FB2200 Flow Computer

The FB2200 flow computer measures and controls gas flow for up to two differential pressure or linear meter runs. With a rugged housing and multiple I/O, communications, and power options, the FB2200 provides accurate and reliable flow measurement in the harshest conditions.

The FB2200 is part of Emerson's new field mount flow computer family that delivers a convenient approach to remote oil and gas sites by addressing challenges to power, safety, measurement reliability, and accuracy.

Designed for simplified configuration and ease of use, the FB2200 is also highly configurable and supports flow and fluid property calculations right out of the box. The flexible design provides exactly what is required for each application. The FB2200 can also be equipped with Mobile SCADA™ functionality allowing you to configure and retrieve site data more safely than before.

The new flow computers also come with the latest Rosemount™ sensor technology, providing high accuracy differential pressure and static pressure measurement with long term stability to help improve measurement confidence and production efficiency.

Features

The FB2200 flow computer includes the following key features:

- Increased measurement confidence and reduced measurement uncertainty
- Industry leading differential and static pressure measurement including 5-year stability
- High accuracy temperature measurement including curve matching via the Callendar-Van Dusen equation
- Reduced need to re-calibrate resulting in less time spent on site
- Simplified configuration and set-up with the FBxConnect™ configuration software tool
- Flexible design with configurable I/O and communication ports to meet site needs
- Standard firmware supports global calculations for orifice, cone, Venturi, nozzle, conditioning orifice, turbine, PD, Auto-Adjust and Coriolis
- Flexible PID control with override complimented by configurable logic blocks and effects
- Easy to interface to 1 or 2 remote 4088B MVT transmitters (DP, P & T) by using one of the 3 onboard serial ports
- Simple selection of engineering units to suit local requirements
- Global Hazardous Area Approvals – Class 1 Div 2, ATEX & IEC Ex nA
- Corrosion resistant aluminum and fiberglass enclosure options include radio mounting bracket and battery box for solar use
- Mobile SCADA allows secure local wireless access from safe area
- Ease of integration with support for Modbus, ROC, BSAP and DNP3 protocols
- Enhanced security helps prevent unauthorized access
- Enhanced alarming and historical data storage and improved audit trail
- Superior performance gives better control of your operations and maximizes profits
- API 21.1 compliant

Mobile SCADA™ with Wi-Fi®

The optional Mobile SCADA™ with Wi-Fi® communications enables you to connect your laptop or tablet to the flow computer through a secure wireless connection. Once connected wirelessly, you can use FBxConnect configuration software to view process values, edit configuration parameters, and collect logs stored in the flow computer – all from within the safe area.

FB2200

Firmware

The base firmware in the FB2200 flow computer comes with all the calculations, features and functionality required to provide consistent measurement with increased confidence for gas metering and control. The flow computer measures static pressure, differential pressure or pulse frequency, and temperature for up to two meter runs.

The flow computer performs gas flow calculations based on the following set of user selectable global calculations. To fully satisfy local requirements the engineering units are fully user selectable between either U.S. or metric, or a combination of each.

The firmware supports the following flow calculations:

- AGA 3 1992/2013 (volume, mass/density, and mass/relative density)
- ISO 5167 1991/1998/2003 (orifice, Venturi, and nozzle)
- Rosemount 405C Compact Orifice and 1595 Conditioning Orifice Plate
- McCrometer V-Cone® and Wafer Cone®
- NUFLO™ Cone
- AGA 7 2006 (pulsed turbine, PD, and ultrasonic)
- AGA 11 2013 (Coriolis pulses)
- Auto-Adjust™ meter

The firmware supports the following property calculations:

- AGA 8 1994 (Detailed, Gross 1, and Gross 2)
- NX-19 1962, MOD, VDI/VDE 2040
- ISO 12213 2009 (parts 2 and 3)
- SGERG 1991 (Std., Alt 1, Alt 2, and Alt 3)
- GPA 2172 2009 (including saturated vapor calculation)
- ISO 6976 1995 (superior and inferior, incorporating Technical Corrigendum 2 [1997] and 3 [1999])

Regarding gas composition, the flow computer can:

- Work with a gas chromatograph (GC) to obtain updates, using Serial or Ethernet, to gas composition on a regular basis;
- Receive updated gas composition from SCADA;
- Receive manual updates for gas composition through FBxConnect; or
- Use a fixed gas composition

The firmware includes the following flow totals:

- Indicated volume
- Corrected (standard) volume
- Mass
- Energy

The firmware supports a fallback mode, when a process variable's value is questionable. The fallback options can be one of the following:

- Use last good value
- Use a fixed fallback value

Alarms and Events

The flow computer supports extensive alarming capability to enhance operational efficiency and improve the audit trail. Alarms are pre-allocated to meter runs and stations for standard values such as pressure, temperature, differential pressure or frequency as well as meter run and station flow rates. In addition to these standard alarms, the FB2200 provides a number of user alarms that you can assign to other database parameters simply by “filling in the blanks” in user alarm templates in the FBxConnect configuration tool. Storage is provided for the most recent 1000 alarms in the alarm log.

The event log stores the significant events during operation and can be configured to either store all events in a single log of 2000 events or the user can select to store the metrology/legal events in a separate log from the operational events. With the latter option the event log capacity is 1000 metrology events and 1000 operation events.

History

The FB2200 features expanded and flexible history capability to ensure measurement confidence and meet the increasing demands for secure data.

The flow computer has four standard periodic logs available providing hourly, daily, weekly, and monthly history. These logs can contain up to 60 variables including flow weighted average data, totals, and gas composition. For averaging, the FB2200 supports either flow weighted or flow dependent which can be linear or formulaic.

