



AMC-RAM-4

Refrigerant Alarm Module

USER MANUAL

IMPORTANT:

Please read the installation and operating instructions completely and carefully before starting.

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1 GENERAL INFORMATION

1.1 WARRANTY

The AMC-RAM-4 is warranted against defects in material and workmanship for a period of two years from date of delivery. Maintenance items are not warranted. During the warranty period, *The Armstrong Monitoring Corporation* will repair or replace components that prove to be defective in the opinion of AMC. Any equipment deemed to be defective by the user should be returned to *The Armstrong Monitoring Corporation* for evaluation (see product return below). **Site visits by Armstrong personnel, to evaluate/repair equipment, are not covered by this warranty.** AMC is not liable for auxiliary interfaced equipment, or for 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 failure is due to misuse or conditions of use.

1.2 LIABILITY

All AMC products must be installed and maintained according to instructions. Only qualified personnel 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 labour 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

<p>CHECK TO ASSURE THE WORKING AREA IS FREE FROM HAZARDS DURING INSTALLATION OR WHEN PERFORMING MAINTENANCE, AND USE PROPER PRECAUTIONS.</p>

1.3 PRODUCT RETURN

All products returned for warranty or service should be shipped by prepaid freight and will be accepted only with RMA or repair number issued by AMC. All products returned to the client will be shipped by freight collect.

1.4 CONTACT INFORMATION

For information please call 1-800-465-5777 or contacts at www.armstrongmonitoring.com or email directly at support@armstrongmonitoring.com.



1.5 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.

1.6 GLOSSARY

Alarm	Alarm is an audible, visual, or physical presentation designed to warn the instrument user that a specific level of a dangerous gas/vapor concentration has been reached or exceeded.
Calibration	Calibration is the procedure used to adjust the instrument for proper response.
ASHRAE 15-2010	<ul style="list-style-type: none">○ American Society of Heating, Refrigerating and Air-Conditioning Engineers○ Safety Standard for Refrigeration Systems○ Standard which establishes procedures for operating equipment and systems which uses refrigerants
CSA B52	<ul style="list-style-type: none">○ Canadian Standards Association○ Mechanical Refrigeration Code○ The purpose of this Standard is to minimize the risk of personal injury by providing minimum requirements for the design, construction, installation, inspection, and maintenance of the mechanical refrigeration systems
PPM	Parts Per Million (1% volume = 10,000PPM)
Percent by volume	Concentration of gas in a mixture expressed as a percentage of total volume.
AMC-RAC	Remote Alarm Controller, This module is responsible for the communication between the AMC-RAM-4 and Gas monitor.

2 PRODUCT INFORMATION

The AMC-RAM-4 is a Refrigerant Alarm Module for use with Monitors from Armstrong Monitoring. The AMC-RAM-4 provides audio and visual indicators when gas concentrations exceed preset thresholds. The AMC-RAM-4 also provides user control of ventilation, as specified in CSA B52 Mechanical refrigeration code and ASHRAE 15-2010 Safety Standard for Refrigeration Systems.

Note:

All Armstrong Monitoring systems must be installed and maintained according to instructions to assure proper operation. Only qualified personnel should install and maintain the equipment. For exchange, re-calibration or extended warranty programs information please call 1-800-465-5777 or through contacts at www.armstrongmonitoring.com

2.1 RAM-4 MODULE

AMC-RAM-4 order number(s)	_____
Module serial number(s).....	_____
Power Supply Requirement.....	13.5 to 35 VDC
Current Requirement per unit.....	225mA
Operating Temperature without Displays.....	-40° to +50°C
Operating Temperature with Displays.....	0° to +50°C
Operating Pressure	0.9 to 1.1 atm
Relative Humidity	0 to 95% RH, non-condensing
Warranty.....	2 Years
Audio	90dBA, 2900Hz @24 inches
Display option scale.....	_____

3 PRODUCT DESCRIPTION

The AMC-RAM-4 is designed to provide remote alarm indication when used in conjunction with the AMC-1AREF series of gas monitors which are equipped with the AMC-RAC (Remote Alarm Controller). The AMC-RAM-4 can also be used to provide remote display of gas concentrations inside the refrigeration plant.

Properly designed/installed detection systems will include a gas monitor equipped with the AMC-RAC module, refrigerant sensor(s) as required, and the appropriate AMC-RAM-4 modules installed inside and outside the refrigeration plant. The AMC-RAM-4 series modules are an intrinsic part of your ASHRAE 15-2010 and CSA B52 compliant monitoring system.

AMC-RAM-4 MODULE OVERVIEW:

