DN100 PN16/10K 100
	XKJ	UNI flange 4"/DN100/100, 316L max 4bar abs/58psia, suitable for 4" 150lbs/DN100 PN16/10K 100
	XLF	UNI flange 6"/DN150/150, PVDF max 4bar abs/58psia, suitable for 6" 150lbs/DN150 PN16/10K 150
	XLG	UNI flange 6"/DN150/150, PP max 4bar abs/58psia, suitable for 6" 150lbs/DN150 PN16/10K 150
	XLJ	UNI flange 6"/DN150/150, 316L max 4bar abs/58psia, suitable for 6" 150lbs/DN150 PN16/10K 150
	XMG	UNI flange DN200/200, PP max 4bar abs/58psia, suitable for DN200 PN16/10K 200
	XNG	UNI flange DN250/250, PP max 4bar abs/58psia, suitable for DN250 PN16/10K 250
	YYY	Special version

020	Sensor Connection:	
	A	Thread ISO228 G3/4
	B	Thread ISO228 G1
	C	Thread ISO228 G1-1/2
	D	Thread ISO228 G2
	E	Thread ANSI NPT3/4
	F	Thread ANSI NPT1
	G	Thread ANSI NPT1-1/2
	H	Thread ANSI NPT2
	Y	Special version

	015	020
FAX50 -		

Flooding protection tube for FDU90



BD: *Blocking distance,* **SD:** *Safety distance*

Usage

The flooding protection tube prevents the level to rise into the blocking distance of the FDU90 sensor even if the sensor is flooded.
The user can set a safety distance SD in the transmitter FMU90/FMU95 and define that a warning signal is generated as soon as the level rises into the safety distance.

Mounting hints

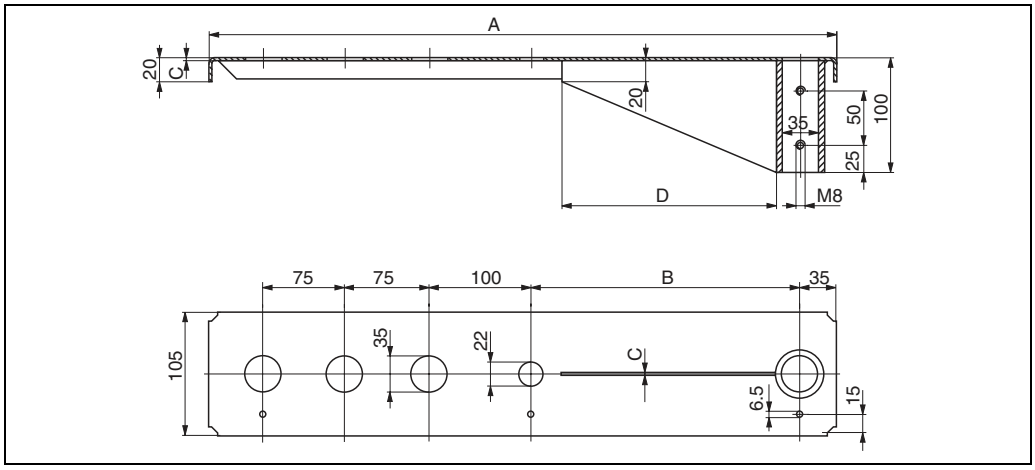
In order to ensure tightness, the supplied gasket has to be applied and the flooding protection tube must be screwed hand tight up to limit stop. When re-equipping the flooding protection tube, repeat the basic setup including the mapping

Note!
- The flooding protection tube has a G1-1/2" thread.
- If it is ordered together with the FDU90 sensor in the product structure, the sensor always has a G1-1/2" thread at its front side, irrespective of the selection in feature 020, "Process connection".
- If the flooding protection tube is ordered as an accessory, it can only be used for sensors with a G1-1/2" thread at the front side.

Material	Weight	Order code
PP	0.12 kg (0.26 lbs)	71091216
Gasket EPDM		

Cantilever

The cantilever is used to mount the sensors FDU90, FDU91 and FDU92 above open channels for example.



