GE
Sensing

OxyTrak™ 390

Panametrics Flue Gas Analyzer

User's Manual

910-264B3
September 2007

The *OxyTrak™ 390 Flue Gas Analyzer* is a Panametrics product. Panametrics has joined other GE high-technology sensing businesses under a new name—GE Sensing.

Warranty

Each instrument manufactured by GE Sensing, Inc. is warranted to be free from defects in material and workmanship. Liability under this warranty is limited to restoring the instrument to normal operation or replacing the instrument, at the sole discretion of GE. Fuses and batteries are specifically excluded from any liability. This warranty is effective from the date of delivery to the original purchaser. If GE determines that the equipment was defective, the warranty period is:

- one year for general electronic failures of the instrument
- one year for mechanical failures of the sensor

If GE determines that the equipment was damaged by misuse, improper installation, the use of unauthorized replacement parts, or operating conditions outside the guidelines specified by GE, the repairs are not covered under this warranty.

The warranties set forth herein are exclusive and are in lieu of all other warranties whether statutory, express or implied (including warranties of merchantability and fitness for a particular purpose, and warranties arising from course of dealing or usage or trade).

Return Policy

If a GE Sensing, Inc. instrument malfunctions within the warranty period, the following procedure must be completed:

1. Notify GE, giving full details of the problem, and provide the model number and serial number of the instrument. If the nature of the problem indicates the need for factory service, GE will issue a RETURN AUTHORIZATION number (RA), and shipping instructions for the return of the instrument to a service center will be provided.
2. If GE instructs you to send your instrument to a service center, it must be shipped prepaid to the authorized repair station indicated in the shipping instructions.
3. Upon receipt, GE will evaluate the instrument to determine the cause of the malfunction.

Then, one of the following courses of action will then be taken:

- If the damage is covered under the terms of the warranty, the instrument will be repaired at no cost to the owner and returned.
- If GE determines that the damage is not covered under the terms of the warranty, or if the warranty has expired, an estimate for the cost of the repairs at standard rates will be provided. Upon receipt of the owner's approval to proceed, the instrument will be repaired and returned.

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Chapter 1

General Information

Introduction

Process plant managers are usually looking for ways to reduce expense and increase profitability. When combustibles are burned as part of the operation, and that combustion is incomplete (allowing unburned fuel to escape), costs go up and profits go down.

A reliable system for analyzing flue gas can provide the necessary information to:

- adjust the flow of oxygen
- increase the efficiency of the combustion
- gain significant cost savings for the overall operation

To meet these specific needs, GE Sensing provides the **OxyTrak™ 390 Flue Gas Analyzer** which monitors the efficiency of a furnace or boiler by measuring excess oxygen and/or ppm_v unburned combustibles in the flue gases.

To measure these two parameters, the **OxyTrak™ 390** uses:

- a zirconium oxide *oxygen* sensor
- a platinum-catalyst *combustibles* sensor (optional)

The oxygen sensor measures excess oxygen or, in a fuel rich environment, equivalent combustibles. The combustibles sensor monitors partially combusted fuel, only in the presence of excess oxygen (i.e. there must be enough oxygen present to burn the fuel). Each **OxyTrak™ 390** may be equipped with an oxygen sensor, a combustibles sensor, or both.

Physical Description

The standard GE Sensing **OxyTrak™ 390 Flue Gas Analyzer** is provided in a general-purpose *weatherproof (IP52, NEMA 2)* enclosure. The analyzer consists of a convection loop/analyzer package and a display controller, which may be mounted either locally or remotely. Figure 1-1 on page 1-2 shows the **OxyTrak™ 390** with local and remote display controllers.

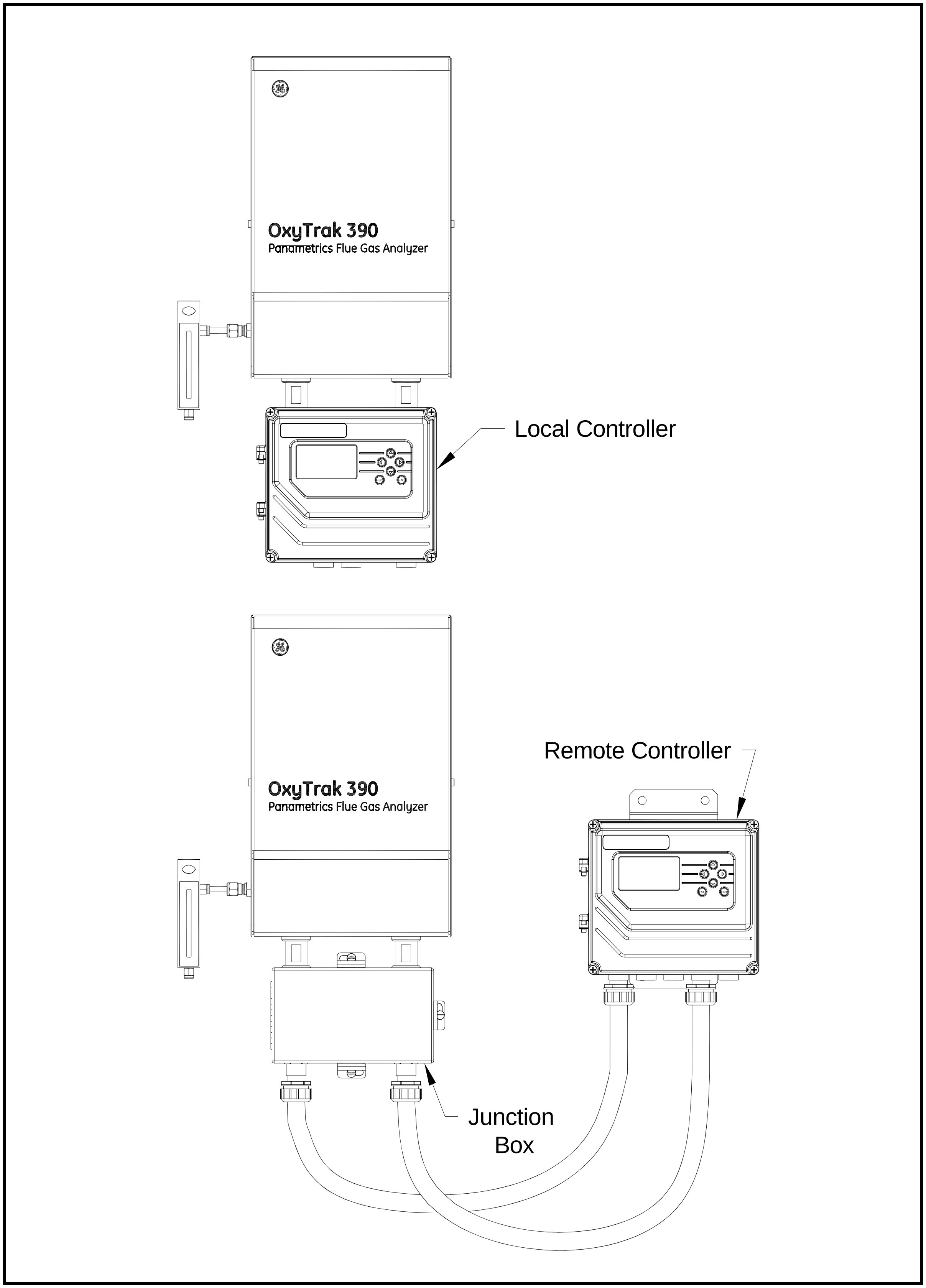


Figure 1-1: Standard OxyTrak™ 390 Configurations

Sample System

The convection loop/analyzer package houses the *sample system*, which consists of the components shown in Figure 1-2 on page 1-4 and Figure 1-3 on page 1-5. The functions of the sample system components are as follows:

- a *manifold* with removable *thermocouple* and *cartridge heaters* to prevent acid components of the flue gas from condensing in the sample system and causing corrosion
- a zirconium oxide *oxygen sensor*
- an optional platinum-catalyst *combustibles sensor* to monitor incomplete combustion of the fuel by burning it in the presence of excess oxygen
- a temperature-controlled *sensor furnace* to maintain the oxygen sensor at a stable operating temperature and to act as the engine for convective sampling
- a *convection loop* to circulate the sample gases through the sample system
- an *aspirator port* to connect to an aspirated probe.

Sample System (cont.)

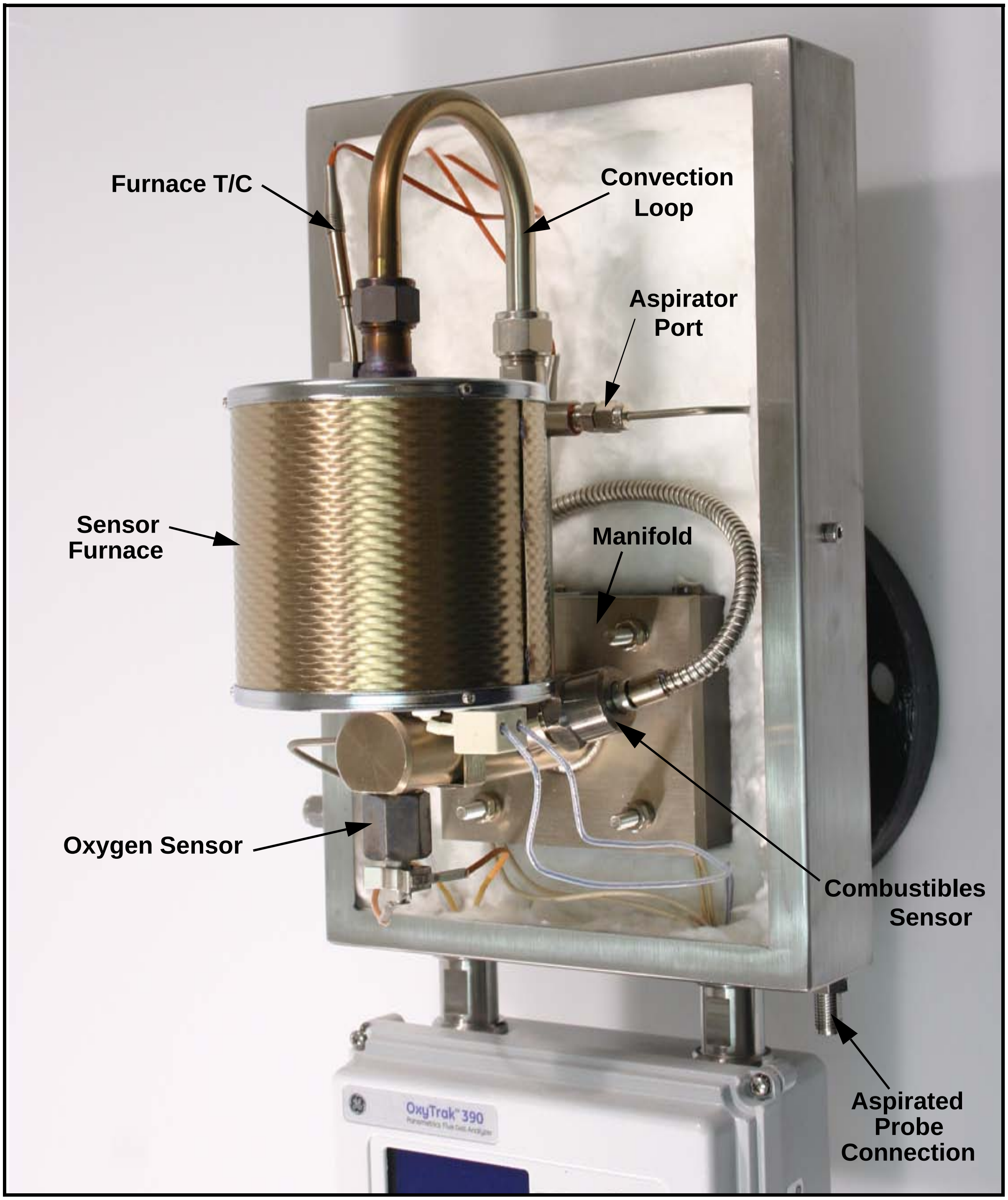


Figure 1-2: The Sample System

Sample System (cont.)

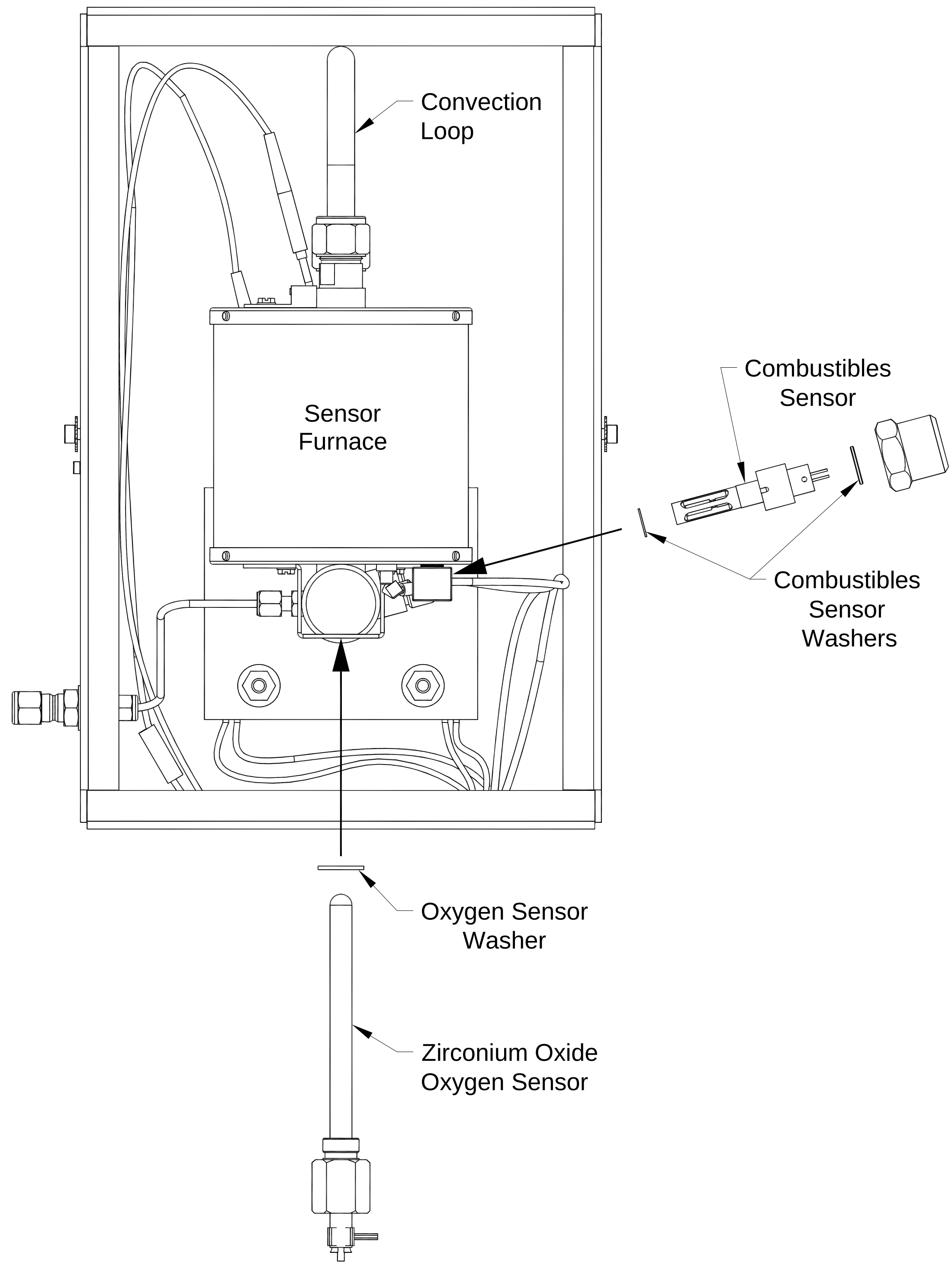


Figure 1-3: Sensor Locations (ref. dwg #705-1088, sht 3)

Sample System (cont.)

Figure 1-4: Combustibles Sensor

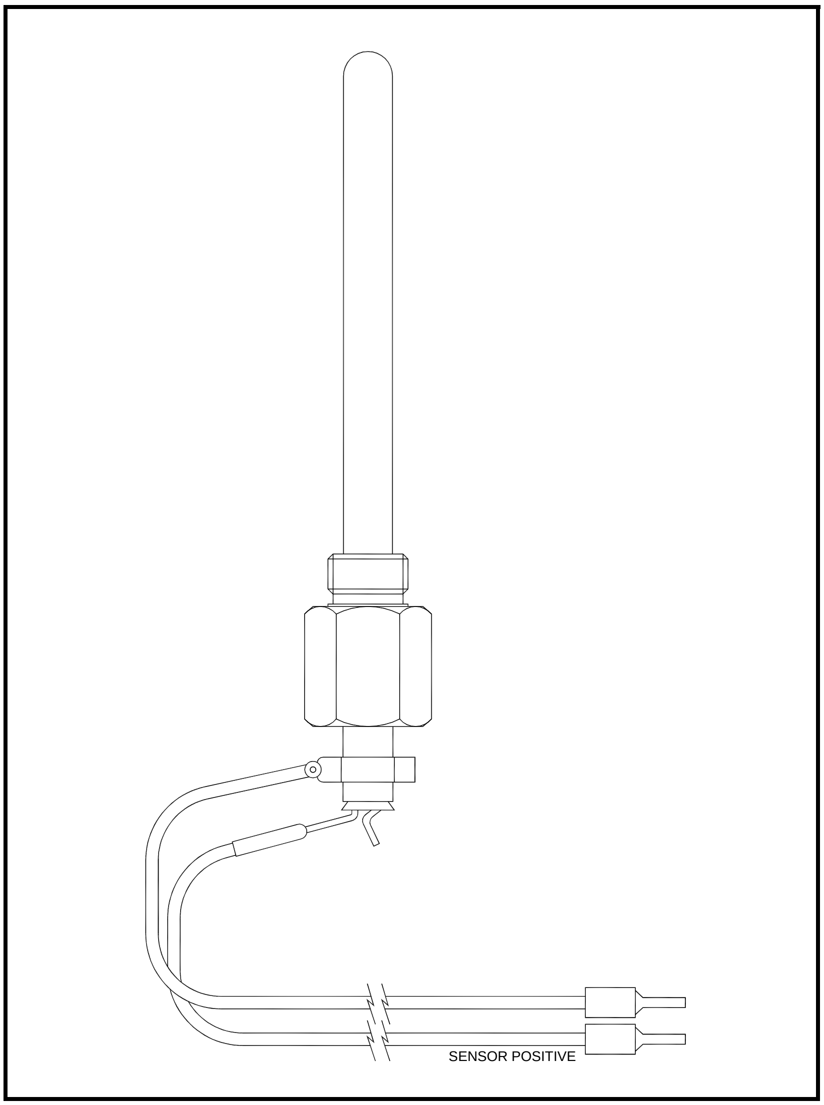


Figure 1-5: Zirconium Oxide Oxygen Sensor

Display Controller

The display controller (see Figure 1-6 below) includes the *terminal blocks* for making all electrical connections and the *furnace temperature control (FTC) circuit board*. The FTC board maintains a constant sensor furnace temperature to improve the accuracy of the oxygen analysis and to extend the life of the oxygen sensor.

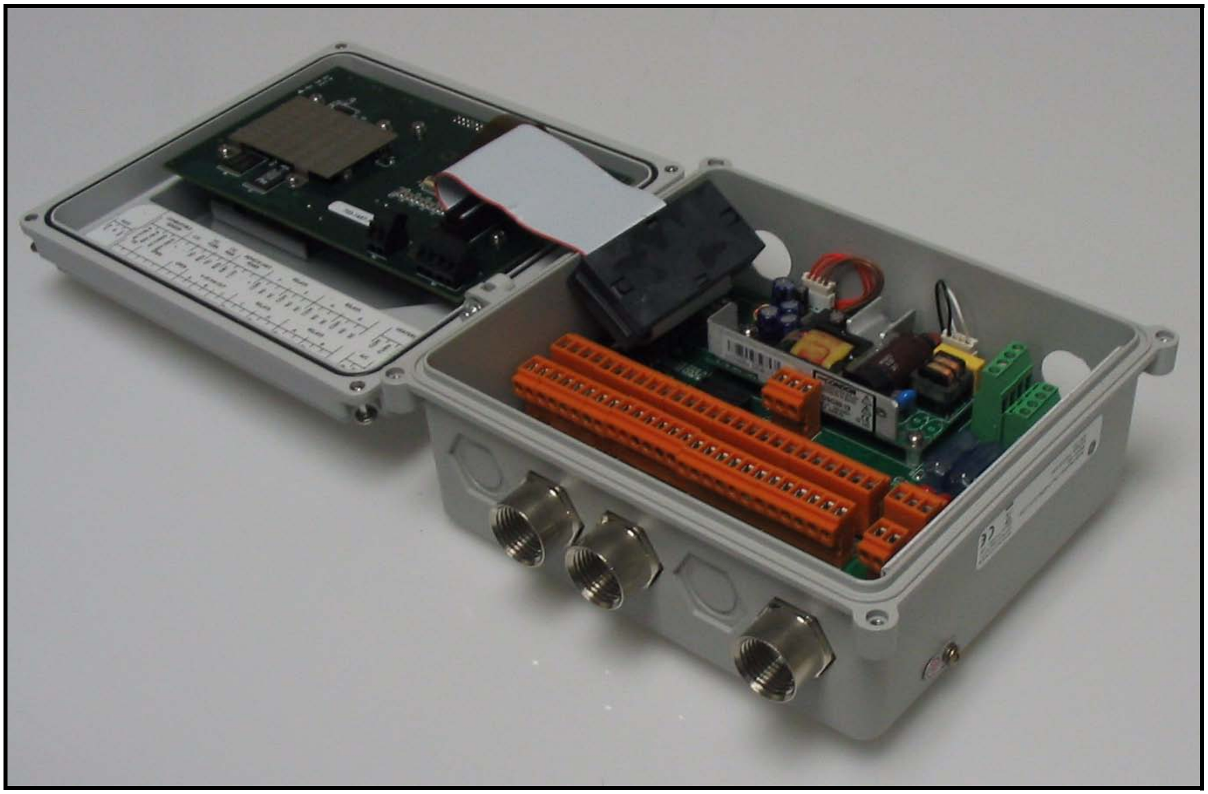


Figure 1-6: Display Controller Interior

The display controller performs the following functions:

- amplifies the oxygen and combustibles sensor outputs
- linearizes the oxygen signal
- controls the sensor temperature
- outputs the reading on a 64 x 128 pixel graphic display
- enables programming using an integral keypad
- provides a linear 4-20 mA analog output
- provides four alarm relays
- provides four auto-calibration relays
- provides RS232/RS485 communications outputs

Principles of Operation

Ideally, every furnace/burner should mix a precise ratio of air to fuel, and the mixture should burn efficiently to yield only heat, water vapor and carbon dioxide. However, because of burner aging, imperfect air to fuel mixtures and changing firing rates, this rarely happens. Monitoring the actual efficiency of the combustion process is easily accomplished with the **OxyTrak™ 390**.

A flue gas sample is drawn into the probe by gaseous diffusion and a gentle convective flow. The sample passes through the probe and into the sample system, where it is maintained at a temperature above 200°C (392°F) by the heater block. In the presence of oxygen, this sample temperature is high enough to burn any partial combustion products that reach the active (platinum-coated) element of the combustibles sensor. The resulting temperature differential between the two combustibles sensor elements is related to the concentration of partial combustion products in the test sample.

Note: *The sampled gas is maintained above 200°C (392°F) to prevent flue gas acids from condensing in the analyzer and causing corrosion.*

The sample then passes into the sensor furnace, which heats the sample gas and the oxygen sensor to 700°C (1,292°F) (a temperature above 650°C (1,202°F) is required for proper operation of the oxygen sensor). The oxygen sensor is covered with a platinum catalyst that causes the burning of all remaining combustibles, enabling the sensor to measure the excess oxygen (or fuel) in the flue gas.

The sensor furnace also generates the convective flow that circulates the sample gas through the sample system. The hot sample gas in the sensor furnace rises out of the furnace and cools, as it is pushed from behind by the hot gases still in the furnace. The cooled sample gases then drop down the other branch of the convection loop and into the annular space between the probe and probe sleeve, where they are carried away by the gas flow in the flue.

Zirconium Oxide Oxygen Sensor

The inside and outside of the zirconium oxide oxygen sensor are coated with porous platinum, forming two electrodes. The sample gas flows past the outside of the sensor, while atmospheric air circulates freely inside the sensor. This atmospheric air is used as the reference gas for making oxygen measurements. See Figure 1-7 below.

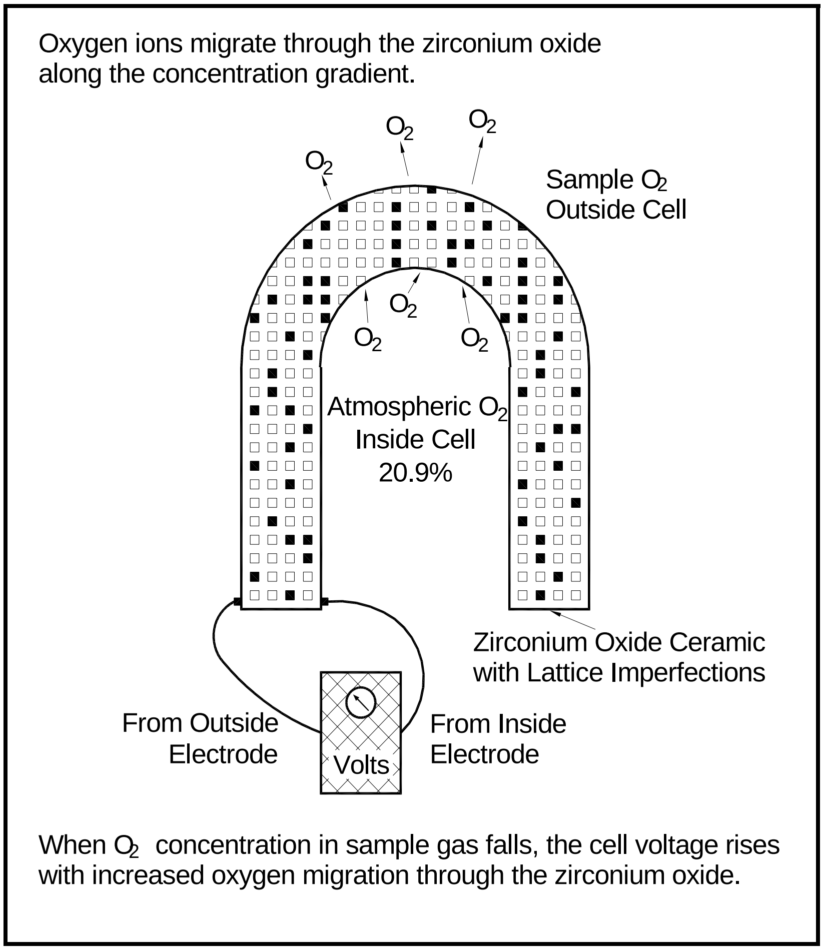


Figure 1-7: Oxygen Migration in the Zirconium Oxide Sensor

At the operating temperature of the oxygen sensor, the atmospheric reference oxygen is electrochemically reduced at the inner electrode, and the resulting oxygen ions seek to equalize with the lower oxygen concentration on the sample side of the cell by migrating through the porous ceramic toward the outer electrode. At the outer electrode they give up electrons to become oxygen molecules again, and are swept away by the sample gas flow.

The lower the concentration of oxygen in the flue gas sample, the greater the rate of ion migration through the ceramic, and the higher the cell voltage due to electron exchange at the electrodes. The cell voltage rises logarithmically as the amount of oxygen in the flue gas falls, allowing the accurate measurement of very low levels of excess oxygen in the flue gas.

Platinum-Catalyst Combustibles Sensor

The combustibles sensor consists of two platinum thermistors mounted side by side in the sample stream. One thermistor, the *active element*, is used to detect/react partial combustion products, while the other thermistor, the *reference element*, provides a baseline. The active element is coated with a black platinum catalyst and the reference element has a white inert surface. As the sample gas passes over the active element, the platinum catalyst causes any combustibles to burn (in the presence of excess oxygen), thereby raising the temperature of the active element above that of the reference element (see Figure 1-8 below).

