

# Sorbent Trap Monitoring

**Apex Instruments, Inc.**

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**Automated Mercury Source Sampler  
XC-6000 and STM-12B Consoles**

Revised 5/1/15

# Console Audit Manual

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This equipment is sold subject to the mutual agreement that it is warranted by Apex Instruments, Inc. free from defects of material and of construction, and that Apex Instruments, Inc. liability shall be limited to replacing or repairing at our facility (without charge, except for transportation), or at customer plant at our option, any material or construction in which defects become apparent within one year from the date of shipment, except in cases where quotations or acknowledgments provide for a shorter period. Components manufactured by others bear the warranty of their manufacturer. This warranty does not cover defects caused by wear, accident, misuse, neglect or repairs other than those performed by Apex Instruments, Inc. at our service center. We assume no liability for direct or indirect damages of any kind and the purchaser by the acceptance of the equipment will assume all liability for any damage which may result from its use or misuse.

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This instrument provides measurement readings to its user, and serves as a tool by which valuable data can be gathered. The information provided by the instrument may assist the user in eliminating potential hazards caused by the utilized process; however, it is essential that all personnel involved in the use of the instrument or its interface, with the process being measured, be properly trained in the process itself, as well as all instrumentation related to it.

The safety of personnel is ultimately the responsibility of those who control process conditions. While this instrument may be able to provide early warning of imminent danger, it has no control over process conditions, and it can be misused. In particular, any alarm or control systems installed must be tested and understood, both as to how they operate and as to how they can be defeated. Any safeguards required such as locks, labels, or redundancy, must be provided by the user or specifically requested of Apex Instruments, Inc. at the time the order is placed.

Therefore, the purchaser must be aware of the hazardous process conditions. The purchaser is responsible for the training of personnel, for providing hazard warning methods and instrumentation per the appropriate standards, and for ensuring that hazard warning devices and instrumentation are maintained and operated properly.

Apex Instruments, Inc. cannot accept responsibility for conditions beyond its knowledge and control. No statement expressed or implied by this document or any information disseminated by the manufacturer or its agents, is to be construed as a warranty of adequate safety control under the user's process conditions.

## Safety Warning Messages

Apex Instruments considers safety very important. Important safety messages are included throughout this manual. Please read all safety warning messages carefully.

Safety warning messages alert the operator to potential hazards that may cause injury or even death. Safety warning messages are accompanied by a safety warning symbol. The symbols are found throughout the manual. Depictions and descriptions of the safety warning symbols are below:



**WARNING/CAUTION:** Warns operator of specific procedures could cause the operator Injury and/or damage the instrument.



**HOT SURFACE:** Warns operator of specific heated components that may be encountered during the procedures. Failure to take notice of this warning may expose the operator to heat sufficient to cause serious burns to skin tissue.



**ELECTRICAL SHOCK:** Warns operator of specific potential electric shock hazards that may be encountered during the procedures. Failure to take notice of this warning may expose the operator to electric shock hazards that may cause serious injury/death and/or damage/destroy equipment.



**QUALIFIED TECHNICIAN:** Warns operator of procedure or service to a component recommending qualified technician only to perform the procedure. **NOTE:** Additional information and comments regarding a specific component or procedure are notated in highlighted notes.

**CAUTION: THE EQUIPMENT IN THIS MANUAL SHOULD ONLY BE UTILIZED FOR THE INTENDED PURPOSE AND IN THE MANNER DESCRIBED.**

**IF ANY EQUIPMENT IS UTILIZED IN A MANNER OTHER THAN THAT FOR WHICH IT WAS INTENDED, DAMAGE TO THE EQUIPMENT AND/OR UNEXPECTED RESULTS COULD OCCUR.**

## **Manuals Statement**

This manual provides required information to guide the operator through the assembly, setup and use of the AK-STM12B Audit Kit. The operator of the AK-STM12B Audit Kit should read this manual thoroughly prior to attempting to perform audits on the XC6000 and STM-12B consoles and be familiar with associated EPA methods pertaining to the aforementioned consoles. Keep this manual readily available for reference while conducting audits.

Prior to use, the consoles should be operating with the most current software and firmware to assure against incompatibility and system performance issues. Please contact Apex Instruments' Technical Services Group if you are unsure of what version of software and/or firmware is currently installed and its compatibility with the latest recommended version.

Apex Instruments, Inc.

Technical Services Group

Email: [support@apexinst.com](mailto:support@apexinst.com)

Tel: (877) 726-3919

Additional manuals may be downloaded from the Apex Instruments website: [www.apexinst.com](http://www.apexinst.com).

## **Abbreviations**

The following abbreviations are used throughout the text; other abbreviations are expanded at first mention in the chapter or subchapter.

DGM\_\_\_\_\_Dry Gas Meter

Hg\_\_\_\_\_Mercury

NIST\_\_\_\_\_National Industry of Standards and Technology

RFD\_\_\_\_\_Reference Flow Device (Alicat)

TC\_\_\_\_\_Thermocouple

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## Introduction

This procedure assumes the user is familiar with the basic operation of the Apex Instruments MercSampler STM-12B and XC-6000 consoles. If necessary please refer to the user manuals for additional information on connections and operations.



Since the STM-12B and XC-6000 consoles will be open during the Console Audit procedure this is a good time to visually inspect the interior of the console and perform any software or firmware upgrades



This document, and screen shots in this manual, is based on version C503020e software and 1008 firmware. If your unit has an earlier version please contact Apex Instruments, Inc. Technical Services Group to obtain the latest version:

Apex Instruments, Inc.

Technical Services Group

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Tel: (877) 726-3919

## 1.1 Overview of the AK-STM-12B MercSampler Audit Kit

The AK-STM-12B Audit Kit is designed for calibrating and auditing the full range of Apex MercSampler consoles in accordance with EPA PS12B and Method 30B.

The key component of the Audit Kit is the Alicat Gas Flow Meter which is considered the Reference Flow Device or RFD. It is an accurate, versatile, dependable and cost effective solution for performing NIST traceable calibrations and audits of mass flow sensors and dry gas meters. The M Series Alicat simultaneously measures volumetric flow, pressure and temperature. The volumes are automatically corrected to standard, temperature and pressure and displayed in real time on the digital display.

