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11370 Breininger Rd. Phone: (800) 542-6646  
P.O. Box 87 (888) mod-safe  
Hicksville, OH 43526 (419) 542-6645  
Email: sales@modsafe.com Fax: (419) 542-6475  
www.modsafe.com

**MST, INC.  
MODEL 5700  
MICROPROCESSOR  
MONITOR**

## **OWNER'S MANUAL**

<b>IMPORTANT WARNING</b>
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WHEN THE CO MONITOR IS CORRECTLY INSTALLED AND MAINTAINED, IT MONITORS THE LEVEL OF CARBON MONOXIDE IN THE RESPIRATORY AIR LINE. THE MONITOR <u>DOES NOT</u> REMOVE CARBON MONOXIDE FROM THE AIR
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**SPECIFICATIONS**  
**MST, INC. MODEL 5700 CARBON MONOXIDE MONITOR AND ALARM**

RANGE: 0-199 PPM CO      SERIAL NUMBER: \_\_\_\_\_  
INITIAL ALARM SETTING: U.S.: 10 PPM CO      POWER: 9 V ALKALINE BATTERY  
   Canada: 5 PPM CO      (Transistor type) - 2 each  
DETECTOR TYPE: ELECTROCHEMICAL CELL

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## I. INTRODUCTION

The MST, Inc. Model 5700 Carbon Monoxide (CO) Monitor and Alarm is a side mounted, battery powered unit. The monitor has been designed, and is certified by the Canadian Standards Association (CSA LR-104195) to be INTRINSICALLY SAFE FOR USE IN CLASS 1, DIVISION I, GROUPS A,B,C&D when used with two "9V" alkaline transistor type batteries. When the monitor is powered by the same two "9V" alkaline batteries, the optional Alarm Repeater, (P/N 80444 - see accessories VI.A), is certified INTRINSICALLY SAFE under the same Certification No. for the same Class/Div/Groups as mentioned above. An internal microprocessor controls the indication and alarm functions in response to the indicator of an electrochemical CO Sensor.

It continuously monitors a compressed air sample introduced to its detector at an approximate rate of 1.0 SCFH and it gives an alarm when:

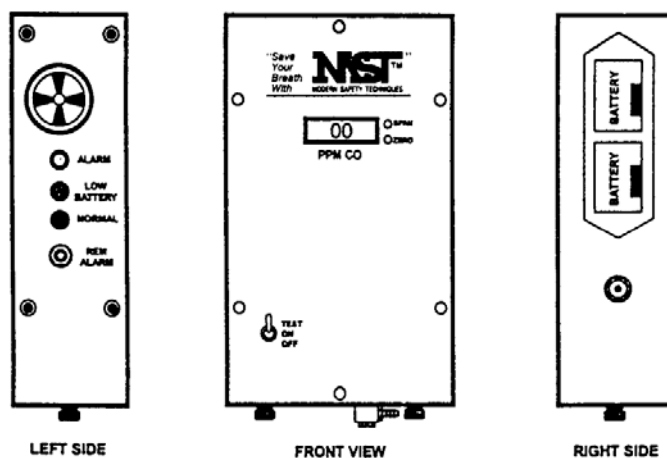
- The CO in the sample exceeds a preset level (adjustable-initially set at 10 PPM; 5 PPM in Canada).
- The battery voltage has diminished to a preset level (non-adjustable).
- There is a discontinuity in the detector circuit.

There are also indicators to show CO concentration and to verify that the instrument is on and operating properly.

The components are assembled into a black powder-coated aluminum housing 6" H x 4" W x 2" D overall. A hose barb, with plastic sample tube attached for introducing the sample gas, extends from the bottom. Available at the front face are the OFF/ON/TEST switch, the display (LCD), SPAN and ZERO adjustments.

The left side contains the indicating lights, the alarm buzzer, and the remote alarm jack. Accessible on the right side are the two battery drawers and the auxiliary power jack.

These items are detailed below.



## II. DETAILED DESCRIPTION

General descriptions of each of the items mentioned in the previous section are provided below. Their functions are indicated in Section III, OPERATION.

### A. FRONT PANEL

#### 1. ON/OFF/TEST Switch

This switch is a three-position type with alternate ON and OFF positions, and a momentary TEST position. Switch is located at the lower left side.

#### 2. Display

Display is a centrally located LCD type and is refreshed every 0.8 seconds; the red ALARM light faintly blinks at the same time.

