HART User Guide for

UltraSonic EX-5

Gas Leak Detector

Instruction Manual

Part No. **MANEX5H**
Revision **0**

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1.0 INTRODUCTION

1.1 SCOPE

The HART configuration of the UltraSonic EX-5 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 UltraSonic EX-5 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.
UtraSonic EX-5 Instruction Manual	This is the MSA UltraSonic EX-5 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	**General Monitors, Inc.**	**Model Number**	**UltraSonic EX-5**
HART ID Code	**223 (DF Hex)**	**Device Type Code:**	**149 (95 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 UltraSonic EX-5 Gas Leak Detector is for detecting pressurized gas leaks. The UltraSonic EX-5 Gas Leak Detector 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 UltraSonic EX-5 Gas Leak 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 UltraSonic EX-5 Gas Leak Detector. A typical setup is illustrated in Figure 1.

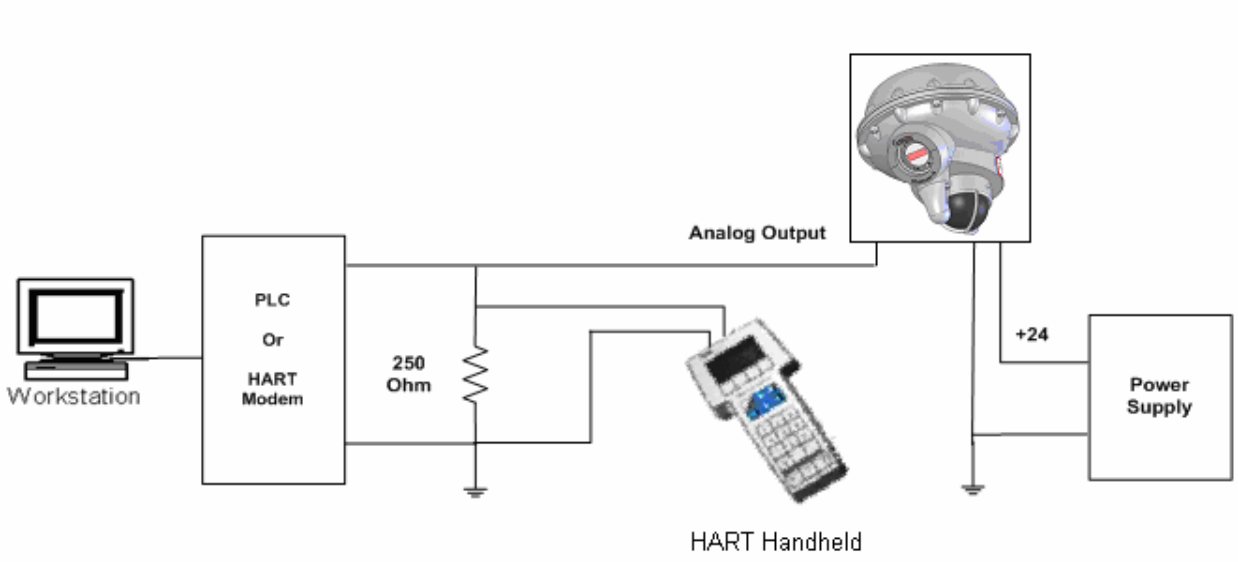

Figure 1: Connecting a PC to a HART Device

Once the detector is installed (see UltraSonic EX-5 Instruction Manual) and connected to a PC, host application, or handheld terminal, the master will begin communication to the UltraSonic EX-5 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 UltraSonic EX-5 Gas Leak Detector. 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 UltraSonic EX-5 Gas Leak Detector 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 <58 dB. 20.0 mA output current corresponds to 104 dB.

4.3 LOCAL INTERFACES, JUMPERS, AND SWITCHES

4.3.1 Local Controls and Displays

Refer to the UltraSonic EX-5 Gas Leak Detector Installation Manual for connection details.

