GG2 COMMUNICATIONS

4-20mA / IMAC / RS485

User Manual

Version: 2, October 2022

Designed and manufactured in Australia by Ampcontrol Pty Ltd

Gasguard®2

AMPCONTROL®

WARNING!

The **warning** symbol highlights a potential risk **malfunction** or loss of **performance**

Please share these warnings with other operators.

CAUTION!

The **caution** symbol highlights a potential risk of **damage to equipment**.

Please share these cautions with other operators.

NOTE

The **note** symbol highlights **key information**.

Please share these notes with other operators.

ENVIRO

The **enviro** (environmental) symbol highlights areas which may have an impact on the surrounding **fauna and/or flora**.

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Before You Begin

Thank you for purchasing from the Ampcontrol GG2 range.

WARNING!

In the interests of **safety and correct equipment operation**, please take the time to read and understand the content in this manual.

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DEFINITIONS

Term	Definition
CO_2	Carbon Dioxide
CH_4	Methane
CO	Carbon Monoxide
O_2	Oxygen
H_2S	Hydrogen Sulphide
NATA	National Association of Testing Authorities, Australia
NDIR	Non-Dispersive Infra-red
Warm Up Time	Time interval, with the equipment in a stated atmosphere, between the time when the equipment is switched on and the time when the indication reaches and remains within the stated tolerances
AS 4641:2007	Electrical apparatus for detection of oxygen and other gases and vapours at toxic levels - general requirements and test methods
AS 2290.3-1990	Electrical equipment for coal mines - maintenance and overhaul Part 3: maintenance of gas detecting and monitoring equipment.
AS/NZS 60079-29.1:2008	Explosive atmospheres part 29.1: Gas detectors - Performance requirements of detectors for flammable gases
IEC 60079.0:2011	Explosive atmospheres - Part 0: Equipment - General requirements
IEC 60079.11:2011	Explosive atmospheres - Part 11: Equipment protection by intrinsic safety "i"
GG2	Gasguard 2
ILAC	International Laboratory Accreditation Cooperation Mutual Recognition Arrangement. ILAC is the international organisation for accreditation bodies operating in accordance with ISO/IEC 17011 and involved in the accreditation of conformity assessment bodies including calibration laboratories (using ISO/IEC 17025), testing laboratories (using ISO/IEC 17025), medical testing laboratories (using ISO 15189), inspection bodies (using ISO/IEC 17020) and proficiency testing providers using ISO/IEC 17043.

1 SAFETY AND OTHER WARNINGS

For safety reasons, the GG2 Display must be installed, operated and serviced only by competent personnel. Please read and understand this instruction manual completely before installing, operating or servicing this equipment. Failure to install or operate this instrument in accordance with the instructions contained in this manual may create hazardous operating conditions.

1.1 Safe Use of Equipment

The equipment supplied has been designed and manufactured to ensure safe operation. The equipment must only be used within the design parameters.

The instructions within this manual must be observed as an aid towards achieving the safest possible installation.

Persons responsible for installation, maintenance, or operation, must observe the following instructions:

1.1.1 Changes to Equipment

Changes in the design and modifications to the equipment are not permitted. Unauthorised changes made to the hardware or operating firmware will void the manufacturer's warranty, and may compromise the integrity of the system into which it is installed and other connected equipment.

1.1.2 Equipment Knowledge

Experience with, or understanding of, this equipment is essential for the safe installation and removal of the equipment. Therefore, please read and understand this manual prior to use. Competency based training courses are recommended and are available on request.

1.1.3 Manual Handling

Precautions have been taken to ensure all equipment is safe to handle and free from sharp edges. However, care should always be taken when handling enclosures and gloves should be worn.

1.1.4 Installation

Correct operation and safety depend on GG2 Display and associated equipment being installed correctly. Mechanical and or electrical installation and maintenance of plant and equipment must only be carried out by appropriately qualified personnel and must be tested thoroughly prior to operation.

1.1.5 Operation

As safety depends on GG2 Display functioning correctly it is highly recommended that all safety functions of the unit be periodically tested to ensure correct operation.

