



ACG+ Service & Troubleshooting Manual

Service & Troubleshooting Manual

Commercial in Confidence

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Warnings, Cautions and Notes

Warnings and Cautions are used in this Manual to highlight potential hazards and safety risks. Notes are used to provide supplementary information that is not hazard-related.



WARNING: THIS INDICATES A POTENTIALLY HAZARDOUS SITUATION THAT, IF NOT AVOIDED, COULD RESULT IN DEATH OR SERIOUS INJURY.



CAUTION: THIS INDICATES A POTENTIALLY HAZARDOUS SITUATION THAT, IF NOT AVOIDED, COULD RESULT IN EQUIPMENT DAMAGE OR LOSS OF DATA.



NOTE: THIS INDICATES INFORMATION THAT IS CONSIDERED IMPORTANT BUT IS NOT HAZARD RELATED.

1 Safety information



WARNING: READ THE SAFETY INFORMATION FULLY BEFORE USING THE ANALOX ACG+.

1.1 Electrochemical sensors (oxygen and carbon monoxide)

Electrochemical sensors contain toxic compounds. Under normal conditions the sensor will be safely sealed. To prevent leakage, the unit must not be exposed to temperatures outside the specified range, or be exposed to organic vapours, which may cause physical damage to the body of the sensor. The unit must not be stored in areas containing organic solvents or in flammable liquid stores.

When the life of the sensor has expired or it is leaking or otherwise damaged it must be disposed of safely in accordance with local regulations.

The carbon monoxide cell contains an acidic electrolyte (sulphuric acid) whilst the oxygen cell contains caustic electrolyte (potassium hydroxide). In the event of an accident, use the following first aid procedures.

Table 1 Electromechanical sensor first aid procedure

Body Part	Effect	First Aid Procedures
Skin	Contact could result in a chemical burn. Persons with pre-existing skin disorders may be more susceptible to the effects of the substance.	Immediately flush the skin thoroughly with water for at least 15 minutes. Remove contaminated clothing and wash before re-use. Obtain medical advice if continued irritation.
Ingestion	Corrosive. May cause sore throat, abdominal pain, nausea, and severe burns of the mouth, throat, and stomach, and may be fatal.	If swallowed DO NOT INDUCE VOMITING. Wash out mouth thoroughly with water and give plenty of water to drink. Obtain medical advice immediately
Eye	Persons with pre-existing eye problems may be more susceptible to the effects of the substance. Corrosive. May cause redness, pain, blurred vision, and eye burns. Contact can result in the permanent loss of sight.	Irrigate thoroughly with water for at least 15 minutes. Obtain medical advice immediately.

Body Part	Effect	First Aid Procedures
Inhalation	<p>Persons with pre-existing impaired respiratory function may be more susceptible to the effects of the substance.</p> <p>Inhalation is not an expected hazard unless heated to high temperatures.</p> <p>Mist or vapour inhalation can cause irritation to the nose, throat, and upper respiratory tract.</p>	<p>Remove to fresh air.</p> <p>Rest and keep warm.</p> <p>Obtain medical advice if applicable.</p>

Should leakage of any electrolyte occur as a result of misuse, incorrect operation, manufacturing error, physical damage, etc. then wear protective gloves when cleaning any spills. Should electrolyte contact skin then the affected area should be washed thoroughly with copious water and medical advice sought if there has been any contact with the eyes or mouth. If connected to any electrical equipment, the sensor should be immediately removed.

1.2 PID lamp cleaning kit

The PID lamp cleaning kit (9300-1022) contains a vial of cleaning compound which contains alumina (CAS Number 1344-28-1) as a very fine powder.

Hazard identification: May cause irritation of respiratory tract and eyes

Storage: Keep container closed to prevent water absorption and contamination

Handling:

- Do not breathe in the powder, avoid contact with skin, eyes and clothing
- Wear suitable protective clothing
- Follow industrial hygiene practices, wash face and hands thoroughly with soap and water after use and before eating, drinking, smoking or applying cosmetics
- The powder carries a TVL (TWA) limit of 10mg/m³

2 Introduction

This manual describes the maintenance procedures for the ACG+ and answers common troubleshooting solutions.

Please refer to P0149-801 for the complete user manual.

3 Recommended spares and accessories

Table 2 List of spares

Item	Description	Part no.
1	VOC in-line filter (6mm inlet/outlet)	6000-0096
2	Internal particulate filter	2533-1008
3	MEC O ₂ full sensor module	MECO2ABAP
4	MEC O ₂ cell (electrochemical)	9100-9212-9HM
5	MEC CO full sensor module	MECCOEBAP
6	MEC CO sensor PCB	MEC-233B
7	MEC CO cell (electrochemical)	9100-2030S
8	MEC VOC full sensor module	MECVOCBAP
9	MEC VOC cell (PID)	9100-2060S
10	MEC VOC sensor PCB	MEC-233C
11	Water vapour sensor	6000-0094
Replacement VOC sensor parts		
12	Disposable electrode stack	9100-2060/ES
13	10.6 eV replacement lamp	9100-2060/LP
14	Replacement spring	9100-2060/SP
Service parts		
15	5S3 CO ₂ full sensor module (0-1000ppm range)	A5S3ASN8A (See note below)
16	5S3 CO ₂ full sensor module (0-10000ppm range)	A5S3ALN8A (See note below)
17	ACG+ Display Module – Configured for CO ₂ , O ₂ , CO, VOC and water vapour	ACGSDA/1 (See note below)
18	ACG+ Display Module – Configured for CO ₂ , O ₂ , CO and VOC	ACGSDA/2 (See note below)
19	ACG+ Display Module – Configured for CO ₂ , O ₂ , CO and water vapour	ACGSDA/3 (See note below)
20	ACG+ Display Module – Configured for CO ₂ , O ₂ , CO	ACGSDA/4 (See note below)
21	Replacement oring for sensor flow adaptor	2323-0017X



