

ABB GAS ANALYZER ETHANE ANALYSIS CALIBRATION PROCEDURE

Editorial Hand-Process Changes Other Than Spelling
Require PPD/CDF Operations Department Co-Head Approval

HPC Number	Date	Section Number	Initials
1.	_____	_____	_____
2.	_____	_____	_____
3.	_____	_____	_____
4.	_____	_____	_____
5.	_____	_____	_____
6.	_____	_____	_____
7.	_____	_____	_____

Approval:

(PPD/CDF Operations Department Co-Head)

(Date)

1.0 Controlled Copies of This Procedure

Four controlled copies of this procedure will exist.

One at the CDF Department Office.

One on the CDF Web Page.

One on CDF ADMIN. Server.

One in the CDF Process Systems Control Room

All other copies will be marked, "**INFORMATIONAL COPY ONLY**"

2.0 The Procedure

To execute a procedure from the checklist, obtain a copy of the appropriate section. Place the completed checklist in the ABB Gas Analyzer Logbook, located in the CDF Process Systems Control Room.

3.0 Checklists

All of the checklists below pertain to the ABB Extrel Questor Gas Analyzer at CDF.

Ethane Analysis Calibration Procedure

Name: _____ Date: _____ Time: _____

- ___ 1. Warning: Ethane sample analyses, calibrations, maintenance, or other ABB analyzer operations may not be performed during a COT System Gas Mix.
- ___ 2. In order to flow UHP Ethane from the Gas Storage Shed, the cylinder heater and the supply line heater must be turned on in cold weather. These devices have local temperature control so they may be safely turned on at any outdoor temperature. Check power cables to the cylinder heaters to be sure they are not damaged before use. To turn these devices on, use circuits 34 and 37 on PP-B0-10 located in the first floor control room annex. After a few minutes, check that the cylinder heaters and the supply line are warm.
- ___ 3. The Questor IV software windows which will need to be open in order to perform a calibration include:
 - Host Communication
 - Instrument Status
 - Instrument Control
 - Instrument Configuration
 - Event Display
 - Analysis Logger
 - Analysis Data Display (file = C2H6ana.dsp)

These are opened by selecting the appropriate Questor IV menu items from the Start button.

- ___ 4. In the Instrument Status window, verify that all status lights are green except the status light for the filament not in use. In the Instrument Configuration window, check to be sure that Power, a Filament, and the heater are ON.
- ___ 5. Open the UHP Helium cylinder valve and the UHP Ethane cylinder valve. If the calibration check was in progress, ethane calibration cylinders # 1 and # 2 valves are already open. These cylinders are used in the ethane calibration as well.
- ___ 6. On the UHP Helium circuit, be sure that MV-100-GR is open. Also, PRV-100-GR and MV-101-GR must be appropriately positioned to achieve a flow in the range of 50 to 80 sccm to the analyzer.
- ___ 7. On the UHP Ethane circuit, open the valve CGSETH2GR from the i-Fix Sample Systems page. Also open MV-130-GR. PRV-130-GR and MV-132-GR must be appropriately positioned to achieve a flow in the range of 50 to 80 sccm to the analyzer. Check the setting of cylinder regulator PRV-2850 to see that it provides adequate pressure to PRV-130-GR. The supply pressure upstream of

PRV-130-GR should be at 10 to 12 psig. Adjust PRV-2850 to achieve this pressure.

- ___ 8. To begin the calibration, UHP Helium gas will be used. The helium gas is provided to the ABB Analyzer in valve position # 1. On the Questor IV Instrument Control window switch to Manual control.

To clear the supply line, go to the Manual Control window. Select:

Valve	001
Method	C2H6ANA
Calibration	- none -
Derivation	- none -
Limits	ETHANA
Host Output	ALL

Click APPLY. Confirm: Yes.

- ___ 9. Check the Instrument Status window to verify your selections.
- ___ 10. Watch the Val 1 column on the Analysis Data Display.
- ___ 11. Be sure that the flow to the analyzer is in the range of 50 to 80 sccm. This is displayed on the i-Fix Sample System page at the outlet of the analyzer. Allow a minute or two while the analyzer switches to and clears the line for valve position 1.
- ___ 12. Wait a minimum of 10 minutes.
- ___ 13. The ethane level should fall below 10 ppm, the oxygen level should be low, and the values displayed in column Val 1 should be relatively stable. When these conditions are true, calibrate for the BACKGROUND by making the following selections in the Manual Control window:

Valve	001
Method	C2H6ANA
Calibration	BAC
Derivation	- none -
Limits	ETHANA
Host Output	ALL

Click APPLY. Confirm: Yes.

