FB3000 Remote Terminal Unit (RTU)

The FB3000 Remote Terminal Unit (RTU) is a microprocessor-based controller that provides the functions required for a variety of field automation applications. The FB3000 monitors, measures, and controls equipment in a remote environment. The FB3000 is ideal for applications requiring flow computation; Proportional, Integral, and Derivative (PID) control loops; logic sequencing control; and up to 36-meter runs.

The FB3000 provides the following features:

- Rugged, reduced-maintenance hardware.
- High isolation, surge, and short circuit protection.
- Low power consumption.
- Wide operating temperature (−40 °C to +75 °C).
- Supports one CPU and up to 31 easily installed modular I/O cards.
- Versatile serial and Ethernet communications.
- Class I, Div. 2 and Zone 2 hazardous location approval.
- Metering station support for up to 36 runs.
- Standard firmware supports Properties Calculations for Natural Gas, Pure Gas, Crude Oil, and Light Hydrocarbons
- Large, configurable history storage.
- Easy-to-use FBxConnect™ configuration software.
- Local operator interface available through USB, serial, and Ethernet ports.
- Support for up to 20 Emerson 4088B transmitters
- Custom programming with the FBxDesigner development suite, which allows you to easily build IEC 61131-3 compliant programs for use with the FB3000.
- Support for rich applications (like FBxStation Control).

Building upon the strong foundation of the FB1000 and FB2000 Series Flow Computers, the FB3000 architecture adds significant benefits through the following advanced features:

- Increased user memory.
- Increased processor speed for demanding applications.
- I/O flexibility, supporting mixed I/O in any I/O slot.
- Enhanced history and logging for improved audit trail.
- Firmware-based PID and logic block flexibility.

Base and Extension Units

The FB3000's polycarbonate resin base and extension chassis have a removable wire guard to protect the wiring terminals. The optional DIN rail mounting allows you to mount the FB3000 chassis on an enclosure backplane. The rugged housings are suitable for use over the complete extended temperature range.

The extensive use of the latest technology in short-circuit protection protects the FB3000's CPU, I/O, and communications modules. This also decreases the need for maintenance at FB3000 installations.

The FB3000 economizes its power consumption for normal operation through the use of internal 3.3-volt electronics. The FB3000 uses power blocks to provide external input power to the voltage levels the FB3000's electronics require.

Emerson FB3000 RTU

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The FB3000 Backplane and Chassis

The FB3000 is available as an 8-slot chassis or a 4-slot chassis. The 8-slot FB3000 backplane supports a central processing unit (CPU), two power input blocks with automatic fail-over, up to 7 input/output (I/O) modules, and up to 7 connection (or "personality") modules, which provide surge protection to the I/O modules and can tailor the I/O modules to your site's particular needs.

The 4-slot FB3000 backplane supports a central processing unit (CPU), one power input block, up to 3 input/output (I/O) modules, and up to 3 connection (or "personality") modules, which provide surge protection to the I/O modules and can tailor the I/O modules to your site's particular needs. For both the 8-slot and 4-slot chassis, the personality modules are inserted below the I/O modules and provide an interface to the field wiring.

The 8-slot base backplane is housed in a chassis and can be extended to support up to three additional backplanes, for a total of four connected chassis. Each of the three additional chassis can support up to eight I/O modules.

The 4-slot base backplane is housed in a chassis and cannot be extended to support additional backplanes. However, the 4-slot chassis can be added to an existing 8-slot chassis to give support for an additional four I/O modules.

The extended backplanes do not need another CPU or power supply if the power requirements are under 5 Amps. For more information, refer to the *Emerson FB3000 Remote Terminal Unit (RTU) Instruction Manual* (part D301851X012) for specific power limitations and hazardous area approvals.

Memory

The FB3000 supports three types of memory:

- Flash: Firmware image, history, alarms, events, and file system
- SRAM (Static Random Access Memory): Data Logs and configuration
- DDR3 SDRAM (DDR3 Synchronous Dynamic Random Access Memory): Firmware and execution memory

The 32-bit microprocessor and the Real-Time Operating System (RTOS) provide both hardware and software memory protection.

Firmware

The firmware that resides in flash memory contains the operating system and application-specific software.

The firmware has a database for events, alarms, and history that stores the last 8000 events, the last 8000 alarms, and six months of hourly records per API Chapter 21.1 (Second Edition, February 2013).