Alicat Scientific flow meters utilize laminar flow and differential pressure technology, resulting in an extremely fast, accurate reference device with no warm-up time and unparalleled versatility. Basic accuracy is  $\pm 0.8\%$  of reading  $\pm 0.2\%$  of full scale.

The Alicat Scientific's M Series mass flow meter meets and exceeds the EPA requirements.

In addition to the RFD, the kit includes all of the necessary accessories for auditing and calibrating temperature and pressure sensors

## 1.2 AK-STM12 Audit Kit

### M-5SLPM-D/5M

#### Includes:

Alicat Flow Meter (Manufacturer Calibration Available)  
 Drier Tube with Indicating Silica Beads  
 Drier Tube Requires SG-3/5B Indicating Silica Beads  
 Tubing Filter  
 Connectors  
 Fittings  
 Power Adapter



### DPGA-00TU4-NIST

Digital Vacuum Gauge. 2.5" Diameter Face.  
 3 Point NIST Certification.  
 0-30" Hg Range, 1/4" Connection  
 (Manufacturer Calibration Available)



### DPT-168-NIST

Handheld Waterproof Digital Thermometer. NIST.  
 Temperature Range: -50° to 300°C (-58° to 572°F)  
 (Annual Replacement Recommended)



### M5C-520

Thermocouple Simulator. Type K. °F or °C.  
 18" Extension Wire Output.  
 -409°F to 2501°F Range  
 (Manufacturer Calibration Available)



### TCA-36HG

Thermocouple Pig Tail with male Type K connector



### AK-6TH16

Thermocouple Calibration Ice Bath (for verifying thermocouples)



### Barometer

Access to local Barometer reading in inches of Hg (Airport, Weather Station, etc.)



## AK-STM12B AUDIT KIT

### 1.3 Compatible Consoles for AK-STM12B Audits

#### STM-12B System

Includes:

Console, Gas Sample Conditioner, Probe and Sample Lines

PC/Laptop running Apex XC-6000 Software

(PC/Laptop not necessary on STM-12B with touchscreen option)

Printer or PDF Printer connected to the PC (PDF printer software located on the XC-6000 Software CD)

Communication cable (USB or Ethernet)



Figure 1-3.1 STM-12B

#### XC-6000 System

Includes:

Console, Gas Sample Conditioner, Probe and Sample Lines

PC/Laptop running Apex XC-6000 Software

Printer or PDF Printer connected to the PC (PDF printer software located on the XC-6000 Software CD)

Communication cable (USB or Ethernet)



Figure 1-3.2 XC-6000  
(IN 8U TRANSPORT CASE)



Figure 1-3.3 XC-6000  
(IN CR-20U CABINET  
WITH SGC-4000HG)

## Alicat Audit Preparation

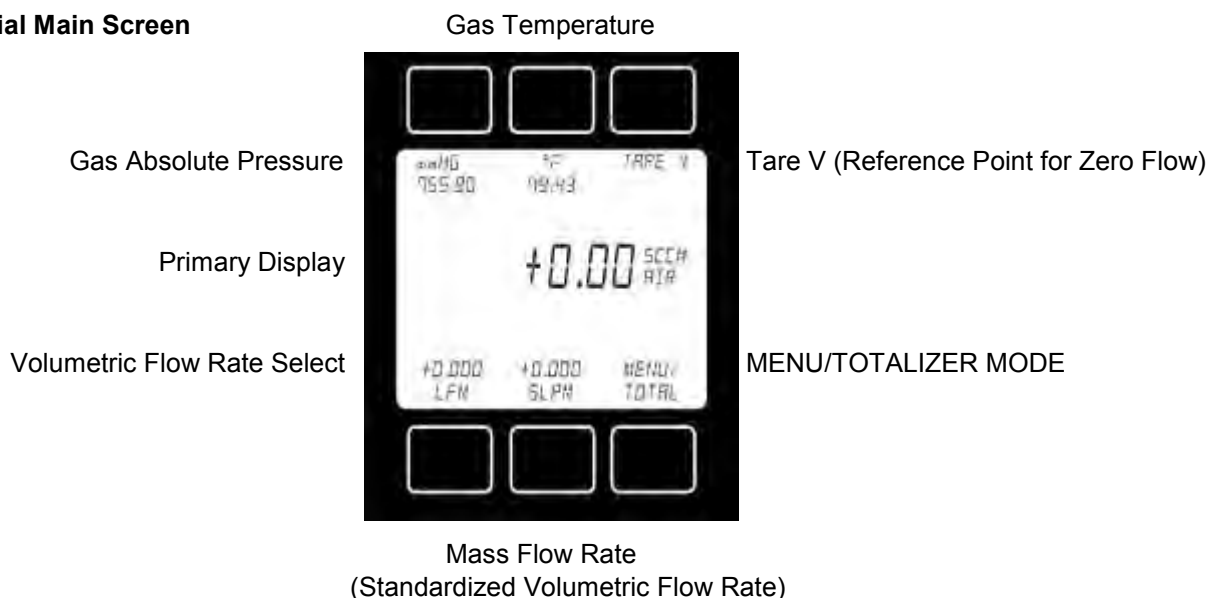
### 2.1 Prepare the Alicat RFD for Console Audit

(Refer to the *Alicat Gas Flow Meter Manual* when necessary)

Power unit **ON**. **MAIN** screen is displayed as shown below:

Figure 2-1

Alicat Initial Main Screen



Allow meter to warm up for a minute or so. Assure there is no flow or pressure on the meter. The unit should be at atmospheric pressure and confirmed to be in a no flow condition.

The Gas Absolute Pressure is a factory set value and there is no option to change the unit of measure.

Set the **Temperature Scale** to **Fahrenheit** by pressing the button above the display twice. Select **°F**. Press **SET** to record the selection and return to the **MAIN** display.

Press the **TARE V** button to reset the reference point for Zero Flow Value.