NOTE: ACG+ TO BE RETURNED TO ANALOX FOR REPLACEMENT OR SERVICE

Table 3 List of accessories

Item	Description	Part no.
1	External PSU, 24VDC, 1.5A, 36W for connection to front panel via panel mount connector (For use with Portable & Fixed variants)	ACGPEXTPSU
2	External PSU, 24VDC, 2.7A, 65W for connection through gland direct onto interface PCB (For use with fixed variants)	ACGEXTPSU
3	Li-Ion rechargeable battery pack kit, universal (Includes charger and battery casing – for portable variants)	P0149-605LU
4	Spare Li-Ion rechargeable battery pack (Includes battery casing lid – for portable variants)	P0149-605LS
5	NiMH rechargeable battery pack kit, universal (Includes charger and battery casing – for portable variants)	P0149-605NU
6	Spare NiMH rechargeable battery pack (Includes battery casing lid – for portable variants)	P0149-605NS
7	Inlet/Calibration adaptor	6000-0201
8	0.5LPM 110L bottle regulator	Contact Analox or source locally
9	Zero calibration gas (not including CO Sensor) – 8% oxygen, balance nitrogen	Contact Analox or source locally
10	Zero calibration gas (For CO Sensor only) – 20.9% oxygen balance nitrogen. Oxygen only span calibration gas (For part number ACGPABXXXXX)	Contact Analox or source locally
11	Nitrogen background span calibration gas, (18ppm carbon monoxide, 18ppm isobutylene, 20.9% oxygen, 900ppm carbon dioxide, balance nitrogen)	Contact Analox or source locally
12	Carbon dioxide only span calibration gas (For part number ACGPABXXXXX) – 9000ppm carbon dioxide, balance nitrogen	Contact Analox or source locally
13	Pressure regulator, compact piston sensed, 300bar max inlet, 0 to 7bar adjustable outlet (Suitable 1/8" NPT fittings required for inlet and outlet), complete with pressure relief valve set at 7.5bar	6000-0164
14	Combined beacon/sounder, 24V DC, IP65 (For fixed variant)	2562-0008
15	30mm open ended spanner	9300-1020
16	Gastec Airtec Tube (Oil Mist) 109A, Pk10	9100-3500
17	Rubber Tube Holder for colorimetric tubes	GAS357
18	8mm to 4mm Push fit reducer (Required for item 17)	6000-0165
19	Drager Oil Impactor, Pk10	9100-3501
20	Override Keyswitch & Gland Kit	P0149-610
21	Humidifier Kit	P0149-660
22	External flow meter sample support kit	P0149-611
23	VOC electrode stack removal tool	9300-1021
24	VOC lamp cleaning kit	9300-1022
25	ACG+ Fixing Kit	P0075-615

3.1 Service requirements

The following tables specify the description of the service parts and their associated part numbers for the 6 monthly, 12 monthly and 24 monthly service requirements.



NOTE: THE SPARES SHELF LIFE IS 3 MONTHS FROM THE DATE OF DESPATCH FROM ANALOX.

Table 4 6 monthly service for ACG+

Item	Description	Part no.
1	10.6 eV replacement lamp	9100-2060/LP
2	Internal particulate filter	2533-1008
3	VOC electrode stack removal tool	9300-1021

Table 5 12 monthly service for ACG+

Item	Description	Part no.
1	10.6 eV replacement lamp	9100-2060/LP
2	Internal particulate filter	2533-1008
3	VOC in-line filter (6mm inlet/ outlet)	6000-0096
4	VOC electrode stack removal tool	9300-1021

Table 6 24 monthly service for ACG+

Item	Description	Part no.
1	10.6 eV replacement lamp	9100-2060/LP
2	Internal particulate filter	2533-1008
3	VOC in-line filter (6mm inlet/ outlet)	6000-0096
4	MEC O ₂ cell (electrochemical)	9100-9212-9HM
5	MEC CO cell (electrochemical)	9100-2030S
6	Water vapour sensor (Capacitive)	6000-0094
7	Replacement o'ring for sensor flow adaptors (5 off)	2323-0017X
8	VOC electrode stack removal tool	9300-1021

4 Maintenance

Certain elements of the ACG+ system require regular, preventative maintenance to ensure optimum operation. Section 3.1 shows the maintenance that is required and the scheduled interval for performing the maintenance.

Table 7 Maintenance schedule of ACG+ components

System component	Maintenance required	Maintenance interval
Oxygen sensor	Replace electrochemical cell	Approx. 2 years or as required.
Carbon monoxide sensor	Replace electrochemical cell	Approx. 2 years or as required.
VOC sensor	Clean PID lamp and electrode stack	As required, recommended every 3 months.
	Replace PID lamp or whole PID cell	Lamp - 5,000 hours (~6 months) Cell – 5 years or as required.
Carbon dioxide sensor	Replace sensor	6 years
Water vapour sensor	Replace water vapour sensor	2 years
Activated charcoal filter	Replace filter	1 year
PID particulate filter	Replace filter	6 months or as required (Depending on how dirty sample is)
Sensor flow adaptor orings	Replace oring	Check yearly and replace if required



NOTE:

A 'RECOMMENDED SPARES AND MAINTENANCE INTERVALS' (P0149-955) GUIDE WILL BE PROVIDED WITH THE ACG+, THIS INCLUDES RECOMMENDED MAINTENANCE INTERVALS AND REPLACEMENT PART NUMBERS. WE RECOMMEND THIS DOCUMENT IS USED TO TRACK ANY MAINTENANCE CARRIED OUT ON THE ACG+.

4.1 Sensor & filter replacement

Before attempting to replace any filters or sensors ensure that the ACG+ is switched off and the gas supply has been isolated and disconnected. Using a Pozi-drive screwdriver loosen the 4 enclosure lid screws and open the lid.

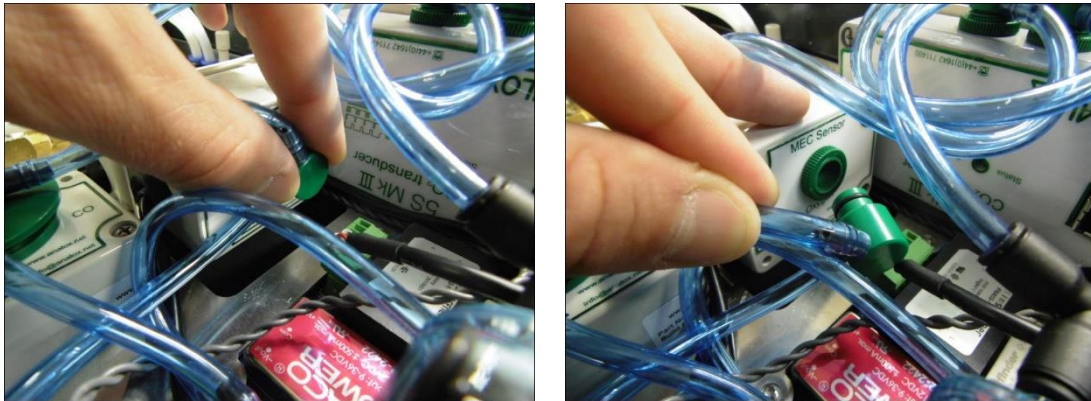


4.1.1 Oxygen cell replacement

The part number for your sensor's replacement cell is: **9100-9212-9HM**

When a replacement cell is received check that the cell has not leaked. The cells are themselves sealed and do not under normal circumstances present a health hazard however if leakage of the electrolyte has occurred use rubber gloves and wear chemical splash goggles to handle and clean up. Rinse contaminated surfaces with water. If contact is made with the electrolyte, refer to section 1 Safety Information.

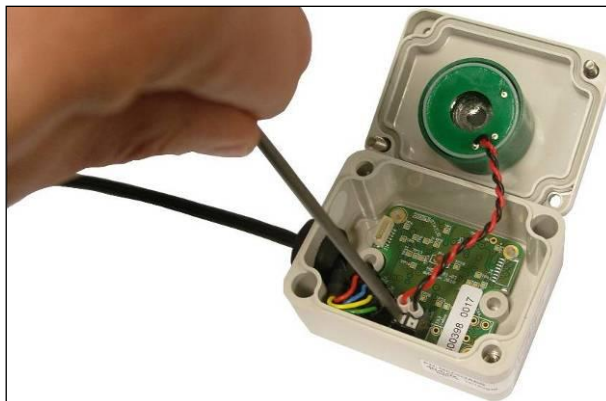
1] Remove the flow adaptor from the sensor inlet.



