

Portable Ultrasonic Flow Measuring System

prosonic flow 92

Temporary volume flow measurement of liquids with "Clamp On" sensors



Features and benefits

- Portable transmitter, battery operated for temporary measurements
- Built-in data logger with a capacity of 40,000 measuring values
- Site Setup operating menus for straightforward commissioning of up to 20 measurement sites
- "Clamp On" sensors, non-contact measurement technique
- The sensors are affixed to the piping from the outside, non-intrusive
- Wide range of nominal pipe diameters:
Sensors U, 1/2" to 4"
Sensors W, 2" to 160"
- Wide temperature range, -5°F to +175°F (-20° to +80°C)
- Hand held measuring transmitter housing protected to NEMA 1 (IP 50)
- Sensors U protection, NEMA 12 (IP 52)
Sensors W, IP 67 (temporary submersion) sensor body; NEMA 12 (IP 52) BNC connector
- Interfaces:
Data readout software for use with PC
4 to 20 mA current input / outputs

Applications

Ideally suited for temporary, bidirectional measurement of pure or slightly dirty liquids with a gas content < 1% or a solids content < 5%.

- Application areas include water, wastewater, ultra pure water with low conductivity, and process facilities
- The "Clamp On" sensors are equally suitable for homogeneous piping materials such as steel, plastic, FRP, glass pipe and lined pipes.

Endress + Hauser

The Power of Know How



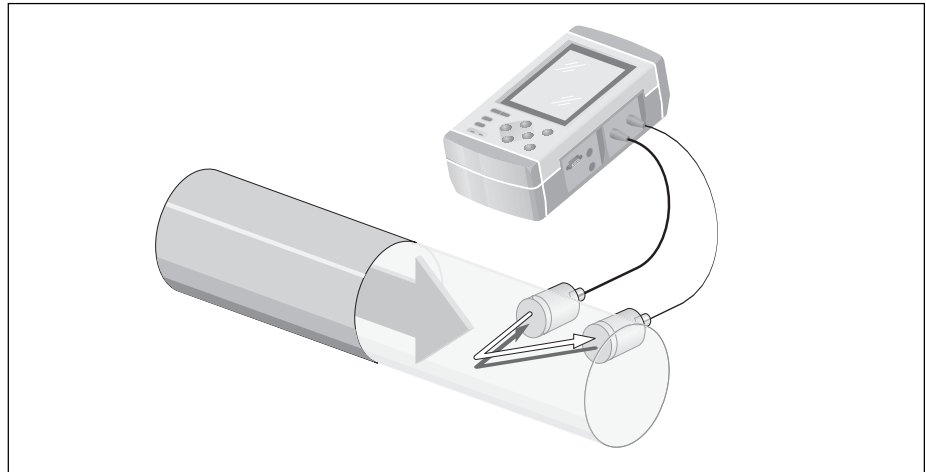
Function and system design

Measuring principle

Prosonic Flow operates on the principle of transit time difference. An acoustic signal (ultrasonic) is transmitted from one sensor to another. This can be either in the direction of flow or against the direction of flow.

The time (transit) that the signal requires to arrive at the receiver is then measured. According to physical principles, the signal sent against the direction of flow requires longer to return than the signal in the direction of flow. The difference in the transit time is directly proportional to the velocity of the flow.

Prosonic Flow calculates the flow rate from the pipe cross-sectional area and the measured transit time difference.



$$v = \Delta t$$

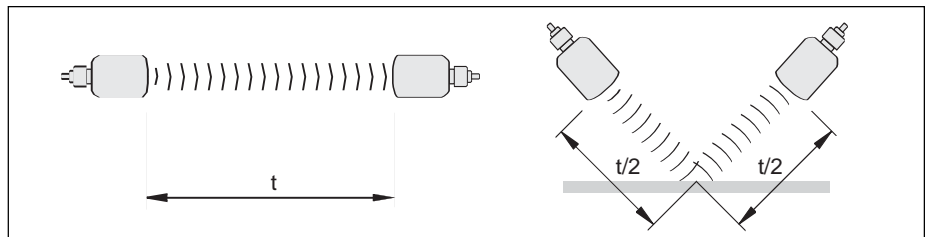
$$Q = v \times A$$

v = flow velocity
 Δt = transit time difference
Q = volumetric flow
A = pipe cross-sectional area

In addition to the volume flow, the system measures the sound velocity in the liquid. The sound velocity can be used to distinguish different liquids or as a measure of product quality. Users can carry out an application-specific calibration of the Prosonic Flow using the Site Setup.

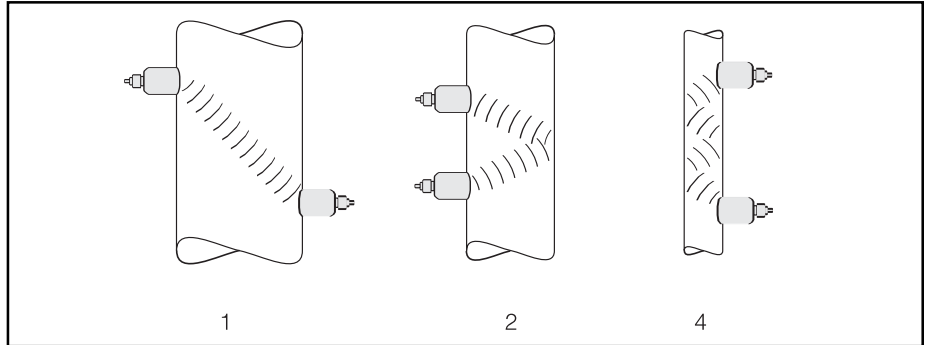
Signal transit time

For accurate measurement, the ultrasonic signal needs a certain minimum signal propagation time (t). The time differential is proportional to the flow velocity. The measurement accuracy, i.e. the actual detected difference in measurement time, increases with the signal transit time (t) in the liquid. With small pipe sizes, it is recommended to use more than one traverse.



