

Application CR01

Ratio/Blending Process Controller

for Volumetric Frequency
Flowmeters



Features

- Tailored for volumetric frequency flow input
- Uses PI Loop Control
- Pump demand contact
- Selection of various control modes
- “Flushing” available via external logic signal
- Allows for cascade trim control when ratio of totals is required
- Allows for non-linear correction
- Selection of second language and user tags
- RTC logging with over 1000 entries
- Selectable protocols on serial ports including Modbus RTU and Printer output
- Backlit display with LCD backup



Overview

The 515 CR01 application is a single loop process controller measuring the volume flow in a main and process lines using frequency flow inputs. It can operate in local (manual), loop, ratio or blend mode and has a tuning menu to easily determine the Proportional Band and Integral Time values used in the PI control algorithm.

The main and process flows are used to determine the net volume flow. The operator can view the actual ratio and deviation and has the ability to change the controlling setpoint directly from the main menu if access has been authorized.

The PI control of the process flow is via a 4-20mA proportional valve or pump controller. It has integral wind-up protection and a deadband and output ramp time can be programmed to reduce wear on valves and actuators and provide for bumpless operation.

Calculations

There are three types of control modes in which the process flow is dependent on the main flow. These are RATIO, BLEND-1 and BLEND-2 modes where the relationship between the flows are as follows:

Ratio Control Mode.

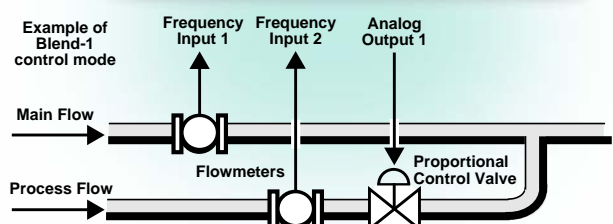
The process flow is a ratio of the main flow (0 to 400% range).

$$Ratio\% = \frac{P_{flow}}{M_{flow}} \times 100$$

Blend Control Modes.

These modes cater for blending points before and after the main flowmeter. The process flow is a ratio of the net (combined) flow (0 to 80% range).

$$Ratio\% = \frac{P_{flow}}{Net_{flow}} \times 100$$



Displayed Information

The front panel display shows the current values of the input variables and the results of the calculations. A list of the variables for this application and their type (total or rate) is shown at the end of this document.

The instrument can be supplied with a real-time clock for data logging of over 1000 entries of the variables as displayed on the main menu.

Communications

There are currently two communication ports available as follows:

- RS-232 port
- RS-485 port (optional)

The ports are available for remote data reading, printouts and for initial application loading of the instrument.

Isolated Outputs

The opto-isolated outputs can re-transmit any main menu variable. The type of output is determined by the nature of the assigned variable. Totals are output as pulses and rates are output as 4-20mA signals. One output is standard, a second output is available as an option.

Relay Outputs

The relay output 1 provides a pump demand contact and the other relays can be used as a fully programmable alarms for any rate type variable. Two relays are standard with an additional two available in the advanced option.

Software Configuration

The instrument can be further tailored to suit specific application needs including units of measurement, custom tags, second language or access levels. A distributor can configure these requirements before delivery.

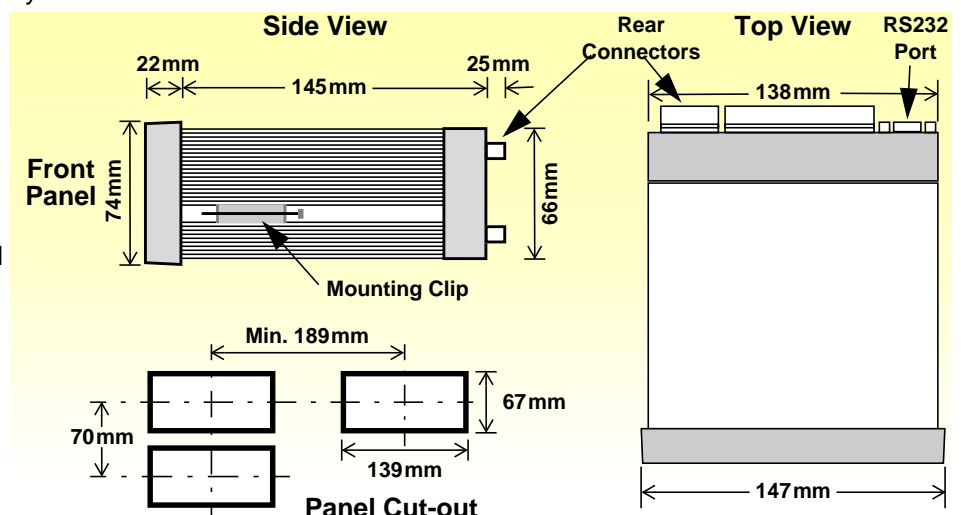
Instrument parameters including units of measurement can be programmed in the field, according to the user access levels assigned to parameters by the distributor.

