

ControlWave® GFC Plus

Gas Flow Computer

Featuring the “Express” Electronics Platform

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

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

OVERVIEW

HARDWARE/PACKAGING FEATURES

- 32-bit ARM9 platform is capable of multiple flow computing and process automation operations.
- Smart, gauge pressure or DP/P sensor assembly can be removed and replaced, independently of the “top end” electronics.
- Precision RTD interface provides very accurate 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/PI.
- Optional I/O expansion includes 2 DI/DO, 4 DI, 2 DO, 2 High-speed Counter Inputs, 3 AI and 1 AO.
- Integral LCD with optional, 25-key keypad allows operators to view and change configurable parameters, on site, without packing a PC.
- Broad selection of modem and wireless communications are instrument package options.



ControlWave GFC Plus comes in a highly integrated package that includes a smart P/T or DP/P/T (shown) sensor assembly, battery/solar power system and a broad selection of modem and radio communications options.

FIRMWARE/SOFTWARE FEATURES

- **ControlWave GFC Plus** 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.
- TeleFlow users will appreciate the compatibility of ControlWave GFC Plus in networking and software solutions for SCADA and EFM data editing/management, as well as the similarity in all operations.

APPLICATION AREAS

ControlWave GFC Plus 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 PLUS VS. CONTROLWAVE GFC

Use of the larger “Plus” enclosure, which accommodates a 33 AH lead acid cell battery and “snap track” options, distinguishes ControlWave GFC Plus from ControlWave GFC.

The larger battery, used in conjunction with either a 30-watt or 40-watt solar panel, allows radios to be operated on fast duty cycle. Since ControlWave GFC uses the smaller, 7 AH battery, slow duty cycle radio operation, only, is recommended for that product.

The larger battery in ControlWave GFC Plus also provides extra capacity for I/O and is recommended if loop power is to be sourced, internally.

Finally, the “Plus” enclosure provides up to four, snap track slots for options such as the Power Distribution Board, 24 Vdc Loop Power Supply and Relay Output Board. ControlWave GFC allows only one such option, which is mounted in the door.

CONTROLWAVE GFC PLUS VS. CONTROLWAVE EFM

The difference between these two products is that ControlWave EFM uses a ControlWave Micro RTU platform while **ControlWave GFC Plus** uses a ControlWave Express RTU platform.

Choose ControlWave EFM instead of ControlWave GFC Plus if the application requires communication ports and/or I/O that are beyond those provided by the ControlWave Express Platform.

CONTROLWAVE GFC PLUS PACKAGE OVERVIEW

ControlWave GFC Plus is delivered in a rugged, fiberglass enclosure that has provisions for not only the electronics but also a display/keypad, smart DP/P/T transducer assembly, battery/solar power system and a broad selection of modem and radio communications options.

Specifications – Package

- Dimensions, Housing: 14 ½” H x 12” W x 8 ½” 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 26 lbs
- With Battery: 57 lbs.
- Maximum w/Battery & Radio: 61 lbs.
- Mounting: Pipe or wall-mounting is recommended; 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 5.0 to 18.0 Vdc
- While this product can operate with nominal power inputs as low as 6 Vdc, note that 12 Vdc nominal is required if an internal radio is used.
- Operating Temperature Range: -40 to 158°F (-40 to 70°C)
- Operating Temperature Range of Lead Acid Cell Batteries is more restrictive: -4 to 140°F (-20 to 60°C)
- Operating Humidity Range: 10 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 (ISA Process Mount)
- Electrostatic Discharge: Meets IEC EN 61000-4-2, EN 61326
- RFI Immunity: In conformity with ENV 50140 radio-frequency electromagnetic field amplitude modulated EMC
- EMC 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 approved as non-incendive for operation in Class I, Division 2 hazardous areas for all configurations

Performance

- Computation Accuracy: 0.01% Corrected Flow, including all input values
- DP Reference accuracy: 0.075% URL
- Static Pressure Reference Accuracy:

0.035% 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 Plus is ordered using a model number specification. The complete model number specification is included at the end of this product data document.

