TELEDYNE MODEL T200UP NITROGEN DIOXIDE (NO-NO_2-NO_x) MONITORING SYSTEM
Section I

Electronic Calibration Branch (ECB) Responsibilities

Standard Operating Procedure Approval

I certify that I have read and approve of the contents of this revision of 2.17.1 with an effective date of April 22, 2016.

Raleigh Central Office Teledyne Model T200UP Nitrogen Dioxide (NO-NO_2-NOx) Lead
Carlton Blakley, Environmental Chemist

Signature: Carlton Blakley Date: April 22, 2016

Electronic and Calibration Branch Lead
Mark Yirka, Electronics Tech III

Signature: Mark Yirka Date: April 5-17-16

Projects and Procedures Branch Supervisor
Joette Steger, Environmental Program Supervisor

Signature: Joette Steger Date: May 25, 2016

Ambient Monitoring Section Chief
Donnie Redmond, Ambient Monitoring Section Chief

Signature: Donnie Redmond Date: 5/26/16

U.S. Environmental Protection Agency
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Signature: _____ Date: _____

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2.17.1 Teledyne Model T200UP Nitrogen Dioxide QA Plan: ECB Responsibilities

Note: The following is a list of "significant changes" from Revision 1.0.

1) Audit frequency and level changes to reflect use Annual Performance Evaluation as described in 40 CFR Part 58 Appendix A Section 3.1.2 for all sites.

2.17.1.1 Equipment Selection and Procurement

The Electronics and Calibration Branch (ECB) of the Ambient Monitoring Section (AMS) of the Division of Air Quality (DAQ) is responsible for the selection, evaluation and procurement of the NO-NO_2-NOx monitoring equipment and related accessories. Further, ECB is responsible for receipt, assembly, testing (at its facility) and installation of NO-NO_2-NOx monitors in the field, evaluation of the on-going performances of NO-NO_2-NOx monitors and related support equipment and scheduled and unscheduled system's maintenance. As a part of its responsibilities, ECB is also expected to maintain a sufficient inventory of monitors, support equipment and replacement parts to minimize loss of NO_2 ambient monitoring data.

Additionally, ECB staff is also responsible for procuring and maintaining dedicated traceable NO standards for the certification of all calibrators and for the independent accuracy auditing of the ambient air quality NO-NO_2-NOx monitors. These standards provide a direct link to establish national standards and thus become basis for the collection of the highest quality ambient monitoring NO_2 data and more so in accordance with current procedures and existing Federal Regulations and Guidelines. The continual accuracy audits performed by the ECB staff provide an ongoing evaluation of NO-NO_2-NOx monitor's performance and site operator's adherence to DAQ approved operating procedures.

The ECB also maintains permanent records of all NO standards used in the calibration and auditing of monitors and sampling equipment used in support of DAQ monitoring activities. There are permanent records at ECB for each NO-NO_2-NOx monitor and sampler used to analyze ambient air quality in the State of North Carolina. Each major component of the NO-NO_2-NOx monitoring system, such as analyzer, calibrator, zero-air supply system, etc, is assigned a dedicated logbook. These logbook records include information related to the performance evaluations and complete records detailing the instruments and equipment placed at each monitoring site. Both permanent records are updated continuously.

The ECB is also responsible for evaluating, developing and recommending changes in the equipment and operating parameters to improve the quality of data collected and procedures used in the collection of data.

2.17.1.2 Ambient Nitrogen Dioxide Monitoring

The North Carolina Ambient Air Nitrogen Dioxide Monitoring System must meet or exceed the Reference and Equivalent Method requirements in 40CFR53.1 and 40CFR58 Appendix C. The NC ambient nitrogen dioxide monitoring system consists of the following:

- Teledyne (TAPI) Model T200UP NO-NO_2-NOx monitor / pump

- Teledyne (TAPI) Model T700U Dynamic Gas Calibrator
- Teledyne (TAPI) Model 701 Zero-air System
- Certified and Traceable National Institute of Standards and Testing-Standard Reference Material (NIST-SRM) "NO" Gas Cylinder
- ESC Model 8832 Data Logger
- Dedicated Site Computer
- Ethernet / Wireless Modem

Note: minor components are not specified but included by reference.

The ECB is responsible for ensuring that all components are compatible with the measurement of ambient levels of atmospheric nitrogen dioxide. The ECB is responsible for the performance of complete system evaluation prior to the field installation and that the system is fully functional at the completion of the installation. On an ongoing basis as needed the ECB provides equipment and instrumentation maintenance and operational support to maximize the collection of the highest quality ambient air pollution data possible in accordance with accepted and approved procedures.

2.17.1.3 Receipt, Testing and Inventory

The ECB shall conduct operational tests after receipt and unpacking of each instrument. Following the Teledyne T200UP Instruction Manual (Chapter 3) setup procedures, Section 2.17.2.2 of NC QA/SOP operator's calibration section, the instrument must sample calibration gas at atmospheric pressure. After initial setup and instrument checks, the instrument is either approved or returned to the manufacturer if any damage or problems that cannot be fixed are identified.

Upon approval of the tested unit, the unit shall be added to the fixed asset system. For each monitor, apply an inventory decal and complete an inventory load sheet showing the planned monitor location. Submit the inventory load sheet to the branch supervisor.

A) Teledyne T200UP NO-NO_2-NOx Monitor testing: The Teledyne T200UP NO-NO_2-NOx monitor should be tested thoroughly before deployment at the monitoring site. This testing will involve among other things:

- Pre-calibration electronic adjustment
- Data logger analog output adjustment
- Setting initial calibration factors and adjustment to PMT
- NO/NO2/NOX operational test zero/span check and calibration
  1) Test zero/span check

Span Points	500 ppb Scale
0	0
1	425
3	20
Titrations	
425ppb NO	405ppb O3
30ppb NO	10ppb O3

2) Test calibration

Span Points	500 ppb Scale
0	0
1	425
3	20
Titrations	
425ppb NO	405ppb O3
70ppb NO	50ppb O3

make sure that:

- the T200UP instrument is in the "**Sample**" mode
- the T700U instrument is in the "**Standby**" mode

Only the main components of the NO_2 monitoring system are discussed briefly here for their operational details. For further details of other NO-NO_2-NOx monitoring system related components refer to the "Operational Manual, Model T200 Nitrogen Oxide Analyzer 13 February 2012", "Model T200UP Photolytic Nitrogen Oxide Analyzer (Addendum to T200 Manual) 27 March 2012", "Model T700U Dynamic Dilution Calibrator 06 October 2010", and "Model T700U Calibrator (Addendum to T700U Manual) 06 October 2010".

2.17.1.4 Teledyne T700U Calibrator Certification (Pre-Site Installation Checks)

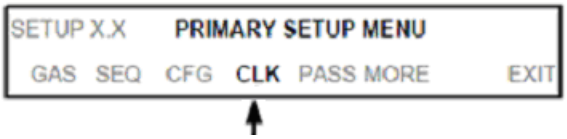
Figure 1 T700U Main Menu Screen

1 = concentration, 2 = mode, 3 = parameter, 4 = touch control buttons

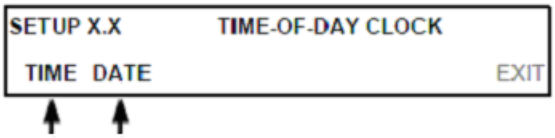
- Calibrator time/date

  To set the calibrator time/date: make sure the calibrator is in the "STANDBY" mode (if not, press "**STBY**"), press "**SETUP**"

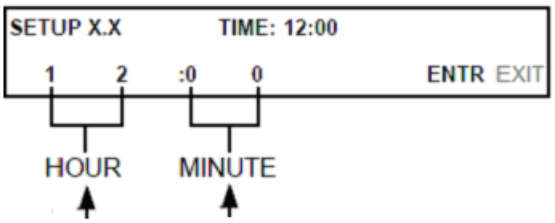
press "**CLK**"



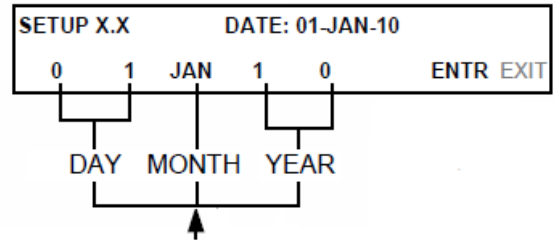
press "**TIME**" or "**DATE**"



select "**TIME**", toggle the "HOUR/MINUTE" buttons to set correct hour/minute, press "**ENTR**", press "**EXIT**" to return to SETUP XX



select "**DATE**": toggle the "DAY/MONTH/YEAR" buttons to set correct day/month/year, press "**ENTR**", press "**EXIT**" to return to SETUP XX



- Source Gas Cylinders

To program the T700U calibrator's source gas input ports for a single gas cylinder;

1) Make sure the calibrator is in the "STANDBY" mode (if not, press "**STBY**")

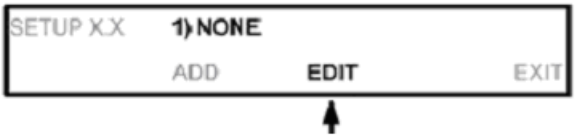
press "**SETUP**"

press "**GAS**"

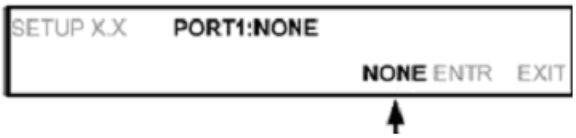
press "**CYL**"

press "**PRT1**" (port #1), PRT2…..

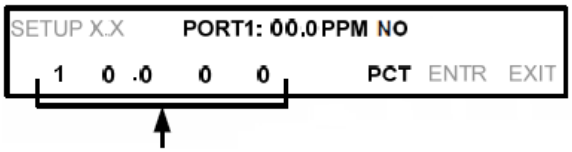
press "**EDIT**"



press "**NONE**" until the desired gas (NO) appears



toggle the left most buttons change the concentration, press "**ENTR**" to accept changes



2.17.1.5 Teledyne T200UP Monitor Certification (Pre-Site Installation Checks)

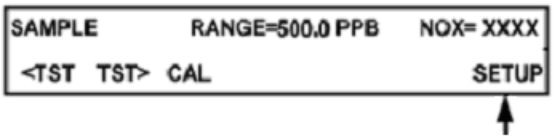
Figure 2 T200UP Main Menu Screen

1 = concentration, 2 = mode, 3 = parameter, 4 = touch control buttons

- Monitor time/date

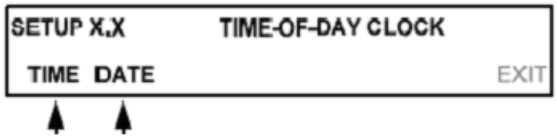
  To set the monitor time/date, make sure the instrument is in the "SAMPLE" mode,

press "**SETUP**"

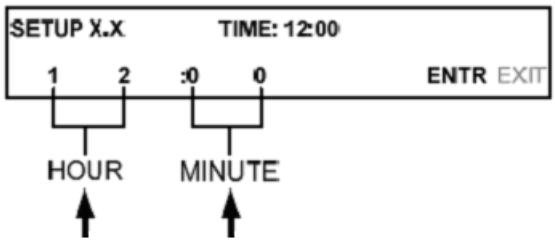


press "**PRIMARY SETUP MENU**"

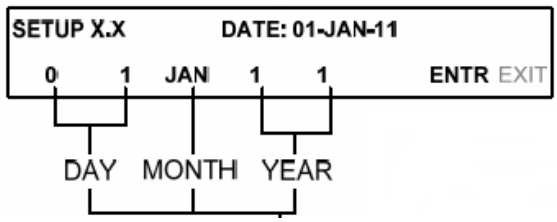
press "**TIME**" or "**DATE**"



toggle the HOUR & MINUTE buttons to make the changes, press "**ENTR**" to accept changes, "**EXIT**" to the SETUP XX screen



toggle the DAY, MONTH & YEAR buttons to make the changes, press "**ENTR**" to accept changes. Press "**EXIT**" to return to the **SAMPLE** mode.



Pre-Calibration Procedures

Note: A filter change and leak check should be done prior to a calibration (see section **2.17.1.7.5**, pg. 35).

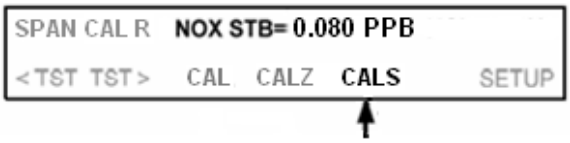
1. Check NOx Offset/Slope and NO Offset/Slope:

Using the T200UP touch control buttons, press "**<TST** "or "**TST>**" to select **NOX SLOPE [value]**, **NOx OffS [value], NO SLOPE [value]**, and **NO OffS [value]**.

Function	Minimum Value	Optimum Value	Maximum Value
NOX Slope	-0.700	1.000	1.500
NO OFFS	-20.0 mV	0.0 mV	150.0 mV
NO Slope	-0.700	1.000	1.500
NOX OFFS	-20.0 mV	0.0 mV	150.0 mV

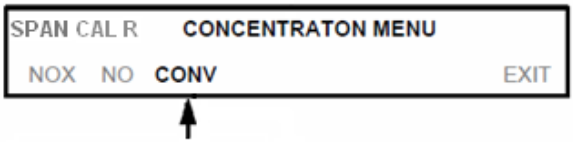
Table 1 NOX/NO Slope & Offset Criteria

2. NOX/NO Slope Reset: Using the T200UP touch control buttons (from the "**SAMPLE**" mode), press "**CALS**"



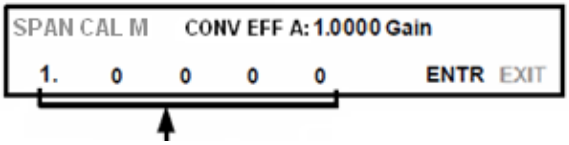
press "**CONC**"

press "**CONV**"



press "**SETA**"

toggle the left most buttons until the "Param" field reads "**1.0000**", press "**ENTR"**



Note: Press "**EXIT"** to go back to "**CONV**" screen, repeat procedure to edit "**SETB**" until the Param field reads "**1.0000**", press "**EXIT**", "**EXIT**", "**EXIT"** to leave the converter efficiency menu

2.17.1.5.1 Span Zero Calibration

- Select the AvTrend icon, enter the "**Username**" followed by the "**Password**", hit "**OK**"
- Select "**Utilities**"
- Select: "**Link to Logger**"
- From the drop down menu select the site
- Select: "**Connect**", when the site has connected
- Select: "**L**" to log onto the site data logger (use site password)
- Press **{ESC}{ESC}** to return to the Home Menu
- Select: "**C**", Configuration Menu
- Select: "**C**", Configure Calibrations
- Select: "**1**", start Single Phase Calibration, <ENTER>
- Select: "**NOXCAL**", <ENTER>
- Select: "**SPAN ZERO**", <ENTER>

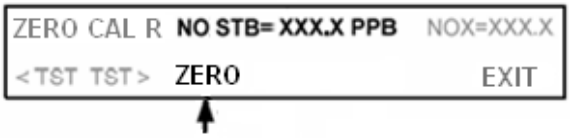
- Select: "**Phase Duration**" (set to 1h), <ENTER>
- Select: "**Start Single Cal (NOW)**", <ENTER>

Monitor Actual values

- Press {**ESC**}{**ESC**} to return to the Home Menu
- Select: "**D**", Real Time Display Menu
- Select: "**C**", Continuous Average Report
- Select: "**Show Channels**", <ENTER>
- Type in parameters: "**NO**", "**NO2**", and "**NOX**", <ENTER>
- Change # of flags to report from "**02**" to "**03**", <ENTER> (the "**<**", "**D**", and "**C**" flags will show)
- Use decimal Positioner?: "**Y**", <ENTER>
- Start continuous report: <ENTER> (this will show the minute averages as they are calculated and keeps all values on screen).