#### 3. SPAN and ZERO Adjustments

Located to the right of the display are two miniature multi-turn slotted-shaft potentiometers, accessible through holes in the panel with a small screwdriver.

### B. LEFT SIDE

The items listed below are aligned toward the rear from the center of the left side panel and from top to bottom are:

#### 1. Buzzer (Piezoelectric - 85 dB(A) at 1 Ft.)

Buzzer is at the top of the side panel. It provides a continuous tone during high CO alarm, a pulsing tone during certain malfunction conditions.

The next three items are colored LED indicating lights that come on when various conditions, described later, are present.

#### 2. ALARM light

Red ALARM light blinks faintly during normal operation and is on steadily during the high CO alarm condition.

#### 3. LOW BATTERY Light

Amber LOW BATTERY light comes on when battery voltage falls to where the instrument will not function properly (about 7.0V). Batteries should be replaced at this time.

#### 4. NORMAL Light

The green NORMAL light acts as a pilot light and glows when the instrument is turned on. At the same time the red ALARM light flickers faintly at intervals of about one second.

#### 5. REM ALARM

A miniature size phone jack is provided for plugging in a remote alarm device so that the alarm sound can be repeated at a distance from the instrument. The outer shell of the jack is grounded to the case, and is negative. This jack will be energized at battery voltage (about 8.5 VDC when operating from "fresh" internal batteries; about 8.9 VDC when operating from continuous operating adaptor, P/N 80247 and about 12 VDC when operating from an external 12 volt battery )whenever instrument is in alarm condition. The P/N 80444 Alarm Repeater is CSA Approved as a remote alarm device.

**WARNING: THE INTRINSIC SAFETY OF THE INSTRUMENT IS VOIDED WHEN ANY OTHER ACCESSORY IS USED AT THE REM. THE IMPEDANCE OF ANY CONNECTED LOAD DEVICE AT THE REM MUST BE AT LEAST 22 OHMS (FOR 12 VDC OPERATION) OR AT LEAST 12 OHMS (WHEN OPERATING FROM INTERNAL BATTERY OR CONTINUOUS OPERATING ADAPTER, P/N 80247) TO AVOID DAMAGE TO THE INTERNAL CIRCUITS.**

#### C. BOTTOM

A rectangular opening in the bottom allows clearance for the detector which is mounted to the upper face of the bottom plate. The bottom plate is held in place by two knurled thumbscrews. The sample inlet fitting and tubing extends from the outer face of the bottom plate.

#### D. RIGHT SIDE

These items are aligned toward the rear of the right side panel.

##### 1. Battery Compartments

There are two battery compartment drawers near the top. They contain the two 9V "transistor" type alkaline batteries, connected in parallel, which power the instrument.

##### 2. Auxiliary Power Jack

A 2.5 mm pin jack is located near the bottom for operating the instrument from an auxiliary 12 V batter or from a Continuous Operation Adapter (COA) An auxiliary battery will extend the time of operation considerably, and the COA will power the instrument as long as power is supplied to it. The outer shell of the jack is grounded to the case and is negative.

**WARNING: THE INTRINSIC SAFETY OF THE INSTRUMENT IS VOIDED WHEN P/N 80247 CONTINUOUS OPERATING ADAPTER OR P/N 80123 12 VDC ADAPTER IS IN USE.**

### **III. OPERATION**

#### **A. PRELIMINARY**

1. Turn instrument on and allow about 5 minutes to stabilize. Verify that the amber LOW BATTERY light is off. (See MAINTENANCE, V.A.)
2. Push up and hold switch in the TEST position.
  - a) The red ALARM light will come on verifying the CO alarm circuit operation.
  - b) The amber LOW BATTERY light will also come on, verifying the low battery detection circuit.
  - c) Green NORMAL light will blink several times, then come on steady verifying continuity of the detector circuits.
  - d) The buzzer will sound and the REM ALARM jack will be energized.
  - e) The display will show an upscale reading.
  - f) Release the switch. Indicators will return to normal and display may first show a negative indication (-XX), then return close to 00.
3. Remove sample inlet tube from sample metering valve outlet fitting and introduce a sample of zero air or nitrogen, free of CO and interfering gases, to the sample inlet tube. The sample flow should be between 0.5 and 1.5 SCFH.
4. Verify that the green NORMAL light is on, the red ALARM light is flickering about once a second and the display is showing 00 (zero), (see Calibration and Adjustment, IV.A).
5. Remove the zero air sample and introduce a known sample of 50 to 150 ppm CO to the sample inlet tube. The sample flow should be between 0.5 and 1.5 SCFH.
6. Verify that the display readings rise upscale and the alarm light and buzzer operate (See Calibration and Adjustment, IV. B).
7. Remove the CO sample.
8. Insert the sample tube into the metering valve outlet fitting and lock in place.
9. Instrument is now ready for normal use. Turn OFF when not in use.

