Flow Measurement

SITRANS FC (Coriolis)

Transmitters / SITRANS FCT040

Overview

FCT040 is the advanced transmitter, offering a wider range of application solutions with improved performance. The user can select additional measurements and functions at time of ordering to include concentration (fraction), viscosity, batch control and heat calculation.

The FCT040 transmitter is available in compact or remote design and can be combined with all SITRANS FC sensors. The selection is made within the complete SITRANS FC ordering code.

Spare transmitters are selected using the SITRANS FC ordering code, but with no sensor selected.

Example of SITRANS FCT transmitter mounted on SITRANS FCS600

FCT transmitter and SITRANS FCS100

Following features are available in the FCT040 transmitter:

- Tube health check

- Standard concentration measurement

- Petroleum measurement function

- Fraction (advanced concentration) measurement

- Viscosity function

- Batching function

Overview (continued)

Specification overview of SITRANS FCT040	
Typical measurement performance	• Mass flow accuracy: ± 0.1% (of rate) • Density accuracy: ± 0.5 kg/m³ (0.03 lb/ft³)
Features and functions	• Easy setup wizard • microSD card • Tube health check • Self-verification • Batch control
Available measurements	• Mass flow • Density • Temperature • Volume flow • Concentration (fraction) • Viscosity • Heat (thermal) energy
Digital communication options	• HART • MODBUS • PROFIBUS PA • PROFINET over Ethernet-APL

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Function

Measurement of heat quantity

- Order code: **S11**

This function calculates the total fuel calorific value of the measured fluid. Either a constant value of the calorific value of the fluid can be used, or an additional device like a gas chromatograph can provide the instantaneous calorific value via the analog input of the FCT040 transmitter. Based on the fluid flow, the total calorific energy of the fluid is calculated.

For questions regarding a specific application, contact your regional Siemens Measurement Intelligence team.

Tube health check

- Order code: **S12**

Tube health check monitors key diagnostics, including tube stiffness, driver and pickups. Self-verification alerts to potential performance issues due to unplanned process events, for example gas or vapor breakout, or solid deposits building up in the tubes. The user defines verification frequency and alarm behavior. Verification results indicate whether preventive maintenance action is required.

Petroleum measurement function

- Order code: **S14**

The Net Oil Computing (NOC) function provides real-time measurements of water cut and includes American Petroleum Institute (API) correction according to API MPMS Chapter 11.1.

Oil sometimes contains entrained gas. SITRANS FC flowmeters measure the density of the combined emulsion oil and gas, which is lower than the oil density. The NOC function includes a Gas Void Fraction (GVF) parameter to be set.

Viscosity function

- Order code: **S15**

Viscosity is sometimes used as reference value to activate other processes like fluid heating systems.

The viscosity estimation is calculated based on a comparison between measured pressure loss and a calculated value between two points of the pipe. A differential pressure transmitter is required to use this function. Its output is connected to the analog input of the FCT040. Based on an iteration process, a viscosity value is determined.

Standard concentration measurement

- Order code: **S16**

Used for concentration measurements of emulsions or suspensions when density of the fluid involved depends only on temperature.

The standard concentration measurement can be used for many low-concentration solutions if there is only minor interaction between the liquids, or if the miscibility is negligible.

Fraction measurement (advanced concentration)

Up to four pre-configured fraction ranges can be selected using the SITRANS FC option order codes from the table below.

