



General Monitors

by MSA

HART USER GUIDE FOR

OBSERVER-i

Ultrasonic Gas Leak Detector

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Instruction Manual

12-15

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1.0 INTRODUCTION

1.1 SCOPE

The HART configuration of the Observer-i ultrasonic gas leak 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 Observer-i 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. |
| Observer-i Instruction Manual | This is the Observer-i Product Instruction Manual. |

Table 1: Reference Documents

2.0 DEVICE IDENTIFICATION

The following Table 2 is the Field Device Identification Data for the instrument.

| Manufacturer's Name | MSA | Model Number | Observer-i |
|----------------------------|--------------|-------------------|--------------|
| HART ID Code | 223 (DF Hex) | Device Type Code: | 150 (96 Hex) |
| HART Protocol Revision | 6.0 | Device Revision: | 1 |
| Number of Device Variables | 0 | | |
| Physical Layers Supported | 1 | | |
| Physical Device Category | FSK | | |

Table 2: Field Device Identification Data

3.0 PRODUCT OVERVIEW

The Observer-i is an ultrasonic gas leak detector for detecting pressurized gas leaks. The Observer-i detects the gas leak by measuring the sound level and reports the measurement in decibel (dB).

3.1 GETTING STARTED

In order to enable HART communication with the Observer-i 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, allow operators to access information from the Observer-i. A typical setup is illustrated in Figure 1.

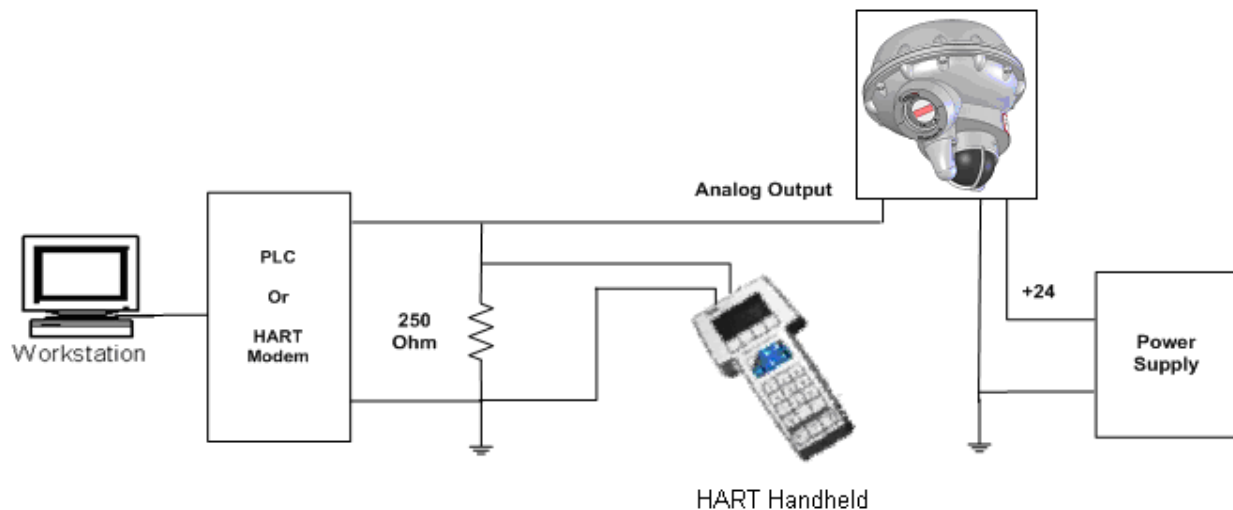


Figure 1: Connecting a PC to a HART Device

Once the detector is installed (see Observer-i Instruction Manual) and connected to a PC, host application, or handheld terminal, the master will begin communication to the Observer-i 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: The 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

A digital display provides indications and display codes that can be viewed through a window on the Observer-i. An analog signal (4-20 mA) and relays provide remote and/or discrete indications of the detector's operation.

4.2 HOST INTERFACE

The HART interface uses the 4-20 mA (analog output) current loop. Refer to the Observer-i Installation Manual for connection details.

