# Application SC04

## Steam
## Flow Computer

for Stacked DP Meters
(ISO 5167 & V-Cones)


## Features

- **Tailored for differential pressure meters with single or stacked transmitters**
- **Uses IAPWS-IF97 steam calculation**
- **Suitable for Water, Saturated and Superheated steam applications**
- **ISO 5167 (2003) DP flow calculations, 9 meter types**
- **V-Cone DP flow calculations, 2 cone types**
- **Selection of second language and user tags**
- **RTC logging with over 1000 entries**
- **Programmable pulse width and scaling of pulse output**
- **4-20 mA retransmission**
- **RS-232 and RS-485 (optional) serial ports**
- **Modbus RTU, Printer and other serial port protocols**
- **Front panel adjustment of 8-24 V DC output voltage**
- **Backlit display**

CE

## Overview

The 515 SC04 application measures the volume, mass and energy content of steam by using single or stacked differential pressure flow inputs in conjunction with temperature and pressure inputs.

A selection of various modes makes it suitable for many steam applications. Flow is calculated according to equations for ISO 5167 or V-Cone meters and accurately accounts for thermal expansion effects.

The energy calculations are based on the IAPWS Industrial Formulation (1997) for the thermodynamic properties of steam. Pressure and temperature values are used to determine the specific volume and enthalpy. The instrument also calculates the isentropic exponent and absolute viscosity which are required for the differential pressure flowrate calculations.

## Calculations

The steam energy calculations are based on the IAPWS Industrial Formulation (1997).

Superheated steam regions are:

| | |
|---|---|
| 0°C < t < 800°C | P < 100 MPa |
| 32°F < t < 1472°F | P < 14500 psia |
| 800°C < t < 2000°C | P < 10 MPa |
| 1472°F < t < 3632°F | P < 1450 psia |

Saturated steam regions are:

0°C < t < 374°C (critical temperature)
32°F < t < 705°F

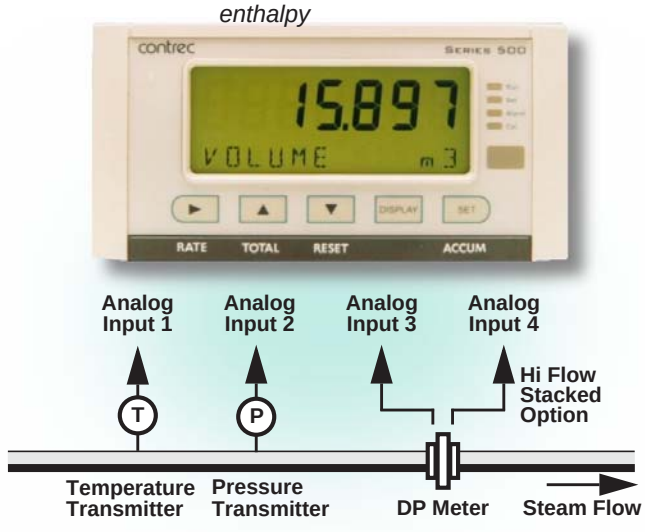
P < 22 MPa (critical pressure)
P < 3190 psia

Water region is:

0°C < t < $t_{saturation}$ at system pressure
32°F < t < $t_{saturation}$ at system pressure

## Formulas

*Volume flow = Mass flow × Specific volume*
*Energy flow = Mass flow × Specific enthalpy*



## 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 two communication ports available as follows:

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

The ports can be used 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 alarms can be assigned to any of the main menu variables of a rate type. The alarms can be fully configured including hysteresis. Two relays are standard with additional two relays available as an 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.

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

## Temperature and Pressure Input Types

Temperature sensor input(s) can be either PT100, PT500, 4-20mA, 0-5V or 1-5V signals. Pressure sensor input(s) can be either 4-20mA, 0-5V or 1-5V signals.