Order code	Fraction description	Type	Range	Units	Temperature range
G01	Sugar / water (sucrose solution)	Mass fraction	0 ... 85	°Bx	0 ... 80 °C (32 ... 176 °F)
G02	NaOH / water (sodium hydroxide solution)	Mass fraction	2 ... 50	%	0 ... 100 °C (32 ... 212 °F)
G03	KOH / water (potassium hydroxide solution)	Mass fraction	0 ... 60	%	54 ... 100 °C (129 ... 212 °F)
G04	NH_4NO_3 / water (ammonium nitrate solution)	Mass fraction	1 ... 50	%	0 ... 80 °C (32 ... 176 °F)
G05	NH_4NO_3 / water (ammonium nitrate solution)	Mass fraction	20 ... 70	%	20 ... 100 °C (68 ... 212 °F)
G06	HCl / water (hydrochloric acid)	Mass fraction	22 ... 34	%	20 ... 40 °C (68 ... 104 °F)
G07	HNO_3 / water (nitric acid)	Mass fraction	50 ... 67	%	10 ... 60 °C (50 ... 140 °F)
G09	H_2O_2 / water (hydrogen peroxide)	Mass fraction	30 ... 75	%	4 ... 44 °C (39 ... 111 °F)
G10	Ethylene glycol / water (homogenous mixture)	Mass fraction	10 ... 50	%	-20 ... +40 °C (-4 ... +104 °F)
G11	Amylum (starch) / water (paste-like suspension)	Mass fraction	33 43	%	35 ... 45 °C (95 ... 113 °F)
G12	Methanol / water (homogenous mixture)	Mass fraction	35 ... 60	%	0 ... 40 °C (32 ... 104 °F)
G20	Alcohol / water (homogenous mixture)	Volume fraction	55 ... 100	%	10 ... 40 °C (50 ... 104 °F)
G21	Sugar / water (sucrose solution)	Mass fraction	40 ... 80	°Bx	75 ... 100 °C (167 ... 212 °F)
G30	Alcohol / water (homogenous mixture)	Mass fraction	66 ... 100	%	15 ... 40 °C (59 ... 104 °F)
G37	Alcohol / water (homogenous mixture)	Mass fraction	66 ... 100	%	10 ... 40 °C (50 ... 104 °F)

The user is responsible to ensure chemical compatibility of the wetted parts material in combination with the measured chemicals. For strong acids or oxidizers, a variant with wetted parts made of alloy 22/2.4602 is advised.

Batching function

Batching and filling processes are found in many industries: food and beverage, cosmetic, pharmaceutical, oil and gas and chemical.

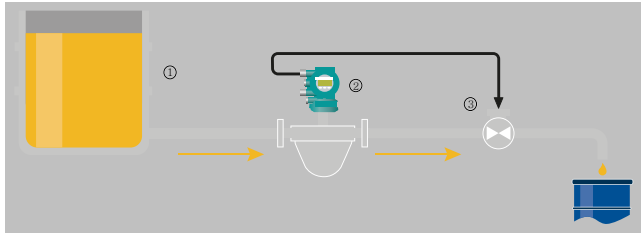# Flow Measurement

SITRANS FC (Coriolis)

Function (continued)

SITRANS FCT040 transmitters offer an integrated batching function to carry out the task. A self-learning algorithm optimizes the process to provide accurate and reliable results.
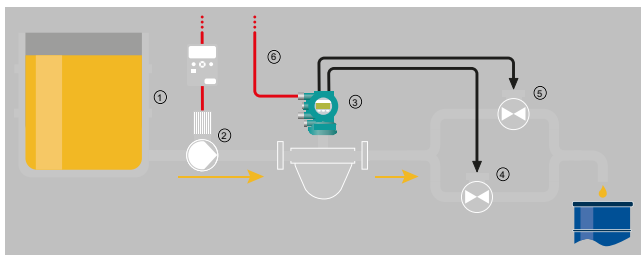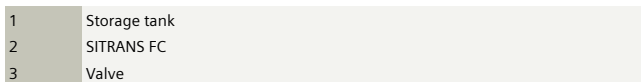
The function supports two filling modes:

- Single-stage batch control with single valve

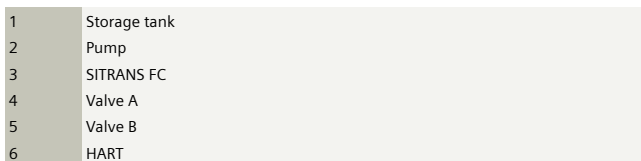- Two-stage batching to control two valves for more accurate filling

The error management function allows the user to set alarms and warnings according to the application.

