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**MST, INC.
MODEL 2002
CARBON MONOXIDE
MONITOR**

**OWNER'S
MANUAL**

IMPORTANT WARNING
WHEN THE CO MONITOR IS CORRECTLY INSTALLED AND
MAINTAINED, IT MONITORS THE LEVEL OF CARBON
MONOXIDE IN THE RESPIRATORY AIR LINE. THE MONITOR
DOES NOT
REMOVE CARBON MONOXIDE FROM THE AIR

**MST MODEL 2002
CARBON MONOXIDE MONITOR**

SPECIFICATIONS:

RANGE:	0-999 PPM CO
POWER REQUIREMENTS:	120/240 VAC-50/60 Hz, 1 PH, OR 12 VDC; 1 A
INTERNAL RELAYS (RL1 & RL2) DRY CONTACT-TYPE MAXIMUM CURRENT RATING:	5A@12 VDC/120 VAC
SENSOR TYPE: ELECTROCHEMICAL. SENSOR LINEARITY AT 68F:	+/-2.5% OF READING
SENSOR TEMPERATURE COEFFICIENT:	+/-10% OF READING PER SIGNAL OVER RANGE 32 - 122F
SAMPLE FLOW RATE:	1.0 SCFH (Standard Cubic Foot per Hour)
OPERATING TEMPERATURE (AMBIENT):	32 - 104F (0 - 40C)
STORAGE TEMPERATURE (AMBIENT):	14 - 122F (-10 - 50C)
PHYSICAL DIMENSIONS:	
WIDTH:	7-5/8" (194 mm)
HEIGHT:	7-5/8" (194 mm)
DEPTH:	4-1/8" (105 mm)
WEIGHT:	2.3 LBS. (1 kg)

MST MODEL 2002 CARBON MONOXIDE MONITOR



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I. INTRODUCTION

The MST, Inc. Model 2002 Carbon Monoxide (CO) Monitor is a continuous CO monitor utilized to sample compressed breathing air. With additional attachments, this monitor can also be used to monitor AREA locations such as parking garages, maintenance rooms, and the like.

WARNING: THE MST MODEL 2002 CARBON MONOXIDE MONITOR IS NOT APPROVED FOR USE IN HAZARDOUS OR EXPLOSIVE ATMOSPHERES. PERSONAL INJURY, PROPERTY DAMAGE OR DEATH COULD RESULT FROM IMPROPER USE OF THIS DEVICE.

The Model 2002 Monitor comes with internal dry contact-type relays that can be utilized to switch external devices such as solenoid valves, alarms, etc. As shipped from the factory, one of these internal relays is powered with 12-14 VDC to provide power to the Remote Alarm Jack located on the bottom of the unit. Should you wish to utilize both internal relays for other applications, please consult factory prior to making any changes.

The internal relays are factory preset to activate when the CO in the air sample exceeds (10) ppm CO (5 ppm CO in Canada). These can be adjusted, if required. Please consult this manual.

II. DETAILED DESCRIPTION INSIDE CLEAR COVER

DISPLAY:	Indicates the amount of CO present (ppm CO) in the air sample.
FUSE:	Main Power Fuse, 1 A 3AG (TYPE 312).
POWER LAMP:	Green Neon Lamp indicates power supplied to unit.
SPAN:	SPAN Adjustment for calibration.
ZERO:	ZERO Adjustment for calibration.

BOTTOM OF UNIT

SAMPLE LINE:	Sample input to internal sensor. Flow Rate 1.0 SCFH.
POWER CORD:	3-Prong Grounded cord for power connection.
REMOTE ALARM JACK:	1/8" Phono Jack for connecting external remote alarm (P/N 8008403) or remote strobe (P/N 8008503). Also can be used to power other devices rated 12-14 VDC, 500 mA (max.).

