Bristol® ControlWave® GFC

Classic Version Gas Flow Computer

When requirements call for an integrated, “all in one box” chart replacement or flow computer, Bristol® ControlWave® GFC, from Emerson Process Management, is a cost effective, competitive solution.

Unlike chart replacements, ControlWave GFC is also able to meets users’ automation needs and easily supervises a two-run metering and regulating station or plunger lift operations at a well site.

ControlWave GFC Overview

Hardware/Packaging Features

- 32-bit ARM9 platform is capable of multiple flow computing and process automation operations.
- Smart, DP/P sensor assembly can be removed and replaced, independently of the the "top end" assembly.
- Precision RTD interface provides very accurate process temperature measurement.
- Very low power consumption minimizes costs of solar/battery power systems, which are also integrated in the package.
- Three serial communication ports are standard.
- Standard I/O includes 2 DI, 2 High-speed Counter inputs and 2 DO.
- Optional I/O expansion includes 3 AI and 1 AO.
- Integral 4-line LCD with 25-key keypad (optional) allows operators to change configurable parameters, on site, without packing a PC.
- Broad selection of modem and wireless communications are instrument package options.
- Operating temperature range is -40 to 158ºF (-40 to 70ºC)
- Class I, Division 2 approved

Firmware/Software Features

- ControlWave GFC is pre-programmed to meet API 21.1 requirements for a two-run metering station with networking via BSAP or Modbus.
- PC web style menu pages are pre-configured for all user operations
- Using our ControlWave Designer, IEC 61131-3 programming environment, any user or third party can modify the standard application or create a completely customized program—and full support from Emerson is available, every step of the way.
- Additional, standard application programs will be introduced on a continual basis.
- Bristol TeleFlow users will appreciate ControlWave GFC’s compatibility in networking and software solutions for SCADA and EFM data editing/management, as well as the similarity in all operations.

Application Areas

ControlWave GFC is appropriate to all applications for “chart replacements” and flow computers, particularly including those that require process control or extension to two meter runs, for example:

- Production wells
- Injection wells
- Production optimization applications
- Off-shore platforms
- Separation plants
- Compressor stations
- Storage facilities
- Transmission metering stations
- Distribution/LDC metering/gate stations

ControlWave GFC Package Overview

ControlWave GFC is delivered in a compact, Lexan enclosure that has provisions for not only the electronics but also a display/keypad, smart sensor assembly, battery/solar power system and a broad selection of modem and radio communications options.

Specifications – Package

- Dimensions, Lexan Housing: 15.77” H x 7.8” W x 9” D
- Clearance: Please allow at least 2.5” space underneath for cabling.
- Dimensions: MVT Assembly (optional): 3” H x 3 ¾” W x 2 ½” D
- Weight: Minimum 10 lbs.
- Battery + MVT 18.5 lbs.
- Maximum with Radio 20 lbs.
- Mounting: This product can be pipe-mounted, wall-mounted or direct-mounted (in the last case, Emerson recommends PGI Direct Mount manifold products); a kit for affixing to a 2” pipe or mast is included.
- Solar Panel Mounting: All solar panels are delivered with all hardware necessary for 2” pipe or mast-mounting.

Specifications – Operating Environment

- Wide operating power input voltage range of 4.9 to 16.0 Vdc
- System can operate as either 6 Vdc nominal or 12 Vdc nominal (note: if a standard model radio is included, the power system must be 12 Vdc. I/O selections also depend on the nominal power input voltage.)
- Operating Temperature Range: -40 to 158ºF (-40 to 70ºC); operating temperature for the lead acid cell battery is limited to -4 to 140ºF (-20 to 60ºC)
- Operating Humidity Range: 0 to 95% RH non-condensing
- Vibration Rating: Maintains proper operation while subjected to a 2.0g acceleration over 10-150 Hz and 1.0g acceleration over 150-2000 Hz.
- RFI Immunity: In conformity with ENV 50140 Radio-frequency electromagnetic field amplitude modulated EMC
- RFI Emissions: EN 55022:1998 Class A ITE emissions requirements (EU); ICES-003 Issue 3 Class A Digital Apparatus emissions requirements (Canada); AS/NZS3548:1995/ CISPR Class A ITE emissions requirements (Australia)
- Nema Rating: Nema 3R (Nema 4x except with a battery vent)

Hazardous Area Approvals

- UL/CUL approved as non-incendive for operation in Class I, Division 2 Hazardous Areas

Performance

- Computation Accuracy: 0.01% Corrected Flow, including all input values
- DP/P Reference accuracy: 0.075% URL
- Pressure Effect on DP: 0.1% URL zero and 0.1% URL span
- Temperature Effects: 0.21% URL

Selection Item Descriptions and Specifications

ControlWave GFC is ordered using a model number specification. The complete model number specification is included at the end of this product data.

Standard equipment includes a weatherproof, Lexan housing, two-board electronics assembly and the standard API 21.1, two-run flow measurement application program. Standard I/O count is 2 DI, 2 HSC and 2 DO.

Also included in the base product are interfaces to Emerson's Bristol multivariable, DP/P sensor assembly, an RTD interface, AUX power output (e.g. to switch power to a radio) and shunt regulator for solar panel charging of an internal, lead acid cell battery.

The model number additionally allows a user to specify all of the following:

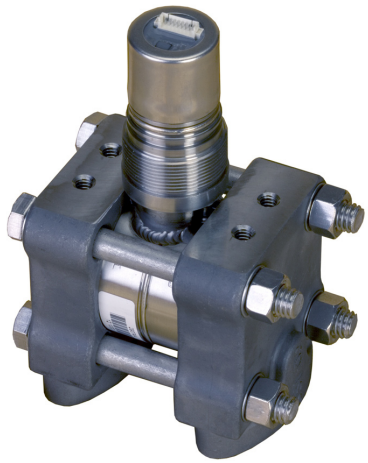
- Integral, Bristol multivariable (MVT), DP/P sensor assembly and upper range limits
- Bendable RTD assembly, pre-wired
- Thermowell
- Either a two-line LCD with two pushbuttons or a four-line LCD with 25-key keypad
- I/O expansion, including 3 AI, 1 AO
- Hazardous area approval –Class I Division 2 for the ControlWave GFC instrument
- Choice of battery and solar power systems
- Choice of embedded modem and radio, which are tightly integrated, OEM models that are installed on the CPU/ System Controller card
- Choice of standard model radio that is installed on a bracket in the Integral Package, not on the CPU / System Controller card; Standard radios are those that are commonly available from Freewave and MDS. ControlWave GFC is limited to one radio, whether it is an OEM model or standard model.
- Polyphaser surge suppressor

Emerson's Bristol Sensor Assembly

The sensor assembly is Selection "ABC" in the model specification, e.g. "142" for the 300" DP / 2000 psig static pressure range pair.

