Technical Information
TI 212F/00/en

Ultrasonic Level Measurement
prosonic P FMU 801

Control of several distributed measuring points
Measured value display on personal computer
Sensors suitable for use in hazardous areas

Features and Benefits

- Economical installation, because fewer cables must be laid
- Fast response, because the process is controlled locally, direct from the transmitter - no delays due to scanning of measuring points or transmission of data
- Simple level display using proven DOS and Windows software
- Guaranteed precision, even when the temperature changes
- Double protection against overspill thanks to optional external limit switch
- Easy, economical expansion with Rackbus RS-485 or PROFIBUS-DP instrumentation

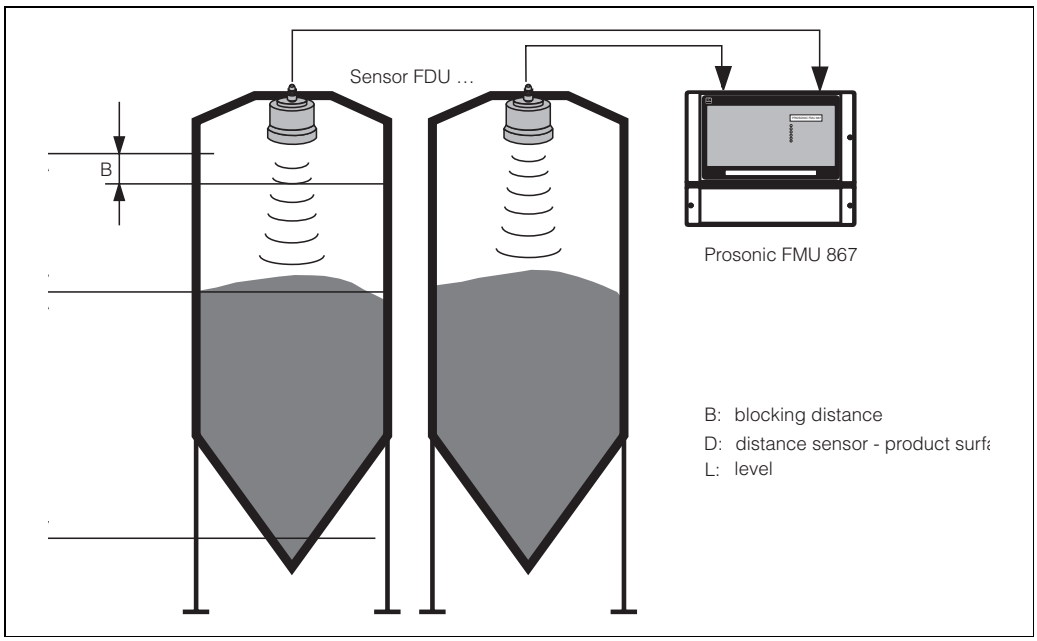
Application

The Prosonic P ultrasonic level measuring system allows parameters from up to 25 distributed measuring points to be configured and displayed on a personal computer.
The economical package is based on the Prosonic FMU 867 transmitter and the ultrasonic sensors FDU 80... 86, which are also suitable for use in explosion hazardous areas or with combustible dusts. Data from the measuring points are transmitted to the personal computer via the Rackbus RS-485 opr PROFIBUS-DP. The values are displayed by the Commugraph or Commuwin II software.

Endress+Hauser
The Power of Know How

Measurement Principle

Ultrasonic Level Measurement



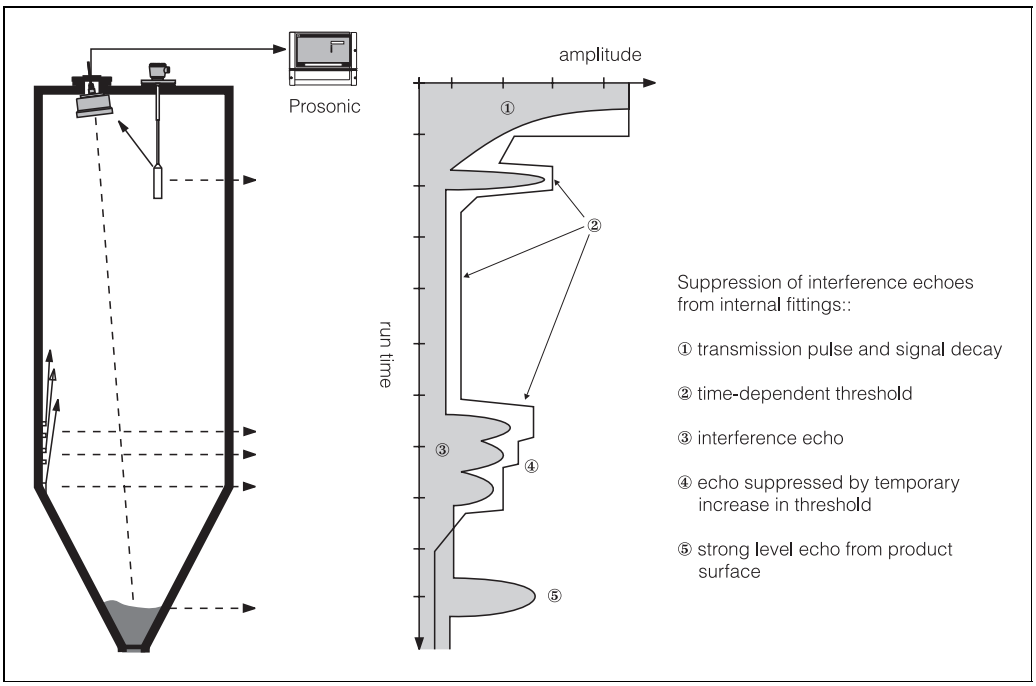
The ultrasonic principle relies on the measurement of the time elapsing between the output of an initial pulse and the reception of its echo from the product surface.

- The measurement is independent of product properties such as specific gravity, conductivity, viscosity, and dielectric constant.
- The measurement precision is unaffected by changes in ambient temperature within the silo or tank: the Prosonic compensates by using the temperature information delivered by the sensor.
- Depending on the sensor, the measuring range is up to 70 m in solids.

Resolution

Range [m]	< 3	3 ... 6	6 ... 12	12 ... 30	30 ... 45	45 ... 70
Resolution [mm]	1	< 2	< 4	< 10	< 20	< 30

Signal Processing



The Prosonic transmitter is equipped with evaluation algorithms in which fuzzy logic elements are also used. Without special configuration, the true level signal is reliably distinguished from:
- sporadic echoes (e.g. from agitator blades)
- noise (e.g. during filling) or
- multiple reflections (e.g. from fine-grained solids or in closed tanks).

Even when the position of the sensor is far from ideal, reliable measurements can still be achieved since the fixed target suppression mode or a filter factor can be called upon.

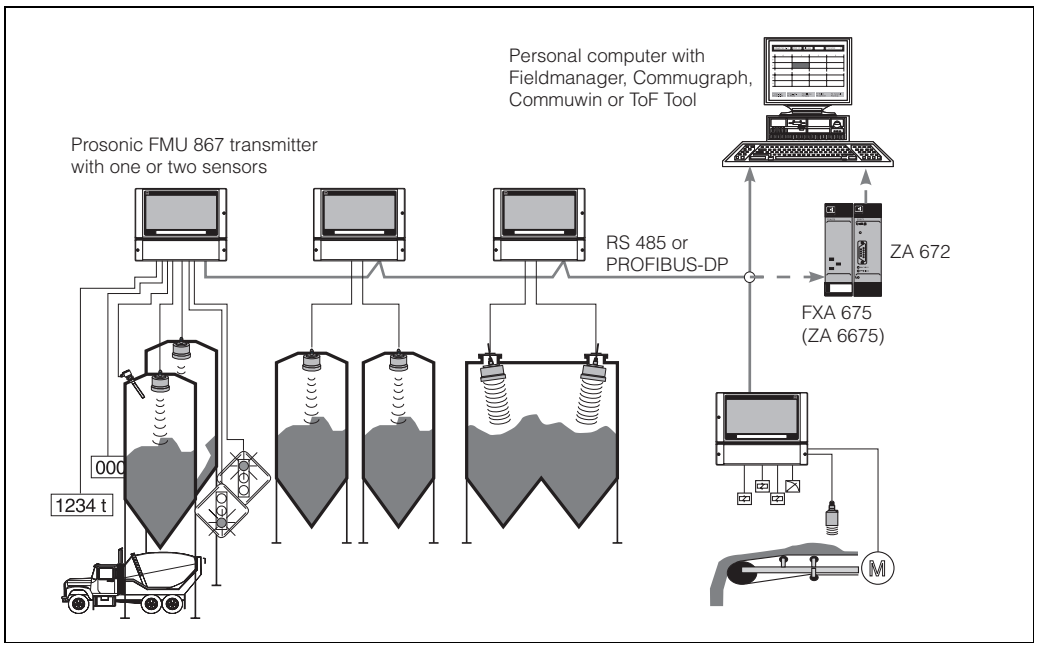
Simple Commissioning

Commissioning time is substantially reduced by the use of pre-set configurations for particular applications. By entering a single parameter the measuring system is set automatically to measure:
- liquids
- products with rapidly changing levels
- fine-grained bulk solids
- coarse-grained bulk solids
- conveyer belts

In addition to the standard operating modes with one sensor, the Prosonic FMU 867 also offers an average level measurement with two.

Equipment architecture

System Components



The measuring system comprises several transmitters Prosonic FMU 867. One or two sensors FDU 80 ... 86 may be operated on each transmitter. For special applications further instruments may be connected to each measuring point:
- separate temperature sensor
- separate limit switch

For parametrization and visualization the transmitters are connected to a Personal Computer via RS 485 or PROFIBUS-DP.

