

# Application SC03

## Steam Flow Computer

for Stacked DP Mass Flowmeters



### Features

- Tailored for differential pressure mass meters with single or stacked transmitters
- Generic differential pressure flow calculations
- Uses IAPWS-IF97 steam calculation
- Suitable for Water, Saturated and Superheated steam applications
- Allows for Specific Enthalpy (initial energy) offset
- Selection of Detail or Basic main menu to suit operator and application
- Selection of second language and user tags
- RTC logging with over 1000 entries
- Programmable pulse width and scaling of pulse output
- 4-20mA retransmission
- RS232 and RS485 or Ethernet (optional) serial ports
- Modbus RTU, Printer and other serial port protocols

### Overview

The 515 SC03 application measures the volume, mass and energy content of steam by using single or stacked differential pressure mass flow inputs in conjunction with a temperature and/or pressure input.

A selection of various modes makes it suitable for many steam applications. The instrument calculates the flow according to generic differential pressure equations and incorporates the conditions at which the flowmeter was calibrated.

The instrument calculates the mass flow and energy according to the IAPWS Industrial Formulation (1997) for the thermodynamic properties of steam. The equations use the pressure and temperature values to determine the specific volume and the specific enthalpy. A specific enthalpy adjustment can be used to offset any initial energy.

### Calculations

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

Superheated steam regions are:

$0^{\circ}\text{C} < t < 800^{\circ}\text{C}$	$P < 100\text{MPa}$
$32^{\circ}\text{F} < t < 1472^{\circ}\text{F}$	$P < 14500\text{psia}$
$800^{\circ}\text{C} < t < 2000^{\circ}\text{C}$	$P < 10\text{MPa}$
$1472^{\circ}\text{F} < t < 3632^{\circ}\text{F}$	$P < 1450\text{psia}$

Saturated steam regions are:

$0^{\circ}\text{C} < t < 374^{\circ}\text{C}$ (critical temperature)
$32^{\circ}\text{F} < t < 705^{\circ}\text{F}$
$P < 22\text{MPa}$ (critical pressure)
$P < 3190\text{psia}$

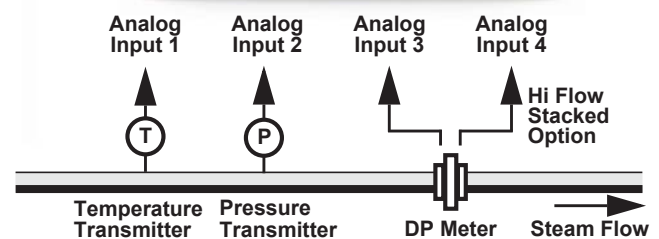
Water region is:

$0^{\circ}\text{C} < t < t_{\text{saturation}}$ at system pressure
$32^{\circ}\text{F} < t < t_{\text{saturation}}$ at system pressure

### Formulas

$\text{Volume flow} = \text{Mass flow} \times \text{Specific volume}$   
 $\text{Energy flow} = \text{Mass flow} \times \text{Net SE}$

$\text{Net SE} = \text{SE} - \text{SE}_{\text{adj}}$  (if  $\text{SE} > \text{SE}_{\text{adj}}$  otherwise 0)  
 (SE = 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:

- COM-1 RS-232 port
- COM-2 RS-485 port (optional) or Ethernet (optional)

All types of ports can be used for remote data reading, while RS-232 and RS-485 serial ports can be used for printouts and for uploading and downloading of the application software to 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 two additional relays available as an option.

## Software Configuration

The instrument can be programmed to suit the particular application needs and the flexible I/O can be assigned as required. Program settings can be changed either via the front panel (depending on assigned access levels) or via the 500 Series Program Manager (500-PM software).

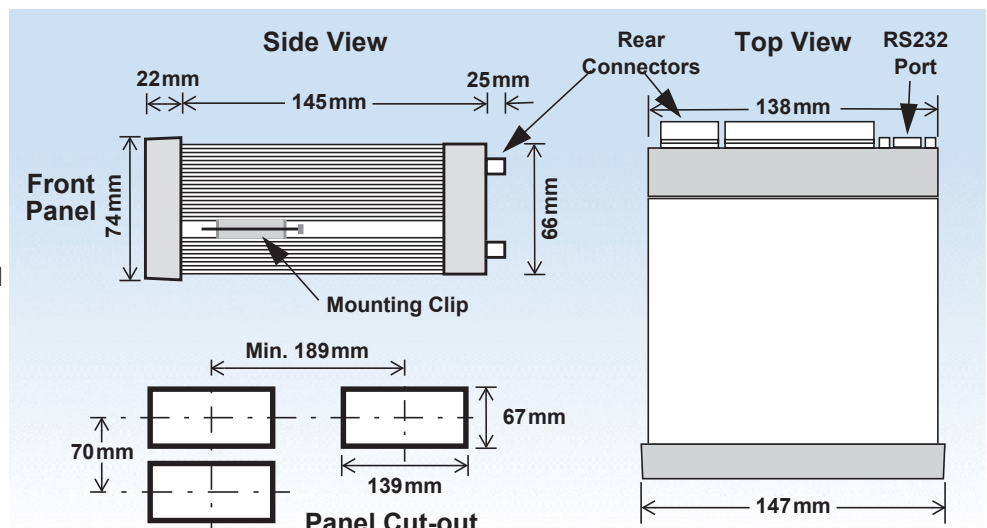
The instrument stores all set-up parameters, totals and logged data in non-volatile memory with at least 30 years retention.

## Dimension Drawings

### Part Number

515.XXXXXX-SC03  
see **Product Codes** to select required features

Default Application software:  
515-SC03-000000



## Analog Input Types

Any analog input can be set to accept a 4-20mA, 0-5V or 1-5V signal, while any inputs assigned to a temperature sensor can also be set to accept a PT100 or PT500 signal.

