ControlWave® GFC Corrector

Emerson's ControlWave® GFC Corrector is a best-fit solution for sites requiring not only linear meter correction but also full RTU functionality, including process I/O, station automation, user programming, and live SCADA network communication using a variety of internal, wireless media.

For customers who require out-of-the box startup pf a dual-meter station, the ControlWave GFC Corrector's standard application program meets API 21.1 requirements.

Hardware/Packaging Features

- A 32-bit, ARM 9 processor, capable of performing multiple flow computing and process automation operations.
- Very accurate, smart, gauge pressure sensor 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.

Firmware/Software Features

- Pre-programmed to meet API 21.1 requirements for a 2-run metering station with networking via BSAP or Modbus.
- Pre-configured with PC web- style menu pages for all user operations.
- Using the ControlWave Designer IEC 61131-3 programming environment, any user or third party can modify the standard application or create a completely customized program.

ControlWave GFC Corrector comes in a compact package that includes a P/T sensor assembly, a Telecounter pulser, battery/solar power system, and a broad selection of modem and radio communication options.

Application Areas

The ControlWave GFC Corrector is appropriate to all applications for electronic, linear meter correction, including those that require monitoring of additional I/O points or extension to two meters, including:

- Medium-to-large gas customers
- Industrials
- Boiler or power generation processes, which can switch fuels
- Distribution/LDC metering/gate stations
- Transmission metering stations
- Production wells
- Compressor stations
- Storage facilities

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Package Overview

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

Specifications: Package

- Housing dimensions:
  - Without TeleCounter Pulser Assembly: 11.73 in. H by 9.99 in W by 7.35 in. D (298 mm H by 254 mm W by 187 mm D)
  - With optional TeleCounter Pulser Assembly (and including base mounting plate): 4.37 in. H x 4.63 in. W x 4.38 in. D (111 mm H by 118 mm W by 111 mm D)
- Weight:
  - Minimum: 10 lbs (4.5 kg)
  - Battery + MVT Assembly: 18.5 lbs (8.39 kg)
  - Maximum with Radio: 20 lbs (9 kg)
- Mounting:
  - Without the TeleCounter pulser assembly, this product must be pipe-mounted or wall-mounted; a kit for affixing to a 2" pipe or mast is available.
  - Solar Panel Mounting: Solar panels are delivered with all hardware necessary for 2" pipe or mast-mounting.

Specifications: Operating Environment

- Wide operating power input voltage range: 5.0 to 18.0 Vdc
- Power inputs: 6 Vdc (nominal); 12 Vdc if an internal radio is used.
- Operating Temperature Range:
  - -40 to 158 °F (-40 to 70 °C)
  - With lead acid cell batteries: -4 to 140 °F (-20 to 60 °C)
- Operating Humidity Range: 10 to 95% RH non-condensing
- 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 and Class I, Division 1 for all configurations except those that include 12 Vdc power or radios.

Performance

- Computation Accuracy: 0.01% Corrected Flow, including all input values
- Gauge Pressure Reference accuracy: 0.075% URL
- Temperature Effects on Pressure Reading: 0.21% URL

Selection Item Descriptions and Specifications

Order the ControlWave GFC Corrector using a model number specification (refer to the device-specific price page).

Standard equipment includes a Lexan housing with 2-line LCD, single board 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 sensor assembly, an RTD interface, an AUX power output (to switch power to a radio), and a shunt regulator for charging an internal, lead acid cell battery from a solar panel. The model number additionally allows you to specify the following:

- Integral gauge pressure sensor assembly and upper range limits
- Pre-wired, bendable RTD assembly
- Thermowell (choice of three common insertion lengths)
- A 2-line LCD with no pushbuttons, a 2-line LCD with two pushbuttons, or a 4-line LCD with a 25-key keypad.
- I/O card, including 2 DI/DO, 4 DI, 2 DO and 2 HSC/DI and optionally an additional 3 AI and 1 AO.
- Hazardous area approval (Class I Division 2)
- Choice of integral, battery, or solar power systems.
- Choice of standard model modem or radio (commonly available from Freewave and MDS) that is factory-installed on an internal bracket.
- PolyPhaser surge suppressor for the radio.
- TeleCounter integral pulser assembly.
- Meter-mounting base plate for popular gas meters.

▪ Stickers for digit blanking and meter index rate.

