



CMM User Instruction Manual



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GENERAL INFORMATION

These units are for monitoring the Carbon Monoxide and Moisture levels in high pressure breathing air systems for use in Self Contained Breathing Apparatus (SCBA) or Self Contained Underwater Breathing Apparatus (SCUBA) and are not suitable for use with any other gasses. They are designed and manufactured to give optimum performance with long life and reliability.

This manual gives the end user all the information required to install and operate this unit and carry out regularly scheduled maintenance to ensure the maximum satisfactory service life.

Servicing facilities and the supply of genuine MAKO replacement parts are provided through a worldwide network of MAKO Distributors. If replacement parts are needed, the user should first contact the local MAKO Distributor. If there is any difficulty contacting a local distributor the end user may contact the MAKO factory representative.

The information given in this manual was correct at the time of it's creation. However, as part of continuous development, modifications to parts and procedures may be made without notice that could affect the maintenance requirements of this unit. Before any maintenance work is undertaken the user is advised to contact the local MAKO Distributor who is supplied with revised and up-dated information.

In any communication concerning these units it is essential to quote the MODEL, SERIAL NUMBER and the YEAR of MANUFACTURE. This information is located on the units' nameplate. (see Fig. 1.3-1)

Throughout this manual all pressures quoted are gauge pressures unless otherwise stated.

Manual Configuration

This manual is broken down by numbered chapters, sections and subsections shown in bold text and separated by periods.

(Chapter #).(Section #).(subsection #).(subsection #)

4.3.2.1 would represent subsection 1 of subsection 2 of section 3 of chapter 4

There can be as many subsections as are needed.

Within this structure could be **headings** in bold which are not numbered.

The pages are designated by chapter and page separated by a dash.

(Chapter #)-(Page number within that chapter)

4-3 would indicate the third page of chapter four.

All illustrations are designated by chapter, section and subsection to which they are associated followed by the number of the illustration separated by a dash

fig.(chapter and section designation)-(number of the illustration within the section indicated)

fig. 4.3.2.1-3 would indicate the third illustration within section **4.3.2.1**

Maintenance

To ensure the continued trouble-free operation of this unit it is important that periodic maintenance and servicing is carried out in accordance with the information given in the 'Maintenance' section of this manual. To assist in this matter your local MAKO Distributor can provide a number of optional maintenance agreements to suit your requirements. These agreements provide the end user with the expertise of our factory trained technicians and the guarantee that only Genuine MAKO parts will be used.

Warranty

The conditions of the MAKO Warranty are set out in the Company's standard Conditions of Sale available from the MAKO Distributor supplying the unit.

USE ONLY GENUINE MAKO PARTS. YOUR WARRANTY COULD BE AFFECTED IF ANY SERVICE OR REPAIR IS CARRIED OUT USING ANYTHING BUT GENUINE MAKO PARTS.



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Mako is part of the
 **CompAir**® Group

DECLARATION OF CONFORMITY

Applicant:

CompAir USA Inc.
1634 SW 17th Street
Ocala, FL 34471 USA



Factory:

CompAir USA Inc.
1634 SW 17th Street
Ocala, FL 34471 USA

Machinery Description:

Compressors & High Pressure Air Equipment

Model/Type Number:

MK X AM
MK X CI
MK X H2
MK X T1
MK X VS

MK Series as listed:

MK X AC	MK X SC
MK X H1	MK X SJ
MK X H3	MK X MJ
MK X T2	MK X HS
MK X MC	

I hereby declare that the machinery complies with the Essential Health and Safety Requirements of the Machinery Directive (98/37/EC) as amended, with the provisions of the Electromagnetic Compatibility Directive (89/336/EEC) as amended and Personal Protective Equipment Directive (89/686/EEC) as amended. This machine is exempt from PED (97/23/EC), reference article 1 clause 3.3 and 3.6.

EMC Standards:

Emissions: EN61000-6-4:2001
immunity: EN61000-6-2:2001

Respiratory Protection Devices Standard:

DIN EN 12021

Machinery Standards:

EN ISO 12100-1,-2
EN 60204-1
EN 1050
EN 1012-1

Engineering Manager - John Downing

6.03.08

Date

Ocala, FL

Location

1. Forward

1.1 Notes On The Unit

MAKO units are the result of many years of research and development. This experience combined with high quality standards guarantee the manufacture of breathing air charging systems which will provide a long service life, high reliability and cost-effective operation.

Declaration Of Conformity

This unit and its accessories as supplied by MAKO conform to the basic health and safety requirements included in the Machinery Directive 98/37/EC and the EMC Directive 89/336/EEC and the Personal Protective equipment Directive 89/686/EEC. The compliance with these directives is signified by the "CE mark" (See fig. 1.1-1)



fig. 1.1-1 CE

1.2 Intended Use

This unit has been constructed in accordance with state-of-the-art technology and recognized safety regulations. Nevertheless, its use may constitute a risk to life and limb of the user or third persons or cause damage to the machine or to other material property, if

- it is not used as intended,
- it is operated by unqualified personnel
- it is improperly modified or changed
- the safety regulations are not observed

Therefore, any person entrusted with the operation, maintenance or repair of this unit must read and follow all safety regulations in this manual. If required, this has to be acknowledged by signature.

in addition,

- relevant accident prevention regulations
- generally recognized safety regulations
- national safety regulations have to be observed.

This system must be operated under technically perfect conditions and in accordance with its intended use and the instructions set out in the operating manual. This system must be operated only by safety-conscious personnel who are fully aware of the dangers involved in the operation of this system. If any functional problem is detected or suspected stop the operation of this system. Report the problem to the appropriate maintenance or service personnel. The problem must be resolved before the system is returned to operation.

Operating the unit within the limits of its intended use also involves observing the instructions set out in the operating manual and complying with the inspection and maintenance directives.

1.3 Maintenance

Carefully performed maintenance is imperative, this ensures that your unit can meet all the requirements for which it was intended. It is therefore imperative to adhere to the specified maintenance intervals and to carry out the maintenance work with deliberate care, especially when the unit is utilized under harsh operating conditions.

Servicing

Please contact your authorized MAKO distributor in the case of malfunctions or when spare parts are required. Our fully trained personnel will ensure that all repairs are carried out properly. Using only genuine MAKO spare parts. Genuine MAKO spare parts are manufactured utilizing state-of-the-art technology, thus guaranteeing the continued reliable performance of the unit.

1. Forward

 www.compaimako.com MakoCompressors, L.L.C. 1634SW17th ST. Ocala, FL 34471 Ph. (352) 732-2268 Fx. (352) 732-7873  www.compair.com 	Model Number, Numéro du modèle, Modellnummer, Numero Modello, N° modelo					
	Date of Manufacture, Datede fabrication, Produktionsdatum, Datadifabbricazione, Fecha de fabricación		Work order, Bondetravail, Arbeitsauftrag, Pedido, Ordinedi lavoro			
	Serial Number, Numero de serie, Seriennummer, Numero di matricola, N° serie		V	~	Hz	A
	Inlet Pressure, Pression d'admission, Eingang Druck, Pressione dell'ingresso, Presion de la entrada	PSI BAR bar Bar	Fill Pressure, Remplir pression, Drückfüllen, Riempire la pressione, Llenar la presión			
			1. PSI BAR bar Bar	2. PSI BAR bar Bar	3. PSI BAR bar Bar	PSI BAR bar Bar
Safety valve, Soupape de sûreté, Sicherheitsventil, Valvola di sicurezza, Valvula de seguridad	1. PSI BAR bar Bar	2. PSI BAR bar Bar	3. PSI BAR bar Bar			
Flow Restriction Rating, Estimation de restriction d'écoulement, Fluss-Beschränkung Bewertung, Valutazione di limitazione di flusso, Grado de la restricción de flujo					Bar/Min, Barre/minute Stab/Minute, Barra/minuto	
Diagram number, Nombre del diagramme, Diagramm-Zahl, Número del esquema, Número del diagrama						

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fig. 1.3-1 MAKO Nameplates

In Case Of Queries

Please enter the data on the nameplate of your unit into the nameplate shown in (fig. 1.3-1). In the case of queries or spare parts orders, please refer to the units series & type as indicated on the nameplate, the identification no. and the year of construction.

1.4 Notes

General

These operating instructions are intended to familiarize the user with the unit and its intended use. The instructions contain important notes on how to operate the unit safely and cost-effectively.

Observing these instructions will help to avoid risks, reduce repair costs, down times and to increase the reliability and service life of the unit.

The operating instructions in this manual are in addition to any applicable local, regional or national, laws, rules and regulations regarding the prevention of accidents and environmental protection. They must always be available at the location of the unit. The operating instructions must be read and followed by any person carrying out work in connection with the unit, i.e. operation, setting up, disposal of any waste and consumables, maintenance, inspection, repair, and transport.

1. Forward

Guarantee

Operate this unit only if you have an exact knowledge of the machine taking into respect these facts.

MAKO cannot be held responsible for the safe operation of the unit if it is used in a manner that does not correspond to the intended use, or for other applications which are not mentioned in this manual.

Warranty claims will not be accepted in the case of

- Operating errors
- Incorrect maintenance
- Wrong auxiliary materials
- Use of spare parts other than genuine MAKO spare parts
- Modifications and changes to the installation

The warranty and liability conditions of the general terms and conditions of MAKO will not be extended by the notes above.

Any unauthorized change to this unit, or the installation of components not accepted by the manufacturer (i.e. fine separator) will result in the withdrawal of the CE mark. As a consequence, any liability and warranty claims will not be accepted by the manufacturer.

Safety Regulations

Danger!

The safety regulations in chapter 3 of the operating instructions must be strictly observed.

Technical Changes

In the course of technical development we reserve the right to modify the units without further notice.

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3. Safety regulations

3.1 Identification Of Safety Guidelines

MAKO is not liable for any damage or injury resulting from the non-observance of these safety instructions or negligence of the usual care and attention required during installation, handling, operation, maintenance or repair, even if this is not explicitly mentioned in these operating instructions.

If any of the regulations contained in these instructions - especially with regard to safety - does not correspond to the local legal provisions, the stricter of both shall prevail.

Danger!

Passages marked with this designation indicate a possible danger to personnel.

Important!

Passages marked with this designation indicate possible damage to unit.

Note.

Passages marked with this designation provide technical or procedural information for the optimal cost-effective use of the unit.

3.2 General Safety Instructions

Organizational Measures

The operating instructions must always be at hand at the place of operation of the unit!

In addition to the operating instructions, all other generally applicable legal and other mandatory regulations relevant to accident prevention and environmental protection must be adhered to and passed on to others! These compulsory regulations may also deal with the handling of hazardous materials or the issuing/wearing of personal protective equipment, or traffic regulations.

Instructions, including supervisory responsibility and duty of notification for taking into account in-plant factors, for example regarding work organization, sequences of operations, personnel assigned to certain tasks, are to be kept with the operating manual.

The personnel entrusted with the operation and/or maintenance of the unit must have read the operating instructions and in particular the chapter on safety regulations before starting work. Reading the instructions after work has begun is too late. This applies especially to persons working only occasionally on the machine, e.g. for setting up or maintenance.

supervisors should check on a regular basis that the personnel are carrying out the work in compliance with the operating instructions and that they are paying attention to the safety requirements!

Observe all safety and warning notices attached to the unit!

See to it that safety instructions and warnings attached to the machine are always complete and perfectly legible.

In the case of safety-relevant changes to the unit or its operating behavior, stop the unit immediately and report the fault to the responsible department or person!

Spare parts have to comply with the technical requirements specified by the manufacturer. This can always be ensured by using only genuine MAKO spare parts.

High pressure hoses have to be changed within stipulated and periodic intervals, even if no safety-relevant faults have been detected.

Adhere to prescribed intervals or those specified in the operating instructions for routine checks and inspections!