The FB3000 performs 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 9(Multipath Ultrasonic)
- AGA 7 2006 (pulsed turbine, PD, and ultrasonic)
- AGA 11 2013 (Coriolis pulses)
- Auto-Adjust™ meter
- API 20.1 Allocation
- API 12.2 Calculation of Petroleum Quantities

The firmware supports the following property calculations:

- AGA 8 1994 (Detailed, Gross 1 and Gross 2)
- AGA 8 2017 Part 1 and Part 2 (GERG 2008)
  Note: AGA 8 Part 2 / GERG provides support for the following pure gases: nitrogen, carbon dioxide, hydrogen, oxygen, carbon monoxide, water vapor, hydrogen sulfide, helium, and argon
- Speed of Sound calculated via AGA 10 and AGA 8 2017 Part 2
- NX-19 1962, MOD, VDI/VDE 2040, Miller
- 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])
- AGA 5 2009

- API 11.1 Temperature and Pressure correction for Crude Oils, Refined Products, and Lubricating Oils
- GPA 8217/API 11.2.4 Table E (formerly TP-27) Temperature Correction for NGL and LPG
- GPA 8117/API 11.2.5 (formerly TP15) Vapor Pressure and API 11.2.2, API 11.2.2M, API 11.1 Pressure Correction for NGL and LPG

The firmware includes the following flow rates and totals for gas DP and gas linear meters:

- Uncorrected volume
- Corrected (standard) volume
- Mass
- Energy
- Integral Value (DP meter) or Pulse Totals (linear meter)

In addition to the normal totals, the firmware also supports the following fault totals which can be enabled for a gas meter. The conditions to trigger the fault totals are user-configurable:

- Uncorrected volume fault totals
- Corrected volume fault totals
- Mass fault totals
- Energy fault totals

The firmware accepts gas density, base density, and specific gravity from any of the following sources:

- Up to 6 gas chromatographs (GC)
- Fixed value
- Periodic download from SCADA
- An external signal, such as analog input
- Calculated based on gas composition
- For liquid meters, the flow meter signal can be provided by either a pulse input, an analog flowrate, or a direct accumulation from the meter electronics.

The firmware includes the following flow rates and totals for API 12.2 and API 20.1 (low water):

- Indicated Volume / Mass
- Gross Volume
- Gross Standard Volume
- Net Standard Volume
- Water Volume
- Mass
- Flow time
- Pulses

The firmware includes the following flow rates and totals for API 20.1 (high water):

- Indicated volume/mass

- Gross Volume
- Oil (Unshrunk and Theoretical Production)
- Natural Gas Liquid
- Flashed Gas
- Water (Uncorrected and Corrected Volume)
- Flow Time Total
- Pulses
  Note: The firmware can accept a water cut from an on-line analyzer or from an off-line analyzer corrected to metering conditions.

Totalizers provide periodic and cumulative totals for all meter types and stations. Additionally, liquid stations can provide batch station, meter totals, and meter averages via the station batching feature. Batch totals and averages can be recorded in transactional history.

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

Meter Runs and Stations

The FB3000 optionally supports up to 36-meter runs with station support. You can group similarly configured meter runs into stations. This simplifies the configuration process since many parameters are set once for the entire station. Using stations can make uploading and downloading more efficient as redundant meter and station data are eliminated.

Any of the 36-meter runs configured as gas DP or gas linear meters can be assigned to any station configured with a fluid type of natural gas. Any of the 36-meter runs configured as liquid meters can be assigned to any station configured with a fluid type of liquid.

Additionally, each station can be configured for gas metering or liquid metering. Gas meters are associated with gas stations; liquid meters are associated with liquid stations. Contract hours and engineering units can be set differently for each station.

Control

The FB3000 supports up to a total of 100 instances of control through PIDs, action blocks, effects, and math blocks. The FB3000 allows flexibility in the amount of control so you can choose exactly how many instances of which type you need. The total of all the control instances cannot exceed 100.

PID Control – The FB3000 supports 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 FB3000 supports action blocks which can be 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 FB3000 supports effects which can 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 FB3000 supports math blocks to 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 calculated value or to any other data base parameter. Mathematical calculations also support standard math functions (POW, EXP, LOG, SQRT, etc.), constants, and operators.

