# GM

## General Monitors

### by MSA

# MODEL IR5500

Infrared Open Path Gas Detector
HART Field Device
Specification

**Instruction Manual**         **12-15**

**Part No.**         **MANIR5500H**
**Revision**         **B/12-15**

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# 1.0 Introduction

## 1.1 Scope

The IR5500 Monitor System 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.

## 1.2 Purpose

This specification is designed to complement the IR5500 Instruction Manual by providing a complete description of this field device from a HART Communications perspective. This specification is designed to be a technical reference for HART capable host application developers, system integrators, and knowledgeable end users.

## 1.3 References

| DOCUMENT NAME | DOCUMENT RELATIONSHIP |
|---|---|
| HART Communications Protocol Specifications | This is used to insure compliance with the HART Communication Protocol. |
| IR5500 Instruction Manual | This is the General Monitors, Inc. IR5500 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 | IR5500 |
|---|---|---|---|
| HART ID Code | 223 (DF Hex) | Device Type Code: | 135 (87 Hex) |
| HART Protocol Revision | 6.0 | Device Revision: | 1 |
| Number of Device Variables | 0 | | |
| Physical Layers Supported | 1 | | |
| Physical Device Category | FSK | | |

# 3.0 Product Overview

The Model IR5500 Infrared Open Path System is a microprocessor-based hydrocarbon gas detector (Figure 13). The system consists of an IR Source unit and a Receiver unit that may be placed from 5-150 meters apart. The General Monitors Model IR5500 is calibrated at the factory and needs no further calibration. The sensitivity of the Model IR5500 can be checked by placing a Test Gas Filter in front of the Receiver unit. It is also relatively maintenance free, requiring only a periodic cleaning of the windows to assure dependable performance. The Model IR5500 Infrared Open Path System continuously monitors

hydrocarbon gases in both the 0 to 5000 ppm•meter and 0 to 5 LEL•meter range for methane. It provides two 4 to 20 mA analog signals proportional to each of the above ranges, in addition to a digital display and an A3 (LEL•meters-Alarm), A2 (LEL•meters-Warn), A1 (ppm•meters-Warn) and FAULT relay contacts.

# 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*

**4.2    Host Interface**

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

*4.2.1    Analog Output: Lower Explosive Limit Meter (LEL.m)*

The primary variable is proportional to the lower explosive limit meter. A 4.0 mA output current corresponds to zero LEL.m. 20.0 mA output current corresponds to 100 of full scale.

**4.3    Local Interfaces, Jumpers, and Switches**

Refer to the Installation Manual for connection details.

*4.3.1    Local Controls and Displays*

Local controls and displays are described in the IR5500 User Manual

*4.3.2    Internal Jumpers and Switches*

There are no internal jumpers or switches in the IR5500 unit.

# 5.0 Device Variables

There are no device variables exposed to the user.

# 6.0 Dynamic Variables

There are there Dynamic Variables exposed to the user.

**6.1    Primary Variable = Lower Explosive Limit Meter (LEL.m)**

The primary variable is proportional to the lower explosive limit. A 4.0 mA output current corresponds to zero LEL. 20.0 mA output current corresponds to 100% of full scale.

**6.2    Secondary Variable = Gas Reading in Part per Million Meter (ppm.m)**

Detected gas in ppm.m.

**6.3    Tertiary and Quaternary Variables = Analog Output (mA)**

The secondary variable is proportional to the part per million meter. A 4.0 mA output current corresponds to zero ppm.m. 20.0 mA output current corresponds to 100 of full scale.

**6.4    Quaternary Variables: Not Applicable**

There are none defined for the IR5500 product.

## 7.0 Status Information

The priority error, which is returned via bytes 0 and 1 of Common Practice Command #48, is shown in Table 2.