RS 485
Depending on system architecture up to 50 measuring points may be connected to the bus. The maximum bus length is 1200 m.

PROFIBUS-DP
Up to 126 transmitters may be connected to each PROFIBUS-DP bus. The maximum bus length depends on the transmission rate:

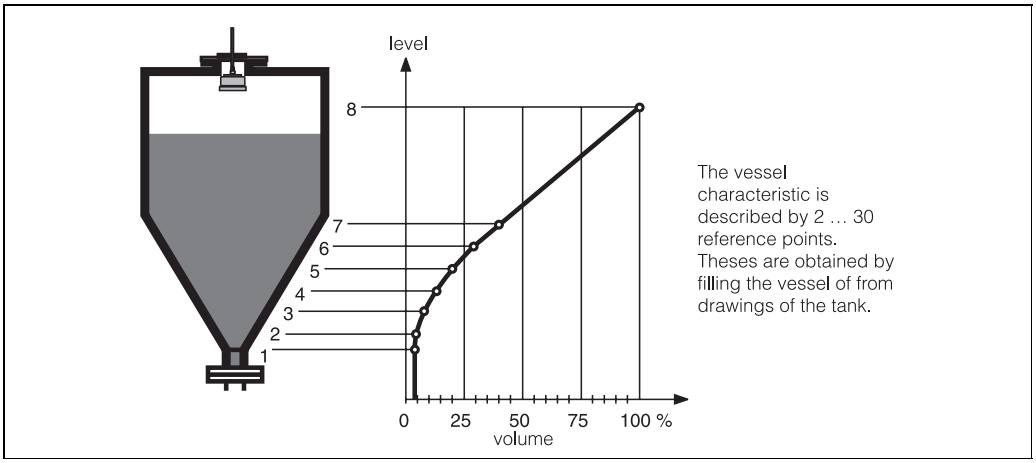
transmission rate (kbit/s)	19,2 - 93,75	187,5	500	1500
max. cable length (m)	1200	1000	400	200

Interfaces to a Personal Computer

RS 485
- for the graphical operating program "Commuwin II":
  - Commubox FXA 192
  - Interfaces FXA 675 and ZA 672

PROFIBUS-DP
- PROFICARD (PCMCIA card)
- PROFIBOARD (PCI Board)

Volume/Weight Measurement



Volume or weight is calculated from level by means of a vessel characteristic which describes their functional relationship. The most common characteristic, a horizontal cylinder, is programmed as a standard feature.

Analogue Outputs

The Prosonic FMU 867 transmitter provides a standard 0/4 ... 20 mA signal at each of its two channels. Depending upon configuration, these are proportional to either level or volume (weight). The start and end of the signal range can be programmed as required.

PROFIBUS-DP output

Up to three cyclic data can be transmitted by the PROFIBUS-DP interface:
- Main value of channel 1 (Level/Volume)
- Main value of channel 2 (Level/Volume)
- Flow counter

Relays

The transmitter is equipped with three relays which can be individually programmed as:
- level limit relays, minimum or maximum fail-safe mode as required, with alternation and time delay for pump or feed control applications.
- trend relays, switching when the filling or emptying rate exceeds the set value
- an alarm relay, switching when an instrument fault is detected.

Function Monitoring

The Prosonic continuously monitors all signal lines from the sensor to the analogue outputs. On detection of a fault:
- all LEDs flash
- the analogue signals switch to –10 %, +110 % or hold the last value
- limit relays respond according to the fail-safe mode selected
- an alarm relay de-energises
- the appropriate state is transmitted via the PROFIBUS-DP interface.

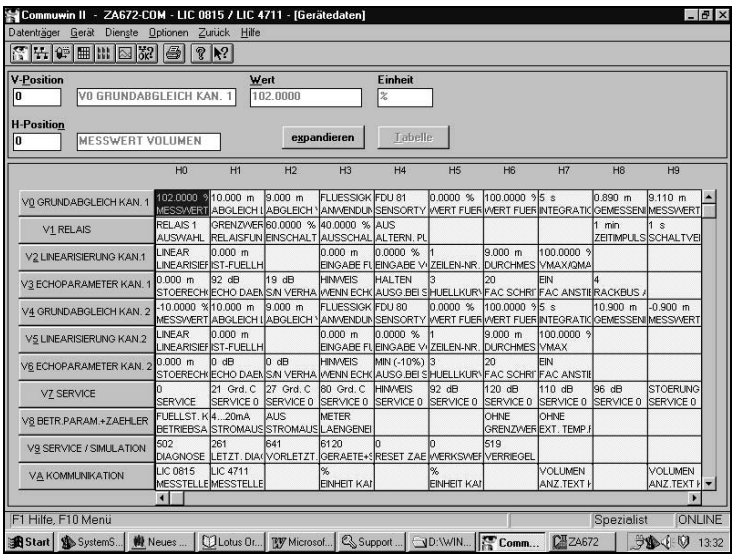
Operation via "Commuwin II"

Functions of the program

When operating with the Commuwin II display and operating program (from version 1.5 onwards) the Prosonic transmitter is set and operated using either an operating matrix mode or the graphic operating mode. The appropriate server (e.g. HART, DPV1 or ZA 672) must be activated. A description of the Commuwin II operating program is given in the operating instructions BA 124F.

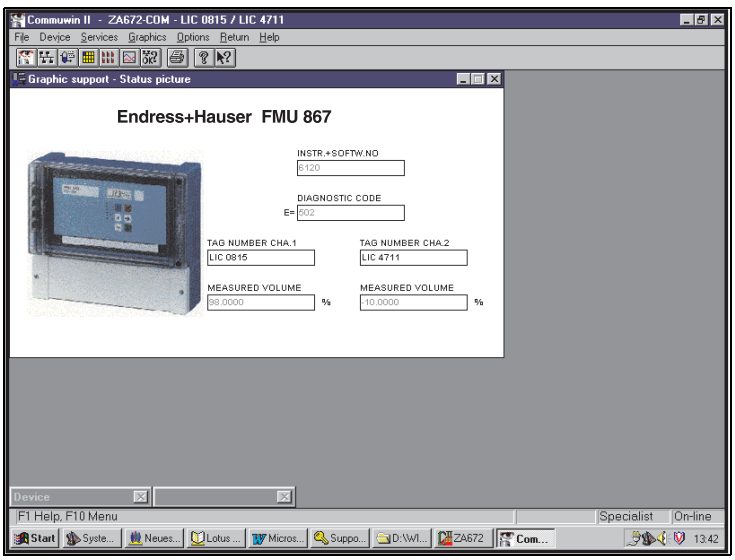
Operating matrix

The functions of the Prosonic FMU can be called up in this operating mode within the instrument parameters menu. Every row of the matrix is assigned to a function group. Every field shows one parameter. The calibration parameters are entered in the appropriate fields.



Graphical operation

In this operating mode the parameters for specific configuration procedures are entered in the appropriate places on the screen.



Connection

RS 485 (Commuwin II from Version 1.5)
- Commubox FXA 192
- Interface cards FXA 675 und ZA 672

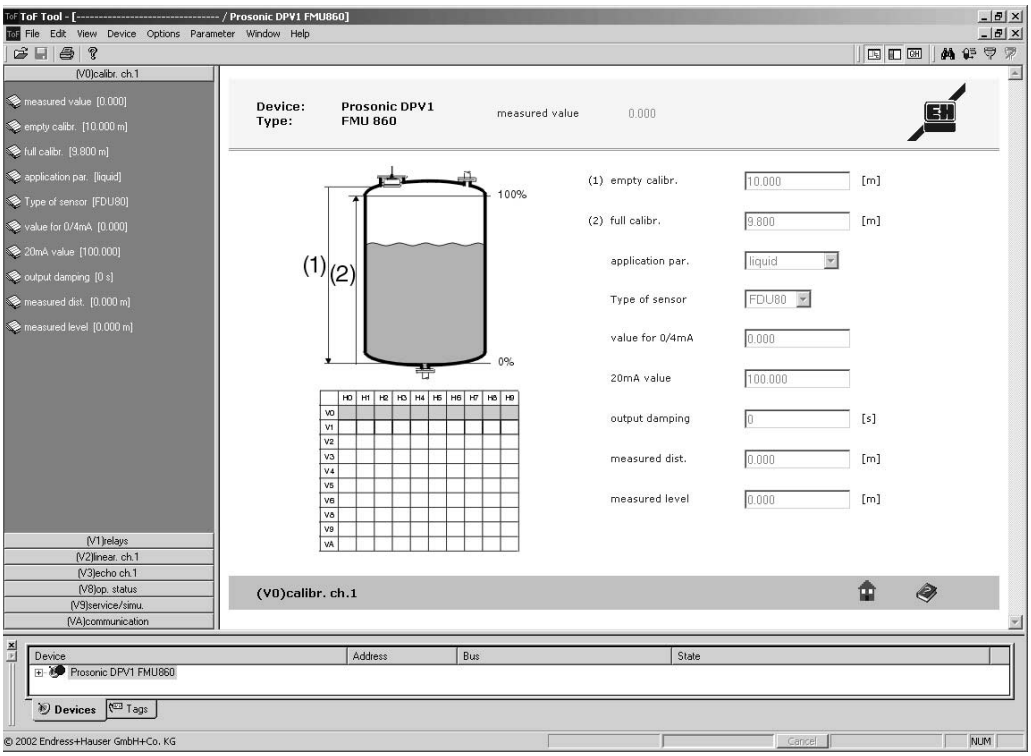
PROFIBUS-DP (Commuwin II from Version 2.07)
- PROFICARD (PCMCIA card)
- PROFIBOARD (PCI Board)

For PROFIBUS-DP instruments the following functions can only be performed by the provided Service Tool and Service Interface:
- Envelope curve display
- Download of parameters
- Functions of the Service matrix (i.e. functions, which are only service-relevant)

Operation via "ToF Tool"

Functions of the program

The ToF Tool is a graphical operation software for instruments from Endress+Hauser that operate based on the time-of-flight principle. It is compatible with the following operating systems: Win95, Win98, WinNT4.0, Win2000 and WinXP.
Operation of the FMU 867 is possible from the ToF Tool version 3.1 onwards. Communication between the PC an the FMU 867 is made possible by the PROFIBUS-DP interface.
All functions of the operating matrix can be accessed.



