

User Guide

Portable gas monitor
Type **PAGM for CO₂** and **Halocarbon**



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Hazardous area warning:

This instrument has not been designed to be intrinsically safe for use in areas classified as hazardous locations. For your safety, DO NOT use it in hazardous (classified) locations. Do not operate this equipment in the presence of flammable liquids, vapours or aerosols.


Combustible/flammable gas warning:

This is NOT a safety device. Some gases which this instrument can detect may be combustible/flammable. When properly configured, this instrument is designed to alarm at concentrations that are lower than the explosive limit of the gas. As such, it is the buyer's responsibility to initiate an immediate planned response to any gas leaks as soon as they are detected. This equipment should NEVER be used to measure or sample gases at or above their respective lower explosive limits. Operation of any electrical equipment in such an environment constitutes a safety hazard.


Warning:

A gas monitor is a delicate and complex device and it is not to be used in any application that is beyond its intended purpose or beyond the scope of its specifications. For details on appropriate use, refer to the general description, application, and operation discussions in this manual. Before risking equipment damage or personal injury, contact the manufacturer if you are unsure of the validity of a particular gas monitor application.


Warning:

A potential risk exists if the operating instructions are not followed.


Warning:

To avoid risk of injury from electric shock, do not open the enclosure when power is applied.


Caution:

Except for the maintenance detailed in this manual, this product should ONLY be opened and / or serviced by authorized personnel. Failure to comply may void the warranty.

1. Visual inspection

When you receive the instrument, please unpack from it from shipping carton and perform visual check on the enclosure to ensure no damage to the external parts of the unit which might have occurred during shipment. Check that all the below items have been received.

PAGM-IR Halogen gas (code no. 080Z2149)	
Item	Qty.
Refrigerant monitor	1
Soft carrying case with shoulder strap	1
Battery pack and charger kit	1
Probe assembly	1
Coalescing filter	1
Carbon filter	1

PAGM-IR CO ₂ (code no. 080Z2148)	
Item	Qty.
Refrigerant monitor	1
Soft carrying case with shoulder strap	1
Battery pack and charger kit	1
Probe assembly	1
Coalescing filter	1

2. Connecting gas-sample probe and exhaust and zero air filter assembly

Before first power up connect all necessary accessories as described on below, this will ensure correct functionality of the unit.

2.1 Gas-Sample Probe

To connect the gas-sample probe to the monitor, connect the probe to the gas sample port (see picture below).

2.2 Purge/Zero Air Carbon Filter Assembly

A Purge/Zero Air Carbon Filter must be installed to properly use the Portable Aspirated Refrigerant/ Gas Monitor (PAGM).

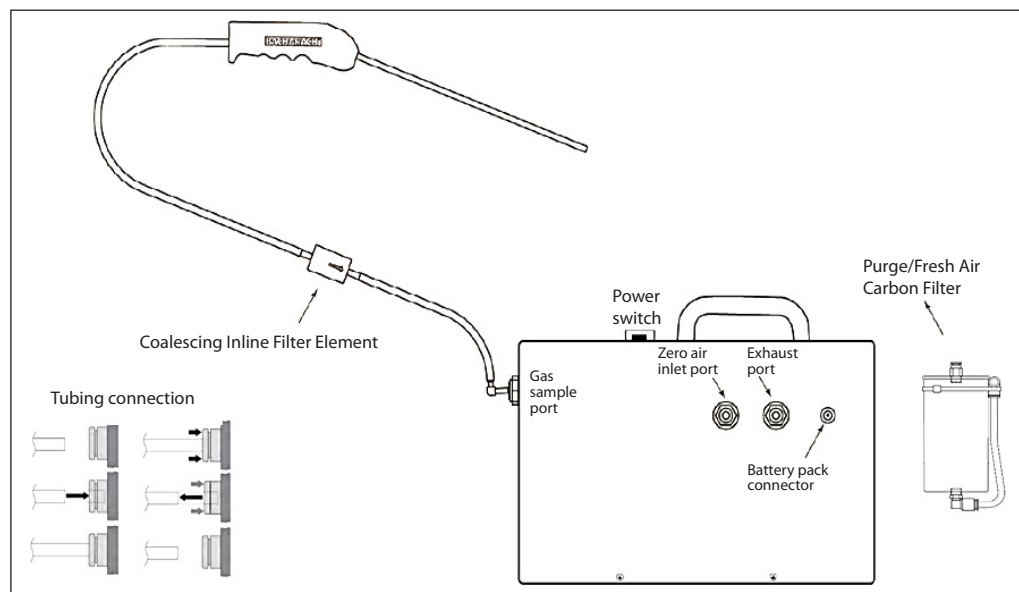
Filter installation:

1. Unfasten the Velcro on the front of the monitor soft case.
2. Slide the Purge/Zero Air Carbon Filter into the front pocket. Route the tubing through the hole in the back of the pocket, along the side of the housing.
3. Insert the connector extending from the Purge/Zero Air Carbon Filter into the Zero Air Inlet Port on the monitor.
4. Refasten the Velcro.

