

# ControlWave® GFC Plus Gas Flow Computer

When requirements call for an integrated, “all-in-one-box” chart replacement or flow computer, Emerson’s ControlWave GFC Plus gas flow computer is a cost effective, competitive solution.

Unlike chart replacements, ControlWave GFC Plus is also able to meet your automation needs and easily supervises a 2-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.

### Hardware/Packaging 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.



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

## 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

## 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, 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 by 12" W by 8 ½" D (368 mm H by 305 mm W by 216 mm D)
- Clearance: Please allow at least 2.5" \*64 mm) of space underneath for cabling.
- Dimensions: MVT Assembly (optional): 3" H by 3 ¾" W by 2 ½" D (76 mm H by 95 mm W by 64 mm D)
- Weight:
  - Minimum 26 lbs. (11.8 kg)
  - With Battery: 57 lbs. (26 kg)
  - Maximum w/Battery & Radio: 61 lbs. (27.6 kg)
- 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 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.



*DP/P Multivariable (MVT) Sensor Assembly*

Most 2-run systems use the integrated sensor assembly for the first run and an external multivariable transmitter, such as the 3808 MVT (which includes the same sensor assembly), for the second meter run.

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

Emerson recommends the practice of “depot level” service, in which the sensor assembly is removed and replaced at the shop rather than out at the site.

Each sensor assembly has a 9-digit part number, which can be used to specify a replacement part.

#### 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 MVS Differential Pressure and Static Pressure

- Combined effects of nonlinearity, non-repeatability, 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:  $\pm 2$  in H<sub>2</sub>O 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” (or “high side”) location.

## Integral Enclosure And LCD/Keypad



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

The ControlWave GFC Plus currently supports only one housing (Selection E), and the liquid crystal display (LCD) and keypad.

You can choose (selection E) either of two LCD/Keypad configurations: a 4-line by 20-character LCD with either a 2-button or 25-button keypad. Both display/keypad assemblies have the same “footprint” on the front door.

**Features: Display/Keypad**

- 4-line by 20-character backlit liquid crystal display (LCD)
- Adjustable display contrast
- Membrane keys with tactile feedback
- Self-adhesive overlay mounts to the enclosure door or panel (the 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

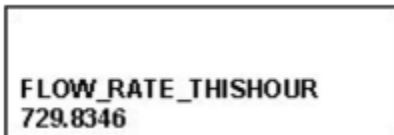
**Specifications: Display/Keypad**

- Window size: 1.1 in. H by 3.1 in. W (28 mm H by 79 mm W)
- Character size: 4 mm H by 3mm W
- Dimensions: 7.4 in. H by 5.5 in. W (188 mm H by 144 mm W)
- Power consumption: 2.5 mA @ 3.3V (0.008 watts)
- Operating Temperature: -4 to 158 °F (-20 to 70 °C)

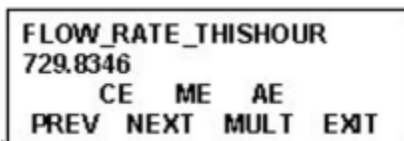
The 2-button display allows you to view site, configuration, and process data. The screens are organized in a series of lists. You can select a list and then manually scroll through the data or define a “scroll list” and set the ControlWave GFC Plus to automatically scroll through this list.

The 25-button Display/Keypad performs the same functions and additionally allows you 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 you 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 left-hand side in the enclosure.

**Specifications: 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
- Three serial communication ports (see *Serial Ports* below)
- 2 DI/PI I/O points (see *I/O Configuration* for specifications)
- Display/Keypad Interface
- Idle and Watchdog LEDs (idle LED can be disabled to conserve power)
- .0 to 18.0 Vdc power supply with Power Fail Sequencer

**Serial Ports****COM1:**

- Physical Interface via DB-9 connector, which is internally linked to the circular Alden connector on the bottom of the enclosure door
- Tx, Rx, and 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**

Currently, you can select either the 1- or 2-run M&R standard application or a TeleFlow Emulator application.