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III. OPERATION

PRELIMINARY

1. Connect the Power Cord to a suitable SWITCHED receptacle according to Local, State and National Regulations. Follow proper electrical codes.
2. Observe that the green “Power” lamp illuminates and that the display is operating showing (3) digits. Note: There may be a “-“ sign to the left of the digits, indicating that the reading is below zero.
3. With the included calibration screwdriver (P/N 80044), carefully adjust the ZERO Adjustment Screw, noting the reading on the display before turning and slowly turn the Zero Pot clockwise to increase the reading, counter-clockwise to decrease the reading. At the alarm level setting (10 ppm in US, 5 ppm in Canada) you will hear the relay(s) activate. Verify the setting is correct. Note: The included remote alarm (P/N 8008403) or optional remote strobe (P/N 8008503) may be plugged into the Remote Alarm Jack and instead of listening for the relay to activate, the device should operate. **WARNING: The remote alarm is very loud (120 dB(A) at 3 Meters) and can damage hearing. Place the alarm face against a suitable muffling material or rag of some type to muffle the sound prior to performing the above test.** To adjust the alarm level setting(s), consult this manual.
4. Perform the calibration procedure as outlined in this manual.

IV. NORMAL OPERATION

During normal operation of MST’s Model 2002 CO Monitor, a continuous air sample is pushed through the internal sensor housing at a flow rate of 1.0 SCFH. The internal sensor outputs a current proportional to the amount of CO that is present in the air sample and this current is converted to ppm (parts per million) CO and read on the display. When CO levels above the alarm set point(s) is achieved, the internal relay(s) are activated and either the remote alarm or strobe is activated, or some other suitable device is connected to its own power supply (relays operated as “dry” contacts). The internal relays have the capability of operating in a “Normally Open” condition, or “Normally Closed” position. When powering MST’s remote devices, the unit is factory wired in the “Normally Closed” position (closes on alarm or power failure).

V. MONITOR CALIBRATION

CALIBRATION FREQUENCY

The MST Model 2002 CO Monitor should be calibrated PRIOR TO USE and rechecked after the first (2) weeks. The monitor should then be calibrated on a MONTHLY basis if it is used on a daily or continuous basis. The monitor should be calibrated on a “PRIOR TO USE” basis if it is only used occasionally (non-continuous or non-daily basis).

CALIBRATION PROCEDURE

(MST Calibration Kit P/N 8003101 or 8003102 Required)

Before calibrating the instrument, connect the power cord to the appropriate power source and verify that the green lamp illuminates and the display is operating properly. Allow the instrument to warm up for a period of five (5) minutes or longer prior to the following calibration procedure.

Disconnect the clear PVC Sample tube (1/8" ID) from the flowmeter by pulling forward (towards sample tube) on the collar of the black quick-connect fitting. This will release the sample tube and it can be removed from the quick-connect fitting. **DO NOT REMOVE THE SAMPLE TUBE FROM THE BRASS FITTING ON THE MONITOR.**

Locate the small white plastic tubing reducer (supplied with MST’s calibration kits) and insert the large end of this reducer into the PVC Calibration tubing (3/16" ID) supplied with the calibration kit. Connect the other end of the PVC Calibration tubing (3/16" ID) to the gas regulator supplied with the calibration kit. **WARNING: To avoid damage to the monitor’s sensor, regulators provided by MUST be used.** Insert the small end of the reducer into the Monitor’s Sample Tube (1/8" ID PVC).

Note: MST’s Small Calibration Kit (P/N 8003101) is furnished with a non-adjustable regulator to ease the calibration procedure. Before attempting to use this kit, be certain that the components are connected as shown in the sketch below prior to attaching the calibration gas bottle(s). Once the bottle(s) are connected, gas will begin flowing. MST’s Large Calibration Kit (P/N 8003102) is supplied with a regulator that has an on/off valve that can be turned off to prevent gas flow until needed.

