Mercury

STMS

APEX INSTRUMENTS, INC.

Sorbent Trap Monitoring System
Model STM-12-TS

Operator's Manual

SORBENT TRAP MONITORING SYSTEM STM-12-TS

Operator's Manual

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Warranty

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.

We reserve the right to employ any suitable material in the manufacture of our apparatus, and to make any alterations in the dimensions, shape or weight of any parts, in so far as such alterations do not adversely affect our warranty.

Important Notice

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.

QUALFIED 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 STM-12B System. The operator of the STM-12B system should read this manual thoroughly prior to attempting to perform sampling with the unit and be familiar with associated EPA methods pertaining to the aforementioned console. Keep this manual readily available for reference while conducting operation of the unit.

Please contact Apex Instruments' Technical Services Group if you have any questions or concerns relative to the operation of this system.

Apex Instruments, Inc.
Technical Services Group
Email: support@apexinst.com
Tel: (877) 726-3919

Additional manuals may be downloaded from the Apex Instruments website: **www.apexinst.com**.

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Introduction

The purpose of this manual is to provide a basic understanding of the Apex Instruments MercSampler Model STM-12B automated sampling console and system components available for Sorbent Trap Monitoring. The STM-12B console is applicable for Mercury Emissions Sampling Using Iodinated Charcoal Traps.

For additional information on the applicable methods, please visit http://www.epa.gov/mats/

1.0 STM-12B MercSampler System Components

1.1 STM-12B Source Sampler Cabinet

The STM-12B console components, SGC-12B gas cooler, condensation bottles and acid scrubbing/ moisture absorbent canisters are contained within a sturdy, virtually weather-tight enclosure with an optional AC unit which may be mounted externally to the enclosure (as shown below).

The enclosure may be conveniently mounted on a stand (as pictured on page 1) or vertically mounted directly to a wall or another fixed structure via mounting fixtures located on the rear of the enclosure.

1.2 STM-12B Source Sampler Console

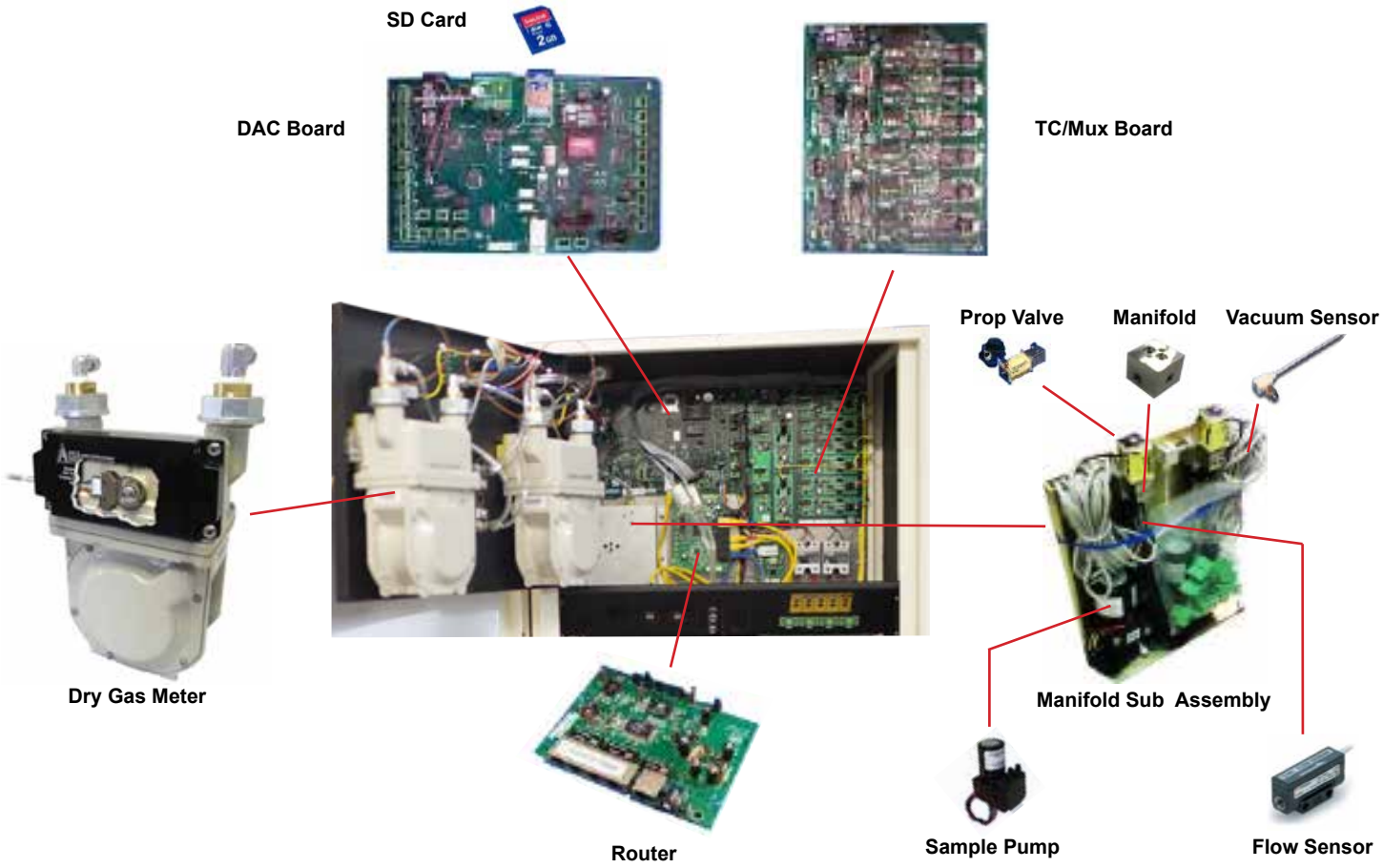
The MercSampler Console is the operator's control station, controlling and capturing data necessary for paired sorbent tube sampling. The basic principle of the console is to control the sample flow rate proportionally to the stack gas flow rate and to determine the standardized volume extracted through each sorbent trap. To capture the samples, a pair of diaphragm vacuum pumps work in concert with proportional valves and mass flow sensors. Optical encoders are mounted inside the gas meters to provide digital feedback for the volume sampled. From additional temperature and pressure measurements the sample volume at standard conditions (USEPA 20°C and 760mmHg) is calculated.

Features and Specifications of Model STM-12B MercSampler Console Components

Meter Display:	Meter Data is displayed via Microsoft Surface 3 Pro Tablet utilizing MercSampler Software. Resolution: 2160 x 1440 (Full HD Plus) Touch screen: Yes (10-point multi-touch) Native Resolution: 2160 x 1440 Diagonal Size:12 in Image Aspect Ratio: 3:2
Dry Gas Meter:	Positive displacement diaphragm meter, 45 Lpm maximum and 0.17 Lpm starting flow rate, 0.7L/revolution
Dual Sample Pumps:	Internal KNF miniature diaphragm pump. Brushless DC (BLDC) Motor rated at 12VDC. >20inHg Maximum Vacuum. ~4Lpm maximum unrestricted flow.
Dual Proportional Valves:	Parker Hannifin Voltage Sensitive Orifice (VSO) Series. 47ohm, 12VDC

Features and Specifications of Model STM-12B MercSampler Console Components

Dual Mass Flow Sensors:	SMC. Airflow Sensor, Signal Conditioning: Amplified Flow/Pressure Range: + 6000 sccm (6.0 SLPM) Linear Range 1LPM Port Style: Manifold (mass flow controller)
Barometric Sensor:	All Sensors 600-1000mBar, 5VDC Supply
Dual Vacuum Sensor:	Vacuum 0-30”Hg, 125mA
Flow Meter:	Dwyer 100-2500 ccm
Umbilical Connections:	Electrical: 4-pin locking Amphenol connectors Sample Line: ¼” Stainless Steel Quick-Connect or Swagelok fittings
Power Requirements:	120VAC/60Hz standard 2 or more 15A circuits depending upon configuration (240VAC/50Hz optional)
Cabinet Dimensions:	40 in x 24 in x 14.5 in (W x H x D) / 35.6 cm x 48.3 cm x 39.4 cm
Weight:	195lbs / 88kg (with stand configuration)

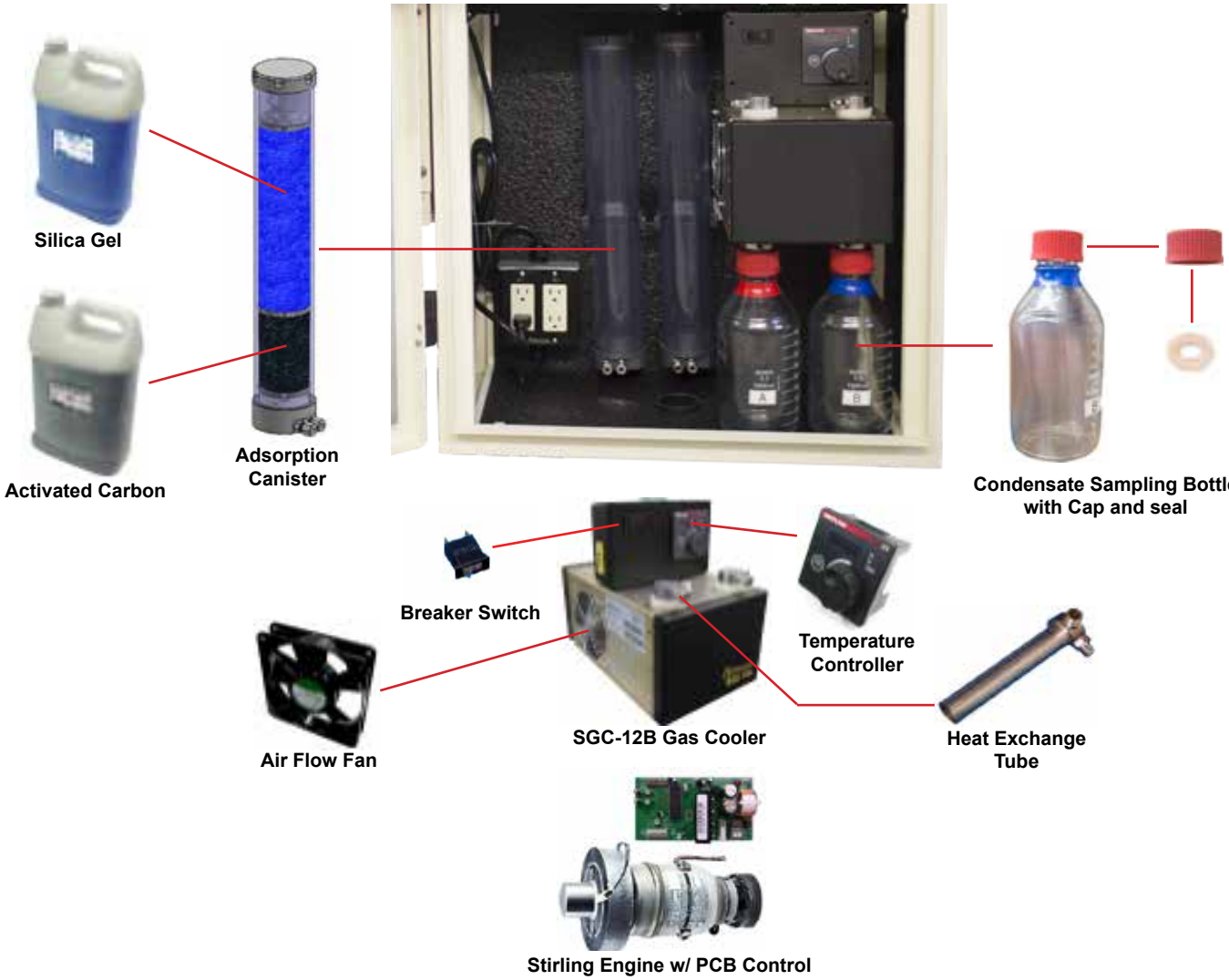


1.3 SGC-12B Gas Cooler

The STM-12B-TS integrated cooler provides a dry sample for the gas meters and simultaneously collects the condensate for determining the stack moisture content (Method 4). The gas cooler uses an industrial grade super efficient Free Piston Stirling Cooler (FPSC) for chilling the gas to a constant dew point. The module is hermetically sealed in a steel casing allowing for fast and easy installation and service.

Features and Specifications of Model SGC-12B Gas Conditioner

Temperature Control:	Digital Display/Analog Temperature Controller w/ Dial Temp Knob
Cooling Capacity:	>40 Watts
Condensor:	Alloy C276, 1” OD X 4” Active Zone
Dual Path Cooling Block:	Anodized Aluminum
Condensate Bottle:	1000 ml Plastic Coated Glass
Acid Scrubber Canisters:	Two 18” Adsorption Housing Assembly
	Filled with 75% Silica Gel/25% Activated Carbon
Maximum Flow Rate:	2 LPM at 20% H_2O Channel
Freeze Protection:	80 Watt Heater



1.4 Mercury Probes

There are 3 types of probes available: 2 Trap Dual Heater, Single Trap Single Heater and the Dual Trap Single Heater Air-Cooled Probes.

HGP Mercury Probe

The heated mercury sorbent trap probes are designed to accept a pair of standard 10mm D sorbent traps. The sorbent traps are placed at the probe inlet to prevent HG trasport losses during sampling. Thraps are sealed in place with compression fittings using glass-filled PTFE ferrules.

The probes are constructed from corrosion resistant tubing. The outer sheath is 2”OD and the inner liners are 1/2” alloy. Alloy C276 is recommended for STM-12B applications.

The probe is fitted with two heaters; one to heat the traps and the second for heating the portion of the probe outside of the stack.

The heated mercury air cooled probes are for use in high stack temperature environments. These probes feature 2” stainless steel or C276 outer sheaths as a standard with indiviually controlled heat zones and integrated stack, trap and probe thermocouples.

HGPA Air Cooled Mercury Probe

Sorbent Trap Shields

1.5 Heated Probe Connection Box

The heated probe connectionbox provides a compact, positive, protective connection point for the umbilical, sampling lines, power connection and thermocouples. The umbilical heat trace neatly fits into the box to provide additional heating for the sample lines to ensure against moisture condensation. The probe sampling tubes are conveniently cleaned by removing the end caps on the sampling "T" fittings and inserting a cleaning brush into the sampling tubes.

1.6 Heated Umbilical Lines

The heated umbilical lines include the self-regulating heater cable, flexible conduit with two replaceable 1/4" PFA sample lines, pass through power and thermocouples for the probe heater. The heated core is insulated with several layers of braided lightweight Pyron OPF yarn which is burn proof and not conductive.

Ends are fitted with cam and groove fittings for easy installation and strain relief. Passing through the fittings on the probe end are the thermocouple connectors, sample lines and heat trace extension with the amphenol power/signal supply external of the fitting.

The opposite end provides the sample lines, electrical power cord, amphenol power/signal cord and male thermocouple jacks which connect to the console.

2.0 Pre-Operational Procedures

2.1 Test Design

Before testing the operator should know the following:
Why is the test to be conducted
Who will use the data
What stacks or emission points are to be tested
What process data is to be collected
What collected data will be correlated to the test results
Where the sample ports are located and type of access
When the test is scheduled and deadlines for reporting
How the method or procedure is followed and how many test runs or process conditions will be tested

Site and Equipment Information:
Site Name and Location
Testing Company and Personnel
Communication Method
Connection Method
Stack Dimensions
Velocity Traverse
Traverse
Pitot ID, Pitot Coeffecient
Trap ID's

Determining Test Parameters:
How long should the test be set for?
What temperature should the probe be?
What temperature should the chiller be?
Which flow- proportional or constant control?
What flow rate should be used?
How is moisture being handled?
Which Alarms should be set?
What Alarm Actions should be used?

2.2 Site Preparation

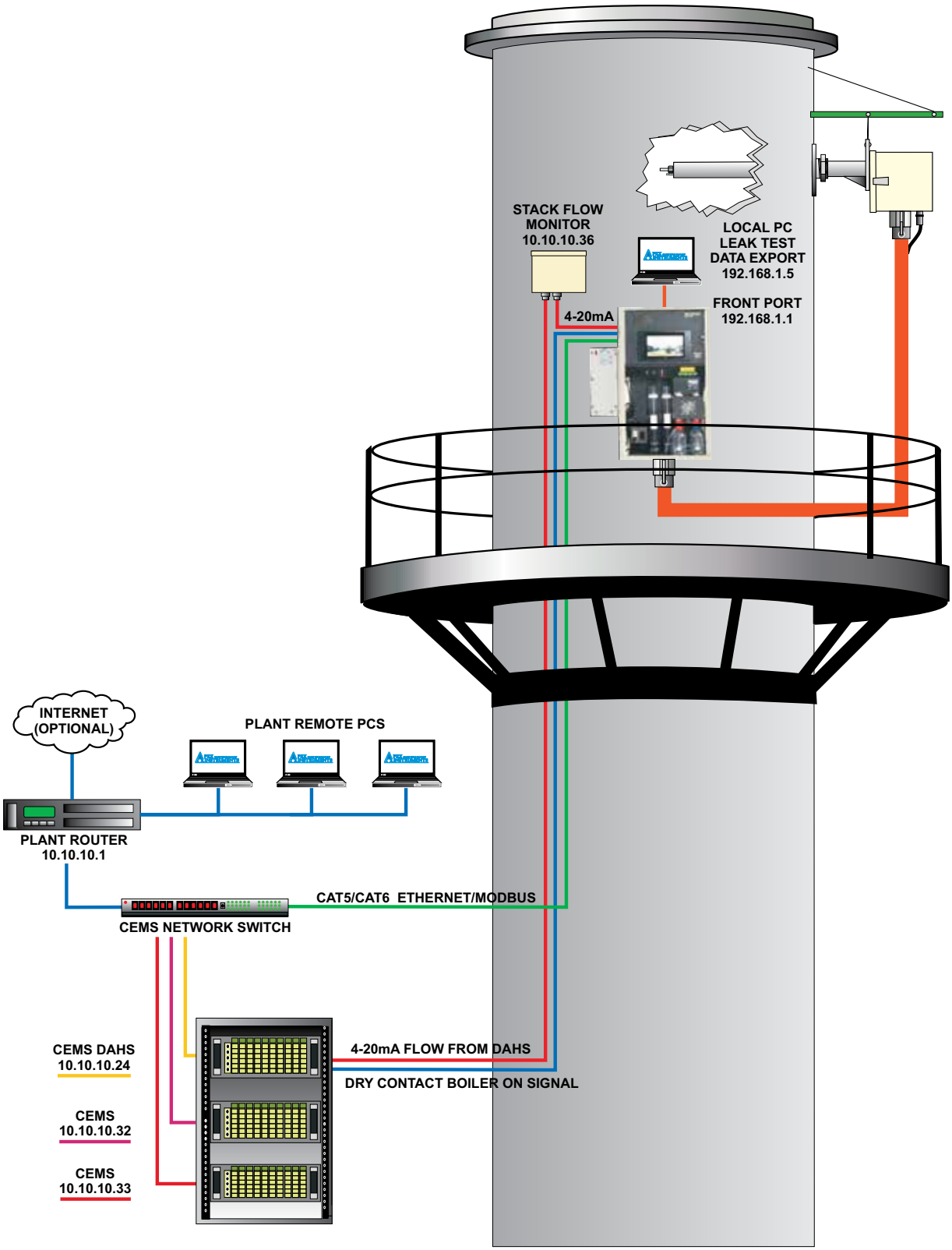
Preparing the site for optimum semi-permanent equipment installation can be very challenging. When sample ports do not have a platform or catwalk, scaffolding must be erected to reach the sampling site. At many sites the operator must use ingenuity to locate the sampling equipment at the sample ports. In most instances a monorail probe support system must be installed.

When selecting the test area for sample ports, the operator should be aware of the working area available. The operator should make note of railings, guardrails or other structures that may obstruct and affect the testing process. Ensure there is clearance to insert and withdraw the probe and attached umbilical from the testing port.

2.3 Site Equipment Location Configurations

The recommended Site Equipment Location Configuration is Configuration 1.

Configuration 1 stipulates all equipment to be located at the Sampling Port Location as shown below.



