# NFPA COMPLIANT

**The Nyad Carbon Monoxide Analyzers meet or exceed CGA Grade-D specifications for air quality as adopted by Federal OSHA.**

**The Nyad Carbon Monoxide Analyzers' quality standards meet or exceed OSHA 1910.134 requirements. When the components are used in accordance with the manufacturer's instructions and recommendations, the "analyzer" meets or exceeds federal regulations presently in force.**

**The Nyad Carbon Monoxide Analyzer should be calibrated monthly and the Carbon Monoxide Sensor shall be replaced every 2 years for accuracy in accordance to the manufactures recommendation.**

1) **OSHA REGULATIONS (Standard-29 CFR) Respiratory Protection 1910.134**

2) **1910.134(i)(1)(ii)(C) Carbon monoxide (CO) content of 5—10 ppm or less.**

**Nyad Carbon Monoxide Analyzer detection range is 0-2,000 ppm and is equipped with alarms when safe levels (5—10 ppm) are exceeded.**

NFPA



nyad inc. process gas analysis

# SERIES 500N

## CARBON MONOXIDE ANALYZER OPERATIONS MANUAL

# INDEX

## SECTION PAGE



# APPENDIX



# RETURN POLICY

Before returning any items (except for recalibration service and repairs) you must call 925.270-3971 8:30 a.m. – 5:00 p.m. PST. Monday through Friday for approval.

Product may be returned for a full refund/credit within 30 days from the date that Nyad originally shipped and must be returned in their original new condition.. Exceptions for special order. Returns for special orders will have 30% restocking fee and must be approved.

Items returned in damaged or altered conditions which cannot be resold as new will have a 30% restocking fee.

All returned items are subject to inspection for use and damage before credit is issued. Returns may incur additional charges if product is returned in damaged conditions.

**Manufacture Warranty/Defective Claims** - You may return product to us for rework, exchange and/or request a full refund/credit. Request must be made from the original purchaser. Upon receipt of a returned item, Nyad will evaluate and determine the warranty claim.

**Damaged Items** – It is your responsibility to inspect your packages for damages/defect on delivery. If product is damaged in transit to you, we must be notified immediately (within 24 hours) so that we can submit a claim the our freight carrier.

**Lost Packages** – Lost Packages must be reported within 30 days of shipment date and verification from the freight carrier that product has not been delivered.

Please contact or email us for further important instructions on filing a lost or damaged package claim.

# TECHNICAL SUPPORT

Nyad, Inc. will offer Technical Support via telephone or email. All technical support shall be related to the Nyad Equipment only. Any other technical issues involving other products and services to the Nyad Equipment will not be the responsibility of Nyad, Inc.; however, our technical support team will offer their best knowledge and support involved in the Nyad Equipment.

**Warranty/Technical Support:**


Ph (925) 270-3971 ext 4
Contact: Dorothy Natividad
Email: Dorothy@nyad.com
www.nyad.com

# WARRANTY

**WARRANTY TERMS**

Nyad, Inc. warrants to the original consumer purchaser that all parts used in the construction or fabrication of the Nyad Equipment will be free from defects in materials and factory workmanship, under normal use and service for ***five years*** from the date of delivery.

Warranty coverage provides the necessary repairs or parts replacement found by Nyad, Inc. to be defective due to bad workmanship or faulty materials.

**LIMITATIONS OF WARRANTY**

The Nyad Equipment is restricted to inspection (FOB the Factory) before warranty is determined, unless other arrangements have been made by Nyad and the original consumer purchaser.

This warranty does not apply to routine service/maintenance, calibrations, repairs and replacement of the carbon monoxide sensor every twenty-four (24) months in accordance with manufacturer's recommendation, or replacements made necessary by fire or water damage, or accident to or improper installation by others, alteration, misuse or abuse to the Nyad Equipment.

This warranty does not cover labor charges or cost incurred for time and expense by other service agencies or personnel involved in maintaining the Nyad Equipment.

**Application of this Warranty is further conditioned upon the following:**

**Installation**. The Nyad Equipment must be properly installed in accordance with Nyad's installation procedures and instructions.

**Proper Maintenance and Operation**. The Nyad Equipment must be properly maintained and operated in accordance with Nyad's maintenance and operating procedures. All service parts must be acquired from Nyad or its authorized representative.

**No Alteration**. The Nyad Equipment must not have been modified or altered from its original conditions at the date of delivery or installation.

**Failure to comply with any of these conditions will void this Warranty.**



# 1. A QUICK TOUR

Your CO monitor is a self-contained unit capable of measuring the concentration of Carbon Monoxide in the range of 0 to 1,000 parts per million by volume *(ppmv).*

The CO monitor features two adjustable alarm contacts, an analog or optional digital signals with adjustable zero and span values and in addition to these features, an auto-calibration function.

# 2. A QUICK HOW-TO

Here's how to place your CO Analyzer into service.

a) Connect a regulated source of sample gas to the 1/8" FNPT connection on the side of the instrument. Inlet pressure should be between 10-20 psig. with a recommended sample flow rate of 200 to 500 cc/min.

b) Connect the instrument to a power source; 115/220 VAC 50/60 Hz, or 12VDC in some units. On NEMA 4 enclosures, it will be necessary to remove the plastic cover to access the switches beneath the front panel.

c) Turn the POWER switch to ON. The switch is located on the left side of the front panel. The CO Analyzer will cycle through its diagnostic routine.

d) The startup routine is complete when a LED above the display comes on and the CO concentration is indicated in units of ppm.

