



Operating Manual
Chillgard VRF

Order No.: 10176317/00

MSAsafety.com

1 SAFETY REGULATIONS

1.1 Correct Use

MSA's CHILLGARD® VRF Refrigerant Detector – hereafter referred to as detector – is designed to detect the presence of the most common halogenated refrigerants, and specifically calibrated to detect R410a.

WARNING

This manual must be carefully read by all individuals who have or will have the responsibility for installing, using, or servicing the product. This product is supporting life and health. Incorrect use, maintenance, or servicing may affect the function of the device and persons who rely on this product for their safety could sustain loss of life or serious personal injury.

Furthermore, the national regulations applicable to the user's country must be taken into account for safe use of this product. Alternative use, or use outside of this specification will be considered as non-compliance. This also applies especially to unauthorized alterations to the product and to commissioning work that has not been carried out by MSA or authorized persons.

1.2 Liability Information

MSA accepts no liability in cases where the product has been used inappropriately or not as intended. The selection and use of this product must be under the direction of a qualified safety professional who has carefully evaluated the specific hazards of the site where it will be used and who is completely familiar with the product and its limitations. The selection and use of this product and its incorporation into the safety scheme of the site is the exclusive responsibility of the employer.

Warranties, also known as guarantees, made by MSA with respect to the product are voided if the product is not used, serviced, or maintained in accordance with the instructions in this manual.

1.3 Safety and Precautionary Measures

WARNING

Carefully review the following safety limitations and precautions before placing this device in service. Incorrect use can cause loss of life or serious personal injury.

- Install, operate, and maintain this instrument in strict accordance with its labels, cautions, warnings, instructions, and within the limitations stated.
- Do not install this detector in outdoor areas or locations where explosive concentrations of combustible gases or vapors might occur in the atmosphere. Do not paint this detector. Painting will interfere with the sampling process of the detector. If painting is being done in an area where the detector is located, exercise care to ensure that paint is not put or splashed on the detector.

WARNING

The unit must always be powered by either a suitable UL/CSA/IEC 60950 Certified power supply which is isolated from line voltage by double insulation, or an appropriately rated UL Listed/CSA Certified Class 2 transformer. Failure to follow the above can result in serious personal injury or loss of life.

3. Connect the wires to the terminal connector located in the base, as indicated in Figure 2. The terminal block on the base includes a label to identify the connections. Figure 3 shows the wiring connection definitions. All units come with an analog and a digital output. The analog output will be either current (mA) or voltage (V) and the digital output will be either BACnet or Modbus. The choice is made based on the part number ordered.

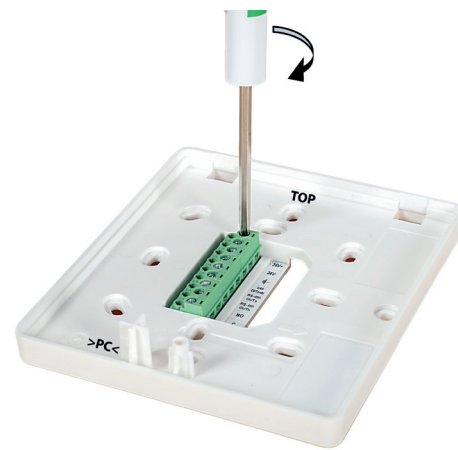


Figure 2: Connecting Wires to Terminal Connector

Terminal Label	Description
24V+	24 V DC+ or AC Line
24V-	24 V DC- or AC Neutral
	Circuit common/analog signal reference
GAS OUT (mA or V)	For (mA) – Gas reading as current (4 - 20 mA = 0 - 1000 ppm) For (V) – Gas reading as voltage (2 - 10 V = 0 - 1000 ppm)

- Protect this detector from vibration and heat; otherwise improper operation may result.
- Verify product operability. Do not use the detector if the function test is unsuccessful or the detector is damaged.
- Ensure that all servicing is performed by MSA authorized technicians, using genuine MSA replacement parts

CAUTION

Install this detector in as clean and dry area as possible and install splash shields to keep water and other contaminants away from the detector; otherwise, damage can occur.