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

Communications

The FB3000 provides up to seven communication ports. The various types of communication ports are:

- Serial Interface– Comm 1, 2, 3, and 4

- Ethernet – Comm 5 and 6
- USB – Comm 7

The USB port functions as a local operator interface (LOI) port to provide a direct link between the FB3000 and a personal computer.

The FB3000 accommodates the following serial communication types:

- EIA-232 (RS-232) for point-to-point asynchronous serial communications.
- EIA-422/EIA-485 (RS-422/RS-485) for half duplex synchronous serial communications, EIA-422 for point-to-point, EIA-485 for multiple-point, 2- and 4-wire.

Using a 4-port Serial Communications module provides the FB3000 with additional MVS serial communications, enabling communication to 4088B transmitters via the additional ports.

Communications Protocols

The FB3000 supports the DNP3 and Modbus host and slave (ASCII or RTU) communication protocols on all serial and Ethernet ports. The USB port supports **only** DNP3.

The Ethernet ports support these communication protocols:

- Modbus encapsulated in TCP/IP protocol (slave and host).
- Modbus TCP/IP protocol (slave and host).
- DNP3 protocol

In addition to DNP3 and Modbus, the FB3000 supports HART-IP. This allows HART Pass through for predictive intelligence and integrated protection technologies like AMS Device Manager.

Power Input Blocks

The FB3000 Power Input blocks provide the RTU with external input power to the voltage levels required by its electronics. The power blocks accept input from 10.5 to 30 Vdc from an AC/DC converter or other 10.5 to 30 Vdc supply.

The IN+ and IN– terminals bring outside power to the power blocks. The LP+ and LP– terminals bring independent loop power supply to the modules.

The FB3000 supports two power supply blocks for automatic fail-over. If one power block fails, the second power block provides power to allow the FB3000 to continue working without interruption.

Additionally, the FB3000 power blocks include a lithium coin cell battery for SRAM backup.

Inputs/Outputs

You can add up to 31 isolated I/O modules to the FB3000 to satisfy a wide variety of field I/O requirements.

Module Installation

Installation and replacement of any I/O module is accomplished by releasing the push-button of any hot-swappable I/O module latches accessible from the front of the unit. Personality modules can be removed and replaced using the quarter-turn screw on those modules. Each I/O module is hot-swappable, meaning you can remove the module and install another module of the same kind while under power. The new module acquires the previous module's configuration.

FBxNet™

FBxNet is a secure, easily configurable, peer-to-peer communication network for exchanging data between Emerson FB3000 RTUs and FB1200 and FB2200 flow computers over an Ethernet connection. FBxNet supports subscriber and publisher devices, where publishers provide data to their subscribers. The FB3000 RTUs and FB1200 and FB2200 flow computers can be publishers; only an FB3000 can be a subscriber. For more information, refer to *FBxNet* product data sheet (part D301905X012).

FBxRemote I/O™

The FBxRemote I/O is a remotely mounted chassis that can bring additional FB3000 I/O to a main or host FB3000. The FBxRemote I/O supports up to 31 slots of I/O when four chassis are used together. The FBxRemote I/O uses the same I/O modules as FB3000, along with the same chassis, power blocks, and DIN rail.

The FBxRemote I/O requires an I/O CPU (3IOCPU) that acts as a bridge to bring input and output signals from the remotely located chassis to the main or host FB3000. The I/O CPU does not support meter runs, control or applications, but does support serial communication for connection to remote devices such as the 4088B transmitter. Additionally, the 3IOCPU must be connected to a main RTU using FBxNet.

Configuration Software

Emerson's FBxConnect™ configuration software is an easy-to-use Microsoft® Windows® based program used to configure, calibrate, monitor, and retrieve historical data from the FB3000. The software uses the Windows-style navigation tree with drop-down menus, context-based dialog boxes, and task-driven Guided Setup routines. It is well-organized and functional for the standard station and meter run firmware application. FBxConnect also provides program customization through Action Blocks, Math Blocks, and Effect logic operations. These can provide control capability, mathematical and logical operations, and database access operations. Finally, the software provides security for controlling access to functions in FBxConnect and you can set passwords to restrict logons to both FBxConnect and the FB3000 RTU itself. For more information, refer to *FBxConnect* product data sheet (part D301735X012).

Security

To secure your valuable process and data, the FB3000 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.

Additionally, the DNP3 protocol lends itself to an added layer of security through Secure Authentication (SA). SA version 5 (SAv5) is available in the FB3000 Flow Computer as a selection in the firmware. SAv5 authenticates the devices which significantly improves resistance to outside influence.