***Zeroing the unit while there is any flow will directly affect the accuracy by providing a false zero point.***

The Gas Units should display **"AIR"** when **Mass Flow Rate** is the **Primary Display**

Assure there are no leaks in the connections to the device. The device is ready to be used in **Totalizer Mode**.



***It is highly recommended to use this device ONLY as configured on page 5. Failure to do so may adversely affect results and/or result in premature unit failure.***

## 2.2 Setting the Alicat RFD in Totalizing Mode

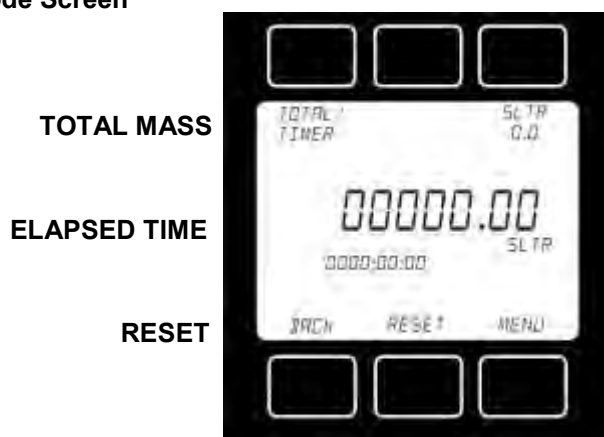
The **Totalizing Mode** screen is accessed by pressing the **TOTAL** button on the **MAIN** display. The **Totalizing Mode** displays the total flow (normally in the units of the main flow screen) that has passed through the device since the last time the totalizer was cleared.

**TOTAL/TIMER:** Pushing the **TOTAL/TIMER** button will cycle the large numbers on the display between total mass and time elapsed.

When counter reaches maximum count it stops counting until the counter is cleared by pressing **RESET**

Figure 2-2

Alicat Totalizing Mode Screen

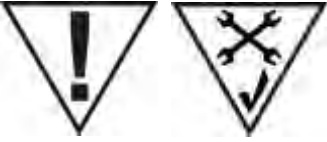


**TOTAL MASS:** The counter can have as many as seven digits. At the time of order, the customer must specify the range. This directly affects the maximum count. For instance, if a range of 1/100ths of a liter is specified on a meter which is totalizing in liters, the maximum count would be 99999.99 liters. If the same unit were specified with a 1 liter range, the maximum count would be 9999999 liters.

**ELAPSED TIME:** The small numbers below the mass total show the elapsed time since the last reset in hours, minutes and seconds. The maximum measurable elapsed time is 9999 hours 59 minutes 59 seconds. The hours count resets when **RESET** is pressed, an RS-232 or RS-485 clear is executed or on loss of power. Press **ELAPSED TIME** to show this as the primary display.

**RESET:** The counter can be reset to zero at any time by pressing **RESET** button.

### 3.1 Optional Quick Step Guide



**It is highly recommended the operator become familiar with the AK-STM12B procedures, equipment and operations before attempting to utilize the Quick Step Guide.**

**The Quick Step Guide may be found on page 23, Appendix A-3.**

**A step-by-step log of the completed console audit procedures as verified by the operator and may be found on pages 24 and 25, Appendix A-4.**

## **Audit Setup**

### **4.1 Audit Setup:**

Ensure the Alicat RFD has been set up for conducting the console audit procedure per pages 4 and 5. Refer to the XC-6000 or STM-12B User Manual if needed.

Depending on the type of enclosure the XC-6000 is mounted in it may be necessary to remove the XC-6000 from its enclosure. The STM-12B is easily accessible by opening the face panel door.

Open the XC-6000 console by removing the screws from the top of the chassis.

Users with XC-6000 portable units (Hardigg Storm Case) gain access by turning the 2 release screws counter clockwise at the top of the front panel and swinging the panel down.



**NOTE: DGMs will not properly function in the horizontal position. Panel must be upright.**

Connect the console, gas conditioner, and probe. Do not turn on the probe heater (switch on the front panel should be off), the heated sample line (the AUX switch on the Gas conditioner front panel should be off) for the gas conditioner. Only connect the Stack thermocouple. Sample lines, pitot lines and other thermocouples do not need to be connected.

Collect the Audit kit, and ancillary items. Fill the Ice Bath container with ice and water.

The Audit kit comes from the factory with a 1/4" nut on the sample line and will readily connect to the STM-12B sample ports. If the XC-6000 has Quick Connects on the Sample A and Sample B In ports remove the Quick Connect from the console, or temporarily install a Quick Connect on the Audit kit sample line.

Power on the console and start the XC-6000 software application on the PC.

Connect the PC to the console by pressing the **"Connect"** button on the XC-6000 Main screen. Ensure that the XC-6000 Time and Date are correct and the clock is running.

Verify the Windows default printer is setup and available. Apex provides a PDF generator that can be used to create a PDF file of the Console Audit Results located in the Apex Utilities directory.

Connect the Audit device to the console Sample A in port.

Set up a 15 minute constant flow rate test at a typical console flow rate to warm up the console gas meters and the Audit device. Check the Bypass boxes on the Pre Leak Test screen, Set Probe screen and Post Leak Test screen as these are not needed for warm up.

## Audit Procedures

### 5.1 Start the XC-6000 Audit Software Application

Power on the console. Start the XC-6000 software application on the PC. Press the **Connect** button on the XC-6000 Software Main screen. Ensure the XC-6000 Time and Date are correct and the clock is running. Verify the Windows default printer is setup and available. Apex provides a PDF generator that can be used to create a PDF file of the Console Audit Results located in the Apex Utilities directory.



Figure 5-1.1  
Initial Screen

Connect the Audit device to the console Sample A in port. Set up a 15 minimum constant flow rate test at a typical console flow rate to warm up the console gas meters and the Audit device. Check the Bypass boxes on the Pre Leak Test screen, Set Probe screen and Post Leak Test screen as these are not needed for warm up. After warm up has completed, go to the **Config/Utilities** screen and select **Console Audit**.



