

## Flow Measurement

SITRANS FS (ultrasonic)

Clamp-on ultrasonic flowmeters

### SITRANS FS290

#### Overview



SITRANS FST090 clamp-on ultrasonic flowmeter

The portable clamp-on ultrasonic flow measurement system SITRANS FS290 is formed by the SITRANS FST090 portable clamp-on flowmeter with FSS200 sensors.

This system represents the next generation of digital flow measurement which allows you to easily measure or check flows in pipes.

#### Benefits

The SITRANS FST090 transmitter is based on the innovative technology of the FST020 and FST030 and is therefore identical in use and operation. The FST090 transmitter is flexible, versatile, practical: in conjunction with the SITRANS FSS200 clamp-on sensors, it is up to practically any challenge.

The main benefits at a glance:

- Easy installation: just clamp it on, with no need to cut pipe or stop flow
- Minimal maintenance: sensors do not require upkeep or cleaning
- No moving parts to foul or wear
- No pressure drop or energy loss
- Wide turn-down ratio
- Precise single path measuring

#### Application



The SITRANS FS290 is often used for temporary checks in water supply and disposal. Cooling or hot water, reference quantities or leaks can be checked quickly in this way. A typical example is the monitoring and testing of fire protection systems or other emergency applications where there is flow.

The portable device is also versatile in the temporary use of measured values for stationary when measuring devices that have been removed for repair or calibration. In fact, the FS290 can be used almost anywhere liquid ultrasonic flow measurement is needed: such as check metering, i.e. the periodic checking of built-in clamp on sensors.

The SITRANS FS290 can be used to measure flow in many different material pipes. However, cement pipes and special plastic composite pipes cannot be used though due to their physical properties.

Inner coatings or liners are stored in the device and are taken into account when entering.

The SITRANS FS290 is suitable for pipes up to 5000 mm (200 inches) and for pipe wall thicknesses up to 50 mm (2.0 inches).

The recommended medium temperature range is from -40 °C to +121 °C. (-40 °F to 250 °F). For higher temperatures Siemens offers high temperature sensors up to maximum 230 °C (446 °F).

The transmitter comes supplied with a liquid table with all common material data for easy media selection. Relevant data can be easily and quickly adopted.

The SITRANS FS290 is not suitable for gases, steam and inhomogeneous liquids.

