FlameGard® 5 MSIR HART

Multi-Spectral Infrared Flame Detector

HART Communication with the FlameGard 5 Multi-spectral Infrared Detector

Instruction Manual

Part No. **MAN5MSIRH**
Revision **0**

Table of Contents

1.0 INTRODUCTION 1
1.1 Scope 1
1.2 Purpose 1
1.3 Who should use this document? 1
1.4 References 1

2.0 DEVICE IDENTIFICATION 1

3.0 PRODUCT OVERVIEW 2
3.1 Getting Started 2

4.0 PRODUCT INTERFACES 3
4.1 Process Interface 3
4.2 Host Interface 3
4.3 Local Interfaces, Jumpers, and Switches 3

5.0 DEVICE VARIABLES 3

6.0 DYNAMIC VARIABLES 3
6.1 Primary Variable = FlameGard 5 MSIR Operating Mode 3
6.2 Secondary, Tertiary, and Quaternary Variables: Not Applicable 3

7.0 STATUS INFORMATION 4

8.0 UNIVERSAL COMMANDS 5

9.0 COMMON PRACTICE COMMANDS 6
9.1 Supported Commands 6
9.2 Burst Mode 6
9.3 Catch Device Variable 6

10.0 DEVICE SPECIFIC COMMANDS 7
10.1 Command #128: Read DIP Switch Override Register (MODBUS Reg 0x07) 7
10.2 Command #129: Write DIP Switch Override Register (MODBUS Reg 0x07) 7
10.3 Command #130: Read DIP Switch Settings Register (MODBUS Reg 0x46) 8
10.4 Command #131: Read Unit Options Register (MODBUS Reg 0x08) 8
10.5 Command #132: Write Unit Options Register (MODBUS Reg 0x08) 9
10.6 Command #133: Read COPM Fault Status Registers 9
10.7 Command #134: Clear COPM Faults (MODBUS Reg 0x13) 10
10.8 Command #135: Remote Alarm Reset (MODBUS Reg 0x11) 10
10.9 Command #136: Remote Alarm Test (MODBUS Reg 0x12) 10
10.10 Command #137: Read Instrument Temperature (MODBUS Reg 0x14) 11
10.11 Command #138: Set/Reset Test Lamp Mode (MODBUS Reg 0x5A) 11
10.12 Command #139: Read Test Lamp Mode (MODBUS Reg 0x5A) 12

10.13 Command #140: Read Alarm Delay (MODBUS Reg 0x5B) 12
10.14 Command #141: Set Alarm Delay (MODBUS Reg 0x5B) 13
10.15 Command #142: Read Time Stamp (MODBUS Reg 0x6A, 0x6B, 0x6C) 14
10.16 Command #143: Read Event Logging Counters (MODBUS Reg 0xA8, 0xB0, 0xB8, 0xC0) 14
10.17 Command #144: Clear Event Logging Counters (MODBUS Reg 0xC1) 15
10.18 Command #145: Read Warning Event Log 15
10.19 Command #146: Read Alarm Event Log 16
10.20 Command #147: Read Fault Event Log 16
10.21 Command #148: Read Maintenance Event Log 17
10.22 Command #149: Set Clock 18
10.23 Command #150: Read Clock 18
10.24 Command #151: Set Run Time Meter 19
10.25 Command #152: Read Run Time Meter 19
10.26 Command #153: Read Power Cycle Flag 20
10.27 Command #154: Set Event Log Index 20
10.28 Command #155: Read Event Log Index 21
10.29 Command #156: Read Remote Alarm Test Mode 21
10.30 Command #157: Set Warning Relay Latched Status 22
10.31 Command #158: Read Warning Relay Latched Status 22
10.32 Command #159: Set Warning Relay De-Energized/Energized Status 22
10.33 Command #160: Read Warning Relay De-Energized/Energized Status 23
10.34 Command #161: Set Alarm Relay Latched Status 23
10.35 Command #162: Read Alarm Relay Latched Status 24
10.36 Command #163: Set Alarm Relay De-Energized/Energized Status 24
10.37 Command #164: Read Alarm Relay De-Energized/Energized Status 25
10.38 Command #165: Set Sensitivity Level 25
10.39 Command #166: Read Sensitivity Level 26
10.40 Command #167: Read PV Mode 26
10.41 Command #168: Read Error Status 27
10.42 Command #169: Read Line Voltage 27
10.43 Command #170: Read Analog Voltage 28

11.0 TABLES 29

11.1 FlameGard 5 MSIR – Device Specific Commands Summary 29
11.2 FlameGard 5 MSIR – Operating Mode - PV Values 30
11.3 COPM Fault Register 31
11.4 Fault Event Log – Cause Description 31
11.5 Maintenance Event Log – Cause Description 31
11.6 DIP Switch Settings Register 32
11.7 Unit Options Settings Register 33

12.0 PERFORMANCE 34

12.1 Sampling Rates 34
12.2 Power-up 34
12.3 Device Reset 34
12.4 Self-Test 34
12.5 Command Response Delay 34
12.6 Busy and Delayed-Response 34
12.7 Long Messages 34
12.8 Non-Volatile Memory 34

12.9 Operating Modes....35
12.10 Write Protection....35

13.0 ANNEX A. CAPABILITY CHECKLIST....35

14.0 ANNEX B. DEFAULT CONFIGURATION....36

15.0 ANNEX C. DEVICE DESCRIPTOR LANGUAGE MENU....37

Table of Tables

Table 1: Field Device Identification Data 1
Table 2: Error Status Information 4
Table 3: FlameGard 5 MSIR – Common Practice Commands 6
Table 4: FlameGard 5 MSIR – Device Specific Commands 29
Table 5: FlameGard 5 MSIR - Operating Mode - PV Values 30
Table 6: COPM Fault Register Values 31
Table 7: Fault Event Log – Cause Description 31
Table 8: Maintenance Event Log – Cause Description 32
Table 9: DIP Switch Settings Register Description 32
Table 10: Unit Options Settings 33
Table 11: Command Response Times 34
Table 12: Capability Checklist 35
Table 13: Default Configuration 36

1.0 Introduction

1.1 Scope

The FlameGard 5 MSIR Multi-Spectral Infrared (MSIR) flame detector complies with HART Protocol Revision 6.0. This document specifies all of the device specific features and documents HART Protocol implementation details. 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.

