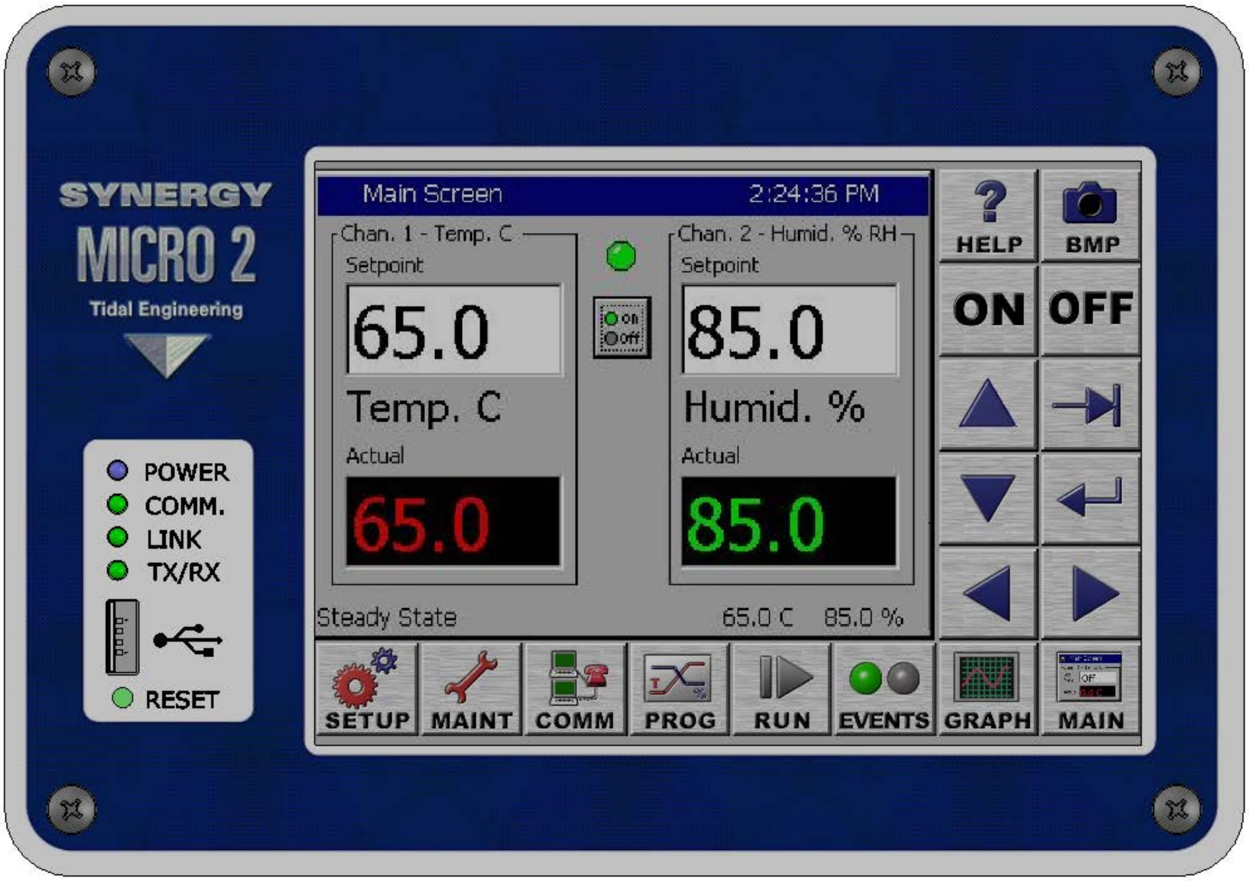
SYNERGY MICRO 2

Designed Specifically For Environmental Test Chambers

A FOUR CHANNEL PROCESS CONTROLLER AND DATA LOGGER

Technical Manual



For One to Four Channel Systems

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Document Number TE1813, Revision G: October 5, 2015

Revision History

Rev.	Date	Revision
C	June 16,2005	First Release
D5	June 27, 2006	Added revision page Updated chapter numbering for sections 8.1.1, 9.7, 11.4
E	October 17, 2006	Updated for Synergy Controller application version 2.0.8. Added for Synergy Micro 2 Controller configuration. Updated Overlay and Web Touch Graphics. Revised Software Upgrade instructions in section 7. Added LCD Backlight CCFT Lamp Replacement instructions in section 7. Updated command set Appendix C to 2.0.8 and added examples. Add section on Macro capability and Bar Code Scanner application. Added replacement parts list, Section 20 Appendix C. General document review and edit. Corrected error in "Analog Retransmit Connections Table" Revised Output Mapping tables in section 6.10 Revised Synergy Controller Compact Interface Panel Layout figures
F	January 10, 2008	Updated for Synergy Controller application version 2.6.10. Added UUT Module Mechanical Drawing Added new section for User Programmable Alarm System. Added 4-20 mA sensor wiring section. Added Space and Altitude section Added Altitude section in L Values for Altitude and Space Chamber Configuration. Added LabVIEW driver section. Added Deviation Alarm feature. Added PID tuning guidelines Added touch screen calibration for Micro unit Simplified Olympic board schematic Added Block Diagram Added High and Low Res Event Screens Added Input Calibration section Added Retro Temperature Only Configuration Add Safety section Added USB Bar Code reader setup for Micro applications Added Installation Section Added bookmark hyperlinks to document
G	October 5, 2015	Updated for Synergy Controller application software version 3.0.7 Build 893. Upgraded figures to show Synergy Micro 2 configuration. Reorganized into 22 sections including 6 Appendices. Added new section for e-mail features. Added new section for network printing features. Updated Space and Altitude section Added Alarm feature enhancements. Added touch screen calibration for Micro 2 unit Simplified Olympic board schematic Replaced CCFT Lamp replacement with LED upgrade procedure.

Table of Contents

1.0 INTRODUCTION

Welcome to the Synergy Controller line of touch screen control systems designed and manufactured by Tidal Engineering Corporation. Synergy Controllers incorporate the latest innovations in environmental test chamber and process oven control and are designed to improve efficiency and simplify test programming and documentation tasks.

The Synergy Micro 2 Controller employs features that maximize the capabilities of your test chamber. It is designed to take complete command of the chamber's conditioning systems with total programming of process variables such as temperature and humidity versus time.

The Synergy Controller employs communication capabilities for the "Global Factory", where data is gathered from around the globe via the Internet; from around the factory floor via Ethernet; and from around the test lab via IEEE 488, RS-485, and RS-232. In addition, these controllers feature: E-mail, FTP, HTTP (Web), PDF plotting, and now Cloud resources.

One of the most powerful features of the Synergy Controller is the WebTouch Remote ™ Web Server which permits control of the equipment from anywhere in the world using a standard web browser. To support global deployment, the Synergy Controller can support multiple languages and employs built-in on-line Help and Wizard systems.

The Synergy Controller utilizes Microsoft's advanced Windows™ Embedded Compact operating system. Windows Embedded Compact is a modular, state-of-the-art, multi-tasking, real-time system. It offers the latest touch screen technology and incorporates Screen Navigation keys and a friendly and powerful user interface.

The Synergy Controller supports USB Hard Disks for data logging, program download / upload. File format is Windows™ compatible, and program, logging and calibration files can all be exchanged with the desktop. File names are also Windows compatible so meaningful names can be used.

Eight Screen Navigation keys provide immediate access to all areas in the system; i.e. the controller is easily switched between setup, programming, and diagnostic tasks. While entering information on one screen, you can switch to another screen to view a setting or parameter, and then return to where you left off on the previous screen. Navigation and control buttons on every screen permit easy access to chamber functions and options. Color real-time data graphing displays important trend information and the versatility and the simplicity built into the new Synergy Controller makes it enjoyable to operate.

The Synergy Controller software was first released in 2001 and has been steadily improved through a continuous process. Numerous software versions have been released in an effort to improve the usability, reliability and features of the controller. This manual refers to the features in the newest major upgrade of the Synergy Controller application, version 3.0.7. Some of the features described in this manual were not available in previous versions. Check the Tidal Engineering website (www.tidaleng.com) for information on the latest version, the newest features, and upgrades.

We welcome feedback on the Synergy Controller and this document and appreciate suggestions for improvements and new features. Thank you for choosing Tidal Engineering's Synergy Controller.

1.1 What's New

The latest software version, Version 3.0.7 Build 893x, offers some powerful new features and capabilities including:

- E-mail
  - Alarms
  - Log Files
  - Plots
- Network printing features.
  - PDF plots
  - Print directly to a network printer.
- User alarms
  - Custom alarms for pressure transducers, Basket jam
- Main screen layout features
  - Display additional sensor values for user information
  - Chamber light switch
  - Toggle switch
  - Font size options; Large, Medium, Small
  - FTP Server
- New Output Primitive Types
  - PWM – General purpose time proportioning output (Up to 8)
  - ON/OFF – Thermostatic Primitive. (Up to 8)
- Updated Help System
  - Spanish Language
  - Edited for clarity
- Graph
  - Improved graph timing accuracy and resolution
  - Additional Graph Scaling features; Time Scale and Vertical Scale
- Events Screen
  - New parameter turns off Humidity events and displays 9 total User Events
  - Display friendly event names like GN2 Purge or LN2 Enable
- Alarm Screen
  - Alarm information enhanced; i.e. Alarm shows source of Digital Input DIN 1
- Improved Cascade Control Algorithm
  - Control Boost Heat and Boost Cool explicitly
- Command Set
  - 200 new commands
- Logging Feature
  - Profile Logging
  - Profile log Auto-Removal
  - Export file naming
  - Warn when full
  - Stop logging or Overwrite option when full.
  - Added Header to all logs and settings that includes chamber information
  - Logging PID Values, constants and variables
- Programming
  - Added Pause Step
  - Change Setpoint while paused
  - Added a "Wait For Tolerance" Parameter for each channel.
  - Display Program Name in the Title Bar of all screens
- Standard Alarms
  - Added Deviation Alarm Feature
  - Added Alarm Delay
  - Custom Behavior capability
- Added Chamber Name feature to allow each chamber to be uniquely identified in chamber in logs & e-mails
- Virtual Sensors
  - Virtual Pressure
  - Wet-Bulb/Dry Bulb
  - Virtual Kft sensor for altitude chambers
- Remote Start Stop Feature controlled by assignable Digital Inputs
- Analog Programming for setpoints
- Added Resume Behavior options
- FTP Server

Appendix A, "Deliver Test Results with Synergy Controller" added to highlight the various ways the controller can format and deliver test results.

1.2 Controller Configurations

This technical manual supports the Synergy Micro 2 and the legacy Synergy Micro and Synergy Micro V configurations. In many cases the features of these configurations are identical.

The Synergy V and Synergy Compact configurations are supported by the prior technical manual (Rev F).

The unique features of each configuration are listed in the table below along with an icon for each. Features that aren't supported by all five configurations are identified in this document with the appropriate icons.

Type	Synergy Micro 2	Synergy Micro	Synergy Micro V	Synergy V	Synergy Compact
Icon					
P/Ns	TE2174-3	TE1704-3	TE1704-5	TE1364	TE1530, TE1666
Processor	ARM	ARM	ARM	x86	x86
Floppy Drive	No	No	No	Yes	Yes
OS	5.0.E1	5.0	5.0	2.11 and 4.2	2.11 and 4.2

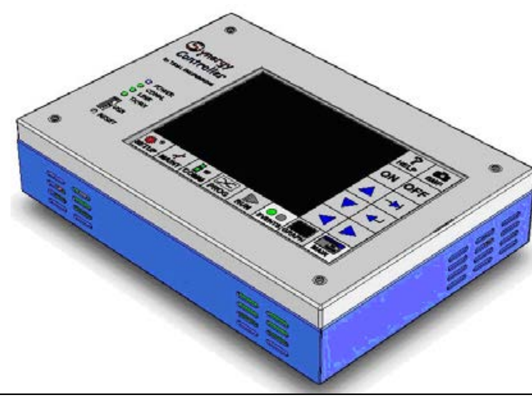
The following table shows each of the above configurations with the corresponding image.

Synergy Micro 2

P/N TE2174-3
Processor ARM
Floppy Drive: No
OS: P/N TE2144

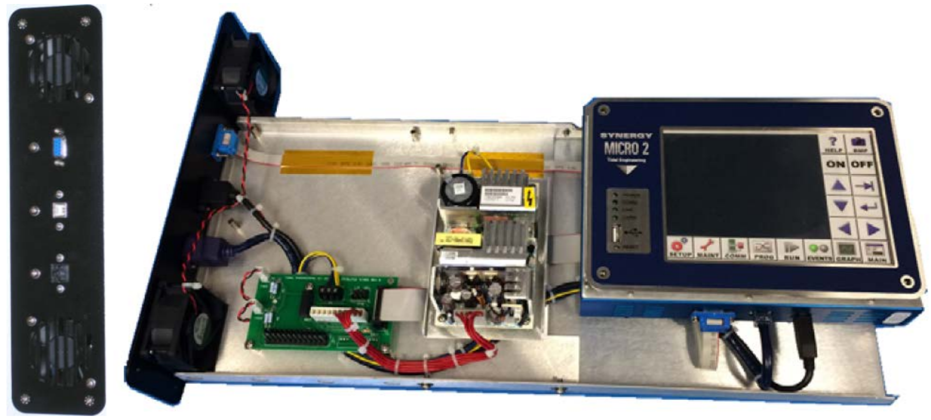
Synergy Micro

P/N TE1704-3
Processor ARM
Floppy Drive: No
OS: P/N TE1860



Synergy Micro 2 V

P/N TE2174-5
Processor Arm
Floppy Drive: No
OS: P/N TE2144



The Synergy V and Synergy Compact configurations below are supported by prior technical manuals; Rev F.

Synergy Compact

P/N TE1666, TE1530
Processor: X86
Floppy Drive: Yes
OS: P/N TE1360

Synergy V

P/N TE1364
Processor: x86
Floppy Drive: Yes
OS: P/N TE1360

In addition to the full-sized Synergy Micro and Micro 2 Controllers, Tidal Engineering offers the more economical Synergy Quattro and the compact ¼ DIN Synergy Nano.

Synergy Quattro

P/N TE1961-3
Processor: ARM
Floppy Drive: No
OS: P/N TE2162

The Synergy Nano is available in four different configurations.

Type	Synergy Nano 1	Synergy Nano 2	Synergy Nano 3	Synergy Nano +
Icon				
P/Ns	TE1858-1	TE1858-2	TE1858-3	TE1858-4
Processor	ARM	ARM	ARM	ARM
Main Outputs	(6) Open Collector	(6) Electro-Mechanical Relays	(6) SSRs Solid State Relays	Expanded Olympic Board
Aux Outputs	(6) Open Collector	(6) Open Collector	(6) Open Collector	Expanded Olympic Board
Event Outputs	(6) Open Collector	(6) Open Collector	(6) Open Collector	Expanded Olympic Board
Ethernet	10/100 BaseT	10/100 BaseT	10/100 BaseT	10/100 BaseT
OS	5.0	5.0	5.0	5.0

Chamber Type Applications

The Synergy Controller supports many different test chamber types including one, two, three and four channel systems. These standard configurations are as follows:

- Generic Temperature Only
- Generic Temperature/Temperature (Thermal Shock Chambers)
- Generic Temperature/Humidity
- Generic Temperature/Humidity Single Stage
- Generic Temperature/Pressure (Altitude and Space Chambers)
- Generic Temperature/Humidity/Pressure
- Generic Temperature/Humidity/Vibration (HALT/HASS Chambers)
- Generic Temperature/Vibration (HALT/HASS Chambers)
- Generic Pressure (Altitude and Space Chambers)
- Retro Temperature Only

See section 6.10 for the specifics of each application.

Contact Tidal Engineering for custom configurations.

1.3 Company Information and Assistance

Congratulations on purchasing the Synergy Controller designed and manufactured by Tidal Engineering.

Headquartered in Randolph, New Jersey, Tidal Engineering designs and manufactures embedded hardware and software for test & measurement and data acquisition products. Tidal also provides engineering services, custom electronic product development and provide turnkey distributed data acquisition and control systems.

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Web Site: www.tidaleng.com

Please have the application version of your Synergy Controller available when contacting us.

Parts Replacement

The Synergy controller has been designed and manufactured to provide years of reliable service. In the event a system should fail, only OEM approved parts should be used as replacements. A list of replacement parts appears at the end of this manual. Please contact the Tidal Engineering for component replacement, or repair.

Notice to Users
TIDAL ENGINEERING PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE-SUPPORT DEVICES OR SYSTEMS UNLESS A SPECIFIC WRITTEN AGREEMENT REGARDING SUCH USE IS OBTAINED FROM TIDAL ENGINEERING PRIOR TO USE.

Life-support devices or systems are devices or systems intended for surgical implantation into the body or to sustain life, and whose failure to perform, when properly used in accordance with instructions for use provided in the labeling and user's manual, can be reasonably expected to result in significant injury.

No complex software or hardware system is perfect. Bugs are always present in a system of any size. In order to prevent danger to life or property, it is the responsibility of the system designer to incorporate redundant protective mechanisms appropriate to the risk involved.

All Tidal Engineering products are 100 percent functionally tested. Additional testing may include visual inspections. Specifications are based on characterization of tested sample units rather than testing over temperature and voltage of each unit. Additional testing or burn-in of a system is available by special order.

Tidal Engineering reserves the right to make changes and improvements to its products without providing notice.

2.0 SPECIFICATIONS

2.1 Data Sheet

FEATURES:

Channels
- Channels: 1 to 4 Process Variables
  - Temperature
  - Humidity
  - Pressure; Altitude or Vacuum
  - Vibration
  - Velocity

LCD
- Type: Color STN; Resolution: 320 x 240
- Size: 5.7" Diagonal
- Backlight: LED

Operating System
- Microsoft Windows™ Embedded Compact
- Touch screen Graphical User Interface

Communications
- 10/100 Base-T Ethernet Networking
- WebTouch Remote™ (Pat. Pending)
  - Web Server Software for Remote Control/Monitoring with Web Browser
- E-mail, Text Message
  - Alarms and Test Data
- FTP Server
  - Profiles, Log Files, etc.
- RS-485 Communications
- RS-232 Communications
- IEEE 488 (GPIB) Communications

Storage
- 2 GB Flash
- 64 MB SDRAM
- Removable USB Flash Disk

Universal Serial Bus (USB)
- USB Flash Memory for Program and Log Files and Upgrades
- USB Mouse
- USB Keyboard
- USB Barcode Scanner

Processors
- Main Processor:
  - Marvel PXA270
- I/O Processor:
  - Rabbit Semiconductor R2000

Programming
- Windows-Friendly Program File Names
- Step Types:
  - Set Point, Jump Loop, Auto Start, Hold, and Stop
- Number of Programs:
  - Only Limited by Onboard Storage

Software Features
- Built-In Context Sensitive Help System
- E-mail, Text Message
  - Alarms and Test Data
- Real-Time Color Graph Display
- Built-In TCP/IP Networking
- Real-Time Clock with Battery Backup
- Automatic Resume After Power Failure
- Software Configurable Chamber Type

Analog Inputs
- Process Voltage Inputs (4):
  - Range: 0-5 VDC; Accuracy: +/- 0.5 mV
  - Resolution: 16 bits
- RTD Inputs (2):
  - Temperature Range: -200° C to 630° C
  - Accuracy: +/- 0.05 Ohms
  - 100 and 500 Ohm Pt. RTD, JIS or DIN
- Machine Diagnostics Inputs (8)
  - Range: 0-5 VDC; Accuracy: +/- 10 mV
  - Resolution: 10 bits

Analog Outputs
- Voltage Outputs (2):
  - Range: 0-5 VDC
  - Accuracy: +/- 0.5 mV
  - Resolution: 12 bits
- Current Outputs (2): (Optional)
  - 4-20 mA or 0-20 mA
- Analog Output Functions:
  - Channel 1, 2, 3 & 4
  - Setpoint, Actual, Heat PID, Cool PID

Digital Outputs
- Total Digital Outputs: (32)
- Triac Outputs: (30) (Optional)
  - Output Rating: 5 A, 250 VAC
- Relay Outputs: (2)
  - Contact Rating: 3 A, 250 VAC
- Event Outputs: (Optional)
  - Up to 6 User-Programmable

Digital Inputs
- Digital Inputs: (16)
  - Ground: TRUE
  - Open Circuit: FALSE
  - Voltage Range: -0.5 to +5.5 VDC

Data Logging
- Interval:
  - 1 Second to 60 Minutes
- Capacity
  - 100 MB
- Data:
  - Process Variables
  - Process Setpoints
  - PID Variables
  - UUT T-Type Thermocouples
  - Alarms and Profiles

Synergy UUT Thermocouple Monitor
- T-Type Thermocouples: (16)
- Total Supported Modules/Sensors: 4/64
- Temperature Range: -200° C to +400° C
- Power: 9 to 28 VDC, 3 Watts
- Controller Powered

Alarms
- Low Program Memory
- Low Storage Card Memory
- TempGard Over-Temperature
- Open Sensor
- High/Low Process Limit
- High/Low Deviation Limit
- User Programmable Alarms
- Internal Communications Failure

Electrical/Mechanical
- Mounting Options:
  - Flush Mount
  - Front Mount
  - Articulating Mounting Arm
- Power Requirements:
  - 100 to 240 VAC
  - 47 to 63 Hz
  - 25 Watts
- Operating Conditions:
  - Temperature: 10° C to 30° C
  - Humidity: 0 to 90% RH, Non-Condensing
- Size: 9.50" W X 6.75" H X 3.25" D
- Weight: 3.5 lbs.