3. Safety regulations

For the execution of maintenance work, tools and workshop equipment adapted to the task at hand are absolutely necessary.

The personnel must be made familiar with the location and operation of fire extinguishers! Observe all fire-warning and fire-fighting procedures!

Selection And Qualification Of Personnel; Basic Responsibilities

Work on or with the unit must be carried out by reliable personnel only. Statutory minimum age limits must be observed!

Employ only trained or instructed personnel and clearly set out the individual limits and responsibilities of the personnel for operation, set-up, maintenance and repair!

Ensure that only authorized personnel work on or with the unit!

Define the machine operator's responsibilities giving the operator the authority to refuse instructions by third persons that are contrary to safety regulations.

Do not allow persons to be trained or instructed or persons taking part in a general training course to work on or with the unit without being continuously supervised by an experienced person!

Work on the electrical equipment of the unit must be carried out only by a skilled electrician in accordance with electrical engineering rules and regulations.

Work on system elements such as high pressure hoses may only be carried out by personnel with special knowledge and experience.

3.3 Changes And Modifications To The Unit

Do not make any changes, modifications or attachments to the unit, which could affect safety, without the supplier's prior permission!

Unauthorized changes to the machine are not permitted for safety reasons.

Genuine MAKO parts were especially designed and selected for this unit. The installation and/or use of any parts other than genuine MAKO parts can therefore affect the active and/or passive safety and reliability of this unit.

The manufacturer is not liable for damage resulting from the use of non-genuine MAKO parts or special accessories. This applies also to the installation and setting of safety equipment and valves as well as to welding on structural or pressurized parts.

3.4 Installation And Normal Operation

In addition to the general technical operation in accordance with the stipulations of the local authorities, we would like to refer in particular to the following regulations.

The system has to be installed in such a way that it is adequately accessible.

The pressure line connected to the air outlet of the system must be fitted stress-free.

The installed unit-specific safety valves only assume the pressure safeguarding function of this unit provided in currently valid standards and regulations.

Electrical connections must meet the local regulations. Power units must be connected to earth and protected from short-circuits by means of fuses.

Normal Operation

The maximum system pressure of the unit can be located on the nameplate of the unit.

Take the necessary precautions to ensure that the unit is used only when in a safe and reliable state!

Operate the machine only when all protective equipment are in place and fully functional!

3. Safety regulations

Check regularly that

- all means of protection are correctly installed and secured.
- all hoses and/or pipes within the system are in good condition, firmly fixed and do not chafe.
- there are no air leaks.
- all fittings are firmly tightened.
- all wires are connected correctly and are in good condition.
- all safety valves and other pressure relief mechanisms are in good order and not blocked by e.g. dirt or paint.
- the safety mechanisms are fully functional.

If compressed air hoses are used they must be of the proper size and suitable for the relevant operating pressure. Do not use chafed or damaged hoses.

Only use hose couplings and fittings of the right type and the correct size.

Before blowing through a hose or an air pipe ensure that the open end is positively held. A free end whips and can cause injuries.

Before loosening or disconnecting any connection ensure that it is not under pressure.

Refrain from any working method which is doubtful in terms of safety.

Never play around with compressed air from this unit!

Never aim compressed air from this unit at yourself or at any other person!

Never use compressed air from this unit to clean your clothing.

Never use compressed air from this unit to clean equipment.

Never operate the system at pressures and temperatures below or above the values indicated in the technical data sheet.

All access panels, etc. have to be closed at all times during the operation of this unit.

Check the unit at the beginning of each startup and at least once every 8 hours of operation for visible damage or problems. Report any problems or changes in the machine's operating behavior to the responsible department or person immediately. In the case of any problem which might effect the safe operation of this unit, stop the unit immediately! Have any problem resolved before restarting the unit!

Follow the start-up and shut-down procedures according to the operating instructions.(see section 6)

3.5 Special Work/Maintenance

DANGER!

During installation, inspections, cleaning and Before carrying out any maintenance work be sure that all pressure is released from the system and the machine is electrically isolated. Never attempt to straighten badly bent tubing or re-use damaged fittings.

On retrofit units that are hardwired into the air system, a lock-out procedure must be followed during installation, inspections, maintenance, or repairs.

Lock Out Procedure

- 1) Announce the lock-out to other personnel.
- 2) Turn off site power box to the unit.
- 3) Lock site power box to the unit in the off position and place warning tag on box.
- 4) Put key in your pocket.
- 5) Make sure unit is clear of all personnel.
- 6) Test lock-out by trying to start the unit.
- 7) Complete required operations.
- 8) Announce that the lock-out condition is being ended and clear the unit of all personnel.
- 9) Take key out of your pocket.
- 10) Unlock the power box and remove warning tag from box.
- 11) Turn the power box on.
- 12) Announce that the unit has power to other personnel.

3. Safety regulations

Follow the adjusting, maintenance and inspection activities and schedule set out in the operating instructions. These activities must only be carried out by skilled personnel, under qualified supervision.

Maintenance and repair work may only be carried out under the supervision of a person who is qualified to do the work.

Inspection, maintenance and repair work may only be carried out with the unit being at rest and depressurized. Protective equipment to be removed for this work has to be properly refitted after completion of these activities.

Always use the correct tools for maintenance and repair work.

Never use inflammable solvents or carbon tetrachloride to clean parts. Take precautions against poisonous vapors from cleaning agents.

In any work concerning the operation or adjustment of the unit and its safety-oriented devices or any work related to maintenance, inspection and repair, always observe the start-up and shutdown procedures set out in the operating instructions.

Ensure that the maintenance area is adequately secured.

During maintenance and when carrying out repair work, cleanliness is very important. Avoid the ingress of dirt by covering parts and free openings with a clean cloth, paper or adhesive tape.

After the completion of each repair, check that all lines and components are clear of any foreign material before assembly.

Care must be taken any time this unit is in operation!

Maintenance And Repair

The employer has to inform the employee of the dangers possibly arising during the repair and maintenance of this unit as well as on how to avoid them; the employee has to observe all measures for safety at work. Safety equipment for the prevention or

elimination of danger has to be maintained regularly and functionally checked at least once a year. Faults observed have to be immediately rectified and/or reported to the responsible person.

Use only genuine MAKO spare parts.

Before removing or opening pressurized components, positively isolate any source of pressure and depressurize the entire system.

Never weld any pressure reservoir or change it in any way.

If work which produces heat, flames or sparks has to be carried out on or near this unit, the adjacent components of this unit have to be protected by means of non inflammable material.

Before releasing this unit for operation after maintenance or overhaul check that the unit is functioning properly and the regulating, shut-down equipment and safety interlocks are working properly.

Electrical components and regulating equipment have to be protected from the ingress of humidity at all times.

Never use etching solvents which could attack the materials used.

Avoid damage to the safety valves and other pressure reducing components. Check in particular for clogging caused by paint, oil carbon or the accumulation of dust, which could deteriorate the effectiveness of these components.

Check the accuracy of pressure and temperature indicators at regular intervals. If the admissible tolerance limits have been exceeded, these devices must be replaced.

Before cleaning the machine with water or steam jet (high pressure cleaner) or other cleaning agents, initiate an electrical lock-out procedure(see section 3.5), cover all openings which have to be protected from the ingress of water, steam or detergents for safety and/or functional reasons, in particular electrical cabinets, components and connections.

3. Safety regulations

After cleaning, remove all covers and masking completely and allow the unit to dry before returning unit to service!

Always re-tighten all threaded connections which have been loosened for maintenance and repair work.

If the set-up, maintenance or repairs require the removal of safety equipment, this equipment has to be replaced and checked immediately.

Ensure that consumables and replacement parts are disposed of in a safe and environmentally friendly manner in accordance with all applicable local, regional and national laws, rules and regulations.

3.6 Warning Of Special Dangers

Electric energy

Use only genuine MAKO fuses with the specified current rating. Switch off the machine/unit immediately if trouble occurs.

Work on the electrical system or equipment must only be carried out by a skilled electrician or by specially instructed personnel under the control and supervision of such an electrician and in line with the relevant electrical engineering rules.

The electrical equipment of this unit is to be inspected and checked at regular intervals. Defects such as loose connections or scorched cables must be rectified immediately. Necessary work on live parts and elements must be carried out in the presence of a second person who can cut off the power supply in case of danger by operating the emergency shutdown or main power switch. Secure the working area. Use insulated tools only.

Gas, Dust, Steam, And Smoke

Carry out welding, flame-cutting and grinding work on the machine/unit only if this has been expressly authorized, as there may be a risk of explosion and fire.

Before carrying out welding, flame-cutting and grinding operations, clean the machine/unit and its surroundings from dust and other inflammable substances and

make sure that the premises are adequately ventilated (risk of explosion)!

Observe and adhere to any existing regulations valid for the place of operation!

Pneumatics

Work on high pressure air equipment must only be carried out by persons with special knowledge and experience of high pressure air systems.

Check all lines, hoses and threaded connections regularly for leaks and obvious damage. Damage must be Repaired immediately. High pressure air may cause serious injury or death.

Depressurize all system sections, pressure pipes, tubing and hoses which are to be removed in accordance with the specific instructions for the assemblies concerned before carrying out any repair work.

Compressed-air lines must be laid and fitted properly. Ensure that no connections are exchanged. The fittings, lengths and quality of hoses must comply with the technical requirements.

Rooms Subject To Explosion Hazards

Danger !

Units must never be operated in areas subject to explosion hazards!

(Exception: Special units with the corresponding technical modifications)

3. Safety regulations

3.7 Symbols And Explanations

The Following Symbols may be used on the unit.



fig. 3.7-1
No Access for Unauthorized Personnel



fig. 3.7-2
Warning, Electrical Shock or Electrocution



fig. 3.7-3
Warning, Pressurized Bottle



fig. 3.7-4
Read Operators Manual before continuing



fig. 3.7-5
Read Technical Manual before continuing



fig. 3.7-6
Warning! See the User Instruction Manual for specific hazards associated with this unit.

See the section of the users manual associated with this area of this unit for specific hazards associated with this area.

3. Safety regulations



fig. 3.7-7
Warning, Release of Pressure



fig. 3.7-8
Lock-Out Procedure Required

3.8 Logs And Daily Inspections

MAKO Supplies a daily log sheet, appendix-A. We recommend that additional copies be made and a daily log book be created. Keep this log book with the unit at all times.

3.8.1 Daily Log Book

The daily log book should be checked each and every time before the unit is turned on.

Out of service

After any automatic shut down or perceived problem unit must be taken out of service and "Out Of Service" must be written in daily log.

Do not try and restart unit until problem is resolved.

Report any such shut-down or problem to

appropriate service personnel.

After problem is resolved the unit is put back in service, the solution is documented, initialed and dated in the daily log.

Daily Inspection & log Entries

1) Check the log to see that no one has taken the unit out of service.

2) After the unit is determined to be in service, **Do not start the unit**, enter the date and time in the daily log and begin your inspections.

3) Walk around unit and look for problems.

If any problems are found that could effect the safe operation of the unit take the unit out of service and report the problem to the appropriate service personnel.

Document any actions taken in daily log.

If no problems are found after unit has been inspected place a check in "Inspection" column and continue.

4) Close all access doors. All access panels must be in place.

5) Place Your initials in the operator column.

6) Unit can now be started.

7) Listen and look for air leaks. If an air leak is detected take the unit out of service. Report leak to the service personnel.

Danger!

High pressure air leaks can be very dangerous.

Document any actions, alarms, concerns or observations in the "Alarms and Comments" column.

When the unit is shut down record the time in the "Start/Stop" column.

