Report Title :
IRmax HART® Field Device Specification

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Change History

Issue	Change	Author	Date
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Contents

1. Introduction

1.1 Scope

The IRmax complies with HART Protocol Revision 7.2. This document specifies all the device specific features and documents HART Protocol implementation details (e.g. the Engineering Unit Codes supported). The functionality of this Field Device is described sufficiently to allow its proper application in a process and its complete support in HART capable Host Applications.

1.2 Purpose

This specification is designed to compliment other documentation (e.g., the *IRmax installation manual*) by providing a complete, unambiguous description of this Field Device from a HART Communication perspective.

1.3 Who should use this document?

This specification is designed to be a technical reference for HART capable Host Application Developers, System Integrators and knowledgeable End Users. It also provides functional specifications (e.g., commands, enumerations and performance requirements) used during Field Device development, maintenance and testing. This document assumes the reader is familiar with HART Protocol requirements and terminology.

1.4 References

For those new to HART refer to the document:

http://www.hartcomm.org/hcf/documents/appguide.pdf for an overview of the HART protocol (both physical and application layers)

Detailed HART specification documents, available from the HART Communication Foundation that are necessary to implement a master HART protocol driver include:

HCF_SPEC-99, Command Summary Specification

HCF_SPEC-127, Universal Command Specification

HCF_SPEC-151, Common Practice Command Specification

HCF_SPEC-307, Command Response Specification

For information on how to install and operate and IRmax refer to:

IRmax User Guide (Crowcon part M07706)

IR2009.net is PC software available from Crowcon.

2. Device Identification

Manufacturer Name:	Crowcon Detection Instruments Ltd	**Model Name(s):**	IRmax
Manufacture ID Code:	24625 (6031 Hex)	**Device Type Code:**	57564 (E0DC Hex)
HART Protocol Revision	7.2	**Device Revision:**	1
Number of Device Variables	0		
Physical Layers Supported	FSK		
Physical Device Category	Current output		

3. Product Overview

IRmax is an ultra-compact infrared (IR) gas detector that delivers rapid fail-safe detection of hydrocarbon gases and vapours. The IRmax is compatible with any 4-20mA control system, operating in either current source or sink mode. The addition of HART over 4-20 enhances the capabilities of the basic IRmax.

An optional IR-Display is also available for the IRmax, making it possible to monitor readings from the IRmax both locally and remotely independent of HART. The IR-Display can (optionally) be fitted with an I.S. HART interface. The IRmax and IR-Display interfaces have been deliberately kept as similar as possible.

Full details of the wiring and function of the IRmax given in the IRmax User Guide (Crowcon part M07706).

4. HART Functional Overview

A HART communicator can connect to the IRmax at any wiring termination point in the loop signal. The HART communicator should be connected across a 250Ω resistor – refer to the HART communicator's operating manual for details. Note that the IRmax will not respond to HART communications until approximately 15 seconds after power has been applied to the IRmax.

HART communication interactions can be password protected. Setting a password disallows all non-read HART operations (except for the writing of the password to unlock the password feature). Read operations are allowed. If password protection is enabled then the IRmax will power-up in a password protected state, and will automatically enter the password locked state 60 seconds after the last valid HART message requiring a response is received. It is therefore necessary to ensure that regular polling of password protected IRmax occurs if an unprotected state is to be maintained.

Within this document, text written in *italics* refers to configuration data in the IRmax that can be edited via IR2009.net. Some of this data can also be modified via HART.

4.1 Use of IRmax HART with the IR-Display

The IR-Display is capable of triggering operations (either through its menu system or via the optional I.S. HART interface) the can interact in some way with functions that can be performed with IRmax HART. For example, it is possible that IRmax HART could trigger a zero operation and whilst this operation is in progress the menu of the IR-Display could be accessed to perform a zero or calibration. In situations such as this the second operation will fail gracefully (menu zero and calibration operations will give a fail message; HART operations will return an appropriate response code).

