

# ST100L Mass Flow Meter

## Thermal Dispersion Air/Gas In-Line Flow Meter



### Model ST100L Features

- Compatible with More than 200 Gases
- Direct Mass Flow Measurement
- Dual Function – Flow and Temperature
- Temperature Service to 250 °F [121 °C]
- No Moving Parts, Non-Clogging
- Best-In-Class Digital / Graphical Readout
- Multiple Analog Outputs
- Extensive Bus Communications Options
- Line Sizes ≤ 2" [50 mm]
- Agency Approvals on Full Instrument
- On-Board Data Logger

The Model ST100L is an in-line, spool piece gas flow meter that combines best-in-class transmitter/electronics and superior calibration to provide a truly state-of-the-art gas flow meter for industrial process and plant applications with line sizes up to 2 inches [50 mm].

#### Flow Element and Process Connections

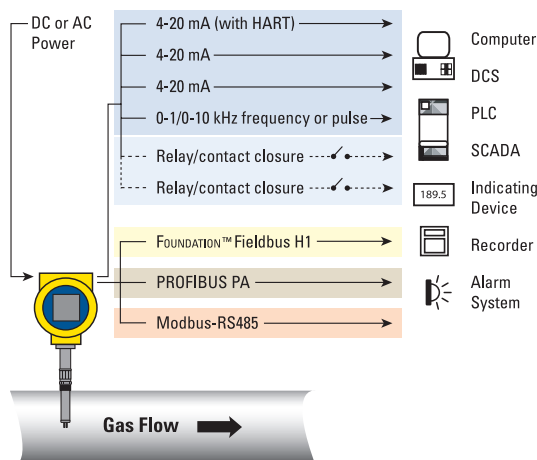
- All welded construction
- 316L stainless steel or Hastelloy-C276
- Fast response and extra-rugged duty choices
- Variable (adjustable) and fixed insertion depths
- NPT, flange, butt weld

#### Transmitter and Electronics

- All metal enclosure
- Four (4) conduit ports
- 2" x 2" [50 mm x 50 mm] backlit LCD readout/display
- Flow, total flow and temperature
- Triple analog outputs with HART
- FOUNDATION™ fieldbus, PROFIBUS PA, Modbus options
- Dual relays/alarms option
- Integral or remote mounting (up to 1000')
- AC or DC power
- FM, FMc, ATEX and IECEx approvals for Division 1, Zone 1 hazardous locations
- Standard and extended range temperature compensation
- Data logging to removable micro-SD card

#### Calibration

- Calibrated to your installation conditions and gas specifications on one of 18 precision, NIST traceable flow stands
- Up to five (5) unique calibrations stored onboard
- SpectraCal™ – 10 user selectable / changeable gases



# Model ST100L Features

Four conduit ports provide greatest signal integrity and separation for power input, analog output lines, digital I/O, relays and/or auxiliary input signals; choice of NPT or M20 threads

AC or DC power supply

Weather-proof, ruggedized, Ex rated enclosures

- Choices for local or remote mounting
- NEMA 4X, IP67

Global agency approvals of entire instrument system for hazardous location installations:

FM, FMc, ATEX, IEC, NEPSI, CPA  
NEPSI, CPA, Inmetro, GOST-R, GOST-K pending

Multiple calibrations

- Up to five independent, separate calibrations
- Multiple gases or mixed gas compositions
- Same gas, different flow range to optimize accuracy and extend turndown up to 1000:1