**Table 2: Error Status Information**

| Byte | Bit | Description | Class | Device Status Bits Set |
|------|-----|-------------|-------|------------------------|
| LSB | 0 | IR Close to Low | Error | 4,7 |
| | 1 | Dirty Lens | Error | 4,7 |
| | 2 | IR is Low | Error | 4,7 |
| | 3 | IR is High | Error | 4,7 |
| | 4 | Wire Shorted | Error | 4,7 |
| | 5 | Low Line Voltage | Error | 4,7 |
| | 6 | Failed to Calibrate | Error | 4,7 |
| | 7 | Failed to Zero | Error | 4,7 |
| MSB | 0 | Gas Check Timeout | Error | 4,7 |
| | 1 | Over Temperature | Error | 4,7 |
| | 2 | XMTR Fault | Error | 4,7 |
| | 3 | Heater Fault | Error | 4,7 |
| | 4 | Setup Menu Fault | Error | 4,7 |
| | 5 | Misc. Fault | Error | 4,7 |
| | 6 | Excess Negative Drift | Error | 4,7 |
| | 7 | NVM Checksum Error | Error | 4,7 |

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, the primary variable, the secondary variable and the tertiary variable for a total of 19 bytes returned. Command 9 returns the PV, the SV and TV.

# 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:

| Command Number | Byte Number | Meaning |
|---|---|---|
| Command 38 | N/A | Reset Configuration Changed Flag. |
| Command 48 | 0 | Returns Priority Error Status, High Byte (See Fault table 3). |
| Command 48 | 1 | Returns Priority Error Status, Low Byte (See Fault table 3). |
| Command 48 | 2 | Returns Error Status High Byte (See Fault table 3). |
| Command 48 | 3 | Returns Error Status Low Byte (See Fault table 3). |
| Command 48 | 4 | Returns Power Cycled Flag |
| Command 48 | 5 | Returns Event Happened Flag |
| Command 48 | 6 | Value = 0: All OK; Bit 0: Maintenance Required; Bit 1:  Fault |
| Command 48 | 7 | Returns 0 |

**Table 3: IR5500 – Supported Common Practice Commands**

### 9.2 Burst Mode

The IR5500 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 IR5500 and at the discretion of General Monitors. They are described here in section 10.0 and are summarized in Table 4

### Command #131: Do Abort

This sends a command to set active head to run mode.

Request Data Bytes

| Byte | Format | Description |
|------|--------|-------------|
| 0 | N/A | N/A |

Response Data Bytes

| Byte | Format | Description |
|------|--------|-------------|
| 0 | N/A | N/A |

Command-Specific Response Codes

| Code | Class | Description |
|------|-------|-------------|
| 0 | Success | No Command-Specific Errors |
| 1 - 5 | | Undefined |
| 6 | Error | Device Specific Command |
| 7 - 127 | | Undefined |

### Command #136: Set Alarm LEL.m Hi Level

This sets the Alarm Hi level for LEL.m

Request Data Bytes

| Byte | Format | Description |
|------|--------|-------------|
| 0 | Unsigned-8 | Alarm Hi level, % of FS |

Response Data Bytes

| Byte | Format | Description |
|------|--------|-------------|
| 0 | Unsigned-8 | Alarm Hi level, % of FS |

Command-Specific Response Codes

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

| Code | Class | Description |
|------|-------|-------------|
| 6 – 127 | N/A | Undefined |

### Command #137: Set Alarm LEL.m Lo (Warn) Level

This sets the Alarm Lo (Warn) level for LEL.m

Request Data Bytes

| Byte | Format | Description |
|------|--------|-------------|
| 0 | Unsigned-8 | Alarm Lo (warn) level, % of FS |

Response Data Bytes

| Byte | Format | Description |
|------|--------|-------------|
| 0 | Unsigned-8 | Alarm Lo (warn) level, % of FS |

Command-Specific Response Codes

| Code | Class | Description |
|------|-------|-------------|
| 0 | Success | No Command-Specific Errors |
| 1 – 2 | N/A | Undefined |
| 3 | Error | Passed Parameter Too Large |
| 4 | Error | Passed Parameter Too Small |
| 5 | Error | Too Few Data Bytes Received |
| 6 – 127 | N/A | Undefined |

### Command #138: Set Alarm ppm.meter Level

This command set Alarm ppm.m level

Request Data Bytes

| Byte | Format | Description |
|------|--------|-------------|
| 0 | Unsigned-8 | Alarm ppm.m level |

Response Data Bytes

| Byte | Format | Description |
|------|--------|-------------|
| 0 | Unsigned-8 | Alarm ppm.m level |

Command-Specific Response Codes

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

| Code | Class | Description |
|------|-------|-------------|
| 6 – 127 | N/A | Undefined |

### Command #139: Reset Alarms

This resets latching alarms.