## 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 may be replaced by Ethernet port.	
20	COM-2 -	RS485 (-)		
21	port G	RS485 ground		
22		1+ Switch 1	Remote Reset CAL Switch – In field access protection	
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 1-2	<i>Term 31 - Common 1-4 on legacy option card</i>	
32	R1	Relay 1		
33	R2	Relay 2		
34	R3	Relay 3		
35	R4	Relay 4		
36	RC	Relay common 3-4	<i>Term 36 only available on new style option card</i>	
E	Mains ground		AC power in 100-240VAC	
N	Mains neutral			
A	Mains active			
RS232 COM-1 port		9-pin serial port		

# Specifications

## Operating Environment

<b>Temperature</b>	+5°C to +40°C (standard - no coating) -20°C to +60°C (with conformal coating) -30°C to +60°C (ExD housing with heater)
<b>Humidity</b>	0 to 95% non condensing (conformal coating) 5% to 85% non condensing (no coating)
<b>Power Supply</b>	100-240 V AC (+/-10%) 50-60 Hz (+/-10%) or 12-28 V DC
<b>Consumption</b>	10W (max) Overvoltage category II
<b>Protection</b>	Sealed to IP65 (Nema 4X) when panel mounted
<b>Dimensions (panel option)</b>	147mm (5.8") width 74mm (2.9") height 170mm (6.6") depth (behind the panel)

## Display

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

## Non-volatile Memory

<b>Retention</b>	> 30 years
<b>Data Stored</b>	Setup, Totals and Logs

## Approvals

<b>Interference</b>	CE compliance
<b>Enclosure</b>	IECEX, ATEX and CSA approved enclosures available for hazardous areas

## Real Time Clock (Optional)

<b>Battery Type</b>	3 volts Lithium button cell - For Issue 7 option card, type CR2450N manufactured by Renata only - For conformal coated 'C' version, type BR2032 manufactured by Panasonic only - For non-conformal coated versions, type BR2032 and CR2032 manufactured by Panasonic or Sony
<b>Battery Life</b>	5 years (typical)

## Analog Input (General)

<b>Overcurrent</b>	100mA absolute maximum rating (30mA for 4-20mA inputs)
<b>Update Time</b>	< 1.0 sec
<b>Configuration</b>	RTD, 4-20mA, 0-5V and 1-5V input
<b>Non-linearity</b>	Up to 20 correction points (some inputs)

## RTD Input

<b>Sensor Type</b>	PT100 & PT500 to IEC 751
<b>Connection</b>	Four Wire
<b>Range</b>	-200°C to 350°C -200°C to 800°C (PT100 extended range)
<b>Accuracy</b>	0.1°C typical 0.2°C typical (PT100 extended range)

## 4-20mA Input

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

## 0-5 or 1-5 Volts Input

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

## Logic Inputs

<b>Signal Type</b>	CMOS, TTL, open collector, reed switch
<b>Overvoltage</b>	30V maximum

## Relay Output

<b>No. of Outputs</b>	2 relays plus 2 optional relays
<b>Voltage</b>	250 volts AC, 30 volts DC maximum (solid state relays use AC only)
<b>Current</b>	3A maximum - mechanical relays 1.5A maximum - solid state relays

## Communication Ports

<b>Ports</b>	COM-1 RS-232 port COM-2 RS-485 or Ethernet port (optional)
<b>Baud Rate</b>	2400 to 19200 baud
<b>Parity</b>	Odd, even or none
<b>Stop Bits</b>	1 or 2
<b>Data Bits</b>	8
<b>Protocols</b>	ASCII, Modbus RTU, Modbus TCP/IP (Ethernet Port), Printer

## Transducer Supply

<b>Voltage</b>	8 to 24 volts DC, programmable
<b>Current</b>	70mA @ 24V, 120mA @ 12V maximum
<b>Protection</b>	Power limited output

## Isolated Output

<b>No. of Outputs</b>	2 configurable outputs
<b>Configuration</b>	Pulse/Digital or 4-20mA output

## Pulse/Digital Output

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

## 4-20mA Output

<b>Supply</b>	9 to 30 volts DC external
<b>Resolution</b>	0.05% full scale
<b>Accuracy</b>	0.05% full scale (20°C) 0.1% (full temperature range, typical)

*Important: Specifications are subject to change without notice.*

# Ordering Information

## Product Codes

Model	Supplementary Code	Description
515	- SC03	
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	4 logic inputs, 2 isolated outputs, 4 relays, real-time clock data logging, RS232 (DB9) & Ethernet communication ports
Relay Type	1	Electromechanical relays only
	2	2 electromechanical relays (1-2) and 2 solid state relays (3-4)
	3	Solid state relays only
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	<b>Conformal coating</b> - required for maximum environmental operating range. Recommended to avoid damage from moisture and corrosion.
	N	<b>None</b> - suitable for IEC standard 654-1 Climatic Conditions up to Class B2 (Heated and/or cooled enclosed locations)
Application Pack Number	SC03	Defines the application software to be loaded into the instrument

Example full product part number is 515.111USC-SC03 (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 <sup>3</sup>		Total
Volume Flowrate	m <sup>3</sup> /min		Rate
Mass	kg		Total
Mass Flowrate	kg/min		Rate
Temperature	Deg C		Rate
Pressure	MPa		Rate
Specific Volume	m <sup>3</sup> /kg		Rate
Specific Enthalpy	kJ/kg		Rate
Specific Enthalpy Adjust	kJ/kg		Rate
Specific Enthalpy Net	kJ/kg		Rate



Example of 500 Series in BZC Ex d enclosure

[www.contrec.co.uk](http://www.contrec.co.uk)



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