Standard equipment includes fiberglass housing with 2-line LCD and 2 function keys, ControlWave Express RTU package with single board main electronics assembly and the standard API 21.1 flow measurement application program. Standard I/O count is 2 DI/PI (Pulse Inputs).

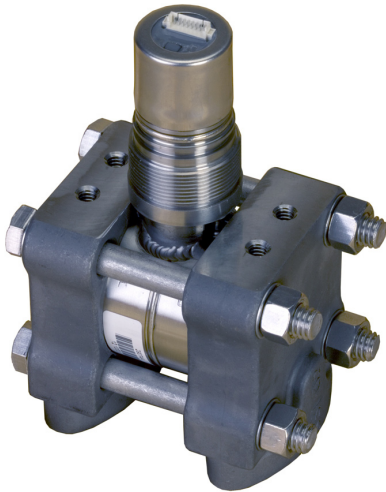
Also included in the base product are interfaces to Emerson's gauge pressure or multivariable, DP/P sensor assembly, an RTD interface, and an AUX power output (e.g. to switch power to a radio).

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

- Integral, gauge pressure or multivariable (MVT), DP/P sensor assembly and upper range limits.
- Bendable RTD assembly, pre-wired
- Thermowell
- A two-line LCD with two pushbuttons or a four-line LCD with 25-key keypad
- I/O card, including 2 DI/DO, 4 DI, 2 DO and 2 HSC/DI and, optionally, an additional 3 AI, 1 AO
- Hazardous area approval – Class I, Division 2
- Choice of integral, battery and solar power systems
- Choice of standard model modem or radio that is installed on an internal bracket. Standard radios are those that are commonly available from Freewave and MDS.
- Polyphaser surge suppressor for the radio

SENSOR ASSEMBLY

Using the sensor assembly, 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 integrated sensor assembly.



Bristol's DP/P Multivariable (MVT) Sensor Assembly

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

If the sensor 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 sensor assembly be removed and replaced at the shop rather than out at the site.

Each sensor assembly has a nine-digit part number, which can be used to specify a replacement part (a listing is included at the end of this product data document).

Physical Specifications – Sensor Assemblies

- MVT Flange & Center Section and Gauge Pressure Sensor 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
- Gauge Pressure Sensor Process Connection: ½" NPT male
- Connects to the Processor Board via a dedicated SPI bus cable.

Accuracy and Performance Specifications – Gauge Pressure or MVT Differential Pressure and Static Pressure

- Combined effects of nonlinearity, nonrepeatability and hysteresis at reference pressure and over the operating temperature range: DP: $\pm 0.075\%$ of Calibrated Span or 0.015% of URL, whichever is greater. SP: $\pm 0.075\%$ of Calibrated Span or 0.015% of URL, whichever is greater.
- Temperature effect on Static and Differential pressure: $\pm 0.21\%$ URL maximum combined shift of zero and span with an ambient temperature change of 60°C (108°F)
- Static Pressure Effects On Differential Pressure: Zero error: $\pm 0.1\%$ URL, for a change in static pressure of 1000 psi; Span error: $\pm 0.1\%$ reading, for a change in static pressure of 1000 psi
- Long Term Stability at Constant Conditions: $\pm 0.1\%$ URL/Year typical
- MVT mounting position effect: ± 2 in H₂O maximum, which can be calibrated out.

MVT ASSEMBLY STATIC PRESSURE ORIENTATION

For a multivariable sensor assembly, you can specify 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 Plus. Following the AGA3-1992 convention, we refer to the static pressure sensor location as the “upstream” (a.k.a. “high side”) location.

INTEGRAL ENCLOSURE AND LCD/KEYPAD

Selection “E” specifies the housing, for which there is currently one choice, and the liquid crystal display (LCD) and keypad.

One of two LCD/Keypad configurations can be selected: 4 line x 20 character LCD with either a two-button or 25-button keypad. Both display/keypad assemblies 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 Plus 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

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)



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

- Power consumption: 2.5 mA @ 3.3V (0.008 watts)
- Operating Temperature: -4 to 158°F (-20 to 70°C)

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 Plus 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 Plus 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.