Synergy Part Numbers
- Synergy Micro 2 Controller
  - P/N TE2174-1
- Synergy Micro 2 Controller, Console
  - P/N TE2174-5
- Synergy Web Touch Remote
  - P/N TE1567
- Synergy Lab Manager Software
  - P/N TE1566-1
- Synergy UUT Thermocouple Monitor
  - P/N TE1299-16
- Synergy Retransmit Signal Conditioner
  - P/N TE1803
- Triac Output Board, 12 Channel
  - P/N TE1151-12
- Triac Output Board, 6 Channel
  - P/N TE1151-6
- Triac Output Board, 5 Channel
  - P/N TE1151-5
- Relay Output Board, 6 Channel
  - P/N TE1708-6

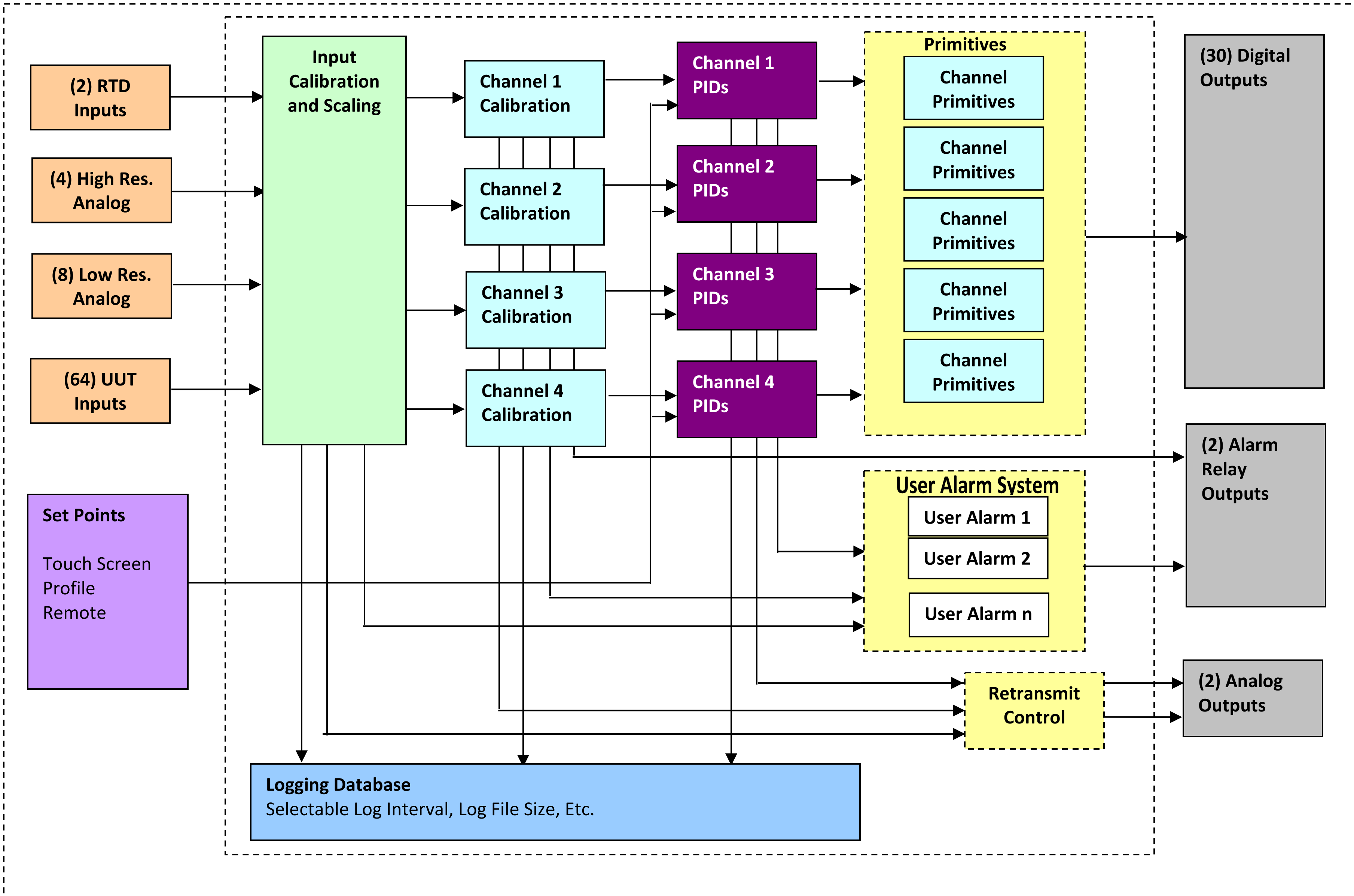
ABOUT TIDAL ENGINEERING

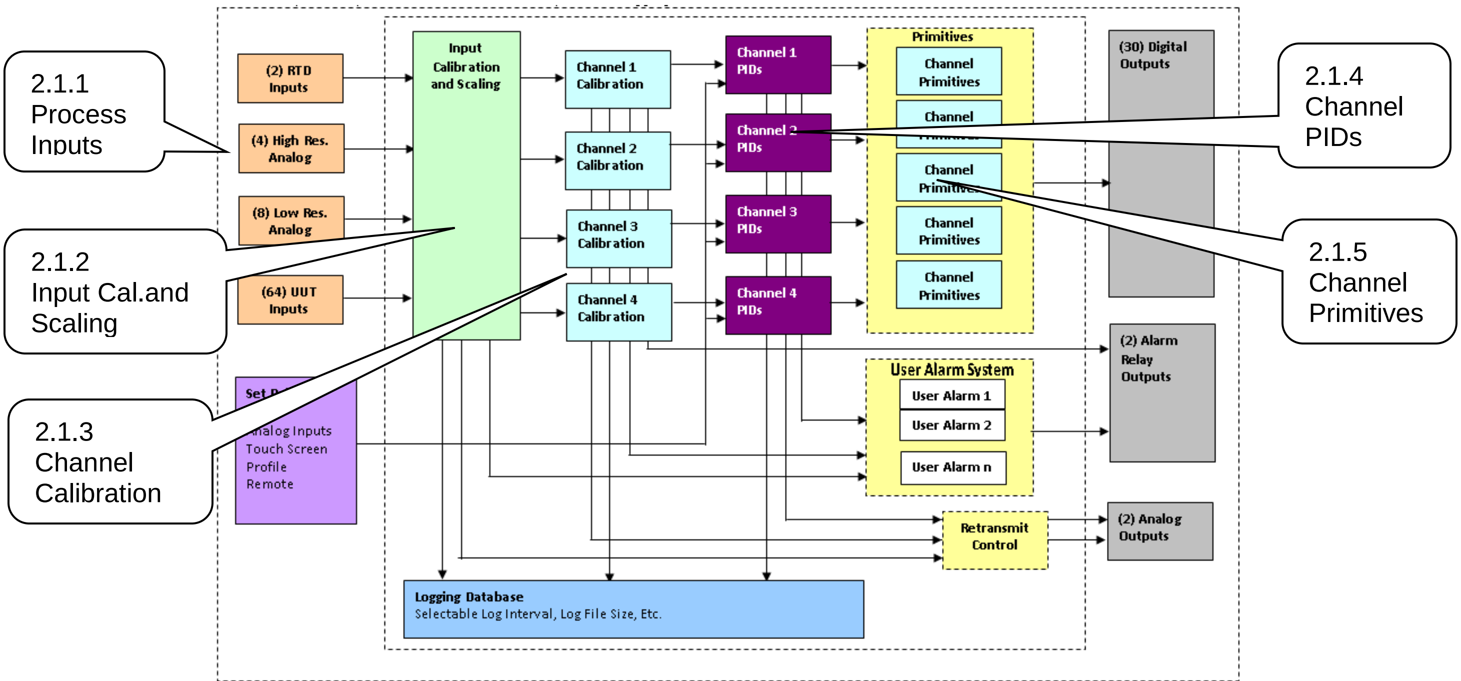
Headquartered in Randolph, NJ, Tidal Engineering Corporation has been designing and building award-winning embedded hardware and software for environmental test and measurement and data acquisition applications since 1992.

2.2 Block Diagrams

The Synergy Controller is a flexible multi-channel control system designed to handle virtually all temperature control applications. The block diagram in the following section identifies the major systems of the controller and their relationships. Two small block diagrams in the two sections following the main block diagram identify each block diagram section and provide a description of each.

Synergy Controller Block Diagram





2.1.1 Process Inputs

The Synergy Controller has multiple inputs. (See detail above) These are listed in the table below.

Inputs	Channels	Application
RTD channels	2	Temperature Measurements
High Resolution 0-5VDC channels, 16-Bit	4	Humidity, temperature and other process variables. 0.0001 Volt resolution
Low Resolution 0-5VDC channels, 10-Bit	8	For refrigeration pressure and process variables. 0.005 Volt resolution
UUT Temperature Inputs T-Type Thermocouples	16 per Module 64 max	Temperature Measurements

Note: All of these inputs can be logged and checked using the user programmable alarm system.

2.1.2 Input Calibration and Scaling

Each Input can be calibrated for the physical measurement, Ohms, Volts or Degrees C.
Each Input can also be scaled to appropriate engineering units. (See the Calibration section)

2.1.3 Channel Calibration

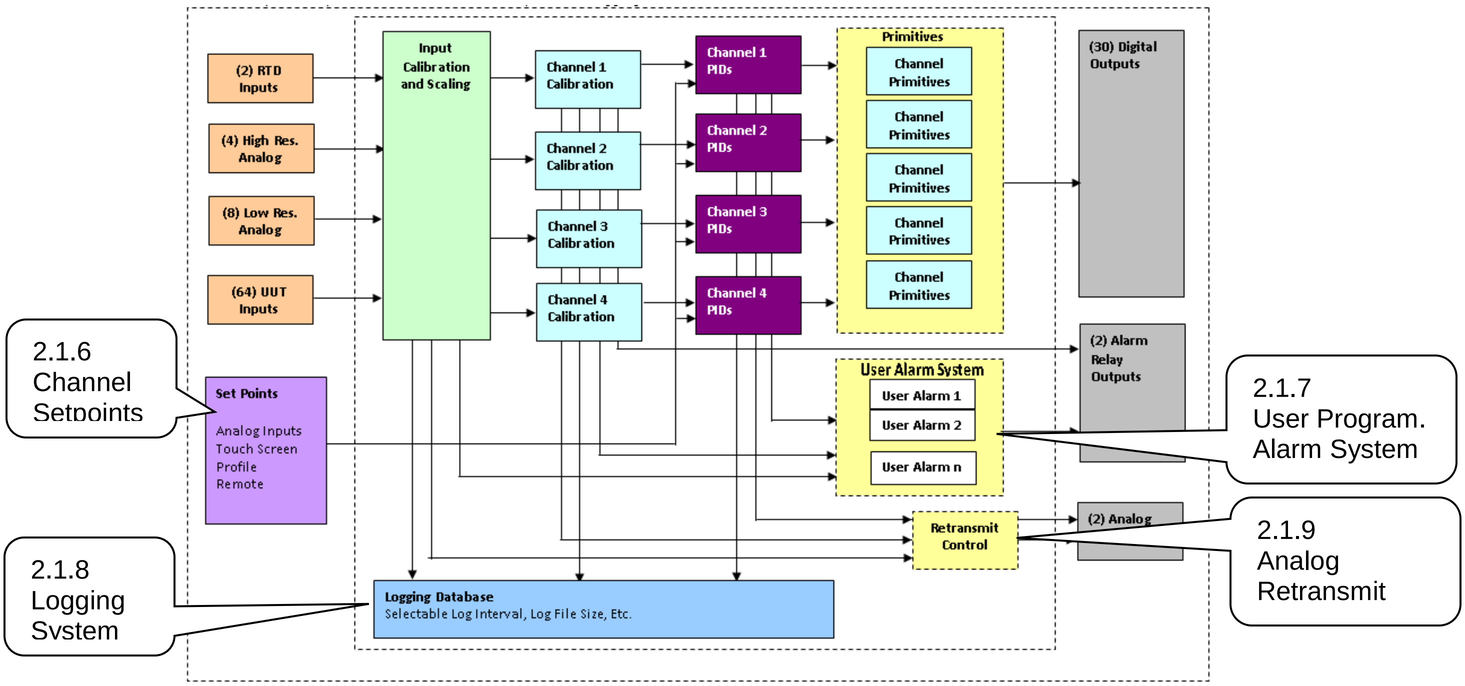
Each Channel is assigned an input. In addition, channel data can be scaled and offset to accommodate Channel errors caused by sensor position, thermal gradients, etc.

2.1.4 Channel PIDs

Each Channel has a set of PID constants and variables. Each channel implements a PID control algorithm that determines its Heat and Cool outputs. The PID variables can be logged for documentation and tuning purposes.

2.1.5 Channel Primitives

The channel primitives are the algorithms that control each output device such as fans, compressors, heaters, etc. The Synergy Controller supports multiple instances of the same primitive. For example in the thermal shock application there are two hot chambers and one cold chamber and thus uses two Heat output primitives. Each primitive output is displayed in the Events/Digital Outputs folder.



2.1.6 Channel Setpoints

Each channel has a setpoint. The setpoint can be a steady-state value, a profile generated setpoint or a remote setpoint from a computer or PLC.

2.1.7 User Programmable Alarm System

A user programmable alarm can be specified for one or more alarms using any input or channel value. These alarms can be used for various purposes including chamber protection, unit-under-test protection, or chamber control. See the user programmable alarm Section 6.14 for details.

2.1.8 Logging System

The logging system is used to capture test results and chamber performance data as well as alarm conditions. The logging system can acquire data from any controller input, channel or PID output. See the logging section 6.11 of the manual for detailed setup instructions.

2.1.9 Analog Retransmit Outputs

The Analog Retransmit Outputs can be used to retransmit process or control variables as a proportional voltage to chart recorders or proportional control valves. There are two retransmit outputs. See Analog Retransmits in the Special Function Section 6.4 for more details,

3.0 APPLICATIONS

The Synergy Controller support s a variety of systems including environmental test chambers, process ovens, thermal platforms, and chillers.

3.1 Environmental Test Chambers

The Synergy Controller series can handle a variety of standard and special environmental test chambers including:

- Multiple Communications options
- WebTouch Remote ™ for remote control with any browser
- Cascade control loops
- Data logging and printing.
- Bar code reader features for error proof setup.
- Temperature Humidity Chambers
- Temperature Humidity Altitude Chambers
- Thermal Vacuum Ovens
- Thermal Vacuum Chambers (Space Simulation)
- HALT/HASS Chambers
- HAST Chambers
- Thermal Shock, 2 Zone and 3 Zone

3.2 Process Ovens

Cascade control loops, data logging and printing, and bar code reader features provide a lot of value in process oven applications in manufacturing operations.

- Data logging and printing.
- E-mail alarms and chart data delivery
- Bar code reader features for error proof setup.

3.3 Thermal Platforms

Thermal platforms are used in testing applications where thermal conduction is the most efficient way to control the test temperature of the Unit-Under-Test (UUT). These are popular in RF component testing application as well as transducer applications. Controller features that add value in these applications are:

- Cascade control loops
- Multi-Channel capability for dual platform applications
- Data logging and printing.
- Bar code reader features for error proof setup.

3.4 Chillers

The remote control and remote sensing features of the Synergy Controller are beneficial in chiller applications.

- Multiple Communications options; Ethernet and RS-232
- WebTouch Remote ™ for remote control with any browser
- Cascade control loops
- Data logging and printing.
- Bar code reader features for error proof setup.

3.5 Other Equipment

Plant growth chambers, Wind Tunnels, and food processing.

4.0 EQUIPMENT SAFETY AND CONTROLLER ALARMS

No complex software or hardware system is perfect. Defects are always present in a software system of any size. In order to prevent danger to life or property, it is the responsibility of the system designer to incorporate redundant protective mechanisms appropriate to the risk involved.

Make sure you completely understand the operation and function of the chamber and the Synergy Controller before you begin using your test chamber.

Dangerous voltages are present in this equipment. Disconnect electrical service of source and tag circuit out before servicing or replacing components.

Do not use the Synergy Controller in any manner not specified in this manual. Improper use may impair the safety features employed and may void your test chamber and controller warranty. Failure to follow the proper operating procedures listed throughout any of the information provided could cause damage to your equipment, personal injury or death.

The Synergy Controller offers multiple built-in alarms to protect the equipment (test chamber, process oven, thermal platform etc.) and the unit-under-test from conditions outside their ratings. The alarms should be carefully set to appropriate limits based on the capabilities of the equipment and the safe limits of product exposure. In addition to these built-in alarms, a secondary controller should always be employed to offer further protection in the case of sensor or controller failure.

4.1 Standard Alarm Limits

The Synergy Controller features standard high and low absolute limits and high and low deviations limits for each channel. Look for the alarms in the setup folder for each channel in section 6.2 under SETUP/Calibration/Channel 1, 2, etc.

4.2 User Programmable Alarm Limits

In addition to the standard alarm limits, the Programmable User Alarm System can provide additional protection against open or failed sensors and process variable outside expected limits. User alarms can be created using redundant sensors for any channel and provide shut down protection to reduce the probability of machinery failure. See section 6.14.

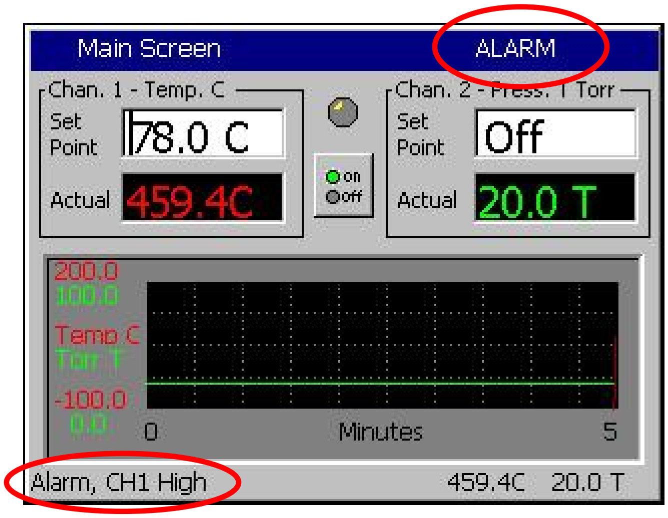
4.3 Secondary Controller Alarms

Redundant protective mechanisms such as a TempGard limit controller should be used to provide complete protection against controller and/or sensor failure. When used with a separate sensor, secondary alarm controllers reduce the probability that a single point failure will cause damage to the chamber or to the product inside. The secondary controller should be wired to remove power from all of the chamber's machinery in order to provide maximum protection.

4.4 Alarm System Testing

It is important that users periodically verify all alarm systems by test. As a minimum, it is important to confirm that chamber shut down occurs and power is removed from heaters, compressor, etc. when standard alarm limits, user programmable alarm limits and secondary controller limits are reached.

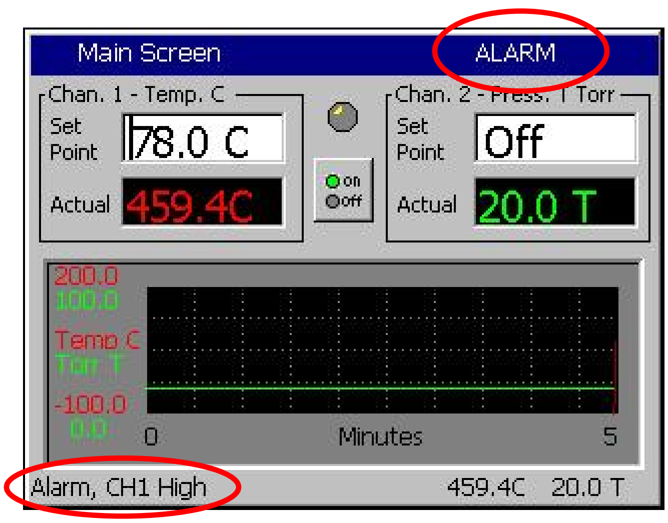
4.5 Alarm Notifications



Channel Alarm Notification

- When any channel alarm limit or deviation limit is exceeded the Synergy Controller's conditioning outputs shut down and the following indications are present:
- "ALARM" flashes in the upper right corner of the touch screen.
- Alarm status is displayed in the lower left hand corner of the touch screen.
- Alarms are listed in the Alarm folder in the Maintenance Screen.
- Alarms are logged in the History File (Log File).

See the Maintenance Screen Section of this manual for additional information



See Section 19.2 E-Mail Delivery to learn how the Synergy Controller can generate text messages and alarm notification e-mails.

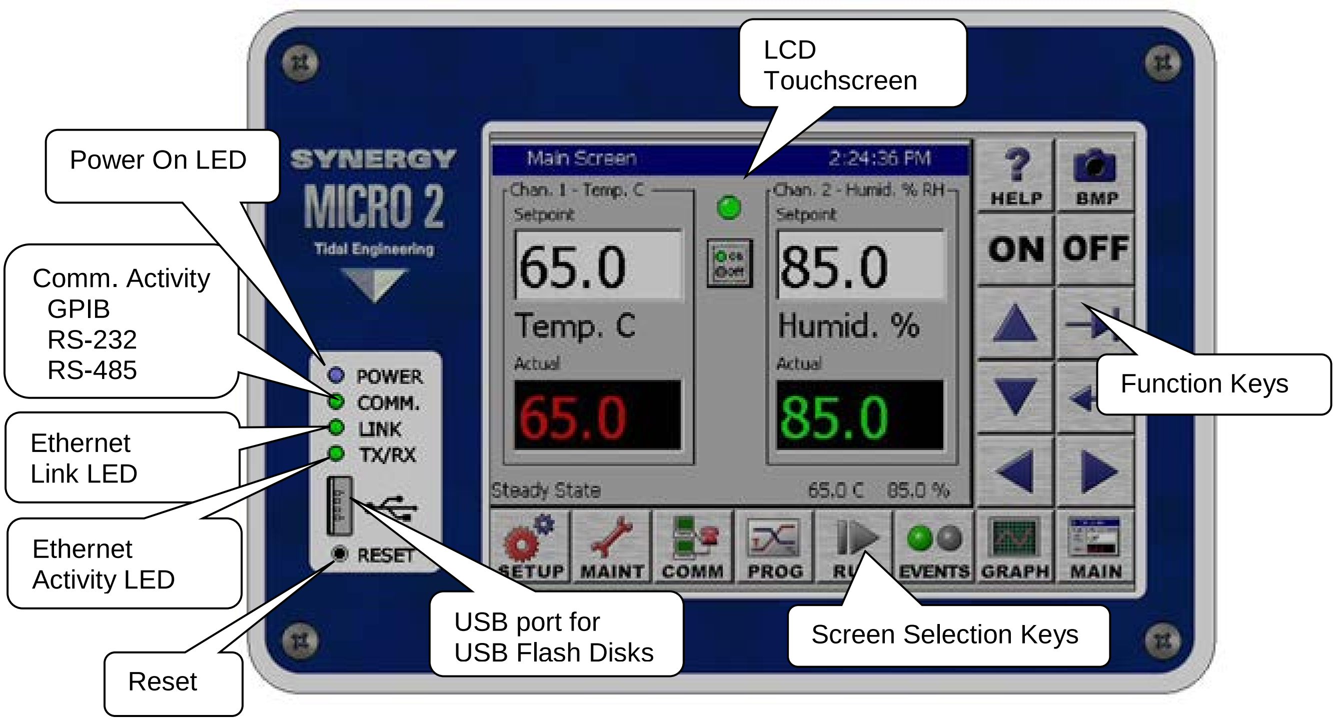
5.0 FRONT PANEL AND CONTROLS

5.1 Front Panel Layout

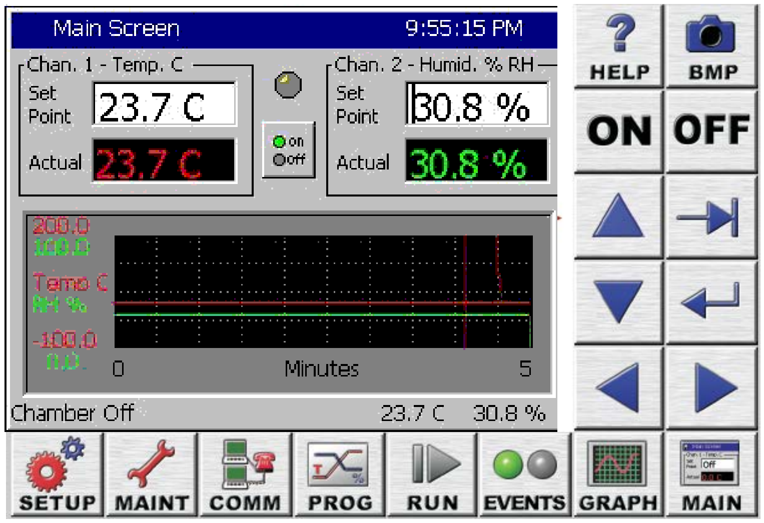
The Synergy Controller features a stainless steel and blue anodize finish as shown below.

The principal components of the Synergy Controller Interface Panel are identified in the layout below.

Synergy Controller– Front View



5.2 User Interface



Help Key: context sensitive help.
BMP Key: take screen shots.