Dimension Drawings

Part Number

515.XXXXXX-CR01
see **Product Codes** to select required features

Default Application software:
515-CR01-000000



All set-up parameters, totals and logged data are stored in non-volatile memory with at least 30 years retention.

Terminal Designations

| Terminal Label | Designation | Comment |
|----------------|--------------|------------------------|
| 1 | FINP 1+ | Frequency Input 1+ |
| 2 | FINP 2+ | Frequency Input 2+ |
| 3 | SG | Signal ground |
| 15 | Vo | + 8-24 volts DC output |
| 16 | G | - DC Ground |
| 17 | Vi | + DC power input |
| 18 | SH | E Shield terminal |
| 19 | | + RS485 (+) |
| 20 | RS485 | - RS485 (-) |
| 21 | G | RS485 ground |
| 22 | | 1+ Switch 1 |
| 23 | | 2+ Switch 2 |
| 24 | LOGIC INPUTS | 3+ Switch 3 |
| 25 | | 4+ Switch 4 |
| 26 | | C- Signal ground |
| 27 | OUT1 | + Output ch 1 (+) |
| 28 | | - Output ch 1 (-) |
| 29 | OUT2 | + Output ch 2 (+) |
| 30 | | - Output ch 2 (-) |
| 31 | | RC Relay common |
| 32 | | R1 Relay 1 |
| 33 | RELAYS | R2 Relay 2 |
| 34 | | R3 Relay 3 |
| 35 | | R4 Relay 4 |
| E | | E Mains ground |
| N | AC MAINS | N Mains neutral |
| A | | A Mains active |
| RS232 port | | 9-pin serial port |

Specifications

Operating Environment

| | |
|--------------------------------------|--|
| Temperature | -20°C to +60°C (conformal coating) +5°C to +40°C (no coating) |
| Humidity | 0 to 95% non condensing (conformal coating) 5% to 85% non condensing (no coating) |
| Power Supply | 100-240 V AC (+/-10%) 50-60 Hz (+/-10%) or 12-28 V DC |
| Consumption | 6W (typical) |
| Protection | Sealed to IP65 (Nema 4X) when panel mounted |
| Dimensions (panel option) | 147mm (5.8") width 74mm (2.9") height 167mm (6.6") depth |

Display

| | |
|--------------------|---|
| Type | Backlit LCD with 7-digit numeric display and 11-character alphanumeric display |
| Digits | 15.5mm (0.6") high |
| Characters | 6mm (0.24") high |
| LCD Backup | Last data visible for 15min after power down |
| Update Rate | 0.3 second |

Non-volatile Memory

| | |
|--------------------|------------------------|
| Retention | > 30 years |
| Data Stored | Setup, Totals and Logs |

Approvals

| | |
|---------------------|--|
| Interference | CE compliance |
| Enclosure | IECEX, ATEX and CSA approved enclosures available for hazardous areas |

Real Time Clock (Optional)

| | |
|---------------------|--------------------------------------|
| Battery Type | 3 volts Lithium button cell (CR2032) |
| Battery Life | 5 years (typical) |

Frequency Input (General)

| | |
|-------------------------|----------------------------|
| Range | 0 to 10kHz |
| Overvoltage | 30V maximum |
| Update Time | 0.3 sec |
| Cutoff frequency | Programmable |
| Configuration | Pulse, coil or NPS input |
| Non-linearity | Up to 10 correction points |

Pulse

| | |
|--------------------|--|
| Signal Type | CMOS, TTL, open collector, reed switch |
| Threshold | 1.3 volts |

Coil

| | |
|--------------------|-----------------------|
| Signal Type | Turbine and sine wave |
| Sensitivity | 15mV p-p minimum |

NPS

| | |
|--------------------|------------------------------|
| Signal Type | NPS sensor to Namur standard |
|--------------------|------------------------------|