T200UP Span Zero Calibration

press "**ZERO**"



allow instrument to stabilize (wait for the "**NOX STB =XXXX**" to drop < 0.100ppb for ~ 15-20 min)

press "**ENTR**" (may have hit "**ENTR**" several times) to change the Offset/ Slope based on the zero-point measurement

- Measured zero must be ± 1 ppb

Abort SPAN0

- Select: "**C**", Configuration Menu
- Select: "**C**", Configure Calibrations
- Select: "**W**", Abort a Calibration Program
- Select: "**NOXCAL**", <ENTER>

Note: once SPAN0 is aborted, calibrator goes to "STANDBY" mode

2.17.1.5.2 Span Point Calibration

Span 1 Calibration

- Press **{ESC}{ESC}** to return to the Home Menu
- Select: "**C**", Configuration Menu
- Select: "**C**", Configure Calibrations

- Select: "**1**", Start Single Phase Calibration, <ENTER>
- Select: "**NOXCAL**", <ENTER>
- Select: "**SPAN1**", <ENTER>
- Select: "**Phase Duration**" (set to 8h), <ENTER>

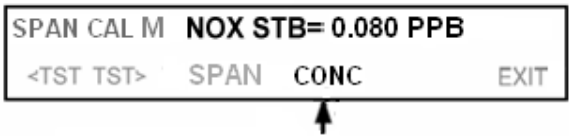
Monitor Actual values

- Press {**ESC**}{**ESC**} to return to the Home Menu
- Select: "**D**", Real Time Display Menu
- Select: "**C**", Continuous Average Report
- Select: "**Show Channels**", <ENTER>
- Type in parameters: "**NO**", "**NO2**", and "**NOX**", <ENTER>
- Change # of flags to report from "**02**" to "**03**", <ENTER> (the "**<**", "**D**", and "**C**" flags will show)
- Use decimal Positioner?: "**Y**", <ENTER>
- Start continuous report: <ENTER> (this will show the minute averages as they are calculated and keeps all values on screen).

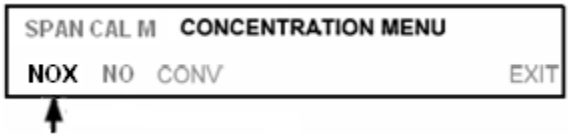
Allow the analyzer to sample the NO calibration gas until the "**NOX STB =XXXX**" to drop < 0.100ppb (~15-20 min)

T200UP Span Calibration

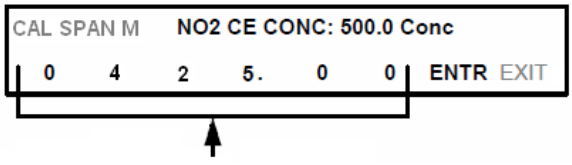
press "**CONC**"



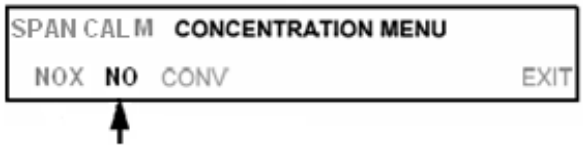
press "**NOX**"



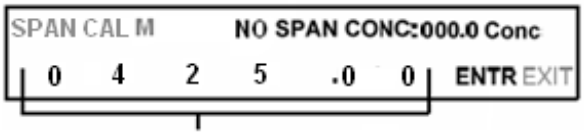
toggle the left most buttons to enter the "**NOX**" concentration (425), press "**ENTR**", press "**EXIT**"



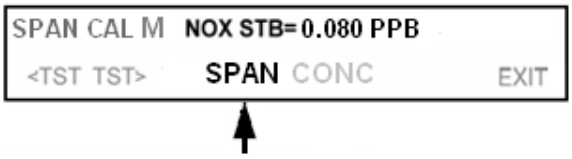
press "**NO**"



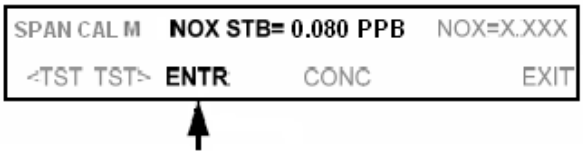
toggle the left most buttons to enter the "**NO**" concentration (425), press "**ENTR**"



Allow instrument to stabilize, wait for the "**NOX STB =XXXX**" to drop < 0.100ppb for ~15-20 min, press "**SPAN**"



press "**ENTR**" (may have to hit "**ENTR**" an extra time)



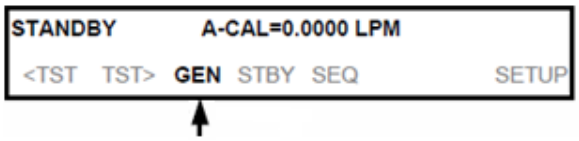
2.17.1.5.3 NO_2 Gas Phase Titration/Calibration

The following procedure uses the converter efficiency (gas phase titration) to calibrate the NO_2 channel. The two points should be located at the 80-90% (**B**) and 10-20% (**A**) levels of FS (in this order).

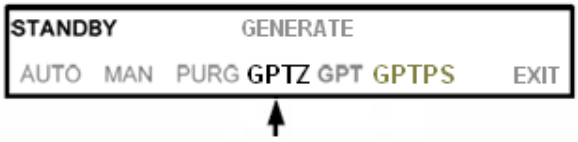
Titration/Calibration	500 ppb Scale	
	NO	O_3
80-90%	425	405
10-20%	70	50

GPTZ: 80-90% FS (500 ppb scale)

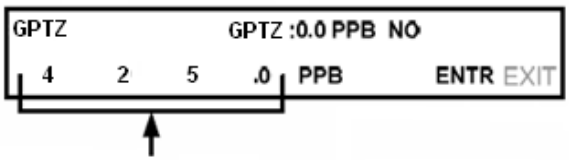
On the T700U, press "**GEN**"



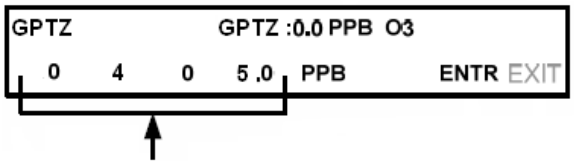
press "**GPTZ**"



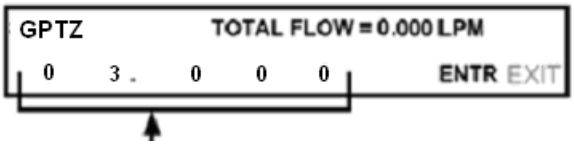
toggle the left most buttons to set the "**NO**" concentration (425) ppb, press "**ENTR**"



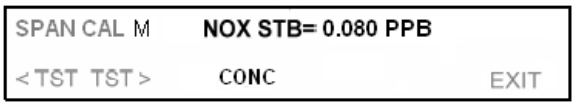
toggle the left most buttons to set the "**O3**" concentration (405) ppb, press "**ENTR**"



toggle the left most buttons to set the "**TOTAL FLOW**" (3.000), press "**ENTR**"



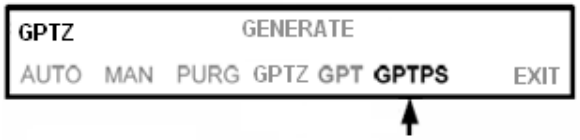
on the T200UP wait for the "**NOX STB =XXXX**" to drop < 0.200ppb (~20-30 min)



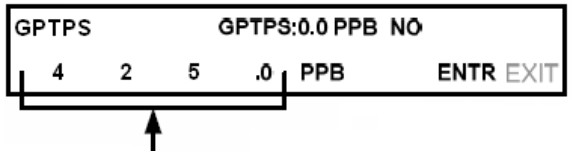
GPTPS: 80-90% FS (500 ppb scale)

on the T700U press "**GEN**"

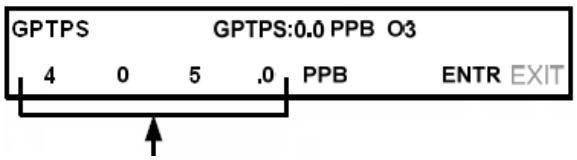
press "**GPTPS**"



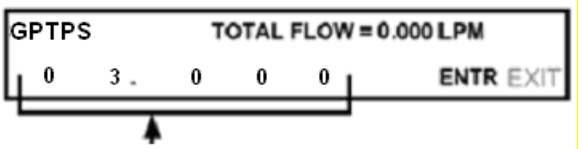
check to see if the "**NO**" concentration (425) ppb, press "**ENTR**"



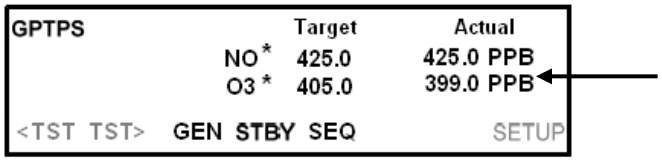
check to see if the "**O3**" concentration (405) ppb, press "**ENTR**"



check to see if the "**TOTAL FLOW"** (3.000), press "**ENTR**"



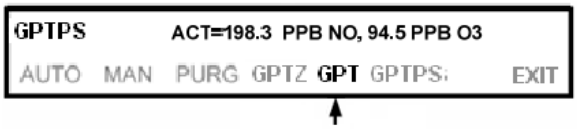
Note: Keep the T700U in **GPTPS** mode until the "**Actual"** value for O_3 is within 1PPB of the "**Target**" value entered (wait for "green active" light to stop flashing) + 5min.



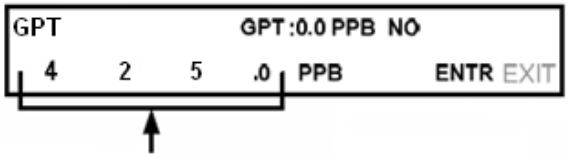
GPT: 80-90% (500 ppb scale)

press "**GEN**"

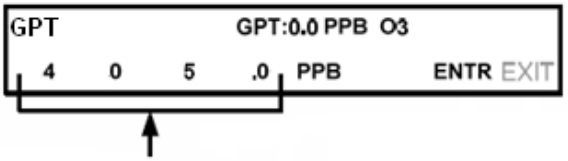
press "**GPT**"



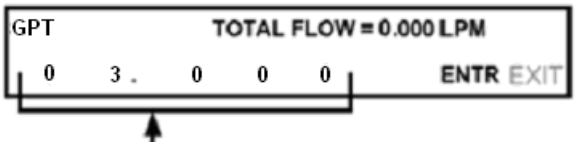
check to see if the "**NO"** concentration (425) ppb, press "**ENTR**"



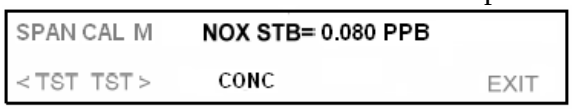
check to see if the "**O3"** concentration (405) ppb, press "**ENTR**"



check to see if the "**TOTAL FLOW"** (3.000), press "**ENTR**"



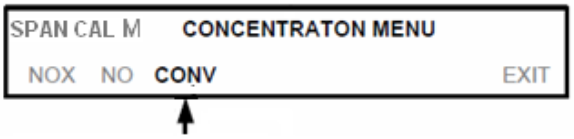
on the T200UP wait for the "**NOX STB =XXXX**" to drop < 0.200ppb (~ 25-30 min)



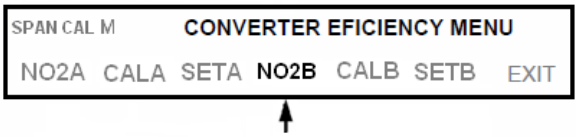
80-90% NO_2 Calibration (500 ppb scale)

press "**CONC**"

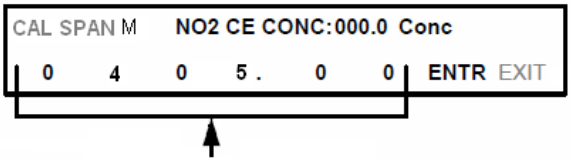
press "**CONV**"



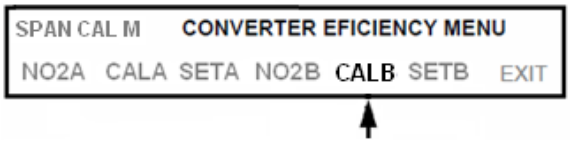
press "**NO2B**"



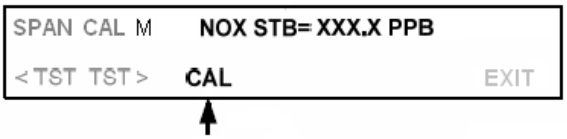
edit the "**NO2B**" to enter "NO2B O3" conc., press "**ENTR**"



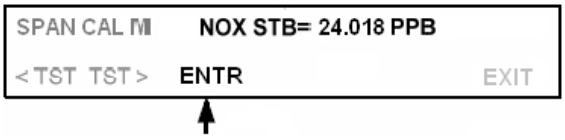
press the "**CALB**" button to calibrate the "**B**" point



press "**CAL**"

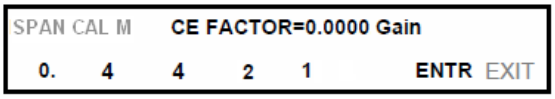


press "**ENTR**", press "**EXIT**"



press "**SETB**"

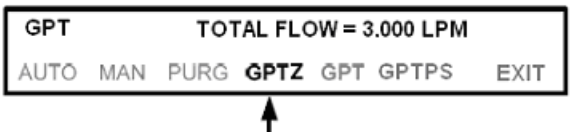
view the "**SETB gain**" CE factor value that appears in the front panel display, press "**EXIT**", "**EXIT**", "**EXIT**"



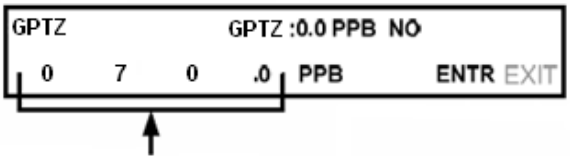
GPTZ: 10-20% FS (500 ppb scale)

On the T700U, press "**GEN**"

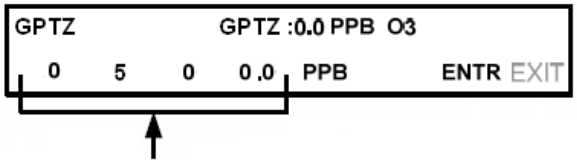
press "**GPTZ**"



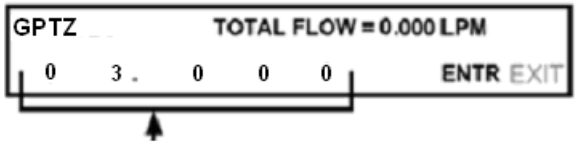
toggle the left most buttons to set the "**NO**" concentration (70) ppb, press "**ENTR**"



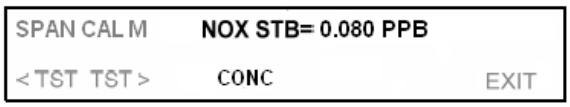
toggle the left most buttons to set the "**O3**" concentration (50) ppb, press "**ENTR**"



toggle the left most buttons to set the "**TOTAL FLOW**" (3.000), press "**ENTR**"

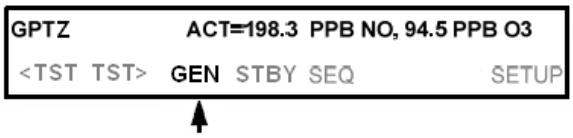


on the T200UP wait for the "**NOX STB =XXXX**" to drop < 0.100ppb (~20-30 min).