The FB2200 can store the following:

- Hourly logs 62 days
- Daily logs 12 months
- Weekly logs 12 months
- Monthly logs 60 months

The flow computer also supports two user periodic logs, the duration or period of each is user selectable between 1 second and 200 hours. The first user periodic logs include 10 parameters over 4,000 periods and the second contains 20 parameters over 500 periods.

The flow computer with FBxConnect provides pre-formatted EFM reports for hours and days. The format of the reports can be .csv, .pdf or secure pdf.

In addition to the above reports, the flow computers can produce FLOWCAL-compliant. cfx files through the FBxConnect tool as well as calibration reports which contain U.S. Bureau of Land Management specific parameters.

Power Options

You can power the FB2200 with an external DC power supply or from an internal rechargeable battery linked to a solar system.

The internal battery can power the device for up to 45 days depending on the application.

Note: The internal battery option is available with Class 1 Div 2 approval only.

Housing Options

The FB2200 has two housing options both suitable for hazardous area installation. The corrosion resistant aluminum and the fiberglass enclosures each protect the electronics from physical damage and harsh environments. The enclosures include a battery box to house a rechargeable battery for use with solar systems and an optional radio mounting bracket. The lockable door also provides a viewing window for the optional LCD. The door can also be fitted with an optional security switch, to generate an alarm each time the door is opened.

Hazardous Area Certifications

The FB2200 has the following Global Hazardous Area Approvals:

- North American certification for Class I Division 2 Groups A, B, C, and D.
- ATEX and IECEx certification for ExnA, Zone 2 hazardous locations.

Configuration Software

Emerson's new FBxConnect™ tool is a Microsoft® Windows®-based tool that enables you to easily monitor, configure, service, and calibrate the FB2200 flow computer. Designed for ease of use, FBxConnect provides at-a-glance monitoring, quick access to commonly performed tasks, and a guided configuration process to quickly get your measurement up and running.

The wizard-driven approach simplifies configuration and ensures that you only need to enter the required data once. Whether you are an experienced engineer or a new technician, you can be confident configuration is done correctly the first time.

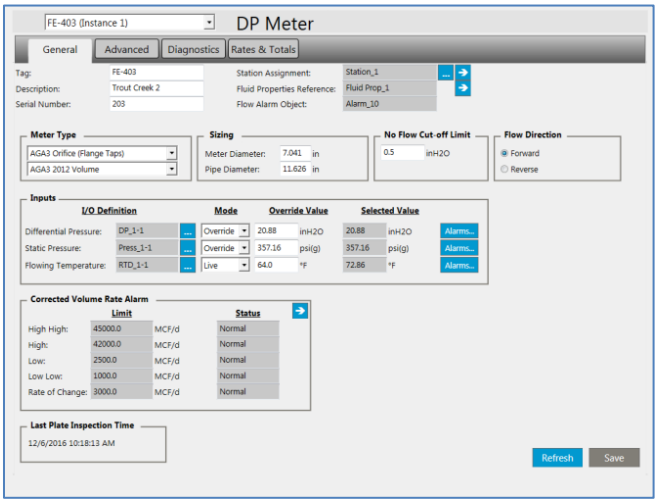
FBxConnect runs on a Windows PC or tablet. You connect securely to the flow computer using one of its serial ports, Ethernet port, or optionally through the Mobile SCADA wireless connection. For more information, refer to product data sheet FBxConnect (D301789X012).

Security

To secure your valuable process and data, the FB2200 provides multi-level role-based access, user account authentication, and password encryption.

The system administrator can set a minimum password length (up to 20 characters) that accommodates lower case, upper case, numbers, and symbols, as well as configure a user lock-out feature that locks out invalid users after a defined number of failed login attempts.

Monitor Screen



DP Meter

Integral Pressure Sensor Options

The flow computer can be supplied with one of three sensor options to suit your metering needs:

- Integral Multivariable Sensor (MVS) measuring both static pressure and differential pressure (DP)
- Integral inline static pressure sensor
- NO integral pressure sensor – external transmitters are used

The NO integral sensor option is typically used at locations where regulations classify the location of the pressure measurement sensor as either C1 D1 or ATEX/IEC Exd Zone 1. In this instance, the FB2200 without an integral sensor can be mounted in the C1 D2 / Zone 2 area and be connected via a serial port to 1 or 2 remote 4088B MVT transmitters.

If the FB2200 has an integral sensor, it can communicate with one remote 4088B transmitter for dual meter run applications.

Enabled by superior sensor technology and engineered for optimal flow performance, the integral pressure sensor on

the flow computer delivers unparalleled accuracy, over a wide range of operating conditions, and industry leading stability to ensure you meet standards and regulations.

Pressure sensors on the flow computer can measure DPs of up to 1000" of water / 2500 mBar and static pressures up to 4000 psi / 275 bar in either gauge or absolute with accuracies up to 0.075%.

Temperature Input (RTD/PRT)

With industry leading measurement accuracy the temperature measurement of the FB2200 ensures that you minimize your measurement uncertainty in all operating conditions. The input accepts 2-, 3-, or 4- wire connections reducing any field wiring induced errors and also supports sensor curve matching utilizing the optional Callendar-Van Dusen constants to define the unique characteristics of the RTD/PRT to further improve process temperature measurement uncertainty.

The FB2200 flow computer's superior static pressure, DP, and temperature measurement performance and stability ensures you meet standards and regulations so you can avoid fines, penalties, leaseholder disputes, and lost revenue.

Inputs and Outputs

Base I/O

In addition to the integral pressure sensor, the FB2200 includes the following I/O points in the base unit:

- Two analog channels – individually software selectable analog inputs (AI) or analog outputs (AO)
- Two discrete channels – individually software selectable discrete inputs (DI), discrete outputs (DO), or pulse inputs (PI)
- One RTD/PRT (2-, 3-, or 4-wire)

Analog Inputs (AI) are individually software configurable for either 4 to 20mA or 1 to 5 Vdc operation.