L00-FMU4xxxx-06-00-00-yy-005

A	B	C	D	Material	Order code
585 (23)	250 (9.84)	2 (0.08)	200 (7.87)	galvanised steel	919790-0000
				316Ti (1.4571)	919790-0001
1085 (42.7)	750 (29.5)	3 (0.12)	300 (11.8)	galvanised steel	919790-0002
				316Ti (1.4571)	919790-0003

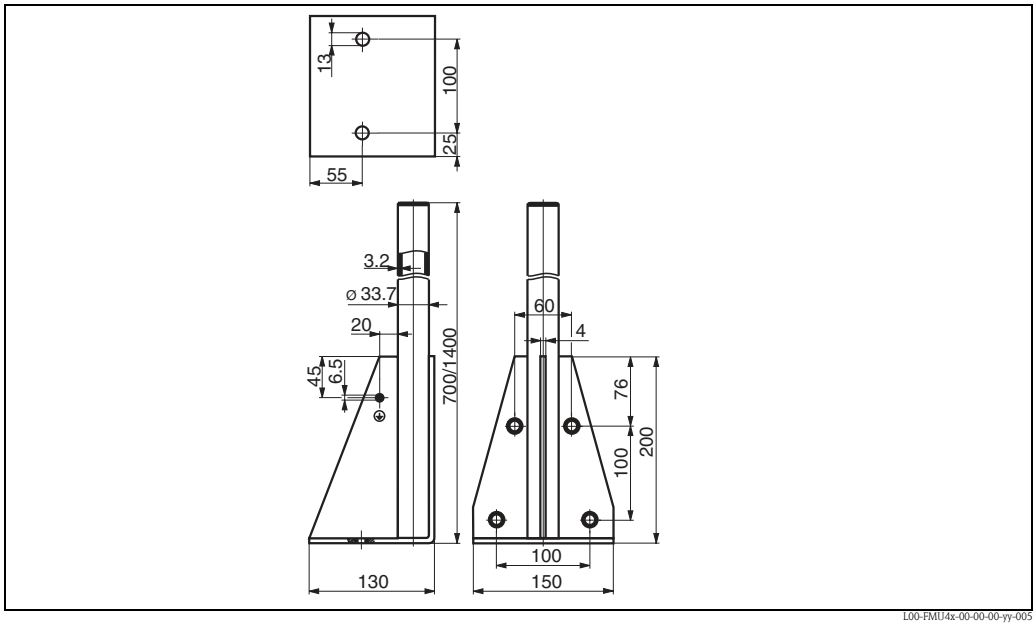
mm (in)

- The 35 mm (1.38 in) orifices are for the sensors FDU9x.
- The 22 mm (0.87 in) orifice may be used for an external temperature sensor (e.g. FMT131).

The cantilever can be mounted in the following ways:
- by a mounting frame (see below)
- by a wall bracket (see below)

Fixing screws are supplied.

Mounting Frame

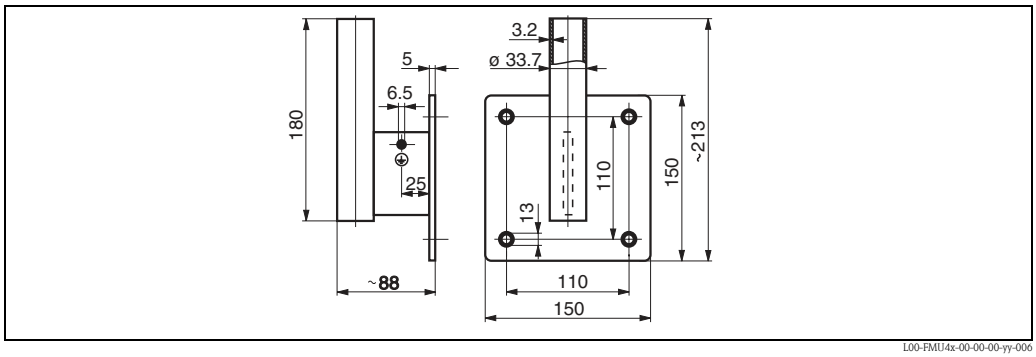


L00-FMU4x-00-00-00-yy-005

Height	Material	Order Code
700 (27.6)	galv. steel	919791-0000
700 (27.6)	316Ti (1.4571)	919791-0001
1400 (55.1)	galv. steel	919791-0002
1400 (55.1)	316Ti (1.4571)	919791-0003

mm (in)