There shall be no changes in any of the performance criteria of the FlameGard 5 MSIR Flame Detector due to the addition of the HART protocol communications channel.

1.2 Purpose

This specification is designed to complement the FlameGard 5 MSIR Instruction Manual by providing a complete description of this field device from a HART Communications 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.

1.4 References

DOCUMENT NAME	DOCUMENT RELATIONSHIP
HART Communications Protocol Specifications	This is used to insure compliance with the HART Communication Protocol.
FlameGard 5 MSIR Instruction Manual	This is the MSA FlameGard 5 MSIR Product Instruction Manual.

2.0 Device Identification

The following Table 1 is the Field Device Identification Data for the instrument.

Table 1: Field Device Identification Data

Manufacturer's Name	General Monitors, Inc.	Model Number	FlameGard 5 MSIR
HART ID Code	223 (DF Hex)	Device Type Code:	128 (80 Hex)
HART Protocol Revision	6.0	Device Revision:	1
Number of Device Variables	0		
Physical Layers	1		

Manufacturer's Name	General Monitors, Inc.	Model Number	FlameGard 5 MSIR
Supported			
Physical Device Category	FSK		

3.0 Product Overview

The FlameGard 5 MSIR is a Multi-Spectral Infrared (MSIR) Flame Detector from MSA. The FlameGard 5 MSIR employs state-of-the-art infrared detectors and a sophisticated Artificial Neural Network (ANN) to produce a system that is highly immune to false alarms such as, arc-welding, hot objects, and other sources of radiation.

3.1 Getting Started

In order to enable HART communication with the FlameGard 5 MSIR detector, users may employ several means including HART handheld communicators or PC-based systems. Using a PC-based software application and a HART interface modem, for example, allows operators to access information from the FlameGard 5 MSIR. Typical setup is shown in Figure 1.

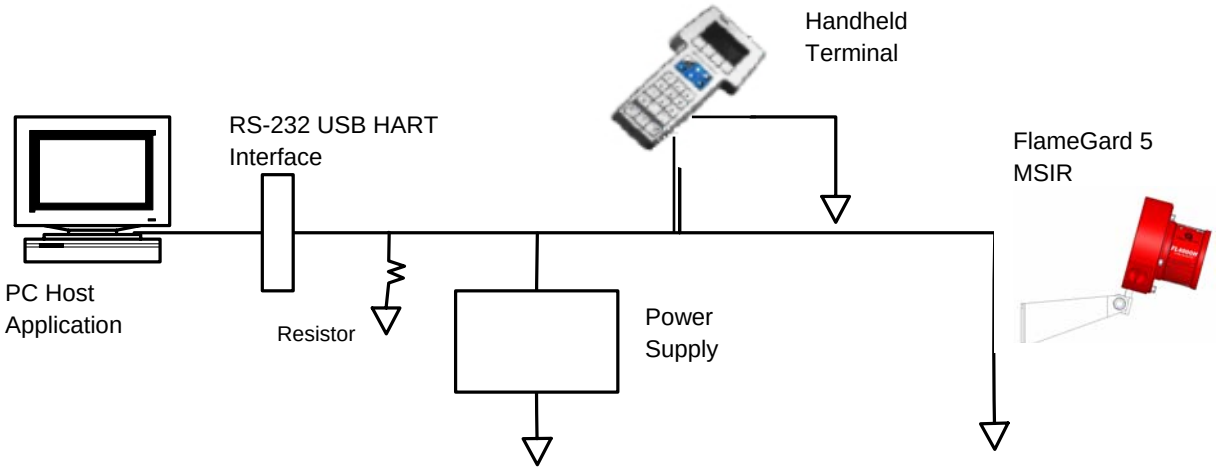


Figure 1 Connecting a PC to a HART device

Once the detector is installed (see FlameGard 5 MSIR Instruction Manual) and connected to a PC, host application, or handheld terminal, the master will commonly begin communication to the FlameGard 5 MSIR by using the HART Command #0. The field device will then respond only if its tag matches. The data in the reply to Command #11 is identical to that of Command #0, so the master can then construct the Unique Identifier for use with further commands.

NOTE: Handheld device allows for the retrieval of diagnostic information and input of device settings as needed and should not be used as a permanent part of a safety system.

4.0 Product Interfaces

4.1 Process Interface

This section describes all interfaces between the devices and the measured process.

4.1.1 Sensor Input Channels

The unit's pyroelectric sensors continually collect data at predetermined wavelengths. These are interpreted by an advanced Artificial Neural Network algorithm to detect flame within the field of view and to reject signals from false flame sources. The results are output to the user via a 4 – 20mA current loop, 3 relays, a HART digital interface, and a MODBUS digital interface

4.2 Host Interface

The HART interface uses the 4 – 20mA current loop. Refer to the Installation Manual for connection details.

4.2.1 Analog Output: FlameGard 5 MSIR Mode

The FlameGard 5 MSIR Mode is output to the user as the primary variable of the HART protocol. Table 5 shows the interpretation of this variable

4.3 Local Interfaces, Jumpers, and Switches

4.3.1 Local Controls And Displays

Refer to the Installation Manual for connection details

4.3.2 Internal Jumpers And Switches

Refer to the Installation Manual for connection details

5.0 Device Variables

There are no device variables exposed to the user.

6.0 Dynamic Variables

There is only one Dynamic Variable exposed to the user.

6.1 Primary Variable = FlameGard 5 MSIR Operating Mode

The device mode is the variable, which corresponds to the MODBUS register 0x01.

6.2 Secondary, Tertiary, and Quaternary Variables: Not Applicable

There are none defined for the FlameGard 5 MSIR product.

7.0 Status Information

The error status, which is returned via Common Practice Command #48, is shown in Table 2 and corresponds to MODBUS register 0x01. This also shows any COPM Faults. These bits may be set at power up to indicate an instrument failure. They may also be set by a failure detected during continuous background diagnostic testing.