## 3. THE SENSOR

The CO sensor is an electrochemical cell which has a life expectancy of about 2 years. Since the cell is an electrochemical device which is self-depleting, the cell output will gradually decrease as it is used.

**SHELF LIFE EXPECTANCY**: APPROXIMATELY 1 YEAR

The sensor uses capillary diffusion barrier technology, which results in a low temperature coefficient and a direct response to concentration relatively unaffected by pressure. The use of electrodes based on fuel cell technology gives a high reserve of activity which makes for long-term stability.

Carbon Monoxide diffusing to the sensing electrode (anode) reacts according to the equation.

$$CO + H_2O = CO_2 + 2H^+ + 2e$$

At the counter electrode (cathode) the reaction is:

$$O_2 + 2H^+ + 2e = 2H_2O$$

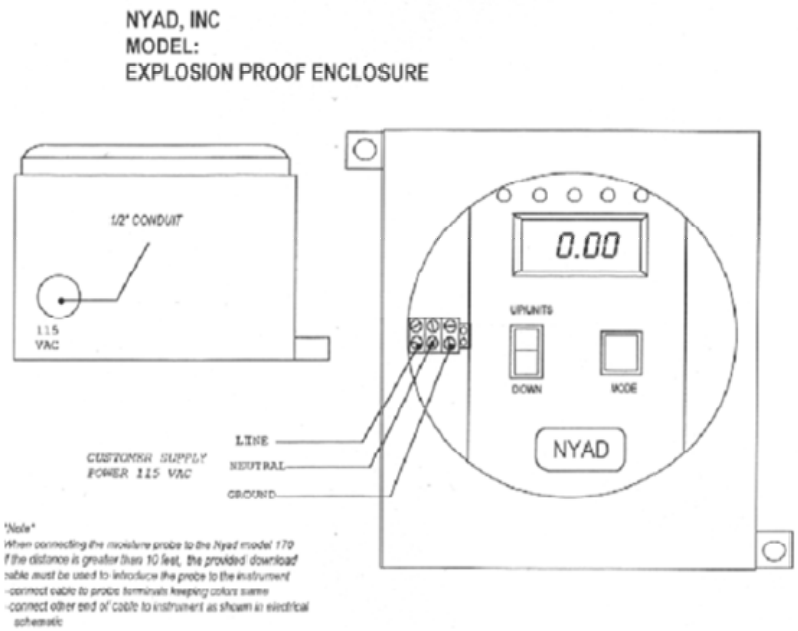
the oxygen requirement being automatically supplied from ambient by controlled diffusion.

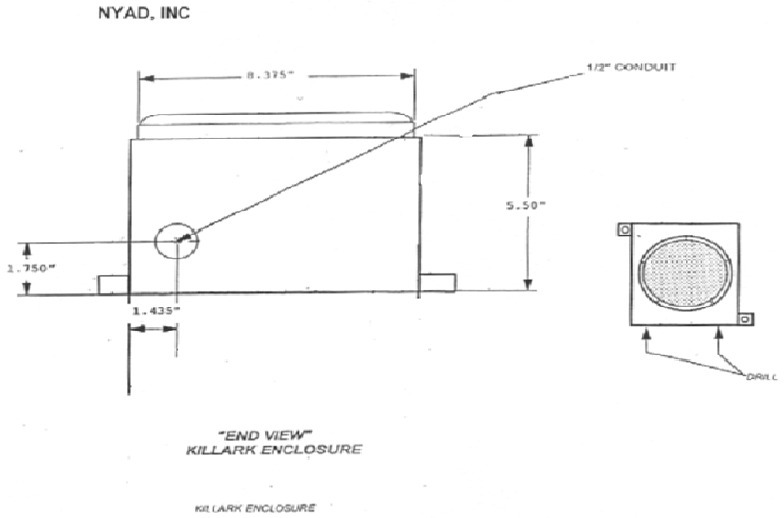
## 4. THE ELECTRONICS

The electronics section of the NYAD Series 500N CO Analyzers, is microprocessor based. The various NYAD sensors all produce a millivolt output. The signal enters the receiver section of the main electronic board which then shapes and amplifies the incoming signal and directs it to the microprocessor.