1.2 Supplementary Documentation

The GG2 Display User Manual is expected to be read in conjunction with the following documentation:

- GG2B011 GG2 Detector User Manual
- GG2B023 GG2 Display User Manual
- GG2B033 GG2 Design, Installation and Maintenance Application Guide

2 RECEIVING AND STORAGE

2.1 Receiving

All possible precautions are taken to protect the equipment against damage or losses during shipment; however, before accepting delivery, check all items against the packing list or bill of loading. If there is evidence of physical damage, notify Ampcontrol immediately.

Notify Ampcontrol immediately in the case of any discrepancies to the packing list. Keep a record of any claims and correspondence. Photographs are recommended.

Where practicable do not remove protective covers prior to installation unless there are indications of damage. Boxes opened for inspection and inventory should be carefully repacked to ensure protection of the contents or else the parts should be packaged and stored in a safe place. Examine all packing boxes, wrappings and covers for items attached to them, retain and store any approval documentation for your safety file as applicable prior to wrapping being discarded.

2.2 Inspection

Equipment that is found to be damaged or has been modified away from its published specifications must not be used. Please contact Ampcontrol if the equipment is suspected to be different than that ordered or if it does not match the published specifications.

2.3 Storage after Delivery

When the equipment is not to be installed immediately, proper storage is important to ensure protection of equipment and validity of warranty.

All equipment should be stored indoors between 0-40˚C, preferably on shelves and protected from moisture and sunlight.

2.4 Unpacking of Equipment

The method of packing used will depend on the size and quantity of the equipment. The following cautions should be interpreted as appropriate.

CAUTION!

Take care when unpacking crates as the **contents may have shifted during transport**.

ENVIRO

The disposal of packaging materials, replaced parts, or components must comply with environmental restrictions without polluting the soil, air or water.

Ensure that any timber and cardboard used as **packaging is disposed of in a safe and environmentally responsible manner**.

Where possible, dispose of all waste products i.e. oils, metals, plastic and rubber products by using an approved recycling service centre.

3 GG2 COMMUNICATIONS

3.1 Overview

The GG2 Display Module is an intrinsically safe apparatus for the purpose of displaying and transmitting sensor data and system information. The GG2 Display consists of a certified GG2 Display Module and associated wiring installed within an IP66 rated stainless steel enclosure.

The GG2 Display is available in three variants, a glanded display supporting iMAC/RS485 communication and two pluggable versions supporting 4-20mA+iMAC and 4-20mA+RS485 communication.

This document details the Modus and iMAC communication protocols. Refer to the following sections

- Modbus Communication – Section 5.
- iMAC Communication – Section 4.

3.2 GG2 Detector Types

The following table outlines some of the common part numbers. For more information on the GG2 range of products, refer to GG2B026 GG2 Monitoring Solution Technical Datasheet.

Table 1: GG2 Detector Type Table

Gas Type	Detector Technology	Measurement Range	Ampcontrol Part Numbers
CH_4	Catalytic	0-5% v/v	177871
CH_4	IR	0-5% v/v	177870
CH_4	IR	0-100% v/v	190998
CO_2	IR	0-2% v/v	180734
CO_2	IR	0-5% v/v	180733
CO	Electrochemical	0-50ppm	177873
CO	Electrochemical	0-100ppm	177874
O_2	Electrochemical	0-25% v/v	177872
H_2S	Electrochemical	0-50ppm	178228
H_2S	Electrochemical	0-100ppm	193071

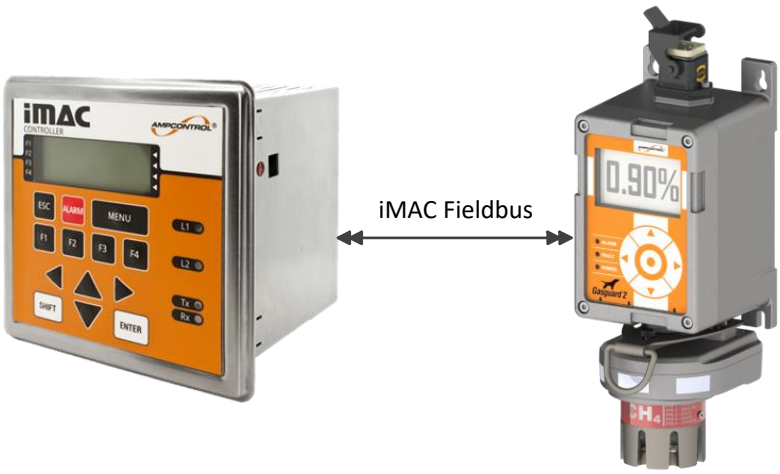

Figure 1: GG2 Example System (iMAC Communication)