## Design

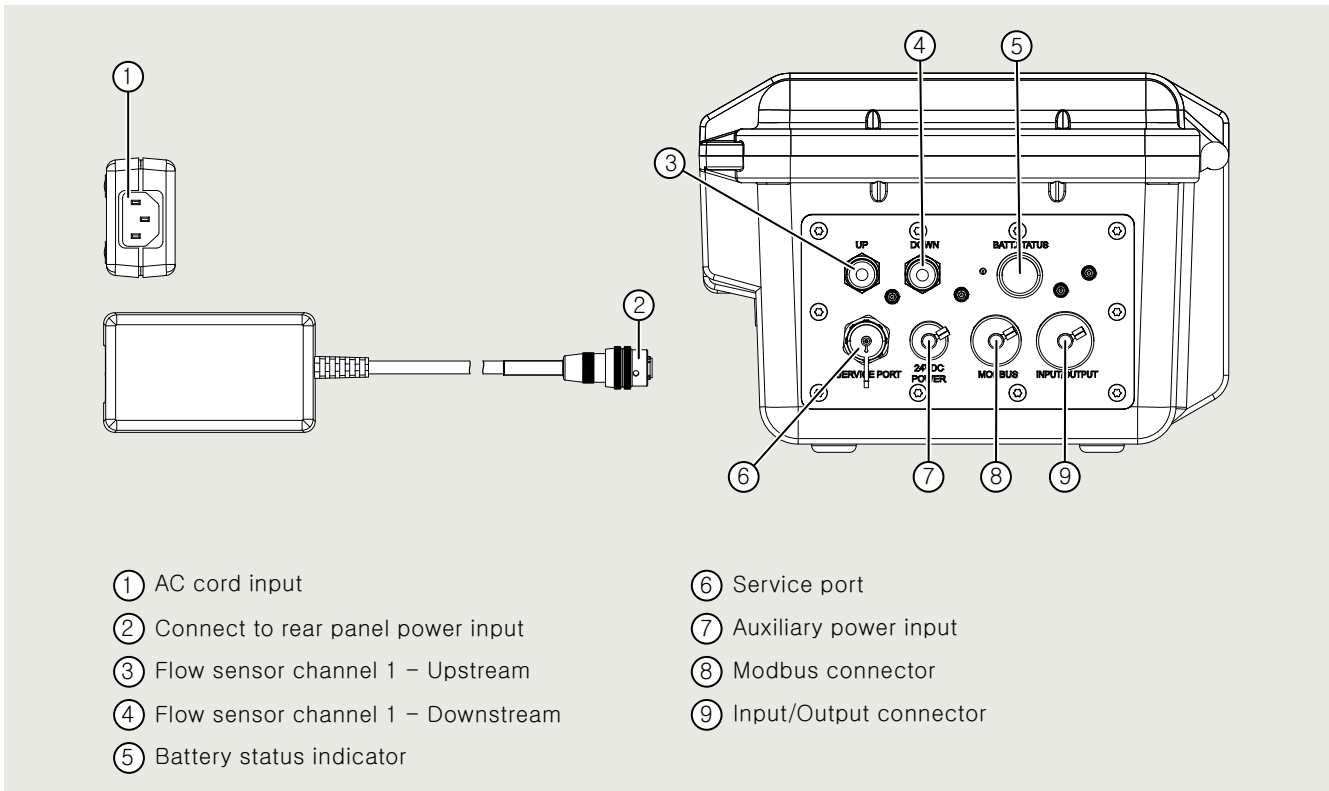


The precision electronics of the SITRANS FST090 portable ultrasonic transmitter are housed in a robust weather proof case. The case protects the electronics under harshest of field conditions. The process and control connections are accessed on the top of the device, with industrial connectors, that can be quickly and securely employed. The system can be powered with an swappable rechargeable battery, providing power for 24 hours or more as well as via mains power with the system's Vac power adapter, for a more permeant installation.

The transmitter reads the measured process values from the transducers and calculates derived values, that are converted into flow values that are then displayed.

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## Connecting plate



SITRANS FST090, AC power and connections

## Easy sensor installation

Mounting rails are ideal for small sensors of sizes A and B. For the larger sensors C, D and E, mounting frames with spacers are suitable. Both rails and frames can be easily attached to the pipe using tension chains without tools. The correct sensor distance is made using calculated index points. The sensors are then clamped exactly there. The distance ruler supplied as standard helps with alignment and specifies the index distance. There is no need to measure the sensor distance on the pipe for the best possible current signal, the sensors are always on optimally aligned for every possible condition.

Magnetic frames can be used universally for all sensor sizes C, D and E. Industrial magnets ensure a strong hold on steel pipes. They can also be used on plastic pipes, with the use of tightening straps that are required for this application. A spacer bar ensures easy sensor positioning.

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#### Mode of operation

The SITRANS FST090 calculates the optimal sensor distance based on the calculation of pipe material, size and wall thickness, taking into account the liquid to be measured. The distance is given as an LTN value and as an index value to a reference point. The LTN value allows the distance between the sensors to be checked precisely.

Each measuring path is formed by two coordinated sensors that transmit ultrasonic signals back and forth through the pipe. Using the time difference between the two signals, the transmitter calculates the resulting measurement.

The transmitter performs analog signal processing for the sensor pair and digitalizes the generated measurements for display. The data measured is periodically recorded on the inserted SD storage card. Data output can be user-defined or take place via either analog signal or Modbus RTU.

Users can install clamp-on sensors on the pipe during ongoing operation, which means the pipe is not cut open and the flow does not need to be stopped.

#### High-tech reduces transmitter errors below 0.15%

The SITRANS FST090 is based on the technology of the industry leading transmitter SITRANS FST030. The analog data acquisition is digitized immediately, thus enabling signal processing in real time. The electronics of the SITRANS FST090 have been developed in so that the transmitter error is less than 0.15% under ideal measuring conditions. For normal use under good conditions, a measurement inaccuracy of 1% or less is realistic.

