Application GN05

Natural Gas (AGA-8 Detailed) Flow Computer

for Stacked DP Meters to AGA-3

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
- AGA-3 DP flow calculations
- 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 GN05 application measures the volume, mass and gross heat content of natural gas. The instrument uses single or stacked flow differential pressure inputs, as well as temperature and pressure inputs.

The instrument calculates the flow according to the AGA-3 differential pressure equations. 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, the AGA-3 recommended 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:

-130°C < t < 400°C	P < 280 MPa
-200°F < t < 760°F	P < 40000 psia

Formulas

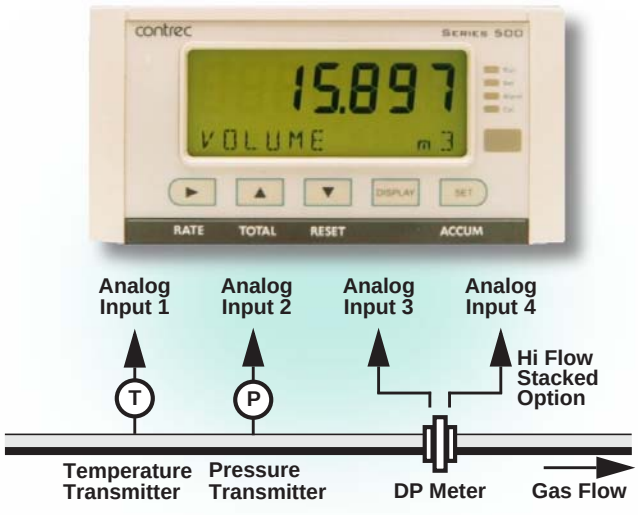
$$Volume\ flow = Mflow / \rho_{flow}$$

$$Corrected\ flow = Mflow / \rho_{ref}$$

$$Heat\ flow = Mflow \bullet H_m$$

where:

$Mflow$	=	mass flow
ρ_{flow}	=	density at flow conditions
ρ_{ref}	=	density at reference conditions
H_m	=	mass gross heating value



Accuracy • Quality • Performance

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

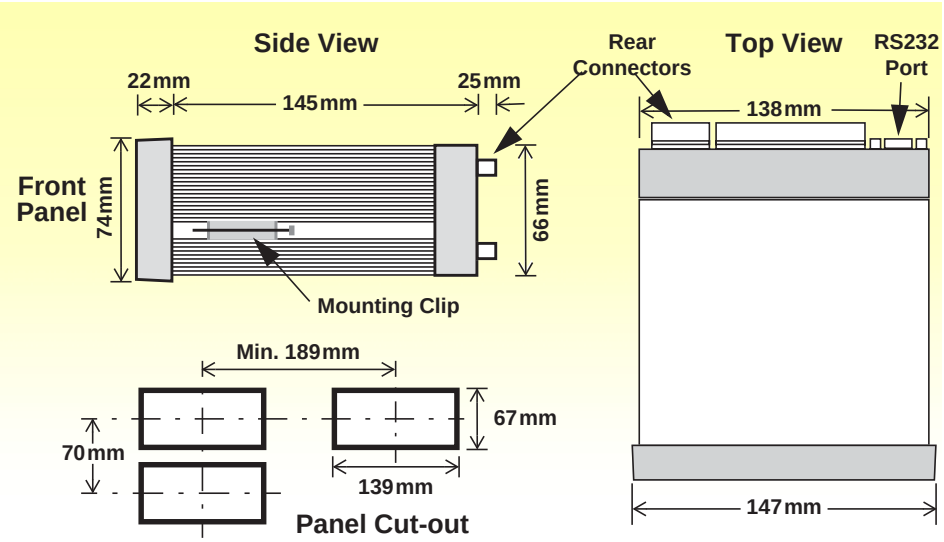
Terminal Label			Designation	Comment
3	SG	-	Signal ground	
5	EXC V	2+	Excitation Term 2+	For AINP1 RTD Input
7	AINP1	+	Analog Input ch 1 (+)	Temperature Input
8		-	Analog Input ch 1 (-)	
9	AINP2	+	Analog Input ch 2 (+)	Pressure Input
10		-	Analog Input ch 2 (-)	
11	AINP3	+	Analog Input ch 3 (+)	Main 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 100-240VAC
N		N	Mains neutral	
A		A	Mains active	
RS232 port			9-pin serial port	

Dimension Drawings

Part Number

515.XXXXXX-GN05
see **Product Codes** to select required features

Default Application software:
515-GN05-000000



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)

Gas Properties Calculations (AGA- 8)

Update Rate	1 sec - gas composition unchanged 2 sec - when changed, 10 components 4 sec - when changed, 21 components

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) 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) 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 (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

4-20mA 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 .						-	**GN05**	
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							**GN05**	Defines the application software to be loaded into the instrument

Example full product part number is 515.111USC-GN05 (this is the number used for placing orders).

Main Menu Variables

Main Menu Variables	Default Units	Preferred Units	Variable Type
Volume	m^3		Total
Volume Flowrate	m^3/min		Rate
Corrected Volume	m^3		Total
Corrected Flowrate	m^3/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

500 Series in Ex410 Enclosure

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