To keep measurement uncertainty at a minimum when external transmitters are being used, both the AI and AO channels have industry-leading measurement accuracy with an excellent performance over a wide ambient temperature range.

Each Discrete Input (DI) channel can also be software configured to function as a latched DI.

The Discrete Output (DO) channels are solid-state, normally open switches rated at 500 mA, enough to directly drive most samplers. Each DO channel can be software configured as a latched, toggled, momentary, timed duration output (TDO), or scaled pulse output.

The PI channels are most commonly used to interface with turbine meters, Coriolis meters, ultrasonic meters, and Positive Displacement (PD) meters. The high speed input supports signal up to 10.5 KHz.

Expansion I/O

In addition to the base I/O provided, the FB2200 I/O capability can be increased by adding two options. The expansion below provides 2500 Vdc isolation from the CPU.

- 8-channel isolated expansion board, providing 4 channels that are individually software selectable as either analog inputs or analog outputs, and 4 channels that are individually selectable as discrete inputs, discrete outputs, or pulse inputs.
- 6-channel isolated expansion board, providing 2 channels that are individually software selectable as either analog inputs or analog outputs, and 4 channels that are individually selectable as discrete inputs, discrete outputs, or pulse inputs.

Note: The 8-channel expansion board option must be added first. The 6-channel expansion board can only be used in units that already have the 8-channel board included.

- Two optional relays allow for additional loads up to 30 Vdc at 6A. 24 Vdc is required to energize the relays or an expansion I/O option must be selected, which enables 24 Vdc loop.

Control

The FB2200 optionally supports control functions including PID control, basic programming through action blocks, effects, and math blocks.

PID Control – The FB2200 supports up to three Proportional, Integral, and Derivative (PID) control loops. Each PID instance supports a primary and an override loop. Each loop has its own user-defined input, output, and override capability.

Typically, a PID control maintains a process variable at set point. If you configure a PID override control, the primary loop is normally in control of the control device but the override loop can take over control of the process if required. A typical example would be primary flow control with a pressure override.

Action Blocks – The FB2200 supports up to 30 action blocks. Action blocks are used in conjunction with effect blocks to monitor a configured condition and to perform an action (effect) when the logic is "true." An action block consists of a user defined Boolean logic statement with two variables. These variables can either be live parameter values or constants.

Multiple action blocks can be chained together to create more complex logic. Each action block includes multiple bypasses, which can temporarily halt the action to be taken for maintenance and safety.

Effects – The FB2200 supports up to ten effects. Effects cause an action to occur when the result of one or more action blocks is active ("true"). Multiple action blocks can

cause the same effect, such as shutting a valve or enabling an alert beacon.

You configure an effect by defining an output parameter and the values to write to that parameter when the effect is either active or inactive. You can also configure an active effect to be self-clearing or to require a manual reset.

Math Blocks – The FB2200 supports up to ten math blocks. Math blocks perform mathematical equations using user-defined variables as inputs. Each math block consists of up to four user-defined variables, three mathematical calculations, and the results of each calculation.

The result of the math block equation can be assigned to a user data point, to drive an output point, to a calculated value or to any other data base parameter. Mathematical calculations also support standard math functions (POW, EXP, LOG, SQRT, etc.), constants, and operators.

FBxConnect checks each calculation string for the correct syntax and uses double precision floating point math throughout the calculation.

User Data Points

User data points are configurable storage areas in the data base. These user data points can store the constants / variables that are inputs to the math blocks in addition to the calculated results of math blocks. They can also be used to represent interim calculation values or values of additional inputs or outputs etc. There are eight user data instances, each with a tag and description, 30 integers (split between byte, short and long), 20 single floating points, and 10 double floating points, providing storage for up to 480 variables.

Communications

The FB2200 provides up to five user-selectable communications ports: three serial ports, one Ethernet port, and one optional port that supports Mobile SCADA Wi-Fi (802.11 b/g) communications using DNP3 protocol.

- COM1 – 4-wire serial communications. Software selectable for EIA-232 (RS-232), EIA-422 (RS-422), or EIA-485 (RS-485) operation.
- COM2 – 2-wire serial communications. Software selectable for EIA-232 (RS-232) or EIA-485 (RS-485) operation.
- COM3 – 2-wire serial communications. Software selectable for EIA-232 (RS-232) or EIA-485 (RS-485) operation.
- COM4 – Mobile SCADA with Wi-Fi (802.11 b/g) communications (optional).
- COM5 – Ethernet. 10/100BASE-T twisted pair. Supports up to seven sessions.

The FB2200 supports multiple communications protocols, including DNP3, Modbus master and slave (ASCII and RTU), BSAP, and ROC on the three serial ports. In addition, the Ethernet port supports RTU Modbus over TCP/IP protocol (master and slave), DNP3/IP, ROC and BSAP.

Mounting Options

The FB2200 supports direct mounting to a manifold on the pipeline, simple wall mounting, or mounting on a two-inch pipe with the stainless steel pipe mounting kit.