Note!
The following functions can only be performed by the provided Service Tool and Service Interface:
- Envelope curve display
- Download of parameters
- Functions of the Service matrix (i.e. functions, which are only service-relevant)

Connection

"ToF Tool" can be connected to PROFIBUS-DP in the following ways:
- PROFICARD (PCMCIA card)
- PROFIBOARD (PCI Board)

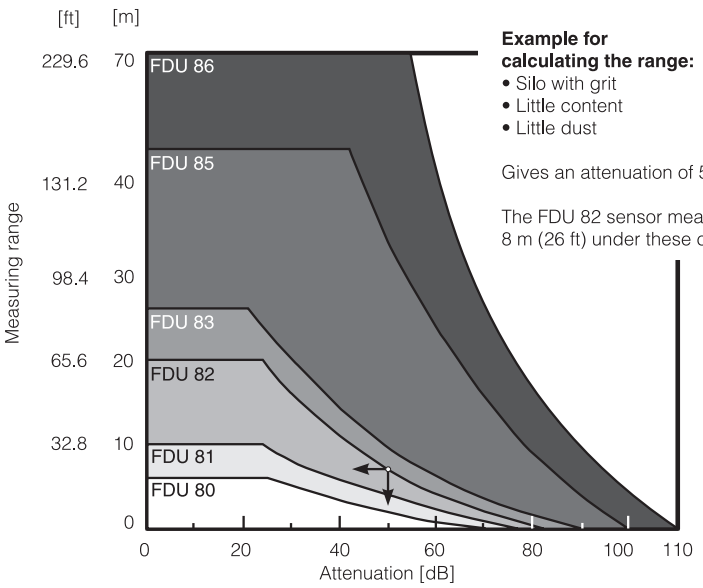
Connection to RS 485 is **not** possible.

Sensor Selection

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



Factors		Attenuation [dB]
Temperature layering (temperature difference between sensor and surface of material)	up to 20 °C up to 40 °C up to 80 °C up to 150 °C	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 (position of lower edge))	lower edge free in silo on collar, lower edge slanted (depending on diameter7length ratio) on collar, lower edge horizontal (depending on diameter7length ratio)	0 10 ... 20 20 ... 40

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

- Check the factors affecting your measurement in the table.
- 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

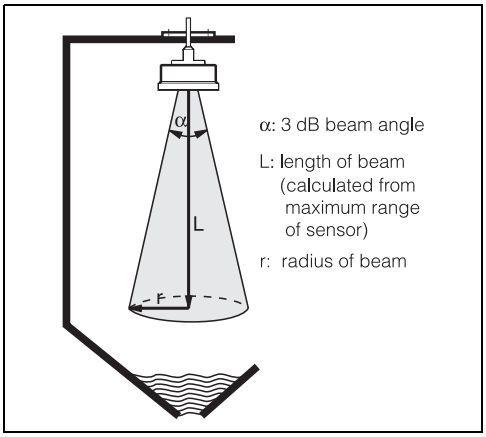
Optimum conditions in tanks or silos are achieved if
- the lower edge of the sensor is below the silo roof
- the detection zone does not include any internal fixtures or the filling curtain
- the surface of the solid is hard and coarse-grained
- the surface of the liquid is calm and no vapour is formed
- 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.

Installation hints for sensors

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.



	Liquids			Solids		
	α	L	r	α	L	r
FDU 80	8°	5 m (16 ft)	0,35 m (1.1 ft)	8°	2 m (6.6 ft)	0,14 m (0.46 ft)
FDU 81	8°	10 m (32 ft)	0,69 m (2.3 ft)	8°	5 m (16 ft)	0,35 m (1.1 ft)
FDU 82	8°	20 m (65 ft)	1,4 m (4.6 ft)	8°	10 m (32 ft)	0,7 m (2.3 ft)
FDU 83	4°	25 m (82 ft)	0,87 m (2.8 ft)	4°	15 m (49 ft)	0,52 m (1.7 ft)
FDU 85				5°	45 m (147 ft)	1,9 m (6.2 ft)
FDU 86				6°	70 m (230 ft)	3,6 m (11.8 ft)

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 Sensor

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

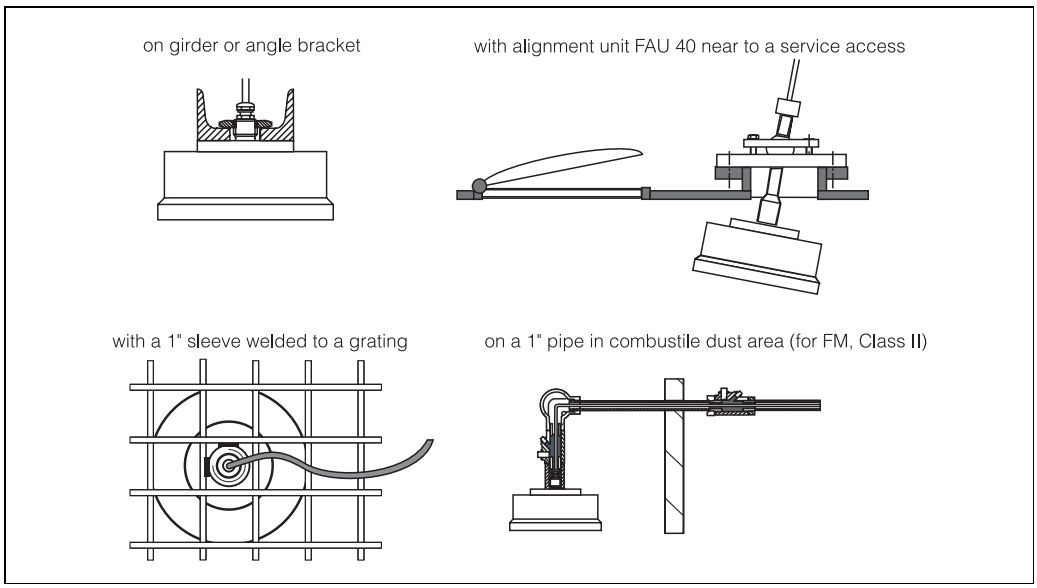
- A constant temperature and sound velocity within the measuring path enable a high degree of accuracy to be achieved. The effects of large temperature variations within the measuring path and changing gas mixtures must be calculated and the Prosonic programmed accordingly.
- With liquids having a high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

Mounting of sensors

Guidelines when Mounting

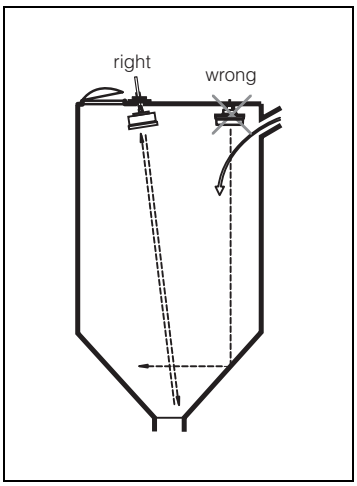
- Check that the maximum level height does not come within the blocking distance of the sensor (See »Technical Data of Sensors« on page 20.).
- If possible, the face of the sensor should lie parallel to the surface of the product.
- The PE or PTFE coating on the diaphragm of the FDU 84, 85 and 86 is 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 athmospheres caused by dust must be observed.
- All national guidelines applicable must be observed in explosion hazardous areas.

Possibilities of Mounting



Mounting in Vessels

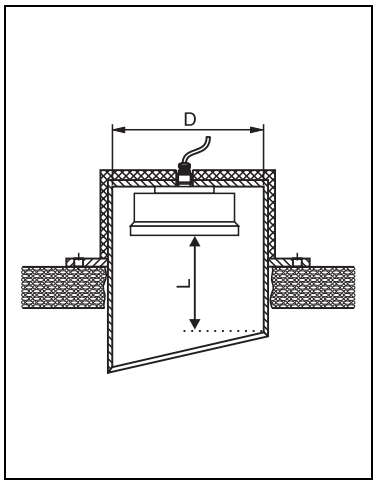
- Install the sensor so that its lower edge projects into the vessel.
- Position the sensor so that neither the filling curtain nor any internal fittings, e.g. an additional limit switch, are within the detection zone.
- The sensor must be positioned at the centre of the outflow funnel so that an echo 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 on a mounting pipe