Table 2: Error Status Information

Byte	Bit	Description	Class	Device Status Bits Set
0 (MOD-BUS Reg #2 MSB)	0	Not Used	N/A	
	1	Not Used	N/A	
	2	Not Used	N/A	
	3	Not Used	N/A	
	4	Not Used	N/A	
	5	Not Used	N/A	
	6	Not Used	N/A	
	7	Reset Short Error	Error	4,7
1 (MOD-BUS Reg #2 LSB)	0	Not Used	N/A	
	1	Not Used	N/A	
	2	Not Used	N/A	
	3	COPM Fault	Error	4,7
	4	Low Voltage	Error	4,7
	5	Not Used	N/A	
	6	Data Flash Error	Error	4,7
	7	Code Flash Error	Error	4,7
2 (MOD BUS Reg #6)	0	Detector 2.2 um Error	Error	4,7
	1	Detector 4.9 um Error	Error	4,7
	2	Detector 4.3 um Error	Error	4,7
	3	Detector 4.45 um Error	Error	4,7
	4	Not Used	N/A	
	5	Not Used	N/A	
	6	Not Used	N/A	
	7	COPM Fault	Error	4,7
3	0	Not Used	N/A	
	1	Not Used	N/A	
	2	Not Used	N/A	
	3	Not Used	N/A	
	4	Not Used	N/A	
	5	Not Used	N/A	
	6	Not Used	N/A	
	7	Not Used	N/A	
4	0	Not Used	N/A	
	1	Not Used	N/A	
	2	Not Used	N/A	
	3	Not Used	N/A	
	4	Not Used	N/A	
	5	Not Used	N/A	
	6	Not Used	N/A	
	7	Not Used	N/A	

Byte	Bit	Description	Class	Device Status Bits Set
5	0	Not Used	N/A	
	1	Not Used	N/A	
	2	Not Used	N/A	
	3	Not Used	N/A	
	4	Not Used	N/A	
	5	Not Used	N/A	
	6	Not Used	N/A	
	7	Not Used	N/A	
6	0	Maintenance Required	Error	4,7
	1	Not Used	N/A	
	2	Not Used	N/A	
	3	Not Used	N/A	
	4	Not Used	N/A	
	5	Not Used	N/A	
	6	Not Used	N/A	
	7	Not Used	N/A	
7	0	Not Used	N/A	
	1	Not Used	N/A	
	2	Not Used	N/A	
	3	Not Used	N/A	
	4	Not Used	N/A	
	5	Not Used	N/A	
	6	Not Used	N/A	
	7	Not Used	N/A	

These bits may be set at power up to indicate an instrument failure. They may also be set by a failure detected during continuous background diagnostic testing.

8.0 Universal Commands

Command 3 returns the current loop variable and the primary variable for a total of 9 bytes returned. Command 9 returns the PV only.

9.0 Common Practice Commands

The following common practice commands are implemented.

9.1 Supported Commands

The following common-practice commands shown in Table 3 are implemented:

Table 3: FlameGard 5 MSIR HART – Common Practice Commands

Command Number	Byte Number	Meaning
Command 38	N/A	Reset Configuration Changed Flag.
Command 48	0	Read additional Device Status.
Command 48	1	Returns Device Error Status = MODBUS Register 0x02 Hi Byte
Command 48	2	Returns Device Error Status = MODBUS Register 0x02 Hi Byte
Command 48	3	Returns 0
Command 48	4	Returns 0
Command 48	5	Returns 0
Command 48	6	Returns 0x01 – “Maintenance Required”
Command 48	7	Returns 0

9.2 Burst Mode

The FlameGard 5 MSIR does not support Burst Mode.

9.3 Catch Device Variable

This Field Device does not support Catch Device Variable.

10.0 Device Specific Commands

The Device Specific commands are used strictly for the unique features of the FlameGard 5 MSIR and at the discretion of MSA. They are described here in section 10.0 and are summarized in Table 4

10.1 Command #128: Read DIP Switch Override Register (MODBUS Reg 0x07)

Read the DIP Switch Override Register.

Request Data Bytes

Byte	Format	Description
None	N/A	N/A

Response Data Bytes

Byte	Format	Description
0	Bits	Override Bit – LSB = 1, enabled: Allow Override. LSB = 0, disabled: Disallow Override

Command-Specific Response Codes

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

10.2 Command #129: Write DIP Switch Override Register (MODBUS Reg 0x07)

Write the DIP Switch Override Register. This command loads the unit options based on the values of either the flash or the actual DIP switch settings.

Request Data Bytes

Byte	Format	Description
0	Bits	Override Bit – LSB = 1, enabled: Allow Override. LSB = 0, disabled: Disallow Override

Response Data Bytes

Byte	Format	Description
0	Bits	Override Bit – LSB = 1, enabled: Allow Override. LSB = 0, disabled: Disallow Override

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
1- 2		Undefined
3	Error	Passed Parameter Too Large
4 – 127		Undefined
5	Error	Too Few Data Bytes Received

10.3 Command #130: Read DIP Switch Settings Register (MODBUS Reg 0x46)

Reads the DIP Switch Settings Register.

Request Data Bytes

Byte	Format	Description
None	N/A	N/A

Response Data Bytes

Byte	Format	Description
0	Bits	DIP Switch Settings Table 9

Command-Specific Response Codes

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

10.4 Command #131: Read Unit Options Register (MODBUS Reg 0x08)

Reads the Unit Options Register.

Request Data Bytes

Byte	Format	Description
None	N/A	N/A

Response Data Bytes

Byte	Format	Description
0	Bits	Unit Options – See Table 10

Command-Specific Response Codes

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

10.5 Command #132: Write Unit Options Register (MODBUS Reg 0x08)

Write the Unit Options Register.

Request Data Bytes

Byte	Format	Description
0	Bits	Unit Options – See Table 10

Response Data Bytes

Byte	Format	Description
0	Bits	Unit Options – See Table 10

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
1 - 6		Undefined
7	Error	Write Protect Mode
8 – 127		Undefined

10.6 Command #133: Read COPM Fault Status Registers

Reads the COPM Fault Status Registers.