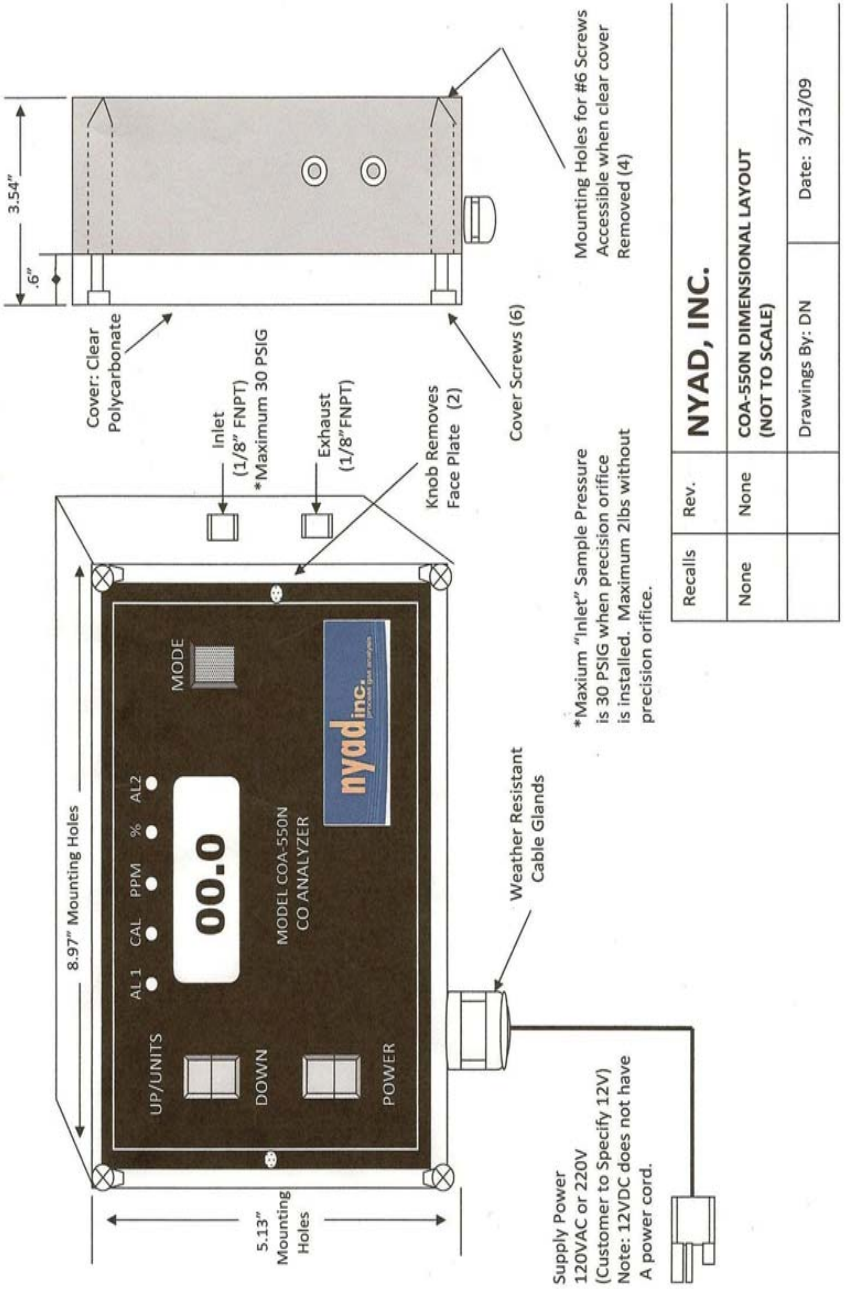
The signal is amplified and converted to engineering units using memory-resident tables containing the relationship between signal and engineering units. The end product of this electronic process is displayed in terms of parts per million by volume (PPMV).






COA-570N (A.5)




COA-550N (A.4)



At this point, the processor performs three functions:

a) Activates the two adjustable alarm contacts (SPDT relays).

b) Analog or Digital (optional) output signals.

c) Displays the measured values on a 4-digit LCD display.

Nyad offers two analog outputs, either a 0-5 volt DC or a 4-20mA current output. Other analog outputs and digital outputs are available and can be factory set as 0-1VDC or 0-10VDC and RS232 or RS485). The zero point and span of these outputs are adjustable in software over the full range of engineering units being measured.

In summary, the microprocessor-based system for all NYAD Analyzers has the function of measuring and amplifying the signals from whichever sensor is being used then converting to engineering units, displaying the value, controlling the adjustable alarm circuitry, and driving the analog output.

## 5. STARTUP DISPLAY

After the analyzer has been installed, all electrical connections have been made and power turned on, the instrument will proceed through its power-up routine with the display and indicators stepping through the following sequence:

a) Displays all segments ON and all LED indicators ON for one second. This step verifies the operation of those devices.

b) Displays the word NYAD for one second.

c) The display indicates the version of the current operating system software. All LED indicators are off followed by EE1.

d) The last step in the startup routine is the display of the current measurement in the units indicated by the

LED located directly above the display. In Approximately six seconds, any alarm conditions will be shown by a red LED alarm indicator.

## 6. FRONT PANEL CONTROLS

The NYAD Model 550N CO Analyzer has two front panel controls that allow the operator to interact with the instrument.