## MONITOR CALIBRATION FREQUENCY:

MONTHLY CALIBRATION\*: If monitor is used on continuous basis, (daily or weekly use).

PRIOR TO USE CALIBRATION\*: If monitor is used on a non-continuous basis.

\*If monitor's alarm is energized, always check calibration to be sure monitor is not malfunctioning and or out of calibration producing a false alarm/reading.

### B. NORMAL OPERATION

1. Instrument will analyze the sample and show CO content on the display, in parts per million (PPM). The green NORMAL light will glow continuously and the red ALARM light will flicker about every second.
2. When the CO concentration exceeds the alarm point (initially set at 10 PPM, 5 PPM for Canada) the red ALARM light will come on steady, the green NORMAL light will go off, the buzzer will sound a steady tone, and the REM ALARM jack will be energized.
3. When the CO concentration drops below the alarm setting, the indicators will automatically return to normal as in paragraph 1 above.

### C. ABNORMAL INDICATIONS

#### 1. Low Battery

As the battery voltage declines toward the end of its life, the following indications occur, which assure that the problem will not be overlooked:

- a) At 7.0 volts, the amber LOW BATTERY light will come on. Battery replacement is recommended at this point, but continued operation is still possible.
- b) At 6.4 volts the buzzer will beep at intervals of about 7 seconds.
- c) At 5.8 volts the buzzer will beep at 1-second intervals and the display will go to --. This malfunction indication will continue until the battery is completely dead.

#### 2. Detector (cell) open circuit

If there is a discontinuity in one or more of the detector leads, or internal to the cell itself, the following malfunction indications will occur:

<u>Open Wire</u>	<u>Green Pilot</u>	<u>Amber Light</u>	<u>Red Light</u>	<u>Buzzer</u>	<u>Display</u>
Red (SENS)	pulsing	off	pulsing	pulsing	SC
Black(CNTR)	pulsing	off	pulsing	pulsing	SC
Blue (REF)	off	off	steady	steady	+1 or 199
All	pulsing	off	pulsing	pulsing	SC

3. Display will not read upscale.

If the display will not move from zero (00) when detector is exposed to sample of CO:

- a) SPAN adjustment set to zero--recalibrate SPAN and set ZERO.
  - b) Cell has lost sensitivity--replace cell.
  - c) Circuit malfunction--repair is needed.
4. Display goes off scale (1).
- a) CO concentration greater than 199 ppm.
  - b) REF wire disconnected or cell has internal failure.
  - c) Circuit malfunction; repair is needed.
5. Display goes below 0 (-02,-1 or SC).
- a) ZERO misadjusted--readjust as in paragraph III. -A-1 through 5.
  - b) SENS, CNTR or all wire(s) disconnected or cell has internal failure.
  - c) Circuit malfunction--repair is needed.

#### **IV. CALIBRATION AND ADJUSTMENT**

After each adjustment in the following steps, allow time for the changes to stabilize. Recheck all adjustments. Turn instrument on and allow at least 5 minutes warm-up before calibration and adjustments are made.

##### **A. ZERO ADJUSTMENT**

1. Remove sample inlet tube from sample metering valve outlet fitting and introduce a sample of zero air or nitrogen, free of "CO" and interfering gases, to the sample inlet tube. The sample flow should be between 0.5 and 1.5 SCFH.
2. Verify that the green NORMAL light is on, the red ALARM light is flickering about once a second and the display is showing "00". If the display is showing other than "00", adjust the ZERO potentiometer (next to the display) so that the reading is "00". Clockwise adjustment increases reading. Notice that the display jumps from 00 to +02 to -02. Try to set the potentiometer midway between the two extremes. Remove the zero air sample.