Figure 5-1.2  
Config/Utilities Screen

## 5.2 Starting the Console Audit

Prior to beginning the Console Audit, the console and the Reference Flow Device should be warmed up. Connect the sample line of the AK-6000, or Reference Flow Device, to the Sample A in line.

Setup a test run for at least 15 minutes at a flow rate between 300cc and 900cc. (Pre and Post Leak Tests may be bypassed). See the XC-6000 Operators Manual for test setup if needed.

Upon completion of the warm up, open the Console Audit screen by pressing the **Console Audit** button on the left side of the **Config/Utilities** screen. Enter the name of the technician in the yellow text box.

XC6000: Audit

**XC6000 Audit - Console Sr# XC6KEM-322**

Audit By:  Date: 04/08/2015

Barometer (inHg)  Next

Notes on Barometric Ref. and Vacuum Gauge Model/Serial #

Apr 8, 2015 11:28:03 AM

\*RFD - Reference Flow Device; this can be a Alcohol Mass Flow or Certified Dry Gas Meter

Ver: C50320e-1008

Help Print Cancel Audit

Figure 5-2

Technician Information Screen

Reference Baro Device Reading



RFD Note

Software/Firmware Version





## 5.3 Barometric Pressure Test:

If the Barometric test fails the Console Audit will fail and must be re-run.

Enter the Barometric pressure from your traceable barometer in inHg, xx.xx, or mmHg if configured for Metric, and press the “**Next**” button. **NOTE: A local Weather Service or Airport reading may be used.**

If the Barometric test passes the following screen is displayed. Enter the information for your reference Barometer and vacuum device in the box provided.

Enter Barometric Pressure and Vacuum Gauge Information

XC6000: Audit

**XC6000 Audit - Console Sr# XC6KEM-322**

Audit By: SBB Date: 04/08/2015

Barometer (inHg)	Vacuum (inHg)	Reference
30.01 29.89 PASSED	Minimum 16 inHg	Side A 24.25

Notes on Barometric Ref. and Vacuum Gauge Model/Serial #

Mettler M-55LPM-D/5M for Barometric Reference M35329

Exeter DPGA-00TU4-NIST Digital Vacuum Gauge D1408321

Wait until the Vacuum Gauge reading has stabilized, then enter the value from the Vacuum Gauge in the yellow box. Then press the [Next] button to continue.

Apr 8, 2015 11:40:01 AM

\*RFD - Reference Flow Device: this can be a  
 Alcotest Mass Flow or Certified Dry Gas Meter.

Help Print Cancel Audit

Ver: C50320e-1008

**Figure 5-3**  
**Barometer Test Passed**

If the barometric test fails you may continue the Console Audit to determine if there are any other areas out of calibration or end the Console Audit and correct each item as they are discovered.

See the section **A-1 How to Correct Out of Tolerance or Failed Sections in the Console Audit** in the Console Audit at the end of this document.



## 5.4 Vacuum Sensor Test:

Connect the vacuum gauge to the A Sample In port on the Console.

Press the **Start Pump** button and wait for the vacuum gauge to stabilize. Enter the value into the Side A reference box and press **Stop Pump**. A message of **PASSED** or **Out of Tolerance** will be displayed.

Move the vacuum gauge to the B Sample In port on the console. Press the **Start Pump Button** and wait for the vacuum gauge to stabilize. Enter the value into the Side B reference box and press **Stop Pump**.

A message of **PASSED** or **Out of Tolerance** will be displayed.

If **Out of Tolerance** you can continue the Console Audit. See section **A1 How to Correct Out of Tolerance or Failed Sections in the Console Audit** at the end of this document on how to resolve

XC6000 Audit - Console Sr# XC6KEM-322

Audit By: SBB Date: 04/08/2015

Barometer (inHg)	Vacuum (inHg)	Reference
30.01 29.69 PASSED	Minimum 16 inHg	Side A 24.25 0.25 PASSED
		Side B 24.65 0.44 PASSED

Notes on Barometric Ref. and Vacuum Gauge Model/Serial #  
 Alcat M-5SLPM-D/5M for Barometric Reference M35329  
 Dwyer DPGA-00TU4-NIST Digital Vacuum Gauge D1400321

Wait until the Vacuum Gauge reading has stabilized, then enter the value from the Vacuum Gauge in the yellow box. Then press the [Next] button to continue.

Apr 8, 2015 11:40:01 AM

\*RFD - Reference Flow Device: this can be a  
 Alcat Mass Flow or Certified Dry Gas Meter

Ver: C50320e-1008

Help Print Cancel Audit

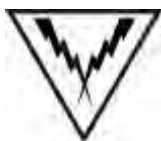
**Figure 5-4**  
**Vacuum Sensor Test Passed**

## 5.5 Thermocouple Test:

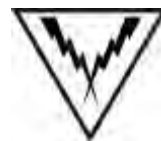
Enter the information for the traceable thermometer in the space provided.

Prepare an Ice Water bath by filling the AK-6TH16 TC Ice Bath Container with a mixture of ice and water. Use the DPT-168-NIST traceable thermometer to measure the temperature of the ice bath and enter the value in the yellow box next to Ice Bath Temperature.

Prior to removal of the DGM thermocouples, identify the thermocouples with labels if not already labeled. Remove the DGM thermocouples from the DGM fittings.



**Figure 5-5.1**  
**DGM Thermocouple Removal and**  
**Placement in Ice Bath Container**



Place **BOTH** DGM thermocouples and the traceable thermometer in the ice bath. Watch the thermocouple readings on the audit screen until **BOTH** DGM temperatures stabilize. When the DGM temperatures have stabilized press the **Next** button.

If the DGM thermocouples are within tolerance, the screen will show **PASSED**. If the DGM thermocouples are out of tolerance a message box will be displayed and the screen will display **FAIL**. Press the **OK** button to continue.

See the section at the end of this document on how to resolve **A-1 How to Correct Out of Tolerance or Failed Sections in the Console Audit**.

Replace the DGM thermocouples into the DGMs taking care to place the A TC into DGM A and the B TC into DGM B.

