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 the successor to the SITRANS FUP1010 in a design that has been tried and tested worldwide. The FST090 transmitter ist 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 measures the flow on pipe wall thicknesses from DN 10 (0.39") to a maximum pipe wall thickness up to 50.8 mm (2.0 inch).

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.
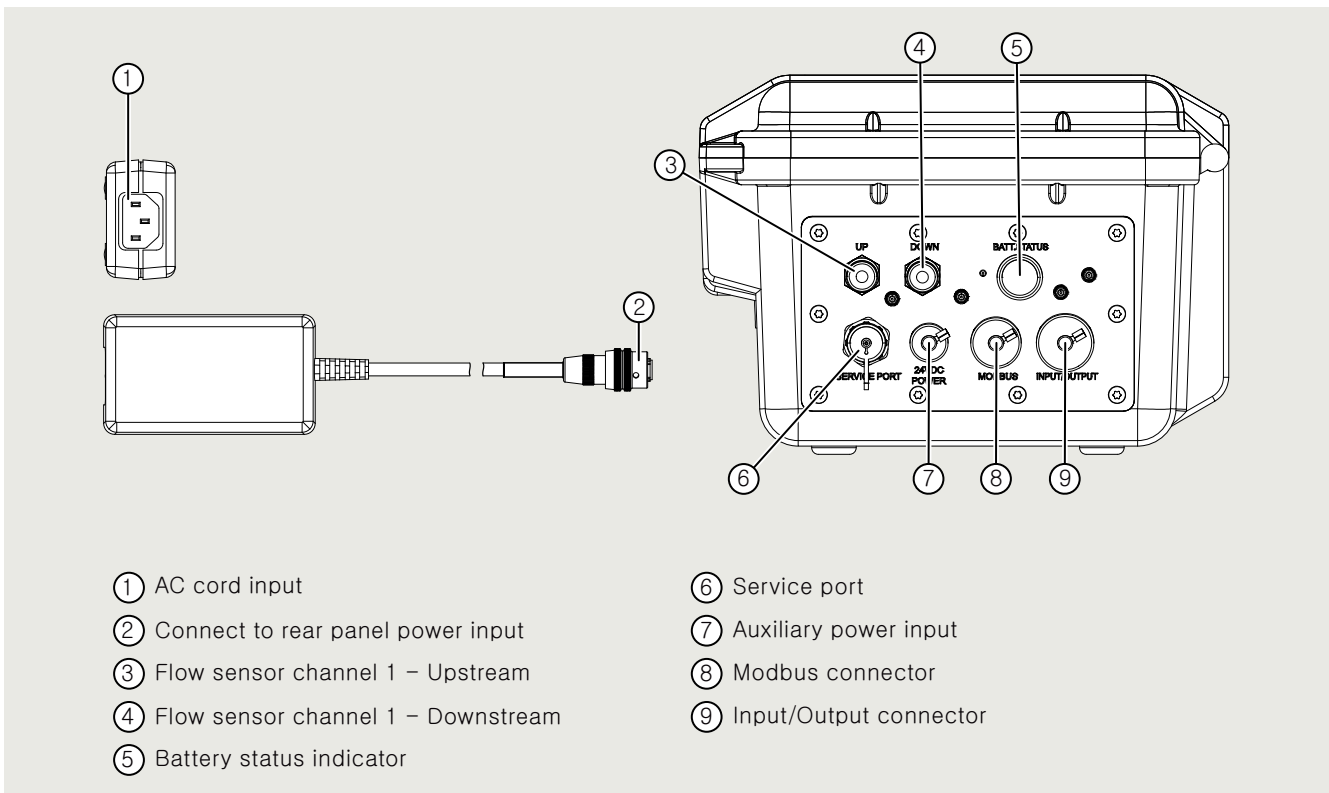
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■ Design

SITRANS FST090 has a modular design with discrete, replaceable electronic modules and connection boards to maintain separation between functions and facilitate field service.
All modules are fully traceable and their provenance is included in the transmitter setup.

The transmitter reads the measured process values from the sensor and calculates derived values. It provides Modbus communications, 1 × 4-20 mA, 1 × relay, 2 × digital inputs for totalizer start/stop and reset and 1 × Pulse/Frequency, USB service port, and a local display. It also adds functionalities such as totalizers, access control, diagnostics, and configuration. The local user interface consists of a display and four buttons for user interaction.