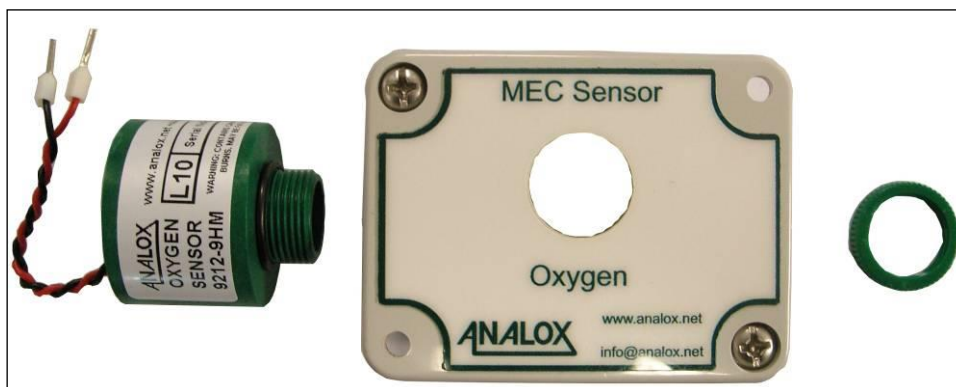
2] Loosen the corner screws of the enclosure and remove the lid.



- 3] Using a terminal screwdriver push down the clamp release button to release the clamp and gently pull the cell wire from the clamp. Repeat this for both the red and black wires.



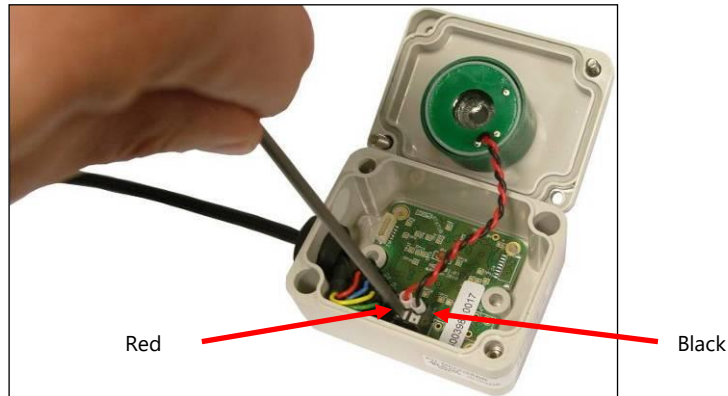
- 4] Unscrew the green locking ring from the chimney of the cell housing and remove from the enclosure lid.



- 5] Fit the new cell in to the enclosure lid and secure in place using the locking ring.



- 6] Using a terminal screwdriver, push down the clamp release button to release the clamp. Push the ferrule of the cell wire in to the clamp and remove the screwdriver from the clamp release button. Gently pull on the wire to ensure that the wire is held by the clamp. Repeat this for both the red and black wires, taking note of the correct polarity as shown below.



- 7] Refit the enclosure lid in place and secure in place using the corner screws.
- 8] Refit the flow adaptor into the sensor inlet

**NOTE:**

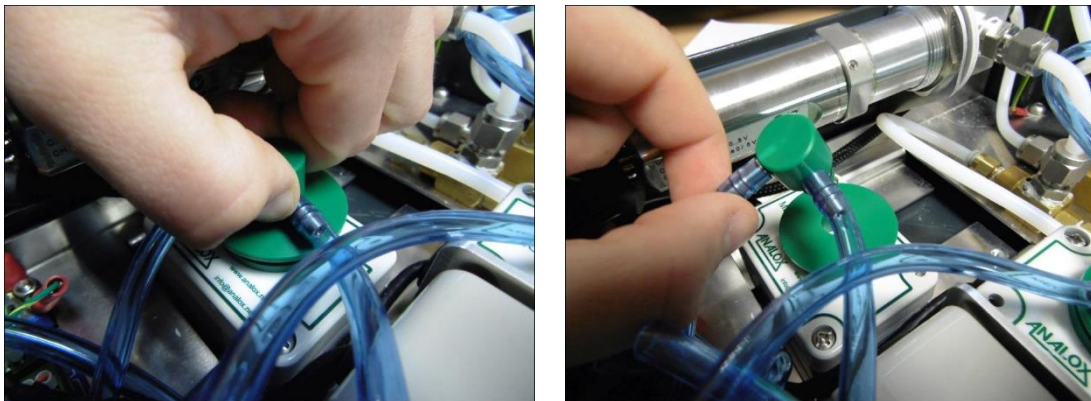
FOLLOWING AN OXYGEN CELL REPLACEMENT A FULL CALIBRATION MUST BE PERFORMED. SEE P0149-801 ACG+ USER MANUAL FOR DETAILS. ALSO, A REPLACEMENT NOTIFICATION RESET SHOULD BE PERFORMED. SEE P0149-801 ACG+ USER MANUAL FOR DETAILS.

4.1.2 Carbon monoxide cell replacement

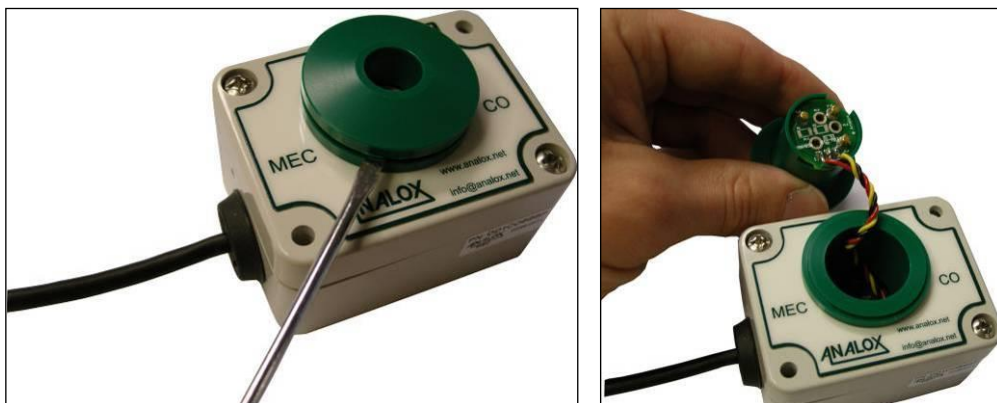
The part number for your sensor's replacement cell is: **9100-2030S**

When a replacement cell is received check that the cell has not leaked. The cells are themselves sealed and do not under normal circumstances present a health hazard however if leakage of the electrolyte has occurred use rubber gloves and wear chemical splash goggles to handle and clean up. Rinse contaminated surfaces with water. If contact is made with the electrolyte, please refer to Section Error! Reference source not found.

- 1] **Remove the flow adaptor from the sensor inlet.**



- 2] **Use a flat blade screwdriver to pop out the cell holder from the sensor bulkhead fitting.**



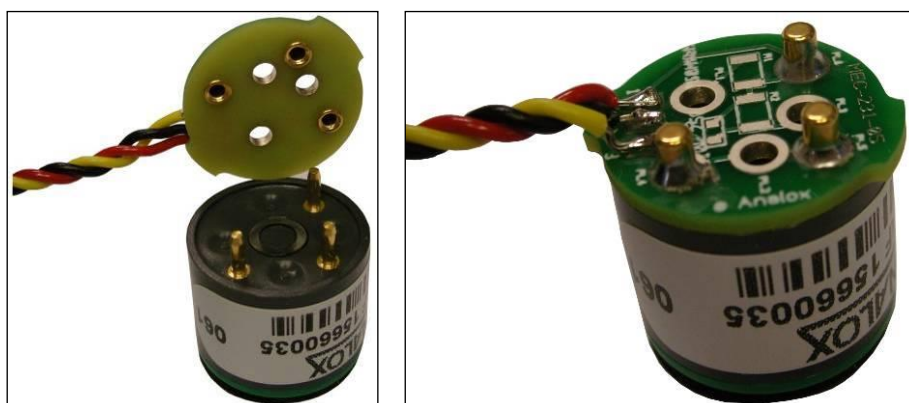
3] Rotate the cell PCB connector clockwise to release from the cell holder.