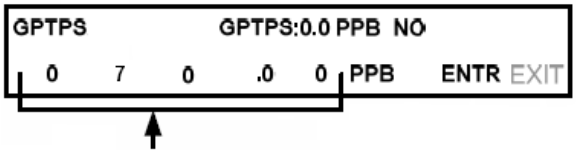
GPTPS: 10-20% FS (500 ppb scale)

On T700U press "**GEN**"

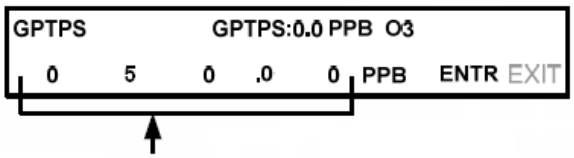


press "**GPTPS**"

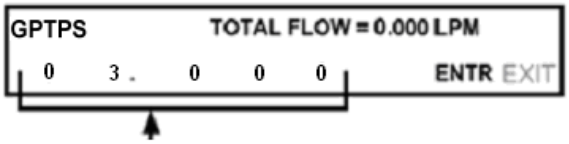
check to see if the "**NO**" concentration (70) ppb, press "**ENTR**"



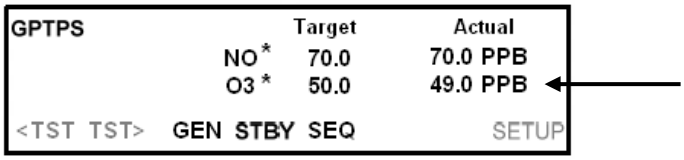
check to see if the "**O3**" concentration (50) ppb, press "**ENTR**"



check to see if the "**TOTAL FLOW"** (3.000), press "**ENTR**"



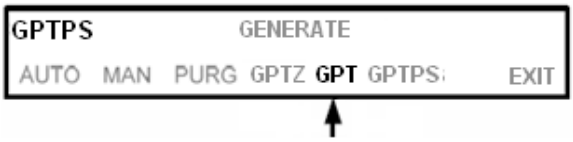
Note: Keep the T700U in **GPTPS** mode until the "**Actual"** value for O_3 is within 1PPB of the "**Target**" value entered (wait for "green active" light to stop flashing) for + 5 min.



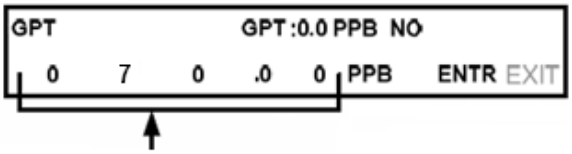
GPT: 10-20% FS (500 ppb scale)

press "**GEN**"

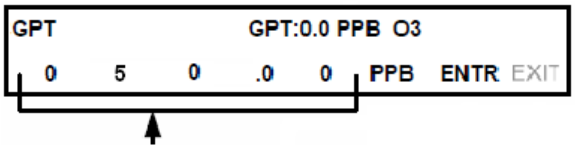
press "**GPT**"



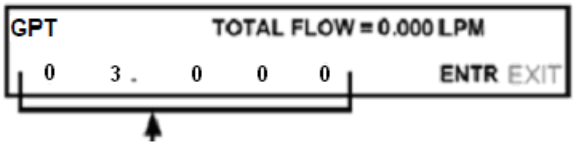
check to see if the "**NO"** concentration (70) ppb, press "**ENTR**"



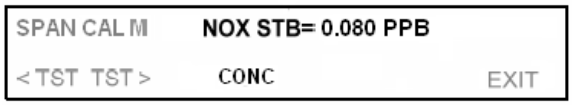
check to see if the "**O3"** concentration (50) ppb, press "**ENTR**"



check to see if the "**TOTAL FLOW"** (3.000), press "**ENTR**"

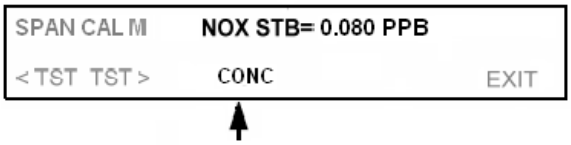


on the T200UP wait for the "**NOX STB =XXXX**" to drop < 0.100ppb (~15-20 min)

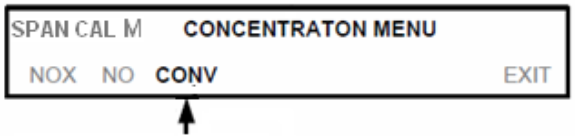


10-20% FS NO_2 Calibration (500 ppb scale)

On the T200UP, press "**CONC**"

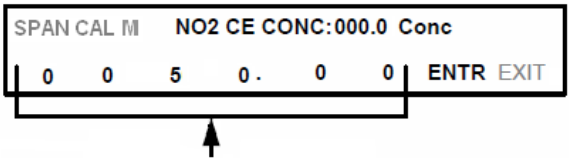


press "**CONV**"



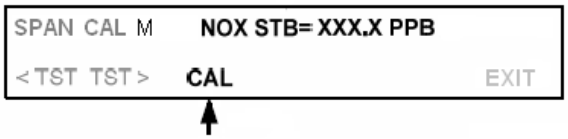
press **"NO2A"**

toggle the left most buttons to edit the NO2A concentration (enter the "NO2A O3" conc.), press "**ENTR**"

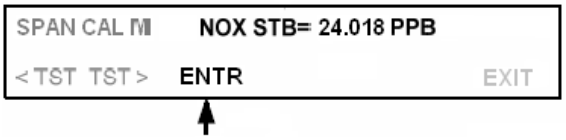


press the "**CALA**" button to calibrate the "**A**" point

press "**CAL**"

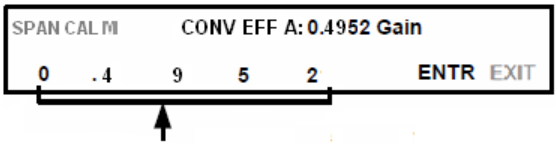


press "**ENTR**", press "**EXIT**"

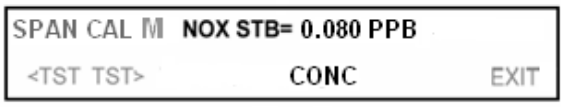


press "**SETA**"

view the " **SETA gain** " CE factor value that appears in the front panel display, press "**EXIT",** "**EXIT",** "**EXIT"** to leave the converter efficiency menu



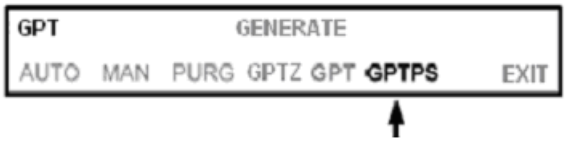
on the T200UP wait for the "**NOX STB =XXXX**" to drop < 0.100ppb (~15-20 min)



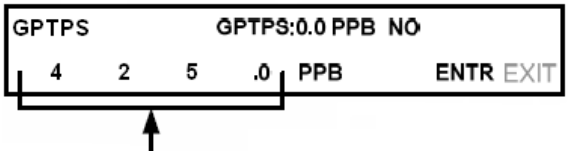
80-90% FS Check (500 ppb scale)
GPTPS:

On the T700U, press "**GEN**"

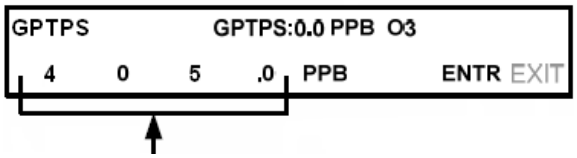
press "**GPTPS**"



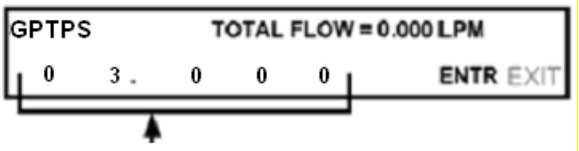
toggle the left most buttons to set the "NO" concentration (425) ppb, press "**ENTR**"



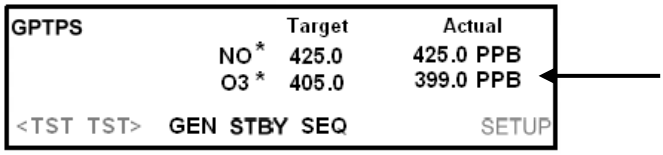
toggle the left most buttons to set the "**O3**" concentration (405) ppb, press "**ENTR**"



toggle the left most buttons to set the "**TOTAL FLOW**" (3.000), press "**ENTR**"



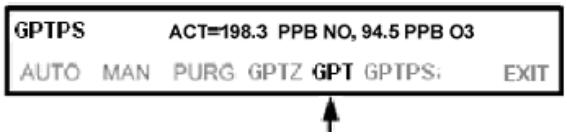
Note: Keep the T700U in **GPTPS** mode until the "**Actual"** value for O_3 is within 1PPB of the "**Target**" value entered (wait for "green active" light on T700U to stop flashing + 5 minutes).



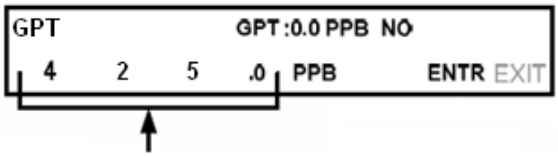
GPT: 80-90% FS (500 ppb scale)

On the T700U, press "**GEN**"

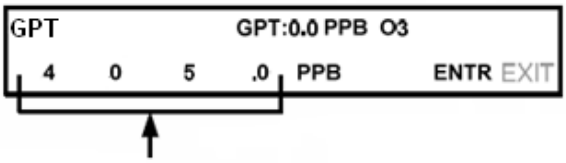
press "**GPT**"



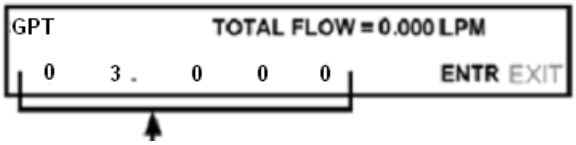
check to see if the "**NO**" concentration (425) ppb, press "**ENTR**"



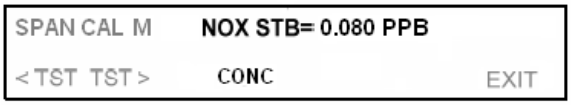
check to see if the "**O3**" concentration (405) ppb, press "**ENTR**"



check to see if the "**TOTAL FLOW**" (3.000), press "**ENTR**"



on the T200UP wait for the "**NOX STB =XXXX**" to drop < 0.200ppb (~20-30 min)



2.17.1.5.4 T700U Calibrator Purge Procedure

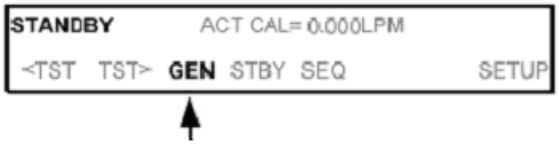
The T700U calibrator's PURGE feature clears residual source gases and calibration mixtures gases from the previous generated steps from the instruments internal pneumatics as well as any external pneumatic lines downstream from the calibrator.

When activated, the "**PURGE**" feature:

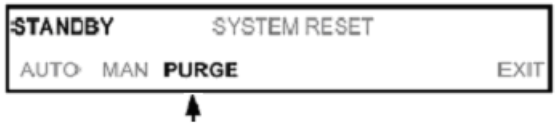
- Opens the diluent (zero air) inlet valve allowing zero air to flow into the calibrator from its external, pressurized source,
- Adjusts the diluent air mass flow controller (MFC1) to maximum flow,
- Adjusts all of the component gas mass flow controllers installed in the calibrator to maximum flows, 10 SLPM and 20 SLPM accordingly, to flush out the pneumatic system of the T700U.

To activate the **PURGE** feature;

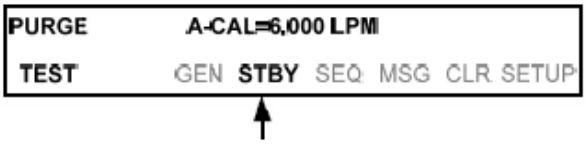
press "**GEN"**



press "**PURGE"**



The actual flow rate of all the cal mass flow controllers rises to the full scale. The T700U will stay in the **PURGE** mode until the **STBY** button is pressed. **Note:** purge the calibrator until NOX STB = < 0.100ppb (~ 5 min) on the T200UP



When the purge is finished, do the following:
Abort SPAN1

- Select: "**C**", Configuration Menu
- Select: "**C**", Configure Calibrations
- Select: "**W**", Abort a Calibration Program

- Select: "**NOXCAL**", <ENTER>

Start SPAN3

- Press {**ESC**}{**ESC**} to return to the Home Menu
- Select: "**C**" Configuration Menu
- Select: "**C**" Configure Calibrations
- Select: "**1**", "Single Phase Cal", <ENTER>
- Select: "**NOXCAL**", <ENTER>
- Select: "**SPAN3**", <ENTER>
- Select: "**Phase Duration**", (set to 1h)
- Select "**Start Single Cal (NOW)**", <ENTER>

Monitor Actual Values

- Press {**ESC**}{**ESC**} to return to the Home Menu
- Select: "**D**", Real Time Display Menu
- Select: "**C**", Continuous Average Report
- Select: "**Show Channels**", <ENTER>
- Type in parameters: "**NO**", "**NO2**", and "**NOX**", <ENTER>
- Change # of flags to report from "**02**" to "**03**", <ENTER> (the "**<**", "**D**", and "**C**" flags will show)
- Use decimal Positioner?: "**Y**", <ENTER>
- Start continuous report: <ENTER> (this will show the minute averages as they are calculated and keeps all values on screen).
- Start SPAN3 and let it stabilize (wait for the "**NOX STB =XXXX**" to drop < 0.100ppb for ~15-20 min)
- Abort SPAN3 using "**C**", "**C**", "**W**", "**NOXCAL**", <ENTER>

Note: once SPAN3 is aborted, calibrator goes to "STANDBY" mode

The procedural details of each of the above are given in the manufacturer's instructional manual "Operational Manual, Model T200 Nitrogen Oxide Analyzer, 13 February 2012" and "Model T200UP Photolytic Nitrogen Oxide Analyzer (Addendum to T200 Manual), 27 March 2012.

2.17.1.6 Calibration Standards and System

Calibration Standards

The ECB shall procure certified protocol standards for the Ambient Monitoring Section. Primary "NO" Standards are used to calibrate and evaluate the ongoing calibration checks and audit performance of the nitrogen monitors at each site. The primary "NO" standard used must be certified, commercially prepared compressed gas standards with a certified accuracy of no worse than ±2 percent.

Standards in the concentration range of ~10 ppm are suitable choices for dilution to prepare low concentration calibration mixtures.

a. Extreme care must be taken to ensure compatibility for all components. Flow rates and concentration outputs must meet the requirements of the monitor.

b. All primary protocol standard calibration gases must be referenced to National Bureau of Standards (NBS) nitrogen in Air Standard Reference Material (SRM) or an NBS/EPA approved gas manufacturer's Certified Reference Material (CRM). A written statement of certification should be obtained which provides the following:

a. a brief description of the certification procedure,
b. cylinder numbers,
c. cylinder gas concentrations,
d. replicate analysis data,
e. balance gas used,
f. NBS, SRM numbers used as standards, and
g. last analysis date.