Emerson Sensor Assembly

The sensor assembly (**ABC** in the model selection, or **022** for the 100 psi gauge pressure sensor) is integrated into the instrument package, and is easiest to implement for a single meter run. However, the standard application program also allows use of external transmitters, with or without the integrated sensor assembly.

Most 2-run systems use the integrated sensor assembly for the first run and an external transmitter 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 that you practice "depot level" service, in which you remove and replace the sensor assembly at your 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

▪ Gauge pressure sensor housing material: 316 SS

▪ Diaphragm material: 316 SS

▪ Fill medium: 200 Silicone

▪ Process connections: ¼" NPT female

▪ Connects to the processor board via a dedicated SPI bus cable.

Accuracy and Performance Specifications

▪ Combined effects of nonlinearity, non-repeatability, and hysteresis at reference pressure and over the operating temperature range: ±0.075% of Calibrated Span or 0.015% of URL, whichever is greater.

▪ Temperature effect on gauge pressure:

▪ ±0.21%URL maximum combined shift of zero and span with an ambient temperature change of 60 °C (108 °F)

▪ Long Term Stability at Constant Conditions: ±0.1% URL/Year typical

Integral Enclosure and LCD/Keypad

Emerson currently offers the ControlWave GFC Corrector in only one enclosure (Selection D), which comes with a liquid crystal display (LCD) and a selection of keypads.

The standard LCD provides two lines and operates in a continuous cycle mode. You can select one of two

optional 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

▪ 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 (this assembly is factory-installed)

▪ Easy configuration via ACCOL III function block

▪ Scrolling display mode

▪ Adjustable timer turns off display when not in use

Above, the LCD with 25-button display; the 2-button version is similar but includes only two arrow keys to scroll through the displays.

Specifications

▪ Window size: 1.1 in. H by 3.1 in. W (28 m H by 79 mm W)

▪ Character size: 4 mm H by 3 mm 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 select a list and manually scroll through the data. You can also define a "scroll list" and set the ControlWave GFC Corrector to automatically scroll through the list.

FLOW_RATE_THISHOUR
729.8346
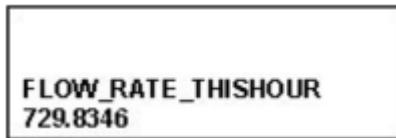
2-button LCD display

The 25-button display/keypad performs the same functions and additionally allows the operator to view and modify ControlWave GFC Corrector 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.

FLOW_RATE_THISHOUR
729.8346
        CE   ME   AE
    PREV NEXT MULT EXIT

25-button LCD display

Mounting Hardware

You can specify (using Selection E) optional hardware for either pole-mounting or wall-mounting. The "pole-mount" kit includes two wall-mounting plates and two pipe clamps.

Without the mounting hardware, the ControlWave GFC Corrector is suitable for process-mounting to a direct-mount manifold. Note that this is appropriate **only** for models with pulser assemblies. Do not process-mount a unit with a gauge pressure sensor but without a pulser assembly.

Processor/Mail Electronics Selection

Currently, one processor choice (Selection F) is available for the ControlWave GFC Corrector The processor electronics assembly consists of a single circuit board, which is installed on the left-hand side in the enclosure. Use Selection G to specify power sources and Selection L to specify optional I/O.

Specifications

- 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 *Specifications: Serial Ports* for further information)
- 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
- 5.0 to 18.0 Vdc Power Supply with Power Fail Sequencer

Specifications: 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 Corrector Standard Application Program

Two programs are currently available as standard applications (Selection G): a 1-2 run Standard M&R and a TeleFlow Emulator program.

The ControlWave GFC Corrector ships with the program (as a .pro file) loaded in flash; the Flash Configuration Program (FCP) is also pre-loaded.
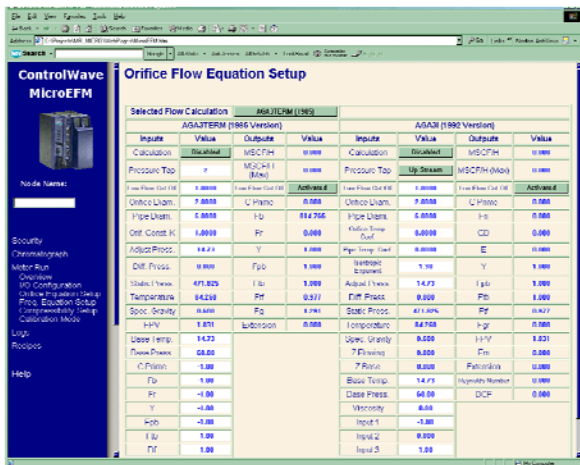
The user interface for the Standard Application Program is a series of straight-forward web-style menu pages.