Request Data Bytes

Byte	Format	Description
None	N/A	N/A

Response Data Bytes

Byte	Format	Description
0	Bits	COPM Fault Register (MODBUS Reg 0x06) – See Table 6
1 - 2	Unsigned-16	Sensor 1 Fault Count
3 - 4	Unsigned-16	Sensor 2 Fault Count
5 - 6	Unsigned-16	Sensor 3 Fault Count
7 - 8	Unsigned-16	Sensor 4 Fault Count

Command-Specific Response Codes

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

10.7 Command #134: Clear COPM Faults (MODBUS Reg 0x13)

Clear the COPM Faults Register.

Request Data Bytes

Byte	Format	Description
None	N/A	N/A

Response Data Bytes

Byte	Format	Description
None	N/A	N/A

Command-Specific Response Codes

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

10.8 Command #135: Remote Alarm Reset (MODBUS Reg 0x11)

Reset the Remote Alarm. This resets any relays which might be latched.

Request Data Bytes

Byte	Format	Description
None	N/A	N/A

Response Data Bytes

Byte	Format	Description
None	N/A	N/A

Command-Specific Response Codes

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

10.9 Command #136: Remote Alarm Test (MODBUS Reg 0x12)

Test the Remote Alarm.

Request Data Bytes

Byte	Format	Description
0	Bits	Test Remote Alarm: 0 = Turn off, 1 = Turn on Alarm

Response Data Bytes

Byte	Format	Description
0	Bits	Test Remote Alarm: 0 = Alarm Off, 1 = Alarm On

Command-Specific Response Codes

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

10.10 Command #137: Read Instrument Temperature (MODBUS Reg 0x14)

Read the temperature of the instrument.

Request Data Bytes

Byte	Format	Description
None	N/A	N/A

Response Data Bytes

Byte	Format	Description
0 - 1	Signed-16	Temperature Value
2	Enum	Degrees Celsius

Command-Specific Response Codes

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

10.11 Command #138: Set/Reset Test Lamp Mode (MODBUS Reg 0x5A)

Set/Reset the Test Lamp Mode.

Request Data Bytes

Byte	Format	Description
0	Bits	Set/Reset Test Mode: 1 = Test Mode, 0 = Non-Test Mode

Response Data Bytes

Byte	Format	Description
0	Bits	Test Mode: 1 = Test Mode, 0 = Non-Test Mode

Command-Specific Response Codes

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

10.12 Command #139: Read Test Lamp Mode (MODBUS Reg 0x5A)

Read the Test Lamp Mode.

Request Data Bytes

Byte	Format	Description
None	N/A	N/A

Response Data Bytes

Byte	Format	Description
0	Bits	Test Mode: 1 = Test Mode, 0 = Non-Test Mode

Command-Specific Response Codes

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

10.13 Command #140: Read Alarm Delay (MODBUS Reg 0x5B)

Read the Alarm Delay.

Request Data Bytes

Byte	Format	Description
None	N/A	N/A

Response Data Bytes

Byte	Format	Description
0	Unsigned-8	Alarm Delay

Command-Specific Response Codes

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

10.14 Command #141: Set Alarm Delay (MODBUS Reg 0x5B)

Set the Alarm Delay. If the DIP override flag is set, then the command will return an ACCESS RESTRICTED code.

Request Data Bytes

Byte	Format	Description
0	Unsigned-8	Alarm Delay

Response Data Bytes

Byte	Format	Description
0	Unsigned-8	Alarm Delay

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
1 – 2		Undefined
3	Error	Passed Parameter Too Large
4		Undefined
5	Error	Too Few Data Bytes Received
6 - 15		Undefined
16	Error	Access Restricted
17 - 127		Undefined

10.15 Command #142: Read Time Stamp (MODBUS Reg 0x6A, 0x6B, 0x6C)

Read the last time that the test lamp check was successfully performed.

Request Data Bytes

Byte	Format	Description
None	N/A	N/A

Response Data Bytes

Byte	Format	Description
0 - 2	Date	Last Successful Test Lamp Check
3	Unsigned-8	Last Successful Test Lamp Check – Hour
4	Unsugned-8	Last Successful Test Lamp Check - Minute

Command-Specific Response Codes

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

10.16 Command #143: Read Event Logging Counters (MODBUS Reg 0xA8, 0xB0, 0xB8, 0xC0)

This command reads the four Event Logging Counters to give the number of events which have been stored in each of the event logs. The four event logs record the most recent 10 events which have been recorded by the instrument. These are the most recent: warning time, alarm time, fault time, and test lamp checkout time. The event logs are stored in most recent order and going back to the least recent event. The most recent event is event number 0 and the least recent is event number 9. If fewer than 10 events have been recorded, then the least recent event times will indicate a time stamp of January 1, 2000.

Request Data Bytes

Byte	Format	Description
None	N/A	N/A

Response Data Bytes

Byte	Format	Description
0 - 1	Unsigned-16	Warning Event Counter
2 - 3	Unsigned-16	Alarm Event Counter
4 – 5	Unsigned-16	Fault Event Counter
6 - 7	Unsigned-16	Maintenance Event Counter

Command-Specific Response Codes

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

10.17 Command #144: Clear Event Logging Counters (MODBUS Reg 0xC1)

This resets the event logging counters to zero – effectively clearing out the event logs of all of the previous information.

Request Data Bytes

Byte	Format	Description
None	N/A	N/A

Response Data Bytes

Byte	Format	Description
None	N/A	N/A

Command-Specific Response Codes

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

10.18 Command #145: Read Warning Event Log

Read Warning Event Log as specified by the event log number. Event 0 is the most recent event. Event 1 is the one just before that and so forth.