PROCESSOR/ MAIN ELECTRONICS



2-button display example



25-button display example

SELECTION

The Processor/Main Electronics board consists of a single circuit board, which is installed on the far, left-hand side in the enclosure.

Specifications for Processor/Electronics

- 32-bit ARM9TDMI RISC Core Processor running at 14 MHz
- Serial Real Time Clock Accurate to 1 second/day at 25 °C
- 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, 9000 Hour

Expected Backup Time

- 3 Serial Communication Ports (see below for further information)
- 2 DI/PI I/O points (please refer to the "I/O CONFIGURATION" section for specifications).
- Display/Keypad Interface
- Idle and Watchdog LED's—Idle LED can be disabled to conserve power
- 5.0 to 18.0 Vdc Power Supply with Power Fail Sequencer
- Information on the Serial Ports:

COM1:

- RS 232
- Physical Interface via DB-9 connector, which is internally linked to the circular, Alden connector on the bottom of the enclosure door
- Tx, Rx, GND with DCD tied to "high" voltage when external cable is plugged in

COM2:

- RS 232
- Physical Interface is an 8-pin terminal block.
- 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.

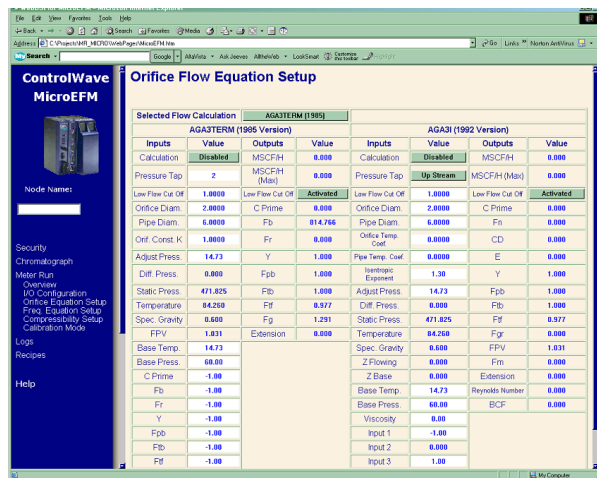
COM3:

- Selectable RS 232 or RS 485, 2-wire or 4-wire
- Physical Interface is a 5-pin terminal block.

CONTROLWAVE GFC PLUS STANDARD APPLICATION PROGRAM

You can select from a variety of standard applications. Currently available are the 1 – 2 run M&R standard application and a TeleFlow Emulator application.

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



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

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 Calibration 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

- 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 sensor assembly 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 Plus 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 Plus 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 Plus 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 Plus 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 Plus configuration variable
- Any change in the state of a ControlWave GFC Plus 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 Plus 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) 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

You can specify the solar/battery power system. For most applications, the 12V, 33 Ampere-hour (AH) battery, that is internal to the housing, can be matched with either a 30-watt or 40-watt, 2" mast-mounting solar panel.

In addition, a lithium battery pack can be specified. This 7.2V, 35 AH, non-rechargeable battery pack is used to back-up the primary power system. The primary power system is either the internal, 12V, 33 AH battery or an external power source.

Note that the lithium battery won't provide power sufficient to operate devices, such as radios, that require 12V nominal power. If the primary power source fails, the lithium battery will be sufficient to

operate the electronics for an extensive time—normally plenty of time to repair the primary power source.

For power loading details, please refer to the Bristol product data sheet entitled, "ControlWave GFC Power System Sizing."

Note that system sizing "red flags," which may tell the user to specify a larger, external power source, include multiple analog loops that operate from the 24V dc/dc power supply rather than 12V and operation of a standard model radio with power constantly on rather than duty cycling.

The 40 watt panel may need to be selected for locations that receive less than 2 sun-hours per day. Again, the Power System Sizing data sheet provides further information.

A charge regulator is always included with the solar panel and must be installed inside a compartment on the back of the panel.

