Digital Monitor AMC-1DBx Series User Manual

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1 INTRODUCTION

1.1 OVERVIEW

This manual has been prepared to assist you in becoming familiar with the Armstrong AMC-1DBx Digital Monitor. This manual contains the information necessary to install and operate the AMC-1DBx Digital Monitor and is intended for personnel who are responsible for installing and operating this equipment.

1.2 SAFETY CONVENTIONS

The following safety conventions are used in this manual to indicate safety practices that should be adhered to when installing or operating the Digital Monitor.

ELEMENT	CONVENTION
NOTE	Used to highlight additional information pertinent to the process being described.
CAUTION	Used to highlight processes that should be performed with care and to obtain the best result.
WARNING	**USED TO HIGHLIGHT PROCESSES THAT MUST BE PERFORMED WITH CARE TO AVOID POSSIBLE DANGEROUS SITUATIONS TO EQUIPMENT OR PERSONNEL.**

1.3 OTHER DOCUMENTS

Refer to the following documents for additional and amplifying information when using and interfacing with the AMC-1DBx Digital Monitor:

1. AMC Manager User Manual
2. AMC-1DBx BAS Interface User Manual
3. AMC400 Series User Manual
4. AMC-1DMB Modular Box Series User Manual

These additional manuals may be requested from Armstrong Monitoring Corp.

2 GENERAL INFORMATION

2.1 WARRANTY

The Digital Monitor AMC-1DBx is warranted against defects in material and workmanship for a period of two (2) years from date of shipment. During the warranty period, *The Armstrong Monitoring Corporation* (AMC) will repair or replace components that prove to be defective in the opinion of AMC. AMC is not liable for auxiliary interfaced equipment, or consequential damage. This warranty shall not apply to any product, which has been modified in any way, which has been repaired by any other party other than a qualified technician or authorized AMC representative, or when such failure is due to misuse or conditions of use.
Any equipment deemed to be defective by the user should be returned to The Armstrong Monitoring Corporation for evaluation. For information about returning products, refer to the PRODUCT RETURN section in this manual.

2.2 LIABILITY

CAUTION All AMC products must be installed and maintained according to instructions to ensure proper operation. Only qualified technicians should install and maintain the equipment.

AMC shall have no liability arising from auxiliary interfaced equipment, for consequential damage, or the installation and operation of this equipment. AMC shall have no liability for labor or freight costs, or any other costs or charges in excess of the amount of the invoice for the products.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, AND SPECIFICALLY THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THERE ARE NO WARRANTIES THAT EXTEND BEYOND THE DESCRIPTION ON THE FACE THEREOF.

WARNING **USE THE PROPER SAFETY PRECAUTIONS AND CHECK TO ENSURE THE WORKING AREA IS FREE FROM HAZARDS DURING INSTALLATION OR WHEN PERFORMING MAINTENANCE.**

2.3 MODIFICATIONS AND SUBSTITUTIONS

Due to an ongoing development program, AMC reserves the right to substitute components and change specifications at any time without incurring any obligations.

2.4 PRODUCT RETURN

All products returned for warranty service will be by prepaid freight. Please obtain a Return Material Authorization (RMA) number from AMC prior to shipping and ensure this RMA number is clearly visible on the outside of the shipping container.
Material shipped without a RMA number issued by AMC will be rejected and returned. All products returned to the client will be freight collect.

Service Department contact information:

Web: www.armstrongmonitoring.com
North America toll free: 1 (800) 465-5777

2.5 GLOSSARY

Term	Description
BACnet	Building Automation and Control networks. BACnet is a communications protocol for building automation and control networks. It is an ASHRAE, ANSI, and ISO standard protocol. BACnet allows communication of building automation and control systems for applications such as heating, ventilating, and air-conditioning control, lighting control, access control, and fire detection systems and their associated equipment. The BACnet protocol provides mechanisms for computerized building automation devices to exchange information, regardless of the particular building service they perform.
BAS	Building Automation System. The control system is a computerized, intelligent network of electronic devices designed to monitor and control building mechanical and lighting systems.
Bps	Bits per Second. In telecommunications and computing, bit rate (sometimes written bitrate, data rate or as a variable R) is the number of bits that are conveyed or processed per unit of time.
CCA	Circuit Card Assembly.
DCS	Distributed Control System. The control system is a computerized, intelligent network of electronic devices designed to monitor and control the mechanical and lighting systems in a building.
EMT and EMI	Electrical Metal Tube conduit also adds an added degree of electrical shielding against EMI (Electro Magnetic Interference) from devices such as RF (Radio Frequencies) radio sources.
IP	The Internet Protocol (IP) is the principal communications protocol used for relaying datagrams (also known as network packets) across an internetwork using the Internet Protocol Suite. Responsible for routing packets across network boundaries, it is the primary protocol that establishes the Internet.
IP Address	An IP address consists of four numbers, each of which contains one to three digits, with a single dot (.) separating each number or set of digits. Each of the four numbers can range from 0 to 255. An example IP address is: 78.125.0.209.
MODBUS	Modbus is a serial communications protocol published by Modicon in 1979 for use with its programmable logic controllers (PLCs). Simple and robust, it has since become one of the de-facto standard communications protocols in the industry, and it is now amongst the most commonly available means of connecting industrial electronic devices.
MODBUS ASCII	Modbus ASCII is used in serial communication and makes use of ASCII characters for protocol communication. The ASCII format uses a longitudinal redundancy check checksum. Modbus ASCII messages are framed by leading colon (‘:’) and trailing newline (CR/LF).
MODBUS RTU	Modbus RTU is used in serial communication and makes use of a compact, binary representation of the data for protocol communication. The RTU format follows the commands/data with a cyclic redundancy check checksum as an error check mechanism to ensure the reliability of data. Modbus RTU is the most common implementation available for Modbus. A Modbus RTU message must be transmitted

	continuously without inter-character hesitations. Modbus messages are framed (separated) by idle (silent) periods.
Parity	A parity bit is a bit that is added to ensure that the number of bits with the value one in a set of bits is even or odd. Parity bits are used as the simplest form of error detecting code. There are two variants of parity bits: even parity bit and odd parity bit. When using even parity, the parity bit is set to 1 if the number of ones in a given set of bits (not including the parity bit) is odd, making the number of ones in the entire set of bits (including the parity bit) even. If the number of on-bits is already even, it is set to a 0. When using odd parity, the parity bit is set to 1 if the number of ones in a given set of bits (not including the parity bit) is even, keeping the number of ones in the entire set of bits (including the parity bit) odd. If the number of set bits is already odd, the odd parity bit is set to 0. In other words, an even parity bit will be set to "1" if the number of 1's + 1 is even, and an odd parity bit will be set to "1" if the number of 1's +1 is odd.
PLC	A Programmable Logic Controller (PLC) or programmable controller is a digital computer used for automation of electromechanical processes, such as control of machinery on factory assembly lines, amusement rides, or light fixtures.
QVGA	The Quarter Video Graphics Array (also known as Quarter VGA, QVGA, or qVGA) is a popular term for a computer display with 320×240 display resolution. QVGA displays are most often used in mobile phones, personal digital assistants (PDA), and some handheld game consoles. Often the displays are in a “portrait” orientation (i.e., taller than they are wide, as opposed to “landscape”) and are referred to as 240×320.
Router	A network device that forwards packets from one network to another. Based on internal routing tables, routers read each incoming packet and decide how to forward it. The destination address in the packets determines which line (interface) outgoing packets are directed to. In large-scale enterprise routers, the current traffic load, congestion, line costs and other factors determine which line to forward to.
UART	A Universal Asynchronous Receiver/Transmitter, abbreviated UART, is a type of "asynchronous receiver/transmitter", a piece of computer hardware that translates data between parallel and serial forms. UARTs are commonly used in conjunction with communication standards such as EIA RS-232, RS-422 or RS-485. The universal designation indicates that the data format and transmission speeds are configurable and that the actual electric signalling levels and methods (such as differential signalling etc.) typically are handled by a special driver circuit external to the UART.
UDP	User Diagram Protocol – see IETF RFC 768
UI	User Interface, the space where interaction between humans and machines occurs.
Zone	An area which is being monitored for which an alarm anywhere in the zone will cause the same result – i.e. if there are three sensors in “Zone 1” and if any of those sensors goes into alarm “Fan A” will turn on. If there were only one sensor per zone, each would turn on its own fan.
RS-485	Rs-485 is a standard defining the electrical characteristics of drivers and receivers for use in balance digital multipoint systems. The standard is published by the Telecommunications Industry Association/Electronic Industries Alliance (TIA/EIA).
<Ver>	Relating to the current firmware version residing in the AMC-1DBx Digital Monitor.

3 PRODUCT INFORMATION

The following information is provided for the AMC-1DBx Series Digital Monitor. The Digital Monitor AMC-1DBx Series consists of several optional assemblies. The product information for those assemblies, if provided, is found in the following sections:

- 3.1 DIGITAL MONITOR AMC-1DBx
- 3.2 AMC-1DPS-7A Power Supply
- 3.3 AMC-1DMB-PS-R (Power Supply and RS-485 4-Port Repeater)
- 3.4 AMC-1DMB-RL RS-485 8-Relays
- 3.5 AMC-1DMB-AI RS-485 8-Analog Inputs
- 3.6 AMC-1DMB-AO RS-485 8-Analog Outputs

This following section provides information about part numbers and serial numbers.

3.1 DIGITAL MONITOR AMC-1DBx

Warranty Period	2 Years		
Power Supply Requirement	120 VAC, 60 Hz, 100 VA or 24VDC 2A		
Operating Temperature	-20 °C to +40 °C (-4 °F to + 104 °F)		
Operating Pressure	Ambient atmospheric pressure		
Relative Humidity	0 – 95% non-condensing		
Buzzer	90 dBa		
Relay Ratings	Maximum Rated current	A	10
	Maximum Rated voltage DC/AC	V DC/AC	30/240
	Single phase motor rating (230 V AC)	kW	0.37
	Breaking capacity DC1: 30V	A	10

CAUTION

- All AMC products must be installed and maintained according to instructions to ensure proper operation.
- Only qualified technicians should install and maintain the equipment.
- The AMC-1DBx CCA in this product does not support 24VAC powering Using 24VAC will damage CCA and may cause unit to incinerate.

3.2 AMC-1DPS-7A Power Supply

Warranty Period	1 year
Model/Type Specific	AMC-1DPS-7A
Power Requirement	120VAC 5.3A 60Hz
Input Fuse	4A 120V Slow Blow
Output Fuse	10A 120V Slow Blow
Secondary Power	24VDC 7A
Dimensions	304.8mm L x 304.8mm W x 101.6 mm H (12” x 12” x 6”)
Weight	NEMA1(Metal): 5.26 kg (11.6 lbs)
Operating Temperature.	0°C to +40°C (32°F to +104°F)
Operating Pressure.....	Ambient Atmospheric Pressure
Relative Humidity	0 – 90% non-condensing

3.3 AMC-1DMB-PS-R (Power Supply RS-485 4 Port Repeater)

Warranty Period. ……..	1 year
Power Requirement…..	9 – 30VDC 30 mA
Input Fuse…….	None
Enclosure	Nema 1 (Metal) wall mount, with conduit knockouts
Dimensions	305mm L x 305mm W x 127mm H (12” x 12” x 5”)
Weight	NEMA1(Metal): 10.6 kg (23 lbs)
Operating Temperature.	-40°C to +85°C (-40°F to +185°F)
Operating Pressure..….	Ambient Atmospheric Pressure
Relative Humidity…….	0 – 90% non-condensing

3.4 AMC-1DMB-RL RS-485 8-Relays

Warranty Period. ……..	1 year
Power Requirement…..	24VDC
Input Fuse…….	None
Enclosure	Nema 1 (Metal) wall mount, with conduit knockouts
Dimensions	254mm L x 254mm W x 127mm H (10” x 10” x 5”)
Weight	NEMA1(Metal): 3.8 kg (8.4 lbs)
Operating Temperature.	0°C to +55°C (32°F to +131°F)
Operating Pressure..….	Ambient Atmospheric Pressure
Relative Humidity…….	0 – 90% non-condensing

3.5 AMC-1DMB-AI RS-485 8-Analog Inputs

Warranty Period. ……..	1 year
Power Requirement…..	24VDC
Input Fuse…….	None
Enclosure	Nema 1 (Metal) wall mount, with conduit knockouts
Dimensions	254mm L x 254mm W x 127mm H (10” x 10” x 5”)
Weight	NEMA1(Metal): 3.8 kg (8.4 lbs)
Operating Temperature.	0°C to +55°C (32°F to +131°F)
Operating Pressure..….	Ambient Atmospheric Pressure
Relative Humidity…….	0 – 90% non-condensing

3.6 AMC-1DMB-AO RS-485 8-Analog Outputs

Warranty Period. ……..	1 year
Power Requirement…..	24VDC
Input Fuse…….	None
Enclosure	Nema 1 (Metal) wall mount, with conduit knockouts
Dimensions	254mm L x 254mm W x 127mm H (10” x 10” x 5”)
Weight	NEMA1(Metal): 3.8 kg (8.4 lbs)
Operating Temperature.	0°C to +55°C (32°F to +131°F)
Operating Pressure..….	Ambient Atmospheric Pressure
Relative Humidity…….	0 – 90% non-condensing

4 PRODUCT DESCRIPTION

This section provides a general product description about the AMC-1DBx gas monitor.

4.1 GENERAL DESCRIPTION

The Gas Monitor AMC-1DBx provides for the power and monitoring of attached sensors. Initially, the communications with the sensors is via digital highways employing RS-485/MODBUS. Actions such as relay activation and/or alarm notification result from information from the sensors, combined with user configurations (i.e. thresholds and timers). User displays provide detailed information on the operation of the monitor and attached devices. The system state/status is reported to supervisory systems through the use of multiple interfaces; contact transfer on relays, current loop interfaces, and digital communications employing protocols such as BACnet and MODBUS.

The Digital Monitor AMC-1DBx enclosure contains a Circuit Card Assembly (CCA) Controller that sources 24VDC from internal or external power supply. Older enclosure utilized a 24VAC transformer that is no longer compatible with a replaced CCA Controller and will require the use of a 24VDC external power supply.

The digital monitor communicates with the digital devices (i.e. AMC400 transmitter/sensors) over RS-485. The monitor supports four (4) RS-485 interfaces for this purpose. Up to 988 transmitter/sensors are supported. The 120VAC monitor also provides 24VDC power for powering a limited number transmitters/sensors (up to 1A, See Table 5-1).

The AMC-1DBx Digital Monitor provides the following functionality:

- Automatic scanning of up to 988 AMC-400 network sensors. Additional support for external remote 4-20mA analog input sensors (also supporting AMC-DTR Dual Sensor Systems); AMC-1DMB-AI which provide additional analog inputs by AMC-1DMBx Modular Box Series with 8 analog inputs per module. Sensors may be assigned to any of 128 zones.
- 4 integral analog outputs. Additional support for external remote analog outputs; AMC-1DMB-AO which provides analog outputs by remote AMC-1DMBx Modular Box Series with 8 analog outputs per module. One analog output is assignable to each zone to reflect the zone's maximum or average gas concentration.
- Independent alarms per zone; ALARM1, ALARM2 ALARM3 and FAIL.
- Triple threshold alarm set points; alarm ON and alarm OFF gas concentrations.
- Alarm thresholds may be independently set for each individual transmitter/sensor.
- Up to 16 integral DPDT 10A relays. Additional support for external remote relays; AMC-1DMB-RL which provides DPDT 10A relay by remote 1DMBx Modular Box Series with 8 relay outputs per module. Each relay is user selectable to be linked to any combination of sensor sources: ALARM3, ALARM2, ALARM1 and FAIL for all 128 zones.
- Independent sensor activation delay to turn ON relays, minimum run time and post run time delays to turn Off relays.
- Four RS-485 / MODBUS highways to communicate with MODBUS slaves (AMC-400 transmitters and relay modules).
- Front panel LCD and membrane keypad user interface.

Figure 4-1 shows the Typical System Network Diagram for the AMC-1DBx Digital Monitor.

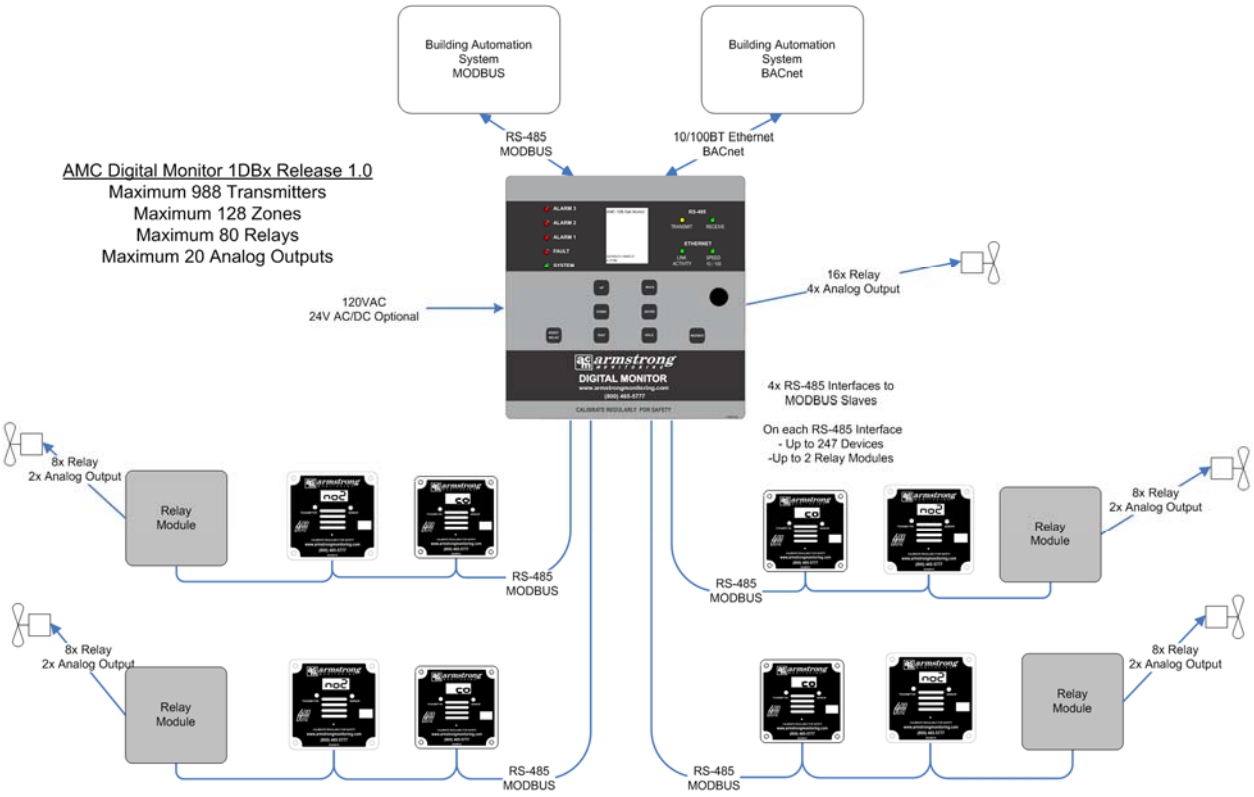


Figure 4-1: Typical System Network Diagram

Figure 4-2: Digital Monitor AMC-1DBx Front Cover shows a view of the AMC-1DBx Digital Monitor front cover.

4.1.1 Monitor Features

FEATURE	DESCRIPTION
1. System Status	1 x Green SYSTEM LED: Power indicator representing power supply health. 1 x Amber FAULT LED: Fault indicator representing system health.
2. ALARM Indication	3 x Red LEDS: Indicators representing 3 alarm indications. OFF – Typically, gas concentration at transmitter(s) is below alarm thresholds. ON – Typically, gas concentration at transmitter(s) has exceeded alarm threshold.

3. MODBUS Operation	1 x Amber LED: Blinks ON when the controller sends MODBUS traffic. 1 x Green LED: Blinks ON when the controller receives MODBUS traffic.
4. ETHERNET	1 x Green LED to indicate Link Activity 1 x Green/Red LED to indicate Link Speed (10/100) Collision
5. Display	A QVGA LCD with backlight used to display menu system operation.
6. DOWN Pushbutton	Editing pushbuttons used to scroll through the current menus, select parameters, and increment or decrement selected parameter options or values.
7. BACK Pushbutton	Editing pushbutton used to move to the previous highest menu level, or exits setup mode from the top level of the setup menu.
8. ENTER Pushbutton	Editing pushbutton that selects a sub-menu or confirms a menu (parameter) choice.
9. RESET RELAY Pushbutton	When pressed, resets any latching relays, providing the alarm condition has subsided.
10. TEST Pushbutton	When pressed, causes continuous activation of all relay outputs (energized or de-energized, depending on configuration), activation of the system fail relay output (to the de-energized state), and continuous activation of the audio alarm (if enabled). Sensor processing and updating of internal status and timers continues. When released, all outputs return to normal operation
11. HOLD Pushbutton	While pressed during normal operation, this pushbutton freezes the display on the currently displayed sensor until it is released. Upon release, the display immediately advances to the next sensor (depending on the display mode selected), allowing the HOLD pushbutton to be used to quickly step through multiple sensors

12. SILENCE Pushbutton

When pressed, this pushbutton silences the audible alarm indication resulting from all active sensor alarms for an individual, adjustable, preset length of time within the range of 0 to 60 minutes or infinite. Set its value to “0” to disable the acknowledge feature.

Configure this pushbutton to also reset all associated relay output indications, subject to defined minimum run times for each relay. Pressing the SILENCE pushbutton in response to new or recurring alarm conditions resets the acknowledge timer to the preset time, including conditions previously acknowledged.

Note: Sensor failure indications cannot be acknowledged, except to reset the system fail relay.

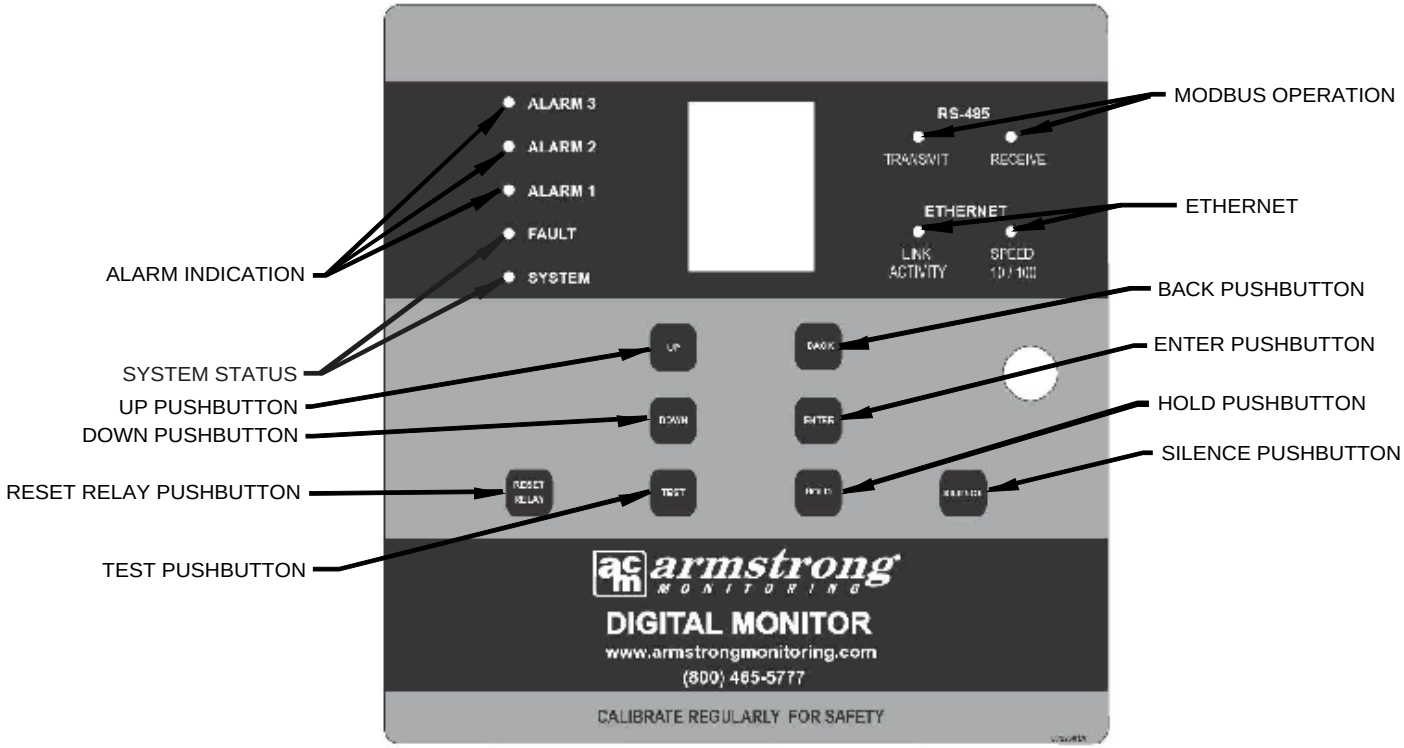


Figure 4-2: Digital Monitor AMC-1DBx Front Cover

4.1.2 Monitor Components

The Gas Monitor AMC-1DBx consists of a number of components which are described in the following paragraphs.

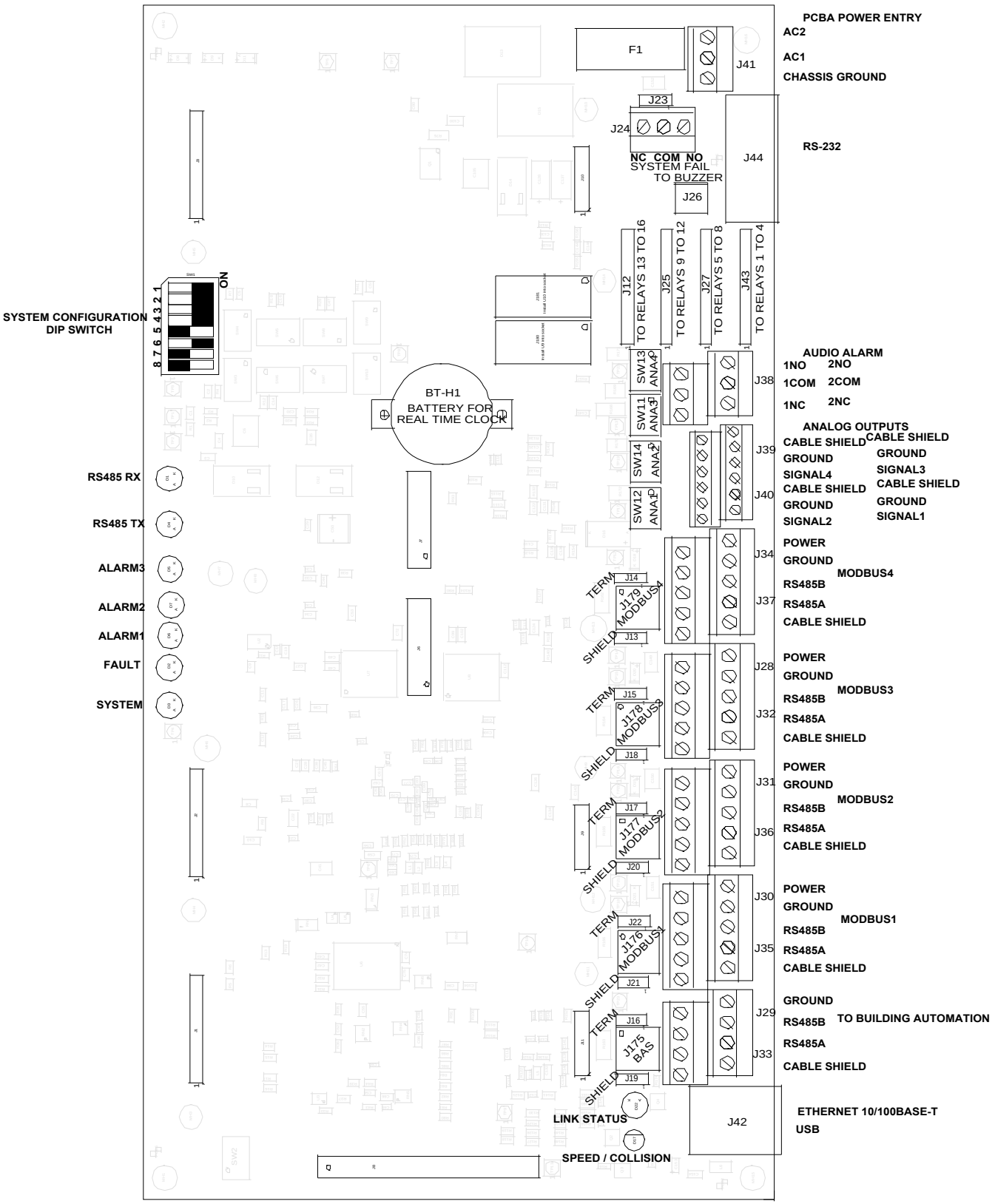


Figure 4-3: Digital Monitor Components

4.1.2.1 System Configuration DIP Switch

The functionality for the supplied dipswitch is identified in Table 4-1.

Table 4-1: System Configuration DIP Switch Functionality

Switch	Function	Normal Position	Description
1	Audio Disable	ON	OFF to disable audio alarm
2	Delay Disable	ON	OFF to disable all sensor activation delays
3	Zero Buff Disable	ON	OFF to disable zero buffering
4	Min Run Disable	ON	OFF to disable all relay minimum run times
5	CAL Mode	OFF	ON to activate CAL mode
6	Post Run Timer	ON	OFF to disable the POST run timer
7, 8	Language Select	See Description	7 OFF, 8 OFF = ENGLISH 7 ON, 8 OFF = FRENCH 7 OFF, 8 ON = SPANISH (future) 7 ON, 8 OFF = GERMAN (future)

Refer to
Figure 4-3: Digital Monitor Components for the location of the System Configuration DIP switch.

