

Gas Mass Flow Measurement



High Purity Mass Flow Measurement

The ST98 High Purity Mass flow meters are ideally suited for the pharmaceutical, biotech, food and beverage, and semiconductor industries. FCI's thermal dispersion technology provides exceptionally accurate and repeatable indications of mass flow rate. The sensing element combines two matched precision resistance temperature detectors (platinum RTDs). The active RTD is preferentially heated with a constant current. The reference RTD senses at the process fluid temperature. As flow passes the element a resistance differential is produced proportional to the mass flow rate.

The transmitter converts the differential temperature into a standard 4-20 mA output signal or HART or PROFIBUS DP bus that has been linearized during the N.I.S.T. traceable calibration of the flow element. Because the ST98 High Purity flow meters are inherently mass flow detectors, no additional components (i.e., pressure and temperature transducers) are required to provide a true mass flow output.

The ST98 HP High Purity features 15 Ra electropolish finish with a 1 inch sanitary flange mated to a 316L inline flow tube. The 316L flow tube features butt weld or sanitary flanged end process connections. The transmitter is housed in a NEMA Type 4, Type 4X or explosion-proof enclosure and may be integrally mounted to the flow element or remotely mounted up to 500 feet away.

ST98 HP FlexMASter High Purity

Features

- No moving parts
- True Mass flow output
- 316L stainless steel with all welded wetted surfaces
- 15 Ra electropolish for ST98 HP High Purity
- Integral electronics configuration
- Gas calibration
- RS232 communication port
- Field scalable 4-20 mA output
- Factory calibrated and certified to N.I.S.T. standards
- Optional LCD display indicating flow rate and process temperature and/or totalized flow
- Remote electronics configuration
- HART or PROFIBUS field communications protocol
- Calibration in hydrogen, helium, argon, etc.
- Oxygen cleaning for wetted surfaces

Industries

- Pharmaceutical
- Biotech
- Food and beverage
- Semiconductor
- Clean processes

Applications

- High purity gas monitoring
- Pill coater air flow monitoring
- CIP and SIP flow and temperature monitoring
- Condenser/evaporator flow control
- Scrubber gas discharge monitoring
- Process flow measurement and monitoring

Instrument Specifications

Flow Range

2.0 SCFM to 3183 SCFM [3,4 NCMH to 5409 NCMH] in air at standard conditions for 70 °F [21,1 °C] and 14.7 psia [1,01325 bar(a)], typical to most gases; all gases must be compatible with the flow element material

Accuracy

Flow: ±1 % reading, +0.5 % full scale accuracy (standard)

Temperature: ±2 °F [±1 °C] (for display only; flow rate must be greater than 5 AFPS [1.5 AMPS])

Repeatability

Flow: ±0.5 % reading

Temperature: ±1 °F [±0.6 °C] (flow rate must be greater than 5 AFPS [1.5 AMPS])

Turndown Ratio: Factory set and field adjustable from 10:1 to 100:1 within calibrated flow range

Temperature Compensation

Standard: ±30 °F [±1 °C]

Optional: ±100 °F [±38 °C]

Agency Approvals

FM, ATEX, CSA, CRN, IEC, CPA, NEPSI, GOST/RTN, CE, PED (system approvals)

Calibration

Performed and certified on N.I.S.T. traceable equipment; typical calibration performed in actual process service gas

Flow Element

Material of Construction

All welded 316L stainless steel

ST98 HP: 15 Ra electropolish (standard); Hastelloy C with 15 Ra electropolish (optional)

Operating Pressure: 0 psig to 250 psig [0 bar to 17 bar(g)]; design pressure to 1000 psig [69 bar(g)], maximum operating pressure limited by customer specified process connection

Operating Temperature: Process temperature -40 °F to +350 °F [-40 °C to 177 °C]; integral electronics rated from 0 °F to 140 °F [-18 °C to 60 °C].

Flow Element Process Connection

ST98 HP: 1" [25 mm] sanitary flange

Flow Element (continued)

Inline Flow Tube

0.75" to 4.0" [19 mm to 102 mm] with butt weld preparation or sanitary flange end connections

Local Enclosure

Standard: NEMA/CSA Type 4 carbon steel, Type 4X aluminum or Type 4X stainless steel; Nonincendive for Class 1, Division 2, Groups A, B, C, D; Suitable for Class II, Division 2, Groups F and G; Class III, Division 2

Optional: NEMA/CSA Type 4X aluminum (meets IP66); Nonincendive for Class 1, Division 1, hazardous locations, Groups B, C, D, E, F and G; and EEx d IIC

Remote Configuration: Transmitter may be mounted remotely from flow element using interconnecting cable up to 500' [152 m]

Flow Transmitter

Operating Temperature: 0 °F to 140 °F [-18 °C to 60 °C]

Input Power: 85 Vac to 265 Vac or 22 Vdc to 30 Vdc; 7 watts maximum, 230 mA maximum

Output Signal

Current: 4 mA to 20 mA, 700 ohms maximum load

Voltage: 0 Vdc to 10 Vdc, 0 Vdc to 5 Vdc, 1 Vdc to 5 Vdc, 100 K ohms minimum load

Communication Port

Standard: RS-232C Serial

Optional: HART or PROFIBUS – DP, Profile 3

Display (optional) 2 line/16 characters per line, indicating flow rate and process and/or totalized flow

Programmer (optional): Hand held plug-in interface (model FC88)

Remote Enclosure (if selected)