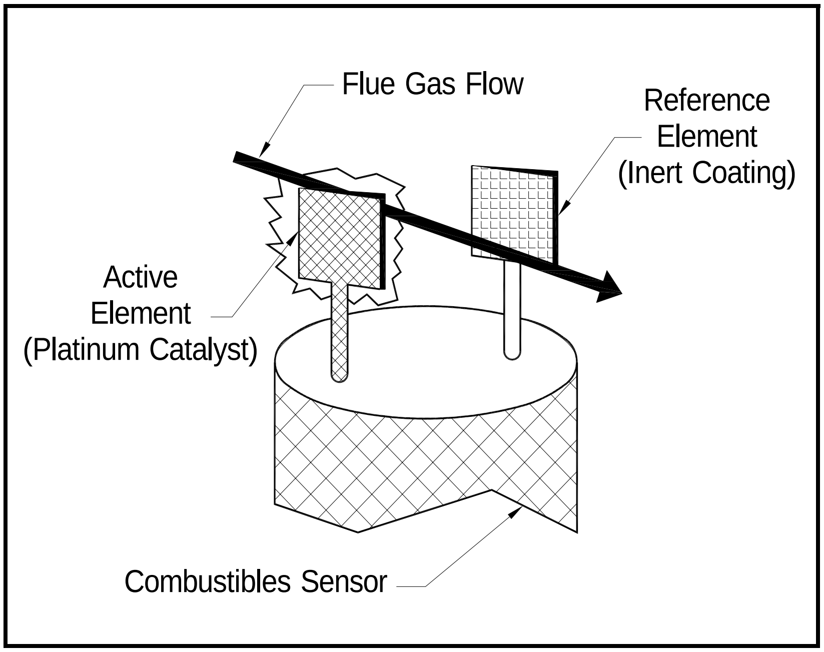


Figure 1-8: Combustibles Sensor Elements

The resulting temperature differential between the active and reference elements is proportional to the concentration of combustibles in the sample, and a corresponding resistance change is then converted into a reading of parts per million by volume (ppm_V) of combustibles.

Heater Control Circuit

The oxygen sensor temperature in the **OxyTrak™ 390** is maintained by a heater, which is part of a complex temperature control loop. This circuit constantly monitors the oxygen sensor temperature, compares it to the set point temperature (700°C), and turns the heater ON or OFF accordingly. The specific type of control circuit used is called a Proportional Integral Derivative (**PID**) loop, because of the three adjustable parameters involved:

- **Proportional Band:** Because the system cannot respond instantaneously to temperature changes, the actual temperature of the oxygen sensor oscillates about the set point. In general, increasing the proportional band reduces the magnitude of these temperature oscillations.
- **Integral Action:** A consequence of increasing the proportional band is the introduction of an offset between the set point and the control point. The integral portion of the control loop acts to move the control point back toward the set point within a specified period of time. Thus, decreasing this integration time reduces the offset more quickly.
- **Derivative Action:** The derivative portion of the control loop applies a corrective signal based on the rate at which the actual temperature is approaching the set point. In effect, the derivative action reduces overshoot by counteracting the control signal produced by the proportional and integral parameters.

The heater control circuit is configured at the factory for optimum performance. Because of the strong interaction between the three parameters involved, properly setting up the PID loop is a very complex matter. As a result, randomly changing the P, I and/or D parameters can seriously degrade the performance of the **OxyTrak™ 390**.

IMPORTANT: *Always contact the factory before attempting to change the default P, I and/or D values.*

Chapter 2

Installation

Introduction

This chapter provides instructions on how to properly install and wire the **OxyTrak™ 390**. Be sure to observe all installation limits and precautions described in this chapter. Pay particular attention to the specified ambient temperature range of –30 to +70°C (-22 to +158°F) for the analyzer and –30 to +60°C (-22 to +140°F) for the controller.

!WARNING!
To ensure safe operation, the OxyTrak™ 390 must be installed and operated as described in this manual. Also, be sure to follow all applicable local safety codes and regulations for installing electrical equipment. All procedures should be performed by trained service personnel only.

Unpacking

Remove the analyzer (see Figure 2-1 below) from its shipping container, and make sure that all items on the packing slip have been received. If anything is missing, contact the factory immediately.

Note: *See Figure 2-6 on page 2-17 (local controller) or Figure 2-7 on page 2-18 (remote controller) for a complete outline and installation drawing of the **OxyTrak™ 390**.*

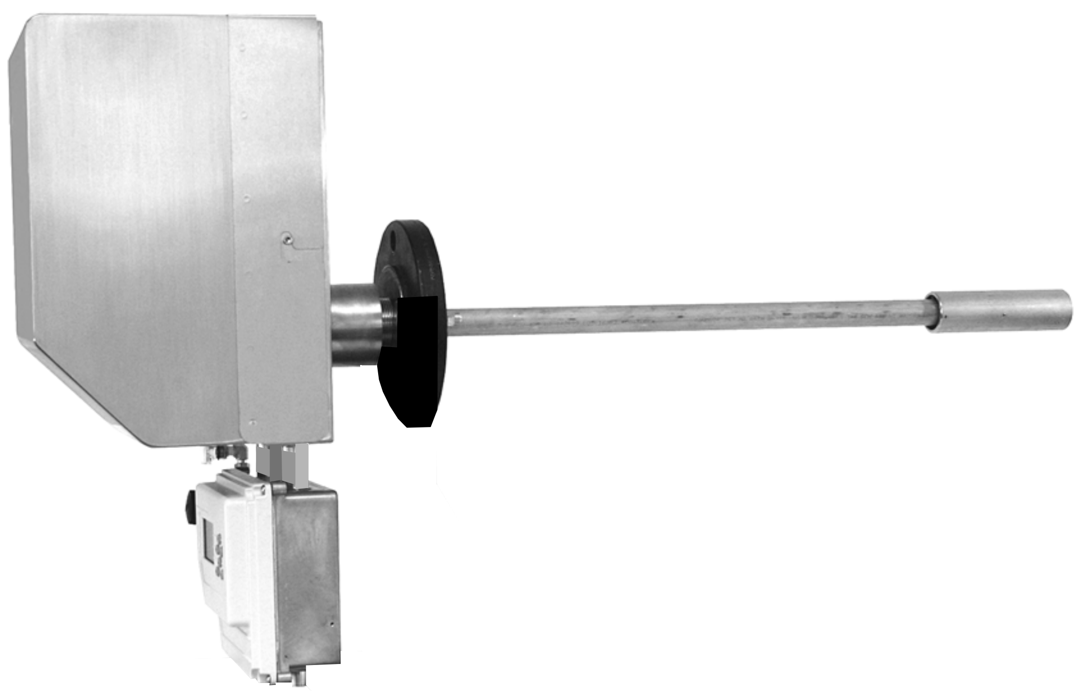


Figure 2-1: Typical OxyTrak™ 390 with Local Controller

Installation Site

Environmental and installation factors should already have been discussed with a GE Sensing applications engineer or field sales person before the **OxyTrak™ 390** arrives.

Selecting the Site

The tip of the probe is typically inserted into the stack to a distance of 1/3 of the stack diameter. Also, the flue gas flow direction should be either perpendicular to the probe or angled away from the open end of the probe (see Figure 2-2 below).

IMPORTANT: *Never allow the flue gas flow to be angled directly <u>into</u> the end of the probe.*

- For *furnaces*, locate the analyzer close to the combustion zone, typically within the radiant section and always before the convection section. Make sure that the probe's maximum operating temperature is not exceeded and that the probe is not situated in a non-homogeneous flue gas mixture.
- For *boilers*, locate the analyzer downstream of the heat exchanger and just before the economizer air heater, if one is installed. The analyzer should not be placed downstream of any air heater, because of possible air leaks that can cause inaccurate readings.

In general, the sample point should be an area of *high turbulence*, which will ensure a good homogeneous mixture of the flue gases. Conditions to be avoided would include *air leaks* upstream of the sample point and *dead spaces* in the vicinity of the sample point.

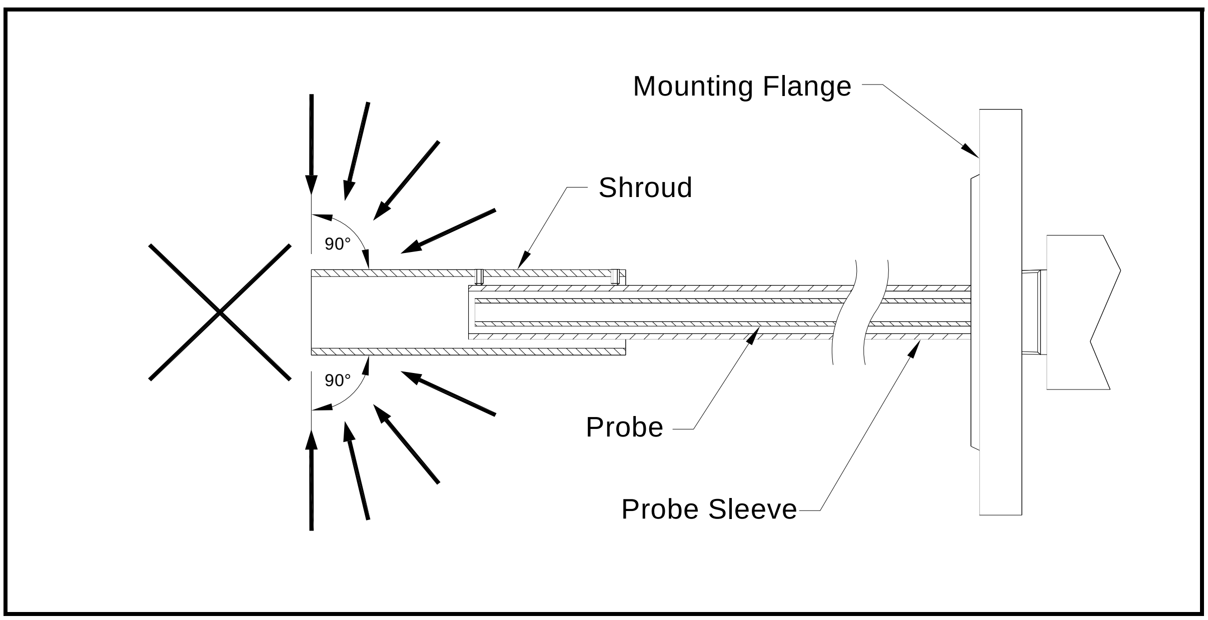


Figure 2-2: Permitted Flue Gas Flow Angles

Selecting the Site (cont.)

Finally, the following installation requirements should be observed:

- Install the **OxyTrak™ 390** in a location that provides ready access for programming, testing, and servicing the unit.
- Protect all cables from excessive physical strain (bending, pulling, twisting, etc.).
- Be sure that the input voltage at the planned installation site is within the limits specified for the **OxyTrak™ 390**.

Preparing the Site

Preparation of the installation site should include the following steps (see Figure 2-8 on page 2-19 and Figure 2-3 below):

Note: *Although a horizontal installation is shown in this manual, other mounting angles are permissible.*

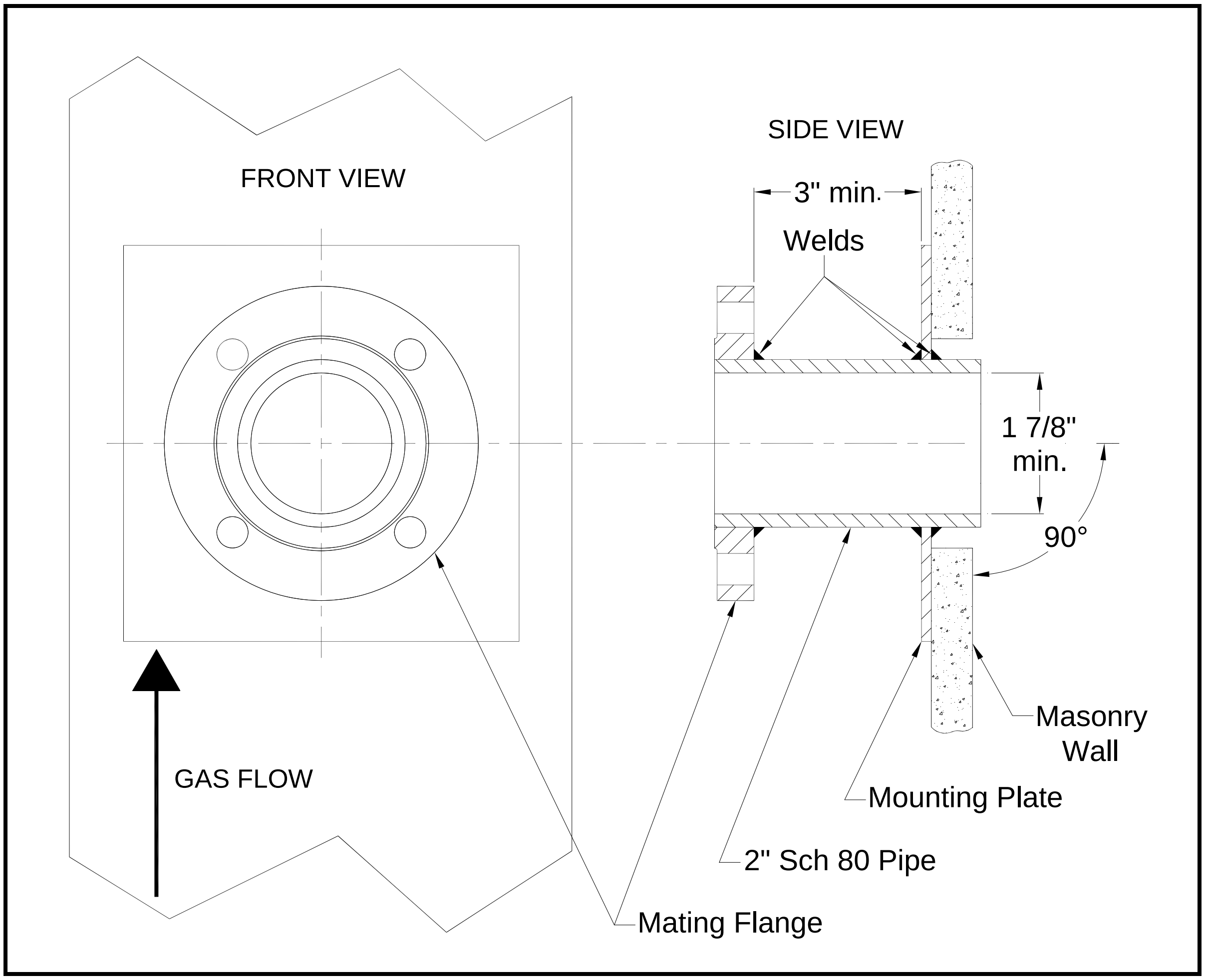


Figure 2-3: A Typical Installation Setup

Preparing the Site (cont.)

1. At the chosen analyzer location on the furnace or boiler wall or on the side of a horizontal or vertical flue duct, drill a hole of the proper diameter to accommodate a short length of pipe having at least a 1 7/8 in. 48 mm) inside diameter. A length of 2” Schedule 80 pipe is suitable for this purpose.
2. Weld the short pipe into a mounting plate, with welds on both sides of the plate. The pipe length must be sufficient to meet the following requirements:
   - One end of the pipe should extend through the rear of the mounting plate sufficiently to enter the wall. For installation in a masonry wall, the pipe should extend entirely through the wall to prevent the probe from becoming trapped, if the wall should crumble.
   - To provide clearance for installing the flange bolts, the pipe must be long enough to provide 4 in. (100 mm) of clearance between the front surface of the mounting plate and the back surface of the mating flange.
3. Weld the mating flange onto the end of the short pipe so that the raised face of the flange faces away from the mounting plate. Be sure that the following requirements are met:
   - One end of the short pipe should be flush with the raised face of the flange.
   - The mating flange should be oriented so that its bolt holes straddle the vertical and horizontal center lines of the mounting plate.

Note: *The **OxyTrak™ 390** can be supplied with an optional flange. If a flange is desired, it must be specified (e.g. 3”-150# flange) at the time of purchase*

4. Attach the mounting plate to the wall with the pipe extending into the drilled hole.

For probe lengths greater than 2 meters (6 feet), a support sleeve is recommended. Refer to Figure E-3 on page E-3.

Mounting

This section explains how to mount **OxyTrak™ 390** analyzer at the site that was prepared in the previous section. The **OxyTrak™ 390** has integral male 1-1/2" NPT mounting threads. This permits a flange to be threaded onto the analyzer, and the resulting assembly is then bolted to the mating flange on the furnace/boiler wall or flue duct.

Caution!
Flue gas condensate is extremely corrosive. The **OxyTrak™ 390** must be wired and powered up immediately after mounting to prevent damage to the unit. If a blowback (purge) system is to be used, install this system and turn it on right away also.

IMPORTANT: *Direct mounting of the **OxyTrak™ 390** into a threaded hole using its mounting threads is not recommended. Always use a mounting flange.*

Note: *Rather than the use of a thread sealant, a high temperature lubricant such as Molykote 1000 is recommended.*

Refer to Figure 2-8 on page 2-19, and complete the following steps to mount the **OxyTrak™ 390** convection loop/analyzer package:

1. Slide a suitable flange gasket over the probe and up against the mounting flange on the analyzer.

Note: *Be sure to use a suitable high temperature gasket for this application.*

2. Orient the analyzer so that the convection loop/analyzer package is vertical, and slide the probe through the hole in the mounting wall until the two flanges meet.
3. Using suitable hardware, make sure the gasket is properly positioned between them, and bolt the two flanges together.
4. Continue as follows:
   a. If you have a local display controller, the physical installation is complete. Proceed to the wiring section on the next page.
   b. If you have a remote display controller, proceed to Step 5.
5. Refer to Figure 2-7 on page 2-18 and mount the remote display controller in a convenient location. Be sure to allow sufficient clearance for programming and operation of the unit.
6. Install suitable cable glands and conduit for the environment, to connect the junction box on the bottom of the convection loop/analyzer package to the display controller (2 places).

Wiring

!Attention European Customers!
To meet CE Mark requirements, install all cables as described on the next page.

IMPORTANT: *For compliance with the European Union's Low Voltage Directive (73/23/EEC), the* ***OxyTrak™ 390*** *requires an external power disconnect device such as a switch or circuit breaker. The disconnect device must be marked as such, clearly visible, directly accessible, and located within 1.8 m (6 ft) of the unit.*

!WARNING!
To ensure safe operation, the OxyTrak™ 390 must be installed and operated as described in this manual. Be sure to follow all applicable local safety codes and regulations for installing electrical equipment. All procedures should be performed by trained service personnel only.

To wire the **OxyTrak™ 390**, see Figure 2-9 on page 2-20 for a local assembly or Figure 2-10 on page 2-21 for a remote assembly, and connect the following items to the display controller (***do <u>not</u> run the line power through the same conduit as the other connections***):

- alarm relays A-D
- calibration relays E-H
- 4-20 mA analog output
- RS232 or RS485 output
- line power (connect through the right-hand port)

If you have a remote display controller, you must also make the following connections between the controller and the junction box:

- oxygen and combustibles sensors
- furnace and manifold thermocouples
- thermocouple cold junction compensation
- furnace and manifold heaters

IMPORTANT: *Do not alter any of the factory-installed wiring.*

To access the terminal blocks for wiring, unthread the four screws on the front of the display controller and swing the cover open. If you have a system with a remote display controller, you must also unthread the three screws on the junction box and swing the cover open.

CE Mark Compliance

For CE Mark compliance, the **OxyTrak™ 390** must meet both the *EMC* and *LVD* directives.

IMPORTANT: *CE Mark compliance is required for all units used in EEC countries.*

EMC Compliance

For *EMC* compliance, the electrical connections must be shielded and grounded as shown in Table 2-1 below. After all the necessary electrical connections have been made, seal any unused cable entry holes with standard conduit plugs or equivalent.

Note: *If the instructions in this section are followed, the unit will comply with the EMC Directive 89/336/EEC.*

Table 2-1: Wiring Modifications for EMC Compliance

Connection	Wiring Modification
Power	1. When connecting the power, select the cable entry closest to the chassis ground. 2. Use shielded cable* to connect the power to the **OxyTrak™ 390** enclosure. Connect the shield to the nearest chassis ground terminal. 3. Connect the power line ground wire to the nearest chassis ground terminal.
Input/Output	1. Use shielded cable* to interconnect the **OxyTrak™ 390** enclosure with any external I/O devices. 2. Connect the shields to the nearest chassis ground terminal.
*Wires enclosed in a properly-grounded metal conduit do not require additional shielding.	

LVD Compliance

For compliance with the European Union's Low Voltage Directive (73/23/EEC), the analyzer requires an external power disconnect device such as a switch or circuit breaker. The disconnect device must be marked as such, clearly visible, directly accessible, and located within 1.8 m (6 ft) of the unit.

Note: *If the instructions in this section are followed, the unit will comply with the Low Voltage Directive (73/23/EEC).*

Wiring the Analog Outputs (A-C)

To wire an analog output device to the **OxyTrak™ 390**, refer to Figure 2-4 on page 2-12 and Figure 2-9 on page 2-20 or Figure 2-10 on page 2-21, and make the following connections to terminal block **J11** in the display controller:

1. Connect the **positive** pin to the input of the analog output device:
   a. Output A - **J11–5** (+)
   b. Output B - **J11–3** (+)
   c. Output C - **J11–1** (+)
2. Connect the **negative** pin to the return of the analog output device:
   a. Output A - **J11–6** (–)
   b. Output B - **J11–4** (–)
   c. Output C - **J11–2** (–)

Wiring the Alarm Relays (A-D)

To wire a warning device to any of the **OxyTrak™ 390** alarm relays (A-D), refer to Figure 2-4 on page 2-12 and Figure 2-9 on page 2-20 or Figure 2-10 on page 2-21, and make the following connections to terminal blocks **J7** and **J8** in the display controller:

1. Connect the **NC** pin to the alarm device input for failsafe operation, or leave this pin unused for non-failsafe operation:
   a. Relay A - **J7–4** (NC)
   b. Relay B - **J7–1** (NC)
   c. Relay C - **J8–4** (NC)
   d. Relay D - **J8–1** (NC)
2. Connect **COM** pin to the alarm device return:
   a. Relay A - **J7–6** (COM)
   b. Relay B - **J7–3** (COM)
   c. Relay C - **J8–6** (COM)
   d. Relay D - **J8–3** (COM)
3. Connect the **NO** pin to the alarm device input for non-failsafe operation, or leave this pin unused for failsafe operation:
   a. Relay A - **J7–5** (NO)
   b. Relay B - **J7–2** (NO)
   c. Relay C - **J8–5** (NO)
   d. Relay D - **J8–2** (NO)

Wiring the Calibration Relays (E-H)

To wire a warning device to any of the **OxyTrak™ 390** calibration relays (E-H), refer to Figure 2-4 on page 2-12 and Figure 2-9 on page 2-20 or Figure 2-10 on page 2-21, and make the following connections to terminal blocks **J9** and **J10** in the display controller:

1. Connect the **NC** pin to the alarm device input for failsafe operation, or leave this pin unused for non-failsafe operation:
    a. Relay E - **J9–3** (NC)
    b. Relay F - **J9–6** (NC)
    c. Relay G - **J10–3** (NC)
    d. Relay H - **J10–6** (NC)
2. Connect the **COM** pin to the alarm device return:
    a. Relay E - **J9–1** (COM)
    b. Relay F - **J9–4** (COM)
    c. Relay G - **J10–1** (COM)
    d. Relay H - **J10–4** (COM)
3. Connect the **NO** pin to the alarm device input for non-failsafe operation, or leave this pin unused for failsafe operation:
    a. Relay E - **J9–2** (NO)
    b. Relay F - **J9–5** (NO)
    c. Relay G - **J10–2** (NO)
    d. Relay H - **J10–5** (NO)

Note: *The **OxyTrak™ 390** relays do not provide power. To use the Blow Back process, connect a power supply in series with Relay H and the Blow Back solenoid valve.*

Wiring the RS232 Output

To wire the **OxyTrak™ 390** to the RS232 serial port on a PC, refer to Figure 2-4 on page 2-12 and Figure 2-9 on page 2-20 or Figure 2-10 on page 2-21, and make the following connections to **J14** in the display controller:

IMPORTANT: *You may make either an RS232 connection or an RS485 connection, but not both at the same time.*

Note: *This connection may be made with a GE Sensing #704-668-xx cable. If this cable is used, pin #1 is the white wire, pin #2 is the red wire, and pin #3 is the green wire.*

1. Connect **J14–1** (OUT) to the transmit pin on the computer.
2. Connect **J14–2** (IN) to the receive pin on the computer.
3. Connect **J14–3** (EN) to the return pin on the computer.

Note: *See GE Sensing document* EIA-RS Serial Communications *(916-054) for a detailed discussion of serial port connections.*

Wiring the RS485 Output

To wire the **OxyTrak™ 390** to a remote RS485 controller, refer to Figure 2-4 on page 2-12 and Figure 2-9 on page 2-20 or Figure 2-10 on page 2-21, and make the following connections to terminal block J13 in the display controller:

IMPORTANT: *One may make either an RS232 connection or an RS485 connection, but not both at the same time.*

1. Connect **J13–1** to **Return** on the RS485 system.
2. Connect **J13–2** to **12V** on the RS485 system.
3. Connect **J13–3** to **(+)** on the RS485 system.
4. Connect **J13–4** to **(–)** on the RS485 system.

Remote Display Option

If you have a local display controller, skip this section and proceed to the next page to wire your line power. Otherwise, wire the remote display controller to the junction box on the convection loop/analyzer package as follows (see Figure 2-4 on page 2-12 and Figure 2-10 on page 2-21):

Wiring the Signal Cable Assembly (704-1104)

1. Wire the *combustibles sensor*:
    a. Using the **RED** wire from the red/black pair, connect junction box terminal **J3–1** (CO ACT / BLK) to display controller terminal **J4–1** (ACT / BLK).
    b. Using the **BLACK** wire from the red/black pair, connect junction box terminal **J3–2** (CO REF / GRN) to display controller terminal **J4–2** (REF / GRN).
    c. Using the **GREEN** wire from the green/black pair, connect junction box **J3–3** (CO ACT / RED) to display controller terminal **J4–3** (ACT / RED).
    d. Using the **BLACK** wire from the green/black pair, connect junction box terminal **J3–4** (CO REF / YEL) to display controller terminal **J4–4** (REF / YEL).
2. Wire the *oxygen sensor*:
    a. Using the **WHITE** wire from the white/black pair, connect junction box terminal **J2–1** (O2+) to display controller terminal **J1–1** (O2+).
    b. Using the **BLACK** wire from the white/black pair, connect junction box terminal **J2–2** (O2-) to display controller terminal **J1–2** (O2-).
3. Wire the *furnace thermocouple*:
    a. Using the **BLUE** wire from the blue/black pair, connect junction box terminal **J1–3** (T/C FURN +) to display controller terminal **J6–3** (T/C FURN +).
    b. Using the **BLACK** wire from the blue/black pair, connect junction box terminal **J1–4** (T/C FURN –) to display controller terminal **J6–4** (T/C FURN –).
4. Wire the *manifold thermocouple*:
    a. Using the **BROWN** wire from the brown/black pair, connect junction box terminal **J1–5** (T/C MAN +) to display controller terminal **J6–5** (T/C MAN +).
    b. Using the **BLACK** wire from the brown/black pair, connect junction box terminal **J1–6** (T/C MAN –) to display controller terminal **J6–6** (T/C MAN –).

Wiring the Signal Cable Assembly (704-1104) (cont.)

5. Wire the *cold junction compensation*:

a. Using the **YELLOW** wire from the yellow/black pair, connect junction box terminal **J1–1** (CJC +) to display controller terminal **J6–1** (CJC +).

b. Using the **BLACK** wire from the yellow/black pair, connect junction box terminal **J1–2** (CJC –) to display controller terminal **J6–2** (CJC –).

Wiring the AC Cable Assembly (704-1102)

1. Wire the *manifold and furnace heaters*:

a. Using **WIRE 1**, connect junction box terminal **J5–1** (MANIFOLD) to display controller terminal **J3–3** (MANIFOLD).

b. Using **WIRE 2**, connect junction box terminal **J5–2** (FURNACE) to display controller terminal **J3–2** (FURNACE).

c. Using **WIRE 3**, connect junction box terminal **J5–3** (COMMON) to display controller terminal **J3–1** (COMMON).

d. Connect the ground wire from a ground standoff in the junction box to a boss in the display controller.