Turn Chamber ON or OFF

Select Keys: Help with entering data and selecting from lists & groups

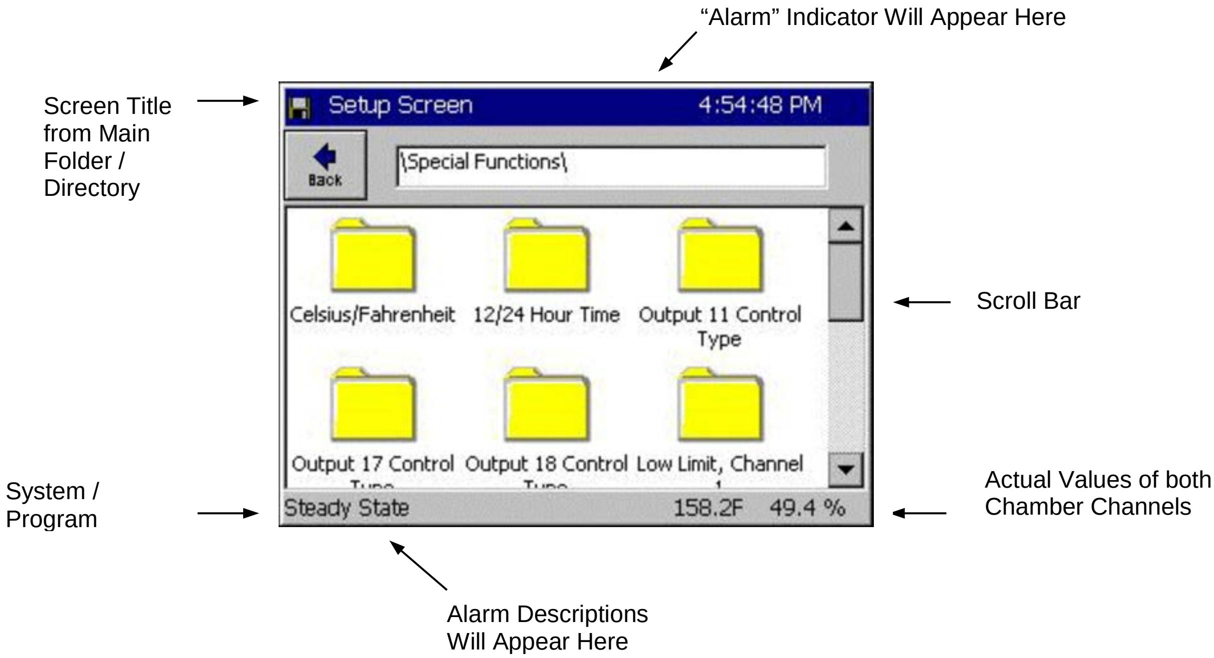
SCREEN NAVIGATION KEYS

SETUP	MAINT	COMM	PROGRAM	RUN	EVENTS	GRAPH	MAIN
The Following Folders and Screen Editors Will Appear When Pressed							
Calibration	Machine Inputs	RS - 232	Screen Editor	Screen Editor	Event Outputs	**Graph Screen**	Screen Editor
PID Settings	Alarms	RS - 485	Create, edit, or load profile	Run Profile	UUT Temps.	Large Graphic Display	Manual Mode Operating Screen
Special Functions	Channel PIDs	IEEE - 488			Digital Outputs		w/ Small Graphic Display
L - Values	About	Ethernet			Digital Inputs		
LCD Settings	File Utilities	Web Server			Hi Res Inputs		
Chamber Setup	Date & Time	TCP / IP Server			Lo Res Inputs		
Logging	Macro Utilities						
Panel Lock							
Languages							

Note: Green cells highlight new folders in this Synergy Controller software release.

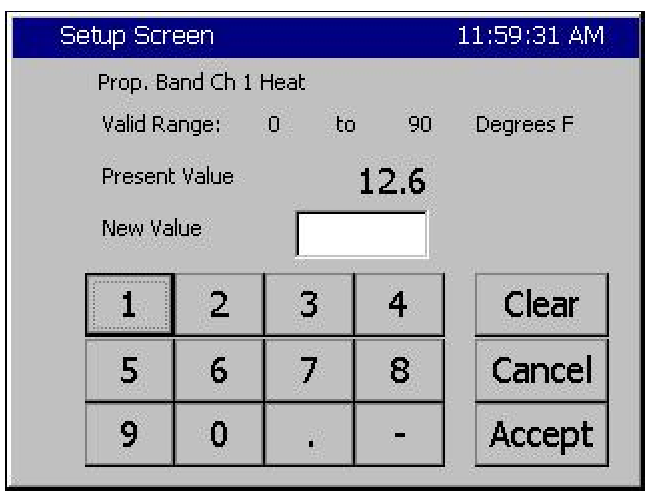
5.2.1 LCD Screen Touch Screen

Synergy Controller incorporates a 320 x 240 color LCD with a touch screen Windows graphical user interface. The screen shot shown below identifies the common elements of the Synergy Controller display. The title bar at the top and the status bar at the bottom of the window are found on most screens.



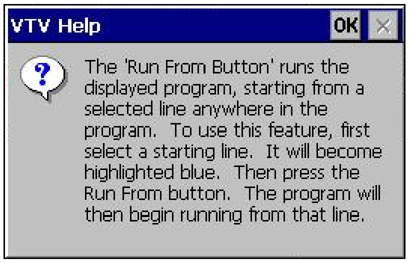
Keypad Screen Example:

The screenshot below shows a typical keypad for numerical data entry.



5.2.2 Function Keys

Help Key:

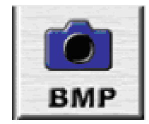


Press the ***Help*** key and then press a location on the touch screen, a small Help window like the one shown will appear with information to assist you.

Press ***OK*** to close the Help screen.

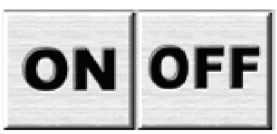
Screen Capture Key:

Press this key to capture a bitmap image of the current screen and store it to a USB Hard Disk. After pressing the key the window at the left will appear. The picture will be saved in memory. To export the bitmap to your storage media go to the Maintenance screen and press the ***Export Screen*** shots button.



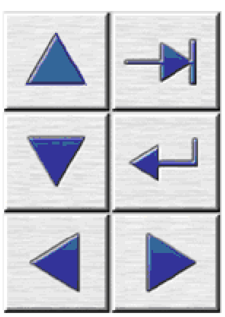
Press ***OK*** to close the Capture screen.

ON / OFF Keys:



These keys are used to turn the chamber On and Off.

Select Keys:

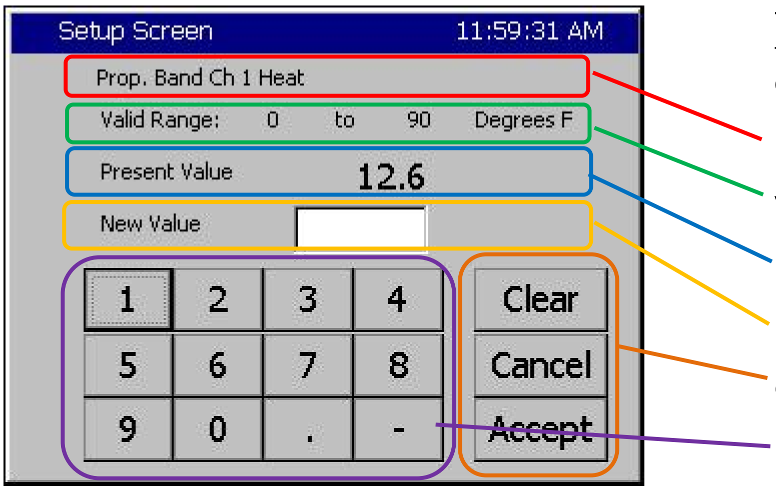


The six keys to the right of the LCD are used to enter data and select from lists and groups. The arrow keys move or scroll from item to item. The ***Enter*** key selects and enters data.

5.2.3 Keypads

Synergy Controller User-Interface uses Numeric and Alpha-Numeric keypad for data entry. The screenshots below provide a few examples.

Numeric Keypad Example:



The number keypad at left is a typical keypad used to enter a controller parameter.

Parameter Name

Valid Range

Present parameter value

New paramter value

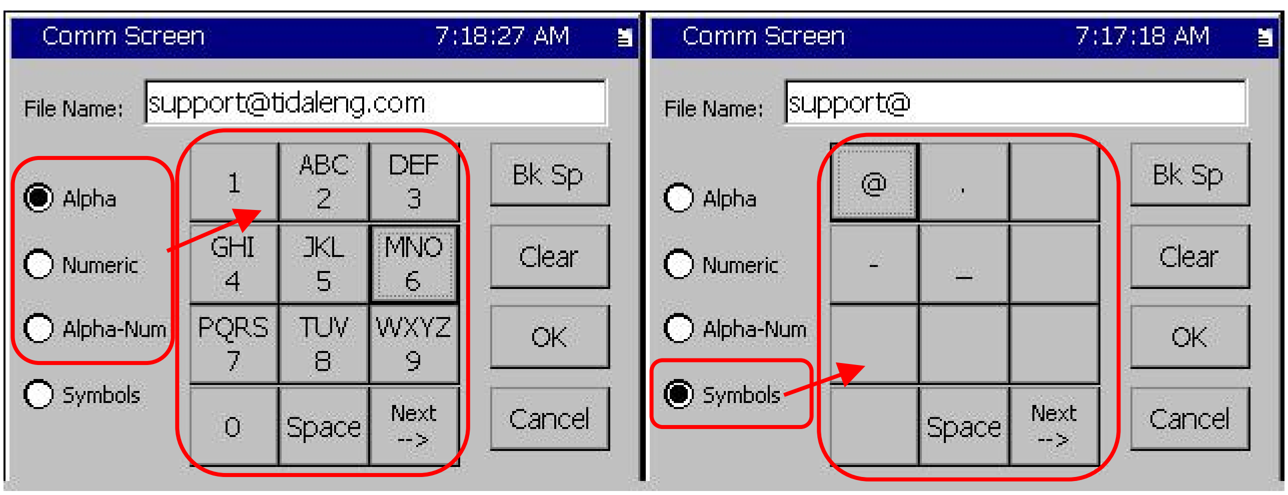
Clear, Cancel, can Accept keys

Numeric Values

Alpha Numeric and Symbol Keypad Example

The Alpha Numeric keypad is based on the T-9 pad used on a cellphone. Use the mode radio-buttons as shown below to select the way to sequence thru the keys. Use the Symbols selection to open the keypad on the below right to enter the symbols used for example in e-mail addresses.

Use the Next -> button to accept a character value and enter another value on the same key.



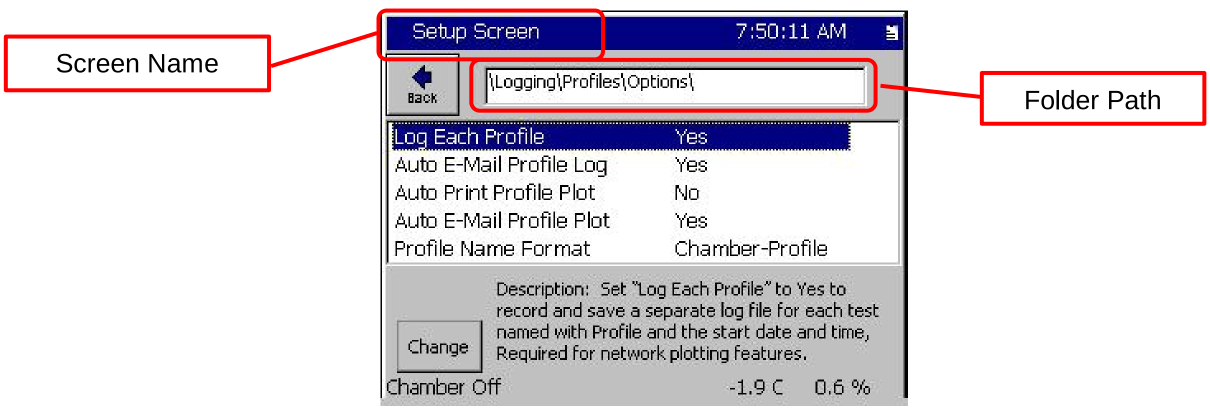
5.2.4 Screen Navigation Keys

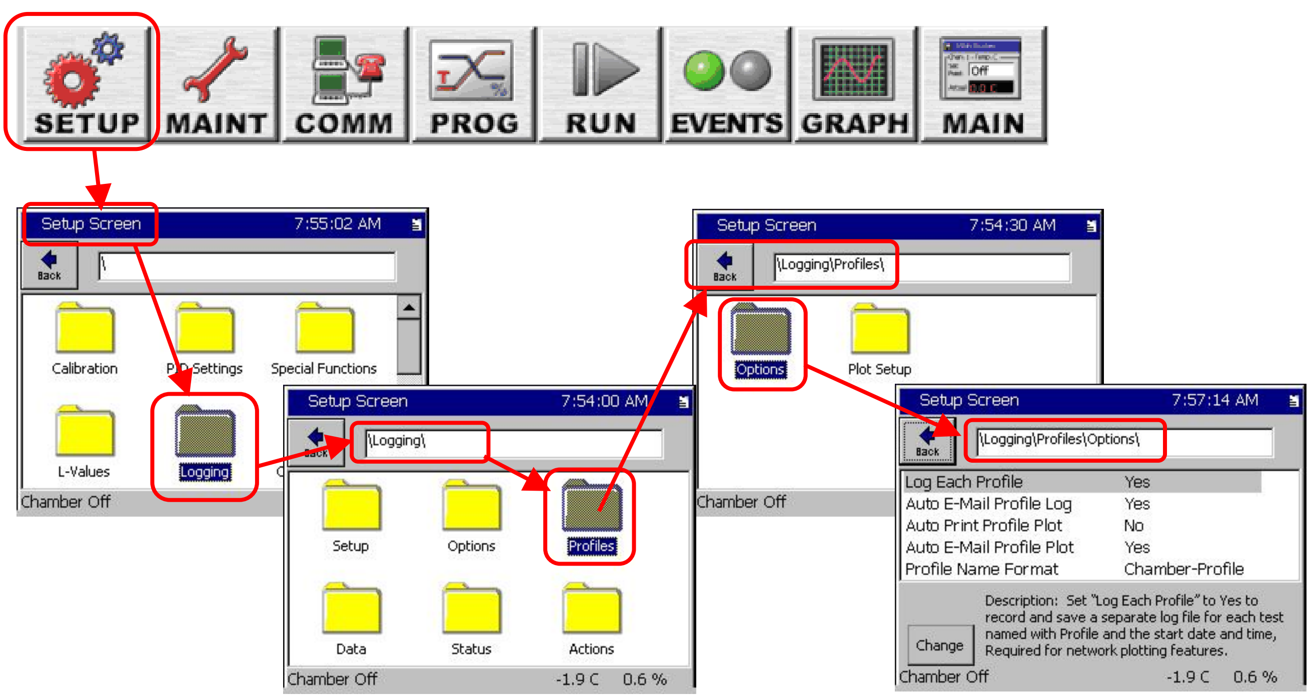
The eight keys below the LCD are the Screen Navigation Keys (Soft keys). These are labeled: SETUP, MAINT, COMM, PROGRAM, RUN, EVENTS, GRAPH, and MAIN. These keys provide easy navigation to the controller's setup, operating and programming features.

All the Synergy Controller screens retain their state so when you navigate away from a screen and return, the folder remains in the state that it as in. For example, you can navigate to the MAIN screen while entering a parameter in the SETUP screen and when you navigate back, the SETUP screen will be as you left it.

5.2.5 Navigating to a Screen Folder Path

Navigating to a specific controller parameter from a screenshot in the technical manual is straightforward using the Screen name in the title bar and Screen Folder Path at the top of the screen. See the example shown below for the Screen Folder Path: **\SETUP\Logging\Profiles\Options**.





5.3 Screen Overview

This section provides a single page overview of the controller's eight screen navigation buttons and screens. For in-depth information on each screen, go to the corresponding manual section. **Screen Navigation Keys:**

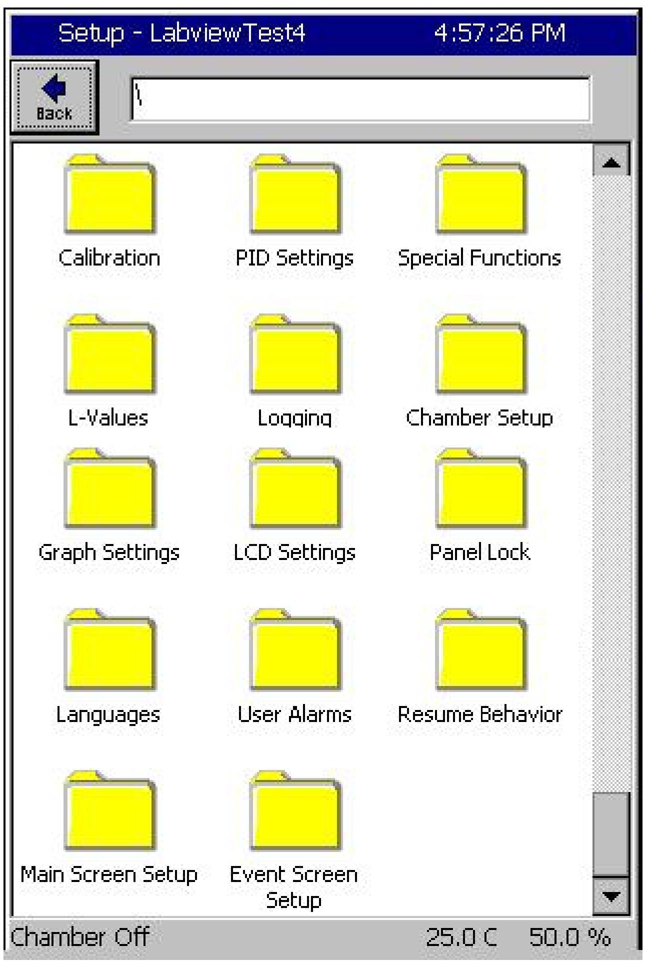
5.3.1 Setup Screen

The Setup screen is used at various times by OEMs and technicians, administrators, and engineers.

The OEM and Chamber Technician will utilize a variety of Setup screens during the initial installation and calibration including: PID Settings, Calibration, Logging, Special Functions, L-Values, Chamber Setup, Resume Behavior, User Alarms, Main Screen Setup, and Event Screen.

The Administrator can use the Panel Lock and Languages screens to control access to the chamber and setup the controller language.

The Engineer/Operator can use the Logging screen to select the logger data, logging interval, and automatic results delivery features. The L-Values are used to optimize the controller for a wide range of test conditions.



<u>SETUP Screen</u>

Provides access to 14 Setup folders.

- Calibration
- PID Settings
- Special Functions
- Logging
- L - Values
- Chamber Setup
- Graph Settings
- LCD Settings
- Panel Lock
- Languages
- User (Programmable) Alarms
- Resume Behavior
- Main Screen Setup
- Event Screen

Details are in Section 6.0 Setup Screen.

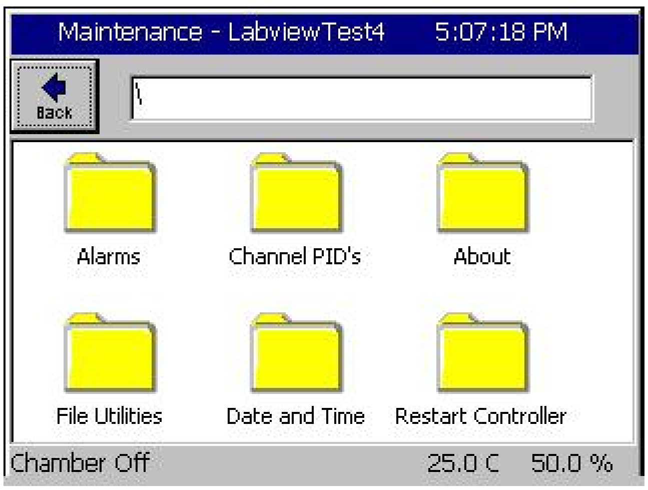
5.3.2 Maintenance Screen

The Maintenance screen is generally used at by OEMs and technicians during setup and tuning and by engineers and operators during operation.

The OEM and Chamber Technician will utilize the following Maintenance screens during the initial installation and calibration: Channel PIDs, File Utilities, Data and Time, and Restart Screens.

The Administrator will typically use the File Utilities to Backup and Restore the controller settings and set the Data and Time using that folder.

The Engineer/Operator will typically use the Alarm screen manage chamber alarms and the Channel PIDs to monitor chamber performance...



MAINTENANCE Screen

These folders contain utilities that are used for the operation and maintenance of the chamber.

- Alarms
- Channel PIDs
- About (Synergy Controller)
- File Utilities
- Date and Time
- Restart Controller

Details are in Section 7.0 Maintenance.

5.3.3 Comm Screen

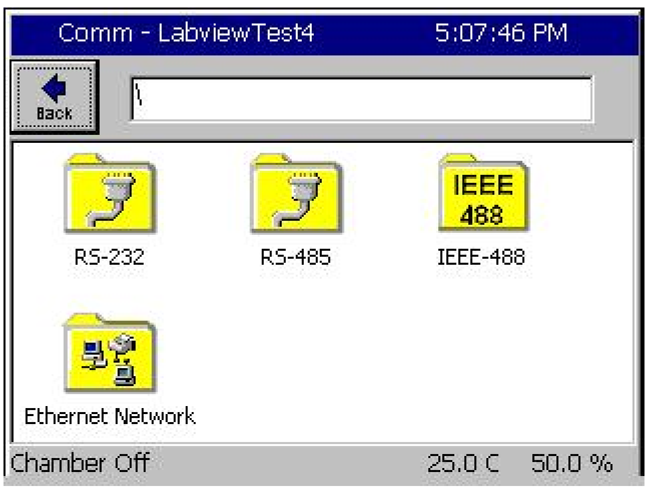
The Communication screen is used at various times by OEMs and technicians, administrators, and engineers.

The four folders in the Communication Screen are used to setup the controller's communications ports. The RS-232 folder is read-only and displays the fixed parameters for the RS-232. The RS-485 port is used to setup the connection to the UUT Thermocouple modules.

The IEEE 488 folder is used for the setup of that port.

The Ethernet Network folder is used to setup the network properties as well as the network services and Network printing.

For example, this folder is used to setup the WebTouch Remote ™ Webserver, the FTP Server, e-mail and the Synergy Server.



<u>COMMUNICATIONS Screen</u>

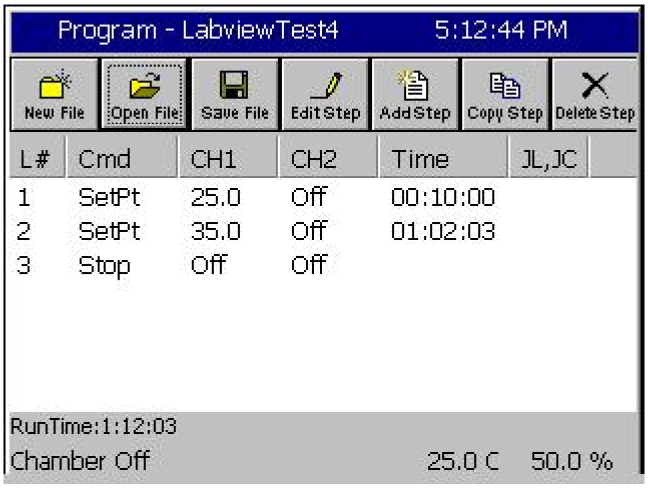
Provides access to six different Communications folders.

- RS - 232
- RS - 485
- IEEE 488
- Ethernet Network

Details are in Section 8.0 Communications.

5.3.4 Program Screen

The Program screen is used at various times by OEMs and technicians, administrators, and engineers to load, save, create and edit controller programs.



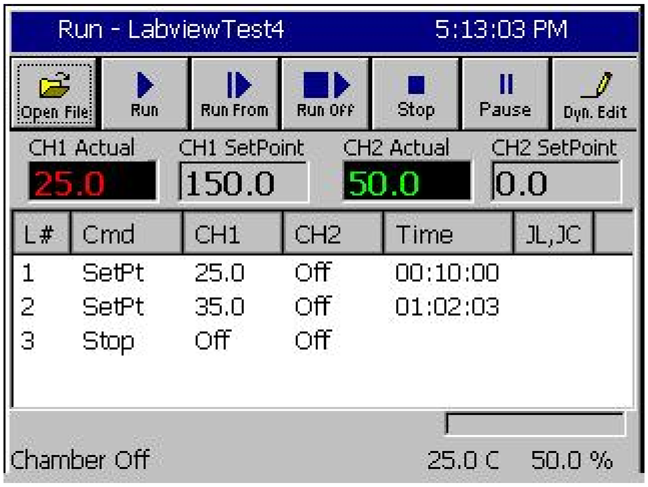
PROGRAM Screen

- Create a New File
- Open and Existing File
- Save the Loaded File
- Edit a program step
- Add a program step
- Copy a program step
- Delete a program step

Details are in Section 9.0 Programming the Synergy Controller.

5.3.5 Run Screen

The Run screen is used by engineers and operators to load, control, and monitor programs.



RUN Screen

- Open File
- Run
- Run From (from a selected step)
- Run Off (program with outputs off)
- Stop
- Pause
- Dynamic Edit

Details are in Section 9.7 Programming the Synergy Controller: Running a Program.

5.3.6 Events Screen

The Events screen is used at various times by OEMs and technicians, engineers and operators.