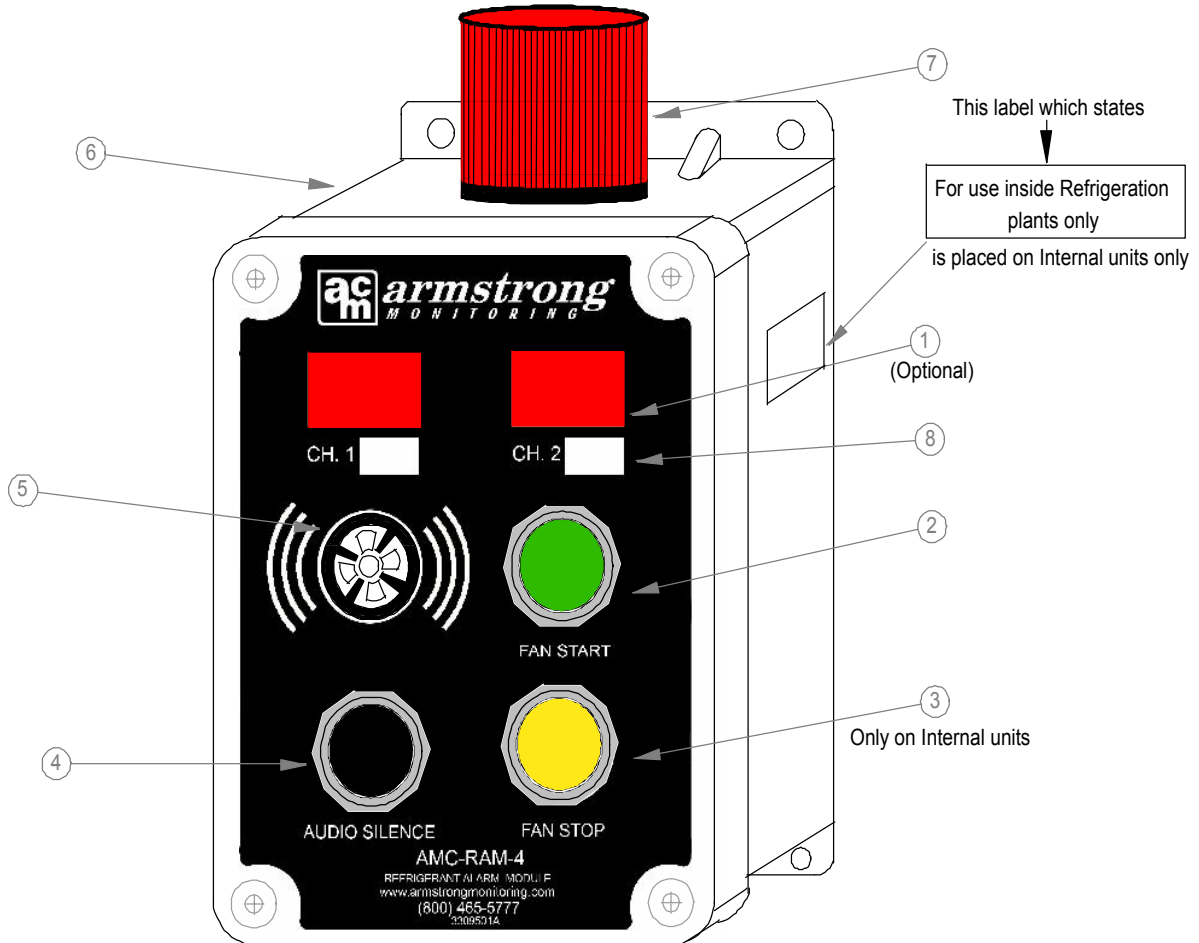


Figure 3-1 AMC-RAM-4 Overview

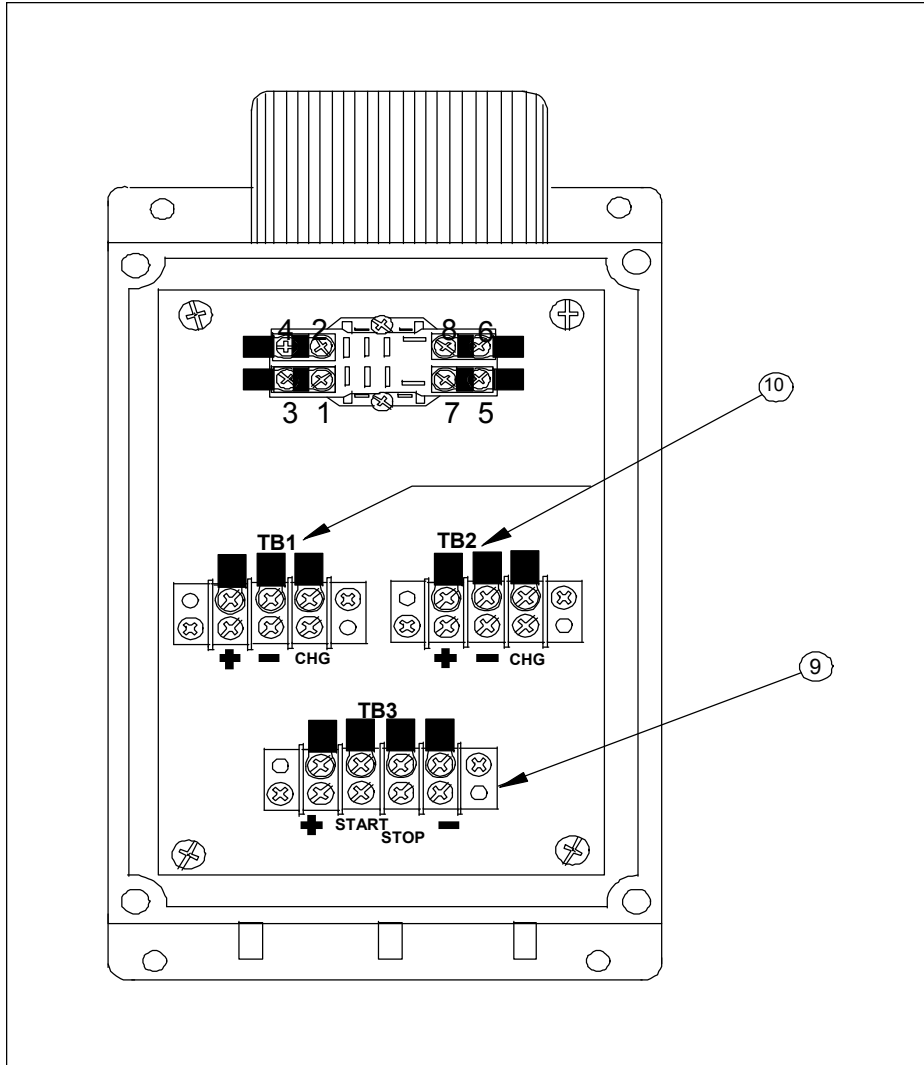


Figure 3-2 AMC-RAM-4 Internal View

AMC-RAM-4 OVERVIEW

1. **Display:** 3 ½ digits, red LED, Options: none 1 or 2. Provides a digital readout of the gas concentrations seen by the sensors.
2. **Fan Start:** The green button is used to start the ventilation anytime, typically before entrance into the machinery room. ASHRAE 15-2010 and CSA 52 specifies that;
 - Readily available fan switches must be installed inside and outside refrigeration plant.
 - Fan switches located outside the refrigeration plant shall be capable of starting but not stopping ventilation.
3. **Fan Stop:** The red Stop button is used to stop the fans or ventilation which has been activated by the FAN Start button on the AMC-RAM-4. AMC-RAM-4's with this option can only be located within the machinery room. ASHRAE 15-2010 and CSA 52 specifies that;

When a LATCHING RELAY(s) configuration is employed at the monitor, the STOP button also provides the RESET function (for the relays).



4. **Audio Silence:** This black button silences the audio alarm of the AMC-RAM-4 module.
5. **Buzzer:** The Audio alert is provided by a buzzer which emits a 2900 Hz tone at in excess of 90 dBA @ 24 inches. The audio alert is activated upon entry into alarm and is silenced by either pushing the Audio Silence button or clearing of the alarm.
6. **Enclosure:** The AMC-RAM-4 employs a NEMA 4X rated polypropylene enclosure which provides protection against the environment, also has a hinged cover to provide easy /quick access for installation and service as well as mounting flanges and holes for expeditious installation.
7. **Strobe light:** A red strobe light is provided as a visual alarm indicator. The strobe light remains active until the refrigerant gas concentration drops to a safe level
8. **Gas Type:** This label identifies the gas type that sensor is monitoring.
9. **Terminal Block 1:** This is a four pole terminal block with wire clamps used for Signal and power connection for the AMC-RAM-4
10. **Terminal Block 2 & 3:** These are three pole terminal blocks with wire clamps, they are used for the wiring up to the optional digital displays



4 INSTALLATION AND OPERATION

The following sections provide guidelines for installation; location and mounting, wiring, and cable selection.

4.1 OPERATION

The optional digital display(s) will indicate the gas concentration measured by the gas sensors. This feature is provisioned by the Gas Monitor AMC-1AREF outputting a 4-20 mA current (which is proportional to the gas concentration) on the twisted pair wiring connected to the digital display(s). A representation of the current measured on the twisted pair wiring is displayed as a gas concentration, by the digital display(s).