Selecting the number of traverses

The Prosonic Flow W sensors offer a choice between 1, 2 and 4 traverses and the U sensors 2 traverses. Please note that every additional reflection will reduce the signal strength (2 traverses = 1 reflection point, etc.). To maintain the best possible signal quality, the least possible number of traverses should be used.



Prosonic Flow W: 1 = 1 traverse, 2 = 2 traverses, 4 = 4 traverses

Prosonic Flow U: 2 = 2 traverses

Recommendations:

To obtain optimum signal strength and the highest level of accuracy, we recommend the following:

- 1/2" to 2" → 2 traverses
- 2" to 3" → 2 or 4 traverses
- 3" to 24" → 2 traverses
- 24" to 160" → 1 traverse

Sensor selection

Prosonic Flow U sensor type: 1/2" to 4" (DN 15 to 100)

Prosonic Flow W sensor type (two versions): 2" to 12" (DN 50 to 300) and 4" to 160" (DN 100 to 4000).

- Both W sensor types can be used in the 4" to 12" range (DN 100 to 300)
- The W sensor type for 2" up to 12" (DN 50 to 300) should be used for pipe wall thicknesses < 0.16" (4 mm). Sensor type for 4" up to 160" (DN 100 to 4000) should be used for pipe wall thicknesses > 0.16" (4 mm).

Commissioning accessories

Information about the process liquid, the precise pipe dimensions and material is required for commissioning and determining the sensor mounting spacing. Data for the most common liquids, pipe materials, and lining materials are stored in the Prosonic Flow 92 program.

For liquids:

WATER - SEAWATER - DISTILLED WATER - AMMONIA - ALCOHOL - BENZENE - BROMIDE - ETHANOL - GLYCOL - KEROSENE - MILK - METHANOL - TOLUOL - LUBRICATING OIL - FUEL OIL - PETROL

For pipe materials:

CARBON STEEL - STAINLESS STEEL - CAST IRON - COPPER - PVC - ALUMINUM - DUCTILE IRON - ASBESTOS CEMENT - GRP - PEEK - PVDF - ACRYLIC GLASS

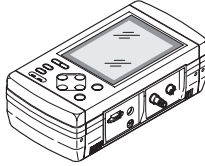
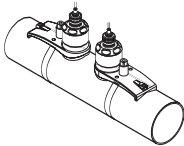
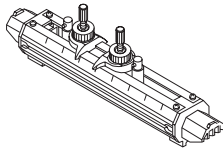
Liner material:

TAR EPOXY - MORTAR - RUBBER - TEFLON - GLASS PYREX - PVC

If your pipe material or liquid is not included in the pre-programmed transmitter selection, establish the required data from the manufacturer's technical data.

Measuring system

The measuring system consists of the following transmitter and flow measuring sensors.

Measuring transmitter	
Prosonic Flow 92 	<ul style="list-style-type: none"> • For operation in nonhazardous areas • Battery operation (power adapter included) • Graphic display • Configuration with push buttons • Site Setup • Data logger measurement • Single channel measurement • NEMA 1 (IP 50) protection • Operation with Prosonic Flow W/U sensors
Flow measuring sensors	
Prosonic Flow W 	<ul style="list-style-type: none"> • Clamp On flow measuring sensors • Sensor pair for flow measurement in the liquid during operation • 2 sensor types for 2" to 160" (DN 50 to 4000) • Temperature range -5° to +175°F (-20° to +80°C) • Stainless steel sensor holders • Degree of protection: Sensor body, IP 67 (temporary submersion) BNC adapter plug, NEMA 12 (IP 52) • Adaptor plug for BNC cables
Prosonic Flow U 	<ul style="list-style-type: none"> • Clamp On flow measuring sensors for small pipe diameters • Sensor pair for flow measurement and sound during operation • 1 sensor type for 1/2" to 4" (DN 15 to 100) • Temperature range -5° to +175°F (-20° to +80°C) • Plastic/aluminum sensor assembly • Degree of protection, NEMA 12 (IP 52)

Component overview



- | | |
|---|--------------------|
| 1 Prosonic Flow 92 transmitter | 5 Power adapter |
| 2 Prosonic Flow W sensors, sensor holders and spacing ruler | 6 Tensioning bands |
| 3 Prosonic Flow U sensor assembly | 7 Coupling paste |
| 4 Sensor connection cables | 8 Carrying case |

Input

Measured variable	Flow velocity (proportional to time differential), converted to volumetric flow rate
Measuring range	Prosonic Flow W / U sensors, typically $v = 0$ to 23 ft/s (0 to 7 m/s) at the specified measuring accuracy
Operable flow range	Over 70 : 1
Input signal	Current input: 4 to 20 mA, not galvanically isolated, for input of externally measured variables (display and data logging)