The screenshot displays the 'XC6000 Audit - Console Sr# XC6KEM-322' window. The 'Audit By' field is 'SBB' and the 'Date' is '04/08/2015'. The 'Barometer (inHg)' is 29.65, and the 'Vacuum (inHg)' is 29.66, both marked 'PASSED'. The 'Reference Console' shows 'Side A' at 24.25 (0.25 PASSED) and 'Side B' at 24.65 (0.44 PASSED). The 'Thermocouples (F)' section shows 'DGM A' at 32.6 (PASSED) and 'DGM B' at 32.3 (PASSED). The 'Ice Bath Temperature' is 32.8, with 'Stack' and 'Chiller' both at 0.0 and marked 'PASSED'. A 'Next' button is visible. A note at the bottom states: 'Please connect the Cal-kit TC connector (or TC pigtail) to the CHILLER Thermocouple port on the back of the XC6000. Then place the other end of the TC in the same reference Ice Bath. Once the temperature has stabilized, press the [Next] button to continue.' The bottom right corner shows 'Ver. C50320e-1006' and buttons for 'Print' and 'Cancel Audit'.

**Figure 5-5.2**  
**Thermocouple Audit Results**

At the end of the probe is the Stack thermocouple. Now dip the end of the probe into the ice bath. When the temperature stabilizes Press **Next**.



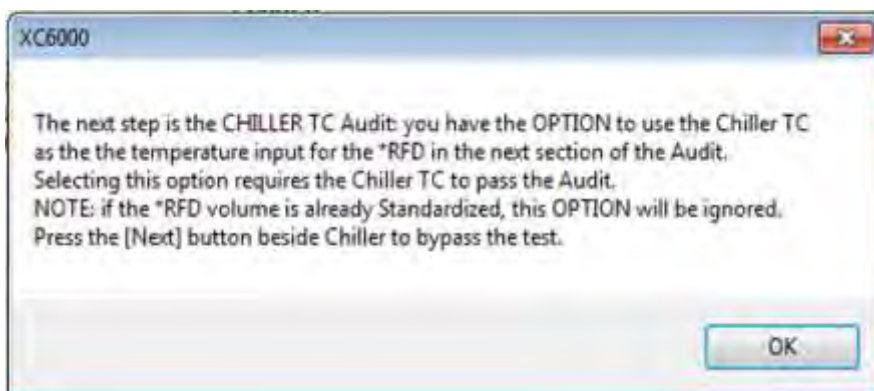
**Figure 5-5.3**  
**Sampling End of Mercury Probe**



**Figure 5-5.4**  
**Stack Thermocouple Inserted into Ice Bath**

A message box will be displayed providing information when using the Audit Kit. When using the AK-STM12B Audit Kit, **DO NOT** Check the Box to use the Chiller TC input. Press the **OK** button to continue.

**Figure 5-5.5**  
**Optional Chiller TC Audit**



If the stack thermocouple is within tolerance the screen will show **PASSED**. If the thermocouple is not in tolerance **Out of Tolerance** will be displayed. See the section at the end of this document on how to resolve **A-1 How to Correct Out of Tolerance or Failed Sections in the Console Audit**.



## 5.6 Auditing DGM-A

Connect the RFD sample line to the Sample A In port on the console. If using the Harding Storm case (Gray Portable Case) connect the RFD sample line to the Sample A In port.

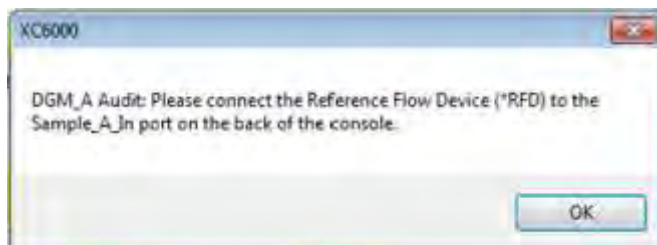


Figure 5-6.1

Connect RFD to DGM-A Inlet

Enter the model and serial number of the RFD into the space provided.



**Make sure the DGM temperature is reading a valid value, close to ambient, and not still in the Ice Bath or 0° F (open connection)**

Check the **Already Standardized** box (if not already checked) below the **\*RFD Gamma**. Enter the test **Flow Rate (ccm)** in whole numbers and **Volume to Test (L)** into the boxes provided. Apex Instruments recommends a minimum of 3.5L for test volume and a flow rate that is the average used in normal operation.

Press the **RESET** on the RFD to reset the counter to ZERO and enter the number **0** into the **RFD (L)** start box. The software will automatically display the DGM A starting temperature in degrees Fahrenheit.

Figure 5-6.2

DGM-A Audit Test Specifications

Press **Next**. The console pumps will start and the status of the test will be displayed. When the test volume has been reached the pumps will automatically stop.

**XC6000 Audit - Console Sr# XC6KEM-322**

Audit By: SBB Date: 04/08/2015

**Barometer (inHg)** 29.65 29.66 **PASSED**

**Vacuum (inHg)** Reference Console  
Minimum 16 inHg **Side A** 24.25 0.25 **PASSED**  
**Side B** 24.65 0.44 **PASSED**

Notes on Barometric Ref. and Vacuum Gauge Model/Serial #  
Alcat M-5SLPM-D/5M for Barometric Reference M35329  
Dwyer DPGA-00TU4-NIST Digital Vacuum Gauge D1400321

**Thermocouples (F)** Ice Bath Temperature **32.8** Thermometer Model/Serial # and Notes  
**DGM\_A** 32.6 **PASSED** **Stack** **Chiller** **Next** DPT-163-NIST 1503041  
**DGM\_B** 32.3 **PASSED** 0.0  
**PASSED** ☐ Use Chiller TC input for RFD\* temperature

\*RFD Model/Serial #: **DGM-SK25EX 21485312**

**DGM\_A** Serial #: 20140817

\*RFD (Gamma): ☒ Already Standardized

Flow Rate (ccm): **400** Start End Notes  
Vol. To Test (L): **5** \*RFD (L): 0 105

DGM\_A Temp(F): 77.5 Console Encoder (L): 0.106

Std. Calibrated Vol. -?- Std. Audit Vol. -?- Diff. Gamma: -?- **Next**

Enter the Ending volume and current temperature for the Reference Flow Device (\*RFD).