Measurement errors in ultrasonic flow measurements are often caused by anomalies in the inlet area. Insufficient distance to a 90° or room bend (3D double bend) causes flow profile disturbances that a clamp-on measuring device cannot easily compensate for. In portable applications, the built in patented anomaly tool helps to improve measurement accuracy under these challenging conditions.

#### Long battery life, easy battery change

An improved energy manager allows battery operation for at least twenty four hours at full load.

A battery change during operation is possible without any problems. As an ideal supplement to existing stationary measurements, the SITRANS FST090 can also be programmed with Siemens Process Device Manager (PDM) software via the USB interface and then integrated into control systems.



SITRANS FST090 transmitter with battery

Selection and ordering data	Article No.	Article No.
<b>SITRANS FS290 clamp-on flowmeter</b>	<b>7ME374</b>	<b>SITRANS FS290 clamp-on flowmeter</b>
Click on the Article No. for the online configuration in the PIA Life Cycle Portal		
<b>Transmitter version</b>		
Transmitter FST090 portable clamp-on	<b>5</b>	
<b>FSS200 sensor pair clamp-on for portable use, incl. suitable pipe mounting material</b>		
No sensor	<b>0 A</b>	
<b>Universal: for all pipe materials; temperature -40 ... +120 °C (-40 ... +250 °F)</b>		
FSS200 universal size A2, for pipes 12.7 ... 50 mm (0.5 ... 2") supplied with portable mounting tracks for pipes up to 130 mm (5")	<b>0 B</b>	<b>1 A</b>
FSS200 universal size B3, for pipes 19 ... 127 mm (0.75 ... 5") supplied with portable mounting tracks for pipes up to 130 mm (5")	<b>0 C</b>	<b>1 B</b>
FSS200 universal C3, for pipes 51 ... 305 mm (2 ... 12") supplied with portable frame set for pipes up to 330 mm (13")	<b>0 D</b>	<b>1 C</b>
FSS200 universal D3, for pipes 203 ... 610 mm (8 ... 24") supplied with portable frame set for pipes up to 330 mm (13")	<b>0 E</b>	<b>1 D</b>
FSS200 universal E2, for pipes 304 ... 600 mm (12 ... 240") supplied with portable frame set for pipes up to 600 mm (24")	<b>0 F</b>	
<b>High Precision: ideal for steel pipes; temperature -40 ... +121 °C (-40 ... +250 °F)</b>		
FSS200 high precision size A1H, for steel pipes with wall thickness 0.6 ... 1 mm (0.03 ... 0.4") supplied with portable mounting tracks for pipes up to 130 mm (5")	<b>0 G</b>	
FSS200 high precision size A2H, for steel pipes with wall thickness 1 ... 1.5 mm (0.04 ... 0.6") supplied with portable mounting tracks for pipes up to 130 mm (5")	<b>0 H</b>	
FSS200 high precision size A3H, for steel pipes with wall thickness 1.5 ... 2 mm (0.06 ... 0.8") supplied with portable mounting tracks for pipes up to 130 mm (5")	<b>0 J</b>	
FSS200 high precision size B1H, for steel pipes with wall thickness 2 ... 3 mm (0.08 ... 0.12") supplied with portable mounting tracks for pipes up to 130 mm (5")	<b>0 K</b>	
FSS200 high precision size B2H, for steel pipes with wall thickness 3 ... 4.1 mm (0.12 ... 0.16") supplied with portable mounting tracks for pipes up to 130 mm (5")	<b>0 L</b>	
FSS200 high precision size C1H, for steel pipes with wall thickness 4.1 ... 5.8 mm (0.16 ... 0.23") supplied with portable frame sets for pipes up to 610 mm (24")	<b>0 M</b>	
FSS200 high precision size C2H, for steel pipes with wall thickness 5.8 ... 8.1 mm (0.23 ... 0.32") supplied with portable frame sets for pipes up to 610 mm (24")	<b>0 N</b>	
FSS200 high precision size D1H, for steel pipes with wall thickness 8.1 ... 11.2 mm (0.32 ... 0.44") supplied with portable frame sets for pipes up to 1200 mm (48")	<b>0 P</b>	