Output

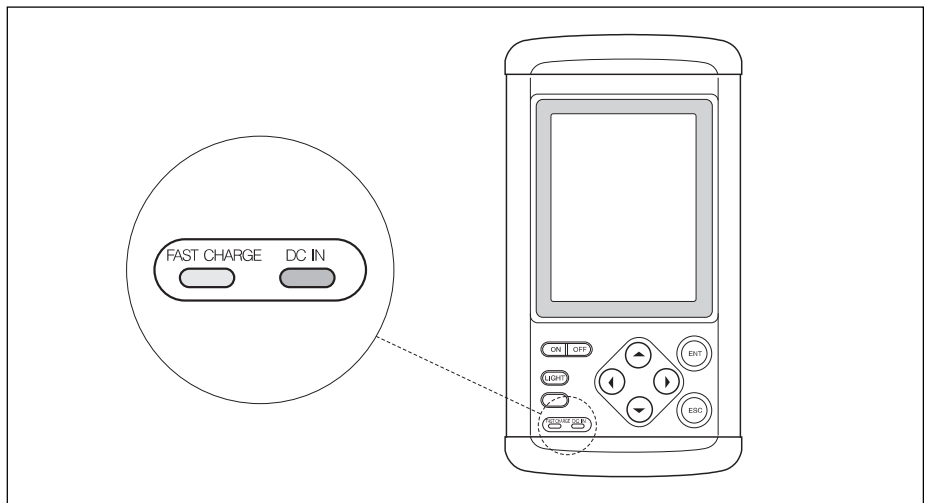
Output signal	Current output: active 4 to 20 mA, $R_L = 0$ to 1 k Ω , galvanically isolated (from ground and analog input)
Signal on alarm	Current output → fail-safe mode selectable
Load	see "Output signal"
Low flow cutoff	Switch points for low flow cutoff are selectable
Galvanic isolation	All circuits for outputs and power supply are galvanically isolated from each other

Power supply

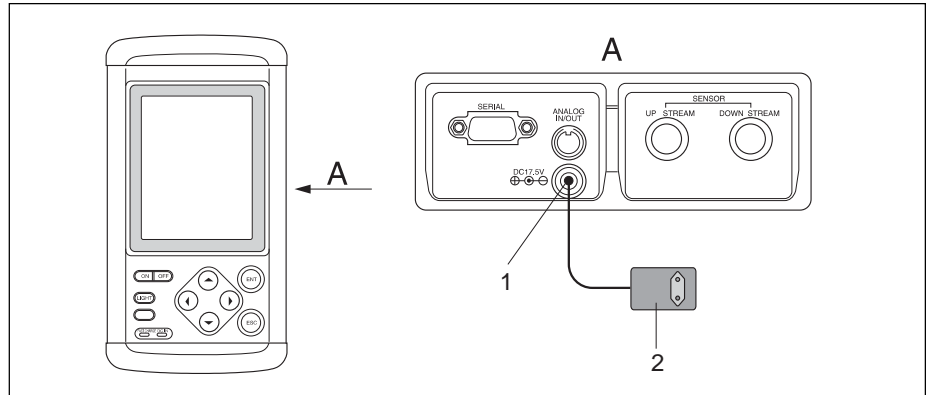
Electrical connection measuring unit

Power supply by built-in battery

To charge battery, turn off instrument power and connect the AC power adapter to the device as shown below. The "FAST CHARGE LIGHT" red LED is on, and the "DC IN" green LED is on. When the instrument battery is fully charged, the "FAST CHARGE LIGHT" red LED flashes. With a fully charged battery pack, the instrument can measure approximately 5 hours (with the display backlight turned off). The required time for charging is approximately 3 hours.



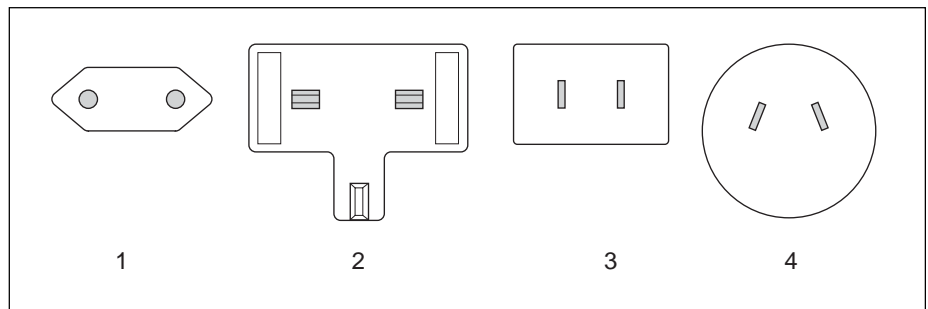
Power supply using power adapter



A = View A
 1 = 17.5 VDC connector
 2 = AC power adapter for power supply and recharging the battery:
 100 to 240 VAC, 47 to 63 Hz, power consumption, ≤ 12 W.

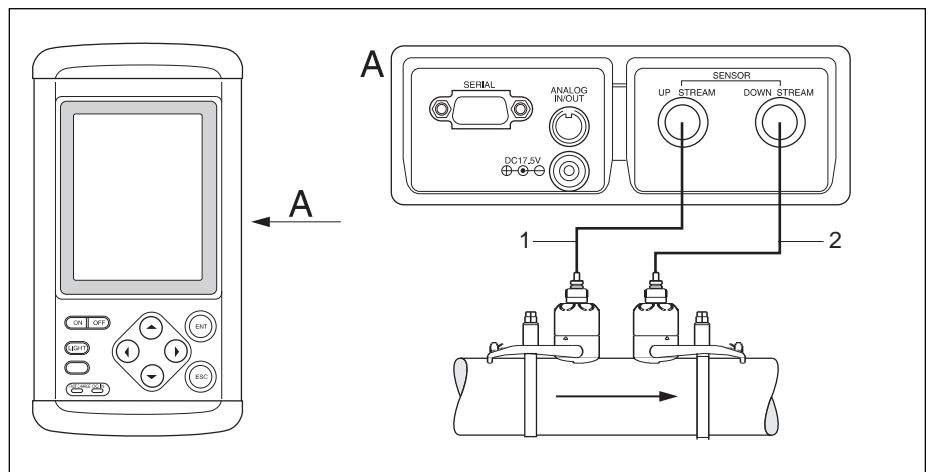
NOTE: Do not use other power adapters, damage may result to the unit.