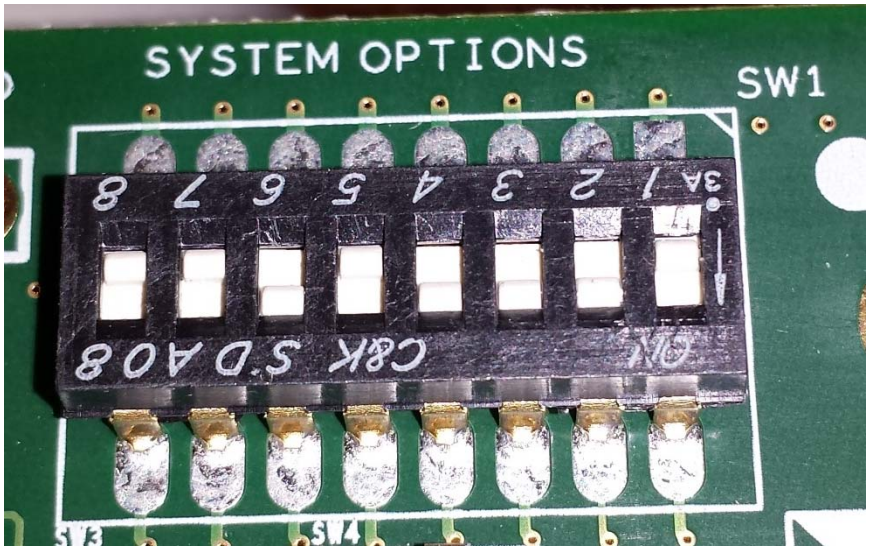


Figure 4-4 System Configuration DIP Switch

1. **Audio Disable**: When in the OFF position this switch will prevent the external buzzer and annunciator from activating on sensor alarm or device failure. Please refer to 4.1.2.10 for connection detail of the buzzer and annunciator. The buzzer can be activated for the following reasons:

- System or Device (Sensor/Relay/Analog Output) Failure,
- Sensor or Zone Sensor Alarm,
- Power-up Data Base Checking,
- SILENCE, RESET_RELAY, TEST or Data Base initialization pushbutton pressed.

Note: Audio beeps for SlLENCE, RESET_RELAY, TEST or Data Base initialization pushbutton action are not disabled by this switch.

2. **Delay Disable:** When in the OFF position this switch will override and programmable delays associated with sensor activation. Sensor activation delays can be configured from 0-3600 seconds for Alarm1-3 and Fail sensor thresholds.

3. **Zero Buffering Disable:** When in the OFF position this switch will override the programmable Zero Buffering value. Zero Buffering is used to inhibit display of gas concentration below a specific threshold. When below this value the sensor will display 0 gas concentration. It can be configured from 0-5% of full scale gas concentration and applies to the all sensors. **Note:** An analog output will still assert its assigned zone sensor(s) gas concentration regardless of the zero buffer setting.

4. **Minimum Run Timer Disable:** When in the OFF position this switch will override any relays currently executing their minimum run timer requirements, thus releasing them from their energised or de-energised state. Minimum run timers can be configured for each relay from 0 to 60minutes and will hold an active relay for the duration once a sensor/zone sensor alarm has occurred. Note: Scheduled zone events don't utilise Minimum Run Timers.

5. **Calibration Mode:** When in the OFF position this switch will ensure all sensor/zone sensor alarms will be de-activated and ignored. This will include any current relay activations held active by their associated minimum and post run timers. Fail devices status will still be displayed, but external audio buzzer and annunciator will be de-activated. Calibration mode should be used when making configuration changes through logged in menu navigation, AMC Manager downloading or MODBUS writes to prevent unnecessary transitions on building's fan controller driven by relays. **Note:** An analog output will still assert its assigned zone sensor(s) gas concentration regardless of calibration mode.

6. **Post Run Timer Disable:** When in the OFF position this switch will override any relays currently executing their post run timer requirements, thus releasing them from their energised or de-energised state. Post run timers can be configured for each relay from 0 to 60minutes and will hold an active relay for the duration once a sensor/zone sensor alarm has cleared. Note: Scheduled zone events don't utilise Post Run Timers.

4.1.2.2 RS-485

Five RS-485 interfaces are provided on terminal blocks, one for each of four MODBUS interfaces to transmitters and a single RS-485 interface to a Building Automation System. To facilitate field replacement, the RS-485 driver IC is mounted in a socket.

CAUTION

Power down the Digital Monitor before replacing any RS-485 driver ICs.

Ensure proper ESD precautions are taken before handling ICs.

Table 4-2 RS-485 driver IC

Interface	IC Location
To Building Automation	J175
To MODBUS 1	J176
To MODBUS 2	J177
To MODBUS 3	J178
To MODBUS 4	J179

The four downstream RS-485 interfaces are provided on dual-row, 5-pin terminal blocks. Pins on the upper row are wired in parallel to the lower row to facilitate placing the monitor in the middle of the bus, thereby requiring two wires per connection. The terminal block supports wire gauges from 14 to 26 AWG. Silks screening is provided on the PCB to identify each pin by function. Refer to
Figure 4-3: Digital Monitor Components to identify the connectors associated with each interface. Table 4-3 shows the pin-out for the dual-row t-pin terminal block.

Figure 4-5 Downstream RS-485 Interfaces

Table 4-3: Dual-Row 5-Pin Terminal Block Pin-out

Signal	Terminal Block Pin #
Cable Shield	1
RS-485 A Signal	2
RS-485 B Signal	3
Ground	4
Power	5

The BAS RS-485 interface is provided on a dual-row, 4-pin terminal block. Pins on the upper row are wired in parallel to the lower row to facilitate placing the monitor in the middle of the bus, thereby requiring two wires per connection. The terminal block supports wire gauges from 14 to 26 AWG. Silk screening is provided on the PCB to identify each pin, by function.

Table 4-4 shows the pin-out for the dual-row 4-pin terminal block.

Figure 4-6 BAS RS-485 Interface

Table 4-4: Dual-Row 4-Pin Terminal Block Pin-out

Signal	Terminal Block Pin #
Cable Shield	1
RS-485 A Signal	2
RS-485 B Signal	3
Ground	4

4.1.2.3 Termination

For each RS-485 interface, field configuration is provided. See Table 4-5.

Table 4-5: RS-485 Field Configuration

Interface	Strap Location	Strap Position		
		Not at end of bus	End of Bus DC Termination	End of Bus AC Termination
To Building Automation	J16	remove	1-2	2-3
To MODBUS 1	J22	remove	1-2	2-3
To MODBUS 2	J17	remove	1-2	2-3
To MODBUS 3	J15	remove	1-2	2-3
To MODBUS 4	J14	remove	1-2	2-3

4.1.2.4 Shield Termination

The RS-485 cable is a shielded cable. The cable shield is terminated on the terminal block. How this shield is handled varies based upon the system wiring. A strap allows the user to select different among three options to select the best solution that works in their site.

The cable shield is shorted to chassis ground at only one point, in order to avoid ground loops with large currents. Typically, the Digital Monitor connects the cable shield of the MODBUS channel to chassis ground. The cable shield of the interface to the Build Automation System is typically not connected to chassis ground at the Digital Monitor; the Building Automation System would provide this connection.

The Digital Monitor provides interface strapping options for connecting the cable shield to ground;

- No connection to chassis ground
- Connected directly (shorted) to chassis ground
- Connected through a parallel resistor-capacitor network to chassis ground

Table 4-6: Cable Shield Termination

Interface	Strap Location	Strap Position		
		No Connection To Chassis Gnd	Shorted To Chassis Gnd	RC Network To Chassis Gnd
To Building Automation	J19	Remove (Typical)	2-3	1-2
To MODBUS 1	J21	remove	2-3 (Typical)	1-2
To MODBUS 2	J20	remove	2-3 (Typical)	1-2
To MODBUS 3	J18	remove	2-3 (Typical)	1-2
To MODBUS 4	J13	remove	2-3 (Typical)	1-2

4.1.2.5 Bias

For each of the downstream RS-485 interfaces, resistors are provided to pull the idle (un-driven) lines to the mark level.

4.1.2.6 Ethernet

A 10/100 Base-T Ethernet connection is provided by the monitor. The Ethernet cable is terminated in an RJ-45 connector which is provided. The connector is mounted so that the cable is parallel to the PCB assembly. The connector is mounted along the bottom edge of the printed circuit board.

Refer to
Figure 4-3: Digital Monitor Components for the location of the Ethernet connector. It is a hybrid connector and has the USB interface integrated into it.

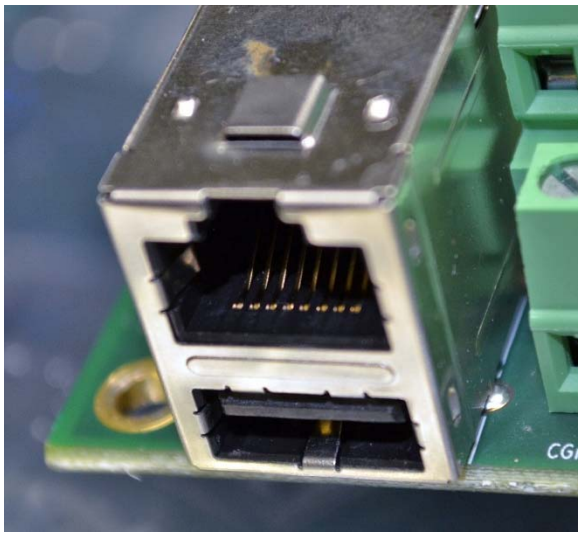


Figure 4-7 Ethernet / USB Connector

Table 4-7 shows the pin-out for the dual-row 4-pin terminal block.

Table 4-7: RJ-45 Connector Pin-out

Pin	Signal
1	Transmit Positive
2	Transmit Negative
3	Receive Positive
4	Connected to 5, unused, 75R AC termination to chassis ground
5	Connected to 4, unused, 75R AC termination to chassis ground
6	Receive Negative
7	Connected to 8, unused, 75R AC termination to chassis ground
8	Connected to 7, unused, 75R AC termination to chassis ground

4.1.2.7 USB

A USB standard-A type connector is provided for interfacing with devices such as USB FLASH drives. The connector is mounted along the edge of the printed circuit board. The USB interface will support USB 1.0 and USB 2.0 devices. Up to 500 mA is available on this interface for powering external devices.
Refer to
Figure 4-3: Digital Monitor Components for the location of the USB connector. It is a hybrid connector and also has an Ethernet interface integrated into it. Refer to Figure 4-7 Ethernet / USB Connector.

Table 4-8 shows the pin-out for the USB standard A-type connector.

Table 4-8: USB Standard A-Type Connector Pin-out

Pin	Signal
1	Vbus (power, +5V)
2	D+
3	D-
4	Power/Signal Ground
shell	Chassis Ground

4.1.2.8 Real-Time Clock

The real time clock of the monitor has backup power provided by an on-PCBA power source. The real time clock is initially set at the factory and arrives at the customer site with the time as per the manufacturing time zone. The real time clock device may be powered off for as much as 6 mouths between manufacturing and initial customer commissioning. The real time clock will survive power outages lasting weeks without loss of the current time.

A 24.5mm 3V (CR2450) lithium coin cell battery is provided on the PCBA to power the real time clock in order to meet the objectives. The battery is replaceable in the field through a battery carrier/socket provided. See Figure 4-8 Battery and Battery Holder for Real-Time Clock.

Refer to
Figure 4-3: Digital Monitor Components for the location of the battery holder.

Figure 4-8 Battery and Battery Holder for Real-Time Clock

4.1.2.9 Relays

The monitor is capable of supporting up to 16 relays within the enclosure for controlling HVAC devices. Additional relays are available with remote devices.

The relays are connected to the monitor through 8 pin plugs. Refer to

Figure 4-3: Digital Monitor Components for the locations of J12, J25, J27 and J43. These connectors are shown in Figure 4-9 8-Pin Headers for Relays below.

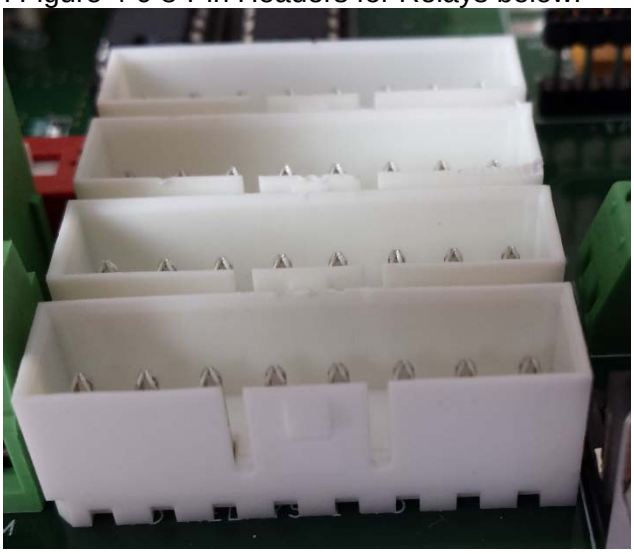


Figure 4-9 8-Pin Headers for Relays

The wiring between the Digital Monitor PCB and the relay is summarized in Table 4-9 Wiring between Relay and Monitor Connectors.

Table 4-9 Wiring between Relay and Monitor Connectors

Relay	Connector	Coil Positive	Coil Negative
1	J43	1	2
2	J43	3	4
3	J43	5	6
4	J43	7	8
5	J27	1	2
6	J27	3	4
7	J27	5	6
8	J27	7	8

Relay	Connector	Coil Positive	Coil Negative
9	J25	1	2
10	J25	3	4
11	J25	5	6
12	J25	7	8
13	J12	1	2
14	J12	3	4
15	J12	5	6
16	J12	7	8

4.1.2.10 External Buzzer and Annunciator

An off-board audio alarm is provided with a buzzer located on the side of the enclosure. Facilities are provided to drive a secondary audio alarm. The audio alarms are activated with on-board relay drivers. The terminal block supports wire gauges from 14 to 26 AWG.

Connection for the audio alarm is facilitated with terminal block J26 and the External Annunciator is provided with terminal block J38.

Refer to
Figure 4-3: Digital Monitor Components for the location of J38.

Figure 4-10 External Annunciator Connector

Table 4-10 shows the pin-out for the audio alarm and terminal block.

Table 4-10: Audio Alarm and Terminal Block Pin-out

Pin	Signal
1	+24V (up to 1.0A)
2	Open Collector to ground

4.1.2.11 System Fail Relay

A fault relay is provided on the monitor. The fault relay is a normally energized relay. A power failure will place it in the state which indicates a fault. The software places this relay in the active state (de-energized) upon a failure being detected from any of the sensor/transmitters.

The fail relay outputs are available on terminal block J24. The relay is rated for 1A at up to 42VDC/30VAC.

Refer to
Figure 4-3: Digital Monitor Components for the location of J34.

Figure 4-11 System Fault Connector

Table 4-11 shows the pin-out for the fail relay and terminal block. The terminal block supports wire gauges from 14 to 26 AWG.

Table 4-11: Fail Relay Terminal Block and Pin-out

Pin	Signal
1	Normally Closed
2	Common
3	Normally Open

4.1.2.12 Analog Outputs

There are four integral analog outputs provided to drive VFD (variable frequency drive) motors. Additional analog outputs are available with remote devices. These external devices are attached to the RS485 interfaces and include the AMC-1DMBx modules. The signal on the analog output is a function (sensor average or peak, averaged over time) of the detected gas levels found on the sensors within a zone. The integral analog outputs can be configured with a switch for voltage or current mode.

An analog output can be configured for two ranges; 4-20mA or 0-20mA. These ranges are with reference to current mode, but also determine the full range operation for voltage mode. The 0-20mA range will give full range for voltage mode. In voltage mode the integral analog output will swing from 0 to 10 volts when configured for full range. In current mode the maximum load for an integral analog output is 500 ohms. Please refer to 6.15.22 SET ANALOG OUTPUTS for complete configuration details.

Note: Failed sensors have a zero gas level and thus the analog output will reflect this. Disabling a zone will return the analog output to its zero gas level. Disabling an active

analog output will leave it with its last gas level. In order to prevent this configure the analog output to out of service mode.

A shielded cable is employed to wire this signal to the target system. For each local analog output, a three-position terminal block is provided. The terminal block supports wire gauges from 16 to 26 AWG.

Table 4-12 shows the pin-out and description for the integral analog outputs and terminal blocks (39, J40).

Table 4-12: Integral Analog Output and Terminal Block Pin-out

	Pin					
	1	2	3	4	5	6
Front Row Ch1, 3	Ch 1 Signal	Signal Ground	Chassis Ground	Ch 3 Signal	Signal Ground	Chassis Ground
Back Row Ch2, 4	Ch 2 Signal	Signal Ground	Chassis Ground	Ch 4 Signal	Signal Ground	Chassis Ground

Refer to
Figure 4-3: Digital Monitor Components for the location of the Analog Output Terminal block.

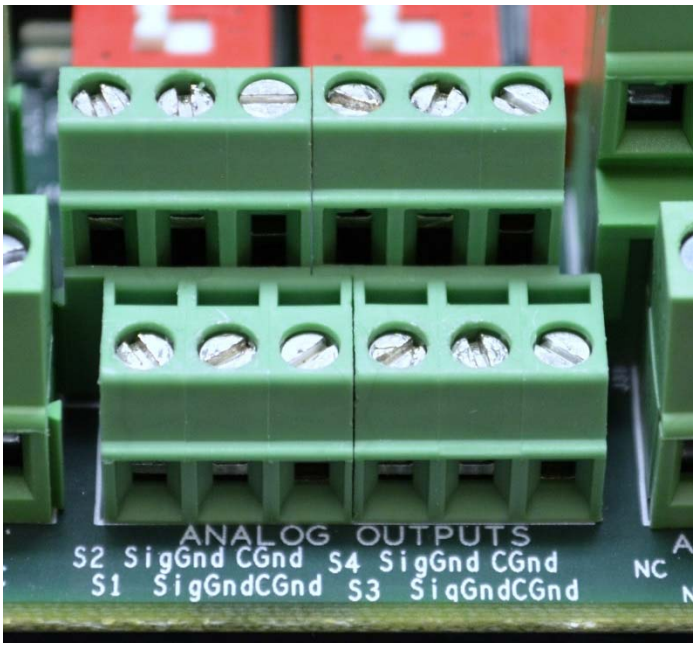


Figure 4-12 Integral Analog Output Terminal Block

The analog output is configured for either voltage or current by the use of a dip switch. **Set to right position for voltage and left position for current.**

Table 4-13: Analog Output and Voltage vs Current Switches

Channel	Switch
Analog Output 1	SW12
Analog Output 2	SW14
Analog Output 3	SW11
Analog Output 4	SW13

4.1.2.13 Analog Inputs

There is support for 4-20mA Sensor inputs with external remote analog input devices. These include the AMC-1DMBx modules. The 4-20mA Sensor Inputs are connected to the external remote device inputs. These external devices are attached to the RS485 Lanes of the AMC-1DBx Gas Monitor. For detailed wiring of AMC-1DMBx modules refer to AMC-1DMBx Series User Manual.

4.1.3 Internal Power Supply

An integral power supply is provided with the 120VAC AMC-1DB1-3XXXXX Digital Monitor. The monitor provides a maximum of 1A for MODBUS devices on MODBUS lanes 1 through 4. If this current is exceeded an external AMC-1DPS-7A or AMC-1DMB-PS-R will be required for powering additional units. The preferred method to address present or future requirements for over 1A is to utilize a 24VDC AMC-1DB1-4XXXXX Digital Monitor as defined in section 5.2.2.

Manufacturing options allow for the following power sources:

- 120VAC
    - Isolation provided by transformer for industrial controls.
- 24VDC
    - No Isolation is provided between power inputs and feeds to transmitters.

The switch/circuit breaker is installed on the DIN rail, the right-hand side, within the enclosure.

A terminal block is provided for connecting power at the power entry point. (8 to 24 AWG wiring)

A ground lug is provided to connect safety ground to the chassis ground of the enclosure. (2 to 14 AWG wiring)

5 INSTALLATION

Follow the guidelines in this section for proper locations and installation of the Digital Monitor AMC-1DBx. In addition to these instructions, ensure installation is compliant with local building and electrical codes. This section covers topics related to installation location, mounting, cable selection, wiring instructions and monitor function programming for the following products:

- AMC Digital Monitor 1DBx
- AMC-1DPS-7A Power Supply
- AMC-1DMB-PS-R, power supply 4 Port Repeater
- AMC-1DMB-AI, 8CH Analog In
- AMC-1DMB-RL, 8CH Relay Module
- AMC-1DMB-AO, 8CH Out Module

5.1 MOUNTING INSTRUCTIONS

Follow the guidelines in this section for proper locations and installation of the Digital Monitor AMC-1DBx series monitor. In addition to these instructions, ensure installation is compliant with local building and electrical codes. This section covers topics related to installation location, mounting, cable selection, wiring instructions and monitor function programming for the Digital Monitor AMC-1DBx series monitor.

5.1.1 AMC-1DBx Digital Monitor Mounting

Securely fasten the AMC-1DBx gas monitor on a solid, non-vibrating surface or structure. Install the unit where it is not exposed to rain or water spray. Install in an area where the local concentration of gas is unaffected by the presence of ventilation systems and away from sources of interference gases. Mount the monitor where the unit can be observed periodically.
For most applications the monitor should be mounted at eye level (1.2 -1.8 m (4-6 ft) from the floor) using the mount provided on the enclosure.

See Figure 5-1 for mounting-hole locations.

WARNING **ALL CABLE ENTRY MUST BE MADE THROUGH THE BOTTOM OF THE MONITOR ENCLOSURE ONLY. OTHER ENTRY LOCATIONS COULD ALLOW FOREIGN MATERIAL TO ENTER THE ENCLOSURE, CAUSING POSSIBLE DAMAGE TO THE INTERNAL COMPONENTS.**

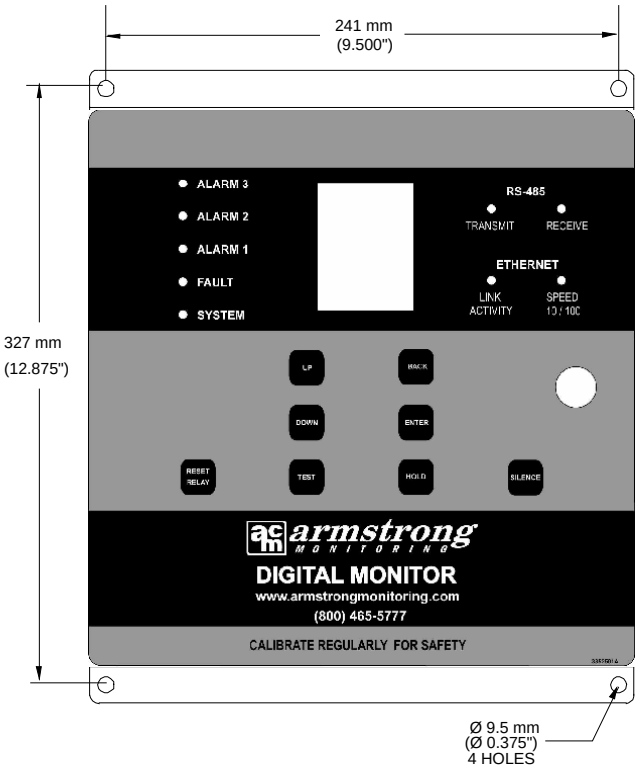


Figure 5-1: Location of Mounting Holes for AMC-1DBx Digital Monitor

5.1.2 AMC-1DPS-7A

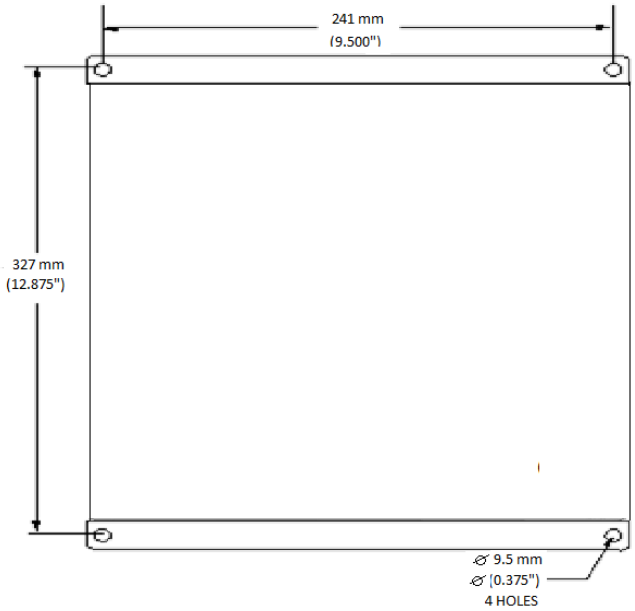


Figure 5-2: Location of Mounting Holes for AMC-1DPS

5.1.3 AMC-1DBM-PS-R

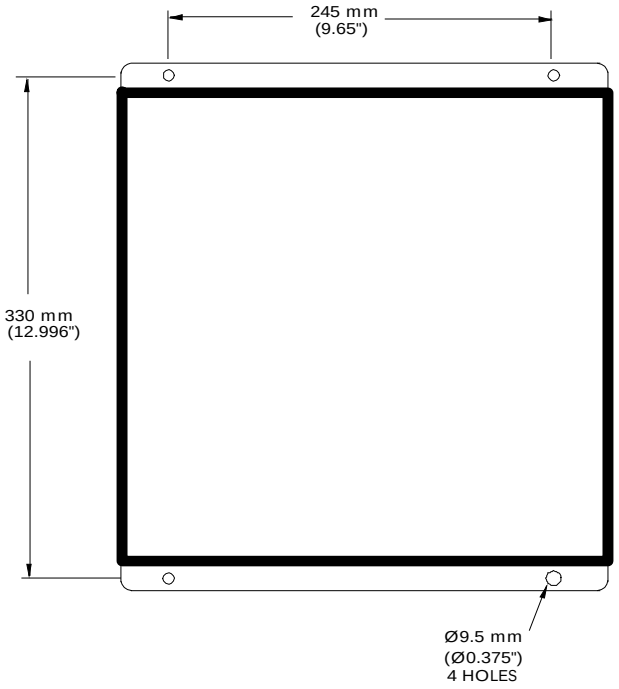


Figure 5-3: Location of Mounting Holes for AMC-1DBM-PS-R

5.1.4 AMC-1DMB-RL

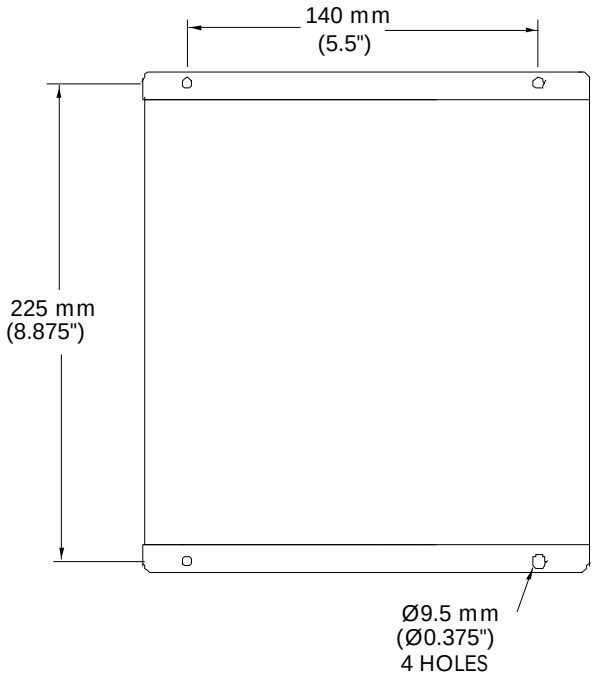


Figure 5-4: Location of Mounting Holes for AMC-1DMB-RL

5.1.5 AMC-1DMB-AO

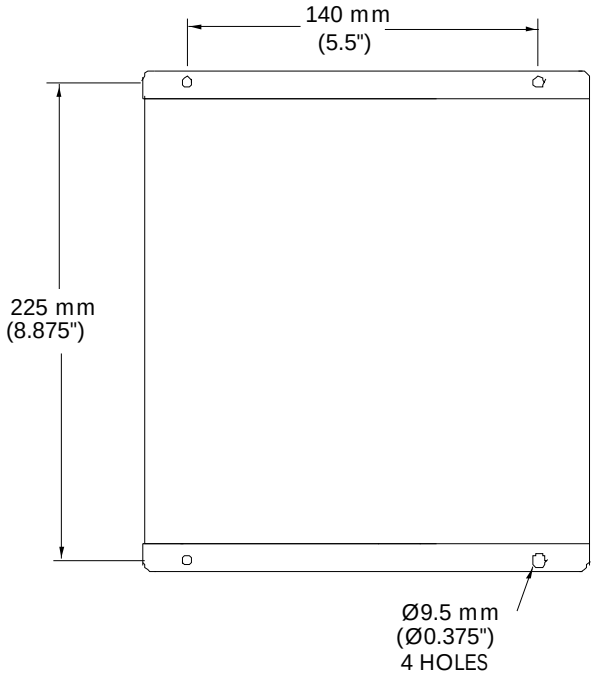


Figure 5-5: Location of Mounting Holes for AMC-1DMB-AO

5.1.6 AMC-1DMB-AI

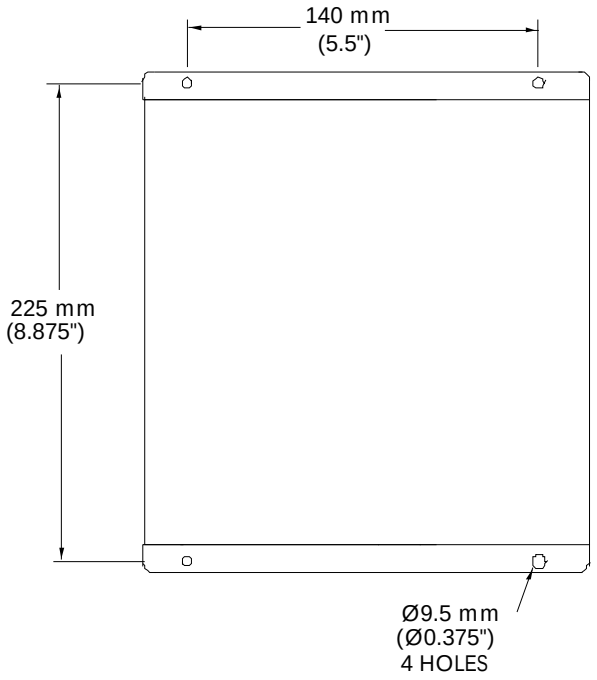


Figure 5-6: Location of Mounting Holes for AMC-1DMB-AI

5.1.7 TRANSMITTER/SENSOR MOUNTING

Mount the sensor/transmitter on a solid, non-vibrating surface or structure in an area where the ambient concentration of gas is not directly affected by the presence of clean air supply, ventilation systems, or blockage by surrounding articles and sources of interference gases. Please, refer to local codes for sensor/transmitter installation information. The installer is required to provide any mounting hardware that may be required. The recommended mounting height is specified in the SENSOR MODULE(S) SPECIFICATION. The conduit entry is from bottom of box to avoid moisture flow into box through conduit.