Connecting plate

1 AC cord input
2 Connect to rear panel power input
3 Flow sensor channel 1 – Upstream
4 Flow sensor channel 1 – Downstream
5 Battery status indicator

6 Service port
7 Auxiliary power input
8 Modbus connector
9 Input/Output connector

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 special spacer rod 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.

SITRANS FS290 clamp-on flowmeter	7ME374 ■ - ■ ■ ■ ■ ■ - ■ ■ ■ ■
↗ Click on the Article No. for the online configuration in the PIA Life Cycle Portal	
Transmitter version	
Transmitter FST090 portable clamp-on	5
Transducer, matched and dedicated sensor pair	
Without sensor	0 A
Ultrasonic clamp-on sensor, universal for all pipe materials; temperature -40 ... +121 °C (-40 ... +250 °F); housing polyethermide corrosion-resistant, incl. coupling gel and sanding sponge	
A2 Universal sensor, supplied with trackmount and straps provided up to 75 mm (3")	0 B
B3 universal sensor, supplied with trackmount and straps provided up to 125 mm (5")	0 C
C3 Universal, supplied with mounting frames and straps provided up to 300 mm (13")	0 D
D3 Universal, supplied with mounting frames and straps provided up to 600 mm (24")	0 E
E2 Universal, supplied with mounting frames and straps provided up to 600 mm (24")	0 F
Ultrasonic clamp-on sensor, for measurements at high temperatures; -40 ... +230 °C (-40 ... +446 °F), incl. coupling gel and grinding paste	
HT size 1: 12.7 ... 100 mm (0.47 ... 3.95") supplied with trackmount and straps provided up to 125 mm (5")	1 A
HT size 2: 30 ... 200 mm (1 ... 8") supplied with trackmount and straps provided up to 250 mm (10")	1 B
HT size 3: 150 ... 610 mm (6 ... 24") supplied with trackmount and straps provided up to 650 mm (26")	1 C
HT size 4: 400 ... 1200 mm (16 ... 48") supplied with trackmount and straps provided up to 1250 mm (50")	1 D
Ultrasonic clamp-on sensor, high-precision sensors for steel pipes; temperature max. -40 ... +121 °C (-40 ... +250 °F); housing polyetherimide / StSt corrosion-resistant, incl. coupling gel and abrasive sponge	
A1H 0.6 ... 1.0 mm (0.025 ... 0.4") supplied with trackmount and straps provided up to 75 mm (3")	0 G
A2H 1.0 ... 1.5 mm (0.04 ... 0.06") supplied with trackmount and straps provided up to 75 mm (3")	0 H
A3H 1.5 ... 2.0 mm (0.06 ... 0.08") supplied with trackmount and straps provided up to 75 mm (3")	0 J
B1H 2.0 ... 3.0 mm (0.08 ... 0.12") supplied with trackmount and straps provided up to 125 mm (5")	0 K
B2H 3.0 ... 4.1 mm (0.12 ... 0.16") supplied with trackmount and straps provided up to 125 mm (5")	0 L
C1H 4.1 ... 5.8 mm (0.16 ... 0.23") supplied with mounting frames and straps provided up to 600 mm (24")	0 M
C2H 5.8 ... 8.1 mm (0.23 ... 0.32") supplied with mounting frames and straps provided up to 600 mm (24")	0 N
D1H 8.1 ... 11.2 mm (0.32 ... 0.44") supplied with mounting frames and straps provided up to 1200 mm (48")	0 P