Using the MVT integrated in the instrument package is the easiest implementation for a single meter run; however, the standard application program also allows use of external transmitters, with or without the MVT.

Most two-run systems use the MVT for the first run and an external, smart multivariable transmitter, such as the Bristol 3808 MVT from Emerson (which includes the exact same wet end assembly), for the second meter run.



Bristol DP/P Multivariable (MVT) Sensor Assembly.

If the MVT assembly requires a repair, the user can change it out and continue operating with the electronics, including flow information, alarms and historical archives, all intact.

Emerson recommends that users practice “depot level” service, in other words, that the MVT assembly be removed and replaced at the shop rather than out at the site.

Each MVT assembly has a nine-digit part number, which can be used to specify a replacement part.

Physical Specifications – Sensor Assembly

- MVT Flange & Center Section Housing Material: 316 SS
- Flange Bolt Material: 316 SS
- Diaphragm Material: 316 SS
- Fill Medium: DC 200 Silicone
- MVT Flange Process Connections: ¼” NPT female
- Connects to the Processor Board via a dedicated SPI bus cable.

Accuracy and Performance Specifications – MVT Differential Pressure and Static Pressure

- Combined effects of nonlinearity, nonrepeatability and hysteresis at reference pressure and over the operating temperature range: DP and SP linear mode: ±0.075% of Calibrated Span or 0.015% of URL, whichever is greater.
- Temperature effect on Static and Differential pressure: ±0.21%URL maximum combined shift of zero and span with an ambient temperature change of 60ºC (108ºF)
- Static Pressure Effects On Differential Pressure: Zero error: ±0.1% URL, for a change in static pressure of 1000 psi; Span error: ±0.1% reading, for a change in static pressure of 1000 psi
- Long Term Stability at Constant Conditions: ±0.1% URL/Year typical
- Mounting position effect: ±2 in H2O maximum, which can be calibrated out.
- Power Supply effect: ±0.005% of URL maximum for any change within specified input power supply voltage range.
- Ripple and noise: Per ISA 50.1 Section 4.6

MVT Assembly Static Pressure Orientation

For a DP/P sensor assembly, selection “D” specifies whether the static pressure sensor is oriented to the right or to the left from the point-of-view of a user looking at the front of the ControlWave GFC. Following the AGA3-1992 convention, we refer to the static pressure sensor location as the “upstream” (a.k.a. “high side”) location.

If an MVT assembly is not selected, in other words, “ABC” is “000,” Selection “D” should also be "0."

Integral Enclosure and LCD/Keypad

The only choice in Selection “E” is between a two-button and 25-button keypad. Both display/keypad assemblies have identical, 4 line x 20 character liquid crystal displays and also have the same “footprint” on the front door.

Features – Display/Keypads

- 4 line by 20 character backlit liquid crystal display
- Adjustable display contrast
- Membrane keys with tactile feedback
- Self-adhesive overlay mounts to the enclosure door or panel (ControlWave GFC Package is delivered with this assembly installed on the door)
- Easy configuration via ACCOL III Function Block
- Scrolling display mode
- Adjustable timer turns off display when not in use

- The standard application program works with either display/keypad.

Specifications – Display/Keypads

- Window size: 1.1” H x 3.1”W (2.8cm x 7.9cm)
- Character size: 4mm H x 3mm W
- Dimensions: 7.4”H x 5.5”W (18.8cm x 14.4cm)
- Power consumption: 2.5 mA @ 3.3V (0.008 watts); Operating Temperature: -4 to 158ºF (-20 to 70ºC)

The 2-button display allows an operator to view site, configuration and process data. The screens are organized in a series of lists. The operator can select a list and then manually scroll through the data. Additionally, a “scroll list” can be defined. The ControlWave GFC can be set to automatically sequence through this list.

The 25-button Display/Keypad performs the same functions and additionally allows the operator to view and modify ControlWave GFC inputs, process variables, calculated variables, setpoints, tuning parameters, and outputs used in a measurement or control application. Status bits include the alarm state, alarm acknowledge, control, and manual (Auto/Man). Providing access to such variable information allows the user complete control over the process operation.

Shown above, is the LCD with 25-button keypad. The 2-button version is similar but includes only two "arrow" buttons to sequence through the lists.

2-button display example

25-button display example

Processor/Main Electronics Selection

Currently, one choice is available in Selection “F.” The electronics assembly consists of two circuit boards, the “CPU/ System Controller,” which is installed on the door of the enclosure—and specified here—and the “Battery Charger & I/O” board, which includes terminations and is installed on the far, left-hand side of the enclosure. Power sources are specified in Selection “JK” and I/O is specified in Selection “O.”

Specifications for CPU and System Controller

- 32-bit ARM9TDMI RISC Core Processor running at 14 MHz
- Serial Real Time Clock
- 512 KB Flash Boot/Downloader
- 2 MB SRAM
- 8 MB Simultaneous Read/write Flash
- Backup Battery for Real Time Clock and SRAM: 300 mA-Hour Lithium Coin Cell, 7142 Hour Expected Backup Time
- 3 Serial Communication Ports (see below for further information)
- Optional, Embedded OEM Modem (specified in selection “P” in the model number)
- Optional, Embedded OEM Spread Spectrum Radio (specified in selection “STU” in the model number)
- Note: Modem and Radio are mutually exclusive
- Display/Keypad Interface
- 6 Status LED’s plus Idle and Watchdog LED’s
- 4.9 to 16.0 Vdc Power Supply with Power Fail Sequencer

Information on the Serial Ports

COM1:

- RS 232
- Physical Interface via a 9-pin male D-sub connector or an 8-pin terminal block (both of which are available)
- Supports RTS, CTS, DTR, DCD and DSR modem control signals
- RS 232 transceivers are enabled by the port’s DTR.
- DCD remains active in power-down mode.

COM2:

- RS 232 or RS 485 or OEM modem or OEM radio (all mutually exclusive)
- RS 232 (default)
- Jumper-configurable as a 4-wire, RS 485 port
- COM2 is used by the OEM modem, if installed.
- COM2 is used by the OEM spread spectrum radio, if installed.
- Physical Interface for RS 232 or RS 485 is an 8-pin terminal block.
- RS 232 supports RTS, CTS, DTR, DCD and DSR modem control signals
- RS 232 transceivers are enabled by the port’s DTR.
- DCD remains active in power-down mode.

COM3:

- RS 485, 2-wire or 4-wire
- Physical Interface is a 5-pin terminal block.
- An eight position switch enables receiver biasing and termination as well as 2-wire or 4-wire selection.