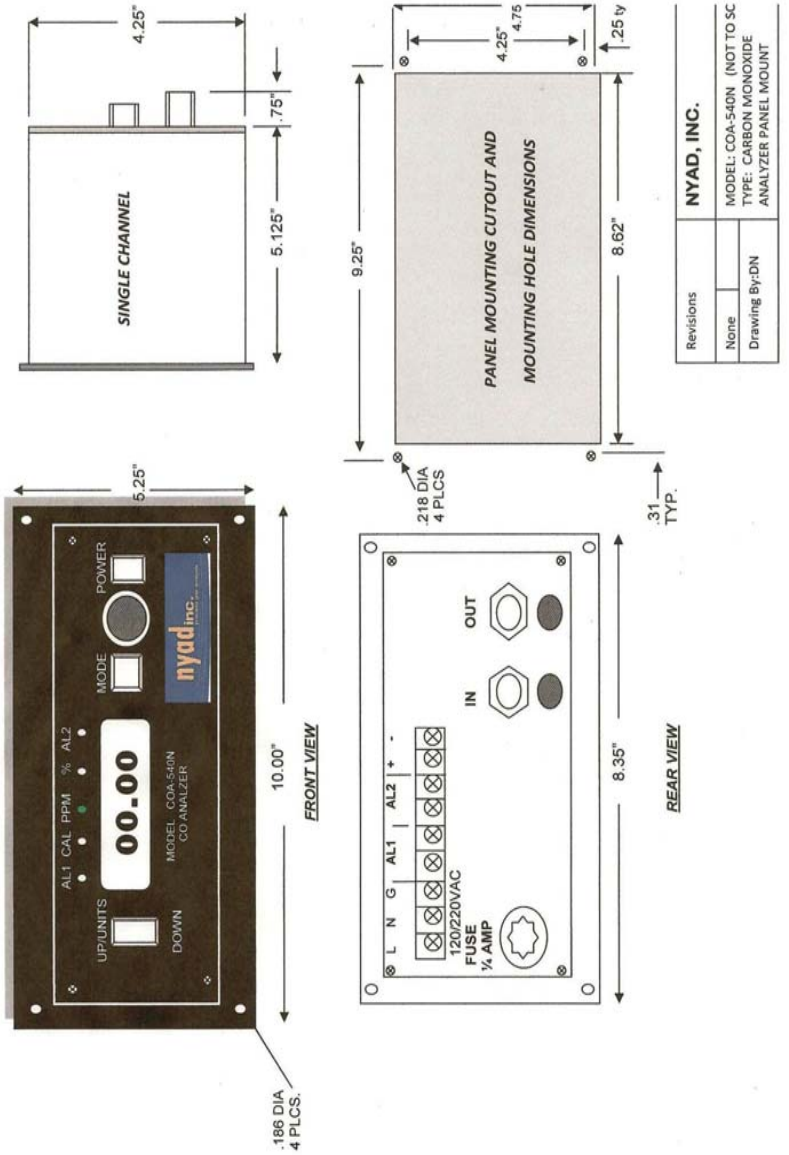

1) UP/UNITS-DOWN—This two-position momentary switch located to the left of the display has three functions:

   a) Changes the value of set point, outputs, and constants.
   b) Changes the calibration values.
   c) Changes toggle function “Hi and Lo”

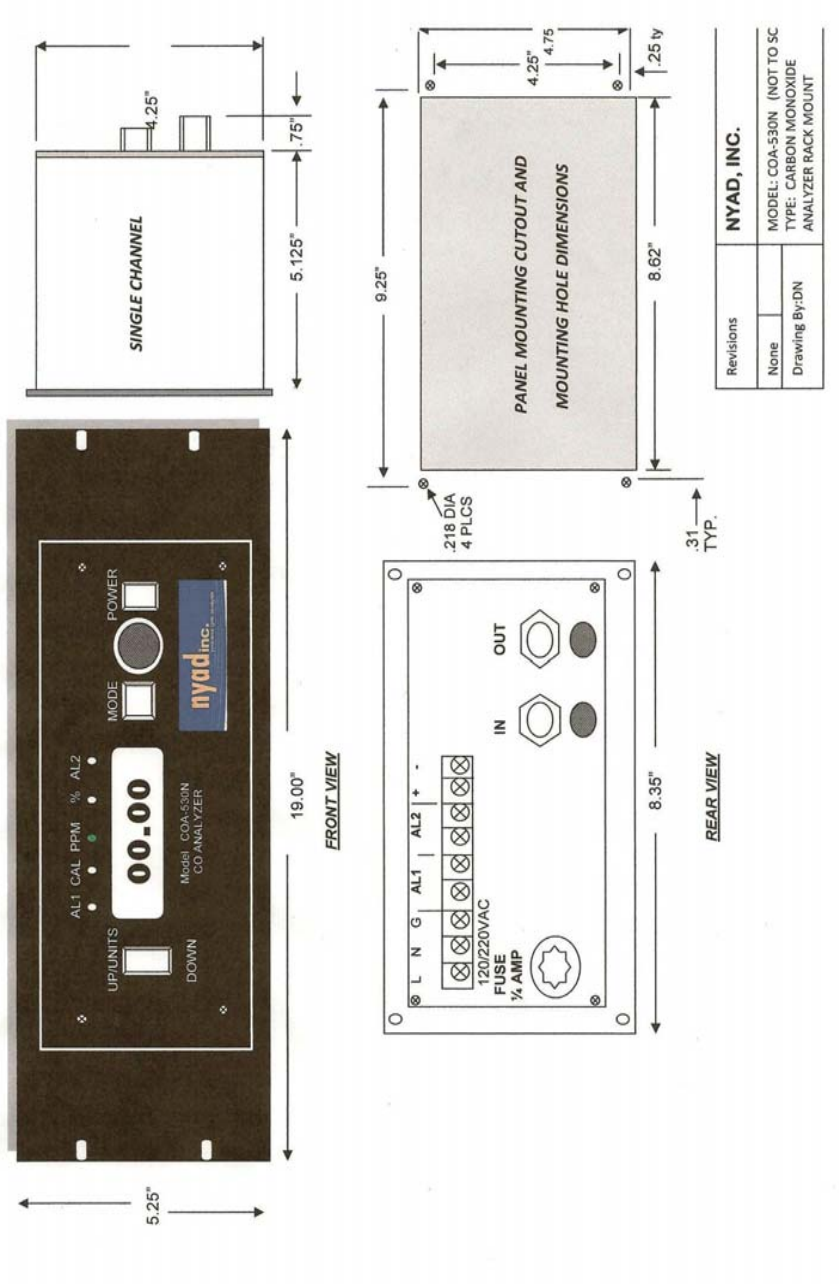
2) MODE— Momentarily pressing and releasing this switch allows the operator to access, interrogate, and reset the other major functions incorporated into this analyzer, namely, Alarm 1, Alarm 2, Output, Toggle , and Calibration.