4] Disconnect the cell from the PCB connector.



5] Connect the new cell to the PCB connector (Note that it will only connect in one orientation).



6] Fit the cell in to the housing and rotate anti-clockwise to lock in place.

7] Refit the cell holder into the sensor bulkhead.

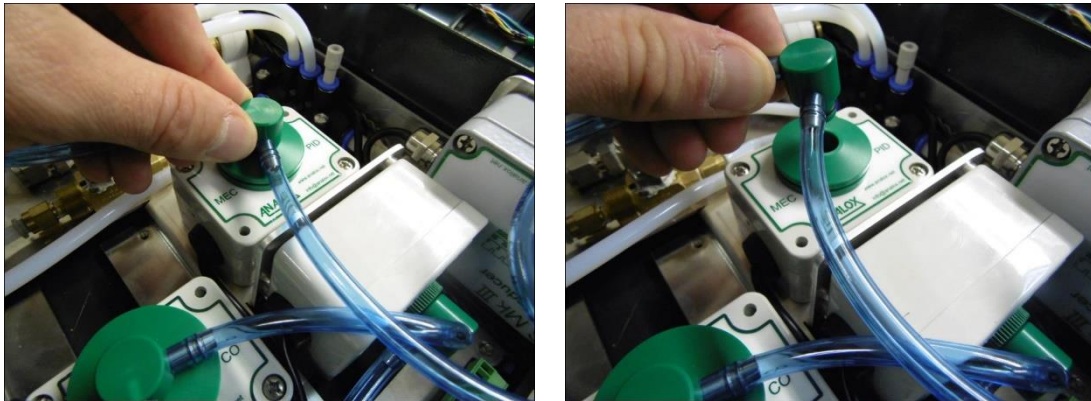
8] Refit the flow adaptor into the sensor inlet.



NOTE: FOLLOWING A CARBON MONOXIDE CELL REPLACEMENT A FULL CALIBRATION MUST BE PERFORMED. SEE P0149-801 FOR DETAILS. ALSO, A REPLACEMENT NOTIFICATION RESET SHOULD BE PERFORMED. SEE P0149-801 ACG+ USER MANUAL FOR DETAILS.

4.1.3 Replacing the CO cell PCB (MEC-233B)

- 1] Remove the flow adaptor from the sensor inlet.



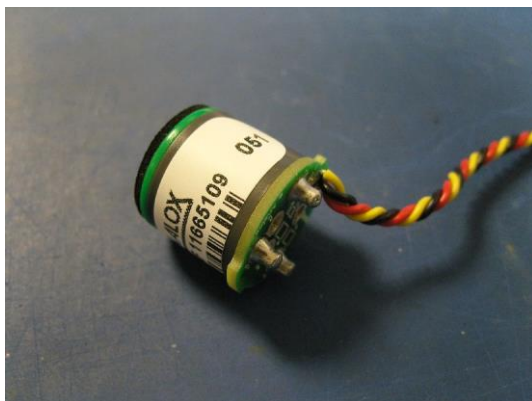
- 2] Use a terminal screwdriver to pop out the sensor holder from the sensor bulkhead fitting.



3] Rotate the CO PCB connector clockwise to release from the CO holder.



4] Disconnect the CO cell from the PCB connector.



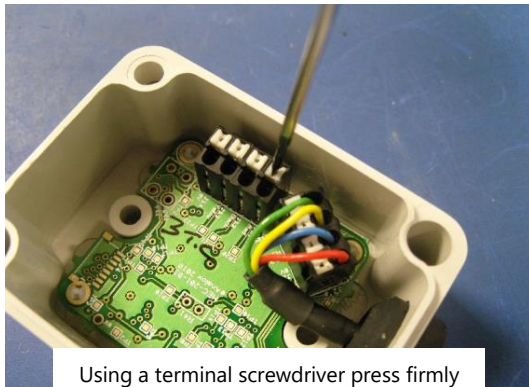
5] Remove the lid from the CO sensor housing and feed the cell PCB through the bulkhead.



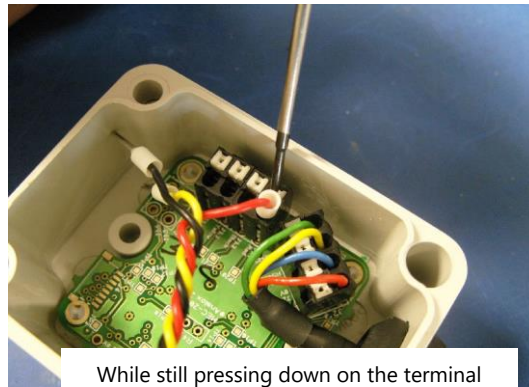
- 6] Disconnect the damaged cell PCB wiring loom from the MEC PCB connector.



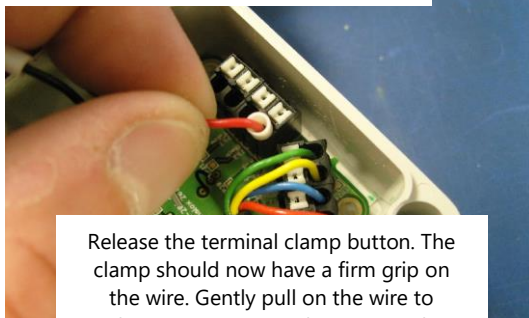
- 7] Connect the sensor wires of the new cell PCB to the corresponding 'Red', 'Black' and yellow terminals of connector J3.



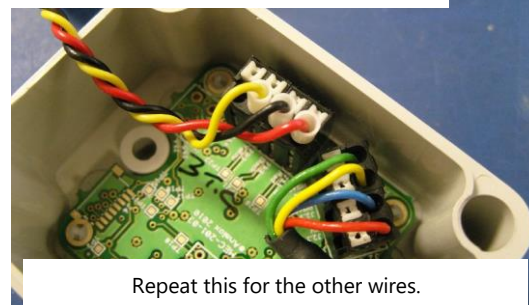
Using a terminal screwdriver press firmly down on the terminal clamp button to open the clamp.



While still pressing down on the terminal clamp button insert the bootlaced wire into the terminal clamp as shown.



Release the terminal clamp button. The clamp should now have a firm grip on the wire. Gently pull on the wire to confirm that the wire is firmly held. If not repeat the steps shown until the wire is held firmly.



Repeat this for the other wires.

- 8] Feed the cell PCB through the bulkhead and refit the lid.



- 9] Connect the CO cell to the new PCB connector. Note that it will only connect in one orientation.