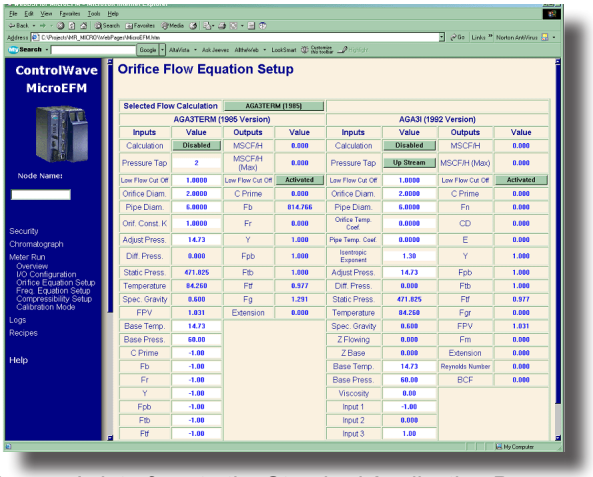
ControlWave GFC Standard Application Program

Selection “GH” allocates two digits in case we offer a large number of standard applications in the future. Currently, the 1 – 2 run M&R load is the only one available.

ControlWave GFC is shipped with the program (.pro file) loaded in Flash and the Flash Configuration Program (FCP) also loaded.

Overview of the Standard Application Program:

- Uses pre-configured web style menu pages for user readings, configuration and maintenance—PC menu pages can be modified and new pages configured to work with a modified application load
- Uses the TechView Utility for calibration of all transducers, including the integral MVT and external, Bristol transmitters (e.g. 3808 MVT)
- The PC menu pages, calibration utility and program load are all included on the BSI Config CD.
- Standard configuration is a one-to-two run station



The user's interface to the Standard Application Program is via a series of straight-forward web style menu pages.

- Each run can be orifice, turbine or ultrasonic meter type
- Flow calculations include the following:
  - AGA3-1992 with selectable AGA8 Gross or AGA8 Detail
  - AGA3-1985/NX-19
  - AGA7/NX-19
  - AGA7 with selectable AGA8 Gross or AGA8 Detail
  - Auto Adjust AGA7/NX-19
  - Auto Adjust AGA7 with selectable AGA8 Gross or AGA8 Detail
  - AGA9
- Allows the user to select the integral MVT or an external transmitter for a single run configuration or as run 1 in a multiple run configuration. External transmitters can be interfaced via RS 485 or analog inputs.
- Includes run switching
- Includes an auto-selector, PID flow/pressure control algorithm per run or per station
- Resides on a BSAP SCADA network
- Supports a sampler and an odorizer
- Hourly Historical Data Log

  The Hourly Data Log holds one record for every contract hour. Hourly logs hold 840 entries or 35 days; this ensures that the previous period of hourly data is always resident in ControlWave GFC FLASH memory. The following items are stored in the Hourly Data Log:
  - Corrected Volume
  - Uncorrected Volume
  - Accumulated Energy
  - Average Static Pressure
  - Average Temperature
  - Average Differential Pressure

- Average Specific Gravity
- Average Heating Value
- Flow Time
- Uncorrected Count

Each log entry also contains the date and time. ControlWave GFC has an Hourly Historical Log for each run.

- Daily Historical Data Log

  The Daily Data Log holds one record for every contract day. The contract hour may be changed by the user. The daily log holds 62 entries; this ensures that the previous calendar month of daily data is always resident in ControlWave GFC FLASH memory. The following items are stored in the Daily Data Log:

  - Corrected Volume
  - Uncorrected Volume
  - Accumulated Energy
  - Average Static Pressure
  - Average Temperature
  - Average Differential Pressure
  - Average Specific Gravity
  - Average Heating Value
  - Flow Time
  - Uncorrected Count

  Each log entry also contains the date and time. ControlWave GFC has a Daily Historical Log for each run.

- Periodic Historical Data Log

  The periodic data log holds one record for every log interval. Log interval is 15 minutes. The Periodic Historical Data Log holds 1440 records, or four days of 15 minute data. The following items are stored in the Periodic Historical Data Log:

  - Flowing Differential Pressure
  - Flowing Static Pressure
  - Flowing Temperature
  - Frequency

  Each log entry also contains the date and time. ControlWave GFC has a Periodic Historical Data Log for each run.

- Audit Trail Alarm and Event Storage

  ControlWave GFC keeps an Audit Trail Buffer capable of storing the most recent 500 Alarms and the most recent 500 Events. Internally, these buffers are maintained separately to prevent recurring alarms from overwriting configuration audit data. Externally, they are reported to the user as a single entity. Both operate in a circular fashion with new entries overwriting the oldest entry when the buffer is full. The following circumstances cause an entry to be made in the Audit Trail Buffer:

  - Any operator change to a ControlWave GFC configuration variable
  - Any change in the state of a ControlWave GFC alarm signal
  - A system restart
  - Certain other system events

- Includes a nominations function
- Allows the user to select engineering units from a broad variety, including English and metric
- Interfaces to a chromatograph and provides energy throughput as well as composition information (note that the same port is allocated for either a chromatograph or external transmitters).
- Self Diagnostics

  ControlWave GFC periodically runs a series of diagnostics to verify the operational status of various system components. The tests include transducer parameters, main and backup battery voltages, software sanity checks, and other indications of system health. An appropriate alarm is generated if any test fails.

Communication Port Configuration for the Standard Application Program

COM1 – Local RS 232 port for configuration via a PC. Flash configuration is BSAP Slave, 115.2K baud rate. The PC port connector, that is accessible, externally, on the bottom of the front door, is connected to this port on the CPU.

COM2 – RS 232 Network port with Flash configuration of BSAP Slave, 9600 baud. The standard application program is compatible with an external communication device (via RS 232), the integral modem, integral OEM radio or standard model radio. If a standard model radio is included, the model will also include a cable that connects this port, on the CPU, to the RS 232 port on the radio.

COM3 – RS 485 port with Flash configuration of BSAP Master at 9600 baud. The standard application program assumes that 3808 MVT smart multivariable transmitters for meter run measurement are to be interfaced to this port.

The standard application program also supports a chromatograph but a Flash Configuration change is required to allow the chromatograph to be interfaced to COM3.

Power System, Charge Regulator and AUX Output

In Selection “JK,” the user can choose from a variety of internal power systems that includes lithium batteries and rechargeable, lead acid cell batteries, the latter of which are matched with solar panels as charging sources.

All associated electronics are included on the “Battery Charger & I/O” card, which is located on the left-hand side of the enclosure.

The Battery Charger & I/O card is offered in a total of four versions, which depend on the nominal input voltage (6 Vdc or 12 Vdc) and the I/O count. The versions are specified in selection “O.” Please see “I/O CONFIGURATION” on page 9.