4.2.1 Analog Output

The primary variable is proportional to the decibel (dB) sound pressure level (SPL). 4.0 mA output current corresponds to <40 dB. 20.0 mA output current corresponds to 120 dB.

4.3 LOCAL INTERFACES, JUMPERS, AND SWITCHES

4.3.1 Local Controls and Displays

Refer to the Observer-i Installation Manual for connection details.

4.3.2 Internal Jumpers and Switches

Refer to the Observer-i Installation Manual for connection details.

5.0 DEVICE VARIABLES

There are no device variables available to the user.

6.0 DYNAMIC VARIABLES

There is only one Dynamic Variable available to the user.

6.1 PRIMARY VARIABLE = DECIBEL (dB)

The primary variable (PV) is proportional to the decibel (dB) SPL. 4.0 mA output current corresponds to <40 dB. 20.0 mA output current corresponds to 120 dB.

6.2 SECONDARY, TERTIARY, AND QUATERNARY VARIABLES: NOT APPLICABLE

There are none defined for the Observer-*i* product.

7.0 ERROR/STATUS INFORMATION

The error status, which is returned via Common Practice Command #48, is shown in Table 3

| Byte | Bit | Description | Class | Device Status Bits Set |
|------|-----|-------------------------|--------|------------------------|
| 1 | 0 | Low Supply voltage | Error | 4,7 |
| | 1 | Not Used | Error | 4,7 |
| | 2 | Acoustic Error | Error | 4,7 |
| | 3 | Not Used | Error | 4,7 |
| | 4 | Remote Alarm Line Error | Error | 4,7 |
| | 5 | Remote Reset Line Error | Error | 4,7 |
| | 6 | Magnet Switch Error | Error | 4,7 |
| | 7 | Internal Voltage Error | Error | 4,7 |
| 0 | 8 | Memory Major Error | Error | 4,7 |
| | 9 | Memory User Error | Error | 4,7 |
| | 10 | Memory HART Error | Error | 4,7 |
| | 11 | Memory Event Error | Error | 4,7 |
| | 12 | Peak dB Low | Status | 4,7 |
| | 13 | Not Used | Error | 4,7 |
| | 14 | Not Used | Error | 4,7 |
| | 15 | Not Used | Error | 4,7 |

Table 3: Error/Status Information

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 4 are implemented:

| Command Number | Byte Number | Meaning |
|----------------|-------------|--|
| Command 38 | N/A | Reset Configuration Changed Flag |
| Command 48 | 0 | Returns Priority Fault, High Byte |
| Command 48 | 1 | Returns Priority Fault, Low Byte |
| Command 48 | 2 | Returns Error Status (same as Modbus register x02), High Byte |
| Command 48 | 3 | Returns Error Status (same as Modbus register x02), Low Byte |
| Command 48 | 4 | Returns Power Cycled Flag |
| Command 48 | 5 | Returns Event Happened Flag |
| Command 48 | 6 | Returns 0x01 = "Maintenance Required" or 0x02 = Alarm or Warning |
| Command 48 | 7 | Returns 0 |

Table 4: Observer-i Common Practice Commands

9.2 BURST MODE

The Observer-i does not support Burst Mode.

9.3 CATCH DEVICE VARIABLE

This Observer-i does not support Catch Device Variable.

10.0 DEVICE SPECIFIC COMMANDS

The Device Specific commands are used strictly for the unique features of the Observer-i and at the discretion of General Monitors, an MSA company. They are described here in Section 10.0 and are summarized in Table 5.

10.1 COMMAND #132: DO ALARM TEST

This command turns Alarm test mode on/off.

Request Data Bytes

| Byte | Format | Description |
|------|------------|-------------|
| 0 | Unsigned 8 | N/A |

Response Data Bytes

| Byte | Format | Description |
|------|------------|-------------|
| 0 | Unsigned 8 | 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 |

10.2 COMMAND #136: SET ALARM LEVEL

This command sets the Alarm Level.

Request Data Bytes

| Byte | Format | Description |
|------|------------|-------------------|
| 0 | Unsigned-8 | Alarm Level in dB |

Response Data Bytes

| Byte | Format | Description |
|------|------------|-------------------|
| 0 | Unsigned-8 | Alarm Level in dB |

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 | N/A | Undefined |
| 5 | Error | Too Few Data Bytes Received |
| 6 – 15 | N/A | Undefined |
| 16 | Error | Access Restricted |
| 17 – 127 | N/A | Undefined |

10.3 COMMAND #139: RESET ALARM

This command resets the latching Alarm relay.