4 IMAC COMMUNICATIONS

4.1 GG2 Detector Removal

If iMAC is activated and the detector is removed, all bit fields will go to all zeros and all numerical values will go to 0xFFFF. The setpoint flag bits and data invalid bit will go high (1) and are exceptions to the previous rule.

4.2 iMAC Registers

4.2.1 Flags Data Register

SCADA* - These registers/bits must be monitored and included in the trip permissives for all safety system applications when this protocol is selected.

Bit	Description	Value	iMAC Exception Trigger?	R/W	Application Notes	SCADA*
0	Analogue input moved away from healthy region and reached Setpoint 1	1 = Warn	Yes	R	This bit is set when it traverses the setpoint.	
1	Analogue input moved away from healthy region and reached Setpoint 2	1 = Warn	Yes	R	This bit is set when it traverses the setpoint.	
2	Analogue input moved away from healthy region and reached Setpoint 3	1 = Trip	Yes	R	This bit is set when it traverses the setpoint i.e. typical used for Tripping in RTGMS / Gas monitoring SLP codes.	☑
3	SP1 flag not set AND SP2 flag not set	1 = Warn	Yes	R	Used for AIM compatibility.	
4	SP2 flag set AND SP3 flag not set	1 = Warn	Yes	R	Used for AIM compatibility.	
5	Power supply < Setpoint A (warn)	1 = Warn	Yes	R	This bit is set when it traverses the setpoint.	
6	Power supply < Setpoint B (trip)	1 = Trip	Yes	R	This bit is set when it traverses the setpoint i.e. typical used for Tripping in RTGMS / Gas monitoring SLP codes.	☑

Bit	Description	Value	iMAC Exception Trigger?	R/W	Application Notes	SCADA*
7	System fault	1 = System has detected a hardware, Detector or software fault. 0 = No fault in operation detected.	Yes	R	System fault E.g. sensor head missing / display <-> head comms fault, etc.	☑
8	Cal cup on	1 = Cup on	Yes	R	The GG2 senses the magnets in our approved cup (E.g. bump test, zero / span adjust, calibration)	
9	*Gas Value Invalid*	1 = Analogue 4-20mA gas reading is not reflecting the real world gas value.	Yes	R	Analogue 4-20mA gas reading is not reflecting the real world gas value. (I.e. it is currently in fault or warmup or otherwise unreliable. This includes the sensor being in warmup, even if 4-20mA is returning the sensor value during warmup).	☑
10	*Detector Head Warmup*	1 = Warmup busy	No	R	GG2 Detector currently in warmup mode	☑
11	Linearity test due	1 = Linearity test due	No	R	International Laboratory Accreditation Cooperation Mutual Recognition Arrangement. Linearity (i.e. NATA) test is now overdue.	
12	Overrange latch on CH4 catalytic detector ***OR*** *NDIR incomplete adjustment*	1 = Overrange latch on CH4 Catalytic detector ***OR*** IR adjustment incomplete	Yes	R	Overrange latch on CH4 catalytic detector CH4 has exceeded full scale. The sensor is switched off to protect it from damage. ***OR*** NDIR incomplete adjustment Non dispersive Infra Red sensors had an incomplete calibration sequence. This is unique to this sensor type. In short, once you start zero/span adjustment, the values are wiped at the start.	☑
13	Hardware fault	1 = Hardware fault	Yes	R	A fault which impedes/prevents gas detection/other critical function has been detected.	☑

Bit	Description	Value	iMAC Exception Trigger?	R/W	Application Notes	SCADA*
14	Telemetry test active	1 = Telemetry test active	Yes	R	The GG2 Display output value is forced via the GG2 UI or the RTGMS (iMAC master) *Refer to Command parameter block 0, parm 2*	
15	Bypass ON	1 = Bypass detected	Yes	R	The Gasguard RTGMS uses a DI4 for bypassing an individual boundary (tripping) detector, This bit is set when the GG2 is addressed to the corresponding bypass i.e. the DI4 module being monitored by the GG2. *Refer to Command parameter block 0, parm3*	

4.2.2 Analogue Input

SCADA* - These registers/bits must be monitored and included in the trip permissives for all safety system applications when this protocol is selected.