5.2 WIRING

See Section 4.1 GENERAL DESCRIPTION for specific wire gauges supported by connectors.

5.2.1 Monitor Wiring

WARNING **ENSURE TO TAKE ALL RELANT SAFETY PRECAUTIONS WHEN HANDLING HIGH VOLTAGE POWER SOURCES.**

The 120VAC AMC-1DB1-3XXXXX Digital Monitor should be used when a maximum of 1A of current is required from its 24VDC output for MODBUS devices. The Digital Monitor provides 4 x 24VDC power plus MODBUS channels. Each 24VDC power lane is limited to 1A with a resettable fuse (PTC). See Figure 5-7 Example of 120VAC Powered Digital Monitor. An additional addendum covers expansion of 120VAC Digital Monitors when MODBUS current requirements

exceed 1A. Note that the preferred Monitor to be used when the present or future system requirements need more than 1A is the 24VDC AMC-1DB1-4XXXXX Digital Monitor.

Table 5-1 Maximum number of sensor on a string limited by drop out voltage

Sensor Type	Number of sensors vs *total current*					
Average distance between points	75ft		150 ft		200 ft	
	16AWG	18AWG	16AWG	18AWG	16AWG	18AWG
Electrochemical 400 CO/NO2	27 – 1.49A	21 – 1.16A	19 – 1.05A	15 - 0.83A	16 - 0.88A	13 - 0.72A
Catalytic	19 – 1.943A	15- 1.51A	13 - 1.28A	10 - 1.10A	12 - 1.16A	9 - 0.97A

_____ - can be powered directly from monitor

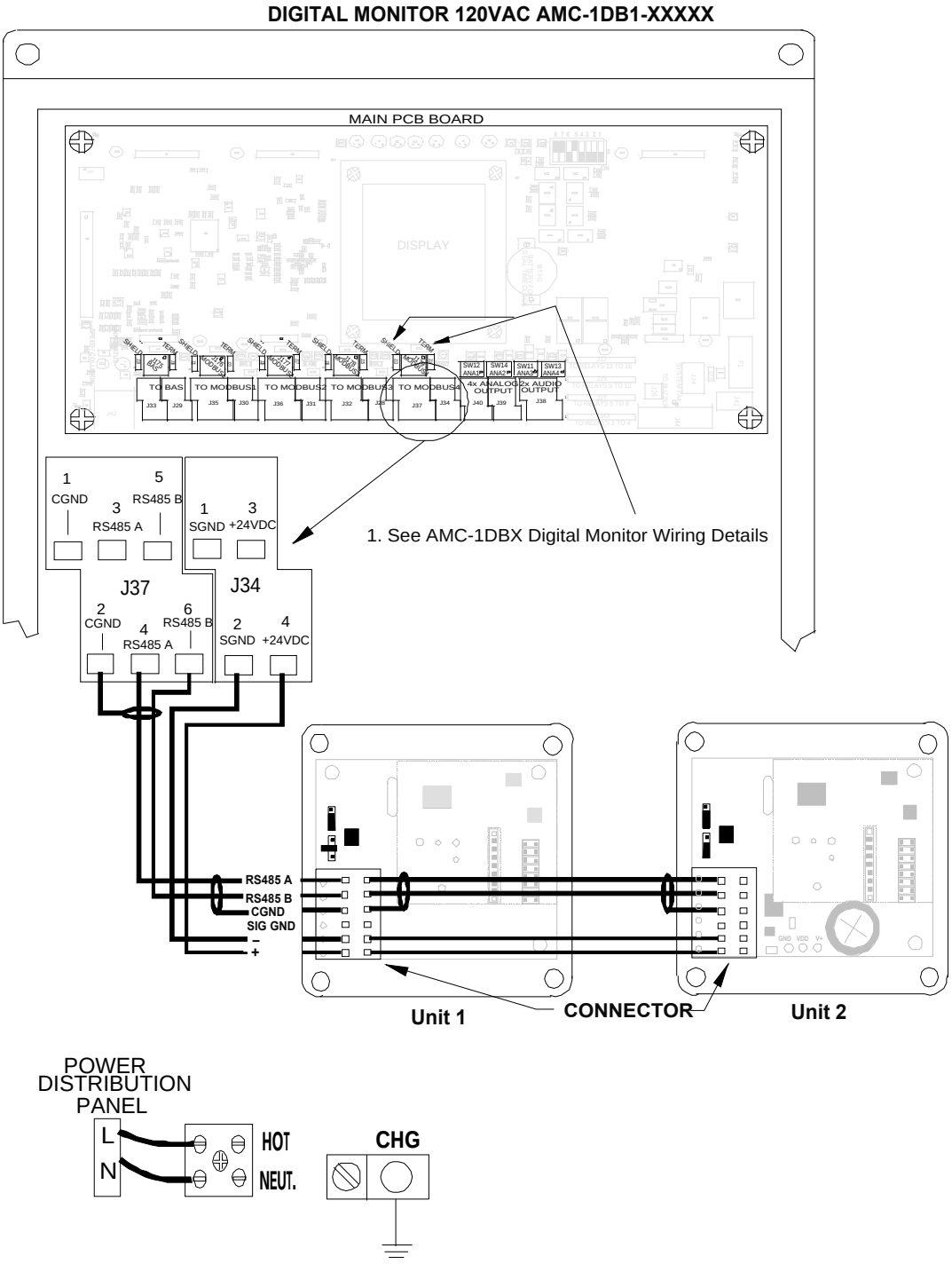


Figure 5-7 Example of 120VAC Powered Digital Monitor

5.2.2 Power Supply Wiring

A minimum of one AMC-1DPS-7A 24VDC Power Supply is required to power both the 24VDC AMC-1DB1-4XXXXX Digital Monitor and all the MODBUS devices (Digital Transmitters, etc). Note that the Digital Transmitters are powered from the Power supply and **NOT** the Digital Monitor. See Figure 5-8. The Monitor's 24VDC output has a DC voltage less than 24V when powered by the 24VDC power supply which is the reason why the AMC-1DPS-7A 24VDC Power Supply should be used to provide transmitter power for this configuration. The AMC-1DPS 24VDC Power Supply will provide 5A for the transmitters and other MODBUS devices. If this current is exceeded an additional AMC-1DPS-7A Power Supply should be employed.

Caution:

For the 24VDC AMC-1DB1-4XXXXX configurations both the SigGnd and +24VDC outputs from the 1DBx Monitor connectors (ex. J34-3 or J34-4) should not be used.

5.2.3 Minimum Voltage

The AMC-1DPS Power Supply and AMC-1DBx Monitor ability to drive a maximum number of AMC-400's (each representing 55 mA load for Electrochemical or 80-130mA for Catalytic) is determined by what other devices are being driven (ex; relay cards), the AWG of wire selected, and the length of cable being powered. If the cable length exceeds a distance that prevents the Digital Transmitter from obtaining the minimum voltage at the V+ Test Point on the Digital Transmitter then both an additional power supply and repeater would be required. Review the Digital Transmitter Manual for this V+ Test Point detail, See Table 5-1 to aid in determining the maximum number of sensors that can be employed.

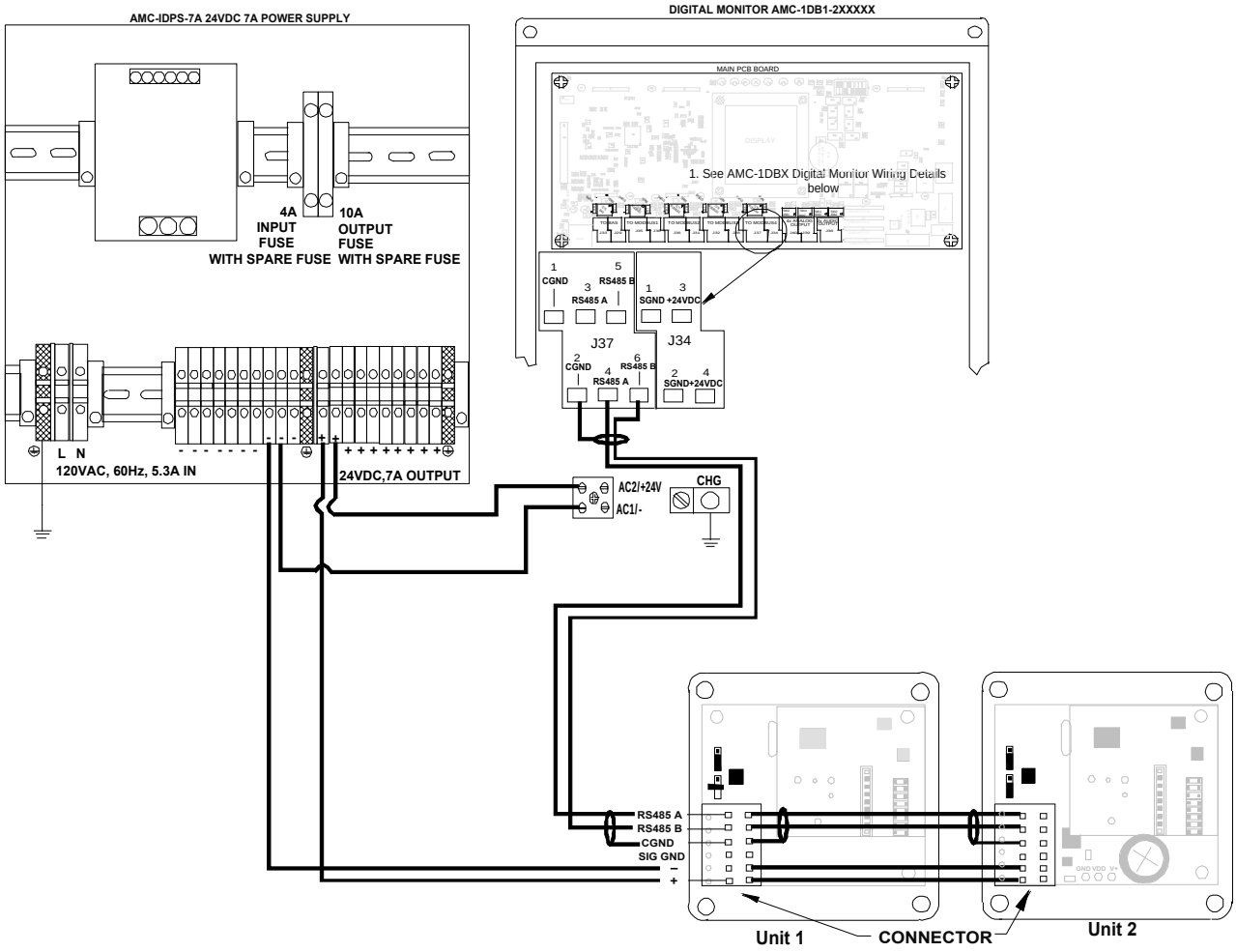


Figure 5-8 Example of 24VDC Powered Digital Monitor

Table 5-2 1DBx MODBUS Connections

	CGND	RS485 A	RS485 B	SGND	+24VDC
MODBUS 1	J35-1 J35-2	J35-3 J35-4	J35-5 J35-6	J30-1 J30-2	J30-3 J30-4
MODBUS 2	J36-1 J36-2	J36-3 J36-4	J36-5 J36-6	J31-1 J31-2	J31-3 J31-4
MODBUS 3	J32-1 J32-2	J32-3 J32-4	J32-5 J32-6	J28-1 J28-2	J28-3 J28-4
MODBUS 4	J37-1 J37-2	J37-3 J37-4	J37-5 J37-6	J34-1 J34-2	J34-3 J34-4

There is a 32 Device limit per RS-485 bus segment. Devices include:

- AMC-1DB1-XXXXX Monitor
- AMC-400 Transmitters
- AMC-DTR Dual Sensor System
- AMC-1DMBx Modular Box Series Devices

- AMC-1DMB-PS-R, power supply 4 Port Repeater
- AMC-1DMB-AI, 8CH Analog In
- AMC-1DMB-RL, 8CH Relay Module
- AMC-1DMB-AO, 8CH Out Module

Repeaters expand the MODBUS capacity by creating additional RS-485 segments. Refer to Modular Box Series User Manual.

5.2.4 Relay Connections

RELAYS:

There are up to 16 DPDT relays which operate as programmed with alarms. For the relay socket terminal connections, see Figure 5-9 Relay Terminal Connections.

The relay contacts are available for activating a remote alarm and/or, blower motors and pumps or lighting circuits.

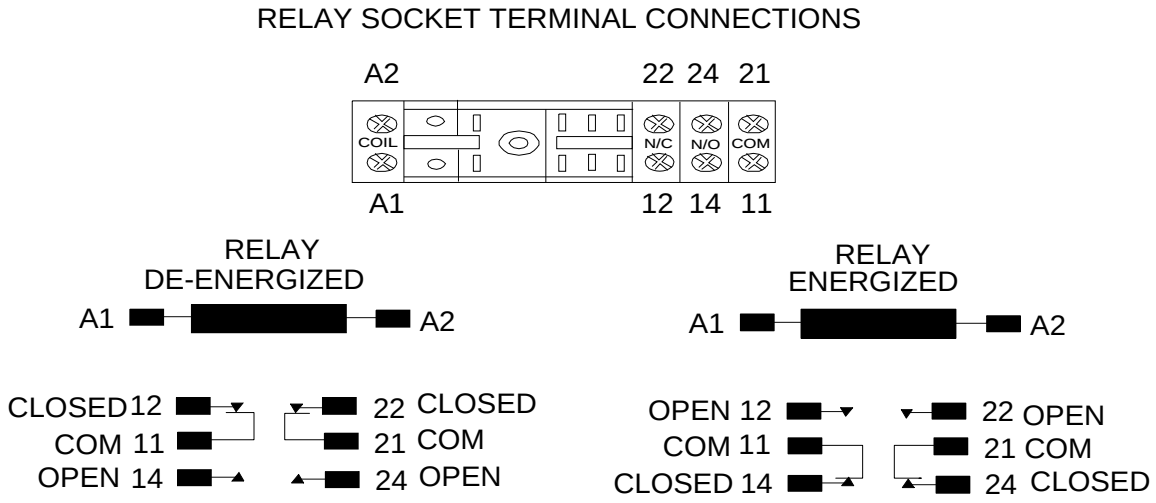


Figure 5-9 Relay Terminal Connections

SENSOR/ TRANSMITTER:

Refer to section 4.1.2.2 RS-485.

ANALOG OUTPUT:

Refer to section 4.1.2.12 Analog Outputs

5.2.5 Cable Selection

The wiring consists of two subsystems:

- the monitor communication
- power supply wiring

A cable is used to connect the RS-485 signals from the digital monitor to digital transmitters in a bus topology. It is required that shielded, twisted pair, cable, 120 ohm impedance is used for the

communications wiring. This bus can be up to 1 Km (1092 yards) in length. An AMC-Repeater is required to extend beyond this distance.

Power supply wiring requires two conductors (+24VDC and SGND). The length of the power supply wiring is dictated by the voltage drop in the wiring. Using thicker wire results in longer distances.

For best signal transmission and maximum noise rejection, run the cable through a steel conduit (the cable shield must be grounded at the monitor).

WARNING **ALL CABLES MUST PASS THROUGH CONDUIT SEALS INSTALLED BETWEEN THE HAZARDOUS (CLASS I, DIVISION 1 OR 2) AND NON-HAZARDOUS AREAS FOR SAFETY REASONS AND TO COMPLY WITH THE LOCAL MUNICIPAL, PROVINCIAL, STATE, OR FEDERAL ELECTRICAL REGULATIONS.**

FOR UL ONLY (U.S.), FOLLOW THE NATIONAL ELECTRICAL CODE (NFPA 70) AND THE AUTOMOTIVE & MARINE SERVICE STATION CODE (NFPA 30A0.

5.2.6 External Power Supply Wiring

Users must connect the AMC-1DPS-7A Power Supply ground to the Monitor's SigGnd if the monitor is powered by isolated 120VAC Power Supply and the AMC-1DPS is used to power transmitters/sensors. The 24VDC terminal block for the AMC-1DPS supports wire gauges from 10 to 22 AWG. Refer to APPENDIX C or Modular Box Series User Manual.

5.3 ALARMS

Alarm detection for each sensor input may be individually programmed to operate in one of four modes: alarms disabled, alarm thresholds on increasing concentration, alarm thresholds on decreasing concentration, and windowed alarm (high/low) operation.

Up to three alarm thresholds may be configured for each sensor input (two thresholds for windowed operation). Each alarm threshold is individually adjustable in increments of % full scale.

An adjustable hysteresis value is applied to alarm detection. This hysteresis is provided to prevent multiple alarms and relay oscillation should a sensor level remain near the threshold setting. The hysteresis level is adjustable from 0 to 5% of full scale in 0.1% increments at the system level for all sensors simultaneously.
Sensors can also be assigned to zones. Zones have up to four relays assigned to them; three alarm thresholds and one fail. When sensors are assigned to a zone they carry in their alarm thresholds as configured in their sensor properties. Additionally one analog output is assigned to the zone representing the peak or average gas concentration for the assigned sensors. This gas concentration is pre-scale based on gas type. Please refer to APPENDIX A GAS TYPES FULL SCALE AND ALARM VALUES for specific fixed pre-scale values.

5.3.1 Enable Audio Cadence

The AMC-1DBx Gas Monitor supports two modes for Audible Alarms; Pulse and Continuous.

The AMC-1DBx audio alarm pulses for various alarm conditions. When external alarm device such as RAM3/RAM4 are connected, the pulse mode causes these attached device(s) to fail (i.e. latching the audio silence). This Audio Cadence sub-menu item allows the user to select the Pulsing or a Continuous alarm signal.

Information about the audio alarm operation can found in Table 5-3.

Table 5-3: Audio Alarm Operation

Status	**Output**
Normal	Off
Device Failure (Sensor, Relay or Analog Out)	Slow pulsing or Continuous.
Alarm	Faster pulsing or Continuous.
Notes: 1. The Dipswitch (see Table 4-1: System Configuration DIP Switch Functionality) enables/disables the audio alarm.	

The Audio Cadence submenu is accessed from the Audible Alarms submenu.

Values are changed by using the UP/DOWN, PREVIOUS and ENTER pushbuttons on the front panel of the AMC-1DBx gas monitor as shown in Table 5-4.

Table 5-4: Enable Audio Cadence

Input (Pushbutton)	**Action**
UP DOWN	Toggles between the available options: • Continuous • Pulse
PREV	Move up one level in menu system to **Set Options**.
ENTER	Saves the selection. Advances to the next option **Zero Buffering**.

6 OPERATION AND CALIBRATION

This section provides information about the operation and calibration procedures for the Gas Monitor AMC-1DBx.

6.1 OPERATION

The Gas Monitor AMC-1DBx provides the power and monitoring functionality for attached sensors. It communicates with the sensors via digital highways employing RS-485\MODBUS, and can access a maximum of 988 sensors/transmitters (4 interfaces x 247 MODBUS addresses per interface).

User displays provide detailed information on the operation of the monitor and attached devices (for example, sensors, relays and analog outputs) through the use of menu and submenu items. The user interface also consists of LEDS as indicated in 4.1.1 Monitor Features. Additionally there is an External Buzzer and Annunciator which offers feedback on the state of the system. Formally the system state/status is reported to supervisory systems through the use of multiple interfaces. These include local devices such as Analog Outputs and digital interfaces employing protocols such as BACnet-IP/MSTP and MODBUS-RTU/TCP.

The monitor must be configured to define the sequence of operation. There are several methods to configure the monitor:

- Using AMC Manager PC Application for remote serial transfer,
- Using USB Device for database file transfer,
- Using Monitor's Menu System,
- Using FTP Ethernet Interface for remote database file transfer,
- Using BAS BACnet-IP/MSTP Interface for remote database file transfer,
- Using BAS MODBUS-RTU/TCP Interface for remote register transfer.

The menu system is password protected for making changes. When the operator is not logged in, they are limited to inspecting the configuration and changing the Option/display mode. When the user is logged in, then they can make changes to the configuration. Once logged in any menu navigation, AMC Manager downloads or BAS MODBUS writes will automatically save the current context to the data base storage device (not including USB) device after idle activity of 60 seconds. Idle activity of 30 seconds or more will also transfer current data base state to the system which will include the RS-485, Ethernet, and BACnet-IP subsystems. Care must be taken not to power off the system until changes are secure in the data base storage device.

Note: Updating the RS-485, Ethernet and BACnet-IP subsystem will cause outages on remote devices. Due to conflicting nature of implementing incomplete data base changes the operator should use the System Configuration DIP Switches to alleviate people's concerns and protect the buildings fan controllers. Please refer to 4.1.2.1 with respect to Audio Disable and CAL Mode for details.

Additionally the Monitor's USB port can be used to save, restore database and upgrade the firmware.

The USB Port with a USB storage device can create and append log files for the following states:

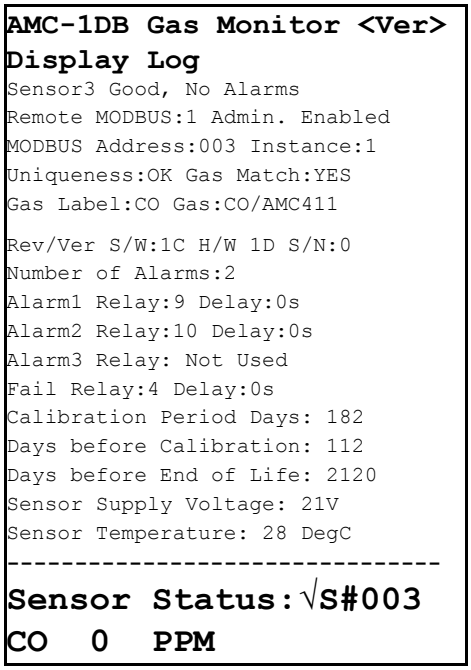
- Sensor,
- Relay,
- Alarm,
- System,
- Administration,
- Security,
- Communication,
- Zone Summary.

Note: For optimal USB performances please use a USB drive which is a type that utilizes its own separate power supply.

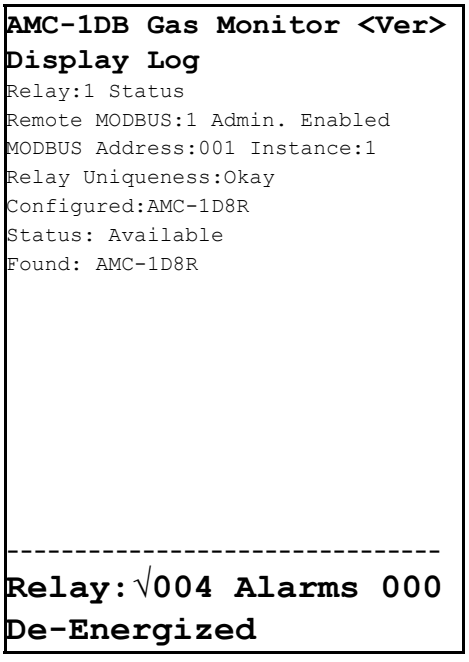
6.2 LCD

The user interface includes a QVGA graphical LCD screen with backlight. The following several examples of screen layouts:

The above display can be configured to show AMC logo when system is idle when Option/Display Mode is set for Disp New Alarms only; Disp Alarms only. The top line of the Gas Monitor AMC-1DBx displays the monitor banner, consisting of the product name and software revision. When the system enters alarm or failed sensor it will switch to the sensor status. The following display is example of sensor status:



The above display can be configured to cycle through sensor device information for each sensor connected to the monitor when Option/Display Mode is set for Disp All Data. Please refer to Get Sensor Status for complete details. Alternatively the display can be configured for relay status. The following display is example of relay status:



The above display can be configured to cycle through relay device information for each relay connected to the monitor when Option/Display Mode is set for Disp All Relay. Please refer to Get Relay Status for complete details.

6.3 LEDS

The user interface consists of 9 product LEDs, 4 power supply LEDs, and 3 Self-Test indicators. Nine of the product LEDS are present on Front Panel and also the monitor board itself. These include:

- System
- Fault
- Alarm1
- Alarm2
- Alarm3
- RS-485 TX
- RS-485 RX
- Ethernet Activity
- Ethernet Speed/Collision

Inside the cabinet there are four power supply LEDs (CH1-CH4 V+) one for each 24V MODBUS channel. Also inside the cabinet are 3 Self-Test LEDs (D1-D3).

6.3.1 System LED

The System LED is lit when the system is up and running without problem. This LED will turn off under the following conditions:

- System Startup sequence,
- Watchdog or brown-out reset status,
- IP or BACnet subsystem problem,
- USB (Universal Serial Bus) subsystem problem,
- RTC (Real Time Clock) subsystem problem,
- D2A (Digital to Analog) subsystem problem,
- Voltage rail subsystem problem,
- Device Uniqueness conflict,
- Gas Type match conflict.

During startup the System LED will turn on and off as self-test and system startup progresses. During start-up and at various times the self-test indicators, D1-D3, may be lit up. If these self-test LEDs remain lit, until system reboots, a hardware problem exists and this system fault must be reported to a qualified technician for repair.

The System LED will turn off and remain off during system operation when the reset cause indicates a watchdog or brown-out reset. A watchdog reset indicates software operation was unable to process the operation of the system. A brown-out reset occurs when the internal VDD power supply drops below 3v. A watchdog or brown-out reset must be reported to a qualified technician. This fault can be cleared by pressing the HOLD pushbutton and the system LED will turn on.

The System LED will also turn off and remain off when the system detects duplication or configuration problem(s) with the IP and/or BACnet interfaces. Correct the IP or BACnet duplication and system LED will turn on.

Additionally the system LED will turn off and remain off if any subsystem problem occurs. The USB subsystem problem can be corrected by removing the USB media. This media maybe corrupted. If any subsystem fault occurs it must be reported to qualified technician. Some subsystem faults are temporary event and can be cleared by pressing the HOLD pushbutton.

Additionally the system LED will turn off if any MODBUS device (Sensor, Relay, Analog Output or Analog Input) has a MODBUS address conflict with another device on that same lane. Please refer to the Get Sensor Status, Get Relay Status, or Get Analog Output Status menus items for uniqueness of devices. Correct the MODBUS address conflict and the system LED will turn on.

Also the system LED will turn off if any sensor's database configuration doesn't match the gas type obtained at MODBUS device registration. At MODBUS device registration the various devices' gas type are queried and checked against the monitor's database for a mismatch which will turn off the system LED to indicate this problem. Correct the mismatch of the sensor's configured gas type with the MODBUS device assigned to it and the system LED will turn on. This may involve changing the actual MODBUS device with the correct gas type unit.

The buzzer and External Annunciator will also be activated, as Pulse or Continuous, defined by the Option Audio Cadence configuration.

6.3.2 Fault LED

The Fault LED is illuminated when a device failure is detected by the system. Device failure could be:

- Failed Sensor Threshold,
- Missing Remote Device (Sensor, Relay or Analog Output).

A failed sensor may be either digital or analog in nature. When a digital sensor fails to respond to a poll request from the digital monitor, the monitor will activate the Fault LED. When the current from an analog sensor is less than (or equal) to the configured fail threshold, the monitor will activate the Fault LED. The typical failed threshold is 2mA for a 4-20mA input current loop.

When Fault LED is lit and the Audible Alarms are set for All Alarms & Fail in the Option Audible Alarms configuration; the buzzer and External Annunciator will be activated as a Pulse or Continuous defined by the Option Audio Cadence configuration.

6.3.3 Alarm1 LED

The Alarm1 LED is illuminated when a sensor has equaled or exceeded its sensor ALARM1 threshold.

When Alarm2 LED is illuminated and the Audible Alarms are set for All Alarms & Fail or All Alarms in the Option Audible Alarms configuration; the buzzer and External

Annunciator will be activated as a Pulse or Continuous defined by the Option Audio Cadence configuration.

6.3.4 Alarm2 LED

The Alarm2 LED is illuminated when a sensor has equaled or exceeded its sensor ALARM2 threshold.

When Alarm2 LED is illuminated and the Audible Alarms are set for All Alarms & Fail or All Alarms in the Option Audible Alarms configuration; the buzzer and External Annunciator will be activated as a Pulse or Continuous defined by the Option Audio Cadence configuration.

Also if the Audible Alarms are set for High Alarm Only and the Sensor Alarm Condition is configured for two alarms then the buzzer and External Annuniciator will also be activated.

6.3.5 Alarm3 LED

The Alarm3 LED is illuminated when a sensor has equaled or exceeded its sensor ALARM3 threshold.

When Alarm3 LED is illuminated and the Audible Alarms are set for All Alarms & Fail, All Alarms, or High Alarm Only in the Option Audible Alarms configuration; the buzzer and External Annunciator will be activated as a Pulse or Continuous defined by the Option Audio Cadence configuration.

6.3.6 RS-485 TX LED

This RS-485 TX LED is illuminated for 1 second and turned off for 1 second every time one or more MODBUS character is transmitted.

6.3.7 RS-485 RX LED

This RS-485 TX LED is illuminated for 1 second and turned off for 1 second every time one or more MODBUS character is received.

6.3.8 ETHERNET ACTIVITY LED

This ETHERNET ACTIVITY LED is illuminated when the physical media has activity.

6.3.9 ETHERNET SPEED/COLLISION LED

This ETHERNET SPEED/COLLISION LED is two colors; Green and Red. The Green LED is illuminated when speed of the physical media is 100Mb/s and not Green when physical media is 10Mb/s. This LED will light Red when the physical media detects a collision.

6.3.10 24V POWER SUPPLY LEDS

There are four 24V Power Supply LEDS, one for each MODBUS channel. Each channel will be illuminated if the fuse associated with that channel is not open.

