

MODEL 48*i* TRACE LEVEL CARBON MONOXIDE (TL-CO)
MONITORING SYSTEM
Section II

Operators Responsibilities

Approval Sign-Off Sheet

I certify that I have read and approve of the contents of this revision of the "MODEL 48i TRACE LEVEL CARBON MONOXIDE (TL-CO) MONITORING SYSTEM, Section II, OPERATORS RESPONSIBILITIES" with an effective date of November 10, 2011.

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Table of Contents

2.36.2	HSCO -TLE Monitoring Site Operation Procedures	4
2.36.2.1	Procedures for Site Operation and Calibration for Trace Level High Sensitivity Carbon Monoxide (CO) Monitors	4
2.36.2.2	CALIBRATION	6
2.36.2.2.1	Operational Checks for HSCO - TLE Monitoring Sites	6
2.36.2.2.2	Filter Change Procedure	15
2.36.2.2.3	Model 48i TLE Leak Check	16
2.36.2.2.4	Multi-Point Calibration	17
2.36.2.2.5	Zero (Ø) Span Check Procedure	22
2.36.2.2.6	Span Check Procedure	23
2.36.2.2.7	Review the Calibration and End	24
2.36.2.3	CALIBRATION CHECK	26
2.36.2.3.1	Operational Checks	26
2.36.2.3.2	Calibration Check Procedure	36
2.36.2.3.3	Zero (Ø) Calibration Check Procedure	38
2.36.2.3.4	Span Check Procedure	39
2.36.2.3.5	Filter Change Procedure	39
2.36.2.3.6	Model 48i TLE Leak Check	40
2.36.2.3.7	Review Calibration Check and End	40
2.36.2.4	Site Calls	44
2.36.2.5	Data Reporting and Validation for Regional Offices	44
2.36.2.6	Quality Assurance Procedures	45
2.36.2.7	Monitor Shutdown Procedure	46

Table of Figures

Figure 1	48i Run Screen	7
Figure 2	48i Front Panel Pushbuttons	8
Figure 3	48i Main Menu	8
Figure 4	48i Cal Background Screen	9
Figure 5	48i Diagnostics Screen	9
Figure 6	48i Alarms Screen	12
Figure 7	48i Multi-Calibration Screen	20

2.36.2 HSCO -TLE Monitoring Site Operation Procedures

Note: The following is a list of "significant changes" from Revision 4.3.

- 1) QA updated per QAP/SOP 2.39 "Standard Operating Procedure (SOP) for Preparing Quality Assurance Plans/SOPs".
- 2) Calibration requirements added to Calibration section.

2.36.2.1 Procedures for Site Operation and Calibration for Trace Level High Sensitivity Carbon Monoxide (CO) Monitors

The U.S. EPA is currently implementing the National Ambient Air Monitoring Strategy (NAAMS). The NAAMS goals include improvement of the scientific and technical competency of the nation's air monitoring networks and increased value in protecting public health and the environment. One of the major areas of investment in the NAAMS is the use of highly sensitive commercial air pollutant monitors for the characterization of the precursor gas CO. A modification was instituted to increase the range from 2 ppm to 5 ppm to improve sensitivity and accuracy or reduce interferences. This revision reflects changes to calibration, calibration check and audit procedures as per NAAMS and Code of Federal Regulations 40CFR 58 promulgated October 17, 2006.

The Division of Air Quality of the Department of Environment and Natural Resources determines the ground level concentration of ambient air ozone and fine particulate matter throughout North Carolina as required by the 1970 Clean Air Act and the subsequent Amendments thereto. In short, the Clean Air Act established ambient air quality as a national resource that must be protected. The EPA is designated the responsibility to administer and assist in the nationwide program to protect and improve air quality and each state is assigned the direct responsibility for assuring air quality within its borders. Besides being one of the "Health and Welfare" based Criteria Pollutants required to be monitored by each state as a means of tracking progress in improving and maintaining ambient air quality, Carbon Monoxide is also a precursor to ozone and particulate matter.

The State of North Carolina operates Trace Level Carbon Monoxide (TLCO) monitors across the state. In order to collect accurate, meaningful data the monitors must be operated in a consistent manner. Trace Level Carbon Monoxide monitoring is conducted at two sites year round to support ozone precursor monitoring and fine particulate precursor monitoring. The goal of this document is to establish a continuous, verifiable, defendable record of events with regard to the site and the instrument.

All original records (records documenting observations, i.e. calibration logbook and site logbook) must be legible, complete, dated, and signed by the operator and retained as part of the permanent analyzer calibration record. The operator's signature on the calibration

logbook form certifies that the calibration has been performed in accordance with this QA/SOP and that the information contained on the form is accurate. All records will be reviewed and verified by the Regional Ambient Monitoring Coordinator and audited by Raleigh Headquarters.

A. Continuous monitoring principles that applies to the 48i TLE HSCO system:

- Data Backup
- Do not perform checks or calibrations between 6:00 AM and 9:00AM "Local Standard Time"
- Calibration Checks:
 - Performed every 14 days, before filter changes and instrument leak checks.
 - Performed every 14 days – PRECISION CHECK
 - Performed following minor repairs that should not affect the calibration of the analyzer: *coalesce* change, inlet sample line replacement, and particulate filter change.
 - Performed before the 146C calibrator and/or gas cylinders are changed out (if not done because of a problem). After the new calibrator has had 24 hours to stabilize, the operator should perform a calibration check. A Calibration check should be performed to evaluate the new/replacement calibrator or cylinder. If the calibration check passes then a Calibration must be performed. If the calibration check fails there has to be a thorough evaluation of why it failed but the existing monitor which is still within an acceptable calibration and operational control should not be changed.
- Calibration:
 - An initial adjusted calibration (hereafter referred to, as "adjusted calibration" must be performed during the site start-up.
 - Calibration (adjusted calibration) is required whenever a system's operation is interrupted: more than two days without power or offline, physical removal/replacement of system's components (monitor, calibrator, cylinder, zero air pak, and sample line) or major repairs/maintenance.
 - A calibration (adjusted calibration) is required when a calibration check (i.e. unadjusted calibration) fails. Replace the filter and perform calibration.
 - Performed every 90 days.

B. Equipment:

- TEI/TECO Model 48i TLE CO Analyzer
- TEI 146C Dynamic Gas Calibrator
- Model 111 Zero Air Supply System
- ESC 8816/8832 Data Logger: primary (PDL) & backup (BUDL)

- Optional Components: Uninterruptible Power Supply (UPS) is recommended if you autopoll your monitors at scheduled times
- Dedicated site PC
- Telephone modem
- Air compressor

C. Safety Issues and Concerns

- A gas cylinder of ~190-ppm carbon monoxide is used as calibration standard. Certain safety precautions are required due to the nature of this gas. Carbon Monoxide (CO) is an odorless, colorless, poisonous gas. Carbon Monoxide enters the bloodstream through the lungs and attaches to red blood cells. CO molecules prevent the flow of oxygen to the heart, brain, and vital organs. As CO accumulates in the bloodstream the body becomes starved for oxygen.
- **Breathing high concentrations of CO can be lethal in minutes. Low concentrations over time can be dangerous as well.**
- **Early symptoms of carbon monoxide poisoning include headache, dizziness, weakness, nausea, vomiting, sleepiness, and confusion.**

2.36.2.2 CALIBRATION

- An initial adjusted calibration (hereafter referred to, as "adjusted calibration" must be performed during the site start-up.
- Calibration (adjusted calibration) is required whenever a system's operation is interrupted: more than two days without power or offline, physical removal/replacement of system's components (monitor, calibrator, cylinder, zero air pak, and sample line) or major repairs/maintenance.
- A calibration (adjusted calibration) is required when a calibration check (i.e. unadjusted calibration) fails. Replace the filter and perform calibration.
- Performed every 90 days.

2.36.2.2.1 Operational Checks for HSCO - TLE Monitoring Sites

1) Site Checks

Upon arrival at the site, observe the outside of the sampling building and probe, looking for vandalism or security breaches. If there is any evidence of vandalism, contact the appropriate law enforcement department (generally this is the city police department if the monitor is within city limits, and the county sheriff's department if outside city limits) and the central office. Record your observations in the logbooks. Except for particulate filter changes, phone ECB (Electronics and Calibration Branch) for guidance before making any adjustments to the front panel controls.

Inspect the Inverted Funnel, Wire Screen, Sample Probe Line, and Calibration

Line: visually inspect and document the condition of the sample delivery and calibration tubing systems. This inspection should also be performed during each site visit. The probe should be turned down, an undamaged inverted funnel on the end, the wire screen

must be in place to protect the sampling probe from insects and foreign material, and the Teflon line must be visible inside the funnel screen.

Power On and Sample Line Check: observe the analyzer, calibrator, computer, and data loggers for indications of power failure, and if needed, correct the cause. Verify the instrument "LCD" panel is lit and there is an audible sound from the external pump. If the analyzer or calibrator lost power, allow an equilibration period of at least an hour for the instrument(s) to stabilize. Visually inspect the tubing, especially at any bends, to ensure that it has not been accidentally kinked, crimped, cut, or insects are nested in the lines. Particulate matter may also load the sample line ahead of the inlet filter. Such restrictions can usually be determined by disconnecting the inlet line of the sample pump. If pump performance is significantly improved and the inlet filter itself is not loaded with particulate matter, the sample line may require replacement. Record all events in the logbook. Notify supervisor and call the ECB for instructions on length of stabilization period and recycling the data logger if necessary.

Station Temperature Check: measure and record the site temperature in °C. Adjust the site thermostats as necessary to maintain the 20° to 30°C range. If the temperature is outside of the 20° to 30°C range, notify the Regional Ambient Monitoring Coordinator and the ECB to correct the problem and invalidate data if necessary.

Check on Gas Cylinder and 146C Calibrator: verify the gas cylinder and calibrator are in certification (calibrator certification sticker on front panel) and document certification dates in logbook. (If the cylinder pressure is less than 500 psig arrange with ECB when the Region will do a calibration check before delivery of the cylinder. Calibrate after the new cylinder is installed per **2.36.2.2 Calibration**. Verify that the 146C has the correct cylinder concentration stored in memory.

146C Calibrator

- Main Menu
- Gas B, <ENTER>
- Tank Conc., <ENTER>

Checks on 48i – TLE Analyzer:

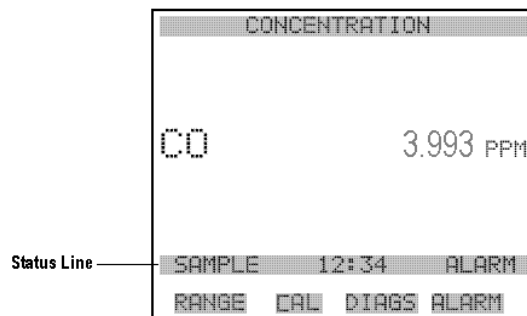


Figure 1 48i Run Screen

Important Keys:

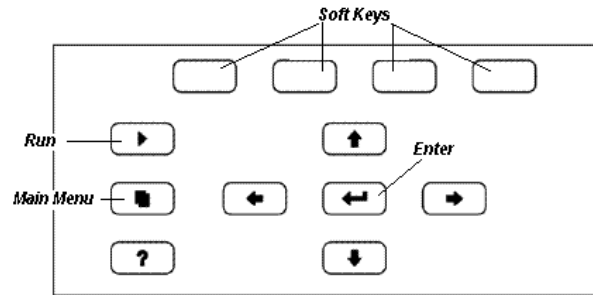


Figure 2 48i Front Panel Pushbuttons

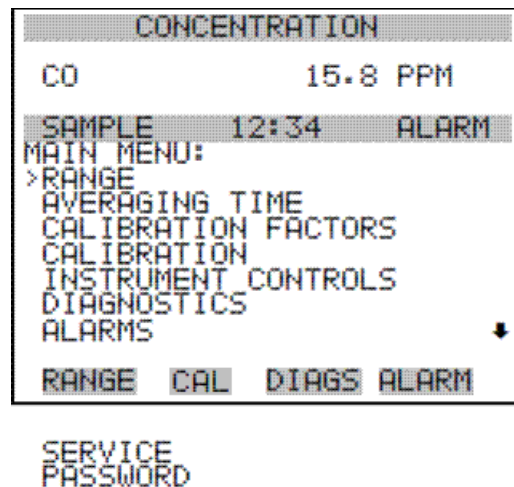



Figure 3 48i Main Menu

Range Check: The Range menu contains the gas units, CO ranges, and the custom ranges.