A. ZEROING THE INSTRUMENT

1. Remove the protective plastic cap (if supplied) from the ZERO AIR cylinder outlet.
2. Open the clear cover on the Model 2002 CO Monitor by depressing the latch on the right side and opening the cover by pulling up on the right side of the cover and swinging it to the left (cover is hinged on left side of monitor).
3. Screw the regulator valve onto the ZERO AIR cylinder outlet, making sure not to “cross thread” the regulator on the cylinder outlet port, and tighten regulator firmly.
4. Observe the display on the instrument. The reading should move to zero (000) after approximately (2) minutes. If the display does not read zero (000), adjust the ZERO potentiometer such that display now reads zero (000).

5. When the above steps have been completed, un-screw the regulatory valve from the Zero Air cylinder and replace plastic protective cap (if supplied).

B. SPANNING THE INSTRUMENT

1. Remove the protective plastic cap (if supplied) from the SPAN GAS cylinder, noting the concentration of carbon monoxide printed on the cylinder.
2. Screw the regulator valve onto the SPAN GAS cylinder outlet, making sure not to “cross thread” the regulator on the cylinder outlet port, and tighten regulator firmly.
3. Observe the display on the instrument. The reading will increase, and then stabilize. As soon as reading is stable (approximately one-2 minutes), compare the value indicated on the display, with the value noted on the SPAN GAS cylinder. Adjust the SPAN potentiometer until the reading indicated on the display matches the concentration of carbon monoxide printed on the SPAN GAS calibration gas cylinder.
4. When the above steps have been completed, un-screw regulator valve from SPAN GAS cylinder and replace protective plastic cap (if supplied).
5. Disconnect the associated calibration test tubing from the monitor and re-connect the monitor’s sample tube to sampling supply fitting, securing with locking collar by pushing collar AWAY from monitor’s sample tubing. Be sure tubing is fully inserted into locking collar tube fitting.

Place all calibration kit components back into protective plastic case to prevent damage or loss of components.

WARNING: ONLY QUALIFIED AND TRAINED ELECTRICAL TECHNICIANS SHOULD PERFORM ANY REPAIRS OR ADJUSTMENTS INTERNAL TO THE MONITOR. PROPERTY DAMAGE, PERSONAL INJURY OR DEATH COULD RESULT.

VI. INTERNAL RELAY ADJUSTMENTS

To change/set the internal relays to activate when the carbon monoxide level reaches a specified point, refer to the following procedure (Note: You must have ZERO AIR available to properly perform this procedure).