If external dc power is available and the user prefers that, exclusively, the "none" selection is appropriate.

A peculiarity in selection of the power system is that the BP solar panels are FM approved for operation in Class I, Division 2 areas while the ControlWave GFC Plus, including the internal battery, is approved for the same by UL.

Therefore, a UL-approved model is ordered by specifying the battery but without the solar panel. The solar panel is then specified by part number.

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

- 12V, 33 AH Lead Acid Cell Battery
- 7.2V, 35 AH Lithium Battery Pack
- 30 Watt Solar Panel
- 40 Watt Solar Panel

Specifications – Charge Regulator and AUX Output

A charge regulator and AUX output are included on the Processor/Main Electronics board. **Please note that this charge regulator is sized for ControlWave GFC, not ControlWave GFC Plus. Solar panels of 10-watt or higher capacity must use external regulators.**

- Input Voltage Range: 5.0 to 18.0 Vdc
- Operating Range: 4.5/4.9V to 18.0V, shutdown occurs at 4.3V nominal (6V power source); 10.3V to 18.0V, shutdown occurs at 9.56V nominal.
- Fuses: 1.5 A from charge regulator, 3.5 A for battery input.
- Surge Suppression: 18VDC 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
- Threshold voltage for shunt at 23°C: 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

HAZARDOUS AREA CERTIFICATION

Class I, Division 2 certification can be specified. ControlWave GFC Plus 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 Plus manual, are, of course, allowed.

BENDABLE RTD

You can choose a bendable RTD that is attached to the ControlWave GFC Plus via an armored cable of 6-foot, 15-foot or 25-foot length. The individual wires attach to a terminal block on the Processor/Main Electronics board. 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. ControlWave GFC Plus supports the full range in the DIN standard, -40 to 660°C.

The DIN EN 60751 equation is:

$$R(t) = R_0 * (1 + At + Bt^2)$$

Where:

$$A = 3.9083 * 10^{-3} \text{ } ^\circ\text{C}^{-1}$$

$$B = -5.775 * 10^{-7} \text{ } ^\circ\text{C}^{-2}$$

$$R_0 = 100\text{ohms}$$

In addition, the user may enter the R_0 , 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 $\pm 0.7^\circ\text{C}$ of uncertainty to the measurement).

- RTD Conversion Accuracy: $\pm 0.1^\circ\text{C}$, or $\pm 0.1\%$ of reading, whichever is greater
- Ambient temperature effect on RTD measurement: $\pm 0.01^\circ\text{C} / ^\circ\text{C}$ max
- Long Term Stability at Constant Conditions: $\pm 0.25^\circ\text{C} / \text{month}$ max

THERMOWELL OPTIONS FOR RTD

For new installations, or those lacking a thermowell, you can choose one of three lengths of thermowell for the RTD.

21V DC/DC POWER SUPPLY

Since the I/O card does not include loop power, this option provides power if 4 – 20 mA loops are to be used or if transmitters that require a voltage higher than the nominal, 12 Vdc supply voltage are to be powered. This option converts the nominal, 12 Vdc input to 21.4 Vdc for field devices such as transmitters.

Please note that, since the minimum input voltage for this option is 10.8 Vdc, it will not work with nominal 6 Vdc or 9 Vdc power sources. While the 21V dc/dc Power Supply is required for use with a Bristol 3508 transmitter, it is not necessary to provide power to 2808 or 3808 MVT models.

For those, we recommend that system power be routed to the transmitter. The Power Distribution Board is a good way to provide power routing to either of those transmitters. Furthermore, the 2808 and 3808 MVT will operate using nominal 6 Vdc and 9 Vdc power sources.

The 21V dc/dc Power Supply is not necessary if loop power is otherwise available or if there are no analog I/O points.

This option is a circuit board that is located on a Snap Track, which is installed onto the back panel in the lower, right-hand section of the enclosure.

Note that the Power Distribution Board is also required if the 21V dc/dc Power Supply is selected. This is another Snap Track option that is located nearby the 21V dc/dc Power Supply.