1.4 Warranty

1. Seller warrants that this product will be free from mechanical defect or faulty workmanship for a period of 18 months from date of shipment, provided it is maintained and used in accordance with Seller's instructions and/or recommendations. This warranty does not apply to expendable or consumable parts whose normal life expectancy is less than one (1) year such as, but not limited to, non-rechargeable batteries, filament units, filter, lamps, fuses etc. The Seller shall be released from all obligations under this warranty in the event repairs or modifications are made by persons other than its own or authorized service personnel or if the warranty claim results from physical abuse or misuse of the product. No agent, employee or representative of the Seller has any authority to bind the Seller to any affirmation, representation or warranty concerning the goods sold under this contract. Seller makes no warranty concerning components or accessories not manufactured by the Seller, but, to the extent possible, will pass on to the Purchaser all warranties of manufacturers of such components. **THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED, IMPLIED OR STATUTORY, AND IS STRICTLY LIMITED TO THE TERMS HEREOF. SELLER SPECIFICALLY DISCLAIMS ANY WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE.**
2. Exclusive Remedy - It is expressly agreed that Purchaser's sole and exclusive remedy for breach of the above warranty, for any tortious conduct of Seller, or for any other cause of action, shall be the repair and/or replacement at Seller's option, of any equipment or parts thereof, which after examination by Seller is proven to be defective. Replacement equipment and/or parts will be provided at no cost to Purchaser, F.O.B. Seller's Plant. Failure of Seller to successfully repair any non-conforming product shall not cause the remedy established hereby to fail of its essential purpose.
3. Exclusion of Consequential Damage - Purchaser specifically understands and agrees that under no circumstances will seller be liable to purchaser for economic, special, incidental or consequential damages or losses of any kind whatsoever, including but not limited to, loss of anticipated profits and any other loss caused by reason of non-operation of the goods. This exclusion is applicable to claims for breach of warranty, tortious conduct or any other cause of action against seller.
4. This detector has no user-replaceable parts. Modification of the unit will void the warranty.

Terminal Label	Description
DATA a (BACnet or Modbus)	For BACnet – RS485 BACnet MSTP (a) connection For Modbus – RS485 Modbus RTU (a) connection
DATA b (BACnet or Modbus)	For BACnet – RS485 BACnet MSTP (b) connection For Modbus – RS485 Modbus RTU (b) connection
NO	Relay – normally open (de-energized)
C	Relay – common
NC	Relay – normally closed (de-energized)

Figure 3: Wiring Connections

4. Align the top side tabs of the cover with the base and snap the cover onto the base, and fasten the screw.
- Note:** Verify cover is securely attached to base by pulling on the top and bottom of the cover as shown in Figure 4.
5. To remove the cover, remove the screw and pull the enclosure away from the base as show in Figure 4.

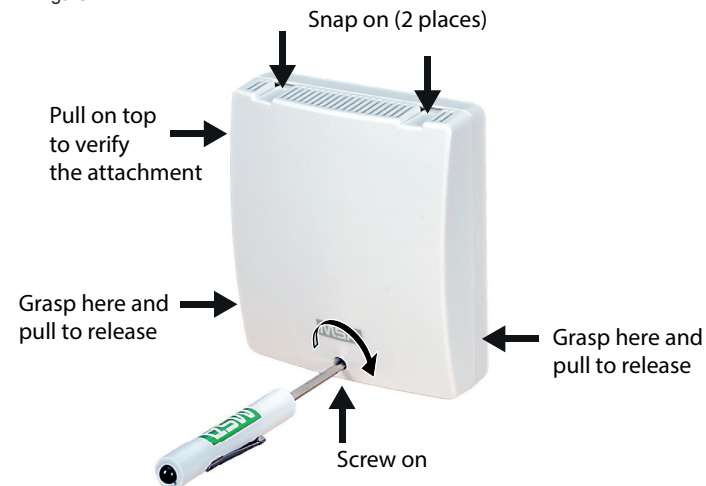


Figure 4: Attaching or Removing the Cover

2 SPECIFICATIONS

This detector detects R410a with a number of output options. This includes analog output (current or voltage) and RS-485 digital output (Modbus or BACnet). Check label provided on the printed circuit board (Figure 1- shows the label).

Power Requirements	24 VDC ±20 %, 24 VAC ±20 %, 50/60 Hz, Class 2
Wiring	14 AWG max (up to 2.5 mm ²), Class 2 copper wiring
Power Consumption	Less than 5 watts
Output Options	4 to 20 mA sourcing, ≤500 Ohm load, 2-10 V, 10 K Ohm load, RS-485: Modbus RTU, BACnet MS/TP
Operating Temp.	0 °C to 60 °C
Humidity	0 to 99 % non-condensing
Size	4.7" x 4.1" x 1.7" (11.9 cm x 10.4 cm x 4.3 cm)
Weight	0.51 lbs. (230 g)
Pressure	Operating 10.2 to 15.7 PSIA (70 to 108 kPa)
Altitude	0-2000 m
Warm-up time	30 Minutes
Pollution Degree	2
Installation Category	II
Range	0 to 1000 ppm
Minimum Detection	25 ppm
Response Time	t50 less than 240 seconds
Repeatability	±10 ppm at 50 ppm
Linearity	±10 ppm from 25-50 ppm, ±20 % of reading from 50 to 1000 ppm
Relay	Rated load: 1 A at 30 VDC, Max. operating current: 1 A, Max. switching capacity: 30 W

3 INSTALLATION GUIDELINES

3.1 Locating the detector

Proper detector location is necessary to ensure accurate measurement of representative air samples.