Request Data Bytes

Byte	Format	Description
None	N/A	N/A

Response Data Bytes

Byte	Format	Description
0 - 3	Unsigned-32	Event Running Time (in Seconds)
4 - 6	Date	Event Date – Day, Month, Year – 1900
7	Unsigned-8	Event Hour
8	Unsigned-8	Event Minute
9	Unsigned-8	Event Second

Command-Specific Response Codes

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

10.19 Command #146: Read Alarm Event Log

Read Alarm Event Log as specified by the event log number. Event 0 is the most recent event. Event 1 is the one just before that and so forth.

Request Data Bytes

Byte	Format	Description
None	N/A	N/A

Response Data Bytes

Byte	Format	Description
0 - 3	Unsigned-32	Event Running Time (in Seconds)
4 - 6	Date	Event Date – Day, Month, Year – 1900
7	Unsigned-8	Event Hour
8	Unsigned-8	Event Minute
9	Unsigned-8	Event Second

Command-Specific Response Codes

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

10.20 Command #147: Read Fault Event Log

Read Fault Event Log as specified by the event log number. Event 0 is the most recent event. Event 1 is the one just before that and so forth.

Request Data Bytes

Byte	Format	Description
None	N/A	N/A

Response Data Bytes

Byte	Format	Description
0 - 3	Unsigned-32	Event Running Time (in Seconds)
4 - 6	Date	Event Date – Day, Month, Year – 1900
7	Unsigned-8	Event Hour
8	Unsigned-8	Event Minute
9	Unsigned-8	Event Second
10	Unsigned-8	Event Cause – See Table 7

Command-Specific Response Codes

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

10.21 Command #148: Read Maintenance Event Log

Read Maintenance Event Log as specified by the event log number. Event 0 is the most recent event. Event 1 is the one just before that and so forth.

Request Data Bytes

Byte	Format	Description
None	N/A	N/A

Response Data Bytes

Byte	Format	Description
0 - 3	Unsigned-32	Event Running Time (in Seconds)
4 - 6	Date	Event Date – Day, Month, Year – 1900
7	Unsigned-8	Event Hour
8	Unsigned-8	Event Minute
9	Unsigned-8	Event Second
10	Unsigned-16	Event Cause – See Table 8

Command-Specific Response Codes

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

10.22 Command #149: Set Clock

Set the internal real-time clock.

Request Data Bytes

Byte	Format	Description
0 – 2	Date	Date in Day, Month, Year-1900
3	Unsigned-8	Hours
4	Unsigned-8	Minutes
5	Unsigned-8	Seconds

Response Data Bytes

Byte	Format	Description
0 – 2	Date	Date in Day, Month, Year-1900
3	Unsigned-8	Hours
4	Unsigned-8	Minutes
5	Unsigned-8	Seconds

Command-Specific Response Codes

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

10.23 Command #150: Read Clock

Read the internal real-time clock setting.

Request Data Bytes

Byte	Format	Description
0	N/A	N/A

Response Data Bytes

Byte	Format	Description
0 – 2	Date	Date in Day, Month, Year-1900
3	Unsigned-8	Hours
4	Unsigned-8	Minutes
5	Unsigned-8	Seconds

Command-Specific Response Codes

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

10.24 Command #151: Set Run Time Meter

Set the internal run time meter.

Request Data Bytes

Byte	Format	Description
0 - 3	Unsigned-32	Run Time Meter Value

Response Data Bytes

Byte	Format	Description
0 - 3	Unsigned-32	Run Time Meter Value

Command-Specific Response Codes

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

10.25 Command #152: Read Run Time Meter

Read the internal run time meter.

Request Data Bytes

Byte	Format	Description
0	N/A	N/A

Response Data Bytes

Byte	Format	Description
0 - 3	Unsigned-32	Run Time Meter Value

Command-Specific Response Codes

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

10.26 Command #153: Read Power Cycle Flag

Read the Power cycle flag. This flag is set equal to one whenever the power is cycled to the unit. When the clock is set via either by command number 149 or 151, this flag is reset to zero.

Request Data Bytes

Byte	Format	Description
0	N/A	N/A

Response Data Bytes

Byte	Format	Description
0	Unsigned-8	Power Cycled Flag Value

Command-Specific Response Codes

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

10.27 Command #154: Set Event Log Index

Set the Event Log Index to a specified value. This index is used by commands 145, 146, 147, & 148 to retrieve the event information stored in the instrument. The events are accumulated automatically by the instrument. The most recent event to have occurred is event #0. The next most recent event to have occurred is event # 1. The least recent event is event # 9.

Request Data Bytes

Byte	Format	Description
0	Unsigned-8	Event Index

Response Data Bytes

Byte	Format	Description
0	Unsigned-8	Event Index

Command-Specific Response Codes

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

10.28 Command #155: Read Event Log Index

Read the Event Log Index to a specified value. This index is used by commands 145, 146, 147, & 148 to retrieve the event information stored in the instrument. The events are accumulated automatically by the instrument. The most recent event to have occurred is event #0. The next most recent event to have occurred is event # 1. The least recent event is event # 9.

Request Data Bytes

Byte	Format	Description
0	N/A	N/A

Response Data Bytes

Byte	Format	Description
0	Unsigned-8	Event Index

Command-Specific Response Codes

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

10.29 Command #156: Read Remote Alarm Test Mode

Read the Remote Alarm Test Mode. A value of 0 indicates normal mode. A value of 1 indicates that the unit is in alarm test mode.

Request Data Bytes

Byte	Format	Description
0	N/A	N/A

Response Data Bytes

Byte	Format	Description
0	Unsigned-8	Remote Alarm Test Mode

Command-Specific Response Codes

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

10.30 Command #157: Set Warning Relay Latched Status

This sets the warning relay to either latched or un-latched. If the DIP override flag is set, then the command will return an ACCESS RESTRICTED code.

Request Data Bytes

Byte	Format	Description
0	Unsigned-8	Relay setting: 1 = latched, 0 = un-latched

Response Data Bytes

Byte	Format	Description
0	Unsigned-8	Relay setting: 1 = latched, 0 = un-latched

Command-Specific Response Codes

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

10.31 Command #158: Read Warning Relay Latched Status

This reads the latched status of the warning relay.