4.3.2 Internal Jumpers and Switches

Refer to the UltraSonic EX-5 Gas Leak Detector 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 <58 dB. 20.0 mA output current corresponds to 104 dB.

6.2 SECONDARY, TERTIARY, AND QUATERNARY VARIABLES: NOT APPLICABLE

There are none defined for the UltraSonic EX-5 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: UltraSonic EX-5 Gas Leak Detector Common Practice Commands

9.2 BURST MODE

The UltraSonic EX-5 Gas Leak Detector does not support Burst Mode.

9.3 CATCH DEVICE VARIABLE

This UltraSonic EX-5 Gas Leak Detector does not support Catch Device Variable.

10.0 DEVICE SPECIFIC COMMANDS

The Device Specific commands are used strictly for the unique features of the UltraSonic EX-5 Gas Leak Detector and at the discretion of MSA. 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
10-13	Unsigned-8	Reserved = 0

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
8	Unsigned-8	Event Minute
9	Unsigned-8	Event Second
10-11	Unsigned-8	Reserved = 0

Byte	Format	Description
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
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 UltraSonic EX-5 Gas Leak Detector, 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 UltraSonic EX-5 Gas Leak Detector 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	Microphone Voltage in miliVolt (Vrms)

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 UltraSonic EX-5 Gas Leak Detector.

Request Data Bytes

Byte	Format	Description
None	N/A	N/A

Response Data Bytes

Byte	Format	Description
0	Unsigned-8	N/A
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	N/A
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 UltraSonic EX-5 Gas Leak Detector 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 #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

10.25 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

10.26 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 ULTRASONIC EX-5 DEVICE SPECIFIC COMMANDS SUMMARY

The following Table 5 is a summary of the UltraSonic EX-5 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
192	Do Calibration
195	Do Acoustic Test
201	Set Alarm Delay Time

Table 5: UltraSonic EX-5 Gas Leak Detector Device Specific Commands

11.2 ULTRASONIC EX-5 – OPERATING MODES

The following is a summary of the UltraSonic EX-5 Gas Leak Detector Operating Modes:

Operating Mode	Value in Hex
Start Up	0x0001
Operational	0x0002
Acoustic Test	0x0004
Calibration	0x0008
Fault	0x0010
Set Up	0x0020
Not Used	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: UltraSonic EX-5 Operating Modes

11.3 ULTRASONIC EX-5 – 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: UltraSonic EX-5 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: UltraSonic EX-5 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

Maintenance Event Cause	Value in Hex
Alarm Test	0x0008
Piezo Calibrated	0x0009

Table 9: UltraSonic EX-5 Maintenance Event Log – Cause Description

11.6 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 UltraSonic EX-5 Detector samples the input signal from Microphone in 10 millisecond intervals.

12.2 POWER-UP

On power up, the UltraSonic EX-5 Gas Leak Detector executes a self-test procedure, which requires approximately 30 seconds. During this time, the Analog Output is set to1.25 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 UltraSonic EX-5 cannot be reset by any command. The unit only resets when power is cycled.

12.4 SELF-TEST

The UltraSonic EX-5 Gas Leak 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 UltraSonic EX-5 Gas Leak Detector 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 UltraSonic EX-5 Gas Leak Detector does not use delayed-response times.

12.7 LONG MESSAGES

The largest data field used by the UltraSonic EX-5 Gas Leak Detector 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 UltraSonic EX-5 Gas Leak Detector 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 UltraSonic EX-5 Gas Leak Detector 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 UltraSonic EX-5 Gas Leak Detector does not support any write protection modes.