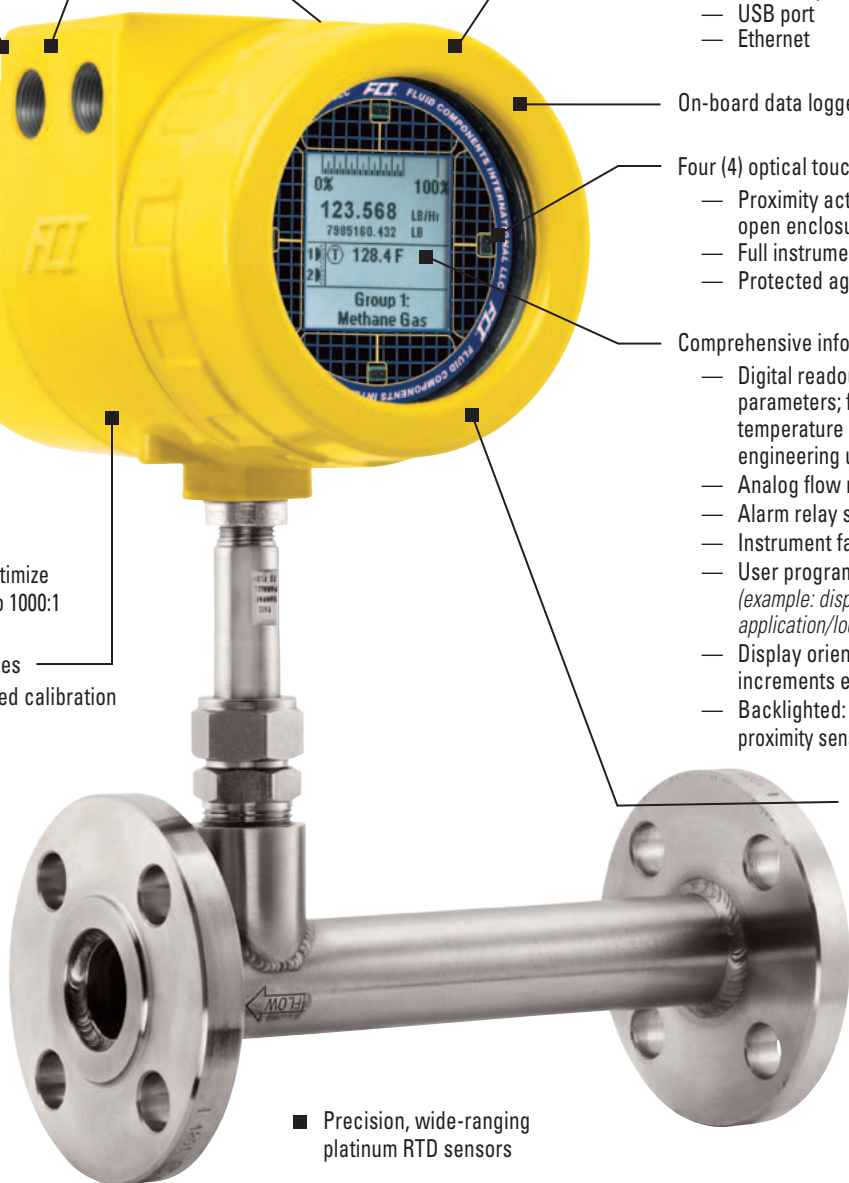
Precision calibration and calibration choices

- Specific gas and application matched calibration in FCI NIST traceable facility
- Exclusive patented SpectraCal gas equivalency calibration with ten (10) user selectable gases

Extensive selection of process connections

- Male NPT
- Female NPT
- ANSI or DIN flanges
- Butt weld

Stainless steel or Hastelloy-C276 wetted parts



Extensive analog and digital communications output choices

- Triple 4-20mA with HART
- FOUNDATION™ fieldbus H1
- PROFIBUS PA
- Modbus RS-485
- 0-1 kHz or 0-10 kHz frequency or pulse
- Dual relays
- USB port
- Ethernet

On-board data logger

Four (4) optical touch buttons

- Proximity activation, no need to open enclosure
- Full instrument programmability
- Protected against unwanted activation

Comprehensive informational display

- Digital readout of all measured parameters; flow rate, total flow, temperature and pressure with engineering units
- Analog flow rate bar graph
- Alarm relay status indication
- Instrument fault indication
- User programmable 17 character field (example: display gas type, tag number or application/location)
- Display orientation rotates in 90° increments electronically
- Backlighted: auto-on activation via proximity sensor or set for always on

Multi-function: measures mass flow rate and temperature

■ Precision, wide-ranging platinum RTD sensors

■ Exclusive equal mass sensors provide optimum performance in processes with wide temperature swings