Example diagram for 1-stage batching

1	Storage tank
2	SITRANS FC
3	Valve

Example diagram for 2-stage batching

1	Storage tank
2	Pump
3	SITRANS FC
4	Valve A
5	Valve B
6	HART

Overview of functions and features

Overview of the main functions and features of FCT040 transmitter	
Primary measurements	• Mass flow rate liquids (0.1% accuracy) • Mass flow rate gases (0.5% accuracy) • Density (accuracy 0.5 kg/m^3(0.03 lb/ft^3)) • Temperature
Secondary measurements	• Volume flow rate liquids • Actual volume flow rate gases • Normal (standard) volume flow rate gases • Standard concentration • Net oil computing • Fraction (up to 4 default ranges) • Fraction (customer specified) • Fraction A & B net mass flow rate • Fraction A & B net volume flow rate
Additional functions	• Heat (thermal energy) calculation • Viscosity calculation (liquids) • Batching and filling • NTEP custody transfer
Configuration and diagnostics	• microSD card (transmitter with display) • Easy setup wizard • Tube health check (self-verification) • Event management to NAMUR NE107
Inputs and outputs	• Up to 4 combined inputs and outputs
Inputs	• Analog input • Status input
Outputs	• Analog output • Pulse (frequency) or status output • Status output • Option for internal pull-up resistor
Digital communications	• HART • MODBUS • PROFIBUS PA • PROFINET over Ethernet-APL
Enclosure options	• Aluminum alloy with standard powder coating • Aluminum alloy with corrosion resistant coating • Stainless steel CF-8M (remote only)
Power supply	• Universal (AC and DC)

Configuration

Overview of available inputs, outputs and digital communications

The table below provides a matrix of all available combinations for the FCT040 transmitter.

Each combination is defined by a blend of two order code options:

- Ch 1 codes in the form "**E..**" define the required type of digital communication.

- Ch 2-4 codes in the form "**F..**" define the required combination of conventional inputs and outputs.

Abbreviations used in the table:

- Pulse or status output is abbreviated to "P/S output".

- Status only output is abbreviated to "S output".

- Status input is abbreviated to "S input".

Ch 1 code	Ch 2-4 code	I/O 1 (Channel 1)	I/O 2 (Channel 2)	I/O 3 (Channel 3)	I/O 4 (Channel 4)
E00	F00	none	none	none	none
E07 [1]	F01	passive mA HART output	passive P/S output	passive mA output	none
E07 [1]	F02	passive mA HART output	passive P/S output	passive mA output	passive P/S output
E07 [1]	F03	passive mA HART output	passive P/S output NAMUR	passive mA output	none
E07 [1]	F04	passive mA HART output	passive P/S output NAMUR	passive mA output	passive P/S output NAMUR
E06	F11	active mA HART output	passive P/S output	none	none
E06	F12	active mA HART output	passive P/S output	passive S output	passive P/S output
E06	F13	active mA HART output	passive P/S output	volt free S input	passive P/S output
E06	F14	active mA HART output	passive P/S output	passive P/S output	active mA input
E06	F15	active mA HART output	passive P/S output	passive P/S output	passive mA input
E06	F16	active mA HART output	passive P/S output	passive mA output	active mA input
E06	F17	active mA HART output	passive P/S output	passive mA output	passive mA input
E06	F18	active mA HART output	passive P/S output	volt free S input	active mA input
E06	F19	active mA HART output	passive P/S output	volt free S input	passive mA input
E06	F20	active mA HART output	passive P/S output	volt free S input	active P/S output
E06	F21	active mA HART output	passive P/S output	volt free S input	active P/S output and pull-up
E06	F22	active mA HART output	passive P/S output	passive P/S output	active mA output
E06	F23	active mA HART output	passive P/S output	volt free S input	active mA output
E14	F31	none	passive P/S output	MODBUS C	MODBUS A & B
E14	F32	passive P/S output	passive P/S output	MODBUS C	MODBUS A & B
E14	F33	active mA input	passive P/S output	MODBUS C	MODBUS A & B
E14	F34	passive mA input	passive P/S output	MODBUS C	MODBUS A & B
E14	F35	active P/S output	passive P/S output	MODBUS C	MODBUS A & B
E14	F36	active P/S output and pull-up	passive P/S output	MODBUS C	MODBUS A & B
E14	F37	active mA output	passive P/S output	MODBUS C	MODBUS A & B
E10	F41	PROFIBUS PA	passive pulse output	none	none
E10	F42	PROFIBUS PA (IS)	passive pulse output (IS)	none	none
E15	F50	PROFINET over Ethernet-APL (IS)	none	1 passive pulse output (IS)	none