To display the Range menu:

- On the 48i front panel, press "**RANGE**" soft key, record number in e-log acceptable range: **CO = 0 to 5 ppm**
- Select:  (to go back to the RUN screen)

Invalidate all data in the wrong range. Notify supervisor and Quality Assurance Coordinator immediately.

Calibration Background and CO Coefficient

Calibration factors are determined during manual multi-point calibration and are used to correct the CO concentration readings. To see the actual reading of an item, move the menu cursor ">" up or down to select the item and press <ENTER>.

To display the Calibration Factors menu:

- From the 48i front panel, press "**CAL**" soft key, select "**CAL BACKGROUND**" <ENTER>, record value for "**CO BKG PPM**", press "**CAL**" soft key (to go back to the CAL screen)

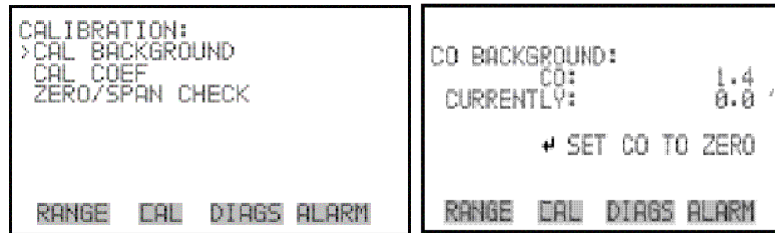


Figure 4 48i Cal Background Screen

- From "CAL" screen, select "CO COEF" record value for "CO COEF", acceptable ranges: **CO BKG PPM – 8 to 10** and **CO COEF - near one**
- press  (to go back to the RUN screen)

Diagnostic Checks: The diagnostic checks are used to troubleshoot the instrument.

To display the Diagnostic menu:

- On the 48i front panel, press "DIAGS" soft key
- To see the actual reading of an item and its minimum and maximum limits, move the menu cursor ">" up or down to select the item and press <ENTER>

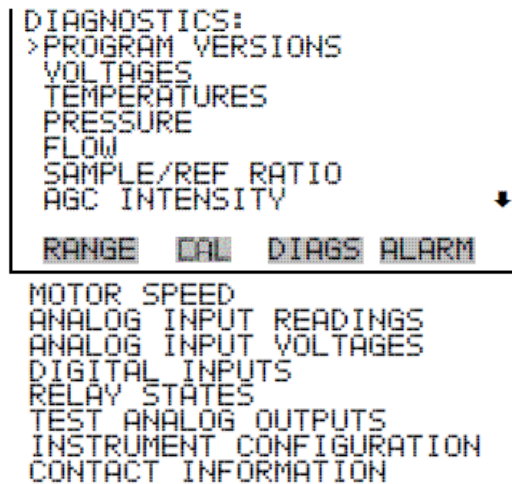


Figure 5 48i Diagnostics Screen

Temperature Check: The Temperatures screen displays the current internal instrument temperature and chamber temperature.

- Press "DIAGS" soft key, select "Temperatures", <ENTER>, acceptable ranges: **Internal (38°C - 45°C)** and **Bench (40°C - 59°C)**. If the readings are not in this range, call the ECB.
- Press "DIAGS" soft key (to go back to the DIAGS screen)

Pressure Check: The Pressure screen displays the current optical chamber pressure.

- Press "DIAGS" soft key, select "Pressure", <ENTER>, acceptable ranges: **250 to 1,000 mmHg**

- Press "**DIAGS**" soft key (to go back to the DIAGS screen)


Flow Check: The Flow screen displays the current sample flow rate.

- Press "**DIAGS**" soft key, select "**Flow**", <ENTER>, acceptable ranges: **0.3 to 1.5 LPM**
- Press "**DIAGS**" soft key (to go back to the DIAGS screen)

Sample/Ref Ratio: The Sample/Reference Ratio screen displays the ratio of the intensities of the light source through the sample wavelength and reference wavelength of the bandpass filter wheel.

- Press "**DIAGS**" soft key, select "**Sample/Ref Ratio**", <ENTER> acceptable ranges: **1.14 to 1.18**
- Press "**DIAGS**" soft key (to go back to the DIAGS screen)

AGC Intensity Check: the AGC Intensity screen displays the intensity (in Hz) of the reference channel Automatic Gain Control (AGC) circuit.

- Press "**DIAGS**" soft key, select "**AGC Intensity**", <ENTER> acceptable ranges: **150,000 to 300,000 Hz**, Note: If reading is not within acceptable ranges, call ECB
- Press  (to go back to the RUN screen)

Model 111 Zero Air Pak and Compressor Checks: the silica gel in the cartridges located on the back of the Zero Air Pak removes the moisture from the compressed air before the carbon monoxide is removed from the dried air by the internal carulite canister. Silica gel, though, has a limited capacity to effectively remove moisture from the air stream. Because of this limited capacity, the silica gel must be replaced every 14 days or less to insure effective moisture removal in both cartridges. Verify that the silica gel is not spent by color change. When the gel is new it is a dark blue in color. If the gel is spent, it is a lighter blue in color with white crystals. If the gel is spent or it has been 14 days since it was last changed, replace it, and return it to the ECB for regeneration. Check the condition of the Purifill. Fresh Purifill is purple and turns brown when saturated. Replace when purple color is less than 20% of the volume. Remove the cartridge holding the Purifill, unscrew the cap, discard used Purifill, replace with fresh and screw on the cap and replace cartridge. Record in the logbook. On an annual basis, change all scrubbing medium.

Verify and record that the outlet pressure on the air compressor is reading between 40 and 50 psi. Verify and record that the ZAP is reading between 20 and 40 psi. If either pressure reading is outside of these ranges, contact the ECB and record corrective action. Also, check and drain any water from the compressor (do this at every site visit).

2) **TEI 48i TLE Analyzer and 146C Calibrator Alarm and Operational Checks**

Basic checks of the instrumentation:

Alarm Check (146C Calibrator)

Check the TEI 146C Run Screen

- a. Press the <MENU> button on the front of the instrument. (Make sure the 146C is in "**Remote**" mode, the 146C has to be in the REMOTE MODE in order to activate the internal span solenoid inside the 48i TLE)

Check for "**Alarm**" on the displays. If no alarms are present, record the "Alarm On" checks in the logbook as "**no**" and continue. If either screen shows an alarm, record the "Alarm On" check as "**yes**" in the logbook for the appropriate instrument(s).

View the Alarm menu to determine the cause:

- b. Use the ↑ or ↓ menu pushbuttons to select the **Alarm Submenu**, <ENTER>
- c. Use the ↑ or ↓ menu pushbuttons to select the item that is in Alarm Status.

NOTE: Items that are not in alarm status are labeled "OK", <ENTER>

- d. Determine the cause of the alarm. Consult with the ECB prior to performing calibrations or maintenance.
- e. Press the <MENU> button twice to return to the main menu screen.

The following Alarm Limit is used in the CO operation of the TEI 146C Calibrators:

<u>Parameter</u>	<u>Min.</u>	<u>Max.</u>
Internal Temperature	18.5°C	47°C

Alarm Checks (48i TLE Analyzer)

The Alarms menu displays a list of items that are monitored by the analyzer. If the item being monitored goes outside the lower or upper limit, the status of that item will go from OK to either LOW or HIGH, respectively. The number in the upper right corner of the display indicates how many alarms have occurred. If no alarms have occurred, the number **zero** is displayed. **NOTE: Items that are not in alarm status are labeled "OK"**

To display the Alarm menu:

- On the 48i front panel, press "**ALARM**" soft key
- To see the actual reading of an item and its minimum and maximum limits, move the menu cursor ">" up or down to select the **Alarm Submenu** items and press <ENTER>.



Figure 6 48i Alarms Screen

- Press (to go back to the RUN screen)

The following Test mode parameter ranges are allowed in the TEI 48i TLE Analyzer:

<u>Parameter</u>	<u>Min.</u>	<u>Max.</u>
Internal TEMP	38 °C	45 °C
Bench TEMP	40 °C	59°C
Pressure	250mm Hg	1000 mm Hg
Flow	.3 LPM	1.5 LPM
Bias Voltage	-130 v	115 v
AGC Intensity	150,000 Hz	300,000 Hz
Motor Speed	100%	

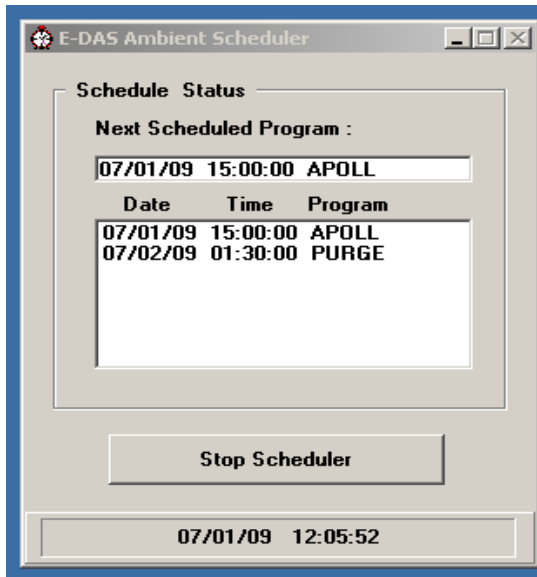
Operational Checks (48i TLE Analyzer and 146C Calibrator)

Cooling Fan Filter Check: on the back of the instruments there are cooling fans with sponge filters inside. Check to ensure the fans are running. Check to see if the filters are clean. The fan housing can be popped off the back of the instrument and the filter may be removed and cleaned if necessary (either by rubbing with a cloth or between your hands to remove any dust or with compressed air). After cleaning, replace the filter and the housing. Record in the electronic logbook.

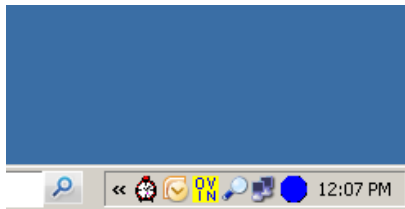
Maintenance and Troubleshooting Documentation: any other suspected mechanical problems see Section 2.36.1 (ECB) for Preventative and Routine Maintenance for Troubleshooting. Document all of the above in the logbook.

Stop Scheduler

Stop the poll editor and scheduler by clicking on the radio button that says "**Stop Scheduler**" to keep from losing data that is being collected on the PDL and the BUDL.

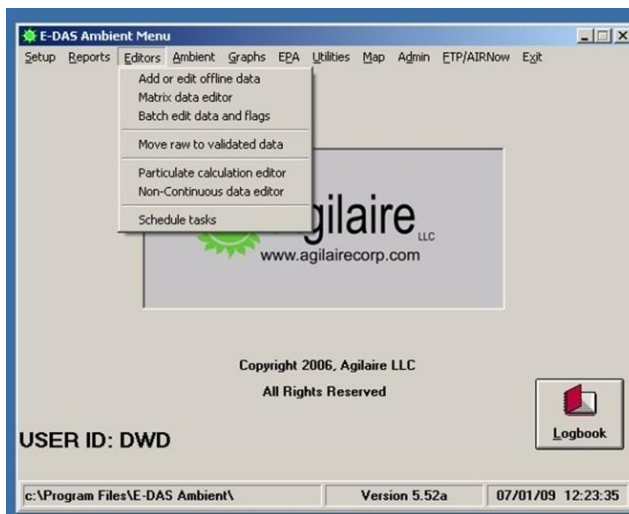


If the scheduler isn't on the screen, there should be a small red alarm clock "icon" down in the bottom right hand corner. Any mouse click will bring up the scheduler so that you can stop the scheduler.