3) POWER— Press to power ON/OFF.






COA-540N (A.3)




COA-530N (A.2)



# 7. SETTING ALARM POINTS

This monitor has two adjustable alarm set points and relays as factory standard. When the measured value of CO concentration exceeds the set point for a sustained period of about 6 seconds, the alarm condition is activated, the SPDT relay (Alarm 1) is energized as well as the red front-panel LED indicator, Al 1.

To determine the current setting for ALARM 1, press the MODE button. The display will show Al 1 and then default to the current value. If this value is acceptable, unit will momentarily in about 6 seconds flash “DISP” and return to the current measured CO value.

If the current setting for ALARM 1 is not acceptable, proceed as follows:

a) Press the UP/DOWN button. You can cycle up or down through the numbers one digit at a time to the desired values or hold for several seconds and the rate will shift to fast.

To set ALARM 2, proceed exactly as described above after pressing the MODE button to display Al 2 and its current value.

If the measured value of CO concentration is higher than the ALARM 1 or ALARM 2 setting, the corresponding LED will illuminate above the display and energize the alarm relay thus activating any warning devices connected to it.

The Nyad CO analyzer is equipped with a toggle function (A1 1T and A2 2T). Set these for Hi when alarm is to detect increasing CO and Lo when detecting decreasing CO.

To determine the current setting for A1 1T, press the MODE button until A1 1T is displayed (Hi or Lo). If this value is acceptable, unit will time out return to display.

To set A2 2T, proceed exactly as described above after pressing the MODE button to display A2 2T (Hi or Lo).

# 8. SETTING ANALOG AND DIGITAL OUTPUT

The NYAD Model 550N Analyzer features a 0-5 VDC and 4-20mA analog output as factory standard. This signal is linearly proportional to ppm CO. To change span values from those set at the factory, these values must first be displayed.

**EXAMPLE:**

As an example, assume we wish to set the output span to range as follows:

| Output | ppm CO |
|---|---|
| (oPHi) 5 volts | 50 |
| (oPLo) 0 volts | 0 |

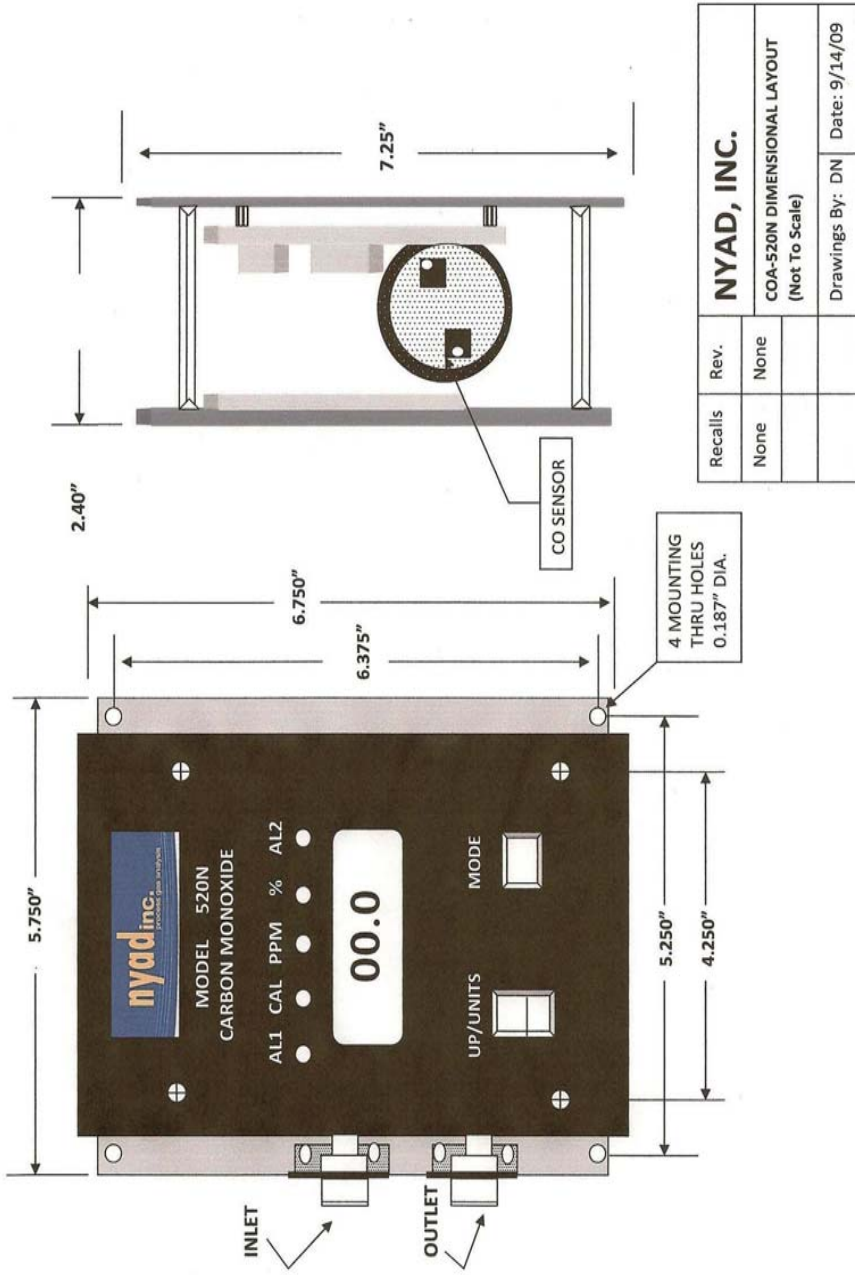
a) Display the current settings by pressing the MODE switch and cycling through Al 1, Al 2, A1 1T, A2 2T to OUTPUT. The display will read "oPLo" and then show the current value of CO concentration corresponding to the Lo end of the analog output when the MODE button is pushed.