FB2200 Flow Computer

CPU Module			
Processor	The central processing unit (CPU) of the flow computer is an NXP® Kinetis® K61 series CPU with an ARM® Cortex® M4 processor.		
Memory	SRAM	8 MB, holds current states of all variables and historical archives	
	Flash	128 MB, holds firmware image and configuration files	
Clock	Type	Real-time clock	
	Accuracy	0 °C to 40 °C	60 seconds/year
		–40 °C to 80 °C	110 seconds/year
	Watchdog Timer	1175 milliseconds	
Diagnostics	Battery voltage monitor, external voltage monitor, SRAM battery status		
Communications			
Ports	COM1	4-wire serial communications. Software selectable for RS-232, RS-422, or RS-485 operation.	
	COM2	2-wire serial communications. Software selectable for RS-232 or RS-485 operation.	
	COM3	2-wire serial communications. Software selectable for RS-232 or RS-485 operation. Can communicate to 4088B transmitters.	
	COM4	Mobile SCADA via Wi-FI (optional) 802.11 b/g.	
	COM5	Ethernet 10/100 Base-T supports up to 7 sessions (1 Modbus Master, up to 3 DNP3, others selectable between ROC, BSAP, and Modbus Slave)	
Protocols	Serial ports support DNP3, Modbus slave (ASCII or RTU), BSAP, and ROC. The Ethernet port supports Modbus TCP/IP protocol (master and slave), DNP3, BSAP, and ROC protocol. Wi-Fi supports DNP3 DNP3 includes level 3 protocol subset		
Base I/O			
The base FB2200 includes the following I/O: ▪ 2 channels that are individually software selectable as either analog inputs or analog outputs ▪ 2 channels that are individually software selectable as either discrete inputs, discrete outputs, or pulse inputs ▪ 1 process temperature input (RTD/PRT)			
Expansion I/O (optional)			
8-Channel I/O Board	Provides 8 I/O channels in addition to the base I/O. Expansion I/O features 2500 Vdc isolation from CPU and ground. **Note:** Specifications for expansion I/O channels are identical to base I/O channels except where noted.		
	Analog Inputs/ Analog Outputs	Quantity	4 channels Each channel is individually software selectable as an AI or AO.
		AO Sourcing	Internal, isolated 24 Vdc

	Discrete Inputs/ Discrete Outputs/ Pulse Inputs	Quantity	4 channels Each channel is individually software selectable as a DI, DO, or PI.	
		DO Switches	500 mA high and low-side	
6-Channel I/O Board	Provides 6 additional I/O channels to a unit with the 8-channel I/O board fitted. Expansion I/O features 2500 Vdc isolation to main CPU. **Note:** Specifications for expansion I/O channels are identical to base I/O channels except where noted.			
	Analog Inputs/ Analog Outputs	Quantity	2 channels Each channel is individually software selectable as an AI or AO.	
		AO Sourcing	Internal, isolated 24 Vdc Loop Supply Output – 200mA maximum load	
	Discrete Inputs/ Discrete Outputs/ Pulse Inputs	Quantity	4 channels. Each channel is individually software selectable as a DI, DO, or PI.	
		DO Switches	500 mA high and low-side	
Relays (Optional)	Provides two relays inside the flow computer enclosure.			
I/O Specifications				
Analog Inputs	Type	Single-ended		
	Input Range	1 to 5 Vdc or 4 to 20 mA (software selectable)		
		Over Range	1 to 5 Vdc	0.8 to 5.2 Vdc
			4 to 20 mA	3.2 to 20.8 mA
	Resolution	16 bits		
	Scan Rate	10 samples per second		
	Input Impedance	1 to 5 Vdc Inputs	200 kΩ	
		4 to 20 mA Inputs	250 Ω	
	Fault Mode	User-entered default value or last good value		
	Software Filter	Software damping is available in FBxConnect configuration software		
	Input Filter	20 HZ @ -3 dB		
	Surge Suppression	30 Vdc		
	Reference Accuracy	+/- 0.05% of span **Note:** To achieve the stated accuracy when analog inputs are used in voltage mode, you must wire analog input reference(s) to the AGND terminals *separately* from the discrete and communication ground references.		
	Ambient Temperature Effect	+/- 0.05% of span per 10°C (18°F) from the calibration temperature		
	Long Term Stability	3 years		
	SNR	87 dB		
	Loop Power	Base I/O	External	

		Optional 8-point I/O	Internal
		Optional 6-point I/O	Internal
Analog Outputs	Type	Single-ended, externally sourced	
	Output Range	4 to 20 mA	
	Resolution	14 bits	
	Surge Suppression	30 Vdc	
	Reference Accuracy	+/- 0.1% of span **Note:** To achieve the stated accuracy when analog outputs are used in voltage mode, you must wire analog output reference(s) to the AGND terminals *separately* from the discrete and communication ground references.	
	Ambient Temperature Effect	+/- 0.05% of span per 10 °C (18 °F) from the calibration temperature	
	Long Term Stability	3 years	
	Fault Mode	User-entered default value or last good value	
	Scan Rate	1 second	
	Surge Suppression	30 Vdc	
	Impedance	Current Mode	Configured to drive a load impedance of 0 to 900 Ω
		Voltage Mode	100 kΩ
	Load Loop Resistance	0 to 900 Ω	
	Max External Supply	30 Vdc	
	Loop Power	Base I/O	External
		Optional 8-point I/O	Internal
		Optional 6-point I/O	Internal
Discrete Inputs	Type	Dry contact or an open collector	
	Scan Rate	1 second	
	Input Filter	10 Hz	
	Input Current	Software selectable 66μA or 2mA	
	Voltage Rating	30 Vdc maximum	
	Frequency	10 Hz maximum	
	Input Type	Latched or unlatched	
	Loop Power	Internally sourced	
	Surge Suppression	30 Vdc	
	Fault Mode	User-entered default value or last good value	
Discrete Outputs	Type	Open drain	