The Gas Monitor AMC-1AREF constantly monitors the signal provided by the sensor/transmitter assemblies. When this signal exceeds WARNING thresholds, power is provided to the RAM4 on the “+” signal wire. When power is provided on the “+” signal wire, the strobe light and audio alarm are activated. These indicators provide users in the immediate area a notification that the gas concentrations exceed safe levels. The audio alarm may be muted by depressing the “Audio Silence” button.

Depressing the FAN Start button activates the fans/ventilation. The fans/ventilation remains activated until the STOP pushbutton is depressed, at which time, if there is no alarm, the fans are deactivated.

If the monitor is configured for latching relays, depressing the STOP button will reset the latched relays (only if the alarm has cleared).

4.2 LOCATION AND MOUNTING

Mount the AMC-RAM-4 module on a solid, non-vibrating surface or structure. These units are installed inside and outside refrigeration plants. Note that other commonly used industry terms for refrigeration plant are the machinery room, chiller room, or the mechanical room. The AMC-RAM-4 modules are wired to Armstrong Gas Monitors equipped with AMC-RAC. The mounting height for the AMC-RAM-4 should be such that the beacon is at or slightly above eye level and all the pushbuttons are accessible. The recommended conduit entry is at the bottom of the enclosure.

AMC-RAM-4 VARIANTS




AMC-RAM-4 has six variants, these include variants with the STOP button that are used within the refrigeration plant and the variants without the STOP button which are used outside the refrigeration plant.

The different AMC-RAM-4 variants are captured on the next page in a graphical table.



AMC-RAM-4 Refrigerant Alarm Module

Table 4-1 Showing AMC-RAM-4 Variants

AMC-RAM-4 Graphic	Variant Part number	Location Inside/Outside Refrigeration plant	Number of Digital Displays	Wiring	
				Number of Shielded Twisted Pair	Number of Individual conductors (18-24 AWG)
	AMC- RAM-421	Inside	2	2	4 Gnd, Alarm, Start, Stop
	AMC- RAM-411	Inside	1	1	4 Gnd, Alarm, Start, Stop
	AMC- RAM-401	Inside	0	0	4 Gnd, Alarm, Start, Stop
	AMC- RAM-422	Outside	2	2	3 Gnd, Alarm, Start
	AMC- RAM-412	Outside	1	1	3 Gnd, Alarm, Start
	AMC- RAM-402	Outside	0	0	3 Gnd, Alarm, Start



4.2.1 WALL MOUNTING

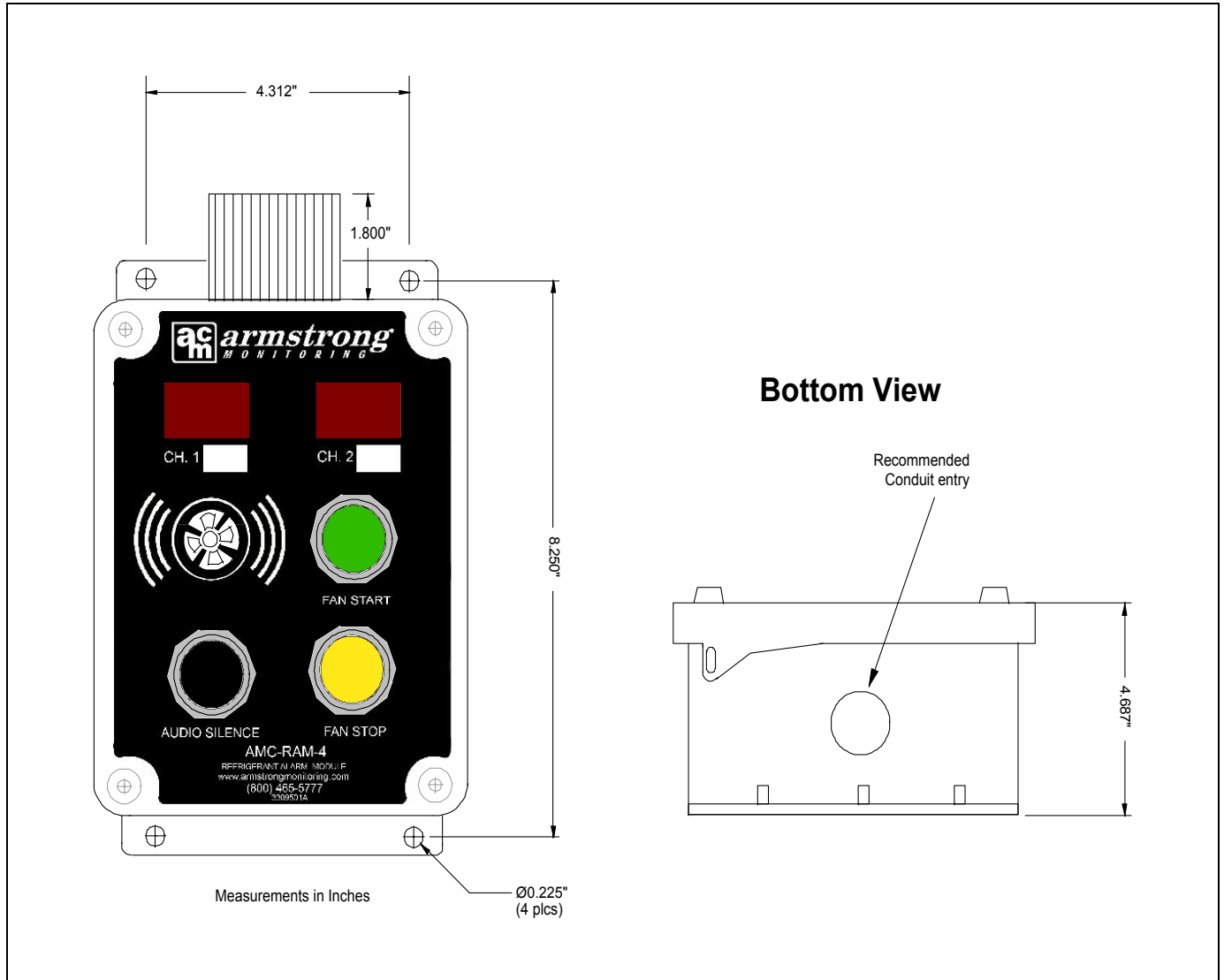


Figure 4-1 Enclosure Mounting



4.3 WIRING

The AMC-RAM-4 module was designed to operate with a power supply voltage range of 13.5V to 35VDC. The AMC-RAM-4 module is typically powered through the Armstrong Monitor AMC-1AREF equipped with the AMC-RAC. The units may also be powered by an external power supply.

Terminal blocks are provided for terminating the field wiring between the AMC-RAM-4 and the monitors.