b) If this displayed value is 0, you may accept it by pressing MODE switch. If you wish to change the setting, proceed as described in Section 7, SETTING ALARM POINTS. Set the desired value using the UP/DOWN switch to cycle the numbers.

c) Press the MODE switch. The display will now read "oPHi" and then show the CO concentration corresponding to the Hi end (5 VDC) of the analog output scale when the MODE is pushed. If this is the desired value, 50 ppm, the unit will momentarily in 6 seconds return to display.

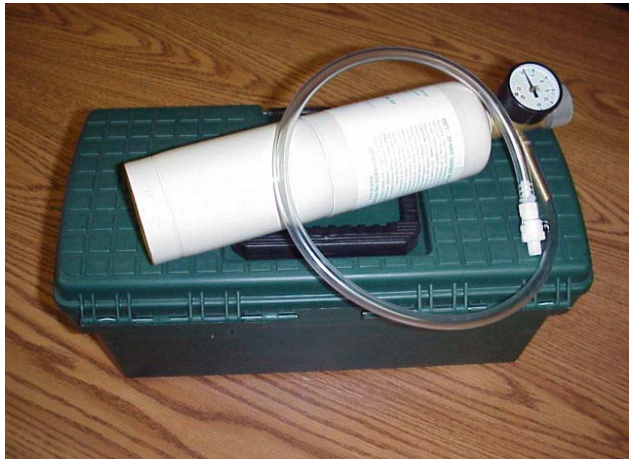
d) If you wish to change the setting, set the desired value by using the UP/DOWN switch as previously described.






COA-520N (A.1)


**Carbon Monoxide Sensor**
**(Fig. 1)**

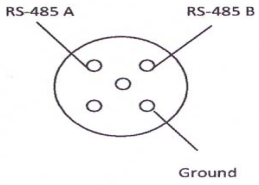


**CO Calibration Kit**
**(Fig. 2)**

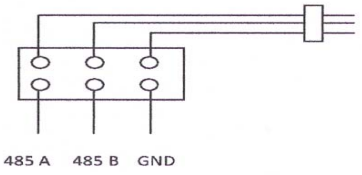


***Digital Output***

The NYAD SerieS 500N analyzers features an optional digital output port. The user has a choice of format either RS-232 or RS-485. The RS-232 option can be accessed from a standard DB-9 connector on the bottom enclosure. The pinout of the RS-485 connector is shown below :




For convenience, a short cable is also provided that brings the output to a three position terminal strip.




To activate the digital output, selection is made from the front panel of the instrument. Turn on the POWER switch, then press the MODE button six times. The display will show PORT. Now press the UP switch and select 0485 by pressing MODE. For RS-232, select 0232.

The digital output is now activated and a constant data stream will be sent every second wit the following information:

Data Output format:

**$UNITS, Display_data, Output, ALARM1, ALARM2, ERROR#1, Line_checksum<CR><LF>**

**Example: $CO, 1.4, 0.238, 0, 0, 0, 1177<CR><LF>**

## 9. DEFAULT VALUES

Series 500N CO Analyzers are preset at the factory with the following standard values:

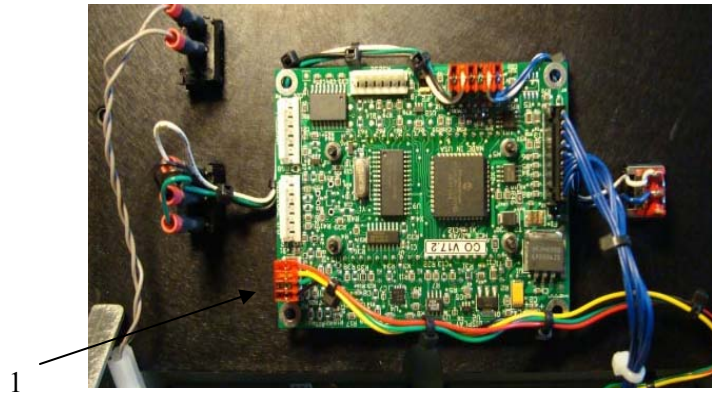
| Function | ppmv |
|---|---|
| Al 1 | 5 |
| Al 2 | 10 |
| Output (oPHi) | 50 |
| Output (oPLo) | 00 |

These setting have been shown by experience to be most used by our customers. However, any of them can be changed from the front panel of the analyzer to values most suitable for your application.