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 |

### Command #141: Set Relay (Alarm) Configuration

This sets relay or alarm configuration.

Request Data Bytes

| Byte | Format | Description |
|------|--------|-------------|
| 0 | Unsigned-8 | Alarm LEL Hi  Relay La/nL: 0 – nL, 1 - LA |
| 1 | Unsigned-8 | Alarm LEL Hi Relay En/dE:  0 – dE, 1 - En |
| 2 | Unsigned-8 | Alarm LEL Lo  Relay La/nL: 0 – nL, 1 - LA |
| 3 | Unsigned-8 | Alarm LEL Lo Relay En/dE:  0 – dE, 1 - En |
| 4 | Unsigned-8 | Alarm ppm  Relay La/nL: 0 – nL, 1 - LA |
| 5 | Unsigned-8 | Alarm ppm Relay En/dE:  0 – dE, 1 - En |

Response Data Bytes

| Byte | Format | Description |
|------|--------|-------------|
| 0 | Unsigned-8 | Alarm LEL Hi  Relay La/nL: 0 – nL, 1 - LA |
| 1 | Unsigned-8 | Alarm LEL Hi Relay En/dE:  0 – dE, 1 - En |
| 2 | Unsigned-8 | Alarm LEL Lo  Relay La/nL: 0 – nL, 1 - LA |
| 3 | Unsigned-8 | Alarm LEL Lo Relay En/dE:  0 – dE, 1 - En |
| 4 | Unsigned-8 | Alarm ppm  Relay La/nL: 0 – nL, 1 - LA |

| 5 | Unsigned-8 | Alarm ppm Relay En/dE:  0 – dE, 1 - En |
|---|---|---|

Command-Specific Response Codes

| Code | Class | Description |
|---|---|---|
| 0 | Success | No Command-Specific Errors |
| 1 - 4 | | Undefined |
| 5 | Error | Too Few Data Bytes Received |
| 6 - 127 | | Undefined |

## Command #142: Reset Event Happened flag

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 - 15 | | Undefined |
| 16 | Error | Access Restricted |
| 17 - 127 | | Undefined |

## Command #143: Read Event Logging Counters

Reads the 5 event logging counters.

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 |
| 8 - 9 | Unsigned-16 | Calibrate Event Counter |

Command-Specific Response Codes

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

### Command #144: Clear Event Logging Counters

This resets the 5 event logging counters in the active head to zero.

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 |

### Command #145: Read Warning Event Log

This reads 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 |

| 10,11 | Unsigned- 16 | N/A (Head Number) |
|-------|--------------|-------------------|
| 12,13 | Unisigned-16 | Warning Code: 0 -LEL Warn, 1 - ppm Warn |

Command-Specific Response Codes

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

### Command #146: Read Alarm Event Log

This reads 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 |
| 10,11 | Unsigned- 16 | 0 |
| 12,13 | Unisigned-8 | Reserved = 0 |

Command-Specific Response Codes

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

### Command #147: Read Fault Event Log

This reads 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 |
| 10-11 | Unsigned-16 | 0 |
| 12-13 | Unsigned-16 | Event Cause – See device specific table |

Command-Specific Response Codes

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

**Command #148: Read Maintenance Event Log**

This reads 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 | Unsigned-8 | Event Log Number |
| 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 |
| 10-11 | Unsigned-16 | 0 |
| 12-13 | Unsigned-16 | Maintenance Code: 0 – Gas Check, 3 - Alignment |

Command-Specific Response Codes

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

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**Command #149: Set Clock**

This sets the internal real-time clock.