4.3.1 AMC-RAM-4 STANDARD WIRING TO AMC-1AREF MONITOR

When the AMC-RAM-4 is connected to the AMC Gas Monitor 1AREF;

- ⇒ It is typically powered by the AMC Gas Monitor 1AREF.
- ⇒ Power to the AMC-RAM-4 is switched through the AMC-RAC within the AMC Gas Monitor 1AREF.
- ⇒ The AMC Gas Monitor 1AREF is configured to activate the AMC-RAC upon detection of an Alarm condition.
- ⇒ Wiring assembly AMC-RAM-4 to 1AREF-Monitor is done through AMC-RAC via a connector.

NOTE

The AMC-RAC employs 4-20 mA current loops on terminal block J1 and utilizes shunts JB1-4 to ensure current loops are completed as required.

4.3.2 JB1-4 DISPLAY SHUNTS

The RAC J1 Pins 1-10 always connect to external units while the RAC J1 Pins 11-20 always connect to internal units. The shunts must be installed correctly to ensure the display current loops exist for different configurations. The balance of Ram-4 functions do not depend on these shunts.

Table 4-2 JB1-4 Display Shunt Placement

<i>JB1-4 install</i>	<i>Ram-4 Configuration</i>
No shunts installed	1 External 2 Display and 1 Internal 2 Display (both Ch1/2 used)
No shunts installed	1 External 1 Display and 1 Internal 1 Display (only CH1 used)
JB2, JB4 installed	2 External 2 Display and 2 Internal No Display (both Ch1/2 used)
JB2 installed	2 External 1 Display and 2 Internal No Display (only CH1 used)
JB1, JB3 installed	2 Internal 2 Display and 2 External No Display (both Ch1/2 used)
JB1 installed	2 Internal 1 Display and 2 External No Display (only CH1 used)



AMC-RAM-4 Refrigerant Alarm Module

Figure 4-2 Standard AMC-RAM-4 to AMC-1AREF Monitor Wiring Diagram

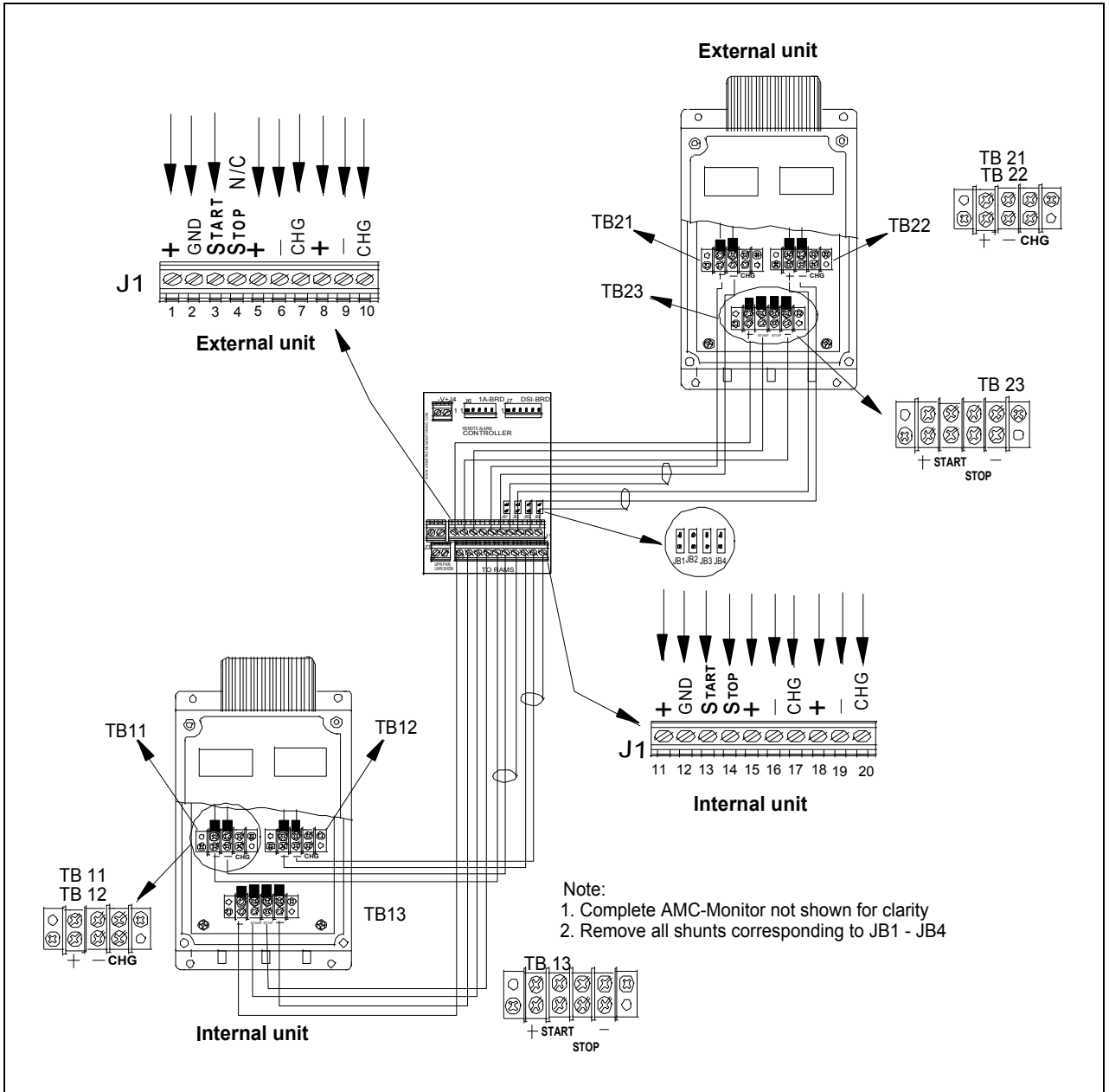




Table 4-3 Wiring AMC-RAM-4 External with (2 displays) to AMC-1AREF Monitor

RAM-4	Function	AMC-1AREF Monitor (RAC)
TB23		J1 Terminal Block position
(+)	RAM-4 Alarm	1
START	Activate Vent Relay	3
STOP	Deactivate Vent Relay	N/C
(-)	Ground	2
TB21		J1 Terminal Block position
(+)	CH1. Current Loop Positive 1	5
(-)	CH1. Current Loop Negative 1	6
CHG	Current Loop Chassis Ground	7
TB22		J1 Terminal Block position
(+)	CH2. Current Loop Positive 1	8
(-)	CH2. Current Loop Negative 1	9
CHG	Current Loop Chassis Ground	10

Table 4-4 Wiring AMC-RAM-4 Internal with (2 displays) to AMC-1AREF Monitor

RAM-4	Function	AMC-1AREF Monitor (RAC)
TB13		J1 Terminal Block position
(+)	RAM-4 Alarm	11
START	Activate Vent Relay	13
STOP	Deactivate Vent Relay	14
(-)	Ground	12
TB11		J1 Terminal Block position
(+)	CH1. Current Loop Positive 1	15
(-)	CH1. Current Loop Negative 1	16
CHG	Current Loop Chassis Ground	17
TB12		J1 Terminal Block position
(+)	CH2. Current Loop Positive 1	18
(-)	CH2. Current Loop Negative 1	19
CHG	Current Loop Chassis Ground	20



4.3.3 MULTIPLE AMC-RAM-4 WIRED TO AN AMC-1AREF MONITOR

When more than two AMC-RAM-4 modules are required, the modules can be connected in parallel BUT the optional displays have to be connected in series. Figure 4-3.