The Leak Detector will periodically (up to 4-minute intervals) draw clean air from an inlet port on the side of the chassis for the CO₂.

The external Purge/Zero Air Carbon Filter must be connected to the intake port in order to absorb any refrigerant present in the area of operation.

Note: When the Carbon Purge/Zero Air filter is saturated and can no longer absorb refrigerant, refrigerant can pass through and offset the baseline measurements of the unit which will than result in unit going into fault condition <0100> error will appear. Please adhere to filter maintenance intervals as below recommended.



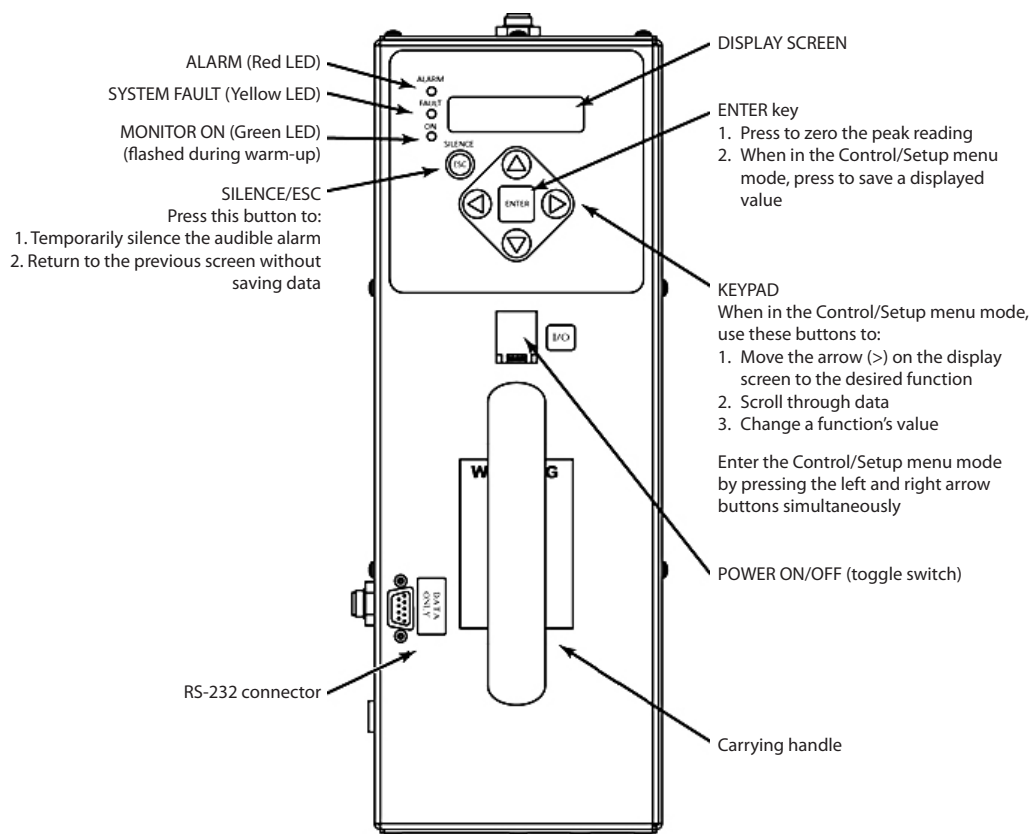
2.3 Battery

The monitor is powered by a rechargeable battery pack located in a pouch on the side of the monitor's soft carrying case. The battery pack can be recharged at any time, regardless of the battery's current charge state. The lithium-ion battery will likely be partially charged. However, you should fully charge the battery prior to operating the PAGM-IR. Refer to the battery manufacturer's instruction sheet for the proper charging procedure.