3.3 Dimensions in mm [inch]

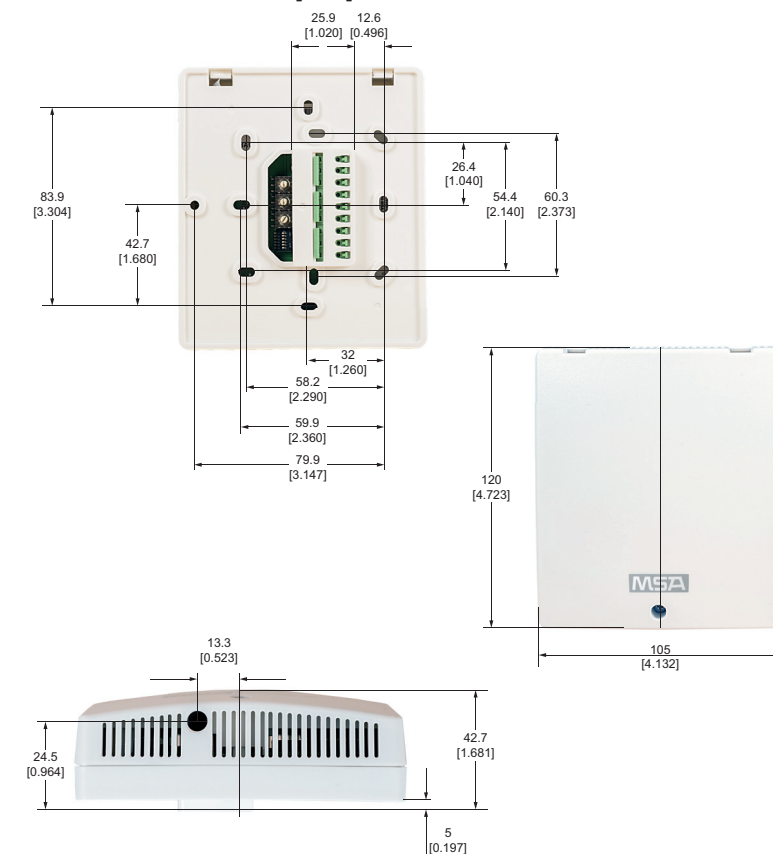


Figure 5: Installation Dimensions

- Locate the detector:
- indoors in a room area where air circulates freely
 - indoors in an area near fittings where refrigerant leaks may occur
 - on a flat, interior surface
 - approximately 12-18 inches (30-45 cm) from floor

- Do not locate the detector:
- near heat sources, such as appliances, direct sunlight or concealed pipes or chimneys
 - on walls or structures subject to excessive vibration
 - in areas where air does not circulate freely, such as behind doors or in corners.

3.2 Mounting the detector

The detector consists of two basic parts, the base and the cover (Figure 1). The cover incorporates the electronics with the sensing elements.

1. Fasten the base to a junction box or other support.
 - The base has a number of openings to allow for mounting to various junction boxes.

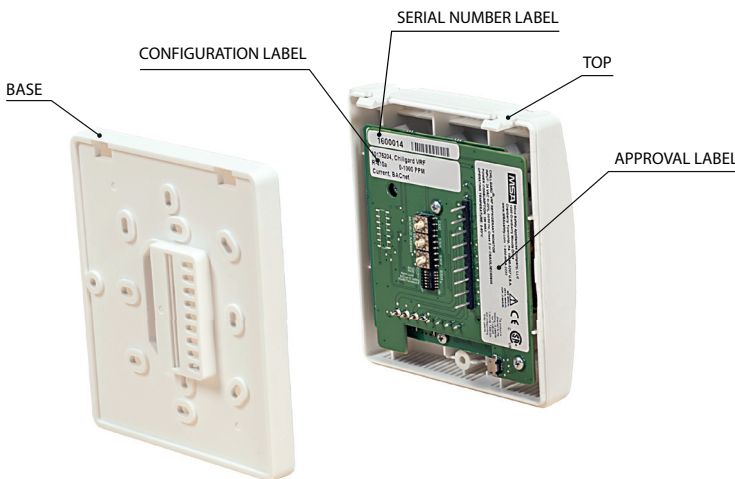


Figure 1: Base and Cover

2. Feed the power and signal wires through the rectangular opening in the base.

4 OUTPUT ACTION

This detector is factory calibrated and ready for immediate use. Once power is applied, the Red LEDs located at the top and bottom of the unit indicate status.