- ___ 14. Watch the Event Display window. Key messages you should see include:
- Valve positioned to 1
 - Clearing delay started - 60

- Clearing delay ended
- old and new calibration values are displayed
- End of Cal step b0 of cal proc BAC
- Valve positioned to 1

- __ 15. After the calibration, watch the Val 1 column values to be sure they are stable. If not, the calibration was performed too soon. Wait until the values are stable and redo this calibration.
- __ 16. Next in the calibration, UHP Ethane gas will be used. The ethane gas is provided to the ABB Analyzer in valve position # 4.

To clear the supply line, go to the Manual Control window. Select:

Valve	004
Method	C2H6ANA
Calibration	- none -
Derivation	- none -
Limits	ETHANA
Host Output	ALL

Click APPLY. Confirm: Yes.

- __ 17. Check the Instrument Status window to verify your selections.
- __ 18. Watch the Val 4 column on the Analysis Data Display.
- __ 19. Be sure that the flow to the analyzer is in the range of 50 to 80 sccm. This is displayed on the i-Fix Sample System page at the outlet of the analyzer. Allow a minute or two while the analyzer switches to and clears the line for valve position 4.
- __ 20. Wait a minimum of 10 minutes.
- __ 21. Be sure the oxygen level is relatively low. If required, the UHP Ethane transfer line may be evacuated with the Pfeiffer vacuum pump.
- (a) Close the UHP Ethane cylinder valve and MV-130-GR.
 - (b) To vent the supply line to atmospheric pressure, open MV-002-GR and then open MV-131-GR.
 - (c) Watch PI-001-GR to see that the supply line is vented.
 - (d) Then promptly close MV-002-GR.
 - (e) With the Pfeiffer pump ON, Open the vacuum pump supply valve, GR_VACPUMP, on i-Fix.
 - (f) Wait for the line pressure to drop to < 3 torr using a Hastings DV-4 gauge connected to the PT_GR_VM_1 port.
 - (g) Close MV-131-GR and GR_VACPUMP, and turn OFF the Pfeiffer pump.
 - (h) Open the UHP cylinder valve and watch for positive pressure on

PI-130-GR.

- (i) Open MV-130-GR and check that the flow rate to the analyzer is in the range of 50 to 80 sccm.

- __ 22. The values displayed in column Val 4 should be relatively stable and the oxygen level low. When these conditions are true, calibrate for FRAGMENTATION by making the following selections in the Manual Control window:

Valve	004
Method	C2H6ANA
Calibration	FRAC2H6
Derivation	- none -
Limits	ETHANA
Host Output	ALL

Click APPLY. Confirm: Yes.

- __ 23. Watch the Event Display window. Key messages you should see include:

- Valve positioned to 4
- Clearing delay started - 60
- Clearing delay ended
- old and new calibration values are displayed
- End of Cal step f0 of cal proc BAC
- Valve positioned to 4

- __ 24. After the calibration, watch the Val 4 column values to be sure they are stable. If not, the calibration was performed too soon. Wait until the values are stable and redo this calibration.

- __ 25. Next in the calibration, Ethane Calibration Cylinder # 1 gas will be used. Cal gas #1 is provided to the ABB Analyzer in valve position # 2. Be sure the Ethane Calibration Cylinder #1 supply valve is open.

To clear the supply line, go to the Manual Control window. Select:

Valve	002
Method	C2H6ANA
Calibration	- none -
Derivation	- none -
Limits	ETHANA
Host Output	ALL

Click APPLY. Confirm: Yes.

- __ 26. Check the Instrument Status window to verify your selections.

- __ 27. Watch the Val 2 column on the Analysis Data Display.
- __ 28. Be sure that the flow to the analyzer is in the range of 50 to 80 sccm. This is displayed on the i-Fix Sample System page at the outlet of the analyzer. Allow a minute or two while the analyzer switches to and clears the line for valve position 2.
- __ 29. Wait a minimum of 10 minutes.
- __ 30. When the values displayed in column Val 2 are stable, calibrate for Cal Gas 1 (Val 2) Sensitivity by making the following selections in the Manual Control window:

Valve	002
Method	C2H6ANA
Calibration	SEINVAL2
Derivation	- none -
Limits	ETHANA
Host Output	ALL

Click APPLY. Confirm: Yes.