The following main power connector adapters are provided with the power supply.



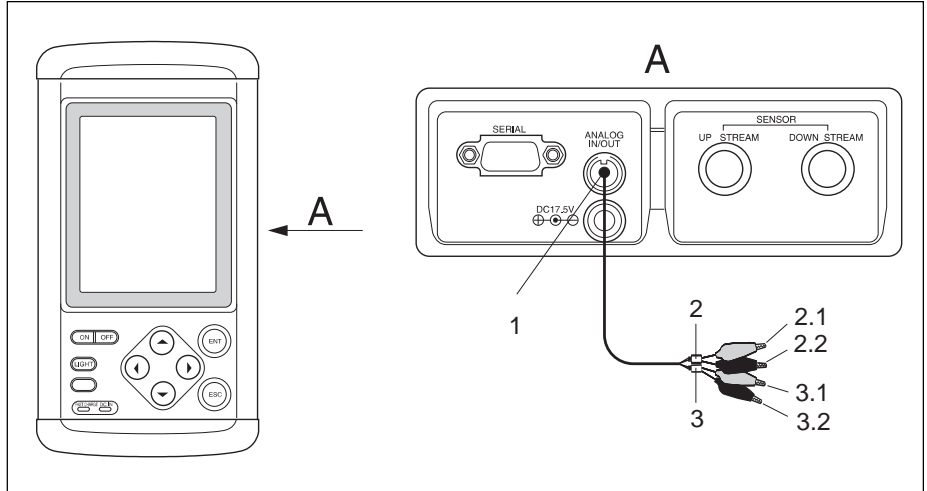
1 = European standard
 2 = UK standard
 3 = USA / Japan standard
 4 = Australian standard

Sensor cable connection



A = View A
 1 = Upstream sensor cable
 2 = Downstream sensor cable

Analog input/output connection



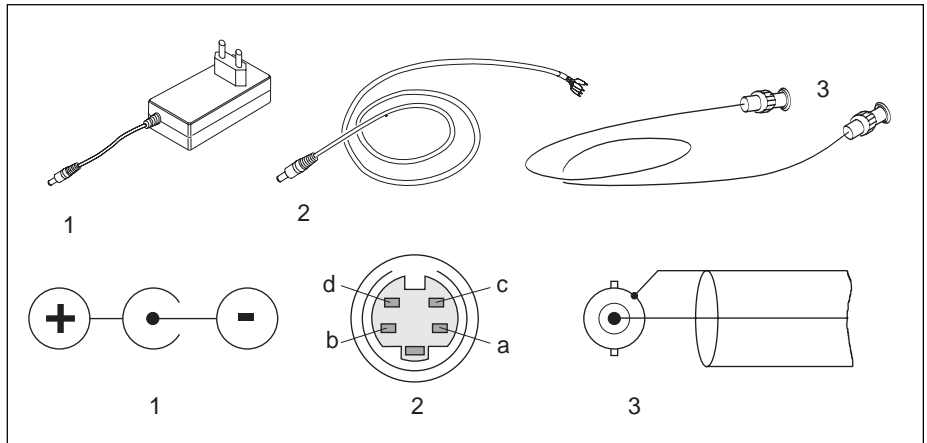
- A = View A
- 1 = Analog input/output connector
- 2 = Analog output wires: 2.1 = red (+), 2.2 = black (-)
- 3 = Analog input wires: 3.1 = red (+), 3.2 = black (-)

Potential equalization

Special measures for potential equalization are not required

Cable connection

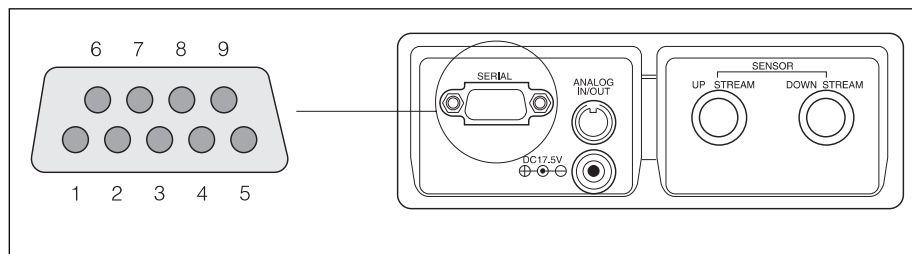
- 1 = Power supply connection of main power supply
- 2 = Signal cable connection (input/output), circular 4-pin connector
- 3 = Sensor cable connection (upstream/downstream), BNC connector



- Transmitter cable connections*
- Signal cable connector (2)*
- a = + analog input, black
 - b = - analog output, red
 - c = - analog input, white
 - d = + analog output, blue

Serial communication connection

- Serial communication connection for data logging, D-SUB, 9-pin

*9-pin connector functions*

- Pin 1: No function*
- Pin 2: R x D, receive data*
- Pin 3: T x D, send data*
- Pin 4: DTR, data terminal ready*

- Pin 5: GND, signal ground*
- Pin 6: DSR, data set ready*
- Pin 7: RTS, send request*
- Pin 8: CTS, send ready*
- Pin 9: No function*

Cable specifications

Sensor cables are provided with the unit in lengths of 16 feet (5 m) and 33 feet (10 m). Main power supply connectors are provided and are chosen according to the country where the unit is in use (refer to page 6).