Caution: Ensure that the power supply at the monitor is large enough to power all devices or use the configuration that has no more than 2 displays per channel.

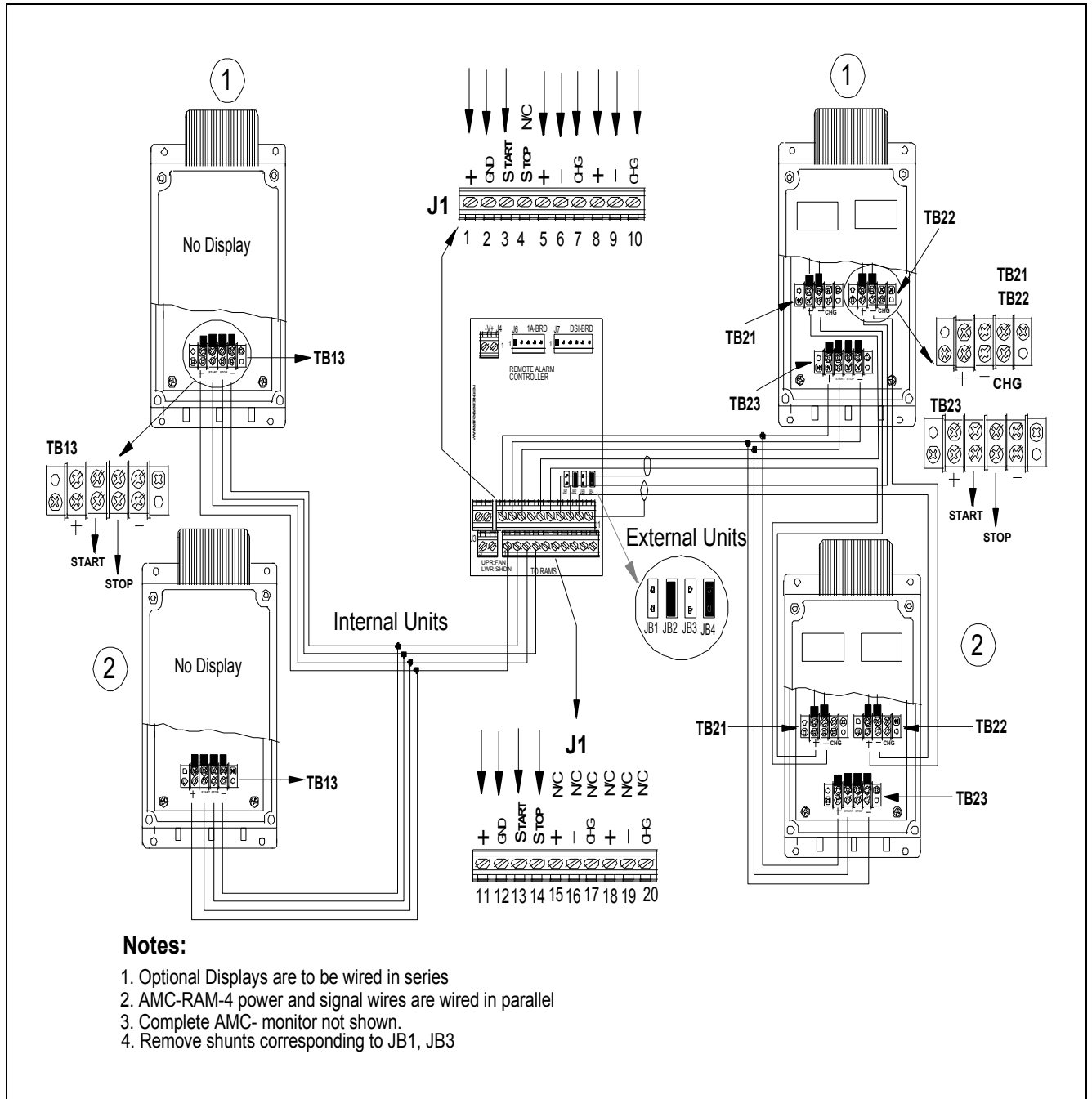


Figure 4-3 Multiple RAM-4 to AMC-1AREF Monitor Wiring Diagram



Wiring multiple External AMC-RAM-4 with display to a AMC-1AREF Gas Monitor

Table 4-5 Wiring Multiple Power and Signal Terminals in Parallel

<i>AMC-RAM-4</i>	<i>Function</i>	<i>AMC-1AREF Monitor/ RAM-4</i>
TB23 Unit 1		J1 Terminal block
(+)	Ram-4 Alarm	1
START	Activate Vent Relay	3
STOP	Deactivate Vent Relay	N/C
(-)	Ground	2
TB23 Unit 2		TB23 Unit 1
(+)	Ram-4 Alarm	+
START	Activate Vent Relay	START
STOP	Deactivate Vent Relay	N/C
(-)	Ground	(-)

Table 4-6 Wiring Multiple Displays for AMC-RAM-4 in Series

<i>AMC-RAM-4</i>	<i>Function</i>	<i>AMC-1AREF Monitor/ RAM-4</i>
TB21 Unit 1		J1 Terminal block and TB21 unit 2
(+)	CH1. Current Loop Positive 1	J1 Terminal block pos. 5
(-)	CH1. Current Loop to next Ram-4	(+) TB21 unit2
CHG	Current Loop Chassis Ground	J1 Terminal block pos. 7
TB21 Unit 2		J1 Terminal block and TB21 unit 1
(-)	CH1. Current Loop return from last RAM-4	J1 Terminal block pos. 6
CHG	Current Loop Chassis Ground	J1 Terminal block pos. 7
TB22 Unit 1		J1 Terminal block and TB22 unit 2
(+)	CH2. Current Loop Positive 1	J1 Terminal block pos. 8
(-)	CH2. Current Loop to next Ram-4	(+) TB22 unit 2
CHG	Current Loop Chassis Ground	J1 Terminal block pos. 10
TB22 Unit 2		J1 Terminal block and TB22 unit 1
(-)	CH2. Current Loop return from last RAM-4	J1 Terminal block pos. 9
CHG	Current Loop Chassis ground	J1 Terminal block pos. 10



Wiring multiple Internal AMC-RAM-4 with no display to an AMC-1AREF Gas Monitor

Table 4-7 Wiring Multiple AMC-RAM-4 with no Displays

<i>AMC-RAM-4</i>	<i>Function</i>	<i>AMC-1AREF Monitor / RAM-4</i>
TB13 Unit 1		J1 Terminal block
(+)	Ram-4 Alarm	11
START	Activate Alarm Relay	13
STOP	Deactivate Alarm Relay	14
(-)	Ground	12
TB13 Unit 1		TB13 Unit 2 (RAM-4)
(+)	Ram-4 Alarm	(+)
START	Activate Alarm Relay	START
STOP	Deactivate Alarm Relay	STOP
(-)	Ground	(-)

NOTES:

- Limit the number of displays for external devices wired up to the AMC-1AREF monitor to 2 per channel due the current requirements of the displays and power supply.
- The Audio Silence will only silence the local AMC-RAM-4, not all AMC-RAM-4s connected to the circuit.
- When additional AMC-RAM-4s are required, an additional power supply may be required at the AMC-RAC.
- Shielded twisted pair wire is recommended for display wiring.