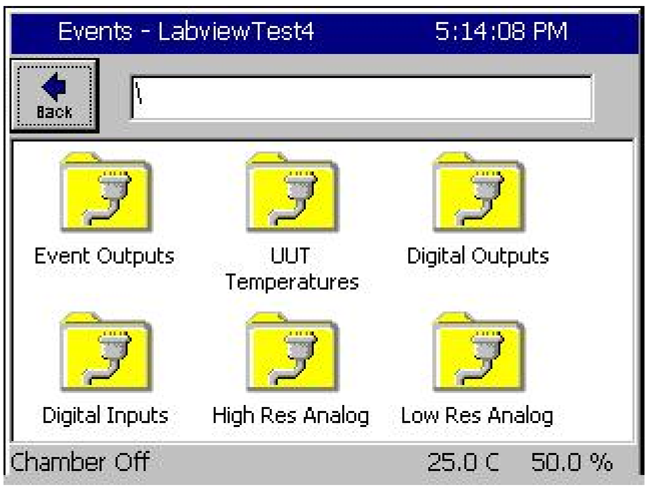
The OEM and Chamber Technician will utilize all of the Events screens during the chamber setup and testing.

The Engineer/Operator uses the Events screen to monitor and control the user defined Event Outputs.

UUT Temperatures folder is used to display up to 64 T-Type Thermocouple from the UUT Thermocouple monitoring system.

The Digital Outputs folder is a visual display of all of the controller outputs and the Digital Inputs folder is a visual display of all of the controller inputs.

The High and Low Resolution analog inputs screens display all of the controller sensor input; i.e. RTDs, Pressure transducers, Humidity Sensors, Vibration, Pressure and altitude sensors.



EVENTS Screen

Provides access to four different Events folders.

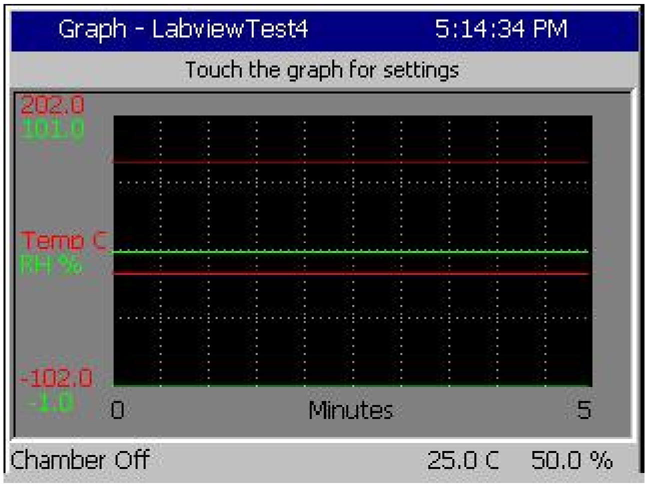
- Event Outputs
- UUT Temperatures
- Digital Outputs
- Digital Inputs
- High Resolution Analog (Inputs)
- Low Resolution Analog (Inputs)

Details are in Section 11.0 Events Directory.

5.3.7 Graph Screen

The Graph screen is used at various times by all users; i.e. OEMs and technicians, engineers and operators to monitor the operation of the equipment.

The Graph scaling, X and Y can be adjusted in the SETUP\Graph Settings folder.



GRAPH Screen

Screen Information:

- Graph channel actual and setpoint values over time.

Control Features:

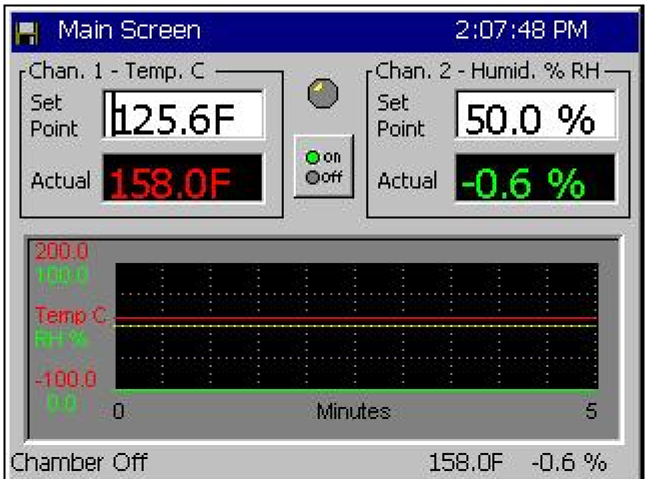
- Access the Graph Setup Screen by touching the graph. You can individually enable and disable the plotting of the setpoint and actual values for each of the chamber variables.

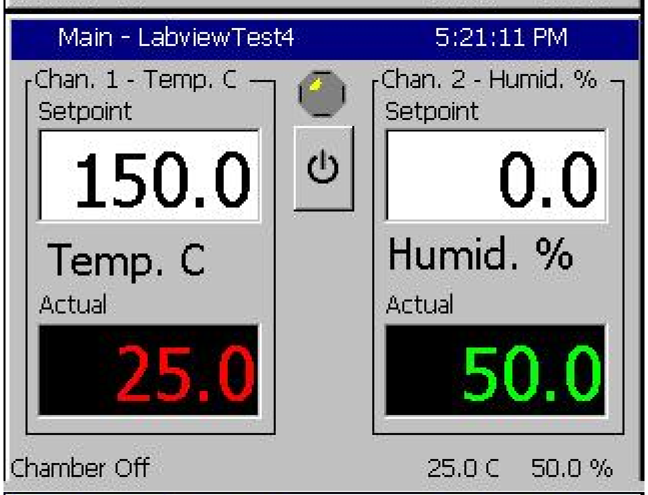
Details are in Section 12.0 Graph Screen.

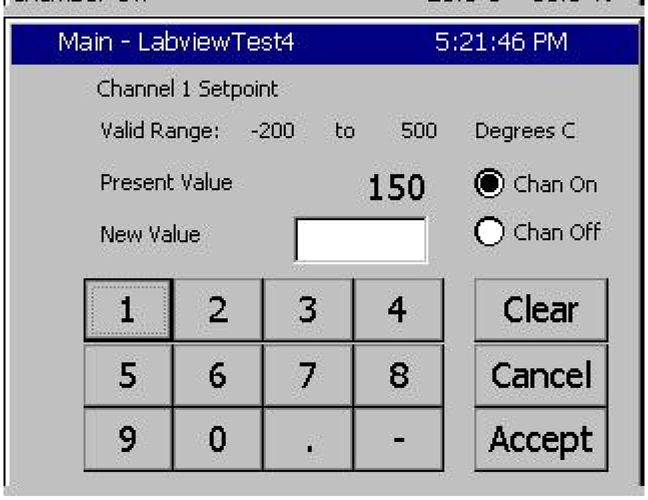
5.3.8 Main Screen

The Main screen is used at various times by all users.

The Main screen provide an On/Off push button and LED and Setpoint for Steady State operation. The Main screen can be adjusted to display a Chamber Light Switch or Event Switch, up to 10 Sensor values, a process graph, and various control channel arrangements from the **SETP\Main Screen Setup** Folder.







<u>**MAIN Screen**</u>

The Main screen is the first screen that appears after power-up. Use this screen to operate the chamber in steady state mode.

Screen Information:

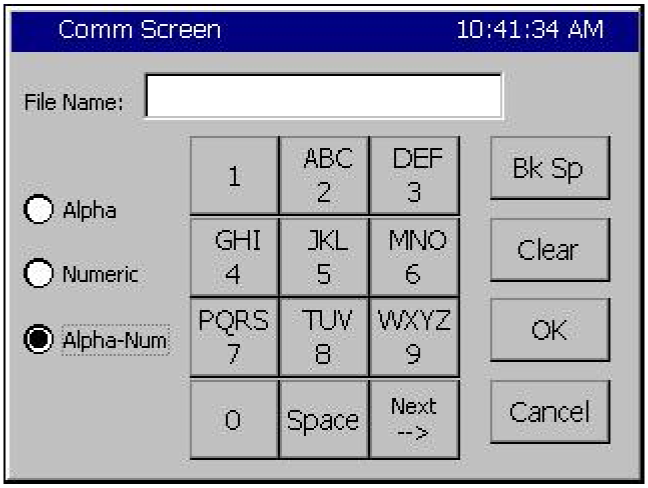
- Actual values for each chamber channel vs. time
  (Product and Air Temperature in Cascade)
- Setpoint values for each chamber channel vs. time.

Control Features:

- You can turn the chamber on and off by pressing the ***On/Off*** button in the center of the screen.
- You can adjust the steady state (manual) setpoint for each channel by pressing on the Setpoint field and entering the value in the keypad that appears.

Details are in
Section 10.0 Steady State Operation.

Key Pad Screen



Alphanumeric data is entered in the Synergy Controller with the T9 Key Pad. When Alpha is selected, pressing a key will cycle through the letters on that key. For example, if the first key pressed is "2" the text box displays the letter "A". When pressed a second time, the text box will display the letter "B" and a third time will show "C". If the next letter is on a different button, just press that button. However, if the next letter is on the same button, press the ***Next ->*** button to save the entry and then select the next key.

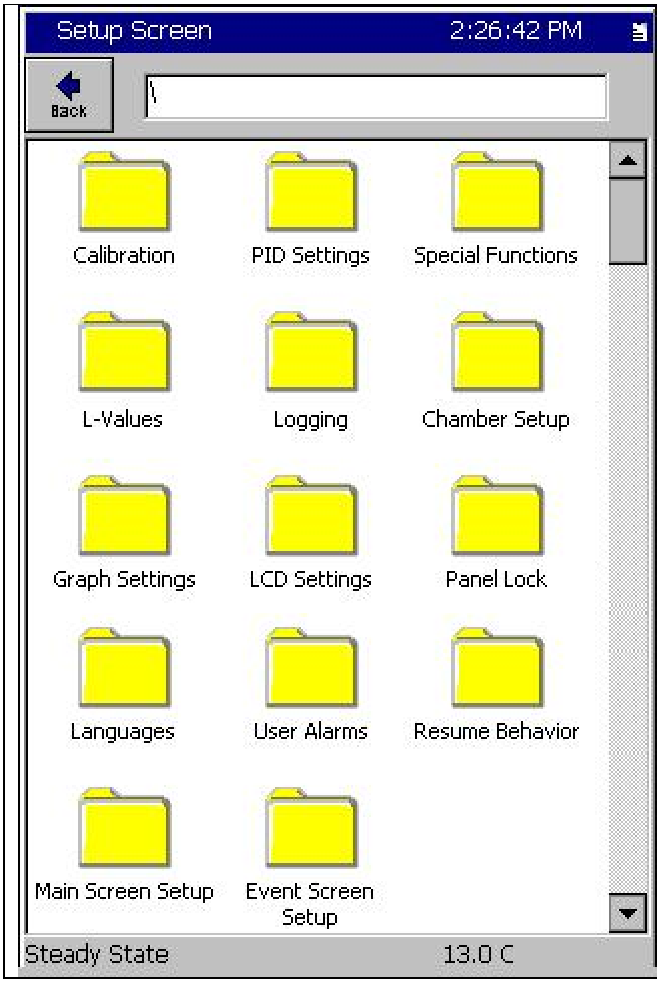
When Numeric is selected, pressing a key displays the number on the key. When Alpha-Num(eric) is selected, press the key to cycle through the letters then the number on the key.

To clear one character, use the ***Back Space (Bk Sp)*** button. To clear all of the characters, use the ***Clear*** button. When you are finished, press ***OK*** to accept the entry**.** To cancel, press ***Cancel***.

6.0 SETUP SCREEN

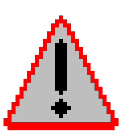
The **SETUP** screen provides access to all of the controller setup parameters. The Setup screen is organized into 14 folders as follows:

6.1 Setup Folder Root Menu



Setup Screen

- **Calibration**
- **PID Settings**
- **Special Functions**
- **L-Values**
- **Logging**
- **Chamber Setup**
- **Graph Settings**
- **LCD Settings**
- **Panel Lock**
- **Languages**
- **User Alarms**
- **Resume Behavior**
- **Main Screen Setup**
- **Event Screen Setup**

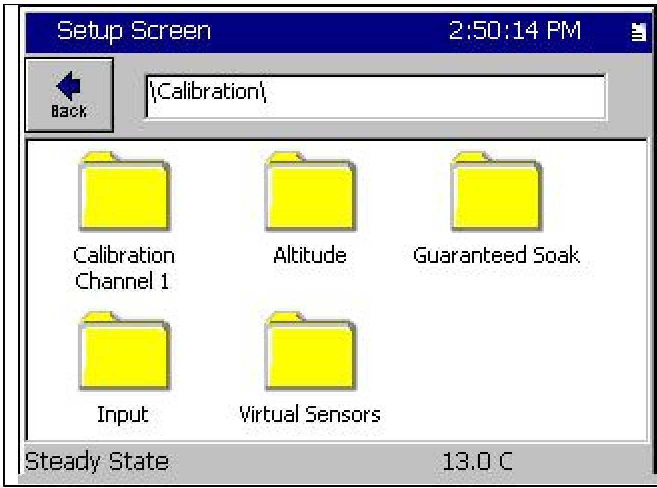


Some of the parameters in the Setup Directory are preset by the installer or equipment manufacturer. Under most circumstances these parameters should not be changed. They are shown and described in the tables for reference only. Some are default settings or may not apply to your chamber. Changes to some of the parameters may affect the chamber operation and void your warranty. Please contact the chamber manufacturer or installer with any questions about your specific chamber.

.

6.2 Calibration

The **SETUP\Calibration** screen provides access to Setup and calibration parameters. This screen is organized into 5 folders as follows:

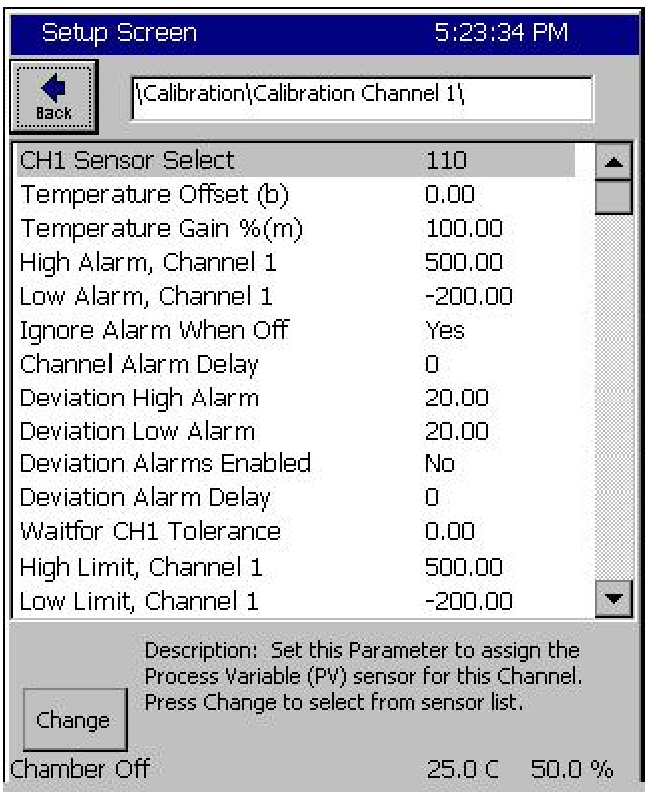


Setup\Calibration Folder

- **Calibration Channel n**
- **Altitude**
- **Guaranteed Soak**
- **Input**
- **Virtual Sensors**

6.2.1 Channel Calibration

The **SETUP\Calibration\Calibration Channel n** Screen contains all of the setup and calibration parameters for channel n. There is a Calibration Channel folder for each channel with the following 14 parameters:



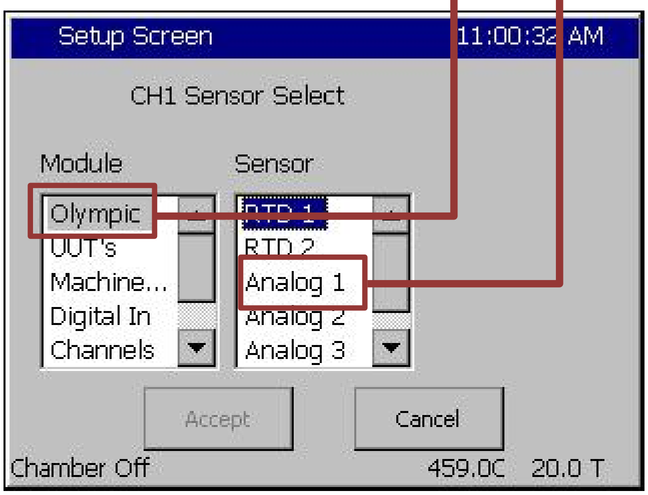
- **CHn Sensor Select**
- **Temperature Offset (b)**
- **Temperature Game %(m)**
- **High Alarm, Channel n**
- **Low Alarm, Channel n**
- **Ignore Alarm When Off**
- **Channel Alarm Delay**
- **Deviation High Alarm**
- **Deviation Low Alarm**
- **Deviation Alarms Enable**
- **Deviation Alarm Delay**
- **Waitfor CHn Tolerance**
- **High Limit, Channel n**
- **Low Limit, Channel n**

SETUP\Calibration\Calibration	
Parameter	**Description**
CH1 Sensor Select	**Channel Sensor Select** Select the channel feedback Sensor
Temperature Offset (b) Temperature Gain %(m)	**Channel Offset and Gain (Span)** Adjust the Channel Offset (b) and Gain %(m) to accommodate channel specific sensor errors such as those caused by the sensor placement. Generally, sensor setup and calibration adjustment should be made in the Input Calibration screens shown in the next section.
Hi Alarm, Channel 1 Low Alarm Channel 1 Ignore Alarm When Off Channel Alarm Delay	**Channel Absolute Alarms** The Synergy Controller can shut down the chamber when the PV goes outside the High and Low Limit Alarm values. The absolute alarm limits can be disabled automatically when the Channel is off using the Ignore Alarm When Off parameter. Alternatively, the Absolute Alarms can be delayed using the Channel Alarm Delay.
Deviation High Alarm Deviation Low Alarm Deviation Alarms Enabled Deviation Alarm Delay	**Channel Deviation Alarms** The Synergy Controller Deviation Alarms will trigger when the Process Error (Process Variable – Setpoint) is outside the Deviation High and Deviation Low Limits. The Deviation Alarms can be disabled or delayed using the Deviation Alarm Enable and Deviation Alarm Delay parameters.
Waitfor CH1 Tolerance	**Wait For Tolerance** The Wait For Tolerance specifies a tolerance window around the Wait For setting. When executing a Wait For step the program will not advance until the Process Variables are within this tolerance.
High Limit, Channel 1 Low Limit, Channel 1	**Channel Limits** The Channel Limits constrain the range of values allowed when entering Setpoints.

6.2.1.1 Channel Sensor Selection

The **SETUP\Calibration\Calibration Channel n\Channel n Sensor Select** parameter determines the sensor for channel n. The sensor is selected from the Sensor Selection screen as follows:

1. Select the Module from the list in the first column.
2. Then select the sensor or the sub-module from the Sensor list.
3. When necessary, select the sensor from the sensor list in third column.



Olympic **(High Resolution Inputs)**
- RTD 1
- RTD 2
- Analog 1
- Analog 2
- Analog 3
- Analog 4
- TC 1*
- TC 2*

UUT **(Up to 64 T-type T/Cs)**
- Module 1 Thru 8
  - Sensor 1 thru Sensor 8

Machine Inputs **(Low Resolution Inputs)**
- Low Res 1 thru 8

Digital Inputs
- Dig. In. 1 thru 16

Channels **(PV)**
- Act CH 1 thru Act CH 4

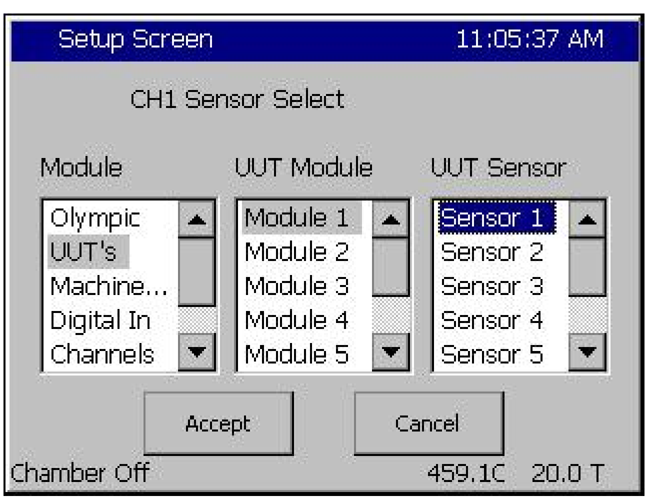
Setpoints **(SP)**
- Setpt CH 1 thru Setpt CH 4

Virtual Sensors
- Dual Press.
- Wet Bulb/Dry Bulb
- Virtual Kft

UUT Sensor Selection

Note: * Direct Thermocouple Inputs are not available on Synergy Micro 2.

Use the TE1908 Thermocouple Signal Conditioner if thermocouples are required.



- To select a sensor from the UUT Thermocouple module, Select UUTs from the Module column, and then select the UUT Module (1 thru 8) and then the Sensor (1 thru 8).

6.2.2 Altitude Value

SETUP\Calibration\Altitude\Altitude Value\	ALT

SETUP\Calibration\Altitude\Altitude Value sets the scaling for the pressure channel. Set the altitude value to 0 for linear scaling for regular pressure transducers. For Granville-Philips transducers, set the parameter to 10, 11 or 12 for exponential scaling. A Registration Key may be required to access this feature. See additional details in the Altitude/Space Chamber Setup section.

6.2.3 Guaranteed Soak

SETUP\Calibration\Guaranteed Soak\	GS

The Guaranteed Soak feature stops a program from advancing until the process variable is within the guaranteed soak limits. Range for this is 0 to 50 degrees. This value applies to each setpoint in the program. As an example, for a setpoint of 100 degrees with a guaranteed soak of 1 degree, the program will wait until a temperature between 99 and 101 degrees is reached before advancing, regardless of the step time. When enabled, the Guaranteed Soak feature will affect all setpoint steps in any profile run on the chamber. An alternative to the system wide Guaranteed Soak setting is the Wait For step which provides soaking on specific steps of the profile. For example, to guarantee a soak at 100C add a Ramp step to 100C then add a Wait For step that waits for 100C. See the Program section of the manual for more information.

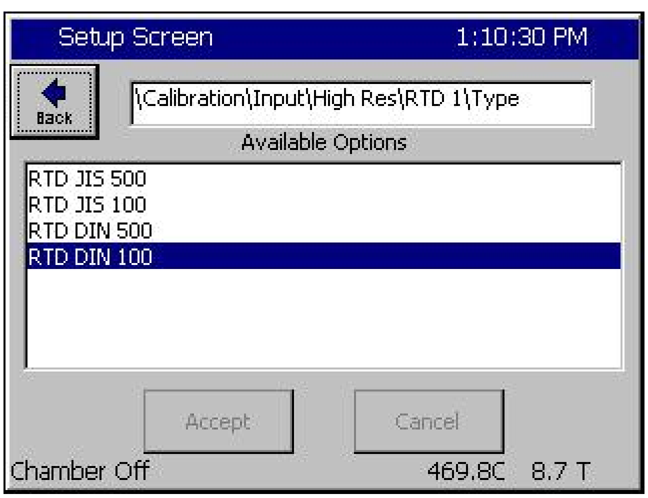
6.2.4 Input Calibration

Each controller input is calibrated and scaled from this folder and sub-folders. Raw calibration calibrates the controller measurement, either Volts or Ohms. The voltage and scale and engineering scale are set for each sensor. The input type is selected from the list. The High Resolution Inputs are the most accurate inputs and typically uses for process variables. The Low Resolution inputs are used for machine parameters like pressure transducers, etc.

6.2.4.1 RTD Calibration

The Synergy Controller chamber accepts up to two Platinum RTD (Resistance Temperature Detector) sensors. RTDs are the most linear, stable and reproducible temperature sensors available. Over the years, both American and European RTD standards have been developed to ensure that RTDs are interchangeable from manufacturer to manufacturer. Platinum RTDs are specified to standards such as DIN (Deutsch Institute fur Normung) and JIS (Japanese Industrial Standard). These standards define the RTD specifications.