Bit	Description	Value	iMAC Exception Trigger?	R/W	Application Notes	SCADA*
15 - 0	4 - 20 mA	4-20mA representation of the Gas Reading.	Yes (See parameters)	R	Value can be forced via the Telemetry Test if system not in Fault. Sensor Reading shown during warmup.	☑ Hard fault values

4.2.3 Power Supply Input

SCADA* - These registers/bits must be monitored and included in the trip permissives for all safety system applications when this protocol is selected.

Bit	Description	Value	iMAC Exception Trigger?	R/W	Application Notes	SCADA*
15 - 8	0 - 24 VDC (MSB for AIM mode)	AIM Mode : 0 - 2400 (0.00 - 24.00 V) GG2 Mode : 0 - 240 (0.0 - 24.0 V)	No	R		
7 - 0	0 - 24 VDC (LSB for AIM mode) 0 - 24 VDC (GG2 mode)					

4.3 Gasguard Live Registers

The following features are available via Ampcontrol's Digital Solution.

4.3.1 Block 0

Linked to the Flags Register.

Block 0	Description	Value	R/W	Application Notes
0,0	iMAC Address - Flags register	0 - 255	W	iMAC Address
0,1	Exception Trigger	100 - 20,000	W	Step change between the 1s samples to trigger exception. Forces the iMAC Controller to temporarily prioritise this module, as opposed to a round robin scan which could have as much as a 30s delay at 300 baud
0,2	Detector gas reading permyriad - unaffected by telemetry test	-32768 to 32768 Permyriad	W	Not overridden by Telemetry testing (is still however subject to fault and warmup values)
0,3	Future use	Bit 15 - 10	W	
	GG2 Configuration lock	Bit 9 (Where 0 is disabled)		Prevents access to configuration menu, factory default reset and reset latched catalytic functions
	AIM Compatibility mode	Bit 8 : Yes = 1 (Power supply register is 16bit)		
	Bypass address	Bit 7 - 0 : 1 to 255 (where 0 is disabled)		iMAC data bus address to monitor for displaying bypass message Relevant bits on the data bus: Data bit 8 = "Remote bypass" (via PLC or similar) Data bit 0 = "Local bypass" (aligns with a DI4 input module)

4.3.2 Block 1

Linked to the Analogue Input Register.

Block 1	Description	Value	R/W	Application Notes
1,0	iMAC Address - Analogue register	0 - 255	W	iMAC address
1,1	Setpoint 1 (Gas)	4000 - 20000	W	RTGMS used for calibration, fault i.e. loss of analogue loop or negative drift alarm
1,2	Setpoint 2 (Gas)	4000 - 20000	W	RTGMS used for Warn
1,3	Setpoint 3 (Gas)	4000 - 20000	W	RTGMS used for Trip

4.3.3 Block 2

Linked to the Power Supply Register.