4. Layout and Function

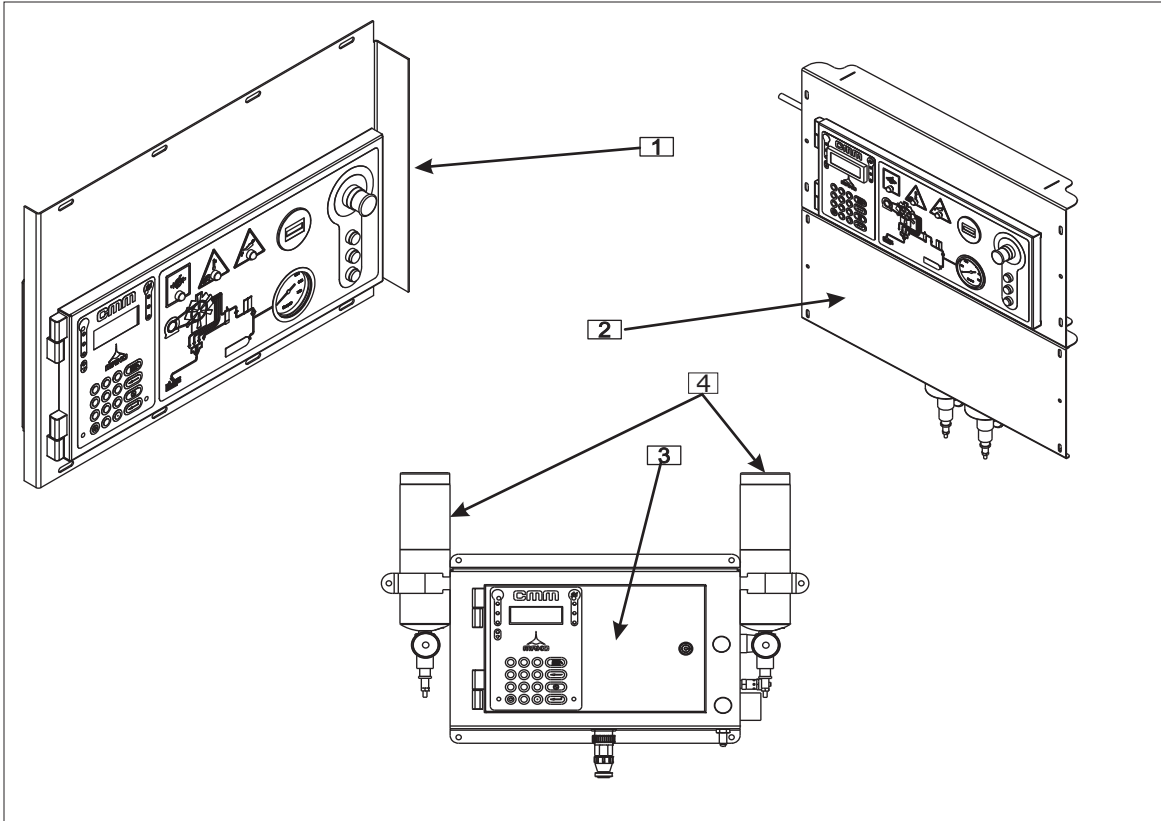


fig. 4.1-1 CMM panels & Wall Mount unit.

Legend

- 1) CMM Panel for BAC units.
- 2) CMM for BAM units.
- 3) CMM Wall Mount unit to be added to any existing high pressure breathing air system.

NOTE: A purification chamber may be needed for full functionality. Consult salesman for details.

- 4) Calibration Sample Gas Bottles.
The gas in these bottles is used to calibrate the CMM unit. One of the bottles contains "Pure Air" with no CO and the other bottle contains "Carbon Monoxide" with a CO content of 20 PPM.

20 PPM sample gas bottle - Part # 003M4884-1

Pure Air sample gas bottle - Part # 009006-7800

4.1 General Description

The Mako CMM monitoring systems (See Fig. 4.1-1) incorporates the functions required to check high pressure breathing air for safe levels of Carbon Monoxide and Moisture content.

Danger!

Do not use CMM monitor for any application other than with breathing air systems.

Configurations

There are two (2) possible CMM options.

- 1) CO Only
- 2) CO and MO

The CMM option provides monitoring of air for unsafe levels of Carbon Monoxide (CO) and Moisture (MO) content in PPM or parts per million per unit volume. The CO only configuration measures carbon monoxide in PPM and displayed in real-time as the compressor system is running.

4. Layout and Function

4.1.1 CO Option

The CMM monitors system air (air exiting the purification system) for high levels of carbon monoxide only while the compressor is running. This is controlled by two systems comprising of a solenoid valve and auxiliary contacts. When the motor contactor engages it closes the auxiliary contact which sends a signal to the CMM that the compressor is running. Once the CMM receives this signal it opens the supply air solenoid allowing air to cross over the CO cell. The monitor has a built in 5 second delay to allow the system air to purge the ambient air in the CO cell housing ensuring the user that the displayed reading is accurately reading the system air free of any ambient contamination.

The supply air is controlled by two regulators. These regulators reduce the system high pressure to 5 PSI that the CMM can accurately determine CO levels. Set the first regulator to 100 PSI and the second to 5 PSI.



fig 4.1.1-1 CO Pressure Reducing Regulators

The CMM monitors supply air input to the CO sensor by a small pressure switch mounted on the CMM board. If no pressure is detected after a short amount of time the CMM will shut the compressor down, alarm, and indicate no CO pressure. This safety ensures the user that adequate flow to the sensor is available for proper monitoring.

Excessive heat buildup can be detrimental to the life and operation of the CO cell. Therefore a red rubber hose has been added to direct the air flow out of the upper control panel and maintain a cool environment as much as possible. The CMM is equipped with a temperature sensor that detects the temperature inside the CO sensor housing to ensure the cell does not see temperatures above operating levels.

Calibration can be completed in a few simple steps. The first is to turn on the zero and twenty PPM calibration cylinders, select calibration from the CMM menus and then observe monitor for completion. (See Section 6.3.3) The first step in the calibration sequence will turn on the 20 PPM calibration solenoid and measure the cylinder for sufficient pressure to calibrate. If insufficient pressure is observed an alarm will sound, stop the calibration process, and indicate the cylinder is empty. The second operation will be to allow flow across the CO cell for sixty seconds. Once this time has elapsed the twenty PPM solenoid closes and the sequence repeats with the 0 PPM calibration cylinder.

4.1.1.1 Solenoids - CMM Control Panel

Inside the CMM control panel are three small solenoids as shown in fig. 4.1.1.1-1.

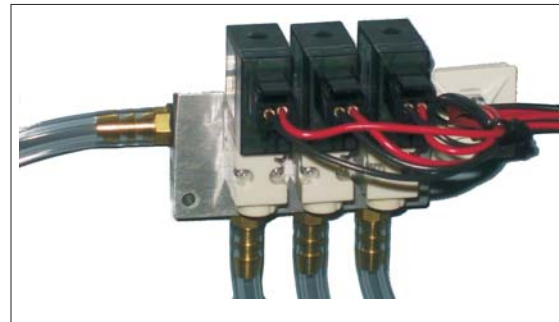


fig.4.1.1.1-1 Solenoid Valves

The solenoids control the flow of the pure air and 20ppm calibration bottles, as well as, the inlet supply air from the compressor.

To extend the life of the CO cell the CMM limits the flow of dry air across the cell for only the duration of the running compressor by operating the supply air solenoid.

4. Layout and Function

Each solenoid is equipped with a LED that illuminates when energized. As operation demands change, whether for standard compressor running or calibration, the LEDs are an instrumental aid in determining proper functionality.

Other notable adjustments:

- Calibration Time Interval – The default time is 90 days between calibrations. However, this can be adjusted between 30-90 days. (See section 6.3.2.2)
- Carbon Monoxide Set-point – The default set-point is 10 PPM. The CMM can be adjusted from 5-10PPM. (See section 6.3.2.1)

4.1.2 MO Option

The CMM is equipped with a moisture sensor located inside the final purification chamber. This location gives the best performance of detecting the level of moisture as breathing air exits the unit. The threshold of grade E breathable air is -65° F dew-point at atmospheric and once air has reached this point a red LED will illuminate, compressor will shut-down, and alarm will sound. (see section 4.2)

The Moisture Option is available for upgrade into compressor systems that are equipped with the CMM and the CO only option. The kit would include a cable, and purification plug to be fitted onto the chamber. With a simple menu driven option selection, the CMM will be able to incorporate the moisture sensor and provide the user with moisture content information of the purification system.

NOTE: A new purification chamber may need to be purchased to complete the moisture upgrade.

Moisture sensors must go through a stabilization period to provide an accurate reading. This period is during each startup of the compressor system. When the motor contactor engages it switches the auxiliary contact which sends a signal to the CMM that the compressor is running. This begins the stabilization period and is indicated by the

blinking green LED on the right side of the display. Moisture (MO) stabilization time can be adjusted from 5-15 minutes. (See section 6.3.4.2)

For proper operation of the CMM moisture indication system a MAKO filter must be installed in the chamber. A small sensor, located on the MO board detects the existence of the filter and will not allow the compressor to run if missing.

4.1.3 Bypass Option

Both systems are capable of being bypassed. This option is for emergency conditions only! The unit may not be put into by-pass if air is known to be outside of the set limits. The purpose of the by-pass is to allow users to operate the compressor system under emergency situations with known good air.

4.1.4 Wall Mount Option

Standard wall mount units are fully equipped to integrate into any compressor system. Wall mount units may only be CO monitors or a combination CO and moisture. **NOTE:** Additional parts may be necessary for integration into older or other manufacture's compressor systems. Supply air from the compressor system may be directly connected to the wall mount unit without reducing the pressure. It has two regulators (similar to fig 4.1.1-1) that reduce the pressure for the CO monitoring.

Caution!

It is important to order the proper voltage wall mount unit. This voltage applies to the control voltage of the compressor.

Electrically 4 wires integrate with the compressor system, and a standard 3-prong plug. Electrical connections can be made to the hour meter and e-stop permissive. The connection to the hour meter energizes a relay which send a signal to the CMM that the compressor is now running. The e-stop permissive is to integrate with control voltage line allowing the CMM to shut the compressor down when an alarm condition has been met.

Both the electrical and moisture cables are standard 10' long; however, longer lengths are available upon request.

4. Layout and Function

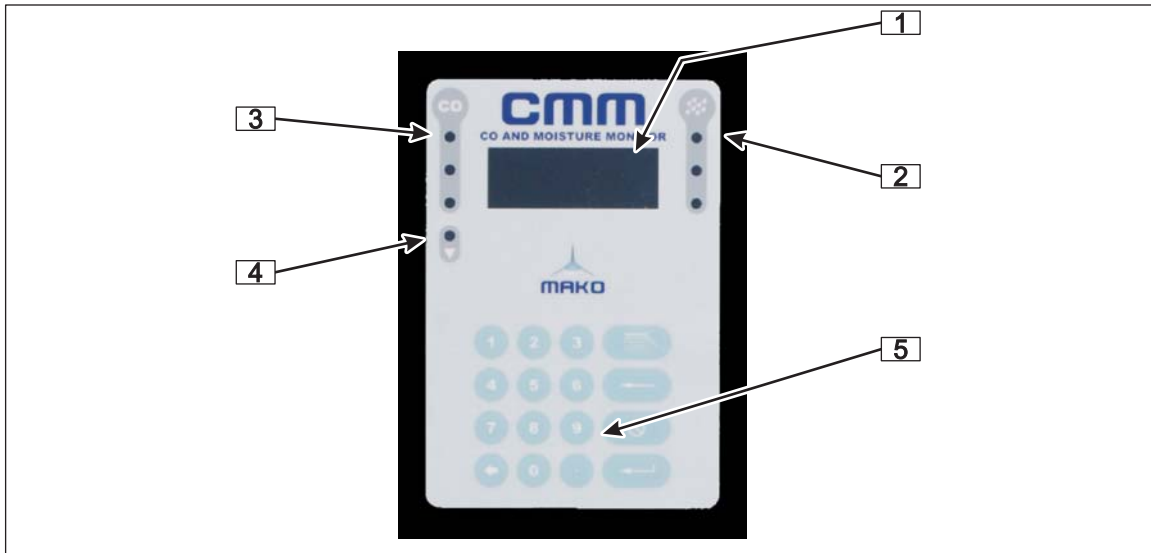


fig. 4.2-1

4.2 Standard CMM Overlay

1) Display - This display will provide information, warnings and menu options needed by the operator, maintenance and service personnel.