Optional built-in Vortab® flow conditioner



## Instrument

- **Measuring Capability:** Flow rate, total flow and temperature
- **Basic Style:** In-line (spool piece), single element
- **Flow Measurement Range:** 0.0062 SCFM to 1850 SCFM [0.01 Nm<sup>3</sup>/h to 3,140 Nm<sup>3</sup>/h] – Air at standard conditions; 70 °F and 14.7 psia [0 °C and 1,01325 bar (a)]
- **Temperature Measurement Range:** Up to 250 °F [121 °C] commensurate with element
- **Media:** All gases that are compatible with the flow element material
- **Accuracy**  
**Flow:**  
 Gas Specific Calibration: ±0.75% reading, ±0.5% full scale  
 SpectraCal™ Gas Equivalency: Typically ±4% reading, ±0.5% full scale; gas conditions specific to application will determine accuracy; *utilize FCI's online tool, AVAL, to evaluate your application and provide expected accuracy*  
**Temperature:** ±2 °F [±1 °C] (display only, flow rate must be greater than 5 AFPS [1.5 m/sec])
- **Repeatability**  
**Flow:** ±0.5% reading  
**Temperature:** ±1 °F [±1 °C] (flow rate must be greater than 5 AFPS)
- **Temperature Coefficient**  
*With optional temperature compensation; valid from 10% to 100% of full scale calibration*  
**Flow:** Maximum ±0.015% of reading / °F up to 250 °F [±0.03% of reading / °C up to 121 °C]
- **Turndown Ratio**  
**Standard:** Factory set and field adjustable from 10:1 to 100:1 within calibrated flow range
- **Temperature Compensation**  
**Standard:** ±30 °F [±16 °C]  
**Optional:** ±100 °F [±55 °C]
- **Agency Approvals**  
 FM, FMc (Canadian): Class I, Division 1, Hazardous Locations; Groups B,C,D,E,F,G  
 ATEX and IECEx: Zone 1, II 2 GD Ex d IIC T4  
 NEPSI, CPA, Inmetro, GOST-R, GOST-K pending
- **Calibration:** Performed on NIST traceable equipment

## Flow Element

- **Material of Construction**  
 All-welded 316L stainless steel; Hastelloy-C optional
- **Operating Pressure:** 250 psig [17 bar (g)]
- **Fixed Connection Flanged:** per flange rating
- **Operating Temperature (Process)**  
 –FP and –S Style Flow Element: -40 °F to 250 °F [-40 °C to 121 °C]
- **ST100L In-line Flow Tube**  
 Flow element is threaded and keyed in an in-line flow tube, calibrated and supplied as a spool-piece; options include low flow injection tubes and built-in Vortab flow conditioners for optimum low flow rangeability and performance  
**Size:** 1" diameter tubing; 1", 1 1/2" or 2" schedule 40 pipe  
**Length:** 9 nominal diameters  
**Process Connections:** Female NPT, male NPT, ANSI or DIN flanges, or butt weld prepared  
**Option:** Flanges sized for flow tube
- **Remote Transmitter Configurations:** Transmitter may be mounted remotely from flow element using interconnecting cable (up to 1000' [300 m])