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 |

10.4 COMMAND #141: SET ALARM RELAY CONFIGURATION

This command configures the relay settings.

Request Data Bytes

| Byte | Format | Description |
|------|------------|--------------------------------------|
| 0 | Unsigned-8 | Alarm Hi Relay La/nL: 0 – nL, 1 – LA |
| 1 | Unsigned-8 | Alarm Hi Relay En/dE: 0 – dE, 1 – En |

Response Data Bytes

| Byte | Format | Description |
|------|------------|--------------------------------------|
| 0 | Unsigned-8 | Alarm Hi Relay La/nL: 0 – nL, 1 – LA |
| 1 | Unsigned-8 | Alarm Hi Relay En/dE: 0 – dE, 1 – En |

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 |
| 16 | Error | Access Restricted |
| 17 – 127 | | Undefined |

10.5 COMMAND #142 RESET EVENT HAPPENED FLAG

This command resets the 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 |

10.6 COMMAND #143: READ EVENT LOGGING COUNTERS

This command reads five event logging counters.

Request Data Bytes

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

Response Data Bytes

| Byte | Format | Description |
|-------|-------------|---------------------------|
| 0 – 1 | Unsigned-16 | 0 |
| 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 |

10.7 COMMAND #144: CLEAR EVENT LOGGING COUNTERS

This command resets the 4 event logging counters to zero (Alarm, Fault, Calibration, and Maintenance events).

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 #146: READ ALARM EVENT LOG

This command reads the 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 | Unsigned-8 | Alarm Detected by: 0: by Classic Mode 1: by Enhanced Mode |
| 11 | Unsigned-8 | Peak dB during the Alarm |
| 12-13 | | Undefined |

Command-Specific Response Codes

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

10.9 COMMAND #147: READ FAULT EVENT LOG

This command reads the 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 | Event Cause – See device specific table |

Command-Specific Response Codes

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

10.10 COMMAND #148: READ MAINTENANCE EVENT LOG

This command reads the 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 |

| Byte | Format | Description |
|-------|------------|--|
| 8 | Unsigned-8 | Event Minute |
| 9 | Unsigned-8 | Event Second |
| 10-11 | Unsigned-8 | Reserved = 0 |
| 12-13 | Unsigned-8 | Code: 4 - Acoustic Test, 8 - Alarm Test and 9 - Piezo Calibrated |

Command-Specific Response Codes

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

10.11 COMMAND #149: SET CLOCK

This command 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 |

10.12 COMMAND #150: READ CLOCK

This command 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 |

10.13 COMMAND #151: SET RUN TIME METER

This command 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 |

| Code | Class | Description |
|---------|-------|-------------|
| 6 – 127 | | Undefined |

10.14 COMMAND #152: READ RUN TIME METER

This command 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 |

10.15 COMMAND #154: SET EVENT INDEX

This command 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, 145-148 and 156. 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 |

10.16 COMMAND #155: GET EVENT INDEX

This command reads the 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 |

10.17 COMMAND #156: READ CALIBRATION EVENT LOG

This command reads the Calibration 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 | Code: 4 - Cal. OK, 5 – Cal. Adjusted, 6 – Cal. Error. |

Command-Specific Response Codes

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

10.18 COMMAND #163: GET FAST CHANGING INFORMATION

This command is used to collect data from the Observer-*i*, which is likely to change at a very fast rate.