[1] Any combinations with passive mA HART output on Channel are only possible with Ex approval. All outputs in these combinations are intrinsically safe.

Flow Measurement

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Transmitters / SITRANS FCT040

Technical specifications

Mechanical specifications

Material specifications			
Housing material options	**Coating**	**Design**	**Order code position 14**
Cast aluminum alloy Al-Si10Mg(Fe)	Standard coating[1]	Remote transmitter	C or D
Cast aluminum alloy Al-Si10Mg(Fe)	Corrosion resistant coating[2]	Remote transmitter	E or F
ASTM CF8M stainless steel	None	Remote transmitter	G or H
Display			
Material of the lid window	Glass		
Mounting bracket[3]			
Material	AISI 316L stainless steel	Mat. no. 1.4404	
Nameplates[4]	**Process temperature range**	**Nameplate material**	
Transmitter with cast aluminum housing	Not applicable	Foil	
Transmitter with ASTM CF8M stainless steel housing	Not applicable	AISI 316L ss	

[1] Standard coating is urethane cured polyester powder coating.
[2] Corrosion protection coating is a three-layer coating with high chemical resistance (polyurethane coating on two layers of epoxy).
[3] Only the remote transmitters are supplied with a mounting bracket.
[4] Nameplate material depends on the materials selected for SITRANS FC sensors.

Electrical specifications

Power supply	
Alternating current voltage (rms)	nominal 24 V AC (-15% ... +10%), or 100 ... 240 V AC (-20% ... +10%)
Frequency	47 ... 63 Hz
Direct current voltage	nominal 24 V DC (-15% ... +20%) or 100 ... 120 V DC (-10% ... +8.3%)
Power consumption	P ≤ 10 W (including sensor)

Notes:

• For DNV approval option supply voltage is limited to 24 V.

• NAMUR NE21 testing specifies the range 24 V DC ±20% under NE21 test conditions.

Power supply failure

In the event of a power failure, the flowmeter data are backed up on a non-volatile internal memory. In case of devices with display, the characteristic sensor values, such as nominal diameter, serial number, calibration constants, zero point and the error history are also stored on a microSD card.

Galvanic isolation

All circuits for inputs, outputs and power supply are galvanically isolated from each other.

Analog inputs and outputs

Analog input

Analog inputs	
Active current input[1]	
Nominal input current range	4 ... 20 mA
Maximum input current range	2.4 ... 21.6 mA
Internal power supply	24 V DC ±20%
Internal load resistance	≤ 160 Ω
Passive current input[2]	
Nominal input current range	4 ... 20 mA
Maximum input current range	2.4 ... 21.6 mA
External power supply	10.5 ... 32 V DC
Internal load resistance	≤ 160 Ω

[1] The active current input is provided for connecting a two-wire transmitter with an output signal of 4 ... 20 mA.
[2] The passive current input is provided for connecting a four-wire transmitter with an active current output signal.

Note: One analog current input is available for external analog devices.