## Flow Transmitter/Electronics

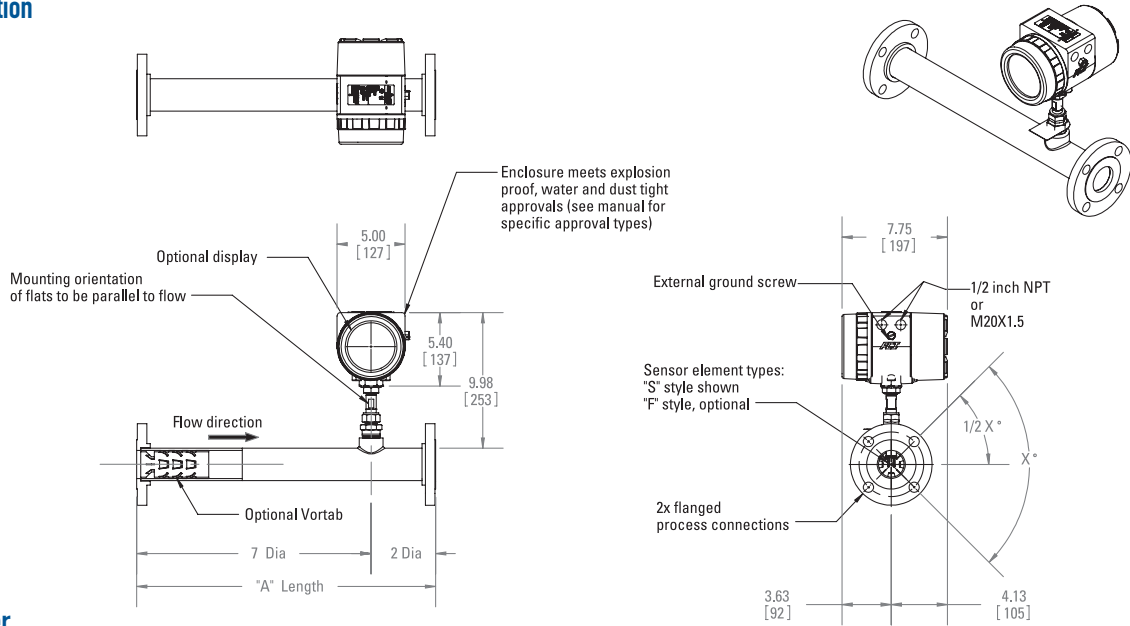
- **Operating Temperature:** 0 °F to 150 °F [-18 ° to 65 °C]
  - **Input Power**  
**AC:** 85 Vac to 265 Vac  
**DC:** 24 Vdc ±20%
  - **Outputs**  
**Analog**  
 Standard: Three (3) 4-20 mA\*, 0-1kHz, or 0-10 kHz pulse/frequency  
 4-20 mA outputs are user assignable to flow rate, temperature and/or if so equipped, pressure; outputs are user programmable to full flow range or subsets of full flow range; pulse/frequency output is user selectable as pulse for external counter/flow totalizer, or as 0-1 kHz or 0-10 kHz frequency representing flow rate  
 \* *Outputs are isolated and have fault indication per NAMUR NE43 guidelines, user selectable for high (>21.0 mA) or low (<3.6 mA)*  
 Optional: Standard output plus two (2) 2A SPDT relays  
 Relays independently user assignable to flow, temperature or pressure; user programmable for hi/lo trip, hysteresis from 00.0 to 99.9 counts and time delay from 00.0 to 99.9 seconds
  - **Digital**  
 Standard: USB, Ethernet  
 Optional: HART (comes standard with analog outputs, V7 compliant) FOUNDATION™ fieldbus H1, PROFIBUS PA or Modbus RS-485
  - **Auxiliary Inputs**  
 Two 4-20 mA input channels; used for FCI administered special configurations to allow ST100L series to accept outputs from external devices such as gas analyzers, gas composition or pressure sensors
  - **Enclosures**  
**Main Transmitter/Electronics:**  
 NEMA 4X, IP67; polyester powder coated aluminum; 4 conduit ports threaded as 1/2" NPT or M20x1.5; 7.74" x 5.40" x 5.00" [196.6 mm x 137.2 mm x 127 mm]; *stainless steel enclosure pending*  
**Local Enclosure (Remote Configuration):**  
 NEMA 4X, IP67; polyester powder coated aluminum; 2 conduit ports threaded as 1/2" NPT or M20x1.5; 3.75" x 4.00" x 3.24" [95 mm x 102 mm x 82 mm]
  - **Data Logger**  
 User programmable for readings per time increment to a maximum of 1 reading/second; removable, circuit board-mountable 2GB micro-SD (secure digital) memory card supplied; stores approximately 21M readings in ASCII comma-separated format
  - **Readout/Display and Optical Touch Buttons (Optional):**
    - Large 2" x 2" [50 mm x 50 mm] LCD; digital plus bar graph and engineering units
    - Digital displays of flow rate, total flow, temperature and pressure (with STP models); user selectable for engineering units
    - Analog bar graph of flow rate
    - Relay/alarm status indication
    - User programmable 17 alphanumeric character field associated with each calibration group
    - Set-Up & Service mode displays text and service codes
    - Backlighting – backlight activated by proximity motion detection, or user may set for always on
    - Four (4) optical touch buttons for user programming of instrument set-up and service interrogation
    - Optical touch button activation through front window – no need to open enclosure to access or activate
    - Display is electronically rotatable in 90° increments to optimize viewing angle
- Note: If readout/display not ordered, all user set-up and service interrogation must be done via computer link to bus comm and/or USB port.*

*Specifications at reference operating conditions of 70 °F, 14.7 psia [21.1 °C, 1.013bar (a)] and straight pipe run 20d upstream, 10d downstream*