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 Utility for calibration of all transducers, including the integral MVT and external transmitters.

▪ The PC menu pages, calibration utility, and program load are all included on the BSI Config CD.

▪ Standard configuration is a 1-2-run station

▪ Each run can be orifice, turbine, or ultrasonic meter type

▪ Flow calculations include:

   o AGA7/NX-19

   o AGA7 with selectable AGA8 Gross or AGA8 Detail

   o Auto Adjust AGA7/NX-19

   o Auto Adjust AGA7 with selectable AGA8 Gross or AGA8 Detail

   o AGA9

▪ Allows you 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 samplers and odorizers

▪ 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 the device's flash memory. The system stores the following items in the Hourly Data Log:

   o Corrected Volume

   o Uncorrected Volume

   o Accumulated Energy

   o Average Static Pressure

   o Average Temperature

   o Average Specific Gravity

   o Average Heating Value

   o Flow Time

   o Uncorrected Count

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

▪ Daily Historical Data Log

The Daily Data Log holds one record for every contract day. You can change the contract hour. The daily log holds 62 entries; this ensures that the previous calendar month of daily data is always resident in the device's memory. The system stores the following items in the Daily Data Log:

   o Corrected Volume

   o Uncorrected Volume

   o Accumulated Energy

   o Average Static Pressure

   o Average Temperature

   o Average Specific Gravity

   o Average Heating Value

   o Flow Time

   o Uncorrected Count

Each log entry also contains the date and time. The device also has a Daily Historical Log for each runs

▪ 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 system stores the following items in the Periodic Historical Data Log:

o Flowing Differential Pressure

o Flowing Static Pressure

o Flowing Temperature

o Frequency

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

▪ Audit Trail Alarm and Event Storage

The ControlWave GFC Corrector 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:

o Any operator change to a device configuration variable

o Any change in the state of a device alarm signal

o A system restart

o 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**: The same port is allocated for **either** a chromatograph **or** external transmitters.

▪ Self Diagnostics

The ControlWave EFM 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 at 115.2K baud rate. The externally accessible PC port connector (located on

he bottom of the front door) is connected to this port on the CPU.

▪ **COM2**
RS-232 Network port with flash configuration of BSAP Slave at 9600 baud. The standard application program is compatible with an external communication device (via RS-232) or a standard radio. If a standard radio is included, the model also includes 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 multivariable transmitters for meter run measurement are interfaced to this port.

The Standard Application Program also supports a chromatograph but a flash configuration change is required to allow the interface between the chromatograph and the COM3 port.

Power System, Charger Regulator, and AUX Output

You can choose (using Selection H) from a variety of internal power systems that include 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 Processor/Main Electronics board, which is located on the left-hand side of the enclosure. Related to the power system, a charge regulator circuit and an auxiliary output (AUX Output) are standard in ControlWave GFC Corrector.

Specifications: Power System, Charge Regulator, and AUX Output

▪ 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

▪ Power consumption: See *I/O Configuration*.

Refer to the Emerson website (*www.Emersonprocess.com/Remote*) for data sheets on the following power system components:

- 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, 6.5-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. Refer to the product data sheet *ControlWave GFC Power System Sizing* (part D301327X012) for further information.

Hazardous Area Certification

Class I Division 2 certification can be selected via Selection J. The ControlWave GFC Corrector 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 Corrector Instruction Manual* (part D301382X012) are, of course, allowed.

Bendable RTD

You can choose (Selection K) a bendable RTD that is attached to the ControlWave GFC Corrector 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 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, the 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 device supports a three-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 Corrector 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:

$A = 3.9083 * 10^{-3}\ °C^{-1}$
$B = -5.775 * 10^{-7}\ °C^{-2}$
$R_0 = 100\ ohms$

In addition, you 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, you can set the coefficients, restore the factory default for these coefficients, and calibrate the internal Reference resistor.

Specification: RTD Input

These specifications are for the interface only, and do not include the RTD probe or wiring.
Note: The RTD probe interchangeability can add $\pm$ 0.7 °C of uncertainty to the measurement.