SETUP\Calibration\ Input\High Res\RTD n\Type\	HIGHn_TYPE

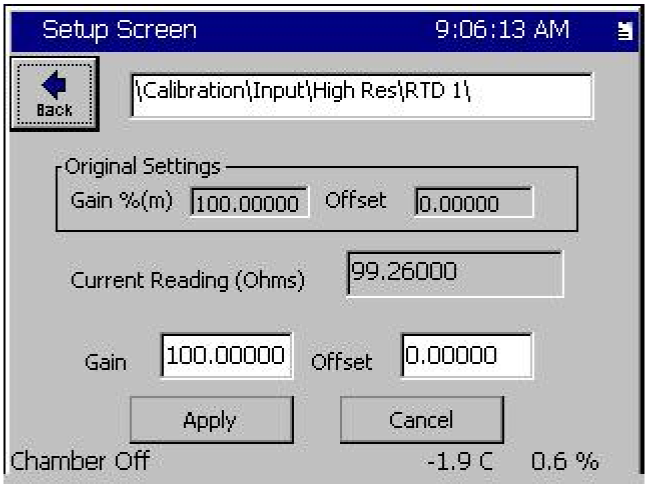


Each of the Synergy Controller's two RTDs can be set for four types:

RTD JIS 500
RTD JIS 100
RTD DIN 500
RTD DIN 100.

Note: In early software versions, the RTD curve was set globally so one RTD curve was used for both sensors.

SETUP\Calibration\ Input\High Res\RTD n\Gain\	HIGHn_GAIN
SETUP\Calibration\ Input\High Res\RTD n\Offset\	HIGHn_OFF



This screen is used to enter an Offset and Gain (span) for the raw data in Ohms. This is used to compensate for a difference in the reading due to sensor position, wiring, etc.

Use the Two Point calibration calculation formula section 16 to calculate the Offset and Gain (span).

6.2.4.2 Analog Voltage Calibration

Each of the controller's analog inputs is calibrated and scaled from this folder. The Raw Calibration parameter is used to calibrate the physical voltage measurement. The voltage scale and engineering scale are used to scale the value to engineering units. These inputs can be scaled to select a wide range of signal conditioners with 0-5VDC and 4-20mA outputs. In addition, when set to the Temperature Type, the Synergy Controller converts inputs from C to F and vice versa. There are four High Resolution Analog inputs and eight Low Resolution Analog inputs eight.

SETUP\Calibration\Input\High Res\Analog n\Raw Calibration\Gain\	HIGHn_GAIN
SETUP\Calibration\Input\High Res\Analog n\Raw Calibration\Offset\	HIGHn_OFF

Set the Raw Calibration gain and offset to calibrate controller. Use the Two Point calibration calculation formula section 16 to calculate the Offset and Gain (span)

SETUP\Calibration\Input\High Res\Analog n\High Eng. Scale	HIGHn_HIGHEU
SETUP\Calibration\Input\High Res\Analog n\Low Eng. Scale	HIGHn_LOWEU

Set the High Engineering Scale to the Full scale output of the sensor. For example 1000 Torr.
Set the Low Engineering Scale to the Zero scale output of the sensor. For example 0 Torr

SETUP\Calibration\Input\High Res\Analog n\High Volts Scale	HIGHn_HIGHVOLTS
SETUP\Calibration\Input\High Res\Analog n\Low Volts Scale	HIGHn_LOWVOLTS

Set the High Voltage Scale to the full scale output of the sensor. For example 5 VDC.
Set the Low Voltage Scale to the zero scale output of the sensor. For example 0 VDC.

SETUP\Calibration\Input\High Res\Analog n\Type	HIGHn_TYPE

Select the Sensor type from the list. Set the type to Temperature to automatically scale the value when the temperature units of measure for the controller are changed from C to F and vice versa.

Set analog input to Vaisala HMM30C to temperature compensate the Vaisala humidity sensor. There are different HMM30C types in the list to allow compensation from a variety of temperature sensors.

Vaisala HMM30C Temperature Compensation

Vaisala Relative Humidity sensors are available in temperature compensated and uncompensated versions (HMM30C) and the Synergy Controller is compatible with both types. In addition the controller can accommodate sensors with 0-5VDC and 4-20mA outputs.

The Synergy Controller uses the Vaisala recommended temperature compensation algorithm for the HMM30C. The algorithm is a second order polynomial defined over four temperature ranges by the following table of coefficients.

Where: a0, a1, b0, b1 are constants with the values as determined in the table below:

Vaisala Constants		
Temp Range (C)	**a0**	**a1**
-40…-20	-0.104980	-0.060009
-20…+15	0.469374	-0.031292
+15…+45	0.000000	0.00000
+45…+180	-1.536460	0.034144
Temp Range (C)	**b0**	**b1**
-40…-20	0.947370	-0.008510
-20…+15	1.050385	-0.003359
+15…+45	1.000000	0.000000
+45…+100	0.889657	0.002452
+100…+180	0.551922	0.005829

And Where:

Offset compensation: A = a0 + b0 * T

Gain compensation: B = b0 + b1 * T

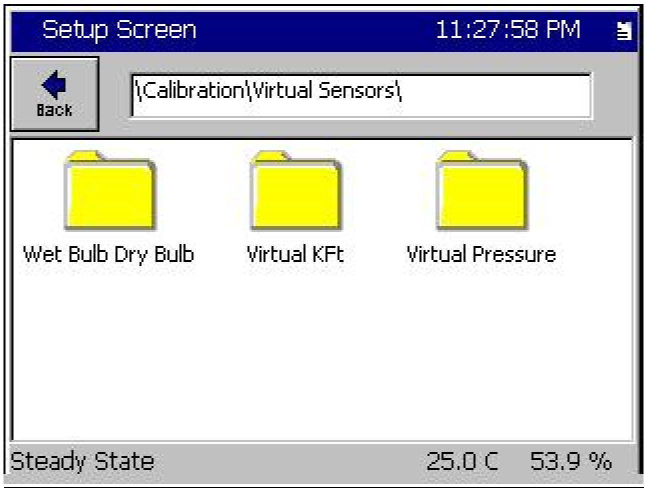
RH Compensated = (RH Raw + A) * B

The following is a table of example temperature readings (T) and uncompensated raw relative humidity readings (RH raw). The last column displays the compensated relative humidity reading (Vaisala RH Corrected).

Vaisala Temperature Compensation								
T	**RH Raw**	**a0**	**a1**	**b0**	**b1**	**A**	**B**	**Vaisala RH Corrected**
60	70	-1.53646	0.034144	0.889657	0.002452	0.51218	1.036777	73.105
60	80	-1.53646	0.034144	0.889657	0.002452	0.51218	1.036777	83.473
60	100	-1.53646	0.034144	0.889657	0.002452	0.51218	1.036777	104.209
70	40	-1.53646	0.034144	0.889657	0.002452	0.85362	1.061297	43.358
70	60	-1.53646	0.034144	0.889657	0.002452	0.85362	1.061297	64.584
70	80	-1.53646	0.034144	0.889657	0.002452	0.85362	1.061297	85.810
70	100	-1.53646	0.034144	0.889657	0.002452	0.85362	1.061297	107.036
80	30	-1.53646	0.034144	0.889657	0.002452	1.19506	1.085817	33.872
80	40	-1.53646	0.034144	0.889657	0.002452	1.19506	1.085817	44.730
80	60	-1.53646	0.034144	0.889657	0.002452	1.19506	1.085817	66.447
80	80	-1.53646	0.034144	0.889657	0.002452	1.19506	1.085817	88.163
80	100	-1.53646	0.034144	0.889657	0.002452	1.19506	1.085817	109.879
85	30	-1.53646	0.034144	0.889657	0.002452	1.36578	1.098077	34.442
85	40	-1.53646	0.034144	0.889657	0.002452	1.36578	1.098077	45.423
85	60	-1.53646	0.034144	0.889657	0.002452	1.36578	1.098077	67.384
85	80	-1.53646	0.034144	0.889657	0.002452	1.36578	1.098077	89.346
85	100	-1.53646	0.034144	0.889657	0.002452	1.36578	1.098077	111.307
100	60	-1.53646	0.034144	0.889657	0.002452	1.87794	1.134857	70.223
100	80	-1.53646	0.034144	0.889657	0.002452	1.87794	1.134857	92.920
100	100	-1.53646	0.034144	0.889657	0.002452	1.87794	1.134857	115.617
54	30	-1.53646	0.034144	0.889657	0.002452	0.307316	1.022065	30.976

6.2.5 Virtual Sensors

The Synergy Controller supports a variety of Virtual Sensor for a variety of applications. The virtual accepts on or more sensors and calculates a new sensor value.



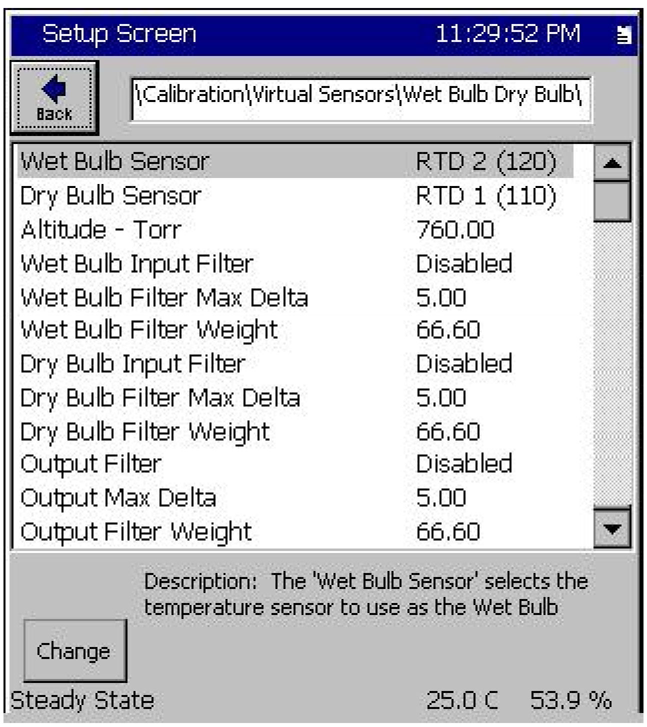
Virtual Sensors

- Wet Bulb-Dry Bulb
- Virtuall Kft
- Virtual Pressure

6.2.5.1 Wet Bulb/Dry Bulb Virtual Sensor

The Virtual Wet Bulb/Dry Bulb sensor measures relative humidity using two temperature sensors as an alternative to an electronic RH sensor. To make these measurements, a wet-bulb sensor infers the amount of moisture in the air when the evaporation from a moist cloth wick placed over the sensor lowers its temperature reading. When the air surrounding the wet-bulb sensor is dry, evaporation of moisture from the wick is faster than when the air is moist. If the air is saturated, no evaporation from the wick occurs and the temperature of the wet-bulb sensor is the same as the temperature of the dry-bulb sensor.

The Wet Bulb/Dry Bulb Virtual Sensor folder includes all of the parameters that configure the sensor.



SETUP\Calibration\Virtual Sensors\Wet Bulb Dry Bulb\Wet Bulb Sensor	WETB_SENID
SETUP\Calibration\Virtual Sensors\Wet Bulb Dry Bulb\Dry Bulb Sensor	DRYB_SENID

Assign the sensor IDs for the two temperature sensors.

SETUP\Calibration\Virtual Sensors\Wet Bulb Dry Bulb\Altitude – Torr\	WBDB_ALT

The Altitude – Torr Sensor parameters sets the pressure at the site to allow the controller to compensate the humidity calculation for the pressure altitude.

SETUP\Calibration\Virtual Sensors\Wet Bulb Dry Bulb\Wet Bulb Input Filter\	WBIN_FLT_ENABLED
SETUP\Calibration\Virtual Sensors\Wet Bulb Dry Bulb\Wet Bulb Filter Max Delta\	WBIN_FLT_MAXD
SETUP\Calibration\Virtual Sensors\Wet Bulb Dry Bulb\Wet Bulb Filter Weight\	WBIN_FLT_WT
SETUP\Calibration\Virtual Sensors\Wet Bulb Dry Bulb\Dry Bulb Input Filter\	DBIN_FLT_ENABLED
SETUP\Calibration\Virtual Sensors\Wet Bulb Dry Bulb\Dry Bulb Filter Max Delta\	DBIN_FLT_MAXD
SETUP\Calibration\Virtual Sensors\Wet Bulb Dry Bulb\Dry Bulb Filter Weight\	DBIN_FLT_WT
SETUP\Calibration\Virtual Sensors\Wet Bulb Dry Bulb\Wet Bulb Input Filter\	WBIN_FLT_ENABLED
SETUP\Calibration\Virtual Sensors\Wet Bulb Dry Bulb\Wet Bulb Input Filter\	WBIN_FLT_ENABLED
SETUP\Calibration\Virtual Sensors\Wet Bulb Dry Bulb\Wet Bulb Input Filter\	WBIN_FLT_ENABLED
SETUP\Calibration\Virtual Sensors\Wet Bulb Dry Bulb\Wet Bulb Input Filter\	WBIN_FLT_ENABLED
SETUP\Calibration\Virtual Sensors\Wet Bulb Dry Bulb\Wet Bulb Input Filter\	WBIN_FLT_ENABLED

Wet-Bulb/Dry-Bulb Virtual Sensor Filter parameters

6.2.5.2 Virtual Kft Sensor

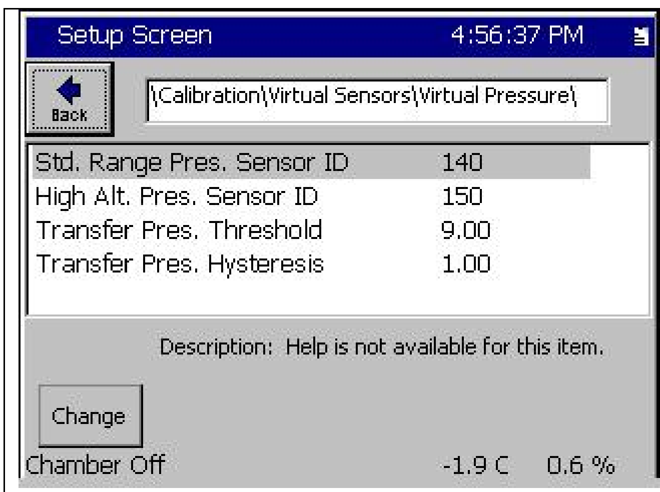
The Virtual Kft. sensor calculates Altitude in Kft (thousands of feet) from a pressure sensor scaled in Torr.

SETUP\Calibration\Virtual Sensors\Virtual KFt\Torr Sensor	VIRTKFTSEN

The Torr Sensor parameter is the sensor ID of the Torr sensor.

5.2.5.3 Virtual Pressure Sensor

The Virtual Pressure sensor combines the readings from two pressure sensors into one sensor to increase the accuracy of the reading over a wide range.



<u>Virtual Pressure Sensor</u>

- Std. Range Pres. Sensor ID
- High Alt. Pres. Sensor ID
- Transfer Pres. Threshold
- Transfer Pres. Hysteresis

The Virtual Pressure sensor combines the readings from two sensors into one sensor to increase the accuracy of the reading over a wider range than possible with a single sensor.

These settings specify the two sensor IDs and control when the virtual sensor switches between the two input sensors. (the transfer pressure threshold and hysteresis which)

These settings specify the two sensor IDs and control when the virtual sensor switches between the two input sensors. (The transfer pressure threshold and hysteresis which)

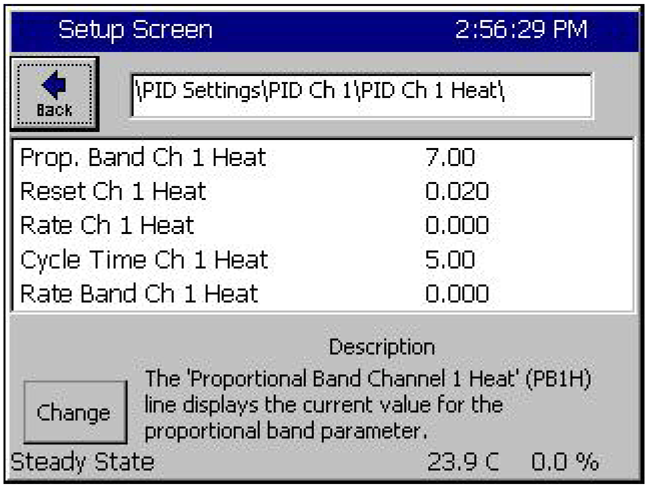
SETUP\Calibration\Virtual Sensors\Virtual Pressure\Std. Range Pres. Sensor ID.	VP_STDALT_SENID
SETUP\Calibration\Virtual Sensors\Virtual Pressure\High Alt. Pres. Sensor ID.	VP_HIALT_SENID
SETUP\Calibration\Virtual Sensors\Virtual Pressure\Transfer Pres. Threshold.	VP_TRANS_PRESS
SETUP\Calibration\Virtual Sensors\Virtual Pressure\ Transfer Pres. Hysteresis	VP_TRANS_HYST

6.3 PID Settings

The Synergy Controller implements the Proportional, Integral, and Derivative (PID) algorithm for each control channel. The Synergy Controller PID algorithms are designed to automatically adjust the output variables to hold the process variable at the setpoint while minimizing instability and error.

The PID Settings screen is used to edit the constants that control the PID algorithms. In general, PID adjustment should only be performed by a qualified technician. If you would like to know more about PIDs we have included a brief tutorial below. For PID tuning procedures, see section 16.0

6.3.1 Heat and Cool



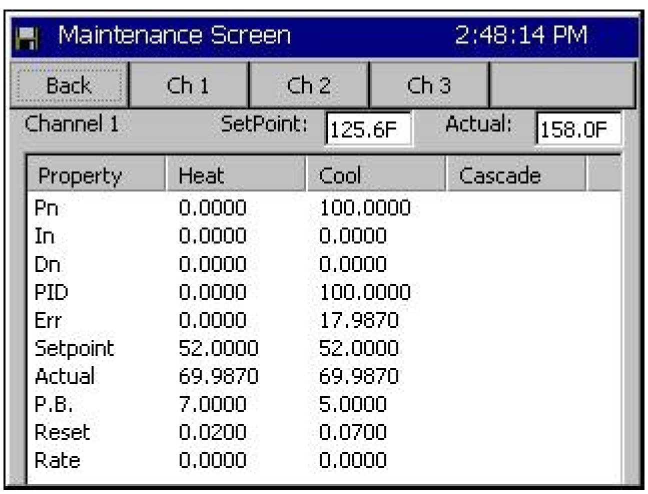
The parameters for Heat and Cool PID are :

- Prop. Band Heating
- Reset Channel n Heating
- Rate Channel n Heating
- Cycle Time for Ch n Heating
- Rate Band for Ch n Heating

Where n is the Channel.

SETUP\PID Settings\PID Ch n\PID Ch n Heat\Prop. Band Ch n Heat\	PBnH
SETUP\PID Settings\PID Ch n\PID Ch 1 Heat\Reset Ch n Heat\	RSnH
SETUP\PID Settings\PID Ch n\PID Ch n Heat\Cycle Time Ch n Heat\	CTnH

When the controller is running, the control action can be monitored from the Channel PIDs screen in the Maintenance directory.



<u>Channel PIDs</u>

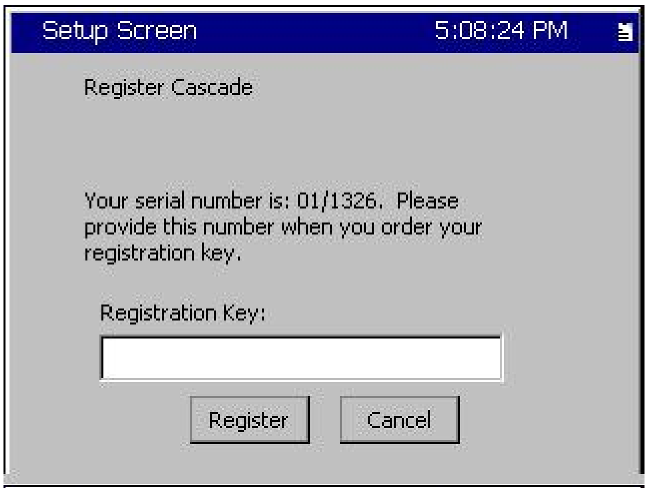
To help with tuning, the control variables for each channel are displayed in the Channel PIDs folder in the Maintenance screen. Tap the Channel button at the top of the screen to select the channel. The following parameters are displayed:

- Pn – Proportional Term
- In – Integral Term
- Dn – Not Used
- PID – PID Output
- Err – Current Error
- Last Err – Last Error
- Delta Err – Difference between current and last error
- P.B – Proportional Band Constant
- Reset – Reset Constant
- Rate – Not Used

6.3.2 Cascade Control

Cascade control is a control system method in which the temperature setpoint and actual readings are taken from the both the air temperature and the unit-under-test. These settings and readings are combined in the PID calculations and offer the user greater speed and more accurate UUT temperature control during the test. Using the Cascade feature allows the operator to control the chambers processes to bring the Unit-Under-Test (UUT) to the desired temperature, rather than just the air temperature. Cascade control provides greater test accuracy in addition to faster and more efficient ramps and soaks.

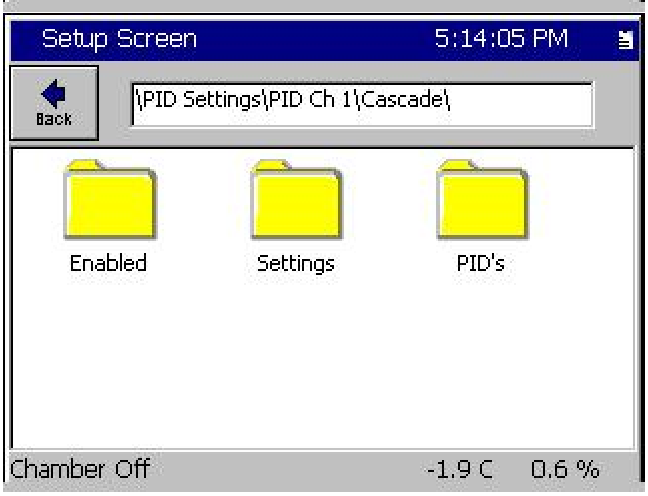
Because the Cascade control is a powerful feature of the Synergy Controller, we have dedicated a separate section for its discussion. See Section 14 Cascade Temperature Control for a detailed and complete description of the Cascade feature.



Register Cascade

The Cascade control feature requires a Registration Key. Contact Tidal Engineering for the Cascade Registration Key for your controller.

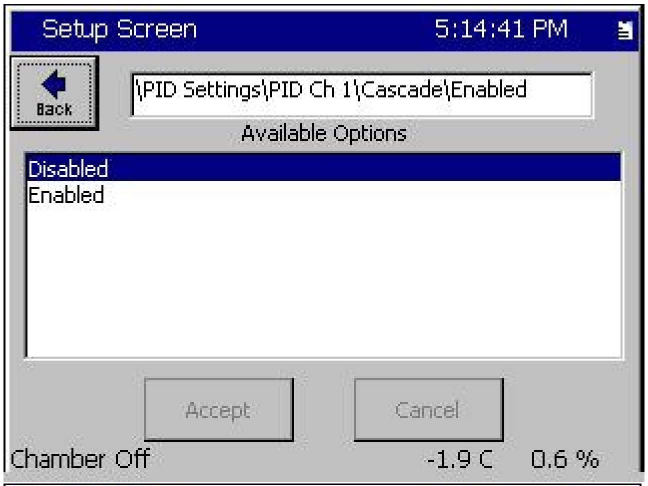
Tap in the Registration Key field to open the number pad. Enter the Registration Key and tap the Register button.