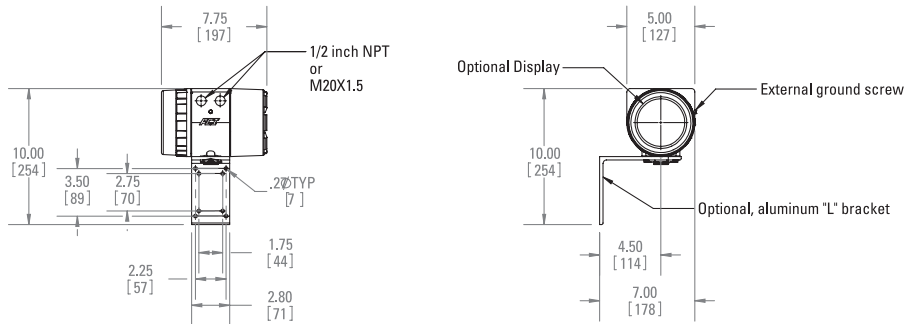
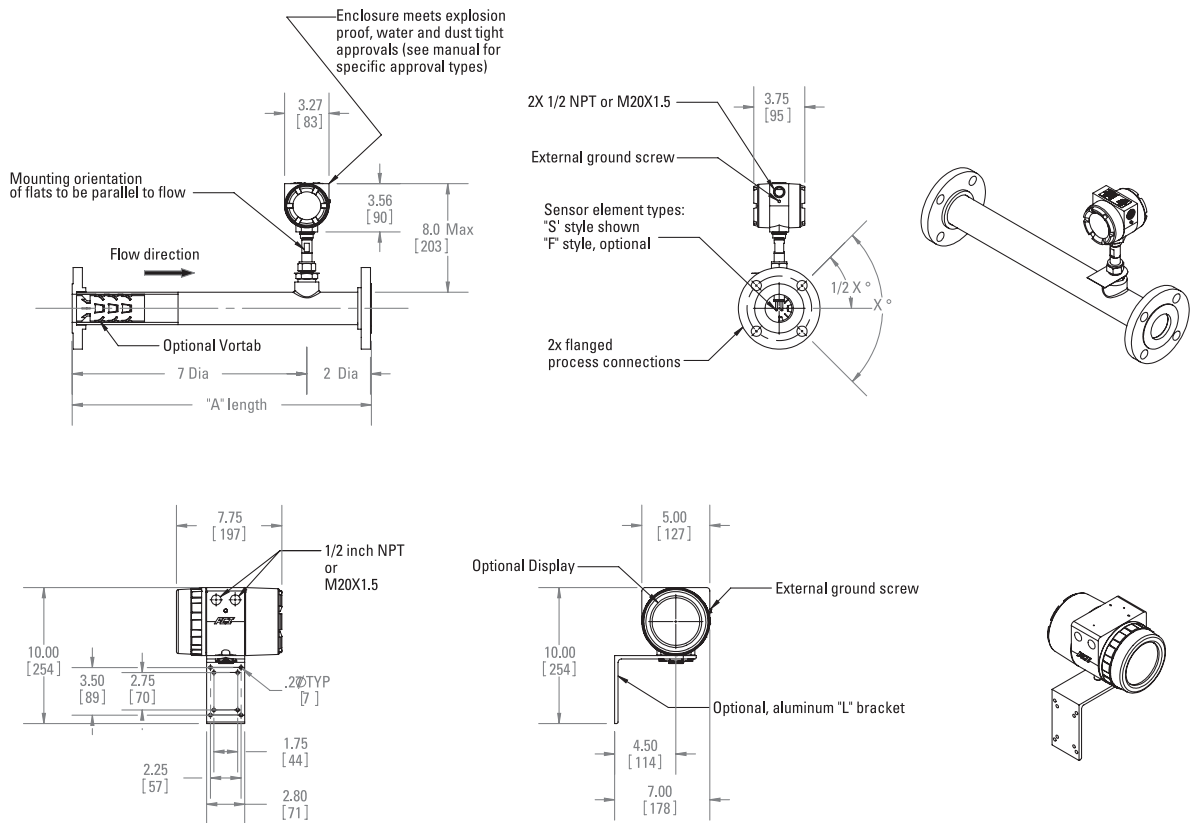
*FCI is a continuous improvement company; specifications subject to change without notice*

# Model ST100L In-Line Mass Flow Meter

## Integral Configuration



## Remote Transmitter



**FCI FLUID COMPONENTS INTERNATIONAL LLC**

Locally Represented By:

Visit FCI online at [www.FluidComponents.com](http://www.FluidComponents.com) | FCI is ISO 9001:2000 and AS9100 Certified

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**ST100L** - 

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Block No.      1    2    3    4    5    6    7    8      9    10    11    12    13      14    15    16    17    18      19

**INSTRUCTIONS:** To order an **ST100L**, please fill in each numbered block above by selecting required codes from the corresponding categories below. Use of any "W" or "\*" codes requires prior approval from FCI. For special data, documentation, test reports or required quality reports, refer to FCI's Engineering and Quality Assurance Order Information Sheets (OIS).