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

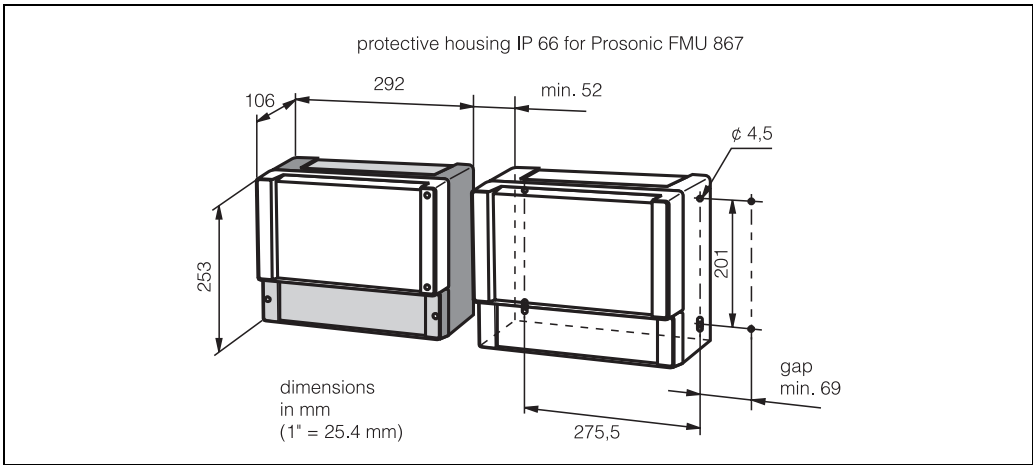
- No build-up of material should form in the pipe.
- Select a pipe with a diameter as large as possible (see figures and table). If there is a possibility The inner surface of the pipe should be as smooth as possible (no edges or welding seams).
- When mounting in the open, the pipe should be insulated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



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

Prosonic Mounting

Field Installation



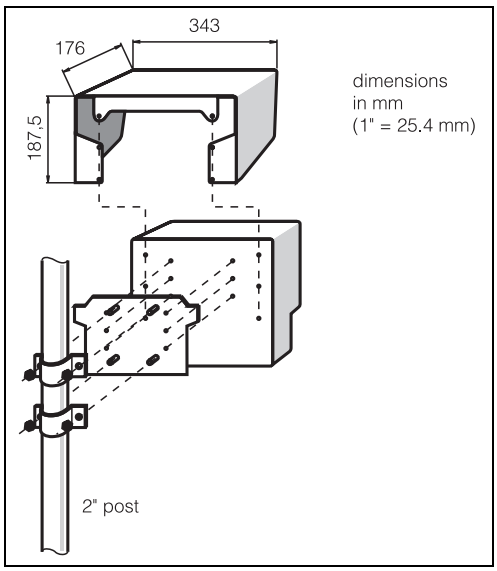
For certified systems, only the sensor may be installed in the explosion hazardous area. The transmitter must always be installed in a safe area either:
- screwed to a wall or
- mounted on a post.

An all-weather protective cover as well as separate overvoltage protectors HAW 261 and HAW 262 in a protective housing are available when the Prosonic is to be mounted outdoors.

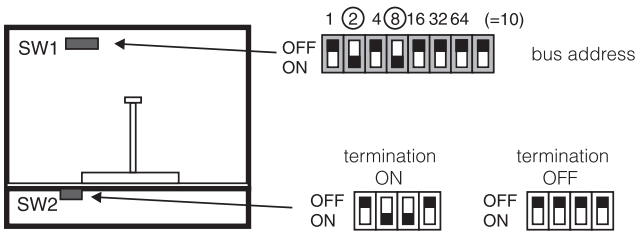
Accessories for mounting of the field housing

Protective Cover
- Material:
  aluminium, blue paint finish (Order No. 919 576-0000);
  stainless steel 1.4301 (≅ SS 304 H) (Order No. 919 567-0001)
- Weight: approx. 1 kg
- Mounting screws supplied.

Post Mounting
- Material: galvanised steel (Order No. for 2" post: 919 566-0000; for 1" post: 919 566-1000); stainless steel 1.4301 (≅ SS304 H) (Order No. for 2" post 919 566-0001; for 1" post: 919 566-1001)
- Weight: 1 kg
- Mounting screws and nuts supplied.



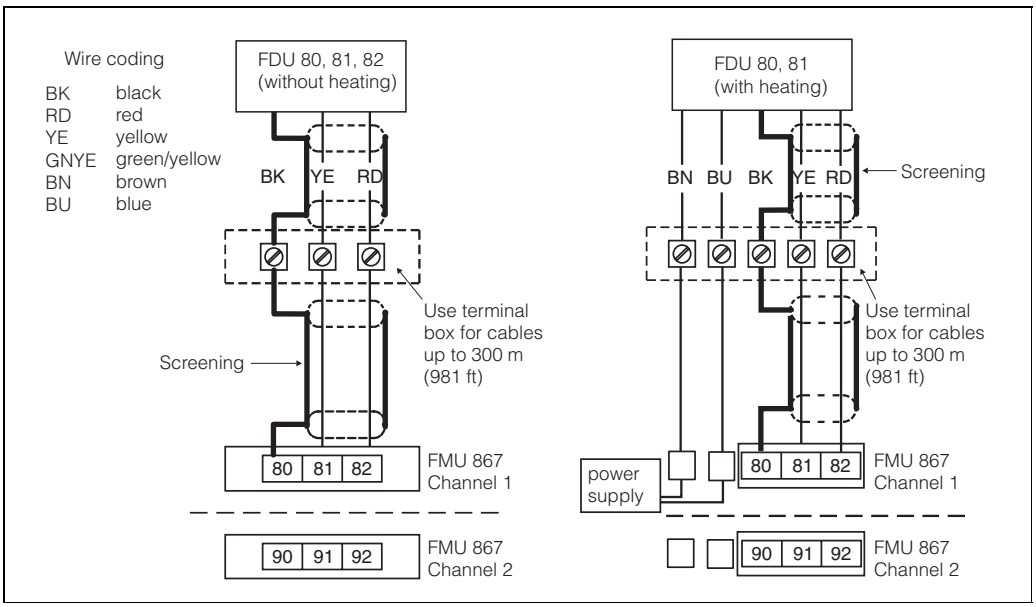
Bus address and Termination



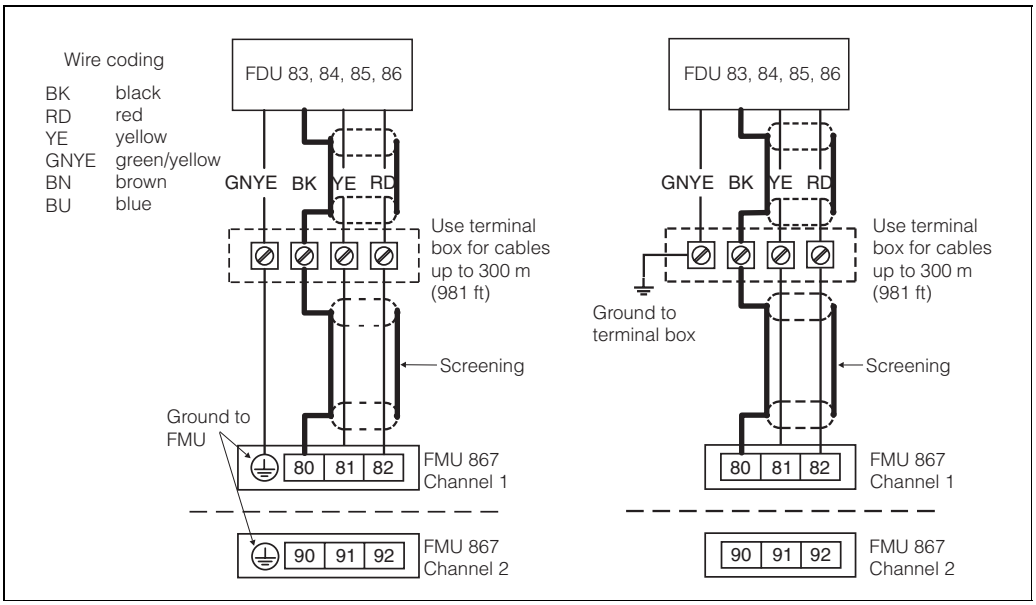
Every transmitter is given a unique address which is configured at the DIP-switch on the printed circuit board.
A second DIP-switch allows the transmitter to be configured as the bus terminator. For the Prosonic furthest from the personal computer this must be set to: OFF-ON-ON-OFF

Electrical Connection of Sensor

Connection diagram FDU 80 ... 82 (with or without heating)



Connection diagram FDU 83 ...86 (Grounding at the FDU or at the terminal box)



Connecting the FDU

The sensors are supplied with a fixed, 5 m or 10 m long cable as standard. They can be connected:

- directly into the FMU connection area. The connecting terminals are designed for cable diameters up to 2.5 mm^2
- via a terminal box.A screened cable is then required which may be up to 300 m in length, up to 6 Ω per core, max. 60 nF; (terminal box not included in delivery) A two wire, screened cable must be used (screening: braided metal max. 6 Ω); The screening serves as a return cable. Do not ground the screening and lay the transmitter without any electrical break.– suitable cable can be ordered from Endress+Hauser). The screening acts as a return line and should exhibit electrical continuity between sensor and transmitter.
- Order No. of additional cable:

FDU 80, 80 F, 81, 81 F, 82	Order No. 928278-0120
FDU 83, 84, 85	Order No. 938278-1021
FDU 86	Order No. 52000261

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

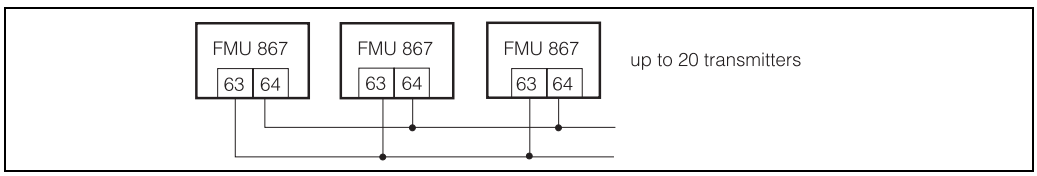
The sensors FDU 80 and FDU 81 can be supplied with heating units. The connecting terminals for the heating unit are delivered with the sensor. They are to be mounted in the connection compartment of the transmitter.
For the connection of the heating cables of the following type should be used:

∅ [mm^2]	0,5 (AWG 20)	0,75 (AWG 18)	1 (AWG 17)
max. length [m]([ft])	150	250	300

Technical data of the external power supply unit for the heating:

- 24 VDC (±10 %)
- current and power consumption: 250mA, 8 W

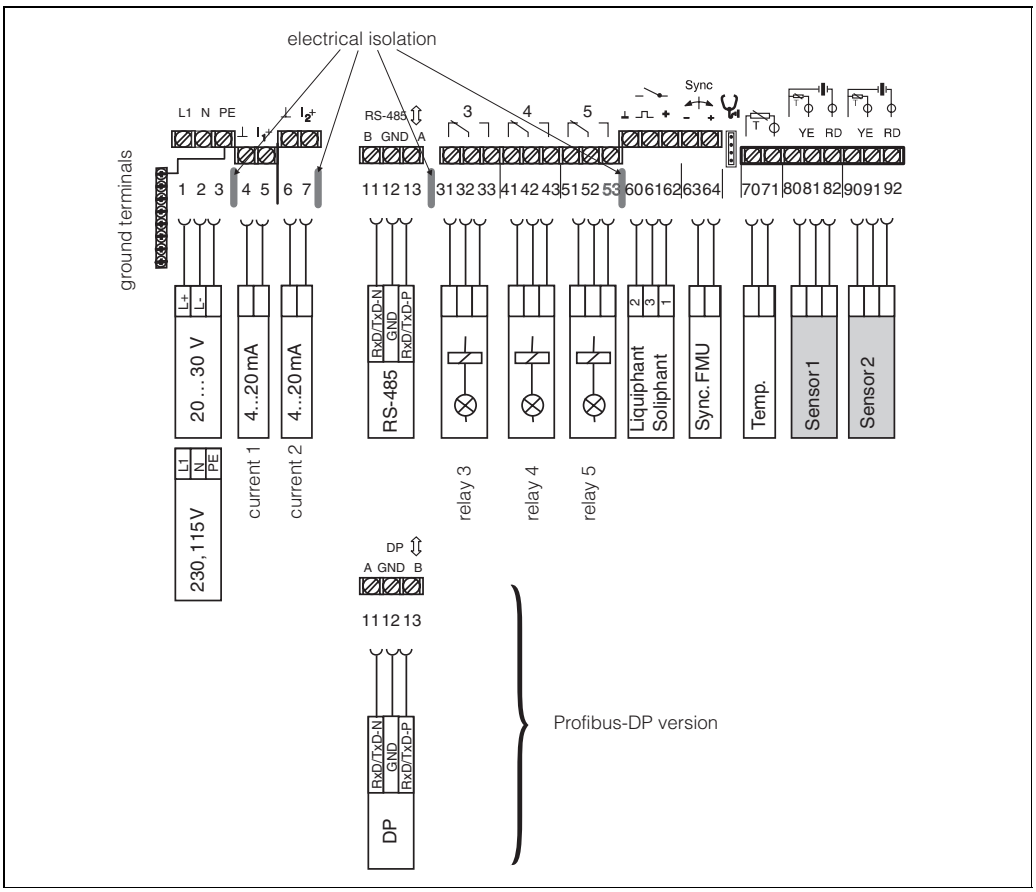
Synchronisation line



In order to avoid cross-talk between parallel routed sensor lines connect the transmitters (max. 20) to a synchronisation line. The sensors are then scanned in sequence. If more devices are present, groups of 20 transmitters should be used. The cables within one group can be in parallel. The cables of different groups must be separated. Common screened cable can be used.

Electrical connection of the Prosonic

Terminal Strip



The terminal strip for cable diameters up to 2.5 mm^2 is in a separate connection compartment. The cable entries are prestamped for easy removal (underside for 5 x Pg 16, 4 x Pg 13.5 [M20x1.5], rear for 5 x Pg 16).

Electrical Isolation

Current output, relay outputs, power connection, sensor input and RS-485 interface are all electrically isolated from one another.
The two current outputs are electrically connected to one another, as are the two sensor inputs.

Power Supply

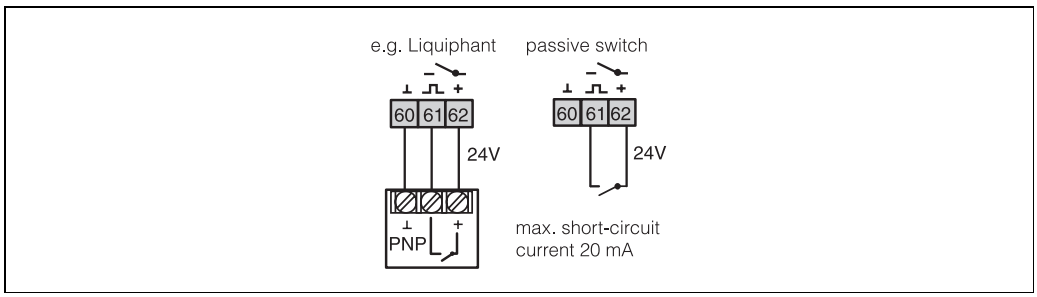
230 V	+10% / -15%	50/60 Hz
115 V	+15% / -22%	50/60 Hz

- Power consumption: maximum 15 VA
- Power supply current: maximum 65 mA at 230 V

Overvoltage Protection

The external overvoltage protection unit HAW 262 for signal outputs is recommended for protecting the transmitter from voltage peaks, especially when mounted in the field. The HAW 261 should be used to protect against mains power voltage peaks.

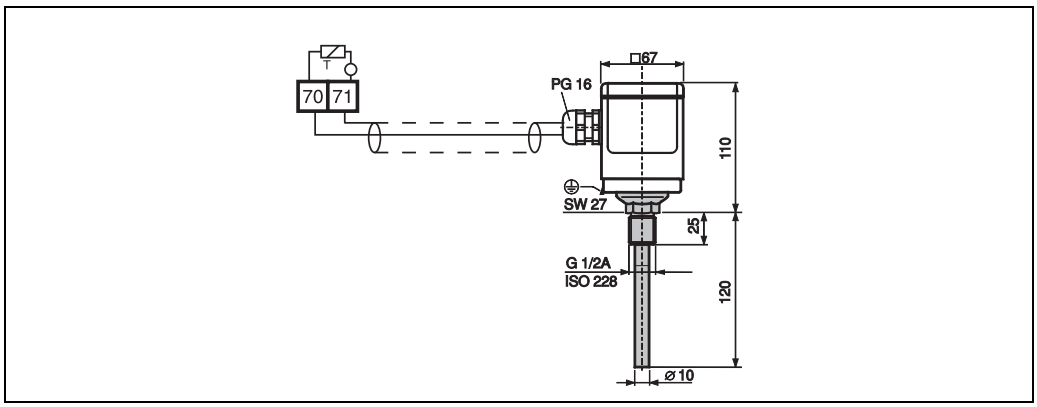
External Limit Switch



An external passive limit switch (breaker contacts) or PNP switch, e.g. Liquiphant or Soliphant (24 V, maximum short-circuit current 20 mA) may be connected.
Cable: commercial 3-core cable, screened or unscreened according to environment, max. 25 Ω per core.

Temperature sensor

An external temperature sensor FMT 131 can be connected.



Bus Installation RS 485

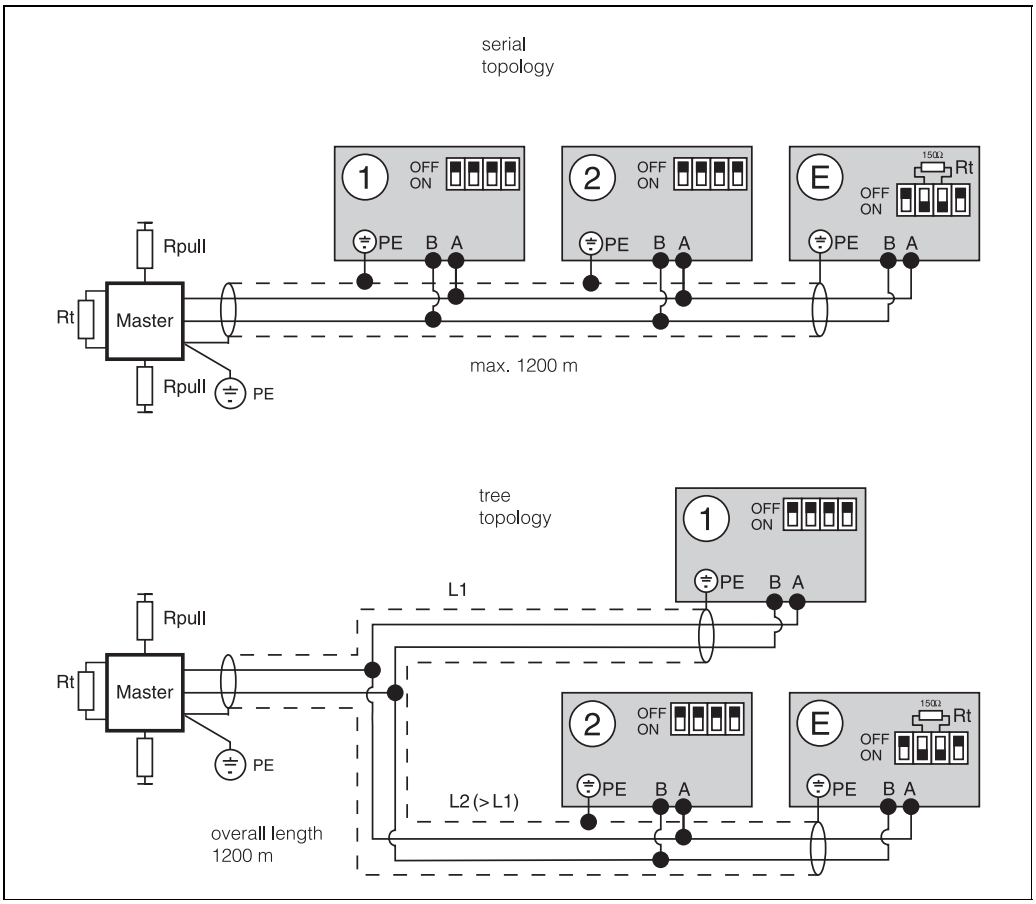
Rackbus RS-485

Normally, up to 25 Prosonic transmitters can be connected to the bus: the actual number depends upon the topology and conditions of operation. The bus is connected to the personal computer via an electrically isolated RS-485 interface card or external RS-232C/RS-495 adapter. The bus uses:

- connecting cable (2-core, twisted and screened)
- cable length: max. 1200 m (3900 ft).