Note, however, that some of these IR-Display operations also set inhibit mode (e.g. when calibrating through the IR-Display menu) and clear inhibit mode (e.g. at the end of an IR-Display menu calibration sequence). This could result in a loop current state set via IRmax HART being unexpectedly changed. In such situations it is the last operation that sets the loop current state that determines what the loop current state is. For this reason it is not recommended that IRmax HART operations (other than simple polling of information) are performed simultaneously with operations on the IR-Display (menu or I.S. HART).

5. Device and Dynamic Variables

5.1 Device Variables

The IRmax does not expose any device variables.

5.2 Dynamic Variables

The IR-Display has 4 dynamic variables. These variables are:

	Meaning	Units
PV	Gas level	%LEL
SV	Optical obscuration	%
TV	Supply voltage	V
QV	Gas level (no zero suppression)	%LEL

5.2.1 Gas Level

This is the gas level, in %LEL, measured by the IRmax. There is a small amount of zero suppression applied to this gas level so that small amounts of measurement noise are not perceived to be extremely low fluctuating gas readings.

This measured gas level is represented on the 4-20mA output of the IRmax, with 0 %LEL representing 4mA and 100 %LEL representing 20mA.

If the gas level is measured is below *-10 %LEL* then the IRmax will enter a Zero Fault condition. The HART More Status Available data bit will be set (see command #48).

5.2.2 Obscuration

This is the percentage obscuration in the system. A clean optical system will have no obscuration, but if contaminants are deposited on the optical system this percentage will increase. The IRmax compensates for obscuration up to 90% when the IRmax will enter a fault state – this fault state will be indicated on the current loop and will set the HART More Status Available data bit (see command #48). There is a pre-obscuration warning triggered when the obscuration is above 75% and the gas level is less than 10% LEL. This will also be indicated on the current loop and and will set the HART More Status Available data bit (see command #48).

5.2.3 Supply Voltage

This is the IRmax supply voltage in V. If the supply voltage falls below 10V or rises above 30V then the HART More Status Available data bit will be set (see command #48).

5.2.4 Gas Level (no zero suppression)

This is an alternative representation of the PV Gas level, without zero suppression.

6. Status Information

The first two bytes in a field device HART message response correspond to the Response Code byte that indicates communications errors and the Field Device Status byte that gives the current operating status of the IRmax. See the reference HCF_SPEC-99, Command Summary Specification for details.

6.1 Response Codes

These are as per the HART specification documents HCF_SPEC-127, Universal Command Specification and HCF_SPEC-151, Common Practice Command Specification.

Note that Response Code 7, In Write Protect Mode, will be returned for all write messages (universal, common practice and device specific) if the IRmax is password protected and has not been unlocked.

6.1.1 New Multi-Definition Errors

The following new multi-definition errors are defined:

Code	Meaning
11	Optics obscured
12	Exact meaning varies by command: Insufficient gas for calibration/Zero error too large
13	IRmax in start-up stabilisation phase
15	IRmax in service mode (Service required)
28	IRmax busy performing a zero or calibration operation
29	Busy conflict – attempt to initiate zero (calibrate) whilst calibrate (zero) operation is still busy

6.2 Device Status

Bit	Meaning
0	IRmax *Zero Fault* or *Span Fault*
1	*Obscuration error* or power supply fault
2	Loop current saturated Loop current < 1mA or >22.7mA
3	Loop current fixed IRmax in inhibit or Ramp (manual) mode, or warning or fault state
4	More status available This bit is set whenever a fault or warning condition is detected in the IRmax. A fault or warning condition in the IRmax would also result in the IRmax current output entering a fault state. Command #48 gives further detail.
5	Cold start
6	Configuration changed
7	Device malfunction IRmax in fault state.

6.3 Additional Device Status (Command #48)

Command #48 returns 6 bytes of device specific status bits as follows:

Byte	Bit	Meaning	Class	Device Status Bits Set
0	0	Power-on stabilisation	INFO	4
	1	*Gas alarm 1*	WARNING	4
	2	*Gas alarm 2*	WARNING	4
	3	*Optics nearly obscured*	WARNING	4
	4	*Optics obscuration error*	ERROR	4
	5	*Zero fault* (gas reading low)	ERROR	4
	6	*Span fault* (gas reading high)	ERROR	4
	7	Unused status 1	ERROR	N/A
1	0	Unused status 2	INFO	4
	1	Unused status 3	ERROR	4,7
	2	Unused status 4	ERROR	4,7
	3	Unused status 5	ERROR	4,7
	4	Unused status 6	ERROR	4,7
	5	Unused status 7	ERROR	4,7
	6	Unused status 8	ERROR	N/A
	7	Unused status 9	ERROR	N/A
2	0	Host/iModule communications fault	ERROR	4,7
	1	iModule changed	WARNING	4,7
	2	Host characterisation error	ERROR	4,7
	3	Host calibration/configuration error	ERROR	4,7
	4	Host check ROM check error	ERROR	4,7
	5	Host RAM failure	ERROR	4,7
	6	Unused status 10	ERROR	N/A
	7	Unused status 11	ERROR	N/A
3	0	Host processor supply low	ERROR	4,7
	1	Host processor supply high	ERROR	4,7
	2	Host supply voltage low	ERROR	4,7
	3	Host supply voltage high	ERROR	4,7
	4	Host software failure	ERROR	4,7
	5	Host detects iModule software failure	ERROR	4,7
	6	Unused status 12	ERROR	4,7
	7	Unused status 13	ERROR	4,7
4	0	iModule temperature low	WARNING	4,7

	1	iModule temperature high	WARNING	4,7
	2	iModule check ROM error	ERROR	4,7
	3	iModule RAM failure	ERROR	4,7
	4	iModule calibration/configuration error	ERROR	4,7
	5	iModule processor supply low	ERROR	4,7
	6	iModule processor supply high	ERROR	4,7
	7	iModule characterisation error	ERROR	4,7
5	0	iModule production process failure	ERROR	4,7
	1	Gas detector under-range or over-range	ERROR	4,7
	2	Reference detector under-range or over-range	ERROR	4,7
	3	Lamp failure	ERROR	4,7
	4	Excessive detector noise (gas or reference)	ERROR	4,7
	5	Detector failure (or optics completely blocked)	ERROR	4,7
	6	Unused status 14	ERROR	4,7
	7	Unused status 15	ERROR	4,7

"Unused" bits are always set to 0.

These bits are set or cleared by the self-test executed at power up. They are also set by any failure detected during continuous background self-testing.

7. Universal Commands

7.1 Command #0

The Device Profile code (response data byte 21) will normally return 2 (discrete device).

7.2 Command #3

Returns PV, SV, TV and QV for a total of 24 bytes.

7.3 Command #6

Note that the IRmax will automatically timeout (exit) loop current disabled mode (multi-drop mode) 5 minutes after the last HART message addressed to the IRmax has been received– this is the *Analogue output hold time*. The assumption is that if a control system cannot regularly poll the IRmax within this time period then the disabling of the loop current was probably in error and so the IRmax reverts to what is considered to be the safest operational mode.

7.4 Command #9

This command can return 1, 2, 3 or 4 device variables (corresponding to PV, SV, TV and QV).

8. Common Practice Commands

8.1 Supported Commands

The following commands are supported:

Cmd #	Meaning
40	Enter/Exit Fixed Current Mode
45	Trim Loop Current Zero
46	Trim Loop Current Gain

8.1.1 Command #40 Enter/Exit Fixed Current Mode

Note that the IRmax will automatically timeout (exit) the fixed current mode after 5 minutes – this is the *Analogue output hold time*. If it is required to prevent this timeout then periodically re-send this command.

8.1.2 Command #45 Trim Loop Current Zero

Write the loop current (as measured by a DVM) with this command. The instrument will calculate the error between this written data and the required loop current and set the appropriate correction factor.

It would be normal to implement this command within a Device Description method: the method would output a constant loop current (normally 4mA) using cmd # 40; request the actual loop measurement from the operator; write the actual loop current using cmd #45; and finally re-connect the process to the loop current either using cmd #40 (writing a fixed current of 0.0) or device-specific cmd #128.

8.1.3 Command #46 Trim Loop Current Gain

Write the loop current (as measured by a DVM) with this command. The instrument will calculate the error between this written data and the required loop current and set the appropriate correction factor.