Flow Element	
<b>Code</b>	<b>[BLOCK 1] Flow Element: Temperature Service, Type and Materials of Construction</b>
<b>4</b>	-F style, 316L stainless steel, to 250 °F [121 °C]
<b>D</b>	-F style, Hastelloy C276, to 250 °F [121 °C]
<b>7</b>	-S style, 316L stainless steel, to 250 °F [121 °C]
<b>G</b>	-S style, Hastelloy C276, to 250 °F [121 °C]
<b>W</b>	Agency approved, customer specified
<b>*</b>	Other, not agency approved
<b>Code</b>	<b>[BLOCK 2] In-Line Body Material of Construction</b>
<b>3</b>	316L Stainless steel; all welded connection of sensor element
<b>4</b>	Hastelloy C276 <sup>15, 18</sup> ; all welded connection of sensor element
<b>Code</b>	<b>[BLOCK 3] In-Line Body Type / Diameter / Length</b>
<b>A</b>	1 inch tubing <sup>18</sup> 9 inch [229 mm]
<b>B</b>	1 inch tubing with 1/8 inch injection tube reducer <sup>18</sup> 9 inch [229 mm]
<b>C</b>	1 inch tubing with 1/4 inch injection tube reducer <sup>18</sup> 9 inch [229 mm]
<b>D</b>	1 inch tubing with built-in Vortab flow conditioner <sup>18</sup> 9 inch [229 mm]
<b>E</b>	1 inch pipe, schedule 40 9 inch [229 mm]
<b>F</b>	1 inch pipe, schedule 40 with built-in Vortab flow conditioner 9 inch [229 mm]
<b>L</b>	1 inch pipe, schedule 80 9 inch [229 mm]
<b>M</b>	1 inch pipe, schedule 80 with built-in Vortab flow conditioner 9 inch [229 mm]
<b>G</b>	1 1/2 inch pipe, schedule 40 13 1/2 inch [343 mm]
<b>H</b>	1 1/2 inch pipe, schedule 40 with built-in Vortab flow conditioner 13 1/2 inch [343 mm]
<b>J</b>	2 inch pipe, schedule 40 18 inch [457 mm]
<b>K</b>	2 inch pipe, schedule 40 with built-in Vortab flow conditioner 18 inch [457 mm]
<b>W</b>	Agency approved, customer specified
<b>*</b>	Other, not agency approved
<b>Code</b>	<b>[BLOCK 4] In-Line Body Type / Diameter</b>
<b>7</b>	NPT, male
<b>8</b>	NPT, female
Table A	Flanged <sup>15</sup>
<b>Z</b>	Butt weld preparation <sup>19</sup>
<b>W</b>	Agency approved, customer specified
<b>*</b>	Other, not agency approved
<b>Code</b>	<b>[BLOCKS 5-7]</b>
<b>BLOCK 5</b>	<b>Code</b>
<b>BLOCK 6</b>	<b>Code</b>
<b>BLOCK 7</b>	<b>Code</b>
<b>0</b>	<b>0</b>
<b>0</b>	<b>0</b>
<i>Block 5, 6, 7 Codes are always "0" with Model ST100L</i>	
<b>Code</b>	<b>[BLOCK 8] Pipe Mounting and Flow Direction</b>
<b>1</b>	Horizontal, flow right-to-left or vertical up
<b>2</b>	Horizontal, flow left-to-right or vertical down

Transmitter and Electronics	
<b>Code</b>	<b>[BLOCK 9] Transmitter Mounting, Enclosure Material and Cable Entry Threading</b>
<b>1</b>	Integral mount, aluminum, NPT cable entries <sup>6</sup>
<b>A</b>	Integral mount, aluminum, metric cable entries <sup>6</sup>
<b>2</b>	Remote mount, aluminum, NPT cable entries <sup>6</sup>
<b>B</b>	Remote mount, aluminum, metric cable entries <sup>6</sup>
<b>3</b>	Integral mount, stainless steel; NPT cable entries <sup>6</sup>
<b>C</b>	Integral mount, stainless steel; metric cable entries <sup>6</sup>
<b>4</b>	Remote mount, stainless steel; NPT cable entries <sup>6</sup>
<b>D</b>	Remote mount, stainless steel; metric cable entries <sup>6</sup>
<b>W</b>	Agency approved, customer specified
<b>*</b>	Other, not agency approved

(continued next page)