Block 2	Description	Value		R/W	Application Notes
2,0	iMAC Address - Power supply register	0 - 255		W	iMAC address
2,1	Power Supply Setpoint A - (AIM Mode) OR SPARE for GG2 Mode	AIM Mode : 1000 - 2400 (10.00 to 24.00) Warn		W	RTGMS used for Warn
		GG2 Mode : n/a			
2,2	Power Supply Setpoint B - (AIM Mode) MSB OR Power Supply Setpoint A - Warn / Alarm (GG2 Mode)	GG2 Mode : 100 - 240 (10.0 - 24.0 V) Warn	AIM Mode 800 - 2400 (8.00 to 24.00) Trip	W	AIM Mode RTGMS used for Trip GG2 Mode used for Warn
	Power Supply Setpoint B - Trip (AIM Mode) LSB OR Power Supply Setpoint B - Trip (GG2 Mode)	GG2 Mode : 80 - 240 (10.0 - 24.0 V) Trip			AIM Mode RTGMS used for Trip GG2 Mode used for Trip
2,3	Hysteresis config	Bit 15 - 12		W	Hysteresis setting 0 - 7.5% in 0.5% steps (1 = 0.5%, 2 = 1% etc.)
	Healthy config	Bit 11 - 9			000': always healthy, '001': healthy < SP1, '010': SP1 ≤ healthy < SP2, '011': SP2 ≤ healthy < SP3, '100': healthy ≥ SP3
	Warmup and fault output behaviour	Bit 8 ‘1’ for high warmup and soft-fault high, ‘0’ for low warmup and soft-fault low on 4-20mA bus			Nominal Values Low Fault - 2.8mA 2800 Low warmup - 3mA 3000 Under range - 3.2mA 3200 NDIR (only) zero shift negative - 3.7mA 3700 Normal range - ~4-20mA 4000-20000 Over range - 20.8mA 20800 High warmup - 21mA 21000 High fault - 21.2mA 21200
	iMAC address for 32-bit sys clock	Bit 7 - 0 1 - 254 (excluding the last address of each data block, which would result in the RTC value being split across two data scan packets. Thus address 3,7,11 etc. are not allowed) Address of MS word of RTC (assumes LS word is address + 1)			The iMAC controller will publish a 32 bit clock on the data bus at this address (and +1), so that the GG2 can use it for a clock sync

4.3.4 Block 3

Only available via a Read/Write S/N. Not visible via regular rollcall page on the Controller.

Block 3	Description	Value	R/W	Application Notes
3,0	Detector Temperature	Degrees C * 100 (signed) -327.68deg C to 327.68deg C	R	
3,1	Detector Pressure	-32768 to 32768 Hectopascals (hPa) (Unprocessed from the LUA parameter module "Pressure")	R	
3,2	Detector Humidity	% * 100 (signed) -xx.xx% to xx.xx% (Using the parameter manager subscription "Humidity")	R	
3,3	Command registers	MSB Command code: '0x00' : Idle '0x1E' : Perform a Catalytic latch reset '0x2D' : Perform a Remote telemetry test	W	To trigger a command, the master device will write a command code and command data into this register, with the busy bit set. On completion of the task, the Gasguard 2 module will modify the result data to reflect the outcome, clearing the busy bit (The command code must not be modified in this step)
		LSB Command data (from master): Bit 7 : 1 = Busy Bit 6 - 0 : Future use (command parameters) *OR* Result data (from module): Bit 7 : 0 = Complete without error Bit 6 - 0 : Future use (command error codes)		

4.3.5 Block 4

Only available via a Read/Write S/N. Not visible via regular rollcall page on the Controller.

Block 4	Description	Value	R/W	Application Notes
4,0	Last time response test result (t90)	0 to 65535; 0.0 to 6553.5s	R	
4,1	Hours since last linearity test	0 to 65535 hours	R	
4,2	Time in seconds of last Cal cup application	0 to 65535 seconds	R	
4,3	Power supply data register	MSB 0 - 240 (0.0 - 24.0 V) (Regardless of AIM / GG2 mode)	-	
	Internal usage	Do not modify or use	R	Do not modify or use

4.3.6 Block 5

Only available via a Read/Write S/N. Not visible via regular rollcall page on the Controller.