## Terminal Designations

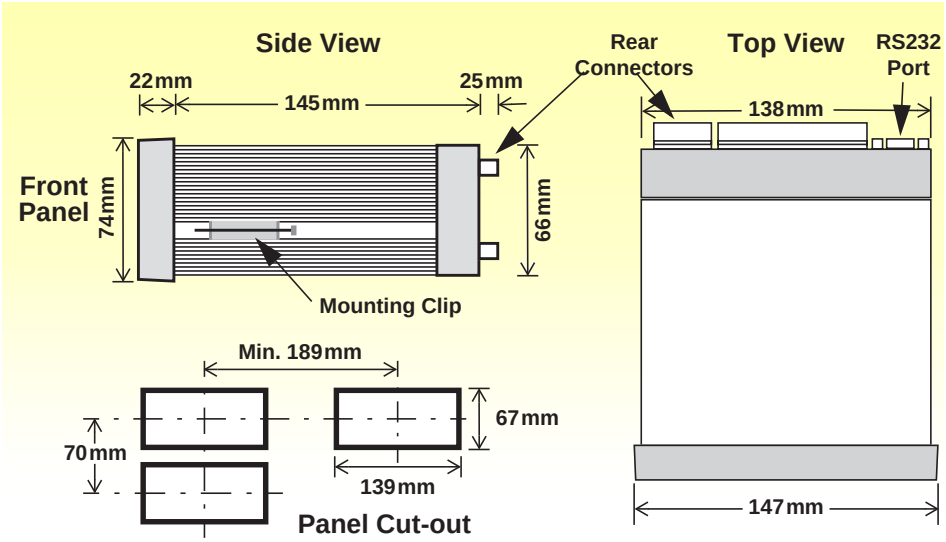
| Terminal Label | | | Designation | Comment |
|---|---|---|---|---|
| 3 | SG | - | Signal ground | |
| 5 | EXC V | 2+ | Excitation Term 2+ | For AINP1 RTD input |
| 7 | AINP1 | + | Analog input ch 1 (+) | Temperature input |
| 8 | | - | Analog input ch 1 (-) | |
| 9 | AINP2 | + | Analog input ch 2 (+) | Pressure input |
| 10 | | - | Analog input ch 2 (-) | |
| 11 | AINP3 | + | Analog input ch 3 (+) | Main or low flow input |
| 12 | | - | Analog input ch 3 (-) | |
| 13 | AINP4 | + | Analog input ch 4 (+) | High flow stacked input |
| 14 | | - | Analog input ch 4 (-) | |
| 15 | Vo | + | 8-24 volts DC output | Overload protected |
| 16 | G | - | DC Ground | |
| 17 | Vi | + | DC power input | DC power in 12-28V |
| 18 | SH | E | Shield terminal | |
| 19 | RS485 | + | RS485 (+) | Optional RS485 port |
| 20 | | - | RS485 (-) | |
| 21 | | G | RS485 ground | |
| 22 | LOGIC INPUTS | 1+ | Switch 1 | |
| 23 | | 2+ | Switch 2 | |
| 24 | | 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 (+) | Optional output |
| 30 | | - | Output ch 2 (-) | |
| 31 | RELAYS | RC | Relay common | |
| 32 | | R1 | Relay 1 | |
| 33 | | R2 | Relay 2 | |
| 34 | | R3 | Relay 3 | Optional relays |
| 35 | | R4 | Relay 4 | |
| E | AC MAINS | E | Mains ground | AC power in 95-135V or 190-260V |
| N | | N | Mains neutral | |
| A | | A | Mains active | |
| RS232 port | | | 9-pin serial port | |

## Dimension Drawings

## Part Number

515.XXXXXX-SC04
see **Product Codes** to select required features

Default Application software:
515-SC04-000000



# Specifications

## Operating Environment

| | |
|---|---|
| **Temperature** | -20°C to +60°C (conformal coating)<br>+5°C to +40°C (no coating) |
| **Humidity** | 0 to 95% non condensing (conformal coating)<br>5% to 85% non condensing (no coating) |
| **Power Supply** | 95...135 V AC or 190...260 V AC or<br>12...28 V DC |
| **Consumption** | 6W (typical) |
| **Protection** | Sealed to IP65 (Nema 4X) when panel mounted |
| **Dimensions** | 147mm (5.8") width<br>74mm (2.9") height<br>167mm (6.6") depth |