6.3.11 Self-Test LEDs (D1-D3)

These LEDs will light during various self-test operations and should not be stay illuminated for more than 15 seconds. If these self-test LEDs remain illuminated a hardware problem exists and this system fault must be reported to qualified technician for repair.

6.4 EXTERNAL BUZZER AND ANNUNCIATOR CONTROL

The external buzzer and annunciator are activated as a Pulse or Continuous defined by the Option Audio Cadence configuration. The external buzzer and Annunciator will be activated under the following:

- Alarm1 LED is illuminated with Option Audible Alarms; All Alarms & Fail
- Alarm2 LED is illuminated with Option Audible Alarms; All Alarms & Fail, All Alarms (with Sensor Alarm Condition set for 2 thresholds.
- Alarm3 LED is illuminated with Option Audible Alarms; All Alarms & Fail, All Alarms, High Alarm Only.
- Fault LED is illuminated with Option Audible Alarms; All Alarms & Fail.

The external buzzer and annunciator will also be activated when the data base Integrity is checked or when the SILENCE, RESET_RELAY or TEST pushbuttons are pressed and when data base initialization confirmation pushbutton is pressed.

6.5 ANALOG OUTPUTS

The system contains 4 integral analog outputs and can control additional remote analog outputs on each of the 4 MODBUS channels. An analog output can be configured for voltage or current, this configuration is controlled by hardware switches located on the monitor board. There are four switches; one for each integral analog output channel. In voltage (right position) or current mode (left position) the database configuration can also provide an additional range setting; 0-20mA(0-10V) or 4-20mA(2-10V) this is known as ***range*** in the database configuration context.

The analog output is assigned to a Zone. An analog output can be configured for peak or average operation and this is known as ***type*** in the database configuration context. The peak operation provides the highest gas concentration for the sensors assigned in that zone while the average provides a sum gas concentration over the number of sensors.

The gas type definition (at the sensor definition) plays a significant role in the peak and average mechanism. For each gas type definition, there exists system fixed scaling value which is used to pre-scaled gas readings prior to peak detection and sensor gas concentration averaging. Gas types like CO and NO2 have different pre-scale values and

are fixed in the monitor's system. Please refer to the table GAS TYPES FULL SCALE AND ALARM VALUES for specific fixed pre-scale values.

A gas type like NO2 which has a highest alarm point set to 3ppm will be pre-scale by 3.3. This will normalizes the gas concentration to the same level as CO which has its highest alarm point set to 100ppm and uses a pre-scale of 1.0.

This pre-scaling is applied to the analog output level. An additional scaling can be configured and applied to the analog output above and beyond the gas type fixed pre-scale mechanism previously discussed and this scaling is known as ***scale*** in the database configuration context. It is applied to final peak or average result.

Additionally there is a filtering of the analog output over a short period of time; 1-60seconds. This configuration is known as ***period*** in the database configuration context. Remote analog output can take many seconds for their updates and therefore can result in delayed and reduced filtering. Integral analog outputs offer better filtering in this respect.

6.6 AMC MANAGER PC Application

The AMC Manager is a monitor database configuration tool that facilitates the configuration of the database associated with this product. It can be used as an alternative to using the menu buttons located on the front panel.

It allows quick and easy changes to the monitor's database including changes to options, sensors, relays, analog outputs and zoning. Additionally, AMC Manager provides a database backup/restore in the event that the current configuration is lost or damaged.

When AMC Manager is progressing in the background the middle area of the monitors LCD display will indicate "AMC Manager in use".

The database can be saved or restored from or to the monitor through the serial communication link or through ADF file placed on a USB storage device.

Using the serial communication link requires some initial menu configuration as described in the menu navigation section Set Options, Serial Mode.

Using USB storage device to restore database will requires a system restart. Please refer to the section DATABASE ON USB STORAGE DEVICE.

6.6.1 AMC-1DMBx Modular Box

The AMC-1DMBx Modular Box series provides remote modules complimenting the AMC Digital Monitor series.

The table below shows the configuration references for the AMC-1DMBx Modular Box series.

	Relay Configuration Part Reference choices	**Sensor** Configuration Part Reference choices	**Analog Out** Configuration Part Reference choices

1DMBx Modular Box	1DBx Monitor User Interface	AMC Manager Application	1DBx Monitor User Interface	AMC Manager Application	1DBx Monitor User Interface	AMC Manager Application
Relay Module	ERERM8 Instance 1-8	AMC-ER8RM_8 Instance 1-8	n/a	n/a	n/a	n/a
Analog In Module	n/a	n/a	BCI8 Instance 1-8	AMC-1DBCI_8 Instance 1-8	n/a	n/a
Analog Out Module	n/a	n/a	n/a	n/a	BCO8 Instance 1-8	AMC-1DBCO_8 Instance 1-8

Please refer to the supplementary AMC Manager User Manual for details.

6.7 BACNET-IP/MSTP INTERFACE

BACnet is a communications protocol for building automation and control networks. It is an ASHRAE, ANSI, and ISO standard protocol. The BACnet-IP offers plug and play of objects used for monitoring the state of the system over Ethernet. Please refer to the supplementary AMC-1DBx BAS Interface User Manual for details.

6.8 BAS MODBUS-RTU/TCP INTERFACE

The BAS MODBUS-RTU is a RS-485 physical link using the MODBUS-RTU digital communication protocol that facilitates the monitoring of the system operation. The BAS MODBUS-TCP uses the ethernet IP physical link and is similar to BAS MODBUS-RTU. The BAS MODBUS-RTU/TCP interface can change register(s) related to the monitor's database and can be used as an alternative to using the menu buttons or AMC Manager PC Tool. Please refer to the supplementary AMC-1DBx BAS Interface User Manual for details.

6.9 LOGGING

The AMC-1DBx can log monitor's runtime information to various devices and ports. The monitor has several different information categories:
Sensor,
Relay,
Alarm,
System,
Administration,
Security,
Communication,
Zone Summary.

The monitor's information can be logged to the following devices and ports:

USB Storage Device,

Display (LCD),
Printer Port,
Console (Remote Telnet over Ethernet).

The logging through USB storage device creates and appends specific information to following files:

SENSOR.LOG,
RELAY.LOG,
ALARM.LOG,
SYSTEM.LOG,
ADMIN.LOG,
SECURITY.LOG,
COMM.LOG.
PRINT.LOG.

The log file can be viewed by removing and installing the USB storage device in a PC or by using FTP or BACnet. User should eject the USB storage device from the Option, Log File, Eject USB menu item. The User does not need to be logged in to eject the USB device. Using the Eject USB menu item will ensure latest information is written to the storage device.

Note: Once the USB is ejected the Monitor must be powered down before re-connecting the USB, if not the Monitor could crash and the USB drive can become corrupt.

When transferring log file(s) with FTP user must apply the username “amc-1dbx” and password “1234” credentials during a FTP session using File Explorer and transfer the log files to PC’s HDD. From File Explorer enter “ftp://<IP ADDRESS>” in the location bar and enter the username and password when prompted. With File Explorer you can transfer selected log files to the PC’s hard drive for future viewing. One your FTP session is complete close file explorer. One your FTP session is complete just close the telnet console window. A Client base FTP PC tool such as FlashFXP can be used to schedule transfers of log files. Scheduling should be limited and utilize transfer rules to reduce FTP activity.

Note: FTP activity reduces monitors performance and large file transfers and long FTP activity should be avoided.

For transferring log file(s) with BACnet please refer to the AMC-1DBx BAS Interface User Manual.

When logging to the Console Port is enabled information items directed to the USB storage device can be concurrently streamed to a remote telnet session. This remote telnet session is available on PC connected to the same Ethernet network as the monitor. Windows PC must have telnet service enabled. Use the following command “telnet <IP ADDRESS>” from command shell where the IP ADDRESS is the monitor’s configured IP address.

When logging to Printer Port is enabled all possible information items can be concurrently streamed to the printer port along with default printer data. This streaming to printer port

is only available when the Option Serial menu item is configured for Printer. A PC can be used to capture the printer stream into a file with an appropriate communication terminal program such as TeraTerm. Log messages can be streamed to the Printer Port when menu item Log File>Printer is enabled while menu item Option>Remote is configured for Printer. Default printer data is the same log items that are present in the appendix PRINT.LOG. Additionally other information can be streamed to the printer port by enabling Log File>Sensor through Log File>Comm. This additional information is the same as present in appendix SENSOR.LOG, RELAY.LOG, ALARM.LOG, ADMIN.LOG, SYSTEM.LOG, SECURITY.LOG and COMM.LOG.

When logging to the Display is enabled information items directed to the USB storage device can be concurrently seen on the LCD Display. ***Note: Enabling Display logging will impact performance of the UI and should be limited to the System category.*** Some categories such as Sensors can output too many records.

The Zone Summary is a USB file called ZONE.CSV containing summary information for the first 48 zone sensors. Please refer to appendix ZONE.CSV Format for details. This USB file can also be transferred to PC's HDD using FTP.

6.10 USB FIRMWARE UPGRADE

The AMC-1DBx has a firmware upgrade mechanism through the USB Port triggered after a power-up. User can obtain latest Firmware image files from Armstrong Monitoring.

The mechanism uses two files placed on a USB storage device installed into the monitor USB port; an image and check file. The image and check files are matched to each other to a specific version of the firmware. The image version and checksum must match the information in the check file in order for a successful upgrade. The monitor's operation will only upgrade current or newer versions of the firmware. Upgrade will require initial system power restart and will reboot upon completion.

This section contains a procedure for upgrading the Firmware on the AMC-1DBx Gas Monitor from a USB storage device:

1. Install a USB storage device into a PC and connected to ArmstrongMonitoring.com. Navigate your browser to the latest AMC-1DBx firmware location.
2. Download the image and check files onto the USB storage device. The site containing the images may have names similar to 10Aquila_1DBx.rbin_***<Ver>*** and the check file may have names similar to 10Aquila_1DBx.csum_***<Ver>***. Choose and download the latest matching versions of image and check files.
3. On the USB storage device rename the image file to **10Aquila.rbin** and check file to **10Aquila.csum**.
4. Power down the Monitor, then place the USB storage device into the USB port of the AMC-1DBx Monitor.
5. Power on the system to initiate firmware upgrade. If presence of 10Aquila.csum file is detected by Monitor's operation after restart it will proceed to try to upgrade the firmware. Firmware upgrade will take place after the USB database restore.

6. After about 30seconds the bottom two lines will display:

```
USB to Flash Upgrade
DON'T POWER OFF!
```

7. Upon completion; the Display Log middle area will indicate:

   ```
   FLASH Upgrade: Need to Reboot...
   ```

   If Display and System logs are enabled additionally information may appear in the Display Log middle area pertaining to FLASH Upgrade.

8. System will automatically reboot. The USB storage device will now have the 10Aquila.csum file renamed to 10Aquila.csum_V{Version Number}. This will prevent the upgrade from occurring again.

6.11 FTP FIRMWARE UPGRADE

The AMC-1DBx has a FTP firmware upgrade mechanism through the Ethernet IP Port triggered using FTP to transfer the latest Firmware image files to the USB Media. Users can obtain latest Firmware image files from Armstrong Monitoring.

The user must apply the username “amc-1dbx” and password “1234” credentials during a FTP session using File Explorer and transfer the log files to PC’s HDD. From File Explorer enter “ftp://<IP ADDRESS>” in the location bar and enter the username and password when prompted. With File Explorer transfer the 10Aquila_1DBx.rbin and 10Aquila_1DBx.csum files from the PC’s hard drive. Once you have transferred these images enter “reboot” from the telnet console. The system will reboot and install the new F/W image similar to the USB Firmware Upgrade mechanism.

6.12 BACnet-IP/MSTP FIRMWARE UPGRADE

The AMC-1DBx has a BACnet-IP/MSTP firmware upgrade mechanism through the Ethernet IP Port or BAS RS485 interface. BACnet-IP/MSTP can transfer the latest Firmware image files to the system. User can obtain latest Firmware image files from Armstrong Monitoring. Please refer to the supplementary AMC-1DBx BAS Interface User Manual for details.

6.13 DATABASE ON USB DEVICE

Once the monitor’s database is configured and stored in Non Volatile RAM a USB storage device can be used to save it. This database can be loaded in AMC Manager or used to restore the monitor’s database at a later time.

This section contains a procedure for saving database on to USB storage device and a procedure for restoring the database from the USB port.

In order to save the Database using USB storage device:

1. Install a USB storage device into the USB port on the monitor.

2. Log in to the system through the menu described in the section menu system Logging In.

3. Log out of the menu system.

4. After a moment the bottom two lines will display:

```
USB-DB Saving…
Please Wait!
```

5. Upon success when Display (LCD) logs are enabled; the Display Log middle area will indicate:

```
Database Saved from USB c:\amc-...
```

   The USB storage device will contain the AMC-1DB.ADF file with the name AMC-1DB.ADF_SAVED{_YEAR_MON_DAY_HOUR_MINUTE}

   These files can now be used to restore the database from a USB storage device. Additionally the AMC-1DB.ADF_SAVED… file can be transferred and opened by the AMC Manager PC tool.

6. If unsuccessful when Display (LCD) logs are enabled; the Display Log middle area will indicate:

```
Can't Save DB to USB
```

   No AMC-1DB.ADF_SAVED…file will be available on the USB storage device.

In order to restore the Database using USB storage device:

1. Rename and place the previous saved ADF file onto the USB storage device with the filename "AMC-1DB.ADF".

2. Reboot system by power restart.

3. After self-test and during startup the monitor LCD Display will show a progress bar just above the bottom two lines. If the ADF file is found the bottom two lines will display:

```
USB-DB Restoring…
Please Wait!
```

4. Upon success when Display (LCD) logs are enabled; the Display Log middle area will indicate:

```
Database Restore from USB c:\...
Monitor database save complete
```

   The AMC-1DB.ADF file on the USB storage device will be renamed to

AMC-1DB.ADF_RESTORED{_YEAR_MON_DAY_HOUR_MINUTE}

5. If unsuccessful when Display (LCD) logs are enabled; the Display Log middle area will indicate:

```
Can't Restore DB from USB
Using previous DB
```

Possible a database mismatch ID message will appear if ADF file is incompatible with existing monitor F/W:

```
Data Base ID Mis-match
```

When restore is unsuccessful the AMC-1DB.ADF and filename will remain unmodified on USB storage device.

6.14 DATABASE from FTP

A database created by AMC Manager can be installed on the monitor's Non Volatile RAM using FTP.

The user must apply the username "amc-1dbx" and password "1234" credentials during a FTP session using File Explorer and transfer the log files to PC's HDD.
From File Explorer enter "ftp://<IP ADDRESS>" in the location bar and enter the username and password when prompted. With File Explorer transfer the 10Aquila_1DBx.rbin and 10Aquila_1DBx.csum files from the PC's hard drive. One you have transferred these images enter "reboot" from the telnet console. The system will reboot and install new the F/W image similar to the USB Firmware Upgrade mechanism.

Additionally any saved database created can be transferred out of the USB media using FTP. Please refer to the section Database on USB Device for details on saving database to USB media. Once you have transferred the database into the USB media enter "reboot" from the telnet console. The system will reboot and install the new database as described in the section DATABASE on USB Device.

6.15 MENU SYSTEM AND FEATURES

6.15.1 Menu Navigation

System setup, configuration and maintenance are performed using the LCD display and the programming keypad located on the front panel of the Gas Monitor AMC-1DBx.

Four pushbuttons are provided, labeled BACK, UP, DOWN and ENTER.

- BACK Pushbutton
  Moves to the previous highest menu level or exits setup mode from the top level of the setup menu.

- UP, DOWN Pushbutton

Scrolls through the current menus, selects parameters, increments or decrements selected parameter options or values.

- ENTER Pushbutton
  Selects a submenu or confirms a menu (parameter) choice.

Note: Access to the configuration functions is password protected. All systems parameters, except selection of the default Display Mode, require a password-protected log in before any parameters can be modified.

6.15.2 LOGGING IN

Entry into System Setup mode is gained by pressing the ENTER pushbutton while in any Display mode.

To log into the monitor

1. Press the ENTER pushbutton.
   The Log In screen is displayed.
2. Press the ENTER pushbutton again.
   The Enter password screen is displayed.
3. Enter the valid 4-character alphanumeric password.
4. Press **ENTER**.
   The Select Sensor menu item is displayed.

The default password is 1234.

Each digit of the password is blanked while the ensuing (following) digits are being entered.

Note: Until a correct password is used to log into the product application, setup data may be viewed but not changed. The user password shall be changeable only after you have logged-in using a valid password.

6.15.3 Changing Password

Once logged-in, you can choose to change the 4-character alphanumeric password.

To change the password

1. Log into the gas monitor.
2. At the Log In screen, press **ENTER**.
3. Enter the valid 4-character password.
4. Press **ENTER**.
   The Select Sensor menu item is displayed.
5. Press the **DOWN** pushbutton.
   The Select Relay menu item is displayed.
6. Continue pressing the **DOWN** pushbutton until the Change Password screen is displayed.
7. Press **ENTER**.
   The New Password screen is displayed.

8. Use the **UP** pushbutton to set the new password to the 4 alphanumeric characters you want and press **ENTER**.

   The Exit Setup screen is displayed.

6.15.4 ADDITIONAL BUTTONS

Four additional buttons are provided on the front panel of the Gas Monitor AMC-1DBx.

- TEST Pushbutton
  While pressed, this pushbutton causes continuous activation of all relay outputs (energized or de-energized, depending on configuration), activation of the system fail relay output (to the de-energized state), and continuous activation of the audio alarm (if enabled). Sensor processing and updating of internal status and timers continues. When released, all outputs return to normal operation.

- HOLD Pushbutton
  While pressed during normal operation, this pushbutton freezes the display on the currently displayed sensor until released. Upon release, the display immediately advances to the next sensor (depending on the display mode selected), allowing the HOLD pushbutton to be used to quickly step through multiple sensors.

- SILENCE Pushbutton
  When pressed, this pushbutton silences the audible alarm indication resulting from all active sensor alarms for an individual, adjustable, preset length of time within the range of 0 to 60 minutes or infinite. Set its value to “0” to disable the acknowledge feature.

  You can configure this pushbutton to also reset all associated relay output indications, subject to defined minimum run times for each relay.
  Pressing the SILENCE pushbutton in response to new or recurring alarm conditions resets the acknowledge timer to the preset time, including conditions previously acknowledged.

  Note: Sensor failure indications cannot be acknowledged except to reset the system fail relay.

- RESET RELAY Pushbutton
  When pressed, this pushbutton resets any latching relays, providing the alarm condition has subsided.

6.15.5 Menu Options

The monitor offers several menu options accessible from the main screen including:

Menu Option	Description
Get Sensor Status	Allows operational status and statistics to be viewed for a specific sensor.
Get Relay Status	Allows operational status and statistics to be viewed for a specific relay.
Get AOUT Status	Allows operational status and statistics to be viewed for a specific Analog Output.
Get RS-485 Status	Allows operational status and statistics to be viewed for a specific interface.
Get Ethernet Status	Allows operational status and statistics to be viewed for the Ethernet interface.

Get System Info.	Allows operational status and statistics to be viewed for various Subsystems.
Set Options	Allows configuration of the system-wide configuration items.
Set Interface	Allows configuration of the monitor digital interfaces and includes the following submenu items: • Set IP Configuration • Set BACnet Configuration • Set MODBUS Configuration • Set Analog Outputs
Select Relay	Provides access to the menu items which configure the system relays.
Select Sensor	Provides access to the menu items which configure the system sensors.
Select Zone	Provides access to menu items for grouping sensors associated with alarm/fail relays and analog output with a provision for a scheduled relay event.
Change Password	Allows changing of the system password, once logged in.
Get System Info	Allows you to view the system status and application license information.

Since the monitor's programming functions are password protected, it is necessary to access the login screen. See Menu Navigation.

6.15.6 Allowable Operations When Not Logged In

You can navigate menus without logging into the monitor. This feature is provided to allow you to view configuration information. Without logging in, you can view new menu items which provide status/statistics information about transmitters and relays.

From the Log In screen, and before entering a password to log in, use the DOWN pushbutton to scroll to and access the following menus:

- Set Options
- Select Sensor
- Select Relay
- Select Zone
- Set Interface
- Get Sensor Status
- Get Relay Status
- Get AOUT Status
- Get RS-485 Status
- Get Ethernet Status
- Get System Info.
- Exit Setup
- Log In.

6.15.7 GET SENSOR STATUS

The Get Sensor status display allows you to view operational status and statistics about the sensor in question. It is available when system is running with Option/Menu Display Mode set for Disp All Data or through the logged out menu; Get Sensor Status.

The bottom two-line display is employed to navigate to the sensor status window. The two-line display indicates;

Line 1:

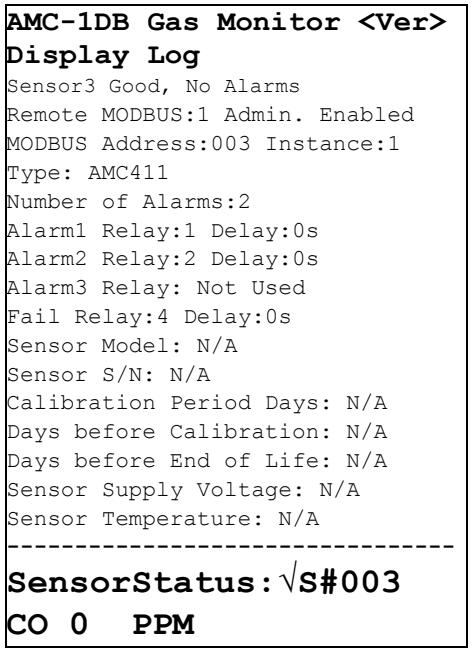
- menu item title
- sensor number
- a check mark (√) indicating the sensor ID is unique within the system

Line 2:

- target gas
- current gas concentration reading
- engineering units assigned

The bottom first line contains the Sensor number; a check mark indicates the Sensor does not have a conflict in the system. A conflict can occur due to duplicate instance or MODBUS addresses assignments. The second line of bottom displays the target gas and current gas concentration with engineering unit assigned.

The middle sensor status area is similar to below and may contain status with N/A (Not Available); these items indicate future features not currently available:



To access the Get Sensor Status menu

1. At the Log In screen, press the **DOWN** pushbutton.

The Set Options screen is displayed
2. Press the **DOWN** pushbutton.
   The Select Sensor screen is displayed.
3. Press the **DOWN** pushbutton.
   The Select Relay screen is displayed.
4. Press the **DOWN** pushbutton.
   The Get Sensor Status screen is displayed.

```
Get Sensor Status
```

Press **ENTER** and navigate to the sensor number and press another **ENTER** to display sensor information.

6.15.8 GET RELAY STATUS

The Get Relay status display allows you to view operational status and statistics about the relay in question. It is available when system is running with Option/Menu Display Mode is set for Disp All Relay or through the logged out menu; Get Relay Status.

The bottom two-line display is employed to navigate to the relay status window. The bottom two-line display indicates;

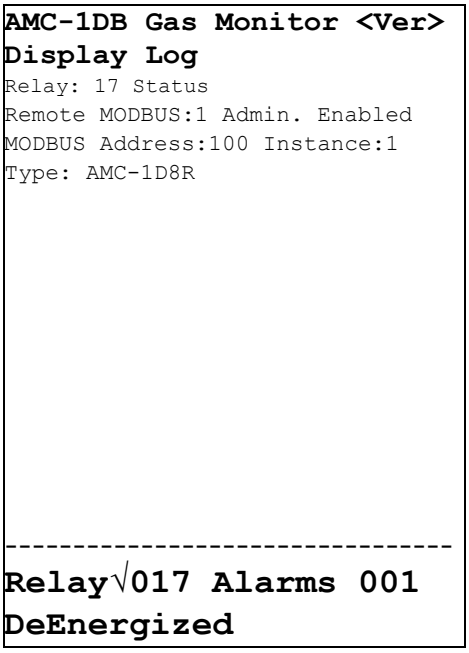
Line 1:
- menu item title
- relay number
- a check mark (√) indicating the relay ID is unique within the system
- Alarms count indicating the number of sensor or zone sensor device(s) associated with the current relay state.

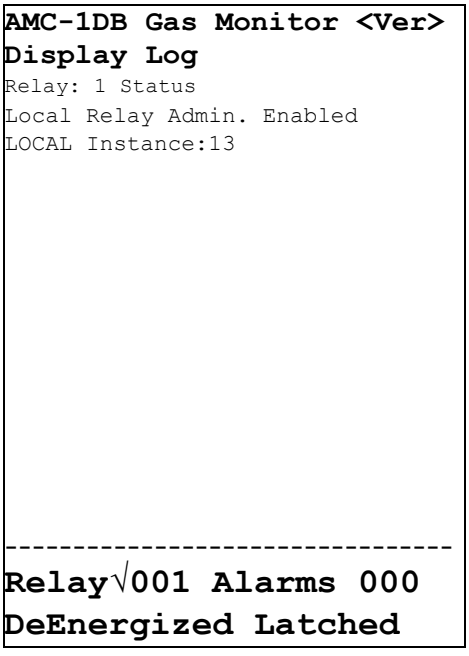
Line 2:
- Relay state.

The bottom two lines of the relay status have shortened relay state items when necessary. The bottom first line contains the Relay number with Alarm Counts; a check mark indicates the Relay does not have a conflict in the system. A conflict can occur due to duplicate instance or MODBUS addresses assignments. The second line of bottom displays the following information with shortened items in bold:

- Power-On delay, Not Found,
- Energized(**Ene**) and De-Energized(**De-Ene**) associated with or without a Zone Event (**ZE**),
- Energized(**Ene**) and De-Energized(**De-Ene**) Pending(**Pend**) associated with or without a Zone Event(**ZE**),
- Energized(**Ene**) and De-Energized(**De-Ene**) Latched associated with or without a Zone Event(**ZE**),
- Energized(**Ene**) and De-Energized(**De-Ene**) Minimum Run Time(**MRT**) associated with or without a Zone Event(**ZE**),
- Energized and De-Energized Post Run Time(**PRT**) associated with or without a Zone Event(**ZE**).

The middle relay status area is similar to below and carries two forms (Remote and Local items):

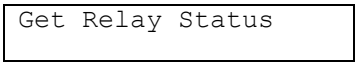




To access Get Relay Status menu

1. At the Log In screen, press the **DOWN** pushbutton.
   The Set Options screen is displayed
2. Press the **DOWN** pushbutton.

The Select Sensor screen is displayed.
3. Press the **DOWN** pushbutton.
   The Select Relay screen is displayed.
4. Press the **DOWN** pushbutton.
   The Get Sensor Status screen is displayed.
5. Press the **DOWN** pushbutton.
   The Get Relay Status screen is displayed.



Press **ENTER** and navigate to the relay number and another **ENTER** to display relay information.

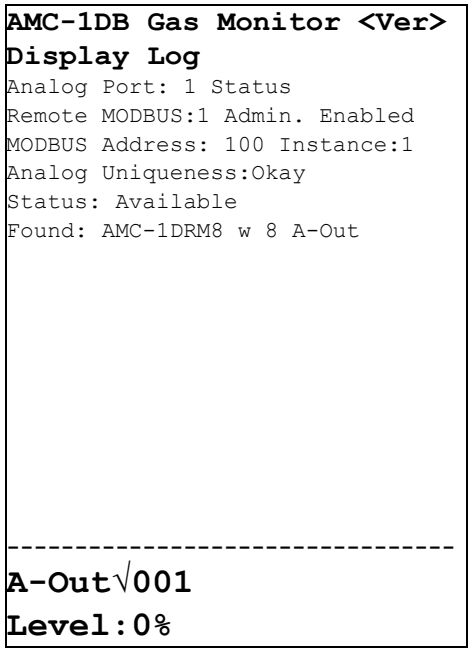
6.15.9 GET AOUT STATUS

The Get AOUT Status menu allows you to view the operational status and level about the Analog Output device in question.

To access the Get AOUT Status menu

1. At the Log In screen, press the **DOWN** pushbutton.
   The Set Options screen is displayed
2. Press the **DOWN** pushbutton.
   The Select Sensor screen is displayed.
3. Press the **DOWN** pushbutton.
   The Select Relay screen is displayed.
4. Press the **DOWN** pushbutton.
   The Get Sensor Status screen is displayed.
5. Press the **DOWN** pushbutton.
   The Get Relay Status screen is displayed.
6. Press the **DOWN** pushbutton.
   The Get AOUT Status screen is displayed.

7. Press **ENTER** and navigate to the Analog Output ID and press another **ENTER** to display information. The bottom two lines contain the Analog Output ID; a check mark (√) indicating the Analog Output ID is unique within the system. The last line contain the percent output Level. The middle Analog Output area contains other information about the device. The middle Analog Output area is similar to the following:

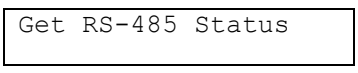


6.15.10 GET RS485 STATUS

The Get RS485 status menu allows you to view operational status and statistics about the interface in question before having to log into the monitor.

To access the Get RS485 Status menu

1. At the Log In screen, press the **DOWN** pushbutton.
   The Set Options screen is displayed
2. Press the **DOWN** pushbutton.
   The Select Sensor screen is displayed.
3. Press the **DOWN** pushbutton.
   The Select Relay screen is displayed.
4. Press the **DOWN** pushbutton.
   The Get Sensor Status screen is displayed.
5. Press the **DOWN** pushbutton.
   The Get Relay Status screen is displayed.
6. Press the **DOWN** pushbutton.
   The Get AOUT Status screen is displayed.
7. Press the **DOWN** pushbutton.
   The Get RS-485 Status screen is displayed.



