ControlWave® XFC Gas Flow Computer

Emerson's ControlWave® XFC is a cost effective, competitive solution when requirements call for a chart replacement or flow computer in a compact, explosion-proof package.

Additionally, ControlWave XFC provides extended capabilities, such as a second meter run or plunger lift control, while maintaining the convenience and simplicity of an integrated, explosion-proof installation

ControlWave XFC Overview

Hardware/Packaging Features

- Smart, gauge pressure or DP/P sensor assembly can be removed and replaced independently of the "top end" assembly.

- Precision RTD interface provides very accurate process temperature measurement.

- Wide (6.0 to 30.0 Vdc) operating input voltage range works with a broad range of power sources.

- Very low power consumption minimizes costs of solar/battery power systems.

- Three serial communication ports are standard.

- Optional I/O includes 2 DI, 2 High-speed Counter inputs and 4 DO as well as an additional 3 AI and 1 AO.

- Integral 2-line LCD operates in a continuous cycle mode.

- Operating temperature range is -40 to 176 °F (-40 to 80 °C).

- Class I, Division 1 (explosion-proof) and Division 2 NI approved.

Firmware/Software Features

- ControlWave XFC 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.

ControlWave XFC comes in a compact explosion-proof package (shown with DP/P sensor assembly).

Application Areas

ControlWave XFC is appropriate to all applications for flow computers, including those that require process control or extension to two meter runs, including:

- Production wells

- Injection wells

- Production optimization applications

- Off-shore platforms

- Separation plants

- Compressor stations

- Storage facilities

- Transmission metering stations

- Distribution/LDC metering/gate stations

Using the gauge pressure sensor, ControlWave XFC provides accurate, P/T measurement for linear meters, including positive displacement, turbine and ultrasonic technologies. The multivariable, DP/P sensor applies best to orifice metering, where accurate, three-variable (DP/P/T) measurement is required.

Package Description

Order the ControlWave XFC using a model number specification.

Standard equipment includes an explosion-proof housing, two-board electronics assembly with 3 serial ports, an RTD

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interface, 2-line LCD, and the standard API 21.1 EFM application program. Emerson's sensor assembly, which provides measurement of gauge pressure or differential pressure plus static pressure, is also standard equipment. The model number additionally allows you to specify the following:

- Sensor upper range limits

- Wetted parts material, stainless steel or Hastelloy C

- Optional manifold adapters

- Optional mounting bracket

- Standard application program

- I/O configuration choices are no I/O; 2 DI, 2 HSC, 4 DO; and 2 DI, 2 HSC, 4 DO plus 3 AI and 1 AO.

Package Specifications

- Housing Dimensions: 9 in. H by 5 in. W by 6 in. D (229 mm H by 27 mm W by 152 mm D)

- Clearance: Allow at least 2.5 in (64 mm) space underneath for cabling

- Dimensions: MVT Wet End (optional): 3 in. H by 3.75 in. W by 2.5 in. D (76 mm H by 95 mm W by 64 mm D)

- Weight: 12 lbs (5.4 kg)

- Mounting: Pipe- or wall-mounting is recommended; a kit for affixing to a 2 in. (51 mm) pipe or mast is optional

- Housing: Low copper aluminum, with polyester paint.

Specifications – Operating Environment

- Wide operating power input voltage range of 6.0 to 30.0 Vdc; shutdown sequence occurs at 5.46 Vdc nominal

- Power input surge suppression: 30V transorb to ground meeting ANSI/IEEE c37.90-1978

- Fuse: 0.375 A slow blow

- Operating Temperature Range: -40 to 176 °F (-40 to 80 °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

- RFI Immunity: In conformity with IEC 61000-4-3 (Level 2): 80MHz to 1000MHz

- ESD: Field connected circuits meet IEC 61000-4-2 for ESD withstand capability up to 4KV

- NEMA Rating: NEMA 4, 4x, and 7

Hazardous Area Approvals

- Explosion-proof for operation in Class I, Division 1 Hazardous Areas: UL/CUL Approved.

- Non-incendive for Class I, Division 2 Hazardous areas: UL/CUL Approved.

Selection Item Descriptions and Specifications

Emerson's Sensor Assembly

Two sensor assemblies are available: the 100 psi gauge pressure sensor (**022** in the model specification) or the 300" DP/2000 psig static pressure multivariable sensor assembly (**142** in the model specification).

Using the integral sensor assembly is the easiest implementation for a single meter run; however, the standard application program also allows use of external transmitters.

DP/P Multivarible Sensor Assembly

Multiple-run systems can use the integral sensor assembly for the first run and an external multivariable transmitter for additional meter runs.

If the sensor assembly requires a repair, you can change it out and continue operating with the "top end" 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 – MVT Assembly

- Flange Material: Hastelloy® C or 316 Stainless Steel

- Flange Bolt Material: Hastelloy C or 316 Stainless Steel

- Diaphragm Material: Hastelloy C or 316 Stainless Steel

- Fill Medium: DC 200 Silicone

- Flange Process Connections: ¼" NPT

- Connects to the main electronics via a dedicated SPI bus cable.