SITRANS FS290 clamp-on flowmeter	7ME374 ■ - ■ ■ ■ ■ ■ - ■ ■ ■ ■
D2H 11.2 ... 15.7 mm (0.44 ... 0.62") supplied with mounting frames and straps provided up to 1200 mm (48")	0 Q
D4H 15.7 ... 31.8 mm (0.62 ... 1.25") supplied with mounting frames and straps provided up to 1200 mm (48")	0 R
Sensor bundle for water and chemical applications	
Sensor kit 01: Water small B3, C3, D3 universal sensors	2 K
Sensor kit 02: Water big A2, B3, C3, D3 E2 universal sensors	2 L
Sensor kit 03: Chemical small C1H, C2H, D1H	2 M
Sensor kit 04: Chemical standard C1H, C2H, D1H, D2H	2 N
Sensor kit 05: Chemical big B2H, C1H, C2H, D1H, D2H	2 P
External battery charger	
No charger	A
Charger type A for Europe (CEE7/7)	B
Charger type C for Australia (AS3112)	C
Charger type D for U.K. (BS1363)	D
Charger type J for Japan (JIS8303)	E
Charger type K for U.S. (NEMA 5-15P)	F
Charger type L for Switzerland (SEV1011)	G
System battery	
No system battery	0
One system battery pack for FST090	1
One system and one additional battery pack for FST090	2
One system and two additional battery packs for FST090	3
Connection for external communication	
Without connection terminal box	0
Connection terminal box, with connection terminals for quick connection to the FST090 multi-connector, for Modbus (8) and the inputs and outputs (9)	1
Number of ultrasonic paths	
One path (two sensors)	1
Enclosure material of the tranmitter	
Polycarbonate Portable enlcosure	B
Digital sensor link	
Sensor link integrated in transmitter	B
Power adapter for the transmitter	
Without power supply unit	0
Power adaptor type A plug for Europe (CEE7/7)	1
Power adaptor type C plug for Australia (AS3112)	2
Power adaptor type D plug for U.K. (BS1363)	3
Power adaptor type J plug for Japan (JIS8303)	4
Power adaptor type K plug for U.S. (NEMA 5-15P)	5
Power adaptor type L plug for Switzerland (SEV1011)	6

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■ **Selection and ordering data**

Options	Order code
Please add "**-Z**" to Article No. and specify Order code(s) and plain text.	
Cable - transmitter	
2 × 6 m (20 ft) PVC coaxial cable FST090 to the sensor with BNC connection	**K21**
2 × 15 m (50 ft) PVC coaxial cable FST090 to the sensor with BNC connection	**K22**
Mass storage	
Mass storage function for SD card (not available for USA)	**S30**

Accessories	Article No.
Cable	
2 × 6 m (20 ft) Coax sensor cable for FST090	**A5E51114688**
2 × 15 m (50 ft) Coax sensor cable for FST090	**A5E51114689**
Power adapter AC/DC	
Power adaptor type A plug for Europe (CEE7/7)	**7ME39403PR00**
Power adaptor type C plug for Australia (AS3112)	**7ME39403PS00**
Power adaptor type D plug for U.K. (BS1363)	**7ME39403PT00**
Power adaptor type J plug for Japan (JIS8303)	**7ME39403PQ00**
Power adaptor type K plug for U.S. (NEMA 5-15P)	**7ME39403PU00**
Power adaptor type L plug for Switzerland (SEV1011)	**7ME39403PV00**
Replacement battery	
Replacement battery	**A5E50949498**
External charger for the battery 100 ... 240 V 50/60 Hz AC	
Charger type A for Europe (CEE7/7)	**7ME39404PR00**
Charger type C for Australia (AS3112)	**7ME39404PS00**
Charger type D for U.K. (BS1363)	**7ME39404PT00**
Charger type J for Japan (JIS8303)	**7ME39404PQ00**
Charger type K for U.S. (NEMA 5-15P)	**7ME39404PU00**
Charger type L for Switzerland (SEV1011)	**7ME39404PV00**
Junction box	
Junction box with terminal connection for fast connection to the FS290 bulk head connection for Modbus (8), the in- and outputs (9)	**A5E50726323**
Cable	
I/O cable with plug for the FST090 (connector 9)	**A5E51100281**
Cable for Modbus with plug for the FST090 (connector 8)	**A5E51100285**
Connector adapter F/BNC	
"F" connector to BNC adapter (order 2 pcs per transducer set)	**CQO:1012NFPA**

Spare parts FST090	Article No.
Complete display incl. panel	**A5E50949222**
FST090 front panel with display, switch, panel, sealing screws, gasket and connection cable to main board	
Complete connecting plate	**A5E50949229**
incl. electronic board with connection cable to main board, gasket, screws, protection caps	
Screws with sealing for connecting plate	**A5E50949232**
All screws, caps and sealing for the connecting plate (without connecting plate)	
Grey battery hatch cover, gasket and screws	**A5E50949234**
Complete housing set, with handle, gasket and screws and mounting flange	**A5E50949238**
Complete package with all housing screws and gaskets	**A5E50949242**
Screws for connecting plate, grey battery protection, housing back plate and lid. Gaskets for connecting plate, grey battery protection, front panel and housing (without housing, connection plate and battery cover)	
Cables and material for mounting the mainboard (without mainboard)	**A5E50949244**
Main electronic board	**A5E50949246**
inclusive cable and connectors	
Board for battery power supply control CCA-Board	**A5E50949248**
Battery holder with SD card adapter including the connecting cables to the mainboard, without 12/30 V DC power supply	**A5E50949249**
FST090 12/30 V DC power supply, electronic board	**A5E51546484**