FSS200 high precision size D2H, for steel pipes with wall thickness 11.2 ... 15.7 mm (0.44 ... 0.62") supplied with portable frame sets for pipes up to 1200 mm (48")	<b>0 Q</b>	
FSS200 high precision size D4H, for steel pipes with wall thickness 15.7 ... 31.8 mm (0.62 ... 1.25") supplied with portable frame sets for pipes up to 1200 mm (48")	<b>0 R</b>	
		<b>Universal high temperature (HT): for all pipe materials; -40 ... +230 °C (-40 ... +446 °F)</b>
		FSS200 Universal HT size 1, for pipes 10 ... 100 mm (0.47 ... 3.95") supplied with mounting tracks for pipes up to 150 mm (6")
		FSS200 Universal HT size 2, for pipes 30 ... 200 mm (1.5 ... 8") supplied with mounting tracks for pipes up to 250 mm (10")
		FSS200 Universal HT size 3, for pipes 150 ... 610 mm (6 ... 25") supplied with mounting tracks for pipes up to 650 mm (26")
		FSS200 Universal HT size 4, for pipes 400 ... 1200 mm (16 ... 48") supplied with mounting tracks for pipes up to 1200 mm (48")
		<b>Sensor bundle - check meter kit with magnet frames, straps and spacer bar</b>
		Standard Performance, for any pipe material:
		<ul style="list-style-type: none"> <li>Small pipe check meter kit – Standard Performance, for diameters 12 ... 400 mm (0.5 ... 16"). Includes universal sensors B3, C3, D3, with tracks, magnet frames, straps, and spacer bar</li> </ul>
		<ul style="list-style-type: none"> <li>Complete pipe check meter kit – Standard Performance, for diameters 8 ... 6100 mm (0.38 ... 240"). Includes universal sensors A2, B3, C3, D3, E2 with tracks, magnet frames, straps, and spacer bar</li> </ul>
		High performance, for steel or plastic pipes and any homogeneous liquid, suitable for in-situ verification of flow instruments and flow surveys on critical applications in all industries:
		<ul style="list-style-type: none"> <li>Medium pipe check meter kit – High Performance, for steel or plastic pipe material with wall thickness 4.1 mm ... 11.2 mm (0.160 ... 0.440") and any homogeneous liquid. Includes high precision sensors sizes C1H, C2H, D1H</li> </ul>
		<ul style="list-style-type: none"> <li>Extended pipe check meter kit – High Performance, for steel or plastic pipe material with wall thickness 4.1 ... 15.7 mm (0.16 ... 620"). Includes high precision sensors C1H, C2H, D1H, D2H</li> </ul>
		<ul style="list-style-type: none"> <li>Complete pipe range check meter kit – High Performance, for steel or plastic pipe material with wall thickness 3 ... 15.7 mm (0.12 ... 620"). Includes high precision sensors B2H, C1H, C2H, D1H, D2H, with mounting tracks, magnet frames, straps, and spacer bar</li> </ul>
		<b>Fast charger for rechargeable battery pack</b>
		No charger
		Charger type A for Europe (CEE7/7)
		Charger type C for Australia (AS3112)
		Charger type D for U.K. (BS1363)
		Charger type J for Japan (JIS8303)
		Charger type K for U.S. (NEMA 5-15P)
		Charger type L for Switzerland (SEV1011)
		<b>Akku-Pack Lithium-Ion for battery use</b>
		No battery
		One battery pack rechargeable
		Two battery pack rechargeable
		Three battery pack rechargeable

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##### SITRANS FS290 clamp-on flowmeter

#### Article No.

7ME374

#### Output signals and Modbus usage

Without connection terminal box

Connection terminal box, with connection terminals for quick connection to the FST090 multi-connector, for Modbus (8) and the inputs and outputs (9)

#### Number of ultrasonic paths

One path (default value 1)