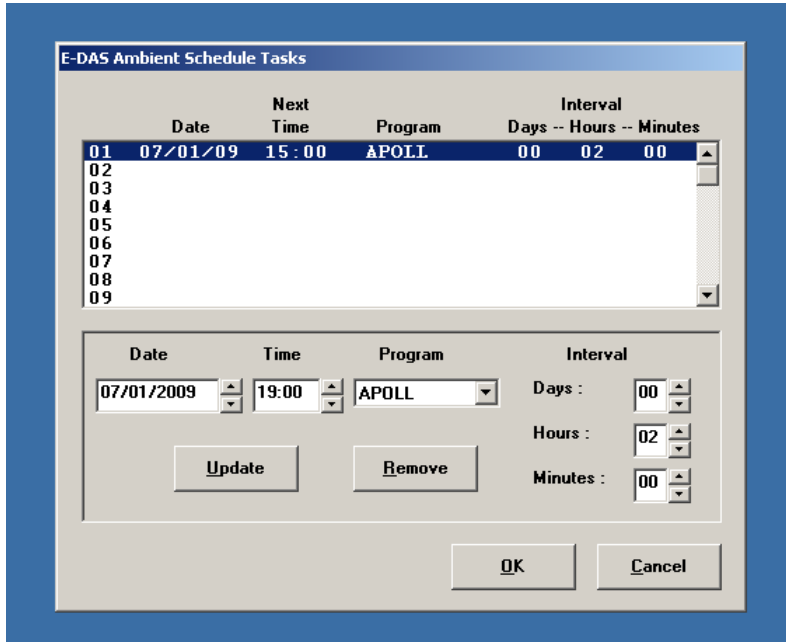


The APOLL task must be set to a later odd hour time after the manual calibration or calibration check will be completed

Then open the EDAS and under the "Editors" pull down menu there is a "Schedule tasks" button. Click on it...



That will bring up the E-DAS Schedule Tasks window...Highlight the "APOLL" line in the top half and set the bottom time for the next odd hour or some odd hour beyond that (two or four hours later today). AND HIT "UPDATE" TO MAKE THE HILIGHTED LINE REFLECT THESE CHANGES.



Setting computer, PDL, and BUDL time/date.

The times for the PDL, BUDL, and computer must be EASTERN STANDARD TIME. The computer, BUDL, and PDL must have the same NIST time ± 1 minute.

Sources for getting the correct time:

1. Call the ECB and ask for the NIST time.
2. Call the NIST Colorado time @ (303) 499-7111 (long distance).
3. Correct time loaded into cell phone.
4. Correct time website, <http://nist.time.gov/>

Check the computer time and date at the lower right hand corner of the computer screen. If the time and date are not correct; click "START" button, control panel, date/time or right click computer time on taskbar, select "Adjust Date/Time", type in changes and select "OK".

PDL & BUDL time and date:

- Double click "Shortcut to Splitscreen"
- Open PDL & BUDL
- Highlight PDL and type 2 letter data logger site code and AQM, (e.g.) "GR AQM" (located on front of data logger, may have to hit {ESC} a couple of times before typing)

- Select: "**L**" Login
- Type password: **XXXXXXXXXX** (not case sensitive), this brings up Home Menu
- Select: "**C**" configuration menu
- Select: "**S**" configure System Parameters
- Highlight "**Logger Time**"
- Type in correct time in the format of: **HH:MM:SS**
- **{ESC}{ESC}{ESC}**
- Highlight BUDL and type the 2 letter data logger site code and AQM (e.g.) "**UG AQM**", (located on front of data logger, may have to hit **{ESC}** a couple of times before typing)
- Select: "**L**" Login
- Type password: **XXXXXX** (not case sensitive), this brings up Home Menu
- Select: "**C**" configuration menu
- Select: "**S**" configure System Parameters
- Highlight "**Logger Time**"
- Type in correct time in the format of: **HH:MM:SS**
- **{ESC}{ESC}{ESC}**

Setup BUDL Analog output

In Service mode, set the BUDL analog output to mirror the PDL digital output to within 30ppb.

On the 48i front panel, press "**DIAGS**" soft key, select **Test Analog Outputs > Voltage Channel 1**

Select **SET TO FULL SCALE**, Full-scale sets the analog outputs to the full-scale voltage,

```
CONNECT METER TO OUTPUT!  
SELECTED OUTPUT:          V1  
SET TO:                    4997  
[←] SAVE VALUE           ↑↓ INC/DEC
```

Select **SET TO ZERO**, zero sets the analog outputs to 0 volts

```
CONNECT METER TO OUTPUT!  
SELECTED OUTPUT:          V1  
SET TO:                    100  
[←] SAVE VALUE           ↑↓ INC/DEC
```

2.36.2.2.2 Filter Change Procedure

The teflon filter needs to be replaced before doing a calibration. After the initial calibration, only change the filter after completing the Calibration. The filter used is a 5.0-micron teflon filter. If there are leaks, correct the problem before doing the

calibration. If there are no leaks, proceed to document the remaining operational checks in this section and then call the ECB before conducting a calibration. Record in logbook.

1. Remove the screws in the filter holder and disassemble.
2. Remove the existing filter.
3. Touching only the outer edges, place the new filter in the holder.
4. Reassemble the filter holder and carefully tighten the screws. **Do not over tighten the filter holder for this can tear the filter and/or damage the holder.**
5. Run a Leak Check to test the integrity of the filter. Record in the logbook.

2.36.2.2.3 Model 48i TLE Leak Check

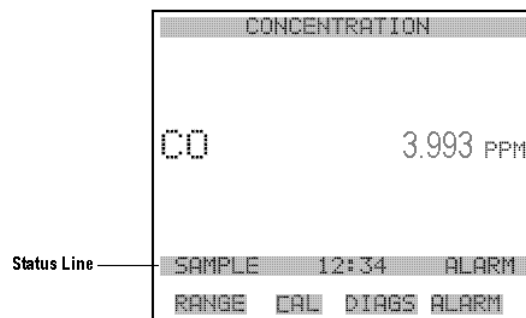
The Leak Check must be performed before a Calibration.

Equipment Required:

Teflon / stainless steel caps - 1/4", wrench


a. Sample Route thru Solenoid:

1. On the 48i front panel, press "**DIAGS**" soft key
2. Select "**Pressure**", <ENTER> to display the "**Pressure**" screen.
3. Disconnect the sample input line **at the filter holder inlet** and cap with a teflon cap. It should take less than three minutes from the time the inlet is plugged to the time the pressure reading drops below 250 mmHg. If not, check to see that all fittings are tight and that none of the input lines are cracked or broken. If no leak is found, remove cap and reconnect sample line.



48i Run Screen

b. Span / Zero Air Route thru Solenoid:

1. Select "**Main Menu**", press  ("**RUN**") until "**ZERO**" appears in the status line.
2. On the 48i front panel, press "**DIAGS**" soft key.
3. Select "**Pressure**", <ENTER> to display the "**Pressure**" screen.
4. Disconnect the probe line before the "T" fitting and cap it where probe line was removed with a cap, remove span in line, cap with metal cap nut. It should take

less than three minutes from the time the inlet is plugged to the time the pressure reading drops below 250 mmHg. If not, check to see that all fittings are tight and that none of the input lines are cracked or broken. If no leak is found, remove cap and reconnect probe line.

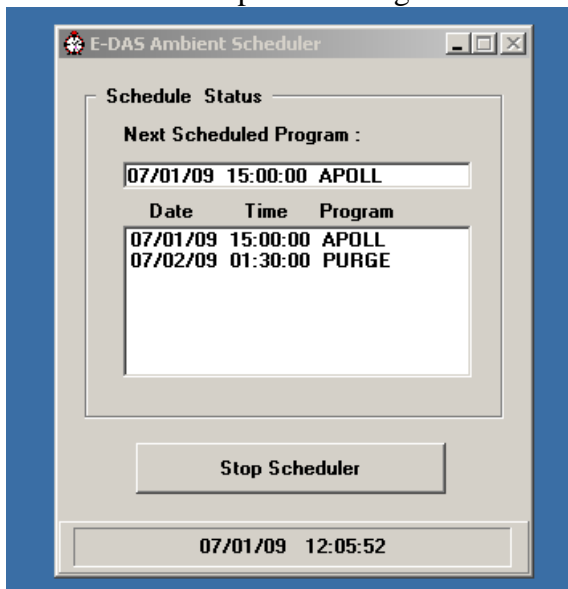
5. Return to sample mode, select **Main Menu**, press  (RUN) until "SAMPLE" appears in the status line.

2.36.2.2.4 Multi-Point Calibration

The 48i will be used to calibrate Span 1, Span 2, and Span 3. During this time, the span levels required for the Calibration will be controlled via the 48i. **Note:** This procedure should not be performed during the last half of the hour (i.e. after XX:30) in order to prevent interruption in data recovery.

Stop Scheduler

The Scheduler needs to first be stopped by clicking on the radio button that says "Stop Scheduler" to keep from losing data that is being collected on the PDL and the BUDL.

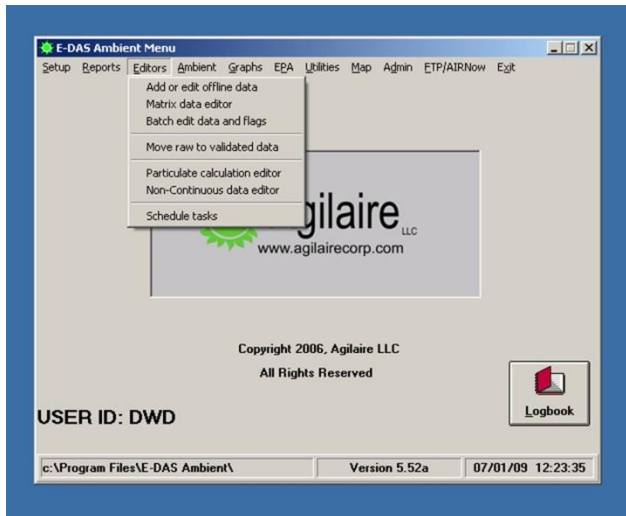


If the scheduler isn't on the screen, there should be a small red alarm clock "icon" down in the bottom right hand corner. Any mouse click will bring up the scheduler so that you can stop the scheduler.

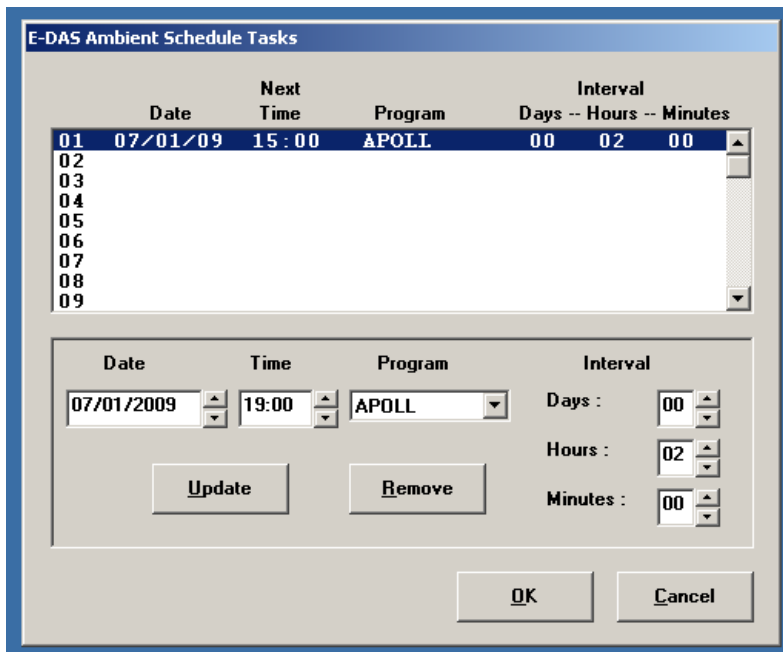


The APOLL task must be set to a later odd hour time after the manual calibration will be completed.