Note: Specify wetted part materials (Hastelloy C or stainless steel) as Selection D.

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

- Combined effects of nonlinearity, non-repeatability and hysteresis at reference pressure and over the operating temperature range (0.035% for 1000 psi SP range): GP, DP and SP linear mode: ±0.075% of Calibrated Span or 0.015% of URL, whichever is greater.

- Temperature effect on Static and Differential pressure: ±0.21%URL (0.17% for 1000 psi SP range) 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: ±0.1% URL, for a change in static pressure of 1000 psi; Span error: ±0.1% reading, for a change in static pressure of 1000 psi

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

- Mounting position effect: ±2 in H2O maximum, which can be calibrated out.

- Ripple and noise: Per ISA 50.1 Section 4.6

Sensor Assembly Wetted Parts Material

You can select the material (316 stainless steel or Hastelloy C) used in the flange bolts, flanges, and diaphragm in the sensor assembly through selection D.

Processor/Main Electronics

The electronics assembly consists of two circuit boards with the CPU, LCD display, communication, dc/dc power system controller functions, and the I/O functions all installed within the explosion-proof housing.

- 32-bit ARM9TDMI RISC core processor running at 14 MHz

- Serial Real Time Clock Accurate to 5 seconds/month 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, 4000-hour backup time

- 3 Serial communication ports (see below for further information)

- 6.0 to 30.0 Vdc Power Supply with Power Fail Sequencer

- 2-line LCD with nine, 7-segment numeric characters plus polarity on line 1 and six, 14-segment alphanumeric characters on line 2.

Serial Ports

Com1

- RS-232

- 3-wire interface

- 300 to 115.2K baud rates

- Physical Interface is on the main termination assembly.

Com2

- RS-232

- 300 to 115.2K baud rates

- Physical Interface is on the main termination assembly.

- Supports RTS, CTS, DTR, and DCD modem control signals

- RS-232 transceivers are enabled by the port's DTR.

- DCD remains active in power-down mode.

Com3

- RS-485, 2-wire

- 300 to 115.2K baud rates

- Physical Interface is on the main termination assembly

Standard Application Program

The 2-run M&R is the only standard application program available for the ControlWave XFC, which ships with the program (as a .pro file) loaded in flash; the Flash Configuration Program (FCP) is also pre-loaded. (If you wish to use your own program, you can order the XFC without an application program.) Program specifics include:

- 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 LocalView Calibration Utility for calibration of all transducers, including the integral sensor and external transmitters.

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

- Standard configuration is a 1-run or 2-run station.

- Each run can be orifice, turbine/PD or ultrasonic.
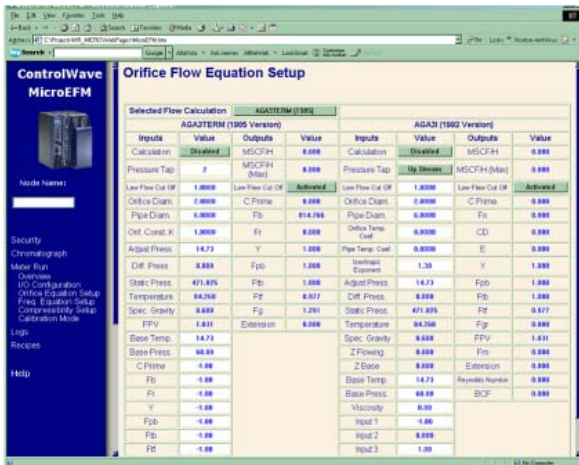
Straight-forward web-style menu pages provide the user interface to the standard application program

- Flow calculations include the following:
  - o AGA3-1992 with selectable AGA8 Gross or AGA8 Detail
  - o AGA3-1985/NX-19
  - 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
  - o Gross or AGA8 Detail
- Allows you to select the integral sensor assembly or an external transmitter. Interface external transmitters via RS- 485 or analog inputs.
- Includes an auto-selector, PID flow/pressure control algorithm
- Includes run switching
- Resides on a BSAP SCADA network
- Supports a sampler and an odorizer
- Provides audit trail and archives
- Includes a nominations function
- Allows you to select engineering units from a broad variety of measurements, including English and metric
- Provides energy throughput as well as composition information
  Note: The standard application program does not support a chromatograph.
- Provides control for external modems and radios for power saving and other modes of operation

Communication Port Configurations for Standard Application

- **COM1**: Local RS-232 port for configuration via a PC; flash configuration is BSAP Slave; 115.2K baud rate.
- **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.
- **COM3**: RS-485 port with Flash configuration of BSAP Master at 9600 baud. The standard application program assumes that a 3808 MVT multivariable transmitter is to be interfaced to this port.

Hazardous Area Certification

Class I, Division 1 certification via the explosion-proof packaging and Class I, Division 2 certification via non-incentive electronics (Selection G).

Manifold Adapters

Optional manifold adapters, which come in a pair (one for each flange for the DP/P sensor assembly), are available in stainless steel (Selection H).

Mounting Bracket

An optional mounting bracket, which affixes to the neck of the housing and allows installation on a wall or 2" pipe, is available (Selection J).