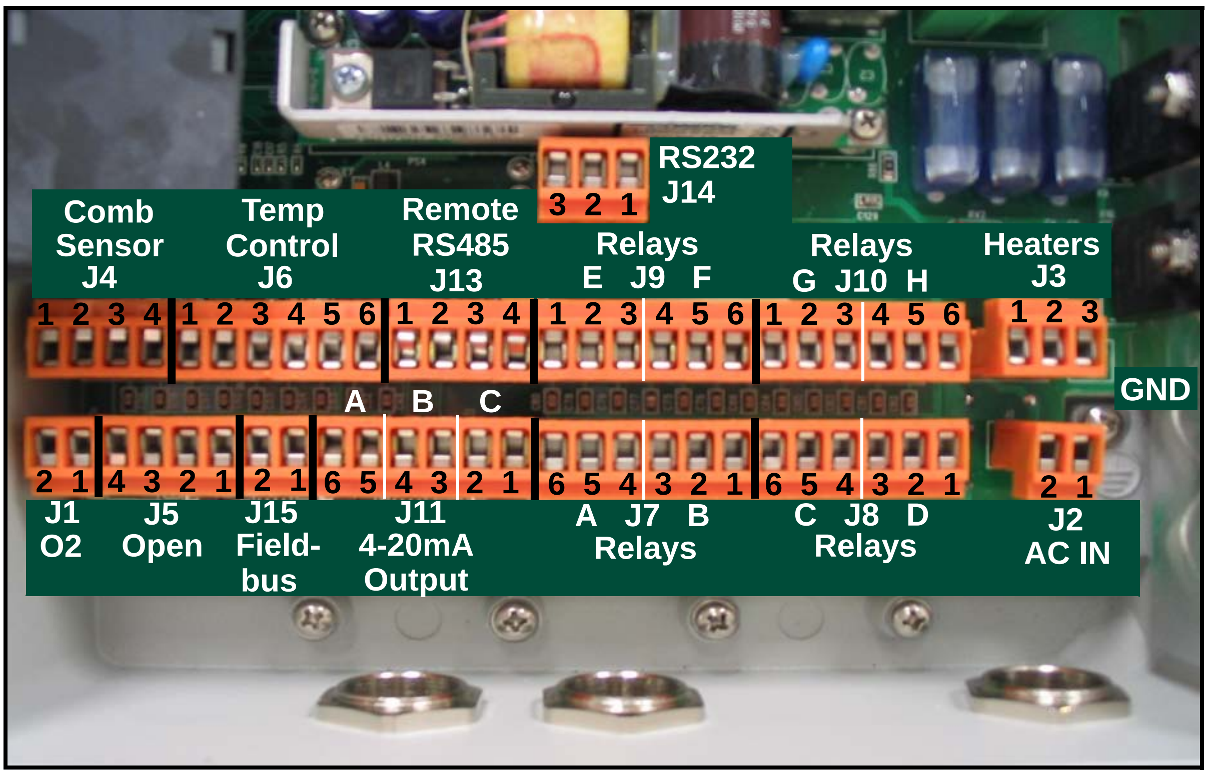


Figure 2-4: Display Controller Wiring Connections

Wiring the Line Power

!WARNING!
Before proceeding, verify that the line power has been turned off at the external disconnect device.

To wire the input voltage to the **OxyTrak™ 390**, complete the following steps. Make these connections only with wire that meets the following specifications:

- minimum 18 AWG individual conductor gauge (max. 12A current)
- voltage rating of 600V minimum
- insulation temperature rating of 105°C minimum

!WARNING!
The wire insulation rating must be at least 15°C above the expected ambient temperature.

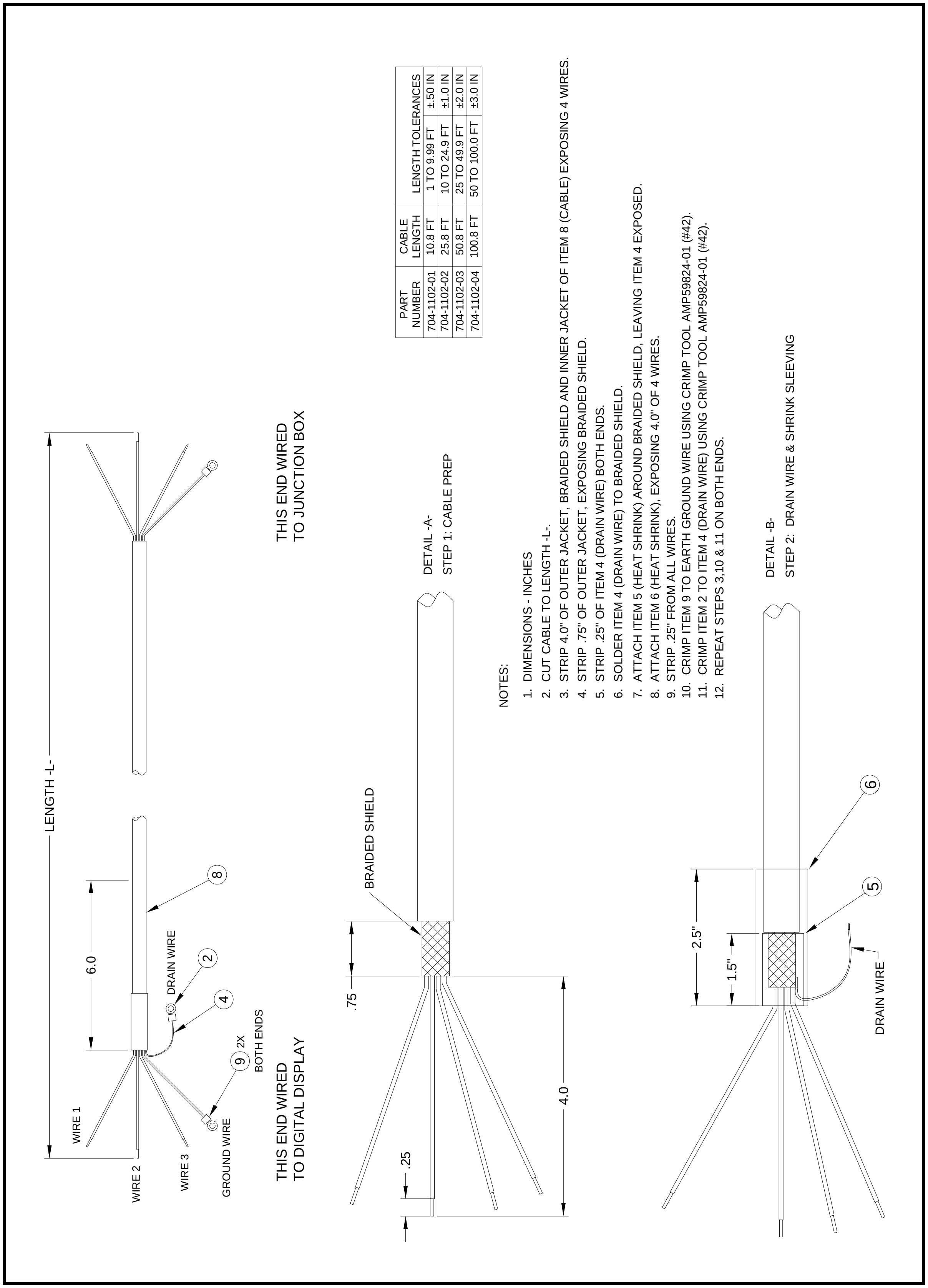


Figure 2-5: AC Cable Assembly (ref. dwg #704-1102)

Wiring The Line Power (cont.)

1. Attach a cable or conduit with the three conductors to the right cable entry port on the display controller.

Caution!
Be sure that the input voltage is within the specified limits for your **OxyTrak™ 390**.

---

2. Connect the line power leads as follows:
   a. Connect the *line* power lead to the LIVE pin (J2, pin #2) on the power connector.
   b. Connect the *neutral* power lead to the NEUT pin (J2, pin #1) on the terminal block.
   c. Connect the *ground* power lead to the earth ground connection in the enclosure.

IMPORTANT: *Do not alter any of the factory-wired power connections in your **OxyTrak™ 390**.*

This completes the wiring of the **OxyTrak™ 390**. Proceed to Chapter 3, *Operation*, for instructions on using the analyzer.

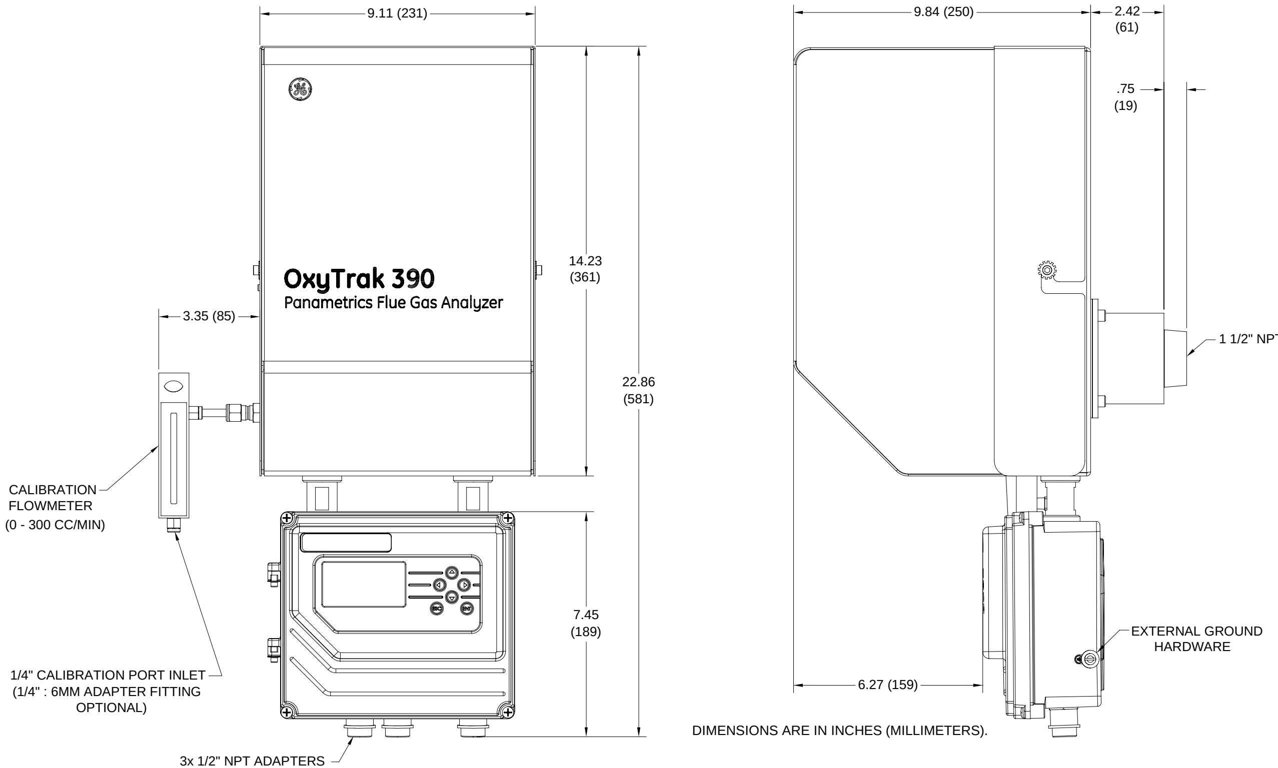


Figure 2-6: Outline and Installation Drawing - Local Controller (ref. dwg #712-1256, sht. 1)

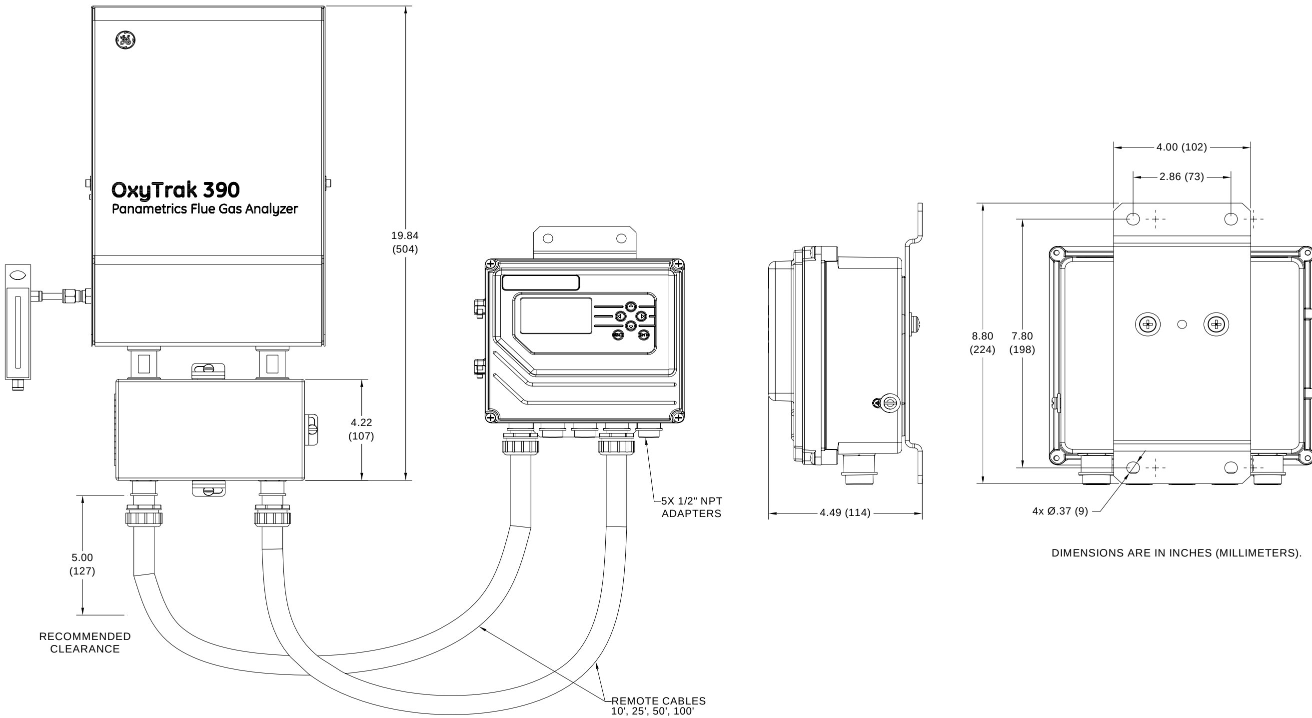


Figure 2-7: Outline and Installation Drawing - Remote Controller (ref. dwg #712-1256, sht. 2)

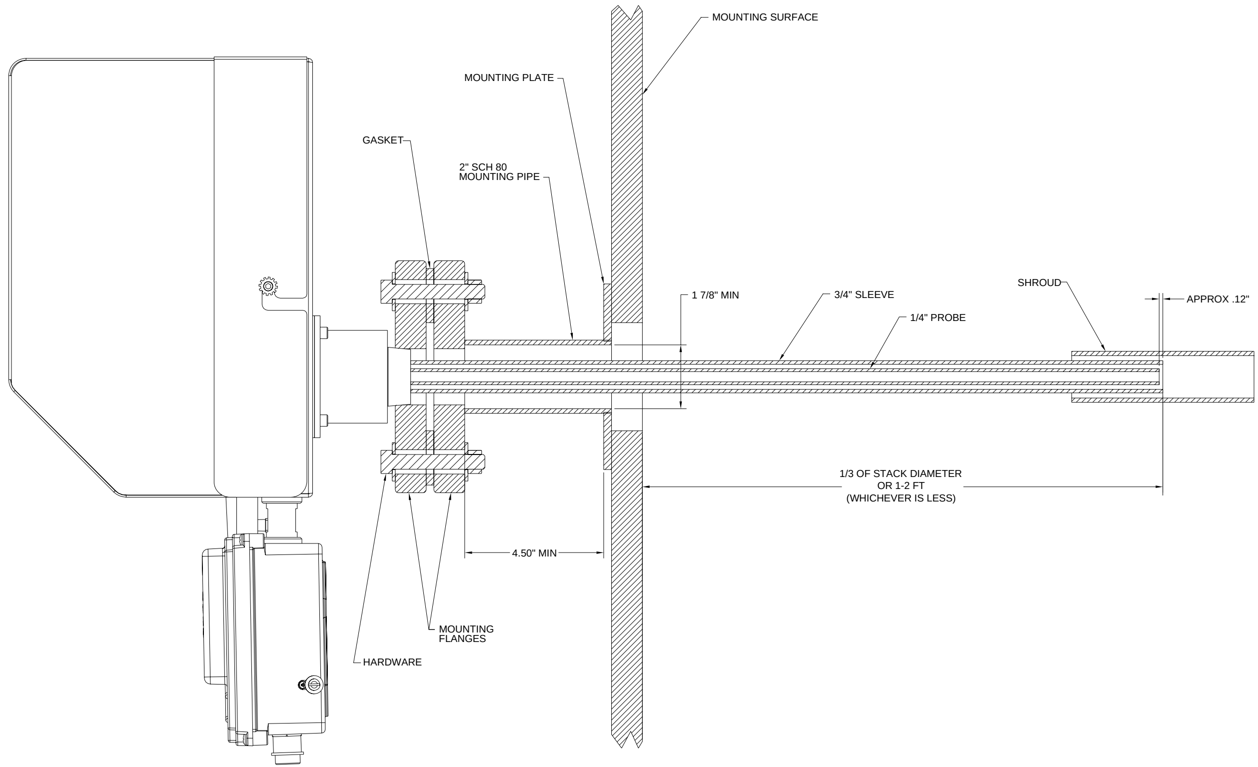
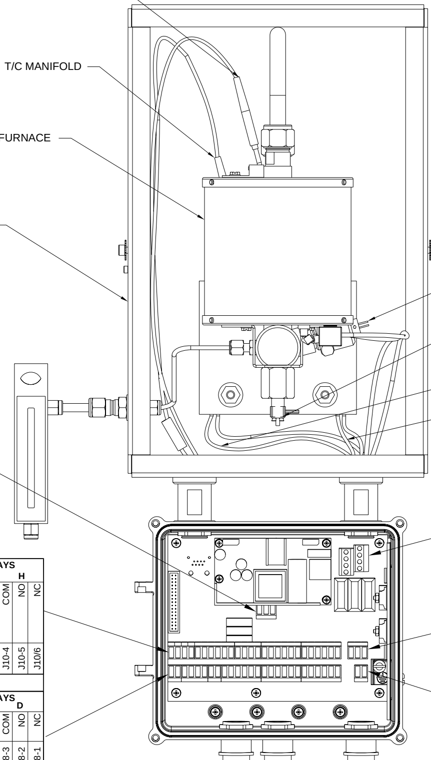


Figure 2-8: Outline and Installation Drawing - Mounting Details (ref. dwg #712-1256, sht. 3)



RS232		
EN	IN	OUT
J14-3	J14-2	J14-1
GRN	RED	WHT

Group	Signal	Terminal
COMB SENSOR	ACT / BLK	J4-1
COMB SENSOR	REF / GRN	J4-2
COMB SENSOR	ACT / RED	J4-3
COMB SENSOR	REF / YEL	J4-4
TEMP CONTROL	CJC (+)	J6-1
TEMP CONTROL	CJC (–)	J6-2
TEMP CONTROL	T/C FURN (+)	J6-3
TEMP CONTROL	T/C FURN (–)	J6-4
TEMP CONTROL	T/C MAIN (+)	J6-5
TEMP CONTROL	T/C MAIN (–)	J6-6
REMOTE RS485	DRTN	J13-1
REMOTE RS485	12V	J13-2
REMOTE RS485	(–)	J13-3
REMOTE RS485	(+)	J13-4
RELAYS E	COM	J9-1
RELAYS E	NO	J9-2
RELAYS E	NC	J9-3
RELAYS F	COM	J9-4
RELAYS F	NO	J9-5
RELAYS F	NC	J9-6
RELAYS G	COM	J10-1
RELAYS G	NO	J10-2
RELAYS G	NC	J10-3
RELAYS H	COM	J10-4
RELAYS H	NO	J10-5
RELAYS H	NC	J10/6

Group	Signal	Terminal
O2	02(–)	J1-2
O2	02(+)	J1-1
OPEN	OPEN	J5-4
OPEN	OPEN	J5-3
OPEN	OPEN	J5-2
OPEN	OPEN	J5-1
FIELD BUS	(–)	J15-2
FIELD BUS	(+)	J15-1
4-20mA OUTPUT A	(–)	J11-6
4-20mA OUTPUT A	(+)	J11-5
4-20mA OUTPUT B	(–)	J11-4
4-20mA OUTPUT B	(+)	J11-3
4-20mA OUTPUT C	(–)	J11-2
4-20mA OUTPUT C	(+)	J11-1
RELAYS A	COM	J7-6
RELAYS A	NO	J7-5
RELAYS A	NC	J7-4
RELAYS B	COM	J7-3
RELAYS B	NO	J7-2
RELAYS B	NC	J7-1
RELAYS C	COM	J8-6
RELAYS C	NO	J8-5
RELAYS C	NC	J8-4
RELAYS D	COM	J8-3
RELAYS D	NO	J8-2
RELAYS D	NC	J8-1

115/120 VAC

TB1-8 LHC	OPEN	TB1-4
TB1-7 RHC	OPEN	TB1-3
TB1-6 FURNACE	RHC	TB1-2
TB1-5 FURNACE	LHC	TB1-1

230/240 VAC

TB1-8 LHC	LHC	TB1-4
TB1-7 OPEN	RHC	TB1-3
TB1-6 FURNACE	RHC	TB1-2
TB1-5 FURNACE	OPEN	TB1-1

HEATERS		
OPEN	OPEN	OPEN
J3-1	J3-2	J3-3

A/C IN		
LIVE	NEUT	GND
J2-2	J2-1	

Figure 2-9: Wiring Diagram - Horizontal, Local Electronics (ref. dwg #702-623)

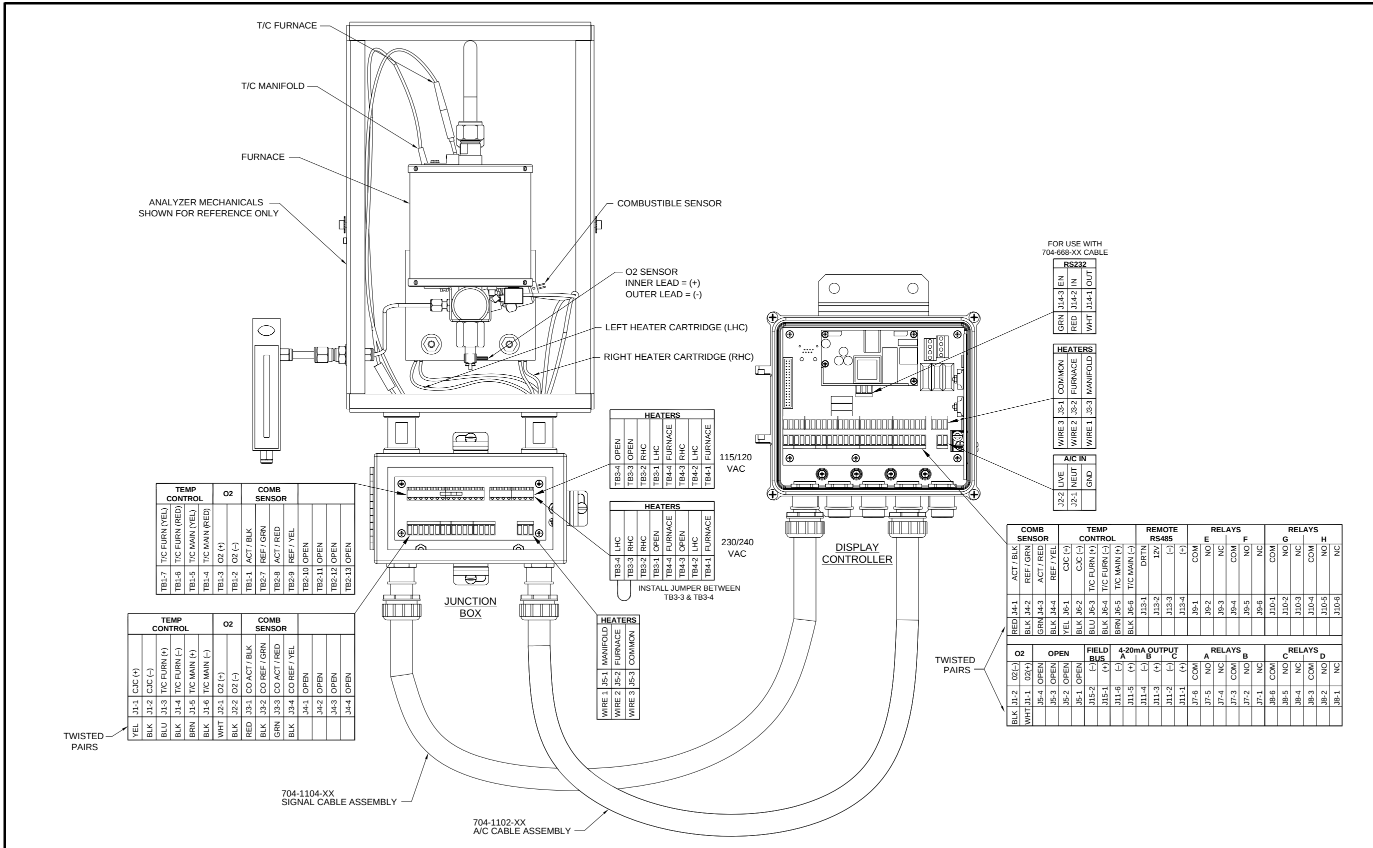


Figure 2-10: General Purpose Wiring Diagram - Remote Assembly (ref. dwg #702-625)

Chapter 3

Operation

Introduction

The **OxyTrak™ 390 Flue Gas Analyzer** is a monitoring device that is very simple to operate. Once it has been properly installed and set up, it simply begins taking readings. However, the analyzer should be allowed to warm up for at least 50 minutes prior to use. Refer to Chapter 2, *Installation*, if all of the required installation requirements have not yet been completed.

!WARNING!
To ensure safe operation, the OxyTrak™ 390 must be installed and operated as described in this manual. Also, be sure to follow all applicable local safety codes and regulations for installing electrical equipment.

This chapter includes discussions of the following topics:

- preventing common problems
- powering up the system
- programming the analyzer
- taking measurements

Preventing Common Problems

Due to the extreme conditions in monitoring flue gases and the complexity of the **OxyTrak™ 390**'s measurement techniques, some simple precautions should be taken. Failure to observe these basic procedures can lead to operational difficulties. Compliance with the following instructions will help to eliminate such common problems:

- Do not use pipe thread compounds on any part of the **OxyTrak™ 390**. Many pipe thread compounds emit combustible vapors that may cause inaccurate readings.
- Do not handle the oxygen sensor any more than is absolutely necessary. Scratches on the platinum electrode or the transfer of skin oils to the electrode can cause erroneous readings.
- Installing a cold probe assembly into a hot flue gas stream can cause damage to the sensor. Always allow the probe assembly to gradually heat up to normal operating temperature, before subjecting it to hot flue gases.
- Be sure the unit has exited *"Warm-up"* mode prior to use.

If any problems not covered in this manual are encountered, contact a GE Sensing representative for assistance.

Cleaning the Enclosure

If the display window or the case of the **OxyTrak™ 390** becomes soiled, use a soft cloth dampened with water for cleaning. Never use solvents or detergents to clean the **OxyTrak™ 390**.

Powering Up the System

Check the wiring connections and make sure all the **OxyTrak™ 390** covers are closed and secured before applying power. Then, energize the external disconnect device to power up the **OxyTrak™ 390** and allow the analyzer to warm up for at least 50 minutes before taking measurements.

IMPORTANT: *For compliance with the European Union's Low Voltage Directive (73/23/EEC), the* ***OxyTrak™ 390*** *requires an external power disconnect device such as a switch or circuit breaker. The disconnect device must be marked as such, clearly visible, directly accessible, and located within 1.8 m (6 ft) of the unit.*

The Display and Keypad

The front panel of the digital controller supplied with the **OxyTrak™ 390**, whether located locally or remotely, includes the components shown in Figure 3-1 below.