4.4 DISTANCE BETWEEN MONITOR/POWER SUPPLY AND AMC-RAM-4

The workable distance between the monitor and the AMC-RAM-4 is a function of the following;

- ⇒ Power Supply voltage
- ⇒ Wire gauge
- ⇒ AMC-RAM-4 load current

The Monitor power supply is generally fixed, based upon monitor type;

- ⇒ 18 (VDC) AMC Gas monitor AMC-1AREF
- ⇒ 13.5 V Minimum operating voltage AMC-RAM-4

Monitor Minimum Output Voltage on Current Interface

- ⇒ 14.5 (VDC) AMC Gas Monitor AMC-1AREF

The wire size is limited to 18-24 gauge wire due to the terminal size on the AMC-RAC.

The graph below shows the distance in feet allowable between the AMC-RAM-4 from the monitor based on wire size and different variants of the AMC-RAM-4

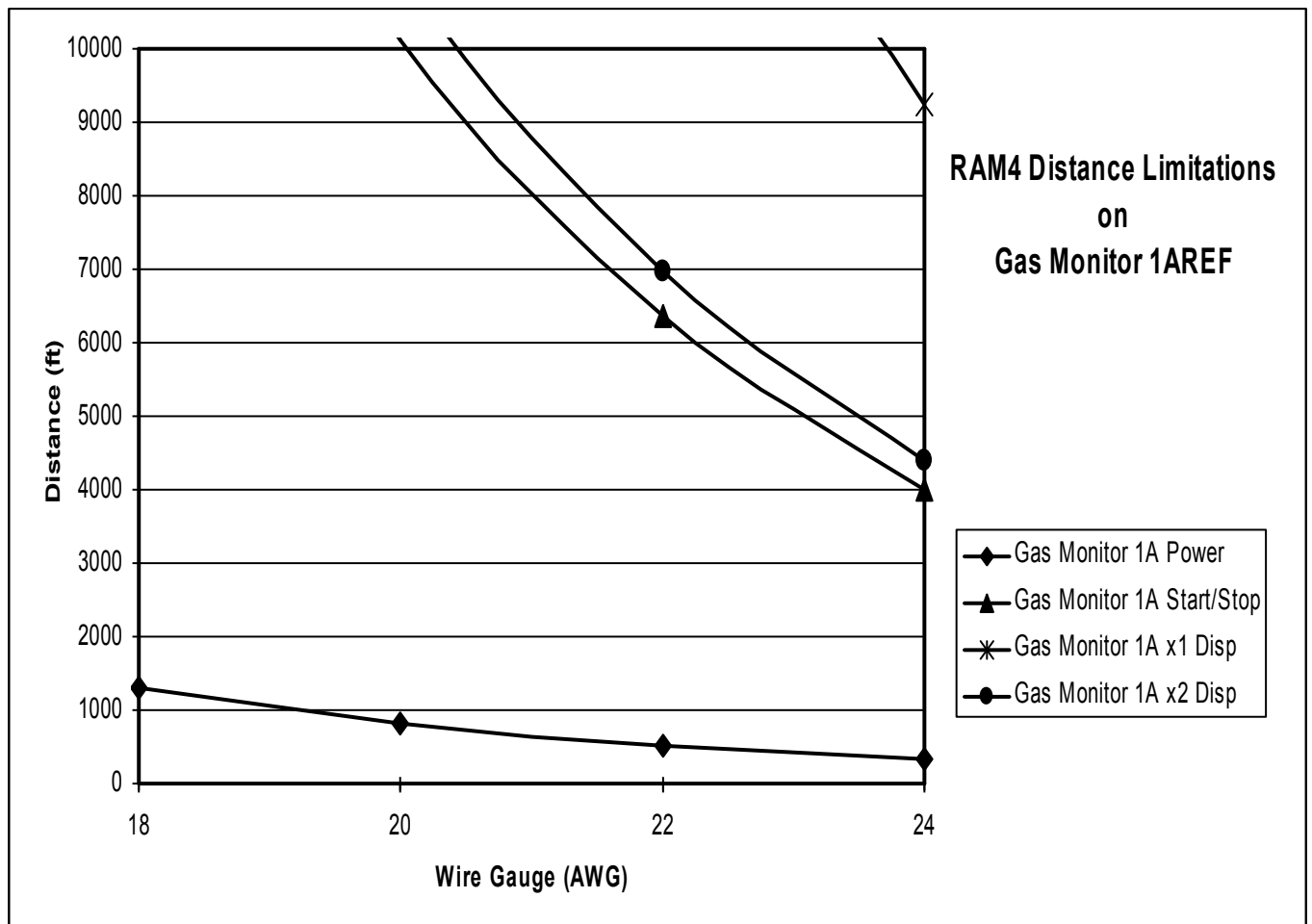


Figure 4-4 Distance Graph (ft) : Power Supply vs Wire Gauge



AMC-RAM-4 Refrigerant Alarm Module

AMC-RAM-4 with displays and Building Automation System wiring to AMC-RAC

When AMC-RAM-4 with displays are wired to AMC-RAC, the Building Automation System can only be wired to the system through a series connection with the AMC-RAM-4 displays as shown below in Figure 4-5