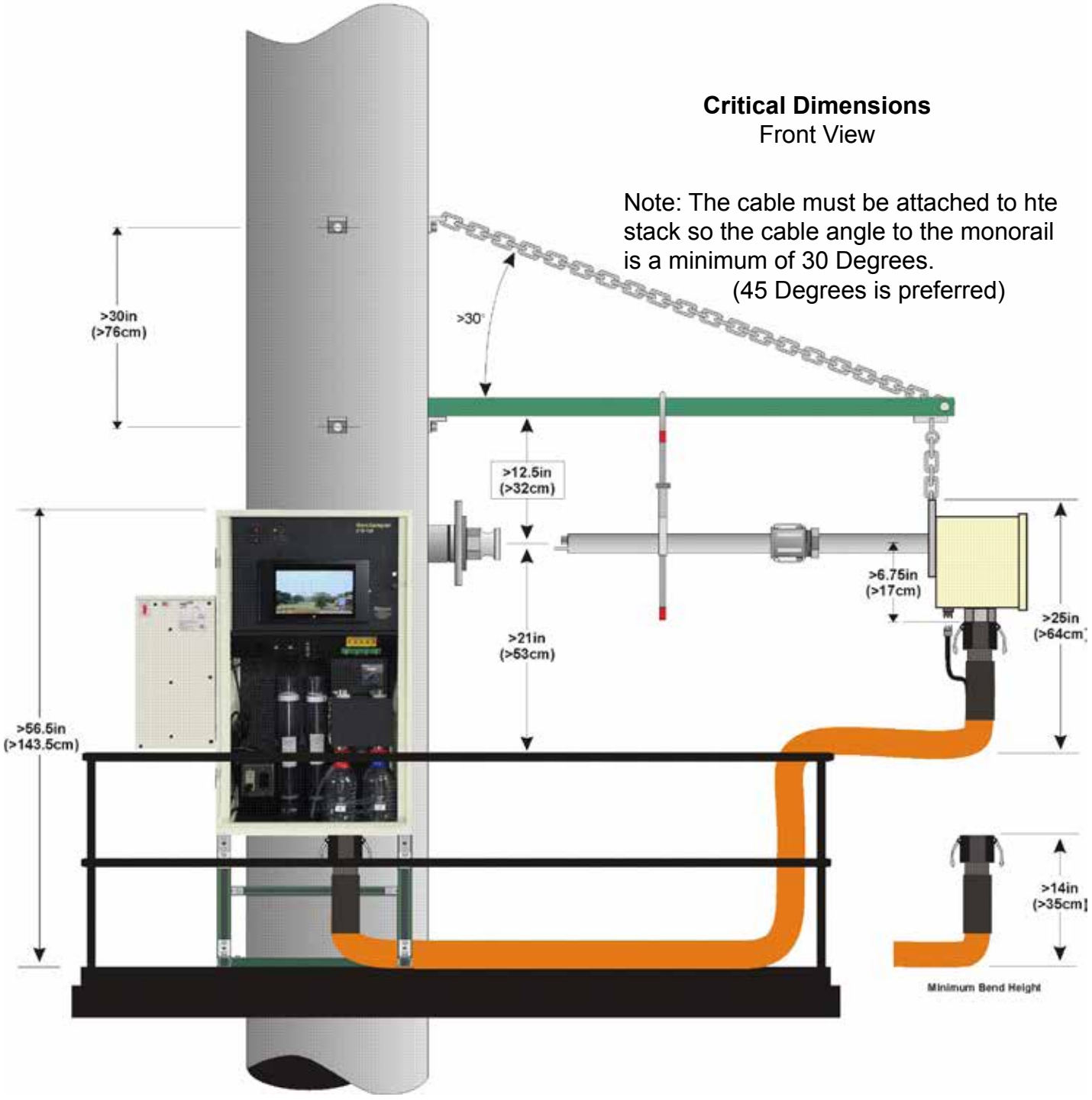
When selecting the site for sample ports, the operator should keep in mind the critical distances the STM-12B-TS system requires in order to operate effectively and efficiently.

The operator must take into consideration:

Height of Probe Port
Length of Probe
Window size, if needed, for Probe (with HSRL connected) to fit through window
Width of Probe Box
Enclosure and Air Conditioner Overall Height
Enclosure and Air Conditioner Overall Width
Enclosure and Air Conditioner Overall Depth
Cabinet Door Service Dimensions

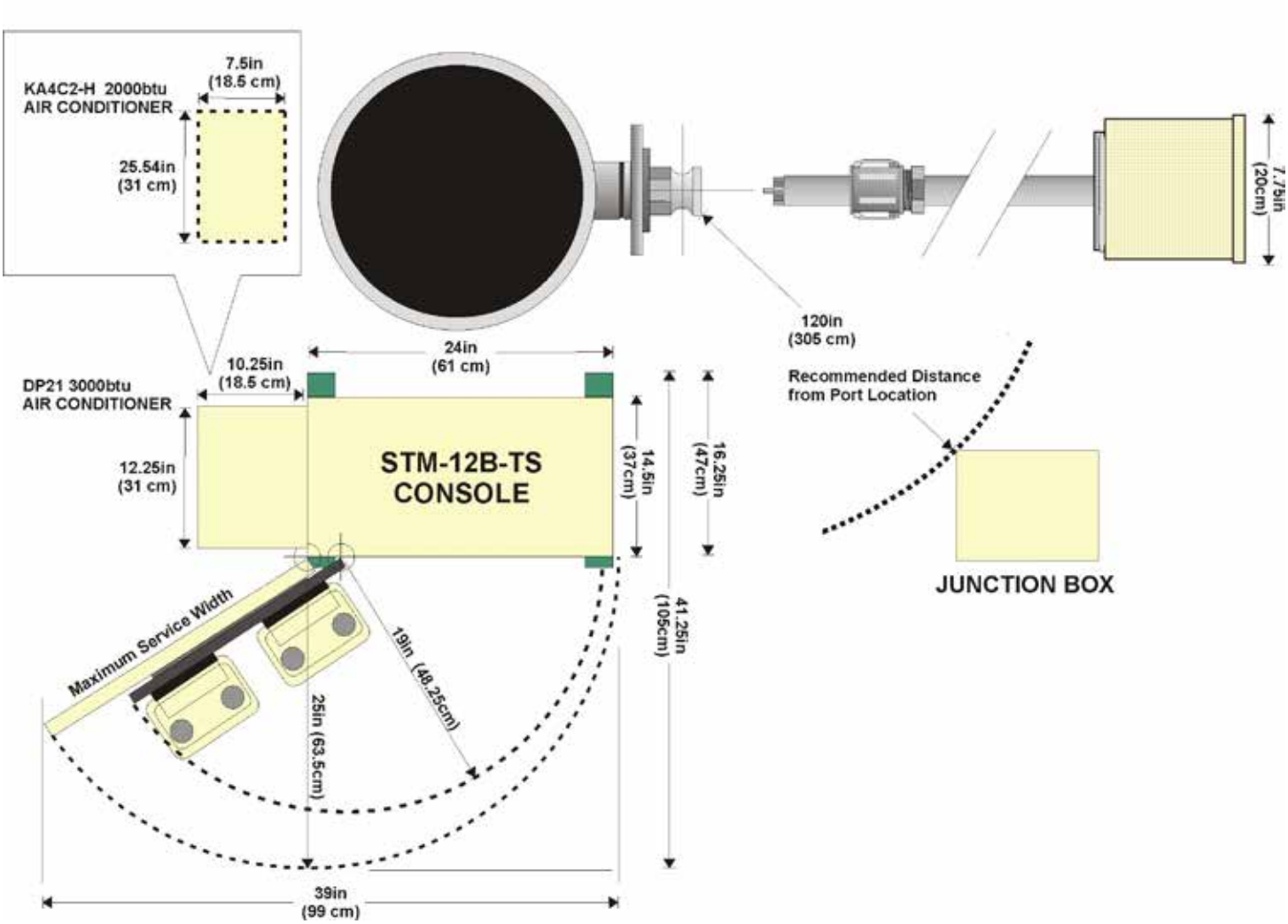
Critical Dimensions
Front View

Note: The cable must be attached to hte stack so the cable angle to the monorail is a minimum of 30 Degrees.
(45 Degrees is preferred)



Critical Dimensions

Look Down View



2.4 Site Assembling Sampling Equipment

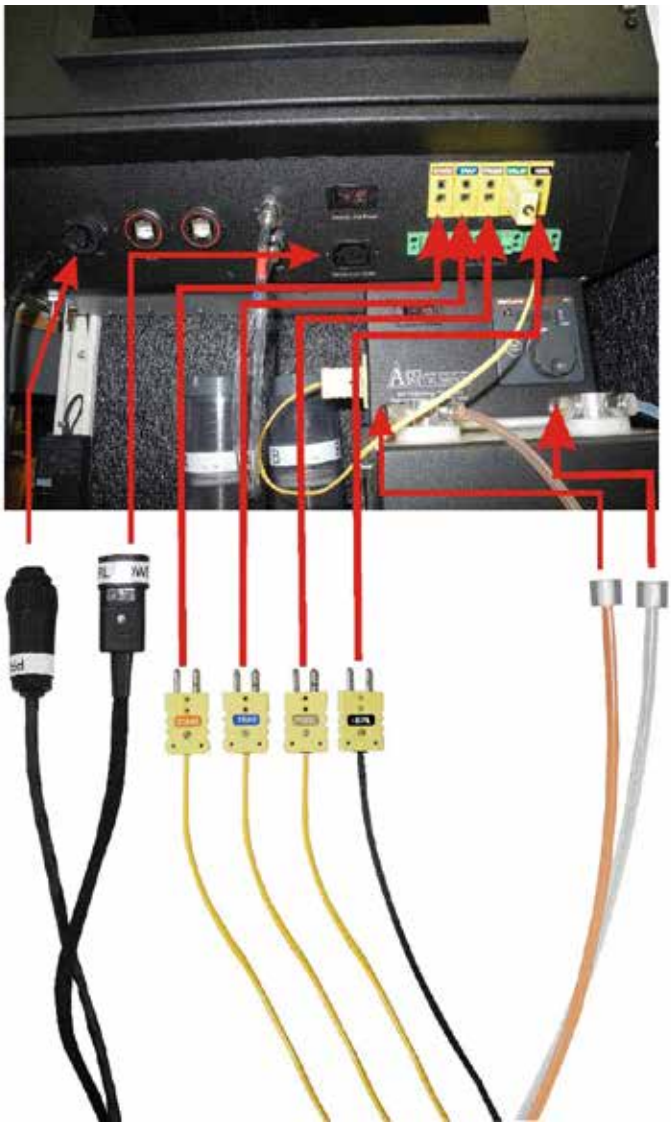
Position and securely attach the console to a supporting frame on the stack or via j-hooks to the floor grate.

Insert the Sample lines, Thermocouples and Power Cord of the HSRL through the coupling located on the bottom of the STM-12B enclosure. NOTE: Start with the Power Cord, Amphenol, Sample lines and then the Thermocouples (ie. Large to Small).

2.5 Console Connections

After the Power Cord, Sample lines and Thermocouple connectors have been inserted through the coupler, connect the HSRL coupler to the Console coupler.

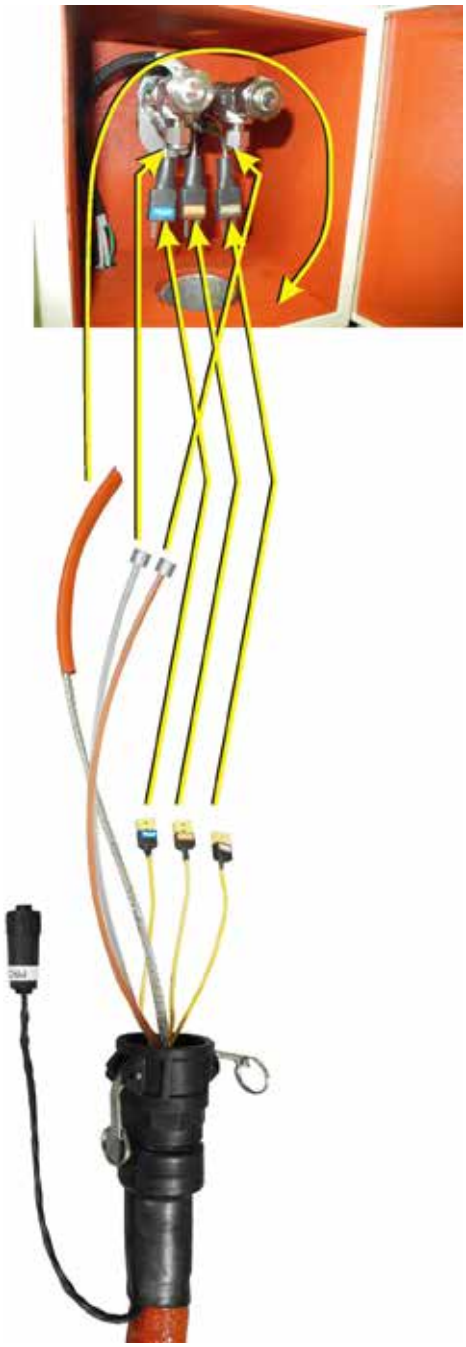
Connect the Power Cord to the power outlet, Connect the sample lines A and B to their respective connections on the Chiller Heat Exchange tubes. Connect the Stack, Trap and Probe Thermocouple Connectors to the corresponding panel jacks on the console.



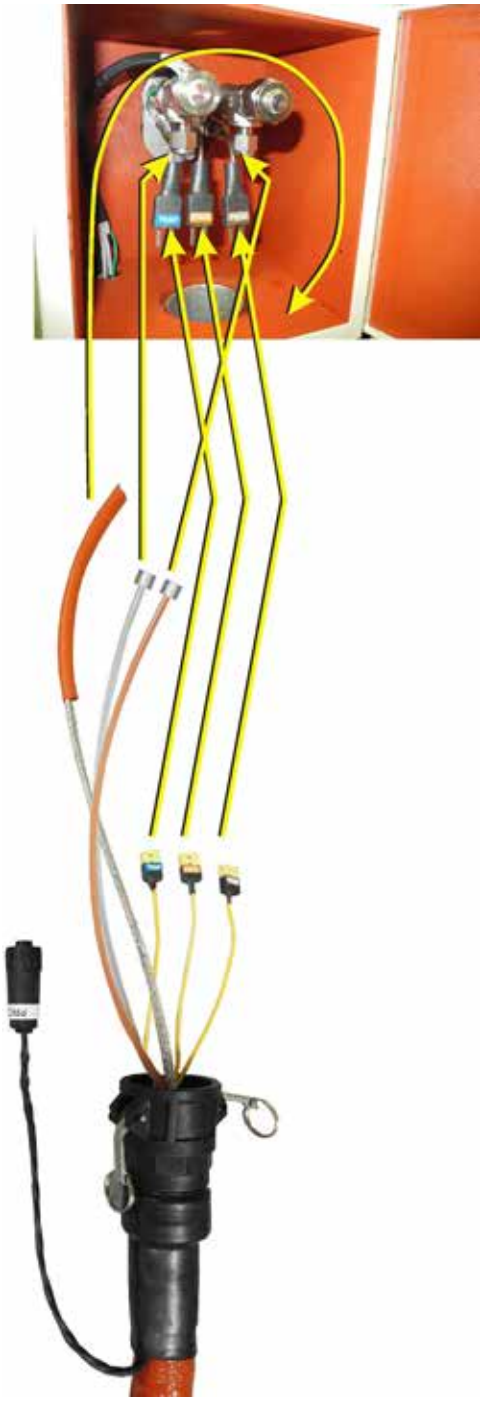
2.6 Probe Connections

Insert the Sample lines, Thermocouples and Heat Trace Lines through the coupling located on the bottom of the Probe Box. NOTE: Start with the Heat Trace, Sample lines and then the Thermocouples (ie. Large to Small). Connect the Probe Power Amphenol to the receptable on the Probe Box.

After the Heat Trace, Sample lines and Thermocouple connectors have been inserted through the coupler, connect the HSRL coupler to the Probe Box coupler.



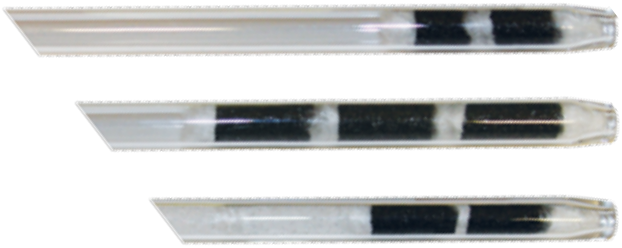
Wrap the Heat Trace around the inside of the Probe Box. Connect the sample lines A and B to their respective connections on the Probe Sample “T”’s A and B. Connect the Stack, Trap and Probe Thermocouple Connectors to the corresponding Probe Thermocouple Jacks.



2.7 Sorbent Traps

PS 12B specifies sampling, and analytical, and quality-assurance criteria and procedures for the performance based monitoring of vapor-phase mercury (Hg) emissions in combustion flue gas streams, using a sorbent trap monitoring system. The principle employed is continuous sampling using in-stack sorbent media coupled with analysis of the integrated samples. The performance-based approach of Appendix K allows for use of various suitable sampling and analytical technologies while maintaining a specified and documented level of data quality through performance criteria.

Method 30B is a procedure for measuring total vapor-phase mercury (Hg) emissions from coal-fired combustion sources using sorbent trap sampling and an extractive or thermal analytical technique. This method is only intended for use only under relatively low particulate conditions (e.g., sampling after all pollution control devices).



The system is designed to capture mercury in a pair of glass tubes called sorbent traps. These traps are partially filled with activated charcoal (carbon) and are divided into two or more sections by fiberglass or glass wool insulation. The stack gas is drawn through the sorbent trap and any mercury present in the gas stream is captured by the sorbent.

The “front” section is designed to capture all of the mercury from the source.

The second section is a buffer, and is designed to capture any mercury that escapes the first section. In most testing, exceeding a certain amount of mercury in this section will invalidate test results.

The third section (if present) is the “spike” section. A known mass of mercury is deposited in this section, and acts as a control to ensure that the first two sections are working properly. When the contents of the third section are analyzed after the sample collection, the results should show the mass of mercury to be the same both before and after sample collection on this section. In most testing, failure to recover the spike will invalidate test results.

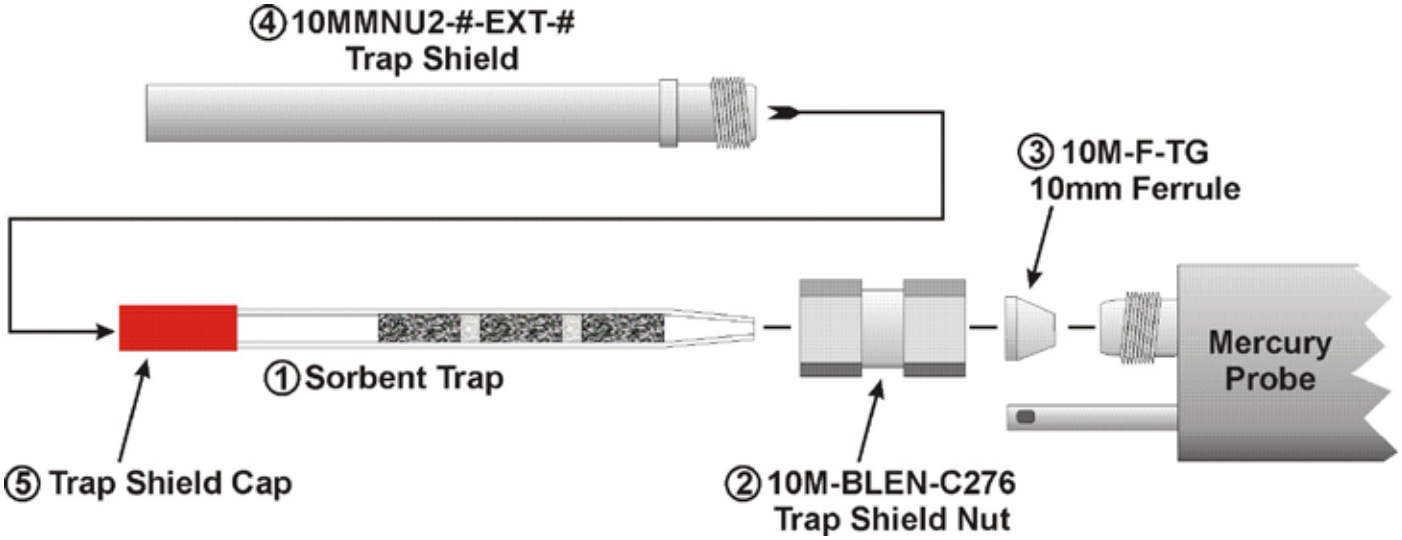
For RATA testing, baseline testing, and engineering studies, two-section traps are generally used. Consult with your local environmental regulatory body to determine the trap types required for your application.

2.8 Sorbent Trap Installation

Slide Sorbent Trap (1) through the Trap Shield Nut (2) and the wide end of a NEW 10 mm Ferrule (3).

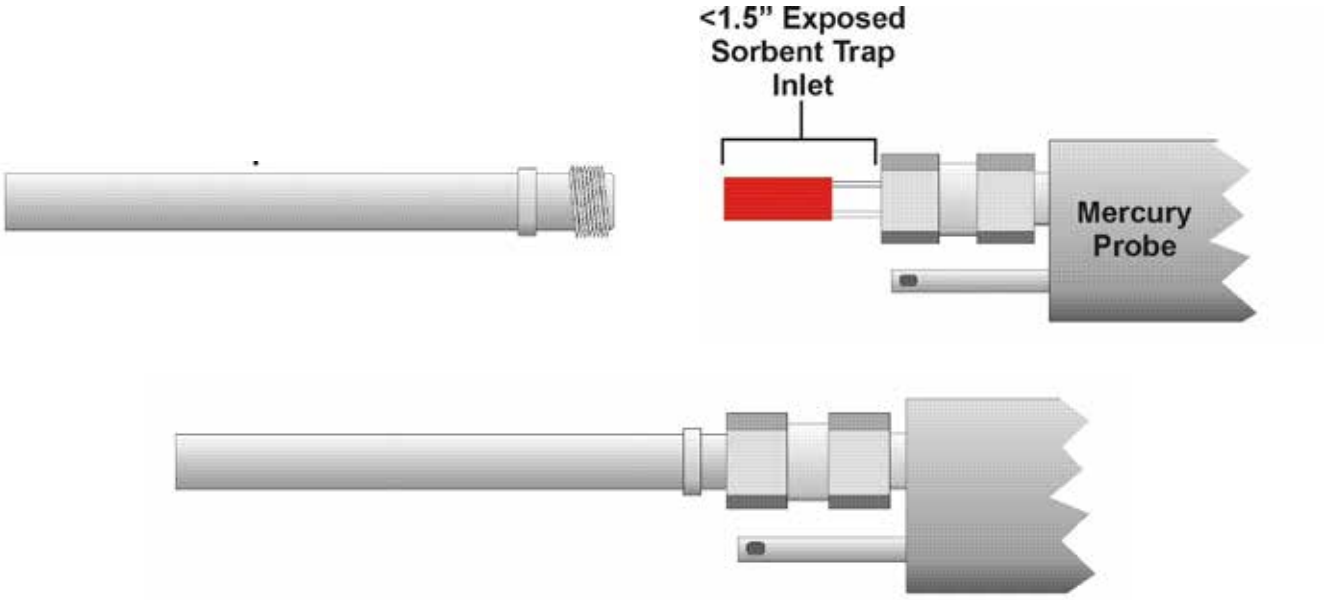
Slide Sorbent Trap into the Mercury Probe sorbent trap receptacle and screw on the Trap Shield Nut finger tight at this time.