- RTD Conversion Accuracy: $\pm$ 0.1 °C, or $\pm$ 0.1% of reading, whichever is greater

- Ambient temperature effect on RTD measurement: $\pm$ 0.01 °C / °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 (Selection L) for the RTD.

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 into the Processor/Main Electronics card. You can choose (Selection M) 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: The HSC inputs ship from the factory with the de-bounce disabled; you can enable or disable it.

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.

Specifications: I/O

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 μA 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 μA 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 μA 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 μA 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 megΩ - 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 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*.

PolyPhaser Option for Radio

If you specify a radio (Selection PQR), you can specify (Selection N) whether a PolyPhaser surge protector is also included. Emerson always recommends the PolyPhaser.

Modem or Radio Option

You can optionally specify the inclusion of a modem or a radio (Selection PQR). 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 the radio. The mounting bracket, as well as all cables and connection,s 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 the 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). Al- lows 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*) 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

Proximity Sensor Interface

The Proximity Sensor Interface (or ISPROX, Selection S) is a Snap Track-mounting board that provides a direct interface to the most common, proximity sensors used in turbine meters. The Snap Track is located inside the door of the Corrector.

This board converts signal levels to those necessary to interface with the pulse inputs (PI) on the processor board or high-speed counter inputs (HSC) on the I/O board in the Corrector. When ordered with the Corrector, the outputs are factory-wired to the pulse inputs. The ISPROX board provides the following:

- 2-wire intrinsically safe, proximity sensor inputs

- Compatible with Pepperl+Fuchs SJ2-N (used in Auto Adjust) and Turck YOX (used in Instromet meters) sensors.

- 2 outputs, which are compatible with PI and HSC inputs in the Corrector (open drain)

- Class I Division 1 and Class I Division 2 rated-approval

- 10 kHz minimum bandwidth

- Power consumption: 3.5 mA at the supply voltage (whether it is nominal 6V or 12V).

Telecounter Pulser Assembly

The optional TeleCounter Assembly (Selection T) provides a direct, mechanical pick-up to the drive shaft on rotary meters. It converts rotations to electronic pulse outputs, which are wired to the pulse input points inside the Corrector. The TeleCounter is mounted to the bottom of the Corrector with a gasketed, water-tight seal and is secured to the Corrector enclosure with four screws.

You can open the TeleCounter in the field to set its gears for clockwise or counter-clockwise rotation. The 8-digit odometer provides a count of 0000000.0 to 9999999.9 revolutions. The magnet wheel and the odometer's tenths wheel increment 10 digits each time the meter completes one revolution.

Mounting Kit

A mounting kit (Selection U) is available that adapts the TeleCounter to the mounting configuration of a particular meter. Selections are for either a standard meter (such as a Roots® or a Rockwell/Equimeter/Invensys/Sensus meter) or an American Meter.

If you already have the adapting hardware (refer to the dimension drawings in this document), select "None" for the mounting kit option.

Digit Blanking

You can specify stickers (Selection V) to place over one or more digits on the mechanical counter. They can be used to match-up with an index on the meter or with a multiplier factor used with the meter. Stickers are available for the tenths, ones and tens digits.

Meter Index Rate

Additional stickers (Selection W) are available to show the meter flow units, in either cubic feet per revolution or cubic meters per revolution. Refer to the device-specific price pages for model numbers.

Accessories

PC Cables

For local PC operations, you can select either a 10-foot (part number 396647-01-4) or a 25-foot cable (part number 396647-02-2). These cables match up to the circular connector on the bottom of the ControlWave GFC Corrector door.

Standard Application Program and PC Menu Pages

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 user menu system 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. Please contact Emerson's Remote Automation Solutions Application Services department for further information.

Product Family Compatibility

The ControlWave GFC Corrector is compatible with Emerson's ControlWave family. It is fully software compatible with the ControlWave Express, the ControlWave GFC, the ControlWave XFC, the ControlWave EFM, the 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 larger installations, in addition to those that require flow computers. ControlWave family products are capable of all measurement and control (M&C) 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 will also find the documentation, networking, and software compatibilities to be very favorable to their asset management.