Block 5	Description	Value	R/W	Application Notes
5,0	Future use	Bit 15 - 3 : Future use	W	
	Time Stamp post-box selection (at Parm 5,2 + 5,3)	Bit 2 - 0 : '000' : Calibration (linearity) test timestamp '001' : Telemetry test start timestamp '010' : t90 test timestamp '011' : RTC time (current)		
5,1	Detector type (incl gas range and units)	Bit 15 - 8 : See detector types spreadsheet (8 bit reserved for this, to avoid limiting the future)	R	
	Future use	Bit 7 - 5 : Future use		
	28 days since Cal cup applied (for > 20s)	Bit 4: 1 = Yes		
	14 days until Linearity test due	Bit 3: 1 = Yes The 6 monthly calibration check is due. Must be performed by NATA certified 3rd parties. E.g. CMTS, Cal Pacific etc.		
	Last Linearity test, number of test points	Bits 2 - 0 : 0 to 6 points		
5,2	Post-box options : 0 : Linearity test timestamp high-word 1 : Telemetry test start timestamp high-word 2 : t90 test timestamp high-word 3 : RTC current high-word	Unix style timestamp, using the Ampcontrol epoch - 01-01-2000 00:00. Big endian Note, it will take the GG2 at least 1.5 second to change the post-box value before it can be read out. (this after the write s/n is complete)	R	
5,3	Post-box options : 0 : Linearity test timestamp low-word 1 : Telemetry test start timestamp low-word 2 : t90 test timestamp low-word 3 : RTC current low-word			

4.3.7 Block 6

Only available via a Read/Write S/N. Not visible via regular rollcall page on the Controller.

Block 6	Description	Value	R/W	Application Notes
6,0	Future use	Future use	W	
6,1	Detector Serial number high word	Detector SyteLine serial number (10 digit) 32 bits (for calibration tracking)	R	
6,2	Detector Serial number low word			
6,3	Future use	MSB : Future use	R	
	Detector Software Version	LSB : 8 bit version number (unsigned)		

4.3.8 Block 7

Only available via a Read/Write S/N. Not visible via regular rollcall page on the Controller.

Block 7	Description	Value	R/W	Application Notes
7,0	Display Serial number high word	Display SyteLine serial number (10 digit) 32 bits (for calibration tracking)	R	
7,1	Display Serial number low word			
7,2	Future use	MSB : Future use	R	
	Display Base Software Version	LSB : 8 bit version number (unsigned)		
7,3	Future use	MSB : Future use	R	
	Display Application Software (LUA) Version	LSB : 8 bit version number (unsigned)		

4.4 Hard Fault Output Values

Refer to MAG-313 Gasguard 2 Gas Monitoring System Recommended Setpoints User Manual located on https://ampcontrolgroup.com/technical-resources/

5 MODBUS COMMUNICATIONS

5.1 GG2 Detector Removal

If Modbus is activated and the detector is removed, all bit fields will go to all zeros and all numerical values will go to 0xFFFF. The setpoint flag bits will go high (1) and are exceptions to the previous rule.

5.2 Register Map

All values can be assumed to be the Modbus default endianness, big-endian. Any exceptions to this will be noted in the Format column.

5.2.1 Safety Registers

SCADA* - These registers/bits must be monitored and included in the trip permissives for all safety system applications when this protocol is selected.

Register	Description	R/W	Detail	Format	SCADA*
1	Detector gas reading permyriad - unaffected by telemetry test	R	Permyriad of full scale, see	Signed Int	☑
2	Bit-inverted Detector gas reading permyriad - unaffected by telemetry test	R	Permyriad of full scale, See	Signed Int, bit inversion	
3	Heartbeat	R	Increments on each cycle, nominally every 100ms.	Unsigned Int	☑
4 – bit 0	Safety Word – system fault	R	system fault	bit	☑
4 – bit 1	Safety gas value invalid i.e. reg 1	R	Safety gas value invalid	bit	☑

5.2.2 Operational Registers

SCADA* - These registers/bits must be monitored and included in the trip permissives for all safety system applications when this protocol is selected.

Register	Description	R/W	Detail	Format	SCADA*
5	Detector gas reading permyriad - may be forced by telemetry test.	R	Permyriad of full scale, see	Signed Int	
6 – bit 0	SP1 flag	R	1 = flag set	bit	
6 – bit 1	SP2 flag	R	1 = flag set	bit	
6 – bit 2	SP3 flag	R	1 = flag set	bit	
6 – bit 3	Cal cup on	R	1 = cup on	bit	
6 – bit 4	Calibration due (every 6 months)	R	1 = calibration due	bit	
6 – bit 5	T90 test due (every 31 days)	R	1 = T90 test due	bit	
6 – bit 6	Detector present	R	1 = detector present	bit	
6 – bit 7	4-20mA loop activation	R	1 = 4-20mA loop active	bit	
6 – bit 8	4-20mA loop fault	R	1 = 4-20mA loop fault	bit	
i6 – bit 9	Latched catalytic detector	R	1 = detector latched	bit	
6 – bit 10	Hardware fault	R	1 = fault	bit	☑
6 – bit 11	Detector warmup	R	1 = in warmup	bit	☑
6 – bit 12	Data valid	R	1 = data valid	bit	☑