Request Data Bytes

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

Response Data Bytes

| Byte | Format | Description |
|---------|-------------|--|
| 0 – 1 | Unsigned-16 | Mode – Depends on Instrument |
| 2 – 3 | Unsigned-16 | Sub Mode – Depends on Instrument |
| 4 – 7 | Float | Analog Output |
| 8 – 9 | Unsigned-16 | Priority Fault (See Table 3: Error/Status Information) |
| 10 – 11 | Bit map | Error Status (in word) |
| 12 | Unsigned-8 | Alarm Hi Trigger Level |
| 13 | Unsigned-8 | N/A |
| 14 | Unsigned-8 | N/A |
| 15 | Unsigned-8 | Power Cycled flag |
| 16 | Unsigned-8 | Event Happened flag |
| 17 | Integer-8 | Decibel (dB) |

| | | |
|-------|-------|---------|
| 18-21 | Float | Peak dB |
|-------|-------|---------|

Command-Specific Response Codes

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

10.19 COMMAND #164: GET SLOW CHANGING INFORMATION

This command is used to collect data from the Observer-*i* which is likely to change at a very slow rate.

Request Data Bytes

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

Response Data Bytes

| Byte | Format | Description |
|-------|-----------|------------------|
| 0 - 1 | Signed-16 | Unit Temperature |
| 2 - 5 | Float | Supply Voltage |
| 6 - 7 | Signed-16 | Reserve |

Command-Specific Response Codes

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

10.20 COMMAND #165: GET SET UP INFORMATION

This command reads the setup information in the Observer-*i*.

Request Data Bytes

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

Response Data Bytes

| Byte | Format | Description |
|------|------------|-------------|
| 0 | Unsigned-8 | N/A |

| Byte | Format | Description |
|-------|-------------|---|
| 1 | Enumerated | N/A |
| 2- 5 | Unsigned-32 | Full Scale |
| 6 | Unsigned-8 | Alarm Hi level in dB |
| 7 | Unsigned-8 | Alarm Hi Relay La/nL: 0 – nL, 1 - LA |
| 8 | Unsigned-8 | Alarm Hi Relay En/dE: 0 – dE, 1 - En |
| 9 | Unsigned-8 | N/A |
| 10 | Unsigned-8 | N/A |
| 11 | Unsigned-8 | N/A |
| 12 | Unsigned-8 | N/A |
| 13 | Unsigned-8 | N/A |
| 14 | Unsigned-8 | N/A |
| 15 | Unsigned-8 | Alarm Delay Time |
| 16 | Unsigned-8 | N/A |
| 17 | Unsigned-8 | N/A |
| 18 | Unsigned-8 | N/A |
| 19-20 | Unsigned-16 | N/A |
| 21 | Unsigned-8 | Enhance Mode Analog Output: 1: Discrete SPL: 4-12mA, 16mA, 20mA 2: Discrete 4mA: 16mA, 20mA 3 : Full SPL : 40-20mA |
| 22 | Unsigned-8 | N/A |
| 23 | Unsigned-8 | N/A |
| 24 | Unsigned-8 | Current Range: 0= 3.5 – 20, 1=1.25 - 20 |

Command-Specific Response Codes

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

10.21 COMMAND #166: GET DEVICE FIRMWARE REVISION

This command reads the Observer-i 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 |

10.22 COMMAND #169: LOAD FACTORY DEFAULT SETTING

This command will load the factory default settings.

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 |

10.23 COMMAND #170: SET CURRENT RANGE

This command sets the 4-20mA analog output range.

Request Data Bytes

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

Response Data Bytes

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

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 |

10.24 COMMAND #171: SET DETECTION MODE

This command sets the Detection Mode.

Request Data Bytes

| Byte | Format | Description |
|------|------------|------------------------------------|
| 0 | Unsigned-8 | 0 – Classic Mode, 1 – Enhance Mode |

Response Data Bytes

| Byte | Format | Description |
|------|------------|------------------------------------|
| 0 | Unsigned-8 | 0 – Classic Mode, 1 – Enhance Mode |

Command-Specific Response Codes

| Code | Class | Description |
|-------|---------|----------------------------|
| 0 | Success | No Command-Specific Errors |
| 1 - 2 | | Undefined |
| 3 | Error | Passed Parameter Too Large |

| Code | Class | Description |
|---------|-------|-----------------------------|
| 4 | | Undefined |
| 5 | Error | Too Few Data Bytes Received |
| 6 - 127 | | Undefined |

10.25 COMMAND #172: SET ENHANCE MODE AO

This command sets the Analog output in Enhance Mode.