- Frequency
- Date and time of each log entry
- Provides an Audit Trail Alarm and Event Storage  
The 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 you 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 generate an entry 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 you to select engineering units from a broad variety of measurements, 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).
- Provides self-diagnostics  
The 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. Any test failures generate an appropriate alarm.

### Communication Port Configuration for the Standard Application Program

- **COM1**  
Local RS-232 port for configuration via a PC; flash configuration is BSAP Slave at 115.2K baud rate. The externally accessible PC port connector, located on the bottom of the front door, connects to this port on the CPU.
- **COM2**  
RS-232 network port with flash configuration of BSAP Slave at 9600 baud rate. The standard application program is compatible with an external communication device (via RS-232) or a standard model radio. If a standard model radio is included, the model also includes a cable that connects this CPU port to the radio's RS-232 port.

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

While 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. In most applications, you can match the internally housed 12V 33 amp-hour (AH) battery with either a 30-watt or 40-watt 2" mast-mounting solar panel.

Additionally, you can also specify a lithium battery pack. This 7.2V, 35 AH, non-rechargeable battery pack backs up the primary power system, which is either the internal 12V, 33-AH battery or an external power source.

The lithium battery **cannot** provide power sufficient to operate devices (such as radios) that require 12V nominal power. If the primary power source fails, the lithium battery provides sufficient power to operate the electronics for an extensive time (normally sufficient time required to repair the primary power source).

Refer to the *ControlWave GFC Power System Sizing* product data sheet (D301327X02) for power loading details. Note the system sizing "red flags," which indicate the need for specifying 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.

You may need to select the 40-watt panel for locations that receive less than 2 sun-hours per day. Refer to the *Power System Sizing* product data sheet for further information.

A charge regulator is always included with the solar panel, which you must install inside a compartment on the back of the panel.

If an external dc power is available and you prefer to use that, select the "None" power option.

**Note:** A peculiarity in the power system selection 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 UL-approved for the same situation. To order a UL-approved model, specify the battery **without** the solar panel. You then specify the solar panel by part number.

### Specifications: Charge Regulator and AUX Output

A charge regulator and AUX output are included on the Processor/Main Electronics board.

**Note:** This charge regulator is sized for the ControlWave GFC, **not** the 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

You can specify a device with Class I, Division 2 certification. The ControlWave GFC Plus is UL-approved as an instrument. That this certification **strictly prohibits** the installation of any other hardware, not indicated by the model number, in the instrument enclosure (except for wiring to and from the I/O and communication and power connections inside the enclosure, in accordance with the *ControlWave GFC Plus Instruction Manual* [D301387X012]).

## 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 you to select an external temperature transmitter.



*Bendable RTD with 12” probe*

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 you can tighten the included fitting to lock it in place and bend the excess length out of the way. Note that a thermowell is *always* required for this bendable RTD.

### RTD Interface Information

The ControlWave GFC Plus supports a 3-wire platinum RTD per DIN 43760. 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 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, you can 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, you can set the coefficients, restore the factory default for these coefficients, and calibrate the internal Reference resistor.

### Specifications: RTD Input

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:  $\pm 0.25$  °C / 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.

## 21 V dc/dc Power Supply

Since the I/O card does not include loop power, this option provides power if 4 –20 mA loops are 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.

**Note:** Since the minimum input voltage for this option is 10.8 Vdc, it **does not** work with nominal 6 Vdc or 9 Vdc power sources.

While the 21V dc/dc Power Supply is required for use with a 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 can 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 you select the 21V dc/dc Power Supply. This is another Snap Track option that is located nearby the 21V dc/dc Power Supply.

### Specifications: 21 V DC/DC Power Supply

- Input voltage: 10.8 to 16.0 Vdc
- Input current: Double the current draw of the output device (that is, 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 the 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 either the minimum I/O configuration (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.

### Pulse Input (PI) Or High Speed Counter (HSC) Input

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:** HSC inputs ship from the factory disabled; you can enable or disable them.

If you anticipate using analog I/O in the future, Emerson recommends that you select the 3 AI/1 AO configuration. Adding points requires you to change out the I/O card, and due to hazardous area certification requirements, that can be done only at the factory.