Table A – Flange [BLOCK 4]			
CS <sup>15</sup>	316L SS	Hast C	Material
	<b>9</b>		ANSI 3/4 inch 150 lb
<b>D</b>	<b>1</b>	<b>C</b>	ANSI 1 inch 150 lb
<b>E</b>	<b>A</b>	<b>G</b>	ANSI 1 inch 300 lb
<b>F</b>	<b>2</b>	<b>H</b>	ANSI 1 1/2 inch 150 lb
<b>K</b>	<b>B</b>	<b>J</b>	ANSI 1 1/2 inch 300 lb
<b>P</b>	<b>3</b>	<b>M</b>	ANSI 2 inch 150 lb
<b>R</b>	<b>L</b>	<b>N</b>	ANSI 2 inch 300 lb
	<b>T</b>		DIN DN25 PN40
	<b>V</b>		DIN DN40 PN40
	<b>6</b>		DIN DN50 PN16
	<b>Y</b>		DIN DN50 PN40
<b>W</b>			Agency approved, customer specified

**Notes**

6. See Notes, page 2
7. Remote cable in an ST100 Series model is 8-conductor; remote cable in an STP100 Series model is 10-conductor. For user-supplied cable, overall shielded conductor type is required and wire resistance must be less than 8 Ohms.
8. Cable suitable for conduit and some cable gland systems. For other cable gland system choices, see ST100 accessories list or contact FCI to supply separately. PVC cable maximum temperature 176 °F [80 °C]; Teflon cable maximum temperature 392 °F [200 °C].
15. Carbon steel flanges available only with 316L stainless steel body type (Block 2, Codes 1 or 3). Cannot select carbon steel flange when Hastelloy is selected in Block 2.
18. With 1" inch tubing:
  - a) Not available in Hastelloy; Block 2 must be Codes 1 or 3 only
  - b) If NPT selected in Block 4 (Code 7 or 8), NPT will be 3/4"
  - c) If flanged, connection must be 3/4" or 1" only and Block 4 Codes 9, D, 1, E or A
19. When welded into process piping, be aware that cutting or un-welding may be required to extract flow meter for service, repair and/or recalibration.

(continued from previous page)

Code	[BLOCK 10] Interconnecting Cable Length for Remote Configuration
0	Not required <i>Specify with integral configurations, user supplied cable, or if cable ordered as separate line item from ST100 series accessories</i> <sup>7,16</sup>
A	10 feet [3 meters] PVC jacketed <sup>8</sup>
B	25 feet [7,6 meters] PVC jacketed <sup>8</sup>
C	50 feet [15 meters] PVC jacketed <sup>8</sup>
D	100 feet [30 meters] PVC jacketed <sup>8</sup>
1	10 feet [3 meters] Teflon jacketed <sup>8</sup>
2	25 feet [7,6 meters] Teflon jacketed <sup>8</sup>
3	50 feet [15 meters] Teflon jacketed <sup>8</sup>
4	100 feet [30 meters] Teflon jacketed <sup>8</sup>
W	Other
*	Non agency approved cable type or length other than above

Code	[BLOCK 11] Transmitter Power Supply and Display
A	24 Vdc power (19.2 Vdc to 28.8 Vdc); no digital display
B	24 Vdc power (19.2 Vdc to 28.8 Vdc); with display
C	85 Vac to 265 Vac power; no display
D	85 Vac to 265 Vac power; with digital display

Code	[BLOCK 12] Transmitter Outputs and Communications
1	(3) 4-20 mA outputs, one with HART; (1) frequency/pulse output
F	FOUNDATION™ fieldbus H1 <sup>9</sup>
M	Modbus 485 <sup>9</sup>
P	PROFIBUS-PA <sup>9</sup>
W	Other
*	Other, not agency approved

Code	[BLOCK 13]
E	Always "E"

**Calibration**<sup>10, 11, 12</sup>

Code	[BLOCK 14] Calibration Application <i>Description for reference only; actual Code must be obtained using FCI AVAL</i> <sup>10, 11, 12</sup>
B	Air, standard
C	Custom, specific gas equivalency (digester gas, flue gas, etc.)
E	Nitrogen, helium, CO <sub>2</sub> , nitrous oxide
1	Natural gas (90% or greater methane content)
2	Natural gas (90% or greater methane content); line sizes smaller than 1 1/2 inch
F	Hydrocarbon (methane, ethane, propane)
G	Hydrogen or hydrogen mixture
H	Air, standard
J	Custom, specific gas equivalency (digester gas, flue gas, etc.)
K	Nitrogen, argon
L	CO <sub>2</sub> , ethelene, argon
M	Propylene or propane to 100 psig [7 bar (g)] maximum
N	Butane, pentane to 15 psig [1 bar (g)] maximum
P	Helium or methane
R	Hydrogen
W <sup>8</sup>	Agency approved, customer specified