Cascade Folders

The Cascade parameters are organized in the following three folders:

- Enable
- Settings
- PIDs



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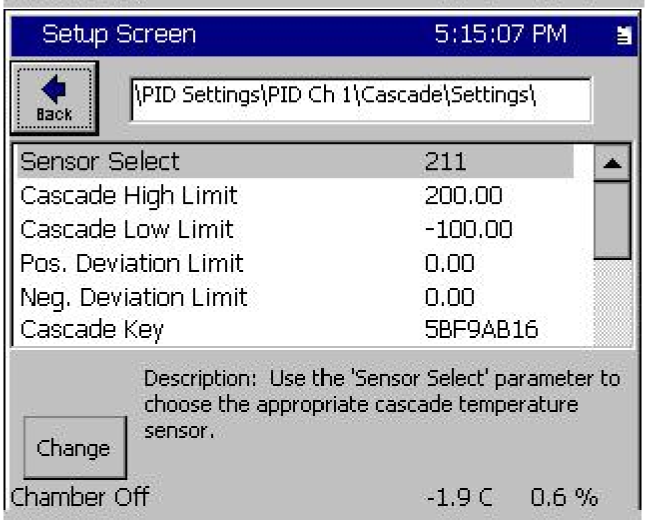
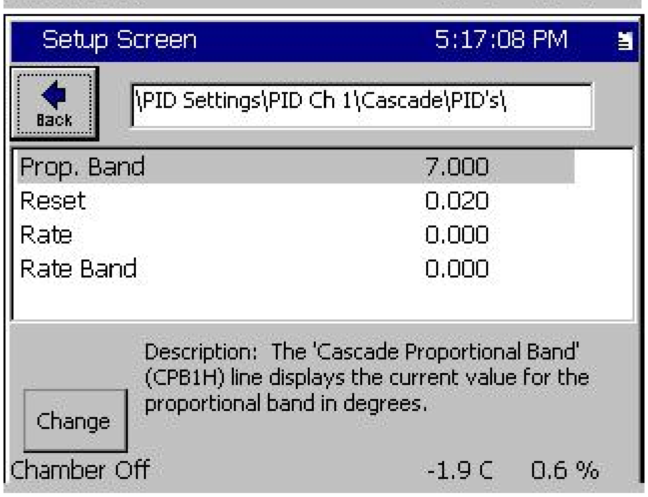


Cascade Settings

The Cascade parameters are organized in the following three folders:

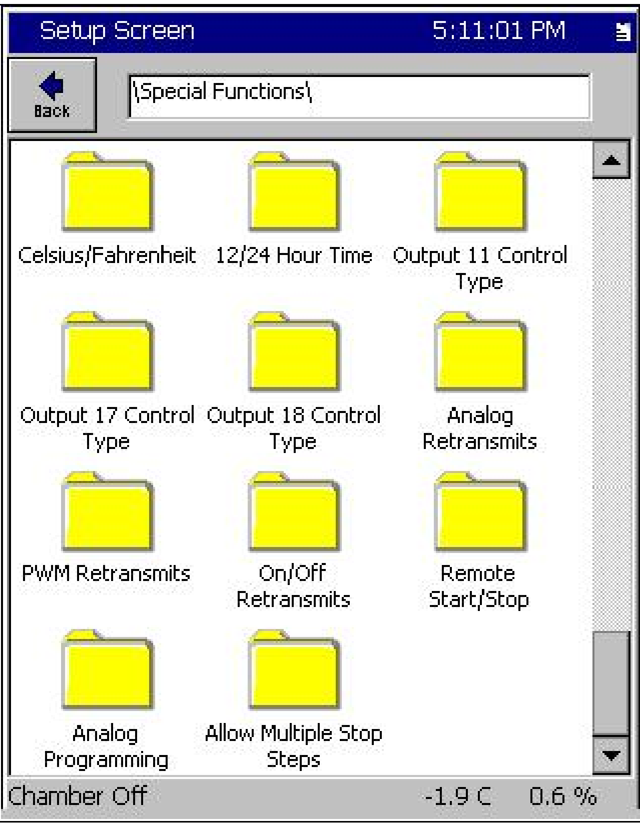
- Sensor Select
- Cascade High Limit
- Cascade Low Limit
- Pos. Deviation Limit
- Neg. Deviation Limit
- Cascade



Cascade PIDs

The Cascade PID parameter control the PID tuning.

6.4 Special Functions



<u>Special Functions</u>

The Cascade parameters are organized in the following three folders:

- Celsius/Fahrenheit
- 12/24 Hour Time
- Output 11 Control Type
- Output 17 Control Type
- Output 18 Control Type
- Analog Retransmits
- PWM Retransmits
- On/Off Retransmits
- Remote Start/Stop
- Analog Programming
- Allow Multiple Stop Steps

Celsius / Fahrenheit

The Celsius/Fahrenheit setting sets the temperature units displayed by the Synergy Controller. The setting is global. All temperature data are automatically displayed according to the C/F setting including currently loaded program files.

12 / 24 Hour Time

The 12/24 Hour Time setting sets the Synergy Controller's time display to either AM/PM format or 24 hour format. The setting is global. All absolute time data is automatically displayed based on this format.

Output 11 Control Type (Ambient Coil)

This setting is used to set the output logic for the Ambient Coil (Output 11) to On/Off control or Time Proportioning control. In On/Off mode the Ambient Coil is either on or off depending on the controller demand. When in Time Proportioning mode the Ambient Coil output is between 0% and 100% depending on the demand required. The default setting is On/Off control mode. On/Off control mode typically enables the chamber to react faster, sacrificing accuracy. Time Proportioning modes allow greater accuracy but may slow temperature and humidity ramp.

Time Proportioning Mode (TPM) can be changed in a program on a step-by-step basis by selecting the OT11 checkbox when creating a program step (see Section 9.0 Programming the Synergy Controller).

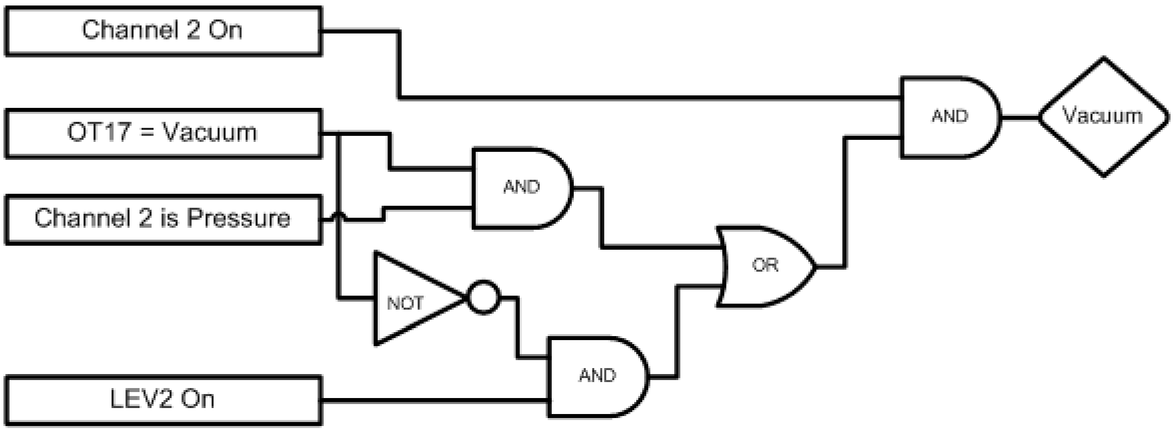
Output 11 or OT11 TPM (Time Proportioned Mode) can be monitored from within the Events screen. To monitor the state of the OT11 TPM setting, go to the *Events\Event Output* folder and observe the LED light next to the **OT11 TPM** label. The light is red when Output 11 is in time proportioning mode, gray when in

On/Off mode. You can monitor the Ambient Coil from the *Events\Digital Outputs* folder. The LED is gray when off, red when on and yellow when in time proportioning mode.

Output 17 Control Type (Vacuum or Purge)

The Output 17 Control Type selects the type of control logic for Vacuum/Purge output. When channel 2 is Altitude, choose either the Vacuum mode or Purge mode. Use vacuum when channel 2 units are in Torr.

Output 17 (Vacuum) Logic Diagram

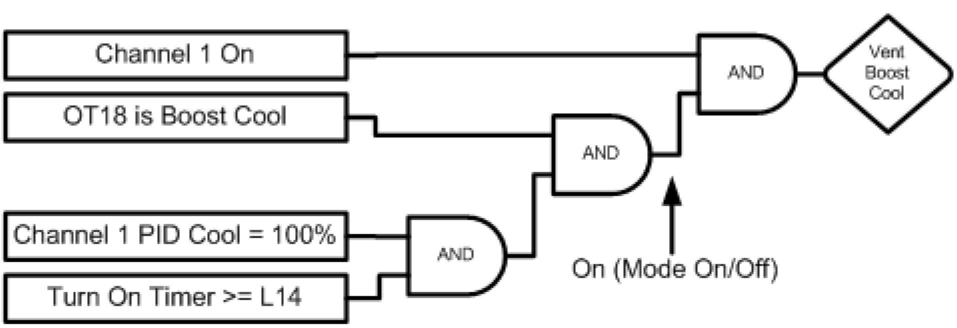


OT17 – Output 17 Control Type	Selects the control logic for the Vacuum device. Can be either Vacuum or Purge
LEV 2	Controls Vacuum device when OT17 is set to Purge

Output 18 Control Type (Vent of Boost Cool)

The Output 18 Control Type selects the type of control logic for Vent/Boost Cool output.

Vent / Boost Cool Logic Diagram



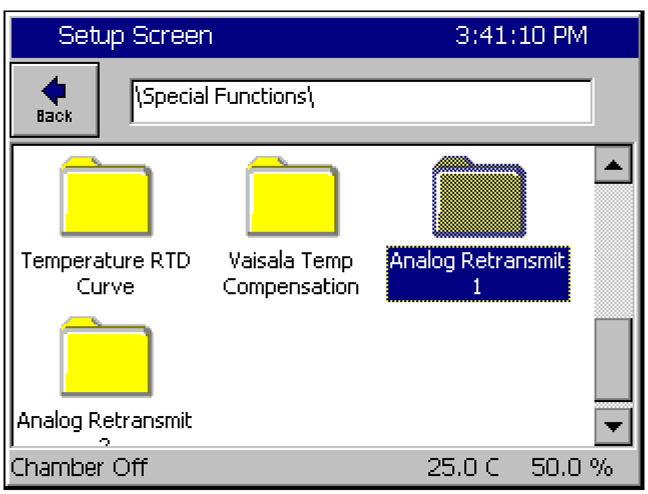
OT18	Selects the Control logic for the Vent – Boost Cool device
L14 Time Delay Boost Cool	Time delay (in seconds) required before Boost Cool is enabled
Note: Turn On Timer is reset when Channel 1 PID Cool < 100%	

Analog Retransmit 1 and 2

One of the optional features often specified with environmental chambers is the circular chart recorder. The chart recorder is a graphing device used to record chamber data such as temperature, humidity and pressure over time. An example of a Tenney Chamber with a circular chart recorder is shown below.

Note that the Synergy Controller includes built in Logging features that can often eliminate the need for a conventional chart recorder.

The Synergy Controller features two analog signals called Analog Retransmit 1 and 2 that can output setpoints, actual process data and internal PID values. The outputs can either be graphed on the chart recorder or, in some equipment; the PID output values can be used to control external steam valve (heat), chilled water (cool) or LN2 liquid nitrogen outputs.

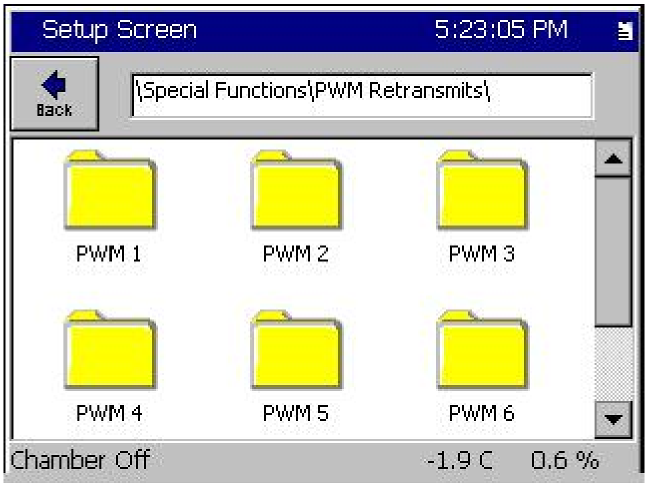


Analog Retransmit 1 Folder

To configure the outputs, press the ***SETUP*** button on the Synergy Controller touch screen and go to the *Setup\Special Functions\Analog Retransmit 1* folder.

Select the Analog Retransmit 1 folder to open the data output mapping options.

PWMs Retransmits

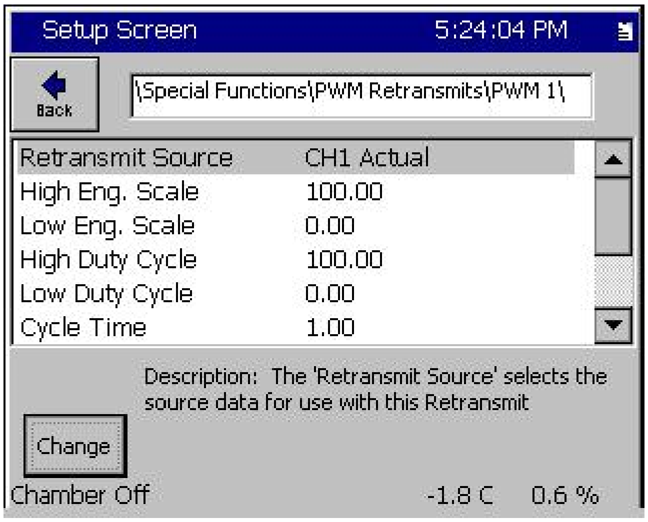


PWM Retransmit Folder

The PWM Retransmit feature is similar to the Analog Retransmit except the output is modulated by varying the Pulse Width, thus the term Pulse Width Modulation. This is also known as Time-Proportioning.

To configure the outputs, press the ***SETUP*** button on the Synergy Controller touch screen and go to the *SETUP\Special Functions\PWM Retransmits.* .

Select the PWM Retransmit 1 folder to open the data output mapping options.

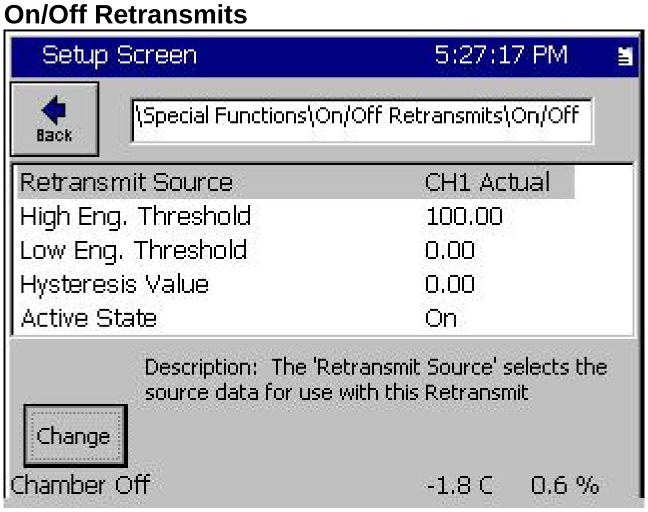


The parameters for each PWM are :

- Retransmit Source
- High Eng. Scale
- Low Eng. Scale
- High Duty Cycle
- Low Duty Cycle
- Cycle Time

The Retransmit source is typically one of the PID Variables; i.e. Channel 2 Heat PID Outputs.

On/Off Retransmits

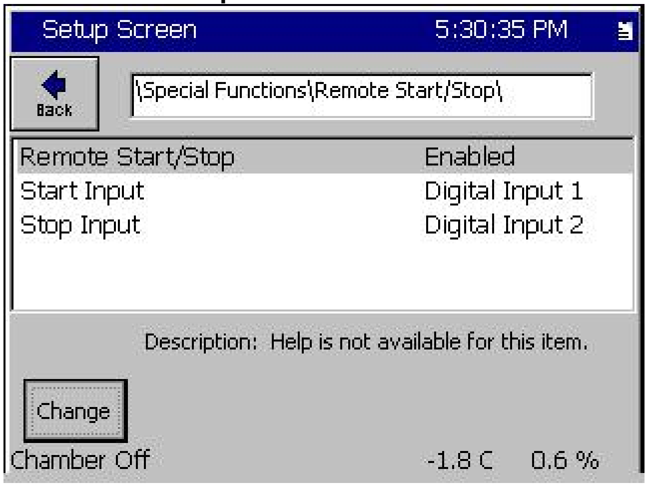


The parameters for each On/Off are :

- Retransmit Source
- High Eng. Scale
- Low Eng. Scale
- Hysteresis Value
- Low Duty Cycle
- Active State

The Retransmit source is typically one of the PID Variables; i.e. Channel 2 Heat PID Outputs. The output is Active when the Retransmit Source Variable is between the High and Low Eng. Scale limits.

Remote Start/Stop

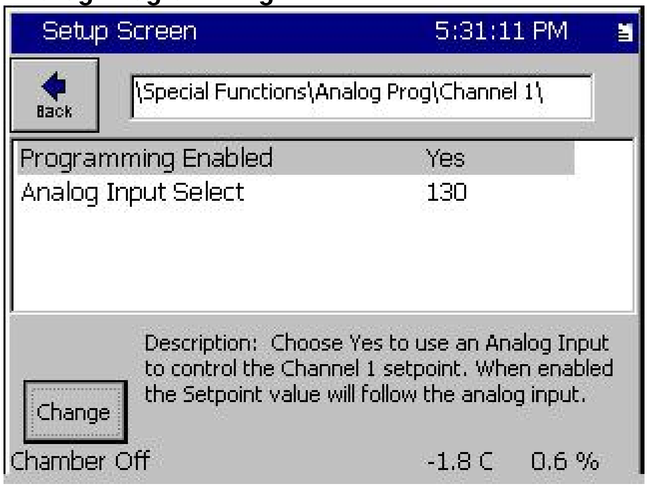


The Remote Start/Stop Parameters:

- Remote Start/Stop Enable
- Start Input
- Stop Input

The Remote Start/Stop inputs can be connected to remote switches and used to turn the controller On and Off remotely.

Analog Programming

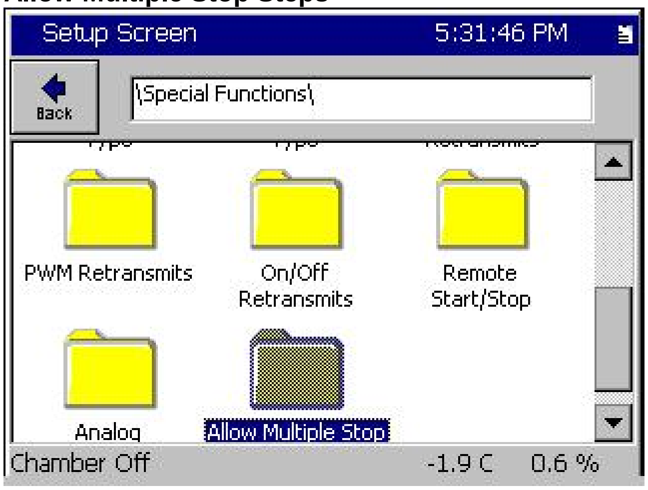


The Analog Programming Feature parameters are:

- Programming Enabled
- Analog Input Select

When Analog Programming is enabled, the controller setpoints can be set using an analog input.

Allow Multiple Stop Steps



Allow Multiple Stop Steps controls a programming option

When enabled, multiple Stop Steps are allowed in a Synergy Controller Program. Otherwise, only one Stop step is allowed in each program.

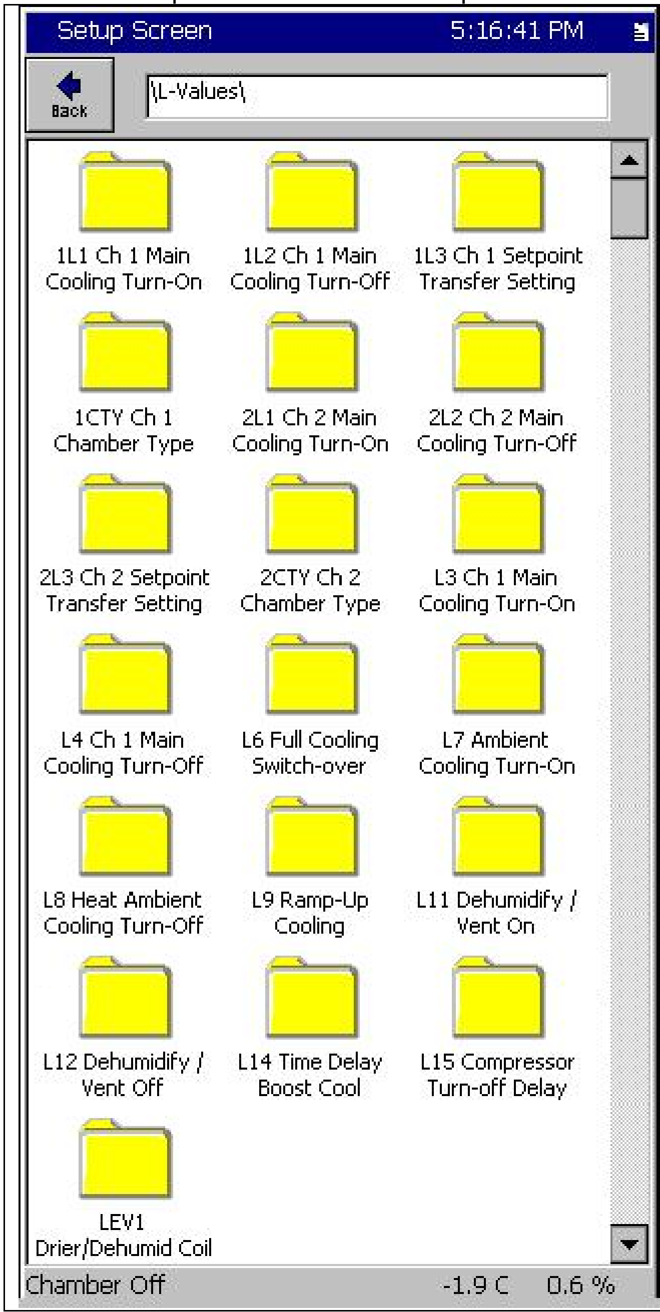
6.5 Settings List

Description	Command	Value
Calibration		
Channel 1		
Ch1 Calibration	CAL1	________________
Ch1 Alarm Low Limit	A1L	________________
Ch1 Alarm High Limit	A1H	________________
Channel 2		
Ch2 Calibration	CAL2	________________
Ch2 Alarm Low Limit	A2L	________________
Ch2 Alarm High Limit	A2H	________________
Altitude	ALT	________________
Guaranteed Soak	GS	________________
PID Values		
Channel 1		
Proportional Band, Ch1 Heating	PB1H	________________
Reset, Ch1 Heating	RS1H	________________
Rate, Ch1 Heating	RT1H	________________
Cycle Time, Ch1 Heating	CT1H	________________
Rate Band, Ch1 Heating	RB1H	________________
Dead Band, Ch1	DB1	________________
Proportional Band, Ch1 Cooling	PB1C	________________
Reset, Ch1 Cooling	RS1C	________________
Rate, Ch1 Cooling	RT1C	________________
Cycle Time, Ch1 Cooling	CT1C	________________
Rate Band, Ch1 Cooling	RB1C	________________
Channel 2		
Proportional Band, Ch2 Heating	PB2H	________________
Reset, Ch2 Heating	RS2H	________________
Rate, Ch2 Heating	RT2H	________________
Cycle Time, Ch2 Heating	CT2H	________________
Rate Band, Ch2 Heating	RB2H	________________
Dead Band, Ch2	DB2	________________
Proportional Band, Ch2 Cooling	PB2C	________________
Reset, Ch2 Cooling	RS2C	________________
Rate, Ch2 Cooling	RT2C	________________
Cycle Time, Ch2 Cooling	CT2C	________________
Rate Band, Ch2 Cooling	RB2C	________________

Description	Command	Value
Special Functions		
Celsius / Fahrenheit	CF	___________
Output 11 Control Type	OT11	___________
Output 17 Control Type	OT17	___________
Output 18 Control Type	OT18	___________
Ch1 Low Range	R1L	___________
Ch1 High Range	R1H	___________
Ch2 Low Range	R2L	___________
Ch2 High Range	R2H	___________
Ch 1 RTD Type	RTD	___________
Vaisala Compensation Enabled	VCMP	___________
Analog Retransmit 1	OUT_420_1	___________
Analog Retransmit 2	OUT_420_2	___________
L-Values		
1L1 Ch1 Main Cooling Turn-On	1L1	___________
1L2 Ch1 Main Cooling Turn-Off	1L2	___________
1L3 Ch1 Setpoint Transfer Setting	1L3	___________
1CTY Ch1 Chamber Type	1CTY	___________
2L1 Ch2 Main Cooling Turn-On	2L1	___________
2L2 Ch2 Main Cooling Turn-Off	2L2	___________
2L3 Ch2 Setpoint Transfer Setting	2L3	___________
2CTY Ch2 Chamber Type	2CTY	___________
L3 Ch1 Main Cooling Turn-On	L3	___________
L4 Ch1 Main Cooling Turn-Off	L4	___________
L6 Ch1 Full Cooling Switch Over	L6	___________
L7 Ambient Cooling Turn-On	L7	___________
L8 Heat Ambient Cooling Turn-Off	L8	___________
L9 Ramp-Up Cooling	L9	___________
L11 Dehumidify / Vent On	L11	___________
L12 Dehumidify / Vent Off	L12	___________
L14 Time Delay Boost Cool	L14	___________
L15 Compressor Turn-Off Delay	L15	___________
LEV1	LEV1	___________

6.6 L – Values

The L-Value parameters control the operation of the chamber outputs.