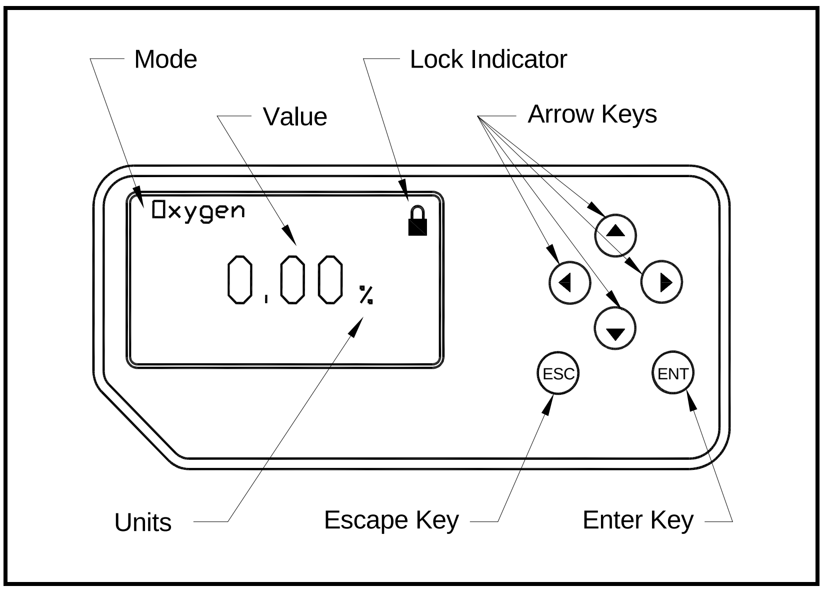


Figure 3-1: Digital Controller Display and Keypad

Note: *The* ***OxyTrak™ 390*** *digital controller has an integral keypad, which permits programming of the instrument without opening the cover. Thus, all programming procedures may be performed while the unit is installed in a hazardous environment.*

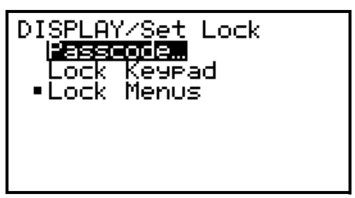
Entering Programming Mode

The **OxyTrak™ 390** software enables the operator to configure the meter for his specific requirements. To accomplish this, it is necessary to leave normal *run mode* and enter *Programming Mode* as follows:

Make sure you are at the normal *run mode* screen. The closed black padlock indicates that the user program is currently locked.

While in normal *run mode*, press the [ESC], [ENTER], and [ESC] keys in sequence. Notice that the black padlock is now open.

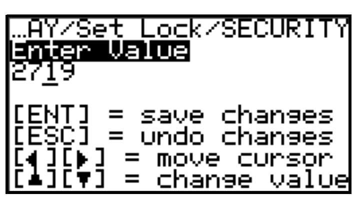
Use the arrow keys to select the padlock (it will change to white on a black background). Then, press the [ENTER] key.



Use the arrow keys to select the [Passcode] option. Then, press the [ENTER] key.

There are two different passcodes that can be used at the next screen:

- *User-Level:* passcode = **2719**
  (see Chapter 4, Setting Up the Display, and Chapter 5, *General Programming*, for instructions)
- *Service- Level Access:* passcode = **7378**
  (see Chapter 6, *Advanced Programming*, for instructions)



Use the arrow keys as indicated to enter the desired [Passcode]. Then, press the [ENTER] key.

Entering Programming Mode (cont.)

Regardless of the password that was entered at the previous screen, this will be the first programming screen.

Exiting Programming Mode

The are two different ways to leave the **OxyTrak™ 390** programming mode. These are described in the following sections.

Temporary Exit

To temporarily leave *Programming Mode*, proceed as follows:

From any point in the user program, press the [ESC] key repeatedly until the *run mode* screen appears.

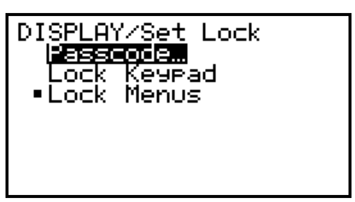
Notice that the padlock is open to indicate that programming mode is unlocked. Also, the current programming level is indicated just below the padlock:

- M1 - indicates that the **2719** passcode is in effect.
- M2 - indicates that the **7378** passcode is in effect.

To reenter programming mode, use the arrow keys to select the M1 or M2 symbol and press the [ENTER] key.

Locking Programming Mode

To lock programming mode, use the arrow keys to select the padlock symbol and press the [ENTER] key. Then, proceed as follows:



Use the arrow keys to select either the [Lock Keypad] option or the [Lock Menus] option. Then, press the [ENTER] key.

The [Lock Menus] option will permit reentry to programming mode for programming the display only. All other programming functions will be locked out. The [Lock Keypad] option will completely lock out programming mode and restore the black, closed padlock.

Note: *If the unit is powered down,* Programming Mode *will be locked when the unit is powered up again.*

Powering Down the System

Powering down the **OxyTrak™ 390** system is as simple as cutting the power to the system at the main disconnect device. However, be sure to heed the warning below.

!WARNING!
If the analyzer is left installed without power, the unit's components become susceptible to acid condensation that will cause corrosion.

If the power must be removed for more than thirty minutes, purge the analyzer through the calibration port with a continuous flow of instrument air at a minimum rate of 150 cc/min (0.3 SCFH).

Taking Measurements

Allow the **OxyTrak™ 390** to warm up sufficiently before taking any measurements. Readings are output to the LCD Display in the format programmed into the system.

If the LCD Display is not included in the system, you may use Equation 3-1 below to convert the **OxyTrak™ 390** analog output reading into percent oxygen.

$$E_{700}\ (\text{mV}) = 48.273 \times \log\left\{\frac{20.9}{\%\ \text{O2 in Sample Gas}}\right\} \tag{3-1}$$

Note: *See Appendix A, The Nernst Equation, for more details on how to perform similar calculations at other operating temperatures.*

Although percent oxygen can still be measured without the LCD Display, the measurement of combustibles can **NOT** be accomplished without the LCD Display.

Chapter 4

Setting Up the Display

Introduction

Although the **OxyTrak™ 390** is set up at the factory with default values that are suitable for many applications, the *User Program* provides a means for customizing many of the meter parameters.

IMPORTANT: *This chapter discusses only those programming options available at the* **2719** *passcode access level. For additional options available at the* **7378** *passcode level, see Chapter 6,* Advanced Programming.

The following procedures for configuring the LCD Display are described in this chapter:

- selecting the *number of display views*
- adjusting the *display contrast*
- selecting the *measurement mode/display parameter*
- selecting the *measurement units*

Note: *While in the* User Program*, press* [ESC] *at any time to abort the current operation and return to the previous menu level.*

Access the *User Program* as described on page 3-3, and refer to the menu map in Figure B-1 on page B-1 while programming the **OxyTrak™ 390** display.

This is the initial programming screen.

From the *Main Menu* screen above, proceed directly to the appropriate section to perform the desired programming task.

Selecting the Number of Views

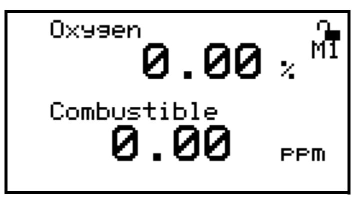
The **OxyTrak™ 390** can be easily configured to display 1, 2, or 3 views. To do so, proceed as follows:

Use the arrow keys to select the [# of Views] option and press [ENTER].

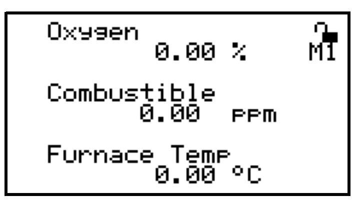
Use the arrow keys to select the desired option and press [ENTER]. You will then be returned to the [Display] main menu.

After your selection, press [ESC] to return to the standard run mode screen, and depending on the option selected above, your display will look like one of the following:

This is a display configured to show 1 view.



This is a display configured to show 2 views.



This is a display configured to show 3 views.

Note: *Any of the* measurement modes *or* measurement units *in any of the displayed views may be programmed by selecting it with the arrow keys and pressing* [ENTER]

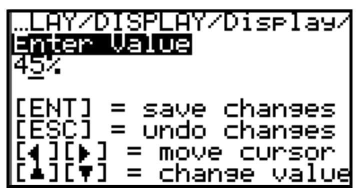
Adjusting the Display Contrast

After entering the *User Program*, as described on page 3-3, the *Main Menu* appears. To adjust the contrast of the LCD display, proceed as follows:

Use the arrow keys to select the [Display] option and press [ENTER].

Use the arrow keys to select the [Contrast] option and press [ENTER].

Note: *The* [Normal] *and* [Reverse] *options in the above menu are used to toggle the display between the normal (black text on a white background) display and a reverse (white text on a black background) display.*



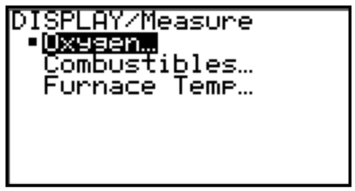
Use the keypad, as indicated, to set the desired contrast percentage and press [ENTER]. You will be returned to the previous menu.

Press [ESC] twice to exit the *User Program*, and return to the normal run mode screen.

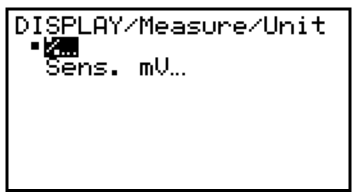
Selecting the Measurement Mode and Units

To select the *measurement mode/display parameter* and *measurement units*, from the run mode screen proceed as follows:

Use the arrow keys to highlight the measurement mode/display parameter and press [ENTER].



Use the arrow keys to select the desired parameter to be displayed and press [ENTER].



Use the arrow keys to select the desired units for the selected measurement mode (see Table 4-1 below) and press [ENTER] to return to run mode.

Table 4-1: Available Measurement Units

Measurement Mode	Measurement Units
Oxygen	% Sens. mV
Combustibles	ppm %
Furnace Temp	°C °F

Note: *If you only wish to change the measurement units, you may use the arrows to highlight the units on the run mode screen to go directly to the* [Units] *menu for the current measurement mode.*

Measurement Units Description

As indicated in Table 4-1 on the previous page, there are several measurement units available for the various measurement modes. Although some of these options are obvious, others require a bit of explanation. The available units are as follows:

- **%** - this is the *percentage* of the specified parameter, by volume, in the sample gas.
- **Sens. mV** - this is the raw *oxygen sensor millivolt output*, which indicates the condition of the oxygen sensor.
- **ppm** - this is the *parts per million* of the specified parameter, by volume, in the sample gas.
- **°C or °F** - this is the furnace *temperature* on the scale indicated.

Chapter 5

General Programming

Introduction

Although the **OxyTrak™ 390** is set up at the factory with default values that are suitable for many applications, the *User Program* provides a means for customizing many of the meter parameters.

Note: *See the Calibration Sheet included with the* ***OxyTrak™ 390*** *and Appendix F in this manual for the factory default settings. If the Calibration Sheet is lost, contact the factory.*

IMPORTANT: *This chapter discusses only those programming options available at the* **2719** *passcode access level. For additional options available at the* **7378** *passcode level, see Chapter 6,* Advanced Programming.

The following submenus are included in the *Main Menu* of the ***OxyTrak™ 390*** *User Program*:

- Display (see Chapter 4 for instructions)
- Calibrate
- Output
- Relays
- Communications
- Setup
- Factory

Note: *While in the* User Program*, press* [ESC] *at any time to abort the current operation and return to the previous menu level.*

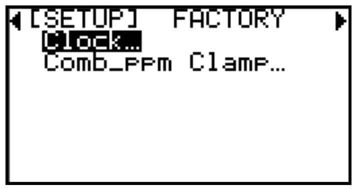
Access the *User Program* (as described on page 3-3) at the **2719** passcode level, and refer to Figure B-1, Figure B-2 and Figure B-3 in Appendix B, while programming the **OxyTrak™ 390** features described in this chapter.

Proceed to the appropriate section to program the desired meter function(s).

Setup Menu (Real Time Clock)

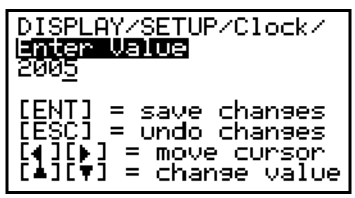
The options available in the [Setup] menu at the **2719** passcode level are the [Clock] submenus and [Comb_ppm Clamp]. To set the **OxyTrak™ 390** *real time clock*, proceed as follows:

IMPORTANT: *The real time clock must be set before programming an automatic calibration schedule.*



At the Main Menu, use the arrow keys to select the [Setup] submenu. Press [ENTER] to access the [Clock] option.

The five clock parameters are now available for programming. Use the arrow keys to select the desired parameter, and press [ENTER].



Use the arrow keys as indicated to enter the desired value for the chosen parameter. When done, press [ENTER].

The two screens above show the programming of the [Year] parameter to a value of 2005. repeat the same procedure to set the [Month], [Day], [Hour], and [Minute] parameters to the desired values.

When you have finished programming the [Setup] menu, press [ESC] until you return to normal run mode.

Calibrate Menu

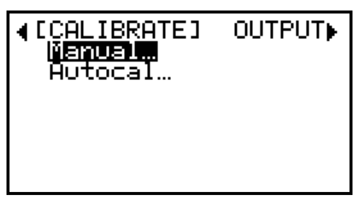
A variety of calibration procedures may be used with the **OxyTrak™ 390** (see page 7-2). As all of the procedures are very similar, only the manual and automatic procedures for performing a *one-gas oxygen* calibration will be described in step-by-step detail. The other procedures are presented in Appendix C, *Calibration Methods*. (Refer to Figure 2-6 on page 2-17 for port locations.)

Manual, One-Gas Oxygen Calibration

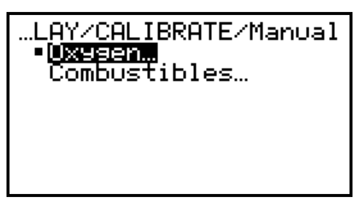
To perform a manual O_2 calibration with one calibration gas, access the user program as described on page 3-3 and proceed as follows:

IMPORTANT: *As an example, these instructions assume the factory default settings of a* 5.00% calibration gas, *a* ±0.02% O_2 calibration tolerance, *and a maximum allowable* furnace temperature change of 20°C. *See Chapter 6,* Advanced Programming, *for instructions on changing these values.*

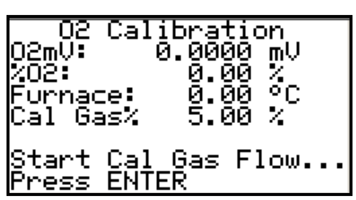
At the [Display] submenu of the *Main Menu*, press the [►] key.



At the [Calibrate] submenu of the *Main Menu*, use the arrow keys to select the [Manual] option and press [ENTER].



Use the arrow keys to select the [Oxygen] option and press [ENTER].



The current calibration data is displayed. Start the calibration (span) gas flow. When mV and % have settled, press [ENTER].

Manual, One-Gas Oxygen Calibration (cont.)

```
   O2 Calibration
O2mV:        0.00 mV
%O2:         0.00 %
Furnace:     0.00 °C

Turn off gas, press
ENT after settled
```

Turn off the calibration gas flow. Allow the reading to return to process, then press [ENTER].

After the calibration is completed, press [ESC] twice to return to normal run mode. If O_2, refer to Appendix G for thermal calibration.

Manual, Two-Gas Combustibles Calibration

To perform a manual combustibles calibration with two calibration gases:

1. Enter the oxygen sensor's calibration menu from the main menu as in the previous section.
2. Supply zero gas at the flow rate entered in the analyzer.

Note: *The flow rate is entered in the analyzer by using the Factory Menu, Comb Cal / Setup / Q Cal).*

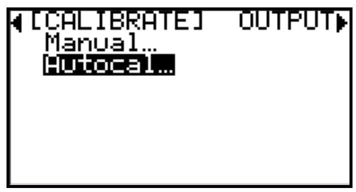
3. After ten minutes, press [ENTER].
4. Supply span gas at the same flow rate.
5. After ten minutes, press [ENTER].
6. Press [ENTER] again to save calibration data.
7. Shut off the span gas.
8. Press [ESC] as required to return to the main menu.

Automatic, One-Gas Oxygen Calibration

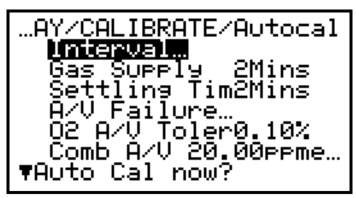
To perform an automatic one-gas O_2 calibration, access the user program as described on page 3-3 and proceed as follows:

IMPORTANT: *As an example, these instructions assume the factory default settings of a* 5.00% calibration gas, *a* ±0.02% O_2 calibration tolerance, *and a maximum allowable* furnace temperature change of 20°C. *See Chapter 6,* Advanced Programming, *for instructions on changing these values.*

At the [Display] submenu of the *Main Menu*, press the [▶] key.



At the [Calibrate] submenu of the *Main Menu*, use the arrow keys to select the [Autocal] option and press [ENTER].



Seven options are now available for programming. Proceed to the appropriate section to program the desired option.

After you have completed the programming of the **OxyTrak™ 390** Autocal process. Press [ESC] until you return to normal run mode and the meter will perform automatic calibrations according the settings programmed in this section.

Autocal Interval

Program the time interval between Autocals as follows:

```
…AY/CALIBRATE/Autocal
  Interval…
  Gas Supply  2Mins
  Settling Tim2Mins
  A/V Failure…
  O2 A/V Toler0.10%
  Comb A/V 20.00ppme…
▼Auto Cal now?
```

Use the arrow keys to select the [Interval] option, and press [ENTER].

```
…ATE/Autocal/Interval
 ▪Hours…
  Days…
```

Use the arrow keys to select the [Hours] option (or see below for the [Days] option), and press [ENTER].

```
…tocal/Interval/Hours
  2 Hours
  3 Hours
  4 Hours
  6 Hours
  8 Hours
 ▪12 Hours
```

Use the arrow keys to select the desired number of hours between Autocals, and press [ENTER].

```
…ATE/Autocal/Interval
 ▪Hours…
  Days…
```

Use the arrow keys to select the [Days] option (or see above for the [Hours] option), and press [ENTER].

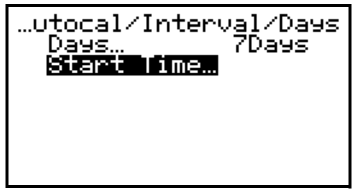
```
…utocal/Interval/Days
  Days…       7Days
  Start Time…
```

Use the arrow keys to select the [Days] option, and press [ENTER].

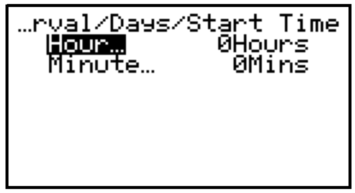
```
…tocal/Interval/Days/
Enter Value
 7Days

[ENT] = save changes
[ESC] = undo changes
[◄][►] = move cursor
[▲][▼] = change value
```

Use the arrow keys as indicated to enter the desired value. When done, press [ENTER].

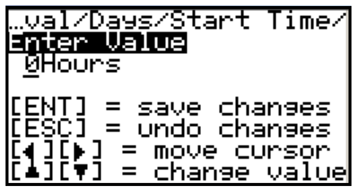
Autocal Interval (cont.)



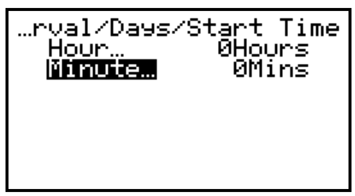
Use the arrow keys to select the [Start Time] option, and press [ENTER].



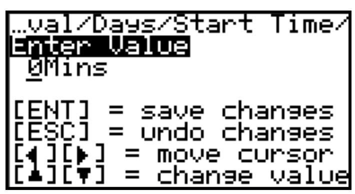
Use the arrow keys to select the [Hour] option, and press [ENTER].



Use the arrow keys as indicated to enter the desired value. When done, press [ENTER].



Use the arrow keys to select the [Minute] option, and press [ENTER].

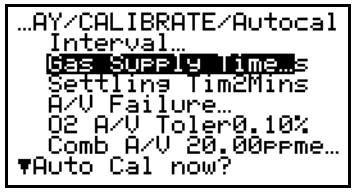


Use the arrow keys as indicated to enter the desired value. When done, press [ENTER].

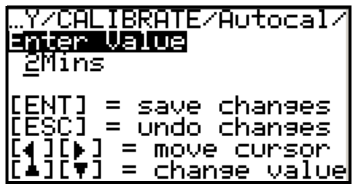
The **OxyTrak™ 390** is now programmed to automatically perform calibrations at the interval programmed in this section. Press [ESC] until you return to the initial [Autocal] menu.

Gas Supply Time

Program the length of time that the calibration gas will flow during an Autocal as follows:



Use the arrow keys to select the [Gas Supply Time] option, and press [ENTER].

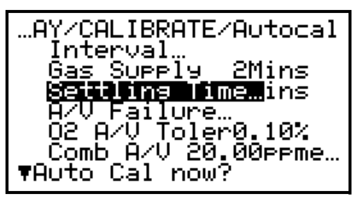


Use the arrow keys as indicated to enter the desired time in minutes. When done, press [ENTER].

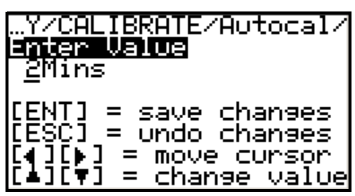
Now, whenever the **OxyTrak™ 390** performs an Autocal, the calibration gas will flow for the length of time programmed above.

Settling Time

Program the length of time allowed for the calibration data to settle during an Autocal as follows:



Use the arrow keys to select the [Settling Time] option, and press [ENTER].



Use the arrow keys as indicated to enter the desired time in minutes. When done, press [ENTER].

Now, whenever the **OxyTrak™ 390** performs an Autocal, the settling time allowed for the calibration data will be as programmed above.

Auto-Verification Failure

As part of the Autocal process, the **OxyTrak™ 390** periodically verifies the current calibration. You can program the manner in which the meter responds to an Auto-Verification failure as follows:

```
…AY/CALIBRATE/Autocal
  Interval…
  Gas Supply  2Mins
  Settling Tim2Mins
  A/V Failure…
  O2 A/V Toler0.10%
  Comb A/V 20.00ppme…
▼Auto Cal now?
```

Use the arrow keys to select the [A/V Failure] option, and press [ENTER].

```
…BRATE/Autocal/Action
 ▪Alarm
  Alarm+ReCal
```

Use the arrow keys to select the desired option. The, press [ENTER].

If you selected [Alarm] above, an auto-verification failure will only trigger the auto-verification alarm. However, if you selected [Alarm+ReCal] above, an auto-verification failure will not only trigger the auto-verification alarm, but it will also initiate an immediate calibration of the instrument.

Oxygen Auto-Verification Tolerance

In the previous section, you programmed the manner in which the **OxyTrak™ 390** responds to an auto-verification failure. In this section, you define what constitutes a failure by specifying the maximum amount of variation in the oxygen calibration reading that will be tolerated. Proceed as follows:

```
…AY/CALIBRATE/Autocal
  Interval…
  Gas Supply  2Mins
  Settling Tim2Mins
  A/V Failure…
  O2 A/V Tolerance…
  Comb A/V 20.00ppme…
▼Auto Cal now?
```

Use the arrow keys to select the [O2 A/V Tolerance] option, and press [ENTER].

```
…Y/CALIBRATE/Autocal/
Enter Value
0.10%

[ENT] = save changes
[ESC] = undo changes
[◄][►] = move cursor
[▲][▼] = change value
```

Use the arrow keys as indicated to enter the desired tolerance value (in $\%O_2$). When done, press [ENTER].

Combustibles Auto-Verification Tolerance

This section is very similar to the previous section, except that it is used to program the auto-verification tolerance for the *combustibles* measurement. Proceed as follows:

```
…AY/CALIBRATE/Autocal
  Interval…
  Gas Supply  2Mins
  Settling Tim2Mins
  A/V Failure…
  O2 A/V Toler0.10%
  Comb A/V Tolerance…
▼Auto Cal now?
```

Use the arrow keys to select the [Comb A/V Tolerance] option, and press [ENTER].

```
…Y/CALIBRATE/Autocal/
Enter Value
 20.00ppm

[ENT] = save changes
[ESC] = undo changes
[◄][►] = move cursor
[▲][▼] = change value
```

Use the arrow keys as indicated to enter the desired tolerance value (in ppm combustibles). When done, press [ENTER].

Auto Cal Now?

This option may be used to force an immediate Autocal using the currently programmed parameters. Proceed as follows:

```
…AY/CALIBRATE/Autocal
▲ Settling Tim2Mins
  A/V Failure…
  O2 A/V Toler0.10%
  Comb A/V 20.00ppme…
 Auto Cal now?
  Yes
 ▪No
```

Use the arrow keys to select the [Yes] response of the [Auto Cal Now?] option (or see the next step). Then, press [ENTER].

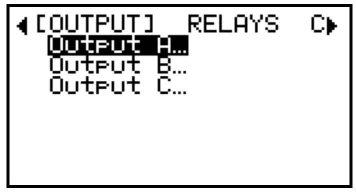
```
…AY/CALIBRATE/Autocal
▲ Settling Tim2Mins
  A/V Failure…
  O2 A/V Toler0.10%
  Comb A/V 20.00ppme…
 Auto Cal now?
 ▪Yes
  No
```

Use the arrow keys to select the [No] response of the [Auto Cal Now?] option (or see the previous step). Then, press [ENTER].

No matter which response you selected above, you will be returned to the main [Calibrate] menu. When you have finished programming the [Calibrate] menu, press [ESC] until you return to normal run mode.

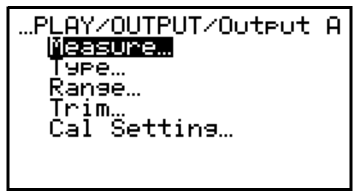
Output Menu

The [Output] menu is used to configure the **OxyTrak™ 390** analog outputs. To configure your outputs, proceed as follows:



At the Main Menu, use the arrow keys to select the [Output] menu. Then, use the arrow keys to select the desired output to configure, and press [ENTER].

Note: *The setup of* [Output A] *is shown here as an example. The other outputs are programmed in a similar manner.*

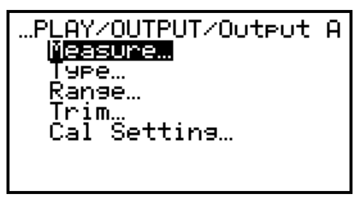


The four programmable output parameters are now available. Use the arrow keys to select the desired option, and press [ENTER].

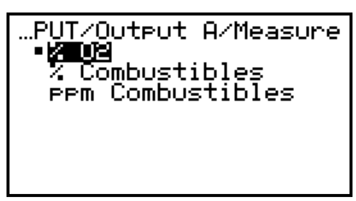
Proceed to the appropriate section to program the option selected at the above screen.

Measure

The [Measure] option is used to specify the measured variable (% oxygen, ppm oxygen, % combustibles, or ppm combustibles) that is sent to the output being programmed.



Use the arrow keys to select the [Measure] option, and press [ENTER].



Use the arrow keys to select the desired output variable, and press [ENTER].

The current **OxyTrak™ 390** analog output will now display the data for the variable chosen above.

Type

The [Type] option is used to specify the type of signal that is used for the analog output being programmed.

```
…PLAY/OUTPUT/Output A
   Measure…
   Type…
   Range…
   Trim…
   Cal Setting…
```

Use the arrow keys to select the [Type] option, and press [ENTER].

```
…OUTPUT/Output A/Type
 ▪4-20mA
   0-20mA
   NAMUR
   Special…
```

Use the arrow keys to select the desired output type, and press [ENTER].

Note: *The Namur NE43 specification requires a 4-20 mA output to be clamped in specific bands to indicate out-of-range errors.*

If you select [Special] at the above prompt, you will be able to specify the [Zero] and [Span] values of your choosing for the analog output range.