13.0 APPENDIX

13.1 CAPABILITY CHECKLIST

Manufacturer, Model, and Revision	General Monitors UltraSonic EX-5 Detector
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	26
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	58 dB
Upper Range Value	104 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

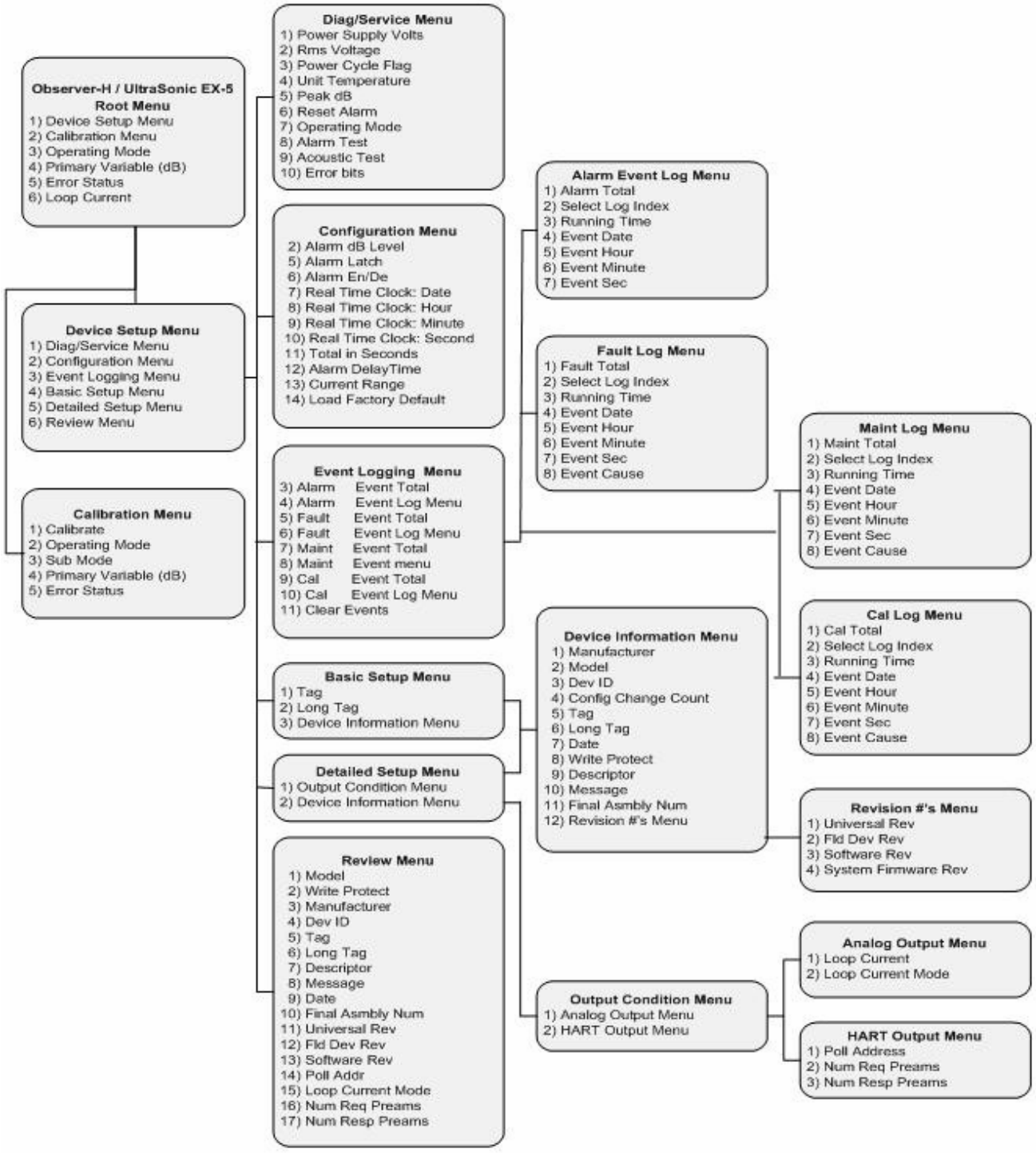

Figure 2: UltraSonic EX-5 Gas Leak Detector Device Description Menu

MSA
The Safety Company

MINE SAFETY APPLIANCES COMPANY
CRANBERRY TOWNSHIP, PENNSYLVANIA, USA 16066
1-800-MSA-INST **www.msanet.com**