#### Default Value B

Polycarbonate portable enclosure (default value B)

#### Digital sensor link

Sensor link integrated in transmitter (default value B)

#### External power supply unit

Without power supply unit

Power adaptor type A plug for Europe (CEE7/7)

Power adaptor type C plug for Australia (AS3112)

Power adaptor type D plug for U.K. (BS1363)

Power adaptor type J plug for Japan (JIS8303)

Power adaptor type K plug for U.S. (NEMA 5-15P)

Power adaptor type L plug for Switzerland (SEV1011)

#### Options

Please add "-Z" to Article No. and specify Order code(s) and plain text.

#### Sensor cable set pair, complete

2 × 6 m (20 ft) PVC coaxial cable FST090 to the sensor with BNC connection

2 × 15 m (50 ft) PVC coaxial cable FST090 to the sensor with BNC connection

#### Mass storage

Mass storage device function (outside USA mandatory)

#### Order code

K21

K22

S30

#### Article No.

#### Accessories

##### Sensor cable set pair, complete

Sensor cable 6 m (20 ft) for FST090

Sensor cable 15 m (50 ft) for FST090

##### External power supply unit

Power adaptor type A plug for Europe (CEE7/7)

Power adaptor type C plug for Australia (AS3112)

Power adaptor type D plug for U.K. (BS1363)

Power adaptor type J plug for Japan (JIS8303)

Power adaptor type K plug for U.S. (NEMA 5-15P)

Power adaptor type L plug for Switzerland (SEV1011)

##### Akku-Pack Lithium-Ion for battery use

Replacement battery

##### Fast charger for rechargeable battery pack

Charger type A for Europe (CEE7/7)

Charger type C for Australia (AS3112)

Charger type D for U.K. (BS1363)

Charger type J for Japan (JIS8303)

Charger type K for U.S. (NEMA 5-15P)

Charger type L for Switzerland (SEV1011)

##### Junction box

Junction box with terminal connection for fast connection to the FS290 bulk head connection for Modbus (8), the in- and outputs (9)

##### Cable

I/O cable with plug for the FST090 (connector 9)

Cable for Modbus with plug for the FST090 (connector 8)

##### Connector adapter F/BNC

"F" connector to BNC adapter (order 2 pcs per transducer set)

#### Article No.

A5E51114688

A5E51114689

7ME39403PR00

7ME39403PS00

7ME39403PT00

7ME39403PQ00

7ME39403PU00

7ME39403PV00

A5E50949498

7ME39404PR00

7ME39404PS00

7ME39404PT00

7ME39404PQ00

7ME39404PU00

7ME39404PV00

A5E50726323

A5E51100281

A5E51100285

CQO:1012NFPA

#### Technical specifications

SITRANS FST090	
<b>Design</b>	
Dimension (L × B × H)	320.4 × 244.8 × 175.4 mm (12.6 × 9.6 × 6.9 inch)
Weight	2.8 kg (6.0 lb)
Housing material	Polypropelen (weatherproof)
<b>Architecture</b>	
Input / display	4 pushbuttons, illuminated graphic display, 240 × 160 pixels
Programming	Menu assistant, free input, 50 measuring locations can be saved
Language selection	Switchable, with 14 languages available (English, German, Italian, French, Spanish, Portuguese, Danish, Swedish, Finnish, Dutch, Chinese, Japanese, Russian, Polish)
<b>Sensors</b>	
Sensor cable	FSS200 clamp-on sensors portable, compatible with older FUP1010 sensors PVC length 6 m (19.6 ft)/ 15 m (49 ft) with connector
<b>Power</b>	
External power supply	Transmitter power: DC 11.5 ... 28.5 V at 10 W External power supply 100 ... 240 V AC / 24 V DC, 10 W
Battery pack	Lithium-ion battery (99 Wh), 24 V DC with operation of up to 24 hours per battery charge. Swapping between battery and power pack possible without interrupting the flow measurement
Charger for battery pack	Battery charger with quick charge function: 19 ... 26 V DC -2.8 A max. External battery charger AC-Adapter: 100 ... 240 V AC 50-60 Hz, 1.7 A
<b>Adjustable measuring range</b>	
Flow rate range	± 12 m/s (± 40 ft/s), depending on the pipe width larger or smaller
Flow direction	Bidirectional
Flow sensitivity	0.001 m/s (0.003 ft/s), independent from the flow rate