Ground the cable screen at both ends. If, for long cables, there is a difference in ground potential, equalise the potentials or ground at one end only.

Topology



When planning the system, attention should be paid to the possible segmentation of the bus according to plant sections. Suitable topologies are:

- Serial bus, max. length 1200 m (3900 ft)
- Tree with max. length 1200 m (3900 ft).

Bus Termination and Power

For reliable transmission of the communication signal:

- set the terminal resistance at the PC card and the Prosonic furthers from the card to 150 Ω

The bus power is provided by the PC card or RS-232C/RS-485 converter.

Bus Installation PROFIBUS-DP

Cable specifications PROFIBUS-DP (Type A according to EN 50 170)

Terminator	135 Ω to 165 Ω at a measuring frequency of 3 MHz to 20 MHz
Cable capacitance	< 30pF per Meter
Core cross-section	>0.34 mm², corresponds to AWG 22
Cable type	twisted pairs, 1x 2, 2x 2 or 1x4 core
Loop resistance	110 Ω per km
Signal attenuation	max. 9 dB over the entire length of the segment
Screening	woven copper sheath or woven sheath and foil sheath

Structure PROFIBUS-DP

The following points should be noted when the bus structure is being planned:
- The max. permissible cable length depends upon the transmission rate. For PROFIBUS RS-485 cable of type A (see table 2.2) the dependency is as follows:

Transmission rate(kBit/s)	19,2 - 93,75	187,5	500	1500
Cable length(m)	1200	1000	400	200

The maximum transmission rate is limited by the slowest instrument on the bus. The maximum rate of the Prosonic FMU is 3 Mbit/s. The FMU recognizes the rate present on the bus and adjusts its own rate automatically.

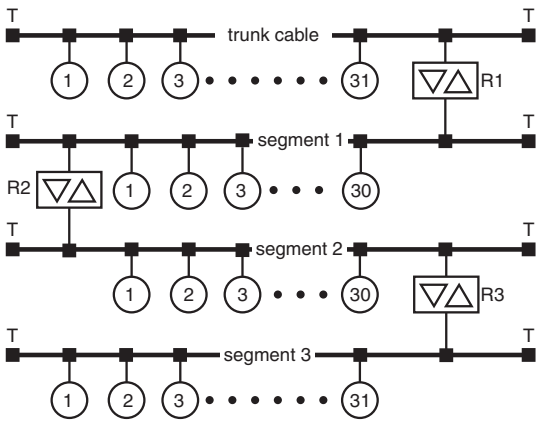
- A maximum of 32 participants per segment is allowed.
- A terminating resistance must be installed at both ends of every segment (ohmic load 220 Ω).
- The cable length and/or the number of participants can be increased by using repeaters.
- There must never be more than three repeaters between any two participants
- The total number of participants in the system is limited to 126 - (2x number of repeaters).

Spurs

A spur is the cable connecting the field device to the T-box. As a rule of thumb:
- For transmission rates up to 1500 kbits/s, the total length (sum) ot the spurs may not exceed 6.6 m.
- Spurs should not be used for transmission rates greater than 1500 kbits/s.

Topology PROFIBUS-DP

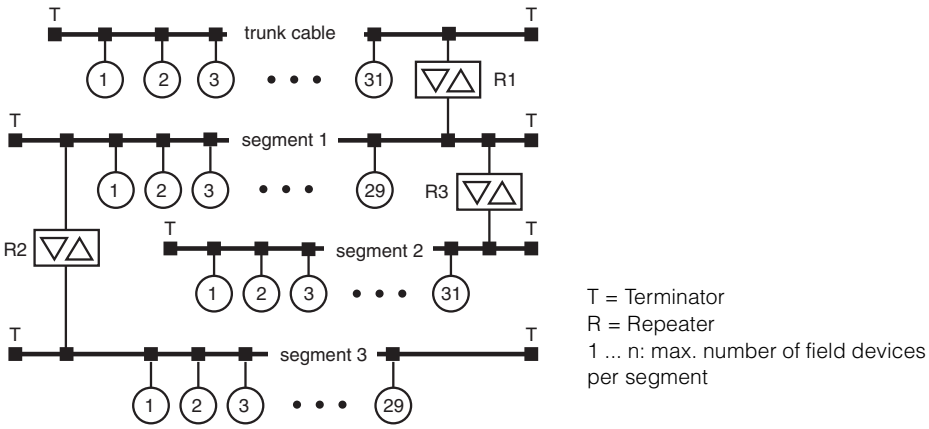
Linear structure



T = Terminator
R = Repeater
1 ... n: max. number of field devices per segment

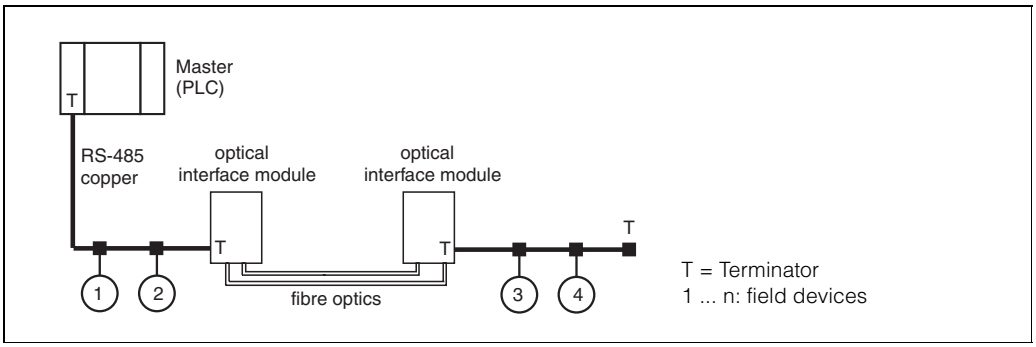
Three repeaters are necessary if the PROFIBUS-DP system is to be developed to the full. The maximum cable length corresponds to 4x the value quoted in the table above. Since three repeaters are used, the maximum number of participants is reduced to 120..

Tree structure



Several repeaters can be used to create a tree structure. The number of participants allowable per segment is reduced by one per repeater: the total number of participants is limited to 126 - (2x number of repeaters).

Optical network



If the PROFIBUS-DP system has to be routed over large distances or in a plant with heavy electromagnetic interference, then an optical or mixed optical/copper network can be used. Provided that all participants support them, very high transmission rates are possible. Technical details can be taken from the PROFIBUS standard.

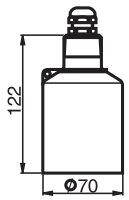
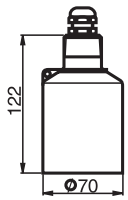
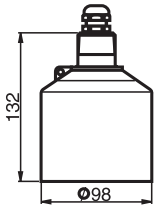
Device database file for PROFIBUS-DP

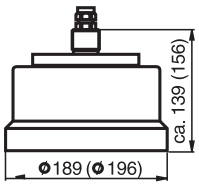
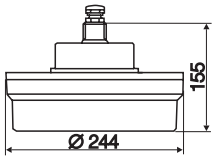
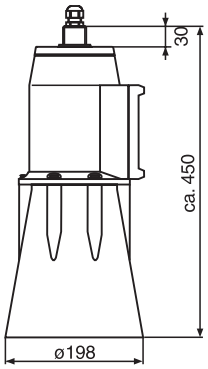
In order to include the field devices into the bus, the PROFIBUS-DP system needs a description of the device parameters, such as output data, input data, data format, transmission rates etc. These data are included in the device database file (*.gsd), which must be provided to the PROFIBUS-DP master during installation.

Bus address for PROFIBUS-DP

Proper communication on the bus requires addressing of the participants. Each participant in the system must be assigned a unique address between 0 and 125. Adressing is performed either via the DIP-switches on the device or via the operating software. For a detailed description see Operating manual BA 198F/00/en.