Additional Features

- **I/O and Communications**
  The FB3000 supports a wide variety of I/O and communications modules to suit many applications.
- **Software-based License Keys**
  Additional software-based license keys are available that grant access to corresponding applications, such as well optimization and meter run calculations.
- **Gas Calculations**
  An optional license key can enable up to 36 gas meter runs using American Gas Association (AGA)

or ISO calculations for any combination of orifice, turbine, ultrasonic, and/or Coriolis meter types.

▪ **Liquid Calculations**
An optional license key can enable up to 36 API Chapter 12.2 / API Chapter 20.1 liquid meters using any combination of turbine, ultrasonic, and/or Coriolis meter types.

▪ **FBxDesigner™**
The FBxDesigner software is an integrated development environment that enables you to build IEC 61131-3 compliant programs which you subsequently download to the FB3000. You use this software, enabled with an optional software-based license key, to develop programs independently of the FBxConnect configuration software. For more information, refer to the *FBxDesigner* product data sheet (part D301861X012) or the FBxConnect online help.

Alarms and Events

The FB3000 supports extensive alarming capability to enhance operational efficiency and improve audit trail. Alarms are pre-allocated to meter runs 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 FB3000 provides several user alarms that you can assign to other database parameters. Storage is provided for the most recent 8000 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 8000 events or store the metrology/legal events in a separate log from the operational events. With the latter option, the event log capacity is 4000 metrology events and 4000 operation events.

History

The history database holds up to 1,380 points in 39 history groups. You can configure the first two history groups to archive at different time intervals (between 1 second and 200 hours). The other 37 history groups can have their own contract hours and are used to archive hourly, daily, weekly, and monthly data.

The FB3000 features expanded and flexible history capability to ensure measurement confidence and meet the increasing demands for secure data.

The FB3000 has four standard periodic logs available providing hourly, daily, weekly, and monthly history. These logs can contain up to 1,350 variables including

average data, totals, and gas composition. For gas meter averages, you can choose between flow-dependent linear per API Chapter 21.1 (2013) or flow-dependent formulaic, flow-weighted linear, or flow-weighted formulaic averages per API Chapter 21.1 (1993). Liquid meter averages are flow-weighted averages per API Chapter 12.

The default history in the FB3000 can store the following standard periodic logs for 640 variables.

▪ Hourly logs   6 months or 4380 records
▪ Daily logs   24 months or 730 records
▪ Weekly logs   60 months or 260 records
▪ Monthly logs   60 months or 60 records

Note: Each log can include up to 610 different parameters. This is only the initial default history. With the flexible history design, the number of variables and the time duration for different periodic logs can be adjusted to meet the application requirement.

The FB3000 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 FB3000 RTU supports transactional history along with standard periodic history. The flexible sizing allows up to 100 transactional history groups and 3100 points, including numeric and string data types. Transactional logging is performed by the built-in liquid station batching feature, by the START/STOP/NEXT triggers, or by external logic such as an application.

The FB3000 with FBxConnect provides pre-formatted EFM reports containing configuration, alarm, events, and hourly and daily history for the specified meter(s) for the specified time period. The format of the reports can be .csv, .pdf or secure pdf.

In addition to the above reports, the FB3000 can produce FLOWCAL-compliant .cfx files through the FBxConnect tool as well as calibration reports that contain U.S. Bureau of Land Management specific parameters.