Related to the power system, a charge regulator circuit and, in the 12 Vdc versions only, an auxiliary output (AUX Output) are standard in ControlWave GFC.

For applications that require maximum “up time,” ControlWave GFC also includes dual power inputs as a standard feature. Typically, one power source is external while the other is an internal source that is specified in Selection “JK.”.

The internal source is considered the Primary Battery. If the Primary Battery is a lead acid cell type, it is connected to the solar panel, which is the charging source.

The external source is considered the Backup Battery and it is not linked to the solar panel. For power to all components except for the AUX Output, the Primary Battery input and Backup Battery input are ”wire OR’ed” via diodes and the system will use whichever provides the higher voltage.

Note that the AUX Output, which is typically used to control power to the radio, is linked only to the Primary Battery and, therefore, will be disabled if power from that source is lost. The AUX Output is available only on 12 Vdc versions of the Battery Charger & I/O Card.

Specifications – Power System, Charge Regulator and AUX Output

- Input Voltage Range: 4.9 to 16.0 Vdc
- Operating Range: +4.5/4.9V to +16.0V (+6V Input Supply) (Shutdown occurs at +4.72/4.33V nominal); +9.6/10.3V to +16.0V (+12V Input Supply) (Shutdown occurs at +10.29/9.56V nominal)
- Fuses: 1.5 A from charge regulator, 3.5 A for each battery input, 1.5 A to the CPU assembly
- Surge Suppression: 16VDC transorb meets ANSI/IEEE C37.90-1978
- Terminations: Pluggable terminal block, max wire size is 16 gauge
- Charge regulator: Temperature-compensated charge control with cut-off

- Cyclic maximum cut-off limits: 8.0V max, 7.63V min for a 6V battery and 16V max, 14.9V min for a 12V battery
- Standby charging circuit limits: 6.33V max, 6.09V min for 6V battery and 12.4V max, 11.9V min for a 12V battery
- Cyclic mode nominal battery voltage at 23ºC: 7.3V for a 6V battery and 14.6V for a 12V battery
- AUX Output Max Load Current: 1.8 A continuous, 2.5 A momentary
- AUX Output "on" Resistance: 0.37 Ohms typical, 0.5 Ohms max

Power consumption: Please refer to the information at the end of the section under "I/O CONFIGURATION."

Please also refer to the Emerson Process Management web site, www.EmersonProcess.com/Remote, for data sheets on the following components in the power system:

- 7.2 Vdc lithium battery
- 6 Vdc, 7 AH lead acid cell battery
- 12 Vdc, 7 AH lead acid cell battery
- 6 Vdc, 1 watt solar panel
- 6 Vdc, 4.3 watt solar panel
- 12 Vdc, 4.5 watt solar panel

Power systems are sized for operation with all I/O but without powering field devices. The 12 Vdc supply is sized to operate a radio in "slow duty cycle" mode. Please refer to the document, ControlWave GFC Power System Sizing, for information.

Hazardous Area Certification

In Selection "L," Class I, Division 2 certification is the only choice. ControlWave GFC is approved by UL as an instrument. Note that this certification strictly prohibits installation of any other hardware, not indicated by the model number, in the instrument enclosure.

Wiring to and from the I/O, communication and power connections inside the enclosure, per the ControlWave GFC manual, are, of course, allowed.

Bendable RTD

Selection "M" allows the user to choose a bendable RTD that is attached to the ControlWave GFC via an armored cable of 6-foot, 15-foot or 25-foot length. The individual wires attach to a terminal block on the "Battery Charger & I/O" card. The terminal block accepts up to three wires.

Normally, this RTD would be used to provide the process temperature input but the standard application program also allows the user to select an external temperature transmitter, instead.

The bendable RTD is a "one size fits all" solution that is perfect for most applications and excellent for depot-level inventory situations in which the ultimate installation (and, therefore, thermowell depth) is not necessarily known.

The 12" probe can quickly be inserted in a thermowell, whereupon the user can tighten the included fitting to lock it in place and bend the excess length out of the way. Note that a thermowell is required for this bendable RTD!

RTD Interface Information

A three-wire platinum RTD per DIN 43760 is supported. The temperature, T, in degrees Celsius is calculated using the Resistance vs. Temperature Tables according to the DIN EN 60751 standard for Class A & B RTDs. The DIN EN 60751 equation is:

R(t) = R0 * (1 + At +Bt2)

Where:

A = 3.9083 * 10-3 °C-1

B = -5.775 * 10-7 °C-2

Ro = 100ohms

In addition, the user may enter the Ro, A, and B coefficients of a custom calibrated RTD, another platinum standard or a different material (Nickel, Balco or Copper).

During the RTD calibration, the user will be able to set the coefficients, restore the factory default for these coefficients, and calibrate the internal Reference resistor.

RTD Input Specifications

These specifications are for the interface, only, not including the RTD probe or wiring (please note that RTD probe interchangeability can add ±0.7°C of uncertainty to the measurement).

- RTD Conversion Accuracy: ± 0.1°C, or ± 0.1% of reading, whichever is greater
- Ambient temperature effect on RTD measurement: ±0.01°C / ºC max
- Long Term Stability at Constant Conditions: ±0.25ºC / month max

Thermowell Options For RTD

For new installations, or those lacking a thermowell, Selection “N” allows the user to choose one of three lengths of thermowell for the RTD.

I/O Configuration

The I/O circuitry is located on the “Battery Charger & I/O” card. In Selection “O,” the user chooses the nominal operating input voltage (6 Vdc or 12 Vdc) and either the minimum I/O configuration of 2 DI, 2 HSC and 2 DO or an expanded version, which additionally includes 3 AI (in the 6 Vdc version) or 3 AI and 1 AO point (in the 12 Vdc version).

It is recommended that users select the 3 AI/1 AO configuration if use of analog I/O is anticipated in the future because addition of the points requires a change-out of the I/O card—due to hazardous area certification requirements, that can be done only at the factory.