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
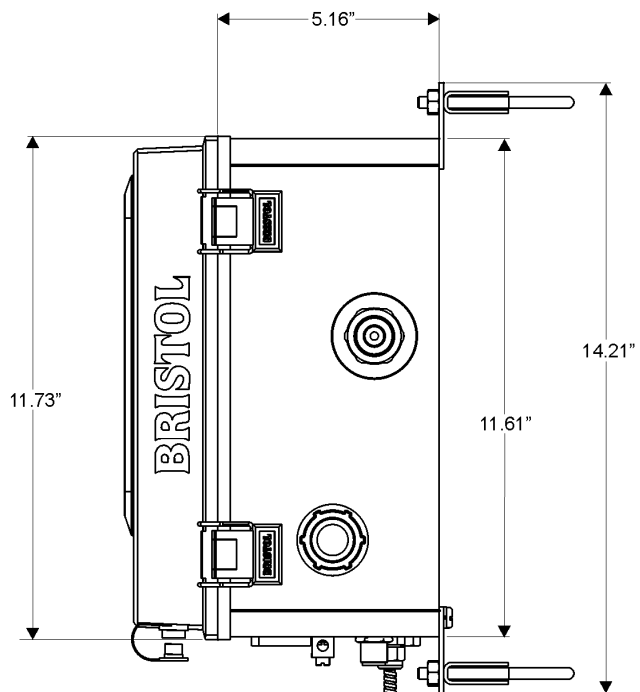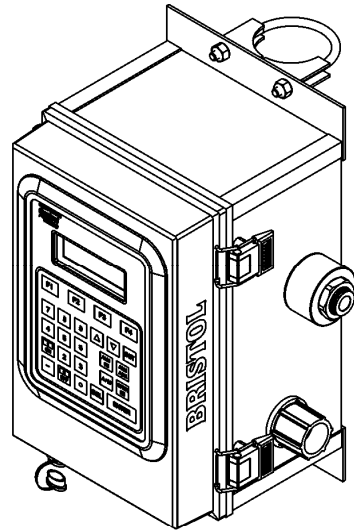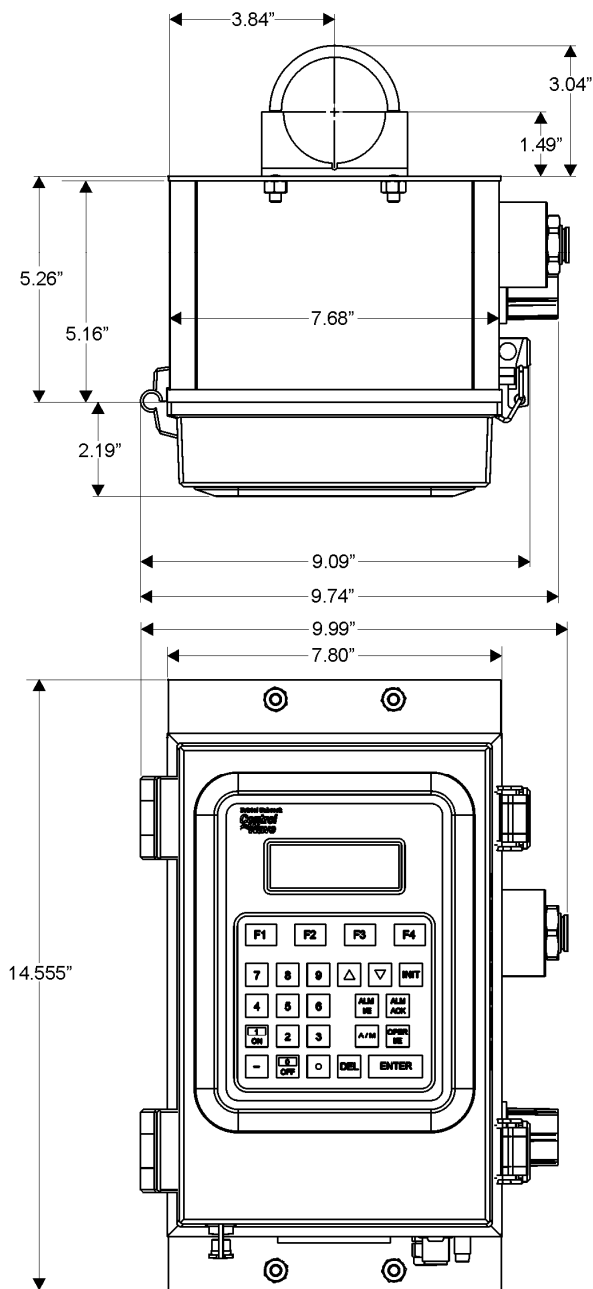
- Average, Compare, and Totalize

- 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.