Position the Sorbent Trap so that no more than 1.5” of the inlet side of the Sorbent Trap is exposed.



Gently tighten the Trap Shield Nut while applying slight pulling pressure on the Sorbent Trap. Stop tightening once the Sorbent Trap cannot be pulled out of position. ***Overtightening the nut may crack the Sorbent Trap***. Repeat the preceding steps for the other Sorbent Trap Channel and then proceed to Section **4.5 *PRE-TEST LEAK CHECK*** before installing the Trap Shields.

After successfully performing ***PRE-TEST LEAK CHECK***, remove the Trap Shield Cap (5) and slide the Trap Shield (4) over the Sorbent Trap and screw into the Trap Shield Nut. Hold the Trap Shield Nut in stationary position. DO NOT allow the Trap Shield Nut to move. Securely tighten the Trap Shield. Repeat this procedure for the other Sorbent Trap and Trap Shield.



Final Assembly

2.9 Method PS-12 and US EPA Resources

Specifications and test procedures for monitoring total vapor phase mercury emissions from stationary sources using a sorbent trap monitoring system. These monitoring systems involve continuous repetitive in-stack sampling using paired sorbent media traps with periodic analysis of the time-intergrated samples. Persons using PS 12B Should have a thorough working knowledge of Methods 1, 2, 3, 4, 5 and 30B in appendices A-1 through A-3 and A-8 to this part.

The analyte measured by the procedures and specifications is total vapor phase Hg in the flue gas, which represents the sum of elemental Hg and gaseous forms of oxidized Hg in mass concentration units of micrograms per dry cubic meter.

These procedures are only intended for use under relatively low particulate conditions (e.g., monitoring after all pollution control devices). This specification is for evaluating the acceptability of total vapor phase Hg sorbent trap monitoring systems installed at stationary sources at the time of, or soon after, installation and whenever specified in the regulations. The Hg monitoring system must be capable of measuring the total concentration of vapor phase Hg (regardless of speciation), in units of µg/dscm.

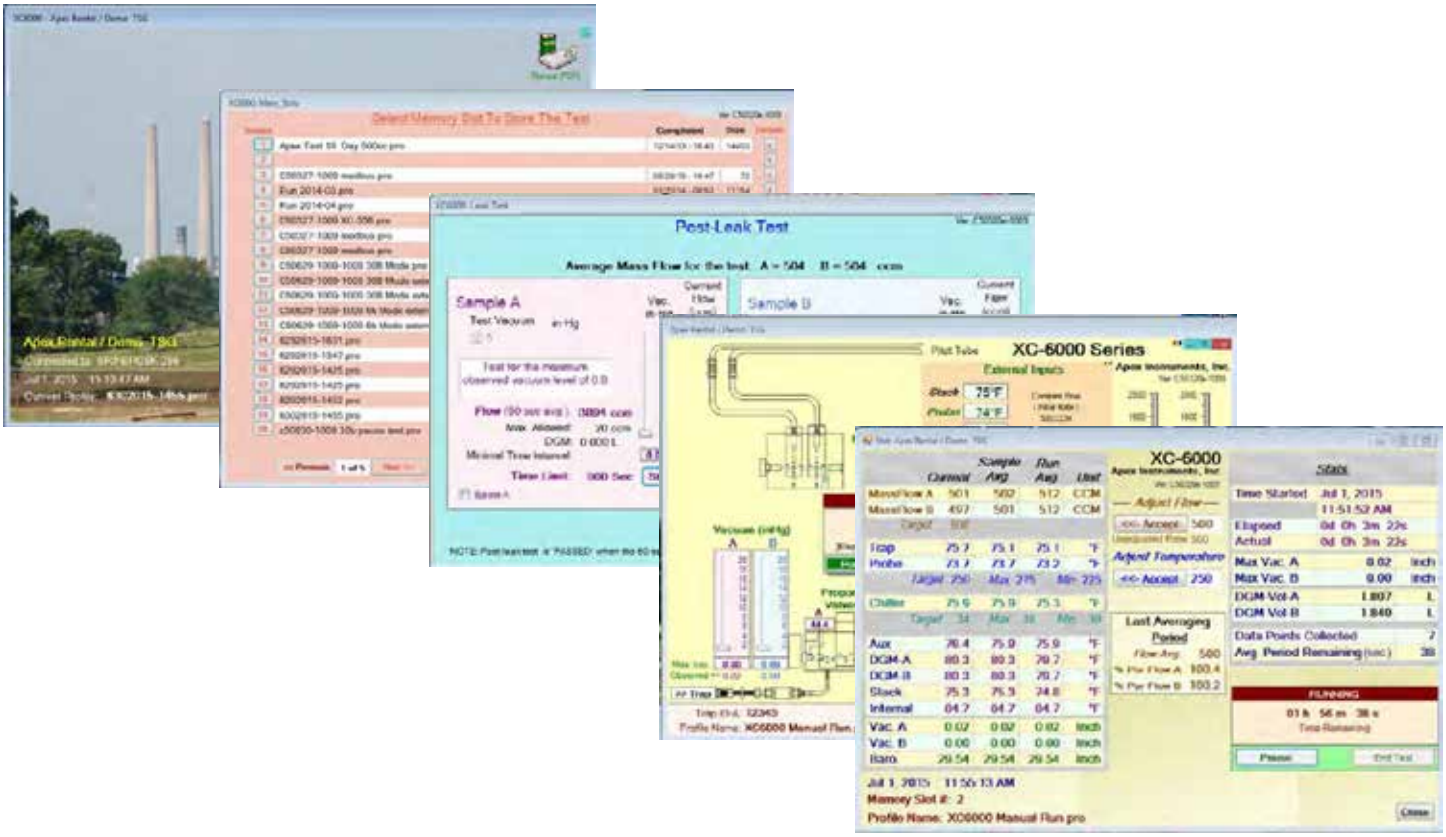
US EPA Resources

EPA Website: www.epa.gov

Method PS-12B Performance Specifications: http://www.epa.gov/ttn/emc/perfspec/ps-12B.pdf

Method PS-12B Related Items on EPA Website:
http://nlquery.epa.gov/epasearch/epasearch?querytext=ps-12b&fld=&areaname=&areacontacts=&areasearchurl=&typeofsearch=epa&result_template=2col.ftl&force=no&filter=sample4filt.hts

3.0 Operating Procedures



3.1 Introduction to the MercSampler Software

The MercSampler includes firmware preloaded on its DAC and TC/MUX boards. Also included is Windows-based interface software. Apex Instruments recommends the purchase of a laptop or desktop computer directly through Apex to ensure computer compatibility and proper loading of software. However, if you prefer to use or purchase your own computer please ensure your computer has, as a minimum, the following specifications

Item	Description	Capacity
CPU	Processor Speed	1GHz+
RAM	Random Access Memory	4MB Minimum
HDD	Hard Drive Capacity	~12MB for Software. Data file storage varies.
O/S	Operating System	Windows XP, Vista, 7, 8 and 10

3.2 Installing Software

MercSampler software will be provided upon purchase of the console. Should firmware and/or software require to be upgraded or reloaded, it may be found on www.apexinst.com. hover over the Links tab, select the Downloads button, click on the link: http://www.apexinst.com/ downloads/public/, select the Apex Software text and select the STM-12B XC-6000 XC-30B xxxxxx-xxxx.zip. Select “Open” and the file folder will begin downloading.

3.2 Installing Software (continued)

To load MercSampler software on your laptop or desktop computer, follow these steps:

1. Open the file folder .
2. The “Apex” directory should be displayed along with installation instructions.
3. Right click on the Apex folder and click select Copy.
4. Double Click on the Windows C: drive.
5. Click on Edit and then click on Paste. If prompted to overwrite files click Yes to All. This should put the Apex folder in the root of the C: drive.
6. Open the Apex file and Right click on the XC6000_xxxxxx application file where xxxxx is the SW version (it will have a red icon to the left of the name).
7. Right click on the file name. Create an icon/shortcut and place on the desktop or taskbar.
8. To run the application Double Click on the XC-6000 icon on the desktop/taskbar. Create or edit existing profiles prior to use.

3.3 Driver Installation

The Apex STM-12B-TS includes a USB connection functionality, which is implemented using a virtual serial port on the connected PC. To install drivers for this serial port, please perform the following steps:

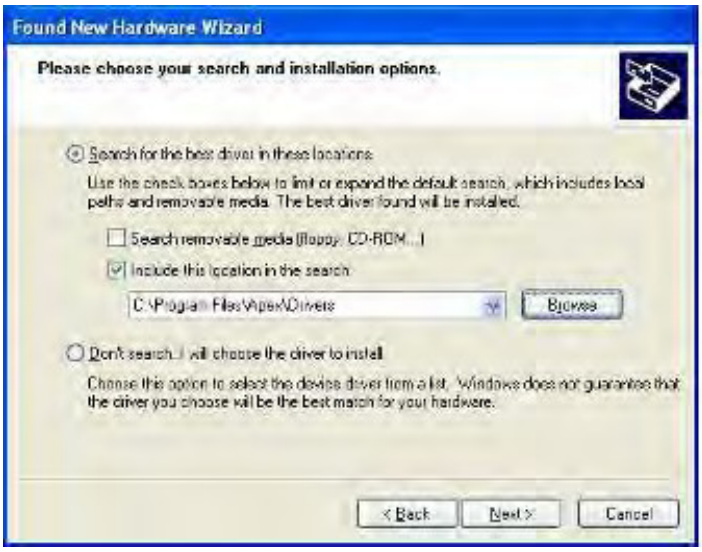
Power down the STM-12B-TS MercSampler, if it is not already powered off, by switching the main Power switch to the “OFF” position.

Connect the STM-12B-TS to the PC using the included USB cable.

Windows will discover the STM-12B-TS. The Windows “Found New Hardware Wizard” will appear onscreen.

3.3 Driver Installation (continued)

Please select “Install from a list or specific location (Advanced.)

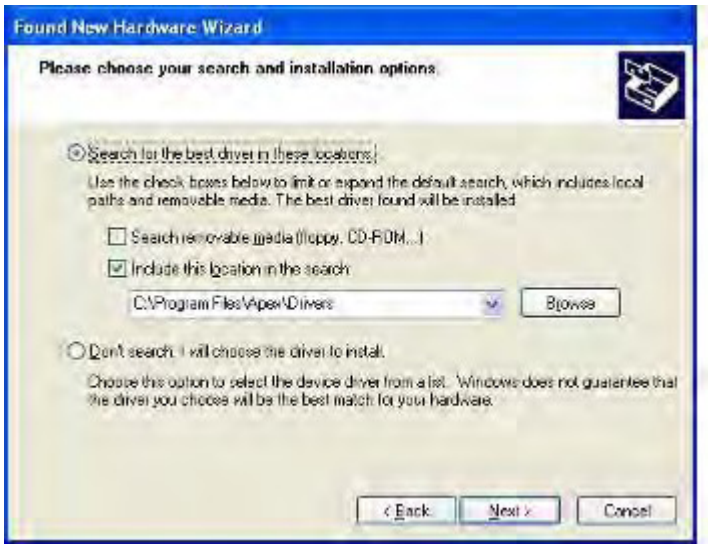


Use the “Browse” button to find the folder where the software application is installed (usually C:\ Apex) and then navigate to the “FT232_UART_Driver” subfolder. (C:\ Apex \FT232_UART_Driver) Click “Next.”

The drivers for the serial converter (UART) will be installed. Press “Finish.”

Windows will then discover the virtual serial port. The installation for the serial port drivers is the same as for the serial converter. The “Found New Hardware Wizard” will start:

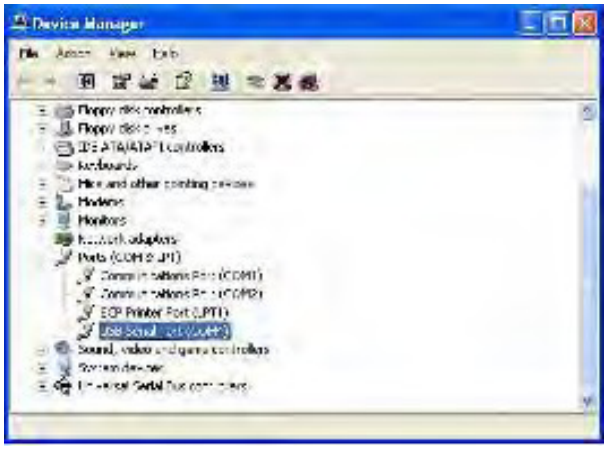
Select “Install from a list or specific location (Advanced,)” and press “Next.”



Select the driver location (same as for the serial converter installed previously) and press “Next.”

The wizard will complete. Press “Finish.”
Open the System Properties control panel (either open Control Panel > System or right click on My Computer and select “Properties.”

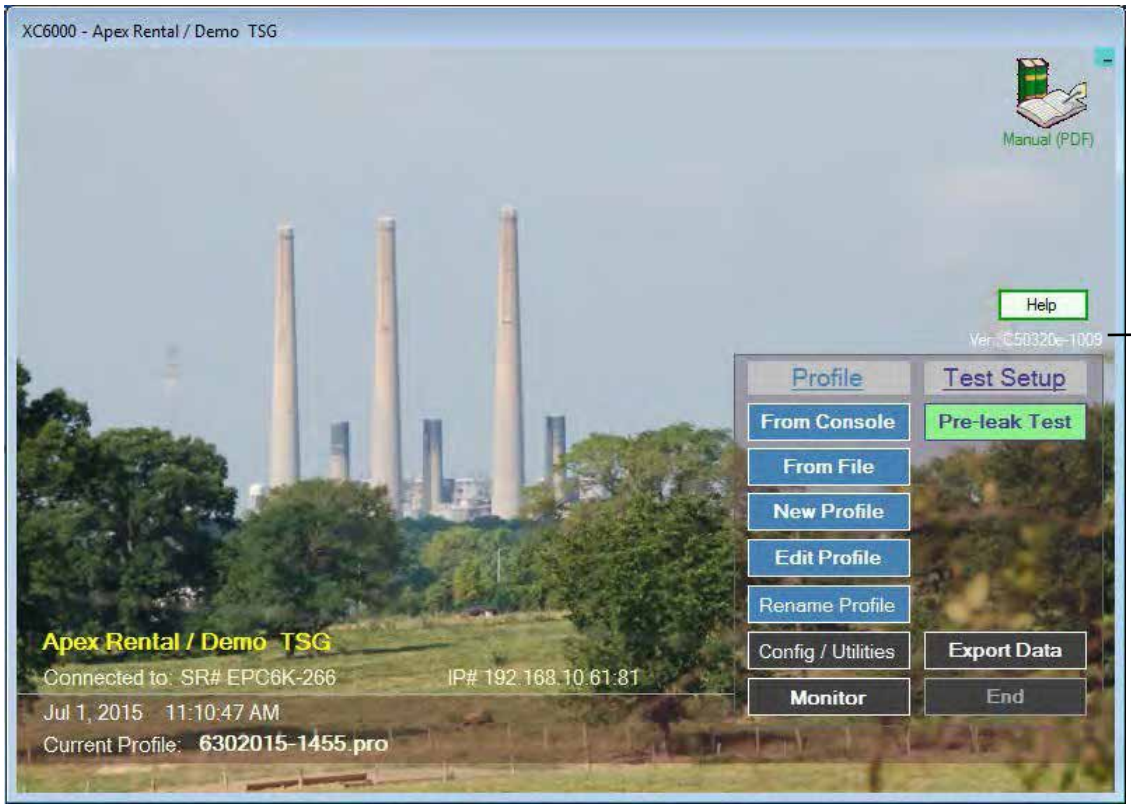
Click the “Hardware” tab, then click “Device Manager.”



When the Device Manager opens, open up the “Ports (COM & LPT)” item and make sure that a “USB Serial Port” is installed. Please make a note of the COM number (in this case, it is COM4, but your installation may vary.)

3.4 Software Operation

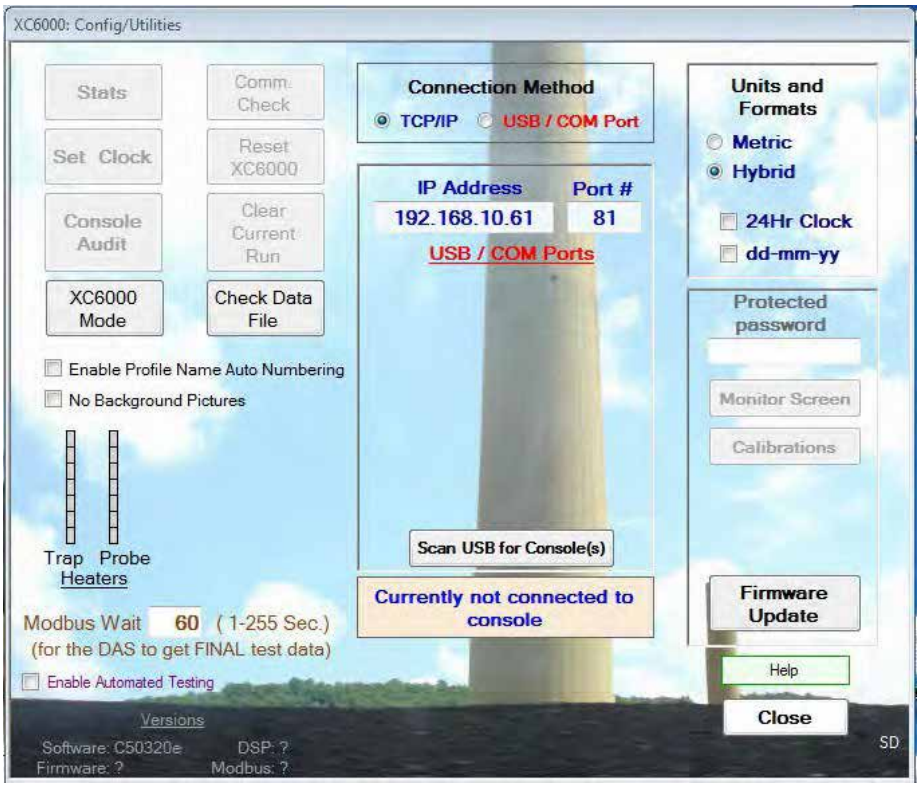
Follow these steps to start the MercSampler software on a laptop or desktop computer: Double click the “XC-6000” icon on your desktop. The Initial Main Screen, as shown below, is displayed. Please take a moment to note the version number of the software. It is displayed on the right, center screen just above the task block as indicated below.



If you have already setup the communication method, single click the “Connect” button. Skip the following section and go to the Test Profile section. Otherwise, follow the instructions to set up the communication between the console and the computer.

3.5 Software Communication

The MercSampler Software communicates via USB or Ethernet (optionally wireless Ethernet). To connect click the “Config/Utilities” Button. The following screen will appear.



To connect via USB follow these steps:

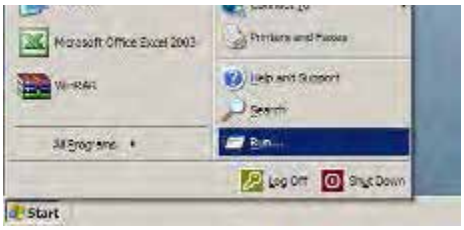
1. Select the “COM Port” button under the Connection Method.
2. Single click the “Locate COM Ports”.
3. Select an available COM Port – make sure that this COM number is the same as the COM number for the USB Serial Port installed previously.
4. Single Click “Return” and the Main Screen will appear.
5. “End” the program and reopen the program by double-clicking the desktop icon.
6. Single click the “Connect” button. The screen will indicate the console ID, communication method and console date/time.

To connect via Ethernet follow these steps:

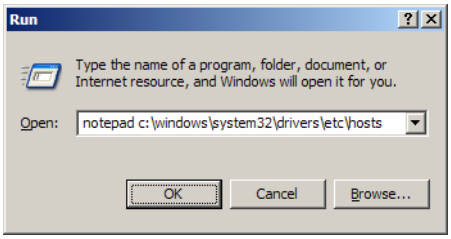
1. Select “TCP/IP” button under the Connection Method.
2. Type in the IP address 192.168.1.2 and Port 81.
3. Single Click “Return” and the Main Screen will appear.
4. “End” the program and reopen the program by double-clicking the desktop icon.
5. Single click the “Connect” button. The screen will indicate the console ID, communication method and console date/time.

Important note: If you experience errors in TCP/IP connection, please follow the steps below:

1. Click the Windows Start button (located in the lower left corner of the screen.)
2. Click the Run… button



3. Type “notepad c:\windows\system32\drivers\etc\hosts” into the Run\Open: Window.



4. The Notepad text editor window should appear, with the Windows HOSTS file loaded.
5. This file enables the user to specify a DNS entry for a static IP address, which is needed for some system configurations.

6. Add the text highlighted above: 192.168.1.2 xc6000
7. Save the HOSTS file by selecting File -> Save from Notepad’s top menu.
8. If you require additional assistance in configuring your TCP/IP settings, including configuring the STM-12B console to join a plant-wide network, please contact Apex Instruments for further technical support.

When connected the main screen identifies the console and the communication method as shown below:

The following summarizes the steps involved in configuring and running a complete test with the MercSampler Console.