	Current	500 mA maximum	
	Operating Voltage Range	30 Vdc maximum	
	Frequency	50 Hz maximum	
	Output Type	Latched, momentary, toggle, TDO, or scaled pulse	
	Surge Suppression	30 Vdc	
	Fault Mode	User-entered default value or last good value	
	Notes: Discrete outputs are rated to 500mA maximum. In a small number of applications, however, the load on the DO could have an effect on the uncertainty of the analog inputs and outputs. The typical increase in uncertainty is around 0.05% and **only** occurs when **all** of the following are true: • **Either** of the two *analog* channels in the base I/O (see page 6) is used as an AI (in voltage mode) or as an AO **and** • **Either** of the two *discrete* channels in the base I/O is used as a DO **and** • The total current load on these two DOs is **greater** than 300mA Analog inputs in current mode and the I/O channels in the expansion I/O boards are **not** affected.		
Pulse Inputs	Type	Dry contact or open collector	
	Frequency	Low Range	0 to 300 Hz
		High Range	0 to 10.5 kHz
	Input Filter	Low Frequency	1 ms software selectable filter
		High Frequency	30 µs software selectable filter
	Input Current	Software selectable 66 µA or 2 mA	
	Voltage Rating	30 Vdc maximum	
	Loop Power	Internally sourced	
	Surge Suppression	30 Vdc	
Temperature Input (RTD/PRT)	Type	2-wire, 3-wire or 4-wire (software selectable)	
	Measuring Range	-200 to +850 °C (-328 to 1562 °F)	
	Reference Accuracy	+/- 0.07 °C from -30 to 60°C (±0.126 °F from -22 to +140 °F) +/- 0.1 °C from -60 to 200°C (±0.18 °F from -76 to 392 °F)	
	Ambient Temperature Effect	−30 to 60°C	+/- 0.017 °C per 10 °C (+/- 0.03 °F per 18 °F) from the calibration temperature
		−60 to 200°C	+/- 0.034 °C per 10 °C (+/- 0.06 °F per 18 °F) from the calibration temperature
	Calculation Type	User selectable between:	Callendar–Van Dusen
			IEC 751/DIN 43760 (α 0.00385/°C)
			IEC (α 0.003920/°C)
	Resolution	24 bits	
	Scan Rate	1 second	

	Voltage Input Impedance	Greater than 3 MΩ DC
	Excitation Current	205 µA
	Surge Suppression	36 Vdc
	Common Mode Rejection	100 dB at DC
	Normal Mode Rejection	100 dB at 50/60 Hz
Relay Option		
SPDT Relay	Internally mounted	Quantity 2 (Relays each require a digital output from the flow computer)
	Input	24 Vdc (24 Vdc is required to energize the relays or an expansion I/O option must be selected, which enables 24 Vdc loop power).
	Contact Rating	0 to 30 Vdc Maximum Current 6A

Integral Sensors

The FB2200 is available with the following integral sensor options:

- Multi-Variable Sensor – providing differential pressure and static pressure
- Static pressure sensor – providing static pressure only
- No integral sensor fitted – with interface to 4088B MVT transmitters or analog transmitters

Multivariable Sensor (optional)

The standard Rosemount™ MultiVariable™ sensor has a stainless steel coplanar flange, a stainless steel (316L) diaphragm, and silicone fill fluid. Optional versions include:

- A Hastelloy® C-276 sensor diaphragm, a Hastelloy C-276 coplanar flange, with either NACE MRO175/ISO 15156 or MRO103 certification
- Stainless steel traditional flange, a stainless steel diaphragm, and silicon fill fluid.

Differential Pressure Input	DP Range 1	−25 to 25 Inches H_2O (−62.16 to 62.16 mbar)		
		Reference Accuracy	± 0.1% span; For spans less than 5:1, ± (0.025+0.015 [USL/Span]) % span	
		Stability	±0.2% USL for 1 year	
		Ambient Temperature Effect per 50°F (28°C)	from 1:1 to 30:1	± (0.2% USL + 0.25% span)
			from 30:1 to 50:1	± (0.24% USL + 0.15% span)
		Static Pressure Effects	Zero Error	± 0.25% USL per 1000 psi (69 bar)
			Span Error	± 0.4% USL per 1000 psi (69 bar)
		Over Pressure Limit	SP Range 3	2000 psi (137.89 bar)
		Burst Pressure Limit	10, 000 psi (689.47 bar)	

	Notes: ▪ 25-inch sensor is only available with static pressure SP Range 3, maximum pressure limited to 2000 psi. ▪ 25-inch sensor is only available with stainless steel sensor and coplanar flange.		
DP Range 2: Standard	0 to 250 Inches H_2O (623 mbar)		
	Reference Accuracy	± 0.1% span; For spans less than 10:1, ± (0.01 [USL/Span]) % span	
	Stability	±0.1% USL for 1 year	
	Ambient Temperature Effect per 50°F (28°C)	from 1:1 to 30:1	± (0.15% USL)
		from 30:1 to 50:1	± (0.20% USL)
	Static Pressure Effects	Zero Error	± 0.1% USL per 1000 psi (69 bar) For Static Pressures above 2000 psi: ± [0.2 + 0.0001 * (Ps - 2000)] % per 1000 psi
		Span Error	± 0.2% USL per 1000 psi (69 bar)
	Over Pressure Limit	SP Range 1	1600 psi (110.32 bar)
		SP Range 2	3626 psi (250.00 bar)
		SP Range 3	3626 psi (250.00 bar)
	Burst Pressure Limit	10,000 psi (689.47 bar)	
	Note: 0.1% accuracy is not available on traditional flange.		
DP Range 2: Enhanced	0 to 250 Inches H_2O (623 mbar)		
	Reference Accuracy	± 0.075% span; For spans less than 10:1, ± (0.025 +0.005 [USL/Span]) % span	
	Stability	±0.125% USL for 5 years; For ±50 °F (28 °C) temperature changes, up to 1000 psi (68.9 bar) line pressure	
	Ambient Temperature Effect per 50°F (28°C)	± (0.0175% USL + 0.1% span) from 1:1 to 5:1, ± (0.035% USL + 0.125% span) from 5:1 to 100:1	
	Static Pressure Effects	Zero Error	± 0.05% USL per 1000 psi (69 bar) For Static Pressures above 2000 psi: ± [0.1 + 0.0001* (Ps - 2000)] % per 1000 psi
		Span Error	± 0.2% USL per 1000 psi (69 bar)
	Over Pressure Limit	SP Range 1	1600 psi (110.32 bar)
		SP Range 2	3626 psi (250.00 bar)
		SP Range 3	3626 psi (250.00 bar)
	Burst Pressure Limit	10,000 psi (689.47 bar)	