Operation in zones of severe electrical interference, the measuring device complies with the general safety requirements in accordance with EN 61010, and EMC requirements of EN 61326.

Power supply**Transmitter:**

- Built-in Ni-Cd battery, continuous operation up to 5 hours (with backlight off). Recharging time, 3 hours (power adapter used).
- Power adapter, 100 to 240 VAC, 47 to 63 Hz

Measuring sensors:

- Powered by the transmitter

Power consumption

DC: < 12 W (including sensor)

Power supply failure

Memory backup with lithium battery, approximately 5 year lifetime.

Performance characteristics**Reference operating conditions**

- Liquid temperature: $+82^{\circ}\text{F} \pm 2^{\circ}\text{K}$ ($+28^{\circ}\text{C} \pm 2^{\circ}\text{K}$)
- Ambient temperature: $+71^{\circ}\text{F} \pm 2^{\circ}\text{K}$ ($+22^{\circ}\text{C} \pm 2^{\circ}\text{K}$)
- Warm-up period: 30 minutes

Installation:

- Inlet run > 10 x OD
- Outlet run > 5 x OD
- Sensors grounded
- Measuring sensors correctly installed

Maximum measured error

For flow velocities between 1.6 ft/s (0.5 m/s) and 23 ft/s (7 m/s) and a Reynolds number of > 10,000, the system accuracy is:

$\pm 0.5\%$ of reading

The system is dry calibrated. The dry calibration factor is calculated based on the actual pipe and liquid properties. The resulting accuracy of the measurement, including the dry calibration uncertainty, is better than 2% typically.

The zero point instability is < 0.03 ft/s (10 mm/s)

Repeatability

$\pm 0.3\%$ for flow velocities > 1.6 ft/s (0.5 m/s)

Operating conditions

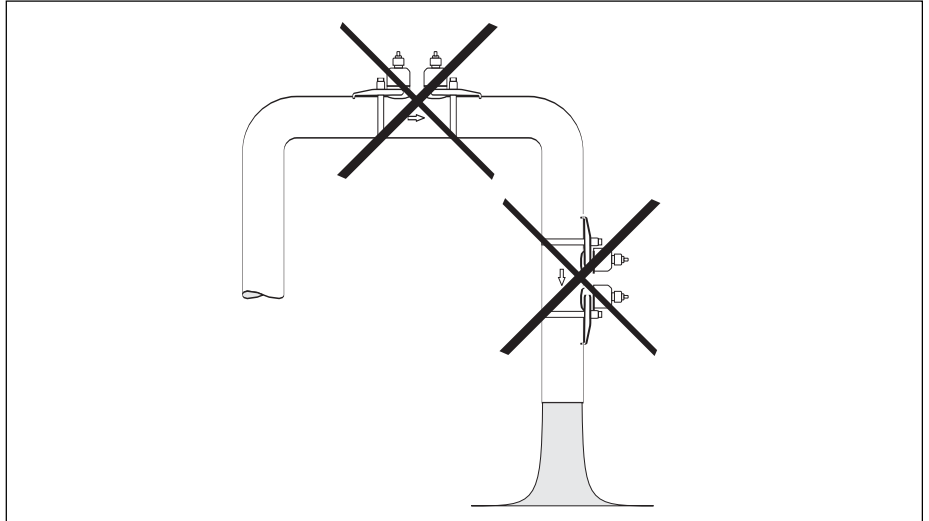
Installation conditions

Installation instructions

Mounting location

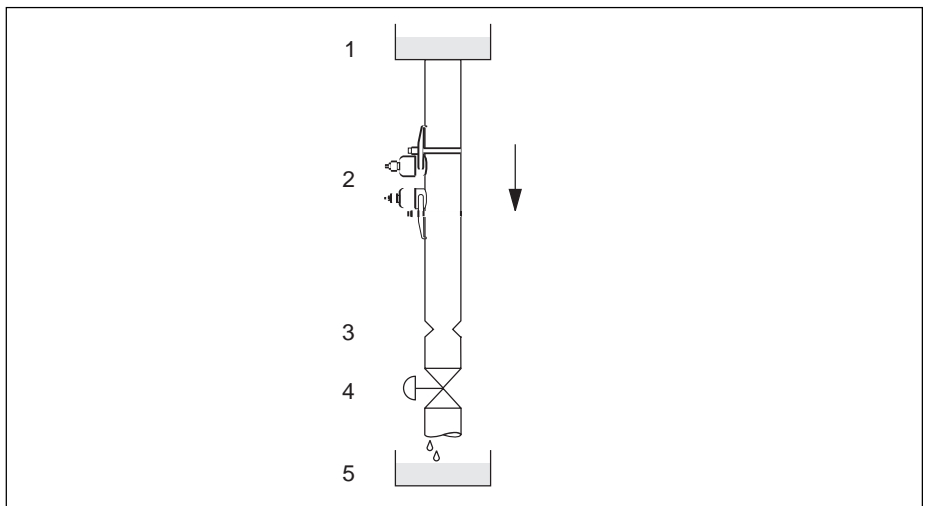
Correct measuring is possible only if the pipe is full. Avoid the following locations:

- Highest point of a pipeline, risk of air accumulating in the line.
- Directly upstream of an open pipe outlet in a vertical pipe.



Vertical pipes

Correct installation in a vertical pipe is possible using the recommendations in the figure below. Restrictions in the piping or an orifice with a smaller cross section than the nominal pipe diameter can prevent the pipe from running empty while the measurement is in progress.