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■ Technical specifications

SITRANS FST090	
Design	
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)
Architecture	
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)
Sensors	FSS200 clamp-on sensors portable, compatible with older FUP1010 sensors
Sensor cable	PVC length 6 m (19.6 ft)/ 15 m (49 ft) with connector
Power supply	DC 11.5 ... 28.5 V at 10 W - optional the FST090 can be powered by a rechargeable battery
	External power supply 100 ... 240 V DC / 24 V DC, 10 W
	External charger with quick charge function, average charging time of the battery: 4.5 hours
Battery operation	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
Adjustable measuring range	
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	
Inputs and outputs	
Digital inputs	
• Stop counter	Optocoupler Enabled ON:
	Input voltage: DC 2 ... 10 V
• Reset counter	Optocoupler Activated ON:
	Input voltage: DC 2 ... 10 V
Output channel 1	
• Current	4 ... 20 mA (isolated)
	External current 10 ... 30 V DC
• Relay	DC 30 V, AC 3 V max. pulse: 41.6 ms ... 5 s Pulse duration
	Frequency: 0 ... 12.5 kHz (50% load cycle)
• Pulse rate	Optical transistor 10 mA, DC 30 V max.
Communication	Modbus RTU RS 485
Diagnostic option	Logger, alarms and events, separated in table shape
USB service connection	USB - SIMATIC PDM / internal memory External memory 4 GB (possible up to 32 GB) for years of recording
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
Environmental conditions	
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
Certificates and approvals	
General safety	UL, ULc, CE

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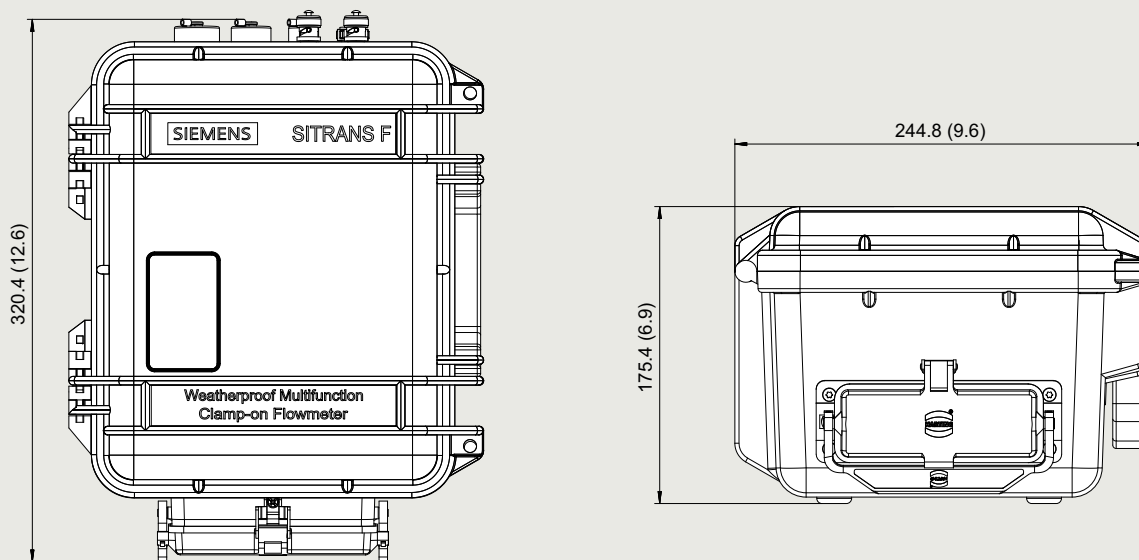SITRANS FS (ultrasonic)
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■ **Dimensional drawings**

SITRANS FST090, dimensions in mm (inch)