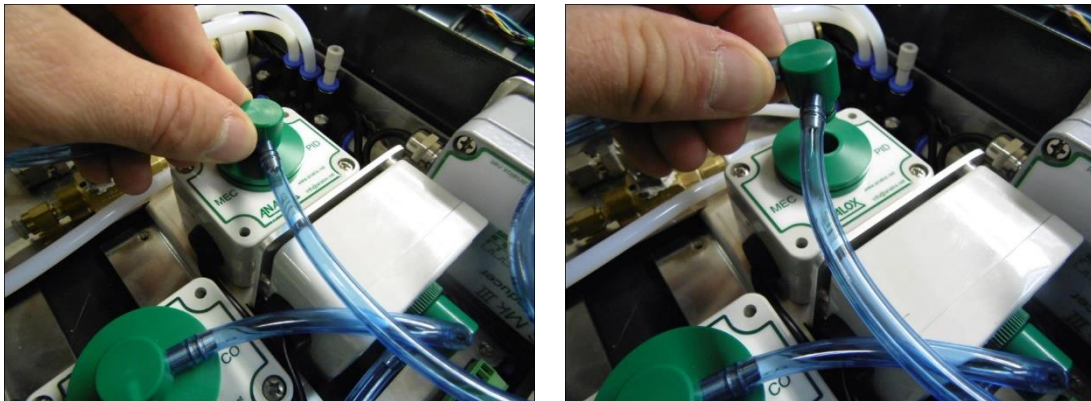
- 10] Fit the cell in to the housing and rotate anti-clockwise to lock in place.
11] Refit the cell holder into the sensor bulkhead.
12] Refit the flow adaptor into the sensor inlet.

4.1.4 VOC maintenance

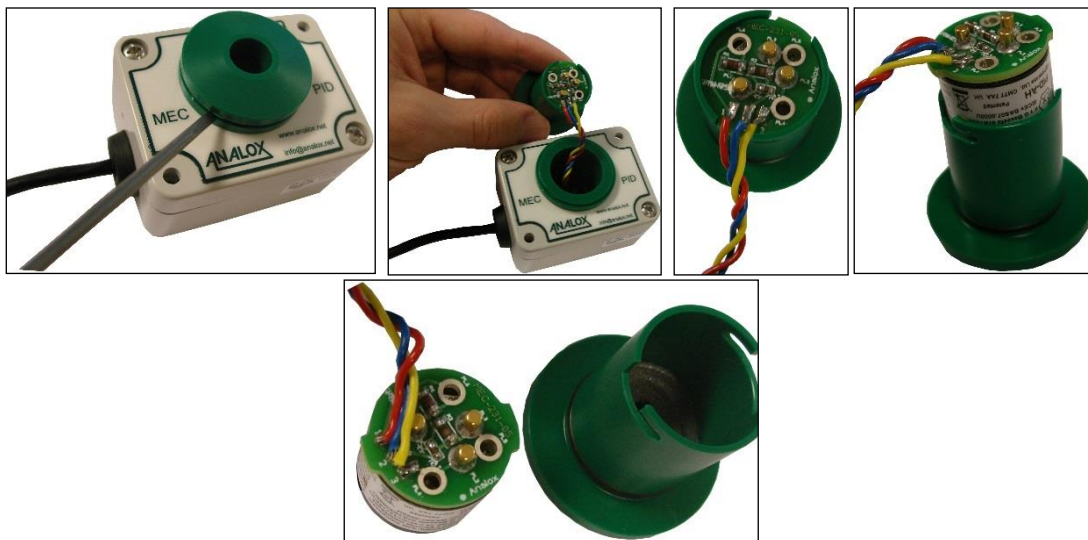
Maintenance of the VOC sensor can be done by the following methods, clean or replace the lamp, or replace the electrode stack. Cleaning the lamp should be performed as required if the sensitivity of the sensor reduces over time. Replacement of the PID lamp should be performed after 5000 hours of use. Replacement of the electrode stack should be performed only if the sensor has been damaged by contamination.

The lamp and electrode stack are both part of the PID component of the sensor. The cleaning and replacement processes are documented below.

1] Remove the flow adaptor from the sensor inlet.



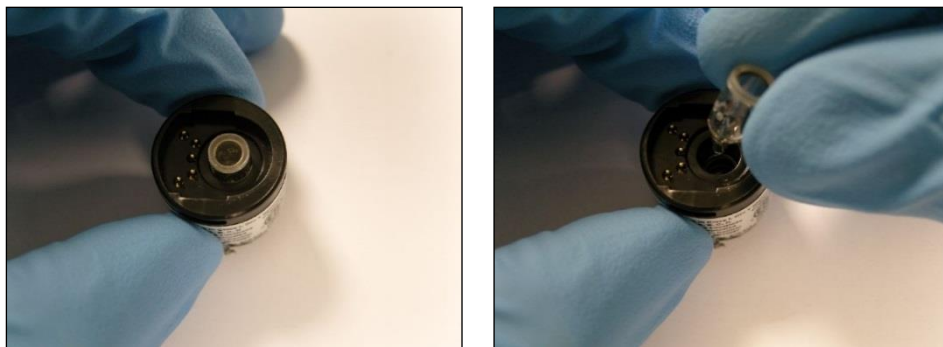
2] Remove the sensor housing from the MEC and then remove the sensor from the housing by twisting the PCB on the rear of the sensor, remove the PCB from the sensor



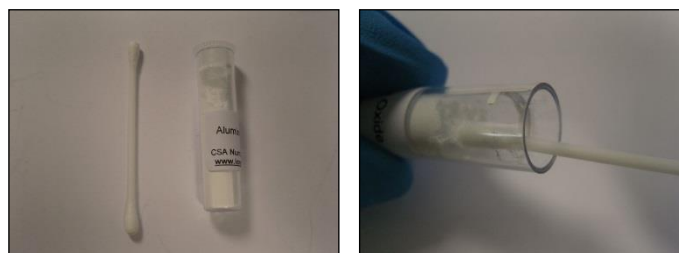
- 3] Using the stack removal tool (9300-1021) insert the ends of the tool into the slots on the sides of the sensor as shown, keeping a finger on top of the stack so as it does not spring away from the sensor and so that the spring and lamp cannot pop out upon removal.



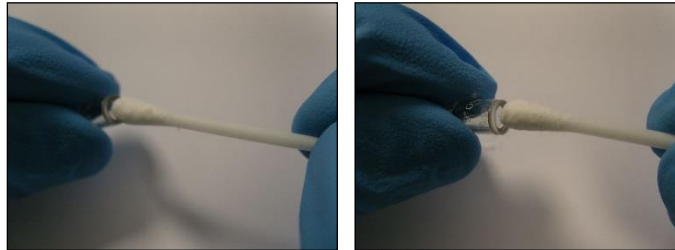
- 4] Carefully remove the lamp from the sensor, making sure that the window of the lamp is not touched.



- 5] Using the lamp cleaning kit (9300-1022) and suitable protective clothing, open the container of cleaning compound, with a clean cotton bud, apply a small amount to one end.



- 6] Using a circular action, clean the lamp by applying light pressure to the lamp window (do not touch the lamp window with fingers), continue polishing until a light squeaking can be heard.



- 7] Remove any residual cleaning compound from the lamp using the clean end of the cotton bud.
- 8] Ensure that the lamp is completely free from any signs of contamination prior to refitting.
- 9] Carefully place the lamp into the rear recess of the electrode stack, this will be held by the O-ring seal in the electrode pellet.



