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**MST, INC.  
MODEL 5701  
MONITOR FOR  
CARBON MONOXIDE AND OXYGEN**

**OWNER'S  
MANUAL**

**IMPORTANT WARNING**

WHEN THE CO MONITOR IS CORRECTLY INSTALLED AND  
MAINTAINED, IT MONITORS THE LEVEL OF CARBON  
MONOXIDE AND OXYGEN IN THE RESPIRATORY AIR LINE.

THE MONITOR DOES NOT  
REMOVE CARBON MONOXIDE FROM, NOR ADD OXYGEN TO  
THE AIR

**SPECIFICATIONS****MST, INC. MODEL 5701 CARBON MONOXIDE/OXYGEN MONITOR AND ALARM**

RANGE: 0-199 PPM CO  
0-25% O<sub>2</sub>

SERIAL NUMBER: \_\_\_\_\_

INITIAL ALARM SETTING: U.S.: 10 PPM CO      POWER: 9 V ALKALINE BATTERY  
Canada: 5 PPM CO      (Transistor type) - 2 each  
19.5% O<sub>2</sub>

DETECTOR TYPE: ELECTROCHEMICAL CELLS

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## I. INTRODUCTION

The MST, Inc. Model 5701 Combination CO and O<sub>2</sub> monitor is an expanded version of the Model 5700 Carbon Monoxide Monitor and Alarm. It consists of a Model 5700 with an added O<sub>2</sub> section, testing the same air sample for CO and oxygen simultaneously, giving separate and independent readings of the two gases and actuating visual and audible alarms whenever either gas goes beyond its preset limits.

### A. *Model 5700 CO Monitor Section*

The MST, Inc. Model 5700 Carbon Monoxide (CO) Monitor and Alarm is a side mounted, battery powered unit. The monitor has been designed, 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. An internal microprocessor controls the indication and alarm functions in response to the indications 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). **NOTE: This monitor will also react to Hydrogen Sulfide (H<sub>2</sub>S).**
- 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.

### ***B. Oxygen Monitor Section***

The oxygen circuitry is built into a small metal housing which is screwed to the top of the 5700. A digital display on the front reads oxygen percentage from 0.0 to 25.0. A slotted shaft control to the left of the display is used to adjust the sensitivity of the circuit to give a correct reading on a known oxygen concentration.

The electronic circuit board within the housing connects to the interior of the Model 5700 by means of five wires extended through a grommet placed in the top of the 5700 housing.

These wires are soldered to terminals on the connector board inside the 5700 except for the two wires which connect to the oxygen sensor by means of push on connectors on a small circuit board.

A special two-cavity flow block is provided to hold the two sensors, CO and oxygen, and inlet and outlet fittings on the bottom allow flow to enter and leave the block.

An alarm adjustment potentiometer is installed within the oxygen section housing. It can be rotated to change the alarm setting, which is initially set at 19.5. The potentiometer is only accessible when the two screws through the top are removed so the accessory can be tilted back.

## **II. DETAILED DESCRIPTION**

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

### **A. 5700 MONITOR 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**

CO 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. OXYGEN A280 MODULE FRONT

1. DISPLAY

O<sub>2</sub> display is a centrally located LCD type and indicates percent of oxygen in sample air.

2. SPAN Adjustment

Located to the left of the display is a miniature multi-turn slotted-shaft potentiometer; accessible through a hole in the module with a small screw driver.

C. 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 and a pulsing tone during a low oxygen alarm and 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. It pulses on and off during a low oxygen 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.

## D. BOTTOM

A rectangular opening in the bottom allows clearance for the detectors which are 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.

## E. 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 battery 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.

## III. OPERATION

### A. PRELIMINARY

1. Turn power switch on and allow circuit about 5 minutes to stabilize. Verify that the green NORMAL light is on and the amber LOW BATTERY light is off. (See MAINTENANCE, V.A.)
2. Verify that the OXYGEN display is on, and reads about 20.

3. Push toggle switch up and hold it 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 CO display will show an upscale reading, O<sub>2</sub> display will not change.
  - f) Release the switch. Indicators will return to normal and display may first show a negative indication (-XX), then return close to 00.
4. Remove sample inlet tube from sample metering valve outlet fitting and introduce a sample of zero air, free of CO and interfering gases, to the sample inlet tube. The sample flow should be between 0.5 and 1.5 SCFH.
5. 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).