Logic Inputs

| | |
|--------------------|--|
| Signal Type | CMOS, TTL, open collector, reed switch |
| Overvoltage | 30V maximum |

Relay Output

| | |
|-----------------------|---|
| No. of Outputs | 2 relays plus 2 optional relays |
| Voltage | 250 volts AC, 30 volts DC maximum (solid state relays use AC only) |
| Current | 3A maximum |

Communication Ports

| | |
|------------------|---------------------------------------|
| Ports | RS-232 port RS-485 port (optional) |
| Baud Rate | 2400 to 19200 baud |
| Parity | Odd, even or none |
| Stop Bits | 1 or 2 |
| Data Bits | 8 |
| Protocols | ASCII, Modbus RTU, Printer* |

Transducer Supply

| | |
|-------------------|---------------------------------|
| Voltage | 8 to 24 volts DC, programmable |
| Current | 70mA @ 24V, 120mA @ 12V maximum |
| Protection | Power limited output |

Isolated Output

| | |
|-----------------------|---|
| No. of Outputs | 1 configurable output (plus 1 optional) |
| Configuration | Pulse/Digital or 4-20mA output |

Pulse/Digital Output

| | |
|--------------------|---|
| Signal Type | Open collector |
| Switching | 200mA, 30 volts DC maximum |
| Saturation | 0.8 volts maximum |
| Pulse Width | Programmable: 10, 20, 50, 100, 200 or 500ms |

4-20 mA Output

| | |
|-------------------|---|
| Supply | 9 to 30 volts DC external |
| Resolution | 0.05% full scale |
| Accuracy | 0.05% full scale (20°C) 0.1% (full temperature range, typical) |

*Important: Specifications are subject to change without notice.
Printer protocol is available only if RTC option is installed.*

Ordering Information

Product Codes

| Model | Supplementary Code | Description |
|-------------------------|--------------------|---|
| 515 | - CR01 | |
| Enclosure | 1 | Panel mount enclosure |
| | 2 | Field mount enclosure (NEMA 4X / IP66) |
| | 3/5 | Explosion proof Ex d (IECEX/ATEX), metric glands (5 specifies heater) |
| | 4/6 | Explosion proof Ex d (CSA), NPT glands (6 specifies heater) |
| Output Options | 0 | 4 logic inputs, 1 isolated output, 2 relays (only relay type 1 is available), RS232 (DB9) communication port |
| | 1 | 4 logic inputs, 2 isolated outputs, 4 relays, real-time clock data logging, RS232 (DB9) and RS485 communication ports |
| | 2/3 | 4 logic inputs, 2 isolated outputs, 4 relays, real-time clock data logging, RS232 (DB9) and Ethernet/RF communication ports (not yet available) |
| Relay Type | 1 | Electromechanical relays only |
| | 2 | 2 electromechanical and 2 solid state relays |
| | 3 | Solid state relays only (not yet available) |
| Power Supply | U | Inputs for 12-28VDC and 100-240 VAC, 50-60Hz (Previous Models: A = 110/120 VAC, E = 220/240 VAC) |
| | D | Input for 12-28VDC power only |
| Display Panel Option | S | Standard option (now with backlight & LCD backup) (original Full option: F, with Infra-Red comms, no longer available) |
| PCB Protection | C | Conformal coating - required for maximum environmental operating range. Recommended to avoid damage from moisture and corrosion. |
| | N | None - suitable for IEC standard 654-1 Climatic Conditions up to Class B2 (Heated and/or cooled enclosed locations) |
| Application Pack Number | CR01 | Defines the application software to be loaded into the instrument |

Example full product part number is 515.111USC-CR01 (this is the number used for placing orders).

Main Menu Variables

| Main Menu Variables | Default Units | Preferred Units | Variable Type |
|-----------------------|---------------------|-----------------|---------------|
| Net Volume | m ³ | | Total |
| Net Flowrate | m ³ /min | | Rate |
| Main Line Volume | m ³ | | Total |
| Main Line Flowrate | m ³ /min | | Rate |
| Process Line Volume | m ³ | | Total |
| Process Line Flowrate | m ³ /min | | Rate |
| Process Ratio | % | | Rate |
| Control Output | % | | Rate |
| Flowrate Deviation | % | | Rate |



500 Series in Ex410 Enclosure

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