Code	[BLOCK 15] Calibrations, Setup and Conditions
0	Standard
A	Extended temperature compensation
B	Extended range (> 100:1 turndown)
C	Vortab
E	Extended temperature compensation and extended range
F	Extended temperature compensation and Vortab
H	Extended range and Vortab
K	Extended temperature compensation, extended range and Vortab

Code	[BLOCKS 16-17] Second Calibration
0 0	Not required
<input type="checkbox"/> <input type="checkbox"/>	Select from Codes shown in Blocks 14-15

Code	[BLOCK 18] Additional Calibration Groups
0	Not required
3	Three (3) calibration groups; two as specified in Blocks 14-17, plus one additional <sup>14</sup>
4	Four (4) calibration groups; two as specified in Blocks 14-17, plus two additional <sup>14</sup>
5	Five (5) calibration groups; two as specified in Blocks 14-17, plus three additional <sup>14</sup>

**General**

Code	[BLOCK 19] Agency Approval
<i>CE Mark always included</i>	
0	Not required
1	FM
2	FMc, CRN
3	ATEX, IECEx <sup>16</sup>
5	EAC (TRCU) <i>Russia</i>
6	Inmetro
7	NEPSI
*	Other <i>Contact FCI for other approvals and conditions of use</i>

**Notes**

6. Transmitter enclosure has four (4) female conduit ports, NPT = 1/2", metric = M20 x 1.5. With remote mount, the local enclosure's conduit port (attached to the flow element) varies by type of process connection and enclosure material specified:

Model	Process Connection	Aluminum		Stainless Steel	
		NPT	Metric	NPT	Metric
ST100, ST102A	Block 3 = C, D, G, M, N, J, F*	(2) 1/2"	(2) M20 x 1.5	(1) 1/2"	(1) M20 x 1.5
ST100, ST102A	Block 3 = P, H, Q, K, R, L, T, V, Y, F**	(1) 1/2"	(1) M20 x 1.5	(1) 1/2"	(1) M20 x 1.5
ST100L	Block 3 = Any	(2) 1/2"	(2) M20 x 1.5	(1) 1/2"	(1) M20 x 1.5
ST110, ST112A, and all STP	Block 3 = Any	(1) 1/2"	(1) M20 x 1.5	(1) 1/2"	(1) M20 x 1.5

\* with 1" or DN25 flange

\*\* with flange size larger than 1" or DN25

- Cable suitable for conduit and some cable gland systems. For other cable gland system choices, see ST100 accessories list or contact FCI to supply separately. PVC cable maximum temperature 176°F [80°C]; Teflon cable maximum temperature 392°F [200°C].
- No analog, frequency/pulse, or other digital bus communications.
- FCI standard conditions are 14.7 psia [1,01 bar(a)] and 70°F [21.1°C].
- Calibration codes must be selected using FCI's proprietary AVAL application evaluation software.
- Transmitter setup, changes to factory supplied standard settings, verification or modification to calibration parameters or diagnostics requires external source communication with the transmitter.
- Customer specified calibration must not exceed temperature and pressure limitations of the ST100 Series product specifications.
- May specify up to three (3) additional calibrations for a total of five (5). Contact FCI for instructions on how to specify third, fourth and/or fifth calibration.
- ATEX/IECEx rated remote requires cable glands or conduit fittings which meet or exceed the installation area's required rating. When rated cable glands, armored cables and non-armored cable supplied are user supplied or selected from ST100 accessories list and ordered separately, enter Code 0 in Block 10.

**Accessories**

Part Number	Description
<b>Sun Shield Kits</b> Shades main transmitter, electronics, and/or display from direct sunlight; 316L stainless steel; attached directly to housing; kit includes shield, all hardware for attachment and instruction sheet	
023241-01	For use with <b>integral</b> mount transmitter
023237-01	For use with <b>remote</b> mount transmitter

Refer to separate ST100 Series Accessories List for a complete listing of all accessories such as cabling, ball valves, documentation test and QA documents and certificates, and spare parts.