Then open the EDAS and under the "Editors" pull down menu there is a "Schedule tasks" button. Click on it...



That will bring up the E-DAS Schedule Tasks window....Highlight the "APOLL" line in the top half and set the bottom "Time" for the next odd hour or some odd hour beyond that (two or four hours later today). AND HIT "UPDATE" TO MAKE THE HILIGHTED LINE REFLECT THESE CHANGES.



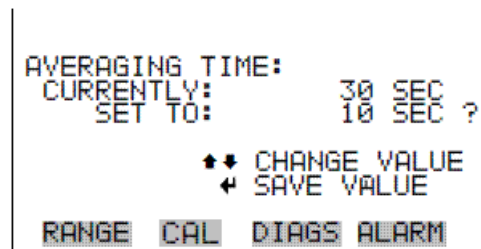
Disable channels on data loggers if channels are up. While disabled, values are collected but flagged as invalid data.

- a. Disable channels
 - {ESC} to Home Menu on PDL
 - Select: "C" Configuration Menu
 - Select: "D" Configure Data Channels
 - Select: "M" "Disable/Mark Channel Offline"
 - Use arrow key to select pollutant, <ENTER>
 - Highlight "COT" then press, <ENTER>
 - From Home Menu repeat steps on BUDL
 - Record time that channels are disabled
- b. Change Zero/Span Check time (The Zero/Span Check menu is used to program the instrument to perform fully automated zero adjustments.)
 - On the 48i front panel, press "CAL" soft key, select "ZERO/SPAN CHECK" <ENTER>



48i Next Date/Time Screen



- "Next Time", change starting time to minimum of 4 hours in advance odd (13 or 17) hour: 46 using the ← → ↑ ↓ pushbuttons press (no real changes are made until is pressed). Example, 01:46, 05:46, 09:46, 13:46, 17:46, 21:46.
- c. Change Averaging Times,
 - In the 48i Main Menu , choose **Averaging Time**, set to **300 sec** using the ↑ ↓ pushbuttons. Press (no real changes are made until is pressed).



48i Averaging Time Screen

Note: The multipoint calibration is only visible in the **Service Mode**.

To see the actual reading of an item, move the menu cursor ">" up or down and press <ENTER>

- In the 48i Main Menu , choose **Instrument Controls > Service Mode > ON**
- In the 48i Main Menu , choose **Service > Multipoint Calibration**.

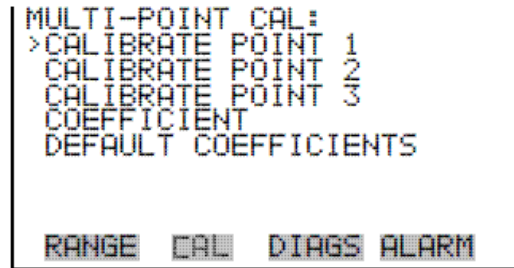





Figure 7 48i Multi-Calibration Screen

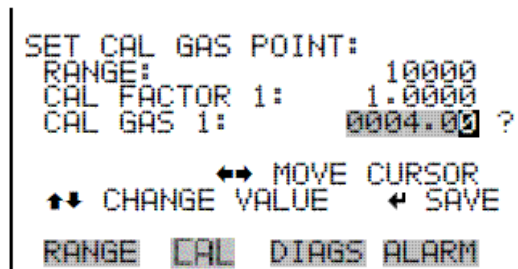
Span 1

- {ESC} {ESC} {ESC} to Home Menu of PDL, select "C" Configuration Menu
- Select: "C" Configure Calibration
- Select: "1" Start a Single Phase Calibration
- Select: **COTCAL** <ENTER>
- Select: **SPAN 1** <ENTER>
- Check to see if "**Phase Duration**" is "1h"
- Select "**Start Single Cal (NOW)** " <ENTER>
- Press {ESC} {ESC} to get to Home Menu of PDL
- Select "**D**" Real Time Display
- Select "**B**" Display Last Base Average: shows the last 1 min average only w/ flag D:Disabled & C:Calibration for COT, <ENTER>

Note: Multiply PPM (146C/48i run screen reading) by 1000 to convert to PPB (PDL/BUDL reading), ex. CAL GAS 1 (4.00 ppm = 4000 ppb).

Note: When span point has stabilized (~25 min PDL/BUDL):

On the 48i Main Menu , choose > **Multipoint Calibration > Calibration Point 1** <ENTER>; enter CAL GAS 1, **4.00 ppm** (2 significant CA figures from 146C) using ← → ↑ ↓ pushbuttons, press  (no real changes are made until  is pressed)



Span 1 Cal Screen

- Select: "C" Configure Calibration
- Select: "W" Abort Calibration
- With down arrow key, select: "COTCAL", <ENTER>

Span 2

Repeat procedure to calibrate Span 2 (CAL GAS 2, **2.00 ppm** (2 significant CA figures from 146C)),

Span 3

Calibrate Span 3 (.250 ppm), **Note:** the 146C span 3 needs to be adjusted to 0.250 ppm: On 146C **Main Menu**, select **Gas B**, select **Span 3**, and then select **Flow PPM**.

Using the Span Flow screen:




To underscore a digit, use the ← or → pushbuttons.

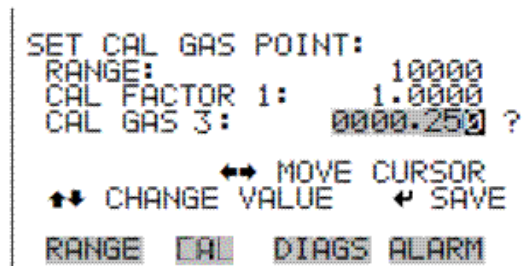
To increment or decrement the underscored digit, use the ↑ or ↓ pushbuttons.

To save the setting, press <ENTER>

- {ESC} {ESC} {ESC} to Home Menu of PDL, select "C" Configuration Menu
- Select: "C" Configure Calibration
- Select: "1" Start a Single Phase Calibration
- Select: **COTCAL** <ENTER>
- Select: **SPAN 3** <ENTER>
- Check to see if "**Phase Duration**" is "1h"
- Select "**Start Single Cal (NOW)**" <ENTER>
- Press {ESC} {ESC} to get to Home Menu of PDL
- Select "D" Real Time Display
- Select "B" Display Last Base Average: shows the last 1 min average only w/ flag D:Disabled & C:Calibration for COT, <ENTER>



Note: When span point has stabilized (~25 min PDL & BUDL):

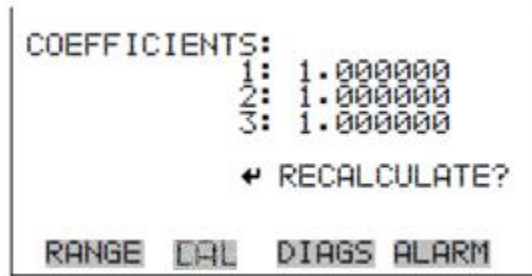
On the 48i Main Menu , choose > **Multipoint Calibration** > **Calibration Point 3** <ENTER>; enter CAL GAS 3, **0.250 ppm** (3 significant CA figures from 146C) using ← → ↑ ↓ pushbuttons, press  to save changes (no real changes are made until  is pressed).



Span 3 Cal Screen

- Select: "C" Configure Calibration
- Select: "W" Abort Calibration
- With down arrow key, select: "COTCAL", <ENTER>

In the 48i Main Menu , choose **Service** > **Multipoint Cal** > **Coefficients**, press  to recalculate calibration coefficients.



48i Calibration Screen

Note: the 146C span 3 needs to be adjusted back to 0.300 ppm: on 146C **Main Menu**, select **Gas B**, select **Span** (3), and then select **Flow PPM**.

Using the Span Flow screen:

To underscore a digit, use the ← or → pushbuttons.




To increment or decrement the underscored digit, use the ↑ or ↓ pushbuttons.

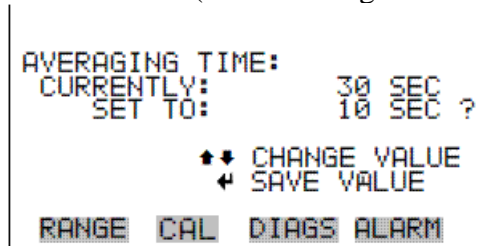
To save the setting, press <ENTER>

Place 48i back in **Sample Mode**,

- In the Main Menu , choose Instrument Controls > **Service Mode** > **OFF**

Change Averaging Times,

- In the 48i Main Menu , choose **Averaging Time**, set to **60 sec** using the ↑ ↓ pushbuttons. Press  (no real changes are made until  is pressed).



48i Averaging Time Screen

2.36.2.2.5 Zero (Ø) Span Check Procedure

Run Calibration Check Span Ø, 0 ppb

- {ESC} {ESC} {ESC} to Home Menu Select: PDL & select "C" Configuration Menu
- Select: "C" Configure Calibration
- Select: "1" Start a Single Phase Calibration

- With down arrow key, select: **COTCAL**<ENTER>
- Select: **SPANØ** <ENTER>
- Under "**Phase Duration**" <ENTER> "1h"
- Press **{ESC}{ESC}** to get to Home Menu of PDL
- Select: "**D**" Real Time Display
- Select "**B**" Display Last Base Average <ENTER>, shows the last 1 min average only w/ flag D:Disabled & C:Calibration for COT
- Select BUDL and start Display Last Base Average
- The BUDL mirrors the activity of the PDL. The instrument control is via the PDL. The BUDL screen is used to view the Real Time data as Last Base Avg.
- Record 5 x 1-minute average carbon monoxide Span Ø event concentrations from the TEI 146C, PDL, and BUDL in the electronic logbook.
- Average the five (5) 146C Display, PDL, and BUDL values for each event. Compare the 146C "True Carbon monoxide" to the corresponding PDL and BUDL values as follows:

	146C	PDL	BUDL
Span Ø	0 ppb	± 35 ppb	± 35 ppb

- Select: "**C**" Configure Calibration
- Select: "**W**" Abort Calibration
- With down arrow key, select: "**COTCAL**", <ENTER>

2.36.2.2.6 Span Check Procedure

Check Span1, Span 2, & Span 3

- **{ESC} {ESC} {ESC}** to Home Menu of PDL, select "**C**" Configuration Menu
- Select: "**C**" Configure Calibration
- Select: "**1**" Start a Single Phase Calibration
- Select: **COTCAL** <ENTER>
- Select: **SPAN 1** <ENTER>
- Check to see if "**Phase Duration**" is "1h"
- Select "**Start Single Cal (NOW)**" <ENTER>
- Press **{ESC} {ESC}** to get to Home Menu of PDL
- Select "**D**" Real Time Display
- Select "**B**" Display Last Base Average: shows the last 1 min average only w/ flag D:Disabled & C:Calibration for COT, <ENTER>
- Select BUDL and select "**B**" start Display Last Base Average
- Record 5 x 1-minute average carbon monoxide Span 1 concentrations from the TEI 146C, PDL, and BUDL in the electronic logbook.
- Average the five (5) 146C Display, PDL, and BUDL values for each event. Compare the 146C "True Carbon monoxide" to the corresponding PDL and BUDL COT values.
- Abort the Span 1 after 5 minute averages have been recorded.

- Check/Record Span 2 (**2000 ppb**) and Span 3 (**300 ppb**) the same way.

2.36.2.2.7 Review the Calibration and End

results from the data logger

	146C	PDL	BUDL
Span 1	4000 ppb	± 160 ppb	± 160 ppb
Span 2	2000 ppb	± 100 ppb	± 100 ppb
Span 3	300 ppb	± 25 ppb	± 25 ppb

COT Span 1 must be within 4%, Span 2 within 5% and Span 3 must be within ± 25 ppb of the actual concentration. If the new calibration curve does not meet the above criteria repeat steps including the checks. If second attempt to calibrate fails, contact ECB. If the criteria are met proceed below.