Range

The [Range] option is used to specify the [zero] and [span] points of the analog output range, as a percentage of the output variable range.

```
…PLAY/OUTPUT/Output A
   Measure…
   Type…
   Range…
   Trim…
   Cal Setting…
```

Use the arrow keys to select the [Range] option, and press [ENTER].

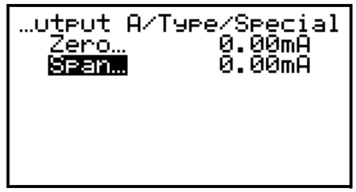
```
…UTPUT/Output A/Range
   Zero…        0.00%
   Span…      100.00%
```

Use the arrow keys to select the [Zero] option, and press [ENTER].

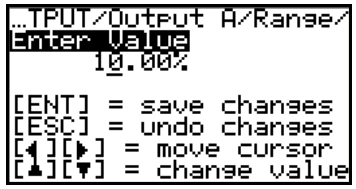
```
…TPUT/Output A/Range/
Enter Value
       0.00%

[ENT] = save changes
[ESC] = undo changes
[◂][▸] = move cursor
[▴][▾] = change value
```

Use the arrow keys as indicated to enter the desired [Zero] point of the output range. When done, press [ENTER].

Range (cont.)



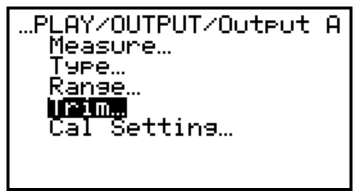
Use the arrow keys to select the [Span] option, and press [ENTER].



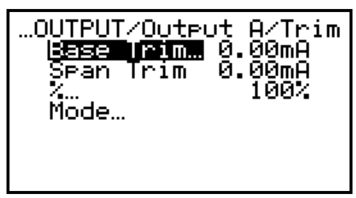
Use the arrow keys as indicated to enter the desired [Span] point of the output range. When done, press [ENTER].

Trim

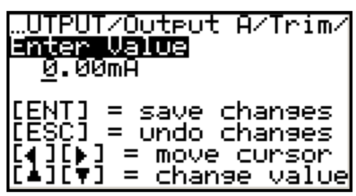
The [Trim] option is used to fine-tune the analog output parameters.



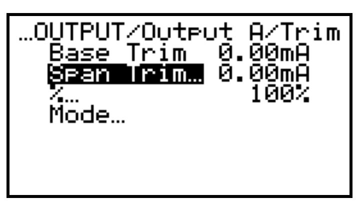
Use the arrow keys to select the [Trim] option, and press [ENTER].



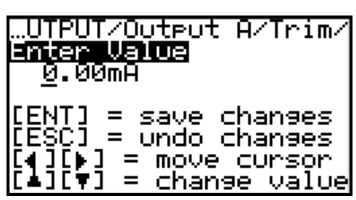
Use the arrow keys to select the [Base Trim] option, and press [ENTER].



Use the arrow keys as indicated to specify the [Zero] point of the analog output. When done, press [ENTER].



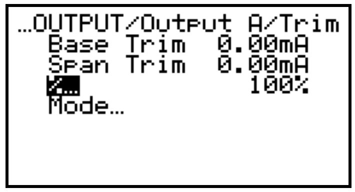
Use the arrow keys to select the [Span Trim] option, and press [ENTER].



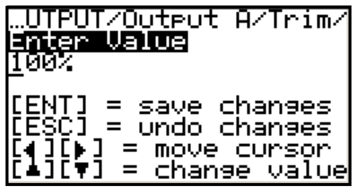
Use the arrow keys as indicated to specify the [Span] point of the analog output. When done, press [ENTER].

Trim (cont.)

The [%] option is used to output a signal at a specified percentage of the analog output range during a [Test] cycle.

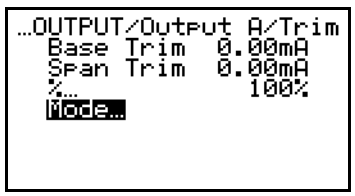


Use the arrow keys to select the [%] option, and press [ENTER].

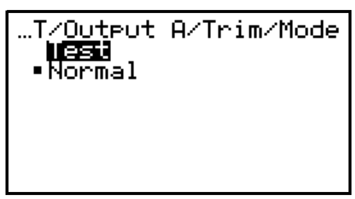


Use the arrow keys as indicated to specify the [%] to be output during a [Test] cycle. When done, press [ENTER].

The [Mode] option is used to test the analog output.



Use the arrow keys to select the [Mode] option, and press [ENTER].



Use the arrow keys to select the [Test] option, and press [ENTER].

The analog output should now be reading a value equal to the percentage of full scale programmed into the [%] option above (if it does not, contact the factory for assistance). After you verify this, continue as follows:

Use the arrow keys to select the [Normal] option, and press [ENTER].

IMPORTANT: *Be sure to set the output to the* [Normal] *mode before you leave the* [Trim] *menu.*

Cal Setting

The [Cal Setting] option is used to specify the manner in which the **OxyTrak™ 390** handles measurement readings during a calibration.

```
…PLAY/OUTPUT/Output A
   Measure…
   Type…
   Range…
   Trim…
   Cal Setting…
```

Use the arrow keys to select the [Cal Setting] option, and press [ENTER].

```
…Output A/Cal Setting
  ▪Hold Last Value
   User Selectable…
   Live Output
```

Use the arrow keys to select the desired option (see description below). When done, press [ENTER].

The available options at the above prompt are as follows:

- [Hold Last Value] - The last valid measurement taken prior to the calibration is displayed while a calibration is in progress.
- [User Selectable] - The user chooses the measurement value that is displayed while a calibration is in progress.
- [Live Output] - The instrument continues to display the actual current measurement value while a calibration is in progress.

If you select [Hold Last Value] or [Live Output], you are immediately returned to the previous menu. If you choose [User Selectable], continue as follows:

```
…tting/Specific Value
   Specific Value…mA
```

At the [Specific Value] option, press [ENTER].

```
…ting/Specific Value/
Enter Value
 1.0mA

[ENT] = save changes
[ESC] = undo changes
[◄][►] = move cursor
[▲][▼] = change value
```

Use the arrow keys as indicated to enter a value. When done, press [ENTER].

When you have finished programming the [Outputs] menu, press [ESC] until you return to normal run mode.

Relays Menu

The [Relays] menu is used to program the **OxyTrak™ 390** alarm relays A-D and to test the system control relays E-H. To program and/or test your relays, proceed to the appropriate section.

Relays A-D

To program the alarm relays A-D, proceed as follows:

```
◄[RELAYS]  COMMUNICA►
   Relay A…
   Relay B…
   Relay C…
   Relay D…
   Relay E (CTRL)…
   Relay F (CTRL)…
▼  Relay G (CTRL)…
```

At the Main Menu, use the arrow keys to select the [Relays] menu. Then, use the arrow keys to select the desired alarm relay to configure, and press [ENTER].

Note: *The setup of alarm* [Relay A] *is shown here as an example. Relays B, C, and D are programmed in a similar manner.*

```
…SPLAY/RELAYS/Relay A
   Type…
   Setting…
   Normal/Failsafe…
```

The three programmable relay options are now available. Use the arrow keys to select the desired option, and press [ENTER].

Proceed to the appropriate section to program the option selected at the above screen.

Type

The [Type] option is used to specify the general category of parameters to which the alarm relay being programmed will respond.

```
…SPLAY/RELAYS/Relay A
   Type…
   Setting…
   Normal/Failsafe…
```

Use the arrow keys to select the [Type] option, and press [ENTER].

```
…/RELAYS/Relay A/Type
 *Measure
 *Diag Errors
 *System Faults
```

Highlight a type and press [ENTER] to select it, as indicated by a [*] to its left. Repeat to select as many types as desired, then press [ESC].

The current **OxyTrak™ 390** alarm relay will now respond to the types of parameters chosen above.

Note: *The next section provides instructions for selecting the specific parameters to be included in each of the three categories above.*

Setting

The [Setting] option is used to choose the specific parameters that are included in each [Type] category for triggering the alarm relay. Also, the details for the alarm's response may be programmed.

```
…SPLAY/RELAYS/Relay A
  Type…
  Setting…
  Normal/Failsafe…
```

Use the arrow keys to select the [Setting] option, and press [ENTER].

The [Measure] submenu:

```
…LAYS/Relay A/Setting
  Measure…
  Diag Errors…
  System Faults…
```

Use the arrow keys to select the [Measure] option, and press [ENTER].

```
…ay A/Setting/Measure
 ▪% O2
  % Combustibles
  ppm Combustibles
  Type…
```

Use the arrow keys to select the [Type] option, and press [ENTER].

```
…Setting/Measure/Type
  High…
  Low…
```

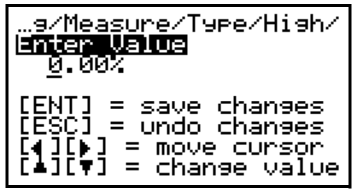
Use the arrow keys to select the desired option, and press [ENTER].

Note: *The alarm* setpoint *is the signal value at which the relay will be triggered. A* [High] *relay is triggered when the signal exceeds the setpoint; a* [Low] *relay is triggered when the signal drops below the setpoint.*

```
…ng/Measure/Type/High
  Setpoint…    0.00%
  Deadband…    0.00%
```

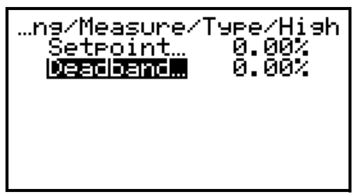
Use the arrow keys to select the [Setpoint] option, and press [ENTER].

Setting (cont.)

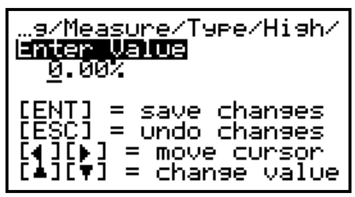


Use the arrow keys as indicated to specify the value for the alarm relay setpoint. When done, press [ENTER].

The [Deadband] option is used to specify a range of values around the setpoint within which the relay will not reset after it has been triggered. This is to prevent the relay from cycling on and off in response to minor fluctuations near the setpoint.

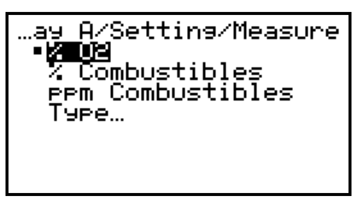


Use the arrow keys to select the [Deadband] option, and press [ENTER].



Use the arrow keys as indicated to specify the deadband value for the alarm relay. When done, press [ENTER].

This completes the programming of the [Type] submenu. Press [ESC] to return to the [Measure] menu.



Use the arrow keys to select the desired measurement parameter to trigger the alarm relay ([% O2] is shown as an example). Then, press [ENTER].

Setting (cont.)

The [Diag Errors] submenu:

```
…LAYS/Relay A/Setting
  Measure…
  Diag Errors…
  System Faults…
```

Use the arrow keys to select the [Diag Errors] option, and press [ENTER].

Note: *This submenu allows you to select one or more diagnostic error signals for triggering the alarm relay.*

```
…/Setting/Diag Errors
 *O2 Over Range
 *O2 Under Range
  O2Cal Error
 *Comb Over Range
  Comb Under Range
 *CombCal Error
```

Highlight a diagnostic error type and press [ENTER] to select it, as indicated by a [*] to its left. Repeat to select as many types as desired, then press [ESC].

Note: *All three oxygen and three combustibles diagnostic errors that are available are listed above.*

The [System Faults] submenu:

```
…LAYS/Relay A/Setting
  Measure…
  Diag Errors…
  System Faults…
```

Use the arrow keys to select the [System Faults] option, and press [ENTER].

Note: *This submenu allows you to select one or more system fault signals for triggering the alarm relay.*

```
…etting/System Faults
 *Furnace Temp Over R
  Furnace Temp Under
 *Furnace Low Temp
 *Block Temp Over Ran
 *Block Temp Under Ra
  Block Low Temp
▼ Active RTD Over Ran
```

Highlight a system fault type and press [ENTER] to select it, as indicated by a [*] to its left. Repeat to select as many types as desired, then press [ESC].

Note: *In addition to the seven system faults listed above, the* [Active RTD Under Range], [Ref RTD Over Range], *and* [Ref RTD Under Range] *options are available in the above list.*

Normal/Failsafe

The [Normal/Failsafe] option is used to choose the mode of operation for the alarm relay being programmed.

Note: *A* [Normal] *relay uses the normally-open contacts and must be energized when a fault occurs; a* [Failsafe] *relay uses the normally-closed contacts and is de-energized when the fault occurs.*

```
…SPLAY/RELAYS/Relay A
  Type…
  Setting…
  Normal/Failsafe…
```

Use the arrow keys to select the [Normal/Failsafe] option, and press [ENTER].

```
…ay A/Normal/Failsafe
 ▪Normal
  Failsafe
```

Use the arrow keys to select the desired option, and press [ENTER].

If you have finished programming the [Outputs] menu, press [ESC] until you return to normal run mode.

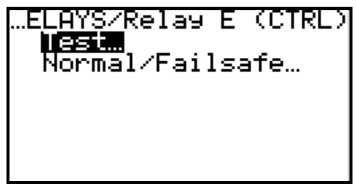
Relays E-H

Note: *The control relays are configured at the factory to perform their designated functions. These relays may not be reprogrammed at the* **2719** *passcode access level. However, the relays may be tested for proper operation.*

To test the *control relays E-H*, proceed as follows:

At the Main Menu, use the arrow keys to select the [Relays] menu. Then, use the arrow keys to select the desired relay to configure, and press [ENTER].

Note: *The setup of* [Relay E] *is shown here as an example. Relays F, G, and H are programmed in a similar manner.*



To [Test] the relay, press [ENTER].

Use the arrow keys to select the [Trip] option, and press [ENTER].

Physically verify that the relay has in fact been tripped. If it has not been tripped, contact the factory for assistance.

Use the arrow keys to select the [Reset] option, and press [ENTER].

IMPORTANT: *Be sure to* [Reset] *the relay before leaving the* [Relays] *menu.*

If you have finished programming the [Relays] menu, press [ESC] until you return to normal run mode.

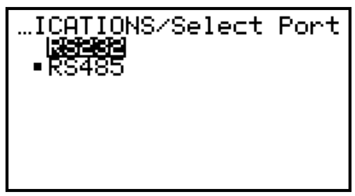
Communications Menu

The [Communications] menu is used to configure the **OxyTrak™ 390** communications port. RS232, RS485, and Ethernet ports are supported. To configure your port, proceed to the appropriate section.

RS232/RS485 Port

As an example, the programming of an RS232 port with the factory default settings is illustrated here. The programming of other configurations is done in a similar manner.

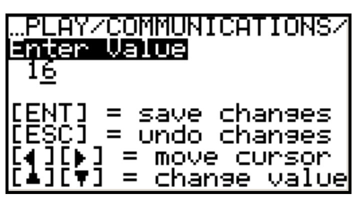
At the Main Menu, use the arrow keys to select the [Communications] menu. Then, use the arrow keys to select the [Select Port] option, and press [ENTER].



Use the arrow keys to select the desired option, and press [ENTER].

IMPORTANT: *The choice you make above must correspond to the actual wiring the was made to the meter during installation (see Chapter 2).*

Use the arrow keys to select the [Node ID] option, and press [ENTER].

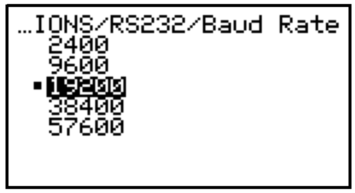


Use the arrow keys as indicated to specify the [Node ID] value for the port. When done, press [ENTER].

Use the arrow keys to select the [Port Settings] option, and press [ENTER].

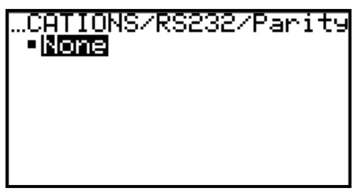
RS232/RS485 Port (cont.)

Use the arrow keys to select the [Baud Rate] option, and press [ENTER].

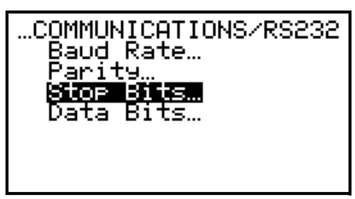


Use the arrow keys to select the desired baud rate, and press [ENTER].

Use the arrow keys to select the [Parity] option, and press [ENTER].



Use the arrow keys to select the desired parity, and press [ENTER].



Use the arrow keys to select the [Stop Bits] option, and press [ENTER].

Use the arrow keys to select the desired number of stop bits, and press [ENTER].

RS232/RS485 Port (cont.)

Use the arrow keys to select the [Data Bits] option, and press [ENTER].

Use the arrow keys to select the desired number of data bits, and press [ENTER].

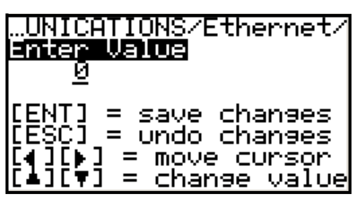
When you have finished programming the [Communications] menu, press [ESC] until you return to normal run mode.

Ethernet Port

To configure an Ethernet port, proceed as follows:

Use the arrow keys to select the [Ethernet Settings] option, and press [ENTER].

Use the arrow keys to select the [Port #] option, and press [ENTER].



Use the arrow keys as indicated to enter the value for the [Port #]. When done, press [ENTER].

Note: *The* [Port #] *is the only programmable parameter at the* **2719** *passcode level.*

When you have finished programming the [Communications] menu, press [ESC] until you return to normal run mode.

Chapter 6

Advanced Programming

Introduction

Although the **OxyTrak™ 390** is set up at the factory with default values that are suitable for many applications, the *User Progra*m provides a means for customizing many of the meter parameters.

IMPORTANT: *This chapter discusses only those additional programming options available at the* **7378** *passcode access level. For the options available at the* **2719** *passcode level, see Chapter 5,* General Programming.

Note: *While in the* User Program*, press* [ESC] *at any time to abort the current operation and return to the previous menu level.*

Access the *User Program* as described on page 3-3, and refer to Figures B-4 to B-5 on pages B-4 to B-5 in Appendix B, *Menu Maps*, while programming the **OxyTrak™ 390** features discussed in this chapter.

This is the initial programming screen.

From the *Main Menu* screen above, proceed directly to the appropriate section to perform the desired programming task.

Display, Relays, and Communications Menus

There are no additional options that become available in these main menus at the **7378** passcode access level. See Chapter 4, *Setting Up the Display*, and Chapter 5, *General Programming*, for a full description of how to program these menus at the **2719** passcode access level.

Output Menu

In the [Measure] option of the [Output] menu, the following two additional choices are available at this passcode level:

- Furnace Temp °C
- Furnace Temp °F

Note: *If necessary, see Chapter 5,* General Programming*, for instructions on navigating to this menu.*

```
…PLAY/OUTPUT/Output A
  Measure…
  Type…
  Range…
  Trim…
  Cal Setting…
```

Use the arrow keys to select the [Measure] option, and press [ENTER].

```
…PUT/Output A/Measure
 ▪% O2
  % Combustibles
  ppm Combustibles
  Furnace Temp °C
  Furnace Temp °F
```

Use the arrow keys to select the desired output variable, and press [ENTER].

The current **OxyTrak™ 390** analog output will now display the data for the variable chosen above. When you have finished programming the [Output] menu, press [ESC] until you return to normal run mode.

Calibrate Menu

In the [Autocal] option of the [Calibrate] menu, the following two additional choices are available at this passcode level:

- O_2 Tolerance
- Comb Tolerance

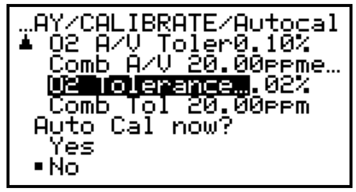
Note: *If necessary, see Chapter 5,* General Programming*, for instructions on navigating to this menu.*

```
◂[CALIBRATE]  OUTPUT▸
 Manual…
 Autocal…
```

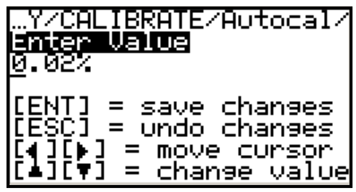
At the [Calibrate] submenu of the *Main Menu*, use the arrow keys to select the [Autocal] option and press [ENTER].

O_2 Tolerance

This option is used to define how close the actual oxygen reading must be to the calibration gas specification for a calibration to be considered complete. Proceed as follows:



Use the arrow keys to select the [O2 Tolerance] option, and press [ENTER].

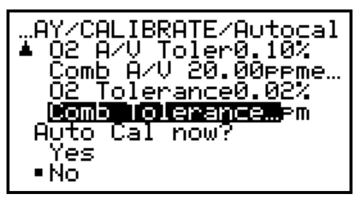


Use the arrow keys as indicated to enter the desired tolerance value (in $\%O_2$). When done, press [ENTER].

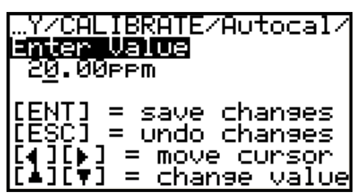
When you have finished programming the [Calibrate] menu, press [ESC] until you return to normal run mode.

Combustibles Tolerance

This section is very similar to the previous section, except that it is used to program the tolerance for the *combustibles* calibration. Proceed as follows:



Use the arrow keys to select the [Comb Tolerance] option, and press [ENTER].



Use the arrow keys as indicated to enter the desired tolerance value (in ppm combustibles). When done, press [ENTER].

When you have finished programming the [Calibrate] menu, press [ESC] until you return to normal run mode.

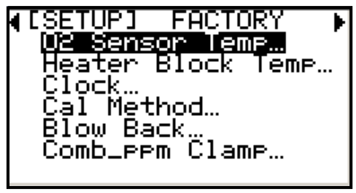
Setup Menu

The [Setup] menu has several additional options that become available at this passcode level. Proceed to the appropriate section to program any of these new options.

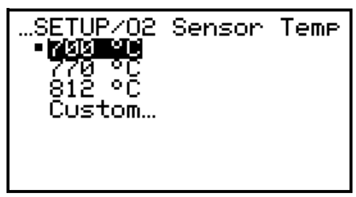
Note: *If necessary, see Chapter 5,* General Programming*, for instructions on navigating to this menu.*

O_2 Sensor Temp

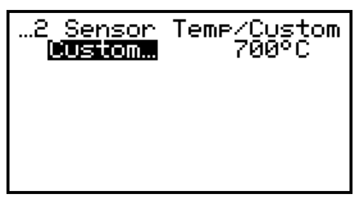
This option is used to specify the operating temperature of the zirconium oxide oxygen sensor (factory default = 700°C).



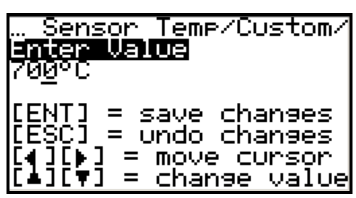
At the [Setup] submenu of the *Main Menu*, use the arrow keys to select the [O2 Sensor Temp] option and press [ENTER].



Use the arrow keys to select the desired operating temperature from the list or choose the [Custom] option. Then, press [ENTER].



If you chose the [Custom] option above, press [ENTER] to program this option.

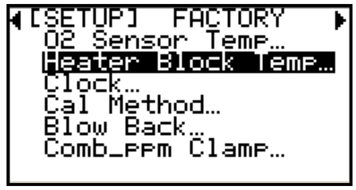


If you chose the [Custom] option above, use the arrow keys as indicated to enter the desired operating temperature. When done, press [ENTER].

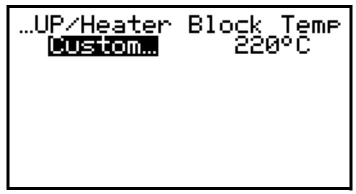
When you have finished programming the [Setup] menu, press [ESC] until you return to normal run mode.

Heater Block Temp

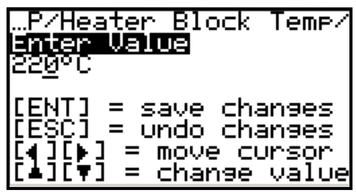
This option is used to specify the operating temperature of the heater block (factory default = 220°C).



At the [Setup] submenu of the *Main Menu*, use the arrow keys to select the [Heater Block Temp] option and press [ENTER].



To program the [Custom] option, press [ENTER].

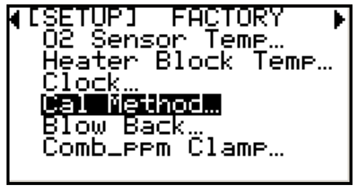


Use the arrow keys as indicated to enter the desired heater block temperature. When done, press [ENTER].

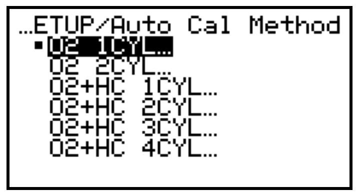
When you have finished programming the [Setup] menu, press [ESC] until you return to normal run mode.

Auto Cal Method

This option is used to configure the **OxyTrak™ 390** for the type of calibration method you wish to use (see Appendix C, *Calibration Methods*, for details on the various choices).



At the [Setup] submenu of the *Main Menu*, use the arrow keys to select the [Cal Method] option and press [ENTER].

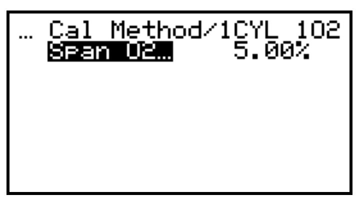


Use the arrow keys to select the desired calibration method from the list. Then, press [ENTER].

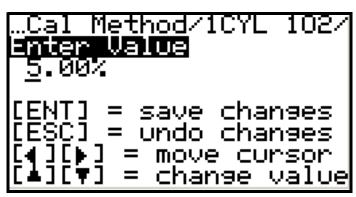
Proceed to the appropriate subsection to complete the programming of your chosen Cal method.

1-Gas Oxygen

This method is used to perform an oxygen calibration with one calibration gas.



To program the O_2 *span gas*, press [ENTER].

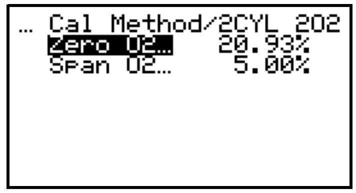


Use the arrow keys as indicated to enter the *span gas oxygen percentage*. When done, press [ENTER].

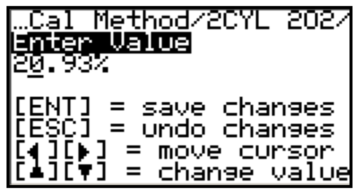
When you have finished programming the [Cal Method] menu, press [ESC] until you return to normal run mode.

2-Gas Oxygen

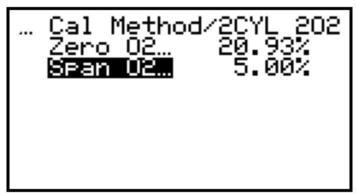
This method is used to perform an oxygen calibration with two calibration gases.



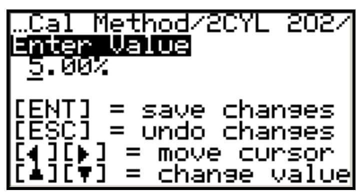
Use the arrow keys to select the [Zero O2] option. Then, press [ENTER].



Use the arrow keys as indicated to enter the *zero gas oxygen percentage*. When done, press [ENTER].



Use the arrow keys to select the [Span O2] option. Then, press [ENTER].

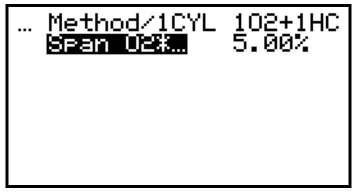


Use the arrow keys as indicated to enter the *span gas oxygen percentage*. When done, press [ENTER].

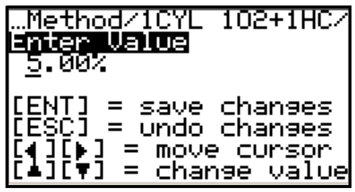
When you have finished programming the [Cal Method] menu, press [ESC] until you return to normal run mode.

1-Gas Oxygen and Combustibles

This method is used to perform both an oxygen calibration and a combustibles calibration with one calibration gas.



To program the O_2* *span gas*, press [ENTER].