FB3000 Remote Terminal Unit

CPU Module (3CPU16) and I/O CPU (3IOCPU)		
Processor	32-bit microprocessor based on the NXP i.MX 6SoloX processor running at 792 MHz	
Memory	Flash	256 MB for firmware image and report files; with 104 MB reserved for file system and 128 MB available for database and history
	SRAM	16 MB for historical data logs and configuration
	Synchronous DRAM	1 GB for firmware execution and execution memory
Battery Backup	Type	Renata 3 V CR1632 Lithium, user-replaceable
	Normal use life	10 years (while power is applied to unit)
	Backup life	4-weeks minimum while maintaining RTC and SRAM data and no power is applied to unit, SRAM battery back-up in the power blocks provide an additional 4900 hours each.
	Shelf life	10 years (with backup battery insulator tab included)
Clock	Type	32 KHz crystal oscillator with regulated supply, battery backed. Year/Month/Day and Hour/Minute/Second
	Accuracy	0° C to −40° C 60 seconds/year −40° C to 75° C 110 seconds/year
	Watchdog Timer	Hardware monitor expires after 3 seconds and resets the processor
Diagnostics	Board Temperature Monitor	Included
	Voltage Monitor Accuracy	2% maximum
Light-Emitting Diodes (LEDs) **Note**: Refer to the *Emerson FB3000 RTU Instruction Manual* (D301851X012) for the sequence and meaning of LEDS.	Module Status	Indicates normal function, hardware status
	Communication Status	Indicates communication status, hardware status
	Termination Status	Indicates the status of personality modules, low battery voltage
	USB	Indicates receive or transmit in progress
	COM1, COM2, COM3, COM4	Indicates communications on these ports in progress
	ISO+T	Indicates RS-485 communications enabled on either COM3 or COM4
	V+	Indicates power applied to personality modules
Communications		
Ports on CPU module	USB	EIA-232D (RS-232D) Standard. 1843.2 Kbps USB 2.0 interface data rate; supports Micro A or Micro B
	Ethernet	10/100/1000 BASE-T twisted pair Quantity: 2
		Maximum Segment 100 m (330 ft)

	Serial Port	EIA-232/EIA-422/EIA-485 (RS-232/RS-422/RS-485)	115.2 Kbps maximum data rate; Quantity - 2
		EIA-485 (RS-485)	115.2 Kbps maximum data rate; Quantity – 2; Support for ten 4088B per serial port
Protocols	USB Port	DNP3	
	EIA-232 and EIA-422/485	DNP3 and Modbus host and slave (ASCII or RTU)	
	Ethernet	DNP3 and Modbus host and slave (ASCII or RTU) encapsulated in TCP/IP or via TCP/IP	
		Note: The Ethernet port supports up to 20 connections per port, each of which is selectable between Modbus slave and DNP3. It also contains a dedicated connection as a Modbus host.	

Input/Output and Communications Modules (optional)

12-channel Mixed I/O	8 channels (user-selectable) of analog, discrete, or pulse inputs; 2 analog outputs; 2 discrete outputs; and 24V loop supply. For more information, refer to the *12-Channel Mixed I/O Module* product data sheet (part D301863X012).
4-channel HART	4 total channels (software selectable as inputs or outputs). For more information, refer to the *FB3000 4-Channel HART Module* product data sheet (part D301911X012).
8-channel Output Module	8 channels (user-selectable) of analog, or discrete outputs. For more information refer to *FB3000 8-Channel Output Module* product data sheet (part D301920X012).
4-port Serial Communications Module	4 serial communication ports. For more information refer to *FB3000 4-Port Serial Communications Module* product data sheet (part D301942X012).

Power

FB3000 Input Power	110 mA	
Battery Backup	Type	Renata 3V CR2450HT Lithium, user-replaceable
	Normal use life	10 years (while power is applied to unit)
	Backup life	Each of the two batteries has a 4900-hour minimum life while maintaining RTC and SRAM data and no power is applied to unit
	Shelf life	10 years (with backup battery insulator tab included)

Note: To determine the unit's final input power requirements, add the input power requirements of the base unit, any optional expansion I/O backplanes, and all appropriate communication or I/O modules together. Input power requirements for individual modules are listed on each module's product data sheet.

Physical

Physical 4-Slot and 8-Slot Chassis

8-Slot Dimensions	243.84 mm H by 222.50 mm W by 83.26 mm D (9.600 in. H by 8.760 in. W by 3.278 in. D). Allow an additional depth of 19 mm (0.75 in.) for cables.

8-Slot Weight	1.65 kg (3.65 lb) for housing, backplane, and CPU.	
	Note: To determine the unit's final weight, add the weight of the 8-slot housing, backplane, and CPU to the number of installed I/O and communications modules. Weights for individual modules are listed on each module's product data sheet.	
4-Slot Dimensions	243.84 mm H by 148.71 mm W by 83.26 mm D (9.600 in. H by 5.855 in. W by 3.278 in. D). Allow an additional depth of 19 mm (0.75 in.) for cables.	
4-Slot Weight	0.6 kg (1.4 lb) for housing, backplane, and CPU.	
	Note: To determine the unit's final weight, add the weight of the 4-slot housing, backplane, and CPU to the number of installed I/O and communications modules. Weights for individual modules are listed on each module's product data sheet.	
Wiring	Size 16 to 22 American Wire Gauge (AWG) for terminal blocks.	
Materials	Housing	Polycarbonate Plastic
	Wire Channel Covers	Polycarbonate Plastic
	Modules	Polycarbonate Resin
Mounting	DIN Rail	7.5 mm and 15 mm
	Direct Mount	4 mounting screws