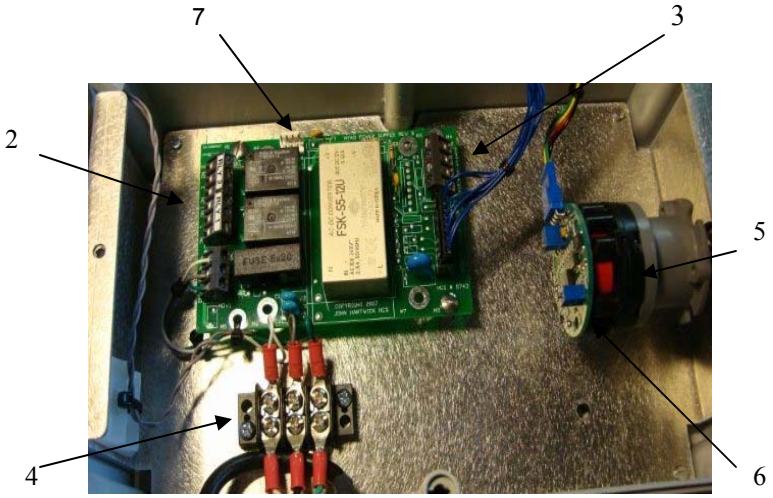
## 10. REFERENCE TABLE

| REFERENCE TABLE | |
|---|---|
| AL 1 | Dry Relay Contact - Alarm 1 |
| AL 2 | Dry Relay Contact - Alarm 2 |
| A1 1t | Toggle AL 1 “Hi or Lo” |
| A2 2t | Toggle AL 2 “Hi or Lo” |
| oPHi | Analog Output “Hi” |
| oPLo | Analog Output “Lo” |
| CAL | Calibration Function |
| No CO | Sensor not detecting CO |
| EroP | Operator Error |






**CO MOTHER BOARD**




**CO POWER SUPPLY BOARD**

| | |
|---|---|
| **1.** | **CO connection to mother board** |
| **2.** | **Relay 1 and Relay 2** |
| **3.** | **Output0-5VDC or 4-20mA** |
| **4.** | **Power 110VAC—220VAC(Brown, Blue, Green)** |
| **5.** | **CO Sensor** |
| **6.** | **CO Electronics** |
| 7. | **Digital Output RS232 or RS485 (Optional)** |

| Troubleshooting Guide | |
|---|---|
| **Symptoms** | **Remedy** |
| **ELECTRONICS** | |
| Unit will not cycle<br>Startup routine not normal | Replace Electronics<br>(Send unit to Nyad) |
| Display is blank with power on<br>Display has missing segments | Replace Display<br>(Send unit to Nyad) |
| **ERROR CODES** | |
| ErOp (Error Operator) | Output out of range. Set output Lo and Hi. See Section 10 Setting Output. |
| E-Lo | Replace CO sensor or CO round electronics. |
| No CO | Sensor not detecting CO Gas. Replace CO sensor. |



# 10. CALIBRATION PROCEDURE

**WARNING**

**High carbon monoxide concentrations are toxic. Take appropriate ventilation precautions when calibrating with a span gas.**

Calibration interval should be carried out once a month and can be performed by a non-certified technician. To calibrate the CO sensor, use a certified sample of span gas. A complete calibration kit is available from NYAD. The kit includes a bottle of certified span gas containing CO in the range of 10 ppm in Nitrogen, a pressure regulator and gauge, connecting hose and fitting, all supplied in a convenient storage case. (See Fig. 2)

a) To begin the process, attach the span gas to the inlet fitting and start the flow of span gas at a rate of about 100 to 250 cc/min.

b) Next, press the MODE button until CAL is displayed. The CAL led light will illuminate indicating the monitor is in CAL mode. Note: If CO gas is not detected, the unit will display “No Co”.

c) The display will now show the current CO value. After the value equilibrates, enter the concentration of your span gas by pressing the UP/DOWN switch. The displayed value should be the value of the span gas concentration.

d) Press the MODE button, ‘DISP” will display and in 5 seconds the unit will return to the current CO value.

e) Turn off and disconnect the span gas. After an equilibration period of 5-10 minutes, the monitor read out will return to zero.

The monitor is now calibrated and ready to be placed into service.

# 11. REPLACING THE SENSOR

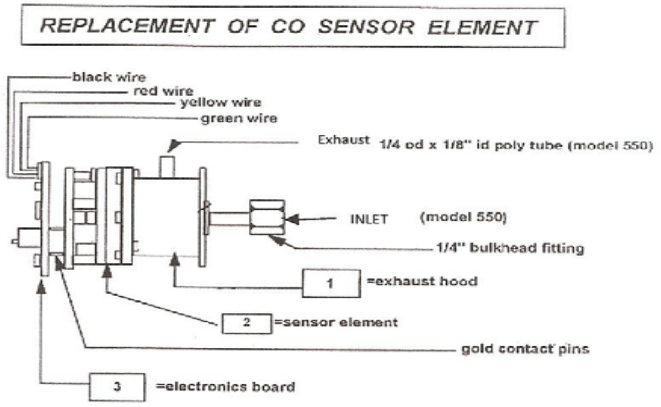
**DANGER**

**Disconnect power to the unit before performing any maintenance to the control board.**

**WARNING**

**The carbon monoxide sensor contains corrosive acid. Do not attempt to open. Before disposing of sensor place it in a polyethylene bag and tie securely. Dispose of sensor in accordance with all applicable regulations.**

a) Remove the plastic cover (6 captive screws).
b) Remove the front panel (two thumb screws).
c) Turn the complete sensor module counter clock wise until it is free of the input fitting.
d) Remove the electronic board from the assembly by pulling it away from the sensor where it is held by three connector pins. Next remove the sensor from its flow chamber by unscrewing the three small screws holding it in place. Discard the depleted cell and replace it with the new one.
e) Reassemble the cell by following the above instructions in reverse.