Specifications for 21V dc/dc Power Supply

- Input voltage: 10.8 to 16.0 Vdc
- Input current: Will be double the current draw of the output device, e.g. 100 mA typical at 12 Vdc with a 50 mA load on the output; 140 mA max over temperature range with a 50 mA output load.
- Output voltage: 21.4 Vdc \pm 0.8 Vdc
- Output Current: 50 mA max
- Ripple/Noise: 20 mV max P-to-P
- Efficiency: 88% typical
- Fuses: F1=500mA (slow blow) protects the power source; F2=350mA (fast blow) protects 21V dc/dc Power Supply from short circuits on the output.

I/O CONFIGURATION

Note that the base I/O, 2 DI/PI, is located on the Processor/Main Electronics board. Also, the RTD input and MVT (Multivariable sensor) interface are located on the Processor/Main Electronics board.

Additional I/O circuitry is located on an optional I/O card, which plugs in to the ControlWave Express chassis. You can choose the minimum I/O configuration of 2 DI/DO, 4 DI, 2 DO and 2 HSC/DI or an expanded version, which additionally includes 3 AI or 3 AI and 1 AO point.

What is the difference between a “PI” (pulse input) and “HSC” (high-speed counter input)? The HSC circuitry includes de-bounce, which is useful with form ‘C’ relays, such as those in some pulser devices. A PI does not include the de-bounce circuitry and is, therefore, not recommended with relays. Note that, in the HSC inputs, the de-bounce can be enabled/disabled by the user and they are shipped disabled.

We recommend 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.

ControlWave GFC Plus I/O Specifications

Pulse/Discrete Inputs

- Inputs located on Processor/Main Electronics board
- Number of points: up to 2 non-interrupting inputs
- Internally sourced, dry contact single ended inputs
- Scan rate: Once per second
- Input filter: 20 microseconds
- Voltage Range: Internally sourced dry contact input - 3.3 Vdc
- On state: >1.6 V, Off state <1.3V
- Input current: 200 μ A nominal at 3.3V per input
- Surge Suppression: meets ANSI/IEEE C37.90-1978; 30V transorb between signal and ground
- Terminations: Pluggable Terminal block accommodates up to 16 gauge wire size

Used as Pulse Input

- Frequency Range: 0-10 kHz
- Debounce: None
- Accumulator: 16 bit

Discrete inputs

- Number of points: 4 DI-only and 2 points that are selectable as inputs or outputs;
- Input configuration: Dry contact
- Input filtering: 15 milliseconds
- Input current for DI points 1 – 4 (those that are DI-only): configurable as 60 μ A for low power applications or 2 mA nominal at 3.3V per input
- Input current for DI points 5 – 6 (those that are selectable as DI or DO): configurable as 200 μ A for low power applications or 2.2 mA nominal at 3.3V per input
- On state: >1.6 V, Off state <1.3V

- Maximum scan rate: once per 250 ms
- Electrical isolation: None
- Surge Suppression: meets ANSI/IEEE C37.90-1978; 30V transorb between signal and ground
- Terminations: Pluggable Terminal block accommodates up to 16 gauge wire size

Discrete Outputs

- Number of points: 2 DO-only and 2 that are selectable as input or output, per-point.
- Configuration: Open Drain MOSFET
- Operating voltage range: 10 – 31 Vdc
- Maximum load current: 400 mA @ 16V and 400 mA @ 30V
- Maximum update rate: once per 250 ms
- Electrical isolation: None
- Surge Suppression: meets ANSI/IEEE C37.90-1978; 30V transorb between signal and ground
- Terminations: Pluggable Terminal block accommodates up to 16 gauge wire size

High Speed Counter Inputs

- Number of points: 2, also operable as DI points.
- Frequency range: 0 – 10,000 Hz
- Input Range: Internally sourced dry contact input
- Input filtering: 20 microseconds
- Accumulator: 16 bit
- Maximum scan rate (program scan of the accumulator): once per 250 ms
- Signal Conditioning: Debounce circuit for contact closures and bandwidth limiting for counter input

Note: HSC inputs on the I/O card include debounce, PI inputs on the Process/Main Electronics card do not.