Installation in a vertical pipe

- 1 Supply tank
- 2 Measuring sensors
- 3 Orifice plate or restriction
- 4 Valve
- 5 Filling tank

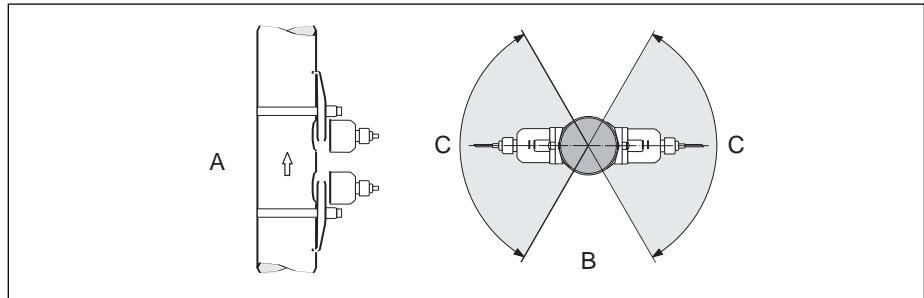
Installation orientation

Vertical (View A)

The recommended flow direction in a vertical pipe is upwards. Entrained solids sink downward and gases rise away from the measuring section. This also allows the pipe to completely drain during no-flow conditions and protects the pipe from solids accumulation.

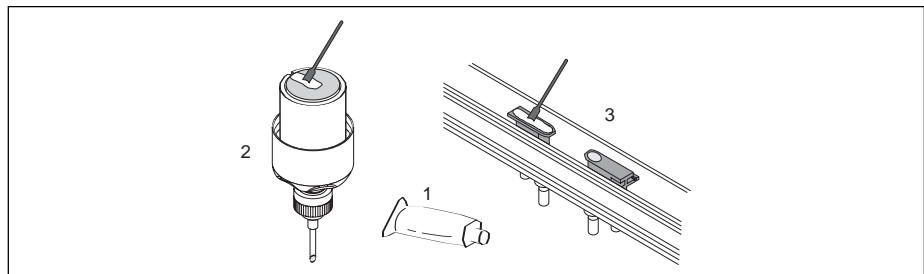
Horizontal (View B)

The recommended horizontal installation orientation is shown below. This ensures that gases in the upper portion or solids in the lower portion have minimal effect on the measurement. The recommended installation range for maximum sensor performance is 120° (gray area C).



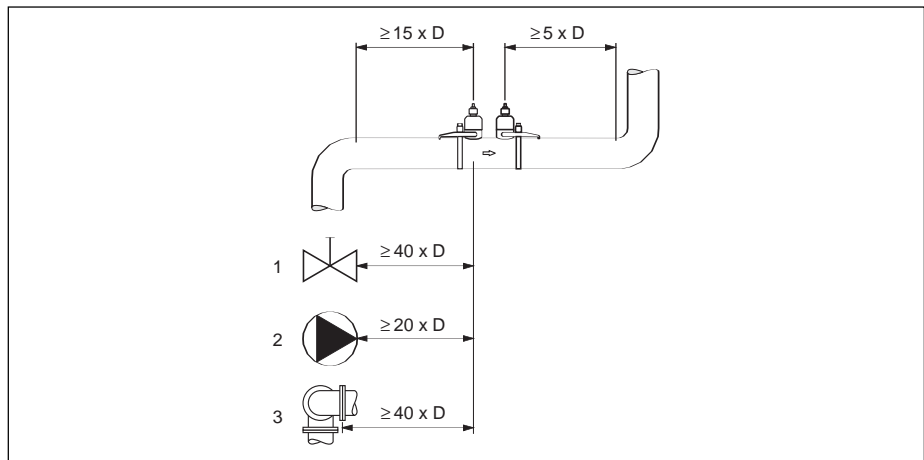
Acoustic coupling medium

A coupling medium (1) is required to ensure good acoustic contact between the sensor and piping. This is applied to the sensor surface (2 and 3) during installation and does not normally require replacement. Replace coupling paste each time measuring point is moved.



Inlet and outlet runs

To ensure a fully developed flow profile, the sensors should be installed upstream from flow obstacles such as bends, reducers, pumps, or valves. The accuracy of measurement can be affected if these values are lower than those given. If there are several obstacles in the flow lines, then the longest inlet or outlet path must always be used.



- 1 = Valve
- 2 = Pump
- 3 = Two pipe elbows in different planes

Connecting cable

Shielded sensor cables are provided in the following lengths:
 15 feet (5 m) or 30 feet (10 m). To ensure measuring accuracy, route the cable well clear of electrical machines and switching elements.

Environment

Ambient temperature

Prosonic Flow transmitter: 15 to 115°F (-10° to +45°C)
 Prosonic W / U measuring sensors: -5° to +140°F (-20° to +60°C)
 Sensor cable PVC: -5° to +160°F (-20° to +70°C)

NOTE: Avoid direct sunlight, particularly in warm climatic regions

Storage temperature

The storage temperature corresponds to the operating (ambient) temperature range of the transmitter, the appropriate flow measuring sensors and sensor cables (see above).