## B. SPAN ADJUSTMENT

To set the span of the instrument, follow the steps below:

1. Introduce a known sample of 50 to 150 PPM "CO" to sample inlet tube. The sample flow should be between 0.5 to 1.5 SCFH.
2. Verify that the green NORMAL light is off, the red ALARM light is on full bright and the stabilized reading (after approximately one minute) is equal to the known concentration of "CO". If the display is showing a difference, adjust the SPAN potentiometer (next to the display) to obtain proper value. Turn clockwise to increase reading. If the span adjustment cannot be made as indicated, the detector needs to be replaced. SEE MAINTENANCE, V.B.
3. Remove the known sample and return the sample inlet tube to the sample metering valve outlet fitting and lock in place.. The instrument is now properly adjusted for use.

## C. ALARM ADJUSTMENT

The alarm level (initially set as shown on the specification page) can be changed if desired, as follows:

1. Remove the screw on upper front edge of right side of case.
2. Using a small-blade screwdriver through the screw hole, locate the ALARM adjustment slotted potentiometer.
3. Set the display reading to the desired alarm level with the ZERO potentiometer.
4. Turn the ALARM potentiometer clockwise until the alarm just activates.
5. Check the setting by turning the ZERO potentiometer CW and CCW to cause the instrument to go into and out of alarm. Observe display to confirm alarm setting level.
6. Return the display reading to 00 with the ZERO potentiometer (NOTE: Zero gas should be used when performing this adjustment).

## V. MAINTENANCE

### A. BATTERIES

Check batteries each time instrument is turned on by noting that the green NORMAL light is on and the amber LOW BATTERY light is off. If the amber light is on, the batteries need replacing.

Batteries are contained in drawers on the right-hand side. To replace the batteries:

1. Pull the small slot in the drawer face toward the front of the instrument to unlatch the drawer and pull the drawer out of the housing.
2. Pry battery out of drawer with fingers and replace with a fresh 9V alkaline transistor type battery, providing for proper polarity by placing minus (-) terminal uppermost in holder. Place bottom of fresh battery against spring and press into place.

**CAUTION: OBSERVE PROPER POLARITY WHEN INSERTING BATTERIES. POLARITY IS MARKED ON THE INSIDE OF THE DRAWERS.**

3. Push drawer back into housing until it latches in place. Drawers inserted incorrectly will not latch.
4. Repeat above steps for the second battery. (It is possible to operate with only one battery, but operating hours will be greatly reduced).

## B. DETECTOR

If the zero or span adjustments cannot be made within the range of their respective potentiometers, the detector needs to be replaced. To replace detector:

1. Remove the two knurled thumb screws at bottom.
2. Pull the bottom plate off of the housing as far as the wiring will allow.
3. Remove detector cell from its cavity in the flow block on top of bottom plate.
4. Pull wire connectors off the pins on the sensor, noting the color coding.
5. Discard old detector cell, keeping in mind that it contains a small amount of sulfuric 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.**

Attach wires to new detector as listed below. If new detector was received with a shorting wire between the Sensing and Reference terminals, remove and discard the wire.

### **Wire Color**

Black  
Blue  
Red

### **Detector Terminal**

CNTR  
REF  
SENSING

6. Put a small amount of Vaseline or similar lubricant on the O-ring seal within the block. Then push the cell into the block until it seats on the ledge half way down.
7. Replace bottom plate and secure it with thumb screws.
8. Allow at least one hour for stabilization, then calibrate as in CALIBRATION AND ADJUSTMENT, IV.-A and B.

#### C. MAIN CIRCUIT BOARD

The principal electronic components are all installed on a printed circuit board which is secured to the front panel by three screws. The board can be removed by taking out the front panel screws and removing the panel, then taking out three screws holding the circuit board to the panel. The wires can then be unplugged from their sockets along the edge of the board. The board can then be sent to MST, Inc. for repair or exchange.

#### D. OTHER COMPONENTS

All of the remaining electronic components are secured to a printed circuit board and are not readily field replaceable. If further repair is needed, it is required that the entire instrument be returned to the factory for rework, to maintain the Intrinsic Safety of instrument.

#### E. REPAIR

For repair of other components, it is recommended that you call your local distributor or MST @ 1-800-542-6646 or 1-888-MOD-SAFE.

### VI. ACCESSORIES

#### A. ALARM REPEATER - P/N 80444

This accessory is a piezoelectric audible alarm (85 dB (A) at 1 Ft.) with a 6 Ft. shielded cable that plugs into the REM of the instrument. It is CSA APPROVED INTRINSICALLY SAFE for use in Class 1, Division I, Groups A,B,C&D when instrument uses two "9V" transistor type alkaline batteries for the power source.