Analog output

Up to two analog outputs can be selected at time of ordering. The analog outputs can be configured to represent the following measured values:

• Flow rate (mass, volume, net partial component flow of a mixture)

• Density

• Temperature

• Pressure

• Concentration

HART communication, when selected, is supplied on channel 1 (I/O 1). The current output may be operated in compliance with the NAMUR NE43 standard.

Analog outputs	
Active current output	
Nominal output current range	4 ... 20 mA
Maximum output current range	2.4 ... 21.6 mA
Load resistance	≤ 750 Ω
Load resistance for secure HART communication	230 ... 600 Ω
Passive current output	
Nominal output current range	4 ... 20 mA
Maximum output current range	2.4 ... 21.6 mA
External power supply	10.5 ... 32 VDC
Load resistance for secure HART communication	230 ... 600 Ω
Load resistance at current output	≤ 911 Ω

Technical specifications (continued)

R in Ω

$$R = \frac{U - 10.5\ V}{0.0236\ A}$$
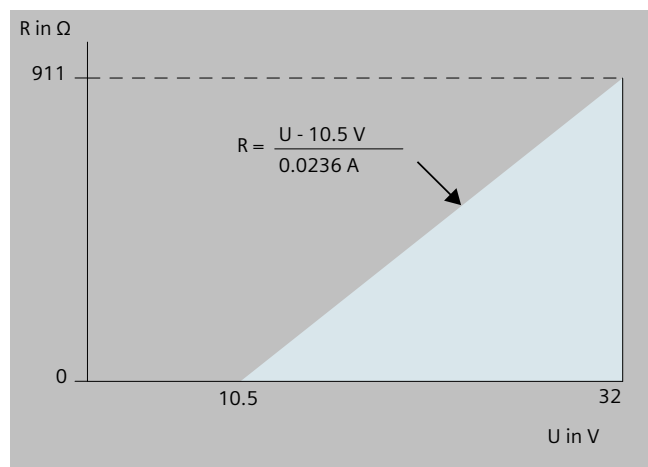
Maximum load resistance as a function of an external power supply voltage

[1] The active current input is provided for connecting a two-wire transmitter with an output signal of 4 ... 20 mA.
[2] The passive current input is provided for connecting a four-wire transmitter with an active current output signal.

Digital inputs and outputs

Digital inputs (status)

Do not connect a signal source with electric voltage.

The status input is provided for use of voltage-free contacts with the following specification:

Resistance when closed	< 200 Ω
Resistance when open	> 100 kΩ

Digital communications

Each transmitter is configured with one default digital communication interface, selectable in the SITRANS FC order code.

HART

When selected, HART communication is supplied on the output terminal pair I/O 1.

Up to three further Input/Output options can be configured for output terminal pairs I/O 2, I/O 3, and I/O 4.

HART is available with either non-intrinsically safe or intrinsically safe outputs.

PROFIBUS PA

- When selected, PROFIBUS PA communication is supplied on the output terminal pair I/O 1.
- PROFIBUS PA interface is available with and without intrinsic safety.
- PROFIBUS PA digital communication signal is in accordance with IEC 61158/61784.
- Maximum voltage and correct polarity must be observed for wiring.
- Power supply: 9 ... 32 V DC
- Current draw: 15 mA (maximum)
- Compliance with PA profile revision 3.02 supporting: Condensed Status (NE107)
- Device identification number (IDENT_NUMBER) adaption