The Data logger Channels must be "Upped" (brought back online) to collect ambient air carbon monoxide concentration data.

b. Abort Calibration on PDL

- Procedure:
 - {ESC} to Home Menu on PDL
 - Select: "C" Configuration Menu
 - Select: "C" Configure Calibrations
 - Select: "W" Abort Calibration
 - Select: "COTCAL" press <ENTER>, this stops the calibration

c. Enable channels

- {ESC} to Home Menu on PDL
- Select: "C" Configuration Menu
- Select: "D" Configure Data Channels
- Select: "E" Enable/Mark Channel Online
- Use arrow key to select pollutant <ENTER>
- Highlight "COT" then press <ENTER>
- Repeat steps on BUDL
- Record time that channels are enabled

The following sequence is used to logout of the PDL and BUDL data logger:

- {ESC}, {ESC} to "Home Menu" on both PDL and BUDL
- Use arrow key to select "O" or hit "O" key to logout
- Repeat for BUDL

The Scheduler must be restarted

Restart the scheduler by clicking on the Scheduler "icon".



You can bring the scheduler back up and see that it's going to run 4 hours down the road.

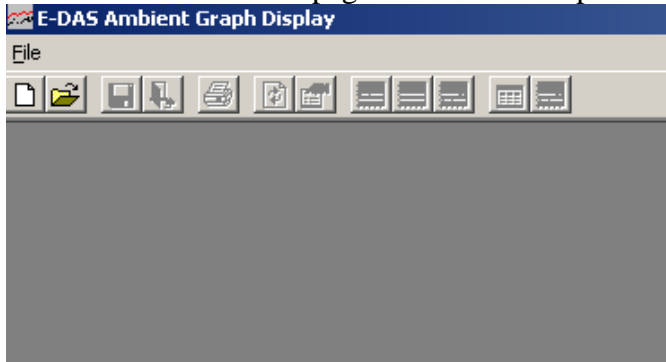
Check to ensure that the data logger is storing minute data on the computer

Check to make sure that we can collect the data from the data logger and store it on the computer. Check to see IF it has actually happened. Minute data only resides in the data logger for about 3 days, beyond that the minute data is overwritten and is lost FOREVER.

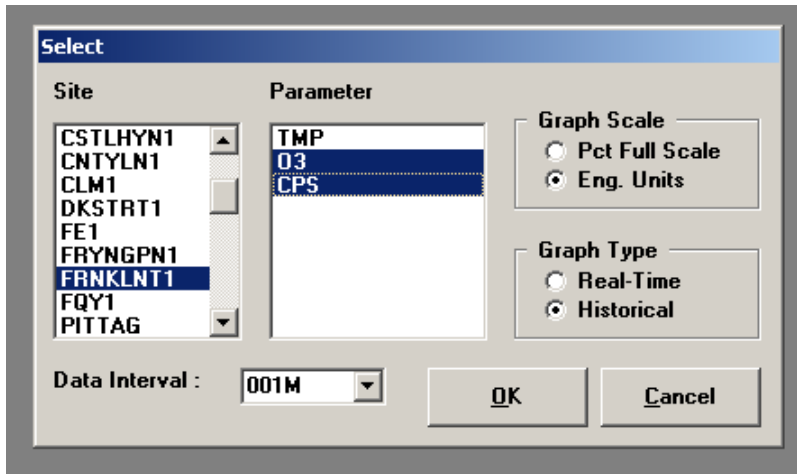
It's real easy to see this data, just open up the graph "**icon**".



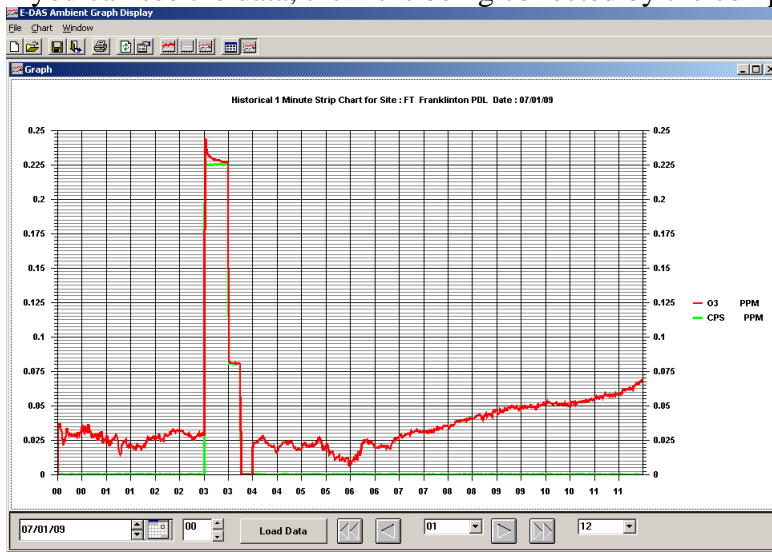
Then click on the white page "**icon**" in the top left hand corner to open the data file area.



Select the PDL or BUDL and graph the data!



If you can see the data, then it is being collected by the computer.



If you can't see the data after hitting "**Load data**"...there is a problem. Call the ECB for instructions.

Turn off Computer screen. **Note: DO NOT** close the ESC Digitrend Operating Software, **DO NOT** turn off the computer.

2.36.2.3 CALIBRATION CHECK

2.36.2.3.1 Operational Checks

1) Site Checks

Upon arrival at the site, observe the outside of the sampling building and probe, looking for vandalism or security breaches. If there is any evidence of vandalism, contact the appropriate law enforcement department (generally this is the city police department if

the monitor is within city limits, and the county sheriff's department if outside city limits) and headquarters. Record your observations in the logbooks and **do not make any adjustments to the front panel controls during these checks.** Except for particulate filter changes, phone ECB (Electronics and Calibration Branch) for guidance before making any adjustments to the front panel controls.

Inspect the Inverted Funnel, Wire Screen, Sample Probe Line, and Calibration

Line: visually inspect and document the condition of the sample delivery and calibration tubing systems. This inspection should also be performed during each site visit. The probe should be turned down, an undamaged inverted funnel on the end, the wire screen must be in place to protect the sampling probe from insects and foreign material, and the Teflon line must be visible inside the funnel screen.

Power On and Sample Line Check: observe the analyzer, calibrator, computer, and data loggers for indications of power failure, and if needed, correct the cause. Verify the instrument "LCD" panel is lit and there is an audible sound from the external pump. If the analyzer or calibrator lost power, allow an equilibration period of at least an hour for the instrument(s) to stabilize. Visually inspect the tubing, especially at any bends, to ensure that it has not been accidentally kinked, crimped, cut, or insects are nested in the lines. Particulate matter may also load the sample line ahead of the inlet filter. Such restrictions can usually be determined by disconnecting the inlet line of the sample pump. If pump performance is significantly improved and the inlet filter itself is not loaded with particulate matter, the sample line may require replacement. Record all events in logbook. Notify supervisor and call the ECB for instructions on length of stabilization period and recycling the data logger if necessary.

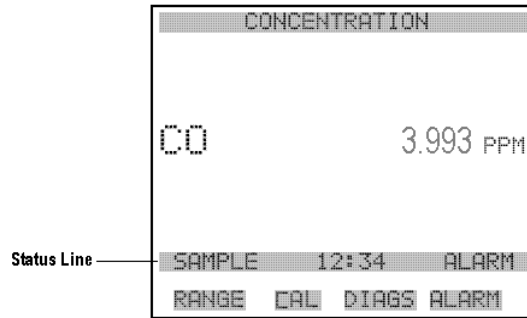
Station Temperature Check: measure and record the site temperature in °C. Adjust the site thermostats as necessary to maintain the 20° to 30°C range. If the temperature is outside of the 20° to 30°C range, notify the Regional Chemist and the ECB to correct the problem and invalidate data if necessary.

Check on Gas Cylinder and 146C Calibrator: verify the gas cylinder and calibrator are in certification (calibrator certification sticker on front panel) and document certification dates in logbook. (If the cylinder pressure is **less than 500 psig** notify ECB so they can arrange for a new cylinder). Verify that the 146C has the correct cylinder concentration stored in memory.

146C Calibrator

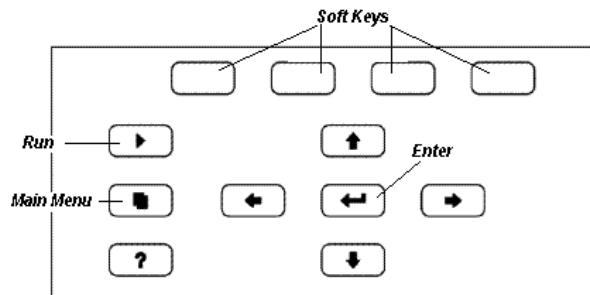
- Main Menu
- Gas B, <ENTER>
- Tank Conc., <ENTER>

Checks on 48i – TLE Analyzer:

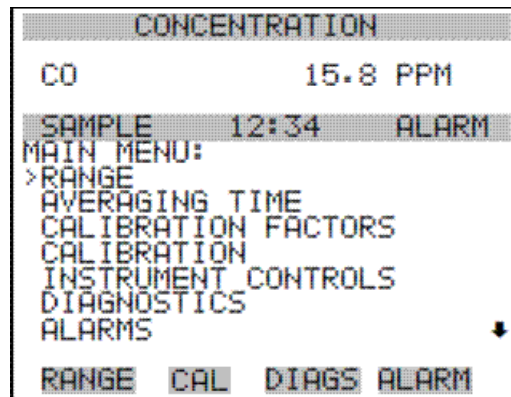


48i Run Screen

Important Keys:



48i Front Panel Pushbuttons




SERVICE
PASSWORD

48i Main Menu

Range Check: The Range menu contains the gas units, CO ranges, and the custom ranges.

To display the Range menu:

- On the 48i front panel, press "**RANGE**" soft key, record number in e-log acceptable range: **CO = 0 to 5 ppm**
- Select:  (to go back to the RUN screen)

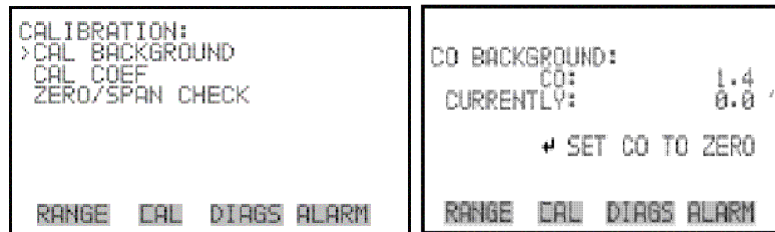
Invalidate all data in the wrong range. Notify supervisor and Quality Assurance Coordinator immediately, conduct a calibration check (2.36.2.3), re-enter the range to the correct entry, then recalibrate (2.36.2.2).

Calibration Background and CO Coefficient


Calibration factors are determined during manual calibration and are used to correct the CO concentration readings. To see the actual reading of an item, move the menu cursor ">" up or down and press <ENTER>.

To display the Calibration Factors menu:

- From the 48i front panel, press "CAL" soft key, select "CAL BACKGROUND" <ENTER>, record value for "CO BKG PPM", press "CAL" (to go back to the CAL screen), acceptable range: **CO BKG PPM = 8-10**



48i Cal Background Screen

- From "CAL" screen, select "CO COEF" record value for "CO COEF", acceptable range: **CO COEF = near 1**
- press  (to go back to the RUN screen)

Diagnostic Checks: The diagnostic checks are used to troubleshoot the instrument.

To display the Diagnostic menu:

- On the 48i front panel, press "**DIAGS**" soft key
- To see the actual reading of an item and its minimum and maximum limits, move the menu cursor ">" up or down to select the item and press <ENTER>



```
MOTOR SPEED  
ANALOG INPUT READINGS  
ANALOG INPUT VOLTAGES  
DIGITAL INPUTS  
RELAY STATES  
TEST ANALOG OUTPUTS  
INSTRUMENT CONFIGURATION  
CONTACT INFORMATION
```

48i Diagnostics Screen

Temperature Check: The Temperatures screen displays the current internal instrument temperature and chamber temperature.