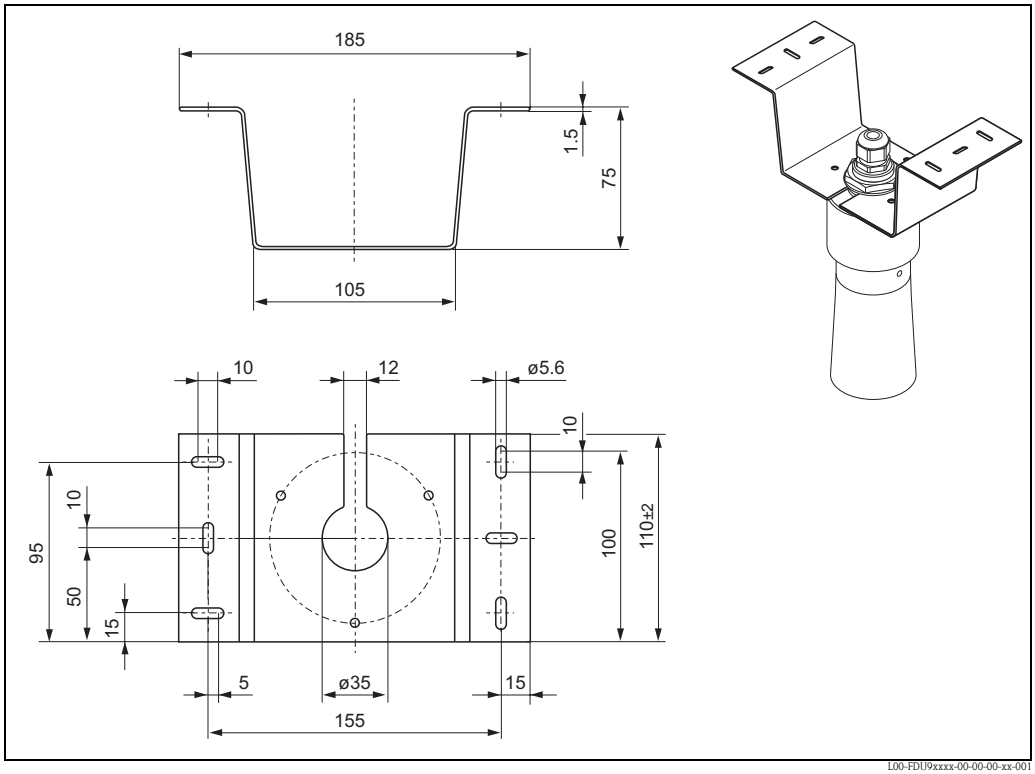
Wall Bracket



L00-FMU4x-00-00-00-yy-006

Material	Order Code
galv. steel	919792-0000
316Ti (1.4571)	919792-0001

Mounting bracket for ceiling mounting

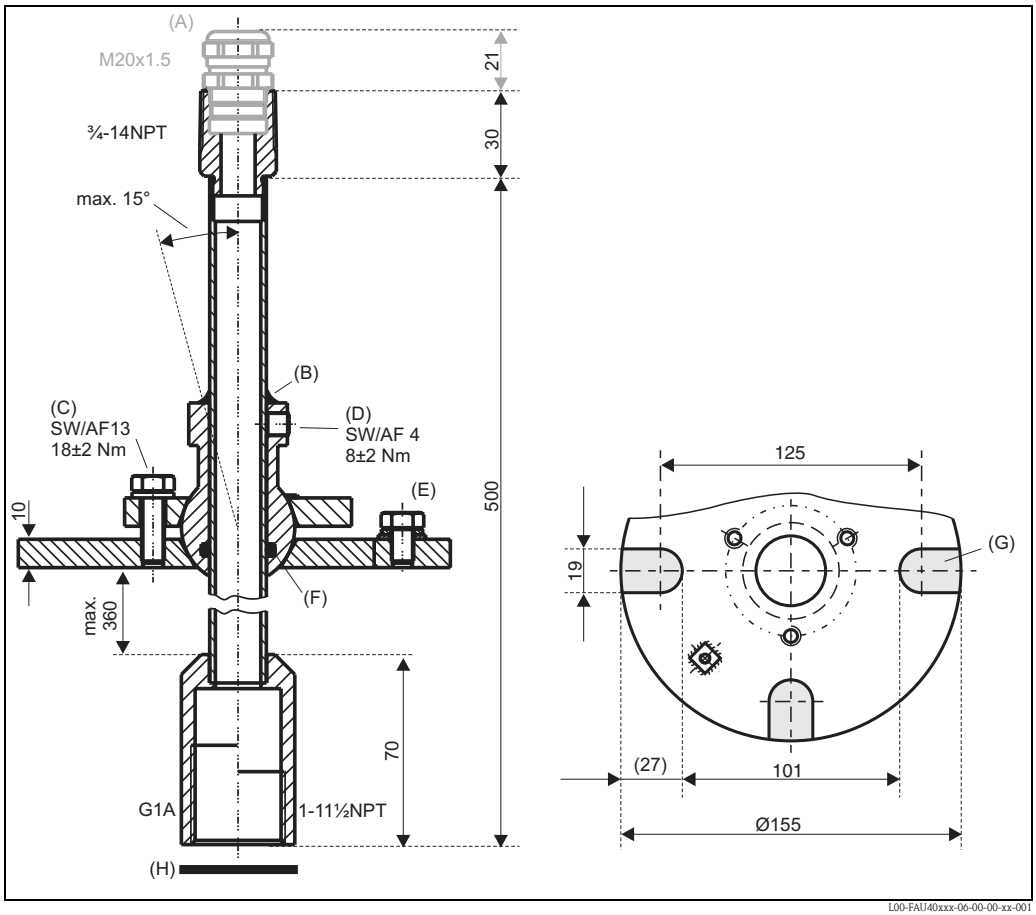


Dimensions in mm

	Material	Order No.
Suited for: FDU90, FDU91, FDU91F, FDU92	316 L (1.4404)	71093130

Alignment unit FAU40

For measurements in solids, usage of the alignment unit FAU40 is recommended. It is designed for simple mounting and alignment of a FDU sensor on the product surface and can be used for zone separation in explosion hazardous areas.



(A): *Cable gland M20x1.5 (present if selected in the product structure),* **(B):** *sealant here,* **(C):** *screw for lateral movement,* **(D):** *two Allen screws for height adjustment,* **(E):** *ground pin,* **(F):** *O-ring,* **(G):** *mounting grooves (present in the UNI flange),* **(H):** *seal supplied with the sensor, must be used for applications in ATEX zone 20*

The alignment unit can be rotated up to 15°.
For further information see Technical Information T00179F.

Product structure

010	**Process connection (Flange)**		
	1		Welding flange, 304/1.4301
	2		UNI flange 2"/DN50/50, 304, max. 1.5 bar abs./22psia suitable for 2" 150lbs / DN50 PN16 / 10K 50
020		**Sensor connection**	
		S	Thread G1, cable gland M20, 304/1.4301
		G	Thread G1, cable gland M20, galvanised steel
		N	Thread NPT1, cable entry3/4, galvanised steel
FAU40 –			product designation

Power supply RNB130 for the FDU90/FDU91 sensor heater

Technical data

- Primary switched-mode power supply
- Input: 100 – 240 V AC
- Output: 24 V DC connection, max. 30 V in the event of a fault
- Connection to monophased a.c. networks or to two phase conductors of three-phase supply networks (TN, TT or IT networks as per VDE 0100 T 300/IEC 364-3) with 100 – 240 V AC nominal voltage

For further information see Technical Information TI00120R.

Product structure

010	**Approvals**				
	A	Non-hazardous area			
020		**Connection**			
		1	Screw strip		
		3	Screw connection, power terminal block		
030			**Version**		
			A	Standard	
RNB130 –					complete product designation

IP66 protective housing for the power supply RNB130

Order code: 51002468
For additional information refer to Technical Information TI00080R.