Selection “O” Options Summary

“0” = Base 2 DI, 2 HSC, 2 DO, 12 Vdc

“1” = Base plus 3 AI, 1 AO, 12 Vdc

“2” = Base 2 DI, 2 HSC, 2 DO, 6 Vdc

“3” = Base plus 3 AI, 6 Vdc

ControlWave GFC I/O Specifications

Discrete Inputs

- Number of points: 2
- Input configuration: Dry contact
- Input filtering: 15 milliseconds
- Input current: Jumper configured as 60 uA nominal at 3.3V per input
- “0” state voltage: Below 1.5V
- “1” state voltage: Above 1.5V
- Maximum scan rate: once per second
- Electrical isolation: None
- Surge Suppression: 16V transorb between signal and ground for 6V system; 30V transorb between signal and ground for 12V system; meets ANSI/IEEE C37.90-1978

- Terminations: Pluggable Terminal block accommodates up to 16 gauge wire size

Discrete Outputs

- Number of points: 2
- Configuration: Open Drain MOSFET
- Maximum load current: 100 mA @ 16V for 6V system; 100mA @ 30V for 12V system
- Maximum update rate: once per second
- Electrical isolation: None
- Surge Suppression: 16V transorb between signal and ground for 6V system; 30V transorb between signal and ground for 12V system; meets ANSI/IEEE C37.90-1978
- Terminations: Pluggable Terminal block accommodates up to 16 gauge wire size

High Speed Counter Inputs

- Number of points: 2
- Frequency range: 0 – 10,000 Hz
- Input Range: Internally source dry contact input
- Input filtering: 20 microseconds
- One shot pulse conditioned signal to MSP counter
- Direct input to MSP pins
- Signal Conditioning: Debounce circuit for contact closures and bandwidth limiting for counter input
- Input current: 200uA per input at 3.3V
- “0” state voltage: Above 1.5V
- “1” state voltage: Below 1.5V
- Electrical isolation: None
- Surge Suppression: 16V transorb between signal and ground for 6V system; 30V transorb between signal and ground for 12V system; meets ANSI/IEEE C37.90-1978
- Terminations: Pluggable Terminal block accommodates up to 16 gauge wire size

Analog Inputs and Outputs

- Channels: Three single ended inputs, one analog output
- Input/Output configurations: Per channel 1-5V or 4-20 mA
- 24 V dc/dc converter is standard, on-board, with terminations available to use 24 Vdc as external loop power. Please see “Field Power Supply,” below.
- Maximum AI scan rate and AO update rate: once per second
- Input Impedance: 1 Meg ohm for 1-5 V inputs, 250 ohm for 4-20 mA inputs
- 4-20 mA Output Compliance: 250 ohm load with 11V external power source 650 ohm load with 24V external power source
- 1-5V output: 5mA maximum output current into external load with voltage range 11 to 30V.
- Analog Input Accuracy: 0.1% of span at 25°C 0.2% of span for –40 to 70°C
- Analog Output Accuracy, Current Output: 0.1% of span at 25°C; 0.2% of span for –20 to 70°C; 0.3% of span for –40 to 70°C
- Analog Output Accuracy, Voltage Output (Iload max = 5mA): 0.1% of span + (2.5 ohms * Iload)/ 4.4V*100 @25°C; 0.2% of span + (2.5 ohms * Iload)/4.4V*100 from –20°C to 70°C; 0.3% of span + (2.5 ohms * Iload)/4.4V*100 from –40°C to 70°C
- Analog Input Settling time: TBD
- Analog Input Conversion time: 20 microseconds
- Terminations: Pluggable Terminal block accommodates up to 16 gauge wire size

Field Power Supply

- ControlWave GFC includes a field device power source that operates at 24 Vdc. This supply is available on in units, which use 12 Vdc nominal source power.

- Please note that efficiency varies from 40% at 5 mA load current to 80% at 100 mA load current.
- For a 5 mA load, source current draw at 12 Vdc is 30 mA.
- For a 100 mA load, source current draw at 12 Vdc is 250 mA.

Power Consumption Information, Processor, Main Electronics, Battery Charger and I/O

The figures, below, assume that the standard application program is running and include the processor, main electronics, battery charger and I/O:

Base unit, without analog I/O, without loop power to any I/O:

- 12 Vdc: 3 mA
- 6 Vdc: 4 mA

Above but with analog I/O, without loop power and analog output operating under-range:

- 12 Vdc: 5 mA
- 6 Vdc: 6.2 mA

Power Consumption with Loop Current or Power to Field Devices:

- Please refer to the information under "ControlWave GFC I/O Specifications."

Switched Network Modem

Selection "P" is where the user specifies whether a modem is included. Physically, an OEM modem card is installed on the CPU/System Controller card. The modem connector is available on the bottom of the CPU/System Controller card.

Please keep in mind that the modem cannot be added after shipment. We always strongly urge users to order the modem in the model number so it is installed at the factory before shipment.

For replacement purposes, the modem kit part number is 396582-03-6.

Polyphaser Option for Radio

If a radio is specified (and that is done, below, in Selection "STU"), Selection "R" allows the user to specify whether or not a Polyphaser surge protector will also be included. Emerson always recommends the Polyphaser.

Radio Option

The last three digits in the model number, Selection "STU," are used to specify a radio. The ControlWave GFC package is limited to one radio. Radios are available either as embedded, OEM modules, which plug into the CPU/System Controller card, or standard models, which are widely available from Freewave and MDS.

Note that modems and radios are all allocated to the network port, COM2, and are, thus, mutually exclusive.

Like the modem, the embedded OEM radio can not be added, later, due to hazardous area certification. We always strongly urge users to order the radio in the model number so it is installed at the factory before shipment.

Replacement OEM radio kits are available and can be ordered by part numbers as follows:

- Freewave Radio Kit – 396582-04-4
- MDS Radio Kit – 396582-05-2

Since some users prefer to procure the radios, separately, Emerson offers "radio ready" configurations for each of the standard (ie. non-OEM) models. Radio-ready models include literally everything except for the radio. The mounting bracket as well as all cables and connections are in place. The user or integrator/installer must simply mount the radio to the bracket and make connections.

It is important to match the radio ready configuration with the specific radio the user expects to install because cables and connections for the antenna, RS 232 port and power all vary by radio model!

For specifications on the radios, please refer to the Emerson Process Management web site, www.EmersonProcess.com/Remote, where individual data sheets are available in pdf format.

Power Consumption Information for the Modem and Radios

NOTE: When conserving power, ControlWave GFC turns power to the radios completely off instead of operating them in the sleep mode.

OEM Modem and Radios

- OEM modem, typical: 180 mA at 3.3Vdc
- OEM Freewave radio, transmit: 500 mA at 12 Vdc
- OEM Freewave radio, receive: 86 mA at 12 Vdc
- OEM Freewave radio, idle: 21 mA at 12 Vdc
- OEM MDS radio, transmit: 510 mA at 13.8 Vdc
- OEM MDS radio, receive: 115 mA at 13.8 Vdc

Standard Model Radios

Freewave FGR Spread Spectrum Radio Figures at 12 Vdc:

- Receive: 75 mA
- Transmit: 500 mA
- Idle: 20 mA

MDS TransNet 900 Spread Spectrum Radio Figures at 13.8 Vdc:

- Receive: 115 mA
- Transmit: 510 mA

MDS models 4710 and 9710 Licensed, UHF Radios with figures at 13.8 Vdc:

- Receive: 125 mA
- Transmit: 2000 mA

MDS entraNet 900 IP Radio Figures at 13.8 Vdc:

- Receive: 100 mA
- Transmit: 510 mA

MDS iNet 900 Ethernet/IP Radio Figures at 13.8 Vdc:

- Receive: 203 mA
- Transmit: 580 mA

Accessories

PC Cables

We have changed the PC connector that is on the bottom of the ControlWave GFC door. We're asking users to please accept our apology for this! Since our sales people objected to the original, DB-9 connector, we have reverted to use of the same circular connector as that used in the TeleFlow products. Therefore, the existing, TeleFlow PC cable will work with ControlWave GFC.