L_Values

The Cascade parameters are organized in the following three folders:

Thermal Shock Chamber Parameters

- 1L1 Ch1 Main Cooling Turn-On
- 1L2 Ch1 Main Cooling Turn-Off
- 1L3 Ch1 Setpoint Transfer Setting
- 1CTY Ch1 Chamber Type
- 2L1 Ch2 Main Cooling Turn-On
- 2L2 Ch2 Main Cooling Turn-Off
- 2L3 Ch2 Setpoint Transfer Setting
- 2CTY Ch2 Chamber Type

Temperature Humidity/ Temperature Only

- L3 Ch1 Main Cooling Turn-On
- L4 Ch1 Main Cooling Turn-Off
- L6 Full Cooling Switch-Over
- L7 Ambient Cooling Turn-On
- L8 Heat Ambient Cooling Turn-Off
- L9 Ramp-up Cooling
- L11 Dehumidify / Vent On
- L12 Dehumidify / Vent Off
- L14 Time Delay Boost Cool
- L15 Compressor Turn-Off Delay
- LEV1 Drier / Dehumidify Coil

L-Value Descriptions

L-Values are parameters for the programmable logic that control processes in the Device Primitives. Flow charts illustrating the Device Primitives are illustrated in Section 6.7 Device Primitives of this manual. Please refer to the Device Primitives flow charts in conjunction with the definitions below when editing L-Values.

Thermal Shock Parameters

1L1 Ch1 Main Cooling Turn-On
Cooling output required to turn on channel 1 cooling. (0 to 100%)

1L2 Ch1 Main Cooling Turn-Off
Heat output required to turn off channel 1 main cooling. (-100 to 100%)

1L3 Ch1 Setpoint Transfer Setting
Temperature threshold for the artificial load output. (-100 to 100C, -148 to 212F)

1CTY Ch1 Chamber Type
Defines the controlling logic for channel 1. (CAP Tube System, Agree Logic, Burn-in Logic, XV Sys Logic)

2L1 Ch2 Main Cooling Turn-On
Cooling output required to turn on channel 2 cooling. (0 to 100%)

2L2 Ch2 Main Cooling Turn-Off
Heat output required to turn off channel 2 main cooling. (0 to 100%)

2L3 Ch2 Setpoint Transfer Setting
Artificial load is enabled above this temperature threshold. (-100 to 100C, -148 to 212F)

2CTY Ch2 Chamber Type
Defines the controlling logic for channel 1. (CAP Tube System, Agree Logic, Burn-in Logic, XV Sys Logic)

Temperature Humidity/Temperature Only

L3 Ch1 Main Cooling Turn-On
The low stage compressor is switched on above this PID Cooling output percentage. (0 to 100%)

L4 Ch1 Main Cooling Turn-Off
Percent heat required before turning off low stage compressor. (0 to 100%)

L6 Full Cooling Switch-Over
Full cooling is switched on at this temperature. (-100 to 100C, -148 to 212F)

L7 Ambient Cooling Turn-On
Percent cooling required that turns on the compressor. (0 to 100%)

L8 Heat Ambient Cooling Turn-Off
Percent heat required to turn off the compressor. (0 to 100%)

L9 Ramp-up Cooling
A temperature setpoint above this threshold turns off the compressor when heating. (-100 to 100C, -148 to 212F)

L11 Dehumidify / Vent On
Percent dehumidify required to enable dehumidify device. (0 to 100%)

L12 Dehumidify / Vent Off
Percent humidify required to turn off dehumidify device. (0 to 100%)

L14 Time Delay Boost Cool
Time delay required before Boost Cool is enabled. (0 to 1200 seconds)

L15 Compressor Turn-Off Delay
Delay required before turning off a compressor. (0 to 5 minutes)

LEV1 Drier / Dehumidify Coil
Selects Drier or the Dehumidify Coil for dehumidification. (Dehumidify Coil, Drier). When equipped with a drier, the chamber will typically be capable of achieving a lower humidity.

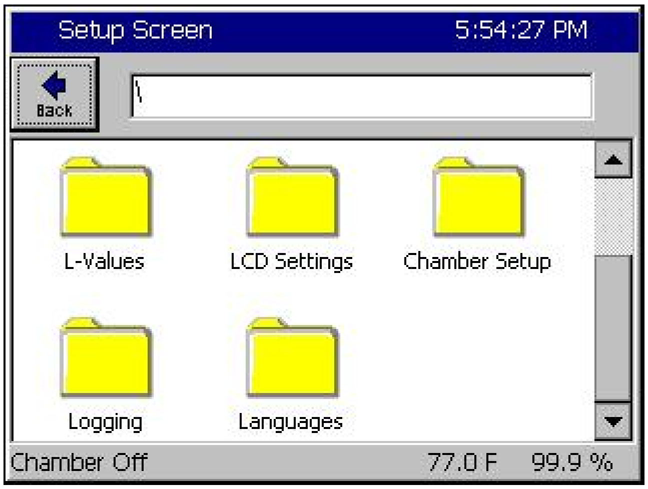
6.7 Logging

The Synergy Controller's logging system periodically captures and stores user selected data at a user specified interval to the Storage Card, the on board non-volatile Flash memory. In addition the logging system also records alarm activity and other abnormal events to the Storage Card. The log data (sometimes called history) can be exported to removable memory for use in test documentation.

6.7.1 Logging Setup

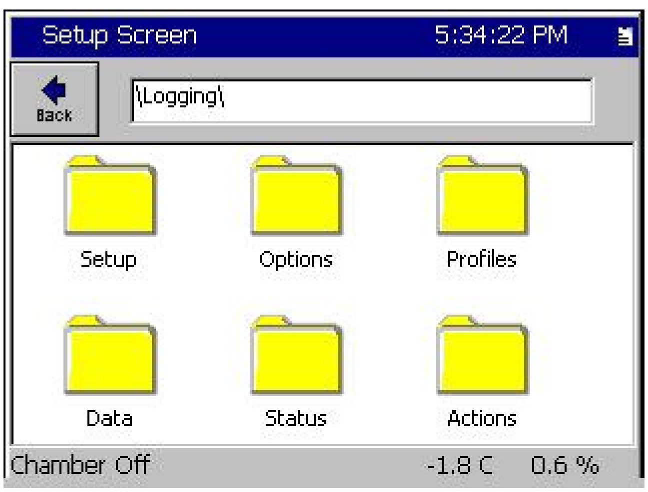
This section describes the Log system setup options and steps.

Note: Before starting a test that requires logging you should consider whether you want to export and then clear the data already stored in memory to minimize the possibility that the Storage Card will fill during the test. Export the history using the Export History folder and then use the Clear History folder in either the *Maintenance\File Utilities* directory or at *Setup\Logging\Clear History*. See Section 7.0 Maintenance for further information.

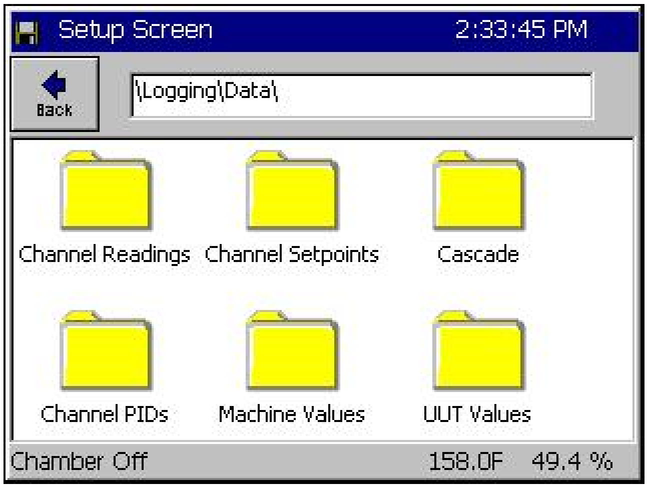


Step #1:

From the main setup directory, select the Logging folder.



Select the Data folder.

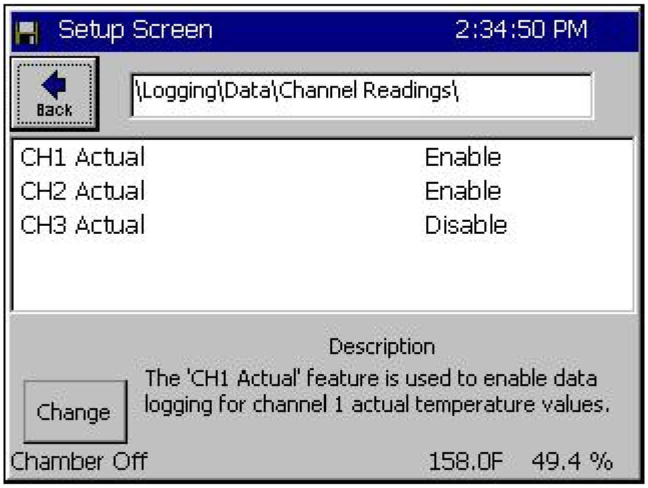


The screen at the left appears. The following data is available for logging.

- Channel Readings (Actual)
- Channel Setpoints
- Channel PIDs
- Machine Values
- UUT Values

Example Log Printout:

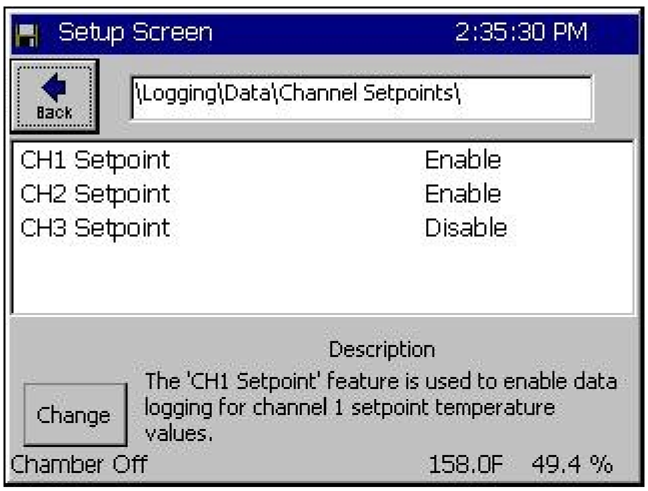
```
Date and Time,       CH1Actual, CH2Actual, CH1Setpoint, CH2Setpoint
02/23/2001 11:33:56, 24.9,      48.0,      25.0         50.0
02/23/2001 11:34:56, 24.9,      50.0,      25.0         50.0
02/23/2001 11:35:56, 25.0,      51.8,      25.0         50.0
```



Step #2: Select the Channel Readings Folder

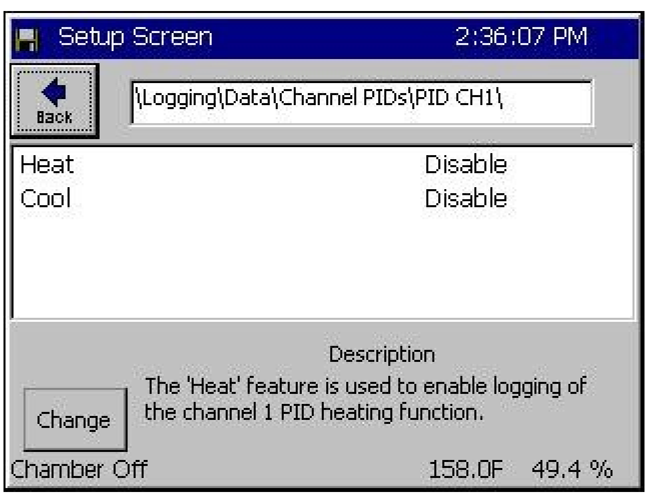
Use this screen to select the process values for each selected channel for logging. Select the channel, press the ***Change*** button, and select Enable in the screen that follows.

♦ Return to the *Logging / Data* directory by pressing the ***Back*** button.



Step #3: Select the Channel Setpoints Folder

Use this screen to enable setpoint logging for each channel. Select the channel, press the ***Change*** button.

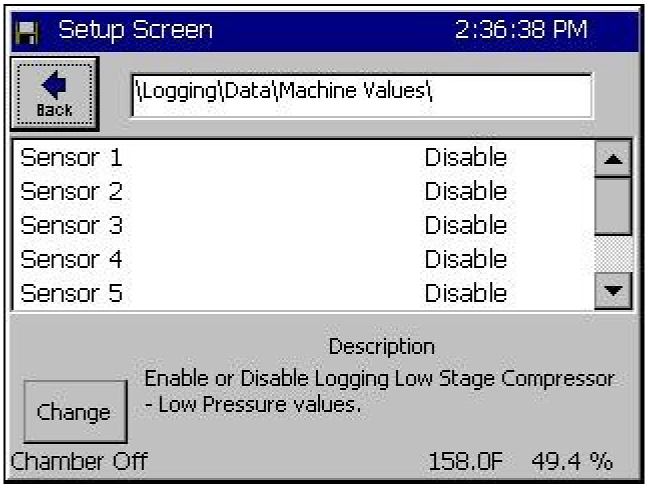


Step #4: Select the Channel PIDs Folder

Control the logging of the Heat and Cool PIDs for Channel n from this screen. These values can be viewed in the Channel PIDs screen of the Maintenance directory.

After selecting the Channel PIDs folder, another screen appears that has three folders labeled PID CH1, PID CH2, and CH3 PID.

Select the desired channel folder. The screen at the left appears. Select Heat or Cool, press the ***Change*** button. Return to the *Logging\Data* directory by pressing the ***Back*** button.



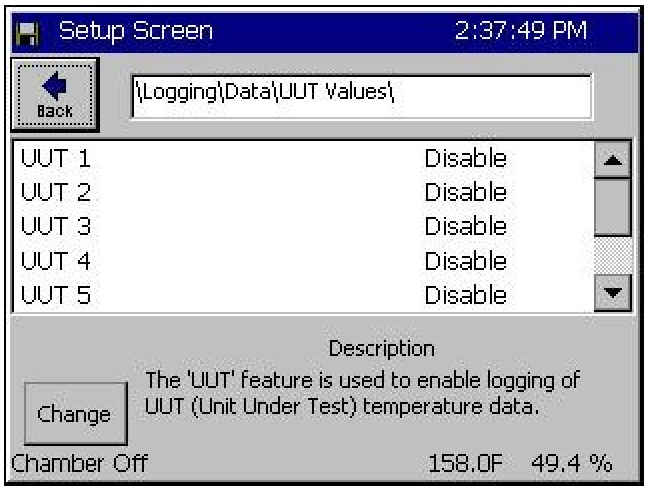
Step #5: Select the Machine Values Folder

Select the Machine Input process values of Sensors 1 thru 8 for logging. These inputs usually consist of compressor suction and discharge pressures and temperatures. These values can be viewed in real-time from the Low Res. Analog Screen in the Events folder.

Select the sensor and press the ***Change*** button.

Scroll down to access sensors 6 - 8.

- Return to the *Logging\Data* directory by pressing the ***Back*** button.



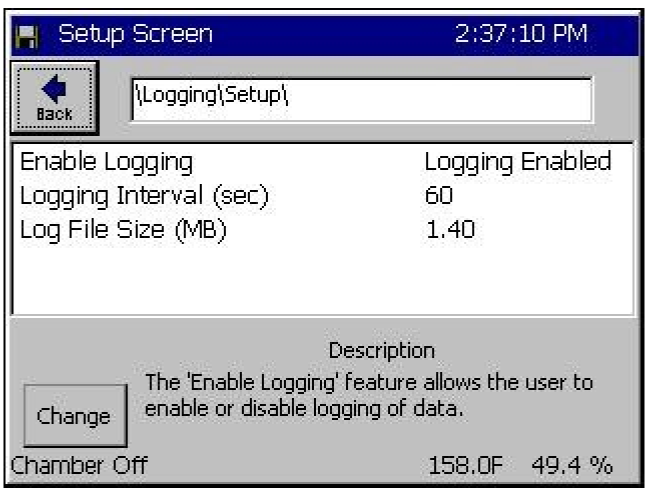
Step #6: Select the UUT Values Folder

Use this screen to enable Units Under Test data logging for UUT1 thru UUT8. These values can be viewed in real-time in the UUT Temperatures screen of the Events directory.

Select the UUT and press the ***Change*** button.

Scroll down to access UUTs 6 - 8.

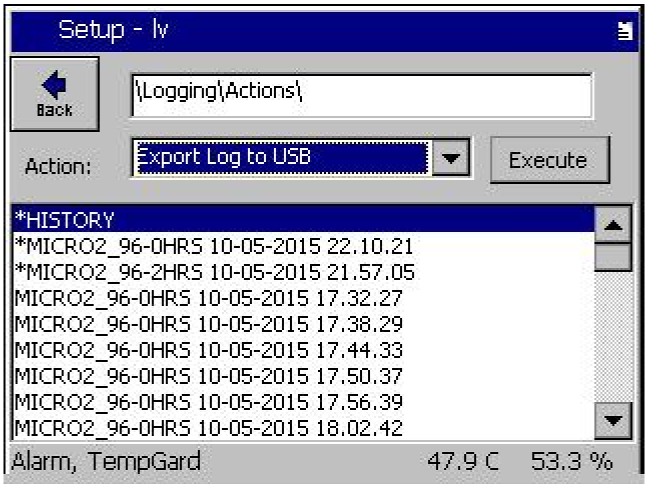
- Return to the Logging directory by pressing the ***Back*** button.



Step #7: Start Logging Operation

From the Logging directory, select the Setup folder. The screen at left appears. Here you set up and start the logging operation.

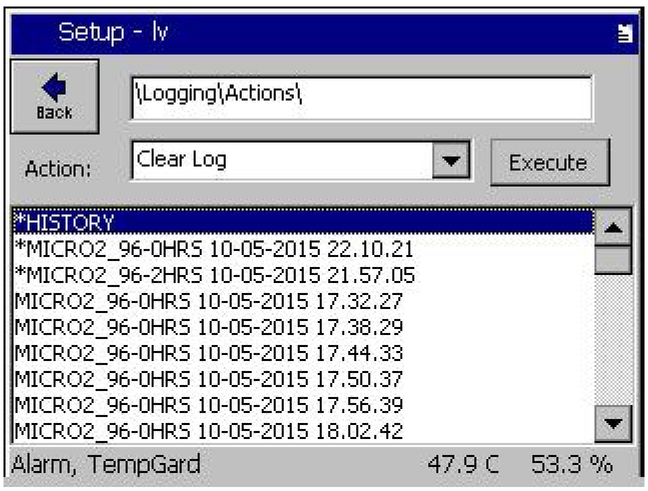
- To change the logging interval, select the parameter and enter the time in seconds on the keypad. The allowable range is 1 to 3600 seconds.
- To change the file size, select the parameter. Press Change and enter the size in the keypad that follows. Range is from 0.25 to 5.0 Megabytes. The upper limit is dynamically calculated based upon available space on the internal Storage Card.
- To enable logging, select the parameter and press the ***Change*** button.



Export Log to USB

The export process is monitored in the Export History Status window. First the Synergy Controller prompts for a USB Hard Disk. If your removable storage media is not installed, install it and press the ***OK*** button.

Once the media is detected the Synergy Controller will automatically export the file. When the export is complete it will confirm a successful export and prompt to close the window by pressing the ***OK*** button. Your export history file is automatically named “exphst00.txt”.



Clear History for Logging Operation

Press the ***Clear History*** button to clear the history file.

Note: The Clear History and Export History folders are also available with the *Maintenance\File Utilities* folder. Once cleared the log data is not recoverable.

Synergy Controller Data Logging Capacity Calculations

As described above, the Synergy Controller records process data, setpoints and machine diagnostics to its Storage Card. This information can be exported at a later time to a USB Hard Disk or to the FTP server and used in a test report or for system troubleshooting as explained in the previous section. Calculations below estimate the Synergy Controller's logging capacity; i.e. the number of history samples that can be recorded on the Storage Card.

The number of samples depends on the number of bytes available on the internal Storage Card and the amount of data that is logged per sample.

SCINFO can be used to determine the number of bytes available on the Storage Card thru the TCP/IP, RS-232 or IEEE communications interface.

Command Format: ? SCINFO.
Response example: “Total: 8128512 Free: 1048576”

To determine the amount of data that is logged, use the following table and formulas. The table below lists the information that can be logged. Each data type requires a specific amount of storage space on the Storage Card. In addition, there are a number of overhead bytes per sample for time and other housekeeping data.

For example, assume that we want to record CH1 Actual (Temperature) and CH2 Actual (Humidity) readings.

Capacity can be calculated as follows:

Samples=X/(Y+Z_1+Z_2+Z_3)

Where:

X=2 MBytes available on Storage Card (Available Storage Card capacity)
Y=21 Bytes (Number of bytes of overhead per sample)
Z_n=(Number of bytes required for n samples)

Thus, the number of samples that can be stored are calculated:

Samples=X/(Y+Z_1+Z_2)
Samples= 2,097,152/(21+6+6)
Samples=63,550

If we record 60 samples per hour we will have the capacity to record for 1,059 hours.

Hours = Samples/Sample Rate
Hours = 63,550/60
Hours = 1,059

The actual time may be less than this since other data stored on the machine including profiles will reduce the number of available bytes. In addition, existing data stored in the history file will reduce the number of samples that can be saved. Other data recorded in the file are alarm events and header information saved when the Synergy Controller is restarted.

Log Data Size		
Data	**Max. Size**	**Description**
CH1 Actual	6 bytes	Temperature
CH2 Actual	6 bytes	Humidity
CH3 Actual	6 bytes	Pressure
CH1 Setpoint	6 bytes	Temperature
CH2 Setpoint	6 bytes	Humidity
CH3 Setpoint	6 bytes	Pressure
CH1 Heat PID	4 bytes	0 to 100%
CH2 Heat PID	4 bytes	0 to 100%
CH3 Heat PID	4 bytes	0 to 100%
CH1 Cool PID	4 bytes	0 to 100%
CH2 Cool PID	4 bytes	0 to 100%
CH3 Cool PID	4 bytes	0 to 100%
Machine Sensor 1	4 bytes	Low Stage Pressure, Low Side
Machine Sensor 2	4 bytes	Low Stage Temperature, Low Side
Machine Sensor 3	4 bytes	Low Stage Pressure, Hi Side
Machine Sensor 4	4 bytes	Low Stage Temperature, Hi Side
Machine Sensor 5	4 bytes	High Stage Pressure, Low Side
Machine Sensor 6	4 bytes	High Stage Temperature, Low Side
Machine Sensor 7	4 bytes	High Stage Pressure, Hi Side
Machine Sensor 8	4 bytes	High Stage Temperature, Hi Side
UUT Device 1	56 bytes	8 Thermocouple readings
UUT Device 2	56 bytes	8 Thermocouple readings
UUT Device 3	56 bytes	8 Thermocouple readings
UUT Device 4	56 bytes	8 Thermocouple readings
UUT Device 5	56 bytes	8 Thermocouple readings
UUT Device 6	56 bytes	8 Thermocouple readings
UUT Device 7	56 bytes	8 Thermocouple readings
UUT Device 8	56 bytes	8 Thermocouple readings

Note that the oldest 4% of the data in the log file will be lost when the log file exceeds the Log File Size set in the *Settings\Logging\Setup* window. Therefore, the required log file size should be calculated using the above technique before any lengthy test to be sure that it will not reach the Log File Size limit. In addition, any data that already exists in the log file should be taken into account. You can export the History file and then clear it using the *Logging\Clear History* folder before a long test to utilize the full capacity of the Storage Card.