Request Data Bytes

| Byte | Format | Description |
|------|--------|-------------|
| 0 – 2 | Date | Date: 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: 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 - 4 | | Undefined |
| 5 | Error | Too Few Data Bytes Received |
| 6 - 127 | | Undefined |

**Command #150: Read Clock**

This reads 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: 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 |

### Command #151: Set Run Time Meter

This sets 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 - 4 | | Undefined |
| 5 | Error | Too Few Data Bytes Received |
| 6 - 127 | | Undefined |

### Command #152: Read Run Time Meter

This reads 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 |

**Command #154: Set Event Index**

This sets the index of logged event to read.    0 – latest event

Request Data Bytes

| Byte | Format | Description |
|------|--------|-------------|
| 0 | Unsigned-8 | Sets index of logged event to read using commands 143 – 146. Range 0 – 9. |

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 - 2 | | Undefined |
| 3 | Error | Passed Parameter Too Large |
| 4 | | Undefined |
| 5 | Error | Too Few Data Bytes Received |
| 6 - 127 | | Undefined |

**Command #155: Read Event Index**

This reads event logged index.

Request Data Bytes

| Byte | Format | Description |
|------|--------|-------------|
| None | 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 |

**Command #156: Read Calibration Event Log**

This reads 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 | Unsigned-8 | Event Log Number |
| 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 |
| 10-11 | Unsigned-16 | N/A |
| 12-13 | Unsigned-16 | Calibrate Code: 1 – Zero, 2 – Cal LEL, 3 – Cal ppm |

Command-Specific Response Codes

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

**Command #163: Read Fast Changing Information**

This reads the fast changing information from the active head.

Request Data Bytes

| Byte | Format | Description |
|------|--------|-------------|
| None | N/A | N/A |

Response Data Bytes

| Byte | Format | Description |
|------|--------|-------------|
| 0 - 1 | Unsigned-16 | Mode |
| 2 - 3 | Unsigned-16 | Sub Mode |
| 4 – 7 | Float | Primary Analog Output (reflect to % LEL.m level) |
| 8 – 9 | Unsigned-16 | Priority fault |
| 10 – 11 | Bit map | Error status |
| 12 | Unsigned-8 | Alarm status : 0 – off, 1 – on |

| 13 | Unsigned-8 | Warn status : 0 – off, 1 – on |
| --- | --- | --- |
| 14 | Unsigned-8 | Alarm ppm status : 0 – off, 1 – on |
| 15 | Unsigned-8 | Power cycled flag |
| 16 | Unsigned-8 | Event happened flag |
| 17-20 | Integer-8 | % of FS |
| 21-24 | Integer-32 | ppm level |
| 25 | Unsigned-8 | Reserved = 0 |
| 26-29 | Float | Secondary Analog Output (reflect to ppm.m ) |
| 30-31 | Unsigned -16 | AJ Number |

Command-Specific Response Codes

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

### Command #164: Read Slow Changing Information

Request slow changing information from the active head.

| Byte | Format | Description |
| --- | --- | --- |
| None | N/A | N/A |

Response Data Bytes

| Byte | Format | Description |
| --- | --- | --- |
| 0 - 1 | signed-16 | Temperature |
| 2 - 5 | float | Voltage |
| 6 - 7 | signed-16 | % blockage or gain |

Command-Specific Response Codes

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

### Command #165: Read Setup Information

Request setup information from the active head.