2) Moisture Level Indicator - This is an optional feature on the CMM unit and if purchased and installed will operate as follows.

Green light = air is indicated to be within established safe limits.

Yellow Light = air is indicated to be safe but is within 10% of the upper safe limits. This condition should be looked into and the condition corrected soon. There is approximately 1 hour of continuous use between yellow warning and red shutdown.

Red Light = air is indicated to be beyond established safe limits. Compressor will shut down and display an alarm message on the display. Take the unit out of service. (see section 3.8.1 and log on Daily Log Book Sheet APP-A)

Danger!

Do not try to use this unit until this issue is resolved.

Moisture monitoring begins only after stabilization period has elapsed which begins each time the compressor starts. This period is necessary for the moisture sensor to

provide an accurate reading of the moisture content due to the low levels being monitored.

3) Carbon Monoxide Level Indicator - This is a standard feature of the CMM unit and will operate as follows.

Green light = air is indicated to be within established safe limits if the unit has been properly calibrated.

Yellow Light = air is indicated to be safe but is within 50% of the upper safe limits. This condition should be looked into and the condition corrected soon.

Red Light = air is indicated to be beyond established safe limits. Compressor will shut down and display an alarm message. Take the unit out of service. (see section 3.8.1 and log on Daily Log Book Sheet APP-A)

Danger!

Do not try to use this unit until this issue is resolved.

4) Calibrating - This light indicates the unit is in the process of calibrating the electronic CO monitor. The unit may not be used until the calibration process has been completed.

5) Keypad - This keypad will allow the maintenance and service personnel to navigate through menu options and change settings. (see section 6.3.1)

5. Transportation and installation

5.1 Transport

Important!

Care should be exercised when removing the unit from its shipping carton to avoid any damage.

5.2 Machine Location

This unit requires the following environment and clearances:

- 1) The unit should be in a relatively clean, debris free, dry shelter out of the elements with an ambient temperature of between (35°F - 2°C) and (113°F - 45°C).
- 2) An appropriate power supply.
- 3) We recommend a minimum clearance of 4 ft (1.22 m) in front of the unit. On wall mount units we recommend 1 ft (305 mm) on both sides top and bottom.
- 4) Unit is to be mounted to a wall or suitable structure in such a way as to provide adequate support and stability.

5.3 Power Supply

During installation, inspections, maintenance, or repairs disconnect power from unit.

MAKO units are completely wired. It is, however, necessary to have a locally licensed qualified electrician install the appropriate power supply in accordance with local code.

5.4 Wall Mount Installation

- 1) Locate an appropriate area for mounting the CMM unit and secure as noted in section 5.2 Machine Location.
- 2) Connect wall mount air inlet with compressor outlet. If necessary, adjust regulators as noted below.

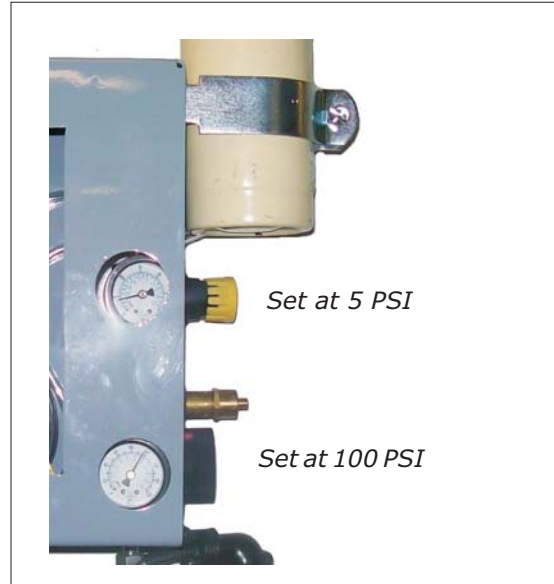


Fig. 5.3-1 Wall Mount Regulator Manifold

The wiring harness consists of 4 wires. Two wires connect to the hour meter that will provide a signal to the CMM indicating the compressor is running. It is important to select the proper voltage to the wall mount system. A relay is installed in the unit that energizes when the hour meter is supplied with voltage.

Important!

Prior to operating wall mount units ensure compressor control voltage matches the unit's order.

The other two wires are the permissive circuit that must be installed correctly for the compressor system to shut down when a fault condition is met.

(Global Style Units)

Entrance to the compressor controls can be made from several different locations. The wall mount harness can be either run from the bottom or top of your machine, keep in mind to run the wire away from the compressor or other heat sources.

5. Transportation and installation

- 3) To make the harness connections it will be necessary to drill into the upper control panel. First, open door to upper control door and look for a clear spot to drill a hole sufficient to fit the relay wiring through. The ideal location is illustrated in fig 5.3-2.



fig. 5.3-2 BAM Upper Control Panel

Once hole is drilled, make sure to remove sharp edges with file or deburring tool. It would be beneficial to use a strain relief to prevent wires from being pulled loose.

- 4) Attach #7 or blue/white wire to negative terminal of hour meter with other wires. Then attach the #6 blue wire to the positive terminal of hour meter with other wires.
- 5) Remove one of the wires from the e-stop contact terminal and butt splice it to one of the two remaining wires.
- 6) The last wire is to be connected to the contact terminal where the original e-stop wire was removed.
- 7) Clean up any debris from drilling. Check to make sure that during this process you did not bend any tubing or disconnect any connections. After making connections, it is highly recommended to tie-wrap wire harness in place to prevent it from moving.
- 8) Connect 110v plug to wall outlet.
- 9) Go to section 6.0 Operating Instructions to set-up and operate your CMM unit.

(Other Compressor Units)

Connections remain the same as illustrated above. The two wires to the hour meter provide power to the internal relay forwarding a control signal to the CMM. Two remaining wires must be put in series with the control voltage.

5.5 Initial Startup Procedure

The unit is preset in the factory. Once the unit is installed and energized the following initial start-up procedure should be carried out by the local distributor or by an Authorized Service Technician to insure proper operation:

- 1) Read and Study this manual before starting this unit.
- 2) Visually check all electrical and pneumatic connections.
- 3) Listen and look for air leaks as system is pressurized. If an air leak is detected take the unit out of service. Report leak to the service personnel.

Danger!

High pressure air leaks can be very dangerous.

- 4) Check and adjust, if necessary, the pressure regulators of this monitoring unit.
- 5) This monitoring system and all the air connections between the air source and this monitoring system must be purged before continuing.
- 6) Power must be applied to the wall mount unit and the CMM must be on for at least 30 minutes before continuing. The compressor does not need to be operating during this time period.
- 7) Calibrate this monitoring unit. (see section 6.3.3 for the calibration instructions)

6. Operating Instructions

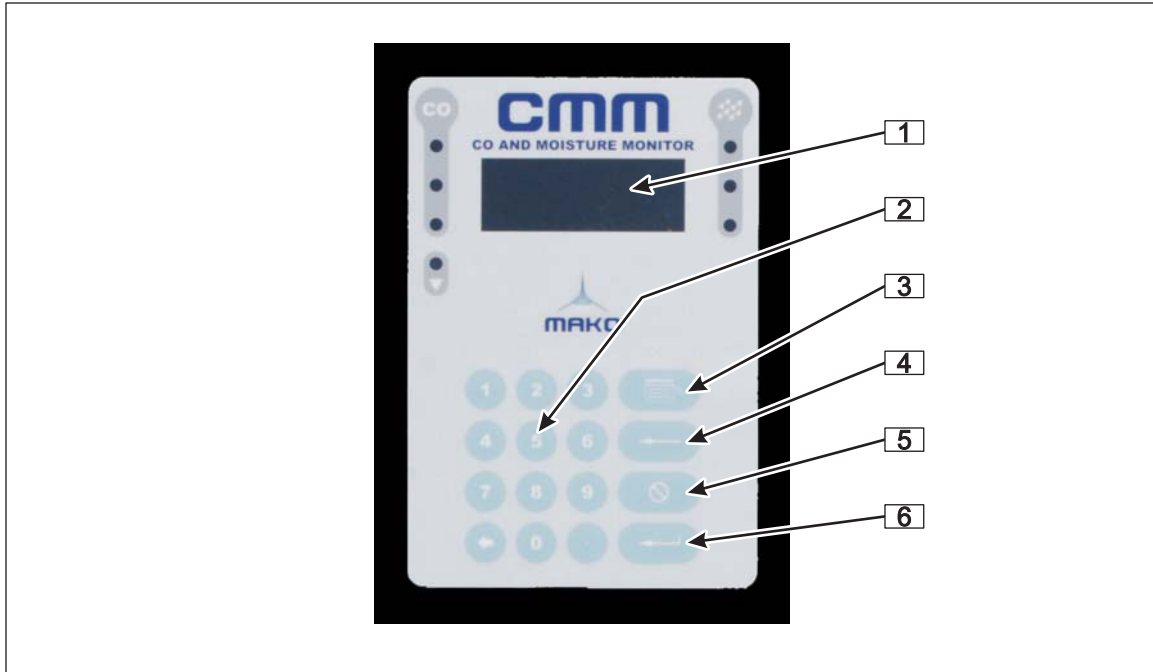


fig. 6.1-1 Standard CMM Controls

Danger!

Please read your owner's manual carefully for important safety information.

6.1 Standard CMM Controls

See section 4.2 for a full description of the Standard CMM Overlay.

[1] - CMM Display.

[2] - CMM Number Pad.

[3] - Menu Command - This button will take you to the main menu of the CMM.

[4] - Previous Command - This button will take you back one screen.

[5] - Cancel Command - This button will allow you to cancel out of a command.

[6] - Enter Command - This button will allow you to enter data that has been punched in.

6.2 Start-Up

Before beginning start-up inspect unit & check logs (see section 3.8 and 3.8.1)

- 1) The CMM retrofit panels will be powered up along with the compressor system.
- 2) The CMM Wall Mount unit will need to be turned on independently. Compressor system should not be able to operate with the CMM wall mount turned off.

6.2.1 Shut-Down

It is not necessary to turn the CMM off during normal day-to-day operation. It is beneficial to leave the unit powered on. However, if the units will not be operated for an extended amount of time then shut down procedures are in order.

- 1) The CMM retrofit panels will be shut-down along with the compressor system.
- 2) The CMM Wall Mount unit will need to be shut-down independently.

6. Operating Instructions

6.3 CMM Commands

The CMM unit will monitor the compressed air output of the system and stop the compressor in the event of high Carbon Monoxide levels or high Moisture levels, if optional Moisture level option is purchased.



```
MAKO          V1.59
Cal Due       73 days
  0 PPM      set 10PPM
```

6.3-1 CMM Main Display

6.3.1 Menu Access

To customize the command program of the CMM unit it will be necessary to access the command menu.

With the CMM unit on press the menu button (see section 6.1 #3) this will display the main menu.



```
1> CO SETUP  4> LNG
2> CALIBRATE NOW
3> BYPASS OPTIONS
```

6.3.1-1 CMM Main Menu

Next punch in the keypad security code and press the enter button. (see section 6.1 #6) The default security code for the CMM unit is 7654 this will unlock the menu for 3 minutes.