- Press "**DIAGS**" soft key, select "**Temperatures**", <ENTER>, acceptable ranges: **Internal (38°C - 45°C)** and **Bench (40°C - 59°C)**. If the readings are not in this range, call the ECB.
- Press "**DIAGS**" (to go back to the DIAGS screen)

Pressure Check: The Pressure screen displays the current optical chamber pressure.

- Press "**DIAGS**" soft key, select "**Pressure**", <ENTER>, acceptable ranges: **250 to 1,000 mmHg**
- Press "**DIAGS**" (to go back to the DIAGS screen)


Flow Check: The Flow screen displays the current sample flow rate.

- Press "**DIAGS**" soft key, select "**Flow**", <ENTER>, acceptable ranges: **0.3 to 1.5 LPM**
- Press "**DIAGS**" (to go back to the DIAGS screen)

Sample/Ref Ratio: The Sample/Reference Ratio screen displays the ratio of the intensities of the light source through the sample wavelength and reference wavelength of the bandpass filter wheel.

- Press "**DIAGS**" soft key, select "**Sample/Ref Ratio**", <ENTER> acceptable ranges: **1.14 to 1.18**
- Press "**DIAGS**" (to go back to the DIAGS screen)

AGC Intensity Check: the AGC Intensity screen displays the intensity (in Hz) of the reference channel Automatic Gain Control (AGC) circuit.

- Press "**DIAGS**" soft key, select "**AGC Intensity**", <ENTER> acceptable ranges: **150,000 to 300,000 Hz**, Note: If reading is not within acceptable ranges, call ECB
- Press  (to go back to the RUN screen)

Model 111 Zero Air Pak and Compressor Checks: the silica gel in the cartridges located on the back of the Zero Air Pak removes the moisture from the compressed air before the carbon monoxide is removed from the dried air by the internal carulite canister. Silica gel, though, has a limited capacity to effectively remove moisture from

the air stream. Because of this limited capacity, the silica gel must be replaced every 14 days or less to insure effective moisture removal in both cartridges. Verify that the silica gel is not spent by color change. When the gel is new it is a dark blue in color. If the gel is spent, it is a lighter blue in color with white crystals. If the gel is spent or it has been 14 days since it was last changed, replace it, and return it to the ECB for regeneration. Check the condition of the Purifill. Fresh Purifill is purple and turns brown when saturated. Replace when purple color is less than 20% of the volume. Remove the cartridge holding the Purifill, unscrew the cap, discard used Purifill, replace with fresh and screw on the cap and replace cartridge. Record in the electronic logbook.

On an annual basis, change all scrubbing medium. Verify and record that the outlet pressure on the air compressor is reading between 40 and 50 psi. Verify and record that the ZAP is reading between 20 and 40 psi. If either pressure reading is outside of these ranges, contact the ECB and record corrective action. Also, check and drain any water from the compressor (do this at every site visit).

2) **TEI 48i TLE Analyzer and 146C Calibrator Alarm and Operational Checks** Basic checks of the instrumentation.

Alarm Check (146C Calibrator)

Check the TEI 146C Run Screen

- 1) Press the <MENU> button on the front of the instrument. (Make sure the 146C is in "**Remote**" mode, the 146C has to be in the REMOTE MODE in order to activate the internal span solenoid inside the 48i TLE)

Check for "**Alarm**" on the displays. If no alarms are present, record the "Alarm On" checks in the logbook as "**no**" and continue. If either screen shows an alarm, record the "Alarm On" check as "**yes**" in the logbook for the appropriate instrument(s).
View the Alarm menu to determine the cause:

- 2) Use the ↑ or ↓ menu pushbuttons to select the **Alarm Submenu**, <ENTER>
- 3) Use the ↑ or ↓ menu pushbuttons to select the item that is in Alarm Status.
NOTE: Items that are not in alarm status are labeled "OK", <ENTER>
- 4) Determine the cause of the alarm. Consult with the ECB prior to performing calibrations or maintenance.
- 5) Press the <MENU> button twice to return to the main menu screen.

The following Alarm Limit is used in the CO operation of the TEI 146C Calibrators:

<u>Parameter</u>	<u>Min.</u>	<u>Max.</u>
Internal Temperature	18.5°C	47°C

Alarm Checks (48i TLE Analyzer)


The Alarms menu displays a list of items that are monitored by the analyzer. If the item being monitored goes outside the lower or upper limit, the status of that item will go from OK to either LOW or HIGH, respectively. The number in the upper right corner of the display indicates how many alarms have occurred. If no alarms have occurred, the number **zero** is displayed. **NOTE: Items that are not in alarm status are labeled "OK".**

To display the Alarm menu:

- From the 48i front panel, press "**Alarm**" soft key
- To see the actual reading of an item and its minimum and maximum limits, move the menu cursor ">" up or down to select the item and press <ENTER>.



48i Alarms Screen

- Press  (to go back to the RUN screen)

The following Test mode parameter ranges are allowed in the TEI 48i TLE Analyzer:

<u>Parameter</u>	<u>Min.</u>	<u>Max.</u>
Internal TEMP	38 °C	45 °C
Bench TEMP	40 °C	59°C
Pressure	250mm Hg	1000 mm Hg
Flow	.3 LPM	.750 LPM
Bias Voltage	-130 v	-100 v
AGC Intensity	150,000 Hz	300,000 Hz
Motor Speed	100%	

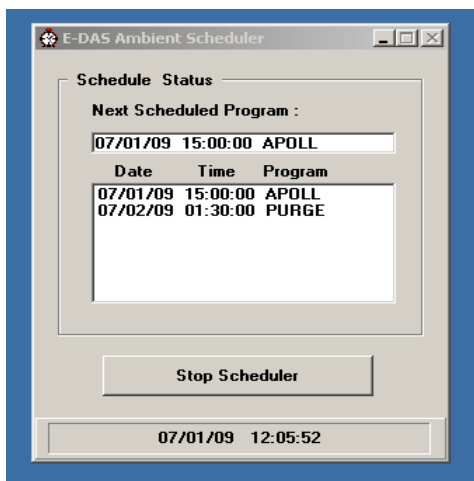
Operational Checks (48i TLE Analyzer and 146C Calibrator)

Cooling Fan Filter Check: on the back of the instruments there are cooling fans with sponge filters inside. Check to ensure the fans are running. Check to see if the filters are clean. The fan housing can be popped off the back of the instrument and the filter may be removed and cleaned if necessary (either by rubbing with a cloth or between your hands to remove any dust or with compressed air). After cleaning, replace the filter and the housing. Record in the logbook.

Maintenance and Troubleshooting Documentation: any other suspected mechanical problems see Section 2.36.1 (ECB) for Preventative and Routine Maintenance or Troubleshooting. Document all of the above in the electronic logbook.

Stop Scheduler

Stop the Scheduler by clicking on the radio button that says "**Stop Scheduler**" to keep from losing data that is being collected on the PDL and the BUDL.

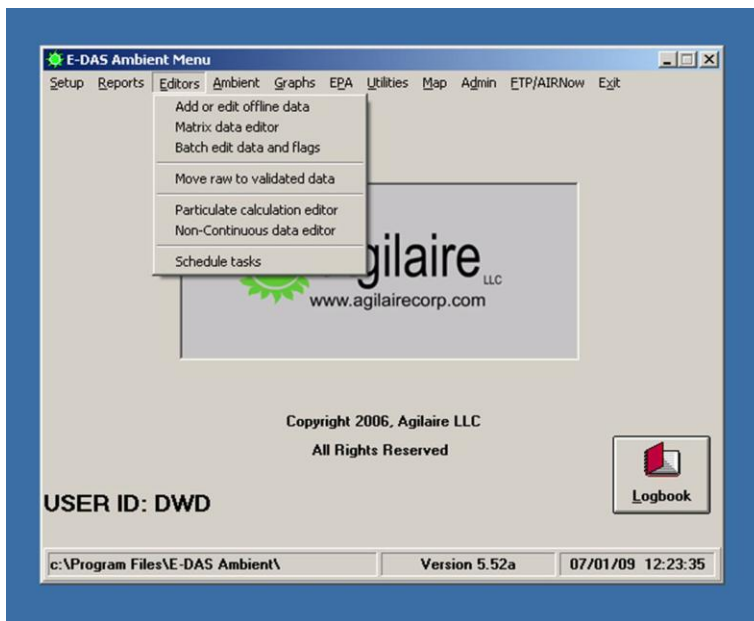


If the scheduler isn't on the screen, there should be a small red alarm clock "**icon**" down in the bottom right hand corner. Any mouse click will bring up the scheduler so that you can stop the scheduler.

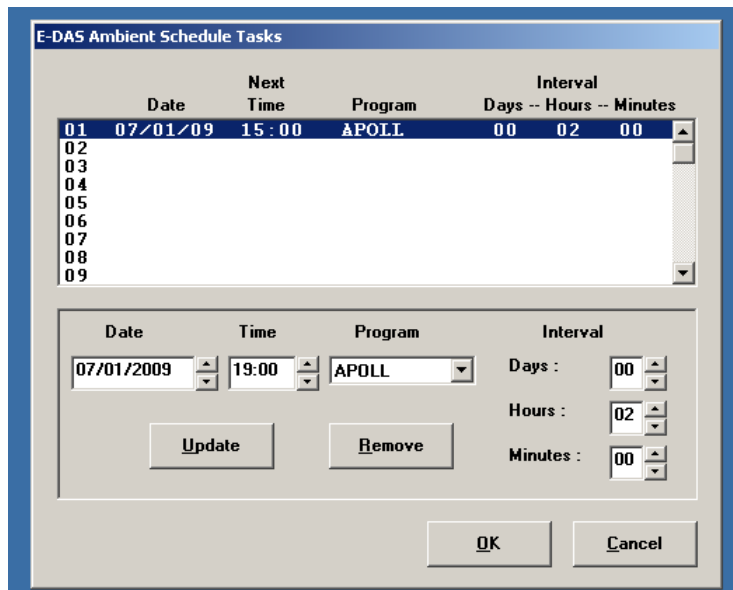


The APOLL task must be set to a later odd hour time after the manual calibration or calibration check will be completed.

Then open the EDAS and under the "**Editors**" pull down menu there is a "**Schedule tasks**" button. Click on it...



That will bring up the E-DAS Schedule Tasks window...Highlight the "**APOLL**" line in the top half and set the bottom "**Time**" for the next odd hour or some odd hour beyond that (two or four hours later today). **AND HIT "UPDATE" TO MAKE THE HILIGHTED LINE REFLECT THESE CHANGES.**



Checking and setting computer, PDL, and BUDL time/date (every two weeks).
The times for the PDL, BUDL, and computer must be EASTERN STANDARD TIME.
The computer, BUDL, and PDL must have the same NIST time ± 1 minute.

Sources for getting the correct time:

1. Call the ECB and ask for the NIST time.
2. Call the NIST Colorado time @ (303) 499-7111 (long distance).
3. Correct time loaded into cell phone.
4. Correct time website, <http://nist.time.gov/>

Check the computer time and date at the lower right hand corner of the computer screen.
If the time and date are not correct; click "START" button, control panel, date/time or right click computer time on taskbar, select "Adjust Date/Time", type in changes and select "OK".

PDL & BUDL time and date:

- Double click "Shortcut to Splitscreen"
- Open PDL & BUDL
- Highlight PDL and type 2 letter data logger site code and AQM, (e.g.) "GR AQM" (located on front of data logger, may have to hit {ESC} a couple of times before typing)
- Select: "L" Login
- Type password: XXXXXXXXXXXX (not case sensitive) this brings up Home Menu

- Select: "C" configuration menu
- Select: "S" configure System Parameters
- Highlight "Logger Time"
- Type in correct time in the format of: **HH:MM:SS**
- {ESC}{ESC}{ESC}
- Highlight BUDL and type the 2 letter data logger site code and AQM (e.g.) "UG AQM", (located on front of data logger, (may have to hit {ESC} a couple of times before typing)
- Select: "L" Login
- Type password **XXXXXX** (not case sensitive)
- Select: "C" configuration menu
- Select: "S" configure System Parameters
- Highlight "Logger Time"
- Type in correct time in the format of: **HH:MM:SS**
- {ESC}{ESC}{ESC}

Setup BUDL Analog output

In Service mode, set the BUDL analog output to mirror the PDL digital output to within 30ppb.