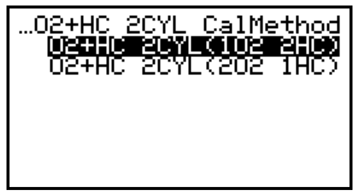
Use the arrow keys as indicated to enter the *span gas oxygen percentage* (*combustibles must be 0 ppm*). When done, press [ENTER].

When you have finished programming the [Cal Method] menu, press [ESC] until you return to normal run mode.

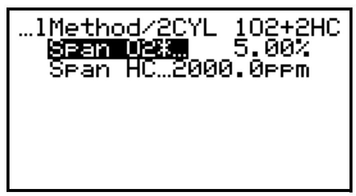
2-Gas Oxygen and Combustibles

This method is used to perform both an oxygen calibration and a combustibles calibration with two calibration gases.

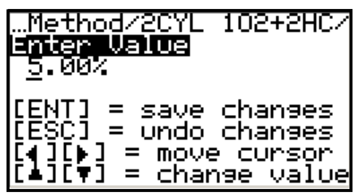
Note: *This method has two variations. One of the calibration gases is always used for one of the oxygen points and the low combustibles point. However, the second calibration gas may be used for either the high oxygen point or the high combustibles point. Only one of the variations is shown here as an example.*



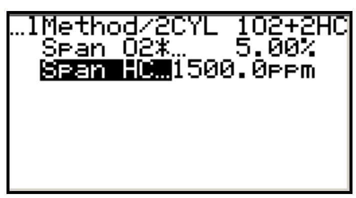
Use the arrow keys to select the [1O2 2HC] option. Then, press [ENTER].



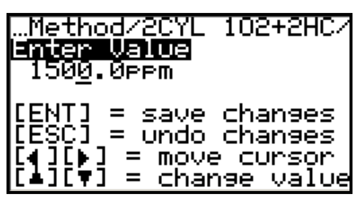
Use the arrow keys to select the [Span O2*] option. Then, press [ENTER].



Use the arrow keys as indicated to enter the *span gas oxygen percentage* (*combustibles must be 0 ppm*). When done, press [ENTER].



Use the arrow keys to select the [Span HC] option. Then, press [ENTER].

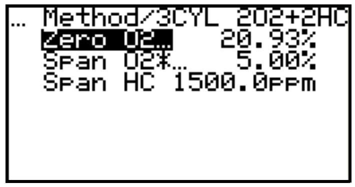


Use the arrow keys as indicated to enter the *span gas combustibles ppm*. When done, press [ENTER].

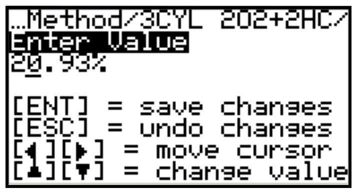
When you have finished programming the [Cal Method] menu, press [ESC] until you return to normal run mode.

3-Gas Oxygen and Combustibles

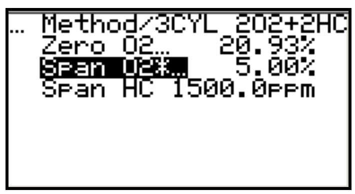
This method uses three calibration gases to perform the oxygen and combustibles calibrations. One of the gases is used for both an oxygen point and the 0 ppm combustibles point.



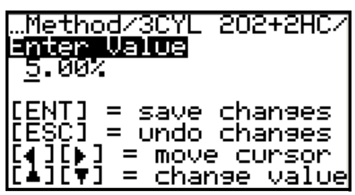
Use the arrow keys to select the [Zero O2] option. Then, press [ENTER].



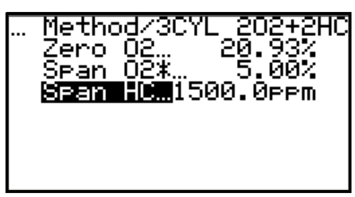
Use the arrow keys as indicated to enter the *zero gas oxygen percentage*. When done, press [ENTER].



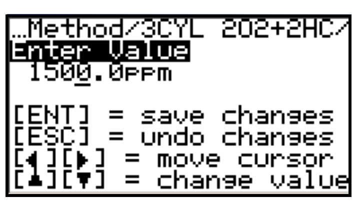
Use the arrow keys to select the [Span O2*] option. Then, press [ENTER].



Use the arrow keys as indicated to enter the *span gas oxygen percentage* (*combustibles must be 0 ppm*). When done, press [ENTER].



Use the arrow keys to select the [Span HC] option. Then, press [ENTER].

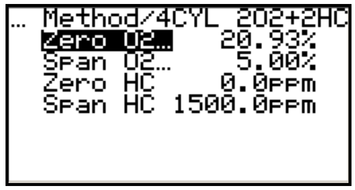


Use the arrow keys as indicated to enter the *span gas combustibles ppm*. When done, press [ENTER].

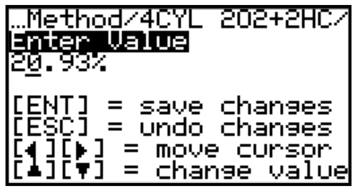
When you have finished programming the [Cal Method] menu, press [ESC] until you return to normal run mode.

4-Gas Oxygen and Combustibles

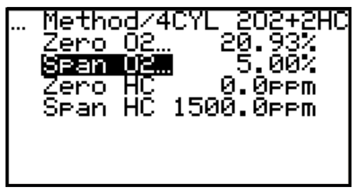
This method uses four calibration gases, 2 for oxygen and 2 for combustibles, to perform the oxygen and combustibles calibrations.



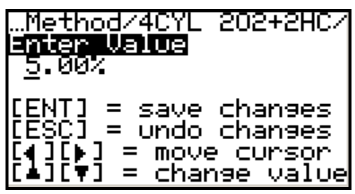
Use the arrow keys to select the [Zero O2] option. Then, press [ENTER].



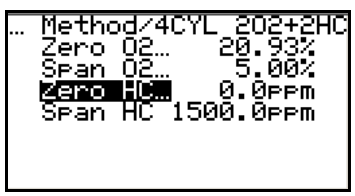
Use the arrow keys as indicated to enter the *zero gas oxygen percentage*. When done, press [ENTER].



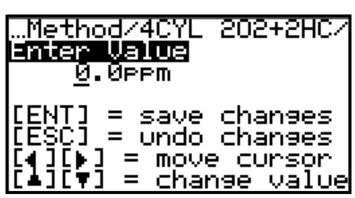
Use the arrow keys to select the [Span O2] option. Then, press [ENTER].



Use the arrow keys as indicated to enter the *span gas oxygen percentage*. When done, press [ENTER].

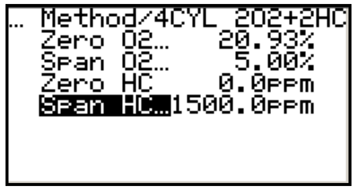


Use the arrow keys to select the [Zero HC] option. Then, press [ENTER].

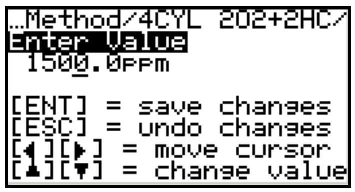


Use the arrow keys as indicated to enter the *zero gas combustibles ppm*. When done, press [ENTER].

4-Gas Oxygen and Combustibles (cont.)



Use the arrow keys to select the [Span HC] option. Then, press [ENTER].



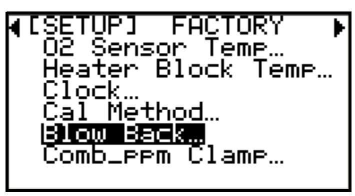
Use the arrow keys as indicated to enter the *span gas combustibles ppm*. When done, press [ENTER].

When you have finished programming the [Auto Cal Method] menu, press [ESC] until you return to normal run mode.

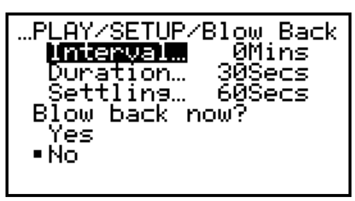
Blow Back

The **OxyTrak™ 390** uses a process called *Blow Back* to purge its sample system by initiating a temporary reversal of the sample gas flow direction. This menu option is used to configure the parameters for that process.

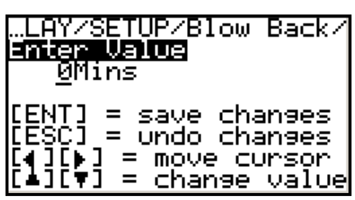
Note: *The Blow Back programming opens and closes Relay H only. Relay H is a switch only and does not provide power. To use the Blow Back process, connect a power supply in series with Relay H and the Blow Back solenoid valve.*



At the [Setup] submenu of the *Main Menu*, use the arrow keys to select the [Blow Back] option and press [ENTER].

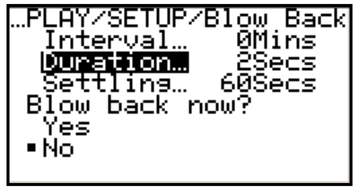


Use the arrow keys to select the [Interval] option and press [ENTER].

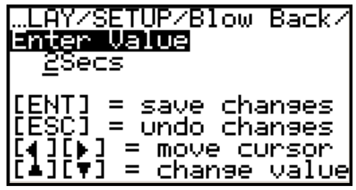


Use the arrow keys as indicated to enter the time in minutes between blowbacks. When done, press [ENTER].

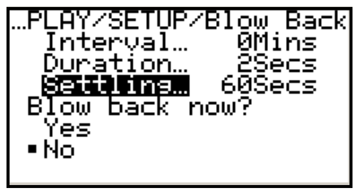
Blow Back (cont.)



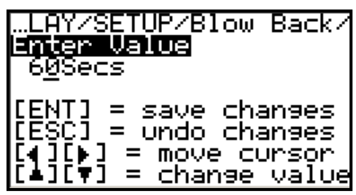
Use the arrow keys to select the [Duration] option and press [ENTER].



Use the arrow keys as indicated to enter the length of time in seconds that the blowback will last. When done, press [ENTER].

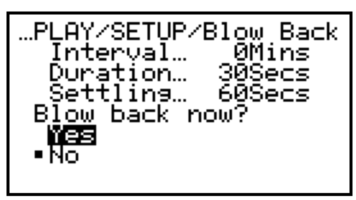


Use the arrow keys to select the [Settling] option and press [ENTER].



Use the arrow keys as indicated to enter the length of time in seconds to allow after the blowback is complete. When done, press [ENTER].

To force an immediate blowback, complete the next step.



Use the arrow keys to select the [Yes] response to the [Blow Back Now] option. Then, press [ENTER] to initiate the blowback.

Note: *If you select the* [No] *option at the above prompt, the blowback will be aborted.*

When you have finished programming the [Blow Back] menu, press [ESC] until you return to normal run mode.

Factory Menu

All of the [Factory] menu options become available at this passcode level. Proceed to the appropriate section to program these options.

Note: *If necessary, see Chapter 5,* General Programming*, for instructions on navigating to this menu.*

Versions

This option is used to display the versions of the instrument software currently installed in your analyzer.

```
◄[FACTORY]
  Versions…
  Upgrade…
  Default Analyzer…
  Thermal Cal…
  Air Of    0.0000mV
  Furnace T 760.0°C
▼ Comb. Sens Cal…
```

At the [Factory] submenu of the *Main Menu*, use the arrow keys to select the [Versions] option and press [ENTER].

```
© 2005 GE SENSING
 S/N:xxxxxxxx
 PCI:xxxxxxxx
 b: XXX.XXX.X
 p: XXX.XXX.X
 x: XXX.XXX.X
```

The current versions of your instrument serial number and software are displayed. When done, press [ESC].

When you have finished programming the [Factory] menu, press [ESC] until you return to normal run mode.

Upgrade

This option is used update or restore the instrument firmware.

```
◄[FACTORY]
  Versions…
  Upgrade…
  Default Analyzer…
  Thermal Cal…
  Air Of    0.0000mV
  Furnace T 760.0°C
▼ Comb. Sens Cal…
```

At the [Factory] submenu of the *Main Menu*, use the arrow keys to select the [Upgrade] option and press [ENTER].

```
…PLAY/FACTORY/Confirm
 ARE YOU SURE?
  Yes
 ▪No
```

Use the arrow keys to select either [Yes] to proceed or [No] to abort. Then, press [ENTER].

When you have finished programming the [Factory] menu, press [ESC] until you return to normal run mode.

Default Analyzer

This option is used restore all programmable parameters to their factory default values.

```
◄[FACTORY]
  Versions…
  Upgrade…
  Default Analyzer…
  Thermal Cal…
  Air Of    0.0000mV
  Furnace T 760.0°C
▼ Comb. Sens Cal…
```

At the [Factory] submenu of the *Main Menu*, use the arrow keys to select the [Default Analyzer] option and press [ENTER].

```
…PLAY/FACTORY/Confirm
 ARE YOU SURE?
  Yes
 ▪No
```

Use the arrow keys to select either [Yes] to proceed or [No] to abort. Then, press [ENTER].

When you have finished programming the [Factory] menu, press [ESC] until you return to normal run mode.

Additional Menu Options

In addition to the previously discussed options, the following menu options are available at the **7378** passcode level:

Caution!
Improper reprogramming of the parameters in these menus will seriously degrade the performance of the **OxyTrak™ 390**.

- Thermal Cal
- Air Offset
- Furnace Temp
- Comb. Cal
- Development

As the parameters programmed in these menus are critical to the proper operation of the **OxyTrak™ 390**, detailed instructions are not provided here. If it becomes necessary to change any of these parameters, you must contact the factory for assistance.

When you have finished programming the [Factory] menu, press [ESC] until you return to normal run mode.

Chapter 7

Specifications

Performance

Accuracy:	*Oxygen:* ±0.1% @0-10% O_2; ±0.2% @10-25% O_2 *Combustibles (Optional):* ±20 ppm or ±5% of reading (whichever is greater)
Repeatability:	*Oxygen:* ±0.05% @0-10% O_2; ±0.1% @10-25% O_2 *Combustibles (Optional):* ±10 ppm or ±2% of reading (whichever is greater)
Output Resolution:	*Oxygen:* ±0.01% *Combustibles (Optional):* ±1% of full scale
Stability:	*Oxygen:* variation <0.2% O_2 per year *Combustibles (Optional):* <200 ppm per year
Measurement Range:	*Oxygen:* 0-1% to 0-100% (user-selectable) *Combustibles (Optional):* 0-500/2000/5000/10000 ppm; 0-2%
Response Time:	*Oxygen:* 90% step change within 20 sec *Combustibles (Optional):* 90% step change within 20 sec (faster response available with optional ejector/aspirator)

Functional

Display:	64x128 pixel graphical with backlight
Analog Output:	3 linearized, isolated 4-20 mA outputs (user-selectable); field-programmable for O_2 or combustibles over any range
Alarm Output:	8 relay; user-programmable for high/low O_2 or combustibles, AutoCal or AutoVerify (2 for O_2 and/or 2 for combustibles), system fault, blowback feature
Digital Output:	Standard: RS232 or RS485 (user-selectable)
Power:	115/120 or 230/240 VAC @50/60 Hz
Power Consumption:	350 W
Ambient Temperature Range:	*Analyzer:* -30 to +70°C (-22 to +158°F) *Controller:* -30 to +60°C (-22 to +140°F)
Flue Gas Temperature Range:	sample probe available in materials for temperatures: up to 1200°F (650°C) 1200 to 1750°F (650 to 950°C) 1750 to 2900°F (950 to 1600°C) 2900 to 3450°F (1600 to 1900°C)
Warm-Up Time:	1 hr
Calibration Verification:	Modes: *Manual*, *AutoCal*, and *AutoVerify* Calibration gas flow rate: 250±10 cc/min

Physical

Sensor Type: *Oxygen:* stabilized zirconium oxide
Combustibles (Optional): catalytic-combustion, platinum resistance thermometer

Wetted Materials: 316 stainless steel, various sample probe materials

Probe Lengths: *Standard Convection Loop:* 24” (0.6 m), 39” (1.0 m), 55” (1.4 m)

Dimensions (overall h x w x d): 22” x 17” x 12”
(not including mounting flange, probe, and probe sleeve)

Total Weight (19 in. probe): 25 lb (11.4 kg)

Mounting: *Standard:* 1 1/2” MNPT
Optional: DN80 PN16, 3” and 4” CS flanges

Housing: *Analyzer:* NEMA 2; IP52
Controller: Weatherproof; NEMA 4X; IP66

European Compliance: complies with EMC Directive 89/336/EEC, 73/23/EEC LVD (installation category II, pollution degree 2) and PED 97/23/EC for DN<25

Calibration

Calibration Options:

1 - 1 gas bottle, O_2 only (auto & manual)

2 - 2 gas bottles, O_2 only (auto & Manual)

3 - 2 gas bottles, O_2 & combustibles (auto & manual)
[O_2 = 1 gas (shared), combustibles = 2 gases (zero & span]

4 - 3 gas bottles, O_2 & combustibles (auto & manual)

5 - 4 gas bottles, O_2 & combustibles (auto & manual)

6 - 1 gas bottle, O_2 & combustibles (auto & manual)

7 - 2 gas bottles, O_2 & combustibles (auto & manual)
[O_2 = 2 gases, combustibles = 1 gas]

Ordering Information

In order to ensure that the proper **OxyTrak™ 390** configuration is supplied for the intended application, a full and accurate model number must be specified at the time of purchase. This model number should be constructed as follows:

IMPORTANT: *Some of the options listed in this section may not yet be available for purchase. Please consult with your GE Sensing representative.*

OxyTrak 390 - B C D E - F G H I

B. *Convection Loop/Analyzer Package*

- **1** = Horizontal, General Purpose
  - IP52, NEMA 2
- **3** = Aspirated, Horizontal, General Purpose
  - IP52, NEMA 2

C: *Display Controller*

- **1** = Local, General Purpose Enclosure
  - IP66, NEMA 4X
  - Option B = 1 (Horizontal, GP) Only
- **2** = Remote, General Purpose Enclosure
  - IP66, NEMA 4X

D: *Oxygen Sensor (Fluxed - Same As FGA300)*

- **1** = Standard (Type 1)
- **2** = High CO/Stoichiometric (Type 2)
- **3** = Incinerator Type Applications (Type 3)

E: *Improved Combustibles Sensor*

- **0** = None
- **1** = Standard (available for option B=1 only)

F: *Input Voltage (±10%)*

- **1** = 115/120 VAC
- **2** = 230/240 VAC

G: *Communications*

- **1** = RS232 & RS485 (No Auxiliary Keypad)

H: *Tropicalization*

- **0** = None
- **1** = Tropicalized

I. *Special*

- **0** = None
- **S** = Special

Ordering Information (cont.)

For example, a horizontal, general purpose **OxyTrak™ 390** with a local, general purpose controller for use with 115 VAC input power and including standard oxygen and combustibles sensors, RS232 & RS485 communications, and diffusion/convection based sampling would be specified as:

Model OxyTrak 390-1111-1100

Appendix A

The Nernst Equation

Introduction

The **OxyTrak™ 390 Flue Gas Analyzer** uses the *Nernst Equation* to calculate the oxygen content of the flue gas. When a Yttrium-doped zirconium oxide ceramic is heated to a temperature above 650°C, it becomes an electrolytic conductor, as vacancies in the crystal lattice permit oxygen ions to diffuse into the ceramic.

If there are different oxygen partial pressures on the two sides of the ceramic cell, oxygen ions will migrate along the resulting *concentration gradient*. This constitutes a transfer of electrons from one face of the ceramic to the other. If the transferred charge is allowed to accumulate, it gives rise to a *potential gradient* acting in the opposite direction, thus tending to oppose further diffusion.

Equilibrium Conditions

Under equilibrium conditions, the potential gradient exactly balances the concentration gradient. Porous coatings of a platinum catalyst on both surfaces of the ceramic cell serve as electrodes, while still allowing the oxygen molecules to penetrate the coating and diffuse into the ceramic. The measured voltage drop across the cell can be directly related to the ratio of the two oxygen partial pressures by means of Equation A-1, the *Nernst Equation,* below:

$$E_{12} = \frac{RT}{nF} \bullet \ln\left[\frac{p_1}{p_2}\right] \tag{A-1}$$

where,

- F = the Faraday = 96,484.56 coulombs
- T = absolute temperature = °K
- R = gas constant = 8.31441 volt-coulomb/mole-°K
- n = # electrons transferred per molecule = 4/mole
- $\ln$ = natural logarithm = $2.303 \log_{10}$
- p_1 = O_2 partial pressure on reference gas side = 0.209
- p_2 = O_2 partial pressure on flue gas side
- E_{12} = voltage on reference face with respect to the flue gas face

The OxyTrak™ 390 Equation

The *Nernst Equation* specifically applicable to the **OxyTrak™ 390** analyzer is obtained by substituting the above values into the general equation, converting the natural logarithm to the common logarithm (base 10) and converting the units for E_{12} to millivolts. This results in Equation A-2 below.

$$E_{12}(\mathrm{mV}) = 0.049605 \bullet T \bullet \log\left[\frac{0.209}{p_2}\right] \qquad \text{(A-2)}$$

The **OxyTrak™ 390** measures the temperature at the sensor and automatically inserts the correct value into the Nernst Equation. For example, at the standard operating sensor temperature of 700°C, Equation A-3 below is used.

$$E_{12}(\mathrm{mV}) = 48.273 \bullet \log\left[\frac{0.209}{p_2}\right] \qquad \text{(A-3)}$$

IMPORTANT: *For units that are operated at sensor temperatures of 770°C or 812°C, replace 48.273 in Equation A-3 above with 51.745 or 53.829, respectively. Do <u>not</u> use the graph or table on the following pages.*

The voltage drop across the zirconium oxide sensor, as calculated from the Equation A-3 above, is then sent to the linearizer circuit. This circuit produces a linear 4-20 mA output that is used to display the percentage of oxygen in the flue gas.

For convenience, the standard Nernst equation for the **OxyTrak™ 390** (Equation A-3 above) has been converted into a graphical format. Use this graph (see Figure A-1 on page A-3) to quickly correlate a raw sensor mV reading with the corresponding oxygen percentage, at the operating temperature of the analyzer. In addition, similar data for some common oxygen percentages is presented in tabular form in Table A-1 on page A-4.

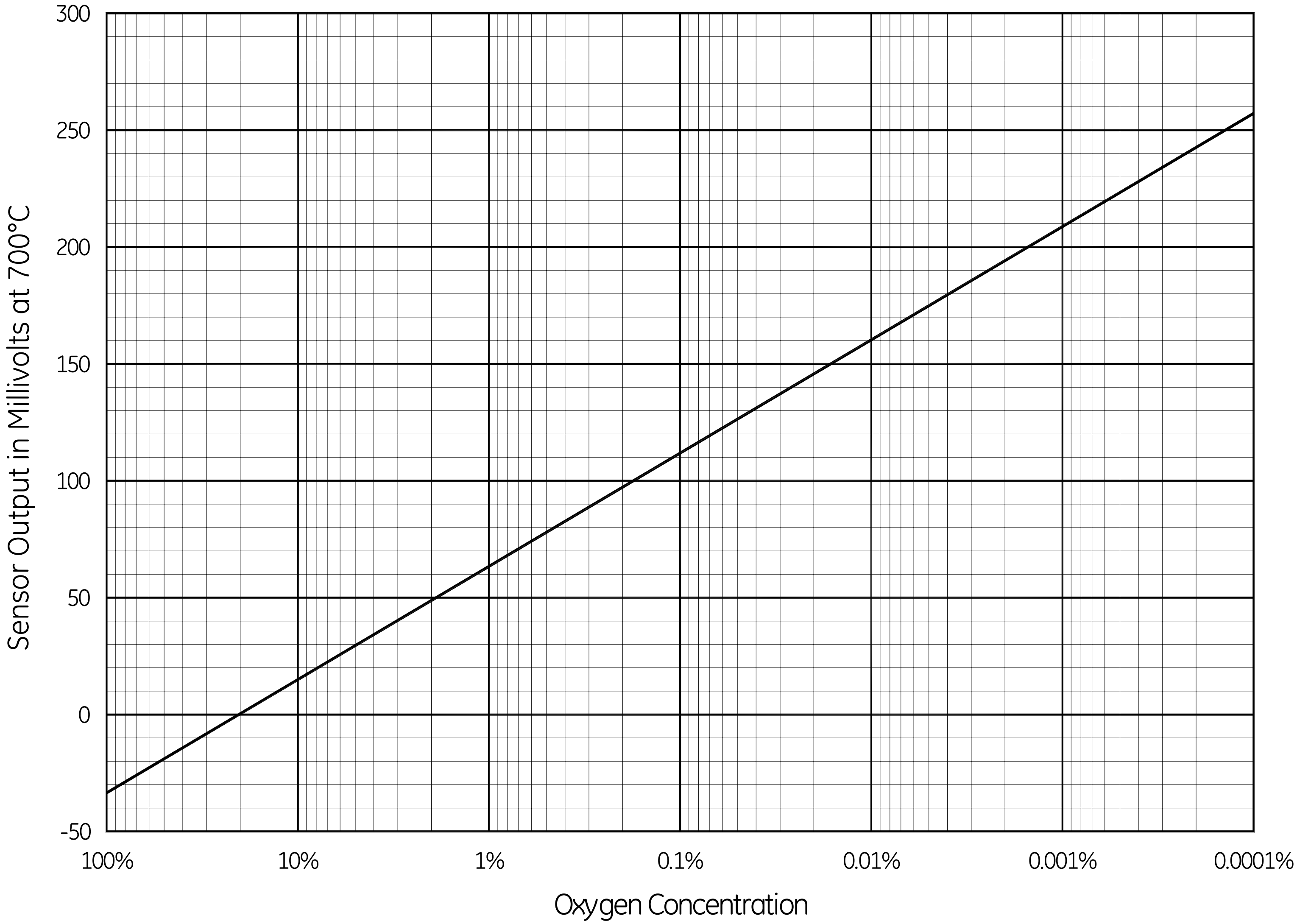


Figure A-1: Oxygen Sensor Output at 700°C

The OxyTrak™ 390 Equation (cont.)