Dimensions: ControlWave GFC Corrector with TeleCounter Pulser Assembly and Gauge Pressure Sensor
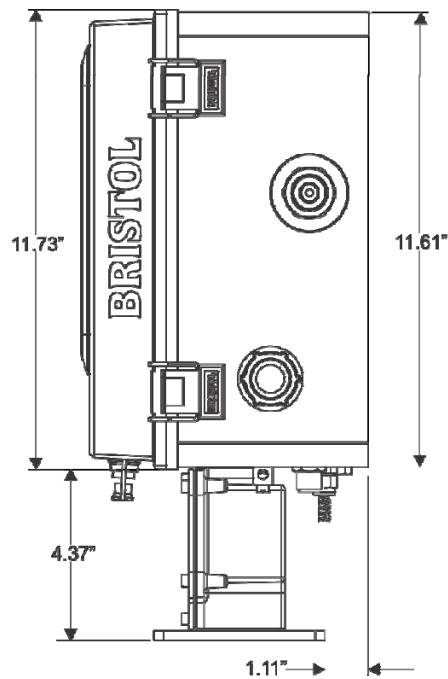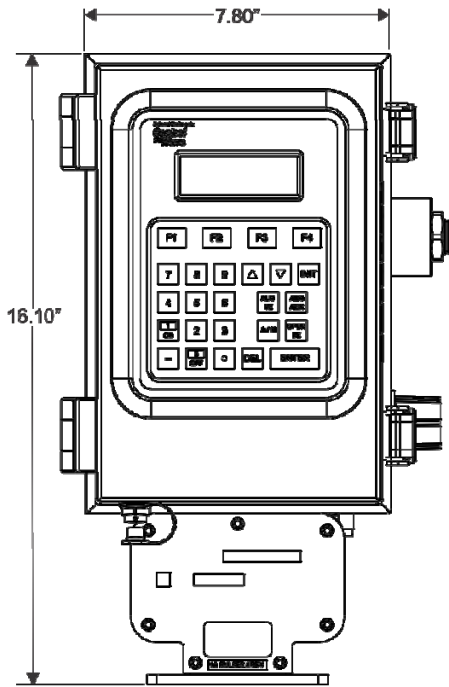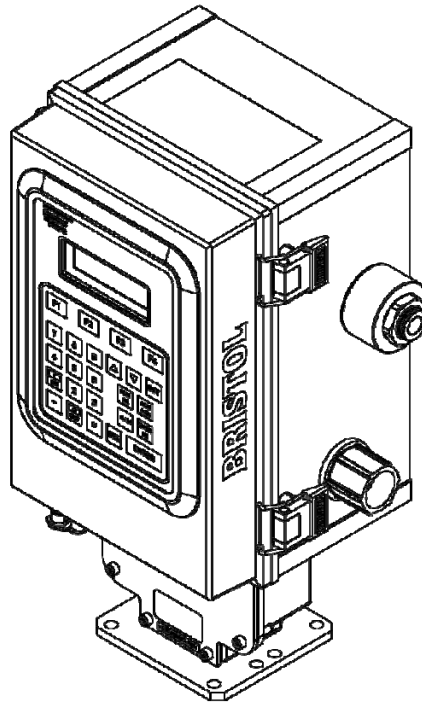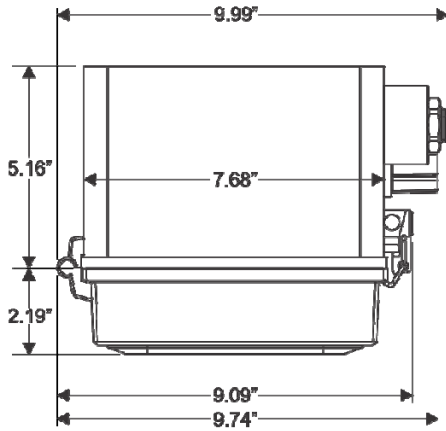
Dimensions: ControlWave GFC Corrector with Gauge Pressure Sensor and Pole-mount Hardware

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 https://www.emerson.com/compliance for up-to-date product information.
	RoHS (China)	

For customer service and technical support,
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