It would be normal to implement this command within a Device Description method: the method would output a constant loop current (normally 20mA) using cmd # 40; request the actual loop measurement from the operator; write the actual loop current using cmd #46; and finally re-connect the process to the loop current either using cmd #40 (writing a fixed current of 0.0) or device-specific cmd #128.

Note that this command assumes that the loop current is set to 20mA to correctly calculate the loop current gain adjustment. If for some reason the loop current is fixed to a different (known) level then scaling of the DVM measurement is required (details not given here).

8.2 Burst Mode

Not supported.

9. Device Specific Commands

9.1 Supported Commands

The following device specific commands are supported:

Cmd #	Meaning
128	Inhibit Mode
129	Zero Gas Reading
130	Calibrate Gas Reading
131	Read Last Calibration Gas Level
132	Read Serial Numbers
133	Read Software Versions
134	Read Password Enable
135	Write Password
136	Read Password Unlock State
137	Write Password to Unlock
138	Read Alarm Levels
139	Write Alarm Levels
140	Read Gas Range
141	Read ID String

9.2 Command #128 Inhibit Mode

The IRmax's analogue output can be set to the *Inhibit Level* or, if the analogue output has been fixed (disconnected from the process through cmd #40 or this command) it may re-connected to the process. Note that the IRmax will automatically timeout from inhibit mode after 5 minutes – this is the *Analogue output hold time*. If it is required to prevent this timeout then periodically re-send this command.

9.2.1 Request Data Bytes

Byte	Format	Description
0	Enum	Inhibit Mode Enable State: 0=re-connect analogue output to processes; 1=set analogue output Inhibit Mode

9.2.2 Response Data Bytes

Byte	Format	Description
0	Enum	Inhibit Mode Enable State: 0=analogue output to connected to processes; 1= analogue output set into Inhibit Mode

Note: The value returned in the response data byte reflects the value actually used by the device.

9.2.3 Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
1		Undefined
2	Error	Invalid Selection
3-4		Undefined
5	Error	Too Few Data Bytes Received
6		Undefined
7	Error	In Write Protect Mode
8-10		Undefined
11	Error	Incorrect loop mode or value (in multi-drop mode)
12		Undefined
13	Error	In Start-up Stabilisation
14-15		Undefined
16	Error	Access Restricted
17-127		Undefined

9.3 Command #129 Zero Gas Reading

This command is essentially the same as the Common Practice Command #43 (not implemented).

Once this command is issued, the response to the command will be code 7, 12, 15, 16, 28, or 29. If the response code 28 is returned then the Zero Gas Reading command should be repeated until a status other than 28 is returned indicating the result of the zero operation.

9.3.1 Request Data Bytes

Byte	Format	Description
None		

9.3.2 Response Data Bytes

Byte	Format	Description
0-1	Integer	Percentage of required operation time completed

Note: The value returned in the response data bytes reflects the value actually used by the device.

9.3.3 Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
1-5		Undefined
6	Error	Zero Failed
7	Error	In Write Protect Mode
8	Error	Undefined
9	Error	Applied Process Too High
10	Error	Applied Process Too Low
11	Error	Optics Obscured
12	Error	Zero Error Too Large
13	Error	In Start-up Stabilisation
14		Undefined
15	Error	In Service Mode
16	Error	Access Restricted
17-27		Undefined
28	Error	Operation in progress (busy)
29	Error	Operation conflict (another operation is in progress, new request aborted)
30-127		Undefined

9.4 Command #130 Calibrate Gas Reading

Calibrate the Primary Variable so it reads the given calibration level with the existing process applied. Typically the IRmax will be placed into Inhibit Mode using cmd #128, suitable calibration gas applied, this command issued to calibrate to IRmax, the calibration gas purged from the IRmax, and then the IRmax removed from Inhibit Mode using cmd #128.

Once this command is issued, the response to the command will be code 5, 7, 15, 16, 28, or 29. If the response code 28 is returned then the Zero Gas Reading command should be repeated until a status other than 28 is returned indicating the result of the zero operation.