Request Data Bytes

| Byte | Format | Description |
| --- | --- | --- |
| None | N/A | N/A |

Response Data Bytes

| Byte | Format | Description |
|------|--------|-------------|
| 0 | Unsigned-8 | Gas ID  100: Methane NFPA  101: Propane NFPA  114: Methane IEC  115: Propane IEC |
| 1 | Enumerated | Measured Units – 240 Factory defined for LEL.m |
| 2 - 5 | Unsigned-32 | Full Scale |
| 6 | Unsigned-8 | Alarm LEL.m level, % of FS |
| 7 | Unsigned-8 | Alarm LEL.m  Relay La/nL: 0 – nL, 1 - LA |
| 8 | Unsigned-8 | Alarm LEL.m Relay En/dE:  0 – dE, 1 - En |
| 9 | Unsigned-8 | Alarm Warn LEL.m level, % of FS |
| 10 | Unsigned-8 | Alarm Warn LEL.m  Relay La/nL: 0 – nL, 1 - LA |
| 11 | Unsigned-8 | Alarm Warn LEL.m Relay En/dE:  0 – dE, 1 - En |
| 12 | Unsigned-8 | Warn ppm.m level, % of FS |
| 13 | Unsigned-8 | Warn ppm.m Relay La/nL: 0 – nL, 1 - LA |
| 14 | Unsigned-8 | Warn ppm.m  Relay En/dE: 0 – dE, 1 - En |
| 15 | Unsigned-8 | Beam Block Delay Time |
| 16 | Unsigned-8 | AO Beam Block Delay Time |
| 17 | Unsigned-8 | Reserved = 0 |
| 18-19 | Unsigned-16 | Reserved = 0 |
| 20 | Unsigned-8 | 0 |
| 21 | Unsigned-8 | 0 |
| 22 | Unsigned-8 | Calibration Level = 50 |
| 23 | Unsigned-8 | 0 |
| 24 | Unsigned-8 | Current Range – 0: 3.5mA – 20mA ; 1: 1.25mA – 20mA |

Command-Specific Response Codes

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

**Command #166: Read System Firmware Rev**

This command read the system firmware revision

Request Data Bytes

| Byte | Format | Description |
|------|--------|-------------|
| None | N/A | N/A |

Response Data Bytes

| Byte | Format | Description |
|------|--------|-------------|
| 0 | Unsigned-8 | System Firmware Revision.  ASCII code |

Command-Specific Response Codes

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

### Command #167: Set Beam Block Delay

This sets the beam block delay time from 0 – 60 minutes.

Request Data Bytes

| Byte | Format | Description |
|------|--------|-------------|
| 0 | Unsigned-8 | Beam block delay time |

Response Data Bytes

| Byte | Format | Description |
|------|--------|-------------|
| 0 | Unsigned-8 | Beam block delay time |

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 - 127 | | Undefined |

### Command #168: Set Analog Output Beam Block Delay

This sets the current beam block delay time from 0 – 60 seconds.

Request Data Bytes

| Byte | Format | Description |
|------|--------|-------------|
| 0 | Unsigned-8 | AO beam block delay time |

Response Data Bytes

| Byte | Format | Description |
|------|--------|-------------|
| 0 | Unsigned-8 | AO beam block delay time |

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 - 127 | | Undefined |

**Command #170: Set Current Range**

This sets the current range to be either one of 2 possible selections.

Request Data Bytes

| Byte | Format | Description |
|---|---|---|
| 0 | Unsigned-8 | 0 – Range 3.5mA - 20mA,  1 -- Range 1.25 - 20mA |

Response Data Bytes

| Byte | Format | Description |
|---|---|---|
| 0 | Unsigned-8 | 0 – Range 3.5mA - 20mA,  1 -- Range 1.25 - 20mA |

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 - 127 | | Undefined |

**Command #191: End Alignment**

This sends a request to the end alignment.

Request Data Bytes

| Byte | Format | Description |
|---|---|---|
| 0 | N/A | N/A |

Response Data Bytes

| Byte | Format | Description |
|---|---|---|
| 0 | N/A | N/A |

Command-Specific Response Codes

| Code | Class | Description |
|---|---|---|
| 0 | Success | No Command-Specific Errors |
| 1 - 5 | | Undefined |
| 6 | Error | Device Specific Command Error |
| 5 - 15 | | Undefined |
| 16 | Error | Access Restricted |
| 17 - 127 | | Undefined |

### Command #195: Do Gas Check

This sends a request to the active unit to put the unit to Gas Check mode.