Digital output

Digital outputs	
Active pulse output available on Pulse/Status output, connection of an electronic counter[1]	
Load resistance	> 1 kΩ
Internal power supply	24 V DC ±20%
Maximum pulse rate	10 000 pulses/s
Frequency range	0 ... 12.5 kHz
Active pulse output available on Pulse/Status output, connection of an electromechanical counter	
Maximum current	150 mA
Average current	≤ 30 mA
Internal power supply	24 V DC ±20%
Maximum pulse rate	2 pulses/s
Pulse width	20, 33, 50, or 100 ms
Active pulse output available on Pulse/Status output, with internal pull-up resistor	
Internal power supply	24 V DC ±20%
Internal pull-up resistor	2.2 kΩ
Maximum pulse rate	10 000 pulses/s
Frequency range	0 ... 12.5 kHz
Passive pulse output available on Pulse/Status output[1]	
Maximum load current	≤ 200 mA
External power supply	≤ 30 V DC
Maximum pulse rate	10 000 pulses/s
Frequency range	0 ... 12.5 kHz
Active status output available on Pulse/Status output[2]	
Load resistance	> 1 kΩ
Internal power supply	24 V DC ±20%
Active status output available on Pulse/Status output, with internal pull-up resistor[3]	
Internal pull-up resistor	2.2 kΩ
Internal power supply	24 V DC ±20%
Passive status output available on Pulse/Status output, or Status output	
Output current	≤ 200 mA
External power supply	≤ 30 V DC
Passive pulse or status output available on Pulse/Status output (NAMUR)	Output signals according to EN 60947-5-6 (previously NAMUR, worksheet NA001)

[1] Maximum voltage and correct polarity must be observed for wiring.
[2] Since this is a transistor contact, maximum allowed current as well as polarity and level of output voltage must be observed during wiring.
[3] A relay must be connected in series to switch alternating voltage.

Summary of available function blocks – PROFIBUS PA

Function block	Code	Description
Transducer block	FTB	Flow
	CTB	Concentration
	LTB	LCD Indicator
	MTB	Maintenance
	SDBT	Advanced diagnostics
Analog input block [1]	AI1	Mass flow
	AI2	Density
	AI3	Temperature
	AI4	Volume flow
	AI5	Reference density
	AI6	Corrected (normal/standard) volume flow

Flow Measurement

SITRANS FC (Coriolis)

Technical specifications (continued)

Function block	Code	Description
Totalizer block [1]	TOT1	Mass
	TOT2	Volume
	TOT3	Corrected (normal/standard) volume
Analog output block [1]	AO	Pressure

[1] Factory default setting. Assignment can be changed by parameter "channel".

Available function blocks are also influenced by the type of device description file (GSD) being used. For further details, please contact your regional Siemens Measurement Intelligence team.

MODBUS

- The MODBUS interface is available with up to two additional Input/Output options.
- When selected, MODBUS communication is supplied on the terminal pairs I/O 3 and I/O 4.
- The digital MODBUS communication signal is in accordance with EIA-485 standard (RS 485).

PROFINET over Ethernet-APL

Display attributes	
Type	4-line dot-matrix display
Resolution	128 × 64 (W × H) dots
Size	64.6 × 31.2 mm (2.54 × 1.23 inch)
Control	via IR switches

Numerical values entered via the display are limited to six digits for process variables and eight digits for totalizer.
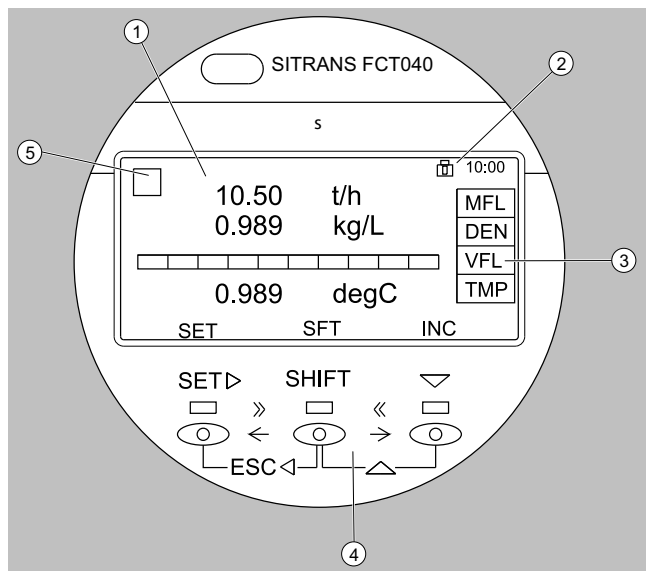
Display layout

1	Measured quantities and units
2	Status icon and time
3	Measured quantity abbreviation
4	IR switches
5	Alarm symbol

The controls on the display are IR switches. They respond as soon as an object, such as a finger, is in proximity. It is not necessary to apply pressure to the display surface.