	START-UP	NORMAL STATE	ALARM	CALIBRATION CHECK	FAULT
LED STATE	Flash at 1 Hz	Flash every 60 seconds	Flash fast at 3 Hz	Flash slow at 0.5Hz (>=50 ppm fixed)	SOLID ON

Relay function:

Relay is normally energized, non-latching. It changes state upon alarm or fault condition.

During a sensor fault, the:

- current output is set to 2 mA or
- voltage output is set to 1 V
- digital output is defined in Register Map.

5 CONFIGURATION

All network communication uses serial framing (8 data bits, no parity, 1 stop bit) regardless of protocol or Baud Rate. The serial framing cannot be changed.

Configuration Switches:

Switches	Function
S300,S301,S302	Modbus address (Range = 1~255) or BACnet MAC address (Range = 0~127)
S303-1,S303-2,S303-3	Baud Rate
S303-4	Alarm level (ON (H) - default 50 ppm, OFF (L) - default 750 ppm)
S303-5	BACnet Instance Number setting (OFF-(L) User's setting, ON (H) factory setting)
S303-6	RS485 Termination match resistor (120 ohms). ON position adds the resistor

Modbus address

S300, S301 and S302 are used to represent a value using the decimal number system for Modbus address (Range = 1~255). S300 is hundreds number, S301 is tens digit number and S302 is units digit number. The changes will only be valid after power reset. Invalid address will cause an address fault.

BACnet MAC address

S300, S301 and S302 are used to represent a value using the decimal number system for BACnet MAC address (Range = 0~127). S300 is hundreds number, S301 is tens digit number, and S302 is units digit number. The changes will only be valid after power reset. Invalid address will cause an address fault.

Baud Rate

S303-1, S303-2 and S303-3 are used to represent the Baud Rate configuration.

S303-1	S303-2	S303-3	Baud Rate	
			BACnet	Modbus
OFF	OFF	OFF	9600	
OFF	OFF	ON	19200	
OFF	ON	OFF	38400	
OFF	ON	ON	57600	
ON	OFF	OFF	76800	
ON	OFF	ON	115200	

Alarm Level

There is one alarm whose value can be switched between two different levels. The factory programmed alarm levels are: 50ppm when switch is in the ON (H) position, and 750ppm when switch is in the OFF (L) position. The alarm values can be edited using a controller. Any changes are valid immediately.

S303-4	Alarm Level
ON (H)	Default 50 ppm
OFF (L)	Default 750 ppm

BACnet Instance Number

Refer to the serial number label (Figure 1) for the default Instance Number (also Serial Number). If switch S303-5 is ON (H) then the factory default is used and is unchangeable. If S303-5 is OFF (L) then a user programmable Instance Number is used, although it is initialized to the factory default.

5.1 BACnet Connection

When connected to a BACnet network, the following parameters must be set properly in order to communicate with the BACnet controller:

- MAC address
- Instance Number
- Baud Rate

This monitor is configured for and connected to a BACnet network and has the following BACnet Objects available for exchange with the BACnet controller.

BACnet Objects:

Object Name	Instance Number	Property	RANGE	
Gas Concentration	1 (default)	Read	0 to 1000 (ppm)	
Gas Number	2 (default)	Read	R-410A=34	
Active Alarm Level	3 (default)	Read	(ppm)	
Fault and Device State	4 (default)	Read	Device Fault	80 (MSB)
			Address Fault	8 (MSB)
			Concentration Alarm	10 (LSB)
			Warm Up Complete	0 (LSB)
High Alarm Level	5 (default)	Read/Write	750 default range = 25-1000	
Low Alarm Level	6 (default)	Read/Write	50 default range = 25-1000	
Instance Number	7 (default)	Read/Write	Default value: Serial Number Label (Figure 1) Range: 0~4194302	
Room TEMP. (°C)	8 (default)	Read		

BACnet Protocol Implementation Conformance Statement (PICS):

Device Profile	BACnet Application Specific Controller (B-ASC)
Data Sharing	Read Property-B (DS-RP-B)
	Read Property Multiple-B (DS-RPM-B)
	Write Property-B (DS-WP-B)
	Write Property Multiple-B (DS-WPM-B)
	COV-B(DS-COV-B)