Main Screen

Profile Options

Load from Flash Memory
Load from File
Load New/Default
Edit Current Profile

Step 1
Load/Edit Profile
Profile Includes:
Test Duration,
Constant vs Proportional

Flow Control
Target Flow Rate
Test Site Info
Alarm Configuration, Etc.
Save Profile

Step 2
Pre-Test Leak Check
Max Vacuum and Optional Variable Levels of 5" Hg and 10" Hg
Troubleshoot/repair leaks
Timeout Period
Accept stores value

Step 3
Set Probe
Insert Probe Confirm Location and Delta P Measurement
Check Temperature values and Set Points

Step 4
Start Test
Program prompts the User to Enter Trap ID's and DGM Mechanical Index Readings

Step 5
Real-time Data
View Real-time data and Check for Irregularities Alarm Actions Communications

Step 6
End Test
Enter Final Reading of DGM index. Remove Probe from Stack Prepare for Leak Check

Step 7
Post-Test Leak Check
Automatically Leak Checks to Max Vacuum Logged During Sampling
Optional Higher Vacuum Levels if Selected

Step 8
Export File
Download Selected Data File(s) to Selected Location, such as Jump Drive, Hard Drive, Network, etc.

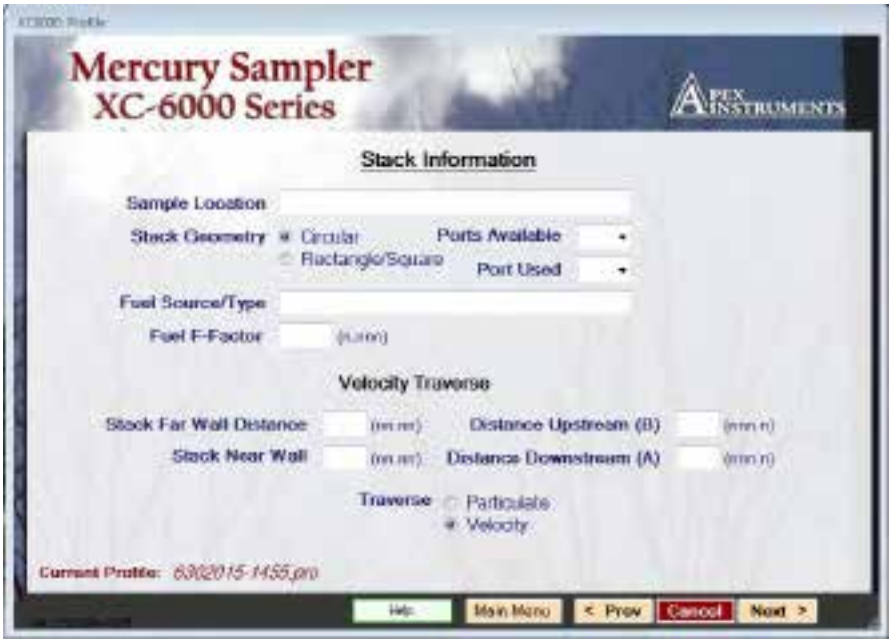
Import into Spreadsheet/Data-base Application

4.0 Test Profile

4.1 Setting Up the Test Profile

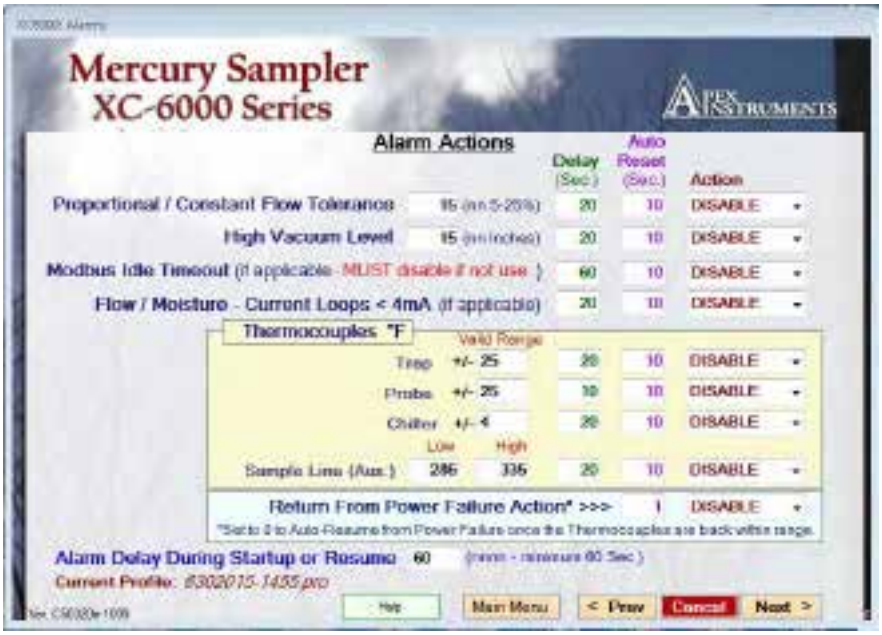
The Test Profile configures the console for running a test. A profile can be loaded from the internal flash memory on the DAC board inside the console. This is done by single clicking the “From Memory” button on the Main screen

Once loaded this filename is visible in the lower left corner of the Main screen. This can be edited by single clicking the “Edit Profile” button. The first screen to appear is the General Information screen shown below. This allows the user to enter the Client’s and Opertor’s information. There are several optional screens in this profile. The user has the option to enter the data and click “Next” to cycle through or this information is optional and can be bypassed by clicking the “Test Setup” Screen.



The Stack Information data is optional and is not used in any calculations. It is for descriptive or reporting purposes only.

The Test Equipment information is also optional. However, the Cartridge or Trap IDs are highly recommended to enter. It is optional here because the user is prompted later to enter this information.



4.2 Alarm Actions

The Alarm Actions screen allows the user to configure the software to trigger an alarm condition based on several available parameters.

Each alarm condition has several parameters that may be set. For each sensor input on the Alarm Actions screen, a valid range or upper limit may be set, depending on the sensor type. Additionally, most alarms feature an auto-reset function, which serves to return the console to a non-alarm state in the case of a non-critical alarm condition.

DELAY (sec.) Length of time alarm condition must continue before alarm action is performed. For an instant alert, set to zero (0.)

AUTO-RESET (sec.) Length of time elapsed before alarm condition resets. When alarm condition resets, Alarm Piezo output and dry contact will deactivate.

ALARM ACTION: Action performed by the software upon reaching an alarm condition. See table below

RETURN FROM POWER FAILURE ACTION:

When the console returns from a power failure, the unit may trigger an alarm. Any available Alarm Action may be used, including END TEST or PAUSE. If ALERT is used, the alarm may be Auto-Reset after a specified interval.

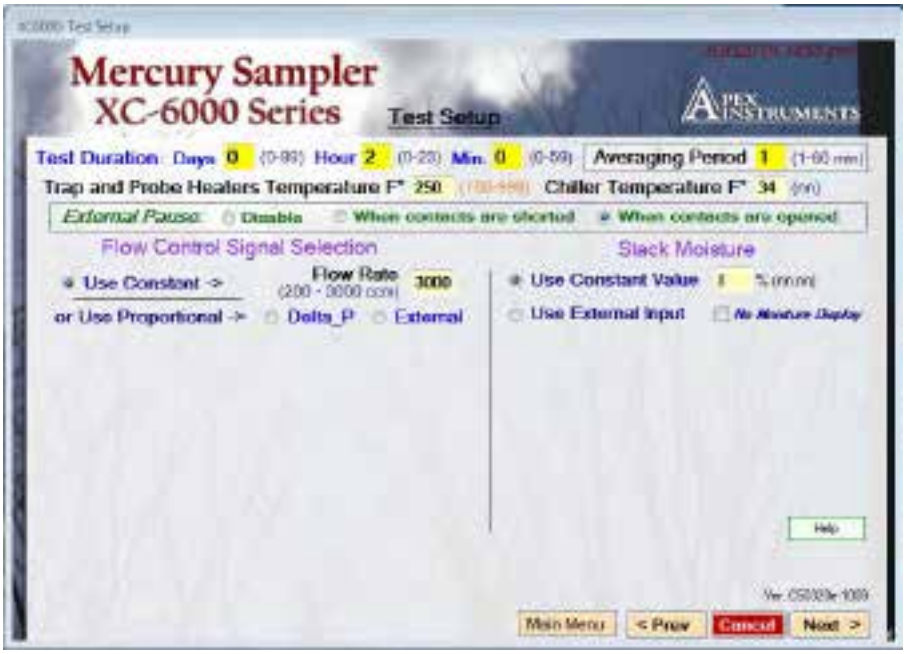
ALARM DELAY (Startup / Resume):

When a test run is started or resumed from a pause condition, the alarms will be disabled for a minimum of 60 seconds, in order to prevent false alarm conditions when establishing the flow baseline. This delay may be extended at the user's discretion.

ACTION	DESCRIPTION OF ACTION
ALERT	Console Alarm dry contact output will close Console Alarm Piezo output will engage May be Auto-Reset or reset manually by operator
PAUSE	Consloe Alarm dry contact output will close Console Alarm Piezo output will engage Test will pause until manually resumed by operator May not be Auto-Reset
END TEST	Console Alarm dry contact output will close Console Alarm Piezo output will engage Test will end and unit will wait for post-leak test May not be Auto-Reset
DISABLE	No Action

4.3 Test Setup

The Test Setup screen is the core of the Test Profile. This is where the user selects the test duration, averaging period, target flow rates, flow control method, etc. The External Pause parameters may be selected on this screen.



4.4 Test Parameters

Duration: Length of time the test is run. Note that this is the total run time, not calendar or clock time. If a test is paused, the unit will ignore the pause time and will continue the test until the entire duration has elapsed. Entered in Days / Hours / Minutes.

Averaging Period:

Duration of block average points stored in the console internal memory.
If a 15-minute averaging period is specified, the unit will average all appropriate data and write data points to storage memory every fifteen minutes. 1-minute averag ing times are recommended for shorter runs. For longer runs (greater than 24 hours) longer averaging times may be used.

Trap and Probe Heaters Temperature:

Set Point for the console-controlled heaters in the If a 15-minute averaging period is specified, the unit will average all appropriate data and write data points to stor age memory every fifteen minutes. 1-minute averaging times are recommended for shorter runs. For longer runs (greater than 24 hours) longer averaging times may be used.

Chiller Temperature:

This parameter does not control the sample conditioner, but it does provide a reference temperature used in setting the alarm values. Typically 35° F.

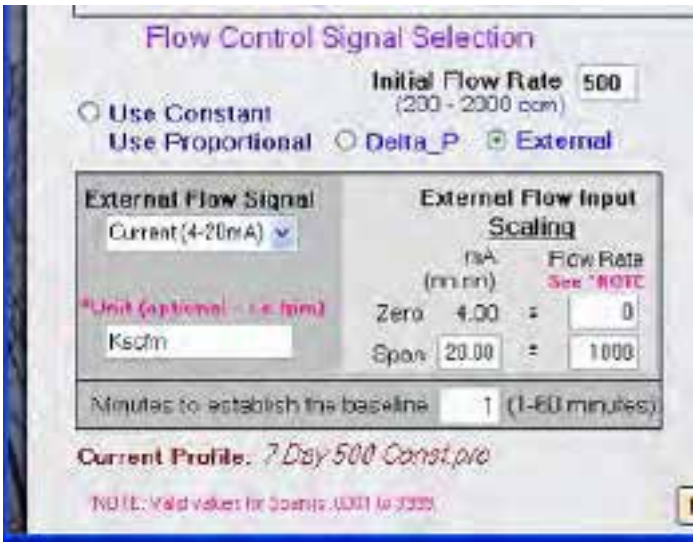
External Pause:

Determines whether the unit will enter a pause state when the External Pause input is activated. Disable will never pause, When contacts are shorted and When contacts are open will pause when their conditions are met. When the unit is paused, the sample pumps are turned off and the elapsed time counter is not incremented.

4.5 External Flow and External Moisture

The software is designed to operate with a proportional flow input, which is used to change the target flow rate of the console. The software can accept an analog input signal (0-10V or 4-20 mA,) a ΔP signal from a pitot transducer, or a digital flow input over Modbus.

In order to use proportional flow, select an initial flow rate and an external flow signal source.



In this example, we have selected 500 cc / min. and 4-20mA for our external flow signal. The External Flow Input Scaling fields are designed to make the exported data agree with the stack flow data obtained by the plant stack flow monitor. If known, input the correct stack flow value observed when the external flow signal is a nominal zero (0V or 4mA.) Then input a known current / voltage and its corresponding stack flow rate. The Unit field is optional but will be shown in the data. If the exact stack flow is not known, the Span mA may be set to the current external signal and the Span Flow Rate may be set to the current load percentage. If this is done, the Unit field should be set to “percent load” to indicate this situation in the data.

The final field is Minutes to establish the baseline, and should be left at 1 minute unless directed otherwise.

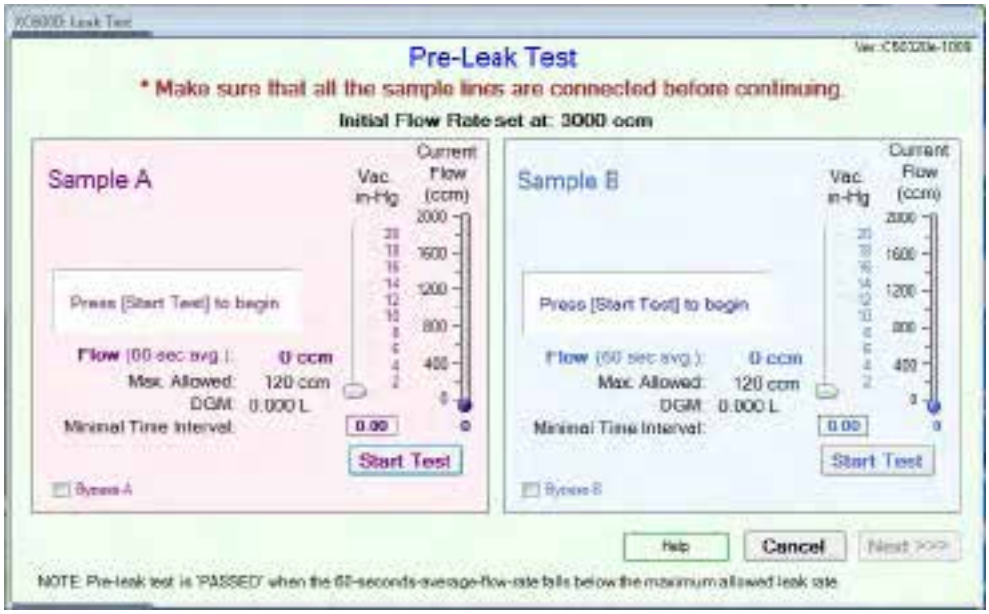
When the software begins sampling, the console will monitor stack flow during the baseline time period and will store the average stack flow in memory. The initial flow rate will be maintained as long as the stack flow is equal to the baseline stack flow. If the stack flow increases, the console sampling flow rate will also increase proportionally.

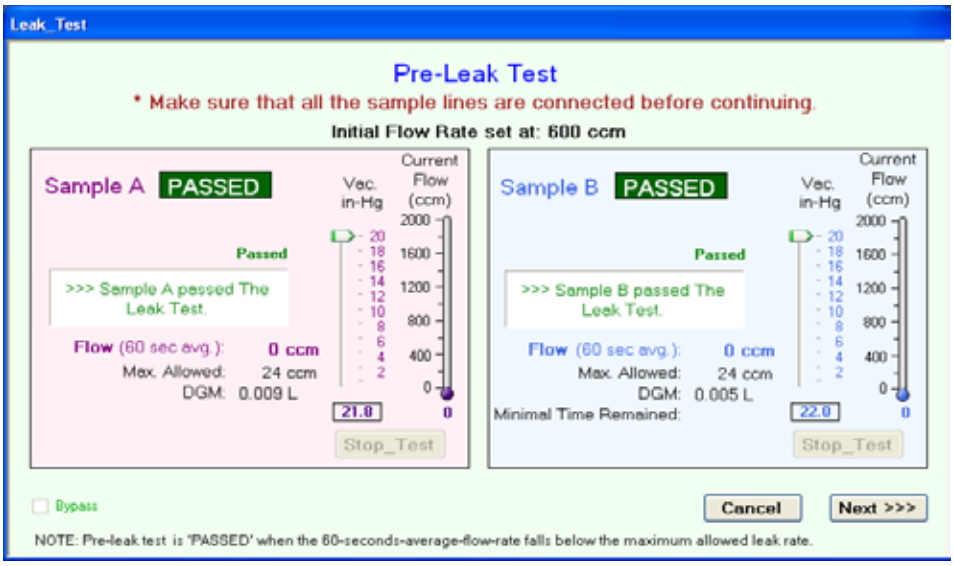
EXAMPLE: The initial flow rate is set to 500 cc/min. The external signal is set to 4-20mA, zero = 0.0001, span 20.00 = 1000 as pictured above. The unit is set to Kscfm (thousands of standard cubic feet per minute.) When the test begins, the stack flow is 875 Kscfm. The software sets its initial flow rate of 500 cc/min to be equivalent to 875 Kscfm. Over the course of the next hour, the load of the station increases from 87.5% to 91%. The stack flow increases from 875 Kscfm to 910 Kscfm (a 4% increase,) and the software increases its sample flow rate from 500 cc/min to 520 cc/min (also a 4% increase.) In this way, the software maintains proportionality during a sample run.

Click “Save” to save this to a location on your hard drive. Please note that selecting “Save” does not write any information to the memory of the console. The software profile is not updated until all pre-test preparations are complete. Click “Main Menu” to start the testing protocol.

4.6 Pre-Test Leak Check

Once back at the “Main” screen single click the “Pre-Test Leak Check” button. The following screen will appear. Ensure the sorbent test tubes are inserted in the probe trap receptacles. Plug the ends of the sorbent tubes with clean stoppers. Click the two “Start Test” buttons to individually leak check Side A and B. This is a required leak check done at maximum vacuum. The leak check vacuum level and flow rate are stored with each test run. The test can be bypassed by checking the “Bypass” button and then selecting “Next>>>”. However, this bypass will be logged and stored with the data.

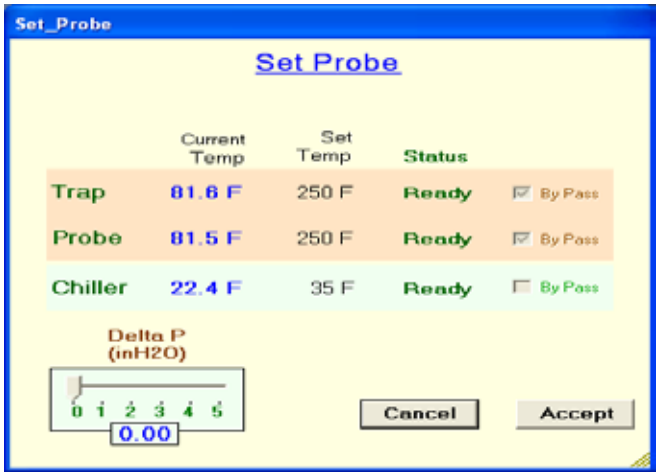




Once the test has passed click the “Next” button. The system prompts you to switch the pumps off using the “Pump Off” button on the screen. Click next to continue. The system will automatically switch these off prior to starting the test.

4.7 Set Probe

The next screen to appear prompts the user to insert the probe when the temperatures are at/near set point. If the internal pitot is being used the current/live delta p reading is shown.

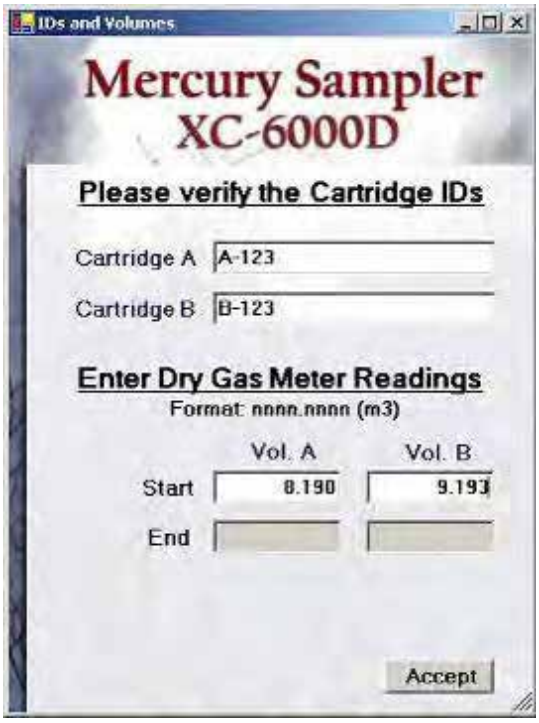


4.8 Test Data Storage Location

The following prompts the user to select a storage location on the flash memory drive inside the box. Single click the number in the left column corresponding to where the data file is to be stored. The user can select one of up to 99 slots. Click the “<<Previous” or “Next>>” buttons to scroll through the list. The system will prompt to confirm the case of overwriting data.

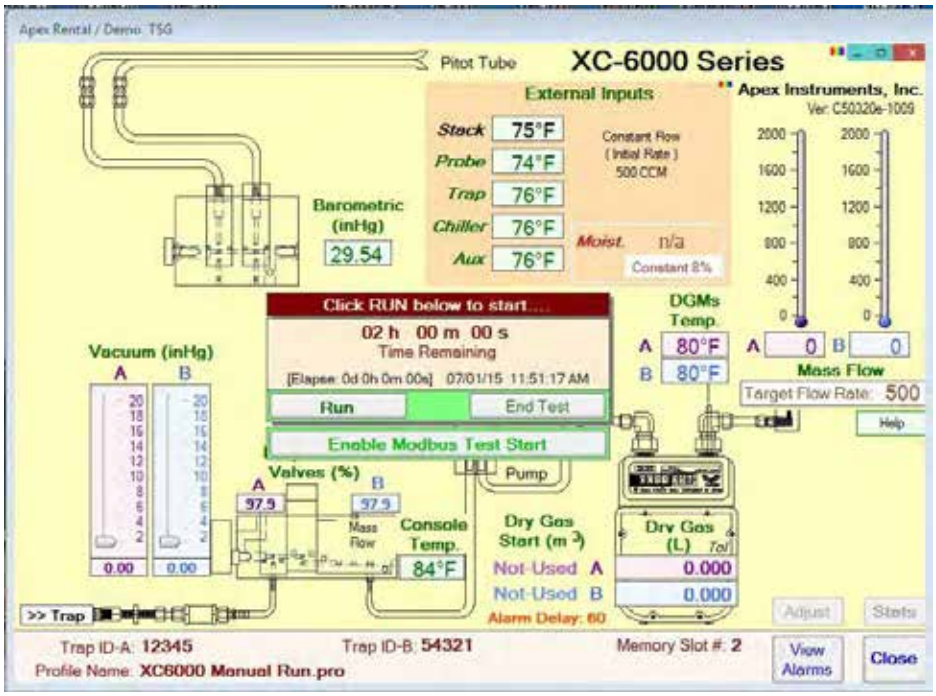
4.9 Mechanical DGM Volume Input

The following prompts the user to enter or confirm the trap ID s and enter the initial dry gas meter mechanical readings. This is used as a redundant backup and functionality check of the metering system.