On the 48i front panel, press "DIAGS" soft key, select **Test Analog Outputs > Voltage Channel 1**

Select **SET TO FULL SCALE**, Full-scale sets the analog outputs to the full-scale voltage,

```
CONNECT METER TO OUTPUT!  
SELECTED OUTPUT:          V1  
SET TO:                    4997  
[←] SAVE VALUE           ↑↓ INC/DEC
```

Select **SET TO ZERO**, zero sets the analog outputs to 0 volts

```
CONNECT METER TO OUTPUT!  
SELECTED OUTPUT:          V1  
SET TO:                    100  
[←] SAVE VALUE           ↑↓ INC/DEC
```

2.36.2.3.2 Calibration Check Procedure

The purpose of the calibration check is to correlate the output of a monitoring system with known, traceable concentrations. A calibration check is required each two weeks (EVERY 14 DAYS OR LESS), but may be conducted more frequently. Conduct the calibration check(s) making **NO ADJUSTMENTS** to the monitor or data system(s).

40 CFR 58 Appendix A requires at least one precision check (300 ppb for the 5 ppm analyzer) performed every two weeks (14 days).

Note: Do not perform checks or calibrations between 6am and 9am (Local Standard Time). This is an important data collection period.

Calibration checks must be performed prior to any component change, alignments, or calibration, if the monitor is operable. If the newly calculated calibration check is within the criteria established and if no components are changed, the new calibration check equation may be used to reduce data and the calibration is not necessary. Conduct the calibration check as follows:

- a. Log in to data logger:
- Double click "Shortcut to Splitscreen"
 - Select PDL and hit {ESC} then type Site ID Code (e.g.) "GR AQM", <ENTER>
 - Select: "L" to login
 - Type password: "XXXXXXXXXX", (not case sensitive) <ENTER>
 - Select BUDL and hit {ESC} then type Site ID Code (e.g.) "UG AQM" <ENTER>
 - Select: "L" to login
 - Type password: "XXXXX" <ENTER>

b. Calibration Check

Disable channels on data loggers if channels are up. While disabled, values are collected but flagged as invalid data.

- Disable Channels on PDL and BUDL Data Logger
 - {ESC} to Home Menu on PDL
 - Select: "C" Configuration Menu
 - Select: "D" Configure Data Channels
 - Select: "M" Disable/Mark Channel Offline
 - Highlight "COT" then press <ENTER>
 - Repeat steps on BUDL
 - Record time that channels are disabled in electronic logbook


c. Change "Zero/Span Check" time (The Zero/Span Check menu is used to program the instrument to perform fully automated zero adjustments.)

- On the 48i front panel, press "CAL" soft key, select "ZERO/SPAN CHECK" <ENTER>



```
NEXT DATE AND TIME:
19 MAR 2005 12:34
PRESS * TO EDIT

RANGE CAL DIAGS ALARM
```





```
NEXT DATE AND TIME:
19 MAR 2005 12:34:56

SETTING: DAYS
  * SET MONTHS
  * CHANGE VALUE
  * SAVE VALUE

RANGE CAL DIAGS ALARM
```

48i Next Date/Time Screen

- "Next Time", change starting time to minimum of 4 hours in advance odd (13 or 17) hour :46 using the ← → ↑ ↓ pushbuttons, press  (no real changes are made until  is pressed). Example, 01:46, 05:46, 09:46, 13:46, 17:46, 21:46.

Note: Multiply PPM (146C/48i run screen reading) by 1000 to convert to PPB (PDL/BUDL reading), ex. CAL GAS 1 (4.00 ppm = 4000 ppb).

2.36.2.3.3 Zero (Ø) Calibration Check Procedure

Run Calibration Check Span Ø, 0 ppb

- {ESC} {ESC} {ESC} to Home Menu Select: PDL & select "C" Configuration Menu
- Select: "C" Configure Calibration
- Select: "1" Start a Single Phase Calibration
- With down arrow key, select: **COTCAL**<ENTER>
- Select: **SPANØ** <ENTER>
- Under "**Phase Duration**" <ENTER> "1h"
- Select: "**Start Single Cal (NOW)**", <ENTER>
- {ESC} to Home Menu of PDL
- Select: "D" Real Time Display
- Select "B" Display Last Base Average <ENTER>, shows the last 1 min average only w/ flag D:Disabled & C:Calibration for COT
- Select BUDL and start Display Last Base Average
- The BUDL mirrors the activity of the PDL. The instrument control is via the PDL. The BUDL screen is used to view the Real Time data as Last Base Avg.
- Record 5 x 1-minute average carbon monoxide Span Ø event concentrations from the TEI 146C, PDL, and BUDL in the logbook in the Calibration Check Table
- Average the five (5) 146C Display, PDL, and BUDL values for each event. Compare the 146C "True Carbon monoxide" to the corresponding PDL and BUDL values as follows:

	146C	PDL	BUDL
Span Ø	0 ppb	± 35 ppb	± 35 ppb

- Abort the Zero Span after 5 minute averages have been recorded.
 - {ESC} to Home Menu of PDL
 - Select: "C" Configuration Menu
 - Select: "C" Configure Calibration
 - Select: "W" Abort Calibration
 - With down arrow key, select: "**COTCAL**", <ENTER>

2.36.2.3.4 Span Check Procedure

Check Span1, Span 2, & Span 3

- {ESC} to Home Menu of PDL, select "C" Configuration Menu
- Select: "C" Configure Calibration
- Select: "1" Start a Single Phase Calibration
- Select: "COTCAL " <ENTER>
- Select: "SPAN1" <ENTER>
- Under "Phase Duration", "1h" <ENTER>
- Select "Start Single Cal (NOW) " <ENTER>
- {ESC} to Home Menu of PDL
- Select: "D" Real Time Display
- Select: "B" Display Last Base Average <ENTER>, shows the last 1 min average only w/ flag D:Disabled & C: Calibration for COT
- Record 5 x 1-minute average carbon monoxide Span 1 Event concentrations from the TEI 146C, PDL, and BUDL in the logbook in the Calibration Check Table
- Average the five (5) 146C Display, PDL, and BUDL values for each event. Compare the 146C "True Carbon monoxide" to the corresponding PDL and BUDL values
- Check/record Span 2 (**2.000 ppm**) and Span 3 (**0.300 ppm**) the same way.

	146C	PDL	BUDL
Span 1	4000 ppb	± 320 ppb	± 320 ppb
Span 2	2000 ppb	± 160 ppb	± 160 ppb
Span 3	300 ppb	± 24 ppb	± 24 ppb

Review Each COT Calibration Check Point results from the data logger. For each point calculate the % difference.

2.36.2.3.5 Filter Change Procedure

During normal operation throughout the season the Teflon filter needs to be replaced at a minimum of once per month with biweekly/14-day changes being recommended. Only change the filter after completing the Calibration Check. The filter used is a 5.0-micron teflon filter.

1. Remove the screws in the filter holder and disassemble.
2. Remove the existing filter.
3. Touching only the outer edges, place the new filter in the holder.
4. Reassemble the filter holder and carefully tighten the screws. **Do not over tighten the filter holder for this can tear the filter and/or damage the holder.**
5. Run a Leak Check to test the integrity of the filter. Record in the electronic logbook.

2.36.2.3.6 Model 48i TLE Leak Check

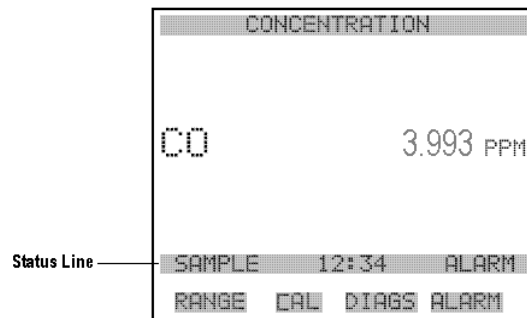
The Leak Check must be performed after a Calibration Check.

Equipment Required:

Teflon / stainless steel caps - 1/4", wrench

a. Sample Route thru Solenoid:

1. On the 48i front panel, press "**DIAGS**" soft key.
2. Select "**Pressure**", <ENTER> to display the "**Pressure**" screen.
3. Disconnect the sample input line **at the filter holder inlet** and cap with a teflon cap. It should take less than three minutes from the time the inlet is plugged to the time the pressure reading drops below 250 mmHg. If not, check to see that all fittings are tight and that none of the input lines are cracked or broken. If no leak is found, remove cap and reconnect sample line.



48i Run Screen

b. Span / Zero Air Route thru Solenoid:

1. Select "**Main Menu**", press ("**RUN**") until "**ZERO**" appears in the status line.
2. On the 48i front panel, press "**DIAGS**" soft key.
3. Select "**Pressure**", <ENTER> to display the "**Pressure**" screen.
4. Disconnect the probe line before the "T" fitting and cap it where probe line was removed from with a cap, remove span in line, cap with metal cap nut. It should take less than three minutes from the time the inlet is plugged to the time the pressure reading drops below 250 mmHg. If not, check to see that all fittings are tight and that none of the input lines are cracked or broken. If no leak is found, remove cap and reconnect probe line.
5. Return to sample mode, select "**Main Menu**", press ("**RUN**") until "**SAMPLE**" appears in the status line.

2.36.2.3.7 Review Calibration Check and End

Calibration Check	146C	PDL	BUDL
Span Ø	0 ppb	± 35 ppb	± 35 ppb

Span 1	4000 ppb	± 320 ppb	± 320 ppb
Span 2	2000 ppb	± 160 ppb	± 160 ppb
Span 3	300 ppb	± 24 ppb	± 24 ppb

All calibration points must be within 8% of the actual concentration. If the data for the Calibration (Zero) Check, Calibration (SPAN 1) check, Calibration (SPAN 2) check, and Calibration (SPAN 3) check is not within the specified limits above; the **Calibration Check is NOT ACCEPTABLE.**

Note: If calibration check fails on final shutdown, **do not** do a calibration. Document possible reasons, investigate if possible.

1. If the Calibration Check is NOT ACCEPTABLE:

A **CALIBRATION** of the Carbon Monoxide Monitor must be performed if the criteria above are not met.

The **CALIBRATION** Sections required to be performed after failing the Calibration Check are:

Section 2.36.2.2.2 **Install a New Teflon Particulate Filter**
Section 2.36.2.2.3 **Perform a Leak Test**
Section 2.36.2.2.4 **Multi-Point Calibration Procedure**

2. If the Calibration Check is ACCEPTABLE (meets criteria above) proceed.

The Data Logger Channels must be "Upped" (brought back on line) to collect ambient air carbon monoxide concentration data.

3. Up the PDL and BUDL channels: Go to the Home Menu (by pressing {ESC} several times if needed), Press "L" and <ENTER> the code when it asks for the password and press <ENTER>.

Enable channels:

- {ESC} to Home Menu on PDL
- Select: "C" Configuration Menu
- Select: "D" Configure Data Channels
- Select: "E" "Enable/Mark Channel Online"
- Use arrow key to select pollutant, <ENTER>
- Highlight "COT" then press, <ENTER>
- Repeat steps on BUDL
- Record time that channels are enabled

Note: In the split screen operation, the data loggers can be accessed by pressing **CTRL** and **{ESC}** to access the **TASK** list, you can <ENTER> onto either of the two data loggers by highlighting the data logger and pressing <ENTER>.

The following sequence is used to logout of the PDL and BUDL data logger:

- **{ESC}**, **{ESC}** to "Home Menu" on both PDL and BUDL
- Use arrow key to select "O" or hit "O" key to logout
- Repeat for BUDL

The Scheduler must be restarted

Restart the scheduler by clicking on the Scheduler "**icon**".



You can bring the scheduler back up and see that it's going to run 4 hours down the road.