Environmental

Operating Temp	−40 to 75 °C (−40 to 167 °F)
Storage Temp	−40 to 85 °C (−40 to 185 °F)
Operating Humidity	IEC68-2-3; 5-95% non-condensing
Radiated Emissions	Meets EN 55011 Class A; ICES-003:1997 Digital Apparatus; and FCC Part 15, Class A
Conformal Coating	Complies with ANSI/ISA S71.04 for Class G3 environments
Mechanical Shock	IEC68-2-27; 11 ms, sinusoidal 50 Gs non-operating, 15 Gs operating
Thermal Shock	IEC68-2-14; Air to air from −20 to 85 °C (−4 to 185 °F)
Radiated/Conducted Immunity	Meets requirements of IEC 61326 Electrical Equipment for use in Industrial Locations
Vibration	1g over 10 to 150 Hz 0.5g over 150 to 200 Hz
Electro Magnetic Compatibility	The following EMC Emissions and Immunity are evaluated per EMC Directive 2014/30/EU. Harmonized Standards Used EN 61326-1:2013 (Immunity) EN 55011:2009+A1:2010 (Emissions) EN 55032:2012 (Emissions) FCC Part 15.019(g):2018 ICES-003 Issue 6 (Emissions)

Immunity	EN 61000-4-2:2009 (Electrostatic Discharge) EN 61000-4-3:2006: +A1:2008+A2:2010 (Radiated Immunity) EN 61000-4-4:2012 (Fast Transients) EN 61000-4-5:2006 (Surges) EN 61000-4-6:2009 (Conducted RF) EN 61000-4-8:2010 (Power Frequency Magnetic Field) EN 61000-4-11:2004 (Voltage Dips, Variations and Interruptions)	
Emissions	EN 61000-3-2:2014 EN 61000-3-3:2013	
Radiated Emissions	EN 55011:2009+A1:2010 EN 55032:2012 FCC Part 15.109(g):2018 ICES-003 Issue 6	

Approvals

Product Markings for Hazardous Locations ▪ Base Chassis and Extension Chassis	CSA C/US	Certified by CSA Certificate Number 70179164 Class I, Division 2, Groups A, B, C, and D, T4 Class I, Zone 2, AEx ec IIC T4 Gc Ex ec IIC T4 Gc
	Evaluated per Approval Standards	CAN/CSA C22.2 No. 213-17 ANSI/UL 121201-2017 (9th Edition) CAN/CSA C22.2 No. 60079-7:16 ANSI/UL 60079-7-2017 (5th Edition) CAN/CSA C22.2 No. 60079-0:19 ANSI/UL 60079-0-2020 (7th Edition) CAN/CSA C22.2 No. 61010-1-12 CAN/CSA-C22.2 No. 61010-2-201-14 UL 61010-1-2012 (3rd Edition) UL 61010-2-201 (1st Edition)
Base and Extension Chassis	ATEX/IEC & UKCA	Certified by SIRA per Certificate Number ATEX Cert: SIRA 19ATEX3013X IECEx Cert: IECEx CSA 19.0003X Product Markings for Hazardous Locations: Ex ec IIC T4, T_{amb} = −40 °C to +75 °C CSAE22UKEX1142X
	Ambient Temperature	−40°C to +75 °C
		EMC Directive 2016

	Evaluated per Approval Standards	IEC 60079-0:2017 Edition: 7.0 IEC 60079-7:2017 Edition: 5.1 EN IEC 60079-0:2018 EN 60079-7:2015/A1:2018 EN IEC 60079-0:2018 EN 60079-7:2015/A1:2018
Product Markings for Metrology	Measurement (Industry) Canada	Approval No.: AG-0646 Device Type: Conversion Device - Flow Computer Approval Type: Category 3, Type B Approved For: Natural Gas Fiscal Measurement
Miscellaneous Approvals	RoHS2	RoHS (2) EU Directive 2011/65/EU
	RoHS	
	KOREA (KC)	EMC - Broadcasting and Communication Equipment Cert. No. 7BC5-91E5-A254-B4B7

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