The display unit includes a slot for the microSD card.

microSD card specifications	
Type	Industrial Grade microSD card, compliant with SD specification version 2.0
Physical dimension	15 × 11 × 1.0 mm (± 0.1 mm) (0.6 × 0.4 × 0.04 inch (± 0.004"))
Capacity	1 GB
Sequential throughput (read)	24.01 MB/s
Sequential throughput (write)	17.96 MB/s

It is recommended to use the microSD card included with the SITRANS FCT transmitter. Functionality of the device cannot be guaranteed if other cards are used.

Cable specifications

For remote type devices, an interconnecting cable must be used to connect the sensor to the transmitter. The device specifications, stated in this document, are valid only if one of the original SITRANS FC interconnecting cables is used.

Standard cable length options are specified up to 30 m are specified in the order code to maintain the stated specifications. Cables longer than 30 m (98 ft) are available but must be ordered as separate items. For further details, please contact your regional Siemens Measurement Intelligence team.

Dimensional drawings

SITRANS FCT040 transmitter dimensions
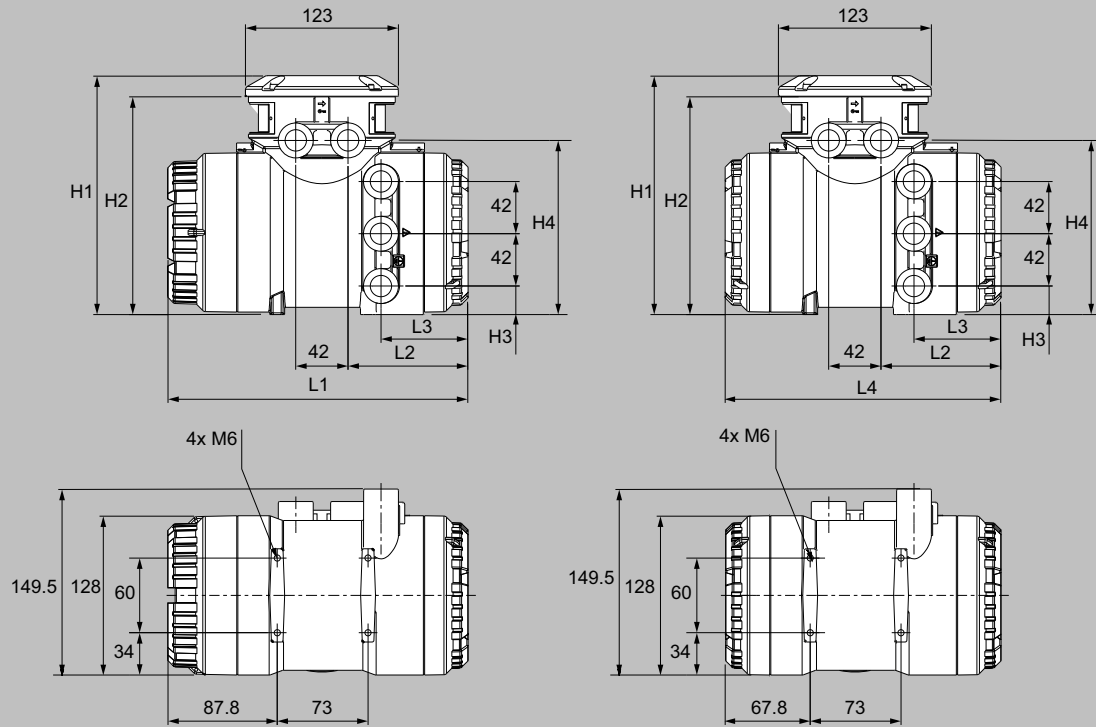
Dimensions of FCT040 transmitter in mm. Transmitter with display shown on the left. Transmitter without display shown on the right.