A copy of this certification should be available to users and should be kept on file in the ECB files.

c. The calibration gas standards will have their own certifications and will be re-verified or recertified after 3 years for 0.5 to 50 ppm NO in oxygen-free nitrogen standards (This 36-month period is allowed because "NO" is somewhat stable (in actual practice most cylinders may be expended sooner).

d. No cylinder gas should be used below a cylinder pressure of 200 psig as shown by the cylinder gas regulator.

e. Each "NO" span gas cylinder shall contain the following minimum traceability information on a label or tag affixed to the cylinder or valve:

a. the concentration of cylinder gas,
b. the last analysis date,
c. the expiration date,
d. the initials of the person performing the analysis,
e. cylinder number, and
f. balance gas.

Model T700U Dynamic Gas Calibrator
The T200UP analyzer is calibrated using a T700U calibrator, which must have flows certified by ECB and traceable to a primary standard according to the requirements in the QA/SOP 2.3.7 TAPI T700U Calibrator.

The three mass flow controllers and photometer in the T700U "audit calibrator" is certified for nine (9) months and the "field calibrator" certifications are good for twelve (12) months.

The Model T700U dynamic gas calibrator supplies the required levels of "NO" to perform zero, precision, span checks and multipoint calibrations. The Model T700U is operated remotely from the data logger to perform zero, precision, and span checks. The calibrator is an accurate mass flow controlled gas dilution system that meets the 40 CFR 50 requirements of ± 2 % accuracy. "NO" gas (usually in an inert gas such as nitrogen) from a NIST traceable protocol certified

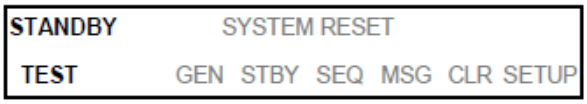
cylinder (of ± 2 % accuracy or less) is blended with "zero-air" to provide desired concentration. From the known calibration of the three mass flow controllers, the exact concentration can be calculated. A typical dilution ratio of 100:1 to 1000:1 is generally used to generate appropriate concentrations.

Teledyne Model T700U Calibrator Component Performance
The most common and/or serious instrument failures will result in a warning message being displayed on the front panel.

The T700U will alert the user that a Warning Message is active by flashing the "FAULT LED", displaying the warning message in the Param field along with the **CLR** button (press "**CLR**" to clear warning message).

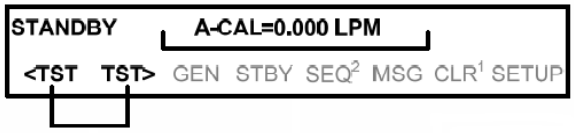
Figure 3 T700U Calibrator Front Screen

To view or clear the various warning messages press:
Make sure the calibrator is in the "STANDBY" mode (if not, press "STBY"), press "**TEST**".



The "**MSG**" button displays if there is more than one warning in queue or if you are in the TEST menu and have not yet cleared the message.

Make sure the calibrator is in the "STANDBY" mode (if not, press "**STBY**"), press "**<TST**" or "**TST>**" (use the **<TST** or **TST>** pushbuttons to select the item). A value of "**XXXX**" displayed for any of the functions indicates an out-of-range reading or the analyzer's inability to calculate it.



T700U Calibrator Front Screen

Note: if T700U reads "**REGULATR PRES WARN**" - after the zero/span is generated, verify the "**CAL Press**" and or "**DIL Press**" is 15-30 psig (press <**TST** or **TST**>).

The following alarm limit is used in the operation of the T700U Calibrators:

BOX TMP (Box Temperature)

- Using the T700U touch control button, press "<**TST**" or "**TST**>" **BOX TMP [value]**: **Shelter ± 5ºC**

Teledyne Model 701 Zero Air Generator

The Teledyne Series 701 Zero Air Generator is a pure air generator system that is capable of continuous delivery of up to 20 standard liters per minute (SLPM), 30 pounds per square inch (PSI) of dry, contaminant-free air. The air is suitable for use as: a zero reference calibration gas, ultra-pure combustion air for flame ionization detector, and service air for pneumatically operated valves. The system is capable of delivering air free from water vapor, particulates, sulfur dioxide (SO2), Hydrogen Sulfide (H2S), Oxides of Nitrogen (NO), Nitrogen Dioxide (NO2), Ozone (O3), and Carbon Monoxide (CO). The delivery pressure should be set to 30 ± 2 psig.

Model 701 Zero Air Generator Checks:

- The pollution scrubber/converter media should be replaced yearly by the ECB.
- Verify that the delivery pressure is set to 30 ± 2 psig. (If the delivery pressure is outside of ± 2 psi range, adjust the pressure using pressure adjust control knob.)
- Check the drain from the air generator.

Teledyne Model T200UP NO_2 Analyzer Component Performance

The following Test mode parameter settings are allowed in the Teledyne T200UP Analyzer:
Note: Verify the monitor is in the "Sample" mode (mode reads "Sample").

Figure 4 T200UP Front Screen

SINGLE MODE

- Using the T200UP touch control buttons, press **SETUP > PRIMARY SETUP MENU > RNGE> RANGE CONTROL MENU > MODE>** SNGL <EXIT>

CONCENTRATION UNITS

- Using the T200UP touch control buttons, press **<TST** or **TST> RANGE [value]**: 500 PPB

RANGE

- Using the T200UP touch control buttons, press **<TST** or **TST> RANGE [value]**: 500 PPB

SAMP FLW (sample flow)

- Using the T200UP touch control buttons, press **<TST** or **TST> SAMPLE FLW [value]**: ~1000 (CC/M)

RCELL Temp (rcell temperature)

- Using the T200UP touch control buttons, press **<TST** or **TST> RCELL TEMP [value]**: 40 ± 0.1 °C

Machine ID

- Using the T200UP touch control buttons, press **SETUP** > **MORE > COMM> ID** Machine ID xxxx

Note: machine ID must be changed to a unique identifier (number) when more than one instrument of the same model is used in a series.

COM2

- Using the T200UP touch control buttons, press **SETUP** > **MORE > COM2** RS 232/RS-485

PMT Temp (pmt temperature)

- Using the T200UP touch control buttons, press **<TST** or **TST> PMT TEMP [value]**: Range of < 5°C ± 2

RCEL (vacuum pressure)

- Using the T200UP touch control buttons, press **<TST** or **TST> RCEL [value]**: <**4.2**" in-Hg-A

Note: pump for the T200UP should be replaced annually

SAMPLE (sample pressure)

- Using the T200UP touch control buttons, press **<TST** or **TST> SAMP [value]**: Ambient ±1 in-Hg-A

NOX SLOPE

- Using the T200UP touch control buttons, press **<TST** or **TST>** to select **NOX SLOPE [value]**: -0.7 to 1.5

NOx OffS

- Using the T200UP touch control buttons, press **<TST** or **TST>** to select **NOX OffS [value]**: -20.0 to 150.0 mV

NO SLOPE

- Using the T200UP touch control buttons, press **<TST** or **TST>** to select **NOX SLOPE [value]**: -0.7 to 1.5

NO OffS

- Using the T200UP touch control buttons, press **<TST** or **TST>** to select **NO OffS [value]**: -20.0 to 150.0 mV

Note: Adjust the operational parameters as necessary if outside these ranges. If adjustments are performed, the stability of the adjusted parameter(s) must be evaluated and recorded prior to proceeding.

The ECB is responsible for setting the operational parameters of each Teledyne T200UP as listed above. Primary standard operation outside of these settings and limits is non-compliant with the NC QA/SOP for ambient air nitrogen dioxide monitoring and the data will be invalidated.

Prior to installation at the monitoring site, the ECB must evaluate the condition and performance of each Teledyne Model T200UP monitor and Model T700U calibrator as needed. The results of the evaluation, findings, and all adjustments are entered into the Model T200UP monitor and Model T700U calibrator logbook, dated, and initialed.

2.17.1.7 Site Monitor Operation / Verification (Site Installation)

After the regional office has obtained permission to use a site from the site owner, and after DAQ Ambient Monitoring Project and Procedures Supervisor have approved the site, the Electronics and Calibration Branch will install the monitor and its appurtenances. Electrical circuits should be dedicated, properly sized and labeled prior to the installation of the monitoring equipment. Inspect the site for integrity and safety. The ECB staff is responsible for the installation of all State operated Teledyne T200UP NO-NO_2-NOx monitoring systems across the State of North Carolina.

The monitor should be switched out on an as needed basis; the calibrators will need to be switched out for recertification every twelve (12) months or as needed. The cylinder will need to be switched out every 24 months or when pressure ≤ 200psi. All procedures should be documented on the 109 Form.

The installation at the monitoring site includes:

- Teledyne (TAPI) Model T200UP NO-NO_2-NOx monitor / pump
- Teledyne (TAPI) Model T700U gas calibrator (QA/SOP 2.3.7)
- Teledyne (TAPI) Model 701 Zero-air System
- Certified and Traceable National Institute of Standards and Testing-Standard Reference Material (NIST-SRM) "NO" Gas Cylinder
- ESC Model 8832 Data Logger
- Pretreated Teflon Sampling Line
- Dedicated Site Computer
- Ethernet / Wireless Modem

The T200UP NO-NO_2-NOx monitor and associated accessories must be installed in a building where room temperature extremes do not fall below 20ºC (68ºF) or exceed 30ºC (86ºF). Check to ensure that the heater and air conditioner are in working order and do indeed maintain the desired temperature range, irrespective of the time of the day and season. Remove the air conditioner filter and clean, if necessary. Check any problems related to the building such as leaks, infestations, etc.

Note: To ensure the uniform collection of air quality data various sample probe-siting criteria must be followed (see 40 CFR 58 Appendix E for details). These criteria are summarized below:

- The monitor probe shall be as near as practicable to the outside nearest edge of the traffic lanes of the target road segment; but shall not be located at a distance greater than 50 meters, in the horizontal (except for the community monitor).
- There must be unrestricted airflow 270º around the probe inlet or 180º if the probe inlet is on the side of a building.
- The probe or at least 80 percent of the monitoring path must be located between 2 and 7 meters above ground level.
- The probe, inlet, or at least 90 percent of the monitoring path must be at least 10 meters or further from the drip line of trees.
- The sample line should be as short as practical and should be PFA Teflon or their equivalent. The sample line is replaced every two years.

Note: Table 2 presents a summary of the general requirements for probe and monitoring path siting criteria with respect to distances and heights.

Table 2 Siting Criteria

Roadway average daily traffic, vehicles per day	Micro Scale Minimum Distance (meters)	Middle Scale Minimum distance (meters)	Neighborhood Scale Minimum distance (meters)
≤1,000	<10 (Probe ht 2-7 m)	<10 (Probe ht 2-15 m)	≥10 (Probe ht 2-15 m)
10,000	<20 (Probe ht 2-7 m)	<20 (Probe ht 2-15 m)	≥20 (Probe ht 2-15 m)
15,000	<30 (Probe ht 2-7 m)	<30 (Probe ht 2-15 m)	≥30 (Probe ht 2-15 m)
20,000	<40 (Probe ht 2-7 m)	<40 (Probe ht 2-15 m)	≥40 (Probe ht 2-15 m)
40,000	≤50 (Probe ht 2-7 m)	>50 to <60 (Probe ht 2-15 m)	≥60 (Probe ht 2-15 m)
70,000	≤50 (Probe ht 2-7 m)	>50 to <100 (Probe ht 2-15 m)	≥100 (Probe ht 2-15 m)
≥110,000	≤50 (Probe ht 2-7 m)	>50 to <250 (Probe ht 2-15 m)	≥250 (Probe ht 2-15 m)

40 CFR Part 58 Appendix E Table E-1, E-4 and QA Handbook for Air Pollution Measurement Systems Table 7-3, 7-4,

A. Verification of Component Performance

Equipment Checks

WARNING: Do not plug in the monitor, modem, data logger, and computer until all cables are connected. ELECTRICAL SHOCK AND/OR EQUIPMENT DAMAGE MAY OCCUR OTHERWISE.

- Connect the Teledyne Model T200UP monitor and Teledyne Model T700U calibrator, power up, and allow a warm-up period for ~1 hour.

Gas Regulator Attachment

1. Connect the regulator to the cylinder and connect the line that will feed the mass flow controller to a vacuum pump.
2. With the cylinder valve tightly closed, open the regulator valve and vacuum the regulator for two minutes.
3. Close the regulator valve and open the cylinder valve. Increase the pressure to 100 psig.
4. Close the cylinder valve.
5. Repeat steps 2 – 4 an additional 4 times. During the last run, drop the regulator pressure to the normal operating level (usually 20-30 psig).
   Do not close the cylinder valve after the last run.
6. Disconnect the line from the vacuum pump and open the regulator valve to allow a very low flow to prevent ambient air from entering the dilution system.
7. Connect the tubing to pollutant mass flow controller in the dynamic dilution system.
8. Fully open the regulator valve.

- Verify and adjust, if necessary, the Model T200UP and Model T700U operational parameters. If system fails to achieve required operational parameters as listed above,

investigate causes and correct per manufacturer's recommendations until met.
- Conduct operational checks for zero / span solenoid and diagnostics / alarms events.
- Document actions on the 109 Form.

Note: the compressor must be plugged into a wall socket and not a surge suppressor.

B. Computer Data Logger System and Wireless Modem

a. Site Polling - manually poll the data logger to review data and edit flags if needed.

- Following the installation of components of the NO-NO_2-NOx monitoring system, the ECB staff should verify the performance and proper functioning of each component.

- Turn the main power "on" of all system components and ensure that components power lights are on. The data logger must be configured and initialized by following the instructions included in the manufacturer's manual.

- The times for the data logger, computer, and AV-Trend must be EASTERN STANDARD TIME. Also, must be synched to the NIST time provider in Colorado (± 1 minute). A task scheduler can be created in AV-Trend to sync the data logger and computer time. This task is accomplished by clicking on the date and time in the lower right corner of the computer screen. Select "**Change date and time settings**". Select "**Internet Time**" tab, and "**Change settings**". Check the box that states "**Synchronize with an Internet time server**". From the Server drop down menu, select "**time.nist.gov**." Press "**Update Now**". Select "**OK**" twice to exit.

  If the data logger time is not within 1 minute of NIST time but it matches the computer time, then there is a problem with the computer time. Either the computer is not synchronizing properly with the NIST time or the clock is drifting too much and needs to be synchronized more often or the computer needs to be replaced.

  If the data logger time is not within 1 minute of NIST time and it does not match the computer time and the computer matches NIST time, then there is a problem with the synchronization of the data logger time with the computer.

  Sources for setting the correct time
  1) Call ECB and ask for NIST time,
  2) Call the NIST Colorado time @ (303) 499-7111,
  3) Correct time loaded into cell phone,
  4) Correct time website, http://tycho.usno.navy.mil/

- Connect the zero air supply/zero air generator and the "NO" concentration standard to the T700U calibrator and the Model T200UP analyzer at atmospheric pressure and per manufacturer instructions if necessary. In order to satisfy all EPA requirements for precision and level 1 span checks (see 40 CFR 58, Appendix A, B), it is recommended that the filter be installed between the sample–span solenoid and the optical bench.