- 10] Take the electrode stack and the mated lamp and insert back into the sensor housing, push home until the electrode stack snaps into place, the top of the electrode stack should be flush with the top of the sensor housing.

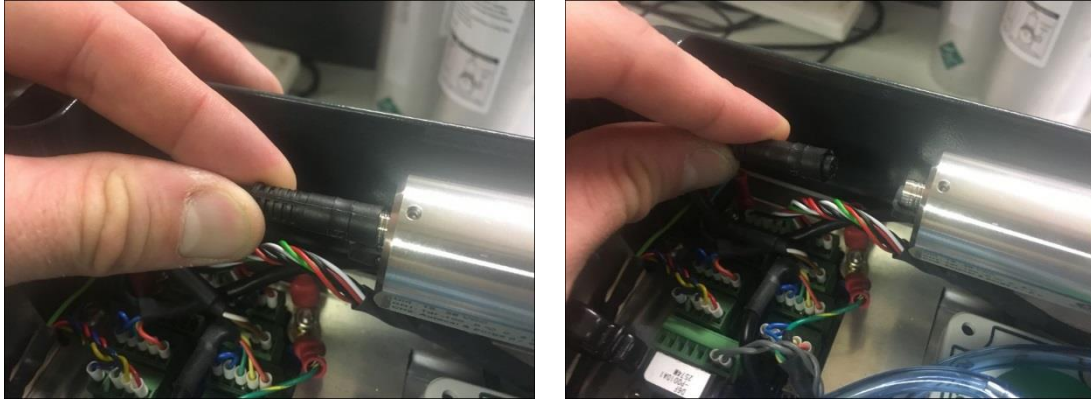
**NOTE:**

FOLLOWING A VOC PID LAMP REPLACEMENT OR CLEANING, OR REPLACING THE ELECTRODE STACK A FULL CALIBRATION MUST BE PERFORMED. SEE P0149-801 ACG+ USER MANUAL FOR DETAILS.

4.1.5 Water vapour sensor replacement

The part number for the replacement water vapour sensor is: **6000-0094**

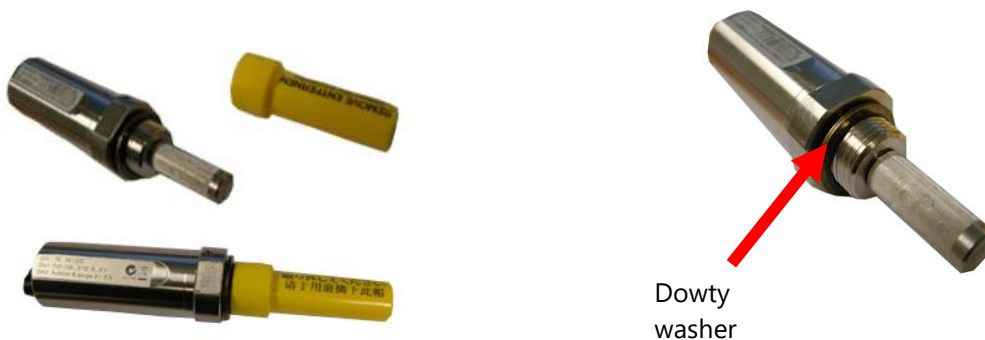
- 1] **Disconnect the cable from the end of the water vapour sensor.**



- 2] **Using a 30mm spanner (part number 9300-1020), loosen the sensor from its housing and unscrew the sensor fully from its mount. Take care when performing this step as the sensor head is delicate.**



- 3] **Unscrew the protective cap from the new sensor and place it over the sensing head of the removed sensor.**



- 4] Ensure that the dowty washer is fitted to the new sensor as shown and insert the new sensor into the sensor housing, taking care not to damage the sensor head. Screw the sensor into its mount and fully tighten using a 30mm spanner
- 5] Re-connect the cable to the new sensor, into the port labelled 'II', checking for correct orientation. Push the connector in full to ensure it is secure.

4.2 Filter replacement

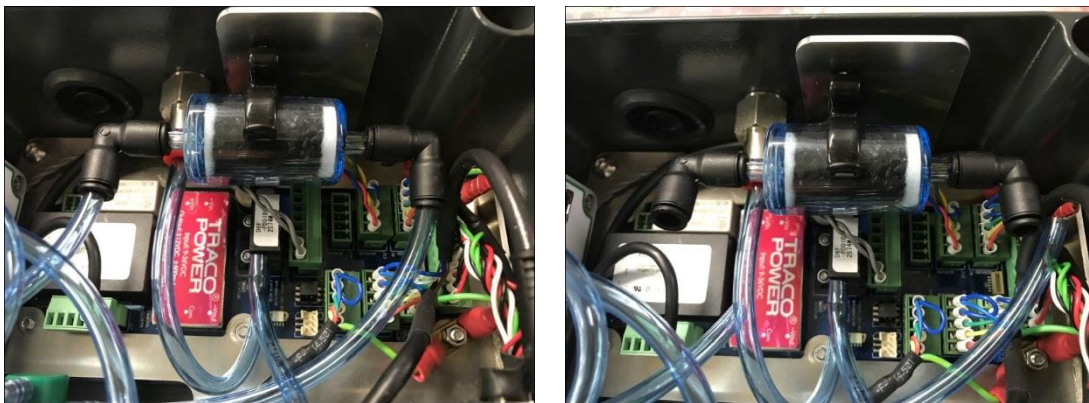
The ACG+ has two types of user changeable filters. These are the internal activated charcoal filter and an internal hydrophobic particulate filter.

4.2.1 Activated charcoal filter replacement

The activated charcoal filter is fitted to absorb any VOCs present in the gas sample before the carbon monoxide content in the gas is measured by the carbon monoxide sensor. The carbon monoxide sensor is cross-sensitive to VOCs so this must be filtered out before gas sample is passed over the carbon monoxide sensor to ensure accurate measurement is made.

The procedure for changing the activated charcoal filter is as follows.

- 1] **Disconnect both 6mm elbow push fittings from filter.**



- 2] **Remove filter from clip and remove the elbows from the filter.**



- 3] **Reverse the above process to fit a new filter.**

4.2.2 Particulate filter replacement

The particulate filter is used to remove larger particles of VOC's as they can after time block the inlet to the PID sensor, thus making the sensor read erratically or not read at all.

The procedure for changing the particulate filter is as follows:

- 1] **Unscrew the filter from both of the male and female luers attached to the 6mm pipework from the inlet manifold.**



- 2] **Reverse the above process to fit a new filter.**

4.3 Service requirements

Certain elements of the ACG+ system are recommended to be replaced every six years to ensure optimum operation. **Table 8** below shows the maintenance that is required and the scheduled interval for performing the maintenance.