8. Press **ENTER** and navigate to the interface number and press another **ENTER** to display information. The bottom two lines contain the interface number (**P**) and the total number of bytes transmitted (**T**) and received (**R**). The middle RS485 area contains other statistics. The statistics include transaction total good and bad, packets transmitted and received with number of timeouts and good and

bad CRCs. Additionally communication errors are counted. The middle RS485 area is similar to the following:

```
AMC-1DB Gas Monitor <Ver>
Display Log
MODBUS1 RS485 Statistics:

Transaction Total:93746
Good:93746, Bad:0

RTU Pkt(s) TX:93756,RX:93756
CRC(s): Good:93756,Bad:0
Timeout(s):0

RX Communication Error(s):0
Gap(s):0,Bad Length(s):0
Dtimer Err(s):0




--------------------------------
RS485 Bytes: P1
T113065 R105400
```

6.15.11 GET ETHERNET STATUS

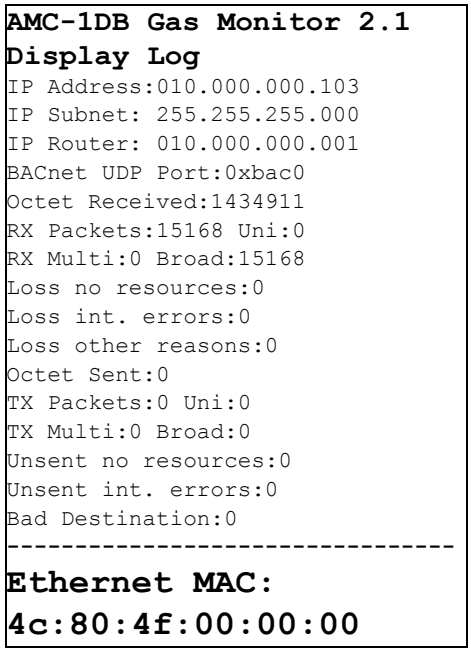
The Get Ethernet status menu allows you to view operational status and statistics about the ethernet in question before having to log into the monitor.

To access the Get Ethernet Status menu

1. At the Log In screen, press the **DOWN** pushbutton.
   The Set Options screen is displayed
2. Press the **DOWN** pushbutton.
   The Select Sensor screen is displayed.
3. Press the **DOWN** pushbutton.
   The Select Relay screen is displayed.
4. Press the **DOWN** pushbutton.
   The Get Sensor Status screen is displayed.
5. Press the **DOWN** pushbutton.
   The Get Relay Status screen is displayed.
6. Press the **DOWN** pushbutton.
   The Get AOUT Status screen is displayed.
7. Press the **DOWN** pushbutton.
   The Get RS485 Status screen is displayed.
8. Press the **DOWN** pushbutton.
   The Get Ethernet Status screen is displayed.

```
Get Ethernet Status
```

9. Press **ENTER** to navigate to the ethernet information. The bottom two lines of the display will show the Ethernet MAC. The middle Ethernet Status area contains other statistics and information including the IP Address, Subnet MASK, IP Router address and BACnet UDP. The statistics include transmitted and received octets and packets and counts for Unicast, multicast and broadcast. Additionally received losses and unsent packets are counted. The middle Ethernet status area is similar to the following:



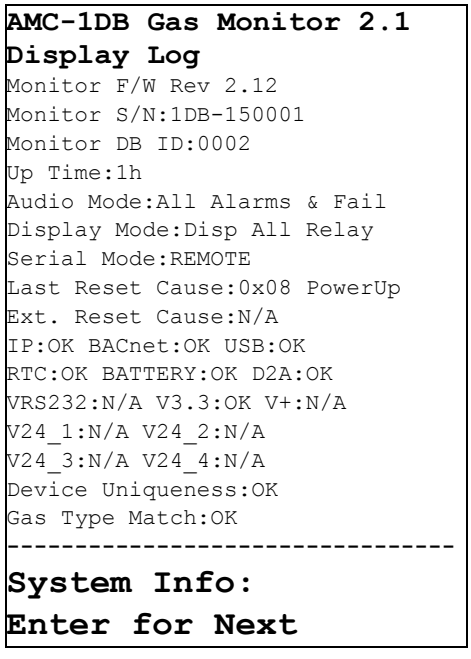
6.15.12 GET SYSTEM INFO.

The Get System Info menu allows you to view information about the system status and application license.

To access the Get System Info screen

1. At the Log In screen, press the **DOWN** pushbutton.
   The Set Options screen is displayed
2. Press the **DOWN** pushbutton.
   The Select Sensor screen is displayed.
3. Press the **DOWN** pushbutton.
   The Select Relay screen is displayed.
4. Press the **DOWN** pushbutton.
   The Get Sensor Status screen is displayed.
5. Press the **DOWN** pushbutton.
   The Get Relay Status screen is displayed.
6. Press the **DOWN** pushbutton.
   The Get RS485 Status screen is displayed.
7. Press the **DOWN** pushbutton.
   The Get Ethernet Status screen is displayed.
8. Press the **DOWN** pushbutton.
   The Get System Info Screen is displayed.

Press **ENTER** to navigate the system status and the license information. The license information is displayed across several screens. Press **ENTER** to navigate to next screens

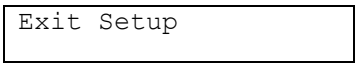


6.15.13 EXIT SETUP

The Exit Setup menu allows you to exit from the monitor setup.

To access the Exit Setup screen

1. At the Log In screen, press the **DOWN** pushbutton.
   The Set Options screen is displayed
2. Press the **DOWN** pushbutton.
   The Select Sensor screen is displayed.
3. Press the **DOWN** pushbutton.
   The Select Relay screen is displayed.
4. Press the **DOWN** pushbutton.
   The Get Sensor Status screen is displayed.
5. Press the **DOWN** pushbutton.
   The Get Relay Status screen is displayed.
6. Press the **DOWN** button.
   The Get RS485 Status screen is displayed.
7. Press the **DOWN** pushbutton.
   The Get Ethernet Status screen is displayed.
8. Press the **DOWN** pushbutton.
   The Get License Info Screen is displayed.
9. Press the **DOWN** pushbutton.
   The Exit Setup screen is displayed.



10. Press **ENTER** to exit the monitor setup.

6.15.14 SELECT SENSOR

The Select Sensor menu allows you to view and change configuration information about the sensor in question. See Figure 6-1: Select Sensor Menu

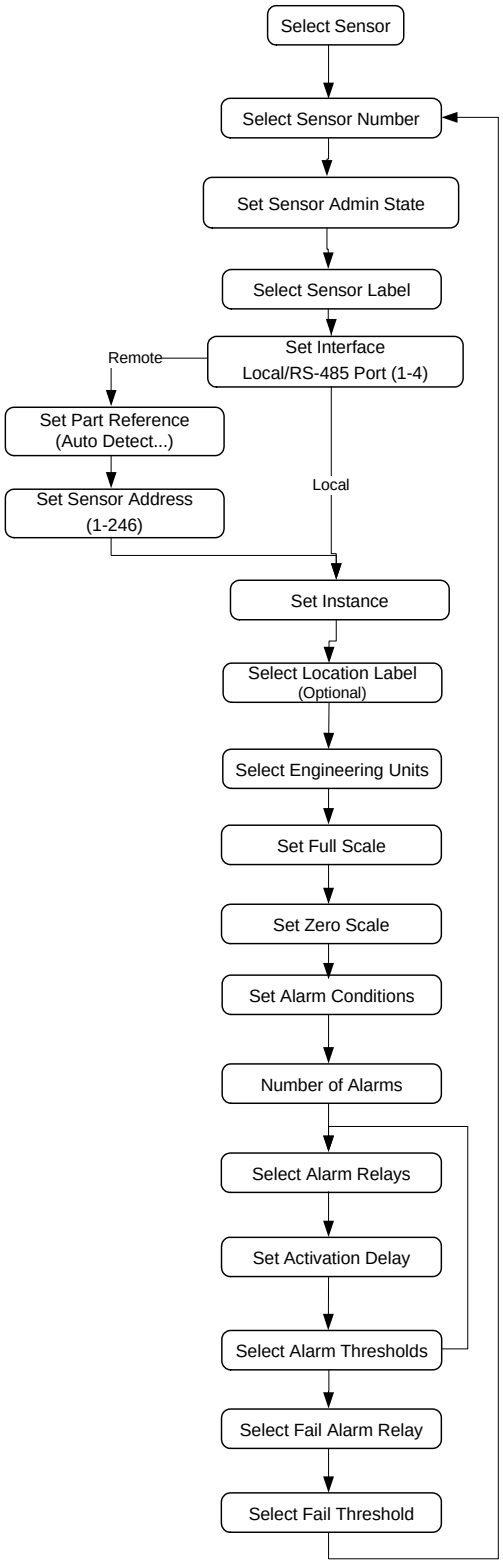


Figure 6-1: Select Sensor Menu

The submenu items listed have various choices selectable with Up and Down pushbuttons. Choice is selectable by the Enter pushbutton, which advances you to the next item. The Previous pushbutton moves you up the hierarchy.

Note: The √ found in the display indicates sensor, relay or analog output is unique. A unique device is one that is not duplicated within systems, address, interface, and instance configuration.

The ↓(down-arrow) located between the display items indicates that the user must press the **ENTER** pushbutton to drill-down to the next submenu item.

To access the Select Sensor menu

1. Log into the gas monitor.
2. At the Log In screen, press **ENTER**.
3. Enter the valid 4-character password.
4. Press **ENTER**.
   The Select Sensor menu item is displayed.

Table 6-1 describes the submenu items found in the Select Sensor menu.

Table 6-1: Select Sensor Submenu

SUBMENU	DESCRIPTION	DISPLAY
Select Sensor	Allows the selection of the sensor of interest for displaying the sensor configuration. (1-988)	Select Sensor 1
Set Sensor Admin State	Shows the selection of the sensor admin state. (Enable/Disable)	Sensor Admin √S#001 Enable
Select Sensor Label	Shows the selection of the sensor label. (See Appendix of gas types)	Existing Label√S#001 CO
Sensor Interface	Shows the selection of the sensor interface.(Modbus1, Modbus2, Modbus3, Modbus4)	Sen. Interface√S#001 Modbus1
Sensor Part Reference	Shows the selection of the sensor Part reference. (Auto Detect, AMC-400, ECGOLD, AMC-DTR, BCI8, AMC-SIR, AMC1D8R, AMC-1DRM2, AMC-1DRM4, AMC1DRM8)	Sen. Part Ref.√S#001 AMC-400
Sensor Address	Shows the selection of the sensor address. (1-247)	Sen. Address √S#001 1
Set Instance	Shows the selection of the sensor instance. (1-4)	Sen R Instance√S#001 1

Set Location Label (Optional)	Shows the setting of the location label. (If option configured from Option menu)	Location Label√S#001 L1
Set Engineering Units	Shows the setting of the engineering units.(PPM, PPB, %LEL,)	Eng. Units √S#001 PPM
Set Full Scale	Shows the setting of full scale.	Full Scale √S#001 100.0 PPM
Set Zero Scale	Shows the setting of zero scale. (Only available on certain gas types. See Appendix of gas types)	Zero Scale √S#001 0.0 DegC
Set Alarm Conditions	Shows the setting of alarm conditions. (Incr. Decr. Disabled, Window)	Alm Condition √S#001 Incr Alarm
Number of Alarms	Shows the setting for the number of alarms. (1-3. See Appendix of gas types)	No of Alarms √S#001 2
Select Alarm Relays	Shows the setting of alarm relays. (1= relay; A1=Alarm Point 1; S=sensor)	Alarm Relay A1√S#001 1
Set Activation Delay	Shows the setting of the activation delay. (in seconds) – Activation delay is the amount of time a sensor must meet the alarm threshold to trigger the sensor alarm.	Act. Delay A1 √S#001 14 sec
Set Alarm Thresholds	Shows the setting of the alarm thresholds.	Alarm Set A1 √S#001 25 %FS 25.0 PPM
Set Fail Alarm Relay	Shows the setting of the fail alarm relay. (select 1-256); (relay=10)	F-Alarm Relay √S#001 10
Set Fail Activation Delay	Shows the setting of the fail activation delay. (select 0-3600 seconds)	Act. Delay A4 √S#001 315 sec
Set Fail Threshold	Shows the setting of the fail threshold.	Fail Thresh √S#001 2.0 mA

Note: The digital monitor uses an internal representation of a 4 – 20 mA interface when dealing with sensors. Operational sensors have gas concentrations represented by mA concentrations between 4 and 20 mA. When a digital sensor is in failure mode, the representation of it's gas concentration will be set to 0 mA.

6.15.15 SELECT RELAY

The Select Relay menu provides access to menu items which configure the system relays. See Figure 6-2.

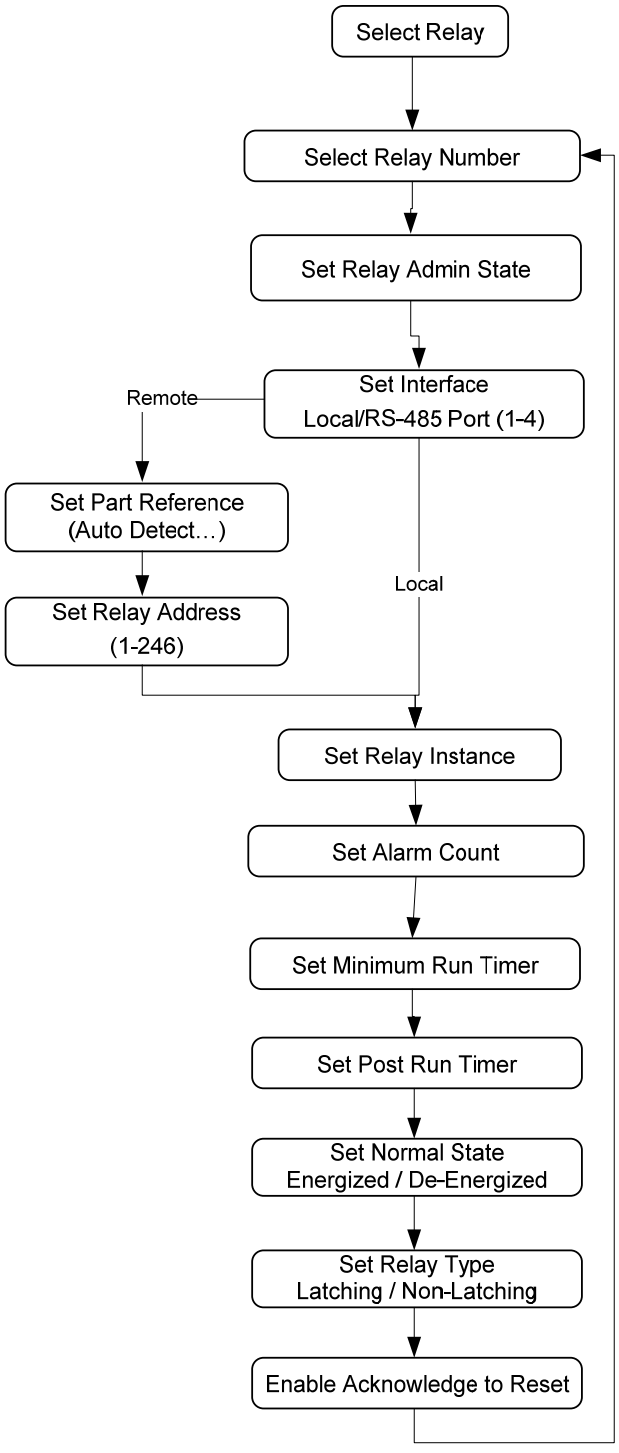


Figure 6-2: Select Relay Menu

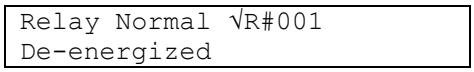
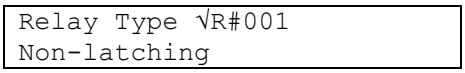
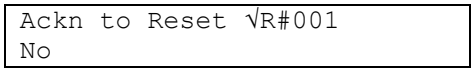
To access the Select Relay menu

1. Log into the gas monitor.
2. At the Log In screen, press **ENTER**.
3. Enter the valid 4-character password.
4. Press **ENTER**.
   The Select Sensor menu item is displayed.
5. Press the **DOWN** pushbutton.
   The Select Relay menu item is displayed.

Table 6-2 describes the submenu items found in the Select Relay menu.

Table 6-2: Select Relay Menu

SUBMENU	DESCRIPTION	DISPLAY
Select Relay	Allows the selection of the relay of interest for displaying the relay configuration. (1-256)	Select Relay 1
Set Relay Admin State	Shows the selection of the relay admin state. (Enable/Disable)	Select Admin √R#001 Enable
Set Interface	Shows the selection of the relay interface. (Local, Modbus1, Modbus2, Modbus3, Modbus4)	Rly. Interface √R#001 Modbus1
Set Relay Part Reference	Shows the selection of the relay Part Reference. (Auto Detect, AMC-1D8R, ERERM8, AMC-1DRM2, AMC-1DRM8, AMC-1DRM4)	Rly. Part Ref.√R#001 Auto Detect
Set Relay Address	Shows the selection of the relay address. (1-256)	Rly. R Address√R#001 100
Set Relay Instance	Shows the selection of the relay instance. (1-16 L=local, 1-8 R=Remote)	Rly R Instance√R#001 1
Set Alarm Count	Shows the selection for the number of alarms. (1-99)	Alarm count √R#001 1
Set Minimum Run Timer	Shows the minimum run time. (0-60, ensures minimum relay active state regardless of alarm/fail event)	Min Run Time √R#001 10 min
Set Post Run Timer	Shows the selection of the post run timer. (0-60, holds the relay in active state after alarm/fail event has cleared)	Post Run Time √R#001 0 min

Set Normal State	Shows the setting for the normal state of the relay. (De-energized/Energized)	
Set Relay Type	Shows the setting for the type of relay. (Blank; Latching/Non-latching)	
Enable Acknowledge to Reset	Allows the acknowledgement to reset the relay. (No/Yes)	

6.15.16 SELECT ZONE

The Select Zone menu (Figure 6-3) creates the following associations:

- Between sensors and analog outputs
- Between sensors and multiple relays
- Between time of day and relays

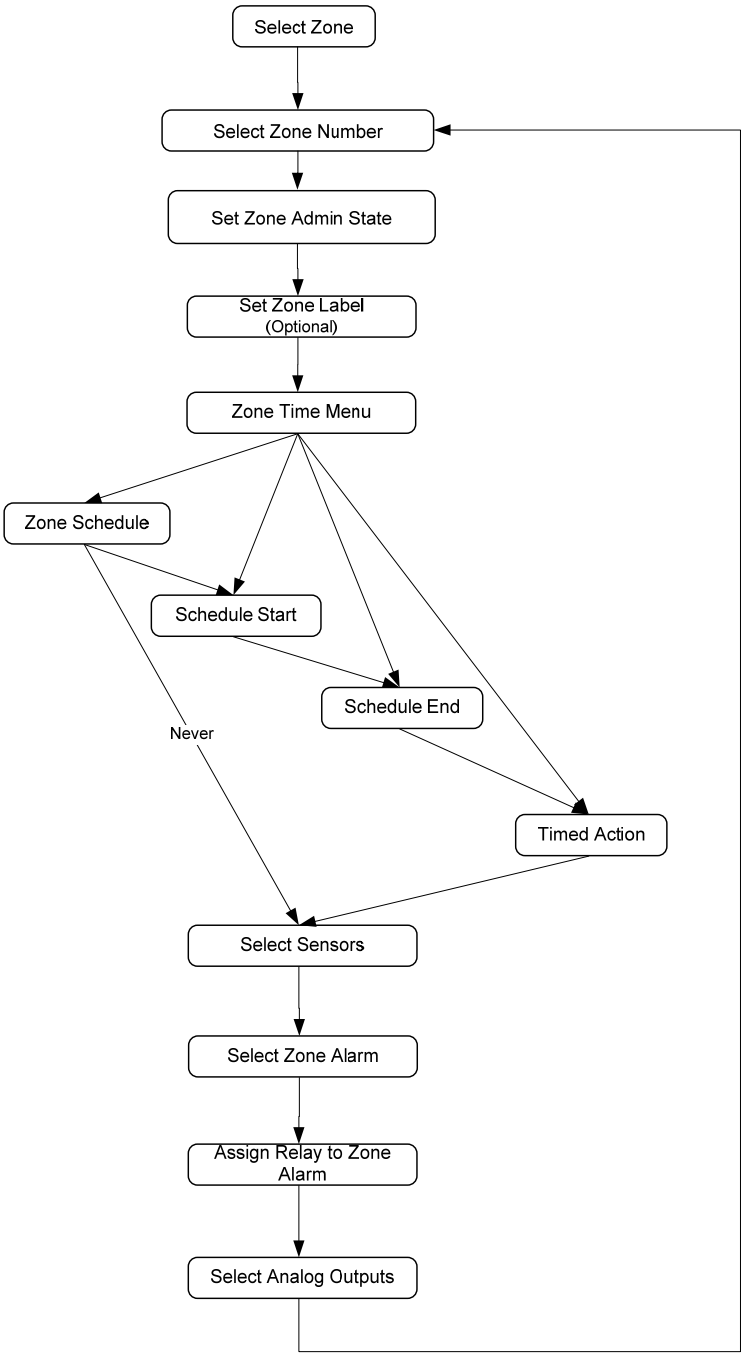


Figure 6-3: Select Zone Menu

To access the Select Zone menu

1. Log into the gas monitor.
2. At the Log In screen, press **ENTER**.
3. Enter the valid 4-character password.
4. Press **ENTER**.
   The Select Sensor menu item is displayed.
5. Press the **DOWN** pushbutton.
   The Select Relay menu item is displayed.
6. Press the **DOWN** pushbutton again.
   The Select Zone menu item is displayed.

Table 6-3 describes the submenu items found in the Select Zone menu.

Table 6-3: Select Zone Submenu

SUBMENU	DESCRIPTION	DISPLAY
Select Zone	Allows the selection of the zone of interest to review or configure. (1-128)	Select Zone Number 1
Set Zone Admin State	Shows the selection of the zone admin state. (Enable/Disable)	Select Zone Z#001 Enable
Set Zone Label	Shows the selection of the zone label that identifies a geographic area. (Zone labels have a max of 20 characters).	Set Zone Label Z#128 4E Parking Garage
Zone Time Menu	Provides access to timed zone events configuration options. (Zone schedule, Timed action, Schedule Start/End)	Zone Time Menu Z#001 Zone Schedule
Zone Schedule	Shows the selection of the zone schedule state. (Never, Sunday's, Monday's, Tuesday's, Wednesday's, Thursday's, Friday's, Mon. to Fri., Mon. to Sun, Mon to Sat)	Zone Schedule Z#001 Disabled
Schedule Start	Shows the selection of the time of day that relays are asserted to the enable or disable state.	Schedule Start Z#001 23:59
Schedule End	Shows the selection of the time of day that relays are released from the enable or disable state.	Schedule End Z#001 00:01

Timed Action — Shows the selection of the relays action. (Enable/Disable)

```
Timed Action Z#001
Enable Relay
```

↓

Select Sensor — Shows the selection of the sensors associated to the defined zone. Up to 128 sensors may be associated with a zone, which are stored in the IDs indicated by the S#. Consecutive IDs can be filled or blanked for a range starting at S#. (ID001-ID128,QUIT)

```
Zone Sensors Z#001
ID001 for:001 @ S987
```

↓

The display's middle area shows the current 128 IDs for the zone (see the following example).

```
AMC-1DB Gas Monitor <Ver>
Display Log
001,002,003,004,005,006,007,008
009,010,011,012,013,014,015,016
017,018,019,020,021,022,023,024
025,026,027,028,029,030,031,032
033,034,035,036,037,038,039,040
041,042,043,044,045,046,047,048
049,050,051,052,053,054,055,056
057,058,059,060,061,062,063,064
065,066,067,068,069,070,071,072
073,074,075,076,077,078,079,080
073,074,075,076,077,078,079,080
081,082,083,084,085,086,087,088
089,090,091,092,093,094,095,096
097,098,099,100,101,102,103,104
105,106,107,108,109,110,111,112
121,122,123,124,125,126,127,128
--------------------------------
Zone Sensors Z#128
ID001 for:001 @ S001
```

Select Relay — Shows the selection of the relays associated with each zone's alarms. (Alarm1 Relay, Alarm2 Relay, Alarm3 Relay, Fail Relay) Note: Actual activation of Alarm Relays is dependent on the sensor's No. of Alarms setting.

```
Zone Relays Z#001
Alarm1 Relay
```

↓

Shows the selection of the zone associated to an Alarm/Fail Relay. (1-256)

```
Alarm1 Relay Z#001
1
```

↓

Select Analog Output — Shows the selection of the zone associated to an analog output. (1-128)

```
Zone AnaOut Z#001
128
```

6.15.17 SET OPTIONS

Configuration items which are used system-wide are configured from the Set Options Menu. See Figure 6-4: Set Options Menu

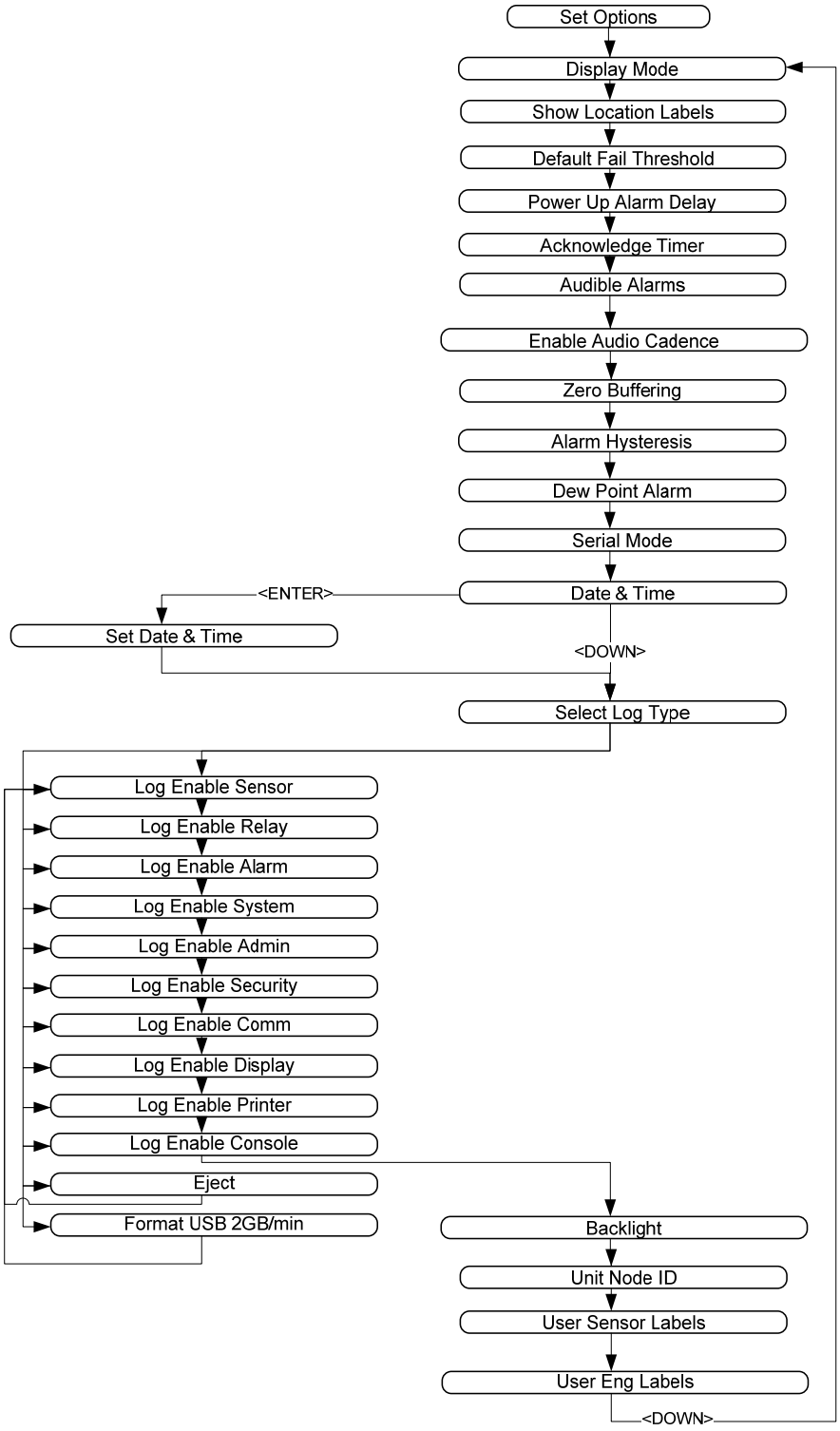


Figure 6-4: Set Options Menu

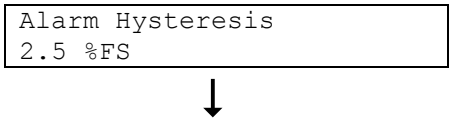
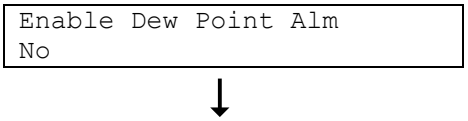
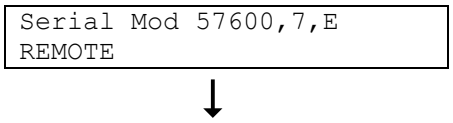
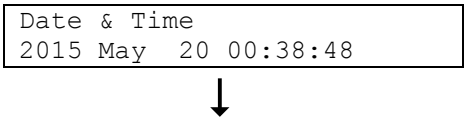
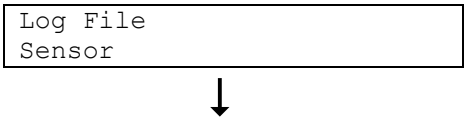
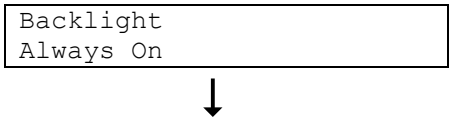
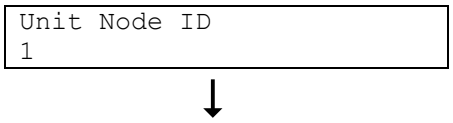
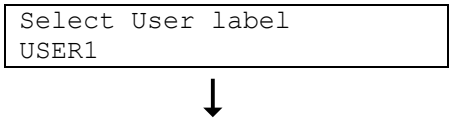
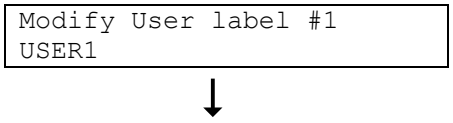
To access the Set Options submenu

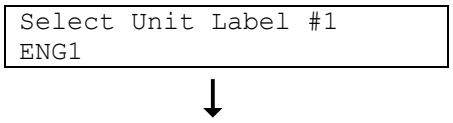
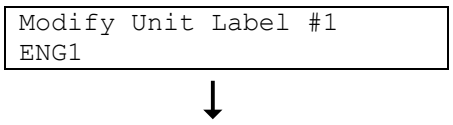
1. Log into the gas monitor.
2. At the Log In screen, press **ENTER**.
3. Enter the valid 4-character password.
4. Press **ENTER**.
   The Select Sensor menu item is displayed.
5. Press the **DOWN** pushbutton.
   The Select Relay menu item is displayed.
6. Press the **DOWN** pushbutton again.
   The Select Zone menu item is displayed.
7. Continue pressing the **DOWN** pushbutton until the Set Options submenu is displayed.