9.4.1 Request Data Bytes

Byte	Format	Description
0-3	Float	Calibration level, in %LEL

9.4.2 Response Data Bytes

Byte	Format	Description
0-1	Integer	Percentage of required operation time completed

9.4.3 Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
1-5		Undefined
6	Error	Calibration Failed
7	Error	In Write Protect Mode
8	Error	Undefined
9	Error	Applied Process Too High
10	Error	Applied Process Too Low
11	Error	Optics Obscured
12	Error	Insufficient Gas Applied For Calibration
13	Error	In Start-up Stabilisation
14		Undefined
15	Error	In Service Mode
16	Error	Access Restricted
17-27		Undefined
28	Error	Operation in progress (busy)
29	Error	Operation conflict (another operation is in progress, new request aborted)
30-127		Undefined

9.5 Command #131 Read Last Calibration Gas Level

This command reads the last calibration gas level used, either by cmd #130 or through the IR-Display.

9.5.1 Request Data Bytes

Byte	Format	Description
None		

9.5.2 Response Data Bytes

Byte	Format	Description
0-3	Float	Last calibration gas level used (in %LEL)

9.5.3 Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
1-15		Undefined
16	Error	Access Restricted
17-127		Undefined

9.6 Command #132 Read Serial Numbers

Reads the serial number of the IRmax Host and iModule.

9.6.1 Request Data Bytes

Byte	Format	Description
None		

9.6.2 Response Data Bytes

Byte	Format	Description
0-15	Latin-1	IRmax Host serial number
16-31	Latin-1	IRmax iModule serial number

9.6.3 Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
1-127		Undefined

9.7 Command #133 Read Software Versions

Reads the full software version strings of the IRmax Host and iModule.

The Software Revision Level returned by the Read Unique Identifier command (cmd #0) returns the software issue of the IRmax (i.e. the component of the instrument that implements the HART communications), multiplied up by 100. So, for example, if the IRmax software version is V1 i1.01 the Software Revision Level would be 101.

9.7.1 Request Data Bytes

Byte	Format	Description
None		

9.7.2 Response Data Bytes

Byte	Format	Description
0-15	Latin-1	IRmax Host software version (e.g. V1 i1.03)
16-31	Latin-1	IRmax iModule software version (e.g. V4 i2.05)

9.7.3 Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
1-127		Undefined

9.8 Command #134 Read Password Enable

This command is used to determine if password protection is currently configured - it reads the password enable/disable configuration. Note that this is not the same as the password lock/unlock state: HART communications will always be unlocked if the password is disabled; HART communications will be locked if the password is enabled and has not been unlocked by writing a valid password to the instrument (Write Password, cmd #135). When an instrument is password locked all write commands will give the Response Code 7, In Write Protect mode.

9.8.1 Request Data Bytes

Byte	Format	Description
None		

9.8.2 Response Data Bytes

Byte	Format	Description
0	Enum	Password enabled state: 0=password protection not enabled; 1=password protection enabled

9.8.3 Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
1-127		Undefined

9.9 Command #135 Write Password

Write password enable state and password to instrument. This turns password protection off/on, and sets the password that must be entered (using command Write Unlock Password, cmd #137) to unlock an instrument that is in password protected mode (locked).

When password protection is turned on the instrument will remain in a password unlocked state – in other words, when password protection is enabled it is not necessary to immediately send the password (through cmd #137) to unlock the instrument. The IRmax will automatically enter the password locked state 5 minutes after the last valid HART message requiring a response is received.

Passwords can be up to 16 bytes long. Shorter passwords can be set.

9.9.1 Request Data Bytes

Byte	Format	Description
0	Enum	Password enable state: 0=disable password protection; 1=enable password protection
1-16	Latin-1	Password needed to unlock instrument

9.9.2 Response Data Bytes

Byte	Format	Description
0	Enum	Password enable state: 0=disable password protection; 1=enable password protection
1-16	Latin-1	Password needed to unlock instrument

Note: The values returned in the response data bytes reflect the values actually used by the device.

9.9.3 Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
1-4		Undefined
5	Error	Too Few Bytes Received
6		Undefined
7	Error	In Write Protect Mode
8-127		Undefined

9.10 Command #136 Read Password Unlock State

Read the current password lock/unlock state. An instrument that is password locked will return the Response Code 7, In Write Protect Mode, for all non-read commands.