Table 8 Service schedule of ACG+ components

System component	Maintenance required	Maintenance interval
VOC sensor	Replace PID cell	5 years
Display module (See note)	Replace display	6 years
Carbon dioxide sensor (See note)	Replace sensor	6 years



NOTE: ACG+ TO BE RETURNED TO ANALOX FOR REPLACEMENT OR SERVICE

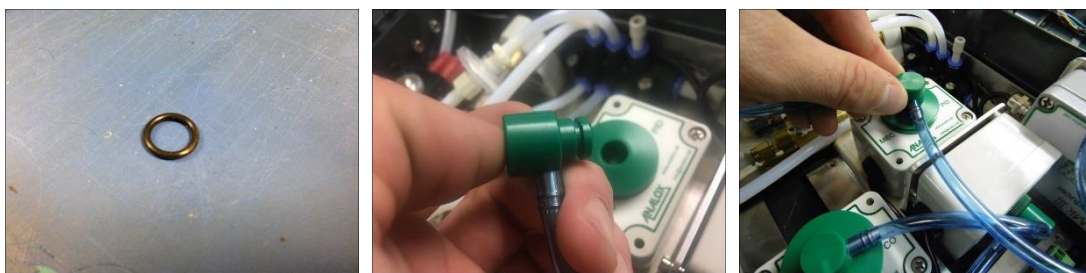
Before attempting to replace any sensors ensure that the ACG+ is switched off and the gas supply has been isolated. Using a Pozi-drive screwdriver loosen the 4 enclosure lid screws and open the lid.

4.3.1 Replacing the flow adaptor orings

- 1] Remove the flow adaptor for the sensor and remove the old oring.



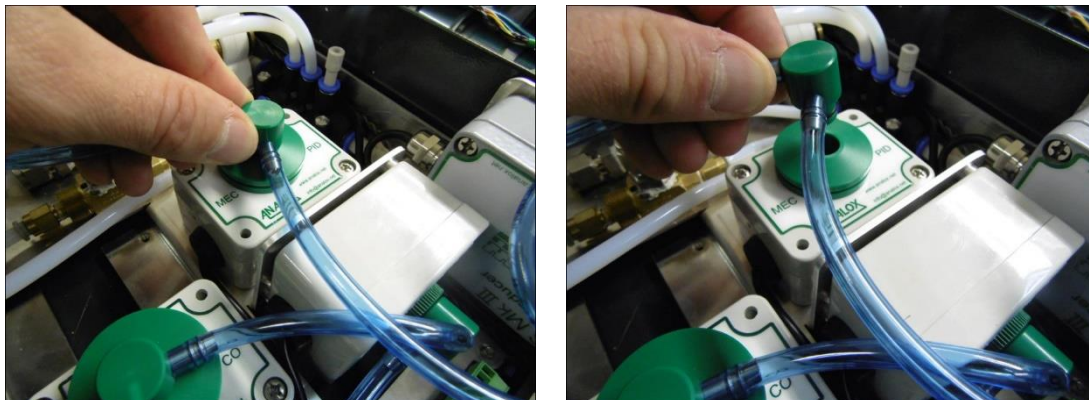
- 2] Take a new 11.1mmOD x 8.1mmID oring (2323-0017X) and refit to the flow adaptor, replace the flow adaptor to the sensor.



4.3.2 Replacing the PID cell

The following process describes how to replace the entire PID component if it is damaged or badly contaminated. The replacement part number for your sensor's PID is: **9100-2060S**.

- 1] To replace the PID component, remove the flow adaptor from the sensor inlet.



2] Use a flat blade screwdriver to pop out the PID holder from the sensor bulkhead fitting.



3] Rotate the PID PCB connector clockwise to release from the PID holder.



4] Disconnect the PID from the PCB connector.



- 5] Connect the new PID to the PCB connector. Note that it will only connect in one orientation.



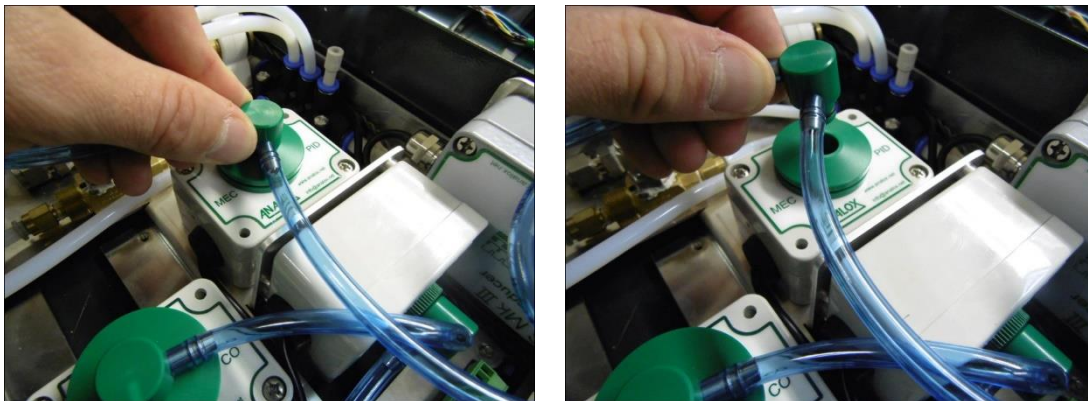
- 6] Fit the PID into the housing and rotate anti-clockwise to lock in place.
- 7] Refit the PID holder into the sensor bulkhead.
- 8] Refit the flow adaptor into the sensor inlet.



NOTE: FOLLOWING A VOC PID LAMP REPLACEMENT OR CLEANING, OR, REPLACING THE CELL A FULL CALIBRATION MUST BE PERFORMED. SEE P0149-801 ACG+ USER MANUAL FOR FULL DETAILS.

4.3.3 Replacing the PID cell PCB (MEC-233C)

- 1] Remove the flow adaptor from the sensor inlet.



2] Use a terminal screwdriver to pop out the PID holder from the sensor bulkhead fitting.



3] Rotate the PID PCB connector clockwise to release from the PID holder.



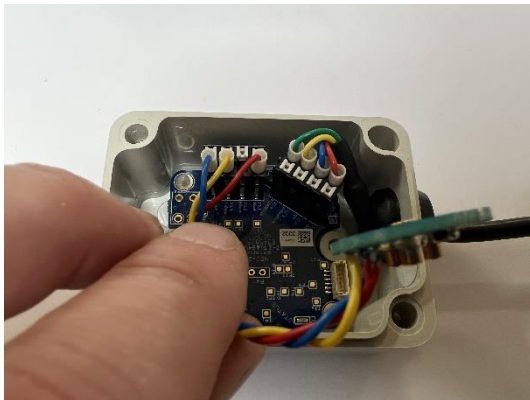
4] Disconnect the PID from the PCB connector.



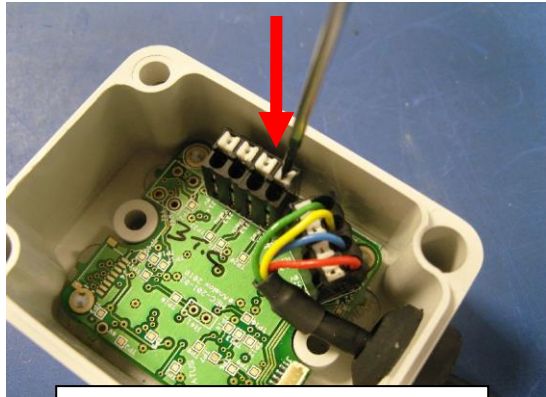
- 5] Remove the lid from the MEC sensor housing and feed the cell PCB through the bulkhead.



- 6] Disconnect the damaged cell PCB wiring loom from the MEC PCB connector.



- 7] Connect the sensor wires of the new cell PCB to the corresponding red, blue and yellow terminals of connector J3.