Technical Data of Sensors

Type	FDU 80	FDU 81	FDU 82
Dimensions [mm]			
Measuring range Liquids	5 m (16 ft)	10 m (32 ft)	20 m (65 ft)
Solids	2 m (6.5 ft)	5 m (16 ft)	10 m (33 ft)
Blocking distance	0,3 m (1 ft)	0,5 m (1.6 ft)	0,8 m (2.6 ft)
Operating frequency at 23 °C	58 kHz	44 kHz	29 kHz
for explosion-hazardous areas	• ATEX II 2 G EEx m II T6/T5 (s. XA 117F-A) • FM Cl.I Div.1	• ATEX II 2 G EEx m II T6/T5 (s. XA 117F-A) • FM Cl.I, Div.1	• ATEX II 2 G EEx m II T6/T5 (s. XA 117F-A) • FM Cl.I Div.1
Materials housing/thread	PG-GF	PG-GF	PG-GF
Weight	0,55 kg (1.2 lbs)	0,6 kg (1.2 lbs)	1,2 kg (1.2 lbs)
Operating temperature	-20 °C ... +60 °C	-20 °C ... +80 °C	-20 °C ... +80 °C
Limits	-40 °C ... +60 °C	-40 °C ... +80 °C	-40 °C ... +80 °C
Max. operating pressure $p_{absolut}$	2 bar (29 psi)	2 bar (29 psi)	2 bar (29 psi)
Relative humidity	100 %	100 %	100 %
Ingress Protection	IP 68	IP 68	IP 68
Mounting	G1B or 1-11 1/2 NPT	G1B or 1-11 1/2 NPT	G1B or 1-11 1/2 NPT
Integrated temperature sensor	x	x	x

Type	FDU 83	FDU 85	FDU 86
Dimensions [mm]	 dimensions in brackets for combustible dust version		
Measuring range liquids	25 m (82 ft)	—	—
Solids	15 m (49 ft)	45 m (147 ft)	70 m (230 ft)
Blocking distance	1 m (3.3 ft)	0,8 m (2.6 ft)	1,6 m (5.2 ft)
Operating frequency at 23 °C	30 kHz	17 kHz	11 kHz
for combustible dusts	• ATEX II 1/2 D IP 68 T 110°C St-Ex Zone 10 (s. XA 032F-A) • FM Cl.II Div.1	• ATEX II 1/2 D IP 68 T 105°C St-Ex Zone 10 (s. XA 032F-A) • FM Cl.II Div.1	• ATEX II 1/2 D IP 68 T168°C (s. XA 056F-B) • ATEX II 2 G EEx m II T3...T6 (s. XA 065F-B) • FM Cl. I/II/III Div.1+2, HT, -40 ... 140°C • ATEX II 1/2 D IP 68 T105°C (s. XA 056F-B) • FM Cl. I/II/III Div.1+2, NT, -40 ... +80°C
Material			
Housing	PA-GF	UP	UP
Thread	1.4304 or Aluminium 1.4571	UP	UP or 1.4301
Diaphragm	EPDM	AL/PE	Al/PTFE
Diaphragm sealing		EPDM	Silicon
Weight	3,1 kg (6.8 lbs)	5,0 kg (11 lbs)	5,0 kg (11 lbs)
Operating temperature	-20 °C ... +80 °C	-20 °C ... +80 °C	-40 °C ... +150 °C
Limits	-40 °C ... +80 °C	-40 °C ... +80 °C	-40 °C ... +150 °C
Maximum operating pressure $p_{absolut}$	1,5 bar (22 psi)	1,5 bar (22 psi)	3 bar (44 psi)
Relative humidity	100 %	100 % (up to 60 °C) 95% (up to 80 °C)	100 %
Ingress protection	IP 68	IP 68	IP 68
Mounting	G1A or 1-11 1/2 NPT	G1A or 1-11 1/2 NPT	G1A or 1 NPT
Integrated temperature sensor	x	x	x

Technical Data Prosonic FMU 867

Signal Inputs

- Sensors: two Prosonic FDU 8x sensors (need not be of same type). Sensor channels switched at 1 s intervals.
- External limit switch: external passive limit switch (contacter) or PNP-switch, e.g. Liquiphant or Soliphant (24 V, max. short-circuit current 20 mA)
- External temperature sensor FMT 131

Analogue Outputs

- 4 ... 20 mA, switchable to 0 ... 20 mA, R_{Lmax}= 600 Ω, identical for second channel, both channels switched to 0 ... 20 mA together
- Output current limitation: 24 mA

PROFIBUS-DP output data

Up to three cyclic data can be transmitted by the PROFIBUS-DP interface:

- Main value of channel 1 (Level/Volume)
- Main value of channel 2 (Level/Volume)
- Flow counter

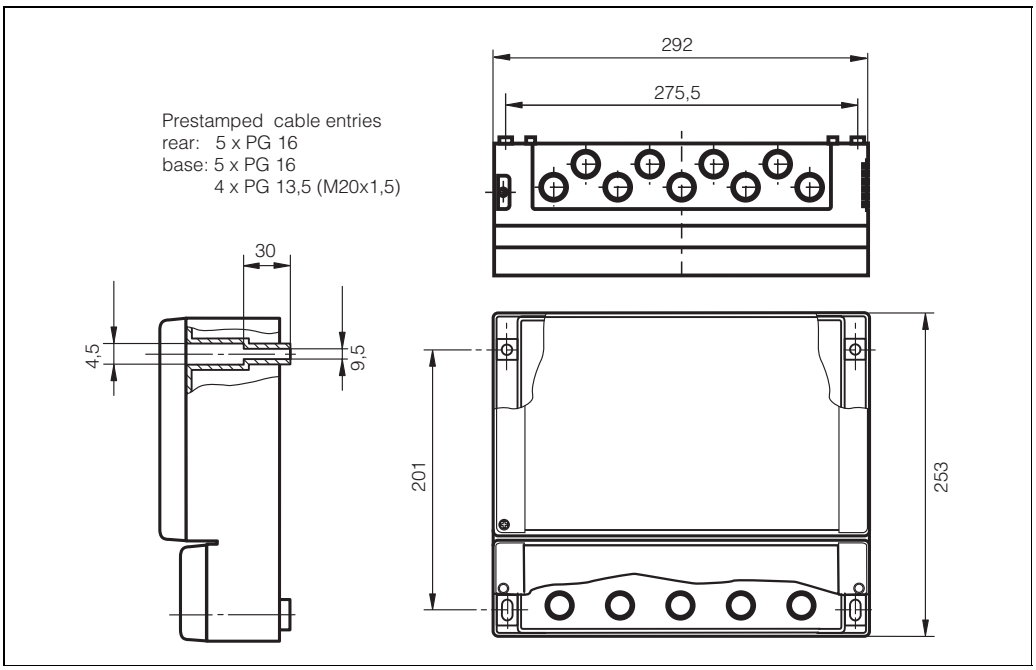
Relays

- Three independent relays, each with a potential-free changeover contact
- Switching capacity for alternating current: 4 A, 250 V; 1000 VA at cos ϕ = 0,7; for direct current: 35 V, 100 W
- Programmable functions
  (Function set individually for each relay, switch-on and switch-off point selectable.)
  – Alarm relay
  – Level limit relay
  – Switching delay
  – Alternating control
  – Trend relay

Display

- Relay LEDs: Every relay is provided with a yellow LED which signals a fault or the switching status: the LED lights when the relay is energised.
- The LED of the alarm relay lights when a fault has been detected.
- Power LEDA green LED lights when the Prosonic is operating correctly

Design, Operating Conditions



- Materials: synthetic housing body (ABS/PC), transparent cover PC (polycarbonate), blue front panel with tag area
- Weight: 2,6kg
- Temperature range for operation: –20 ... +60 °C (storage: –40 ... +80 °C)
- Protection (DIN 40 050): IP 66 with closed housing and cable entries with same protection (IP 40 with open housing, IP 20 when connection compartment opened)
- Electromagnetic compatibility: Interference emission to EN 61326, Electrical equipment Class B; Interference immunity to EN 61326, Annex A (Industrial)
  for PROFIBUS-DP instruments: Interference emission to EN 61326, Electrical equipment Class A; Interference immunity to EN 61326
- Relative humidity: 95% average annual humidity, condensation permissible (DIN 40 040, Type R)
- Mechanical load: 2 g (10 ... 55 Hz) and 15 g for 11 ms (DIN 40 040, Type W)

Accuracy and Effects of Variables

- Measuring uncertainty: typically 0.2 % for maximum measuring span and smooth surface (the sum of linearity, hysteresis and reproducibility)
- Maximum resolution: 1 mm for FDU 80
- Load effects: insignificant in the permitted range

Technical Data of System Components

Rackbus RS-485

- Number of participants: max. 25 Prosonic transmitters.
- Protocol: Rackbus RS 485
- Baudrate: 19200 Bits/s, fixed
- Cable: screened, twisted pairs
- Topology: serial bus, electrically isolated, tree-structure optional, taps max. 3 m (10 ft)
- Length: max. 1200 m (3900 m), including taps or branches (for tap length <<3 m (10 ft) negligible).

PROFIBUS-DP

- max. 126 participants on the bus
- max 32 participants per segment
- Protocol: PROFIBUS-DP according to EN 50170, Parts 1 - 3, Version DPV1
- supported Baudrates: 19.2 kBaud, 45.45 kBaud, 93.75 kBaud, 187.5 kBaud, 500 kBaud, 1.5 MBaud
- Cable: Type A according to EN 50 170, twisted pairs, 1x2, 2x2 oder 1x4
- Topology: Linear or tree
- Length: max. 1200 m, depending on topology; several kilometres for fibre optics.