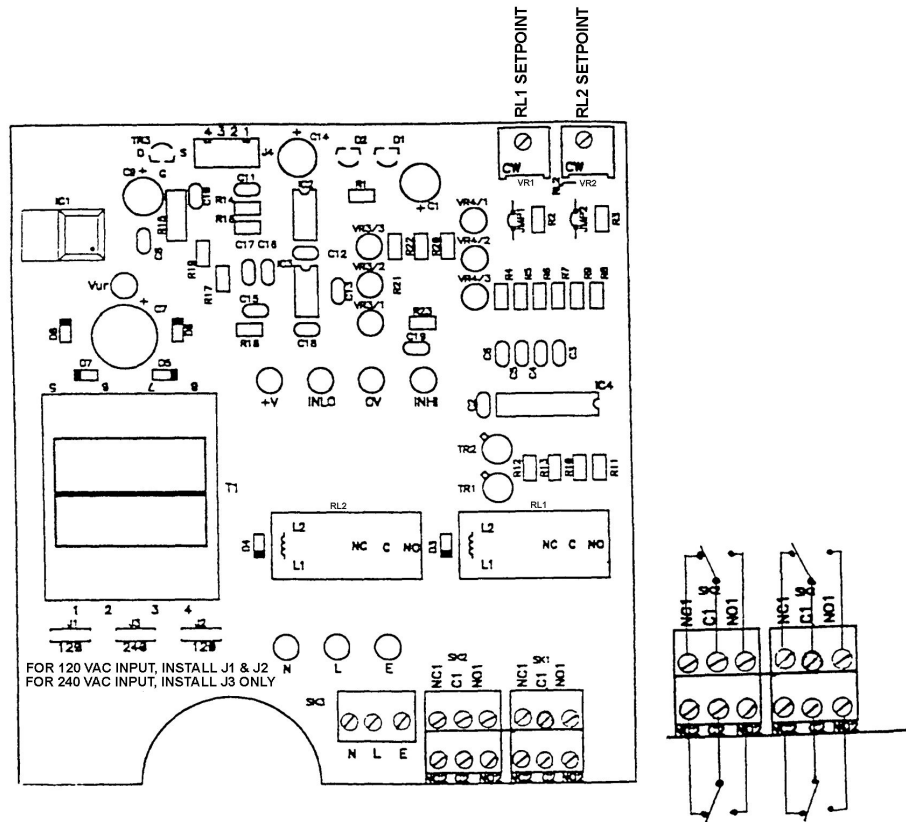
1. Disconnect power source from the monitor and open front clear cover as described in the “Calibration Procedure” noted above.
2. With the proper screwdriver, remove the four (4) small phillips-head screws located on the front cover plate to expose the main circuit board. Carefully lift off the cover by grasping the fuse holder diameter and gently pulling upward. **DO NOT USE EXCESSIVE FORCE AND DO NOT PULL COVER FURTHER THAN WIRING WILL ALLOW. DAMAGE TO MONITOR COULD OCCUR.**
3. Move faceplate cover slightly to the left of the monitor’s plastic housing, being careful not to damage any wiring or components.
4. Locate the two (2) small potentiometers situated in the UPPER RIGHT HAND corner of the main circuit board. The one on the left adjusts RL1 and the one on the

- right adjusts RL2.
5. Making sure that no components are interfering or contacting any of the internal main circuit board components, connect appropriate power source and observe that monitor green power lamp illuminates and display is operating properly.
 6. Slowly adjust the ZERO calibration potentiometer to the setting you wish the internal relay to activate at. Then, slowly adjust the correct RL() potentiometer first counter-clockwise and then clockwise until you hear the relay activate. Slowly adjust the RL() potentiometer counter-clockwise until you just hear the relay activate.
 7. Slowly adjust the ZERO calibration potentiometer counter-clockwise until the monitor display reads "000" and then slowly clockwise until you hear the relay activate. Observe the display to verify that it was the setting you wished the relay to activate at.
 8. Repeat steps 6 & 7 for the second relay, if desired.
 9. Disconnect power source and carefully replace front faceplate, making sure wires are not caught under edge of faceplate and nothing is interfering with internal components or wiring.
 10. Reconnect power source and retest the setting per #7 above.
 11. Re-zero monitor calibration using ZERO air as outlined in the "Calibration Procedure" noted above.

VII. INTERNAL WIRING

Except for sensor replacement, this device contains no user-serviceable parts, however a trained electrical technician may, at their option, attach various control and alarm devices to the terminal strip located under the sensor access door. A ½" electrical "knockout" is provided at the lower end of the monitor (to the right of the Remote Alarm Jack) for purposes of connecting various devices to this monitor. Refer to the following schematic for proper location and connections to terminal strips.

The two (2) banks of two (2) terminal strips on the lower right hand side on the main circuit board are used to provide dry contact relay connections. The relays in the monitor are DPDT-type relays and the lower side of the second bank from the right is utilized by the factory to power the Remote Alarm Jack (making and breaking power derived from the main circuit board). The remaining terminal strips are dry contact-type only. The bank on the farthest right is activated by the alarm setting made by the RL1 adjustment potentiometer. The next bank left of that is activated by the alarm setting by the RL2 adjustment potentiometer. **Proper wiring practices shall be followed in all instances regarding connections to these terminal strips.**



VIII. MAINTENANCE

Except for fuse replacement, sensor replacement and calibration, this device does not require any maintenance unless subjected to abuse or neglect. Make sure the air sample supply is free from any oils, water or solvent to prevent the sensor from premature failure. Keep all solvents away from plastic housing at all times.