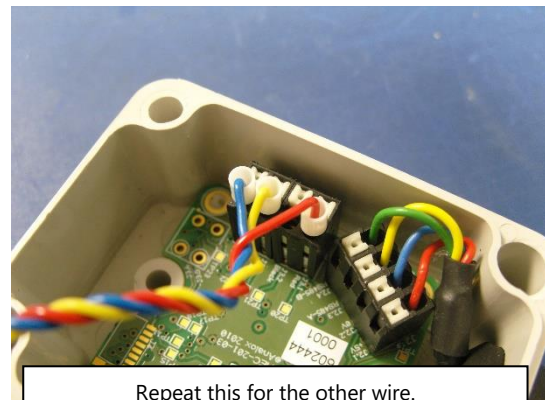
Using a terminal screwdriver press firmly down on the terminal clamp button to open the clamp.



While still pressing down on the terminal clamp button insert the bootlaced wire into the terminal clamp as shown.



Release the terminal clamp button. The clamp should now have a firm grip on the wire. Gently pull on the wire to confirm that the wire is firmly held. If not repeat the steps shown until the wire is held firmly.



Repeat this for the other wire.

- 8] Feed the PCB back through the bulkhead and refit the lid.



- 9] Connect the PID to the PCB connector PCB. Note that it will only connect in one orientation.



- 10] Fit the PID into the housing and rotate anti-clockwise to lock in place.
11] Refit the PID holder into the sensor bulkhead.
12] Refit the flow adaptor into the sensor inlet.

5 FAQ's (most common solutions)

5.1 Recommended calibration gas concentrations

Sensor	Recommended low calibration concentration	Recommended high calibration concentration
O ₂	0 to 10% O ₂	20 to 25% O ₂
CO ₂ (0 to 1000ppm range)	0ppm CO ₂	800 to 1000ppm CO ₂
CO ₂ (0 to 10000ppm range)	0ppm CO ₂	8000 to 10000ppm CO ₂
VOC	0ppm VOC	15 to 20ppm isobutylene (C ₄ H ₈)
CO	0ppm CO*	15 to 20ppm CO*
H ₂ O	Not for user calibration	Not for user calibration

*When performing a calibration of carbon monoxide (CO), due to the nature of the CO cell chemistry, a balance of air (20.9% oxygen) should be present in the calibration gas mix in order to ensure maximum sensor accuracy.

5.2 Maintenance schedule of ACG+ components

System component	Maintenance required	Maintenance interval
Oxygen sensor	Replace electrochemical cell	Approx. 2 years or as required.
Carbon monoxide sensor	Replace electrochemical cell	Approx. 2 years or as required.
VOC sensor	Clean PID lamp and electrode stack	As required, recommended every 3 months.
	Replace PID lamp or whole PID cell	Lamp - 5,000 hours (~6 months) Cell – 5 years or as required.
Carbon dioxide sensor	Replace sensor	6 years
Water vapour sensor	Replace water vapour sensor	2 years
Activated charcoal filter	Replace filter	1 year
PID particulate filter	Replace filter	6 months or as required (Depending on how dirty sample is)
Sensor flow adaptor orings	Replace oring	Check yearly and replace if required

5.3 CO₂ sensor range fault

For a CO₂ sensor to be out of range it could be down to three things.

- Calibration- the sensor may need to complete a calibration. Refer to P0149-801 ACG+ User Manual.
- You may need to adjust the alarm set point. See section 5.11.2 of P0149-801 ACG+ User Manual.
- Warm up- the sensor may just be in a warm-up period after it has been turned on. This means that the readings displayed are not valid. For this, wait for up to 60 seconds for it to level out.

5.4 VOC Sensor cannot calibrate

When calibrating you need the right gases for both high and low calibration points of the ACG+ (see 5.1)

- 1] **Fit the 0.5 LPM gas flow regulator accessory or suitable regulator to the calibration gas bottle.**
- 2] **Connect the outlet of the regulator to the inlet/calibration gas connector accessory and then connect the inlet/calibration gas connector to the calibration inlet on the ACG+. Push the fitting on fully until it latches in place.**
- 3] **Open the valve on the flow regulator attached to the bottle and then open the inlet valve on the front panel. The ACG+ should register that there is flow to the sensors.**
- 4] **Allow 10 minutes for the sensors to settle to stable readings on the calibration gas.**
- 5] **To perform an adjustment, from the main menu select 'Calibration' then select the bottle that is currently attached. The calibration adjustment screen will be shown.**
- 6] **To begin a calibration adjustment, press the 'Begin calibration' context button.**
- 7] **Allow the sensors 1 minute to stabilise after calibration and check that the readings shown are reasonable for the calibration gas applied.**
- 8] **To finish, close the valve on the bottle flow regulator and close the inlet valve on the front panel then disconnect the calibration connector from the ACG+ by pressing the release catch and gently removing.**
- 9] **Repeat for a high calibration as necessary. (Note that both low and high calibration adjustment should be performed in order to reset calibration due notifications).**

To exclude any of the sensors from calibration:

- To exclude sensors, press 'OK' whilst the calibration screen is shown to allow sensor selection. Use the up and down buttons to select a sensor to Exclude.
- To exclude the highlighted sensor, press the 'Enable/Disable' context button. The excluded sensor will be unchecked and greyed out.
- To re-enable the sensor for adjustment, press the 'Enable/Disable' context button again. This can be repeated for multiple sensors.
- To exit editing mode so that the adjustment can be performed, press the 'Exit Edit' context button.

5.5 COMMS

There are 2 comms fault states. A comms fault state (where the sensor is at fault) and an inlet comms fault state (where it is an inlet fault). These are both classed as system faults. There are 2 resolutions to system faults depending on its source.

If it's the sensor then you must contact support. If it's the inlet Check that all connections between the display module and the chassis board are secure. Restart the ACG+ device to see if the fault clears. If not, contact support or send it back for repairs.

5.6 COSHH Regulations

The ACG+ can be used to test the quality of breathing air to overall protect personnel from hazardous substances covered by COSHH regulations. The ACG+ measures O₂, CO₂, CO, VOC's, and H₂O. This is approved in ACOP9 and BS EN 12021.

However, where the risk assessment for a process highlights a gas that is not measured by the ACG. I.e., a hazardous substance used, produces a harmful gas in quantities greater than safe exposure limits, such that it is a danger.

Depending upon the gas in question it may be possible to test for the gas using the ACG's sample support function with a colorimetric tube specific to the gas. This is a feature that adds flexibility to the user to use a variety of tubes for any gas type. If this is not possible then the ACG would not be suitable as the only test method employed under the COSHH regulations.

5.7 Heliox/Trimix mixes

The ACG+ cannot be used to measure Heliox and Trimix mixes as the use of helium will produce inaccurate reading in the sensors. This inaccuracy is caused by the effect helium has on the internal flow rates of the gases to the sensors and a direct effect on the sensitivity of some sensors. We have plans to develop a version of the ACG for this purpose, please contact Analox for information.

5.8 Nitrox gas mixes

The ACG+ can be used to measure Nitrox mixes as the sensor ranges allow measurements of up to 50% Nitrox in O₂. However, it should be noted that the accuracy of the sensors is not sufficient enough to comply with standards for Nitrox gas mixes. The new ACG plans should be able to fix this issue.