I/O Configuration

You can choose a device configuration without I/O; with 2 DI, 2 HSC, and 4 DO; or one with 2 DI, 4 DO, 2 HSC plus 3 AI and 1 AO (Selection K).

Note: Emerson recommends that you select an I/O configuration if you anticipate the use of any I/O in the future because addition of the points requires an exchange of the I/O card which, due to hazardous area certification requirements, must be done at the factory.

I/O Specifications

Discrete Inputs

- Number of points: 2
- Input configuration: Internally sourced, dry contact
- Input filtering: 15 ms
- Input current: 60 μA nominal
- On-state: > 1.5 V; off-state < 1.5 V
- Maximum scan rate: once per second.
- Electrical isolation: none
- Surge suppression: 30V transorb between signal and ground meets ANSI/IEEE C37.90-1978

- Terminations: Pluggable terminal block accommodates up to 14-gauge wire size.

Discrete Outputs

- Number of points: up to 4

- Configuration: Open Drain MOSFET, externally sourced

- Maximum load current: 400 mA @ 30 seconds

- Maximum update rate: once per second

- Maximum scan rate: once per second.

- Electrical isolation: none

- Surge suppression: 30V transorb between signal and ground meets ANSI/IEEE C37.90-1978

- Terminations: Pluggable terminal block accommodates up to 14-gauge wire size.

High Speed Counter

- Number of points: 2

- Input range: Internally sourced, dry contact input

- Frequency Range: 0-10,000 kHz

- Input filtering: 20 microseconds

- One-shot pulse conditioned signal to MSP counter

- Signal conditioning: debounce circuit for contact closure and bandwidth limiting for counter input

- Input current: 200 μA

- On-state: > 1.5 V; off-state: < 1.5 V

- Electrical isolation: none

- Surge suppression: 30V transorb between signal and ground meets ANSI/IEEE C37.90-1978

- Terminations: Pluggable terminal block accommodates up to 14-gauge wire size.

Analog Inputs

- Number of points: 3 inputs, single ended

- Range: 1-5 Vdc, externally powered

- Input Impedance: 1 megΩ

- Filter: since pole

- Accuracy: $\pm$ 0.1% of full scale at 25 °C; $\pm$ 0.2% of full scale from -20 to 70 °C; and $\pm$ 0.3% of full scale from -40 to 80 °C

- Maximum scan rate: once per second.

- Surge suppression: 9V transorb between signal and ground meets ANSI/IEEE C37.90-1978

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

Analog Outputs

- Number of points: 1 analog output

- Range: 4-20 mA Sink

- Maximum drive for 4-20 mA output: 450 Ohms

- Resolution: 16-bit

- Accuracy: $\pm$ 0.1% of full scale at 25 °C; $\pm$ 0.2% of full scale from -20 to 70 °C; and $\pm$ 0.3% of full scale from -40 to 80 °C

- Maximum update rate: once per second

- Surge suppression: 9V transorb between signal and ground meets ANSI/IEEE C37.90-1978

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

RTD Interface Information

The XFC 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 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 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.

RTD Input Specifications

Specifications are for the interface only and do not include the RTD probe or wiring. 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

Accessories

Bendable RTD

The ControlWave XFC supports a bendable RTD that attaches to the ControlWave XFC via an armored cable of 6-foot, 15-foot, or 25-foot length. The individual wires attach to a terminal block on the termination plate.

The RTD assembly includes a fitting, which is installed in the right-hand (when looking at the termination plate end of the instrument) conduit port.

The RTD would normally provide the process temperature input but the standard application program also allows you to alternately 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 the user can tighten the included fitting to lock it in place and bend the excess length out of the way.

Note: A thermowell is required for this bendable RTD.

The bendable RTD assembly is approved **only** for use in Class I, Division 2 hazardous areas and is **not** explosion-proof.

Bendable RTD Assembly Part Numbers

- 6-foot Cable - 621564-01-0-KIT

- 15-foot Cable - 621564-02-8-KIT

- 25-foot Cable - 621564-03-6-KIT

Standard Application Program and PC Menu Pages

The ControlWave XFC normally comes pre-loaded with the Standard Application Program (.pro) file) in flash. The PC menu pages, however, 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 LocalView Calibration Tool 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 Solutions Application Services department for information.

Product Family Compatibility

ControlWave XFC is compatible with both ControlWave PAC/RTU products (shown above) and other members of the ControlWave flow computer family.

ControlWave XFC is compatible with Emerson's ControlWave family. It is fully software-compatible with ControlWave GFC, 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 customers whose operations include a number of larger installations in addition to those that require flow computers. ControlWave family products are capable of all measurement and control functions at sites such as major, custody-transfer metering stations, compressor stations, off-shore platforms, processing plants and storage facilities.

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

Open Standards

By employing open standards for programming, network configuration, and communications, 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-flops, counters, and timers

- Ladder diagram functions (coils and contacts, etc.)

- Numerical, arithmetic, and Boolean functions (Sine, Cosine, Add, Sub, Square Root, And, Or, etc.)

- Selection and 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.

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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