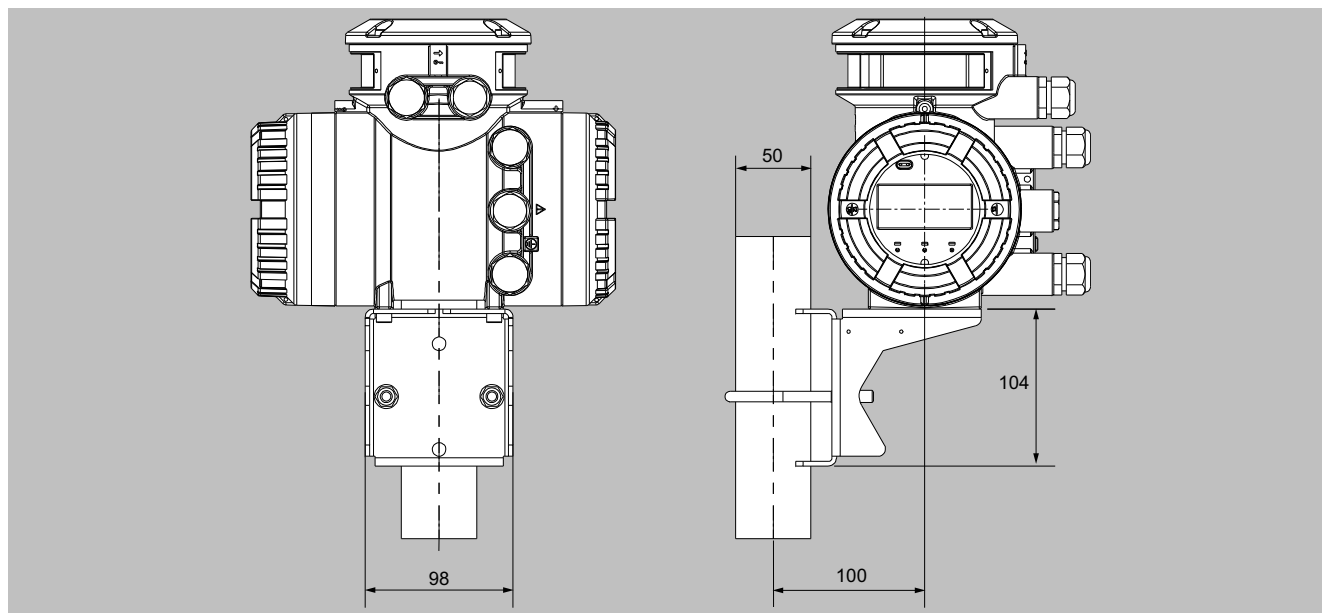Dimensions L1 to L4 and H1 to H4 (material options: stainless steel, aluminum)

Material	L1 in mm (inch)	L2 in mm (inch)	L3 in mm (inch)	L4 in mm (inch)	H1 in mm (inch)	H2 in mm (inch)	H3 in mm (inch)	H4 in mm (inch)
Stainless steel	255.5 (10.06)	110.5 (4.35)	69 (2.72)	235 (9.25)	201 (7.91)	184 (7.24)	24 (0.94)	150.5 (5.93)
Aluminum	241.5 (9.51)	96.5 (3.8)	70 (2.76)	221 (8.7)	192 (7.56)	175 (6.89)	23 (0.91)	140 (5.51)

Dimensional drawings (continued)

Dimensions of transmitter in mm, attached to mounting bracket

Transmitter weights

Design type	Transmitter enclosure material	Weight in kg (lb)
Remote	Cast aluminum	4.2 (9.3)
	CF-8M stainless steel	12.5 (27.6)

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