Request Data Bytes

| Byte | Format | Description |
|------|------------|---|
| 0 | Unsigned-8 | 1 – Discrete SPL (4-12mA for 40-120dB, 16mA for Warn, 20mA for Alarm) 2 – Discrete (4mA Stand by, 16mA for Warn and 20mA for Alarm) 3 – Full SPL (4 - 20mA for 40 to 120dB) |

Response Data Bytes

| Byte | Format | Description |
|------|------------|---|
| 0 | Unsigned-8 | 1 – Discrete SPL (4-12mA for 40-120dB, 16mA for Warn, 20mA for Alarm) 2 – Discrete (4mA Stand by, 16mA for Warn and 20mA for Alarm) 3 – Full SPL (4 - 20mA for 40 to 120dB) |

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 |

10.26 COMMAND #192: DO CALIBRATION

This command initiates calibration 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 - 15 | | Undefined |
| 16 | Error | Access Restricted |
| 17 - 127 | | Undefined |

10.27 COMMAND #195: DO ACOUSTIC TEST

This command initiates Acoustic Test 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 – 15 | | Undefined |
| 16 | Error | Access Restricted |
| 17 – 127 | | Undefined |

10.28 COMMAND #201: SET ALARM DELAY TIME

This command sets the alarm delay time.

Request Data Bytes

| Byte | Format | Description |
|------|------------|---|
| 0 | Unsigned 8 | Alarm delay: Alarm Delay Time = set value x10s. Ex: Set value =1 mean 1x10s = 10s or set value = 2 means 2x10=20s... |

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 - 127 | | Undefined |

11.0 TABLES

11.1 OBSERVER-*i* DEVICE SPECIFIC COMMANDS SUMMARY

The following Table 5 is a summary of the Observer-*i* Device Specific Commands.

| Command Number | Meaning |
|----------------|-------------------------------|
| 132 | Do Alarm Test |
| 136 | Set Alarm Level |
| 139 | Reset Alarms |
| 141 | Set Relay State |
| 142 | Reset Event Happening Flag |
| 143 | Read Event Logging Counters |
| 144 | Clear Event Logging Counters |
| 146 | Read Alarm Event Log |
| 147 | Read Fault Event Log |
| 148 | Read Maintenance Log |
| 149 | Set Time Clock |
| 150 | Read Time Clock |
| 151 | Set Running Time |
| 152 | Read Running Time |
| 154 | Set Event Index |
| 155 | Read Event Index |
| 156 | Read Calibrate Event Log |
| 163 | Get Fast Changing Information |
| 164 | Get Slow Changing Information |
| 165 | Get setup Information |
| 166 | Get Device Firmware Revision |
| 169 | Load Default Setting |
| 170 | Set Current Range |
| 171 | Set Detection Mode |
| 172 | Set Enhance Ao Mode |
| 192 | Do Calibration |
| 195 | Do Acoustic Test |
| 201 | Set Alarm Delay Time |

Table 5: Observer-*i* Device Specific Commands

11.2 OBSERVER-*i* – OPERATING MODES

The following is a summary of the Observer-*i* Operating Modes:

| Operating Mode | Value in Hex |
|-----------------|--------------|
| Start Up | 0x0001 |
| Operational | 0x0002 |
| Acoustic Test | 0x0004 |
| Calibration | 0x0008 |
| Fault | 0x0010 |
| Set Up | 0x0020 |
| SB100 Test | 0x0040 |
| Alarm Test | 0x0080 |
| Cal. Pending | 0x0100 |
| Piezo Calibrate | 0x0200 |
| Alarm | 0x0400 |
| Show Rev. | 0x0800 |
| Not Used | 0x1000 |
| Not Used | 0x2000 |
| Not Used | 0x4000 |
| Not Used | 0x8000 |

Table 6: Observer-*i* Operating Modes

11.3 OBSERVER-*i* – CALIBRATION SUBMODE

This mode indicates the calibration status during the calibration.

| Operating Submode | Value in Hex |
|-------------------|--------------|
| Apply 1701 | 0x0001 |
| Cal. in Progress | 0x0002 |
| Cal. Adjustment | 0x0004 |
| Cal. OK | 0x0008 |
| Cal. Error | 0x0010 |