DP Range 3: Standard	0 to 1000 Inches H_2O (2.5 bar)		
	Reference Accuracy	± 0.1% span; For spans less than 10:1, ± (0.01 [USL/Span]) % span	
	Stability	±0.1% USL for 1 year	
	Ambient Temperature Effect per 50°F (28°C)	from 1:1 to 30:1	± (0.15% USL)
		from 30:1 to 50:1	± (0.20% USL)
	Static Pressure Effects	Zero Error	± 0.1% USL per 1000 psi (69 bar) For Static Pressures above 2000 psi: ± [0.2 + 0.0001* (Ps - 2000)] % per 1000 psi
		Span Error	± 0.2% USL per 1000 psi (69 bar)
	Over Pressure Limit	SP Range 2	3626 psi (250.00 bar)
		SP Range 3	3626 psi (250.00 bar)
	Burst Pressure Limit	10, 000 psi (689.47 bar)	
	Notes: ▪ 0.1% accuracy is **not** available on traditional flange. ▪ 1000" DP range with 0.1% accuracy **only** available with stainless steel sensor and coplanar flange. ▪ 1000" DP range is **not** available with 300 psi static pressure (SP Range 1).		
DP Range 3: Enhanced	0 to 1000 Inches H_2O (2.5 bar)		
	Reference Accuracy	± 0.075% span; For spans less than 10:1, ± (0.025 +0.005 [USL/Span]) % span	
	Stability	±0.125% USL for 5 years; For ±50 °F (28 °C) temperature changes, up to 1000 psi (68,9 bar) line pressure	
	Ambient Temperature Effect per 50°F (28°C)	± (0.0175% USL + 0.1% span) from 1:1 to 5:1, ± (0.035% USL + 0.125% span) from 5:1 to 100:1	
	Static Pressure Effects	Zero Error	± 0.05% USL per 1000 psi (69 bar) For Static Pressures above 2000 psi: ± [0.1 + 0.0001* (Ps - 2000)] % / per 1000 psi
		Span Error	± 0.2% USL per 1000 psi (69 bar)
	Over Pressure Limit	SP Range 2	3626 psi (250.00 bar)
		SP Range 3	3626 psi (250.00 bar)
	Burst Pressure Limit	10, 000 psi (689.47 bar)	
	Note: 1000" DP range is **not** available with 300 psi static pressure (SP Range 1).		

Static Pressure Input				
The following details are for the static pressure measurement of the MultiVariable sensor				
	SP Range 1	Gauge	−14.2 to 300 psi_g (−0.98 to 20.68 bar)	
		Absolute	0.5 to 300 psi_a (0. 03 to 20.68 bar)	
		Reference Accuracy	Standard	± 0.1% span; For spans less than 5:1, ± [0.017 (USL/Span)] % span
			Enhanced	± 0.075% span; For spans less than 5:1, ±[0.013(USL/Span)] % span
	SP Range 2	Gauge	−14.2 to 1500 psi_g (−0.98 to 103.42 bar)	
		Absolute	0.5 to 1500 psi_a (0.03 to 103.42 bar)	
		Reference Accuracy	Standard	± 0.1% span; For spans less than 5:1, ± [0.017 (USL/Span)] % span
			Enhanced	± 0.075% span; For spans less than 5:1, ±[0.013(USL/Span)] % span
	SP Range 3	Gauge	−14.2 to 3626 psi_g (−0.98 to 250.00 bar) **Note:** When used with 25" H_20 DP Sensor, maximum static pressure is 2000 psi.	
		Absolute	0.5 to 3626 psi_a (0.03 to 250.00 bar) **Note:** When used with 25" H_20 DP Sensor, maximum static pressure is 2000 psi.	
		Reference Accuracy	Standard	± 0.1% span; For spans less than 5:1, ± [0.017 (USL/Span)] % span
			Enhanced	± 0.075% span; For spans less than 5:1, ±[0.013(USL/Span)] % span
	Stability	Standard Accuracy	±0.1% USL for 1 year	
		Enhanced Accuracy	±0.125% USL for 5 years	
	Ambient Temperature Effects per 28 °C (50 °F)	Standard Accuracy	± (0.175% USL) from 1:1 to 10:1, ± (0.225% USL) from 10:1 to 25:1	
		Enhanced Accuracy	± (0.050% USL + 0.125% span) from 1:1 to 10:1, ± (0.060% USL + 0.175% span) from 10:1 to 25:1	

Static Pressure Sensor (optional)				
The following section applies to the "In-Line" Integral Static Pressure sensor, without differential pressure, which would typically be used with linear meters that provide a pulsed signal for flow. These static pressure sensors are provided in stainless steel with a 1/2 "– 14 NPT Female process connection.				
Static Pressure Input	SP Range 1	Gauge	−14.7 to 150 psi_g (−1.01 to 10.34 bar)	
		Absolute	0 to 150 psi_a (0 to 10.34 bar)	