Additional documentation

Innovation booklet

IN00003F

Ultrasonic measurement – the solution for your application

Technical Information

TI00397F

Technical Information for the transmitter Prosonic S FMU90

TI00179F

Technical Information for the alignment unit FAU40

Operating instructions (for transmitter FMU90)

Depending on the instrument version, the following operating instructions are supplied with the Prosonic S FMU90:

Operating instructions	Output	Application	Instrument version
BA00288F	HART	■ level measurement ■ alternating pump control ■ screen and rake control	FMU90 – *******1**** FMU90 – *******2****
BA00289F		■ flow measurement ■ backwater and dirt detection ■ totalizers and counters	FMU90 – *2*****1**** FMU90 – *4*****1**** FMU90 – *2*****2**** FMU90 – *4*****2****
BA00292F	PROFIBUS DP	■ level measurement ■ alternating pump control ■ screen and rake control	FMU90 – *******3****
BA00293F		■ flow measurement ■ backwater and dirt detection ■ totalizers and counters	FMU90 – *2*****3**** FMU90 – *4*****3****

These operating instructions describe installation and commissioning of the respective version of the Prosonic S. It contains those functions from the operating menu, which are required for a standard measuring task. Additional functions are contained in the "Descripiton of Instrument Functions" (BA00290F, see below).

Description of Instrument Functions (for transmitter FMU90)

BA00290F

contains a detailed description of **all** functions of the Prosonic S and is valid for all instrument versions. A PDF file of this document can be found
- on the CD-ROM, which is supplied together with the instrument
- in the internet at → see: www.en.endress.com → Download

Safety Instructions

The following Safety Instructions are supplied with certified versions of the sensors. If the sensors are used in hazardous areas, comply with all the specifications in these Safety Instructions.

Sensor version	Certificate	Safety Instructions
ATEX		
■ FDU90 - J... ■ FDU91 - J... ■ FDU91F - J... ■ FDU92 - J...	■ II 2 G Ex ma IIC T5 Gb (FDU90) ■ II 2 G Ex ma IIC T6 Gb (FDU91/91F/92)	XA00321F
■ FDU90 - E... ■ FDU91 - E... ■ FDU91F - E... ■ FDU92 - E... ■ FDU93 - J... ■ FDU95 - J... ■ FDU96 - J...	■ II 2 G Ex ma IIC T5 Gb (FDU90) ■ II 2 G Ex ma IIC T6 Gb (FDU91/91F/92/93/95/96) ■ II 1/2 D Ex ta/tb IIIC Txx°C Da/Db IP68 ■ II 2 D Ex tb IIIC Txx°C Db IP68	XA00322F
■ FDU93 - E... ■ FDU95 - E... ■ FDU96 - E...	■ II 1/2 D Ex ta/tb IIIC Txx°C Da/Db IP68 ■ II 2 D Ex tb IIIC Txx°C Db IP68	XA00323F
IEC Ex		
■ FDU90 - C... ■ FDU91 - C... ■ FDU91F - C... ■ FDU92 - C... ■ FDU93 - D... ■ FDU95 - D... ■ FDU96 - D...	■ IEC Ex ma IIC T5 Gb (FDU90) ■ IEC Ex ma IIC T6 Gb (FDU91/91F/92/93/95/96) ■ IEC Ex ta/tb IIIC Txx°C Da/Db IP68 ■ IEC Ex tbIIIC Txx°C DbIP68	XA00481F
■ FDU90 - D... ■ FDU91 - D... ■ FDU91F - D... ■ FDU92 - D...	■ IEC Ex ma IIC T5 Gb (FDU90) ■ IEC Ex ma IIC T6 Gb (FDU91, FDU91F, FDU92)	XA00482F
■ FDU93 - C... ■ FDU95 - C... ■ FDU96 - C...	■ IEC Ex ta/tb IIIC Txx°C Da/Db IP68 ■ IEC Ex tbIIIC Txx°C Db IP68	XA00483F

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