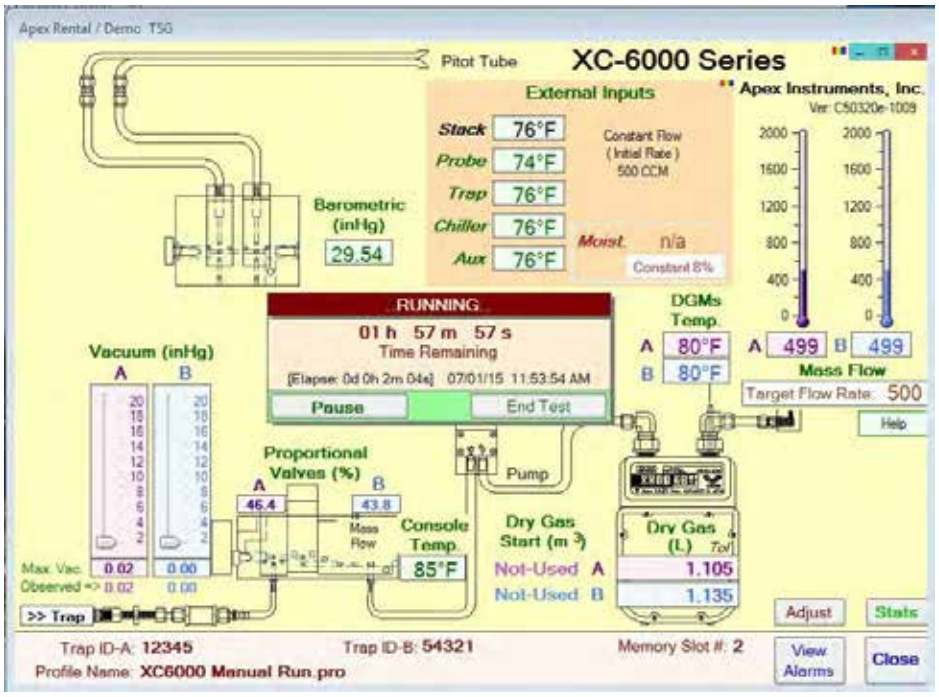


4.10 Start Test

After clicking “Accept” the following screen appears. The system is ready to start the test.



To start, click “Run” and the system should indicate flow with the digital rotameters in the top right of the screen. Also, check to ensure the electronic totalizer on the gas meter is incrementing.

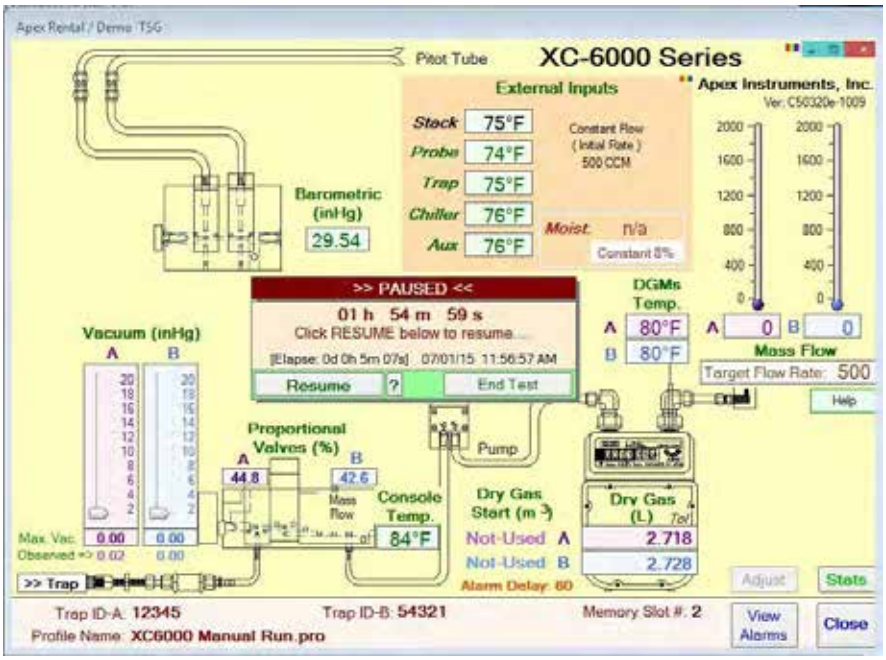


4.11 Stat Screen

To see a non-graphical representation of the run data screen, single click the “Stat” button and the following screen will appear. This screen does override other screens and will need to be closed in order to open another screen. Close this screen by clicking the X box in the top right of the screen.

4.12 Pause Test

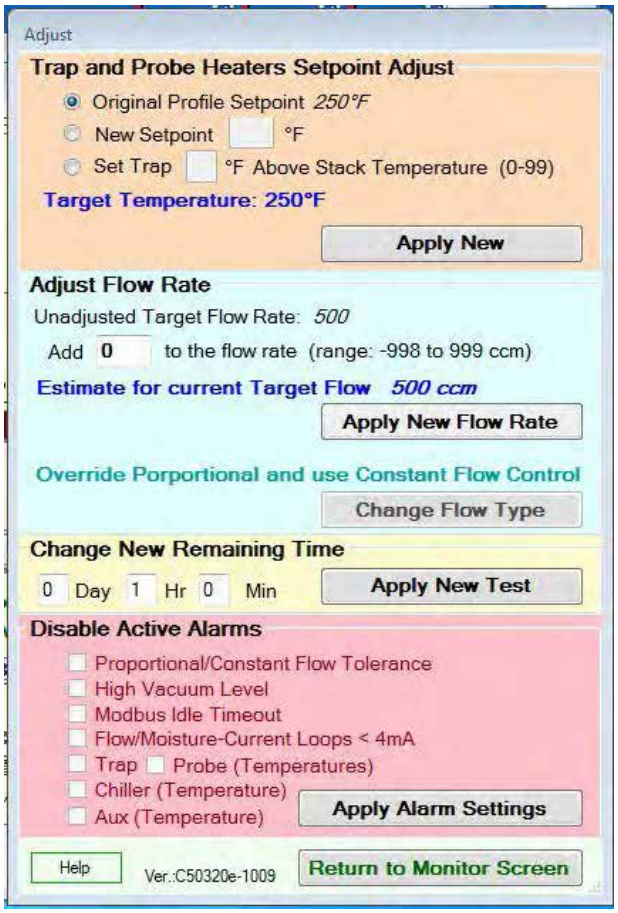
To pause the test, single click the “Pause” button in the center of the screen. The button will then toggle to “Run” to continue the test.



In addition, a remote pause functionality has been integrated into the software. By interfacing with the remote pause connector on the rear panel of the unit, the user may pause the test without the need for a connected PC. The remote pause functionality is discussed in the Test Setup menu.

4.13 Adjust Screen

The software is designed to offer flexibility during testing as well as when creating profiles. Press the **Adjust** button to change the trap / probe heater set point or the target flow rate during testing,



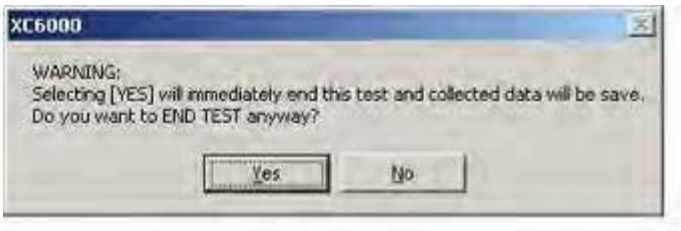
The **Trap Heater Setpoint Adjust** section allows either an arbitrary set point or a set point 0-99 degrees F above the stack temperature to be set. The original set point is stored and may be recalled using this screen as well.

The **Adjust Flow Rate** section allows the flow rate to be increased or decreased from the original target flow rate. Positive numbers between 0 and 999 add to the flow rate, while negative numbers between -1 and -998 reduce the flow target.

After changing any parameters on the **Adjust Screen**, press the **Apply New Temperature** and / or **Apply New Flow Rate** buttons, and then close the screen by pressing the **Close** button.

4.14 End Test

To end the test there are two options. The user can wait until the system times out and automatically stops the test. Second, the user can end the test early by single clicking the “End Test” button in the center of the graphical run data screen. The system will prompt the user to confirm this action.

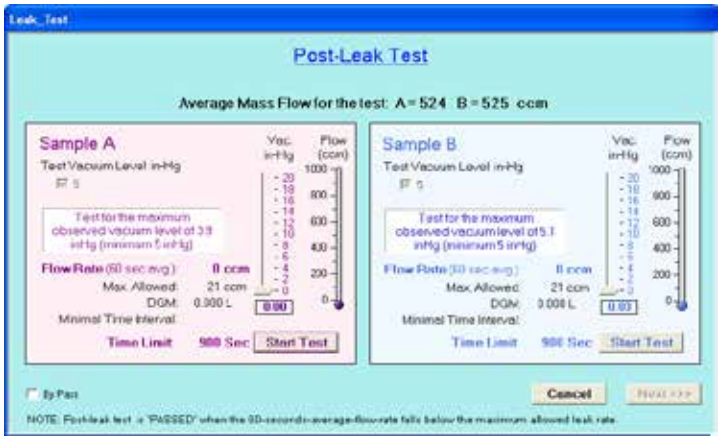


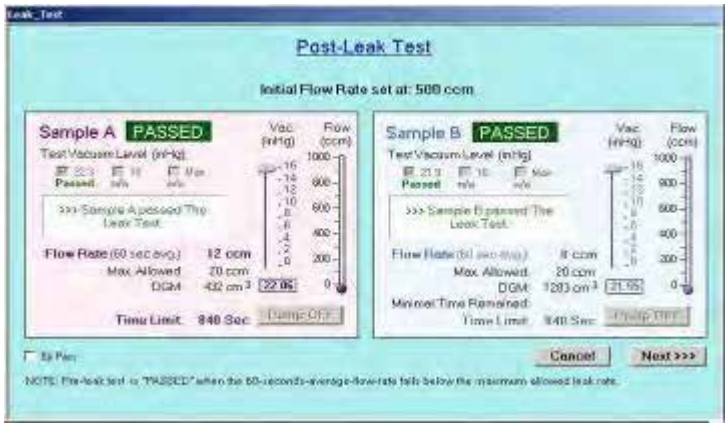
The following prompt informs the user the system will store the data.

The following prompt informs the user the Post-Test Leak check is next and to remove the probe from the stack and plug the ends of the traps.

4.15 Post-Test Leak Check

The following screen displays the status of the leak check and allows the user to start/ pause the leak check. The system has logged the highest vacuum achieved for both flow channels A and B as displayed in the center box and will control the vacuum level to just over those levels. Just like with the Pre-Test Leak Check, the user can bypass this step but no leak check data will be stored. However, if no Post-Leak is performed the sample run data will be invalid.

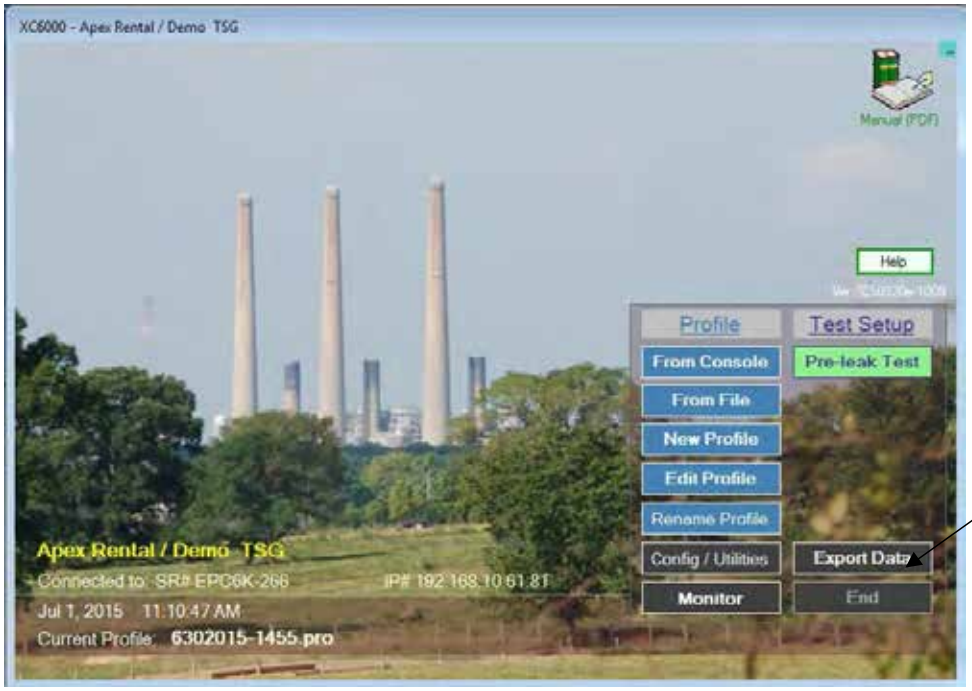




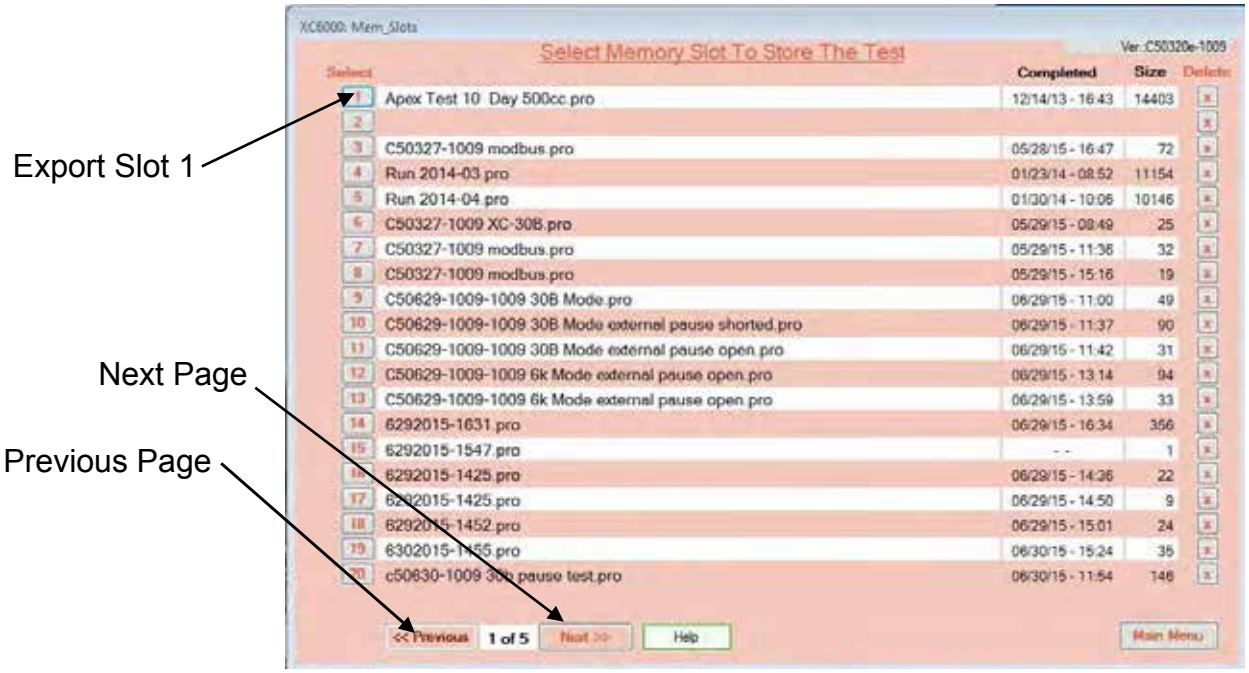
After both flow channels have passed. Click the “Next>>>” button and cycle off the pumps and the system will inform the user it is storing the leak check data.

4.16 Export Data

The system will now go back to the main screen. To export and view the data file(s), Click on the Export Data box



Now select test data to export, the bottom right of screen will indicate sample run just completed.



Click on the button corresponding to the slot number of the test to be exported.

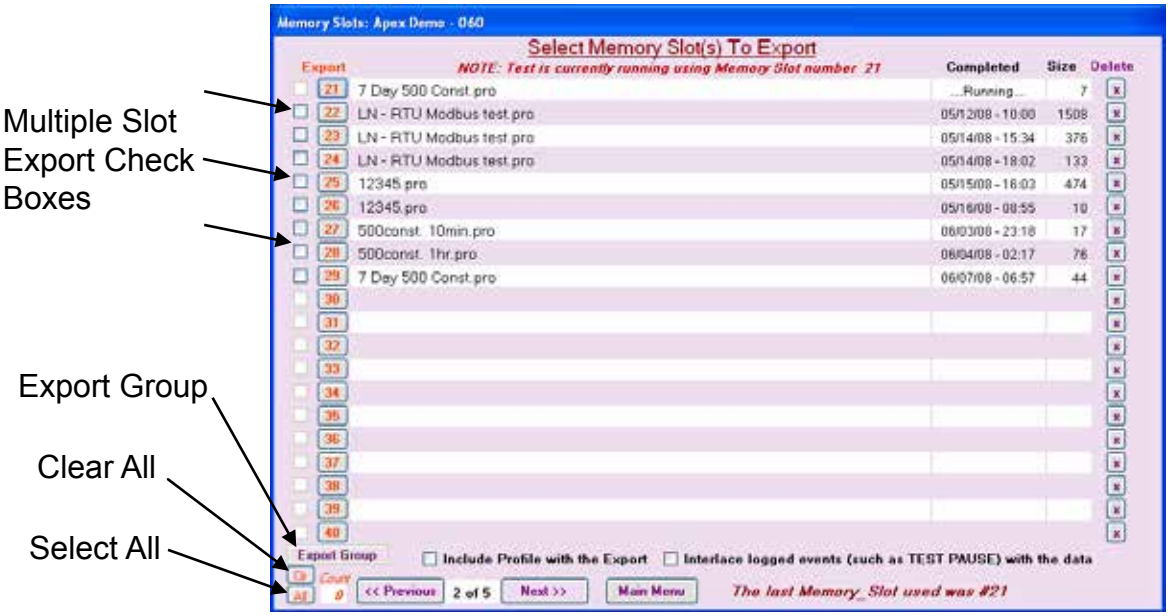
The software supports 99 memory slots, which may be accessed 20 at a time using the **Previous** and **Next** buttons.

4.16 Export Data (continued)

Once the slot number button is pressed, the following dialog box will prompt the user to save the file to a local or network location. A text file (.txt) and a comma separated value (.csv) file will be generated at this user-specified location. The text file can be viewed in various applications such as Notepad, Word Pad, Word, Excel, etc. The CSV file is formatted to be opened in a spreadsheet application such as Excel.

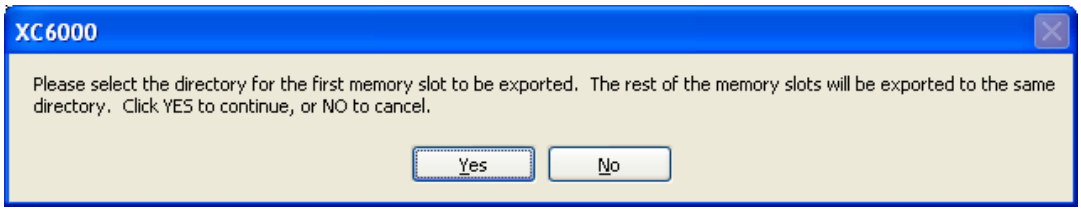
4.17 Multi-File Export

The software also supports multi-file export, which will export a group of completed test profiles to a folder on the local hard drive. To use multi-file export, select the Multiple Slot Export check boxes next to the slots desired. To select all available slots, press the **ALL** button. To clear all selected slots, press the **CLR** button.



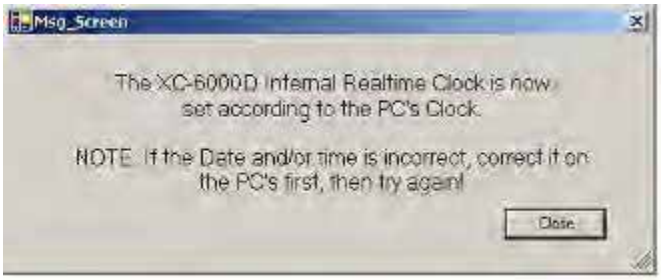
4.17 Multiple File Export (continued)

After the slots are selected, press the Export Group button. The software application will prompt the user for a directory as in single file export. With a multiple file export, all slots will be exported to the directory selected for the first slot. Exported files will be named based on their profile name, and all will be given unique filenames.



4.18 Set Clock

The Config/Utilities screen has various other functions built-in. The “Set Clock” button automatically synchronizes the MercSampler Console time with the clock time of the computer connected.



Appendix 1

Upgrading Firmware

From time to time, Apex Instruments may release updated device firmware for the STM-12B console. These firmware upgrades may add additional functionality or capabilities to the console, and may be required in order to use the latest version of the monitor / control client software. If the XC-6000 software displays a message regarding your firmware revision number, please contact Apex Instruments to get more information.