\*RFD - Reference Flow Device: this can be a  
Alcat Mass Flow or Certified Dry Gas Meter **Help** **Print** **Cancel Audit**

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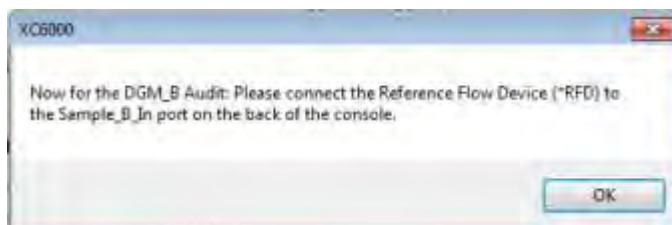
**Figure 5-6.3**  
**DGM-A Audit Test Results**

Enter the ending volume value, in liters, of the RFD into the **End** box and Press **Next**.

If the **Calibrated Gamma** and the **Audited Gamma** are within  $\pm 5\%$  the test will display **Passed** and a message box will be displayed instructing the user to connect the RFD to the Sample B in port on the console.

## 5.7 Auditing DGM-B

Connect the RFD to the Sample B In port on the back of the console. Press the **OK** button to continue.



**Figure 5-7.1**  
**Connect RFD to DGM-A Inlet**

The RFD Gamma **Already Standardized Check Box** should be checked, the test **Flow Rate (ccm)** and **Volume to Test (L)** will be automatically filled in based upon the information entered in the DGM A test. These values can be changed if desired.

Press the **RESET** button on the RFD to reset the counter to ZERO and enter the number **“0”** into the RFD **Start** box. The RFD starting temperature will automatically be entered.

Press **Next** and the console pumps will start and the status of the test will be displayed. When the test volume has been reached the pumps will stop.

**Figure 5-7.2**  
**DGM-B Audit Test Specifications**



When the test volume is reached enter the reading from the RFD into the RFD **End** box and press the **Next** button to continue.

If the Calibrated Gamma and the Audited Gamma are within  $\pm 5\%$  the test will display **Passed**.

If the test exceeds the limit the test will indicate **Audit FAILED** in a red horizontal banner.

**XC6000 Audit - Console Sr# XC6KEM-322**

Audit By: SBB Date: 04/08/2015

**Barometer (inHg)** 29.65 29.67 **PASSED** **Vacuum (inHg)** Reference Console  
 Minimum 16 inHg Side A 29.66 0.44 Fail Min. Vac.  
 Side B 29.48 1.02 Fail Min. Vac.

Notes on Barometric Ref. and Vacuum Gauge Model/Serial #  
 Alicat M-55LPM-D/5M for Barometric Reference M35329  
 Dwyer DPGA-00T14-MIST Digital Vacuum Gauge D1400321

**Thermocouples (F)** Ice Bath Temperature 76.8 Thermometer Model/Serial # and Notes  
 DGM\_A 77.0 **PASSED** Stack Chiller  
 DGM\_B 76.4 **PASSED** 75.3 0.0  
 Not Required  
☐ Use Chiller TC input for RFD\* temperature

\*RFD Model/Serial #: DGM-SK25EX 21485312

**DGM\_A** Serial #: 20140817  
 \*RFD (Gamma): Start End Compute Notes  
☒ Already Standardized \*RFD (L): 0 105 0.1050  
 Flow Rate (ccm): 400  
 Vol. To Test (L): 5 DGM\_A Temp(F): 77.5 Console Encoder (L): 0.106  
 Std. Calibrated Vol. 0.105 Std. Audit Vol. 0.103 Diff. Gamma: 1.6% **PASSED**

**DGM\_B** Serial #: 20140724  
 \*RFD (Gamma): Start End Compute Notes  
☒ Already Standardized \*RFD (L): 0 152 0.1050  
 Flow Rate (ccm): 400  
 Vol. To Test (L): 5 DGM\_B Temp(F): 77.5 Console Encoder (L): 0.105  
 Std. Calibrated Vol. 0.105 Std. Audit Vol. 0.152 Diff. Gamma: 5.6% **FAILED**

**>>> Audit FAILED <<<**

\*RFD - Reference Flow Device: this can be a  
 Alicat Mass Flow or Certified Dry Gas Meter

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 Help Print Done!

**Figure 5-7.3**  
**Audit Test Results**



## 5.8 Audit Test Results

If the Calibrated Gamma and the Audited Gamma are within  $\pm 5\%$  the test display **Passed**. If the test exceeds the limit the test will fail.

**XC6000 Audit - Console Sr# XC6KEM-322**

Audit By: SBB Date: 04/08/2015

**Barometer (inHg)** 29.65 29.67 **PASSED** **Vacuum (inHg)** Reference Console  
Minimum 16 inHg *Side A* 29.66 0.44 *Fail Min. Vac.*  
*Side B* 29.48 1.02 *Fail Min. Vac.*

Notes on Barometric Ref. and Vacuum Gauge Model/Serial #  
Alcal M-5SLPM D/5M for Barometric Reference M35326  
Dwyer DPGA-00T04-NIST Digital Vacuum Gauge: D1M00321

**Thermocouples (F)** Ice Bath Temperature 76.5 Thermometer Model/Serial # and Notes  
*DGM\_A* 77.0 **PASSED** *Stack* *Chiller* DPT-168-NIST 1503041  
*DGM\_B* 76.4 **PASSED** 75.3 0.0  
Not Required  
☐ Use Chiller TC input for RFD\* temperature

\*RFD Model/Serial #: DGM-SK25EX.21485312

**DGM\_A** Serial #: 20140817

*RFD (Gamma):	Start	End	Compute	Notes
<input checked="" type="checkbox"/> Already Standardized	*RFD (L): 0	105	0.1050	
Flow Rate (ccm): 400			0	
Vol. To Test (L): 5				
DGM_A Temp(F): 77.5				
Console Encoder (L): 0.105				
Std. Calibrated Vol. 0.105	Std. Audit Vol. 0.103	Diff. Gamma: 1.6%	<b>PASSED</b>	

**DGM\_B** Serial #: 20140724

*RFD (Gamma):	Start	End	Compute	Notes
<input checked="" type="checkbox"/> Already Standardized	*RFD (L): 0	152	0.1050	
Flow Rate (ccm): 400			0	
Vol. To Test (L): 5				
DGM_B Temp(F): 77.5				
Console Encoder (L): 0.105				
Std. Calibrated Vol. 0.105	Std. Audit Vol. 0.105	Diff. Gamma: 0.6%	<b>PASSED</b>	

**>>> Audit PASSED <<<**

\*RFD - Reference Flow Device: this can be a  
Alcal Mass Flow or Certified Dry Gas Meter

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Help Print Done!