	SP Range 2	Gauge	−14.7 to 800 psi_g (−1.01 to 55.15 bar)
		Absolute	0 to 800 psi_a (0 to 55.15 bar)
	SP Range 3	Gauge	−14.7 to 4000 psi_g (−1.01 to 275.79 bar)
		Absolute	0 to 4000 psi_a (0 to 275.79 bar)
	Reference Accuracy	Standard	± 0.1% span For spans less than 10:1, ± (0.01 [USL/Span]) % span
		Enhanced	± 0.075% span For spans less than 10:1, ± (0.025 + 0.005 [USL / Span]) % span
	Stability	Standard	± 0.1% USL for 1 year
		Enhanced	± 0.125% USL for 5 years
	Ambient Temperature Effects per 28 °C (50 °F)	Standard	± (0.175% USL) from 1:1 to 30:1 ± (0.225% USL) for 30:1 to 50:1
		Enhanced	± (0.050% USL + 0.125% span) from 1:1 to 30:1 ± (0.060% USL + 0.175% span) for 30:1 to 100:1
	Over Pressure Limit	SP Range 1	1500 psi (103.42 bar)
		SP Range 2	1600 psi (110.32 bar)
		SP Range 3	6000 psi (413.69 bar)
	Burst-Pressure Limit	11,000 psi (758.42 bar)	
Power			
External DC Power Supply	10.5 Vdc to 30 Vdc external supply (Max power at 10 watts)		
Optional Rechargeable Lead Acid Battery	Internal mounted 10.5 Ah 12 Vdc battery The battery can power the unit for up to 45 days without any solar charging depending on the application, ambient temperature, solar regulator type, and can be charged by a suitable solar panel and solar charge regulator/controller panel. **Note:** This option is available **only** with Class 1 Div 2 approval		
Solar Panel and Regulator Options	Optional 30W 12 Vdc solar panel with built-in SunKeeper™ SK-6 regulator. With the SunKeeper SK-6 solar regulator the battery can power the unit without charging up to 32 days the depending on the application. Optional internally mounted SunSaver SS-6-12 Vdc regulator. With the SunSaver S-6-12 solar regulator the battery can power the unit without charging up to 45 days depending on the application. **Note:** These options are available **only** with Class 1 Div 2 approval		
Loop Output Power	24 Vdc, 200mA maximum		
SRAM Battery	Lithium coin cell type BR2335 Life expectancy of 5–7 years with power; 10,000 hours without power		

Power Modes

To keep power consumption to a minimum, especially for remote sites, the FB2200 can run in two different power modes, low and standard. The FB2200 normally runs in low power mode for standard metering applications.

When running in low power mode, the radio power control function is used to switch to standard power mode and enable the serial ports. During communication periods, the unit uses the standard power mode and then automatically reverts to low power mode when the communication period is over.

Notes:

- Serial connection to a remote 4088B MVT can run in low power mode.
- If PID control, math/logic blocks, or Ethernet communications are enabled, or a serial port is set to Modbus master or the additional 8 or 6 channels I/O is fitted and enabled, the unit will run in the standard power mode.

The local display and Mobile SCADA with Wi-Fi can be configured to switch off after a period of inactivity (configurable between 1 and 60 minutes) or be permanently left on.

When running in low power mode, if you need to use more than the default number of data points for logging, consult the *Emerson FB2200 Flow Computer Instruction Manual* (D301784X012) to determine the possible impact on power consumption.

The figures below are typical power values in mW measured at room temperature.

Low Power Mode	**Base unit** with integral multivariable DP and pressure sensor and temperature measurement, single DO available, single meter run		55 mW @ 12.3Vdc	
	Base unit with integral multivariable DP and pressure sensor and temperature measurement, 2 discrete & 2 analog channels available, single meter run		67 mW @ 12.3Vdc	
	Base unit with integral multivariable DP and pressure sensor and temperature measurement, communicating to remote 4088 - dual meter run (4088 Externally powered)		120 mW @ 12.3Vdc	
	Additional Load Options	Mobile SCADA and Display active	398 mW @ 12.3Vdc	
		DO active (1 Hz, 50:50 duty cycle, no load)	12 mW @ 12.3Vdc	
		PI active (10KHz, 50:50 duty square wave)	12 mW @ 12.3Vdc	
Standard Power Mode	**Base unit** with integral multivariable DP and pressure sensor and temperature measurement, single meter run		240 mW @ 12Vdc	290 mW @ 24Vdc
	Base unit with temperature measurement, (no integral sensor) communicating to remote 4088 (externally powered), single meter run		220 mW @ 12Vdc	268 mW @ 24Vdc
	Base unit with integral multivariable DP and pressure sensor and temperature measurement, 2 discrete and 2 analog channels available, single meter run		260 mW @ 12Vdc	313 mW @ 24Vdc
	Base unit with temperature measurement, integral static pressure sensor and pulsed input, single meter run		276 mW @ 12Vdc	330 mW @ 24Vdc
	Base unit with integral multivariable DP and pressure sensor and temperature measurement, communicating to remote 4088 - dual meter run (4088 externally powered)		250 mW @ 12Vdc	300 mW @ 24Vdc
	Additional Load Options	Display and Backlight active	159 mW @ 12Vdc	188 mW @ 24Vdc
		Mobile SCADA	191 mW @ 12Vdc	199 mW @ 24Vdc