Before the unit can be used please connect the battery pack the unit is designed for a 16 V DC input. Set battery voltage output to 16 V (refer to the battery manufacturer's instruction sheet for details).

A fully charged battery pack will power the monitor for a minimum of 8 hours.

3. Front Panel Display & Controls



PAGM-IR FOR CO₂ - ONLY

Important:

- The CO₂ PAGM-IR (PN: 080Z2148) displays CO₂ PPM gas readings that are relative to ambient air, NOT absolute CO₂ PPM readings.
- If the air in purge air bag is contaminated, use the EMPTY BAG function to clear the bag, then fill the bag with clean air.

4. General operation

To turn ON the monitor, lift up the shield located in front of the handle and press the red power ON/OFF switch.

Important:

- The CO₂ PAGM-IR (PN: 080Z2148) during warm-up needs to be filled with ambient/clean air (outside prior to CO₂ testing).

When the monitor has been powered ON immediately all front panel lights turn ON and a splash screen appears showing the monitor's current firmware revision level. After a brief moment the Warm Up screen is displayed along with the front panel ON light (green) blinking allow the monitor to warm up for approx. 5 minutes.



4.1 Normal operation

PAGM-IR for halogen gas

After the Warm Up has finished the unit is ready to measure gas, please select the appropriate gas using the display menu.

During normal operation Display screen shows when the monitor is performing the following functions:

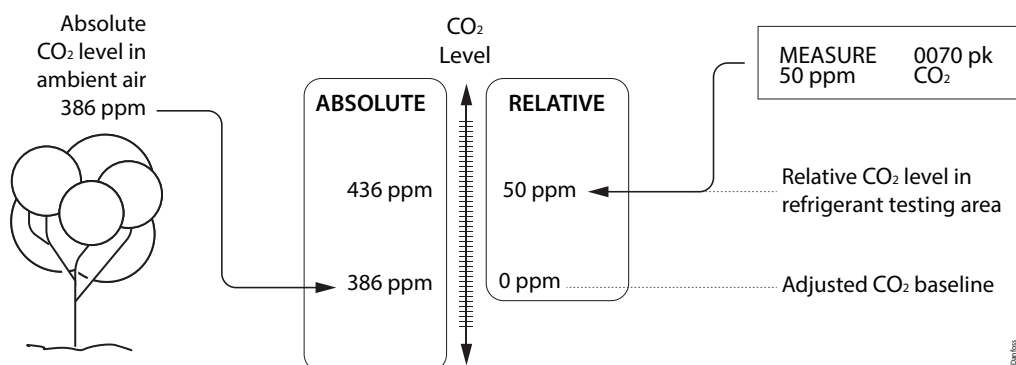
- **MEASURE** indicates that the monitor is actively measuring the refrigerant gas level at the sample point. To reset the peak value to zero, press the ENTER button.
- **PURGE** is displayed when the monitor is resetting baseline ppm value using fresh Air.
- **PRES CHK** is displayed when the monitor is performing an atmospheric pressure check, which is done to ensure the accuracy of the gas measurement under varying atmospheric conditions. This pressure check is performed every 30 minutes.



PAGM-IR for CO₂

Important:

- The CO₂ PAGM-IR (PN: 080Z2148) has an internal purge air bag that needs to be filled with ambient/clean air prior to CO₂ testing. This air is used to purge the IR detector of sample gas and establish a "zero" ppm baseline. Therefore, for greatest accuracy, it is important to ensure the purge air bag is filled with clean ambient air from outside (away from breathing, car exhaust, etc.).
- The CO₂ PAGM-IR (PN: 080Z2148) displays CO₂ PPM gas readings that are relative to ambient air, NOT absolute CO₂ PPM readings.
- If the air in purge air bag is contaminated, use the EMPTY BAG function to clear the bag, then fill the bag with clean air.



Immediately after warm-up a message appears and an audible alarm is sounded when the monitor's internal Purge Air Bag is empty to fill in the Purge Air Bag press ENTER – see below message.

The purge bag needs to be filled with fresh/clean air failure to do so can result in wrong ppm readings or Bag Fill Fault - error code <2000>.

After the bag has been filled with air it will last for approximately 40 minutes of normal operation after that time the bag needs to be filled again, press the ENTER button to start the refill process ensure that it is filled with clean/fresh air.

After the air bag has been filled successfully, the monitor starts or resumes normal operation by displaying the Data Display Screen Measure.