- Input current: 200uA per input at 3.3V
- On state: >1.6 V, Off state <1.3V
- Electrical isolation: None
- Surge Suppression: meets ANSI/IEEE C37.90-1978; 30V transorb between signal and ground
- Terminations: Pluggable Terminal block accommodates up to 16 gauge wire size

Analog Inputs

- Number points: 3 AI optional
- AI Resolution: 14 bit
- Input Configuration: Externally sourced. Single-ended inputs, jumper selectable 4–20 mA or 1–5 Vdc
- Input Impedance: 1 megOhm - 1 to 5 Vdc;
- 250 Ohm - 4-20 mA
- Input Filtering: 12 Hz
- Maximum scan rate: once per 250 ms
- Channel Settling Time: 600 ms to be within 0.01% of input signal
- Input accuracy:
 - 0.1% of span at 25oC;
 - 0.2% of span -40 oC to 70 oC
- Surge Suppression: meets ANSI/IEEE C37.90-1978; 30V transorb between signal and ground
- Terminations: Pluggable Terminal block accommodates up to 16 gauge wire size

Analog Output

- Number of Channels: 1 AO optional
- Output configurations: Selectable externally sourced 4-20 mA or 1-5 Vdc:
- 250 ohm with 12 V external source
- 650 ohm with 24 V external source

- 1-5 Vdc @ 5mA max, 11 to 30 Vdc external source
- D/A resolution: 12 bit
- Maximum update rate: once per 250 ms
- Accuracy:
 - 0.1% of span @ 25oC for current output; 0.1% + 3% of span @ 25oC for voltage;
 - 0.3% of span @ -40 to 70 oC for current 0.3% + 3% of span @ -40 to 70 oC for voltage
- Surge Suppression: meets ANSI/IEEE C37.90-1978; 30V transorb between signal and ground
- Terminations: Pluggable Terminal block accommodates up to 16 gauge wire size

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: 6 mA

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

- 12 Vdc: 7 mA
- 6 Vdc: 14 mA

Power Consumption with Loop Current or Power to Field Devices:

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

POWER DISTRIBUTION BOARD

This option, specified in Selection "O," organizes the power wiring inside the enclosure. The Power Distribution Board is required if any of the following is selected:

- Lithium Battery Backup
- 21V dc/dc Loop Power Supply
- Relay Board
- Standard Model Radio

The Power Distribution Board will be pre-wired to all the above-listed items, as well as the solar panel and power input on the Processor/Main Electronics board.

The Power Distribution Board is located on the left-most Snap Track in the lower, right-hand area, inside the enclosure.

RELAY BOARD

The Relay Board is another Snap Track option located nearby the Power Distribution Board.

Users can select one or two of these options if on/off control devices operate under conditions that are higher than the 100 mA/35 Vdc ratings of the MOSFETS on the ControlWave **Express** discrete outputs.

Four solid state relays (SSRs), organized in a form 'C' configuration corresponding to two discrete outputs, are included. The user must specify, the I/O card.

The Form C relay output signals can be configured via on-board jumpers, for opposite or identical conditions:

- Both Normally Open (NO) or Normally Closed (NC)
- One Normally Open with the other Normally Closed

Specifications for the Relay Board

Terminations

- Pluggable terminal block, maximum wire size is 14 gauge

Input Requirements

- Power Source Range: 3-15 Vdc
- SSR Input Impedance: 400 Ohms
- Maximum Sink Current from DO point MOSFET:
- 20 mA (both SSRs in Normally Closed mode)
- Minimum Current Load: 100 mA

Output Requirements

- Contact Ratings: 3-60 Vdc
- Maximum Current: 3 Amps @ 25°C or 1.5
- Amps @ 70°C

If the Relay Board is selected, the Power Distribution Board is also required and connections between the two will be pre-wired.

POLYPHASER OPTION FOR RADIO

If a radio is specified, you can specify whether or not a Polyphaser surge protector is also included. Emerson always recommends the Polyphaser.