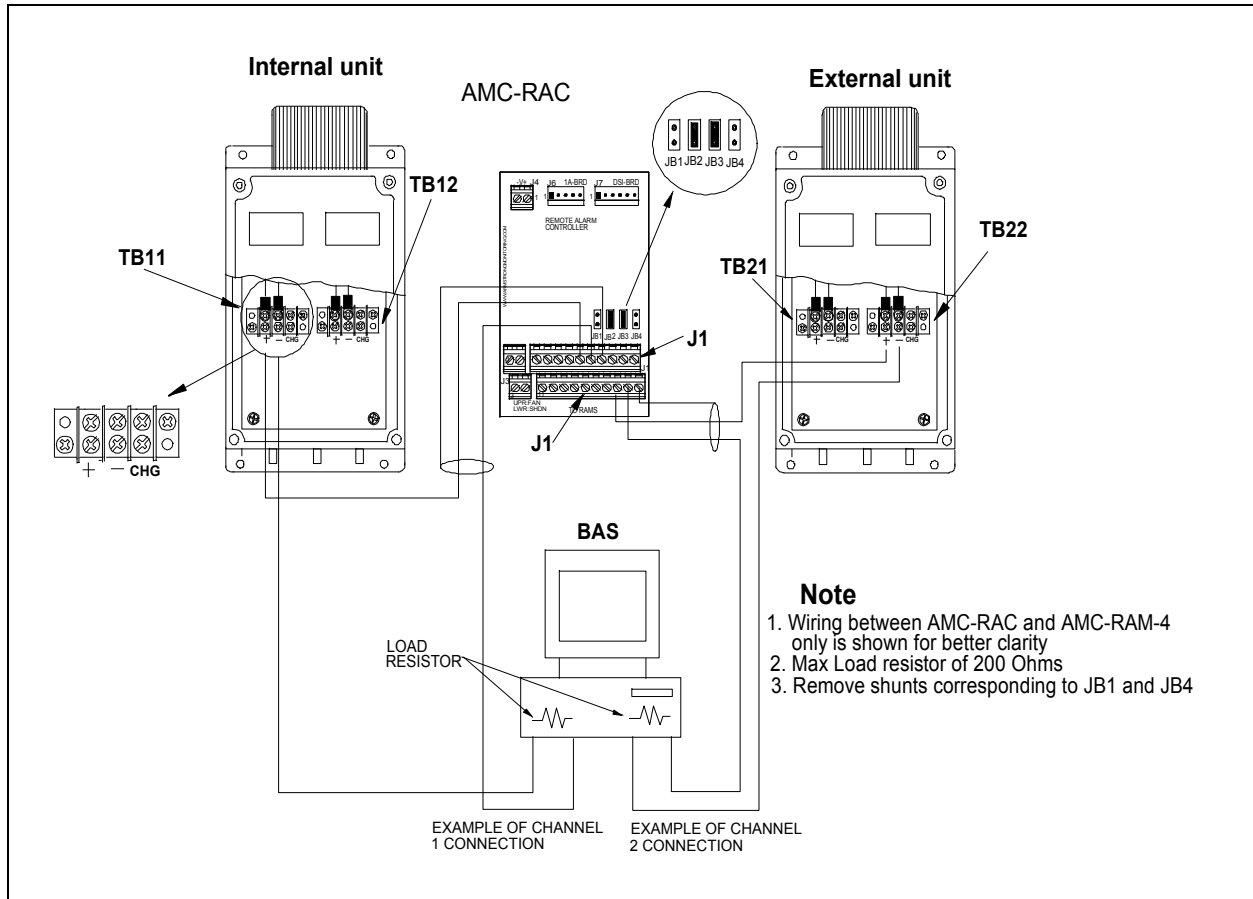


Figure 4-5 AMC-RAM-4 with Displays, BAS and AMC-RAC

Table 4-8 Wiring AMC-RAC to AMC-RAM-4 Internal with Displays and BAS Channel 1

AMC-RAC	Function	AMC-RAM-4	BAS CH.1
J1 Terminal Block pos.5 (+)		TB 11(internal) +	
N/A		TB 11(Internal) -	(+)
J1 Terminal Block pos.6 (-)		N/A	(-)
J1 Terminal Block pos.7 (CHG)			

Table 4-9 Wiring AMC-RAC to AMC-RAM-4 External with Displays and BAS Channel 2

AMC-RAC	Function	AMC-RAM-4	BAS CH.2
J1 Terminal Block pos.18 (+)	CH2. Current Loop Positive 1	TB 22(external) +	
N/A		TB 22(external) -	(+)
J1 Terminal Block pos.19 (-)	CH2. Current Loop Negative 1	N/A	(-)
J1 Terminal Block pos.20 (CHG)	Current Loop Chassis Ground		



BAS wiring to the AMC-RAC.

When there are no AMC-RAM-4s with displays connected to the AMC-RAC, The Building Automated System is wired directly to the AMC-RAC as shown in the Figure 4-6.

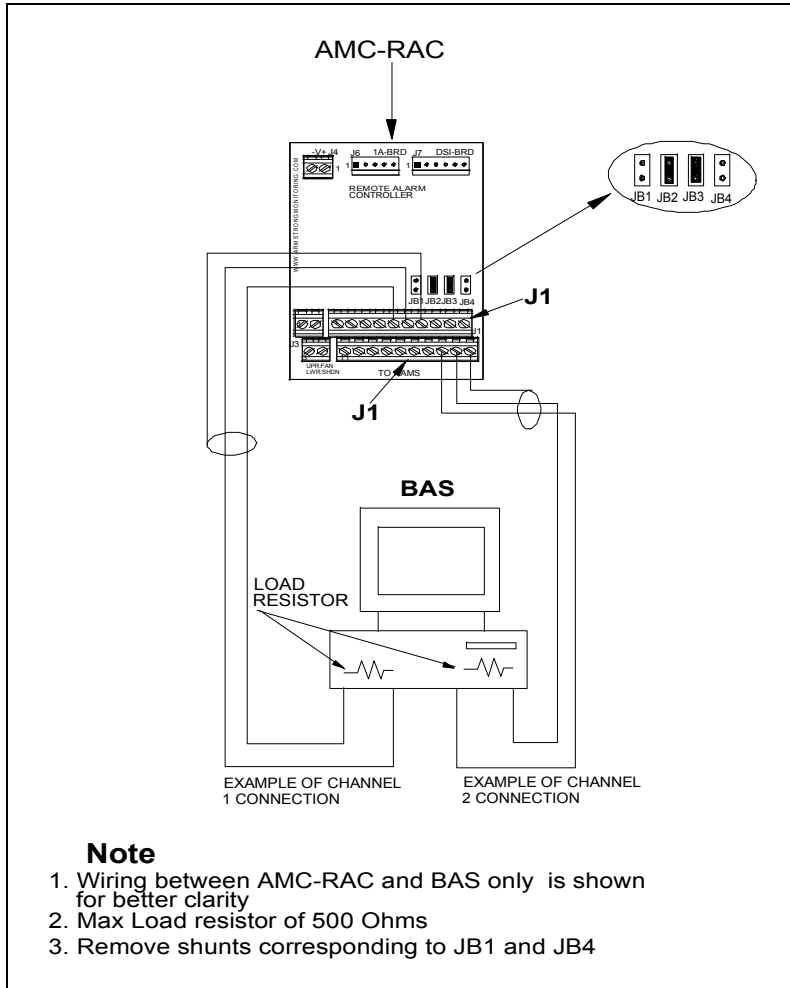


Figure 4-6 Wiring the BAS to 1AREF Monitor (RAC)

Table 4-10 AMC-RAC to BAS Channel 1 Connection

AMC-RAC	Function	BAS CH.1
J1 Terminal Block pos.5 (+)	CH1. Current Loop Positive 1	(+)
J1 Terminal Block pos.6 (-)	CH1. Current Loop Negative 1	(-)
J1 Terminal Block pos.7 (CHG)	Current Loop Chassis Ground	

Table 4-11 AMC-RAC to BAS Channel 2 Connection

AMC-RAC	Function	BAS CH.2
J1 Terminal Block pos.18 (+)	CH2. Current Loop Positive 1	(+)
J1 Terminal Block pos.19 (-)	CH2. Current Loop Negative 1	(-)
J1 Terminal Block pos.20 (CHG)	Current Loop Chassis Ground	



The Graph below shows examples of wire length allowable between the AMC-1AREF monitor, AMC-RAM-4 with display and Building Automation System with different Load resistances for the setup.