DB-9 Cable

The DB-9 cables are null modem, 9-pin female-to-9-pin female, which match up to the weatherproof hood assembly on the bottom of the ControlWave GFC door.

10-foot Cable – p/n 396647-01-4

25-foot Cable – p/n 396647-02-2

TeleFlow Cable

The TeleFlow cables match up to the circular, Alden connector, which is now shipping with ControlWave GFC products.

10-foot Cable – p/n 395402-01-8

25-foot Cable – p/n 395402-02-6

TeleFlow CABLE ADAPTER

An adapter is available to match up the TeleFlow PC cable so it can be used with the DB-9 connector, which was originally used on ControlWave GFC. Users can plug the circular connector, on the existing cable, to the adapter, which, in turn, plugs into the DB-9 connector inside the weatherproof hood on the bottom of the ControlWave GFC door.

Adapter – p/n 395694-01-9

STANDARD APPLICATION PROGRAM AND PC MENU PAGES

ControlWave GFC comes pre-loaded with the Standard Application Program (.pro file) in Flash. However, the PC menu pages are not loaded in Flash but are available either via the Emerson web site or on a CD. The CD is the "BSI Config" CD, which also contains the LocalView Calibration Tool as well as a copy of the Standard Application Program.

BSI Config CD – p/n 395575-02-8

For users wishing to modify the Standard Application Program, it is be available as source code. Please contact Emerson's Remote Automation Solutions Application Services department for information.

Product Family Compatibility

ControlWave GFC is compatible with Emerson's Bristol ControlWave family. It is fully software-compatible with ControlWave XFC, ControlWave EFM, ControlWave Micro and the ControlWave Process Automation Controller (PAC). The ControlWave PAC provides the highest I/O capacity and supports up to three Ethernet ports as well as redundancy.

This family compatibility is a major benefit to users whose operations include a number of larger installations in addition to those that require flow computers. ControlWave family products are capable of all measurement & control functions at sites such as major, custody-transfer metering stations, compressor stations, off-shore platforms, processing plants and storage facilities.

Users will not only appreciate the similarity in much of the hardware but will also find the documentation, networking and software compatibilities to be key to their asset management.

Only ControlWave brings the perfect combination of industry standards to minimize learning, engineering and implementation costs.

Open standards for programming, network configuration and communication

By adhering to such industry standards as Ethernet, TCP/IP, Microsoft Windows®, COM/DCOM, FTP, OLE and ActiveX, ControlWave is able to achieve the highest degree of openness in control system architecture and bring the optimal process efficiency and productivity needed to ensure a successful system implementation.

ControlWave Designer with ACCOL III

To minimize your engineering and development time, we have adopted the international standard for controller programming, IEC 61131-3. ControlWave Designer is a fully IEC 61131-3-compliant programming environment for the ControlWave family of products. ControlWave Designer includes all five IEC 61131-3 process languages for batch, continuous and discrete control: Function Block Diagram, Structured Text Sequential Function Chart, Ladder Logic Diagram and Instruction List.

ControlWave Designer includes an extensive library of more than 200 basic IEC 61131-3 functions and function blocks common to many IEC 61131-3 based products. These include:

- Counters, Timers
- Ladder diagram functions – coils and contacts,

etc.

- Numerical, Arithmetic & Boolean functions – Sine, Cosine, Add, Sub, Square Root, And, Or, etc.
- Selection & Comparison – Min, Max, Greater than, Equal, Less than, etc.
- Type conversions – Integer to Real, Boolean to Word, etc.

ACCOL III

In addition to the basic functions and function blocks, ControlWave Designer brings the benefit of many years experience in measurement and SCADA to Emerson's Bristol ACCOL III function block library. ACCOL III includes over sixty function blocks that are valuable for use in oil & gas and process measurement & control applications. Further, ACCOL III is designed to take full advantage of the significant features offered by ControlWave.

Briefly, this library includes function blocks for:

- AGA gas flow and API liquids calculations
- Audit, Archive, File Handling
- Average, Compare, Totalize
- Scheduling & Sequencing
- PID & Lead/Lag

In addition, ControlWave ensures data integrity, in the event of a communication interruption, by storing critical time-stamped alarm and historical data in the controller memory. This data is then securely retrieved when communication is restored.

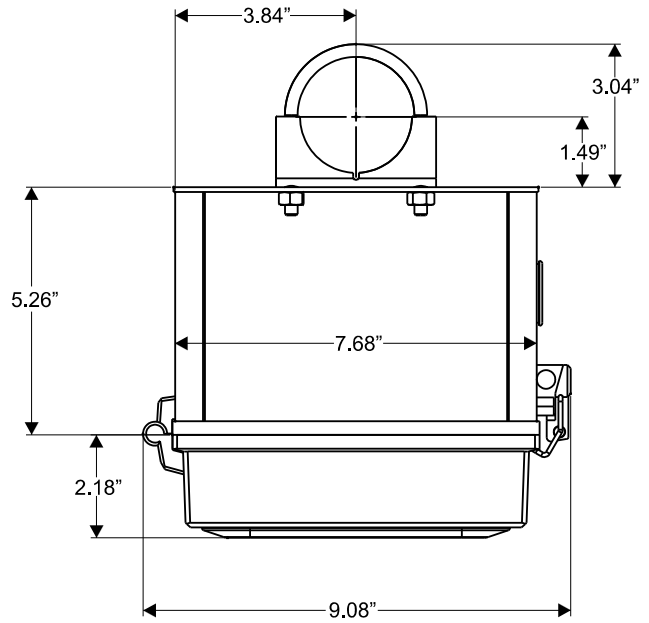
Emerson Process Management
Remote Automation Solutions