**WARNING: THE INTRINSIC SAFETY OF THE INSTRUMENT IS VOIDED WHEN THE FOLLOWING ACCESSORIES ARE USED.**

#### B. CONTINUOUS OPERATION ADAPTER (115 VAC) - P/N 80247

This accessory will supply operating power to the instrument as long as it is plugged into active 115V AC outlet, whether or not batteries are installed. The Adapter will convert the 115 VAC to 7.5 VDC, 650 mA.

1. Plug continuous operation adapter into an active, fused (1 amp) 115 V 50/60Hz outlet. NOTE: To prevent unnecessary electrical interference, the outlet should be on a dedicated circuit free of any intermittent heavy loadings such as pumps, compressors or heaters.
2. Plug adapter cord connector into socket on the lower right-hand side of the instrument.
3. Adapter will power the instrument as long as the 115 VAC source remains active.
4. Since the adapter voltage is slightly higher than that of the internal batteries, the adapter will supply the power. Blocking diodes protect the internal interface.

#### C. CONTINUOUS OPERATION ADAPTER (12 VDC) - P/N 80123

This accessory will allow the use of an external 12 volt DC battery, such as an automotive or compressor battery, to provide continuous operation of the instrument. Care must be taken to observe that the proper voltage (12 VDC) and polarity (Red clip is positive, Black clip is negative) is maintained.

**WARNING: FAILURE TO OBSERVE PROPER POLARITY AND/OR PROPER VOLTAGE COULD RESULT IN PERSONAL INJURY, DAMAGE TO THE INSTRUMENT AND VOIDING OF WARRANTY.**

#### D. RECHARGEABLE BATTERY PACK (12 VDC) P/N 8013501

This battery is used where the instrument is to be operated for a prolonged time without AC power. The Rechargeable Battery System consists of a 12 Volt, 4.5 Amp-Hour sealed lead acid-type battery enclosed in a 4.75" W x 4.75" H x 3.7" D protective plastic housing, UL listed 12 Volt DC, 200 mA charger (P/N 80135) and connecting cord (P/N 8038301) to allow the system to be connected to the instrument.

1. Plug connecting cord (P/N 8038301) from battery into instrument's socket located on lower right-hand side.
2. A fully charged battery (24 hour charge time) should power the instrument up to 250 hours.
3. Since the voltage of the Rechargeable battery is slightly higher than that of the 2 internal 9-Volt transistor type batteries, the rechargeable battery will supply the power when connected. Blocking diodes protect the internal 9-Volt transistor-type batteries

#### E. REMOTE EXTERNAL ALARM/STROBE - P/N 8066901

This accessory is a piezoelectric audible alarm (110 dB (A) at 10 ft.) with a 20 Ft. cord that plugs into the REM of the instrument. This alarm can be supplied with up to 250 Ft. of cord.

- F. REMOTE EXTERNAL STROBE - P/N 8008503  
(The continuous operation adapters, P/N 80247 or 80123, must be used in conjunction with this accessory due to voltage requirements).

This accessory is a 150,000 CP strobe with a flash rate of 60 per minute. The operating life of this strobe is 800 hours. The strobe comes with a 20 ft. cord that plugs into the REM of the instrument. This alarm can be supplied with up to 250 Ft. of cord.

## VII. PARTS LIST

The following is a list of optional accessories and items that would most likely need replacement during the life of the instrument.

<u>Identifier</u>	<u>Description</u>
80052	Normal light, green
80053	Alarm light, red
80081	Low battery light, amber
80082	Buzzer
80132	Battery, alkaline, 9 V transistor type (utilizes two)
80133	Cell, CO detector
80061	Flow block
80062	Thumb screw, 10-32 (two required)
80247	Continuous Operation Adapter, 115 VAC ( <i>VOIDS Intrinsic Safety</i> )
80123	Continuous Operation Adapter, 12 VDC ( <i>VOIDS Intrinsic Safety</i> )
8013501	Rechargeable Battery Pack System, 12 VDC ( <i>VOIDS Intrinsic Safety</i> )
8066901	Remote External Alarm/Strobe - 20 Ft. Cord ( <i>VOIDS Intrinsic Safety</i> )
8008503	Remote External Strobe - 20 Ft. Cord ( <i>VOIDS Intrinsic Safety</i> )
80444	Alarm Repeater - 6 Ft. Shield Cable ( <i>Approved Intrinsically Safe</i> )