Register	Description	R/W	Detail	Format	SCADA*
6 – bit 13	Sensor aged. Sensor performance has deteriorated due to age.	R	1 = sensor aged	bit	
6 – bit 14	Out of operational temp range.	R	1 = temp out of range	bit	
6 – bit 15	Telemetry test active	R	1 = telemetry test in progress	bit	
7	RESERVED				
8 – bit 0	System bypass	R/W	Write 1 to put device into bypass. Write 0 to leave bypass.	bit	
8 – bit 1	Reset latched catalytic	R/W	Write 1 to activate the reset, the value should clear to 0.	bit	
9 – bits 0-7	FACTORY USE ONLY				
9 – bit 8	Atmospheric pressure fluctuation too great to obtain stable reading	R	1 = true	bit	
9 – bit 9	Sensor reading has gone above 100%	R	1 = above range	bit	
9 – bit 10	Sensor reading has gone below -10%. Auto clears when reading goes above 0%	R	1 = under range	bit	
9 – bit 11	FACTORY USE ONLY				
9 – bit 12	Unexpected calibration values	R	1 = calibration values are not correct	bit	
9 – bits 13-15	RESERVED				
10 – bits 0-11	FACTORY USE ONLY				
10 – bit 12	Detector warming up		1 = in warmup	bit	
10 – bit 13	Catalytic latch		1 = detector latched	bit	
10 – bit 14	Incomplete adjustment (NDIR)		1 = adjustment incomplete	bit	
10 – bit 15	FACTORY USE ONLY				
11	Detector pressure		Hectopascals (hPa)	Signed Int	
12	Detector temperature		Degrees Celsius(°C) * 100	Signed Int	
13	Detector humidity		Permyriad	Signed Int	
14	Detector bus voltage		Millivolts	Signed Int	

5.2.3 ID Info

SCADA* - These registers/bits must be monitored and included in the trip permissives for all safety system applications when this protocol is selected.

Register	Description	R/W	Detail	Format	SCADA*
15	Maximum engineering unit value	R	Real world gas value – span	Signed Int	
16	Minimum engineering unit value	R	Real world gas value – zero	Signed Int	
17	Engineering unit number of decimal places	R		Unsigned Int	
18	Detector type	R	Please see 3.2 for details	Unsigned Int	
19	Detector Serial Number - Hi Word	R		32bit Unsigned Int	
20	Detector Serial Number Lo Word	R			
21	Display Serial Number Hi Word	R		32bit Unsigned Int	
22	Display Serial Number Lo Word	R			
23	Display Application Software Version	R		Unsigned Int	
24	Display Firmware Version	R		Unsigned Int	
25	Detector Firmware Version	R		Unsigned Int	

5.2.4 Setup

SCADA* - These registers/bits must be monitored and included in the trip permissives for all safety system applications when this protocol is selected.

Register	Description	R/W	Detail	Format	SCADA*
26	Setpoint 1 permyriad (see	R/W	Must be <SP2	Signed Int	
27	Setpoint 2 permyriad (see	R/W	Must be >SP1 and <SP3	Signed Int	
28	Setpoint 3 permyriad (see	R/W	Must be >SP2	Signed Int	
29	Normal operation range.	R/W	0: never activate setpoint 1: healthy < SP1 2: SP1 ≤ healthy < SP2 3: SP2 ≤ healthy < SP3 4: healthy ≥ SP3	Unsigned Int	
30	RTC date and time	R	Time in seconds since 01-01-2000 00:00 All zeros if time lost or faulty	32 bit Unsigned Int	
31	RTC date and time	R			

5.2.5 Maintenance

SCADA* - These registers/bits must be monitored and included in the trip permissives for all safety system applications when this protocol is selected.