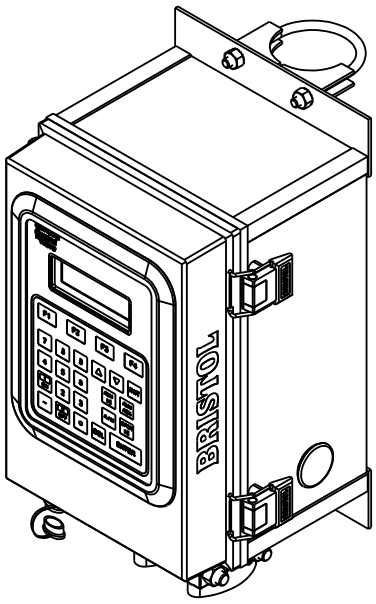
Watertown, CT 06795 USA T 1 (860) 945-2200
Mississauga, ON 06795 Canada T 1 (905) 362-0880
Worcester WR3 8YB UK T 44 (1) 905-856950

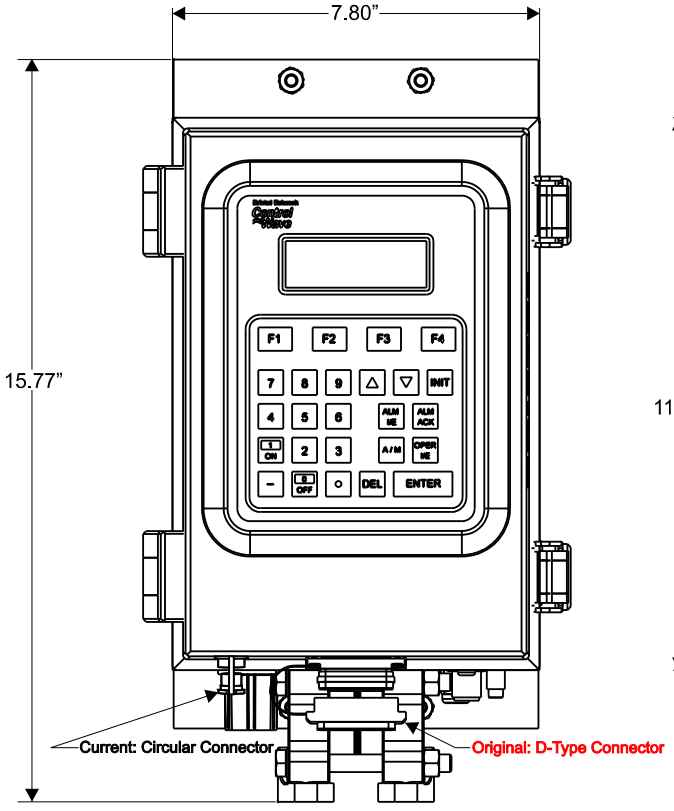
Website: www.EmersonProcess.com/Remote

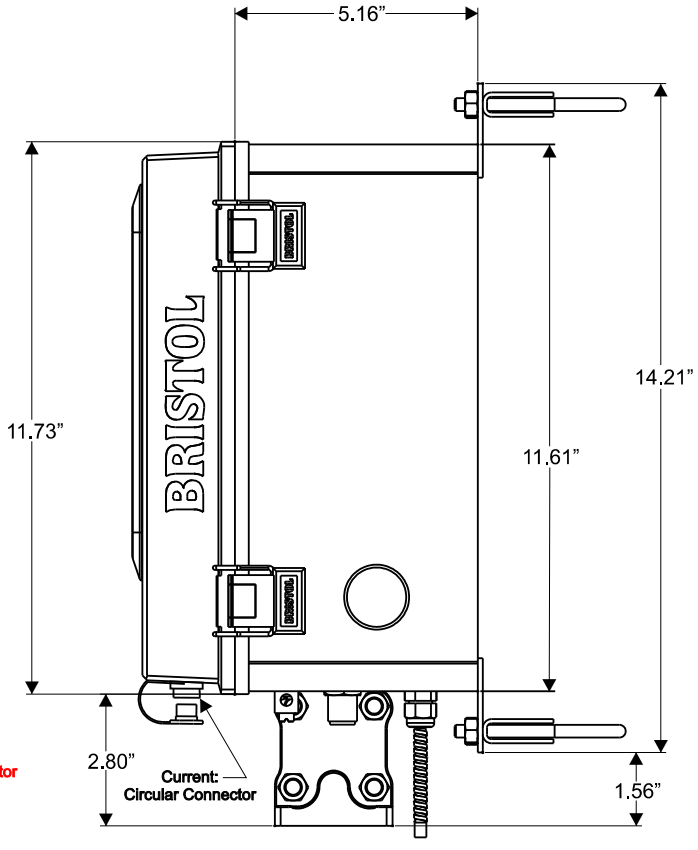
EMERSON™
Process Management

Bristol® ControlWave® GFC Classic









Model Number: CWM-GFC-2 -A B C - D E F - G H - J K - L M N - O P - R - S T U

	DESCRIPTION		CODE
A B C	**Integral Sensor Assembly - Either Gauge Pressure or DP/P**		**A B C**
	No Integral Sensor		0 0 0
10	DP/P Sensors - DP URL (in H2O) / Static Pressure URL (psig)		
	150 / 1000	Standard Application Note: The standard load does not necessarily require the integral sensor. It allows the user to select the integral wet end or an external transmitter.	1 2 1
	150 / 2000		1 2 2
	150 / 500		1 2 3
	100 / 2000		1 3 2
	300 / 1000		1 4 1
	300 / 2000		1 4 2
	25 PSID / 2000		2 0 2
	25 PSID / 4000		2 0 4
D	**Static Pressure Flange Orientation**		**D**
	No Wet End		0
	Ustream on the Left (Standard)	Specify in	1
20	Upstream on the Right	ABC above.	2
E	**Integral Enclosure and LCD/Keypad**		**E**
	7½" x 11¾" Lexan with 2 button Keypad	Standard Application Note:	1
30	7½" x 11¾" Lexan with 25 button Keypad	Works with either keypad.	2
F	**Processor/Main Electronics Board Selection**		**F**
40	Standard		1
G H	**Application Program**		**G H**
50	Standard Single Run		0 1
J K	**Power System**		**J K**
	None - External Power Source is Necessary		0 1
	7.2 V Lithium Battery, Single		0 2
	7.2 V Lithium Battery, Dual		0 3
60	6 V, 7 AH Lead Acid Cell Battery and 6 V, 1 W Solar Panel System		0 4
	6 V, 7 AH Lead Acid Cell Battery and 6 V, 4.3 W Solar Panel System		0 5
	12 V, 7 AH Lead Acid Cell Battery and 12 V, 4.5 W Solar Panel System		0 6