Current software and firmware versions may be obtained from Apex Instruments.

The STM-12B firmware may be programmed using a PC and the Apex Firmware Programming Cable. PLEASE NOTE: The drivers for the programming cable and the version of the STM-12B firmware most current at the time of shipment are installed along with the Apex software. Please install the Apex XC-6000 software before attempting to upgrade the firmware.

The Apex Firmware Programming Cable uses a USB Serial Converter similar to the one in the main console. When connecting the Firmware Programming Cable to the PC for the first time, the Found New Hardware Wizard may appear.

The programming cable is shipped with new consoles inside the STM-12B console.

Programming Cable

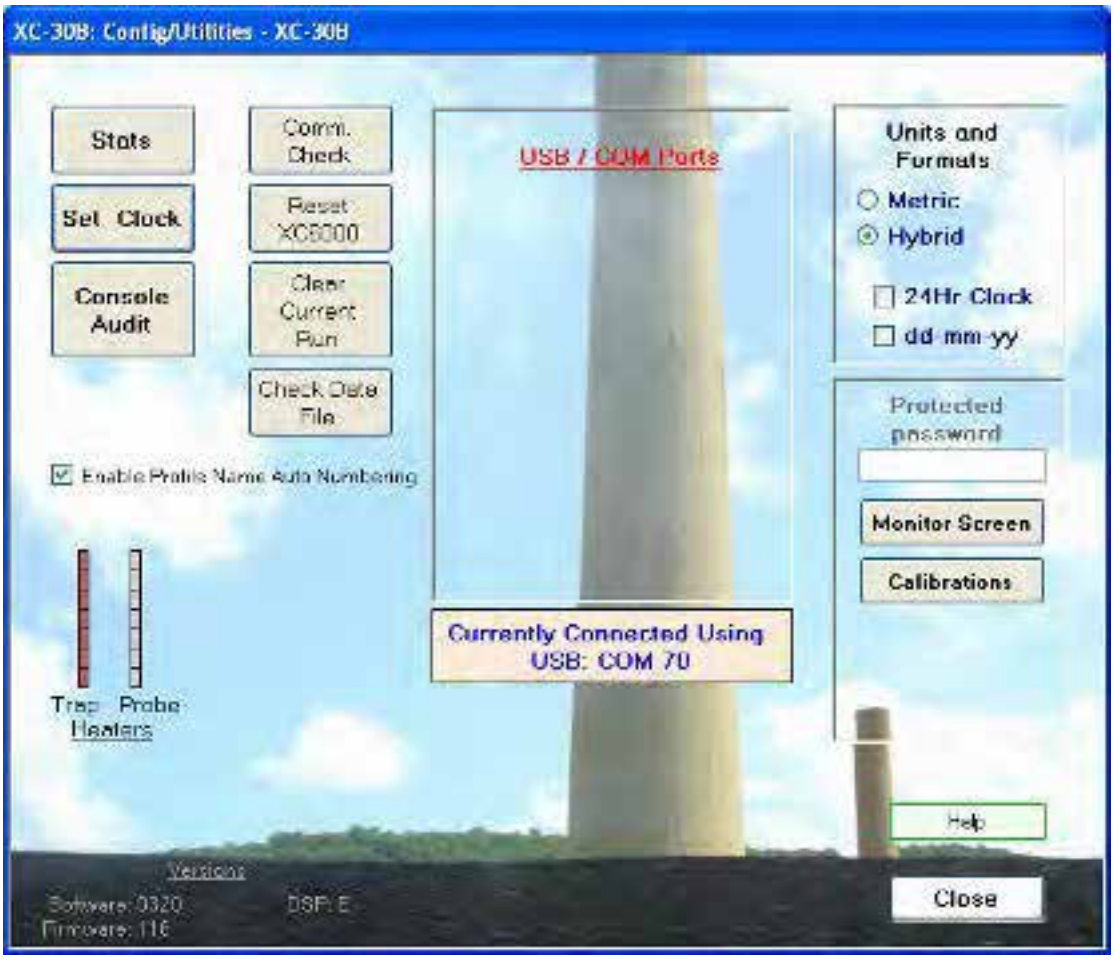
The programming cable has a 6-pin Molex connector and a 4-pin USB A connector. Please use the same steps as for connecting the STM-12B to the PC via USB. The programming cables use the same USB converter as the STM-12B so no additional drivers are necessary. The COM port installed may not be the same as the STM-12B virtual COM port, consult the Device Manager and note the COM number of the new serial port installed by the Apex Firmware Programming Cable.

Important Notes About Upgrading Firmware:

The older versions of the XC-6000 firmware lack several important new features of the current STM-12B consoles. These include the ability to set alarms based on test conditions, the optional ability to sample at flow rates above 1Lpm, and the provision for communication with the optional ModBus module. In addition, the calibration tables for the older versions may not be immediately compatible with the newer versions, and some conversion must be performed.

Before upgrading your STM-12B firmware, please connect the console to your current software and make a note of the application and firmware version.

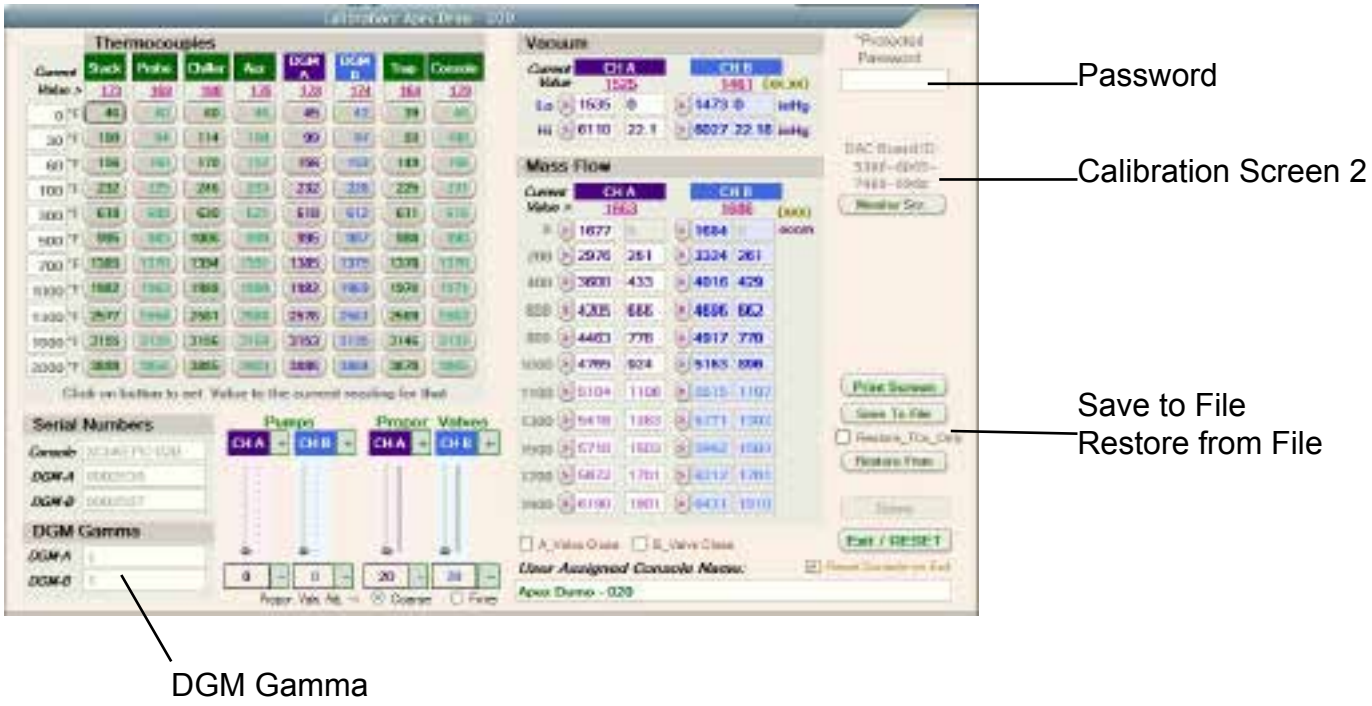
This can be found on the Config/Utils screen in the lower left corner.



Make a note of these version numbers. The new software CD will list the version included.

Once connected, enter the Config / Utilities screen and then the Calibration screen. Enter the word “enable” (no quotes all lowercase) into the protected password space on the Calibration screen. Press the “Save to File” button. Choose a location for your saved table, and give it a unique name.

IMPORTANT NOTE: Always save the STM-12B calibration table to a file before upgrading the console firmware.



Programming the STM-12B Firmware

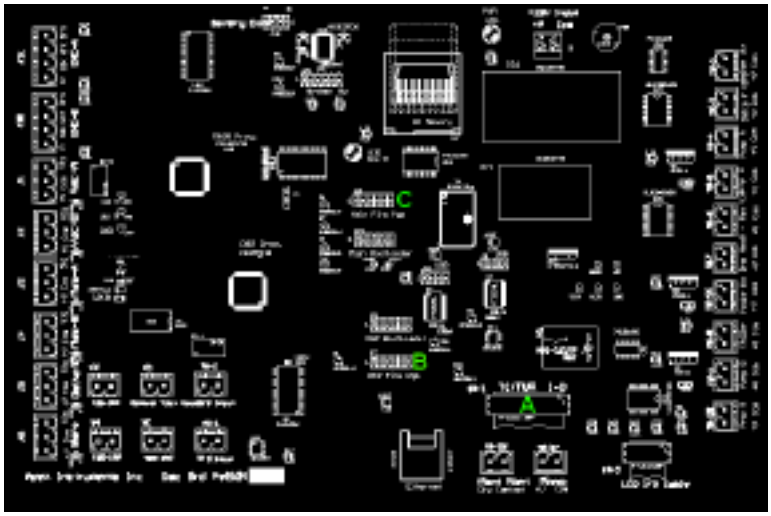
1. Ensure STM-12B console is powered off. Disconnect any connecting cables from the console, and remove the console from its rack enclosure. Remove the screws from the top of the unit and the on the outside left and right edges of the rear panel, and open the lid of the console by pulling the top/ back cover towards the rear. The cover is mounted on a hinge at the back bottom of the console

Programming the DSP Processor – SKIP THIS STEP IF DSP IS ALREADY AT THE CURRENT VERSION!

2. Remove the 20-pin ribbon cable coming from the STM-12B TC/MUX board. Reference: Figure DAC-1 below, item A.

3. Connect the 6-pin Molex connector on the end of the programming cable to the DAC board header labeled **DSP Firm Pgm**.

Reference: Figure DAC-1 below, item B.

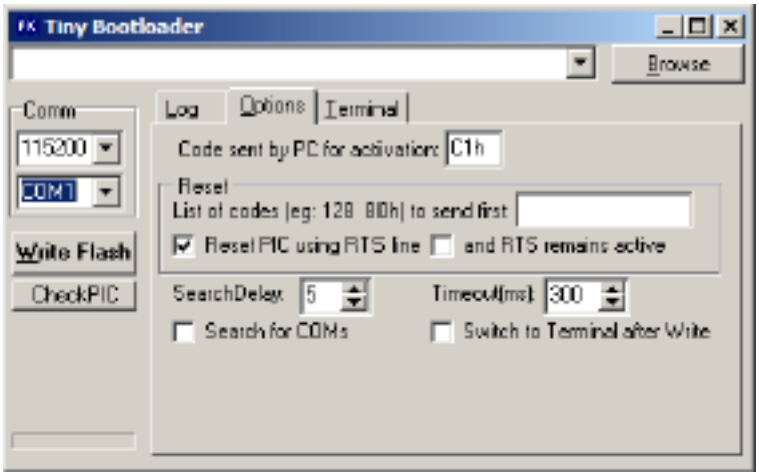


4. Power on STM-12B console

5. Navigate to the install location ***default: C:\Apex\Firmware***

6. Execute **dl.exe**

7. The Tiny Bootloader window will launch



8. Click Browse and select ApexDSP_XX.hex (XX is the version) from the current directory

9. Select the following options:
   Comm: 115200
   Comm (use the COM number noted earlier)
   Enable Options -> Reset PIC using TRS line

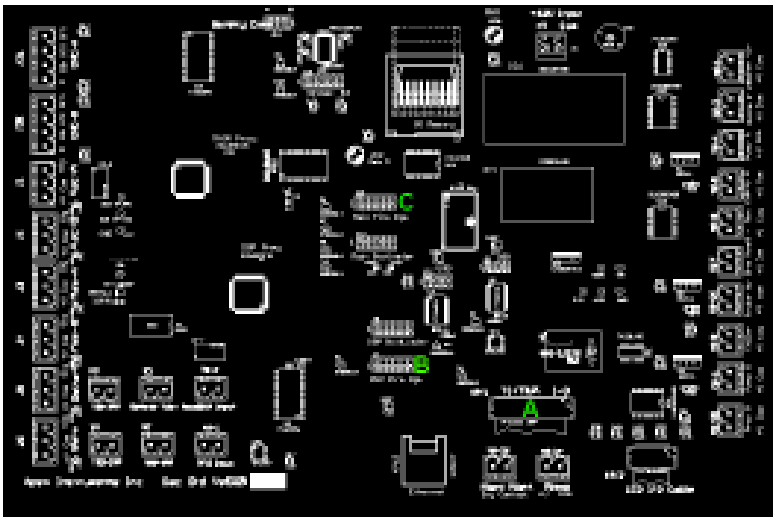
10. Click Write Flash

11. When update is complete, Log window will read Write OK. The writing process should take between 3 and 6 seconds. If you receive an “Error” power off the console then back on again then press the write button.

12. Power off STM-12B console and remove 6-pin Molex connector on the end of the programming cable from the DAC board.

Programming the Main Processor

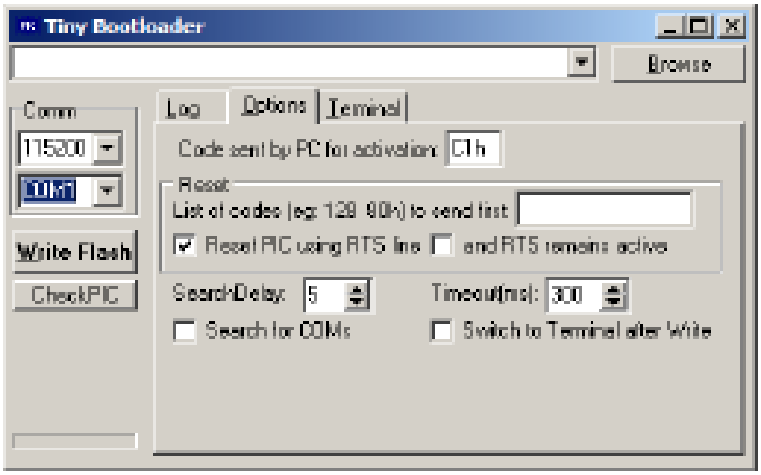
13. Connect the 6-pin Molex connector on the end of the programming cable to DAC board header labeled **Main Firm Pgm**
Reference: Figure DAC-1 below, item C.



14. If the Tiny Bootloader is already open skip to step 17. Navigate to the install location.
default: C:\Apex\Firmware

15. Execute **dl.exe**

16. The Tiny Bootloader window will launch.



17. Click Browse and select ApexMAIN_XX.hex (XX is the version)from the current directory

18. Select the following options: (same as for DSP Processor)
    Comm: 115200
    Comm (use the COM number noted earlier)
    Enable Options -> Reset PIC using TRS line
19. Power on the STM-12B console
20. Click Write Flash

21. When update is complete, Log window will read Write OK. The writing process should take between 45 and 60 seconds. If you receive an “Error” power off the console then back on again then press the write button.

22. Power off STM-12B console and remove 6-pin Molex connector on the end of the programming cable from the DAC board.

23. Power on the STM-12B console and connect using the XC-6000 MercSampler application. The version number of the console should appear in the upper right of the application window once connected. Ensure that the version number that the console reports matches the version number of the supplied firmware update.

After a successful upgrade:

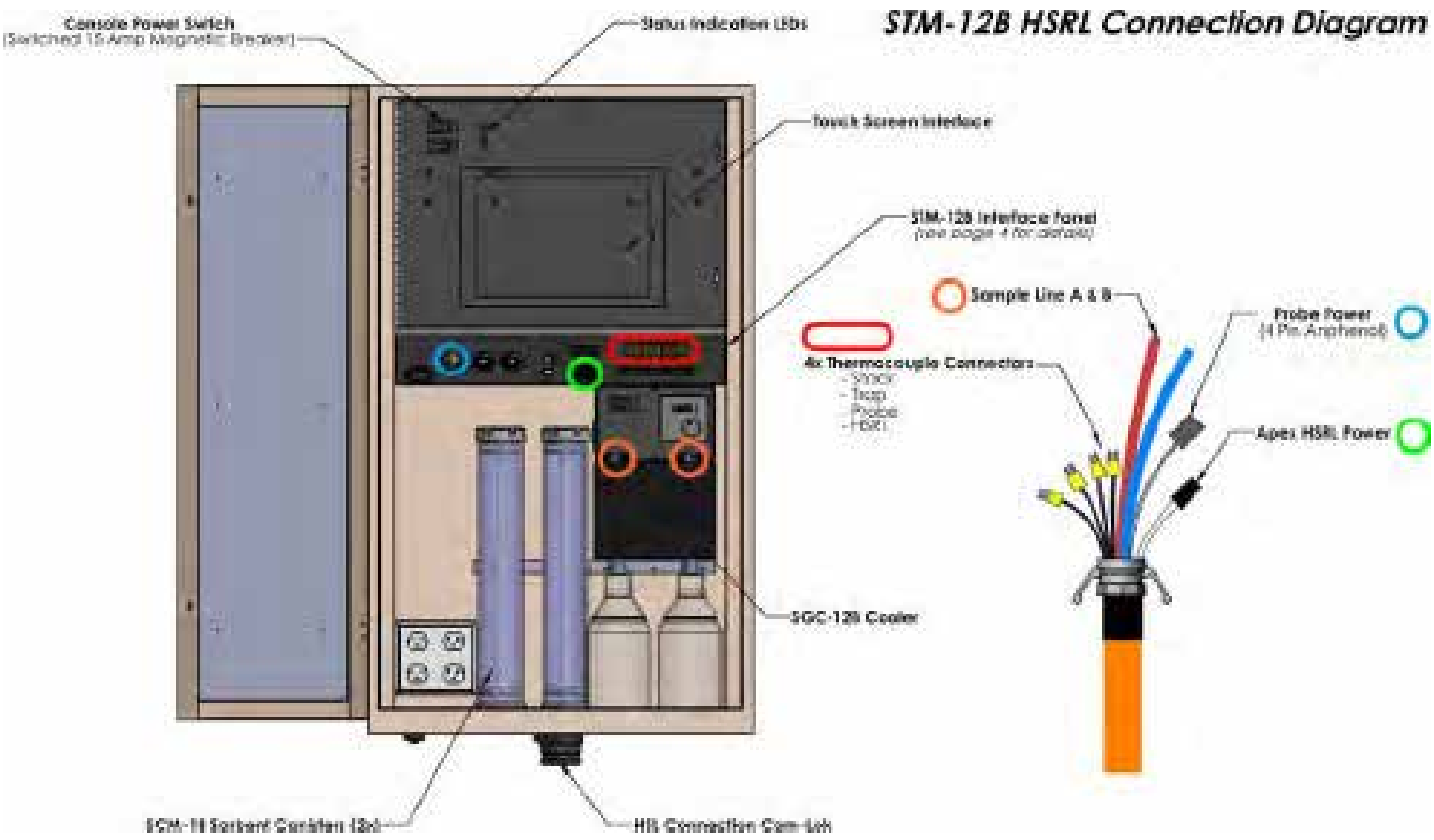
Once the console has been upgraded, the calibration table will need to be converted to the new format. Connect to the console and enter the Config / Utilities screen. Press the “Set Clock” button to ensure that the software displayes the correct time and date set. Close the Config / Utilities screen and observe the date and time on the Main screen to make sure the time and date are correct and that the time is advancing. Then re-enter the Config / Utilities screen and go to the Calibration screen.

Enter “enable” (no quotes) in the password field and press the “Save” button. Once the table is saved, press “Save to File” and save a copy of the new table with a new filename. Press the Exit / Reset button to reset the console and apply the new calibration factors.

Older test profiles may cause errors when used with newer firmware. To avoid this, create new profiles for performing sample runs. If an older profile must be used, please step through the profile one screen at a time (press the “Next” button) and save the profile with a new filename. The profile should be automatically converted to the newest version.