MODEM OR RADIO OPTION

You can specify a modem or radio option. Radios are 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.

Since some users prefer to procure the radios, separately, Emerson offers "radio ready" configurations for each of the 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!

Modem Specifications

The auto-dial / auto-answer modem is the same, Cermetek model that is used in the TeleFlow products. This modem provides a sleep mode that conserves power while allowing it to wake up when a call comes in.

Function: Provides PSTN (Public Switched Telephone Network) communications.

Operating Modes: Sync or Async. 2-wire switched network - Half or Full Duplex.

Line Type: Two-wire loop start lines.

Modem Configuration: "AT" based commands.

Data Rate: V.32 bis - 9600 bps, V.32 - 9600 bps, V.22 bis - 2400 bps, V.22 - 1200 bps or 600 bps, V.21 - 300 bps, Bell 103J - 300 bps, Bell 212A - 1200 bps.

Telephone Functions: Dialing and answering by AT commands. Automatic answering is also programmable.

Approvals: Telephone - FCC Part 68 (also suitable for approval within Canada).

Trans. Output Levels: -10 dBm fixed (USA) - (0-15 dBm adjustable – firmware dependent).

PSTN Arrangements: Loop Start arrangement (transmission output does not exceed -10 dBm). Allows connection to any voice telephone jack.

Isolation: Data Access Arrangement (DAA) with 1000 Vac (Modem to PSTN).

Sleep Mode Current: 0.5 mA (max) @ 12V (Input

Voltage); 1.0 mA (Max) @ 6V (Input Voltage)

Surge Capability: Withstand surge of 100A with 10 x 160 microsecond waveform.

Temperature: Operating Range: -40° to +60°C (-40° to 140°F); Storage Range: -40° to +85°C (-40° to 185°F)

Relative Humidity: 15% to 90%, non-condensing

Radio Specifications

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.

Radio Power Consumption

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

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

For local PC operations, users can select either a ten-foot or 25-foot cable. These cables match up to the circular connector on the bottom of the ControlWave GFC Plus door.

10-foot Cable – p/n 395402-01-8

25-foot Cable – p/n 395402-02-6

STANDARD APPLICATION PROGRAM AND PC MENU PAGES

ControlWave GFC Plus 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 Process Management web site or on a CD. The CD is the “BSI Config” CD, which also contains the TechView 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 available as source code. Please contact Emerson’s Remote Automation Solution Application Services for information.

PRODUCT FAMILY COMPATIBILITY

ControlWave GFC Plus is compatible with Emerson's ControlWave family. It is fully software-compatible with ControlWave GFC, 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.

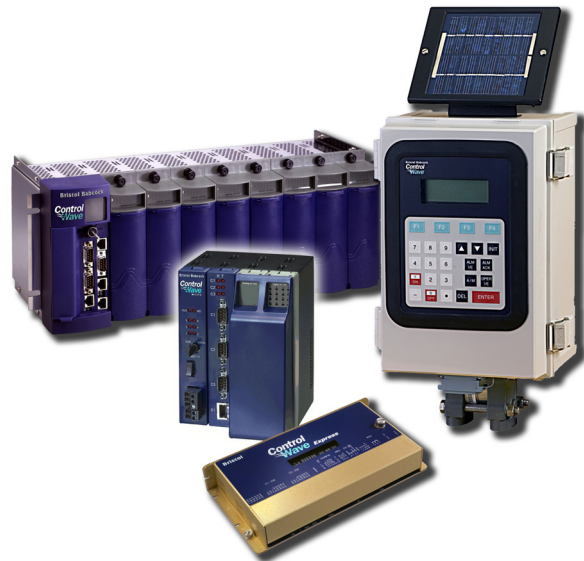
Open standards for programming, network configuration and communication

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

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 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.