Figure 5-8  
Console Audit Results

When the Console Audit is complete a message at the bottom of the screen will display Console Audit **Passed** with the current date and time.

If the Console Audit failed the message **Audit Failed** will be displayed across the screen on a red banner.

## Printing the Console Audit Results



### 6.1 Printing the Console Audit Results

Press the **Print** button and the Console Audit will be printed to the Windows default printer. If you are using a PDF printer a dialog box will open. Enter a file name and select a location to save the Console Audit then press “**Save**”.

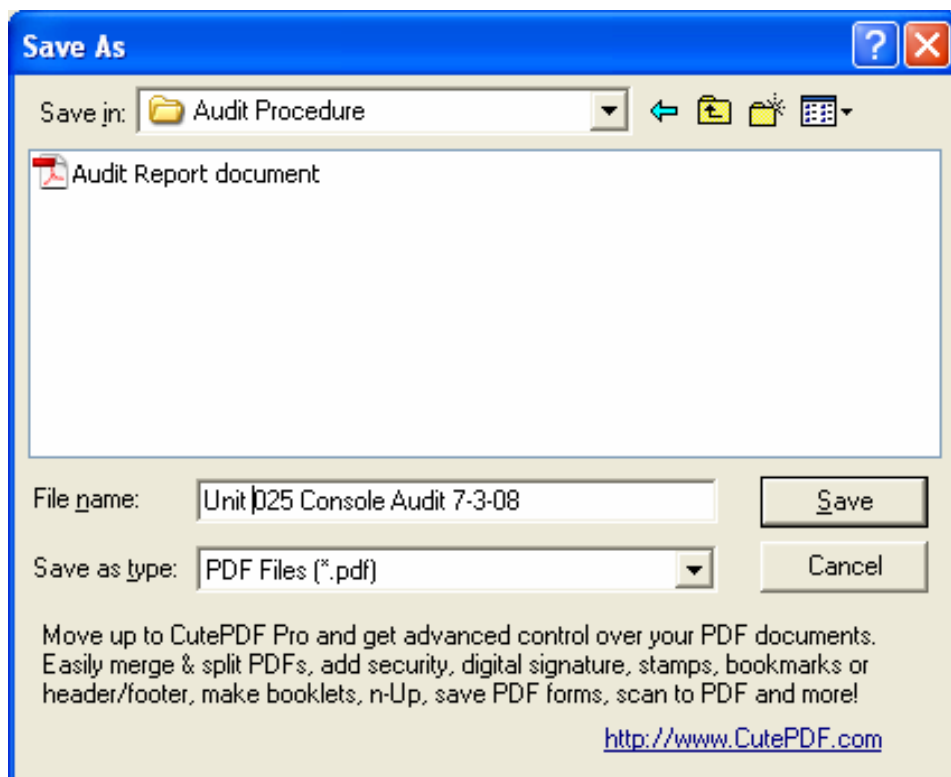


Figure 6-1.1

Printing Results as PDF to File

Verify your Console Audit printed correctly. Press the **Done** button and a confirmation box will be displayed. Press the **Yes** button to exit or press **No** to go back to the Console Audit screen to re-print the Console Audit Report.

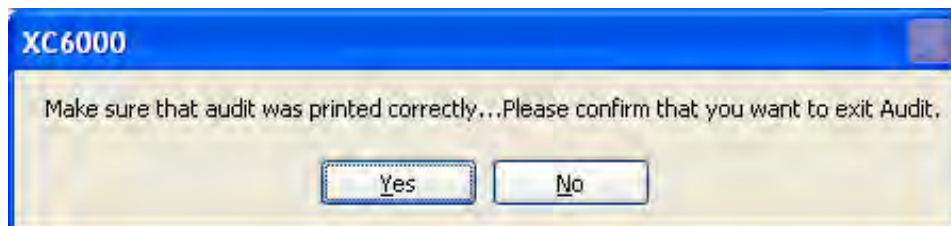


Figure 6-1.2

Printing Confirmation Screen

## **Appendix**

### **A-1 How to Correct Out of Tolerance or Failed Sections in the Console Audit:**

If it is required to recalibrate the console to factory specifications contact your Apex Instruments Technical Services or refer to the appropriate Calibration Manual.

**Barometric Test:** If the Barometric test fails the Console Audit fails and should not be used until recalibrated to factory specifications.

**DGM TC Test:** If the DGM TC test fails the Console Audit fails and should not be used until recalibrated to factory specifications.

**DGM Volume:** If the DGM Volumetric test fails the Console Audit fails and should not be used until recalibrated to factory specifications.

**Vacuum Test:** If the Vacuum test results are Out of Tolerance the console will pass the Console Audit but should be recalibrated.

**Chiller TC Test:** If the Chiller TC test results are Out of Tolerance the console will pass the Console Audit and can continue to be used, but the RFD temperature must be measured with a NIST traceable thermometer capable of reading a Type K thermocouple (chromel / alumel.) The audit will fail if the DGM and RFD temperatures are out of tolerance.

**Stack TC Test:** If the Stack TC test results are Out of Tolerance the console will pass the Console Audit and can continue to be used.