Table A-1: mV to % O_2 Conversion at 700°C

mV	% O_2	mV	% O_2	mV	% O_2
-32.819	100	9.954	13	92.791	0.25
-31.743	95	11.632	12	97.469	0.20
-30.610	90	13.456	11	103.500	0.15
-29.411	85	15.454	10	112.000	0.10
-28.140	80	17.663	9	126.532	0.05
-26.787	75	20.133	8	160.273	0.01
-25.341	70	22.932	7	161.349	0.0095
-23.787	65	26.164	6	162.482	0.0090
-22.109	60	29.986	5	163.681	0.0085
-20.285	55	34.664	4	164.952	0.0080
-18.287	50	40.695	3	166.305	0.0075
-16.078	45	49.196	2	167.751	0.0070
-13.609	40	63.727	1	169.305	0.0065
-10.809	35	64.803	0.95	170.983	0.0060
-7.578	30	65.936	0.90	172.807	0.0055
-3.755	25	67.135	0.85	174.805	0.0050
-2.900	24	68.406	0.80	177.014	0.0045
-2.007	23	69.759	0.75	179.483	0.0040
-1.075	22	71.205	0.70	182.283	0.0035
-0.100	21	72.759	0.65	185.514	0.0030
0.923	20	74.437	0.60	189.337	0.0025
1.998	19	76.261	0.55	194.015	0.0020
3.132	18	78.259	0.50	200.046	0.0015
4.330	17	80.468	0.45	208.546	0.0010
5.601	16	82.937	0.40	223.078	0.0005
6.954	15	85.737	0.35	256.819	0.0001
8.400	14	88.968	0.30		

Appendix B

Menu Maps

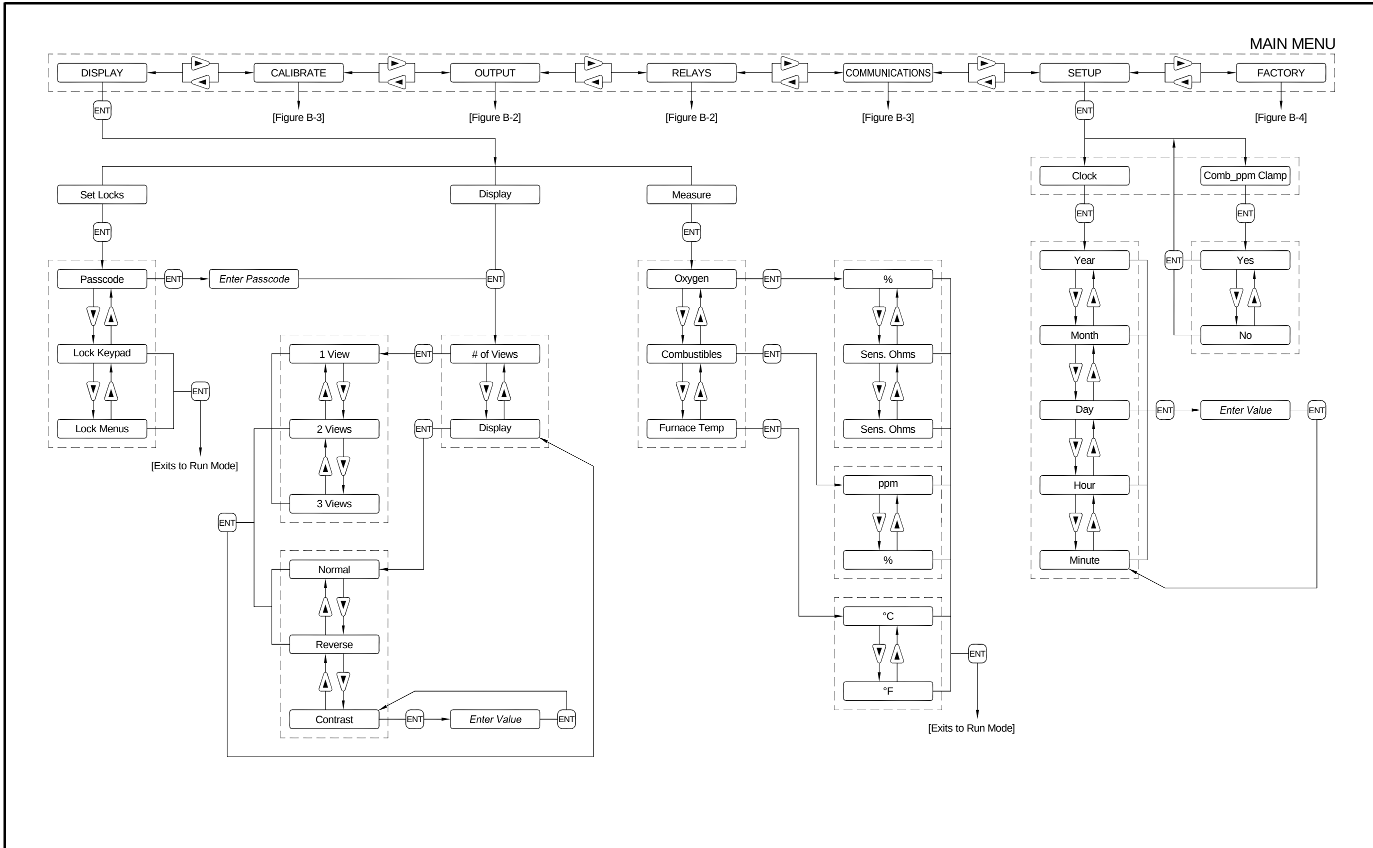


Figure B-1: Display and Setup Menu Map (2719 passcode)

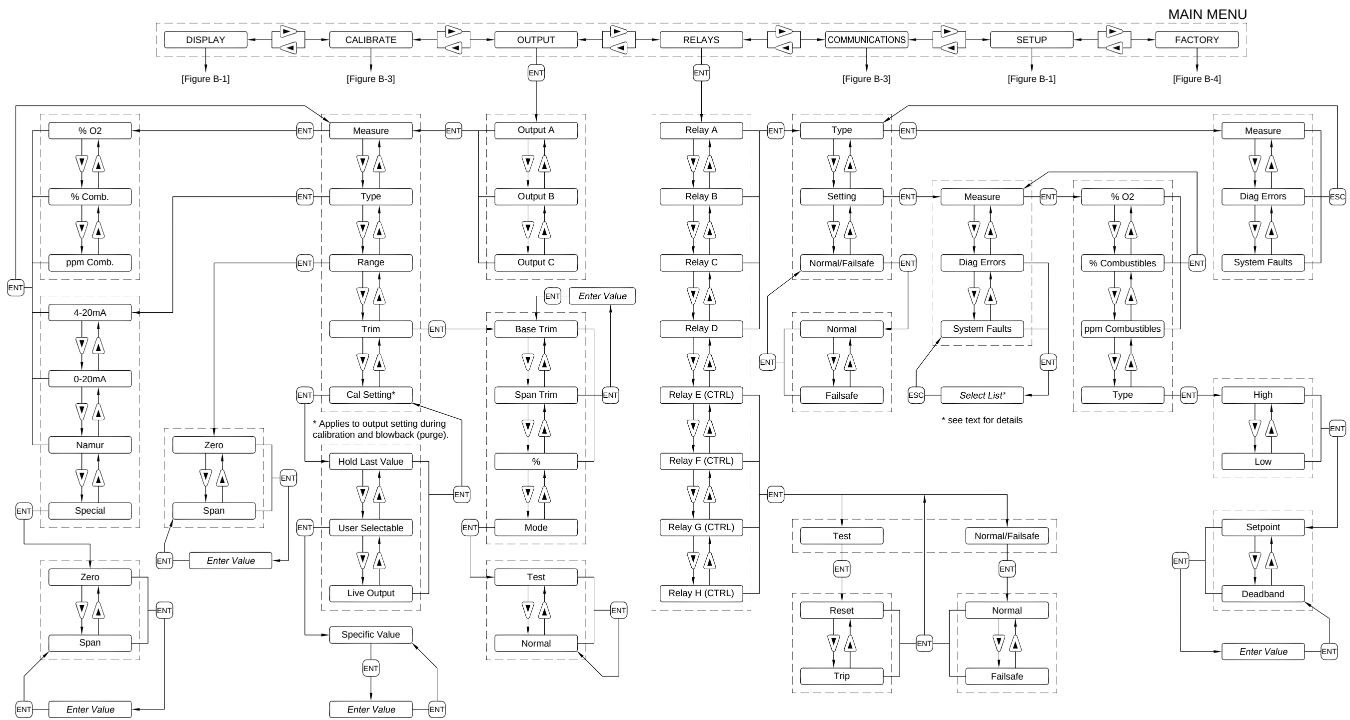


Figure B-2: Outputs and Relays Menu Map (2719 passcode)

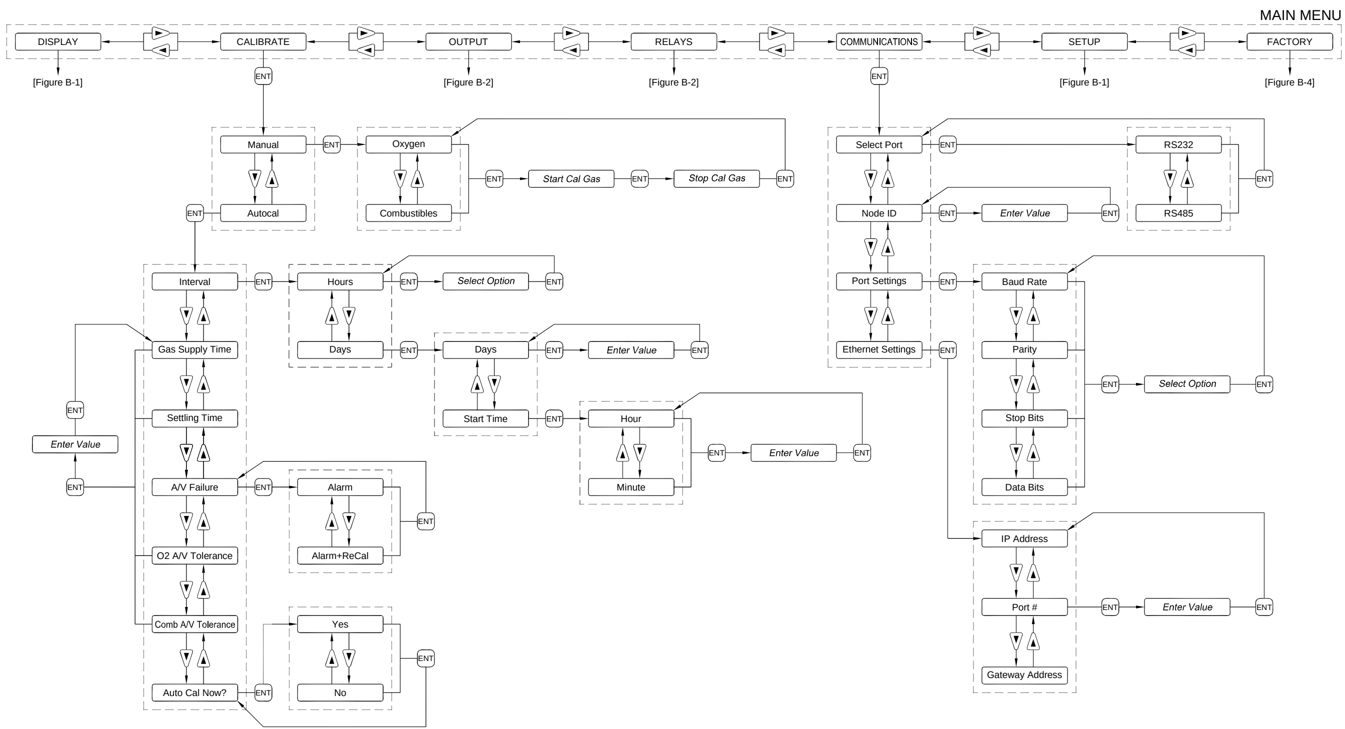


Figure B-3: Calibrate and Communications Menu Map (2719 passcode)

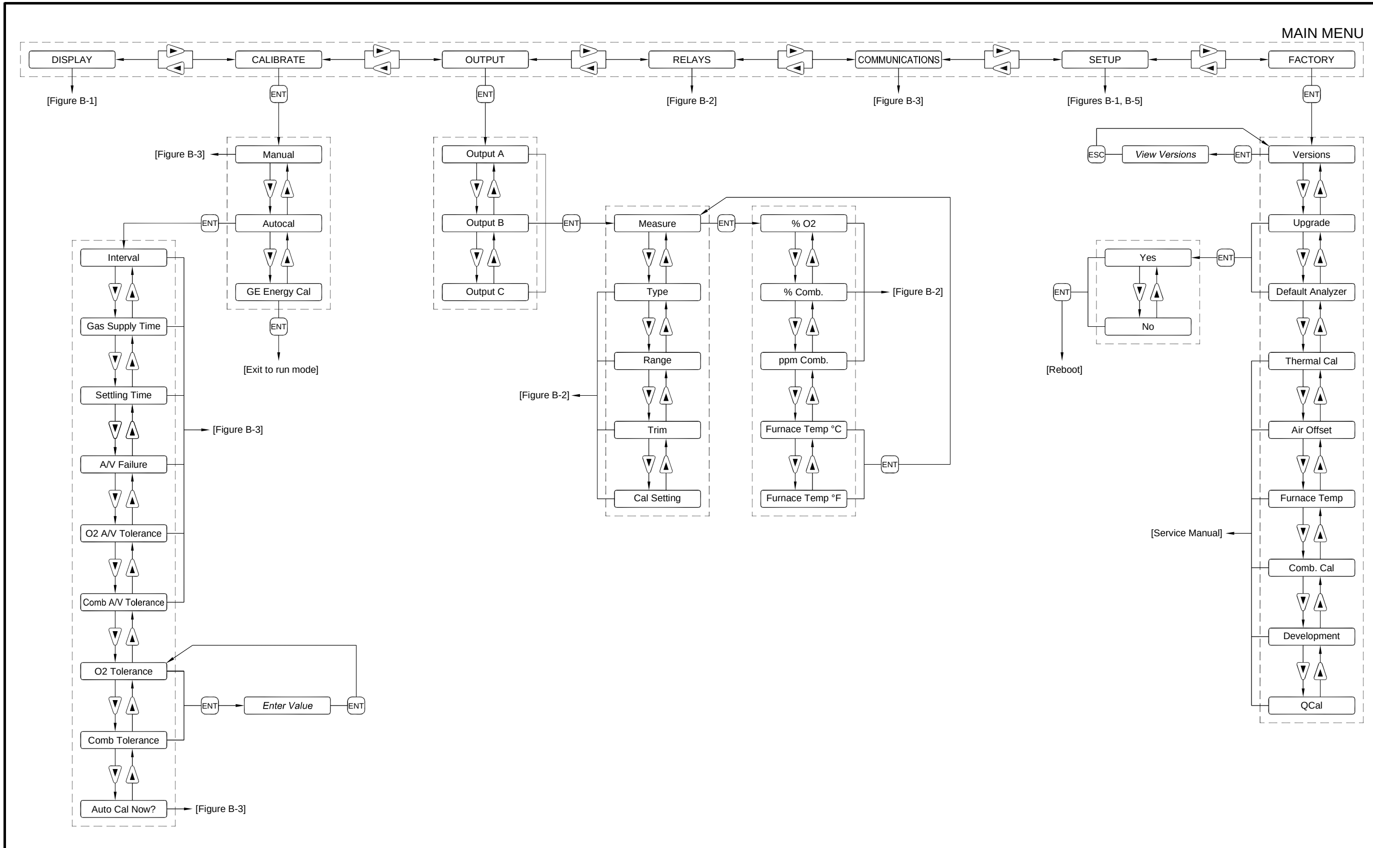


Figure B-4: Calibrate, Output, and Factory Menu Map (7378 passcode)

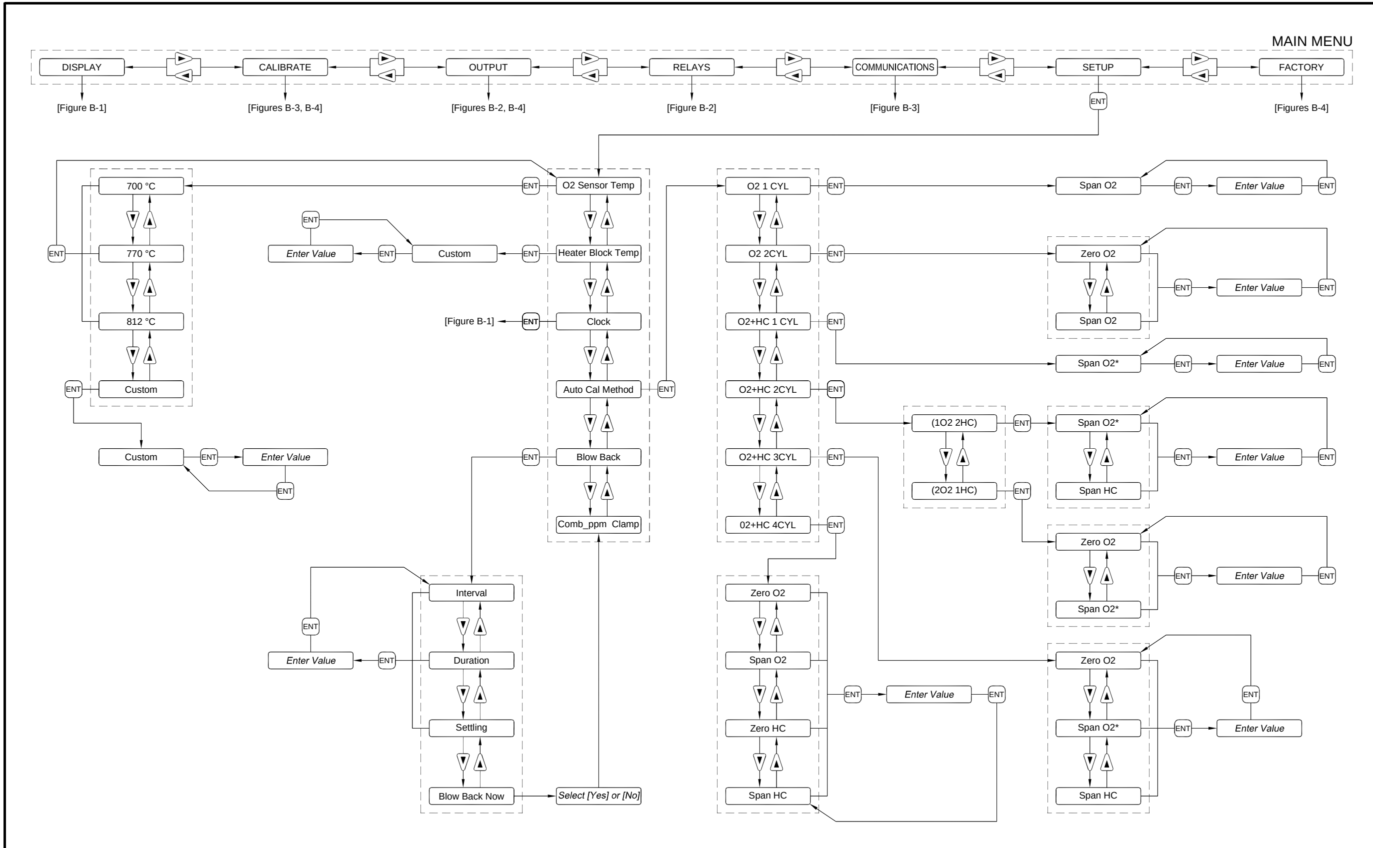


Figure B-5: Setup Menu Map (7378 passcode)

Appendix C

Calibration, Standard Convection

Introduction

To meet a variety a application requirements, The **OxyTrak™ 390** has been designed for calibration using a number of different methods. The available methods include:

- **Method 1A -** manual O_2 calibration using 1 calibration gas
- **Method 1B -** autocal O_2 calibration using 1 calibration gas
- **Method 2A -** manual O_2 calibration using 2 calibration gases
- **Method 2B -** autocal O_2 calibration using 2 calibration gases
- **Method 3A -** manual O_2 & Combustibles calibration using 2 calibration gases
- **Method 3B -** autocal O_2 & Combustibles calibration using 2 calibration gases
- **Method 4A -** manual O_2 & Combustibles calibration using 3 calibration gases
- **Method 4B -** autocal O_2 & Combustibles calibration using 3 calibration gases
- **Method 5A -** manual O_2 & Combustibles calibration using 4 calibration gases
- **Method 5B -** autocal O_2 & Combustibles calibration using 4 calibration gases
- **Method 6A -** manual O_2 & Combustibles calibration using 1 calibration gas
- **Method 6B -** autocal O_2 & Combustibles calibration using 1 calibration gas
- **Method 7A -** manual O_2 & Combustibles calibration using 2 calibration gases
- **Method 7B -** autocal O_2 & Combustibles calibration using 2 calibration gases

Step-by-step instructions are provided in Chapter 5, *General Programming*, for calibration methods 1A and 1B. As the other methods employ the same basic programming techniques, such detailed instructions for these methods are not necessary. Instead, a basic outline for these procedures is presented in this appendix. Also, instructions for configuring the **OxyTrak™ 390** for the intended calibration method are presented in Chapter 6, *Advanced Programming*.

Method #1

Calibration method #1, whether implemented in manual mode or using the autocal process, includes the following steps:

1. Obtain the one calibration gas:
   a. **Gas #1:** A gas with known oxygen content, to be used as the span gas in a 1-gas oxygen calibration.
2. Install a system to deliver the calibration gas to the **OxyTrak™ 390** at the proper flow rate and pressure.
3. Program all user-programmable calibration parameters.
4. Initiate, either manually or automatically, the calibration process.
5. Allow the calibration to continue until the new %O_2 reading is within the programmed tolerances.

Method #2

Calibration method #2, whether implemented in manual mode or using the autocal process, includes the following steps:

1. Obtain the two calibration gases:
   a. **Gas #1:** A gas with known oxygen content, to be used as the zero gas in a 2-gas oxygen calibration.
   b. **Gas #2:** A gas with known oxygen content, to be used as the span gas in a 2-gas oxygen calibration.
2. Install a system to deliver the calibration gases to the **OxyTrak™ 390** at the proper flow rate and pressure.
3. Program all user-programmable calibration parameters.
4. Initiate, either manually or automatically, the calibration process.
5. Allow the calibration to continue until the new O_2 reading is within the programmed tolerances.

Method #3

Calibration method #3, whether implemented in manual mode or using the autocal process, includes the following steps:

1. Obtain the two calibration gases:
   a. **Gas #1:** A gas with known oxygen content, to be used as the span gas in a 1-gas oxygen calibration and as a zero gas in a 2-gas combustibles calibration.
   b. **Gas #2:** A gas with known combustibles content, to be used as the span gas in a 2-gas combustibles calibration.
2. Install a system to deliver the calibration gases to the **OxyTrak™ 390** at the proper flow rate and pressure.
3. Program all user-programmable calibration parameters.
4. Initiate, either manually or automatically, the calibration process.
5. Allow the calibration to continue until the new O_2 and combustibles readings are within the programmed tolerances.

Method #4

Calibration method #4, whether implemented in manual mode or using the autocal process, includes the following steps:

1. Obtain the three calibration gases:
   a. **Gas #1:** A gas with known oxygen content, to be used as the zero gas in a 2-gas oxygen calibration.
   b. **Gas #2:** A gas with known oxygen content, to be used as the span gas in a 2-gas oxygen calibration and the zero gas combustibles calibration.
   c. **Gas #3:** A gas with known combustibles content, to be used as the span gas in a 2-gas combustibles calibration.
2. Install a system to deliver the calibration gases to the **OxyTrak™ 390** at the proper flow rate and pressure.
3. Program all user-programmable calibration parameters.
4. Initiate, either manually or automatically, the calibration process.
5. Allow the calibration to continue until the new O_2 and combustibles readings are within the programmed tolerances.

Method #5

Calibration method #5, whether implemented in manual mode or using the autocal process, includes the following steps:

1. Obtain the four calibration gases:
   a. **Gas #1:** A gas with known oxygen content, to be used as the zero gas in a 2-gas oxygen calibration.
   b. **Gas #2:** A gas with known oxygen content, to be used as the span gas in a 2-gas oxygen calibration.
   c. **Gas #3:** A gas with known combustibles content, to be used as the zero gas in a 2-gas combustibles calibration.
   d. **Gas #4:** A gas with known combustibles content, to be used as the span gas in a 2-gas combustibles calibration.
2. Install a system to deliver the calibration gases to the **OxyTrak™ 390** at the proper flow rate and pressure.
3. Program all user-programmable calibration parameters.
4. Initiate, either manually or automatically, the calibration process.
5. Allow the calibration to continue until the new O_2 and combustibles readings are within the programmed tolerances.

Method #6

Calibration method #6, whether implemented in manual mode or using the autocal process, includes the following steps:

1. Obtain the one calibration gas:
   a. **Gas #1:** A gas with known oxygen and combustibles content, to be used as both a span gas in a 1-gas oxygen calibration and a zero gas in a 1-gas combustibles calibration.
2. Install a system to deliver the calibration gases to the **OxyTrak™ 390** at the proper flow rate and pressure.
3. Program all user-programmable calibration parameters.
4. Initiate, either manually or automatically, the calibration process.
5. Allow the calibration to continue until the new O_2 and combustibles readings are within the programmed tolerances.

Method #7

Calibration method #7, whether implemented in manual mode or using the autocal process, includes the following steps:

1. Obtain the two calibration gases:
   a. **Gas #1:** A gas with known oxygen content, to be used as the span gas in a 2-gas oxygen calibration.
   b. **Gas #2:** A gas with known oxygen content, to be used both as the zero gas in a 2-gas oxygen calibration and as a zero gas in a 1-gas combustibles calibration.
2. Install a system to deliver the calibration gases to the **OxyTrak™ 390** at the proper flow rate and pressure.
3. Program all user-programmable calibration parameters.
4. Initiate, either manually or automatically, the calibration process.
5. Allow the calibration to continue until the new O_2 and combustibles readings are within the programmed tolerances.

Calibration Gases

Table C-1 below lists the acceptable specifications for the various **OxyTrak™ 390** calibration gases.

Table C-1: Calibration Gas Specifications

Method	Gas #	Minimum	Default	Maximum
1	1	0.01% O_2	5.00% O_2	10.00% O_2
2	1	8.00% O_2	20.93% O_2	25.00% O_2
	2	0.01% O_2	5.00% O_2	10.00% O_2
3	1	0.01% O_2 0 ppm Comb	5.00% O_2 0 ppm Comb	10.00% O_2 10% of Range
	2	60% of Range	Full Range	120% of Range
4	1	8.00% O_2	20.93% O_2	25.00% O_2
	2	0.01% O_2 0 ppm Comb	5.00% O_2 0 ppm Comb	10.00% O_2 10% of Range
	3	60% of Range	Full Range	120% of Range
5	1	8.00% O_2	20.93% O_2	25.00% O_2
	2	0.01% O_2	5.00% O_2	10.00% O_2
	3	0 ppm Comb	0 ppm Comb	10% of Range
	4	60% of Range	Full Range	120% of Range
6	1	0.01% O_2 0 ppm Comb	5.00% O_2 0 ppm Comb	10.00% O_2 10% of Range
7	1	8.00% O_2	20.93% O_2	25.00% O_2
	2	0.01% O_2 0 ppm Comb	5.00% O_2 0 ppm Comb	10.00% O_2 10% of Range

Appendix D

Calibration, Aspirated Flow

Response Test

The response test is performed at the **OxyTrak™ 390**'s initial installation only. The purpose of this test is to set the aspirator at a flow rate to achieve the desired response time. Allow the unit to warm up for two hours before beginning the response test. (Refer to Figure E-1 on page E-1 for port locations.)

1. Supply air to the aspirator and set it to 4 SCFH (Standard Cubic Feet per Hour).
2. Record the excess O_2% measurement from the stack once it is stable.
3. Switch the air supply from the aspirator port to the purge port at 300cc/min until the O_2% reading is stable.
4. Switch the air supply back through the aspirator port.
5. Record the 90% step change from 21% O_2 to process the O_2% recorded in step 2. This is the unit's response time.
6. Repeat steps 1-5, increasing the aspirator flow rate by 1 SCFH until the desired response time is achieved.

IMPORTANT: *DO NOT EXCEED 10 SCFH. Doing so may affect the analyzer's performance.*

Calibration Gas Flow Rate Test

The calibration gas flow test is performed after the Response Test is complete. The purpose of this test is to set the calibration gas flow to a rate sufficient enough to perform field calibrations. (Refer to Figure E-1 on page E-1 for port locations.)

1. Set the aspirator flow rate to the desired flow rate setpoint.
2. Record the excess O_2% measurement from the stack once it is stable.
3. Supply air (21% O_2) through the calibration port at a rate of 0.5 SCFH until the reading is stable.
4. If the unit's reading is a mix between the 21% O_2 and the excess O_2% from the process, increase the flow rate by 0.5 SCFH.
5. Repeat step 4 until the reading measures 21%.

Note: *Increase the calibration gas flow rate an additional 0.5 SCFH to ensure that no dilution will occur while performing a combustible sensor's field calibration.*

Oxygen Sensor Field Calibration

An oxygen sensor field calibration may be performed upon initial installation, but is not required. It can also be performed as often as required thereafter. An oxygen sensor field calibration can be programmed to occur automatically using the **OxyTrak™ 390**'s auto-calibration capability. (Refer to Figure E-1 on page E-1 for port locations.)

Manual Calibration

Follow the steps on page 5-3 to perform a manual, oxygen sensor field calibration.