Request Data Bytes

Byte	Format	Description
0	N/A	N/A

Response Data Bytes

Byte	Format	Description
0	Unsigned-8	Relay setting: 1 = latched, 0 = un-latched

Command-Specific Response Codes

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

10.32 Command #159: Set Warning Relay De-Energized/Energized Status

This sets the warning relay to either De-Energized or Energized. If the DIP override flag is set, then the command will return an ACCESS RESTRICTED code.

Request Data Bytes

Byte	Format	Description
0	N/A	N/A

Response Data Bytes

Byte	Format	Description
0	Unsigned-8	Relay setting: 1 = Energized, 0 = De-Energized

Command-Specific Response Codes

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

10.33 Command #160: Read Warning Relay De-Energized/Energized Status

This reads the Energized/De-Energized status of the warning relay.

Request Data Bytes

Byte	Format	Description
0	N/A	N/A

Response Data Bytes

Byte	Format	Description
0	Unsigned-8	Warning Relay Status: 1 = Energized, 0 = De-Energized

Command-Specific Response Codes

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

10.34 Command #161: Set Alarm Relay Latched Status

This sets the alarm relay to either latched or un-latched. If the DIP override flag is set, then the command will return an ACCESS RESTRICTED code.

Request Data Bytes

Byte	Format	Description
0	Unsigned-8	Alarm Relay Status: 1 = Latched, 0 = Unlatched

Response Data Bytes

Byte	Format	Description
0	Unsigned-8	Alarm Relay Status: 1 = Latched, 0 = Unlatched

Command-Specific Response Codes

Code	Class	Description
0	Success	No Command-Specific Errors
1 - 15		Undefined
16	Error	Write Protect Mode
17 - 127		Undefined

10.35 Command #162: Read Alarm Relay Latched Status

Read the Remote Alarm Test Mode. A value of 0 indicates normal mode. A value of 1 indicates that the unit is in alarm test mode.

Request Data Bytes

Byte	Format	Description
0	N/A	N/A

Response Data Bytes

Byte	Format	Description
0	Unsigned-8	Alarm Relay Status: 1 = Latched, 0 = Unlatched

Command-Specific Response Codes

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

10.36 Command #163: Set Alarm Relay De-Energized/Energized Status

This sets the alarm relay status to be either De-Energized or Energized. If the DIP override flag is set, then the command will return an ACCESS RESTRICTED code.

Request Data Bytes

Byte	Format	Description
0	Unsigned-8	Alarm Relay Status: 1 = Energized, 0 = De-Energized

Response Data Bytes

Byte	Format	Description
0	Unsigned-8	Alarm Relay Status: 1 = Energized, 0 = De-Energized

Command-Specific Response Codes

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

10.37 Command #164: Read Alarm Relay De-Energized/Energized Status

This reads the Energized/De-Energized status of the alarm relay.

Request Data Bytes

Byte	Format	Description
0	N/A	N/A

Response Data Bytes

Byte	Format	Description
0	Unsigned-8	Alarm Relay Status: 1 = Energized, 0 = De-Energized

Command-Specific Response Codes

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

10.38 Command #165: Set Sensitivity Level

This sets the unit sensitivity. It may have the values of high, medium, or low. If the DIP override flag is set, then the command will return an ACCESS RESTRICTED code.

Request Data Bytes

Byte	Format	Description
0	Unsigned-8	Unit Sensitivity Level: 0 = High, 1 = Medium, 2 = Low

Response Data Bytes

Byte	Format	Description
0	Unsigned-8	Unit Sensitivity Level: 0 = High, 1 = Medium, 2 = Low

Command-Specific Response Codes

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

10.39 Command #166: Read Sensitivity Level

This reads the unit sensitivity. It may have values of high, medium, or low.

Request Data Bytes

Byte	Format	Description
0	N/A	N/A

Response Data Bytes

Byte	Format	Description
0	Unsigned-8	Unit Sensitivity Level: 0 = High, 1 = Medium, 2 = Low

Command-Specific Response Codes

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

10.40 Command #167: Read PV Mode

This reads the Primary Variable mode of the unit. It is the same as MODBUS register 0x01.

Request Data Bytes

Byte	Format	Description
0	N/A	N/A

Response Data Bytes

Byte	Format	Description
0	Unsigned-8	PV = replicate of MODBUS Reg 0x01

Command-Specific Response Codes

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

10.41 Command #168: Read Error Status

Read the Instrument Error Status. This is similar to MODBUS Register 0x02 except that the errors are prioritized as listed in the description.

Request Data Bytes

Byte	Format	Description
0	N/A	N/A

Response Data Bytes

Byte	Format	Description
0	Unsigned-8	Error Status: 0 = No Error, 1 = Low Voltage, 2 = COPM Fault, 3 = Reset Line Shorted, 4 = FLASH Error.

Command-Specific Response Codes

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

10.42 Command #169: Read Line Voltage

Read the Line Voltage. This is the voltage as seen at the CPU input measured in Volts.

Request Data Bytes

Byte	Format	Description
0	N/A	N/A

Response Data Bytes

Byte	Format	Description
0 – 3	Float	Line Voltage in Volts
4	Enum	VOLTS

Command-Specific Response Codes

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

10.43 Command #170: Read Analog Voltage

This replicates the functionality of Command #2 for the AMS.

Request Data Bytes

Byte	Format	Description
0	N/A	N/A

Response Data Bytes

Byte	Format	Description
0 – 3	Float	Analog Output
4 - 7	Float	Analog Output as a percent of full scale

Command-Specific Response Codes

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

11.0 Tables

11.1 FlameGard 5 MSIR – Device Specific Commands Summary

The following Table 4 is a summary of the FlameGard 5 MSIR Device Specific Commands. The Reg values in the Meaning Column denote the corresponding MODBUS Register.