Product Data Document

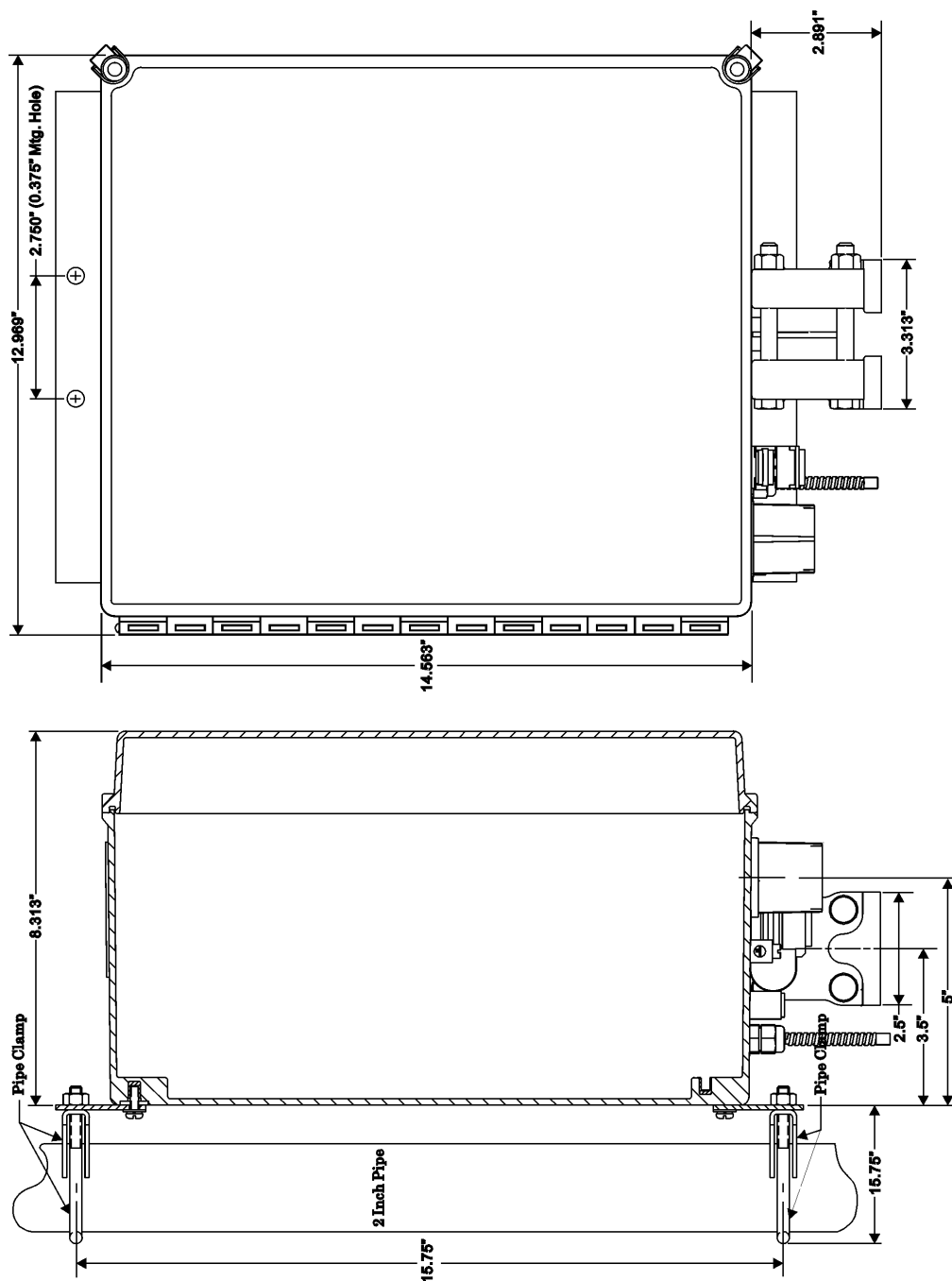
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ControlWave GFC Plus

DIMENSIONS

Integral, DP/P MVT assembly and Pole Mount hardware are shown.



Remote Automation Solutions

www.EmersonProcess.com/Remote


EMERSON
Process Management

Product Data Document

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ControlWave GFC Plus

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