- __ 31. Watch the Event Display window. Key messages you should see include:

- Valve positioned to 2
- Clearing delay started - 60
- Clearing delay ended
- old and new calibration values are displayed
- End of Cal step s0 of cal proc SENVAL2
- Valve positioned to 2

- __ 32. After the calibration, watch the Val 2 column values to be sure they are stable. If not, the calibration was performed too soon. Wait until the values are stable and redo this calibration.
- __ 33. Next in the calibration, Ethane Calibration Cylinder # 2 gas will be used. Cal gas #2 is provided to the ABB Analyzer in valve position # 3. Be sure the Ethane Calibration Cylinder #2 supply valve is open.

To clear the supply line, go to the Manual Control window. Select:

Valve	003
Method	C2H6ANA
Calibration	- none -
Derivation	- none -
Limits	ETHANA

Host Output ALL

Click APPLY. Confirm: Yes.

- ___ 34. Check the Instrument Status window to verify your selections.
- ___ 35. Watch the Val 3 column on the Analysis Data Display.
- ___ 36. Be sure that the flow to the analyzer is in the range of 50 to 80 sccm. This is displayed on the i-Fix Sample System page at the outlet of the analyzer. Allow a minute or two while the analyzer switches to and clears the line for valve position 3.
- ___ 37. Wait a minimum of 10 minutes.
- ___ 38. When the values displayed in column Val 3 are stable, calibrate for Cal Gas 2 (Val 3) Sensitivity by making the following selections in the Manual Control window:

Valve	003
Method	C2H6ANA
Calibration	SEINVAL3
Derivation	- none -
Limits	ETHANA
Host Output	ALL

Click APPLY. Confirm: Yes.

- ___ 39. Watch the Event Display window. Key messages you should see include:
 - Valve positioned to 3
 - Clearing delay started - 60
 - Clearing delay ended
 - old and new calibration values are displayed
 - End of Cal step of cal proc SENVAL3
 - Valve positioned to 3
- ___ 40. After the calibration, watch the Val 3 column values to be sure they are stable. If not, the calibration was performed too soon. Wait until the values are stable and redo this calibration.
- ___ 41. To download these results to the ABB controller, follow these steps:
 - From the START button, select
 - Questor IV
 - Editor
 - Methods Editor

Open the file C2H6ana.mw. Then open the Fragment Matrix window. In the File menu, select Use Calibration Result. Then from the File menu, select Save. Now close out of the Methods Editor.

- ___ 42. In the Instrument Control window, select SEQUENCE and then APPLY. After this selection, the current Task Code Request from the ABB Gas Analyzer i-Fix page becomes active.

Be sure that flow is maintained to the Gas Analyzer. If the ethane sample is not immediately tested, switch the Task Code Request to 13 (Valve position 16) to purge the analyzer with nitrogen gas. Verify that the flow rate to the analyzer is in the range of 50 to 80 sccm.

- ___ 43. Close each of the cylinder valves: UHP Helium, UHP Ethane, Calibration cylinder #1, and Calibration cylinder #2. Close the valve CGSUHPETH from the i-Fix Sample Systems page. Turn off PP-B0-10 circuits 34 and 37.

4.0 DEVIATIONS

None are allowed.

5.0 Required Training and Authorized Training Personnel

CDF Gas Systems Engineer
CDF Gas Systems Manager

The training should be documented on a standard Fermilab Training Form and the Training Expiration date should be tied to the end date of the Collider Run (e.g. "the end of Collider Run II"). The completed forms must be inserted in the CDF Department Office copy of this procedure.

6.0 Training Materials

This procedure covering the operation and maintenance of the ABB Gas Analyzer must be read and understood. The ABB Questor Analyzer Smartware Manual must be reviewed and understood in order to perform calibrations. Review of the Gas Analyzer Piping and Instrumentation Drawing # 2563.370-ME-405215 is required.

The authorized training personnel must give a training lecture on the use of the ABB Questor Analyzer.

7.0 List of Trained People for this Procedure

A list of trained personnel for this procedure is to be kept in a separate section at the end of the CDF Department copy of the procedure.

8.0 References and Supporting Documentation

For a layout of the ABB Gas Analyzer piping and instrumentation, see Fermilab drawing # 2563.370–ME-405215. Additional supporting documentation includes the ABB Extrel Questor GP Software/Hardware Manual.