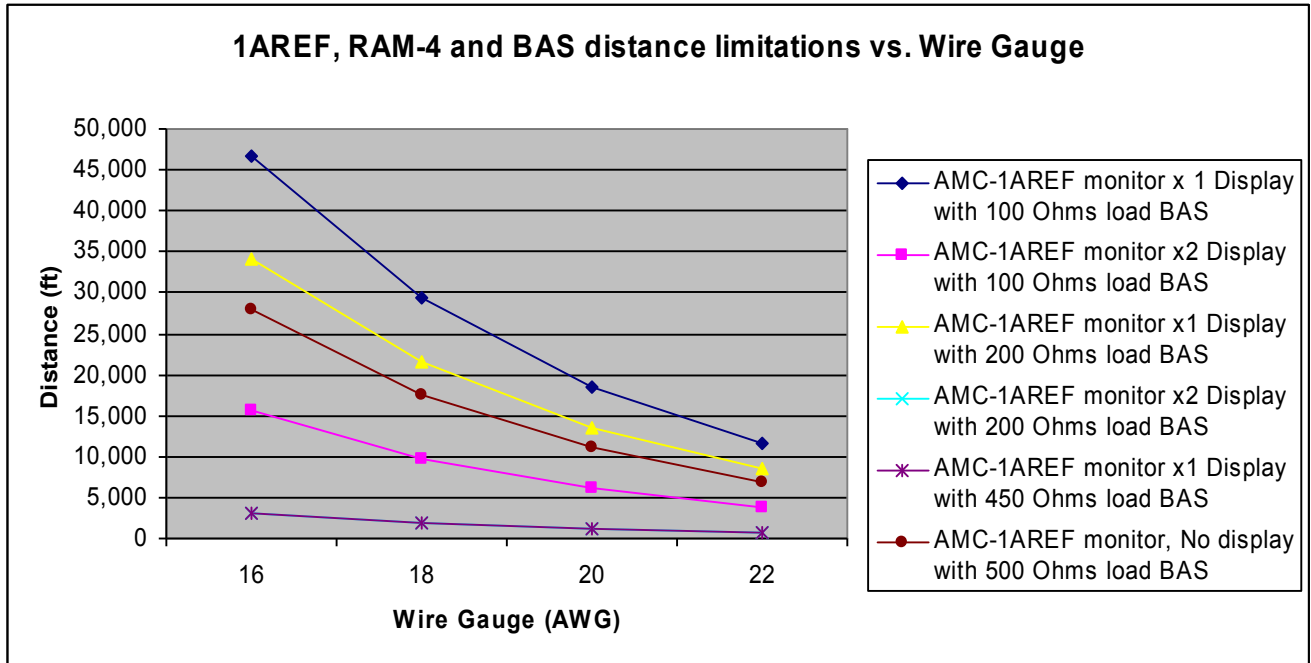


Figure 4-7 Graph Showing Distance (ft) Vs. Wire Gauge (AWG) for various System Setups

Note:

1. Wire length for the following setups is the same; Gas Monitor AMC-1AREF x2 Display with BAS 200 Ohms resistance and Gas Monitor AMC-1AREF x1 Display with BAS 450 Ohms resistance.
2. Recommended maximum load resistance BAS is 200 Ohms per channel; for setup AMC-1AREF monitor, Ram-4 with 2 displays per channel

5 CALIBRATION

The procedure below illustrates how to calibrate the Optional displays to its factory-calibrated readings of “000” with a 4mA input and “1000” with a 20mA input typically

NOTE: Some gases have different ranges, suitable ranges for different gas ranges will be set by the manufacturer.

When performing DIP-switch settings, be sure the DIP switch’s small actuators are firmly engaged in their fully-ON or fully-OFF positions:

1. Set both R3 and R7 fully clockwise.
2. Set all the DIP-switches as shown in Figure 5-1. For display ranges other than 1000 please contact AMC.
3. Apply a precision 4mA input and adjust R3 until the meter’s display reads”000”
4. Apply a precision 20mA input and adjust R7 until the meter's display reads “1000” or suitable full scale value.

Repeat steps 3 and 4 to verify the two adjustments did not affect one another.

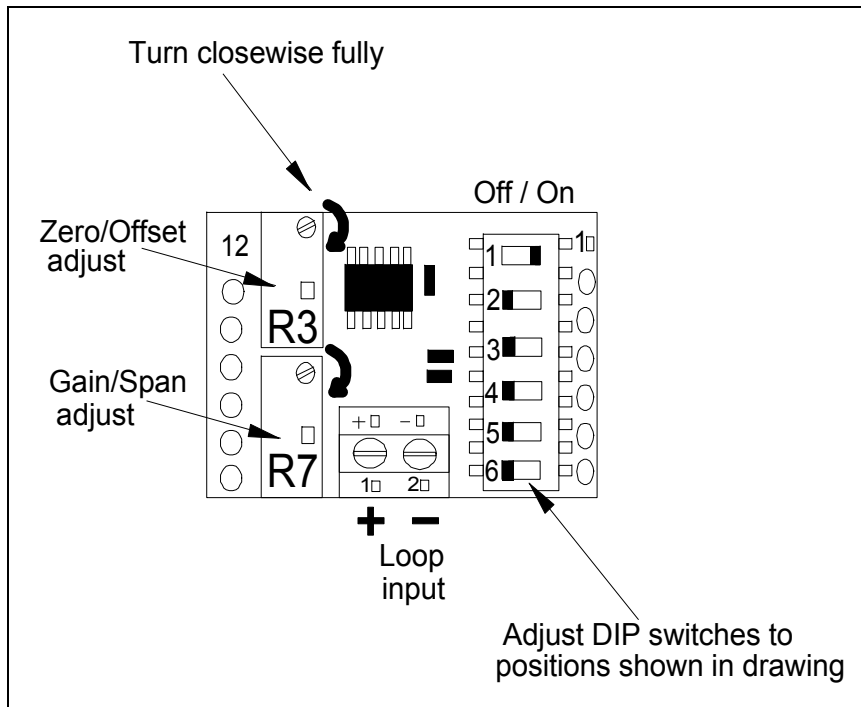


Figure 5-1 Optional Display Calibration Procedure



6 PREVENTIVE MAINTENANCE

6.1 GENERAL

The module enclosure should be brushed or wiped clean once a year or more, of any dust or dirt which settles on it, depending on the accumulation.

6.2 VERIFICATION OF OPERATION

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