Degree of protection

Prosonic Flow 92 transmitter: NEMA 1 (IP 50)
 Prosonic Flow W measuring sensor: sensor body, IP 67 (temporary submersion); BNC cable adapter, NEMA 12 (IP 52)
 Prosonic Flow U measuring sensor: NEMA 12 (IP 52)

Shock and vibration resistance

According to IEC 68-2-6

Electromagnetic compatibility (EMC)

To EN 61326/A1 (IEC 1326) "Emission to Class A requirements"

Process conditions

Medium temperature range

Prosonic Flow W/U sensors: -5°F to +175°F (-20° to + 80°C)

Medium pressure range (nominal)

Perfect measurement requires that the static liquid pressure is higher than vapor pressure

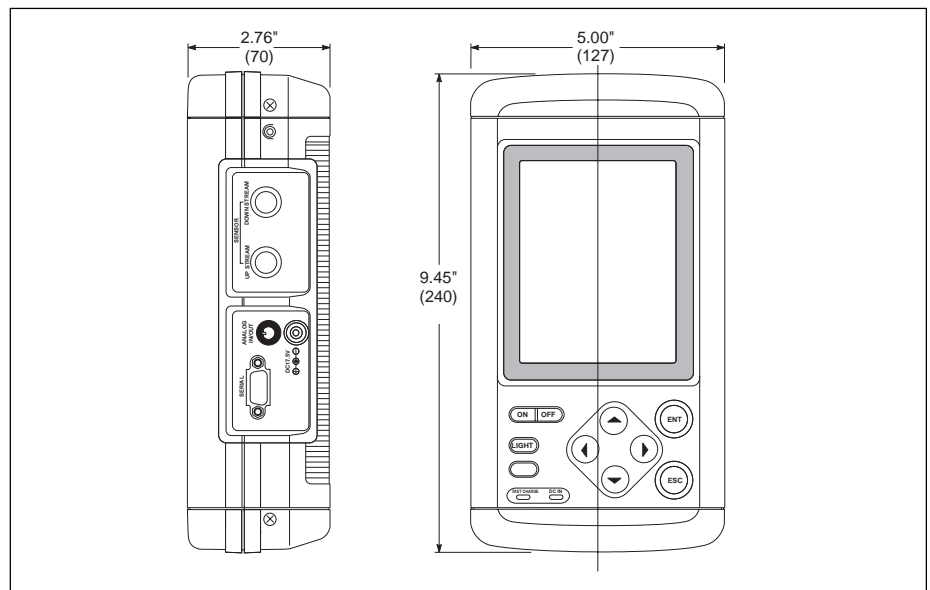
Pressure loss

No pressure loss

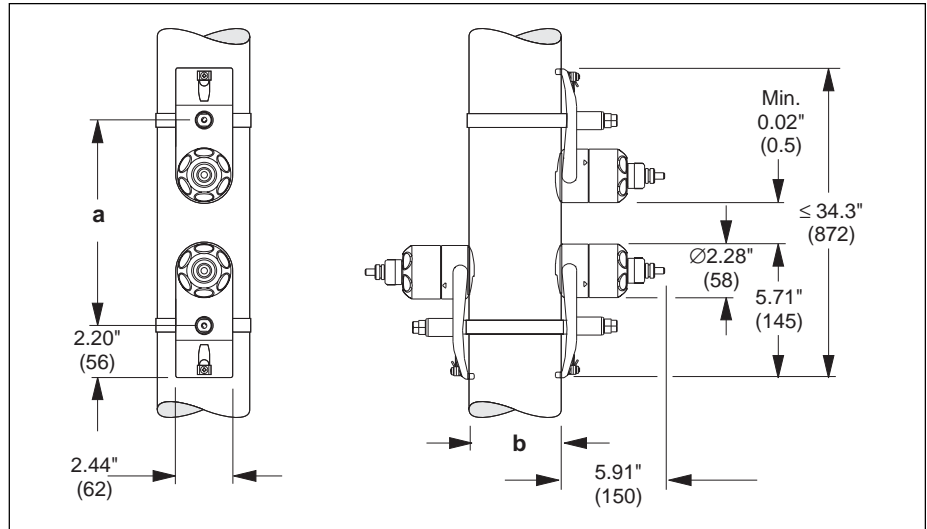
Mechanical construction

Dimensions

Handheld transmitter housing

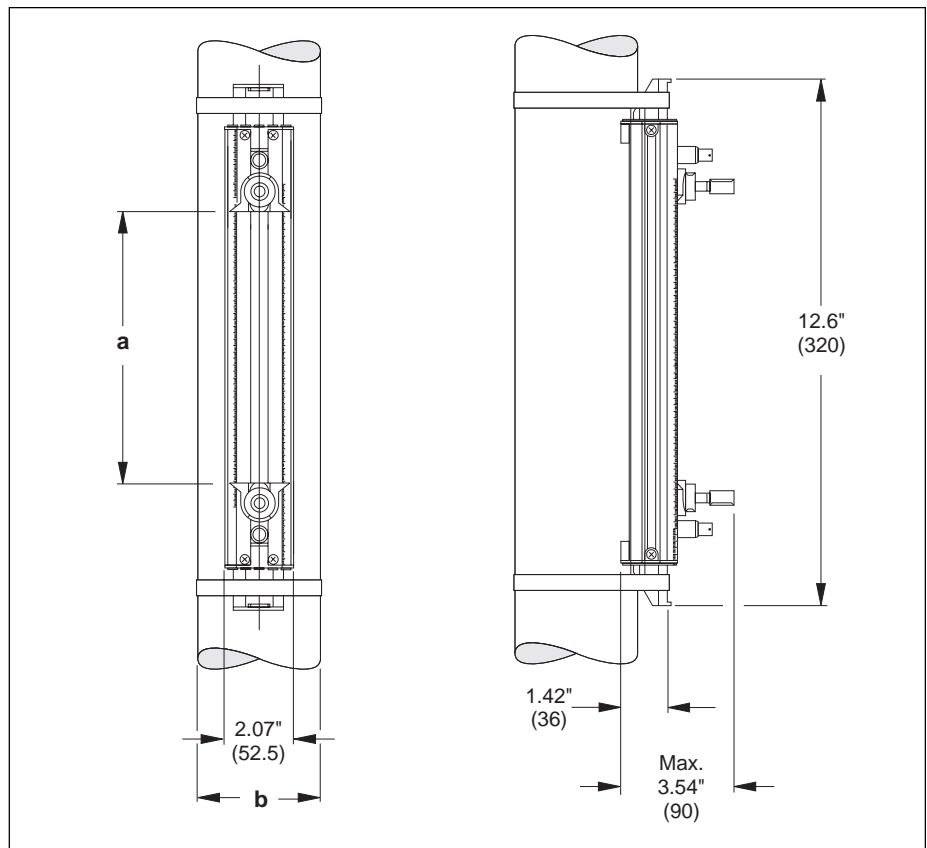


Prosonic Flow W sensor



a = Sensor distance, can be determined using Site Setup
b = Pipe outer diameter (defined by application)