Hardware requirements

	Hardware requirements for Commuwin II
Personal Computer	min.: 386 / 25 Mhz recommended >486 / >100MHz
Main memory	Windows 3.1/3.11: min. 4MB, recom. 8MB Windows 95: min. 4 MB, recom. 16MB Windows NT 4.xx: min.12 MB, recom.32 MB
Hard disc	recommended: 60 MB
Graphics card	VGA (640x480)
Interfaces	1 spare slot for serial port RS-485 or RS-232 C port for converter
Drives	3 1/2" drive; CD drive

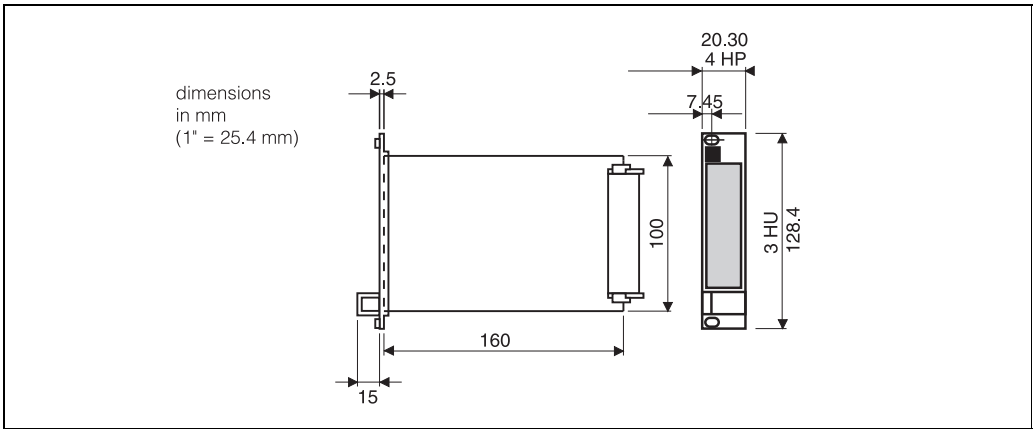
Hardware requirements for "ToF Tool"

	minimum	recommended
Personal Computer	Intel P5; 133 MHz	Intel P6; 200 MHz or higher
Main memory	32 MB	64 MB
VGA Graphics card	256 colours 800 x 600	True color 1024 x 768
Operating system	• Windows 95 (Y2K Bugfixes) • Windows 98 (Y2K Bugfixes) • Windows NT 4.xx (SP 6a or higher) • Windows 2000 (SP 1)	
Hard disc	ca. 10 MB for ToF Tool ca. 1 MB for each DD (Device Driver) ca. 0,5 MB for each DDE-Server (Interface Server)	
Drives	• 3 1/2" disc drive • CD-ROM drive	
Interfaces	• PC interface card (page 24) or • Interface adapter(page 24) or • Commubox FXA 192 (page 24)	

Commubox FXA 192 RS 232C/RS 485 interface

- Power: External power pack 115 V/ 230 V
- Electrical connection for computer: 9-pin Sub-D-connector
  Electrical connection for transmitter: 4 mm screw terminals
- Nominal operating temperature: 0 °C ... +70 °C
- Humidity: 0% ... 95% (no condensation)
- Dimensions of housing: 190 x 135 x 70 mm
- Baudrate: 9600 bit/s, 7 data bits, 1 stop bit, even parity

Rackbus/RS 485 interface FXA 675



- 19", 4 HP, Racksyst II plug-in card to DIN 41 494 (Europe card)
- Ingress protection of Front panel: IP 20
  Ingress protection of Card: IP 00 (DIN 40 050)
- Weight: approx. 0,14 kg
- Midpoint plug conforming to DIN 41 612, Part 3, Type F (25-pole)
- Rack installation kit 25/2
- Operating temperature: 0 °C ... +70 °C
- Power supply: 24 V DC (20 V ... 30 V) residual ripple: 2 V_{PP} within tolerance
- Supply current: max. 70 mA
- Power consumption max. 2 W at 24 V
  Power consumption max. 2 W at 30 V
- Rackbus interface
  Rackbus RS 485 interface with 2 ports
- Transmission rate: 19,2 kBit/s
- Conversion delay: ca. 60 µs per interface

PROFIBUS-DP Interface

- PROFICARD (PCMCIA card); Order-No. 016570-5200
- PROFIBOARD (PCI Board); Order-No. 52005721

Ordering information

Product structure

FMU 801							
	5 m in liquids / 2 m in solids						
	A	FDU 80, cable: 5 m					
	B	FDU 80; cable: 10 m					
	E	FDU 80; ATEX II 2 G, EEx m II T5/6; cable: 5 m					
	F	FDU 80; ATEX II 2 G, EEx m II T5/6; cable: 10 m					
	I	FDU 80; FM Cl.I Div.1; cable: 5 m					
	J	FDU 80; FM Cl.I Div.1; cable: 10 m					
	X	No FDU 80 sensor					
		10 m in liquids / 5 m in solids					
		A	FDU 81, cable: 5 m				
		B	FDU 81; cable: 10 m				
		E	FDU 81; ATEX II 2 G, EEx m II T5/6; cable: 5 m				
		F	FDU 81; ATEX II 2 G, EEx m II T5/6; cable: 10 m				
		I	FDU 81; FM Cl.I Div.1; cable: 5 m				
		J	FDU 81; FM Cl.I Div.1; cable: 10 m				
		X	No FDU 81 sensor				
			20 m in liquids / 10 m in solids				
			A	FDU 82, cable: 5 m			
			B	FDU 82; cable: 10 m			
			E	FDU 82; ATEX II 2 G, EEx m II T5/6; cable: 5 m			
			F	FDU 82; ATEX II 2 G, EEx m II T5/6; cable: 10 m			
			I	FDU 82; FM Cl.I Div.1; cable: 5 m			
			J	FDU 82; FM Cl.I Div.1; cable: 10 m			
			X	No FDU 82 sensor			
				25 m in liquids / 15 m in solids			
				A	FDU 83, cable: 5 m		
				B	FDU 83; cable: 10 m		
				E	FDU 83; ATEX II 1/2 D; cable: 5 m		
				F	FDU 83; ATEX II 1/2 D; cable: 10 m		
				I	FDU 83; FM Cl.II Div.1;cable: 5 m		
				J	FDU 83; FM Cl.II Div.1; cable: 10 m		
				X	No FDU 83 sensor		
					45 m in solids		
					A	FDU 85, cable: 5 m	
					B	FDU 85; cable: 10 m	
					E	FDU 85; ATEX II 1/2 D; cable: 5 m	
					F	FDU 85; ATEX II 1/2 D; cable: 10 m	
					I	FDU 85; FM Cl.II Div.1; cable: 5 ml	
					J	FDU 85; FM Cl.II Div.1; cable: 10 m	
					X	No FDU 85 sensor	
						70 m in solids	
						A	FDU 86; cable: 5 m
						B	FDU 86; cable: 10 m
						E	FDU 86; -40...+140 °C, ST.Ex Zone 10 / ATEX II 1/2 D, cable: 5 m
						F	FDU 86; -40 ... +140 °C, ST.Ex Zone 10 / ATEX II 1/2 D, cable: 10 m
						G	FDU 86; ATEX II 2 G EEx m II T3 ... T6, 5cable: 5 m
						H	FDU 86; ATEX II 2 G EEx m II T3 ... T6, cable: 10 m
						I	FDU 86, FM Cl.I/II/III Div.1/2, HT, -40 ... 140 °C, cable: 5 m
						J	FDU 86, FM Cl.I/II/III Div.1/2, HT, -40 ... 140 °C, cable: 10 m
						K	FDU 86, ATEX II 1/2 D, -40 ... +80°C, cable: 5 m
						L	FDU 86, ATEX II 1/2 D, -40 ... +80°C, cable: 10 m
						O	FDU 86, FM Cl.I/II/III Div.1/2, NT, -40 ... +80 °C, cable: 5 m
						P	FDU 86, FM Cl.I/II/III Div.1/2, NT, -40 ... +80 °C, cable: 10 m
						X	No FDU 86 sensor

FMU 801												
							Process connection					
							1	G 1" BSP thread				
							2	1" NPT thread				
								Power supply				
								A	230 V AC for FMU 867, one instrument for 2 sensors			
								B	115 V AC for FMU 867, one instrument for 2 sensors			
									Interface			
									8	without adapter		
									7	COMMUBOX FXA 192, 230 V AC, for COMMUWIN II-SW		
									5	COMMUBOX FXA 192, 115 V AC, for COMMUWIN II-SW		
									6	FXA 675 double channel, for COMMUWIN II-SW		
									A	Profiboard plug-in card		
									B	Proficard PCMCIA card		
									9	special converter		
										PC Software		
										D	COMMUWIN II RS 485 for configuration	
										E	COMMUWIN II RS 485for configuration and visualisation	
										F	COMMUWIN II for Proficard for configuration	
										G	COMMUWIN II for Proficard for configuration and visualisation	
										H	ToF Tool PROFIBUS-DP for matrix operation	
										1	COMMUWIN II for Profiboard for configuration	
										2	COMMUWIN II for Profiboard for configuration and visualisation	
										C	Software not selected	
FMU 801												Product designation

Scope of supply

- Sensors according to selection
- appropriate number of transmitters FMU 867
- Service Interface und Service Tool (for PROFIBUS-DP instruments)
- Operating manual (BA 128F)
- Interfaces as ordered according to product structure

Supplementary Documentation

System Information	**SI 018F/00/en** Commuwin II, MS-Windows™ software for intelligent field instruments
	SI 043F/00/de ToF Tool
Operating instructions	**BA 124F/00/a2** Operating instructions forCommuwin II
	BA 198F/00/de PROFIBUS-DP/-PA: Planning and commissioning guidelines
Technical Information	**TI 189F/00/en** Technical Information for sensors Prosonic FDU 80…86
Safety instructions	**XA 032F-A** FDU 83/84/85 ATEX II 1/2 D IP 68 T105°C resp. T110°C bzw. T111°C
	XA 056F-B FDU 86 ATEX II 1/2 D IP 68 T168°C resp. T105°C
	XA 065F-B FDU 86 ATEX II 2 G
	XA 117F-A FDU 80/80F/81/81F/82 ATEX II 2 G EEx m II T6/5

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