Standard: NEMA /CSA Type 4 carbon steel, Type 4X aluminum or stainless steel (meets IP66); Nonincendive for Class 1, Division 2, Groups A, B, C, D; Suitable for Class II, Division 2, Groups F and G; Class III, Division 2

Optional: NEMA/CSA Type 4X aluminum (meets IP66); Nonincendive for Class 1, Division 1, hazardous locations, Groups B, C, D, E, F and G; and EEx d IIC



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ST98 HP

FlexMASter® Insertion High Purity
Mass Flow Meter



Flow Element (FE) Flow Transmitter (FT) General

ST98 HP - S - -

Block No. 1 2 3 4 5 6 7 8 9 10

INSTRUCTIONS: To order an **ST98 HP**, please fill in each numbered block above with the appropriate code from the categories below. Once you have determined all the specifications, contact an FCI representative or FCI directly for price information or additional options not shown. Consult FCI on the cost of special data and documentation. Final acceptance of the part number is subject to FCI's approval.

[Block 1] Flow Direction	Code
Horizontal right to left or Vertical up	1
Horizontal left to right or Vertical down	2
[Block 2] Material of Construction	Code
For High Purity	
316L stainless steel 15 Ra electropolish	1
Agency approved, customer specified	W
Other	*
[Block 3] Flow Tube Assembly ²	Code
For High Purity	
1" sanitary flange with 316L sanitary tee per BPE specifications	S
[Block 4] Flow Tube Size	Code
Not required ³	0
3/4" [19 mm] length	T
1" [25 mm]	1
1 1/2" [38 mm]	B
2" [51 mm]	2
2 1/2" [63,5 mm]	C
3" [76 mm]	3
4" [102 mm]	4
Agency approved, customer specified	W
[Block 5] Process Connection	Code
Not required ³	0
Butt weld preparation	B
Sanitary flange	S
Agency approved, customer specified	W

[Block 6] Enclosure ⁴	Code
Integral Configuration	
Nonincendive for Class I, Division 2, Groups A,B,C,D; Suitable for Class II, Division 2, Groups F and G; Class III, Division 2 (meets IP66)	
	
Carbon steel NEMA Type 4	A
Aluminum NEMA Type 4X	1
Stainless steel NEMA Type 4X	J
Nonincendive for Class I, Division 1, hazardous locations Groups B,C,D, E, F and G; EEx d IIC	
	
Aluminum NEMA Type 4X	B
Remote Transmitter Configuration⁹	
Local Enclosure	Remote Enclosure
Aluminum (Standard)	Carbon steel NEMA 4 per Code A, Block 6
Aluminum (Standard)	Aluminum NEMA 4X per Code 1, Block 6
Aluminum	Stainless steel, NEMA 4X per Code J, Block 6
Aluminum (Standard)	Aluminum hazardous locations per Code B, Block 6
Aluminum (Standard)	None, panel-mounted transmitter
Agency approved, customer specified ⁶	W
Other	*

[Block 7] Transmitter Option ¹²	Code
4-20 mA output, no display	0
4-20 mA output, with display	A
HART protocol, 100 Vac to 240 Vac (50/60 Hz) ¹⁴	B
HART protocol with display, 100 Vac to 240 Vac (50/60 Hz)	C
HART protocol, 9 Vdc to 36 Vdc	D
HART protocol with display, 9 Vdc to 36 Vdc ¹⁴	E
Agency approved, customer specified	W
Other	*
[Block 8] Interconnecting Cable	Code
Not required	0
PVC Jacket	
10' [3 m]	A
25' [7,6 m]	B
50' [15 m]	C
Agency approved, customer specified ⁵	W

[Block 9] Calibration Code 1: Code Application ^{6,7,10,11}	Code
Air	B
Air equivalency	C
Nitrogen, helium, argon, carbon dioxide, nitrous oxide	E
Air	H
Air equivalency	J
Nitrogen or argon	K
Carbon dioxide, ethylene, or ethane	L
Propylene or propane 100 psig [7 bar(g)] maximum	M
Hydrogen	R
Low flow calibration	S
Agency approved, customer specified ⁸	W
[Block 10] Calibration Code 2: Code Application	Code
Standard	0
Temperature compensation	A

- Notes**
- ◀ Shorter manufacturing lead times are available when these are selected in every Block
 - * Voids agency approvals; contact FCI
 - 2. All units must be installed with an FCI supplied tee
 - 3. Only spare or replacement units may be ordered without a tee; they will be supplied with a protective cover and loose gasket
 - 4. Enclosure is required for agency approval
 - 5. Wire resistance must be less than 8.0 ohms
 - 6. Minimum turndown ratio is 10:1 and maximum is 100:1 for all conditions
 - 7. SFPS is the abbreviation for standard feet per second; this is the gas velocity at 14.7 psia [1,01 bar(a)] and 70°F [21,1°C]
 - 8. Customer specified calibration shall not exceed temperature and pressure limitations of the Model ST98 specifications
 - 9. Remote configuration is only available with aluminum local enclosure as described in Code B, Block 6
 - 10. Calibration parameters are only as specified. Different units of measure are field selectable within the flow, temperature and pressure parameters specified by using the hand held FC88 calibrator/communicator
 - 11. Calibration Codes must be selected by using FCI's application evaluation software (AVAL)
 - 12. Transmitter setup, changes to factory supplied standard settings, verification or modification to calibration parameters or diagnostics requires external source communication with the transmitter; via RS232 port use Model FC88 communicator or PC with PC interface kit or via HART bus (if selected)