Prosonic Flow U sensor



a = Sensor distance, can be determined using Site Setup, 0 to 5.31" (0 to 135 mm)
b = Pipe outer diameter (defined by application)

Weight

Prosonic Flow 92 transmitter:

- 3 lbs (1.5 kg)

Measuring sensors:

- W sensors, including holders and tension bands, 6 lbs (2.8 kg)
- U sensors, including tension bands, 1 lb (0.6 kg)

Materials

Prosonic Flow transmitter:

- Hand held housing, plastic case

Measuring sensors W:

- Sensor housing, nickel plated brass, C38500 (UNS)
- Sensor fixing brackets, 304 SS (AISI)
- Sensor contact surface, chemical resistant plastic
- Tension bands, textile

Measuring sensors U:

- Sensor housing, plastic
- Sensor mounting rail, aluminum alloy / plastic
- Sensor contact surface, chemical resistant plastic
- Tension bands, textile

Sensor cables:

- PVC

Human interface

Display elements

- Liquid crystal graphic display, 240 x 320 dot (with backlight)
- Custom configurations for presenting different measured values and status variables
- Supported languages for display: English, German, French, Italian and Spanish

Operating elements

9 push buttons:

ON, OFF, ESC, ENT, LIGHT, , , , 

RS-232C (not isolated)

- Maximum 9600 BPS transmission speed
- Maximum cable length, 30 feet (15 m)

Serial communication

Logging functions:

- Site data (name, piping, liquid, sensor mounting method, type of sensor) for up to 20 sites
- A maximum of 40,000 data points (time, velocity, flow rate, totals, analog input, status) can be stored in memory

Certificates and approvals

CE mark

By attaching the CE mark, Endress+Hauser confirms that the instrument has been successfully tested and fulfills all legal requirements of the relevant EC directives.

Other standards and guidelines

Housing protection ratings (IP code), EN 60529

Protection Measures for Electrical Equipment for Measurement, Control, Regulation, and Laboratory Procedures, EN 61010

"Emission to class A requirements", EN 61326/A1 (IEC 1326): Electromagnetic compatibility (EMC requirements)

The power adapter is approved according to UL/UL-C and IEC 950

Ordering Information

Prosonic Flow 92

Prosonic Flow 92 portable ultrasonic flowmeter includes carrying case, 15 feet PVC sensor cables, power adapter and data readout software for use with a PC.

92TA1 - ¹ ²

- 1 Standard flow sensor kit
 - A W-sensor kit, 4" to 160", -4°F to +175°F
Adapter plug, sensor holders, installation set (2" to 59"),
and acoustic coupling paste
 - B W-sensor kit, 2" to 12", -4°F to +175°F
 - X Without W-flow sensors, 2" to 160"
- 2 Flow sensor kit for small diameter pipe
 - A U-sensor kit, 1/2" to 4", -4°F to +175°F, including mounting rail,
installation set, and acoustic coupling paste
 - X Without U-flow sensor, 1/2" to 4"

U-Flow sensor set

For use with the Prosonic Flow 92 transmitter

DK9TF - ¹

- 1 Sensor type
 - A U-clamp on sensor, 1/2" to 4", -4° to +175°F, including mounting rail

Adapter plug set

For use with the Prosonic Flow 92 transmitter and BNC sensor cables

DK9AP - ¹

- 1 Adapter plug set
 - A Adapter plug set for W sensors only

Installation set

For use with the Prosonic Flow 92 transmitter

DK9MC - ¹ ²

- 1 Sensor fastening
 - A Without sensor fastening
 - B U-sensor strapping band, 1/2" to 4"
 - C W-sensor strapping bands, 2" to 59"
 - D W-sensor strapping bands, 40" to 160"
- 2 Mounting support tool for W sensors
 - 1 Without mounting support tool
 - 2 Variable spacing ruler, 4" to 24", for W sensor only
 - 3 Traverse positioning tool, supports one traverse sensor mounting,
for W sensor only

Sensor cable set

For use with the Prosonic Flow 92 transmitter

DK9BC - ¹
□

- 1 Cable type and length
 - A PVC cable, BNC adapter, 15 ft (5 m), -4°F to +165°F
 - B PVC cable, BNC adapter, 30 ft (10 m), -4°F to +165°F

Carrying case

Softside carrying case for Prosonic Flow 92 Order Number: **50102921**

Accessories

Mounting accessories

- Coupling paste, -40°F to +175°F PN: DK9CM-1
- Tension bands, U sensor, 1/2" to 4" PN: See "Installation Set" page 14
- Tension bands, W sensor, 2" to 60" PN: See "Installation Set" page 14
- Tension bands, W sensor, 40" to 160" PN: See "Installation Set" page 14

For application and selection assistance,
in the U.S. call 888-ENDRESS

For total support of your installed base, 24 hours
a day, in the U.S. call 800-642-8737

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