The Calibration Check control is via the calibrator:

2.17.1.7.1 Span Zero Check Procedure

- Press {**ESC**}{**ESC**} to return to the Home Menu
- Select: "**C**", Configuration Menu
- Select: "**C**", Configure Calibrations
- Select: "**1**", start Single Phase Calibration, <ENTER>
- Select: "**NOXCAL**", <ENTER>
- Select: "**SPAN ZERO**", <ENTER>
- Select: "**Phase duration**" (set to 1h), <ENTER>
- Select: "**Start single cal (NOW)**", <ENTER>

Monitor Actual Values

- Press {**ESC**}{**ESC**} to return to the Home Menu
- Select: "**D**", Real Time Display Menu
- Select: "**C**", Continuous Average Report
- Select: "**Show Channels**", <ENTER>
- Type in parameters: "**NO**", "**NO2**", and "**NOX**", <ENTER>
- Change # of flags to report from "**02**" to "**03**", <ENTER> (the "**<**", "**D**", and "**C**" flags will show)
- Use decimal Positioner?: "**Y**", <ENTER>
- Start continuous report: <ENTER> (this will show the minute averages as they are calculated and keeps all values on screen).
- Start SPAN0 and let it stabilize (about 30 to 45 minutes, not trending in any direction)

Abort SPAN0

- Press {**ESC**}{**ESC**} to return to the Home Menu
- Select: "**C**", Configuration Menu
- Select: "**C**", Configure Calibrations
- Select: "**W**", Abort a Calibration Program
- Select: "**NOTCAL**" <ENTER>

Note: once SPAN0 is aborted, calibrator goes to "STANDBY" mode

2.17.1.7.2 Span Check Procedure

- Press **{ESC}{ESC}** to return to the Home Menu
- Select: "**C**", Configuration Menu
- Select: "**C**", Configuration Calibrations
- Select: "**1**", start Single Phase Calibration, <ENTER>
- Select: "**NOXCAL**", <ENTER>
- Select: "**SPAN1**", <ENTER>
- Select: "**Phase Duration**" (set to 8h), <ENTER>
- Select "**Start Single Cal (NOW)**", <ENTER>

Monitor Actual Values

- Press {**ESC**}{**ESC**} to return to the Home Menu
- Select: "**D**", Real Time Display Menu
- Select: "**C**", Continuous Average Report
- Select: "**Show Channels**", <ENTER>

- Type in parameters: "**NO**", "**NO2**", and "**NOX**", <ENTER>
- Change # of flags to report from "**02**" to "**03**", <ENTER> (the "**<**", "**D**", and "**C**" flags will show)
- Use decimal Positioner?: "**Y**", <ENTER>
- Start continuous report: <ENTER> (this will show the minute averages as they are calculated and keeps all values on screen).
- Start SPAN1 and let it stabilize (about 30 to 45 minutes, not trending in any direction)

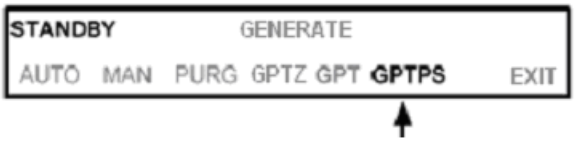
2.17.1.7.3 Titration Procedure

The gas phase titration procedure uses NO_2 to check the converter efficiency of T200UP. The following procedure uses gas phase titration to calibrate the NO_2 channel. The two points should be located at the 80-90% of full scale and 2-5% of full scale (in this order).

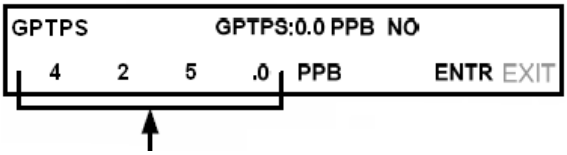
GPTPS: 80-90% FS (500 ppb scale)

press "**GEN**"

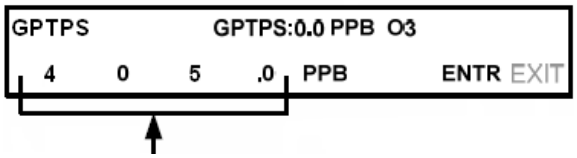
press "**GPTPS**"



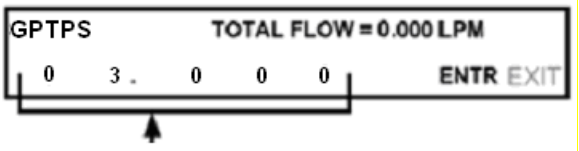
toggle the left most buttons to set the "**NO**" concentration (425) ppb, press "**ENTR**"



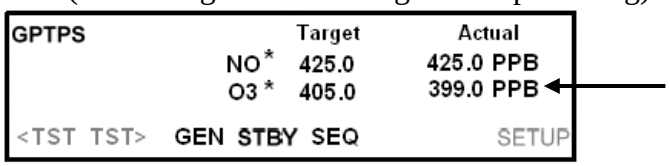
toggle the left most buttons to set the "**O3**" concentration (405) ppb, press "**ENTR**"



toggle the left most buttons to set the "**TOTAL FLOW"** (3.000), press "**ENTR**"



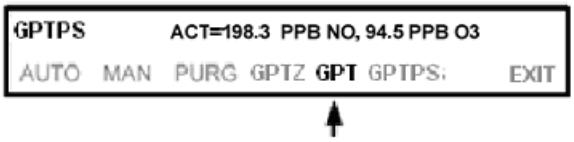
Note: Keep the T700U in **GPTPS** mode until the "**Actual"** value for O_3 is within 1PPB of the "**Target**" value entered (wait for "green active" light to stop flashing) + 5min.



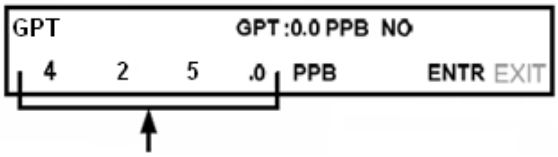
GPT: 80-90% FS (500 ppb scale)

press "**GEN**"

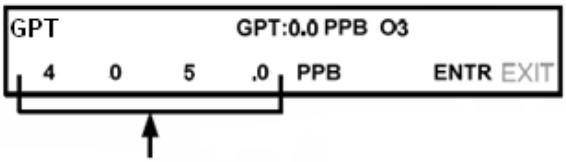
press "**GPT**"



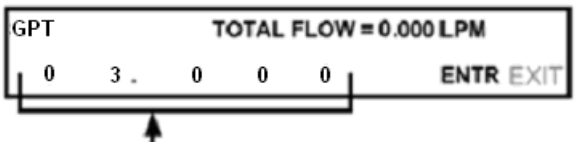
check to see if the "**NO"** concentration (425) ppb, press "**ENTR**"



check to see if the "**O3"** concentration (405) ppb, press "**ENTR**"



check to see if the "**TOTAL FLOW"** (3.000), press "**ENTR**"



Allow the analyzer to sample for an adequate period to achieve stability.

Note: Verify the gas phase titration for the 2-5% level results are acceptable.

2.17.1.7.4 Purge Procedure

Purge the calibrator until NOX STB= < 0.100ppb

- Abort SPAN1 using "**C**", "**C**", "**W**", "**NOTCAL**" <ENTER>

Check SPAN3

- Press **{ESC}{ESC}** to return to the Home Menu
- Select: "**C**", Configuration Menu
- Select: "**C**", Configure Calibrations
- Select: "**1**", start Single Phase Calibration, <ENTER>
- Select: "**NOXCAL**", <ENTER>
- Select: "**SPAN3**", <ENTER>
- Select: "**Phase Duration**" (set to 1h), <ENTER>

- Select "**Start Single Cal (NOW)**", <ENTER>

Monitor Actual Values

- Press {**ESC**}{**ESC**} to return to the Home Menu
- Select: "**D**", Real Time Display Menu
- Select: "**C**", Continuous Average Report
- Select: "**Show Channels**", <ENTER>
- Type in parameters: "**NO**", "**NO2**", and "**NOX**", <ENTER>
- Change # of flags to report from "**02**" to "**03**", <ENTER> (the "**<**", "**D**", and "**C**" flags will show)
- Use decimal Positioner?: "**Y**", <ENTER>
- Start continuous report: <ENTER> (this will show the minute averages as they are calculated and keeps all values on screen).
- Abort SPAN3 using "**C**", "**C**", "**W**","**NOTCAL**" <ENTER>

  Note: once SPAN3 is aborted, calibrator goes to "STANDBY" mode

- Leave channels down for calibration.
- Turn off computer screen. **DO NOT** close the AV-Trend Software, **DO NOT** turn off the computer.

A calibration check should also be performed by the ECB, following any one of the activities listed below:

- A new site installation
- A monitor replacement
- A calibrator replacement
- Any repairs that may affect the calibration of the instrument such as the pump, and span gas

2.17.1.7.5 Particulate Filters Inspection and Replacement

The particulate filter should be inspected often for signs of plugging or contamination.

When filter (PN 002730000) is changed (see **Figure 7**, pg. 37), handle it and the wetted surfaces of the filter housing as little as possible. Do not touch any part of the housing, filter element, PTFE retaining ring, glass cover and the o-ring with your bare hands. Teledyne API recommends using gloves or tweezers to avoid contamination of the sample filter assembly.

To change the filter, the T200UP should be in the "SAMPLE" mode:

1. Remove the exhaust port line from the instrument rear panel (see **Figure 5**, pg. 36).

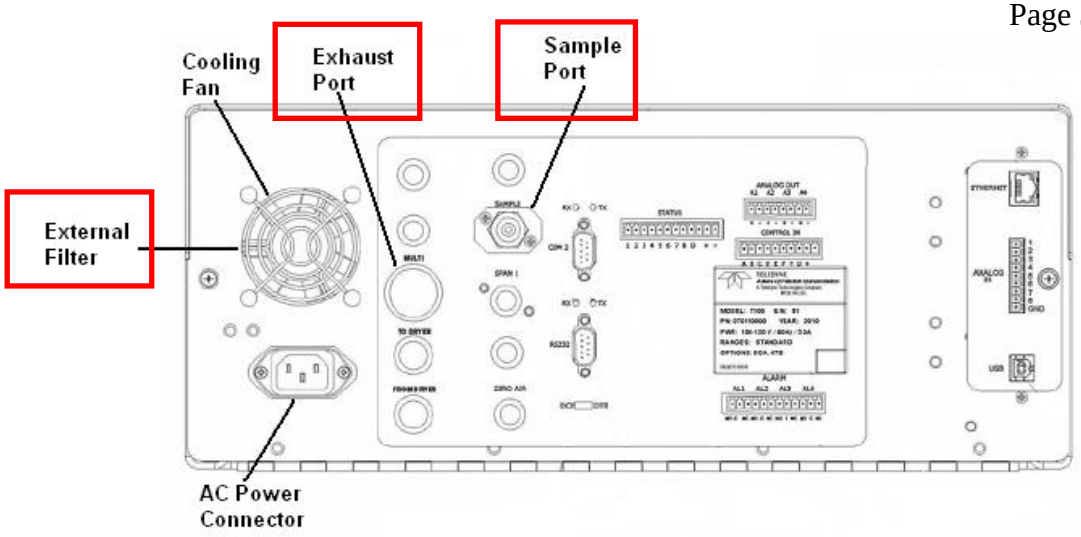


Figure 5 T200UP Rear Panel

2. Open the T200UP's hinged front panel and unscrew the hold down ring on the filter assembly (see **Figure 7**, pg. 37).
3. Carefully remove the hold down ring, glass filter cover, o-ring, PTFE o-ring, and filter element.
4. Replace the filter, being careful that the element is fully seated and centered in the bottom of the holder.
5. Reinstall the PTFE o-ring with the notches up and aligned with the hole. Inspect the seal between the edge of filter and the PTFE o-ring to assure a proper seal. Next install the o-ring, the glass cover, and then screw on the hold down ring, hand tighten.
6. Re-install the exhaust port line to the instrument.
7. The filter does not require conditioning.

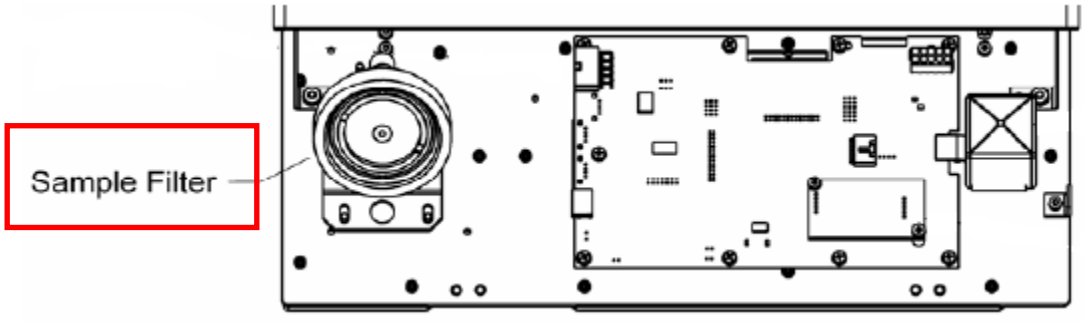


Figure 6 T200UP Hinged Front Panel

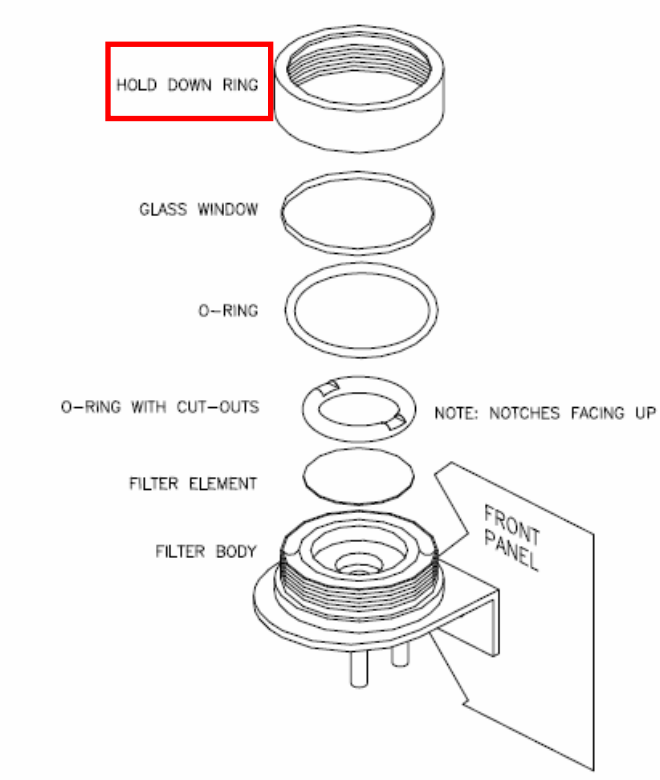


Figure 7 T200UP Particulate Filter

2.17.1.7.6 Vacuum Leak and Pump Check

Leaks are the most common cause of analyzer malfunction. The method described here is easy, fast and detects, but does not locate, most leaks. It also verifies the sample pump condition.

1. Remove the top cover and cap the O3 dryer vent (see **Figure 8**, pg. 38).
2. Remove the sample line and cap the sample inlet port (see **Figure 5**, pg. 36), cap must be wrench-tight.
3. After several minutes, note the "**RCEL**" pressure (press "**<TST**" or "**TST>**" **RCEL [value]**) and the "**SAMP**" pressure (press "**<TST**" or "**TST>**" **SAMP [value]**) readings:
   - If both readings are within 0.2 in-Hg-A **of each other** the pump is in acceptable condition. If the pressure is greater than 0.2 in-Hg-A, check the caps and try the test again. If it fails a second time, conduct an investigation of the system.
   - It is still possible that the instrument has minor leaks.
4. Remove the caps and re-connect the sample line.

Note: this will probably cause a warning message by flashing the "FAULT" LED (press "**CLR**" to clear warning message).

