

## Application GN04

### Natural Gas (AGA-8 Detailed) Flow Computer

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



### Features

- Tailored for differential pressure meters with single or stacked transmitters
- AGA-8 Natural Gas Detail Characterization Method calculations for gas compositions with up to 21 components
- Gross heating values calculated to ISO 6976:1995 and GPA Standard 2172-96
- ISO 5167 (2003) DP flow calculations, 9 meter types
- V-Cone DP flow calculations, 2 cone types
- 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 GN04 application measures the volume, mass and gross heat content of natural gas. The instrument uses single or stacked differential pressure meters such as orifice plates, nozzles, venturi tubes or V-Cones as well as temperature and pressure sensor inputs.

The instrument calculates the flow according to the differential pressure equations for the ISO 5167 or V-Cone meters. The flow calculations incorporate the conditions at which the flowmeter was calibrated and accurately account for thermal expansion effects.

The AGA-8 Detail Characterization Method is used to obtain accurate values of density and compressibility factors for the flow calculations. For other gas properties, such as viscosity and isentropic exponent, user entered values are used.

### Calculations

The gas density and compressibility factor calculations are based on the AGA-8 equations. The calculations are valid for the region:

$$\begin{aligned} -130^{\circ}\text{C} < t < 400^{\circ}\text{C} & \quad P < 280\text{MPa} \\ -200^{\circ}\text{F} < t < 760^{\circ}\text{F} & \quad P < 40000\text{psia} \end{aligned}$$

### Formulas

$$\text{Volume flow} = M_{\text{flow}} / \rho_{\text{flow}}$$

$$\text{Corrected flow} = M_{\text{flow}} / \rho_{\text{ref}}$$

$$\text{Heat flow} = M_{\text{flow}} \cdot H_m$$

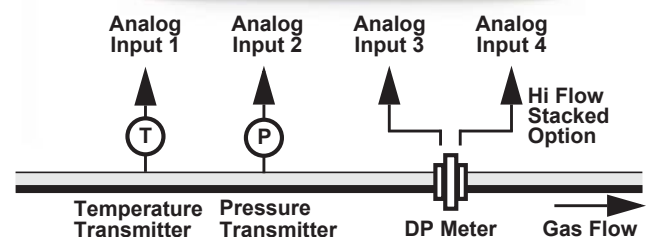
where:

$M_{\text{flow}}$  = mass flow

$\rho_{\text{flow}}$  = density at flow conditions

$\rho_{\text{ref}}$  = density at reference conditions

$H_m$  = mass gross heating value



## 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).

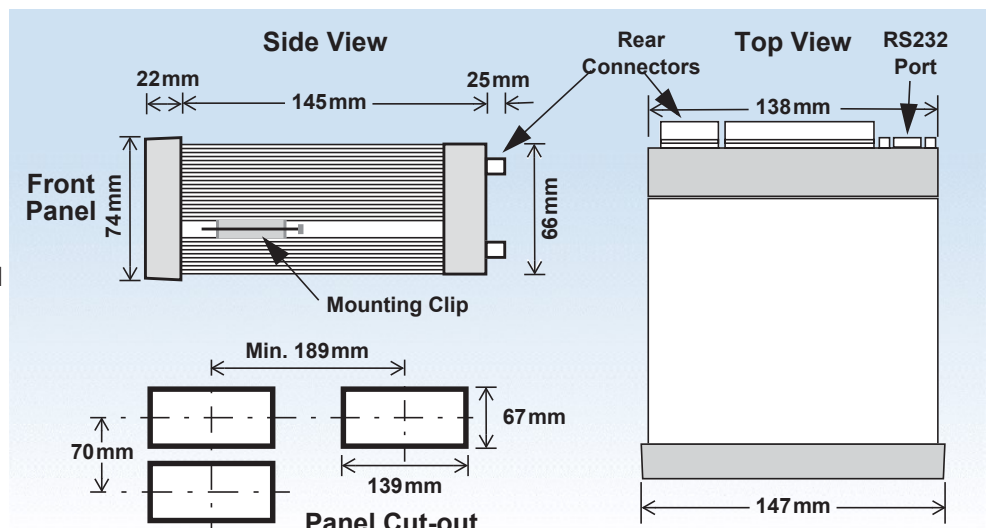
The instrument stores all set-up parameters, totals and logged data in non-volatile memory with at least 30 years retention.

## Dimension Drawings

### Part Number

515.XXXXXX-GN04  
see **Product Codes** to select required features

Default Application software:  
515-GN04-000000



## 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+
7	AINP1 +	Analog Input ch 1 (+)
8	-	Analog Input ch 1 (-)
9	AINP2 +	Analog Input ch 2 (+)
10	-	Analog Input ch 2 (-)
11	AINP3 +	Analog Input ch 3 (+)
12	-	Analog Input ch 3 (-)
13	AINP4 +	Analog Input ch 4 (+)
14	-	Analog Input ch 4 (-)
15	Vo +	8-24 volts DC output
16	G -	DC Ground
17	Vi +	DC power input
18	SH E	Shield terminal
19	RS485 +	RS485 (+)
20	COM-2 -	RS485 (-)
21	port G	RS485 ground
22	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 (+)
30	-	Output ch 2 (-)
31	RC	Relay Common 1-2
32	R1	Relay 1
33	R2	Relay 2
34	R3	Relay 3
35	R4	Relay 4
36	RC	Relay common 3-4
E	Mains ground	AC power in 100-240VAC
N	Mains neutral	
A	Mains active	
RS232 COM-1 port		9-pin serial port

*Term 31 - Common 1-4 on legacy option card*

*Term 36 only available on new style option card*

# 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)

## Gas Properties Calculations (AGA- 8)

<b>Update Rate</b>	1 sec - gas composition unchanged 2 sec - when changed, 10 components 4 sec - when changed, 21 components
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## 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

## 4-20 mA 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	- GN04	
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	GN04	Defines the application software to be loaded into the instrument

Example full product part number is 515.111USC-GN04 (this is the number used for placing orders).

## Main Menu Variables

Main Menu Variables	Default Units	Preferred Units	Variable Type
Volume	m <sup>3</sup>		Total
Volume Flowrate	m <sup>3</sup> /min		Rate
Corrected Volume	m <sup>3</sup>		Total
Corrected Flowrate	m <sup>3</sup> /min		Rate
Heat	GJ		Total
Heat Flowrate	GJ/h		Rate
Mass	kg		Total
Mass Flowrate	kg/min		Rate
Temperature	Deg C		Rate
Pressure	MPa		Rate
Differential Pressure	kPa		Rate
Reynolds Number	E+3		Rate
Compressibility Factor	- - -		Rate



Example of 500 Series in BZC Ex d enclosure

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



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