Verify that the Oxygen reading goes to 20.9 or 21.0 %, (see Calibration and Adjustments, IV.A)
6. 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.
7. Verify that the CO display reading rises upscale and the alarm light and buzzer operate (See Calibration and Adjustment, IV. B).
8. Remove the CO sample.
9. Insert the sample tube into the metering valve outlet fitting and lock in place.
10. 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 Model 5700 display, in parts per million (PPM). The green NORMAL light will glow continuously and the red ALARM light will flicker about every second.

The oxygen display will show oxygen content of the sample in percent oxygen, which if normal will read 21%.

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.

When the oxygen concentration drops below 19.5%, the red ALARM light will pulse on and off as will the buzzer and the green NORMAL light will be on steady.

When either abnormal condition is corrected, the indicators and alarms will automatically return to normal.

### 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. CO Sensor open circuit

If there is a discontinuity in one or more of the sensor 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. Oxygen Sensor open circuit

If oxygen sensor or its wiring becomes disconnected, the oxygen pulsing alarm will come on.

## 4. CO 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.

## 5. CO 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.

## 6. CO 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.

7. Oxygen display low reading

If the oxygen reading cannot be set as high as 21, oxygen sensor needs replacement.

#### 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 adjustments are made.

##### A. ZERO CO ADJUSTMENT AND OXYGEN SPAN ADJUSTMENT

1. Remove sample inlet tube from sample metering valve outlet fitting and introduce a sample of zero air, 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 CO 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.

During this test, confirm that oxygen display reads 20.9 to 21. If it does not, turn the SPAN adjustment screw next to the Oxygen display to make display read 20.9% or 21.0% oxygen.

##### B. CO 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 and 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. CO 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 CO 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).

#### C. OXYGEN ALARM ADJUSTMENT

The oxygen alarm level is factory-set but can be adjusted using the internal potentiometer. To adjust:

1. Remove two screws from the top of oxygen section, allowing the housing to be tilted to the rear.
2. When tilted, the small internal potentiometer is accessible, and can be turned with a small screwdriver.
3. While instrument is in operation, turn oxygen SPAN to give the reading at which the alarm action is desired.
4. Turn the ALARM potentiometer clockwise until the alarm is off; then turn it counterclockwise slowly until the alarm just comes on.
5. Return the SPAN setting to 21.0; the alarm will stop. (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. CO SENSOR

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

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. Unscrew the two screws holding socket plate to flow block on top face of bottom plate.
4. Unplug the socket plate from the top of the sensor.
5. Remove sensor cell from its cavity in the flow block on top of bottom plate.
6. 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.**

7. Plug the 4-wires socket onto the sensor, carefully aligning the four pins. If new detector was received with a shorting spring between the Sensing and Reference terminals, remove and discard the spring.
8. Confirm that there is an O-ring seal within the block. Then insert the cell into the block and secure it in place with the two screws. Tighten snugly, but not enough to bend the socket plate severely.
9. Replace bottom plate and secure it with thumb screws.
10. Allow at least one hour for stabilization, then calibrate as in CALIBRATION AND ADJUSTMENT, IV.-A and B.

#### E. OXYGEN SENSOR

When oxygen cell fails, it will produce a low reading that cannot be corrected at maximum setting of SPAN control. To replace:

1. Remove bottom plate, giving access to the flow block.
2. Unplug the two-wire connector that mates with the tabs on back of sensor.
3. Work the sensor out of its holder, by pushing back and forth while pulling out of block.
4. Install new oxygen sensor, Part No. 80367 in the same way, first lubricating the O-ring seal lightly with vaseline. Be sure the sensor is installed with the label facing in the same direction as before, so polarity will be correct.(NOTE: Grey wire is “negative” and White wire is “positive”).
5. Reset SPAN as before.

#### D. 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.

E. 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.

F. 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.

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 - P/N 8008403**

This accessory is a piezoelectric audible alarm (119 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. INTRINSIC SAFETY**

The Model 5700 was designed to be intrinsically safe for use in hazardous environments, and in its standard form it carries CSA Approval LR 104195. The Model 5701 is equally safe from an electrical standpoint, but has not been submitted for examination as yet so cannot carry the CSA label.

The accessories listed in Section VI, with the exception of VI. A., have not been submitted to CSA so should not be considered suitable for use in classified hazardous areas.

## VIII. PARTS LIST

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

<b><u>Identifier</u></b>	<b><u>Description</u></b>
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
80367	Cell, Oxygen detector
	Flow block, combination CO and O <sub>2</sub> cable, CO sensor
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> )
8008403	Remote External Alarm - 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> )