Appendix 2

Electrical Subsystem

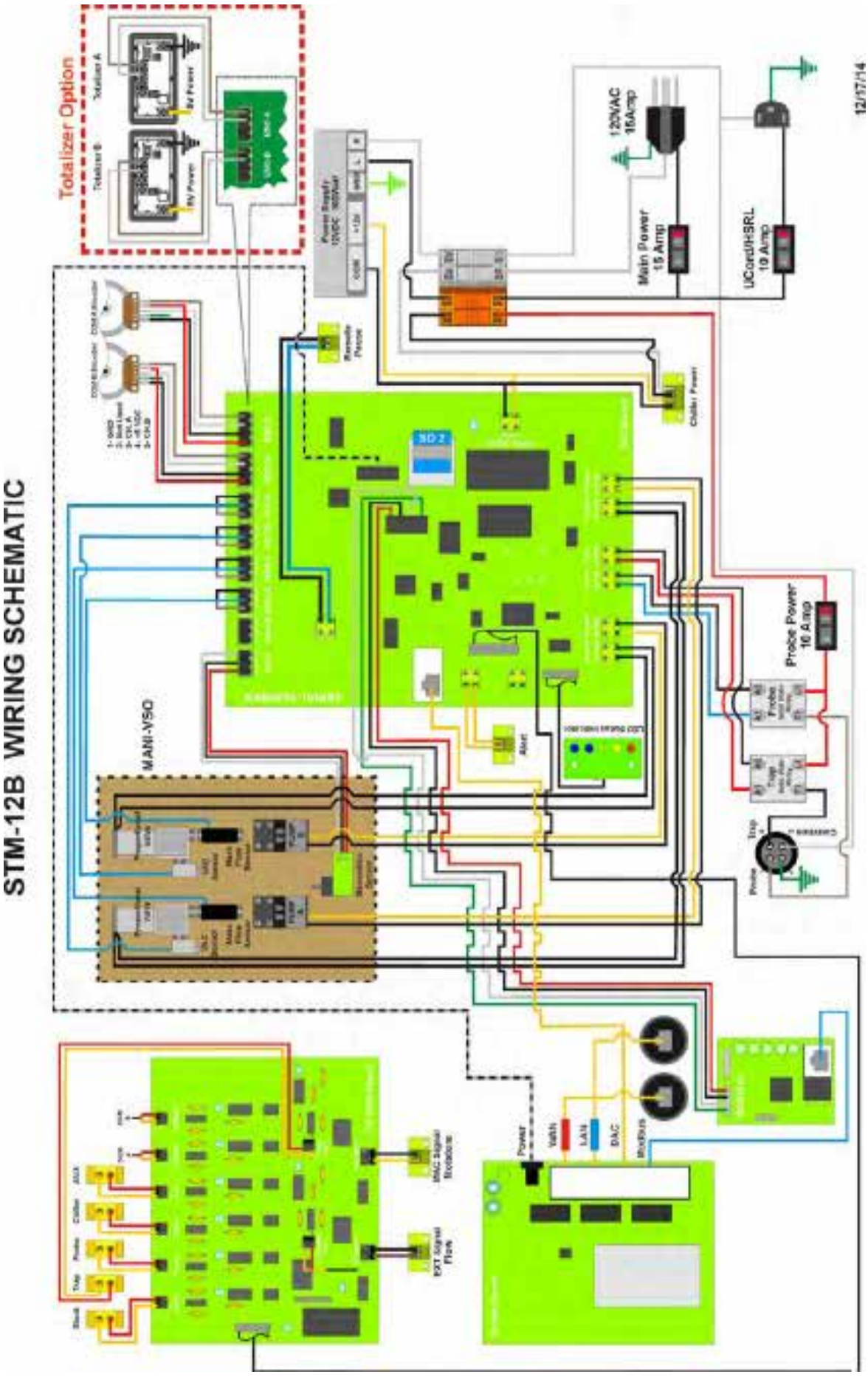


The Source Sampler Console is factory-configured for 115 VAC / 60 Hz electrical power. Configuration for 220 VAC / 50 Hz operation is an available option.

The AC electrical subsystem provides switch power to each circuit, controlled by two switches: MAIN and PROBE.

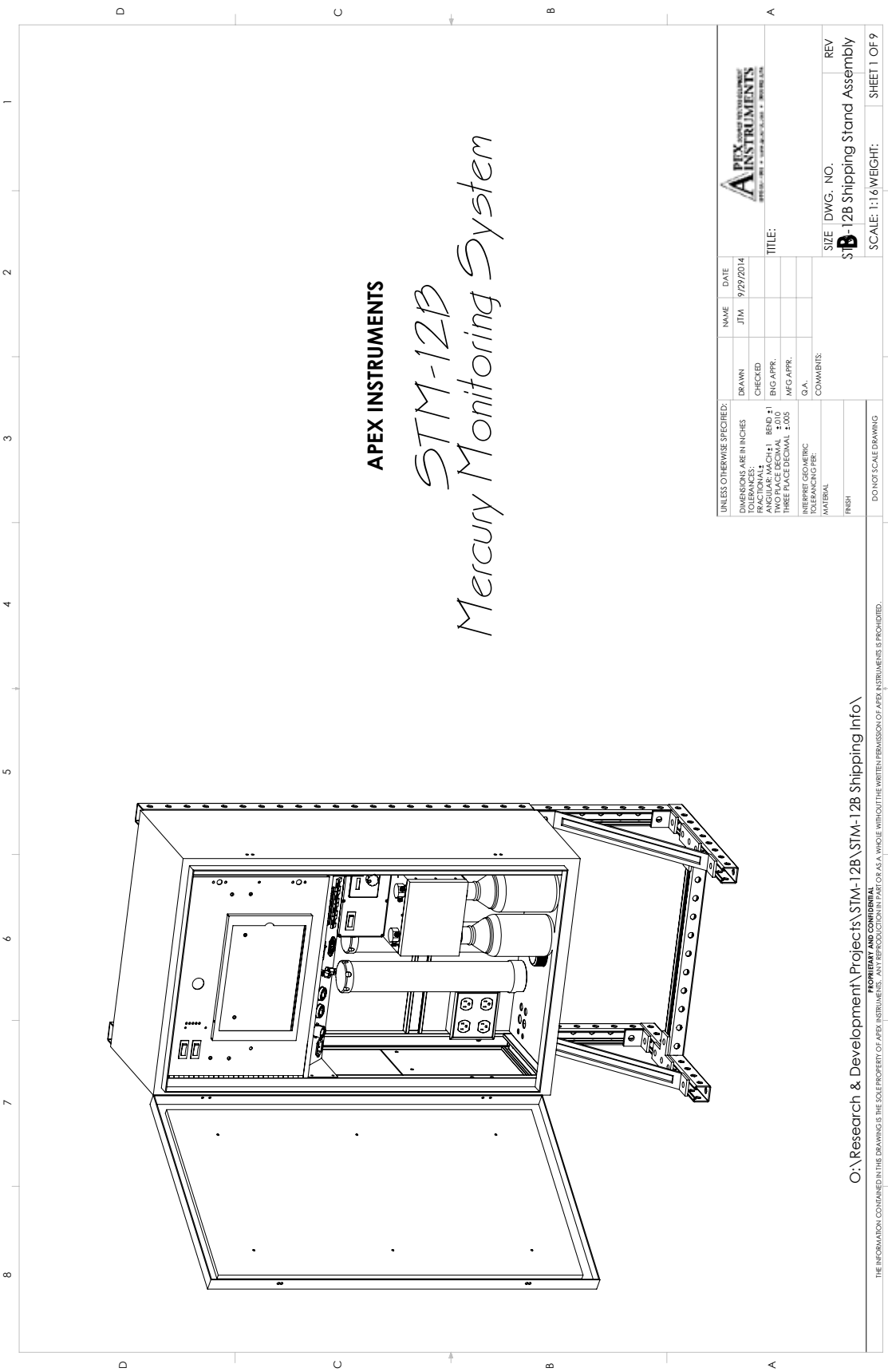
All circuits are protected by a MAIN 15 Amp (10 Amp for the 220V system) circuit breaker. Additionally, the probe is protected by a 10 Amp breaker. These circuit breakers detect and interrupt overload and short circuit conditions, providing an important safety factor. If the circuit breaker opens, or “trips,” indicating interruption of the circuit, investigate and repair the electrical fault, then reset the breaker by pressing the circuit breaker switch.

Two custom-designed and manufactured circuit boards, a Data Acquisition and Control (DAC) board and Thermocouple (TC-MUX) board, are utilized.

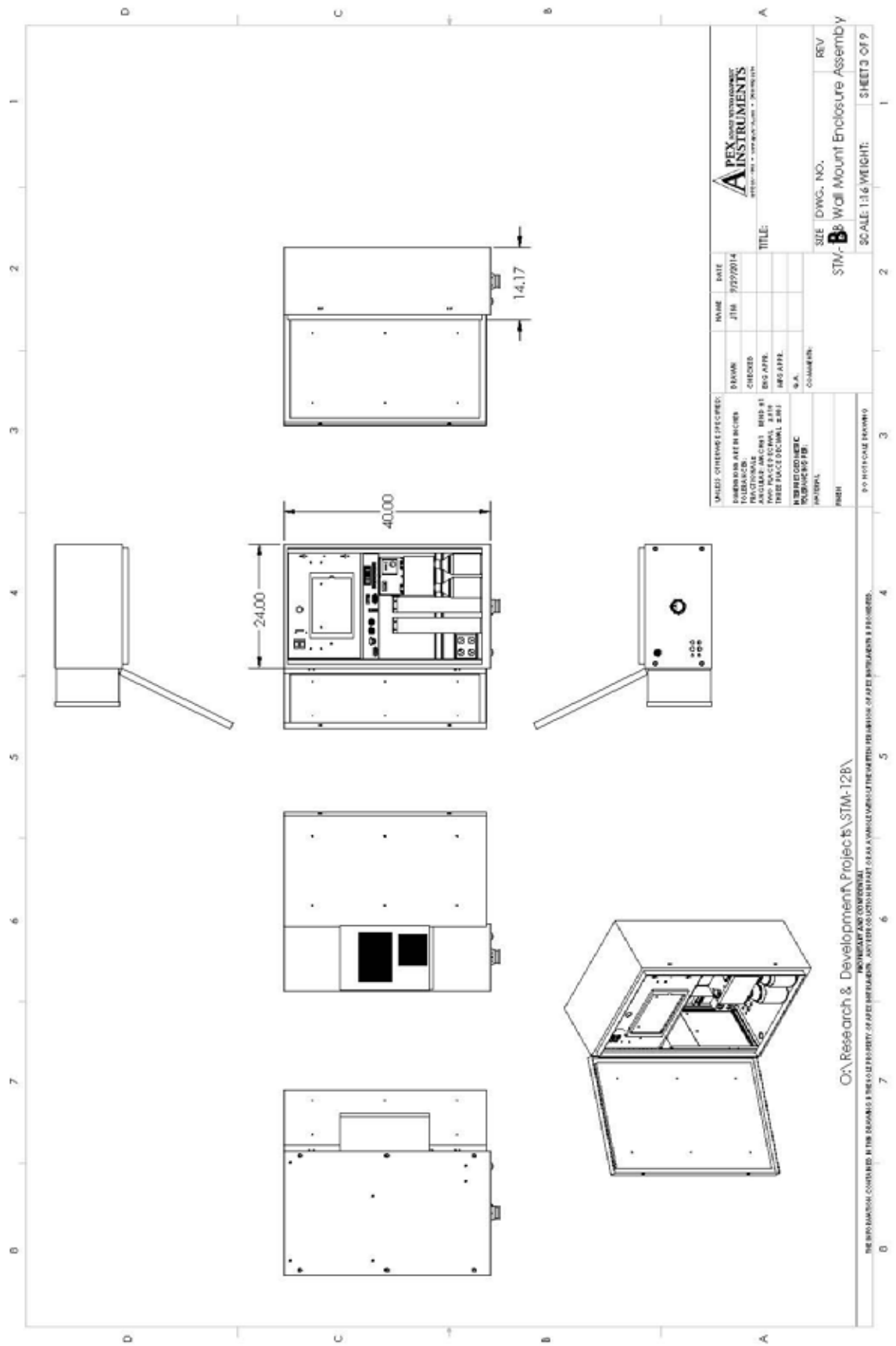

STM-12B WIRING SCHEMATIC
Totalizer Option
MANI-VSO
Main Power
15 Amp
UCord/HSRL
10 Amp
Probe Power
10 Amp
12/17/14