## Display

| | |
|---|---|
| **Type** | Backlit LCD with 7-digit numeric display and<br>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** | ATEX, FM, CSA and SAA approved enclosures<br>available for hazardous areas |

## Real Time Clock (Optional)

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

## Analog Input (General)

| | |
|---|---|
| **Overcurrent** | 100mA absolute maximum rating |
| **Update Time** | < 1.0 sec |
| **Configuration** | RTD, 4-20mA, 0-5V and 1-5V input |
| **Non-linearity** | Up to 20 correction points (some inputs) |

### RTD Input

| | |
|---|---|
| **Sensor Type** | PT100 & PT500 to IEC 751 |
| **Connection** | Four Wire |
| **Range** | -200°C to 350°C |
| **Accuracy** | 0.1°C typical (-100°C to 300°C) |

### 4-20mA Input

| | |
|---|---|
| **Impedance** | 100 Ohms (to common signal ground) |
| **Accuracy** | 0.05% full scale (20°C)<br>0.1% (full temperature range, typical) |

### 0-5 or 1-5 Volts Input

| | |
|---|---|
| **Impedance** | 10MOhms (to common signal ground) |
| **Accuracy** | 0.05% full scale (20°C)<br>0.1% (full temperature range, typical) |

## 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<br>(solid state relays use AC only) |
| **Current** | 3A maximum |

## Communication Ports

| | |
|---|---|
| **Ports** | RS-232 port<br>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 |

### 4-20mA Output

| | |
|---|---|
| **Supply** | 9 to 30 volts DC external |
| **Resolution** | 0.05% full scale |
| **Accuracy** | 0.05% full scale (20°C)<br>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** . | | | | | | - SC04 | | |
| **Enclosure** | 1 | | | | | | | Panel mount enclosure |
| | 2 | | | | | | | Field mount enclosure (not yet available) |
| | 3/5 | | | | | | | Explosion proof Ex410 with metric glands (5 specifies heater version) |
| | 4/6 | | | | | | | Explosion proof Ex410 with NPT glands (6 specifies heater version) |
| **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** | | | | E | | | | For 220/240 VAC |
| | | | | A | | | | For 110/120 VAC |
| | | | | D | | | | For DC power only 12-28 VDC |
| **Display Panel Option** | | | | | F | | | Fully optioned (with backlight & LCD backup) |
| **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** | | | | | | | SC04 | Defines the application software to be loaded into the instrument |

Example full product part number is 515.112EFC-SC04 (this is the number used for placing orders).

## Main Menu Variables

| Main Menu Variables | Default Units | Preferred Units | Variable Type |
|---|---|---|---|
| Energy | MWh | | Total |
| Power | MW | | Rate |
| Volume | $m^3$ | | Total |
| Volume Flowrate | $m^3$/min | | Rate |
| Mass | kg | | Total |
| Mass Flowrate | kg/min | | Rate |
| Temperature | Deg C | | Rate |
| Pressure | MPa | | Rate |
| Specific Volume | $m^3$/kg | | Rate |
| Differential Pressure | kPa | | Rate |
| Reynolds Number | E+3 | | Rate |


500 Series in Ex410 Enclosure


**www.contrec.co.uk**

Made in Britain

**Contrec Europe Limited**
Riverside, Canal Road
Sowerby Bridge, West Yorkshire
HX6 2AY United Kingdom
Tel: +44 1422 829920
Email: sales@contrec.co.uk

**Contrec - USA, LLC**
916 Belcher Drive
Pelham, Alabama
AL 35124 United States
Tel: (205) 685 3000
Email: contrec@contrec-usa.com

**Contrec Systems Pty Ltd**
5 Norfolk Avenue
Ringwood, Victoria 3134
Melbourne Australia
Tel: +61 413 505 114
Email: info@contrec.com.au