Appendix E

Default Settings

Calibration Sheet Example

The default settings are the settings when the unit is first powered up. Later, in the factory, some of the default settings are changed for the specific calibration of a specific unit. Here is a typical factory calibration data sheet:

OxyTrak 390 Calibration Sheet

OxyTrak 390 S/N:	R118
OxyTrak 390 Part Number:	OxyTrak390-3211-1100
Sales Order Number:	508010000098
Calibration Date:	June 16, 2006
Technician:	M. Morales

Output	Type	Range
A	4 to 20 mA	0-10 % O2
B	4 to 20 mA	0-2,000 ppm CO + H2
C	4 to 20 mA	0-10 % O2

Field Calibration

Calibration Method	2 Cylinders 1 O2 + 2 HC (Comb)
Cal Gas Cylinder One	5.0% O2 / balance N2
Oxygen	5.0 % O2
Combustibles Zero Gas	0 ppm Combustibles (CO + H2)
Cal Gas Cylinder Two	1000 ppm CO, 500 ppm H2, 1% O2
Combustibles Span Gas	1,500 ppm Combustibles (CO + H2)

Oxygen Factory Calibration Data

O2 Sensor Serial Number	2243 VI
Furnace Temp:	770.1
Air Offset:	-0.3214 mV

Software Versions

B: BOOT.001.B
P: INST.002.E
X: XML.002.E

Combustibles Factory Calibration Data

Combustibles Sensor Serial Number	2363 E
Aspirator Flow	4 L/m 8.5 SCFH
Zero Gas	0 ppm
Span Gas	21,000 ppm
Slope	0.7909
Intercept	178.8151

Display Defaults

Note: *Default settings are in* ***bold*** *text.*

[DISPLAY]

- **[# of Views]**
  - **[1 View]**
  - [2 Views]
  - [3 Views]
- [DISPLAY]
  - [Normal]
  - **[Reverse]**
  - [Contrast] **45%**

Calibrate Defaults

Note: *Default settings are in **bold** text.*

- **[CALIBRATE]**
  - **[Manual]**
    - [Oxygen]
    - [Combustibles]
  - [Autocal]
    - [Interval]
      - **[Hours]**
        - [2 Hours]
        - [3 Hours]
        - [4 Hours]
        - [6 Hours]
        - [8 Hours]
        - **[12 Hours]**
      - [Days]
        - [Days] — **7 Days**
        - [Start Time]
          - [Hour] — **0 Hours**
          - [Minute] — **0 Mins**
    - [Gas Supply Time] — **2 Mins**
    - [Settling Time] — **2 Mins**
    - [A/V Failure]
      - [Alarm]
      - **[Alarm+ReCal]**
    - [O2 A/V Tolerance] — **0.10%**
    - [Comb A/V Tolerance] — **20.00 ppm**
    - [O2 Tolerance] — **0.02%**
    - [Comb Tolerance] — **20.00 ppm**
    - [Auto Cal Now?]
      - [Yes]
      - **[No]**
  - [GE Energy Cal]

Output Defaults

Note: *Default settings are in **bold** text.*

Output A

[OUTPUT]
- [Output A]
  - [Measure]
    - **[%O2]**
    - [% Combustibles]
    - [ppm Combustibles]
    - [Furnace Temp DegC]
    - [Furnace Temp DegF]
  - [Type]
    - **[4-20mA]**
    - [0-20mA]
    - [NAMUR]
    - [special]
      - [Zero] **0.00 mA**
      - [Span] **0.00 mA**
  - [Range]
    - [Zero] **0.00 %**
    - [Span] **10.00 %**
  - [Trim]
    - [Base Trim] **0.00 mA**
    - [Span Trim] **0.00 mA**
    - [%] **0 %**
    - [Mode]
      - [Test]
      - **[Normal]**
  - [Cal Setting]
    - **[Hold Last Value]**
    - [User Selectable]
      - [Specific Value] **1.0 mA**
    - [Live Output]

Output B

[Output B]
- [Measure]
  - [%O2]
  - [% Combustibles]
  - **[ppm Combustibles]**
  - [Furnace Temp DegC]
  - [Furnace Temp DegF]
- [Type]
  - **[4-20mA]**
  - [0-20mA]
  - [NAMUR]
  - [special]
    - [Zero] **0.00 mA**
    - [Span] **0.00 mA**
- [Range]
  - [Zero] **0.00 ppm**
  - [Span] **2000.00 ppm**
- [Trim]
  - [Base Trim] **0.00 mA**
  - [Span Trim] **0.00 mA**
  - [%] **0 %**
  - [Mode]
    - [Test]
    - **[Normal]**
- [Cal Setting]
  - **[Hold Last Value]**
  - [User Selectable]
    - [Specific Value] **1.0 mA**
  - [Live Output]

Output C

[Output C]
    [Measure]
        [%O2]
        [% Combustibles]
        [ppm Combustibles]
        [Furnace Temp DegC]
        [Furnace Temp DegF]
    [Type]
        [4-20mA]
        [0-20mA]
        [NAMUR]
        [special]
            [Zero] **0.00 mA**
            [Span] **0.00 mA**
    [Range]
        [Zero] **0.00 %**
        [Span] **10.00%**
    [Trim]
        [Base Trim] **0.00 mA**
        [Span Trim] **0.00 mA**
        [%] **0 %**
        [Mode]
            [Test]
            [Normal]
    [Cal Setting]
        [Hold Last Value]
        [User Selectable]
            [Specific Value] **1.0 mA**
        [Live Output]

Relays Defaults

Note: *Default settings are in **bold** text.*

- **[RELAYS]**
  - [Relay A]
    - [Type]
      - [Measure]
      - [Diag Errors]
      - [System Faults]
    - [Setting]
      - [Measure]
        - **[%O2]**
        - [% Combustibles]
        - [ppm Combustibles]
        - [Type]
          - [High]
            - **[Setpoint] 0.00 %**
            - **[Deadband] 0.00 %**
          - [Low]
            - **[Setpoint] 0.00 %**
            - **[Deadband] 0.00 %**
      - [Diag Errors]
        - [O2 Over Range]
          - [Setpoint] **100.00 %**
        - [O2 Under Range]
          - [Setpoint] **0.01 %**
        - [O2 Cal Error]
        - [Comb Over Range]
          - [Setpoint] **30000.00 ppm**
        - [Comb Under Range]
          - [Setpoint] **0.00 ppm**
        - [Comb Cal Error]
      - [System Faults]
        - [Furnace Temp Over Range]
        - [Furnace Temp Under Range]
        - [Furnace Low Temp]
        - [Block Temp Over Range]
        - [Block Temp Under Range]
        - [Block Low Temp]

[Active RTD Over Range]
[Active RTD Under Range]
[Ref RTD Over Range]
[Ref RTD Under Range]
[Normal/Failsafe]
[Normal]
[Failsafe]
[Relay B]
[Type]
[Measure]
[Diag Errors]
[System Faults]
[Setting]
[Measure]
[% O2]
[% Combustibles]
[ppm Combustibles]
[Type]
[High]
[Setpoint] 0.00 %
[Deadband] 0.00 %
[Low]
[Setpoint] 0.00 %
[Deadband] 0.00 %
[Diag Errors]
[O2 Over Range]
[Setpoint] **100.00 %**
[O2 Under Range]
[Setpoint] **0.01 %**
[O2 Cal Error]
[Comb Over Range]
[Setpoint] **30000.00 ppm**
[Comb Under Range]
[Setpoint] **0.00 ppm**
[Comb Cal Error]
[System Faults]
[Furnace Temp Over Range]
[Furnace Temp Under Range]

[Furnace Low Temp]
[Block Temp Over Range]
[Block Temp Under Range]
[Block Low Temp]
[Active RTD Over Range]
[Active RTD Under Range]
[Ref RTD Over Range]
[Ref RTD Under Range]
[Normal/Failsafe]
[Normal]
[Failsafe]
[Relay C]
[Type]
[Measure]
[Diag Errors]
[System Faults]
[Setting]
[Measure]
[% O2]
[% Combustibles]
[ppm Combustibles]
[Type]
[High]
[Setpoint] 0.00 %
[Deadband] 0.00 %
[Low]
[Setpoint] 0.00 %
[Deadband] 0.00 %
[Diag Errors]
[O2 Over Range]
[Setpoint] **100.00 %**
[O2 Under Range]
[Setpoint] **0.01 %**
[O2 Cal Error]
[Comb Over Range]
[Setpoint] **30000.00 ppm**
[Comb Under Range]
[Setpoint] **0.00 ppm**

[Comb Cal Error]
[System Faults]
[Furnace Temp Over Range]
[Furnace Temp Under Range]
[Furnace Low Temp]
[Block Temp Over Range]
[Block Temp Under Range]
[Block Low Temp]
[Active RTD Over Range]
[Active RTD Under Range]
[Ref RTD Over Range]
[Ref RTD Under Range]
[Normal/Failsafe]
[Normal]
[Failsafe]
[Relay D]
[Type]
[Measure]
[Diag Errors]
[System Faults]
[Setting]
[Measure]
[% O2]
[% Combustibles]
[ppm Combustibles]
[Type]
[High]
[Setpoint] 0.00 %
[Deadband] 0.00 %
[Low]
[Setpoint] 0.00 %
[Deadband] 0.00 %
[Diag Errors]
[O2 Over Range]
[Setpoint] **100.00 %**
[O2 Under Range]
[Setpoint] **0.01 %**
[O2 Cal Error]

[Comb Over Range]
[Setpoint] **30000.00 ppm**
[Comb Under Range]
[Setpoint] **0.00 ppm**
[Comb Cal Error]
[System Faults]
[Furnace Temp Over Range]
[Furnace Temp Under Range]
[Furnace Low Temp]
[Block Temp Over Range]
[Block Temp Under Range]
[Block Low Temp]
[Active RTD Over Range]
[Active RTD Under Range]
[Ref RTD Over Range]
[Ref RTD Under Range]
[Normal/Failsafe]
[Normal]
[Failsafe]
[Relay E]
[Test]
[Reset]
[Trip]
[Normal/Failsafe]
[Normal]
[Failsafe]
[Relay F]
[Test]
[Reset]
[Trip]
[Normal/Failsafe]
[Normal]
[Failsafe]
[Relay G]
[Test]
[Reset]
[Trip]

[Normal/Failsafe]

[Normal]

[Failsafe]

[Relay H]

[Test]

[Reset]

[Trip]

[Normal/Failsafe]

[Normal]

[Failsafe]

Communications Defaults

Note: *Default settings are in **bold** text.*

[COMMUNICATIONS]

[Select Port]

[RS232]

[RS485]

[Node ID]

[NodeID] 16

[Port Settings]

[Baud Rate]

[2400]

[9600]

[19200]

[38400]

[57600]

[Parity]

[None]

[Stop Bits]

[1]

[Data Bits]

[8]

[Ethernet Settings]

[IP Addr]

[Port #] 0

[Gateway Addr]

Setup Defaults

Note: *Default settings are in **bold** text.*

[SETUP]

[O2 Sensor Temp]	
[700 DegC]	
[770 DegC]	
[812 DegC]	
[Custom]	
[Custom]	**700 DegC**
[Heater Block Temp]	
[Custom]	**220 DegC**
[Clock]	
[Year]	**2004**
[Month]	**12**
[Day]	**15**
[Hour]	**12**
[Minute]	**59**
[Cal Method]	
[O2 1CYL]	
[Span O2]	**5.00 %**
[O2 2CYL]	
[Zero O2]	**20.93 %**
[Span O2]	**5.00 %**
[O2+HC 1CYL]	
[Span O2*]	**5.00 %**
[O2+HC 2CYL]	
[O2+HC 2CYL(1O2 2HC)]	
[Span O2*]	**5.00 %**
[Span HC]	**1500.0 ppm**
[O2+HC 2CYL(2O2 1HC)]	
[Zero O2]	**20.93 %**
[Span O2*]	**5.00 %**
[O2+HC 3CYL]	
[Zero O2]	**20.93 %**
[Span O2*]	**5.00 %**
[Span HC]	**1500.0 ppm**

[O2+HC 4CYL]

[Zero O2] **20.93 %**

[Span O2] **5.00 %**

[Zero HC] **0.0 ppm**

[Span HC] **1500.0 ppm**

[Blow Back]

[Interval] **0 Mins**

[Duration] **2 Secs**

[Settling] **60 Secs**

[Blow back now?

[Yes]

[No]

[Comb_ppm Clamp]

[Clamp negative ppm?]

[Yes]

[No]

Factory Defaults

Note: *Default settings are in **bold** text.*

[FACTORY]

[Versions]

[Upgrade]

[Are you sure?]

[Yes]

[No]

[Default Analyzer]

[Are you sure?]

[Yes]

[No]

[Thermal Cal]

[Thermal Cal]

[Temp Limit] **20 DegC**

[O2 Tolerance] **0.02 %**

[Cal Delay] **5 Mins**

[Air Offset] **0.0000 mV**

- [Furnace Temp] **600.0 DegC**
- [Comb Cal]
  - [Setup]
    - [Block Temp]
      - [Temp Setpoints] **2**
      - [Temp 1] **220 DegC**
      - [Temp 2] **240 DegC**
    - [Cal Gas]
      - [Gas Points] **5**
      - [Gas 1] **0 ppm**
      - [Gas 2] **3000 ppm**
      - [Gas 3] **6000 ppm**
      - [Gas 4] **12000 ppm**
      - [Gas 5] **21000 ppm**
      - [Gas 6] **1500 ppm**
    - [Type]
      - [Non-Aspirator]
      - **[Aspirator]**
    - [Qcal] **240 cc/m**
  - [Perform]
    - **[Temp 1]**
      - **[CalGas 1]**
      - [CalGas 2]
      - [CalGas 3]
      - [CalGas 4]
      - [CalGas 5]
      - [CalGas 6]
    - [Temp 2]
      - [CalGas 1]
      - [CalGas 2]
      - [CalGas 3]
      - [CalGas 4]
      - [CalGas 5]
      - [CalGas 6]
  - [Edit]

Aspirator

[Temp 1]

[CalGas 1]

[Ref ohms]		**1810.81**
[Act ohms]		**1811.17**

[CalGas 2]

[Ref ohms]		**1819.36**
[Act ohms]		**1838.11**

[CalGas 3]

[Ref ohms]		**1827.91**
[Act ohms]		**1865.04**

[CalGas 4]

[Ref ohms]		**1845.00**
[Act ohms]		**1918.91**

[CalGas 5]

[Ref ohms]		**1870.64**
[Act ohms]		**1999.72**

[CalGas 6]

[Ref ohms]		**1000.00**
[Act ohms]		**1000.00**

[Temp 2]

[CalGas 1]

[Ref ohms]		**1849.34**
[Act ohms]		**1849.78**

[CalGas 2]

[Ref ohms]		**1857.90**
[Act ohms]		**1876.38**

[CalGas 3]

[Ref ohms]		**1866.46**
[Act ohms]		**1902.98**

[CalGas 4]

[Ref ohms]		**1883.59**
[Act ohms]		**1956.18**

[CalGas 5]

[Ref ohms]		**1909.28**
[Act ohms]		**2035.98**

[CalGas 6]

[Ref ohms]		**1000.00**
[Act ohms]		**1000.00**

Non-Aspirator

[Temp 1]

[CalGas 1]

[Ref ohms]	**1933.47**
[Act ohms]	**1934.31**

[CalGas 2]

[Ref ohms]	**1936.90**
[Act ohms]	**1945.44**

[CalGas 3]

[Ref ohms]	**1940.34**
[Act ohms]	**1957.02**

[CalGas 4]

[Ref ohms]	**1947.01**
[Act ohms]	**1979.83**

[CalGas 5]

[Ref ohms]	**1956.89**
[Act ohms]	**2013.72**

[CalGas 6]

[Ref ohms]	**1000.00**
[Act ohms]	**1000.00**

[Temp 2]

[CalGas 1]

[Ref ohms]	**1968.50**
[Act ohms]	**1969.32**

[CalGas 2]

[Ref ohms]	**1972.40**
[Act ohms]	**1980.74**

[CalGas 3]

[Ref ohms]	**1975.94**
[Act ohms]	**1992.16**

[CalGas 4]

[Ref ohms]	**1982.53**
[Act ohms]	**2014.29**

[CalGas 5]

[Ref ohms]	**1992.31**
[Act ohms]	**2047.11**

[CalGas 6]

[Ref ohms]	**1000.00**
[Act ohms]	**1000.00**

Factory Defaults (cont.)

[Development]

[Furnace PID]

[Setpoint]	**600.0 DegC**
[PropBand]	**25.0 DegC**
[IntTime]	**560.0 Secs**
[MaxTemp]	**950.0 DegC**

[Manifold PID]

[Setpoint]	**220.0 DegC**
[PropBand]	**5.8 DegC**
[IntTime]	**70.0 Secs**
[MaxTemp]	**350.0 DegC**

[O2 Cal PID]

[Setpoint]	**5.00 %**
[PropBand]	**0.30 %**
[IntTime]	**600.0 Secs**

[GE Energy]

[Start Purge]	**0**
[Calibration Cycle]	**24586**
[Start Cal Cycle]	**0**
[ZeroCal Duration]	**3 Mins**
[SpanCal Duration]	**3 Mins**
[LongPurge Duration]	**5 Mins**
[Sample Delay Time]	**60.0 Secs**
[Init Sample Delay Time]	**60.0 Secs**
[Zero Cal Valve]	**0**
[Span Cal Valve]	**0**
[Purge Valve]	**0**
[Aspirator]	**0**
[Settling]	**15 Mins**
[Span O2*]	**5.00 %**
[Span HC]	**1500.0 ppm**
[Comb. Offset]	**0**
[Comb. Cal Sample Duration]	**3 Mins**
[Start Sample Time Delay]	**0**

Factory Defaults (cont.)

[Cal Factor]	**1.0000**
[Comb. Cal Slope]	**1.0000**
[Comb. Cal Intercept]	**0.0000**
[Fast Cal Limit]	**20.0**
[Thermal Cal Limit]	**50.0**
[Comb ppm Avg]	**1**
[Start Span Cal PID]	**0**
[SpanCal PID Status]	**0**
[Service Busy]	**0**

Appendix F

Blow Back Sample System

Installation

To install a Blow Back Sample System, see Figure F-1 on page F-2 and complete the following:

1. Mount the sample system near the **OxyTrak™ 390** using the four mounting holes located at each corner of the plate.
2. Close all valves.
3. Using ¼” tubing with compression fittings, connect the Solenoid Valve to the Blow Back/Calibration Port, the Flowmeter to the Aspirator Port and the Gas Inlet to the gas source.
4. When compression fitting connections have been secured, connect the sample system to its electrical source and open the valves.

Settings

1. Set the Inlet Pressure Regulator to 4.5 bars.
2. Adjust the Blow Back Needle Valve for 125 cc/min and remove the handle.
3. Adjust the Aspirator Needle Valve to set the aspirator gas flow at 10 SCFH.

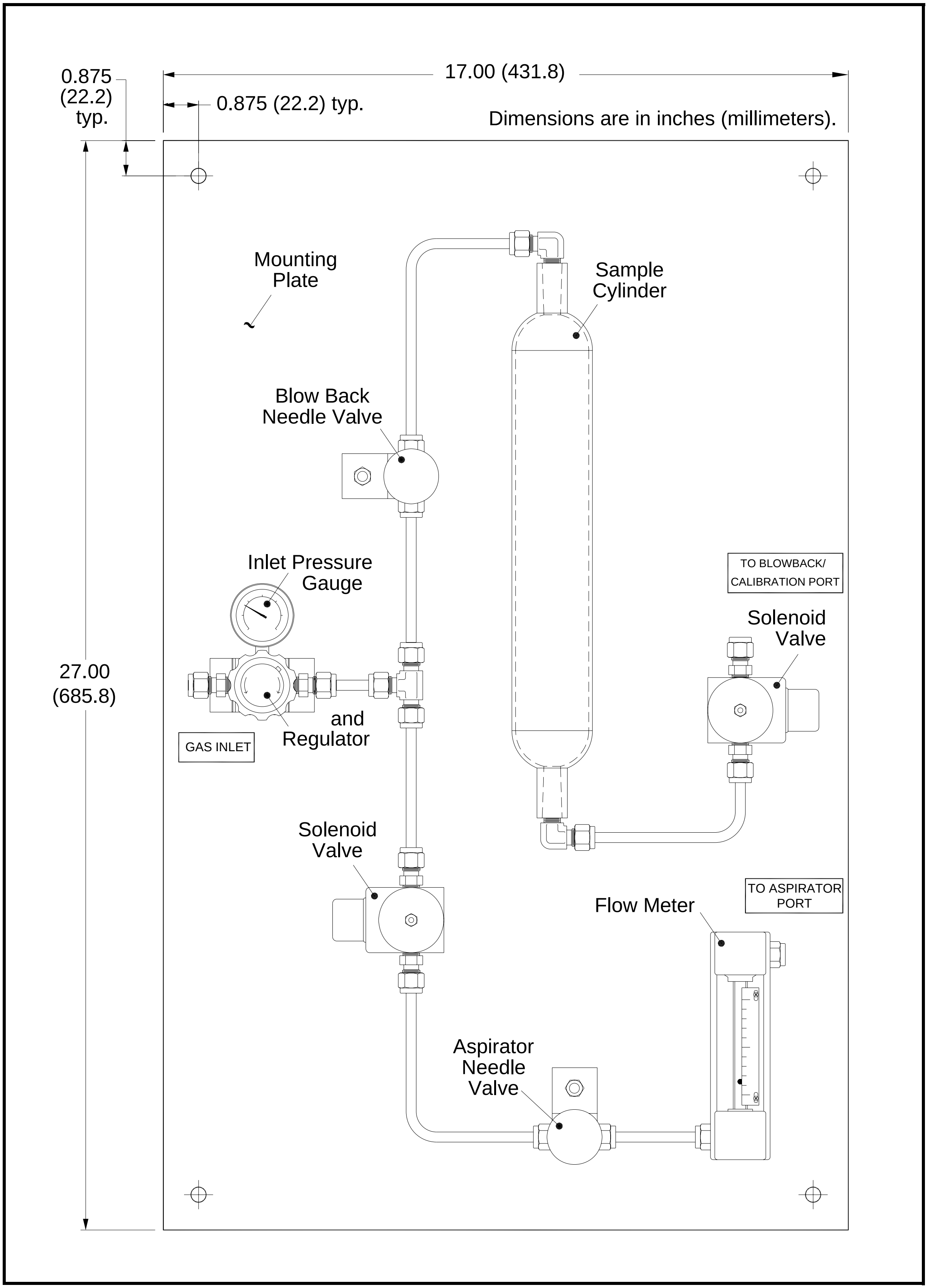


Figure F-1: Blow Back Sample System (ref. dwg #733-366)

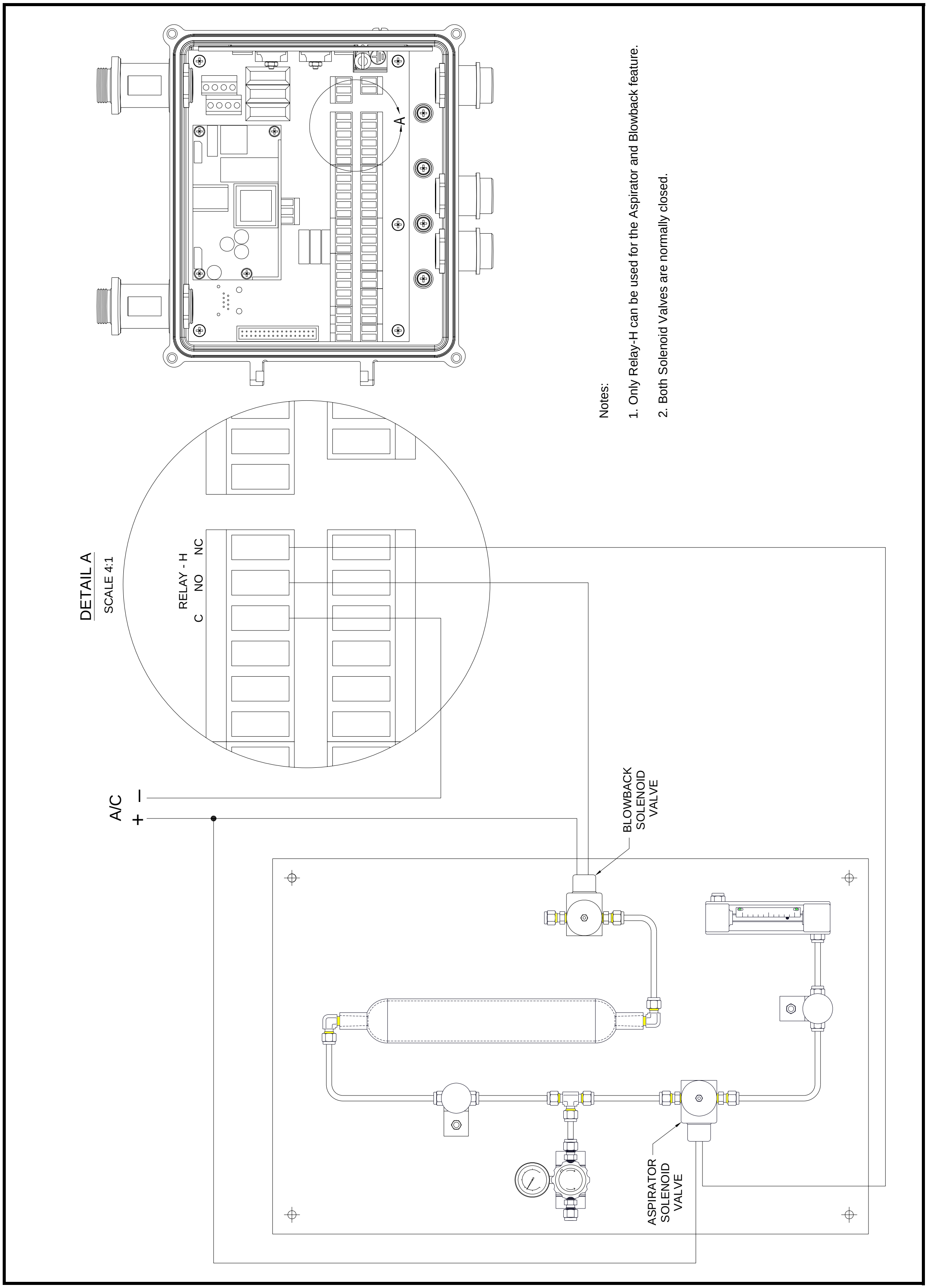


Figure F-2: Aspirator & Blowback Panel Wiring Diagram (ref. dwg #702-681)

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Index (cont.)

Index (cont.)

GE
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DECLARATION OF CONFORMITY

We,

GE Sensing
1100 Technology Park Drive
Billerica, MA 01821
USA

declare under our sole responsibility that the

OxyTraK™ 390 Flue Gas Oxygen Analyzer
OxyTraK™ 411 In Situ Flue Gas Oxygen Analyzer

to which this declaration relates, are in conformity with the following standards:

- EN 61326:1998, Class A, Annex A, Continuous Unmonitored Operation
- EN61010-1:1993 + A2:a995, Overvoltage Category II, Pollution Degree 2

following the provisions of the

- Electromagnetic Compatibility Directive 89/336/EEC
- Low Voltage Directive 73/23/EEC

April 23, 2007
Date of Issue

Gary Kozinski
Mr. Gary Kozinski
Certification & Standards, Lead Engineer

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GE
Sensing

DECLARATION DE CONFORMITE

Nous,

GE Sensing
1100 Technology Park Drive
Billerica, MA 01821
USA

déclarons sous notre propre responsabilité que les

OxyTraK™ 390 Flue Gas Oxygen Analyzer
OxyTraK™ 411 In Situ Flue Gas Oxygen Analyzer

rélatif á cette déclaration, sont en conformité avec les documents suivants:

- EN 61326:1998, Class A, Annex A, Continuous Unmonitored Operation
- EN61010-1:1993 + A2:a995, Overvoltage Category II, Pollution Degree 2

suivant les régles de

- Electromagnetic Compatibility Directive 89/336/EEC
- Low Voltage Directive 73/23/EEC

April 23, 2007
Date of Issue

Mr. Gary Kozinski
Certification & Standards, Lead Engineer

TÜV ESSEN
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U.S.

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KONFORMITÄTS-ERKLÄRUNG

Wir,

GE Sensing
1100 Technology Park Drive
Billerica, MA 01821
USA

erklären, in alleiniger Verantwortung, daß die Produkte

OxyTraK™ 390 Flue Gas Oxygen Analyzer
OxyTraK™ 411 In Situ Flue Gas Oxygen Analyzer

folgende Normen erfüllen:

- EN 61326:1998, Class A, Annex A, Continuous Unmonitored Operation
- EN61010-1:1993 + A2:a995, Overvoltage Category II, Pollution Degree 2

gemäß den Europäischen Richtlinien,

- Electromagnetic Compatibility Directive 89/336/EEC
- Low Voltage Directive 73/23/EEC

April 23, 2007
Date of Issue

Gary Kozinski

Mr. Gary Kozinski
Certification & Standards, Lead Engineer

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