## Specifications

| | |
|---|---|
| Model Numbers | COA-520N (OEM), COA-530N (Rack Mount), COA-540N (Panel Mount), COA-550N, (Nema 4), COA-570N (Nema-7X) |
| Units | PPM (Parts Per Million) |
| **Standard** | |
| Display | 4 Digit LCD, 0.5" High |
| Alarm | Dual Dry Relay Contacts (SPDT 1A@120V) |
| Analog Output | 0-5VDC or 4-20mA (Adjustable zero and span) |
| Power | 120VAC 50/60 Hz, 1W Max, 220V |
| Memory | Non-Volatile Data Memory |
| Inlet | 1/8" FNPT |
| Calibration | Auto Calibration |
| **Options** | |
| Audible Alarm | |
| Digital Output | RS232, RS485 |
| Power | 12V |

## Sensor

| | |
|---|---|
| Type | Electrochemical Fuel Cell |
| Range | 0 to 2,000 ppmv |
| Accuracy | +/- 0.5% |
| Response Time | 90% in 30 seconds |
| Operating Humidity | 0 to 99% RH non-condensing |
| Inlet Pressure | 65 lbs Max |
| Operating Temperature | -5 to +40 degrees C |
| Sensor Life in Air | Up to 24 Months at 30 degrees C |
| Sensor Shelf Life | 1 Year |
| Replacement | Every two years |
| Sensor Warranty | 1 Year |
| Calibration Gas | CO span gas (20-25 ppm) |
| Calibration Interval | Once a month |
| Sample Flow | 100-250 cc/min. recommended |

## Enclosures

| | |
|---|---|
| OEM | **5.75"Wx6.75"Hx2.4"D** |
| **NEMA-4** | **9.5"W x 6.25"H x 3.5"D** |
| **Panel** | **10"W x 5.25"H x 6"D** |
| **Rack** | **19"W x 5.25"H x 6"D** |
| **Nema-7X** | **8.37"Wx9.87"Wx6.53"D** |

## What is carbon monoxide?

Carbon monoxide (CO) is a colorless, odorless deadly gas. Because you can't see, taste, or smell it, carbon monoxide can kill you before you know it's there. Carbon monoxide, known by the chemical formula "CO", is a poisonous gas that kills approximately 534 people in the United States alone every year. Of that number, about 207 people were killed by carbon monoxide emitted from a consumer product, like a stove or water heater.

## What are the sources of CO?

CO is a by-product of incomplete combustion. CO sources can include malfunctioning appliances -- including furnaces, stoves, ovens and water heaters -- that operate by burning fossil fuels such as natural or liquefied petroleum (LP). When malfunctioning appliances aren't adequately ventilated, the amount of CO in the air may rise to a level that can cause illness or even death. Other CO sources include vehicle exhaust, blocked chimney flues, fuel-burning cooking appliances used for heating purposes, and charcoal grills used in the home, tent, camper, garage or other unventilated areas.

## Why is carbon monoxide so dangerous?

The great danger of carbon monoxide is its attraction to hemoglobin in the bloodstream. When breathed in, it enters the bloodstream and replaces the oxygen molecules found on the critical blood component, hemoglobin, depriving the heart and brain of the oxygen necessary to function. When CO is present in the air, it rapidly accumulates in the blood, causing symptoms similar to the flu, such as headaches, fatigue, nausea, dizzy spells, confusion, and irritability. As levels increase, vomiting, loss of consciousness, and eventually brain damage or death can result.



# CARBON MONOXIDE DANGER LEVELS

**Levels of Carbon Monoxide are considered dangerous. The chart below shows the health effects of CO exposure.**

| CO concentration (parts per million) | Symptoms |
|---|---|
| 50 | No adverse effects with 8 hours of exposure. |
| 200 | Mild headache after 2-3 hours of exposure. |
| 400 | Headache and nausea after 1-2 hours of exposure. |
| 800 | Headache, nausea, and dizziness after 45 minutes; collapse and loss of consciousness after 1 hour of exposure. |
| 1,000 | Loss of consciousness after 1 hour of exposure. |
| 1,600 | Headache, nausea, and dizziness after 20 minutes of exposure. |
| 3,200 | Headache, nausea, and dizziness after 5-10 minutes; collapse and loss of consciousness after 30 minutes of exposure. |
| 6,400 | Headache and dizziness after 1-2 minutes; loss of consciousness and danger of death after 10-15 minutes of exposure. |
| 12,800 | Immediate physiological effects, loss of consciousness and danger of death after 1-3 minutes of exposure |

**The U.S. Standards for CO levels are as followed:**

Maximum of 35 ppm of CO for 1-hour exposure (not be exceeded more than once per year).

Maximum of 9 ppm of CO for 8-hour exposure (not to be exceeded more than once per year).