PURGE AIR EMPTY <ENTER> TO FILL	RECHARGING PURGE AIR...	MEASURE 00070pk 50ppm CO2
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4.2 System Faults Screen

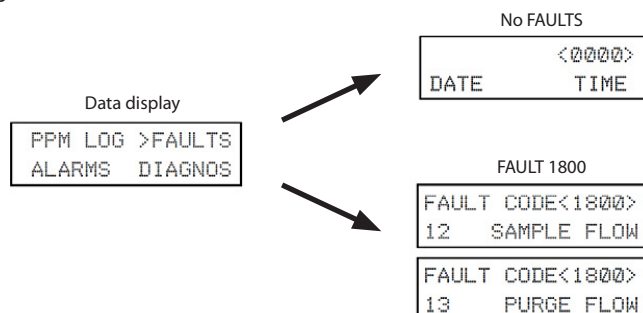
To access the Main Menu from the Data Display screen, press both the Keypad Left and Right buttons at the same time. Next, use the Keypad buttons to move the arrow (>) until it points to the desired function, and then press the ENTER button to select that function.

If a system malfunction occurs the front panel FAULT light will flash and the audible alarm, if activated will start beeping.

The FAULT light and audible alarm will automatically turn OFF after the cause of the fault has been eliminated.

Pressing the SILENCE button while a fault condition still exists causes the internal audible alarm to turn OFF for a period of time as set by the SILENCE. The front panel FAULT light will continue to flash.

Once the FAULT function is selected on the Data Display press the ENTER button to select that function. FAULT menu will appear which contains records of the last 30 fault events. The most recent event is displayed when the Fault screen is first displayed. After 30 events have been recorded, the newest record overwrites the oldest. Each record lists an event's numeric fault code plus the date and time at which the event occurred. If the fault is still present when the FAULTS function is selected, then the current cause of the fault is displayed. If the cause of the fault has been cleared, then the Faults Log screen will show <0000> along with the date and time the fault was cleared, see fault table below for troubleshooting.



The cause of the fault is identified by a numeric fault code. To convert the fault code into a text description of the fault, first press the ENTER button and then use the Keypad buttons to scroll through the display until the text description of the fault appears. If the fault code is a combination of two or more faults, then continue to use the Keypad buttons until all fault text descriptions have been displayed. For example, the fault code <1800> represents the summary of both a Sample Flow <0800> and a Purge Flow <1000> fault as shown to the left.

Code	Type	Description
<0001>	Box Temperature Fault	Enclosure temperature is outside normal range (or IR detector has failed). Monitor has been subjected to extreme temperatures potential damage to the unit. Contact service department for further instructions.
<0002>	Bench Temperature Fault	Optical sensor is outside normal operating range (or IR detector has failed). Monitor has been subjected to extreme temperatures potential damage to the equipment. Contact service department for further instructions.
<0004>	Manifold Pressure Fault	The manifold pressure is outside its normal operating range (or IR detector has failed). Enter the DIAG function and record ALL data. Contact service department for further instructions.
<0040>	Fill Flow Fault	The purge-air bag's pressure drop is outside expected limits. Check for a punctured bag or disconnected tubing. Refill the bag using FILLBAG function - see manual for instruction. If the issue persist contact service department.
<0080>	Over Range Fault	Monitor exposed to a gas level that exceeded 65,000 ppm
<0100>	Zero Filter Fault	PAGM for halocarbons indicates contamination in the carbon filter. The filter need to be replaced, replace the filter. PAGM for CO₂ the purge-air bag is contaminated with gas. Take monitor to a clean-air area and use the EMPTYBAG and FILLBAG functions to decontaminate the purge-air bag, If the issue persist contact service department.
<0200>	Gain Set Fault	The digipot autotune has failed. Contact service department for further instructions.
<0400>	A/D Fault	A fault has occurred in the analog-to-digital circuitry. Turn on/off unit if the issue persist. Contact service department for further instructions.
<0800>	Sample Flow Fault	Check for a restriction in the gas-sample inlet or exhaust. Check the external Coalescing Inline Filter and/or internal Hydrophobic Filters replace if necessary. Once the air stream has been restored, the monitor will return to normal operation after it completes a purge cycle. If the issue persist contact service department.
<1000>	Purge Flow Fault	Check for a restriction in the gas-sample exhaust. Check the external Carbon Filter and/or internal Hydrophobic Filter replace if necessary. Once the purge air stream has been restored, the monitor will return to normal operation after it completes a purge cycle.
<2000>	Bag Fill Fault	A punctured bag or disconnected tubing. Refill the bag, FILLBAG function - see manual for instruction. If the issue persist contact service department.
<4000>	Zero Range Fault	The IR detector's output voltage is out of tolerance. Enter the DIAG function and record all data. Contact service department for further instructions.
<8000>	Clipping Fault	The detector voltage may be out of tolerance. Use the DIAG function to check the IR detector voltage. Contact service department for further instructions.