Table 6-4 describes the submenu items found in the Set Options menu.

Table 6-4: Set Options Submenu

SUBMENU	DESCRIPTION	DISPLAY
Display Mode	Allows the selection of the display mode. (Disp All Data; Disp All Relay; Disp New Alarms only; Disp Alarms only; Disp Raw input)	Display Mode Disp All Data
Show Location Labels	Allows the selection of showing the location labels. (Yes/No)	Show Location Labels Yes
Default Fail Threshold	Shows the selection of the default fail threshold. (0.1-4.0mA)	Def Fail Threshold 1.9 mA
Power Up Alarm Delay	Shows the selection of the power up alarm delay setting. (1-999 seconds)	Power Up Alarm Delay 60 sec
Acknowledge Timer	Shows the selection of the acknowledge timer setting. (Blank; 0-60 minutes infinite)	Ackn Timer 0 min
Audible Alarms	Shows the selection of the audible alarm. (All Alarms; all Alarms & Fail; H-Alarms On)	Audible Alarms All Alarms & Fail
Audio Cadence	Shows the selection of the audible cadence. (Continuous; Pulse)	Audio Cadence Continuous
Zero Buffering	Shows the selection of zero buffering. (0.0 %FS to 5.0 % FS)	Zero Buffering 2.0 %FS

Alarm Hysteresis	Shows the selection of the alarm hysteresis. (0.0 %FS to 5.0 % FS)	
Enable Dew Point Alarm	Shows the selection to enable the alarm dew point. (Yes/No)	
Serial Mode	Shows the selection of the Serial Mode choice. (Remote; Printer) Printer serial mode will configure a port to dump periodic system information. Remote serial mode allows transfer of system configuration to and from a remote AMC Manager application.	
Date and Time	Shows the selection of the date and time. This selection contains fields for local date and time and can be adjusted using the UP and DOWN buttons. The ENTER button will progress to the next field. The time fields use a 24 hour h:m:s format.	
Log File	Shows the selection of the log file enables; Sensor; Relay; Alarm; System; Admin; Security; Comm; Display; Printer; Console; Eject USB; Format USB (Enable/Disable).	
Backlight	Shows the selection of the backlight setting. (Always On; Power Save)	
Unit Node ID	Allows the selection of the unit node ID (1-9). Unit node ID is applicable when Serial Mode is configured for Remote. A remote AMC Manager application can support up to 9 nodes.	
Select User Label	Shows the selection of the user label (USER1 through USER9). User label allows custom gas labels to be added to the sensor configuration menu.	
Modify User Label	Allows the modification of the user label. (Labels USER1 through USER9 can be changed to a 7 character custom label)	

Select Unit Label	Allows the selection of the unit label. Engineering Unit Label allows custom gas units to be added to the sensor configuration menu.	
Modify Unit Label	Allows the modification of the unit label. (Unit ENG1 through ENG9 can be changed to a 4-character custom unit)	

6.15.18 SET INTERFACE

The Set Interface menu is the top level menu item used to configure the digital interfaces for the monitor. See Figure 6-5.

From this top level you can navigate to configuration menus for the following interfaces:

- RS-485 interfaces facing downstream to the MODBUS slave devices (transmitters, relay modules and annunciators)
- RS-485 interface facing upstream to the BAS
- Ethernet/IP interface to the attached LAN (see Set IP Configuration)
- BACnet interfaces to the BAS (see Set BACnet Configuration)
- MODBUS interface facing upstream to the BAS (see Set MODBUS Configuration)
- Analog outputs (Set Analog Out)

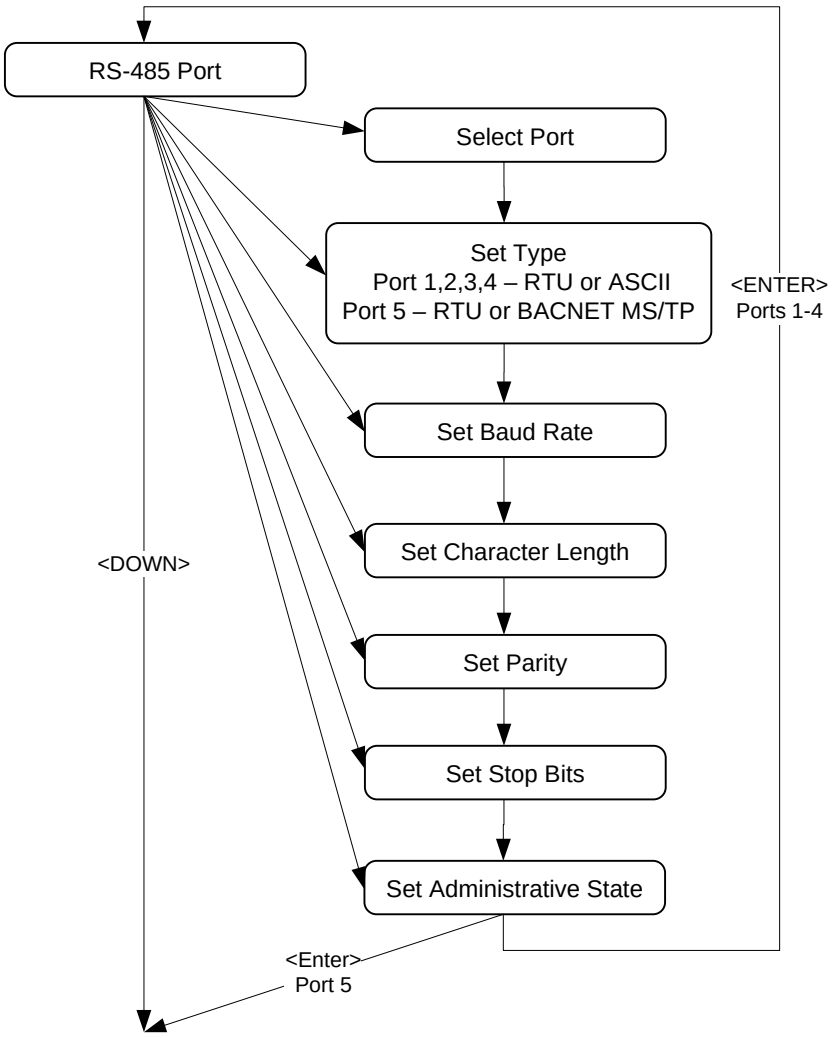


Figure 6-5: Set Interface (RS-485) Menu

To access the Set Interface menu

1. Log into the gas monitor.
2. At the Log In screen, press **ENTER**.
3. Enter the valid 4-character password.
4. Press **ENTER**.
   The Select Sensor menu item is displayed.
5. Press the **DOWN** pushbutton until the Set Interface submenu is displayed.

Table 6-5 describes the submenu items found in the Set Interface menu.

Table 6-5: Set Interface Submenu

SUBMENU	DESCRIPTION	DISPLAY
RS485 Port	Allows the selection of the RS-485 port. RS-485 ports are configured here for use in sensor; relay and analog output set interface selection.	RS485 Port Select RS485 Port
Change RS485 Port	Provides the changing of the RS-485 port. (Ports 1-4 to sensors, relays and analog outputs 5 to BAS)	Change RS485 Port 1 (To Sensor etc.)
RS485 Protocol	Allows the selection of the RS-485 protocol. (MODBUS RTU; BACNET MSTP; MODBUS ASCII)	RS485 Protocol P1 MODBUS RTU
RS485 Baud P1	Allows the selection of the RS-485 baud rate. (1200, 2400, 4800, 9600, 19200, 38400, 76800, 115200)	RS485 Baud P1 9600 bps
RS485 Character Length P1	Allows the selection of the RS-485 character length. (MODBUS ASCII= 7, 8 bits; MODBUS RTU/BACNET MSTP= 8 bits only)	RS485 Char. Len. P1 8 bits
RS485 Parity P1	Allows the selection of the RS-485 parity. (MODBUS ASCII/MODBUS RTU=None, Even, Odd; BACNET MSTP=None only)	RS485 Parity P1 Even
RS485 Stop Bits P1	Allows the selection of the RS-485 stop bits. (MODBUS ASCII/MODBUS RTU=1, 1.5, 2 bits; BACNET MSTP=1 bit)	RS485 Stop Bits P1 1 bit
RS485 Admin P1	Allows the selection of the RS-485 admin state. (Enable/Disable)	RS485 Admin P1 Enable

6.15.19 SET IP CONFIGURATION

The AMC-1DBx digital monitor contains one 10/100baseT Ethernet power. The monitor supports the IP protocol over this interface. The IP protocol is required to support BACnet/IP, MODBUS TCP, web and telnet services.

The IP protocol requires the following configuration items to enable successful communications:

- IP Address
- Subnet mask
- Router IP Address

The default IP Configuration parameters are:

- IP Address 10.0.0.103,
- IP Subnet Mask 255.255.255.0,
- Router IP Address 10.0.0.1

The IP Address, IP Subnet Mask or Router IP Address cannot be set to all 1's or all 0's.

The Set IP Configuration submenu is displayed in Figure 6-6. This submenu is accessed from the Set Interface menu.

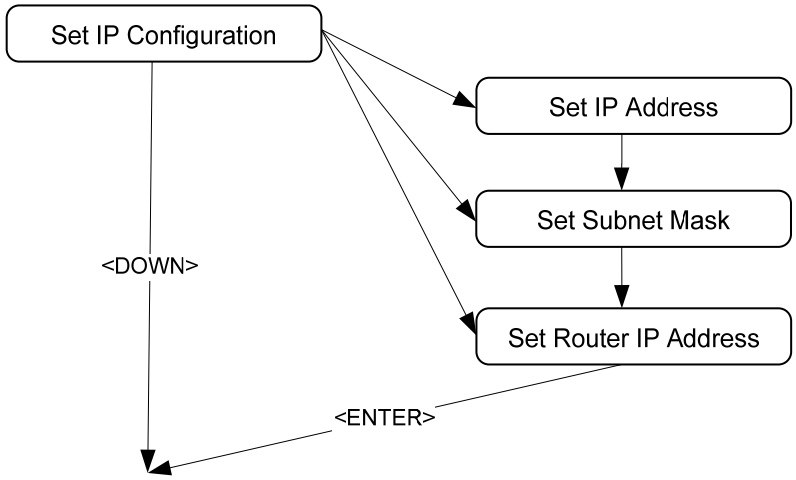


Figure 6-6: Set IP Configuration Submenu

To access the Set IP Configuration submenu

1. Log into the gas monitor.
2. At the Log In screen, press **ENTER**.
3. Enter the valid 4-character password.
4. Press **ENTER**.
   The Select Sensor menu item is displayed.
5. Press the **DOWN** pushbutton until the Set Interface submenu is displayed.
6. Configure the Set Interface submenu items as necessary.
   Once the configuration of the Set Interface submenu items is completed, the IP Configuration submenu is displayed.

Table 6-6 describes the items found in the Set IP Configuration submenu.

Table 6-6: Set IP Configuration Submenu

SUBMENU	DESCRIPTION	DISPLAY
IP Configuration Set IP Address	Allows the selection of the IP address. (Set IP Address, Set Net Mask, Set Router IP Addr)	IP Configuration Set IP Address
IP Address	Shows the selection of the IP address. (0-255 for each network segment)	IP Address 010.000.000.103
IP NetMask	Shows the selection of the IP NetMask. (0-255 for each network segment)	IP NetMask 255.255.255.000
IP Router	Shows the selection of the IP router. (0-255 for each network segment)	IP Router 010.000.000.001

6.15.20 SET BACnet CONFIGURATION

The AMC-1DBx digital monitor supports BACnet or EthernetIP and RS-485.
In order to support BACnet, the following site-specific attributes require configuration:

- Set BACnet Device Name
- Set BACnet Device ID
- Set BACnet Network Number
- Set BACnet Transport

if BACnet IP;

- Set BACnet IP UDP Port
- Set BACnet IP BBMD Address
- Set BACnet IP Time to Live.

If BACnet MSTP;

- Set BACnet MSTP Address
- Set BACnet MSTP Maximum Masters
- Set BACnet MSTP Timeout.

The Set BACnet Configuration submenu is displayed in Figure 6-7.

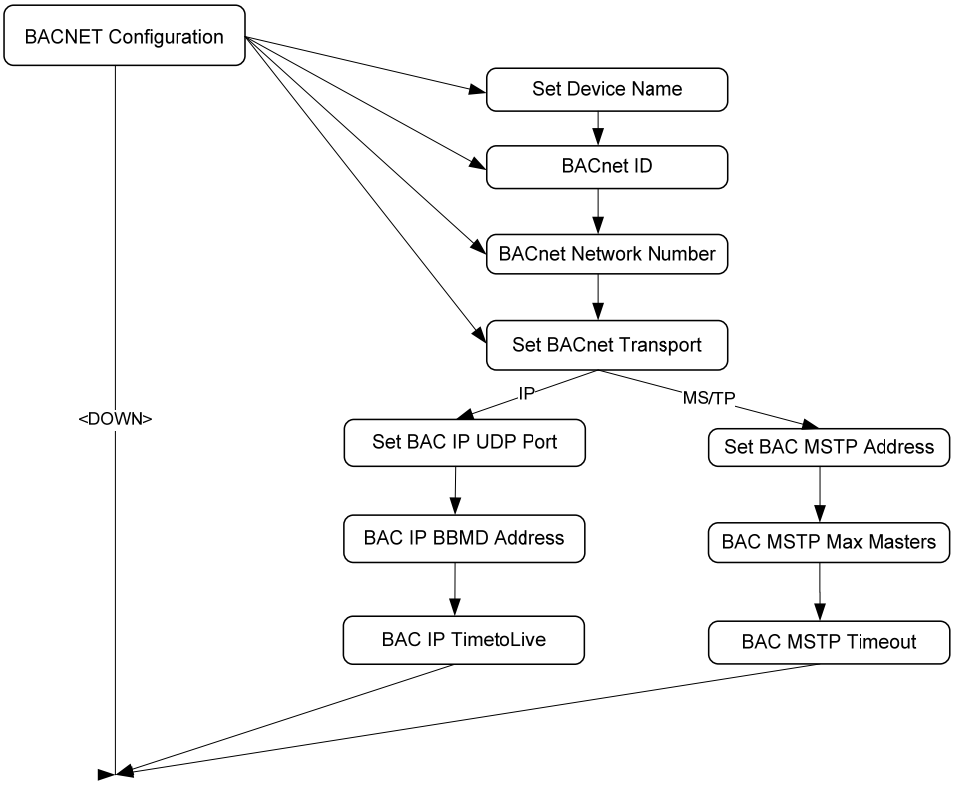


Figure 6-7: Set BACnet Configuration Submenu

To access the Set BACnet Configuration submenu

1. Log into the gas monitor.
2. At the Log In screen, press **ENTER**.
3. Enter the valid 4-character password.

4. Press **ENTER**.
   The Select Sensor menu item is displayed.
5. Press the **DOWN** pushbutton until the Set Interface submenu is displayed.
6. Configure the Set Interface submenu items as necessary.
   Once the configuration of the Set Interface submenu items has been completed, the IP Configuration submenu is displayed.
   Once the configuration of the IP Configuration submenu is completed, the Set BACnet Configuration submenu is displayed.

Table 6-7 describes the items found in the Set BACnet Configuration submenu.

Table 6-7: Set BACnet Configuration Submenu

SUBMENU	DESCRIPTION	DISPLAY
BACnet BAS SetDevice Name	Allows the setting of the device name. (Set Device Name, Set Transport, Set Network Number, Set Device ID)	BACnet BAS Set Device Name
BACnet Name	Shows the selection of the BACnet name. (maximum of 20 characters)	BACnet Name AMC-1DBx BACnet Name
BACnet ID	Shows the selection of the BACnet ID. (any number between 0 and 4,194,303)	BACnet ID 1000003
BACnet Network Number	Shows the selection of the BACnet network number. (0-65534)	BACnet Network Number 00000
Configure BACnet Transport	Shows the selection of the BACnet transport types. (BACnet IP, BACnet MSTP). (If transport set to BACNET IP, go to Set BAC IP UDP Port)	Set BACnet Transport BACNET MSTP
Set BAC MSTP Address	Shows the selection of the BAC MSTP address. (Min value=1, max value=127, default value=127)	Set BAC MSTP Address 127
Set BAC MSTP Max Master	Shows the selection of the BAC MSTP max master number. (Min value=1, max value=127, default value=127)	BAC MSTP Max Masters 127
Set BAC MSTP Timeout	Shows the selection of the BAC MSTP timeout. (20-100ms, default value=20ms)	BAC MSTP Timeout 72 ms
Set BAC IP UDP Port	Shows the selection of the BAC IP UDP protocol. (UDP port is a 16-bit value between 47808 and 47823. BACnet typically uses port 47808)	Set BAC IP UDP Port 47820

Set BAC IP BBMD Address	Shows the selection of the BAC IP BBMD address. (0-255 for each network segment) A non-zero value will require registration with a BACnet Broadcast Master Device.	BAC IP BBMD Address 000.000.000.000
Set BAC IP TimetoLive	Shows the selection of the BAC IP Time to Live setting (0-65535 seconds).	BAC IP TimetoLive 00060 seconds

6.15.21 SET MODBUS CONFIGURATION

The monitor provides a single RS-485 port which interfaces to management systems such as BAS, DCS or PLC. The following menu items shown in Figure 6-8 provide the necessary site-specific configurations for interconnecting the MODBUS interface between systems.

These configuration items consist of:

- Slave MODBUS Address
- Slave MODBUS Lockcode
- Slave MODBUS Protocol

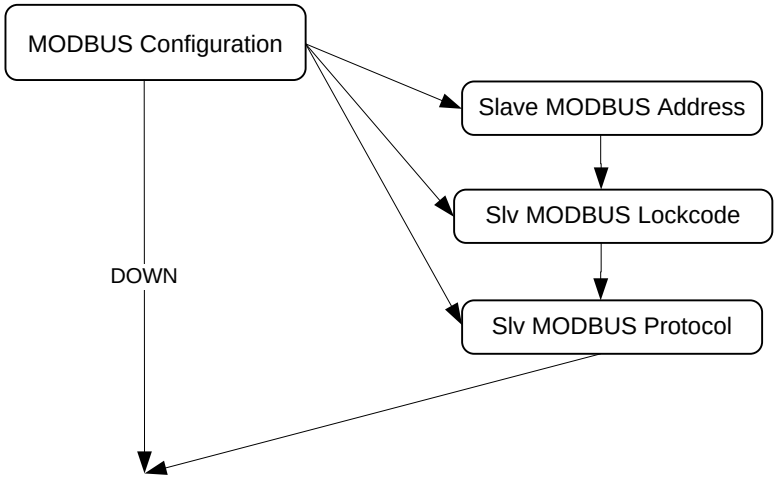


Figure 6-8: Set MODBUS Configuration

To access the Set MODBUS Configuration submenu

1. Log into the gas monitor.
2. At the Log In screen, press **ENTER**.
3. Enter the valid 4-character password.
4. Press **ENTER**.
   The Select Sensor menu item is displayed.
5. Press the **DOWN** pushbutton until the Set Interface submenu is displayed.
6. Configure the Set Interface submenu items as necessary.
   Once the configuration of the Set Interface submenu items has been completed, the IP Configuration submenu is displayed.

Once the configuration of the IP Configuration submenu is completed, the BACnet Configuration submenu is displayed.

Once the configuration of the BACnet submenu is completed, the MODBUS BAS submenu is displayed.

Table 6-8 describes the items found in the Set MODBUS Configuration submenu.

Table 6-8: Set MODBUS Configuration Submenu

SUBMENU	DESCRIPTION	DISPLAY
Set MODBUS	Allows the setting of the MODBUS device. (Slave Address, Protocol, Un-Lock Code)	MODBUS BAS Slave Address
Slave MODBUS Address	Shows the selection of the slave MODBUS address. (1-247)	Slave MODBUS Address 156
Slave MODBUS Lockcode	Shows the selection of the slave MODBUS lockcode (0-65534). BAS must write this pattern into the MODBUS register at 500 to unlock write access to all other writable BAS MODBUS registers. See Appendix for BAS MODBUS register memory map.	Slv MODBUS Lockcode 55535
Slave MODBUS Protocol	Shows the selection of the slave MODBUS protocol. (TCP or RTU)	Slv MODBUS Protocol SLAVE MODBUS RTU

6.15.22 SET ANALOG OUTPUTS

The Set Analog Outputs menu shown in Figure 6-9 provides access to the items which configure the system analog outputs. The Analog Outputs require the following items to be configured for correct operation:

- Analog Output port number
- Administrative State
- Interface (either a unique device and instance on the MODBUS, or a local device and instance on the monitor)
- Range (0-10V or 2-10V)
- Scaling
- Type (group average or group maximum)
- Sample Period

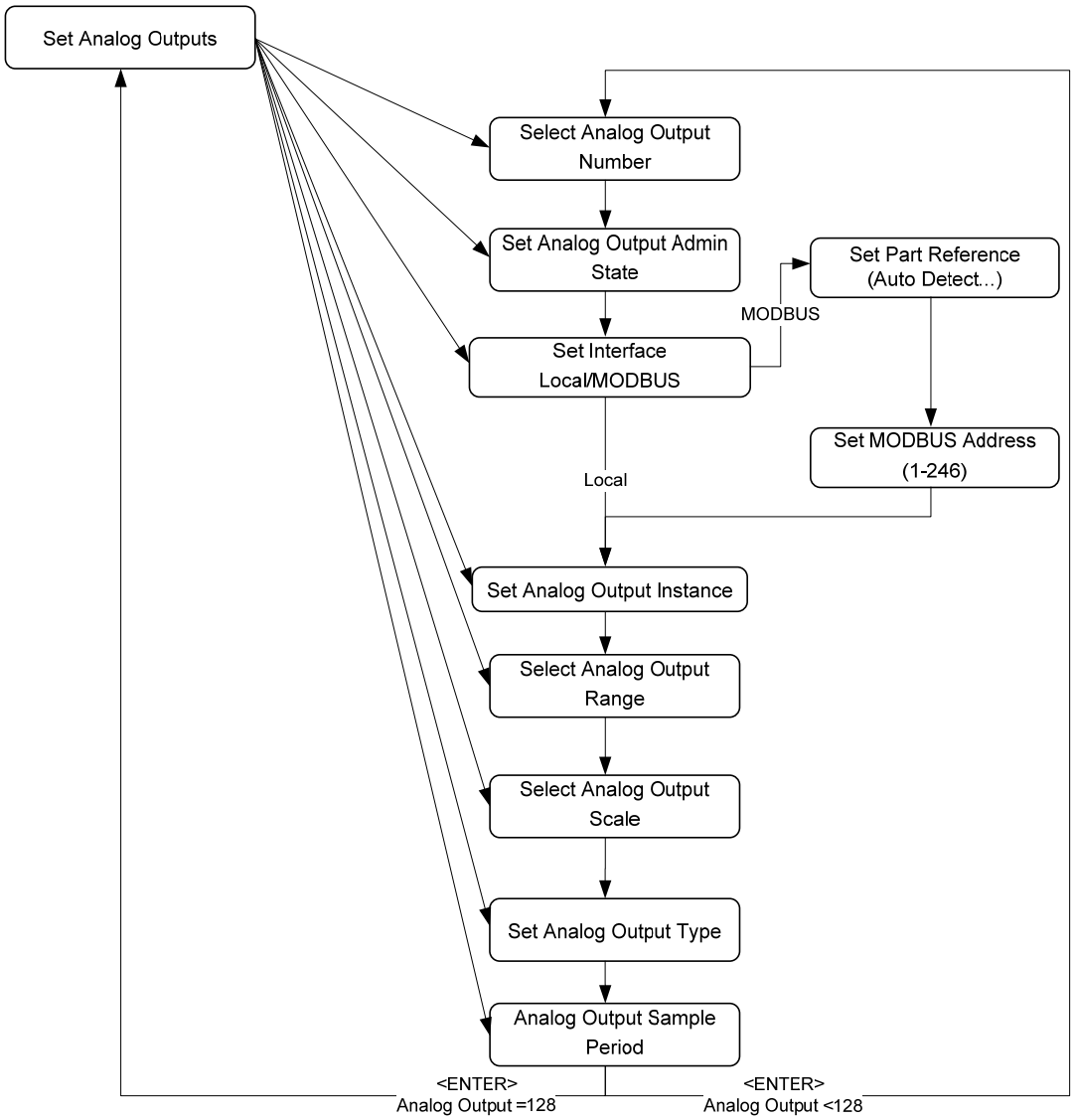


Figure 6-9: Set Analog Outputs

To access the Analog Out submenu

1. Log into the gas monitor.
2. At the Log In screen, press **ENTER**.
3. Enter the valid 4-character password.
4. Press **ENTER**.
   The Select Sensor menu item is displayed.
5. Press the **DOWN** pushbutton until the Set Interface submenu is displayed.
6. Configure the Set Interface submenu items as necessary.
   Once the configuration of the Set Interface submenu items has been completed, the IP Configuration submenu is displayed.

   Once the configuration of the IP Configuration submenu is completed, the BACnet Configuration submenu is displayed.

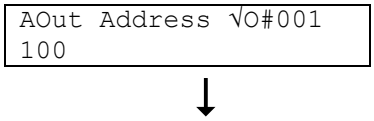
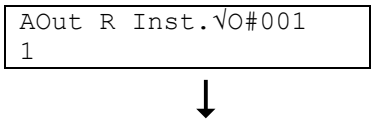
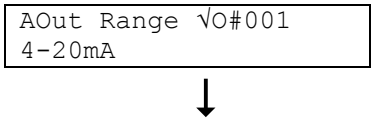
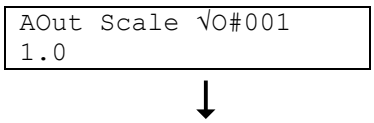
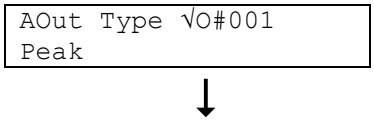
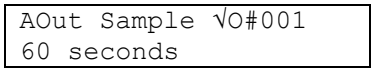
   Once the configuration of the BACnet submenu is completed, the MODBUS BAS submenu is displayed.

   Once the configuration of the MODBUS BAS submenu is completed, the Analog Out submenu is displayed.

Table 6-9 describes the items found in the Analog Out submenu.

Table 6-9: Analog Out Submenu

SUBMENU	DESCRIPTION	DISPLAY
Analog Out	Allows the setting of the analog out menu items which configure the system analog outputs.	Analog Out
Analog Out Select Analog Out #	Shows the setting of the analog out item. (Analog Out Admin, AnaOut Interface, AnaOut Range, AnaOut Scale, AnaOut Type, AnaOut Sample)	Analog Out AnaOut Interface
Analog Output Number	Shows which analog interface is to be configured. (1 to 128)	Select Analog Out # 1
Analog Output Admin State	Shows the setting of the analog output admin state. (Out of Service, Disable/Enable) Out of Service mode enables the analog output at a fixed 0.0mA level when proper communication to the device is achieved.	AOut Admin √O#001 Enable
Analog Output Interface	Shows the setting of the analog output interface. (Local, Modbus1, Modbus2, Modbus3, Modbus4)	AOut Interface√O#001 Modbus1
Analog Output		AOut Part Ref.√O#001 Auto Detect

Part Reference	Shows the setting of the analog device part reference. (Auto Detect, BCO8, AMC-1D8R AMC-1DRM2, AMC-1DRM8, AMC-1DRM4)	
Analog Output Address	Shows the setting of the analog output address. (1-247)	
Analog Output Instance	Shows the setting of the analog output instance. Instances can be local (L) or remote (R).	
Analog Output Range	Shows the setting of the analog output range. (0-20mA, 4-20mA)	
Analog Output Scale	Shows the setting of the analog output scale. (0.1 to 20.0) Scale will multiply the outputs level by the scale value. Using a scale greater then one (1) can saturate the output.	
Analog Output Type	Shows the setting of the analog output type. (Average, peak) The Average and Peak selection refers to how zone data is assigned to this output. Peak will select to highest level from the list of zone sensors while average will calculate a mean level from the list of zone sensors. When an Analog Output is assigned to more than one zone, the higher numbered zone's data will prevail.	
Analog Output Sampling Period	Shows the setting of the analog output sampling period (1 to 60 seconds). The sampling period provides a running averaging of up to 60 samples over a period of 60 seconds. This allows output smoothing over the sampling period. System performance and periodic device updates prevent ideal smoothing.	

6.15.23 MONITOR COMMISSIONING AND INSTALLATION SCENARIOS

6.15.23.1 System Startup

System startup begins at powering on the monitor and continues until the monitor is in communications with the downstream peripherals and the upstream peers and masters.

Item	Remarks
1. Power-On Reset • Voltage Monitor holds CPU in reset for 3 seconds • Places the System Fail relay in fail safe position.	If voltages are too low, the Monitor will be stuck in this state. If the processor or FLASH memory is faulty no LED activity may occur.
2. Board Level Self-Test – failures reported to display and LEDs. • During startup the System LED will turn on and off as Power On Self-test is performed. • The LCD backlight with turn and Display will begin to perform screen fills with white and black patterns.	Exercises DDR2 memory and the Display Controller, if any test fails: • FAULT LED will remain lit with other combinations of D1-D3 and ALARM1-3 LEDs will indicate failure. • The monitor will reboot over and over. • This monitor faults must be reported to qualified technician for repair. Do not advance to the next step.
3. AMC Monitor Banner and Firmware version will be displayed.	System Initialized, if any test fails: • The System LED will turn off and remain off at this point. If the reset cause was a watchdog or brown-out reset. • This fault can be cleared by pressing the HOLD pushbutton. • This monitor fault must be reported to qualified technician for repair.
4. Database Verification	Data Base and Data Base storage device are checked. The verification test prompts the user to accept default

	database and self-test will be performed on data base storage device, if any test fails: • FAULT LED will remain lit with other combinations of D1-D3 and ALARM1-3 LEDs. The monitor will reboot over and over. • These monitor faults must be reported to qualified technician for repair. Do not advance to the next step.
5. Establish communications with downstream peripherals; relays, analog outputs and sensors.	If the system detects a missing device the FAULT LED will turn on, the external buzzer and Annuniciator will also be activated.
6. Establish communications with Upstream peer and masters.	If the system detects a duplication or configuration problem with the IP and/or BACnet interfaces. The System LED will turn off, the extern buzzer and Annuniciator will also be activated.