Model Number: CWM-GFC-2 -A B C - D E F - G H - J K - L M N - O P - R - S T U

	DESCRIPTION		CODE
L	**Hazardous Area Certification**		**L**
	None		0
70	Class I, Division 2 Non-incendive (CUL - NI)		1
M	**Bendable RTD**		**M**
	None	Standard Application Note:	0
80	With RTD, 6 Foot Cable Length	For the temperature input, the	1
	With RTD, 15 Foot Cable Length	std. load allows the user to select	2
	With RTD, 25 Foot Cable Length	this RTD or an external transmitter.	3
N	**Thermowell Options for RTD**		**N**
	None		0
90	With Thermowell, 2 1/2” Insertion Length		1
	With Thermowell, 4 1/2” Insertion Length		2
	With Thermowell, 7 1/2” Insertion Length		3
O	**I/O Configuration**		**O**
	Base 2 DI, 2 DO, 2 HSC 12 Vdc	IMPORTANT: I/O selection must match nominal	0
	Base + 3 AI and 1 AO 12 Vdc	input voltage range, 6 Vdc or 12 Vdc.	1
100	Base 2 DI, 2 DO, 2 HSC 6 Vdc	Standard Application Note: Works with any I/O	2
	Base + 3 AI (no AO) 6 Vdc	configuration; I/O is not necessarily required.	3
P	**Switched Network Modem - Mutually exclusive to Radio (STU)**		**P**
	None	Standard Application Note: Works with either	0
150	With Internal Dial-line Modem	the modem or radio.	1
R	**Radio Cable/Mounting Hardware and Polyphaser Option**		**R**
	No Radio		0
160	Without Polyphaser	Select Radio Option	1
	With Polyphaser	in S T U below	2

Model Number: CWM-GFC-2 -A B C - D E F - G H - J K - L M N - O P - R - S T U

	DESCRIPTION		CODE
S T U	**Radio Option - Mutually exclusive to Modem (P)**		**S T U**
170	None		0 0 0
	OEM MDS Transnet Radio	OEM Radios are embedded modules that plug	1 0 1
	OEM Freewave Radio	in to the CPU card in the flow computer.	1 0 2
	Standard Freewave Radio	"Standard" radios are located on the Radio	1 0 3
	Standard Freewave Radio Ready	Bracket in the flow computer enclosure.	1 0 4
	Standard MDS Transnet Radio	Standard Application Note: Works with either	2 0 1
	Standard Transnet Radio Ready	the modem or radio.	2 0 2
	Standard MDS 9810 Radio with Diag		3 0 1
	Standard MDS 4710A Radio with Diag		3 1 0
	Standard MDS 4710B Radio with Diag		3 1 1
	Standard MDS 9710A Radio with Diag		3 2 0
	Standard MDS 9710B Radio with Diag		3 2 1
	Standard MDS 4710 A/B, 9710 A/B, 9810 Radio Ready		3 2 2
	Standard MDS EntreNet 900 Radio (Serial Remote)		4 0 1
	Standard MDS EntreNet 900 Radio (Ethernet Remote)		4 0 2
	Standard MDS EntreNet 900 Radio (Access Point)		4 0 3
	Standard MDS EntreNet Radio Ready		4 0 4
	Standard MDS iNet 900 Radio (Remote Serial Gateway)		4 2 0
	Standard MDS iNet 900 Radio (Remote Ethernet Bridge)		4 2 1
	Standard MDS iNet 900 Radio (Access Point/Remote Dual Gateway)		4 2 2
	Standard MDS iNet 900 Radio Ready		4 2 3

DESCRIPTION	PART NUMBER
PC Cables	
PC Cable - 10 Foot Null Modem, 9-pin Female-to-9-pin Female	396647-01-4
PC Cable - 25 Foot Null Modem, 9-pin Female-to-9-pin Female	396647-02-2
Electronics Assemblies or Boards	
Processor Board Assembly	400074-02-8
I/O Board Assembly, 2DI, 2DO, 2HSC, 12Vdc (corresponds to selection O=0)	400073-04-8
I/O Board Assembly, 2DI, 2DO, 2HSC, 3AI, 1AO, 12Vdc (corresponds to O=1)	400073-03-0
I/O Board Assembly, 2DI, 2DO, 2HSC, 6Vdc (corresponds to O=2)	400073-02-1
I/O Board Assembly, 2DI, 2DO, 2HSC, 3AI, 6 Vdc (corresponds to O=3)	400073-01-3
Fuses and Miscellaneous Items	
Fuse on Processor Board, 5 X 20 mm, 1A (PC 840)	391196-07-1
Lithium Battery for RAM backup on Processor Board, 3V, 0.3 AH (PC 853)	395620-01-5
Fuse on all I/O Boards, MSB, 1.5A SB	395603-10-2
Fuse on all I/O Boards, MSB, 3.5A SB	395603-07-2
Fuse on 6V I/O Boards only, MSB, 0.5A QB	395603-09-9
Power System Components	
7.2V Lithium Battery Pack (Dual packs are simply two of these) (PC 227)	395413-01-0
6V 7 AH Lead Acid Cell Battery (PC 227)	395407-01-0
12V 7 AH Lead Acid Cell Battery (PC 227)	395407-02-8
6V 1 Watt Solar Panel (BP Model MSX-01) (PC 227)	395404-01-0
Mounting Kit for 1 Watt Solar Panel (PC 227)	621429-03-1-kit
6V 4.3 Watt Solar Panel (Showa Model BT1814) (PC 227)	395435-01-3
Mounting Kit for 6V 4.3 Watt Solar Panel (PC 227)	621430-01-3-kit
12V 4.5 Watt Solar Panel (BP Model SX-5/12) (PC 227)	395435-02-1
Mounting Kit for 12V 4.5 Watt Solar Panel (PC 227)	621431-01-0-kit
RTD Assemblies and Thermowells	
12" Bendable RTD with 6 Foot Cable (PC 227)	392610-01-9
12" Bendable RTD with 15 Foot Cable (PC 227)	392610-02-7
12" Bendable RTD with 25 Foot Cable (PC 227)	392610-03-5
Spare Ferrite Bead for RTD Wires (loop wires through & around once) (PC 834)	395449-01-4
Thermowell, 2 1/2" insertion length, 316 Stainless Steel (PC 463)	388908-02-5
Thermowell, 4 1/2" insertion length, 316 Stainless Steel (PC 463)	388908-03-3
Thermowell, 7 1/2" insertion length, 316 Stainless Steel (PC 463)	388908-05-0

DESCRIPTION		PART NUMBER
Multivariable (DP/P) Sensor Assemblies		
150" / 1000 psi	The wet end assembly includes the replacement component but does not include the cable, screws or collar.	396531-01-6
150" / 2000 psi		396531-02-4
150" / 500 psi		396531-03-2
100" / 2000 psi		396531-04-0
300" / 1000 psi		396531-05-9
300" / 2000 psi		396531-06-7
25 psid / 2000 psi		396531-07-5
25 psid / 4000 psi		396531-09-1
Cable - MVT Wet End to System Controller		396612-01-6