4.3 Related to fault codes page

The DIAG function displays sensor data and status information useful to users for troubleshooting various fault conditions. Explanations of the data shown in these screens are given below.

First diagnostic screen

4. 20885v <0000> 29.05cD 14.58psi	Bench Voltage Detector Temperature °C * Pressure Reading
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Screen item	Description
Sensor voltage	This is the current peak-to-peak output of the IR detector. In the absence of gas this value can range from 3.90000 – 4.50000 V
Noise	The noise value is a 16 point running average of the noise portion of the IR detector's output. This reading is valuable mainly when gas is NOT present.
Detector Temperature	This is the current detector temperature in °C
Box Temperature	This is the current internal enclosure temperature in °C
Fault Code	Current fault code. A value of <0000> indicates that no faults are being detected.
Pressure Reading	This is the pressure as measured every purge cycle with the sample pump off and the gas-sample inlet open. Its value is weather and altitude dependent and can range from 10.0 – 15.5 PSIA.
Purge Valve Asterisk (*)	The purge valve can be opened and closed by pressing the Keypad Left button . An asterisk appears on the display when the purge valve is open causing the monitor to draw air from its purge-air port.

Second diagnostic screen

0.00075n <0000>
35.40cB 14.59psi

Noise Fault Code
Box Temperature °C * Pressure Reading

Screen item	Description
PPM Level	Parts Per Million level is the current detected gas level, and is the volume concentration referenced to standard temperature and pressure.
Average Absorption Unit	This is the optical absorbency. In the absence of the gas the absorbency is 0.00000 au. When sampling gas, its value varies proportionally with the gas concentration
μMoles/Liter	This is the absolute concentration in micro-moles per liter of gas.
Detector Voltage	This is a running average of the IR detector's sensor voltage.
Purge Valve Asterisk (*)	The purge valve can be opened and closed by pressing the Keypad Left button . An asterisk appears on the display when the purge valve is open causing the monitor to draw air from its purge-air port.

5. Maintenance

The Refrigerant Monitor requires periodic maintenance to ensure peak performance and accuracy including replacement of internal and external filters and calibration accuracy check refer to the manual for reference.

5.1 Replacing filters

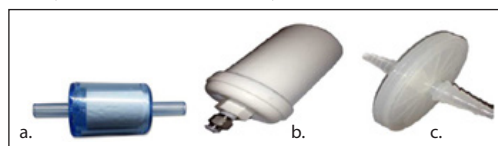
External Coalescing Inline Filter and Internal Hydrophobic Filters replacement filter replacement should be carried out at least once every 6 months but is dependent on the environment and usage. If used in harsh environment where a large amount of dust and moisture particles are present in atmospheres the maintenance intervals need to be shortened.

The intervals for the Purge/Fresh Air Carbon filter might vary and is related to time the equipment is used and ppm it was exposed to see table below.

Carbon filter maintenance intervals	
Approximate ambient refrigerant	
Level	Filter replacement interval
0 ppm	6 months
5 ppm	250 hrs
10 ppm	200 hrs
20 ppm	150 hrs
100 ppm	100 hrs

Replace the following components using Danfoss Maintenance Kit – **LP-DHGM-MM**

- Coalescing inline Filter Element (Qty. 1)
- Purge/Fresh Air Carbon Filter (Qty. 1)
- Hydrophobic Filters (Qty. 2)



Note: Individual components not sold separately

After periodic maintenance the unit can experience faults <0200>, <2000>, <8000> please contact Danfoss technical support department for further assistance how to adjust the unit settings.