Request Data Bytes

| Byte | Format | Description |
|---|---|---|
| 0 | N/A | N/A |

Response Data Bytes

| Byte | Format | Description |
|---|---|---|
| 0 | N/A | N/A |

Command-Specific Response Codes

| Code | Class | Description |
|---|---|---|
| 0 | Success | No Command-Specific Errors |
| 1 - 2 | | Undefined |
| 3 | Error | Parameter too Large |
| 4 | Error | Parameter too Small |
| 5 - 15 | | Undefined |
| 16 | Error | Access Restricted |
| 17 - 127 | | Undefined |

### Command #197: Do Align

This sends a request to the active unit to put the unit to Align mode.

Request Data Bytes

| Byte | Format | Description |
|---|---|---|
| 0 | N/A | N/A |

Response Data Bytes

| Byte | Format | Description |
|---|---|---|
| 0 | N/A | N/A |

Command-Specific Response Codes

| Code | Class | Description |
|---|---|---|
| 0 | Success | No Command-Specific Errors |
| 1 – 2 | | Undefined |
| 3 | Error | Parameter too Large |
| 4 | Error | Parameter too Small |
| 5 – 15 | | Undefined |
| 16 | Error | Access Restricted |
| 17 – 127 | | Undefined |

# 11.0  Tables

## 11.1  IR5500 – Device Specific Commands Summary

The following Table 4 is a summary of the IR5500 Device Specific Commands. The Reg values in the Meaning Column denote the corresponding Modbus Register.

**Table 4: IR5500 – Device Specific Commands**

| Command Number | Byte Number | Meaning |
|---|---|---|
| 131 | | Do Abort |
| 136 | | Set Alarm LEL.m Hi Level |
| 137 | | Set Alarm LEL.m Lo (Warn) Level |
| 138 | | Set Alarm ppm.m Level |
| 139 | | Reset Alarms |
| 141 | | Set Relay (Alarm) Configuration |
| 142 | | Reset Event Happening Flag |
| 143 | | Read Event Logging Counters |
| 144 | | Clear Event Logging Counters |
| 145 | | Read Warning Event Log |
| 146 | | Read Alarm Event Log |
| 147 | | Read Fault Event Log |
| 148 | | Read Maintenance Log |
| 149 | | Set Clock |
| 150 | | Read Clock |
| 151 | | Set Run Time Meter |
| 152 | | Read Run Time Meter |
| 154 | | Set Event Index |
| 155 | | Read Event Index |
| 156 | | Read Calibration Event |
| 163 | | Read Fast Changing Information |
| 164 | | Read Slow Changing Information |
| 165 | | Read Setup Information |
| 166 | | Read System FW Rev. |
| 167 | | Set Beam Block Delay Time |
| 168 | | Set AO Beam Block Delay Time |
| 170 | | Set Current (AO) Range |
| 191 | | End Align |
| 195 | | Do Gas Check |
| 196 | | Do Align |

## 11.2  IR5500 – Operating Mode - PV Values

The following Table 5 is a summary of the IR5500 Operating Mode Values:

| Operating Mode | Value in Decimal |
|---|---|
| RUNNING | 1 |
| CALIBRATION | 2 |
| ZEROING | 4 |
| CAL IN PROCESS | 8 |

| Operating Mode | Value in Decimal |
|---|---|
| APPLY GAS | 16 |
| REMOVE GAS | 32 |
| STARTUP | 64 |
| TEMPERATURE CORRECTION | 128 |
| ALIGN MODE | 256 |
| GAS CHECK | 512 |
| ZERO / CAL | 1024 |

**Table 5: IR5500 - Operating Mode Values**

| Operating Sub-Mode | Value in Decimal |
|---|---|
| <blank> | 0 |
| ppm.m Warn | 1 |
| Warn | 2 |
| Warn & ppm.m Warn | 3 |
| Alarm | 4 |
| Alarm & ppm.m Warn | 5 |
| Alarm & Warn | 6 |
| Alarm, Warn & ppm.m Warn | 7 |