6.3.2 CO Setup

By pressing "1" while in the main menu you will access the CO setup options.



```
1> CO SETPOINT
2> CO CAL PERIOD
3> CO AUTOCAL On/Off
```

6.3.2-1 CMM CO Setup menu

6.3.2.1 CO Set Point

By pressing "1" while in the CO setup menu (see section 6.3.2) you will access the CO set point screen. This will allow the CO set point to

to be changed to meet local rules and regulations.



```
CO PPM LIMIT 10PPM
Range(5 - 10)
PPM:
```

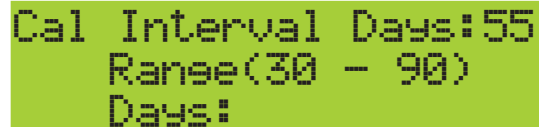
6.3.2.1-1 CMM CO Set Point Screen

The first line shows the PPM the unit is currently set at. The second line shows the limits of where it can be set. The third line will show the PPM you have keyed in.

From the CO set point screen(see fig. 6.3.2.1-1) key in the set point required and press enter (see section 6.1 #6)

6.3.2.2 Cal Interval

By pressing "2" while in the "CO SETUP" menu (see section 6.3.2) you will access the "CO Cal Period" screen.



```
Cal Interval Days:55
Range(30 - 90)
Days:
```

fig. 6.3.2.2-1 CMM Cal Interval Screen

This screen will allow you to adjust how often the CO monitoring system is to be calibrated.

The first line shows the number of days between calibrations the unit is currently set at. The second line shows the limits of where it can be set. The third line will show the number of days between calibrations you have keyed in.

From the "Cal Interval" screen(see fig. 6.3.2.2-1) key in the Calibration Interval required and press enter (see section 6.1 #6)

6.3.2.3 Automatic Cal

Although automatic calibration is a selectable option, it is not fully operational.

This option will be available soon. To calibrate CMM refer to section 6.3.3

Do Not Use Automatic Calibration

Manual Calibration is the only way to ensure safe calibration at this time.

6. Operating Instructions

6.3.3 Calibrate Now

The CMM unit must be on for a minimum of 30 minutes before calibration can be started. This time will allow the CO sensor cell to stabilize. By pressing "2" while in the main menu (see section 6.3.1) you will access the "CALIBRATE NOW" screen.

Follow on screen instructions for calibration procedures.



TURN ON BOTTLES!
PRESS 1

fig 6.3.3-1

If the sample bottles are not opened or empty, you will receive an error message during the calibration phase indicating which bottle is empty.



PRESS 9
TO CALIBRATE

fig 6.3.3-2



CALIBRATING...
■■■■■■

fig. 6.3.3-3 Calibrating Screen

During the calibration sequence the progress bar will be displayed and the calibration in progress LED will turn on. (see fig.4.2-1#4)

When the calibration is finished "Calibration Complete" will be displayed.



CALIBRATION COMPLETE
PRESS 1

fig 6.3.3-4



TURN OFF BOTTLES!
PRESS 1

fig 6.3.3-5

Pressing 1 will complete the calibration sequence and display the main menu. (see figure 6.3.1-1)

6.3.4 By-Pass CO or MO Monitors

DANGER!

This is to be done in EMERGENCY situations ONLY when AIR is KNOWN to be ACCEPTABLE.

By pressing "3" while in the "Main Menu" (see section 6.3.1) you will access the "CO MO BYPASS" menu.



1) CO BYPASS
2) MO BYPASS
3) MO TIMEOUT

fig.6.3.4-1 CO MO BYPASS MENU

In this example we will show the CO monitor bypass procedure. The MO monitor bypass follows the same pattern.)

By pressing "1" while in the "CO MO BYPASS" menu (see fig. 6.3.4-1) you will access the "CO MONITOR Bypass" menu.



1)BYPASS CO Monitor
2)Cancel CO BYPASS

fig. 6.3.4-2 CO Bypass Menu

By pressing "1" while in the "CO Bypass" menu (see fig. 6.3.4-2) you will bypass the CO monitoring system.



1)BYPASS CO Monitor
2)Cancel CO BYPASS
CO BYPASSED!
CO ALARM BYPASSED

fig. 6.3.4-3 CO ALARM BYPASSED

6. Operating Instructions

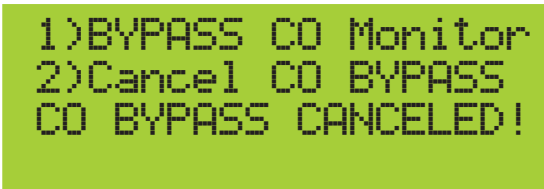
Danger!

CO ALARM or MO ALARM
HAS BEEN BY-PASSED!

6.3.4.1 To Cancel The CO or MO By-Pass

(In this example we will show the cancel CO monitor bypass procedure. The cancel MO monitor bypass follows the same pattern.)

From the "CO ALARM BYPASSED" menu (see fig. 6.3.4-3 and section 6.3.4) press "2" to cancel the CO alarm bypass.



```
1)BYPASS CO Monitor
2)Cancel CO BYPASS
CO BYPASS CANCELED!
```

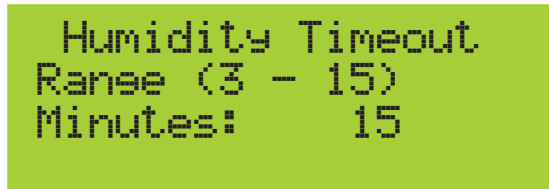
fig.6.3.4.1-1

6.3.4.2 MO Time-Out Menu

The moisture sensor must have a stabilization period to ensure adequate flow across the sensor which will provide the level or accuracy required. During this stabilization period the air must be purged to atmosphere. Only monitored breathing air should be used in storage and all filling apparatus.

This period is adjustable through this menu. The default is 15 minutes with the adjustability from 5 to 15 minutes. Shorter times can be used, however, if the sensor has not stabilized it will prematurely shut-down on high dew-point.

From the "CO MO Bypass Menu" select #3 to gain access to this Menu.



```
Humidity Timeout
Range (3 - 15)
Minutes:      15
```

fig 6.3.4.2-1

Enter the desired time and press enter key.

7. Maintenance

DANGER!

During installation, inspections and before carrying out any maintenance work be sure that all pressure is released from the system and the machine is electrically isolated. Never attempt to straighten badly bent tubing or re-use damaged fittings.

CAUTION!

Never tighten any fitting when it is under pressure.

IMPORTANT!

Tampering with safety valves invalidates the warranty.

On CE units the pressure setting of each pressure relief valve can be found on the tag attached to the relief valve.

On retrofit units that are hardwired into the air system, a lock-out procedure must be followed during installation, inspections, maintenance, or repairs.

Lock Out Procedure:

- 1) Announce the lock-out to other personnel.
- 2) Turn power off at main box.
- 3) Lock power box in the off position.
- 4) Put key in your pocket.
- 5) Document lock out and reasons for the lock out in the daily log book.
- 6) Make sure unit is clear of all personnel.
- 7) Test lock-out by trying to start the unit.
- 8) Complete required operations.
- 9) Announce that the lock-out condition is being ended and clear the unit of all personnel.
- 10) Take key out of your pocket.
- 11) Unlock the power box.
- 12) Turn the power box on.

- 13) Announce that the unit has power to other personnel.
- 14) Document that lockout has been lifted and any actions taken in the daily log book.

7.1 Maintenance Schedule

Daily Or Each Time Unit Is Operated Inspect unit and Check Logs per sections 3.8 and 3.8.1.

The calibration schedule will be maintained and adjusted electronically within the CMM unit.(see section 6)

7. Maintenance

7.2 CO Replacement

The average life span of this CO cell is approximately 2 years depending on usage. When calibration fails three consecutive times it indicates a failure that could result in replacement. Troubleshooting must be done to verify that the CO cell must be replaced.

Access to CO cell is made by entering the upper control panel.

IMPORTANT!

An Anti-Static Strap is highly recommended. This is to prevent static discharge to the CO monitor board during the change of the sensor. When using a static strap follow the manufacturing procedures for hookup.

- 1) Turn compressor system and CMM off.
- 2) Open CMM Door
 - Wall Mount: Use allen key from front
 - BAM/BAC: Access to door lock is through right side enclosure door.
 - See fig.7.2-1 for view of latch inside. BAM/BAC unlocks from back of CMM enclosure.



fig. 7.2-1 BAM interior view

- 2) Open latch, Open Door
- 3) Locate CO Housing.

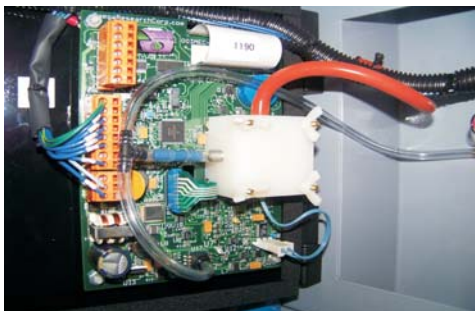


fig. 7.2-2

- 4) Static Strap should be put on at this point.
- 5) Remove four Nylon wing nuts see fig. 7.2-3



fig. 7.2-3

- 6) Gently pull CO housing from CO sensor board.
Hoses and wires are sufficiently long enough to remove without disconnecting. (See figure 7.2-3)
- 7) Locate 003MEC-5 and remove gently.



fig. 7.2-4

Warning!

The 003MEC-5 is a unique CO sensor specifically made for our CMM product.

Do not substitute other CO sensors in place of the 003MEC-5.

- 8) Carefully place new 003MEC-5 CO sensor onto board. Care should also be taken not to touch the center of the CO cell. Note locations of pins on cell vs. holes on board before attempting to insert. Inserting incorrectly may result in damage to the board. When pins are correctly aligned, insertion will require a light push to seat it flush on the board.

7. Maintenance

- 9) Remount CO Housing and secure with four nylon wing nuts. Tighten securely but do not over tighten or damage will occur to board.
- 10) Close door and re-latch.
- 11) Perform manual calibration as listed in section 6.3.3 of this manual.

7.3 Replacement of MO Cell

Typically, the MO sensor cell does not need replacing. If you find through proper troubleshooting that your MO sensor has failed, then follow these procedures to replace the MO sensor cell.

Tools highly recommended: Anti-Static Strap

- 1) Turn CMM off.
- 2) Isolate compressor from storage and bleed air from compressor unit.
- 3) Locate final purification chamber.



fig. 7.3-1

Unscrew electronic connector from tube.

- 2) Note: Put on Anti-Static Strap to prevent static from damaging new MO sensor cell.
- 3) Unscrew top of purification tube. (Use of strap wrench or insert two $\frac{3}{8}$ -16 screws in the tapped holes provided for leverage.)
- 4) Once purification tube cap is removed it will look like fig. 7.3-2 below.



fig7.3-2

- 5) Loosen the two (4-40 x $\frac{3}{8}$ pan head) screws (Mako pn: 003Z0719) which will allow you to remove the MO sensor cell from the top cap cavity. This is attached to wiring so it will not be completely removed until the electronic connector is disconnected. By holding the MO sensor cell and pulling at the wiring socket this should disconnect easily.
- 6) Carefully, take new MO sensor out of static free bag, grabbing it by the outer edges of the sensor to avoid static discharge to the board. Insert the new MO sensor into the wiring connector making sure that the ears of connectors engage with the lock on the MO sensor.
- 7) Align the MO sensor with the stand offs inside the purification cap. You may need to hold this in place.
- 8) Insert the two (4-40) screws and fasten securely.
- 9) Apply food safe grease or silicone to o-rings of purification cap.
- 10) Remount purification cap to purification tube. Make sure to fasten securely but do not over tighten.

IMPORTANT!