Table 4: FlameGard 5 MSIR – Device Specific Commands

Command Number	Byte Number	Meaning
Command 128		Read DIP Switch Override Reg 0x07
Command 129		Write DIP Switch Override Reg 0x07
Command 130		Read DIP Switch Settings Register 0x46
Command 131		Read Unit Options Reg 0x08
Command 132		Write Unit Options Register 0x08
Command 133	0	Read COPM Fault Status Reg 0x06
Command 133	1	COPM Counts sensor 1 Reg 0x0D
Command 133	2	COPM Counts sensor 2 Reg 0x0E
Command 133	3	COPM Counts sensor 3 Reg 0x0F
Command 133	4	COPM Counts sensor 4 Reg 0x10
Command 134		Clear COPM Faults Reg 0x13
Command 135		Remote Alarm Reset Reg 0x11
Command 136		Remote Alarm Test Reg 0x012
Command 137		Read Sensor Temperature Reg 0x14
Command 138		Set/Reset Test Lamp Test Mode Reg 0x5A
Command 139		Read Test Lamp Test Mode Reg 0x5A
Command 140		Read Alarm Delay Reg 0x5B
Command 141		Set Alarm Delay Reg 0x5B
Command 142		Test Lamp Time Stamp Reg 0x6A, 0x6B, 0x6C
Command 143		Read Event Logging Counters: Reg 0xA8, 0xB0, 0xB8, 0xC0
Command 144		Clear Event Logging Counters Reg 0xC1
Command 145		Read Warning Event Log Register
Command 146		Read Alarm Event Log Event Register
Command 147		Read Fault Event Log Register

Command Number	Byte Number	Meaning
Command 148		Read Maintenance Event Log Register
Command 149		Set Clock
Command 150		Read Clock
Command 151		Set Run Time Meter
Command 152		Read Run Time Meter
Command 153		Read Power Cycle Flag
Command 154		Set Event Log Index
Command 155		Read Event Log Index
Command 156		Read Remote Alarm Test Register
Command 157		Set Warning Relay Latched Status
Command 158		Read Warning Relay Latched Status
Command 159		Set Warning Relay De-Energized/Energized
Command 160		Read Warning Relay De-Energized/Energized
Command 161		Set Alarm Relay Latched Status
Command 162		Read Alarm Relay Latched Status
Command 163		Set Alarm Relay De-Energized/Energized
Command 164		Read Alarm Relay De-Energized/Energized
Command 165		Set Unit Sensitivity
Command 166		Read Unit Sensitivity
Command 167		Read PV Mode
Command 168		Read Error Status
Command 169		Read Line Voltage
Command 170		Read Analog Voltage

11.2 FlameGard 5 MSIR – Operating Mode - PV Values

The following Table 5 is a summary of the FlameGard 5 MSIR Operating Modes:

Table 5: FlameGard 5 MSIR - Operating Mode - PV Values

Operating Mode	Primary Variable Value in Decimal
Power-Up Delay	1
Warn Non-Latching Only	2
Warn and Alarm Non-latching	3

Operating Mode	Primary Variable Value in Decimal
Warn Latching Only, Alarm Off	4
Alarm Latching Only	5
Warn & Alarm Latching	6
Ready State	7
Alarm Test	10
COPM Fault Detected	11
Warn Latching, Alarm Non-latching, Alarm On	12
Test Lamp Cycle	13
Test Lamp Cycle – Fire	14

11.3 COPM Fault Register

The following Table 6 describes the COPM Faults as reported by Command #133:

Table 6: COPM Fault Register Values

Bits	Cause
0	Detector 1 is in fault
1	Detector 2 is in fault
2	Detector 3 is in fault
3	Detector 4 is in fault
7	At least one of the above detectors is in fault.

11.4 Fault Event Log – Cause Description

The following Table 7 describes the cause as reported by the read event log commands:

Table 7: Fault Event Log – Cause Description

Code	Cause
0	No Fault
1	Low Voltage Fault
2	COPM Fault
3	Reset Short
4	Checksum error

11.5 Maintenance Event Log – Cause Description

The following Table 8 describes the cause as reported by the read event log commands:

Table 8: Maintenance Event Log – Cause Description

Bits	Cause
0	Test Lamp Successful Calibrate
1 – 15	N/A

11.6 DIP Switch Settings Register

The following Table 9 describes the description of the unit options registers:

Table 9: DIP Switch Settings Register Description

#	Option	Off/Open = 0	On/Closed = 1
1	High Sensitivity	1 and 2	
2	Medium Sensitivity	2	1
3	Low Sensitivity	1	2
4	0-Second ALARM Time Delay		3 and 4
5	8-Second ALARM Time Delay	3	4
6	10-Second ALARM Time Delay	3 and 4	
7	14-Second ALARM Time Delay	4	3
8	ALARM Non-Latching	5	
9	ALARM Latching		5
10	WARN Non-Latching	6	
11	WARN Latching		6
12	ALARM Normally Energized		7
13	ALARM Normally De-Energized	7	
14	WARN Normally Energized		8
15	WARN Normally De-Energized	8	

11.7 Unit Options Settings Register

The following Table 10 describes the description of the unit options registers:

Table 10: Unit Options Settings

Off = 0, On = 1, De = De-energized, En = Energized, La = Latched, NL = Non-Latched

	Warn	Alarm	Warn	Alarm	Delay	Delay	Sensitivity	Sensitivity
Bit	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**
OFF= 0	**De**	**De**	**NL**	**NL**				
ON =1	**En**	**En**	**La**	**La**				

Delay Settings

Time	Bit 4	Bit 3
0 sec	**ON**	**ON**
8 sec	**ON**	**OFF**
10 sec	**OFF**	**OFF**
14 sec	**OFF**	**ON**

Sensitivity Settings

Sensitivity	Bit 2	Bit 1
High	**OFF**	**OFF**
Medium	**OFF**	**ON**
Low	**ON**	**OFF**
Undefined	**ON**	**ON**

12.0 Performance

12.1 Sampling Rates

The FlameGard 5 MSIR Flame Detector samples each detector at 10 msec intervals.

12.2 Power-up

On power up, the FlameGard 5 MSIR Flame Detector executes a self-test procedure, which requires approximately 15 seconds. During this time, the analog output is set to 3.5mA. After the self-test is satisfactorily completed, the unit sets the PV to a value representing the mode of the instrument.

12.3 Device Reset

The FlameGard 5 MSIR Flame Detector cannot be reset by any command. The unit only resets when power is cycled.