Table 7: Observer-*i* Calibration Submode

11.4 CALIBRATION EVENT LOG – CAUSE DESCRIPTION

This event cause indicates the result of calibration.

| Calibration Event Cause | Value in Hex |
|-------------------------|--------------|
| Calibration OK | 0x0004 |
| Calibration Adjusted | 0x0005 |
| Calibration Error | 0x0006 |

Table 8: Observer-*i* Calibration Event Log – Cause Description

11.5 MAINTENANCE EVENT LOG – CAUSE DESCRIPTION

This event cause indicates the type of maintenance.

| Maintenance Event Cause | Value in Hex |
|-------------------------|--------------|
| Acoustic Test | 0x0004 |
| Alarm Test | 0x0008 |
| Piezo Calibrated | 0x0009 |
| SB100 Test | 0x000A |

Table 9: Observer-*i* Maintenance Event Log – Cause Description

11.6 ALARM EVENT LOG – DETECTION DESCRIPTION

| Alarm Event Detection | Value in Hex |
|-----------------------|--------------|
| By Classic Mode | 0x0000 |
| By Enhanced Mode | 0x0001 |

11.7 FAULT EVENT LOG – CAUSE DESCRIPTION

The following Table 10 describes the cause as reported by the read event log commands:

| Bits | Cause |
|------|-------------------------|
| 0 | Low Supply voltage |
| 1 | Not Used |
| 2 | Acoustic Error |
| 3 | Not Used |
| 4 | Remote Alarm Line Error |
| 5 | Remote Reset Line Error |
| 6 | Magnet Switch Error |
| 7 | Internal Voltage Error |
| 8 | Memory Major Error |
| 9 | Memory User Error |
| 10 | Memory HART Error |
| 11 | Memory Event Error |
| 12 | Not Used |
| 13 | Not Used |
| 14 | Not Used |
| 15 | Not Used |

Table 10: Fault Event Log – Cause Description

12.0 PERFORMANCE

12.1 SAMPLING RATES

The Observer-i samples the input signal from Microphone in 10 millisecond intervals.

12.2 POWER-UP

On power up, the Observer-i executes a self-test procedure, which requires approximately 30 seconds. During this time, the Analog Output is set to 1.25 mA or 3.5 mA depending on the setting. After the self-test is satisfactorily completed, the unit sets the Primary Variable to a value representing the mode of the instrument.

12.3 DEVICE RESET

The Observer-i cannot be reset by any command. The unit only resets when power is cycled.

12.4 SELF-TEST

The Observer-i 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 Observer-i responds as follows:

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

Table 11: Command Response Times

12.6 BUSY AND DELAYED-RESPONSE

The Observer-i does not use delayed-response times.

12.7 LONG MESSAGES

The largest data field used by the Observer-i is in response to Command 20 & 22 (Read/Write Long Tag): 34 bytes including the two status bytes.

12.8 NON-VOLATILE MEMORY (NVM)

The Observer-i uses NVM 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 Observer-*i* reports dB readings while in RUN mode. Various other modes are used to support the calibration and setup of the instrument.

12.10 WRITE PROTECTION

The Observer-*i* does not support any write protection modes.

13.0 APPENDIX

13.1 CAPABILITY CHECKLIST

| Manufacturer, Model, and Revision | MSA Observer- <i>i</i> |
|--------------------------------------|------------------------------|
| Device Type | Ultrasonic Gas Leak Detector |
| HART Revision | 6.0 |
| Device Description Available | Yes |
| Number and Type of Sensors | 1 Microphone |
| Number and Type of Actuators | 0 |
| Number and Type of Host Side Signals | 1: 4 – 20 mA analog |
| Number of Device Variables | 0 |
| Number of Dynamic Variables | 1 |
| Mapable Dynamic Variables | No |
| Number of Common-Practice Commands | 2 |
| Number of Device-Specific Commands | 28 |
| Bits of additional device status | 8 |
| Alternative Operating Modes | No |
| Burst Mode | No |
| Write-protection | NA |

Table 12: Capability Checklist

13.2 DEFAULT CONFIGURATION

| Parameter | Default value |
|------------------------------|---------------|
| Lower Range Value | 40 dB |
| Upper Range Value | 120 dB |
| PV Units | Decibel (dB) |
| Sensor type | Microphone |
| 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 13: Default Configuration