6.15.23.2 Adding a New Transmitter

New transmitters will be added to the monitor when customers increase the number of transmitters, either as a result of increased floor plan space or additional gas types. Follow the steps outlined in the following table to add a new transmitter:

Step	Action	Comment
1.	Set the monitor's appropriate RS-485 Interfaces to "Admin Disable" mode.	It is very likely that MODBUS errors will be seen during this install. Disabling the monitor's appropriate RS-485 will force the alarming functions into fail state for that interface. Audio alarms can be disabled with position 1 of dipswitch.
2.	Install the transmitter.	The mounting instructions for transmitters are provided in the transmitter user manual. Select an appropriate location for the transmitter with the following considerations:

- Coverage – ensure it will physically monitor the intended area.
- Airflow – ensure it is not mounted under any air intake ducts.
- Wiring – the RS-485 wiring is a bus. Long stubs are not permitted.
- Conduit – ensure that the wiring is in EMT.
- Powering – is the power supply appropriately sized? After voltage drops in the wiring, will there remain sufficient voltage for the transmitter to operate?
  See the transmitter specifications.
- Access – ensure the transmitter is located where service personnel can have access for calibration purposes.

Mount the transmitter housing to a solid structure (i.e. a wall) at nose height.

Run the wiring to the Transmitter.

- If the transmitter is added in the middle of the bus, be aware that while the bus is “opened” to add a new transmitter, the monitor will be able to communicate with transmitters on the same side of the open.
- If the transmitter extends the bus and becomes the new end unit, ensure the bus termination is removed from the previous end unit. The new unit must be strapped to provide bus termination.

3. Configure the MODBUS address on the transmitter.

- If the transmitter has been ordered with the correct MODBUS address factory configured, this step will not be required.
- If the transmitter has been taken from inventory or service stock, then the configured MODBUS address contained within it is likely not correct. Determine the correct MODBUS address to be employed (see the monitor configuration) and configure it into the transmitter. For as long as an incorrect MODBUS remains configured in the transmitter, monitor indications may be that a previously serviceable transmitter is experiencing communication problems due to the duplicate MODBUS address.

4. Add configuration information for the new transmitter into the monitor database.

5. Set the monitor's appropriate RS-485 Interfaces to "Admin Enable" mode.

- Use the Select Sensor menu to configure the new transmitter into the monitor database.
- Use AMC Manager as an alternative when configuring the monitor from the front panel.

6.15.23.3 Downstream MODBUS Timeout

The MODBUS protocol provides error checking to ensure that messages that are received are verified to be intact and error free. However, errors can occur on the RS-485 interface, which cause the messages to fail the error checking by the receiver of the message. This results in either the transmitter not 'seeing' a message from the monitor, or the monitor does not 'see' the response to a message.

For this reason, when the monitor fails to receive a response from a transmitter, the message will be sent up to 3 times, - the original message plus two retries – before moving to the next transmitter.

- When the monitor discards frames due to error checking, the sensor will appear as fail in the sensor display and the monitor enters fail state.
- Considerations: disable a transmitter that requires too many retries.

12. **Sensor Activation Delay**. When gas concentration crosses a given alarm threshold, the alarm is not activated until the concentration remains above the threshold for the Activation Delay period of time. If the gas concentration falls below the alarm threshold, then the channel activation timer is cleared. The activation delay is set in seconds. Use of the activation delay avoids reacting to temporary transients and/or noise from the sensor.

13. **Minimum Run Timer**. After gas concentration decreases/increases to below/above the Threshold (subject to hysteresis), the relay is kept activated for a minimum period of time defined in the Minimum Run Timer. The minimum run timer ensures that the external fan operation does not suffer from stutter starts, where the fan is activated for under 5 seconds, then deactivated. Fan stutter starts can be a major source of maintenance on the mechanical components (motors, belts, pulleys, etc.) of the fans. The Minimum Run Timer may expire while the sensor signal is still in the alarm state.
The Minimum Run Timer is commonly confused with the Post Run Timer described in the following paragraph.

14. **Post Run Timer**. Once the sensor signal falls below the alarm threshold, then the Post Run Timer keeps the relay activated until the timer expires. The Post Run Timer provides the benefits of the Minimum Run Timer, and additionally ensures that the ventilation is activated long enough to ensure that the gas concentration is well below alarm thresholds.
    The Post Run Timer is commonly confused with the Minimum Run Timer previously described.

6.15.23.4 Zone Operation

The Zone programming allows a group of sensors to be applied to a dedicated set of Alarm/Fail relays. This group could be located on a single floor of an underground parking facility where the group of sensors controls the same ventilation component. The sensors act as a group controlling these relays with the same thresholds set forth in their sensor configuration. Any sensor of the group meeting or exceeding its gas concentration threshold will trigger the assigned ventilation fan. If additional sensors have similar gas concentrations no change to the fan is experienced. The ventilation fan will not be turned off until all sensors in a group fall below their threshold. Additionally an analog output assigned to the zone will track the zone's average or peak gas concentration. A scenario for VFD fans is described in the Analog Output Operation content below. Additionally, the zone contains scheduled relay events whereby these fans can be activated during high use periods such as a rush hour where fresh air is desirable. These scheduled relay events could also be used by the facility during routine inspections.

6.15.23.5 Analog Output Operation

The analog output is representative (average or peak) of the readings seen by all the transmitters in a zone. The analog output is intended to control devices such as variable frequency drive (VFD) fans, in which case the fans turn faster for higher gas concentrations.

6.15.23.6 Repeater

AMC offers a rugged, industrial-grade, optically-isolated RS-485 Hub / Splitter /Repeater, which can be used to expand RS-485 networks by splitting one RS-485 network into four, in turn increasing the maximum number of nodes and the distance covered by an RS-485 network. It was designed so that data coming from the input (RS-485) will transmit to all four loops of RS-485 networks. However, each loop of RS-485 devices will transmit data back to the input only, thus reducing any possible interference between each loop of the RS-485 devices. Also, the failure of any individual loop will not affect other loops, making the RS-485 networks more robust and reliable.

The product features opto-isolation circuitry, which effectively protects your RS-485 devices from ground loops, transient surges, remote lightning and spikes. Opto-isolation also eliminates ground loop and noise problems. The unit supports data rates up to 115,200 bps and features data format auto-sensing and self-adjusting; therefore, no DIP switch or jumpers are required.

Three indicators (only visible when the enclosure door is open) are provided:

- Power Indicator
- Traffic on Slave Bus Indicator
- Traffic on Master Bus Indicator

Refer to Modular Box Series User Manual.

7 PREVENTIVE MAINTENANCE

This section covers all preventive maintenance aspects of the Gas Monitor AMC-1DBx. First, a description of general maintenance is provided followed by a verification of operation

7.1 GENERAL

The monitor unit should be brushed or wiped clean, once a year or more, of any dust or dirt, depending on the accumulation.

The unit SHOULD NOT be submerged in water or other liquids. Also, hosing and other conditions that could cause a liquid to enter the enclosure should be avoided.

7.2 VERIFICATION OF OPERATION

Verification of operation should be performed at least once every 6 months. For highly demanding applications more frequent verification is recommended.

To verify the operation of the system, make sure that the green power LED indicator is on steady state. Push and hold the test button to verify the audio and WARNING and ALARM relays are operational.

8 INSTALLATION TIPS AND TRICKS

8.1 CABLING

- The Communications Cable must have the following characteristics;
  - Shielded, twisted pair, 14-26AWG
  - Characteristic Impedance:120ohms
  - Low Capacitance: ~13pf/ft conductor to conductor and ~ 23pf/ft conductor to shield
- The recommended Power Cable is 14-26 AWG
  - Selected cable must meet Application and/or local regulatory requirements.
  - Wire gauge will affect maximum distance between transmitters and power supply. Thicker wire, greater distance.
  - Route cabling in conduit to avoid damage to cabling.
- Route cabling in conduit to avoid damage to cabling.
- The communications cable shield must be grounded at the monitor end. The shield is wired to the T-connector at each transmitter, to maintain end to end continuity.
- Route cabling away from AC power cabling and any source of electro-magnetic interference (EMI) or radio frequency interference (RFI) such as power transformers, electric motors, etc.
- EMT (Electrical Metal Tube) conduit also adds an added degree of electrical shielding against EMI (Electro-Magnetic Interference) from devices such as RF (i.e. radio) sources.
- All cabling must enter the sensors and monitors from the bottom to ensure protection against water damage due to water inside the conduit from condensation or leaks.
- Ensure that there are no short or open circuits in the sensor cabling.
- Verify that there is no AC or DC voltage present on the sensor cabling prior to connecting the cabling to either the sensor or the monitor.

8.2 EQUIPMENT LOCATION

- Mount all equipment away from any source of electro-magnetic interference (EMI) or radio frequency interference (RFI) such as power transformers, electric motors, etc.
- Mount sensors in accordance with the installation guidelines for the specific species of gas to be detected; i.e. CO sensors should be mounted at breathing height etc.
- Equipment must be positioned such that the chance of water damage is minimized; i.e. away from fire suppression sprinkler heads, away from wet or damp locations where there would be a risk of water damage.
- Ensure a balanced layout of sensors in order to cover the intended area.
- Ensure that sensors are not in close proximity to clean air sources.

8.3 POWER AND GROUNDING

- All power and grounding connections to equipment must be made in accordance with applicable electrical and building codes.

- Use a separate, dedicated, noise free, 15 amp power circuit, with an appropriately labeled circuit breaker.

APPENDIX A GAS TYPES FULL SCALE AND ALARM VALUES

The values in the following table are the default values applied in the sensor configuration when a specific gas label is initially selected. Use this table to help determine whether to change the sensor configuration from its default configuration to meet a specific application.

Ontario Exposure Limits 2010 Nov			**Gas Type**	**Span**	**Alarm1 Eng Units**	**Alarm1 %FS**	**Alarm2 Eng Units**	**Alarm2 %FS**	**Alarm3 Eng Units**	**Alarm3 %FS**	**Eng Units**	**Alarm Type**	**Number Of Alarms**	***Analog Out***
Name	**TWA**	**STEL**												***Fixed Pre-Scale***
Carbon Monoxide	25	100	CO	100	25	25.00%	100	100.00%			PPM	INCR.	2	***1.0***
Nirogen Dioxide	3	5	NO2	10	1	10.00%	3	30.00%			PPM	INCR.	2	***3.3***
Methane			CH4	100	20	20.00%	40	40.00%			LEL	INCR.	2	***2.5***

APPENDIX B GENERAL LOG ITEMS

This appendix describes the log items for Sensor, Relay, Alarm, Security, Administration, Communication and System. Once enabled messages assigned to its group will be logged on a file in the USB Storage device. Log files are text files.

The following lists of current log files are found in the root directory of the storage device:

- SENSOR.LOG
- RELAY.LOG
- ALARM.LOG
- SYSTEM.LOG
- ADMIN.LOG
- SECURITY.LOG
- COMM.LOG
- PRINT.LOG
- ZONE.CSV

At the start of each day, the active log files are moved into an archive folder. The archive log folders are stored under the folder named by Serial Number such as “130001/logs/Year_Month”. For example folder “130001/Logs/2015_05” holds the log files for the month of May, in the year 2015. The log files themselves are renamed, the three digit extension “.log” is replaced with a two digit day of month value. For example “RELAY.05” would be the log file “RELAY.LOG” from the fifth day of the month. Lastly, it is recommended that periodically the USB storage device be backed-up to secure offline storage to ensure the information is not lost. Also removing old log files from USB storage device will increase performance of the operating environment.

Additionally some messages can be directed to the LCD Display or a Telnet Console if the menu item Log File>Display or Log File>Console are enabled.

Upon startup the system log file contains the operating tasks created and the current DIP Switch settings as follows:

NETSETUP_TASK created
USB_MFS_TASK created
MODBUS1_TASK created
MODBUS2_TASK created
MODBUS3_TASK created
MODBUS4_TASK created
SLV_MODBUS_TASK created
MODBUS_RX_LED_TASK created
MODBUS_TX_LED_TASK created
MONITOR_SCOM_TASK created
MONITOR_ADC_TASK created
Watch-dog enabled
USB Device Plugged In
DIP Switch Changed Detected
Old:0x00 New:0xd0
DIP Switch[8:1]: %11010000
0=OFF/Enabled 1=ON/Disabled
LANGB,LANGA,POST RUN,
CAL. MODE ON,MIN. RUN,
ZERO BUFFER,SENSOR DELAY, AUDIO]

The DIP Switch information is also display when change is detected. The Admin and Alarm logs will also display details related to the specific DIP Switch bits.

Additional task messages and monitor information are also displayed in system log file or LCD display upon startup (some details provide later):
TELNET_Server created
TELNET_TASK created
DB_RESTORE_USB_TASK created
No USB Restore DB File
MONITOR_TASK created

AMC-1DB Gas Monitor <Ver>
TIME 2015,5,15 16:37:00 Day:6
Reset Cause:0x08 PowerUp
MAC:4c804f000004 from FLASH
SN:1DB-130001 from FLASH

MONITOR_SWITCH_TASK created
FLASH Upgrade: No USB check file:10aquila.elf.csum
DEVICE_UNIQUENESS_TASK created
Continuous Buzzer Inactive
LOCAL_RELAY_ANALOG_OUT_TASK created
AMC_MANAGER_TASK created
BACSERVER_TASK created.

The following information about various subsystems is logged into the System log or Admin log files upon startup:
Buzzer Activated for Checking Data Base
System Failure Cleared
System IP:OK
System BACnet:OK
System D2A:OK
System Battery:OK
System USB:OK
System RTC:OK
System V+:OK
System V24_1/V24_2/V24_3/V24_4:OK
System V3_3:OK
System VRS232:OK
System Device Uniqueness:OK
System Sensor Gas Match:OK
Sensor Alarm Cleared
Device Failure Cleared
Test Pushbutton Cleared
Data Base Failure Cleared.

The following startup messages are described further detail below:

- AMC-1DB Gas Monitor <Ver>
- TIME <Date and Time>
- MAC:<MAC> from FLASH
- SN:<SN> from FLASH
- Last Reset Cause:<Cause>
- Watch-dog enabled
- No USB Restore DB File
- No USB Device to Restore DB
- Database Restore from USB <Filename>
- Monitor database save complete

- MODBUS Updated from Data Base
- BACnet Updated from Data Base.

The "**AMC-1DB Gas Monitor <Ver>**" message will appear in system log file or on the LCD display. It displays the current F/W version. The F/W can be upgraded to the FLASH device from the USB Storage device, please check Armstrong Monitoring for latest available F/W.

Additionally the **MAC**: and **SN** messages will appear at system start up. These items are fixed in the FLASH device.

The "**Reset Cause:0x08 PowerUp**" messages will appear upon system start up. Additionally there are several other reset causes; 0x08 PowerUP, 0x04 Ext. Reset and 0x02 Watchdog Reset. External Reset is further decoded into an additional message indicating the type of external reset; PushButton., Brown Out or Multiple.

The "**Watch-dog enabled"** message will appear at start up when the watch-dog device has been activated. The Watch-dog device provides checking of the system integrity and will reset the system when incorrect operation is detected. A Watch-dog reset cause message will be displayed whenever the system restarts due to this issue. Additionally the System LED will stay turned off upon watch-dog restart and can be re-lit by pressing the HOLD Pushbutton.

The "**No USB Restore DB File**" message will appear if there is no data base restore file present on the USB Storage device at start up. The "**No USB Device to Restore DB**" message will appear if there is no USB Storage device installed. The data base restore file is used on start up to change the configuration created by AMC Manager or restores a previous save data base. A message similar to "**Database Restore from USB c:\amc-1db.adf_restored_2013_8_27_10_45**" will appear if the file amc-1db.adf is present on the USB Storage device at start up. The "**Monitor database save complete**" message will appear when the system has successfully saved data base changes into the battery backed storage device. This message can appear whenever the data is changed. During lengthy data base change the data base is only saved when change activity ceases for a period of 1 minute.

The "**MODBUS Updated from Data Base**" message will appear when the RS-485 MODBUS subsystem is configured. It can also occur when MODBUS is reconfigured due to data base changes. Again during lengthy data base change the MODBUS is only updated when change activity ceases for a period of 30 seconds.

The "**BACnet Updated from Data Base**" message will also appear when BACnet is configured or re-configured after data base changes. The BACnet is only updated when change activity ceases for a period of 30 seconds.

All log files get timestamps every 10 seconds and also get stamp with MODBUS traffic summary every minute.

The **TIME** message contains the following format:
TIME <YEAR,MONTH,DAY> <24HR:MIN:SEC> Day <1-7=Sun.to Sat.>.

The example below indicates a timestamp of Monday Aug 27/2012 at 12:00:17 am:
TIME 2013,8,27 00:00:17 Day 2.

There are five MODBUS channels; 1-4 are for sensors, relays, and analog output devices and channel 5 for BAS communication. The MB5 summary will appear periodically (every minute) when this channel is active. The **MB** (**M**OD**B**US) summary message contains the following format:
MB<Channel> TA(s) T:<Total Transactions>,G:<Good Transactions>,B:<Bad Transactions>.

An MODBUS summary is as follows:
MB5 TA(s) T:391,G:391,B:0
MB2 TA(s) T:0,G:0,B:0
MB3 TA(s) T:0,G:0,B:0
MB4 TA(s) T:0,G:0,B:0

MB1 TA(s) T:445,G:445,B:0.

When USB system logging is enabled the system status is logged every minute as follows:
Monitor F/W Rev: <Ver>
Monitor S/N:1DB-130001
Monitor DB ID:0002
Up Time:55h
Audio Mode:All Alarms & Fail
Display Mode:Disp All Relay
Serial Mode:REMOTE
Last Reset Cause:0x08 PowerUp
Ext. Reset Cause:N/A
IP:OK BACnet:OK USB:OK
RTC:OK BATTERY:OK D2A:OK
VRS232:OK V3.3:OK V+:OK
V24_1:OK V24_2:OK
V24_3:OK V24_4:OK
Device Uniqueness:OK
Gas Type Match:OK.

The preceding information contains the Monitor F/W Revision, S/N, Data Base ID and up time. The device display mode and audio mode and last reset cause are also displayed. Additionally “OK” or “BAD” status is indicated for all the major subsystems. Also “OK” or “BAD” status is indicated for all MODBUS devices; individual device status can be obtained from the get Relay, Sensor or Analog Output Status menus. A system wide Gas Type Match indicator is also displayed with “OK”, “Possible” or “BAD” status. Gas Type match occurs when the sensor configuration (i.e. data base) matches the gas type obtained from the sensor device (not all sensor devices support gas type information). Individual gas match status can be obtained from get Sensor Status menu.

The **Date and Time Changed** message will appear when the date and time is changed from various sources, they can be changed remotely (i.e. AMC Manager), from Menu, or from BAS.
The **Date and Time Changed** message contains the following formats:
Date and Time Changed <Source>.

The following are other possible log messages of the general group:

- Battery(Database/RTC) Okay

The above “**Battery(Database/RTC) Okay**” message occurs after a battery warning log message has occurred and the battery is replaced. This battery backs up the DataBase NV (Non-Volatile) storage and RTC (Real Time Clock).

- Network Updated from Data Base

The above “**Network Updated from Data Base”** message will also appear when the IP configuration has been changed. The Network is only updated when change activity ceases for a period of 30 seconds.

- No Sensors Available

The above “**No Sensors Available**” will appear when system is currently running with no sensors discovered and can occur briefly at system start. This message may also be displayed when no sensors have been configured in the data base.

- USB Device Plugged In
- USB Stick Ejected from Menu
- USB Device Unplugged

The above "**USB Device Plugged In**" or "**USB Device Unplugged**" messages will appear when USB storage device is inserted or removed. The "**USB Stick Ejected from Menu**" message will appear when the USB device is un-mounted through the menu; this will ensure all existing log messages are flushed to their appropriate log file and closed.

- USB Format Selected from Menu
- USB Format Skipped Device Ejected
- USB Format Complete

The above "**USB Format Selected from Menu"** message will appear when the built in USB Storage formatting facility is performed. The message "**USB Format Complete**" is logged upon successful USB format. This USB formatting can be quite lengthy and can be alternatively performed on any PC platform in less time. The message "**USB Format Skipped Device Ejected**" will be displayed if the USB device is not detected upon format request.

- FLASH Upgrade: Need to Reboot to re-initialize NANDFLASH Driver and start new image

The above "**FLASH Upgrade: Need to Reboot to re-initialize NANDFLASH Driver and start new image"** occurs at system start up when FLASH F/W upgrade is complete. The FLASH F/W can be upgraded when the 10Aquila.elf.bin and 10Aquila.elf.csum files are detected at start up on the USB Storage device. Further log details about FLASH Upgrade can be found in the system log file when enabled.

- No USB Device to Save DB
- Database Saved to USB <Filename>

The above "**No USB Device to Save DB**" message will appear if there is no USB device present when the data base save is activated. Data base save is activated when user logs off the menu system. A message similar to "**Database Saved to USB c:\amc-1db.adf_saved_2013_8_27_10_45**" will appear upon completion if the USB storage device is present.

- Display Logging suspended during remote AMC Manager activity
- Console Logging suspended during remote AMC Manager activity
- Display Logging re-enabled after remote AMC Manager activity
- Console Logging re-enabled after remote AMC Manager activity
- AMC Manager in use.

The above messages are displayed when AMC Manager activity causes the Display and/or Console logging to be suspended or re-enabled. Due to improved transfer times of the AMC Manager Printer Port these interfaces are suspended.

The following are exceptional messages that are not normally logged they indicate a problem in the system and should be addressed:
Low Voltage detected on Battery(Database/RTC) at Startup
Low Voltage detected on Battery(Database/RTC)

Could not create MONITOR_TASK
Could not create UPGRADE_FW_TASK
Could not create DB_SAVE_TASK
Could not create DEBUG_PRINT_TASK
Could not create SENSOR_LOG_TASK
Could not create RELAY_LOG_TASK
Could not create ALARM_LOG_TASK
Could not create SYSTEM_LOG_TASK
Could not create ADMIN_LOG_TASK
Could not create SECURITY_LOG_TASK

Could not create COMM_LOG_TASK
Could not create PRT_LOG_TASK
Could not create TELNET_TASK
Could not create NETSETUP_TASK
Could not create LCD_DISPLAY_TASK
Could not create LCD_TIME_TASK
Could not create DB_RESTORE_USB_TASK
Could not create DB_RESTORE_USB_TASK
Could not create MONITOR_TASK
Could not create UPGRADE_FW_TASK
Could not create LOCAL_RELAY_ANALOG_OUT_TASK
Could not create MODBUS1_TASK
Could not create MODBUS2_TASK
Could not create MODBUS3_TASK
Could not create MODBUS4_TASK
Could not create SLV_MODBUS_TASK
Could not create MODBUS_RX_LED_TASK
Could not create MODBUS_TX_LED_TASK
Could not create MODBUS_UPDATE_TASK
Could not create MONITOR_SWITCH_TASK
Could not create MONITOR_SCOM_TASK
Could not create DEVICE_UNIQUENESS_TASK
Could not create BACSERVER_TASK
Could not create FORMAT_USB_TASK
Could not create DB_SAVE_USB_TASK
Could not create ZONE_SCHEDULING_TASK
Could not create Telnet_server
Could not create SHELL_TASK
Could not create USB_MFS_TASK

Error Installing <NV Device Name>
Error installing dtim<DMA Timer #>
Error Installing <Printer Device Name>
Error Installing <Console Device Name>
Error Installing <Log Device Name>
Error installing < NV Device Name>
RTCS failed to initialize, error = <Error Number>
USB Failed to Install
eGUI/D4D initialization failed
tfs install returned: <TFS Eror #>

Opening <Log Device Name> device driver failed
Opening dtim<DMA Timer #> interrupt driver failed
Opening <Device Name> device driver failed
Opening <Printer Device Name> device driver failed
Opening <Console Device Name> device driver failed
Unable to open flash device <NV Device Name>
Could not open <I2C Device Name> device

FLASH Upgrade: Bad USB image file:10aquila.elf.rbin:<CS>cksum differs from 10aquila.elf.csum:<CS>
FLASH Upgrade: Need to Reboot to re-initialize NANDFLASH Driver
FLASH Upgrade Fatal: Will retry until successful; check USB files:10aquila.elf.rbin and 10aquila.elf.csum
FLASH_IOCTL_ENABLE_BUFFERING failed.
FLASH_IOCTL_GET_BLOCK_MAP failed.
Monitor Image Save Compare failed

BAD IP:<IP Address> In Use
BAD BACnet ID <ID> In Use
BACnet Abort: <Reason>
BACnet Reject: <Reason>

Watch-dog disabled by USER ENTER_PB at start-up
Watch-dog disabled compiled time definition
Watch-dog not kicked; incorrect running task count:<Task Count #>

Can't Display; BAD VRAM BWalk Field of Zeros
Can't Display; BAD VRAM BWalk Field of Ones
Can't Display; BAD VRAM AWalk Field of Zeros
Can't Display; BAD VRAM AWalk Field of Ones
Can't Display; BAD VRAM March Field of Ones
Can't Display; BAD VAM March Field of Zeros

Failed to get <Buffer Name> buffer
NAND Flash Bad Block #<Block Number>Found
No Monitor Database in <NV Device Name>, can't Seek: ERROR
No Monitor Database in <NV Device Name>, can't read: ERROR
No Monitor Database in <NV Device Name>, block erased
Failed Monitor Database Save Compare
Can't Save DB to USB Device
Can't Restore DB from USB
Using previous DB
Can't save Database; BAD SRAM BWalk Field of Zeros
Can't save Database; BAD SRAM BWalk Field of Ones
Can't save Database; BAD SRAM AWalk Field of Zeros
Can't save Database; BAD SRAM AWalk Field of Ones
Can't save Database; BAD SRAM March Field of Ones
Can't save Database; BAD SRAM March Field of Zeros
Data Base ID Mis-match

Can't _timer_create_component
Can't create save_monitor_db_timer event
Can't create update_modbus_timer event
Can't create Monitor_reenable_console_display_logs_event_ptr
Can't create Monitor_lite_lcd_event_ptr

Can't open save_monitor_db_timer event
Can't open update_modbus_timer event
Can't open Monitor_reenable_console_display_logs_event_ptr
Can't open Monitor_lite_lcd_event_ptr

_timer_start_oneshot_after() failed for Save_Monitor_Database
_timer_start_oneshot_after() failed for Modbus_update
_timer_start_oneshot_after() failed for Monitor_reenable_console_display_logs
_timer_start_oneshot_after() failed for Monitor_lite_lcd

Writing to dtim<DMA Timer #> interrupt failed
dtim<DMA Timer #>: Couldn’t flip MB<Channel #> TO_WRITE
dtim<DMA Timer #>: Couldn’t flip MB<Channel #> TO_READ

Couldn't set I2C DAC Bus address
I2C DAC not available

Bad parameters for Do_MAS_Modbus_sensors
Bad parameters for Do_MAS_Modbus_relays
Bad parameters for Do_MAS_Modbus_analog_outs

UE_ISR In ISR: <0 or 1> ,PC: 0x<Address> and SR: 0x<Status Register>
UE_ISR TIME <Year,Month,Day Hour:Minute:Second> Day:<0 to 7>
UE_ISR Vector #: <Vector Number>
UE_ISR Task Id: 0x<Task Number> and Stack Frame: 0x<Stack Pointer>
WD_ISR In ISR: <0 or 1> ,PC: 0x<Address> and SR: 0x<Status Register>
WD_ISR TIME <Year,Month,Day Hour:Minute:Second> Day:<0 to 7>
WD_ISR Vector #: <Vector Number>
WD_ISR Task Id: 0x<Task Number> and Stack Frame: 0x<Stack Pointer>

APPENDIX A.1 SENSOR.LOG Format

The SENSOR.LOG file messages can appear in the USB Storage device when the menu item Log File>Sensor is enabled.

The **RS-485** messages will appear when the RS-485 system has been reconfigured due to changes to the sensor configuration. This will list all sensors configured on the Modbus channels 1-4 whether enabled or disabled for the system. Local device will not appear is this list. The RS-485 number can range from 1:4 while the Sensor number is from 1-988.
The **RS-485** message contains the following format:
RS485:<Channel #> Sensor:<Sensor #> <Enabled or Disabled>.

The **Sensor** messages will appear once per minute listing all configured sensors for the system. The Alarms/Activity format is base on the number alarms configured and the current sensor activity. The "_" indicates no activity while the "*" indicates active and "#" indicates silenced.
The **Sensor** messages contains the following format:
Sensor <Sensor #> <Gas Type> <Gas Concentration> <Alarms/Activity>.

The example below indicates Sensor 248 is a NO2 sensor with 0 ppm gas concentration and configured for 2 alarms and has no alarms active:
Sensor 248 NO2 0 PPM ALM:1_2_ .

The example below indicates Sensor 1 is a CO sensor with 100 ppm gas concentration and configured for 2 alarms and has all alarms currently active:
Sensor 001 CO 100 PPM ALM:1*2*.

The example below indicates Sensor 1 is a CO sensor with 100 ppm gas concentration and configured for 2 alarms and has all alarms currently silenced:
Sensor 001 CO 100 PPM ALM:1#2#.