Never bottom out purification cap onto chamber. Proper installation is to tighten to bottom then back-off no more than 1/4 turn

- 11) Reattach cable to purification cap. (Make sure to orient pins when attaching)

8. Troubleshooting

8.0 General

The bottom line of the display is strictly for messages/alarms that indicate the CMM is operating outside of normal parameters. The first step in troubleshooting is understanding the messages and why they are being displayed. Charts on the following pages will list the messages, explanations, and corrections.

8.1 Initial Investigation

1. Is the configuration correct?
 - The CMM may not be set-up correctly according to application. It may be set-up as a CO and MO monitor but the compressor system should only be CO.
 - The configuration can be changed in the Factory Menu.
2. Are the plugs securely fastened in the rear of the CMM board, and wired correctly?
 - Three orange plugs are used on the CMM with different sizes, and each securely fastens only one way.
 - Refer to section 8.2 for CMM Wiring
3. Troubleshoot messages according to charts on pages 8-4 and 8-5.
4. Contact Customer Service for more information.

8.2 CMM Wiring

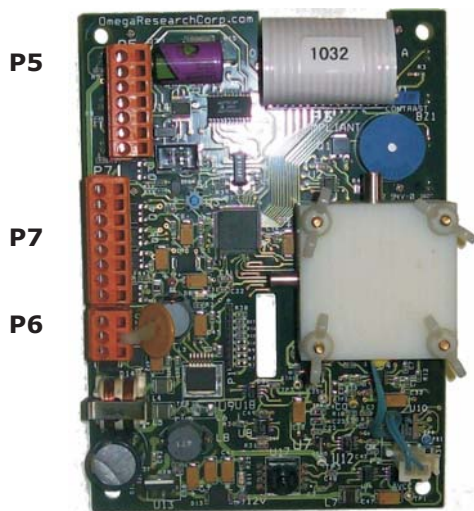


fig 8-2.1 Plug designation

8.2.1 (P5) Moisture Cable Plug

This plug is only used when the moisture option has been installed with the CMM monitor. It is the communication cable between the CMM and the MO sensor board.

This plug has 7 pins oriented with pin 1 toward the top of the CMM board.

- Pin 1 - Green/Yellow - Earth Ground
- Pin 2 - Brown
- Pin 3 - White
- Pin 4 - Black
- Pin 5 - Red
- Pin 6 - Green
- Pin 7 - Blue

8.2.2 (P7) Harness Plug

This plug is used to interface with the controller and solenoids for the operation of the system. It contains both inputs and outputs. Wall Mount and Units contain the same set-up.

This plug has 8 pins oriented with pin 1 toward the top of the CMM board.

- Pin 1 - Not Used
- Pin 2 - (25) 0 PPM Solenoid Valve
- Pin 3 - (26) 20 PPM Solenoid Valve
- Pin 4 - (28) Compressor Permissive Relay
- Pin 5 - (27) Supply Air Solenoid
- Pin 6 - (30) Auxiliary Contact
- Pin 7 - Not Used
- Pin 8 - (29) Auxiliary Contact

Pins 6 and 8 are used to indicate when the compressor is running. The auxiliary contacts are located on the side of the starter. When the starter is engaged then it closes the auxiliary contacts producing the signal to the CMM that the compressor is running.

8.2.3 (P6) Power Plug

This plug supplies power to the CMM board for operation.

This plug has 3 pins oriented with pin 1 toward the top of the CMM board.

- Pin 1 - Earth Ground - Not used - It is linked with pin1 of P5.
- Pin 2 - Negative 12 - 24 VDC
- Pin 3 - Positive 12 - 24 VDC

8. Troubleshooting

8.3 Reset

The CMM has a reset button that simulates a power on/off cycle. The primary use is after a program has been loaded. However, it may be used at any time. It does not reset the CMM board to factory settings.

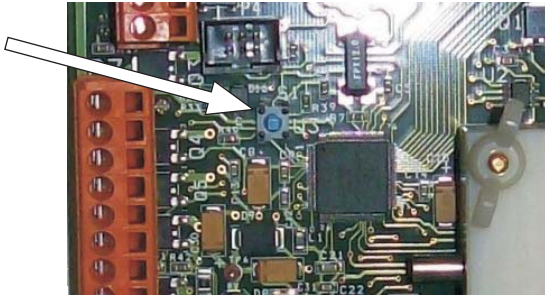


fig 8.3-1 Reset Button

8.4 Factory Menu

The factory menu may be accessed to re-initialize or change the date/time screen.

To access the Factory Menu press Menu 9 684075 at the main menu. During key entry the display will not change until the last digit is entered.

```
1) CONFIG    2) INIT
3) TEST      4) TIME
5) SERIAL #
```

fig 8.4-1

8.4.1 CONFIG Menu

The menu will allow the user to reconfigure the CMM unit for the two options: CO and MO or CO only.

Press 1 to enter configuration screen

```
CONFIG =      19
NEW CONFIG =
```

FIG 8.4.1-1

The first line indicates the current configuration. The user may enter the new configuration and press enter.

The two configurations are:

19 = Carbon Monoxide and Moisture

5 = Carbon Monoxide only

8.4.2 Initialization Menu

This menu will initialize the CMM and reset it to factory settings and clear the E-PROM memory. This should only be done by authorized personnel.

CMM units with an asterisk in the version number on the main screen indicates that an initialization is required.

Initialization is also needed after a new version program is entered into the CMM unit.

Press 2 in the factory menu to enter the initialization menu.

```
PRESS 9 TO
RESET HOURS & EEPROM
```

fig 8.4.2-1

Press 9 to confirm the initialization must be performed.

8.4.3 Test Menu

This menu will test the LEDs for operation. Once started the LEDs will flash on-off for approximately one minute. The CMM may be reset by turning the unit off-on or by pressing the reset button.

```
PRESS 9 TO TEST
```

fig 8.4.3-1

Press 9 to confirm entry into the test sequence.

8. Troubleshooting

8.4.4 Time Menu

This menu will coordinate the date and time of the CMM unit with real-time. This is important to set correctly for the CO calibration period to function as expected.

The date/time should be entered by the factory, however, it should also be checked at start-up.

To enter/check the date/time press 4 at the factory menu.



fig 8.4.4-1

Enter the date/time information in the format shown on the screen.

8.4.5 Serial # Menu

This menu stores the serial number of the CMM board and should not be changed.

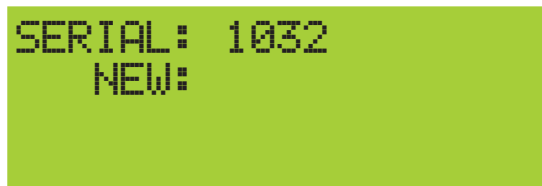


fig 8.4.5-1

Ensure the serial number matches the number on the rear of the CMM.

8. Troubleshooting

SCREEN MESSAGES THAT CAN OCCUR ON THE CMM SCREEN AND POSSIBLE SOLUTIONS

Message	Possible Cause	Possible Solution
CO LEVEL HIGH	<i>CO Level above programmed limit</i> <i>CO content of incoming air to high</i> <i>CO system requires calibration</i> <i>BAD CO cell</i>	1) Check surrounding area for idling vehicles which would cause high levels of CO. 2) Remote mount the air intake to an area for a clean air source. 3) Re-Calibrate CO. (if unit fails 3 attempts of calibration, replace cell)
CO MON. FAIL	<i>CO cell detected missing, or CO level out of allowed sensor range</i> <i>CO cell not installed or installed improperly</i> <i>CO system requires calibration</i> <i>BAD CO cell</i>	Re-Calibrate CO. (if unit fails 3 attempts of calibration, replace cell)
CO TEMP HIGH	<i>CO sensor temperature above limit</i> <i>Ambient temperature to high</i> <i>Temperature of air to CO cell to high</i> <i>CO systems temperature sensor improperly positioned</i>	Lengthen the system air hose to CMM and protect from direct heated air flow.
CO PRESSURE	<i>Air pressure to CO cell to low</i> <i>Disconnected or restricted air source tube</i> <i>Control system upset, cycle power</i>	Increase the System Air Pressure up to 6 PSI limit. Ensure System Air solenoid valve is activating (red LED) upon system air demand. Disconnect air leading into CO cell and verify flow upon system air demand. Ensure all air lines are connected and secured.
RH TEMP	<i>RH sensor temperature to high</i> <i>Air temperature to humidity filter to high</i>	Remote mount air intake. Allow ample time for compressor cool-down.

8. Troubleshooting

Message	Possible Cause	Possible Solution
RH SENSOR FAIL	<i>RH sensor failed to communicate</i> <i>Cable disconnected</i> <i>Bad RH sensor module</i>	Check wiring from CMM board to moisture board. Check CMM program version of 1.51 or later.
FILTER MISSING	<i>Detected missing moisture filter</i> <i>Cable disconnected</i> <i>Bad RH sensor module</i>	Check wiring from CMM board to moisture board. Incorrectly configured for moisture monitoring (contact local distribution.)
Dewpoint High	<i>Dewpoint above set maximum level</i> <i>Filter saturated and needs to be replaced</i> <i>Bad RH sensor module</i>	Replace filter

8. Troubleshooting

THESE CODES ARE TO ONLY USED BY TECHNICIANS OR DISTRIBUTORS

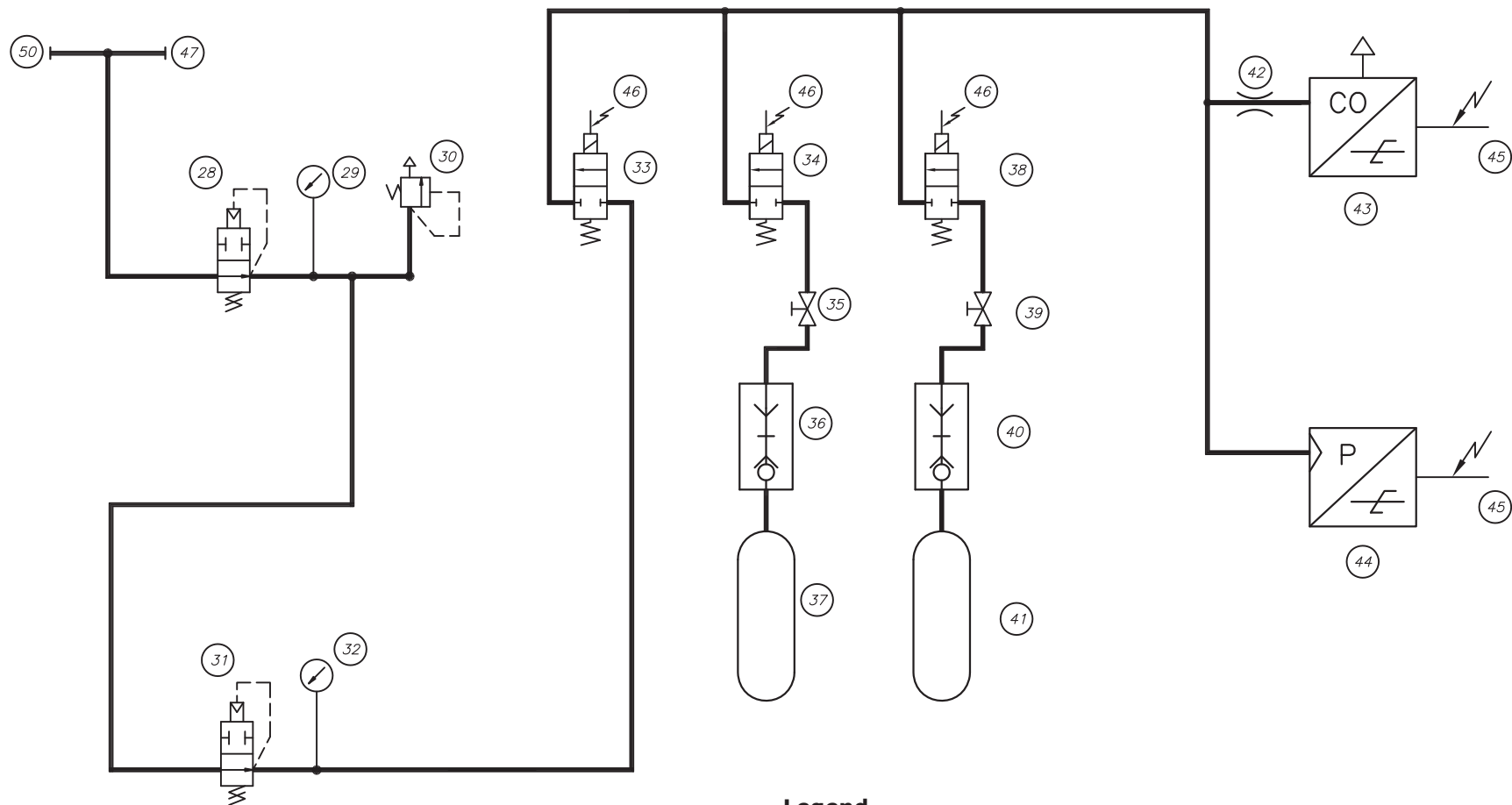
THE FOLLOWING ARE FACTORY SETTINGS FOR DATE, TIME AND OTHER MI SC FUNCTIONALITY. PRESS "MENU" BUTTON THEN 9684075 AND THIS WILL BRING YOU TO THE FACTORY SETTINGS MENU. NOTE: THE NUMBERS WILL NOT DISPLAY ON THE SCREEN WHEN YOU TYPE