## 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  $\mu$ 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  $\mu$ 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  $\mu$ 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: De-bounce circuit for contact closures and bandwidth limiting for counter input

**Note:** HSC inputs on the I/O card include de-bounce; PI inputs on the Process/Main Electronics card **do not**.

- Input current: 200  $\mu$ A 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 25 °C; 0.2% of span - 40 °C to 70 °C
- 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 @ 25 °C for current output; 0.1%+ 3% of span @ 25 °C for voltage;
  - 0.3% of span @ -40 to 70 °C for current output; 0.3%+ 3% of span @ -40 to 70 °C 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 values shown 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

- Base unit 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: refer to *I/O Specifications*.

#### Power Distribution Board

This option organizes the power wiring inside the enclosure (choose Selection O). Located inside the enclosure on the left-most Snap Track in the lower, right-hand area, the Power Distribution Board is required if you select any of the following:

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

The Power Distribution Board is pre-wired for these items, as well as for the solar panel and power input on the Processor/Main Electronics board.

#### Relay Board

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

You 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 discrete outputs.

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

Using the on-board jumpers, you can configure the Form C relay output signals for opposite or identical conditions:

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

#### Specifications: Relay Board

- Terminations: Pluggable Terminal block accommodates up to 14-gauge wire size
- 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 you select the Relay Board, the Power Distribution Board is *required* and the factory pre-wires connections between the two.

## PolyPhaser Option for Radio

If you specify a radio, you can specify whether 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:** All modems and radios are pre-allocated to the COM2 network port and are 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 everything except for the radio. The mounting bracket as well as all cables and connections are in place. The integrator/installer mounts the radio to the bracket and makes the connections.

It is important to match the radio ready configuration with the specific radio you expect to install, since cables and connections for the antenna, RS-232 port, and power vary by radio module.

#### Specifications: Modem

The optional auto-dial auto-answer modem provides a sleep mode that conserves power while allowing it to wake up when a call comes in.

- Function: provides Public Switched Telephone Network (PSTN) communications.
- Operating Modes: Sync or Async 2-wire switched network, half or full duplex
- Line Type: 2-wire loop start lines.
- Modem Configuration: "AT" based commands.
- Data Rates: 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% RH non-condensing

#### Specifications: Radio

Refer to the Emerson Process Management website ([www.EmersonProcess.com/Remote](http://www.EmersonProcess.com/Remote)) for individual data sheets available in pdf format.

#### Radio Power Consumption

**Note:** To conserve power, the ControlWave GFC Plus turns power to the radio **completely off** instead of operating it in 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, you can select either a 10-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 (part number 395402-01-8)
- 25-foot Cable (part number 395402-02-6)

## Standard Application Program and PC Menu Pages

The 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 website or on the BSI Config DVD (part number 395575-02-8), which also contains the TechView utility as well as a copy of the Standard Application Program.

If you want to modify the Standard Application Program, it is available as source code. 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.

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



*The ControlWave Product Family*

## Open Standards

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 achieves the highest degree of openness in control system architecture and brings 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, Emerson has 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:

- Flip-flop, counters, and 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

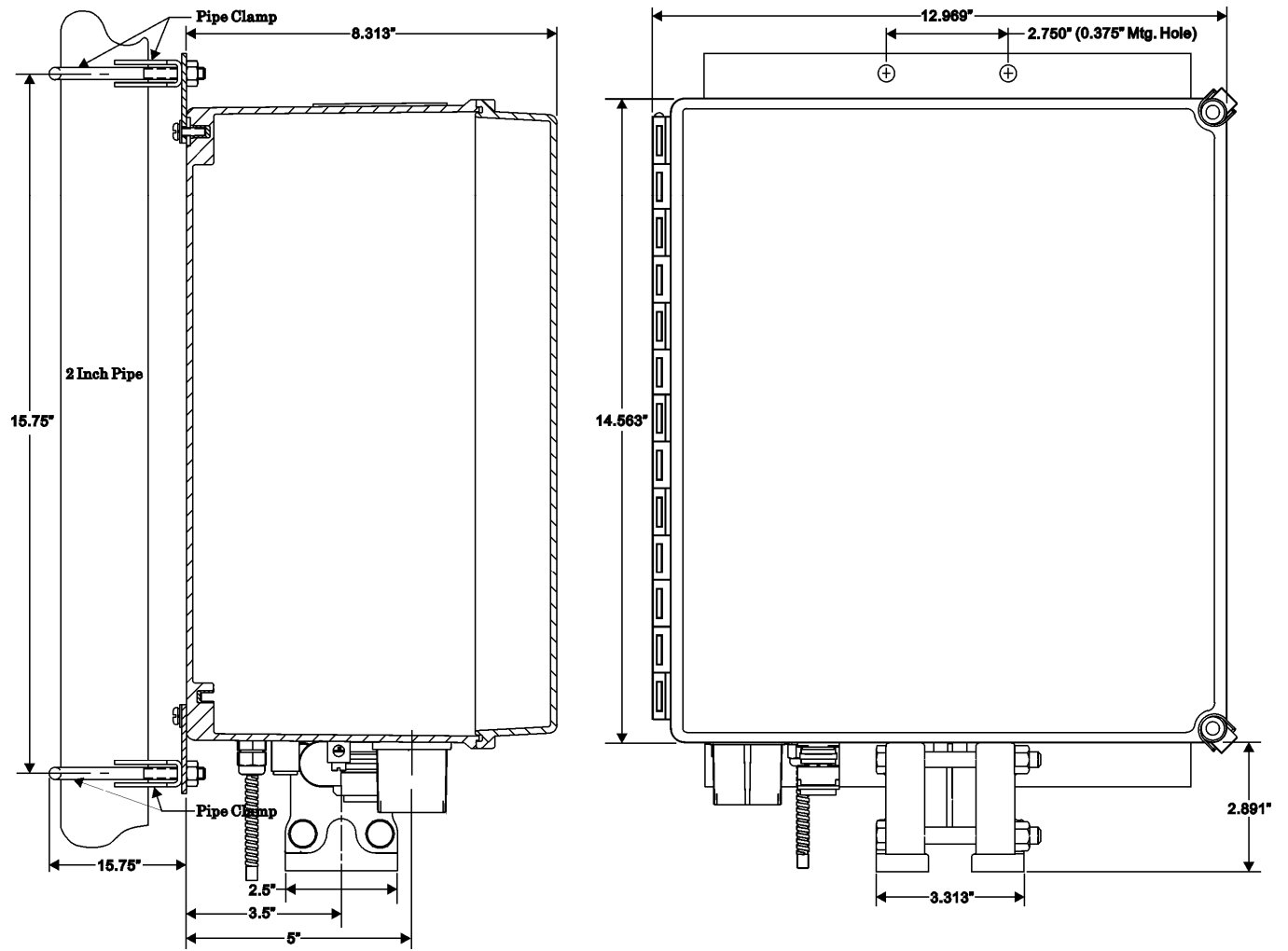
In addition to the basic functions and function blocks, ControlWave Designer brings the benefit of many years of experience in measurement and SCADA to the ACCOL III function block library. ACCOL III includes over 60 function blocks that are valuable for use in oil & gas, water & waste water, and process measurement & control applications. Further, ACCOL III is designed to take full advantage of the significant features ControlWave offers.

Briefly, this library includes function blocks for:

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


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

### ControlWave GFC Plus Dimensions





**Approvals**

Miscellaneous Approvals	RoHS2	RoHS (2) EU Directive 2011/65/EU: This product may be considered out-of-scope when used for the intended design purpose in a Large Scale Fixed Installation (LSFI). Consult <a href="https://www.emerson.com/compliance">https://www.emerson.com/compliance</a> for up-to-date product information.
	RoHS (China)	

For customer service and technical support, visit [www.EmersonProcess.com/Remote/Support](http://www.EmersonProcess.com/Remote/Support).

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