Property	Object Type		
	Device	Analog Input	Analog Values
Max APDU Length	R		
Segmentation Support	R		
APDU Timeout	W(10~65535,65.535s)		
Number APDU Retries	W(0~10)		
Max Master	W(1~127)		
Max Info Frames	R		
Device Address Binding	R		
Database Revision	R		
Active COV Subscriptions	R		
Present Value		R	R/W
Status Flags		R	R
Event State		R	R
Reliability		R	R
Out-Of-Service		R	R
Units		R	R
Priority Array			R
Relinquish Default			R
COV Increment		W	W

5.2 Modbus RTU Connection

When connected to a Modbus network the following parameters must be set properly in order to communicate with the Modbus controller:

- Modbus address
- Baud Rate

The following registers are available for exchange with the Modbus controller.

Modbus Objects:

REGISTER NAME	PDU ADDRESS	LOGICAL ADDRESS	Property	RANGE	
Gas Concentration	0x0000	1	Read	0 to 1000 (ppm)	
Gas Number	0x0001	2	Read	R-410A=34	
Active Alarm Level	0x0002	3	Read	(ppm)	
Fault and Device State	0x0003	4	Read	Device Fault	80 (MSB)
				Address Fault	8 (MSB)
				Concentration Alarm	10 (LSB)
				Warm Up Complete	0 (LSB)
High Alarm Level	0x0004	5	Read/Write	750 default range = 25-1000	
Low Alarm Level	0x0005	6	Read/Write	50 default range = 25-1000	
Room TEMP. (°C)	0x0008	9	Read		

6 CALIBRATION CHECK

This detector with Photoacoustic infrared technology is designed to operate with a stable baseline for years of operation. However, a unit must be checked periodically to verify that it detects refrigerant gas. The calibration check can be done with the following MSA equipment:

- (P/N 603806) Polyurethane Tubing
- (P/N 467895) 0.25 LPM regulator
- (P/N 10077766) Gas cylinder, 100ppm R410A in Nitrogen

Device Management	Dynamic Device Binding-B (DM-DDB-B)
	Dynamic Object Binding-B (DM-DOB-B)
	Device Communication Control-B (DM-DCC-B)
	Reinitialize Device-B (DM-RD-B)
Data Link Layer Options	MS/TP Master (Clause 9), Baud Rates: 9600, 19200, 38400, 57600, 76800, 115200
Static device binding Supported	NO
Character Sets Supported	ISO 10646 (UTF-8)
Segmentation Capability	NO

BACnet Standard Object Types supported:

Property	Object Type		
	Device	Analog Input	Analog Values
Object Identifier	R	R	R
Object Name	R	R	R
Object Type	R	R	R
System Status	R		
Vendor Name	R		
Vendor Identifier	R		
Model Name	R		
Firmware Revision	R		
App Software Revision	R		
Protocol Version	R		
Protocol Revision	R		
Services Supported	R		
Object Type Supported	R		
Object List	R		

A calibration check of the sensor requires a supply of:

- ZERO GAS (air or nitrogen). It may be possible to use ambient air if user is certain it does not contain refrigerant gas or an interfering component
- SPAN GAS Cylinder comprised of refrigerant gas of appropriate concentration

6.1 Calibration Check Procedure

To verify proper sensor operation:

1. If the active alarm level is lower than the concentration of calibration gas, please be aware that the relay may activate. You may modify the active alarm level via Modbus or BACnet or you may switch to the alternate alarm level using switch S303-4 (refer to Alarm Level section above).
2. If appropriate, deactivate any equipment connected to the outputs, or disconnect the wiring of the outputs.

CAUTION

If any control instruments connected to this detector are wired to external devices (e.g., horns, exhaust fans, and fire suppression systems), these devices may activate during the following procedures. To prevent activating these devices while adjusting this monitor, disconnect the wiring to the control device. Return all wiring to the control device when the calibration procedure is completed.

3. With the tubing connected to the regulator and cylinder, place tubing in the opening at the bottom of this unit (see Figure 6).
4. Open the regulator and apply gas. This process may take up to five minutes.
5. If the unit is operating properly:
 - The Red LED:
 - illuminates when concentration level > Calibration Check level or Active Alarm level
 - is visible through the upper and lower enclosure vents.
 - the relay will activate if the Active Alarm level is exceeded.
6. Turn off regulator and remove tubing from opening.
7. Allow gas level to return to normal.
8. Reactivate any equipment connected to the outputs or reconnect the wiring to the outputs.
9. Remember to restore any alarm level settings that may have been changed for the Calibration Check.



Figure 6: Applying Calibration Gas