MENU	TYPE NUMBER	SCREEN READS	COMMENTS
CONFIG	1	CONFIG = 19 NEW CONFIG =	19 = CO & MO 5 = CO ONLY
INIT	2	PRESS 9 TO RESET HOURS AND EEPROM	AS STATED
TEST	3	PRESS 9 TO TEST	TESTS ELECTRICAL FUNCTIONALITY OF THE UNIT. ON/OFF SWITCH MUST BE CYCLED TO RESET
DATE	4	0004150755 FORMAT: YYMMDDHHMM	SETTING DATE AND TIME
TIME	4	0004150755 FORMAT: YYMMDDHHMM	TIME FORMAT IS IN MILITARY TIME
SERIAL	5	SERIAL: 000002 NEW:	SETTING SERIAL NUMBER

Daily Log Book Sheet

[illegible]

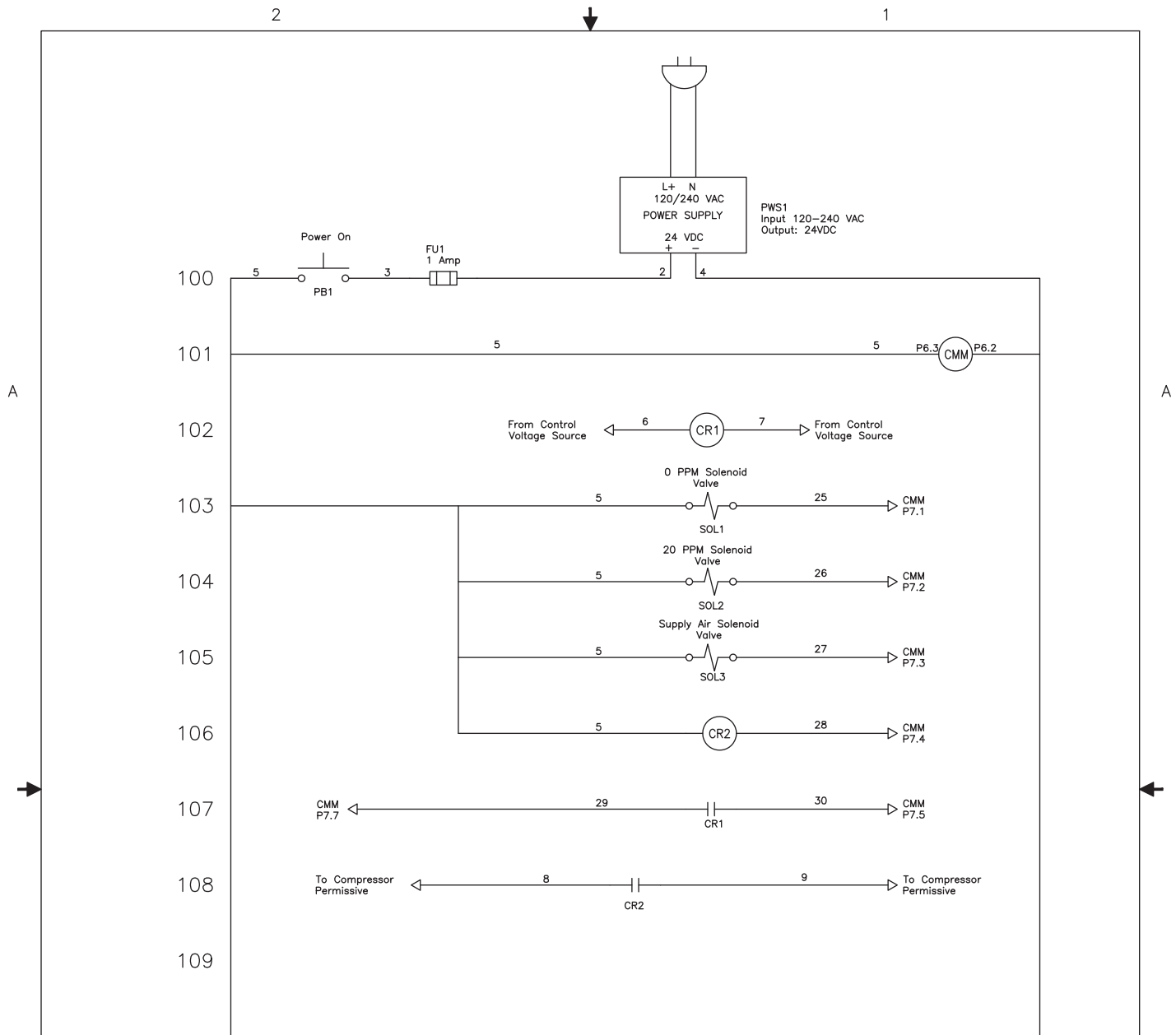
Appendix B - P&ID of Typical CMM



Legend

Item No.	Description
28	High Pressure Regulator
29	Pressure Gauge
30	Pressure Relief Valve
31	Low Pressure Regulator
32	Pressure Sample Gauge
33	System Air Solenoid Valve
34	20 PPM Solenoid Valve
35	20 PPM Cylinder Valve
36	20 PPM Quick Disconnect
37	20 PPM Cylinder
38	0 PPM Solenoid Valve

Item No.	Description
39	0 PPM Cylinder Valve
40	0 PPM Quick Disconnect
41	0 PPM Cylinder
42	Flow Restrictor Orifice
43	CO Sensor Cell
44	Pressure Sensor
45	To CMM
46	From CMM
47	Compressor System Outlet
50	To Storage



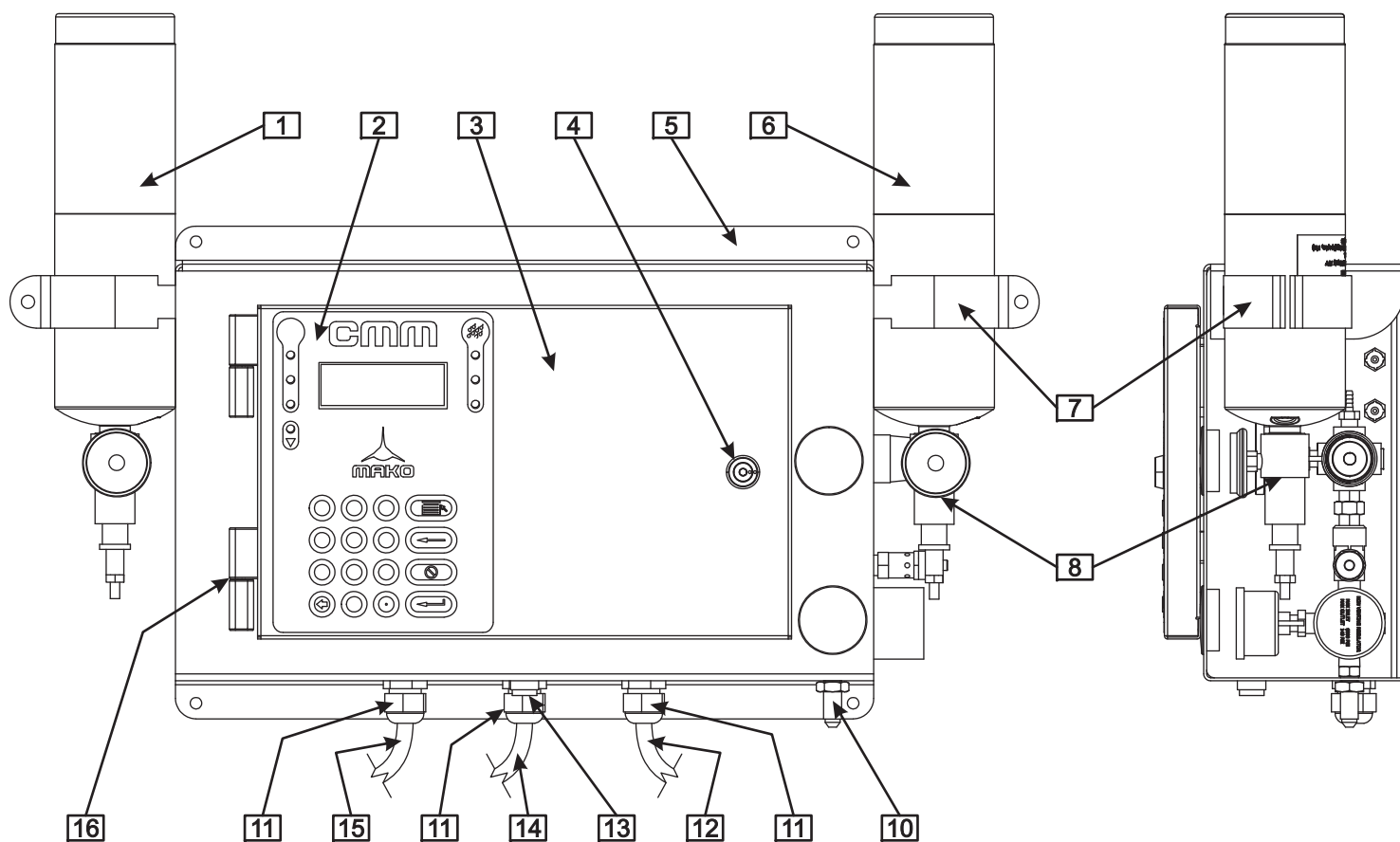
Notes:

1. CR1 voltage dependent upon customer specified compressor control voltage.

CR1 Voltage _____ V AC/DC
circle one

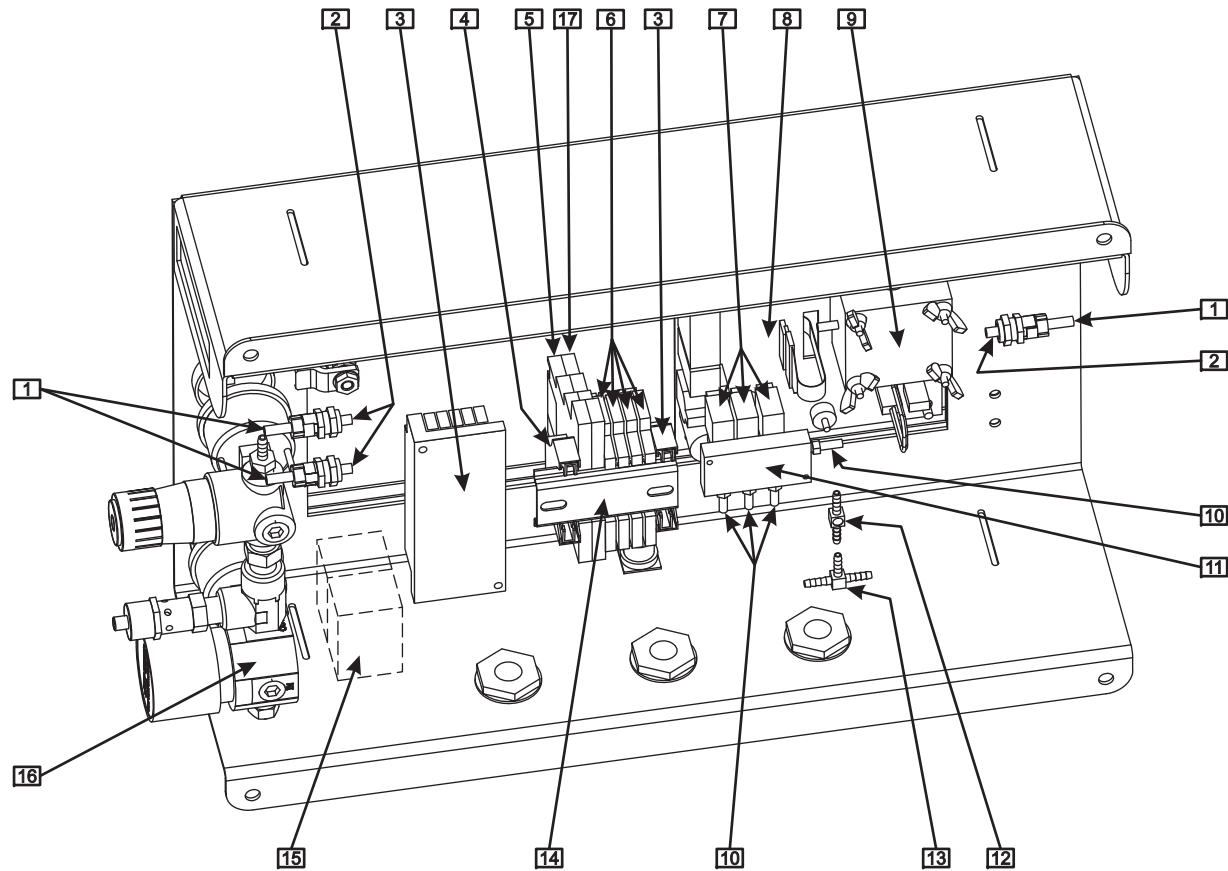
PRODUCT LINE		DESCRIPTION		PART NO.		DRAWN	
ACC		CMM Wall Mount Electrical Schematic		EL09100		J Downing	
				QUANTITY REQUIRED PER ASSEMBLY		APPROVED	
				1		J Downing	
				MATL		DATE	
						Oct. 8, 2007	
				JOB NO.		SIZE	
				STD LN		A	
				SCALE		REV	
				NONE		0	
				SHT		OF	
				1		1	
				THIRD ANGLE PROJECTION			

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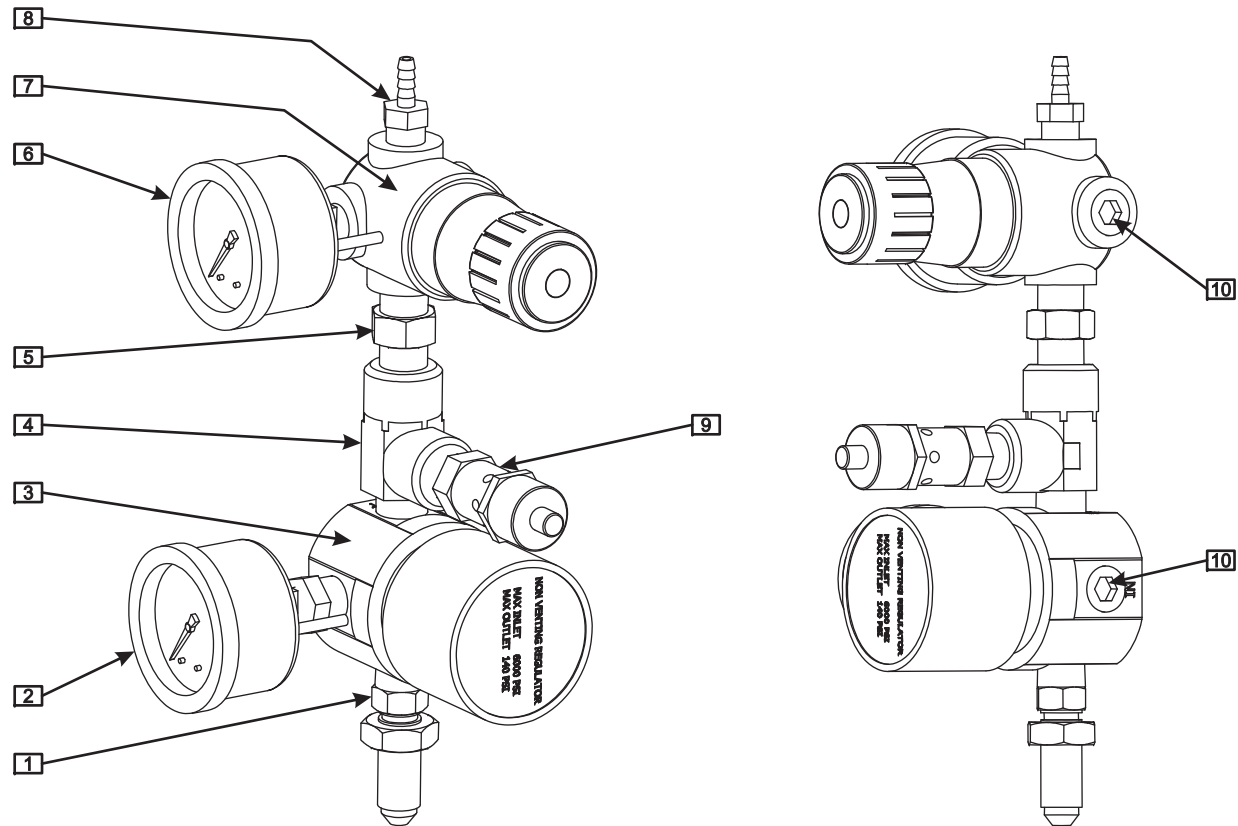
Item No	View	Description	Part No.	Qty.
1	----	0 PPM Cylinder	009006-7800	1
2		CMM Overlay, with Membrane	003CMM08319	1
3	----	CMM Door, Wall Mount	008PUR09011	1
200		Internal View of Enclosure		
4	----	Door Latch- Tool Operated - Small	003E35675	1
5	----	CMM Wall Mount Housing - Welded	008PUR09013	1
6	----	20 PPM Cylinder	003M48841	1
7	---	Clamp, Test Cylinder	003P1120	2
8	----	Regulator, Sample Gas Flow	003E410	2

Item No	View	Description	Part No.	Qty.
10	300	Inlet Manifold Assembly		
11	----	Strain Reliev - Bulkhead	EL016	3
12	400	Moisture Sensor Assembly Cable		
13	----	Switch - On/Off - Green LED	003E0246	1
14	----	Power Cord	003M484	1
15	----	Compressor Harness		1
16	----	Hinge - In-Line Lift Off	003961050050	2

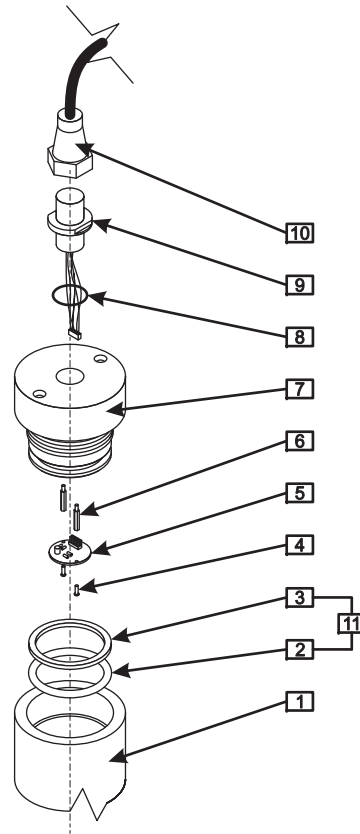


Item No	View	Description	Part No.	Qty.
1	----	Fitting, QD, Male, 1/8"	003MEC-TUBQDM	3
2	----	Fitting, Bulkhead, QD, Female 1/8"	003MEC-TUBQDF	3
3	-----	Power Supply IN: 110V-240VAC OUT: 24VDC	EL065	1
4	-----	End Stop	003EN10300226	2
5	-----	CMM Run Indicator Relay (Hour Meter) 12VDC	003E416-12	1
	-----	CMM Run Indicator Relay (Hour Meter) 24VDC	003E416	1
6	----	Terminal Block	0031492-LD3	5
7	-----	Solenoid Valve	003E408	3
	----	Solenoid Valve Harness	003E404	3
8	----	CMM	003MEC-4	1
9	----	CO Sensor Cell Housing	-----	1

Item No	View	Description	Part No.	Qty.
	-----	CO Sensor Cell	003MEC-5	1
	----	Hose, Exhaust Red Rubber	003E440	1
10	-----	Connector, Hose Barb	003E407	4
11	-----	Manifold, 3 Stage	003E405	1
12	-----	Flow Restrictor, Barbed	003E403	1
13	-----	Tee, Barbed 1/8"	003E401	1
14	----	Rail, DIN (order by inch)	003DR1	
15	----	CMM Run Indicator Relay (Hour Meter) 110VAC	003M6002/003M6021	1
16	300	Supply Air Control Manifold	-----	----
17	----	CMM Permissive Relay (24VDC)	003E416	1
18	----	Tubing, 1/8" Clear (Order by the Foot	003E406	---



Item No	View	Description	Part No.	Qty.
1	----	Fitting, Bulkhead 1/4 MNPT x 1/4 MJIC	003MEC-5	1
2	----	Gauge, Back Mount 0-160 PSI	00977413	1
3	----	Regulator, Pressure In: 6000 PSI Out: 0-140	003BB13AL2KVA4	1
4	----	Fitting, Tee 1/4 MNPT-1/4 FNPT	CONSM1350	1
5	----	Fitting, Nipple 1/4 MNPT	CONSM1357	1
6	----	Gauge, Back Mount 0-30 PSI	003X0404	1
7	----	Regulator, Pressure IN: 120 PSI OUT: 0-15	003X0190	1
8	----	Fitting, Barb, 1/8 MNPT x 1/8 Tube	003125HB22	1
9	----	Valve, Safety 175 PSI	003111X	1
10	----	Plug, Hex 1/4 NPT	CONSM1358	2



Item No	View	Description	Part No.	Qty.
1	----	Chamber, Final Purification	-----	1
2	----	O-Ring (Not Sold Separately)	-----	1
3	----	Back-Up O-Ring (Not Sold Separately)	-----	1
4	----	Screw, Pan Head 4-40 x 3/8"	003Z0719	2
5	----	PCB, Moisture Sensor	003MEC-7	1
6	----	Spacer	00381F4267	2
7	----	Plug, Chamber, Final Purification	00521-186	1
8	----	O-Ring	001RR95602/0041	1
9	----	Harness, Plug, Moisture Sensor	003MEC-3	1
10	----	Cable, Moisture Sensor to CMM 3'	003MEC-4CBL3	1
	----	Cable, Moisture Sensor to CMM 5'	003MEC-4CBL5	1
	----	Cable, Moisture Sensor to CMM 10'	003MEC-4CBL10	1
11	----	O-Ring and BackUp Ring Kit (includes 2 ea. Item # 2 and 3)	005M310	1