5.2 Replacing Internal Hydrophobic Filters

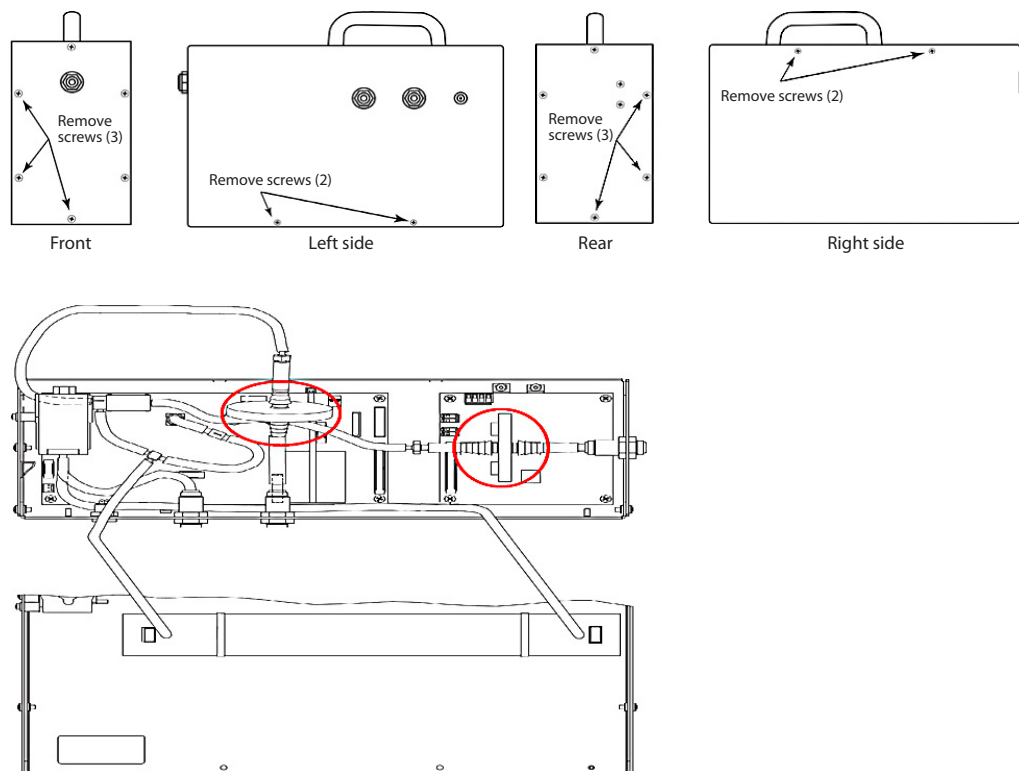
When servicing the parts inside the Refrigerant Monitor, disassemble the monitor's metal chassis as follows:

Items Required:
Medium Phillips head screwdriver

Disassemble procedure:

- Remove monitor and its battery pack from the soft carrying case.
- Unplug battery pack from monitor.
- Remove a total of 10 screws from the locations shown in the illustrations below.
- Carefully separate the metal chassis.
- Locate filters shown in the illustrations below – red circle
- Pull off tubing from both ends of filter and remove filter from instrument.
- Attach tubing to new filter. Ensure correct orientation of the filter – the flow direction is highlighted with an arrow or/and green label.
- Reassemble monitor.

Note: When fitting the Hydrophobic Filters please observe the correct orientation as fail to do so will result in monitor fault condition – “NO FLOW” code <0800>.



5.3 Verification

Accuracy check should be performed once every 12 months to ensure peak performance of the unit see below guidelines.

Important: The accuracy check can only be performed when the unit is in Normal Operation – see above. Do NOT use pure refrigerant to perform this test as doing so will damage the unit.

PAGM-IR for CO₂

- Using a regulator, inflate a plastic bag (at least 20 L) with CO₂ mixture of known concentration (recommended 5000 ppm)
- Insert the wand and seal the plastic bag opening while minimizing any leakage. Let the PAGM stabilize over a few minutes
- The PAGM-IR should read within +/- 5% of the calibrated gas minus the ambient CO₂ level (typically ~390 ppm).
Example: unit exposed to 5000 ppm should read 4610 ppm +/- 5%, which is from 4380 – 4840 ppm

PAGM-IR for halogen gas

- Set-up the unit to measure R134A gas,
- Using a regulator, inflate a plastic bag (at least 20 L) with R134A gas mixture of known concentration (recommended 500 ppm)
- Insert the wand and seal the plastic bag opening while minimizing any leakage. Let the PAGM stabilize over a few minutes
- The PAGM-IR should read within +/- 5% of the calibrated gas ppm value
Example: Unit exposed to 500ppm should read between 475 and 525ppm.

If the unit is outside the parameters please contact Danfoss technical support department for further assistance.