Field re-calibration of the Barometric Sensor, Vacuum Sensors and Thermocouple Sensors is an easy task and can be done with the components of the M-5SLPM-D/5M Audit Kit. Please contact Apex Instruments Inc. for details if your unit requires recalibration in the field.

DGM re-calibration may be performed in the field if 2 M-5SLPM-D/5M Audit Kits are available. Please contact Apex Instruments, Inc. for further information regarding this procedure.

Refer to the console calibration documents for further information or contact Apex Instruments for support.

## A-2 Setup and Calibration of Barometer



For additional information please refer to the provided manual.

### 1) Set date and time

- a. Press the Time button to enter the Time mode.
- b. Press and hold the time button for 2 seconds. The EU or US will begin to flash
- c. If the unit is flashing EU press the + or - buttons until US is displayed.
- d. Press the time button and the month starts flashing.
- e. Use + and - keys to select the current month.
- f. Press the Time button and the day starts flashing.
- g. Use the + and – button to select the current day.
- h. Press the Time button and the 12-hour or 24-hour starts flashing.
- i. Use the + and – button to select the 12/24 hour format.
- j. Press the Time button and the hour starts flashing.
- k. Use the + and – button to select the current hour.
- l. Press the Time button and the minute starts flashing.
- m. Use the + and – button to select the current minute.
- n. Press the Time button to exit.

### 2) Set Temp units to F

- a. Press the Time button to enter Time mode
- b. Press and hold the + and – buttons at the same time for 2 seconds. The Temperature units will toggle between C and F.

### 3) Set barometer to inHG

- a. Press the BARO button to enter the barometer mode.
- b. Press and hold the + and – buttons simultaneously for 2 seconds
- c. Unit will beep. Repeat b until the display shows inHg.

### 4) Set altitude to feet

- a. Press the ALT button to enter the altimeter mode.
- b. Press and hold the + and – buttons at the same time for 2 seconds.
- c. Unit will toggle between meters and feet.

### 5) Set barometer

- a. Calculate the current barometric by obtaining the local barometric pressure which is adjusted to sea level.
- b. Adjust barometric pressure to compensate for altitude. Station Pressure = local pressure – (altitude in feet X .001) Example local barometric pressure reported at the airport is 30.04 and the XC-6000 is at 600' above sea level. Station Pressure would be 29.44= 30.04-(600 X .001)
- c. Press the BARO button to enter the barometric mode.
- d. Press the BARO and TIME buttons simultaneously for 2 seconds.
- e. The barometric pressure will start to flash.
- f. Use the + and – button to enter the correct barometric pressure.
- g. Press the BARO button to exit.

### 6) Leave the unit in BARO mode.

## A-3 Quick Step Guide for STM-12B/XC-6000 Consoles



This Quick Step Guide assists the user with the Console Audit and XC-6000/STM-12B Operations. Refer to the XC-6000/STM-12B Operators Manual and pages 7-26 of this manual for complete Audit Procedure.

1. Make sure the Windows default printer is set to Adobe PDF printer or equivalent. Go to Windows OS for help.
2. Prepare the XC-6000 for the audit by removing from the case, disconnecting lines etc.  
 Prepare the STM-12B by opening the cabinet door and front face panel allowing access to the DGMs.
3. Power the console **ON** and perform a 15 minute warm up test.
4. At the conclusion of the warm up test return to the initial screen and press the **Config/Utils** button.
5. From the **Config/Utilities** screen press the **Console Audit** button
6. Type Technician's name in the yellow rectangular box.
7. Type the reference device\*(see NOTE) barometric pressure reading in the small yellow box and press **Next** button.  
**\*NOTE: Local weather station or other service may be used. Indicate such in area provided for step #8**
8. Type model type and serial number for the barometric pressure reference device and vacuum reference device.
9. Assure the vacuum reference device is set in inches of Hg. Connect the reference vacuum gauge to the console Sample A inlet port. **Assure vacuum gauge is ZEROED.** Press **Start Pump** button. Type the reference device vacuum reading into the box once the reading has stabilized. Press **Next**.
10. Connect the reference vacuum gauge to the XC-6000 Sample B inlet port. Press **Start Pump** button. Type the reference device vacuum reading into box once the reading has stabilized. Press **Next**.
11. Type the model and serial number of the reference thermometer.
12. Prepare ice bath and use the reference thermometer and place in the ice bath. Let reference thermometer stabilize and record temperature in the corresponding **Ice Bath Temperature** box.
13. Place both the DGM A & B TCs in the ice bath at the same time. When the temperature stabilizes type the temperature of the reference thermometer in the box. Press **Next**. Return the TCs to the DGMs.
14. Dip the end of the probe into the ice bath. When the Stack TC temperature stabilizes press **Next**.
15. **DO NOT** Check the box that says **"Use Chiller Input for RFD temperature"**.
16. Type the model and serial number for the RFD in the box.
17. Connect the RGFM to the Sample A inlet port.
18. Press the **RESET** button to set the ZERO reference point for the RFD.
19. Make sure the **RFD (Gamma) Already Standardized Box** is checked. Type the Flow rate (ccm) in whole numbers and the Total Volume to Test in liters. 10 liters is recommended. Type "0" as the RFD starting value.
20. Recheck to make sure you are in Totalizing Mode. Press the **RESET** button on RFD to reassure a ZERO starting point. Press **Next**.
21. The console will automatically begin and end the test when the volume to test has been reached.
22. When the test has ended type the results volume value from the Alicat RFD and press **Next**.
23. The test results will display **"Std Calibrated Vol."** **"Std. Audit Vol."** **"Diff. Gamma"** and either **Passed** or **Failed** at the bottom of the DGM A display field.
24. If the test **Failed**, there is a **Redo A** option above the **"Notes"** box to the right of the Audit screen. Repeat steps 19 through 23.
25. If the test **Passed** select **Next**.
26. Connect the RFD to the Sample B inlet port of the console. Repeat steps 19 through 25.
27. A bold banner will appear across the Audit screen denoting **Audit Passed** with date or **Audit Failed**.
28. Press the **Print** button to print or to create a PDF file of the Audit Report.
29. Press **Done** to close the Console Audit application.