**Table 6: IR5500 - Operating Sub-Modes**

## 11.3  Fault Event Log – Cause Description
The following Table 7 describes the cause as reported by the read event log commands:

| Bits | Cause |
|---|---|
| 0x0000 | <none> |
| 0x0001 | CLOSE TO LOW IR |
| 0x0002 | DIRTY LENS |
| 0x0004 | LOW IR |
| 0x0008 | HIGH IR |
| 0x0010 | WIRE SHORTED |
| 0x0020 | LOW LINE VOLTS |
| 0x0040 | FAILED TO CALIBRATE |
| 0x0080 | FAILED TO ZERO |
| 0x0100 | GAS CHECK TIME OUT |
| 0x0200 | OVER TEMPERATURE |
| 0x0400 | XMTR FAULT |
| 0x0800 | HEATER FAILURE |
| 0x1000 | FAILED SET UP MENU |
| 0x2000 | MISC. FAULT |
| 0x4000 | EXCESS NEGATIVE DRIFT |
| 0x8000 | NVM CHECKSUM FAULT |

**Table 7: Fault Event Log – Cause Description Performance**

## 11.4  Sampling Rates
The IR5500 samples each detector at 1 msec intervals.

**11.5 Power-up**
On power up, the IR5500 executes a self-test procedure (unit displays 'SU'), which requires approximately 2 minutes. During this time, the analog output is set to 1.25 or 3.5mA. After the self-test is satisfactorily completed, the unit sets the PV to a value representing the mode of the instrument.

**11.6 Device Reset**
The IR5500 cannot be reset by any command. The unit only resets when power is cycled.

**11.7 Self-Test**
The IR5500 goes through a self-test upon power cycle. Should any of the tests fail, the unit immediately reports a fault condition.

**11.8 Command Response Delay**
The IR5500 responds as follows:

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

**Table 8: Command Response Times**

**11.9 Busy and Delayed-Response**
The IR5500 does not use delayed-response times.

**11.10 Long Messages**
The largest data field used by the IR5500 is in response to Command 21: 34 bytes including the two status bytes.

**11.11 Non-Volatile Memory**
The IR5500 uses external NVM to hold the device's configuration parameters. New data is written to this memory immediately on execution of a write command.

**11.12 Operating Modes**
The IR5500 reports lower explosive limit meter (LEL.m) and part per million meter (ppm.m) detected. Various other modes are supported related to the calibration of the instrument.

**11.13 Write Protection**
The IR5500 does not support any write protection mode.

## Annex A. Capability Checklist

| Manufacturer, model, and revision | General Monitors, Inc., IR5500, Revision 1 |
|---|---|
| Device type | IR Open Path Gas Detector |
| HART revision | 6.0 |
| Device Description available | Yes |
| Number and type of sensors | 1 |
| Number and type of actuators | 0 |
| Number and type of host side signals | 2: 4 - 20mA analog |
| Number of Device Variables | 0 |
| Number of Dynamic Variables | 3 |
| Mappable Dynamic Variables? | No |
| Number of common-practice commands | 2 |
| Number of device-specific commands | 30 |
| Bits of additional device status | 8 |
| Alternative operating modes? | No |
| Burst mode? | No |
| Write-protection? | Mfg Only |

**Table 9: Capability Checklist**

## Annex B. Default Configuration

| Parameter | Default value |
|---|---|
| Lower Range Value | N/A |
| Upper Range Value | N/A |
| PV Units | LEL.m (Percent Lower Explosive Limit meter) |
| Secondary Units | ppm.m (Part Per Million meter) |
| Tertiary Units | mA |
| Sensor type | IR |
| Number of wires | 3 |
| Damping time constant | N/A |
| Fault-indication jumper | N/A |
| Write-protect jumper | N/A |
| Number of response preambles | 5 |

**Table 10: Default Configuration**

**General Monitors**
by MSA

# Annex B. DD menu diagram

**IR5500 Root Menu**
1) Device Setup Menu
2) Service Menu
3) Gas ID
4) LEL.m Full Scale
5) Mode
6) Sub Mode
7) Primary Variable
   (LEL.m)
8) Loop Current
9) Secondary Variable
   (PPM.m)
10) Tertiary Variable
    (second Ao for PPM.m)
11) Error Status