9.10.1 Request Data Bytes

Byte	Format	Description
None		

9.10.2 Response Data Bytes

Byte	Format	Description
0	Enum	Password lock state: 0=unlocked (write access in not protected); 1=locked (write access is protected)

Note: The values returned in the response data bytes reflect the values actually used by the device.

9.10.3 Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
1-127		Undefined

9.11 Command #137 Write Password to Unlock

Write password to unlock a password protected instrument. This command has no effect if password protection has not been enabled (through cmd #135).

If an incorrect password is sent to the instrument then the instrument will remain protected, or, if password protected and unlocked, will enter the locked (password protected) state.

Passwords can be up to 16 bytes long. A password is correct if it is the right length and all characters match.

9.11.1 Request Data Bytes

Byte	Format	Description
0	Enum	Password enable state: 0=disable password protection; 1=enable password protection
1-16	Latin-1	Password needed to unlock instrument

9.11.2 Response Data Bytes

Byte	Format	Description
0	Enum	Password enable state: 0=disable password protection; 1=enable password protection
1-16	Latin-1	Password needed to unlock instrument

Note: The values returned in the response data bytes reflect the values actually used by the device.

9.11.3 Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
1-4		Undefined
5	Error	Too Few Bytes Received
6		Undefined
7	Error	In Write Protect Mode
8-127		Undefined

9.12 Command #138 Read Alarm Levels

Read the configured alarm levels.

9.12.1 Request Data Bytes

Byte	Format	Description
None		

9.12.2 Response Data Bytes

Byte	Format	Description
0-3	Float	*Alarm 1* level (in %LEL)
4-7	Float	*Alarm 2* level (in %LEL)

9.12.3 Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
1-127		Undefined

9.13 Command #139 Write Alarm Levels

Write new alarm levels to the IRmax. Both alarm levels must be greater than 0.

9.13.1 Request Data Bytes

Byte	Format	Description
0-3	Float	*Alarm 1* level (in %LEL)
4-7	Float	*Alarm 2* level (in %LEL)

9.13.2 Response Data Bytes

Byte	Format	Description
0-3	Float	*Alarm 1* level (in %LEL)
4-7	Float	*Alarm 2* level (in %LEL)

Note: The values returned in the response data bytes reflect the values actually used by the device.

9.13.3 Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
1-3		Undefined
4	Error	Passed Parameter Too Small
5	Error	Too Few Bytes Received
6		Undefined
7	Error	In Write Protect Mode
8-127		Undefined

9.14 Command #140 Read Gas Range

Read the gas identification data – name and range (in measurement units).

9.14.1 Request Data Bytes

Byte	Format	Description
None		

9.14.2 Response Data Bytes

Byte	Format	Description
0-3	Float	Gas range (in measurement units, normally 0-100% LEL)
4-19	Latin-1	Gas name

9.14.3 Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
1-127		Undefined

9.15 Command #140 Read ID String

Read the instrument identification string. This is the (optional) string that is shown on switch on.

9.15.1 Request Data Bytes

Byte	Format	Description
None		

9.15.2 Response Data Bytes

Byte	Format	Description
0	Enum	Has ID string been defined? 0 = ID string not defined; 1 = ID string defined
1-32	Latin-1	*ID string* (if it is defined)

9.15.3 Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
1-127		Undefined

10. IRmax Configuration Data

Some of the information in this document refers to parameters that are configurable in the IRmax. It is usual for the default values to be maintained, but for completeness the parameters that can be modified are given below. Use IR2009.net to change this data. Alarm levels may be changed through HART.

Data	Description	Default
Zero Fault	Gas level at which zero fault is triggered.	-10 %LEL
Span Fault	Gas level at which span fault is triggered.	Unused
Obscuration Warning	Percentage obscuration level at which a warning is triggered	90%
Alarm 1	Alarm 1 level	20% LEL
Alarm 2	Alarm 2 level	40% LEL
Inhibit Level	Gas level equivalent of the loop current output when IRmax is placed into inhibit mode – this is the output level that is normally set prior to applying gas for a calibration.	0% LEL (equiv. to 4mA)
ID String	Optional identification string displayed at start-up	Blank
Analogue output hold time	Timeout from fixed current mode – this includes inhibit mode and ramp mode	5 minutes

11. Change History

11.1 Issue 1

First release.