13.3 DEVICE DESCRIPTION LANGUAGE MENU

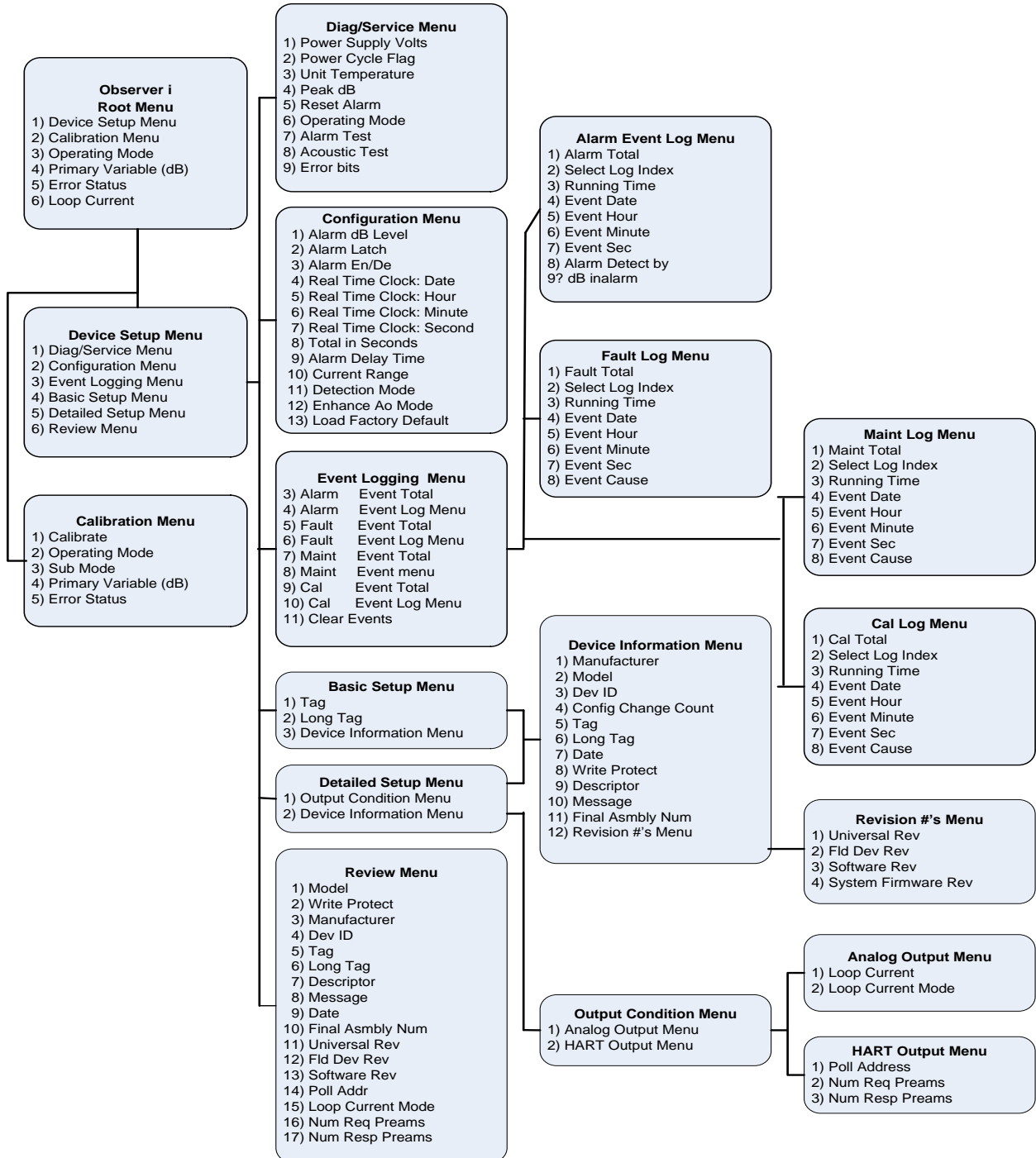


Figure 2: Observer-i Device Description Menu