**Diagnostic Menu**
1) Supply Voltage
2) Unit Temperature
3) Beam Block
4) Power Cycle Flag
5) Error bits

**Warning Event Log Menu**
1) Warning Total
2) Select Log Index
3) Running Time
4) Event Date
5) Event Hour
6) Event Minute
7) Event Sec

**Alarm Event Log Menu**
1) Alarm Total
2) Select Log Index
3) Running Time
4) Event Date
5) Event Hour
6) Event Minute
7) Event Sec

**Device Setup Menu**
1) Diagnostic Menu
2) IR5500 Setup Menu
3) IR5500 Event Menu
4) Basic Setup Menu
5) Detailed Setup Menu
6) Review Menu

**IR5500 Setup Menu**
1) Warning LEL.m Level
2) Alarm LEL.m Level
3) Alarm PPM.m Level
4) Warning LEL.m Latch
5) Warning LEL.m DE/En
6) Alarm LEL.m Latch
7) Alarm LEL.m DE/En
8) Alarm PPM.m Latch
9) Alarm PPM.m DE/En
10) Beam Block Delay
11) Ao Beam Block Delay
12) Current Range
13) Real Time Clock: Date
14) Real Time Clock: Hour
15) Real Time Clock: Minute
16) Real Time Clock: Second
17) Total in Seconds

**Fault Log Menu**
1) Fault Total
2) Select Log Index
3) Running Time
4) Event Date
5) Event Hour
6) Event Minute
7) Event Sec
8) Event Cause

**Calibration Log Menu**
1) Cal. Total
2) Select Log Index
3) Running Time
4) Event Date
5) Event Hour
6) Event Minute
7) Event Sec
8) Event Cause

**Service Menu**
1) Gas Check, Menu
2) Alignment Menu
3) Reset Alarm

**IR5500 Event Log Menu**
1) Warn Event Total
2) Warn Event Log Menu
3) Alarm Event Total
4) Alarm Event Log Menu
5) Fault Event Total
6) Fault Event Log Menu
7) Maint Event Total
8) Maint Event menu
9) Calibration Event Total
10) Calibration Event Menu
11) Clear Events

**Maint Log Menu**
1) Maint Total
2) Select Log Index
3) Running Time
4) Event Date
5) Event Hour
6) Event Minute
7) Event Sec
8) Event Cause

**Gas Check Menu**
1) Gas Check
2) Abort
3) %LEL.m
4) PPM.m
5) Mode
6) Sub Mode
7) Error Status

**Device Information Menu**
1) Manufacturer
2) Model
3) Dev ID
4) Config Change Count
5) Tag
6) Long Tag
7) Date
8) Write Protect
9) Descriptor
10) Message
11) Final Asmbly Num
12) Revision #'s Menu

**Basic Setup Menu**
1) Tag
2) Long Tag
3) Device Information Menu

**Revision #'s Menu**
1) Universal Rev
2) Fld Dev Rev
3) Software Rev
4) System FW Rev

**Align Menu**
1) Align
2) aj Number
3) End Align
4) Mode
5) Sub Mode

**Detailed Setup Menu**
1) Output Condition Menu
2) Device Information Menu

**Review Menu**
1) Model
2) Write Protect
3) Manufacturer
4) Dev ID
5) Tag
6) Long Tag
7) Descriptor
8) Message
9) Date
10) Final Asmbly Num
11) Universal Rev
12) Fld Dev Rev
13) Software Rev
14) Poll Addr
15) Loop Current Mode
16) Num Req Preams
17) Num Resp Preams

**Output Condition Menu**
1) Analog Output Menu
2) HART Output Menu

**Analog Output Menu**
1) Loop Current
2) Loop Current Mode

**HART Output Menu**
1) Poll Address
2) Num Req Preams
3) Num Resp Preams