Register	Description	R/W	Detail	Format	SCADA*
32	Last Min Value permyriad. May be written with 0 to reset.	R/W	Write 0 to this register to reset the Last Peak Values (LPVs)	Signed Int	
33	Last Min Value time and date	R	Time in seconds since 01-01-2000 00:00	32bit Unsigned Int	
34	Last Min Value time and date	R			
35	Last Max Value permyriad. May be written with 0 to reset.	R/W	Write 0 to this register to reset the Last Peak Values (LPVs)	Signed Int	
36	Last Max Value time and date	R	Time in seconds since 01-01-2000 00:00	32bit Unsigned Int	
37	Last Max Value time and date	R			
38	Last linearity test checkpoint 1 target permyriad	R		Signed Int	
39	Last linearity test checkpoint 1 result permyriad	R		Signed Int	
40	Last linearity test checkpoint 2 target permyriad	R		Signed Int	
41	Last linearity test checkpoint 2 result permyriad	R		Signed Int	
42	Last linearity test checkpoint 3 target permyriad	R		Signed Int	
43	Last linearity test checkpoint 3 result permyriad	R		Signed Int	
44	Last linearity test checkpoint 4 target permyriad	R		Signed Int	
45	Last linearity test checkpoint 4 result permyriad	R		Signed Int	
46	Last linearity test checkpoint 5 target permyriad	R		Signed Int	
47	Last linearity test checkpoint 5 result permyriad	R		Signed Int	
48	Last linearity test checkpoint 6 target permyriad	R		Signed Int	
49	Last linearity test checkpoint 6 result permyriad	R		Signed Int	
50	Last linearity test number of test points	R		Signed Int	
51	RESERVED				
52	Detector Last linearity test Date (in Ampcontrol date format)	R	Time in seconds since 01-01-2000 00:00	32 bit Unsigned Int	
53	Detector Last linearity test Date	R			

Register	Description	R/W	Detail	Format	SCADA*
54	Last t90 result in 0.1s (e.g. 101 = 10.1s)	R		Unsigned Int	
55	Detector last t90 test date (in Ampcontrol date format)	R	Time in seconds since 01-01-2000 00:00	32 bit Unsigned Int	
56	Detector last t90 test date (in Ampcontrol date format)	R			
57	Time in seconds cal cup left on last	R	increments while cal cup on, doesn't roll over past FFFF	Unsigned Int	
58	Detector last Cal Cup applied date (in Ampcontrol date format)	R	Time in seconds since 01-01-2000 00:00	32 bit Unsigned Int	
59	Detector last Cal Cup applied date (in Ampcontrol date format)	R			
60	Time in seconds last spent in telemetry test	R	increments during active test	Unsigned Int	
61	Detector last telemetry test date (in Ampcontrol date format)	R	Time in seconds since 01-01-2000 00:00	32 bit Unsigned Int	
62	Detector last telemetry test date (in Ampcontrol date format)	R			
63	Detector Last in-situ adjustment date (Ampcontrol date format)	R	Time in seconds since 01-01-2000 00:00	32 bit Unsigned Int	
64	Detector Last in-situ adjustment date (Ampcontrol date format)	R			
65	Detector coms error count	R	clear on sensor power up, accumulate and hold at FFFF	Signed Int	
66	Detector hours of run time since build/overhaul	R	max out at FFFF, don't roll over	Unsigned Int	
67	Display hours of run time since build/overhaul	R	max out at FFFF, don't roll over	Unsigned Int	
68	Time in seconds last spent in bypass	R	increments during active bypass	Unsigned Int	
69	Display bus voltage	R	Millivolts (mV)	Signed Int	
70	4-20mA conversion value	R	µA. Intended 4-20mA analog signal value	Unsigned Int	
71	RTC date and time (Ampcontrol format, High Word, Write Only)	W	Ampcontrol Epoch	32 bit Unsigned Int	
71	RTC date and time (Ampcontrol format, Low word, Write Only)	W	Ampcontrol Epoch		
↓	Spare				
100	GG2 Configuration lock Prevents access to configuration menu, factory default reset and reset latched catalytic functions	W	Bit 0 - 1 = configuration menu locked	bit	