12.4 Self-Test

The FlameGard 5 MSIR Flame Detector goes through a self-test upon power cycle. Should any of the tests fail, the unit immediately reports a fault condition.

12.5 Command Response Delay

The FlameGard 5 MSIR Flame Detector responds as follows:

Table 11: Command Response Times

Response Type	Response Time
Minimum	20ms
Typical	50ms
Maximum	100ms

12.6 Busy and Delayed-Response

The FlameGard 5 MSIR Flame Detector does not use delayed-response times.

12.7 Long Messages

The largest data field used by the FlameGard 5 MSIR Flame Detector is in response to Command 21: 34 bytes including the two status bytes.

12.8 Non-Volatile Memory

The FlameGard 5 MSIR Flame Detector uses EEPROM to hold the device's configuration parameters. New data is written to this memory immediately on execution of a write command.

12.9 Operating Modes

The FlameGard 5 MSIR reports flame detection by setting the instrument in a series of different modes.

12.10 Write Protection

The FlameGard 5 MSIR does not support any write protection mode.

13.0 Annex A. Capability Checklist

Table 12: Capability Checklist

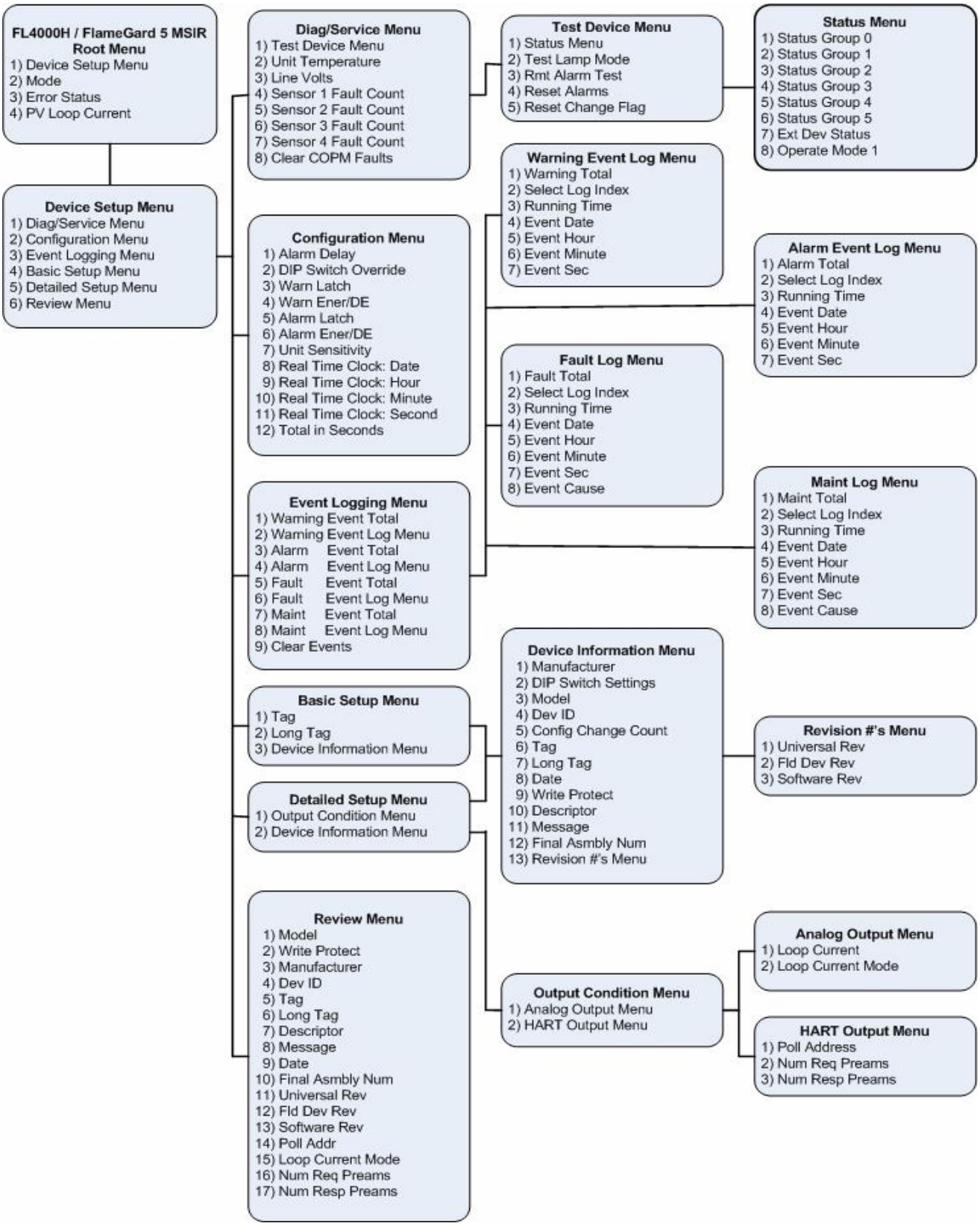
Manufacturer, model, and revision	**General Monitors, Inc. FlameGard 5 MSIR Flame Detector**
Device type	Infrared Flame Detector
HART revision	6.0
Device Description available	Yes
Number and type of sensors	4 Internal
Number and type of actuators	0
Number and type of host side signals	1: 4 – 20mA analog
Number of Device Variables	0
Number of Dynamic Variables	1
Mappable Dynamic Variables?	No
Number of common-practice commands	3
Number of device-specific commands	15
Bits of additional device status	8
Alternative operating modes?	No
Burst mode?	No
Write-protection?	Mfg Only

14.0 Annex B. Default Configuration

Table 13: Default Configuration

Parameter	Default value
Lower Range Value	N/A
Upper Range Value	N/A
PV Units	FlameGard 5 MSIR Operating Mode
Sensor type	Pyroelectric Infrared
Number of wires	3
Damping time constant	N/A
Fault-indication jumper	N/A
Write-protect jumper	N/A
Number of response preambles	5

15.0 Annex C. Device Descriptor Language Menu



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