		Mobile SCADA and Display active	233 mW @ 12Vdc	245 mW @ 24Vdc
		DO active (1 Hz, 50:50 duty cycle, no load)	20 mW @ 12Vdc	23 mW @ 24Vdc
		PI active (10KHz, 50:50 duty square wave)	14 mW @ 12Vdc	15 mW @ 24Vdc
		Additional 8 channel I/O board fitted (isolated)	228 mW @ 12Vdc	280 mW @ 24Vdc
		Additional 6 channel I/O board fitted (isolated)	68 mW @ 12Vdc	66 mW @ 24Vdc
		Ethernet enabled 100 Mbit	430 mW @ 12Vdc	466 mW @ 24Vdc
		Ethernet active 100 Mbit	640 mW @ 12Vdc	650 mW @ 24Vdc
		Loop power supply	310 mW @ 12Vdc	393 mW @ 24Vdc
Physical				
Aluminum Enclosure	Construction	Powder coat aluminum, with lockable door		
	Ingress Protection	IEC 60529 IP66 & NEMA 4X		
	Dimensions	356 mm H by 305 mm W by 152 mm D (14 in. H by 12 in. W by 6 in. D)		
	Mounting	2 in. pipe, direct manifold, or panel mount		
	Wiring	Size 12 to 28 American Wire Gauge (AWG) (0.3 to 2mm diameter)		
	Wiring Access	2 conduit entry points, 3/4 in. NPT 1 blanked 5/8” (16mm) hole		
	Weight	FB2200 with MVS coplanar flange sensor: 10.75 Kg (23.7 lb)		
		FB2200 with static pressure sensor: 9.98 Kg (22 lb)		
		FB2200 without sensor: 8.21 Kg (18.1 lb)		
		Internal battery: 3.28 Kg (7.23 lb)		
Fiberglass Enclosure	Construction	Compression molded fiberglass, with lockable door		
	Ingress Protection	IEC 60529 IP66 & NEMA 4X		
	Dimensions	305 mm by 254 mm by 152 mm (12 in. by 10 in. by 6 in.)		
	Mounting	2-inch pipe, direct manifold, or panel mount		
	Wiring	Size 12 to 28 American Wire Gauge (AWG) (0.3 to 2mm diameter)		
	Wiring Access	2 conduit entry points, 3/4 in. NPT 1 blanked 5/8” (16mm) hole		
	Weight	FB2200 with MVS coplanar flange sensor: 6.94 Kg (15.3 lb)		
		FB2200 with static pressure sensor: 6.17 Kg (13.6 lb)		
		FB2200 without sensor: 4.4 Kg (9.7 lb)		
		Internal battery: 3.28 Kg (7.23 lb)		
HMI	20 characters per line; 4 lines in display.			

Security Switch (Optional)	Provides an alarm each time the enclosure door is opened.	
Local Display (Optional)	Type	Backlight LCD display
Environmental		
Operating Temperature	−40 °C to +80 °C (−40 °F to +176 °F) (see ambient temps in Approvals section) **Note:** Please check Approvals section for any restrictions. The display exhibits increased response time and decreased contrast at temperatures below −30 °C (−22 °F).	
Storage Temperature	−40 to 85 °C (−40 to 185 °F)	
Operating Humidity	5 to 95%, non-condensing	
Conformal Coating	All boards are conformal coated and comply with ANSI/ISA S71.04 Class G3 environment	
Electro Magnetic Compatibility	The following EMC Emissions and Immunity are evaluated per EMC directive 2014/30/EU. Harmonized standards used: EN 61326-2-3-2013 Immunity EN 61326-1-2013 Emissions	
Immunity	EN 61000-4-2 (Electro Static Discharge) EN 61000-4-3 (Radiated Immunity) * EN 61000-4-4 (Fast Transients) EN 61000-4-5 (Surges) EN 61000-4-6 (Conducted RF) EN 61000-4-8 (Power Frequency Magnetic Field) EN 61000-4-17 (Voltage Ripple) EN 61000-4-29 (Voltage Dips and Interrupts) *Meets CE compliance 10V/m industrial requirements (deviations < 1% span for RTD and Pressure readings in addition to original specification)	
Radiated Emissions	EN 550022 Class A	
Vibration	2g over 10 to 150 Hz 1g over 150 to 200 Hz	
Approvals		
Product Markings for Hazardous Locations	UL	Class I, Div 2 Groups A, B, C, D Hazardous Locations, Temperature Code T4
	Ambient Temperature	Aluminum enclosure -40 °C to +80 °C (-40 °F to +176 °F) (no battery) -40 °C to +45 °C (-40 °F to +113 °F) (with rechargeable lead acid battery) Note 1 -40 °C to +60 °C (-40 °F to +140 °F) (with optional relays) Fiberglass enclosure -35 °C to +80 °C (-31 °F to +176 °F) (no battery) -35 °C to +45 °C (-31 °F to +113 °F) (with rechargeable lead acid battery) Note 1 -35 °C to +60 °C (-31 °F to +140 °F) (with optional relays)
	Note 1: Maximum ambient temperature for models with the internal SunSaver SS-6-12 Vdc solar regulator is 60 °C (140 °F). However, the internal lead acid battery is limited to +45 °C (+113 °F).	
	Evaluated per Approval Standards	ANSI/ISA 12.12.01-2015 CSA C22.2 No. 213-15, 1st Ed CSA C22.2 NO. 61010-1-12 3rd Ed. UL61010-1 3rd Ed.

	UL	ATEX Cert: DEMKO 16 ATEX 1579X IECEx Cert: IECEx UL 16.0069X Ex nA IIC T4 Gc
		Ambient Temperature: −25 to +55 °C (−13 to +131 °F)
		
		Evaluated per Approval Standards: Directive 2014/34/EU EN 60079-0:2012+A11:2013 EN 60079-15:2010
		Note: ATEX and IECEx approval requires the use of an external DC power supply.
Miscellaneous Approvals	Customs Union	 TR CU 004/2011, TR CU 020/2011 Conforms to the requirements of the technical regulations of the Customs Union
	RoHS2	**Device without integral MVS or SP Sensor**: RoHS (2) EU Directive 2011/65/EU **Device with integral MVS or SP Sensor**: RoHS (2) EU Directive 2011/65/EU: This product may be considered out-of-scope when used for the intended design purpose in a Large Scale Fixed Installation (LSFI). Consult https://www.emerson.com/compliance for up-to-date product information.
	RoHS	

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