SITRANS FST090	
<b>Input/output connector</b>	
Digital inputs	Optocoupler Enabled ON: Input voltage: DC 2 ... 10 V Optocoupler Activated ON: Input voltage: DC 2 ... 10 V
• Stop counter	
• Reset counter	
Output option	4 ... 20 mA (isolated) External current 10 ... 30 V DC DC 30 V, AC 3 V max. pulse: 41.6 ms ... 5 s Pulse duration Frequency: 0 ... 12.5 kHz (50% load cycle) Optical transistor 10 mA, DC 30 V max.
• Current	
• Relay	
• Pulse rate	
<b>Communication</b>	
Communication	Modbus RTU RS 485
<b>Diagnostic option</b>	
Diagnostic option	Logger, alarms and events, separated in table shape
<b>USB service connection</b>	
USB service connection	USB - SIMATIC PDM / internal memory External memory 4 GB (possible up to 32 GB) for years of recording
<b>Accuracy</b>	
Accuracy	At speeds above 0.3 m/s (1 ft/s), ±1.0% of flow rate
Repeatability	±0.25% (according to ISO 11631)
Zero drift	0.1% of the flow; < ±0.001 m/s (±0.003 ft/s)
Data repetition rate	100 Hz
<b>Environmental conditions</b>	
Operating temperature	-10 ... +50 °C (14 ... 122 °F)
Storage temperature	-20 ... +60 °C (-4 ... +140 °F)
Protection class	• IP65 with lid closed • IP67 with lid open
<b>Certificates and approvals</b>	
General safety	UL, ULc, CE

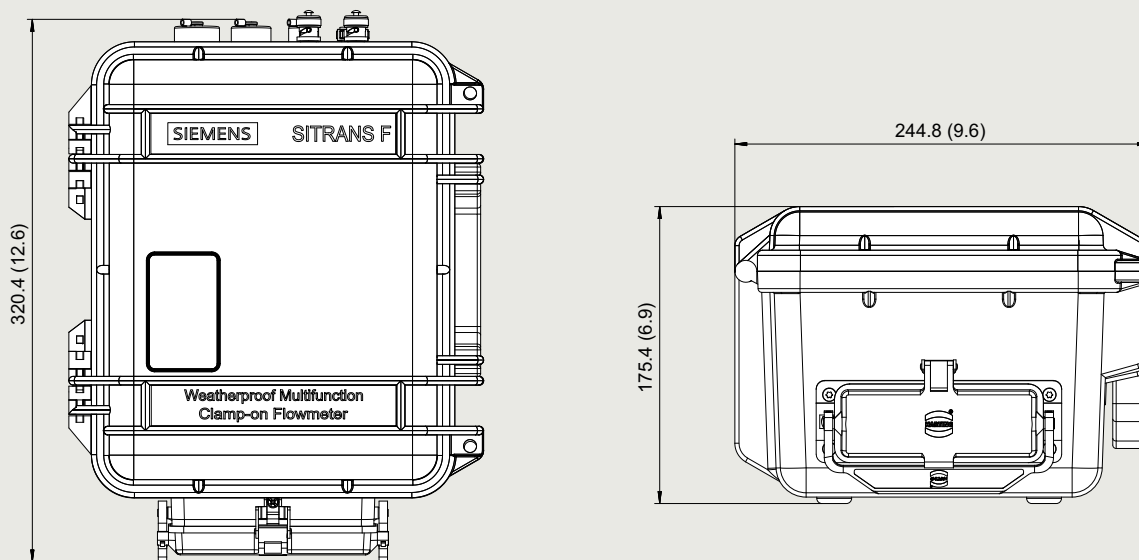
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#### Dimensional drawings



SITRANS FST090, net weight 4.1 Kg (9.038 lb), dimensions in mm (inch)