The following are exceptional **Sensor MB** messages that are not normal; they indicate a problem in the system and should be addressed, the Modbus channel number will be from 1:4:
Sensor <MB Channel #>:<MB Address> Inst:<Instance #> Bad Possible Bad Gas Match
Sensor <MB Channel #>:<MB Address> Inst:<Instance #> Bad Gas Match
Sensor <MB Channel #>:<MB Address> Inst:<Instance #> Missing Device Fault
Sensor <MB Channel #>:<MB Address> Inst:<Instance #> Bad Status Fault
Sensor <MB Channel #>:<MB Address> Inst:<Instance #> Bad Read of Status Fault
Sensor <MB Channel #>:<MB Address> Inst:<Instance #> Bad Device Product Type Fault
Sensor <MB Channel #>:<MB Address> Inst:<Instance #> <Device Name> Bad Read Fault
Sensor <MB Channel #>:<MB Address> Inst:<Instance #> <Device Name> Bad Registration Fault
Sensor <MB Channel #>:<MB Address> Inst:<Instance #> <Device Name> Bad TEMP Read Fault

Sensor <MB Channel #>:<MB Address> Inst:<Instance #> Bad <Device Name> Product Type Fault
Sensor <MB Channel #>:<MB Address> Inst:<Instance #> Bad <Device Name> Gas Type Fault.

APPENDIX A.2 RELAY.LOG Format

The RELAY.LOG file messages can appear in the USB Storage device when the menu item Log File>Relay is enabled.

The **RS-485** messages will appear when the RS-485 system has been reconfigured due to changes to the relay or Analog Output configuration. It will list all relay or analog output remotely configured on the MB1-4 whether enabled or disabled in the system. Local devices will not appear is this list.

The RS-485 number will be from 1:4 while the Relay number is from 1-256 and Analog Output number is from 1-128. It contains the following formats:
RS485:<Channel #> Relay:<Relay #> <Enabled or Disabled>
RS485:<Channel #> Analog Output:<Analog Output #> <Enabled or Disabled>.

The **Local Relay** or **Analog Output** messages will appear when a Relay or Analog Output that is integral to the system has been reconfigured as local in their configuration. It will list all integral relay or analog output devices locally configured whether enabled or disabled in the system. Remote devices will not appear is this list. The Local Relay instance number is from 1-16 and Local Analog Output instance number is from 1-4.
The **Local Relay** or **Analog Output** message contains the following formats:
Local Relay :<Instance #> <Enabled or Disabled>
Local: Analog Output :<Instance #> <Enabled or Disabled>.

The **Relay number** messages will appear once a minute to display the state of all configured relays. It shows the number of Alarm counts and current relay position. The Relay number is from 1-256. The Alarms count is the total of triggered sensors and zones assigned to that relay.
The relay state can be:
seconds of Power-On
No Relays Found
Not Found, Enerigized
DeEnergized
Pending
Latched
Zone Event (ZE)
Minimum Run Time (MRT) minutes
Post Run Time (PRT) minutes fields.

The **Relay number** message contains the following format:
Relay <Relay #> Alarms <Alarm count> <relay state>.

In the **Relay MB** message the Modbus channel number will be from 1:4 while displaying Relay's Modbus device state in Boolean. It contains the following format:
Relay <MB Channel #>:<MB Address>:<MB Instance #> Value:<Boolean 0 or 1>.

The following are exceptional **Relay MB** messages that are not normal; they indicate a problem in the system and should be addressed:
Relay <MB Channel #>:<MB Address>:<Remote Instance #> Missing Device Fault
Relay <MB Channel #>:<MB Address>:<Remote Instance #> Not Ready Fault
Relay <MB Channel #>:<MB Address>:<Remote Instance #> Bad Write Fault
Relay <MB Channel #>:<MB Address>:<Remote Instance #> Bad Read Fault
Relay <MB Channel #>:<MB Address>:<Remote Instance #> Bad Registration Fault
Relay <MB Channel #>:<MB Address>:<Remote Instance #> Bad Device Product Type Fault

Relay <MB Channel #>:<MB Address>:<Remote Instance #> Bad <Device Name> Product Type Fault.

The **Relay Local** messages will appear once a minute to display the state of all local integral relays. The Local instance number will be 1 to 16 and the value will be 0 or 1 representing the relays current state. A value of 0 for a relay configured for DeEnergized is normal, while a value of 1 is normal for relay configured as Energized.
The **Relay Local** message contains the following format:
Relay Local Inst: <Local Instance #> Value :<relay state>.

The **Analog Out** messages will appear once a minute to display percentage of full span and the analog output type (0-20mA or 4-20mA) for the analog outputs assigned to zones.
The **Analog Out** message contains the following formats:
Analog Out<Analog Output #>:%<percentage> full scale with <type mA> type
Service **Analog Out**<Analog Output #>:<%> full scale with <type mA> type.

The following are exceptional **Analog Out MB** messages that are not normal; they indicate a problem in the system and should be addressed:
Analog_out <MB Channel #>:<MB Address>:< MB Instance #> Missing Device Fault
Analog_out <MB Channel #>:<MB Address>:< MB Instance #> Bad Registration Fault
Analog_out <MB Channel #>:<MB Address>:< MB Instance #> Not Ready Fault
Analog_out <MB Channel #>:<MB Address>:< MB Instance #> Bad Read of Status Fault
Analog_out <MB Channel #>:<MB Address>:< MB Instance #> Bad Write Fault
Analog_out <MB Channel #>:<MB Address>:< MB Instance #> Bad Device Product Type Fault
Analog_out <MB Channel #>:<MB Address>:< MB Instance #> Bad <Device Name> Product Type Fault.

The **Zone** event messages will appear throughout a schedule cycle for a zone relay. A zone scheduled event involves a relay number which is enabled or disabled on schedule defined by its configuration. The schedule field is shown as weekday event**,** Monday to Sunday, Monday to Friday or Monday to Saturday. The zone event cycle consists of three phases; created, cleared and completed. The creation will enable or disable the Relay number as per the configuration. The clear will start the de-activation of the relay number and the completion indicates when the relay number associated with the zone has returned to normal operation. The day number is 1-7 with Sunday being 1 and Saturday being 7 and a Zone event messages can be cleared and completed on the same day or next day.
The **Zone** event messages contain the following format:
Zone <Zone #> Relay <Relay #> <Schedule> <Phase> <Day, Same Day, Next Day> <Day #>.

APPENDIX A.3 ALARM.LOG Format

The ALARM.LOG file messages can appear in the USB Storage device when the menu item Log File>Alarm is enabled.

The **Buzzer** messages will appear when it is activated or cleared for various reasons.
The **Buzzer** message contains the following format:
Buzzer <Activated or Cleared> <reason>.

The buzzer reasons can be one of the following:
Checking the Data Base,
System Failure,
Alarm, Device Failure,
SILENCE Pushbutton,
RESET_RELAY Pushbutton,
TEST Pushbutton,
Sensor Alarm.

In some cases the buzzer cleared reason is log on a separate line as follows:
System Failure Cleared

Sensor Alarm Cleared
Device Failure Cleared
Test Pushbutton Cleared
Data Base Failure Cleared
Cleared Data Base Good.

The **Alarm LED** message will appear when front panel LEDs are activated or cleared.
The **ALARM LED** message contains the following formats:
<Fault **Alarm> LED** <Cleared or Activated>
Alarm<number> **LED** <Cleared or Activated>.

The **Start Alarm Sensor** message will appear when sensor delay timer is started. The level can be 1 to 3 and sensor number can be 1-988.
The Start Alarm Sensor message contains the following format:
Start Alarm <Level> **Sensor**:<Sensor #> Delay, Raw Value:<Sensor level>

The sensor level is a value between 0-4000mV simulating 0-20mA into 200ohm load. A value of 4000mV represents full span gas concentration and 800 represents no gas concentration at 4mA and 0 represents a failed sensor at 0mA. When default threshold is configured for 2mA any values under 400mV is a failed sensor. Digital sensors that are not communicating have a level of 0mV or 0mA.

The **Increasing, Decreasing, Window Alarm** message will appear when sensor alarm state becomes active. The Level can be 1 to 3 and sensor number can be 1-988.
The **Increasing, Decreasing** and **Window Alarm** message contains the following formats:
Increasing Alarm <Alarm Level> Sensor:<Sensor #> Active
Decreasing Alarm <Alarm Level> Sensor:<Sensor #> Active
Window Alarm <Alarm Level> Sensor:<Sensor #> Active.

The **Alarm Relay** message will appear when Relay alarm state changes.
The **Alarm Relay** message contains the following format:
Alarm Relay:<Alarm Level> <Pending or Activated> with <timer type> <and Latching>.

The following alarm states, timer types and Latching are possible:
Pending with Delay Timer
Activated with Delay Timer
Pending with MRT
Activated with MRT
Pending with PRT
Activated with PRT
Pending with Delay Timer and LATCHING
Activated with Delay Timer and LATCHING
Pending with MRT and LATCHING
Activated with MRT and LATCHING
Pending with PRT and LATCHING
Activated with PRT and LATCHING
where MRT is Minimum Run Time value and PRT is Post Run Time value.

The **Zone Alarm/Fail** message will appear when alarm or failed relay associated with a zone is active or inactive. The zone number is 1-128 and the alarm level is 1-3 and sensor number can be 1-988.
The **Zone Alarm/Fail** message contains the following formats:
Zone:<Zone #> **Alarm**<Level> Sensor:<Sensor #> <Active or Inactive>
Zone:<Zone #> **Fail** Sensor:<Sensor #> <Active or Inactive>.

Other possible Alarm log file messages:
Dew Point Alarm ambient temperature Sensor:<Sensor #> Active
Dew Point Alarm surface temperature Sensor:<Sensor #> Active

Dew Point Alarm relative Humidity Sensor:<Sensor #> Active.

Additionally the Alarm log tracks detail of the DIP Switch User Options when change is detected:
DIP Switch Language:<English or French>
DIP Switch Post Run Time:<Disabled or Enabled>
DIP Switch Calibration Mode:<Disabled or Enabled>
DIP Switch Minimum Run Time:<Disabled or Enabled>
DIP Switch Zero Buffer:<Disabled or Enabled>
DIP Switch Sensor Delay:<Disabled or Enabled>
DIP Switch Audio:<Disabled or Enabled>.

APPENDIX A.4 SYSTEM.LOG Format

The SYSTEM.LOG file messages can appear in the USB Storage device when the menu item Log File>System is enabled.

The System Log displays the following messages associated with BACnet:
AMC-1DBx BACnet Name
GNU SourceForge BACnet Stack Version 0.5.7
Max APDU: 1476
BACnet BIP Device ID: 677003.

The System Log displays the **Buzzer** messages similar to ALARM.LOG items:
Buzzer Activated for Checking Data Base
Reset Cause Cleared by Hold Pushbutton
Buzzer Activated
Buzzer Activated for Silence Pushbutton
Buzzer Activated for RESET_RELAY Pushbutton
Buzzer Activated for System Failure
Buzzer Activated for Sensor Alarm
Buzzer Activated for Device Failure
Buzzer Activated for Test Pushbutton
Buzzer Cleared
System Failure Cleared
Sensor Alarm Cleared
Device Failure Cleared
Test Pushbutton Cleared
Data Base Failure Cleared .

The System Log displays the system tasks as they are created. Below is a list of task creation message that appear at start up (due to start up sequence not all messages are displayed in System log file):
TELNET_Server created
TELNET_TASK created
DB_RESTORE_USB_TASK created
MONITOR_TASK created
MONITOR_SWITCH_TASK created
BACSERVER_TASK created
DEVICE_UNIQUENESS_TASK created
LOCAL_RELAY_ANALOG_OUT_TASK created
ZONE_SCHEDULING_TASK created.
DB_SAVE_TASK created
UPGRADE_FW_TASK created
NETSETUP_TASK created
MODBUS1_TASK created

MODBUS2_TASK created
MODBUS3_TASK created
MODBUS4_TASK created
SLV_MODBUS_TASK created
MODBUS_RX_LED_TASK created
MODBUS_TX_LED_TASK created
MODBUS_UPDATE_TASK created
MONITOR_SWITCH_TASK created
MONITOR_SCOM_TASK created
DB_SAVE_USB_TASK created
ZONE_SCHEDULING_TASK created
SHELL2_TASK created
USB_MFS_TASK created.

Additionally the following **FLASH Upgrade** messages can be displayed when 10Aquila.elf.csum and 10Aquila.elf.bin file are detected on USB storage upon start up (Some of the messages only occur during a fault situation):
FLASH Upgrade: Ignoring Version detected in USB check file:10aquila.elf.csum
FLASH Upgrade: No USB EMAC file:EMAC.txt
FLASH Upgrade: Obtained MAC:<MAC> in FLASH
FLASH Upgrade: Proceeding with upgrade; Ignoring checksum in 10aquila.elf.csum
FLASH Upgrade: Need to Reboot to re-initialize NANDFLASH Driver and start new image
FLASH Upgrade: No USB check file:10aquila.elf.csum
FLASH Upgrade: No USB image file:10aquila.elf.rbin
FLASH Upgrade: Bad USB image file:10aquila.elf.rbin
FLASH Upgrade: No USB check file:10aquila.elf.csum
FLASH Upgrade: Bad USB check file:10aquila.elf.csum
FLASH Upgrade: Old Version detected in USB check file:10aquila.elf.csum
FLASH Upgrade: Upgrade skipped; Flash contents newer then USB check file:10aquila.elf.csum
FLASH Upgrade: No USB EMAC file:EMAC.txt
FLASH Upgrade: Bad USB EMAC file:EMAC.txt
FLASH Upgrade: Obtained SN:<Serial Number> in USB file:EMAC.txt
FLASH Upgrade: Obtained MAC:<MAC Number> in USB file:EMAC.txt
FLASH Upgrade: Checksum mismatch between USB image file:10aquila.elf.rbin:<CS> and FLASH Device:<CS>
FLASH Upgrade: Proceeding with upgrade; Flash contents differ from USB image file:10aquila.elf.rbin
FLASH Upgrade: Checksum match between USB image file:10aquila.elf.rbin:<CS> and FLASH Device:<CS>
FLASH Upgrade: No upgrade needed; EMAC.txt file same as FLASH MAC
FLASH Upgrade: No upgrade needed; Flash contents the same as USB image file:10aquila.elf.rbin **FLASH Upgrade**: Flash contents the same as USB image file:10aquila.elf.rbin
FLASH Upgrade: Proceeding with upgrade; EMAC.txt file differs from FLASH MAC.

Other possible SYSTEM Log messages:
Date and Time Changed from Menu
Date and Time Changed Remotely (AMC Manager)
Date and Time Changed from BAS
Error Installing CONSOLE_PORT
Shell2 exited...

APPENDIX A.5 ADMIN.LOG Format

The ADMIN.LOG file messages can appear in the USB Storage device when the menu item Log File>Admin is enabled.

The Data Base Changed messages are logged when Data base is changed from various sources:

AMC Manager,
Menu
BAS.

Additionally the Data Base Changed can be forced due to; Data base initialization**,** Data Base Recovery or Sensor default configuration.
The Data base Changed message has the following format:
Data base Changed **<**Source>.

The Logging choice changes are tracked from the various sources.
The logging items are 1 to 10 representing:
Sensor, Relay
Alarm
System
Admin
Communication
Security
Telnet Console
LCD Display
Printer Port
where the boolean change is 0 or 1 for disabled or enabled.

The Logging Choice message has the following format:
Logging Choice Item<1 to 10>=<Boolean 0 or 1> Changed <Source>

Data base change items are specifically tracked when initiated by AMC Manager.
The following messages are logged during AMC Manager downloads:
Data Base ID Changed Remotely (AMC Manager)
Configuration 1 Values Changed Remotely (AMC Manager)
Serial Mode Changed Remotely (AMC Manager)
Configuration 2 Values Changed Remotely (AMC Manager)
Other Gas Labels Changed Remotely (AMC Manager)
Engineering Units Changed Remotely (AMC Manager)
Zone Labels Changed Remotely (AMC Manager)
Sensor Values Changed Remotely (AMC Manager)
Relay Values Changed Remotely (AMC Manager)
Analog Output Values Changed Remotely (AMC Manager)
Zone Values Changed Remotely (AMC Manager)
Zone SensorID Values Changed Remotely (AMC Manager)
Interface Values Changed Remotely (AMC Manager)
MODBUS Ports 1-4 Values Changed Remotely (AMC Manager).

Additionally the Administration log tracks changes to the MODBUS, RS-485, BAS and PRINTER PORT interfaces:
Modbus Changed due to Menu Action
RS485:<Channel> <Enabled or Disabled>
BAS MODBUS <Enabled or Disabled>
Serial Mode Changed to Printer from Menu .

Additionally the the Administration log tracks detail of the DIP Switch User Options when change is detected:
DIP Switch Language:<English or French>
DIP Switch Post Run Time:<Disabled or Enabled>
DIP Switch Calibration Mode:<Disabled or Enabled>
DIP Switch Minimum Run Time:<Disabled or Enabled>
DIP Switch Zero Buffer:<Disabled or Enabled>
DIP Switch Sensor Delay:<Disabled or Enabled>

DIP Switch Audio:<Disabled or Enabled>.

APPENDIX A.6 SECURITY. LOG Format

The SECURITY.LOG file messages can appear in the USB Storage device when the menu item Log File>Admin is enabled. The Security log tracks password changes, system menu log in and log out and BAS MODBUS write access.

The following messages can appear in the security log file:
Password Accepted from Menu
Password Changed from Menu
Log In Attempted from Menu
Log Out Occurred from Menu
Logged Out Remotely (AMC Manager)
BAS MODBUS Lockcode Write Match Achieved from BAS
BAS MODBUS Lockcode Updated from Menu.

APPENDIX A.7 COMM.LOG Format

The COMM.LOG file messages can appear in the USB Storage device when the menu item Log File>Comm is enabled. The communication log monitors Ethernet and MODBUS conditions.

The following running Ethernet and BACnet messages appear in the communication log file every minute:
IPAddr:<IP Address>
IPSubnet:<IPSubnetMask>
IP Router:<Router Address>
BACnet ID:<BACnet ID>
Octet Received:<RX OCTETS>
RX Packets:<RX PACKETS> Uni:<RX UNICAST>
RX Multi:<RX MULTICAST> Broad:<RX BROADCAST>
Loss no resources:<RX MISSED>
Loss int. errors:<RX ERRORS>
Loss other reasons:<RX DISCARDED>
Octet Sent:<TX OCTETS>;
TX Packets:<TX PACKETS> Uni:<TX UNICAST>
TX Multi:<TX MULTICAST> Broad:<TX BROADCAST>
Unsent no resources:<TX MISSED>
Unsent int. errors:<TX ERRORS>
Bad Destinations:<TX DISCARDED>.

The following Ethernet and BACnet exception messages appear in the communication log file when they occur and indicate problem(s) in the system which should be addressed:
BAD IP:<IP Address> In Use
BAD BACnet ID <ID> In Use
BAD BACnet ID:<UDP Port>.

The following running MODBUS messages appear in the communication log file every minute for each Modbus channel:
MB<Channel #> Pkt(s) TX:<Count> RX:<Count>
MB<Channel #> CRCs G:<Count>,B: <Count>
MB<Channel #> TO:<Count>,dtim:<Count>
MB<Channel #> CE:<Count>,Gap:<Count>,Len:<Count>
MB<Channel #> Char(s) TX:<Count>,RX:<Count>.

The following MODBUS exception messages appear in the communication log file when they occur and indicate problem(s) in the system which should be addressed:
MB<MB Channel #>:<MB Address> Timeout
MB<MB Channel #>:<MB Address> Short Message
MB<MB Channel #>:<MB Address> Bad RX CRC
MB<MB Channel #>:<MB Address> RX PARITY: <Count> FRAMING: <Count> OVERRUNS: <Count> DROPPED:<Count>
MB<MB Channel #>:<MB Address> RX PACKET GAP:<Count> PARITY: <Count> FRAMING: <Count> OVERRUNS: <Count> DROPPED: <Count>.

The following Sensor exception messages also appear in the communication log file as a result previous MODBUS exception messages:
Sensor <MB Channel #>:<MB Address> Inst:<Instance #> Bad Possible Bad Gas Match
Sensor <MB Channel #>:<MB Address> Inst:<Instance #> Bad Gas Match
Sensor <MB Channel #>:<MB Address> Inst:<Instance #> Missing Device Fault
Sensor <MB Channel #>:<MB Address> Inst:<Instance #> Bad Status Fault
Sensor <MB Channel #>:<MB Address> Inst:<Instance #> Bad Read of Status Fault
Sensor <MB Channel #>:<MB Address> Inst:<Instance #> Bad Device Product Type Fault
Sensor <MB Channel #>:<MB Address> Inst:<Instance #> <Device Name> Bad Read Fault
Sensor <MB Channel #>:<MB Address> Inst:<Instance #> <Device Name> Bad Registration Fault
Sensor <MB Channel #>:<MB Address> Inst:<Instance #> <Device Name> Bad TEMP Read Fault
Sensor <MB Channel #>:<MB Address> Inst:<Instance #> Bad <Device Name> Product Type Fault
Sensor <MB Channel #>:<MB Address> Inst:<Instance #> Bad <Device Name> Gas Type Fault.

The following Relay exception messages also appear in the communication log file as a result previous MODBUS exception messages:
Relay <MB Channel #>:<MB Address>:<MB Instance> Missing Device Fault
Relay <MB Channel #>:<MB Address>:<MB Instance> Bad Read Fault
Relay <MB Channel #>:<MB Address>:<MB Instance> Bad Write Fault.

The following Analog Output exception messages also appear in the communication log file as a result previous MODBUS exception messages:
Analog_out <MB Channel #>:<MB Address>:<MB Instance> Missing Device Fault
Analog_out <MB Channel #>:<MB Address>:<MB Instance> Bad Read of Status Fault
Analog_out <MB Channel #>:<MB Address>:<MB Instance> Bad Write Fault.

APPENDIX A.8 PRINT.LOG Format

The PRINT.LOG file messages can appear in the USB Storage device when the menu item Log File>Printer is enabled. The print log is comma separated sensor information. The RAW format message is provided every minute as follows:

<YEAR,MONTH,DAY> <24HR:MIN:SEC> Day <1-7=Sun.to Sat.>,**Raw,**
<Sensor1 level>,
<Sensor2 level>,
<Sensor3 level>,
…
<Sensor986 level>,
<Sensor987 level>,
<Sensor988 level>

The sensor level is a value between 0-4000mV simulating 0-20mA into 200ohm load. A value of 4000mV represents full span gas concentration and 800 represents no gas concentration at 4mA and 0 represents a failed sensor at 0mA. When default threshold is configured for 2mA any values under 400mV is a failed sensor. Digital sensors that are not communicating have a level of 0mV or 0mA.

Once a hour on the first minute the gas label for each sensor is display as follows:

<YEAR,MONTH,DAY> <24HR:MIN:SEC> Day <1-7=Sun.to Sat.>,**Labels,**
<Sensor1 label>,
<Sensor2 label>,
<Sensor3 llabel>,
…
<Sensor986 label>,
<Sensor987 label>,
<Sensor988 label>

The gas label is a string of gas label (ie. CO or NO2).

Once an hour on the second minute the Engineering Units for each sensor is display as follows:

<YEAR,MONTH,DAY> <24HR:MIN:SEC> Day <1-7=Sun.to Sat.>,**Eunits,**
<Sensor1 engineering units>,
<Sensor2 engineering units>,
<Sensor3 engineering units>,
…
<Sensor986 engineering units>,
<Sensor987 engineering units>,
<Sensor988 engineering units>,

The engineering unit is a string of gas engineering units (ie. PPM, %LEL).

Once an hour on the third minute the 10x Zero for each sensor is display as follows:

<YEAR,MONTH,DAY> <24HR:MIN:SEC> Day <1-7=Sun.to Sat.>,**Span,**

<Sensor1 10x Zero>,
<Sensor2 10x Zero>,
<Sensor3 10x Zero>,
…
<Sensor98610x Zero>,
<Sensor987 10x Zero>,
<Sensor988 10x Zero>,

The 10x Zero is a string of the 10 times zero off gas number (ie.0000).

Once an hour on the four minute the 10x Span for each sensor is display as follows:

<YEAR,MONTH,DAY> <24HR:MIN:SEC> Day <1-7=Sun.to Sat.>,**Span,**

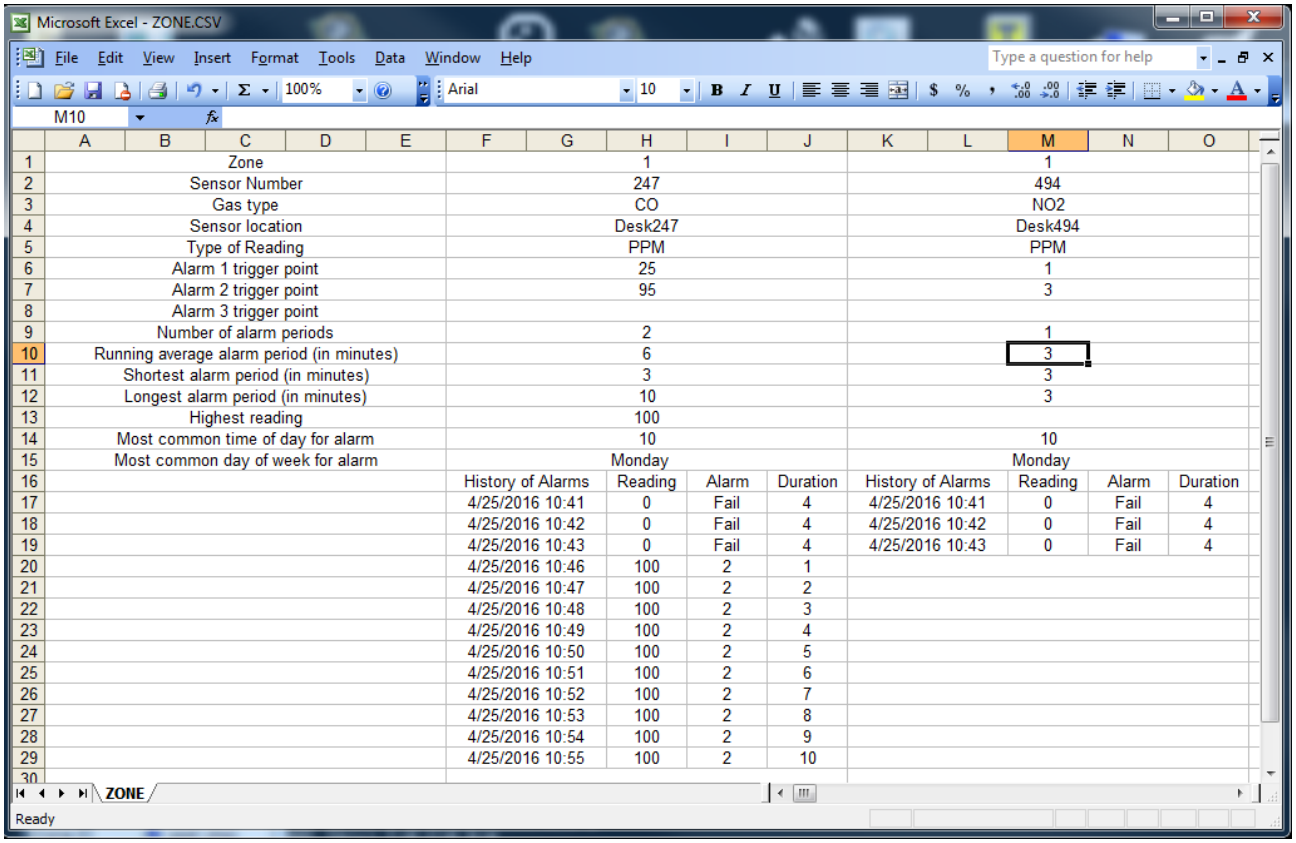
<Sensor1 10x Span>,
<Sensor2 10x Span>,
<Sensor3 10x Span>,
…
<Sensor98610x Span>,
<Sensor987 10x Span>,
<Sensor988 10x Span>,

The 10x Span is a string of the 10 times full scale span number (ie.1000, 0100).

APPENDIX A.9 ZONE.CSV format

The ZONE.CSV file will appear in the USB Storage device, there is no enable for ZONE.CSV file. It will be created if a USB device if inserted into monitor. The ZONE.CSV is a comma separated file and best displayed in Windows Excel. To improve the look in Excel selected and change the FORMAT CELL to Horizontal: Center Across Selection and Vertical: Center.

Below is an example. At the top of the ZONE.CSV are 15 rows. These rows contain various zone summaries. The rest of the file is sensor records captured at the time of alarm under the History of Alarms. There are no records for sensors not in alarm. This file is maintained for a month period and then archived under the subdirectory <Serial Number>\LOGS\<YEAR_MONTH>. There are maximum of 256 columns possible. Each zone sensor occupies 5 columns so there is a maximum of about 48 zone sensors that can be displayed.



Microsoft Excel - ZONE.CSV

1	Zone	1		1
2	Sensor Number	247		494
3	Gas type	CO		NO2
4	Sensor location	Desk247		Desk494
5	Type of Reading	PPM		PPM
6	Alarm 1 trigger point	25		1
7	Alarm 2 trigger point	95		3
8	Alarm 3 trigger point			
9	Number of alarm periods	2		1
10	Running average alarm period (in minutes)	6		3
11	Shortest alarm period (in minutes)	3		3
12	Longest alarm period (in minutes)	10		3
13	Highest reading	100		
14	Most common time of day for alarm	10		10
15	Most common day of week for alarm	Monday		Monday
16		History of Alarms / Reading / Alarm / Duration		History of Alarms / Reading / Alarm / Duration
17		4/25/2016 10:41 / 0 / Fail / 4		4/25/2016 10:41 / 0 / Fail / 4
18		4/25/2016 10:42 / 0 / Fail / 4		4/25/2016 10:42 / 0 / Fail / 4
19		4/25/2016 10:43 / 0 / Fail / 4		4/25/2016 10:43 / 0 / Fail / 4
20		4/25/2016 10:46 / 100 / 2 / 1		
21		4/25/2016 10:47 / 100 / 2 / 2		
22		4/25/2016 10:48 / 100 / 2 / 3		
23		4/25/2016 10:49 / 100 / 2 / 4		
24		4/25/2016 10:50 / 100 / 2 / 5		
25		4/25/2016 10:51 / 100 / 2 / 6		
26		4/25/2016 10:52 / 100 / 2 / 7		
27		4/25/2016 10:53 / 100 / 2 / 8		
28		4/25/2016 10:54 / 100 / 2 / 9		
29		4/25/2016 10:55 / 100 / 2 / 10		

APPENDIX C WIRING DIAGRAM

The following details using a 24VDC power supply to power an additional lane of transmitters.