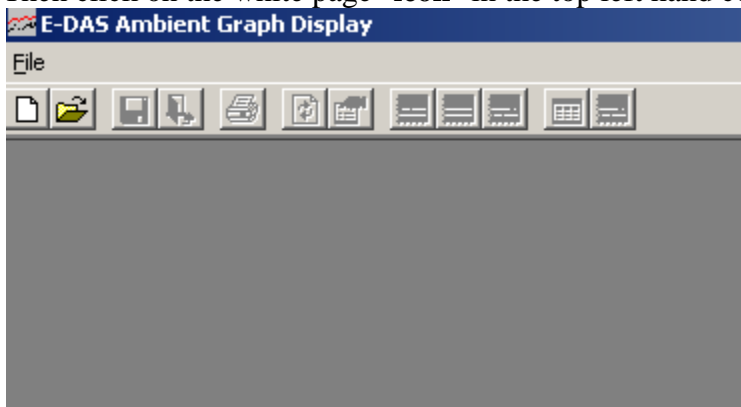
Check to ensure that the data logger is storing minute data on the computer

Check to make sure that we can collect the data from the data logger and store it on the computer.

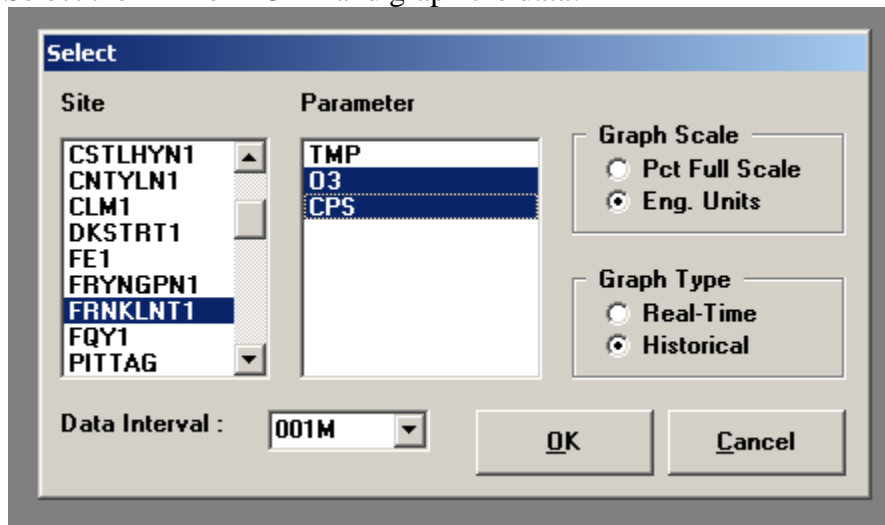
Check to see IF it has actually happened. Minute data only resides in the data logger for about 3 days, beyond that the minute data is overwritten and is lost FOREVER. It's real easy to see this data, just open up the graph "**icon**".



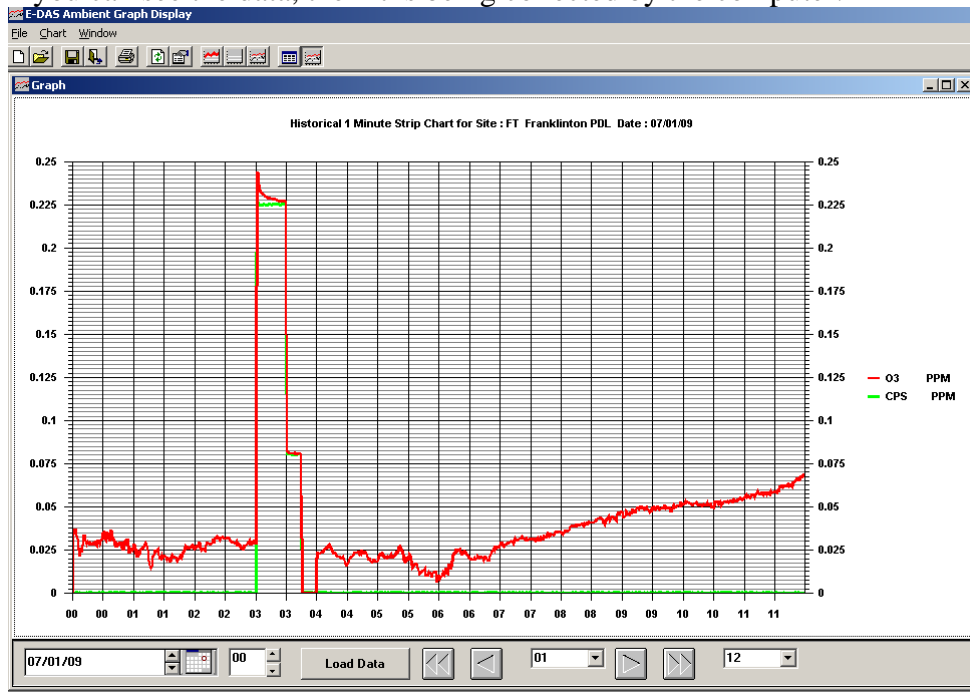
Then click on the white page "**icon**" in the top left hand corner to open the data file area.



Select the PDL or BUDL and graph the data!



If you can see the data, then it is being collected by the computer.



If you can't see the data after hitting "**Load data**", call the ECB for instructions.

Turn off Computer screen. **Note: DO NOT** close the ESC Digitrend Operating Software, **DO NOT** turn off the computer.

2.36.2.4 Site Calls

(See *Section III: Regional Office Responsibilities: EDAS set-up; Retrieval, Review, Correction and Storage of Data; Report Submission*, for site operator's duties between visits.)

To minimize travel some site operational checks must be made by telephone. Site calls are recommended every working day. Calls to a site can be made at any time; however an effort to avoid calling during the first 5 minutes of an hour should be made in order to avoid conflict with the calls made by the automated polling process of the DMSSB (Data Management and Statistical Services Branch) headquarters computer. At a minimum request yesterday's data and today's data. If calling on a Monday, retrieve the data for Friday, Saturday, and Sunday data as well.

Note: Make sure the modem speed (BAUD rate) is set correctly for the corresponding site (i.e. if set to 300 BAUD it will not work usually on a 2400 BAUD). If you are uncertain as to what speed modem your site is operating, call the ECB or DMSSB for assistance. Often times a site operator can call a site if it is set to the incorrect BAUD rate, and the site will NOT respond. This is a common problem and can easily be avoided by making sure the rate(s) correspond.

Review the Reports For Flagged Data.

Flags are assigned to data to indicate its validity. If no flag follows a value, the data is assumed accurate and valid. These data are used in all appropriate averages. Compare any flagged data with what is expected to occur such as nightly auto-calibrations. If any of the flagged data appears unusual make a note to check the back up data collected during the next site visit. If several values are invalid, a site visit may be needed. If a channel is incorrectly marked "D" (down) the data may be valid and you will need to notify headquarters of any valid data to be reported.

Compare the monitor zero results to the zero for each day. Compare the monitor span results to the known calibrator output for each day. Review the power failure report. Review the log for temperature inside the building. See the section (*III*) on "polling" for complete flag and review procedures.

2.36.2.5 Data Reporting and Validation for Regional Offices

(See *Section IV: Continuous Monitor QA Plan Section, Headquarters Responsibilities.*)

Data Validation for Regional Offices: The regional office is responsible for data validity.

Verify that all periods of missing or invalid data have been accounted for, and the reasons have been identified for missing or invalid data on the Monthly File Listing or on an AQ-42 in remarks.

The operator must review all AQ-42s for unusually high or low concentrations.

The operator signs, dates, and submits the completed AQ-42s to the DMSSB in Ambient Monitoring in Raleigh. Each month, the DMSSB initiates a data review by creating a raw data spreadsheet for each field office. Each month, the Regional Offices will be requested to send selective sets of BUDL data that are needed beyond what is already needed by DMSSB for verifying the missing value imputations supplied by the field office. DMSSB requested Backup Data Logger files should be FTP'd to the DMSSB within 5 working days.

All monthly data should be submitted to headquarters within 10 working days from the end of the collection month.

All data, including logbooks and supporting printouts must be kept for five years.

2.36.2.6 Quality Assurance Procedures

The Quality Assurance Program requires strict adherence to approved procedures including the performance of specific tasks and activities. The determination of adherence to the approved procedures and the quality of ambient air data collected at each site includes the biweekly precision point analysis performed by the site operators, the monitor accuracy audits performed independently by the ECB, and a complete systems audit performed by the staff of the Ambient Monitoring Section of the Division of Air Quality of each monitoring site and the ECB. This approach provides the essential ongoing and independent evaluation of data quality and reliability for the entire ambient air quality data set collected at each site and statewide. **Strict adherence to the established approved procedures is required to enable the Division of Air Quality to certify that the data collected is true and representative of the ambient levels of carbon monoxide in the State of North Carolina.** Certain information must be available to the auditor. Even though this information can be provided through access to the instrument logbook, use a Continuous Monitor Quality Assurance Report form (AQ121 / CMQAR) to give a better overview of each audit. (See Appendix B for the CMQAR example.)

Site Operator Responsibilities

The critical part of the site operator's role in the Quality Assurance Program is the adherence to approved operating procedures, performing the required precision point analysis, and maintaining accurate records of all monitoring site activities. It is the site operator's responsibility to notify the Regional Air Quality Chemist of the performance of each carbon monoxide monitoring system during and/or immediately following each

monitoring site visit. The site operators and the Regional Air Quality Chemist are jointly responsible for timely data validation and reporting.

Precision Point Analysis. Every two weeks (**EVERY 14 DAYS OR LESS**), the precision point analysis must be performed on each TL-HSCO analyzer as part of the Calibration Check procedures. The results of this precision point analysis are required to be reported to the DMSSB at the end of each quarter. Data validation must be conducted by the operator on a routine basis according to section IV of this QA plan.

The Regional Ambient Monitoring Coordinator should verify that all site visits and precision analysis are conducted as required.

Accuracy Auditing.

The ECB performs all CO monitoring sites accuracy audits. The operator shall assist if requested by ECB auditor in conducting accuracy audits.

Interagency Auditing.

Interagency audits may take place between the DAQ and Local Programs. Also, U.S.E.P.A. Region IV may schedule audits for various parameters, including CO, throughout the year.

Audit Evaluation and Corrective Action.

For the precision audit and the accuracy audit, corrective action should be initiated by the Project and Procedures Branch supervisor, and documented at the bottom of the AQ121 Audit Form. An investigation must be undertaken to determine the cause of unusually poor audit results when any result exceeds a $\pm 10\%$ difference. Documentation of the correction will be provided to the Section Chief, with the QA report.

Data Verification.

The Regional Air Quality Chemist is responsible for all data verification activities.

Systems Auditing.

The Regional Ambient Air Monitoring Staff shall participate and assist in the Annual Systems Audit performed by the Ambient Monitoring Section. All records and documentation must be available for review.

2.36.2.7 Monitor Shutdown Procedure

1. Down the associated parameter.
2. Disable the associated calibrations on the PDL by selecting "**Configure Calibrations then Change Old Cal Program**". From the list choose "**COTCAL**" for CO. Change the dates of the next auto cal on the Starting Time to a future date.
3. Turn the CO monitors power off. Pull the power plugs out for protection from lightning.
4. Shut off the cylinder valve and the outlet valve on the regulator.
5. Contact ECB, PPB and DMSSB Supervisor to acknowledge site shutdown.

Sign-Off Sheet

I certify that I have read, understand and agree to follow the contents of Revision 4.4 of the "MODEL 48i TRACE LEVEL CARBON MONOXIDE (TL-CO) MONITORING SYSTEM, Section II, OPERATOR RESPONSIBILITIES" QAP/SOP with an effective date of November 10, 2011. **Sign, date and return to the Ambient Monitoring Section Chief.**

Debbie Manning, Regional Ambient Monitoring Coordinator: _____

Eddie Todd, Regional Ambient Monitoring Coordinator: Eddie Todd 11/21/2011

Site Operator: [Signature] 12-6-2011

Site Operator: [Signature] 11-15-2011