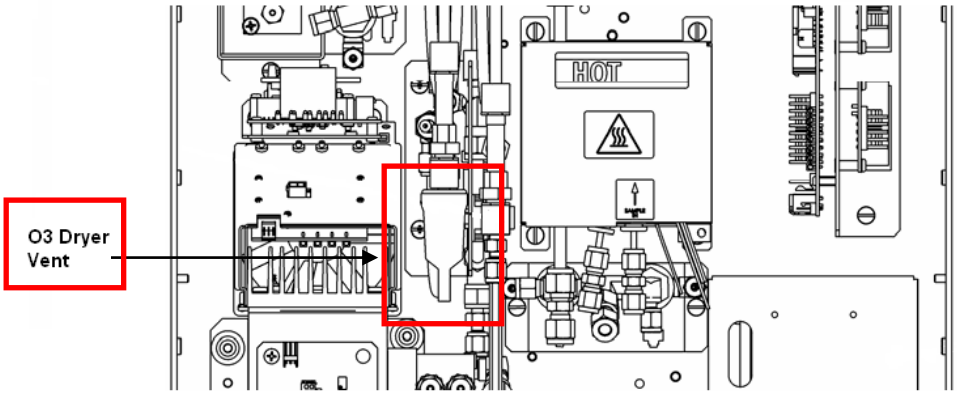


Figure 8 T200UP O3 Dryer Vent Location

2.17.1.8 Equipment Identification

The Model T200UP NO-NO_2-NOx Analyzer, Model T700U Gas Calibrator, Model 701 Zero Air Generator, data logger and computer identification numbers will be documented / logged on the 109 Form.

2.17.1.9 NO-NO_2-NOx Monitoring System Maintenance

ECB is also intimately involved in the overall monitoring system maintenance to ensure optimum continual NO_2 data quality. Generally, maintenance can be subdivided into two groups:

Preventive (scheduled) maintenance and corrective (immediate on-the-spot repair) maintenance.

- Preventive maintenance is an orderly program of cleaning, lubricating, reconditioning, adjusting, and testing equipment to prevent failure during use. An effective preventive maintenance program will increase both the data completeness and reliability of the entire monitoring system.
- Corrective maintenance involves having necessary parts available to replace parts for the monitors located in the field.

Note: ECB staff must document any and all maintenance activities, irrespective of type in the instrument logbook.

Preventive Maintenance
Included here are some of the periodic maintenance procedures for some of the main components of the monitoring system that must be performed by the ECB staff to ensure proper operation.

T200UP - see manufacturer's instructional manual "Operational Manual, Model T200 Nitrogen Oxide Analyzer, 13 February 2012" and "Model T200UP Photolytic Nitrogen Oxide Analyzer (Addendum to T200 Manual), 27 March 2012, Initial Release Rev A" for other related details and or for replacement of any other subassembly modules of the NO-NO_2-NOx monitoring system.

T700U - see manufacturer's instructional manual "Operational Manual, Model T700 Dynamic Dilution Calibrator, 6 October 2010" and "Model T700U Calibrator (Addendum to T700 Manual), 6 October 2010".

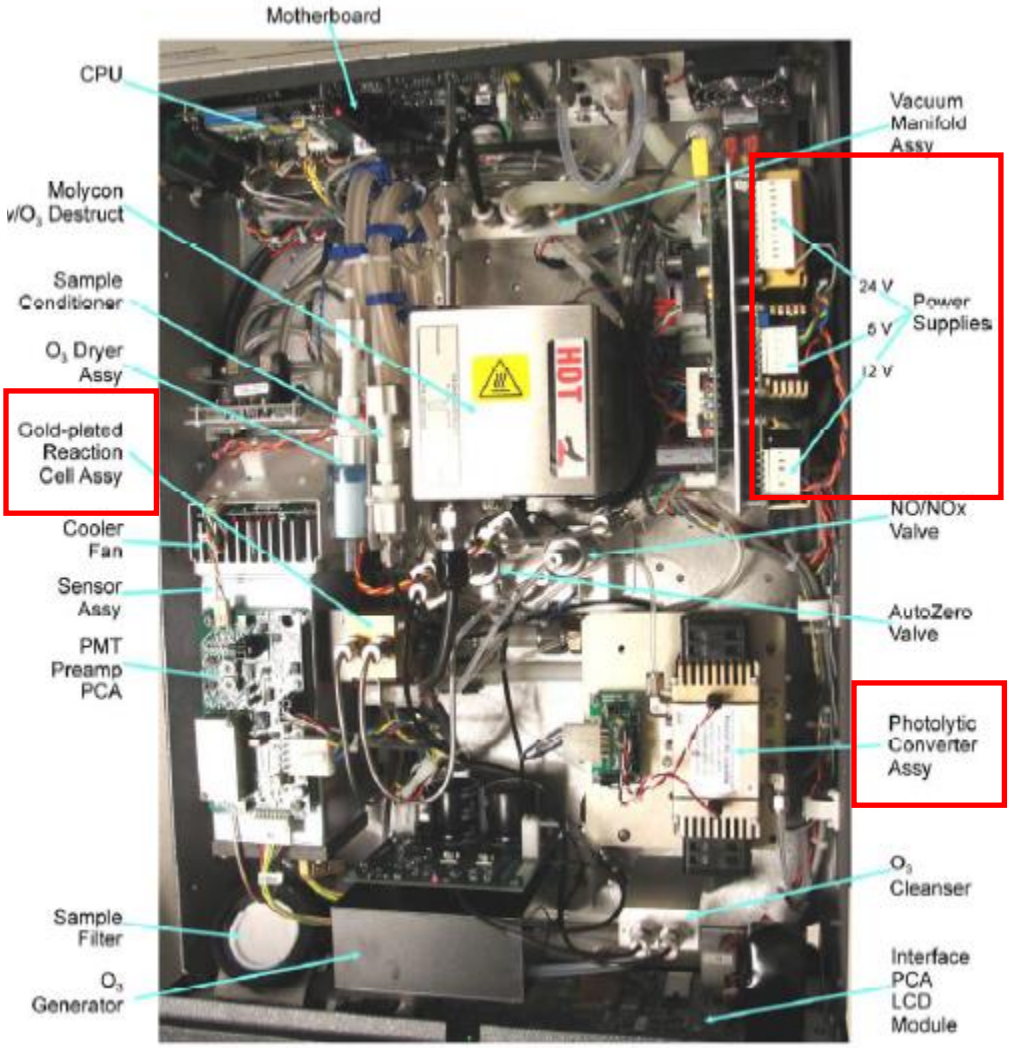


Figure 9 T200UP Top View

a. **Lamp Replacement or Cleaning**

Equipment Required:
Lamp Assembly (KIT 000328)
Screwdriver

1. Power OFF the instrument.
2. Remove the setscrew located in the top, center of the front panel.
3. Remove the top cover of the analyzer.
4. Slide the cover backward until it clears the analyzer's front bezel
5. Lift the cover straight up.

6. Locate the photolytic converter assembly (see **Figure 9**, pg. 39) and remove both lamp assemblies as follows:
   a. Gently disconnect the electrical connectors (they are delicate) between the housing and each lamp assembly.
   b. Remove the four socket head cap screws holding the body of the converter to the base plate. Remove the Photolytic Converter assembly from the analyzer.
   c. Remove the four screws that secure the lamp assembly at either end of the housing.
   d. Follow either Step i or Step ii next, and then continue to Step 7.
   Cleaning- For cleaning, use distilled water and a non-abrasive, lint-free cloth.
      i. For cleaning, wipe the LED array and the interior of the Teflon chamber.
      ii. For replacement, remove each lamp assembly and install the replacement lamp assemblies.
7. Reassemble in reverse order (screws, electrical connection).
8. Conduct a leak check per instructions in the T200UP manual Maintenance section.
9. Check the converter efficiency.

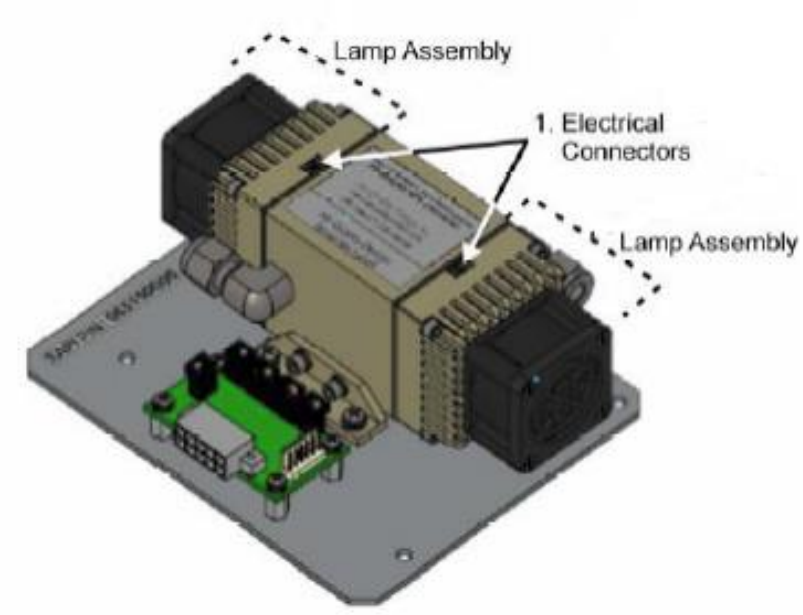


Figure 10 T200UP Lamp Assembly

b. **Cleaning the Reaction Cell**

A dirty reaction cell will cause excessive noise, drifting zero or span values, low response or a combination of all. Locate the reaction cell, see **Figure 9**, pg. 39 and **Figure 11**, pg. 42.

To clean the reaction cell, it is necessary to remove it from the sensor housing.

1. Turn off the instrument power and vacuum pump.
2. Disconnect the black 1/4" exhaust tube and the 1/8" sample and ozone air tubes from the reaction cell. Disconnect the heater/thermistor cable.
3. Remove two screws (Teledyne API P/N SN144) and two washers holding the reaction cell to the PMT housing and lift the cell and manifold out.
4. Remove two screws (Teledyne API P/N SN150) and two washers.

5. The reaction cell will separate into two halves, the stainless steel manifold assembly and the black plastic reaction cell with window gasket, stainless steel reaction cell sleeve, optical filter and O-rings.
6. The reaction cell (both plastic part and stainless steel sleeve) and optical filter should be cleaned with Distilled Water (DI - Water) and a clean tissue, and dried thereafter.
7. Usually it is not necessary to clean the sample and ozone flow orifices since they are protected by sintered filters.

- If tests show that cleaning is necessary, refer to the manual on how to clean the critical flow orifice.

8. **Note**: Do not remove the sample and ozone nozzles. They are Teflon threaded and require a special tool for reassembly. If necessary, the manifold with nozzles attached can be cleaned in an ultrasonic bath.
9. Reassemble in proper order and re-attach the reaction cell to the sensor housing. Reconnect pneumatics and heater connections, then re-attach the pneumatic sensor assembly and the cleaning procedure is complete.
10. After cleaning the reaction cell, it is also recommended to exchange the ozone supply air filter chemical as described in Section 11.3.3 of the manual.
11. After cleaning, the analyzer span response may drop 10 - 15% in the first 10 days as the reaction cell window conditions. This is normal and does not require another cleaning.

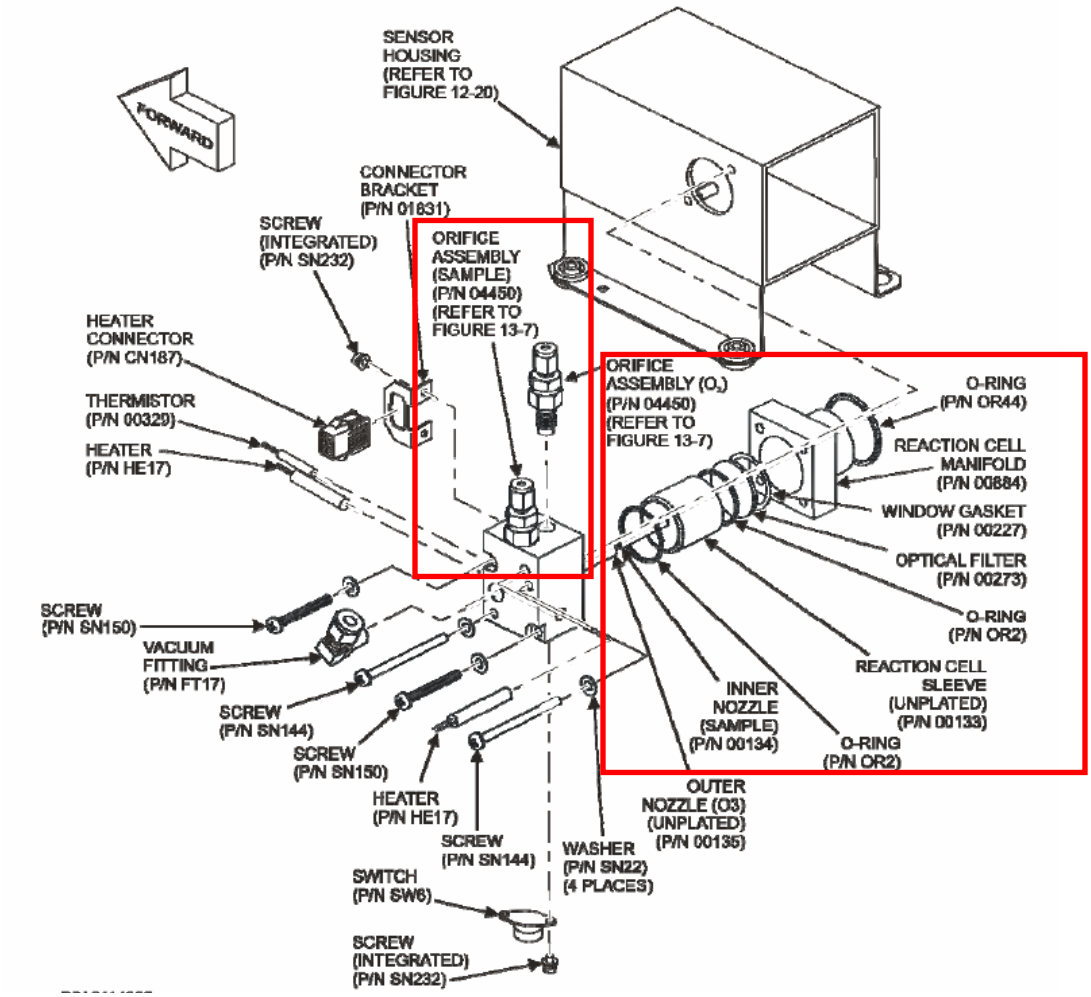


Figure 11 T200UP Reaction Cell

c. **DC Power Supply Replacement**

DC Power Supply (5 VDC, 12VDC, and 24 VDC)

1. Turn instrument OFF, unplug the power cord, and remove the cover.
2. Disconnect all the power supply electrical connections. Note connector locations to facilitate re-connection.
3. Locate the three DC Power Supplies, see **Figure 9**, pg. 39.
4. Loosen the captive screw securing the power supply to the chassis plate and lift out the power supply
5. Turn the power supply upside down and remove the four retaining screws securing the power supply to the power supply plate and remove the power supply.
6. To install the DC power supply, follow the previous steps in reverse.

d. **Rebuilding the External Sample Pump**

The sample pump head periodically wears out and must be replaced when the **RCEL** pressure exceeds 4.2 in-Hg-A. **Note:** the external sample pump should be replaced annually.

1. A pump rebuild kit is available from the factory. Refer to the label on the pump for the part number. Instructions and diagrams are included in the kit.
2. A flow and leak check after rebuilding the sample pump is recommended.
3. A span check and re-calibration after this procedure is necessary as the response of the analyzer changes with the RCEL pressure.

e. **Procedure for Replacing Filters on External Pump**

1. Power down the analyzer and pump.
2. For internally mounted filters, skip the next two steps.
3. Remove the analyzer exhaust tube from the dust filter.
4. Remove the particle filter from the pump by pushing the white plastic ring into the fitting and pulling the filter out of the fitting.

Note: If necessary, use needle-nose pliers to pry the filter out of the fittings.