SENSOR REPLACEMENT

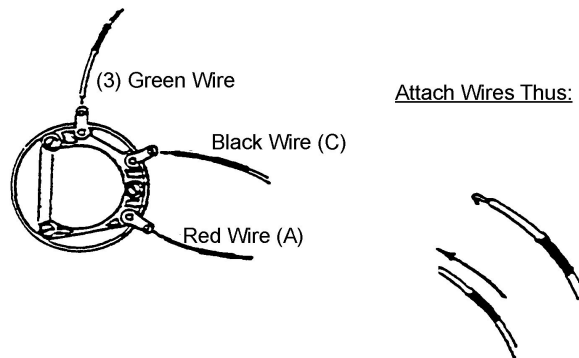
(NOTE: For Revision - REV.3 - versions, skip no's 5 and 6 below - sensor plugs into a small green circuit board and soldering is not required.)

1. Disconnect the monitor from the power source.
2. Loosen the two (2) screws from the front access cover to allow the cover to be removed.
3. The sensor is a circular device secured to a flow housing by three (3) screws that has three (3) colored wire soldered to three (3) tabs that protrude from the edge of the sensor. (NOTE: Revision - REV.3 has plugin type sensor connector and no soldering is required.)
4. Remove the three (3) screws and carefully lift sensor away from sensor flow housing, being careful not to stress the wires or lose the O-ring seal located under the sensor.

5. Snip the three (3) wires (red, black and green) close to the old sensor. Remove and discard the sensor keeping in mind that the sensor contains a small amount of sulphuric acid.

WARNING: SULFURIC ACID IS POISONOUS AND CAN CAUSE SEVERE BURNS. DO NOT ALLOW ACID TO CONTACT SKIN OR EYES. IF EYES ARE EXPOSED TO ACID, FLUSH THOROUGHLY AND SEEK IMMEDIATE MEDICAL ATTENTION. ALWAYS WASH HANDS THOROUGHLY AFTER HANDLING DETECTOR CELL.

6. Strip and tin the three (3) wires and solder them neatly to the three (3) sensor tangs of the new sensor according to the following sketch. **DO NOT USE EXCESSIVE HEAT-SENSOR DAMAGE WILL OCCUR AND THIS WILL VOID WARRANTY.**
7. Replace the sensor in the flow housing, making sure O-ring seal is located properly and secure sensor with three (3) screws.
8. Replace access cover and secure with two (2) screws.
9. Calibrate instrument according to the above "Calibration Procedure."



REPLACEMENT PARTS

(Please contact your local distributor to purchase these parts.)

REPLACEMENT CO SENSOR:	80045
REPLACEMENT SENSOR O-RING	80562
REPLACEMENT POWER LAMP	80570
REMOTE ALARM (W/20' CORD)	8008403
REMOTE STROBE (W/20' CORD)	8008503
SMALL CALIBRATION KIT	8003101
LARGE CALIBRATION KIT	8003102
REPLACEMENT FUSE	80569

Consult Factory for any other replacement parts.

MST INC. SHALL NOT BE LIABLE FOR ANY INJURY, LOSS OR DAMAGE, (DIRECT OR CONSEQUENTIAL), ARISING OUT OF THE USE OF OR THE INABILITY TO USE THIS PRODUCT, BEYOND THE REPLACEMENT OF DEFECTIVE MATERIALS OR WORKMANSHIP. USERS OF SUPPLIED AIR RESPIRATORS SHOULD EVALUATE THEIR OWN PARTICULAR APPLICATION AND PERFORM THEIR OWN TESTS FOR AIR QUALITY TO DETERMINE THE SUITABILITY FOR USE OF THIS PRODUCT.

For further information, or questions about service or maintenance care of this unit, contact your local distributor or MST, Inc. at (800) 542-6646.