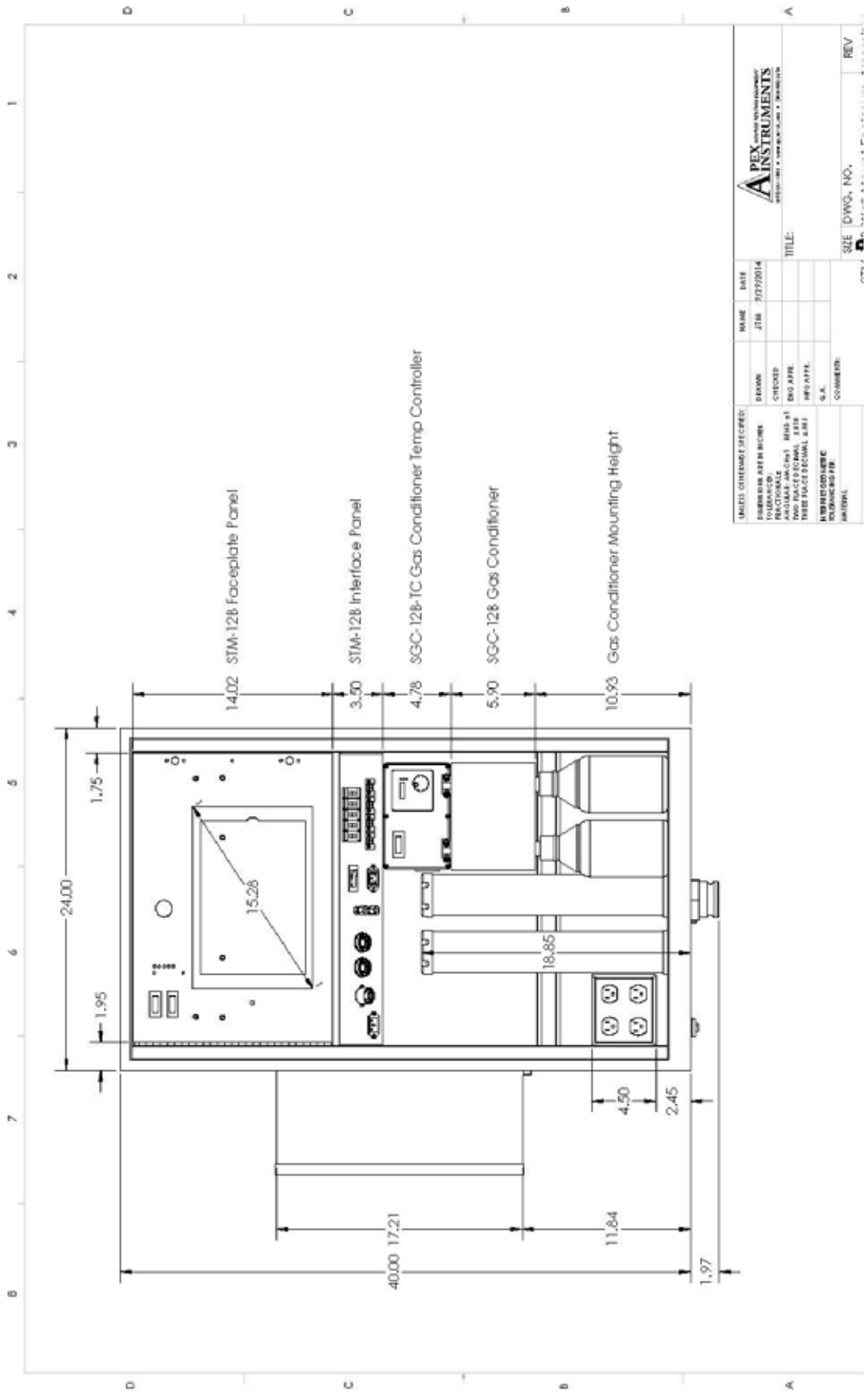
Appendix 3

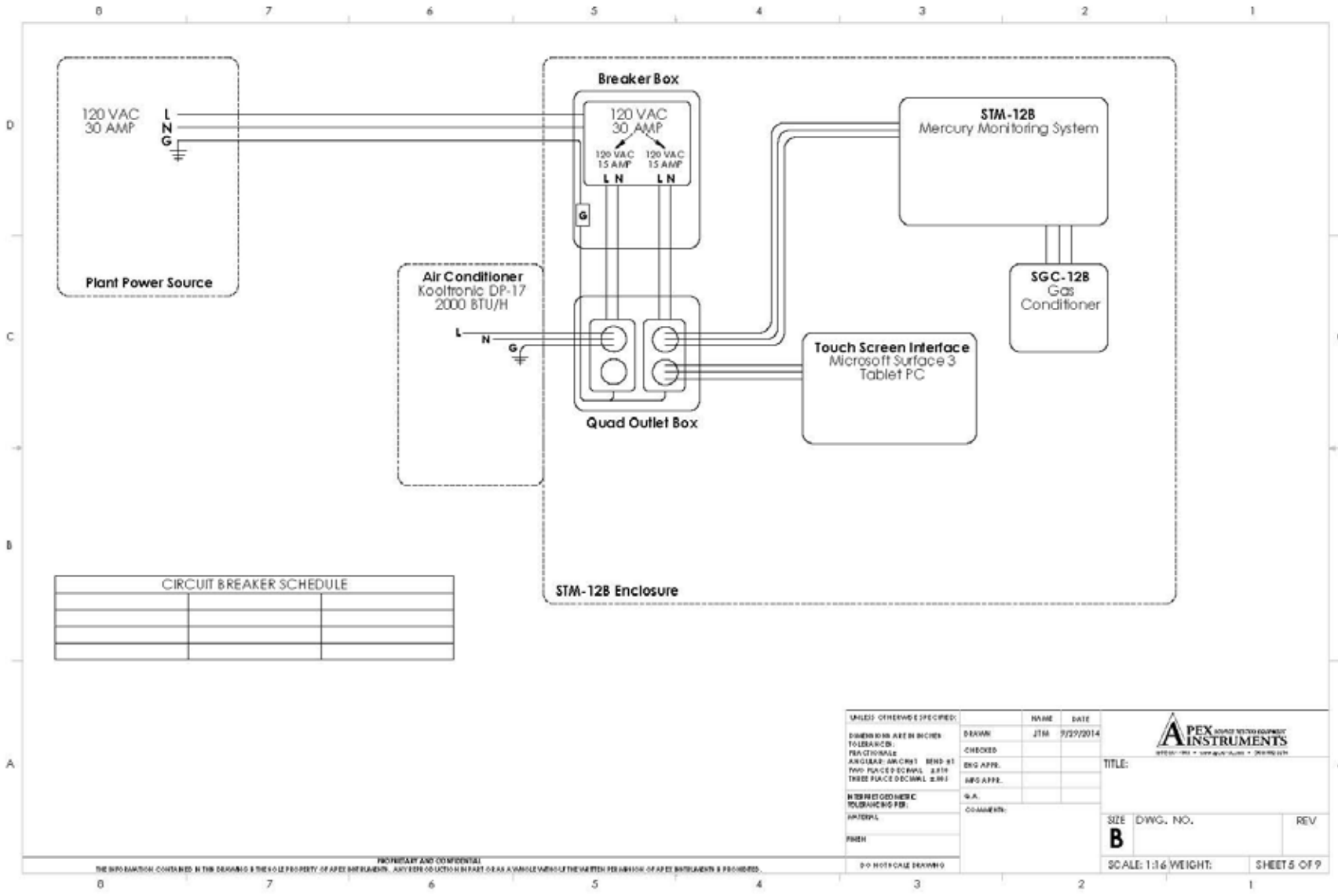
Console Drawing Package

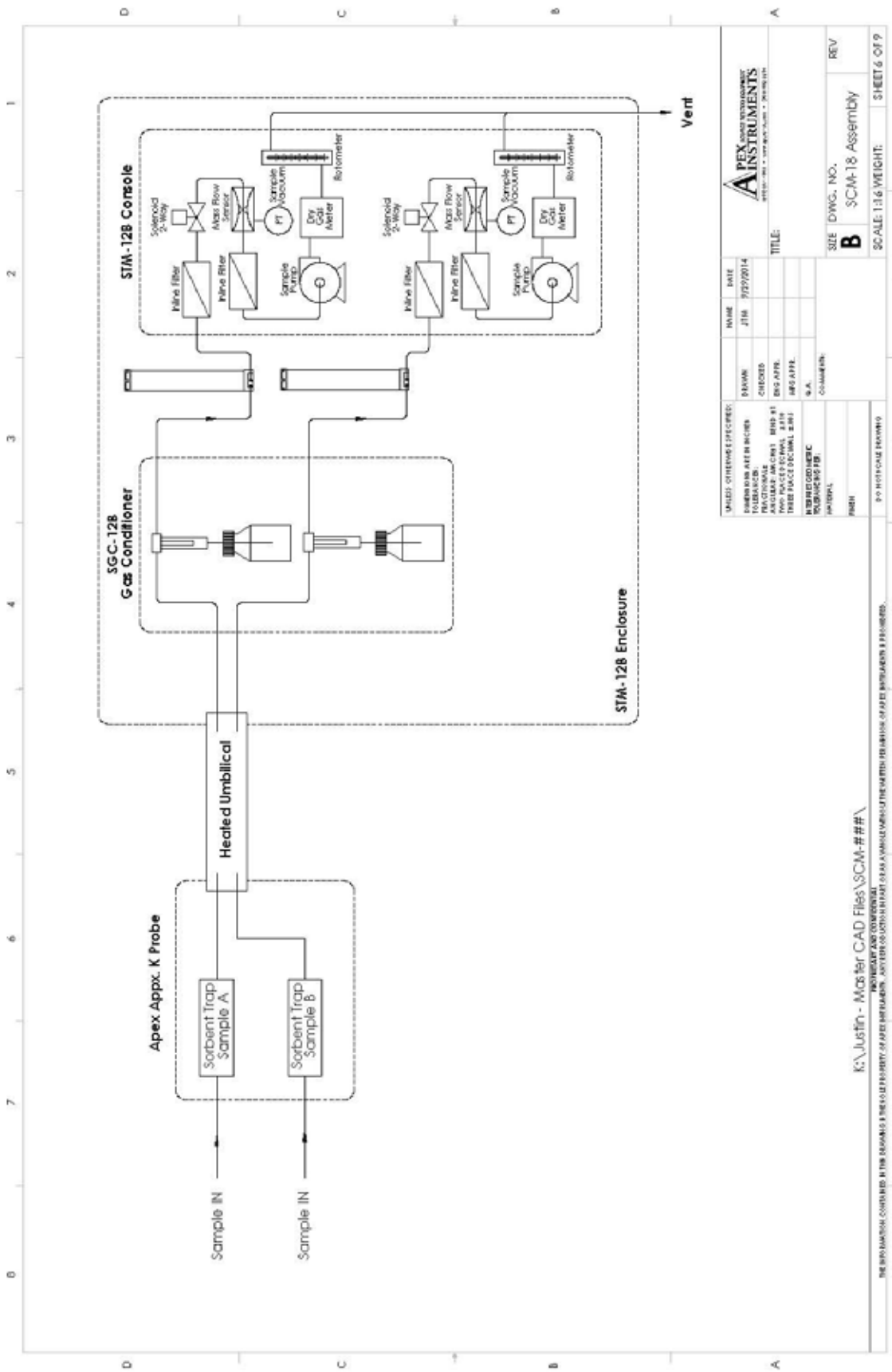


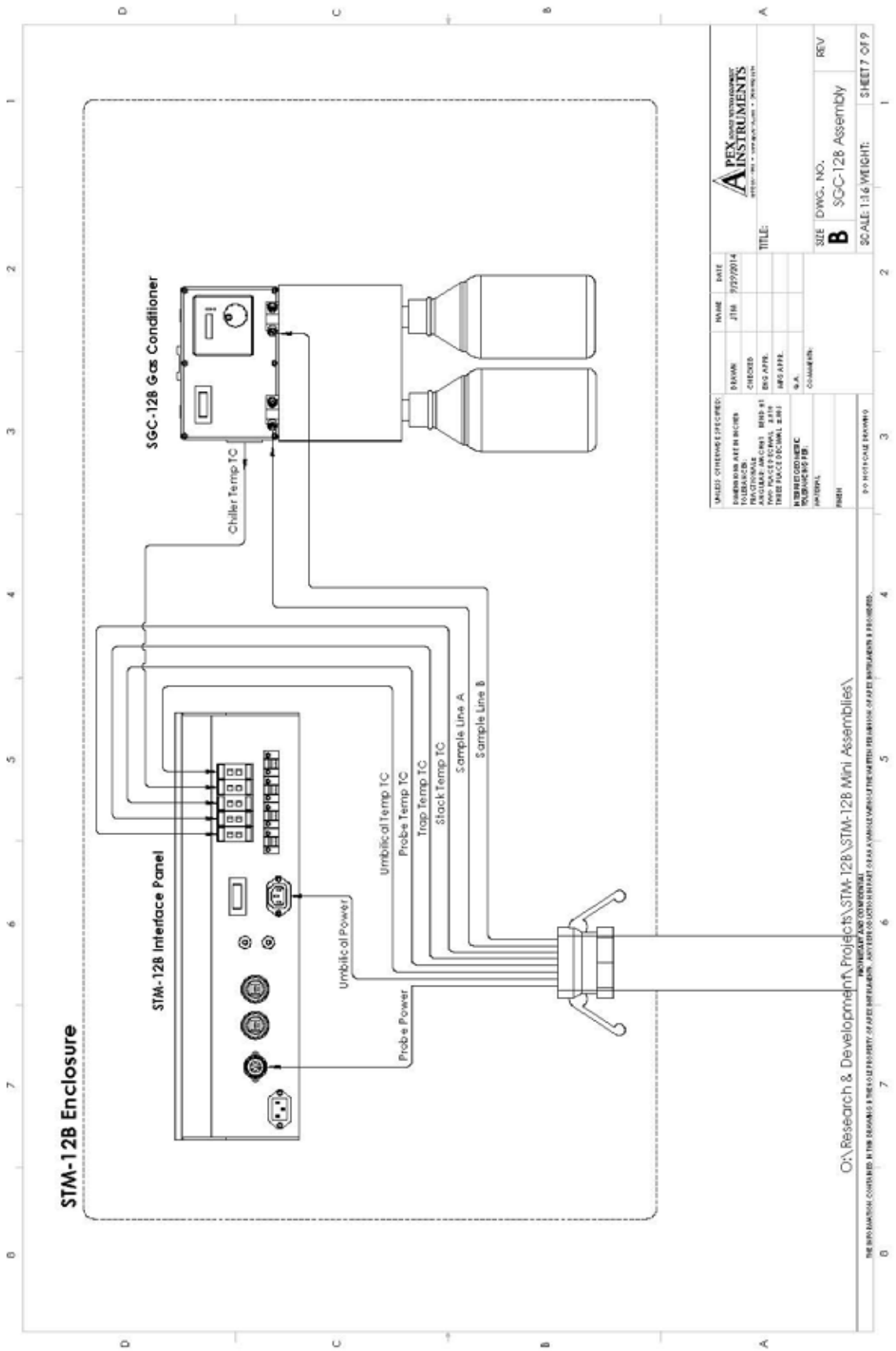
APEX INSTRUMENTS
TITLE:
STM-12B High Level Assembly
SIZE
B
DWG. NO.
REV
SCALE: 1:1
WEIGHT:
SHEET 2 OF 9
C:\Research & Development\Projects\STM-12B\STM-12B Diagrams & Illustrations\


14.17
40.00
24.00
C:\ Research & Development\ Projects\ STM-12B\
STM-12B Wall Mount Enclosure Assembly
APEX INSTRUMENTS
SIZE
DWG. NO.
REV
SCALE: 1:6 WEIGHT:
SHEET 3 OF 9

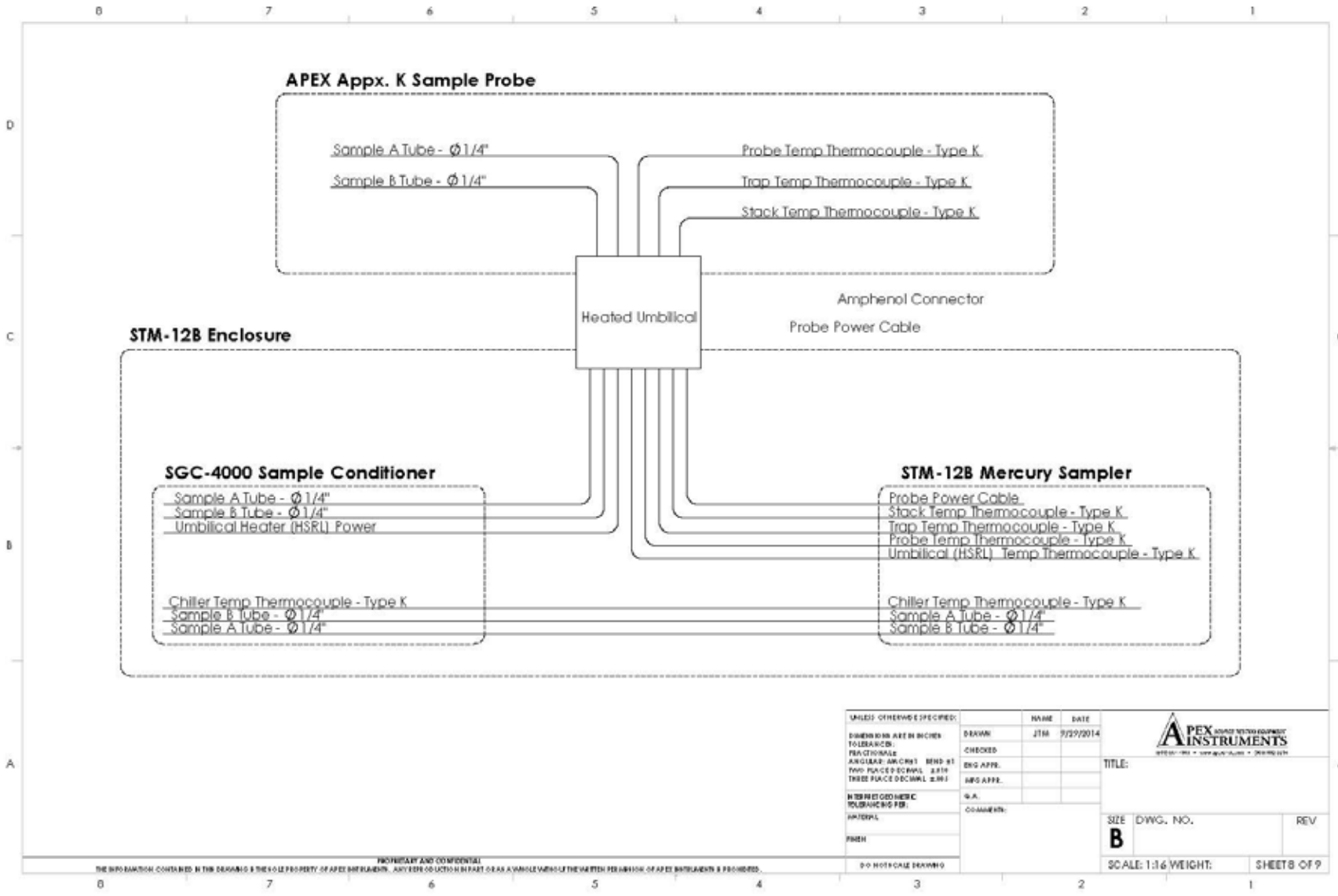

STM-128 Faceplate Panel
STM-128 Interface Panel
SGC-128-TC Gas Conditioner Temp Controller
SGC-128 Gas Conditioner
Gas Conditioner Mounting Height
14.02
3.50
4.78
5.90
10.93
24.00
1.75
1.95
15.28
18.85
4.50
2.45
40.00
17.21
11.84
1.97
APEX INSTRUMENTS
TITLE:
SIZE
DWG. NO.
REV


120 VAC
30 AMP
L
N
G
Plant Power Source
Breaker Box
120 VAC
30 AMP
120 VAC
15 AMP
120 VAC
15 AMP
L N
L N
G
STM-12B
Mercury Monitoring System
SGC-12B
Gas
Conditioner
Air Conditioner
Kooltronic DP-17
2000 BTU/H
L
N
G
Quad Outlet Box
Touch Screen Interface
Microsoft Surface 3
Tablet PC
STM-12B Enclosure
CIRCUIT BREAKER SCHEDULE
UNLESS OTHERWISE SPECIFIED:
DRAWN
JTM
9/29/2014
CHECKED
ENG APPR.
MFG APPR.
Q.A.
COMMENTS:
NAME
DATE
TITLE:
SIZE
B
DWG. NO.
REV
SCALE: 1:16 WEIGHT:
SHEET 5 OF 9
PROPRIETARY AND CONFIDENTIAL
DO NOT SCALE DRAWING


STM-128 Console
Solenoid 2-Way
Mass Flow Sensor
PT
Sample Vacuum
Rotometer
Dry Gas Meter
Inline Filter
Sample Pump
SGC-128
Gas Conditioner
STM-128 Enclosure
Vent
Heated Umbilical
Apex Appx. K Probe
Sorbent Trap Sample A
Sorbent Trap Sample B
Sample IN
Sample IN
K:\Justin - Master CAD Files\SCM-###\
APEX INSTRUMENTS
SIZE B
DWG. NO. SCM-18 Assembly
REV
SCALE: 1:16 WEIGHT:
SHEET 6 OF 9


STM-12B Enclosure
STM-128 Interface Panel
SGC-128 Gas Conditioner
Chiller Temp TC
Umbilical Temp TC
Probe Temp TC
Trap Temp TC
Stack Temp TC
Sample Line A
Sample Line B
Umbilical Power
Probe Power
O:\Research & Development\Projects\STM-128\STM-128 Mini Assemblies\
SIZE B
DWG. NO. SGC-128 Assembly
REV
SCALE: 1:16 WEIGHT:
SHEET 7 OF 9

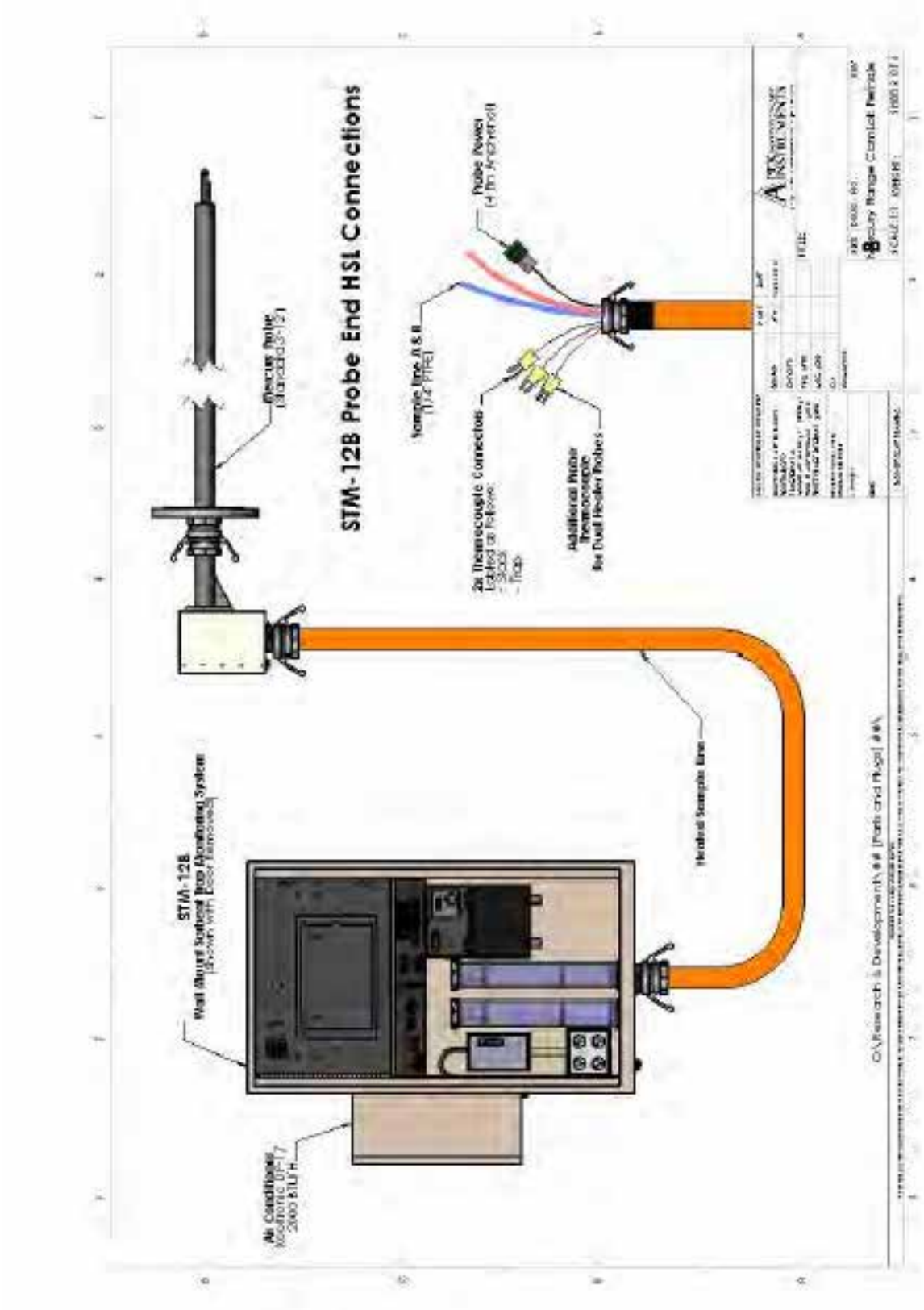
Apex Instruments Inc. Phone: (919) 557-7300 Fax: (919) 557-7110 Web: www.apexinst.com Email: info@apexinst.com



STM-12B Enclosure
STM-12B Console
External Analog Inputs
Stack Flow
Moisture
Remote Pause
Alarm
Alternate LAN Connection for Local Device
External LAN Access
(RJ-45 Pass Thru)
WAN
LAN
APEX INSTRUMENTS
SIZE
B
DWG. NO.
REV
SCALE: 1:3.6 WEIGHT:
SHEET 9 OF 9

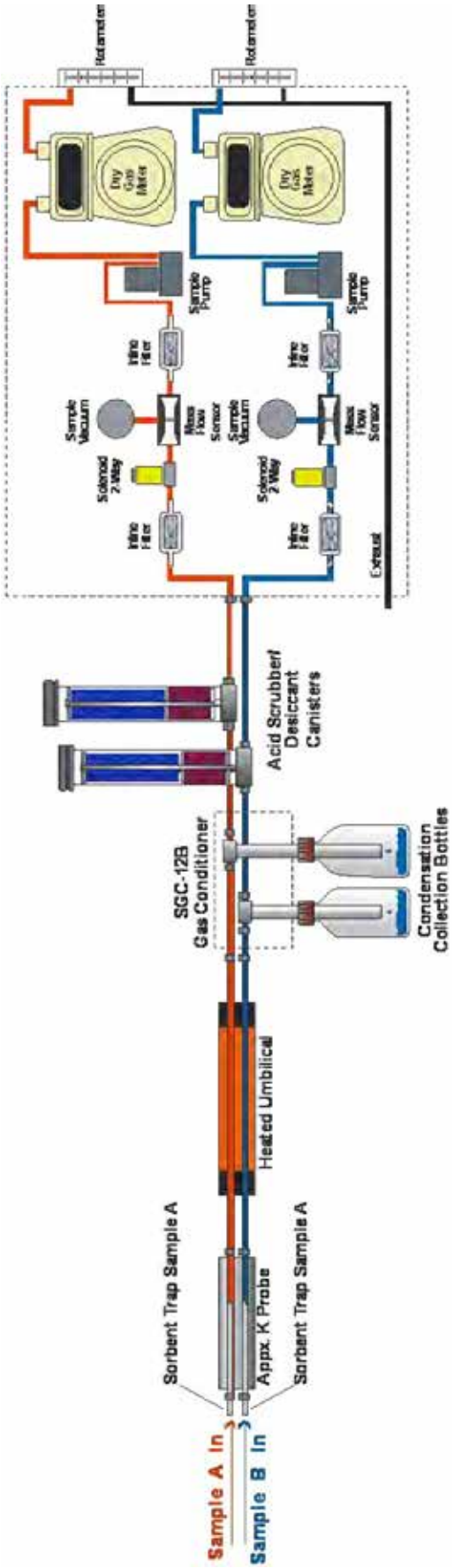
Appendix 4

Console Connection Diagram



Appendix 5

System Plumbing Diagram



The MercSampler Console is comprised of plumbing and electrical (including thermocouple and electronic circuits) subsystems that work together to give appropriate control and feedback.

Appendix 6

Sorbent Canister Assembly Fill Ratios

APPENDIX 7

Recommended Maintenance

Apex Instruments recommends a regularly scheduled maintenance plan for every system and its integral components to assure accurate, efficient and reliable operation of the equipment. All maintenance items listed below are to be considered at least quarterly unless otherwise noted.

The STM-12B System contains the following maintenance components:

Console
Audit Kit
Gas Conditioner
Water Slip Sensor (Optional Component)
Sample Line
Probe

Console

DIF N70 Inline Filters

Replace as needed when visible discoloration or debris on filter element

SD Card

Maintain Data Slots 1-99- Clean old data or backup to another source as required

Quarterly

Electrical

- Switches
- Receptacles
- Power Cords
- Power Supply
- Connections
- Circuit Boards
- CB Connections
- Wiring/Ribbon Cables
- CAT 5/6 Cables

Tubing Integrity and Nuts/Ferrules
Cooling Fan
Thermocouple Jacks
Tablet and Retaining Frame
Totalizers
Support Frame (If used)
Door Hinges
Door Latches and Keepers
Door Latch
Ethernet Connector
USB Connector
Programming Cable- ***Check Apex Instruments' website for latest software/firmware loads***

Conduct Quarterly Audit

Conduct Yearly DGM Calibrations

Audit Kit

Quarterly

Alicat
- NIST Certification (per unit expiration date)
- Power Supply

DIF N70 Inline Filter
Desiccant Tube
Drier Rite
Tubing/Ferrule/Nuts
Thermocouple
Thermos

NIST Device Certification (per unit expiration date)
- Thermometer
- Pressure Gauge
- Barometer
- TC Simulator

Gas Conditioner

Sample Bottles, Cap and Seal
- **Empty after use and inspect before each test run**

Canisters, Connections, Silica Gel/Activated Carbon, Body/Cap Integrity
- **Inspect before each test run**

Quarterly

Electrical
- Temperature Controller
- Switches
- Receptacles
- Power Cord

Internal
- Power Supply
- Heat Exchange Tubes
- Tubing Integrity
- Nuts/Ferrules
- Wiring
- TC Jacks
- Stirling Engine
- Stirling Engine PCB
- Fan

Jumper Assembly
- Lines
- Nuts/Ferrules
- Thermocouple

Waterslip Sensor (Optional Component)

Quarterly

- Wiring
- Sensors
- Sensor Housings
- Warning Light (On Chiller)

Sample Line

Quarterly

- Thermocouple Connectors
- Sample Line Integrity
- Ferrules and Nuts
- Power Cord
- Heat Trace
- Amphenol Connector
- Oversheath Integrity
- Cam Locks

- Clean Sample Lines

Probe

Quarterly

- Internal Probe Box
  - Wiring
  - Thermocouples
    - Stack
    - Trap
    - Probe
  - Amphenol Connector
  - Cam Lock
  - Door Hinges
  - Door Latch and Clasp
  - T-Fittings
    - A
    - B

  - External
    - Probe Body
    - Trap Shield Threads
    - Stack Thermocouple

  - Internal
    - Clean/Purge Sample Tube A **(or as required post test)**
    - Clean/Purge Sample Tube B **(or as required post test)**

  - Thermocouples
  - Trap Heater
  - Probe Heater

NOTICE:

2015/6 Replacement Parts Guide

The ***2015/6 Replacement Parts Guide*** is available for Mercury Consoles.

The guide may be downloaded from the Apex Instruments website:

www.apexinst.com

NOTICE:

Console Audit Manual

The ***Console Audit Manual*** is available for the Mercury Consoles.

The manual may be downloaded from the Apex Instruments website:

www.apexinst.com

NOTICE:

DGM Calibration Procedure Manual

The ***DGM Calibration Procedure Manual*** is available for Mercury Consoles.

The manual may be downloaded from the Apex Instruments website:

www.apexinst.com