5. Push a new filter into the pump fitting and ensure that the arrow on the filter points towards the pump.
6. Push the exhaust tubing onto the filter. Skip the next two steps.
7. For internally mounted filters at the inside rear panel, remove the chassis and locate the filter between the vacuum manifold and the exhaust port fitting.
8. Disconnect the clear tubing from the filter body and change the filter with the arrow pointing against the gas flow. To remove the hose clamps, slide the two clamp ends in opposite directions with a needle-nose pliers until the clamp comes apart. Reconnect the tubing by using the same or new clamps and pushing tightening them until a good seal is achieved.
9. Restart the pump and clear any error warnings from the front panel display.
10. After about 5 minutes, check the RCEL pressure reading and ensure that it is similar to its value before changing the filter but less than 4.2 in-Hg-A.

f. **T200UP Converter Replacement**

1. Turn off the analyzer power.
2. Remove the instrument cover, locate the converter (see **Figure 9**, pg. 39) and allow the photolytic converter to cool
3. Remove the converter assembly cover as well as the insulation (top layer and corner cut out layers) until the converter assembly can be seen.
4. Remove the tube fittings from the converter assembly.
5. Disconnect the power and the thermocouple from the converter assembly.
6. Unscrew the steel cable clamp (for the power leads) from the converter housing with a Phillips-head screw driver.
7. Remove the converter assembly (converter cartridge and band heater) from the converter housing.

- Make a note of the orientation of the tubes relative to the heater cartridge.

8. Unscrew the band heater and loosen it.
9. Remove the old converter cartridge.
10. Wrap the band heater around the new replacement converter cartridge and tighten the screws using a high-temperature anti-seize agent (Teledyne API P/N CH42) such as copper paste.

- Ensure to use proper alignment of the heater with respect to the converter tubes.

11. Replace the converter assembly by routing the cables through the holes in the converter housing and reconnecting them properly.
12. Reconnect the steel cable clamp around the power leads for safe operation.
13. Reattach the tube fittings to the converter and replace the insulation (top layer and corner cut out layers).
14. Reinstall the converter assembly cover.
15. Reinstall the instrument cover and power up the analyzer.
16. Allow the converter to burn-in for 24 hours, and then recalibrate the instrument.

g. **T200UP Converter Efficiency Check**

Note: This operation should be done when the photolytic converter is replaced. A converter efficiency check should be done at the 80-90% and 10-20% FS levels ("Operational Manual, Model T200 Nitrogen Oxide Analyzer 13 February 2012", Section **12.7.11**, pg. 298).

1. For the sake of numbers, 160 PPB NO gas was chosen as a reference point, you don't have to pick these values, they are just an example. There is also an assumption that the analyzer has a good calibration done @ 160 PPB NO span gas. If this is not the case, then once you are done with the leak check on the analyzer, input your 160 PPB NO span gas & calibrate the analyzer.

NOTE: For the GPT to be performed correctly there must be a minimum of 10-20% MORE NO than O3 produced. For example, if the ozone produced is 140 PPB then the NO used must be 160 or more.

2. Leak check the machine to ensure that there are no leaks in the analyzer.
3. If you have input a CE factor into the instrument firmware (this would be in the CALCONC- CONV-SET menu) other than 100%, change this back to 100% for the duration of this test.
4. The first gas check is to test to see how much the converter is eating NO gas or out gassing NO gas. Perform a straight dilution with NO gas & air as a diluent gas. Input this 160 PPB NO gas into the analyzer, allow the machine to stabilize, & write down the NOx value on your data sheet on line 6.
5. For the T700U generate 160 PPB of NO, and 0 PPB of O3. Generate a GPTZ with 160 PPB of NO and 140 PPB of O3. After allowing time to stabilize, record the NOX value on line 7, and the NO value on line 8. This is to allow for the extra flow from the ozone generator to be taken into account for when determining the change in the total concentration of gas takes place.
6. The next step is to perform your GPTPS. Generate 160 PPB of NO gas & input 140 PPB of O3. Allow instrument to run for 30 minutes or until the green sample light on the front display stops flashing.

7. The next step is to perform your GPT. Generate the same 160 PPB NO gas & input 140 PPB of O3 (or generate 160 PPB NO & 140 PPB NO2, if that's what your calibrator says). Allow the machine to stabilize for 30 minutes & then write down the NOx value on line **9** & the NO value on line **10**.
8. Subtract line **7** from line **6** & put that onto line **8**
9. Subtract line **10** from line **9** & put that onto line **11**
10. Put the number from line **8** into the letter **A** on line **12** & put the number from line **11** into the letter **B** on line **12**.
11. Divide **A** by **B** & multiply it by 100 & put it into letter **C** on line **12**.
12. Put the number in letter **C** onto the **C** on line **13** & subtract that value from 100 & put it into letter **D** on line **13**. This is the converter efficiency.
13. This value should be >96%. For CEMS applications, a CE of <96% might be acceptable, depending on application & the guideline set up by the regulatory agency. In any application, check application, check with your regulatory agency to see what the minimum CE factor is before replacing the converter.

6 (NOx ORIG) (NOX mode, O3 off) _____ PPB
7 (NOx REM) (NOX mode, O3 on) _____ PPB
8 NOX LOSS (2 - 3) _____ (***A***) (<4% of NOx ORIG; ex: for 160PPB 4% is 6PPB)
9 (NO ORIG) (NO mode, O3 off) _____ PPB
10 (NO REM) (NO mode, O3 on) _____ PPB
11 NO2 (5 - 6) _____ (***B***)
12 Efficiency LOSS [(***A*** / ***B***) x 100] = [(***A***/ ***B***) x 100] = ***C*** %
13 Total Conv Eff [100% – ***C***] = 100% - ***C*** = ***D*** % (> 96%)

h. **Replacing Critical Flow Orifices**

There are several critical flow orifices installed in the T200U (see **Figure 12**, pg. 46 for location of each orifice). Despite the fact that these flow restrictors are protected by sintered stainless steel filters, they can, on occasion, clog up, particularly if the instrument is operated without sample filter or in an environment with very fine, sub-micron particle-size dust.

To clean or replace a critical flow orifice:

1. Turn off power to the instrument and vacuum pump.
2. Remove the analyzer cover and locate the reaction cell (see **Figure 11**, pg. 42).
3. Unscrew the 1/8" sample and ozone air tubes from the reaction cell.
4. For orifices on the reaction cell:
   Unscrew the orifice holder with a 9/16" wrench.
   This part holds all components of the critical flow assembly.
   Appendix B (manual) contains a list of spare part numbers.
5. For orifices in the vacuum manifold (see **Figure 15,** pg. 48): the assembly is similar to the one shown in except:
   Without the orifice holder, P/N 04090, and bottom O-ring, P/N OR34 and;
   With an NPT fitting in place of the FT 10 fitting.

6. After taking off the connecting tube, unscrew the NPT fitting.
7. Take out the components of the assembly:
   - spring
   - sintered filter
   - two O-rings
   - the orifice

Note: For the vacuum manifold only, you may need to use a scribe or pressure from the vacuum port to get the parts out of the manifold.

8. Discard the two O-rings and the sintered filter and install new ones.
9. Reassemble the parts (as shown in **Figure 13**, pg. 47).
10. Reinstall the critical flow orifice assembly into the reaction cell manifold or the vacuum manifold.
11. Reconnect all tubing, tubing, power up the analyzer and pump. After a warm-up period of 30 minutes, carry out a leak test.

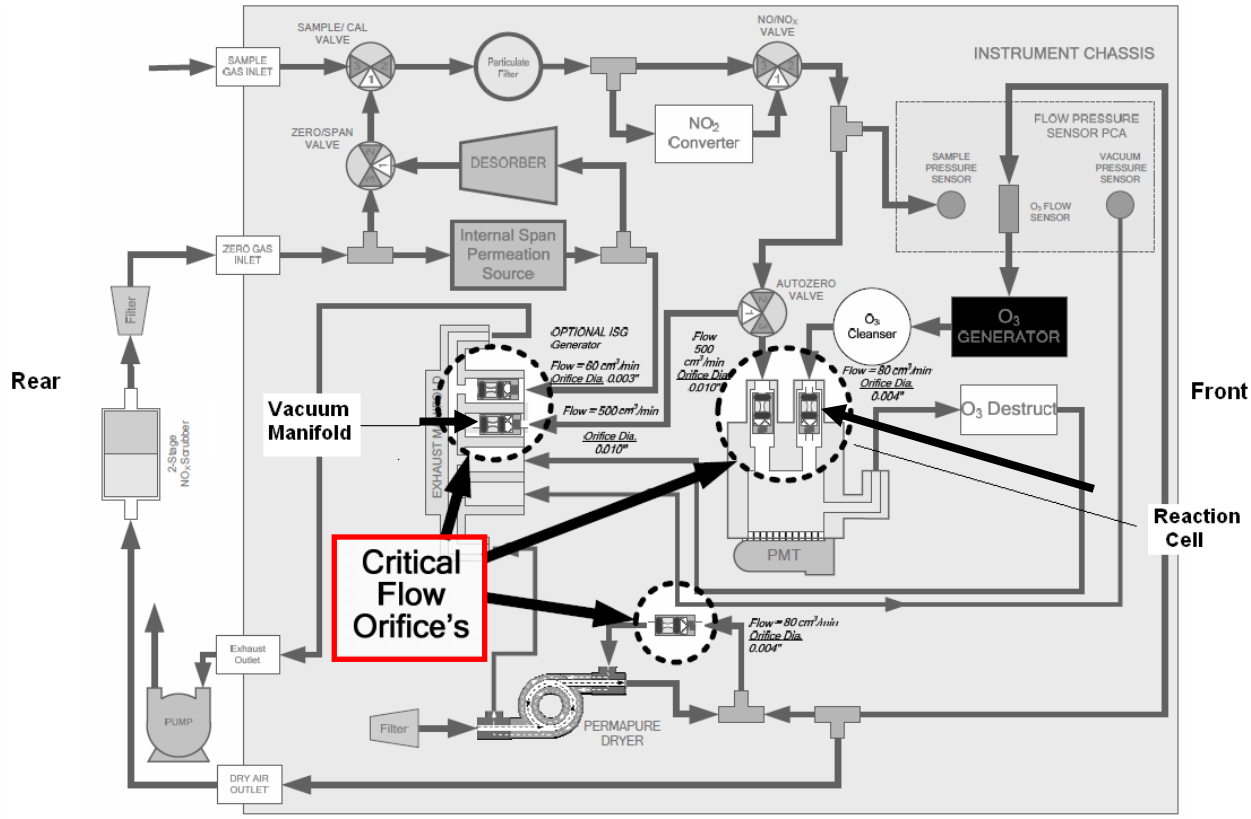


Figure 12 T200UP Critical Flow Orifice Locations

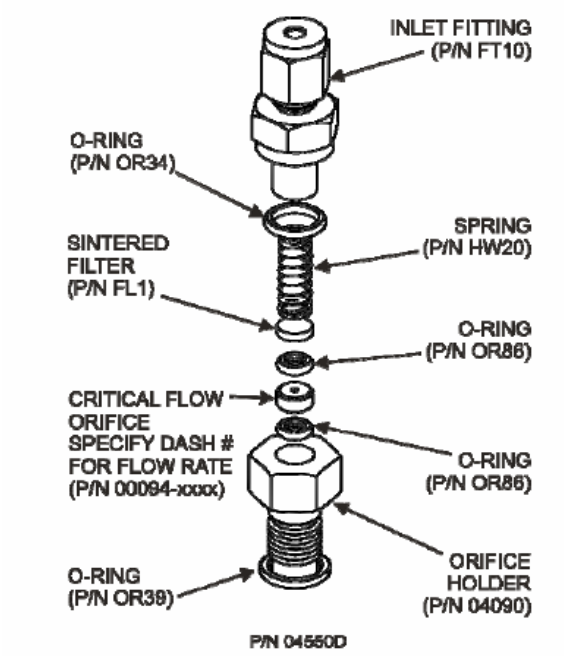


Figure 13 T200UP Critical Flow Orifice

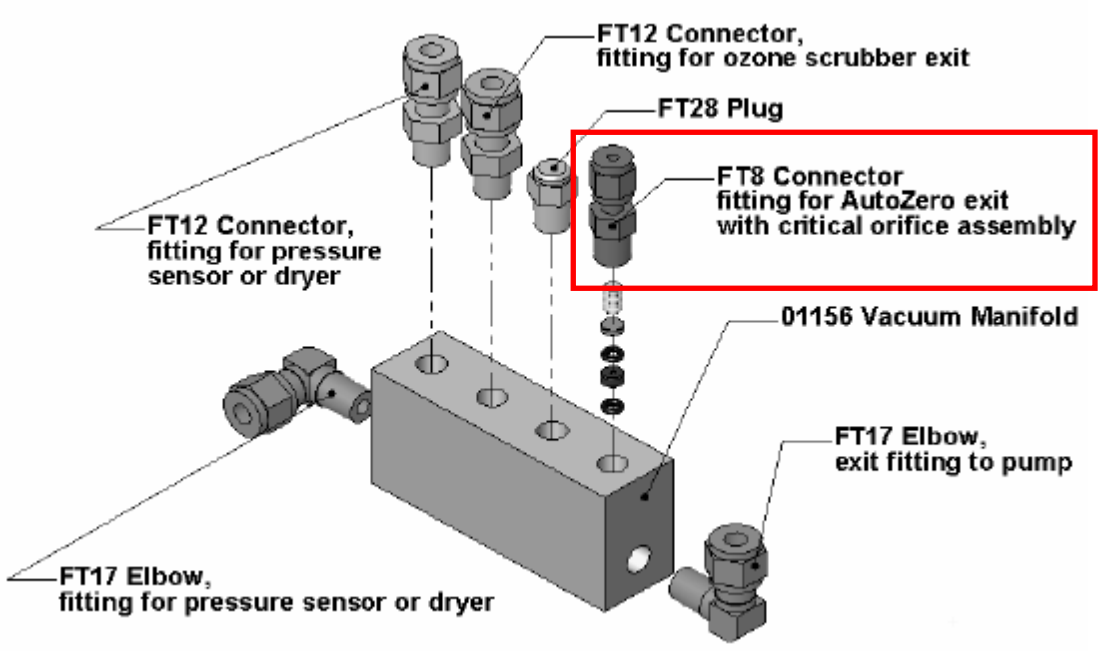


Figure 14 T200UP Vacuum Manifold Orifice

Corrective Maintenance

Caution: All power should be turned off on the instrument before any electrical maintenance is performed.

The following are step-by-step procedures to be used by the ECB staff to replace the subassembly modules in the monitoring system (see manufacturer's instructional manuals "Operational Manual, Model T200 Nitrogen Oxide Analyzer, 13 February 2012" and "Model T200UP Photolytic Nitrogen Oxide Analyzer (Addendum to T200 Manual), 27 March 2012, Initial Release Rev A" for other related details and or for replacement of any other subassembly modules of the NO-NO_2-NOx monitoring system).

a. **Solenoid Valve Replacement**
Solenoid Valve

1. Disconnect solenoid. **Note electrical connections to facilitate re-connection.**
2. Remove plumbing from solenoid. Note plumbing connections to facilitate re-connection.
3. Pull solenoid valve from mounting clip.
4. To replace solenoid, follow previous steps in reverse.

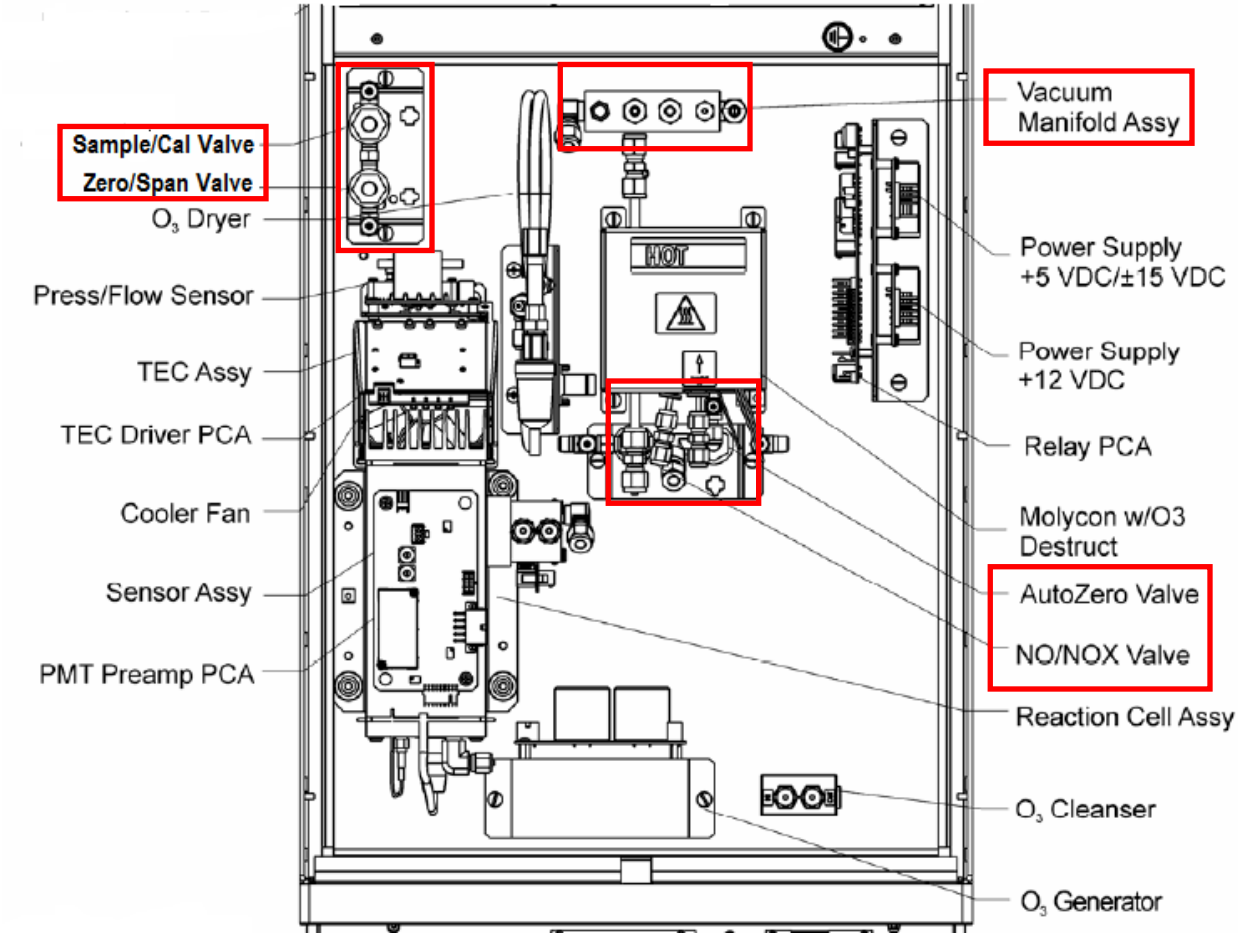


Figure 15 T200UP Solenoid Valve Location

b. **External Filters**:
Check external filters located on rear panel assembly (see **Figure 5**, pg. 36), clean/replace if needed.

Routine Maintenance
As a part of routine maintenance and or during any (including during site audit) site visit, ECB will perform following:

1. Document the time and reason for the site visit in the site logbook.
2. Check that site-building temperature is between 20ºC and 30ºC.
3. Check that the probe and sample line are connected and secure.
4. Check the air conditioner, heater and lines for adequate/proper function
5. Check that the building is secure. Vandalism is to be reported to the ECB Supervisor.
6. Check site building for any problems (e. g. leaks, infestations, etc.).
7. Check that the heat tape is working and the site insulation is adequate
8. Check that all monitoring systems are operating within normal ranges (unless the reason is for site start-up).
9. Down any channels for monitors being repaired, replaced or audited during the repair, replacement or audit.
10. Up any channels after monitors are repaired, replaced or audited after the repair, replacement or audit.
11. Time duration wise, change the sample probe and funnel every year.

Caution: <u>All power should be turned off on the instrument before any electrical maintenance is performed.</u>

2.17.1.10 Accuracy Audits and Reporting

As a part of the NO-NO_2-NOx system maintenance, the ECB will perform the accuracy audits.

1. Each NO-NO_2-NOx monitor in the network must be audited at least once each year with an effective date of April 27, 2016 (ref 40 CFR Part 58 Appendix A Section 3.1.2 Annual Performance Evaluation as described in for all sites). The ECB staff should perform the audit using an audit cylinder and calibrator that is different from the standards and calibrators used for calibration and spanning.

- One point must be within two to three times the method detection limit of the instruments within the PQAOs network.

- The second point will be less than or equal to the 99th percentile of the data at the site or the network of sites in the PQAO or the next highest audit concentration level.

- The third point can be around the primary NAAQS or the highest 3-year concentration at the site or the network of sites in the PQAO.

2. Connect the T700U audit calibrator as per manufacturer’s instruction. Secure a separate certified Protocol II cylinder of "NO" gas, connect and purge regulator as per manufacturer’s instructions.

3. Follow the T700U audit calibrator procedures.

4. Plug in the audit calibrator, turn the power "**ON**" and allow audit calibrator to equilibrate.

During the site visit for the audit, ECB staff will:

1. Check site temperature.
2. Check that the probe/sample lines are connected.
3. Check that the funnel is clean and in place.
4. Check that the building is secured.
5. Check that all components of the monitoring system are operating adequately.
6. Conduct the accuracy audit, titrations and calculate percent differences while at the site.

For the continuous NO-NO_2-NOx monitors, the ECB must not perform audits between 6:00 AM and 9:00AM "Local Standard Time". The cylinders and calibrators used for auditing must be a different one than the calibrator and cylinder used for calibration and spanning. The T700U "audit calibrator" must be certified for nine (9) months. The auditor must not be the same as the one who conducts the routine monitoring, calibrations, and analysis. The monitor must operate in its normal sampling mode, and the audit gas must pass through the existing sample inlet and particulate filter.

At least three (3) NO/NOX concentrations must be introduced to the analyzer being audited and these must be between the following ranges:

Audit Level	Concentration Range	Criteria
Zero	0.000 ppm	± 0.001 ppm
1	0.0003 - 0.0029 ppm	± 0.0015 ppm
6	0.0500 - 0.0999 ppm	10%
7	0.1000 - 0.2999 ppm	10%

At least three (3) NO_2 converter efficiencies must be introduced to the analyzer being audited and these must be between the following ranges:

Audit Level	Concentration Range	Criteria
1	0.0003 - 0.0029 ppm	≥ 96%
5	0.0030 - 0.0049 ppm	≥ 96%
7	0.1000 - 0.2999 ppm	≥ 96%

ECB completes the AQ 121 and AQ 109 report form, reviews the report and forwards the information to the Section Chief of Ambient Monitoring ***within 5 workdays*** of conducting the audit.

If audit results are not within the acceptable range of Zero - ± 0.001 ppm, Level 1 - ± 0.0015 ppm, Level 6 & 7 - ± 10% of the expected values, the auditor will print out the last auto-calibration, calculate percent differences and contact the ECB Supervisor. The ECB Supervisor immediately will investigate the audit results and determine the problem(s). If the problem is with the ECB equipment, the ECB Supervisor fixes the problem with the audit equipment and notifies the staff to repeat the audit.

However, if the problem(s) is determined to be with the site equipment, then the ECB Supervisor takes appropriate steps to either make arrangement to repair or replace the site equipment. In this case, the ECB Supervisor informs the site operator of his action(s). If the problem is a major site operation problem, the ECB Supervisor informs the site operator, the Regional Ambient Monitoring Coordinator, and the Projects and Procedures Supervisor.

Disable the data logger channels: While disabled, values are collected but flagged as invalid data.

- Press {**ESC**}{**ESC**} to return to the Home Menu
- Select: "**C**", Configuration menu
- Select: "**D**", Configure data channels
- Select: "**M**", Disable/Mark Channel Offline
- Select: "**NO**", <ENTER>
- Select: "**M**", Disable/Mark Channel Offline
- Select: "**NO2**", <ENTER>
- Select: "**M**", Disable/Mark Channel Offline
- Select: "**NOX**", <ENTER>

5. **Start the audit**: use the procedure included in the NO-NO2-NOx 2.17.2 Monitoring System Section II, "Operator Responsibilities, Rev. 1.1, January 19, 2016".

6. **Start audit SPAN0**: ECB activates the certified audit calibrator for "**SPAN0**".
   - Press {**ESC**}{**ESC**} to return to the Home Menu
   - Select: "**C**", Configuration menu
   - Select: "**C**", Configuration Calibrations
   - Select: "**1**", start Single Phase Calibration, <ENTER>
   - Select: "**NOXCAL**", <ENTER>
   - Select: "**SPAN0**", <ENTER>
   - Scroll down and highlight "**Phase duration**" (set to 1h), <ENTER>
   - Scroll down and select: "**Start Single Cal** (**NOW**)", <ENTER>

Monitor Actual values

- Press {**ESC**}{**ESC**} to return to the Home Menu
- Select: "**D**", Real Time Display Menu
- Select: "**C**", Continuous Average Report
- Select: "**Show Channels**", <ENTER>
- Type in parameters: "**NO**", "**NO2**", and "**NOX**", <ENTER>
- Change # of flags to report from "**02**" to "**03**", <ENTER> (the "**<**", "**D**", and "**C**" flags will show)
- Use decimal Positioner?: "**Y**", <ENTER>
- Start continuous report: <ENTER> (this will show the minute averages as they are calculated and keeps all values on screen).
- Start SPAN0 and let it stabilize (about 30 to 45 minutes)
- Record 5 consecutive stable (not trending in any direction) one-minute averages

- Abort SPAN0 using "**C**", "**C**", "**W**", "**NOXCAL**", <ENTER>

7. **Start audit SPAN1**: ECB activates the certified audit calibrator for "**SPAN1**".
   - Press {**ESC**}{**ESC**} to return to the Home Menu
   - Select: "**C**", Configuration menu
   - Select: "**C**", Configuration Calibrations
   - Select: "**1**", start Single Phase Calibration, <ENTER>
   - Select: "**NOXCAL**", <ENTER>
   - Select: "**SPAN1**", <ENTER>
   - Scroll down and highlight "**Phase duration**" (set to 8h), <ENTER>
   - Scroll down and select: "**Start Single Cal** (**NOW**)", <ENTER>

Monitor Actual values

- Press {**ESC**}{**ESC**} to return to the Home Menu
- Select: "**D**", Real Time Display Menu
- Select: "**C**", Continuous Average Report
- Select: "**Show Channels**", <ENTER>
- Type in parameters: "**NO**", "**NO2**", and "**NOX**", <ENTER>
- Change # of flags to report from "**02**" to "**03**", <ENTER> (the "**<**", "**D**", and "**C**" flags will show)
- Use decimal Positioner?: "**Y**", <ENTER>
- Start continuous report: <ENTER> (this will show the minute averages as they are calculated and keeps all values on screen).
- Start SPAN1 and let it stabilize (about 30 to 45 minutes)
- Record 5 consecutive stable (not trending in any direction) one-minute averages
- Conduct the remaining audit point levels using the previous procedure.
- Abort SPAN1 using "**C**", "**C**", "**W**", "**NOXCAL**", <ENTER>
- Repeat the span procedure for the remaining audit points

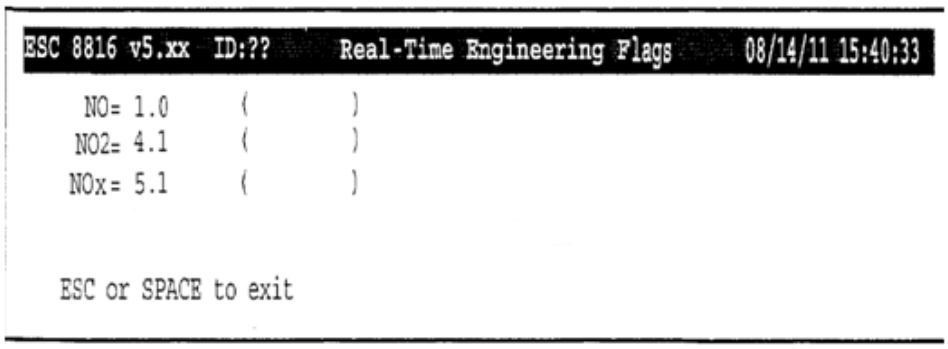
8. Conduct the three audit titrations
9. Up the data logger channels
   - Press {**ESC**}{**ESC**} to return to the Home Menu
   - Select: "**C**", Configuration Menu
   - Select: "**D**", Configure Data Channels
   - Select: "**E**", Enable/Mark Channel Online
   - Select: "**NO**", <ENTER>
   - Select: "**E**", Enable/Mark Channel Online
   - Select: "**NO2**", <ENTER>
   - Select: "**E**", Enable/Mark Channel Online
   - Select: "**NOX**", <ENTER>

Check to see if flags are disabled and instrument is polling

Monitor Actual Values

- Select "**D**", Real Time Display Menu
- Select "**C**", Continuous Average Report
- Select: "**Show Channels**", <ENTER>
- Type in parameters "**NO**", "**NO2**", "**NOX**", <ENTER>

- Change # of flags to report from "**02**" to "**03**", <ENTER>
- Use decimal Positioner? Type "**Y**", <ENTER>
- Start continuous report: this will show minute averages as they are calculated and keeps all values on screen



- Press {**ESC**}{**ESC**} to return to the Home Menu
- Press "**O**" from the "Home Menu" or use ↓ key to highlight "**Log Out / Exit**".

IMPORTANT NOTE: After pressing "**O**" and successfully logged out, make sure you click "**Disconnect**" to finalize the log out action.

Turn off computer screen, **DO NOT** turn off the AV-Trend software, **DO NOT** turn off the computer.

AIR QUALITY SECTION
MAINTENANCE ORDER

Region: _____ Site: _____ Date of Service: _____

Requested By: _____

Action Requested: Repair _____ Supply _____ Maintain _____ Audit _____ Installation _____ Removal _____

Requested Action: _____

Shop Use Only - Action Taken: _____

Removed Cylinders:

Cylinder: Type _____ PPM _____ SN _____ PSI _____ Expires _____

Cylinder: Type _____ PPM _____ SN _____ PSI _____ Expires _____

Cylinder: Type _____ PPM _____ SN _____ PSI _____ Expires _____

Installed Cylinders:

Cylinder: Type _____ PPM _____ SN _____ PSI _____ Expires _____

Cylinder: Type _____ PPM _____ SN _____ PSI _____ Expires _____

Cylinder: Type _____ PPM _____ SN _____ PSI _____ Expires _____

Travel Time: Departed: _____ AM PM Returned: _____ AM PM

Vehicle #: _____ Vehicle #: _____

Logbook(s) Updated: YES NO N/A T Drive Updated: YES NO N/A

Site Temperature	OK _____	Corrected	_____
Probe / Sample Line Connected	OK _____	Corrected	_____
Funnel Clean and In Place	OK _____	Corrected	_____
Building Security	OK _____	Corrected	_____
All Monitoring Systems Operating	OK _____	Corrected	_____

Remarks / Parts Used: _____

Date Signed: _____ Technician(s): _____