6.8 Chamber Setup

The Chamber Setup Directory is used for factory setup. The chamber type specified in the Synergy Controller must match the chamber that it is controlling. The Chamber Type setting maps software outputs to chamber hardware. Each chamber type has as specific map that is unique to that type of chamber. The operator should NEVER change this setting. It should only be modified by a qualified technician.

Generic Temperature Only
Generic Temperature/Temperature *
Generic Temperature/Humidity *
Generic Temperature/Humidity Single Stage
Generic Temperature/Pressure
Generic Temperature/Humidity/Pressure
Generic Temperature/Vibration
Retro Temperature Only

The Chambers Types in the list above that are identified with * support VersaTenn retrofit fit applications.

WARNING: Incorrect Chamber Type settings may cause severe damage to your chamber.

Chamber Output Mapping

The Synergy Controller can be configured for many chamber types. Each chamber type has a unique device output mapping. For example, the fan is driven by Output 1 on Temp-Humidity and Temp-Only chambers, and by Output 10 for Temp-Temp chambers.

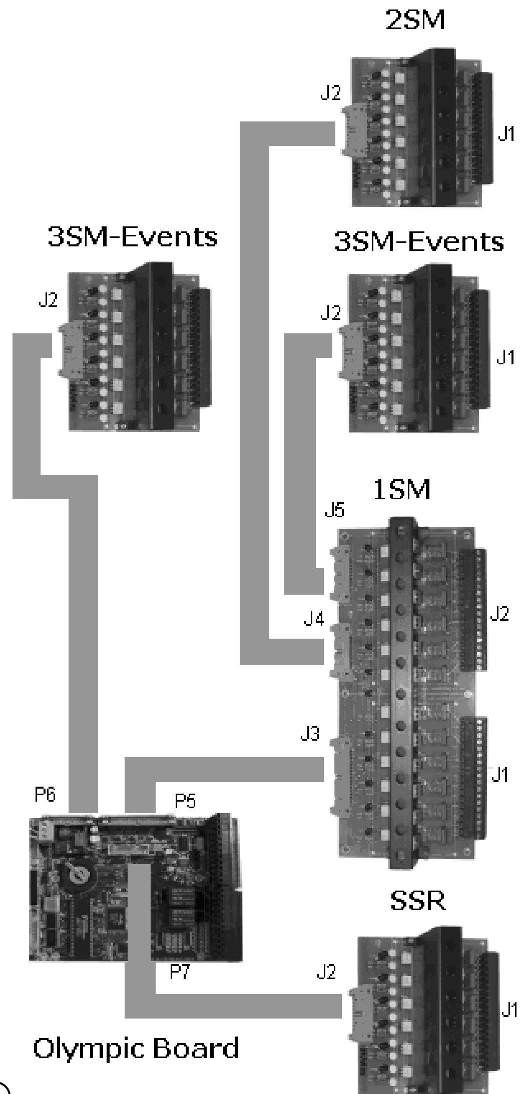
The following tables list the output mappings for the supported chamber types including retrofit configurations; i.e. when the Synergy Controller is installed on a chamber with a VersaTenn, VersaTenn II or VersaTenn III.

Output Map Abbreviations:

- SM – Switching Module
- SSR – Solid State Relay
- P# - Olympic Board Connector Labels
- J# - Output Board Connector Labels

Switching Module Configuration

The Olympic board drives all of the outputs for the chamber thru solid state switches called Switching Modules (SM). In some cases there is more than one way to connect a specific output. This provides flexibility when wiring the chamber to support new and retrofit installations. The figure at the right shows the different the ways Olympic board can be connected to the various SM boards.



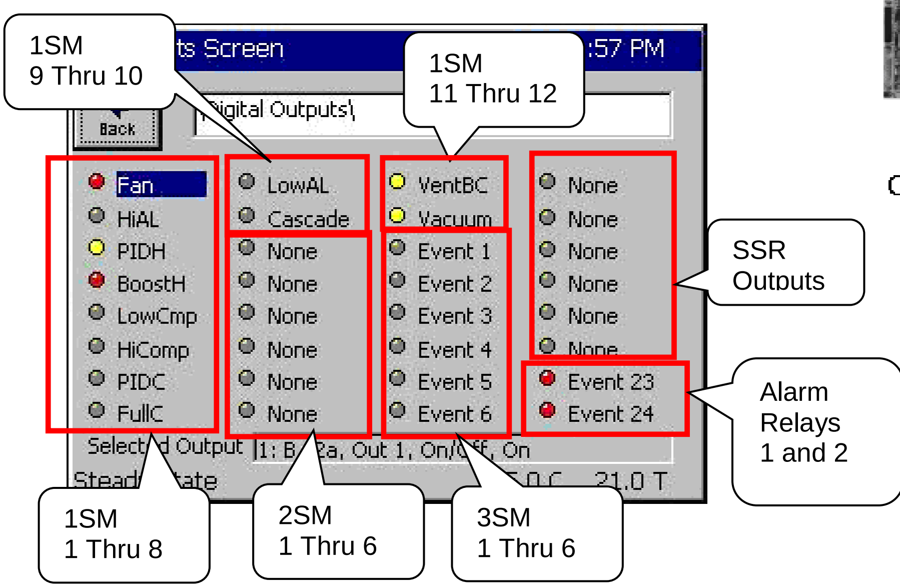
For example, note that the 3SM-Event outputs can be connected two ways; directly to the Olympic board P6 connector or thru the 1SM- J5 connector as shown at the right

In addition, some chamber definitions provide the same function to more than one output. This is referred to as mirroring.

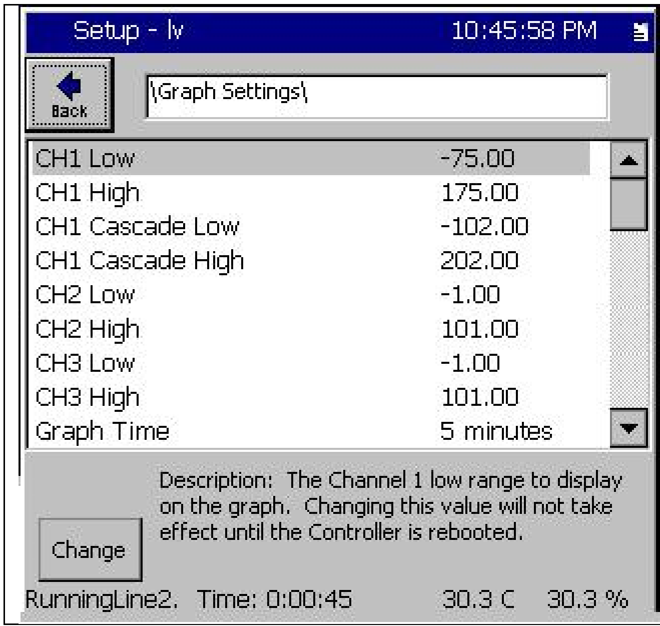
For example, in the Generic Temperature Humidity configuration the “Humidify” output is available on 2SM-2 and SSR-2. The SSR outputs emulate the VersaTenn III SSR outputs which simplifies VersaTenn controller retrofits. To further support retrofits, the 5-Channel output board is wired to emulate the wiring of the VersaTenn III SSR outputs.

Installation section 17.0 describes the SSR outputs for retrofit configurations in greater detail.

The Screenshot below shows the position of each switching module on the EVENTS/Digital Output Screen.



6.9 Graph Settings



The Graph Settings Paramters Control both the chart on the Graph Screen as well as the chart on the Main Screen.

6.10 LCD Settings

The LCD Brightness feature changes the brightness of the LCD touch screen. If your Synergy Controller is at eye level or you work in very light conditions such as a room with direct sunlight, you may want to set the LCD screen to a slightly darker setting. If your Synergy Controller is mounted in a location that requires the operator to view the screen at a sharp angle or in a low light room, you can set the LCD to a brighter output.

Note that this function is controlled by a potentiometer on Synergy Micro and Synergy Micro V units. See the figure in the installation section of this manual.

6.11 Panel Lock

Panel Lock is a security feature that either partially or completely restricts access to the Synergy Controller. This feature can protect a chamber from unauthorized access. When Panel Lock is enabled, access is only permitted when the operator enters the password.

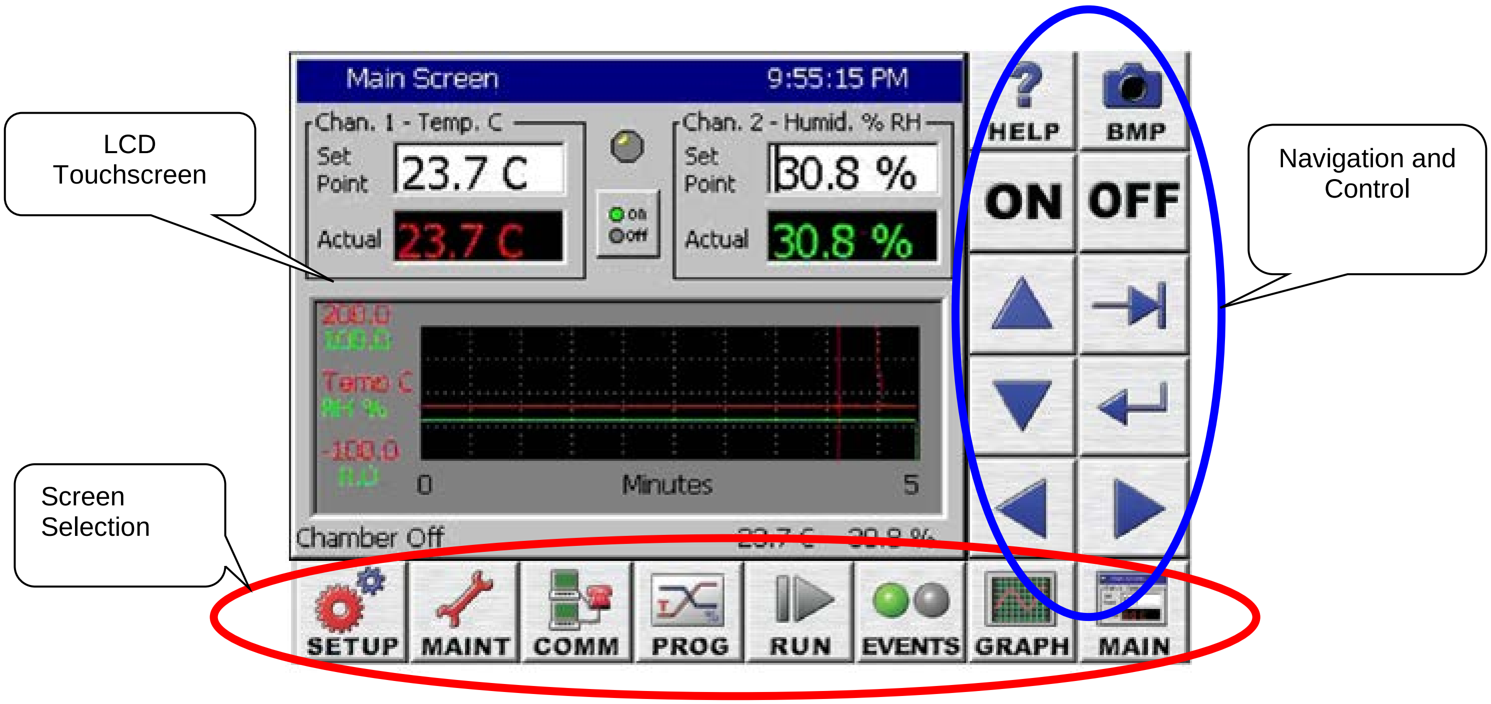
User access to specific controller areas can be restricted appropriately for each user function.

The enhanced Panel Lock feature provides 5 levels of access security:

1. Administrator
2. Maintainer
3. Engineer
4. Operator
5. Unrestricted

The Synergy Controller user interface consists of the LCD Touch screen, eight Screen Selection buttons below the LCD, and 10 Navigation and Control buttons to the right.

With the new Panel Lock features, each Screen Selection button is assigned a security level from the five available levels. General Synergy controller screen features and Default user levels are summarized in the table below.



Screen	Screen usage summary	Default Access
SETUP	Chamber Configuration, Settings and PID values	Administrator
MAINT	Time/Date, Monitoring	Maintenance
COMM	Communications setup, Network Setup	Engineer
PROG	Program creation and editing	Engineer
RUN	Program Run	Operator
EVENTS	Input and Output Monitor and User Event control	Operator
GRAPH	Process variable and Setpoint graphing	Unrestricted
MAIN	Steady State control setpoints, Graph, and On/off feature.	Operator

Panel Lock Feature Setup

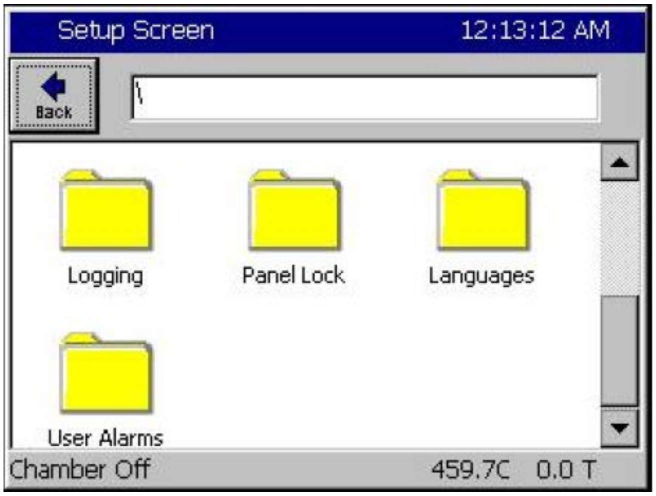
To setup the Panel Lock feature follow these steps:

1. Specify the password for each user level.
2. Specify the user level for each of the 8 Screens.
3. Set the Panel On/Off Keys as required.
4. Set Unlock Duration time (in units of minutes).
5. Set Panel Lock to "Locked".

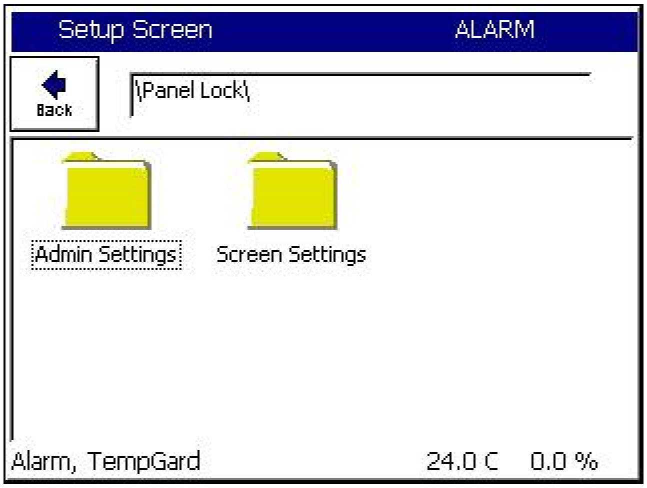
Once locked, access to your controller is now restricted.

Any user touch on a password protected screen, whether locally through the touch screen or via a web browser will pop up a password entry dialog box. The user can enter the password to unlock that screen or press Cancel and return to the Main screen.

The Panel Lock feature setup is done from the Setup screen’s Panel Lock Folder.

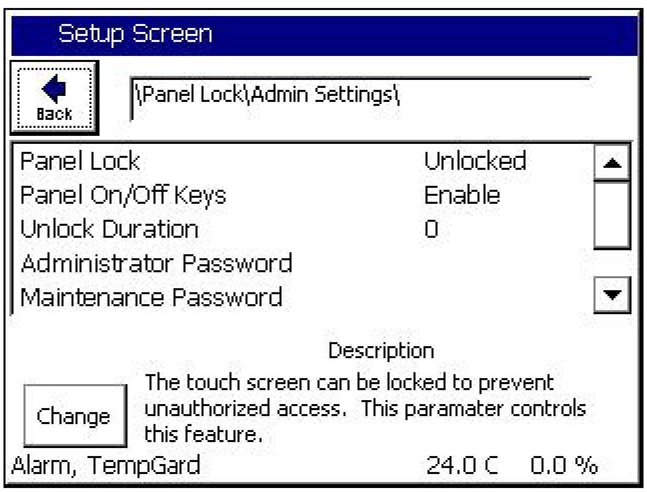

Setup Screen
12:13:12 AM
Back
\
Logging
Panel Lock
Languages
User Alarms
Chamber Off
459.7C
0.0 T

In the \Panel Lock\ folder there are two subfolders; Admin Settings and Screen Settings as shown below.

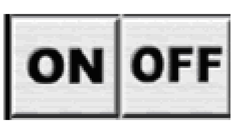


The \Panel Lock\Admin Settings\ folder is used to enable the Panel Lock feature and control Panel Lock options and passwords. The panel lock options control the function of Panel Lock in two ways:

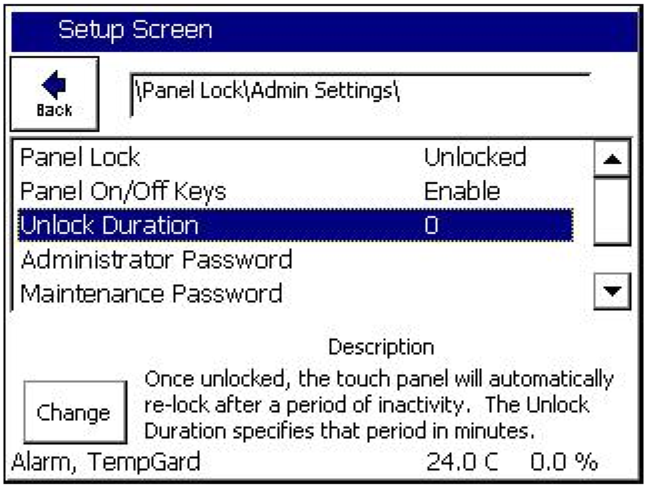
1. Panel On/Off Keys Enable/Disable.
2. Unlock Timer Duration



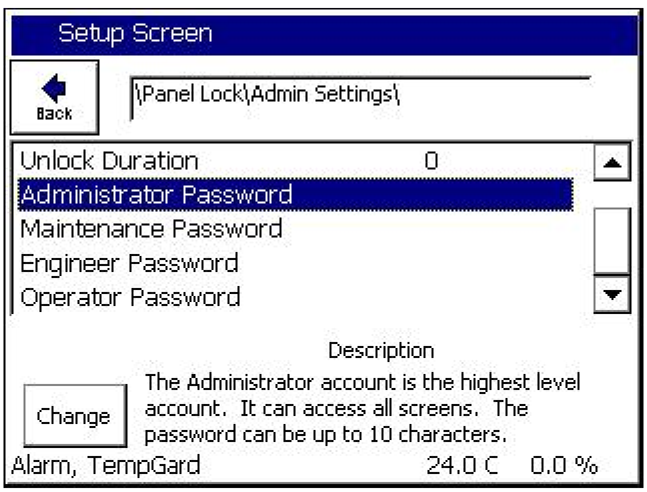
1. Panel On/Off Keys, when set to Enable, allow the use of the ON/OFF keys on the controller when the panel is locked. Enabled is the recommend setting for safety reasons.



2. Once unlocked, the touch panel will automatically re-lock after a period of inactivity. The Unlock Duration setting specifies this period in minutes.



The Panel Lock Passwords are listed in the \Panel Lock\Admin Settings\ folder in the order of access privilege. The Administrator password has the highest privilege and can access all the controller screens. The password can be up to 10 alpha-numeric characters. To change the password, select the user level and press the Change button to open the T-9 pad, and then enter the new password.

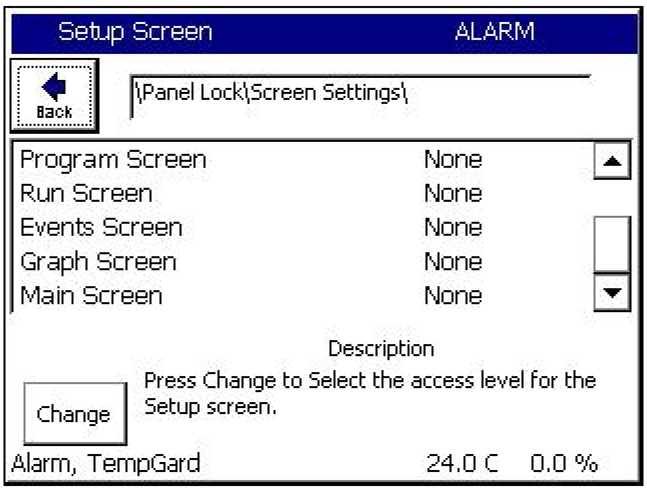


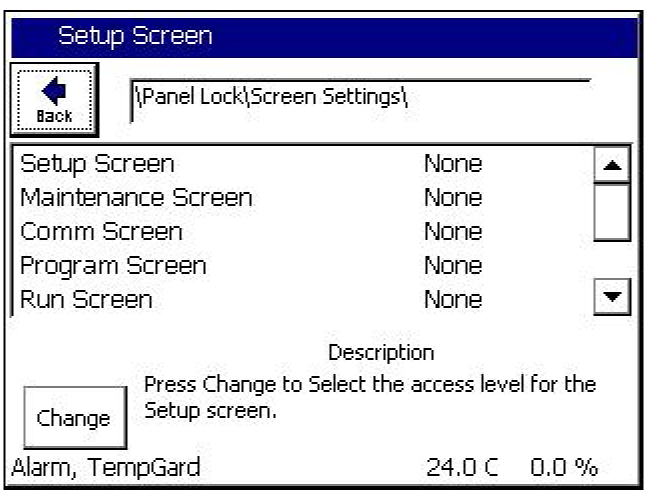
The \Panel Lock\Screen Settings\ folder is used to assign the user level for each screen. The suggested user levels are listed in the table below.

Default User Levels

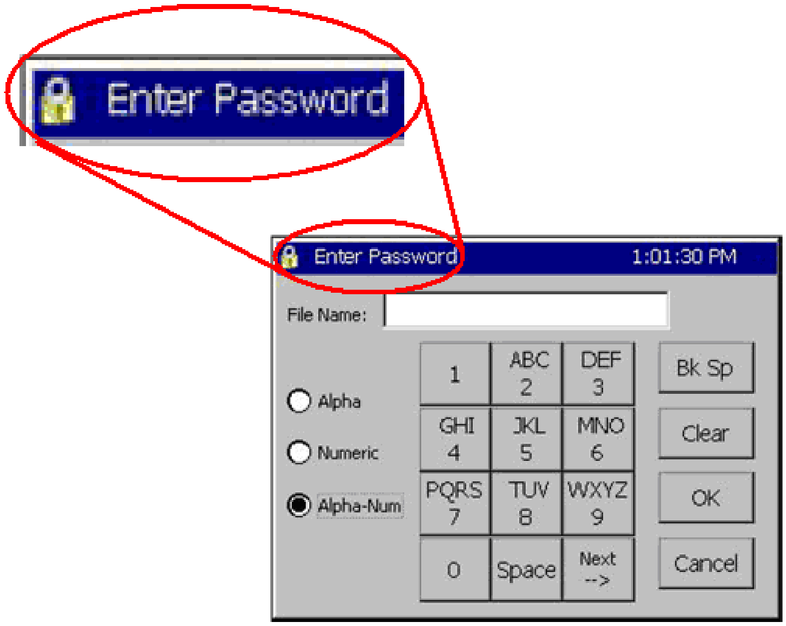
Screen	Default Access
SETUP	Administrator
MAINT	Maintainer
COMM	Engineer
PROG	Engineer
RUN	Operator
EVENTS	Operator
GRAPH	Unrestricted
MAIN	Operator

The \Panel Lock\Screen Settings\ folder is shown below:
(Note that the vertical scroll bar must be used to view all 8 screens in the list)





When the Panel is locked, access is only permitted on screens assigned a user level other than “none” after the user enters an appropriate password.



When the “Enter Password” dialog appears, the user must enter the password and then press OK to unlock the panel.

Once unlocked, the touch panel will allow access to any screens assigned that access level or any lower level screens.

In addition, the panel will automatically re-lock after a period of inactivity. The unlock duration setting specifies that period in minutes.

The user can go to the \Panel Lock\Admin Setup\ folder to clear the password without waiting for the Unlock Duration inactivity timer to expire by unlocking and re-locking the panel.

6.12 Languages

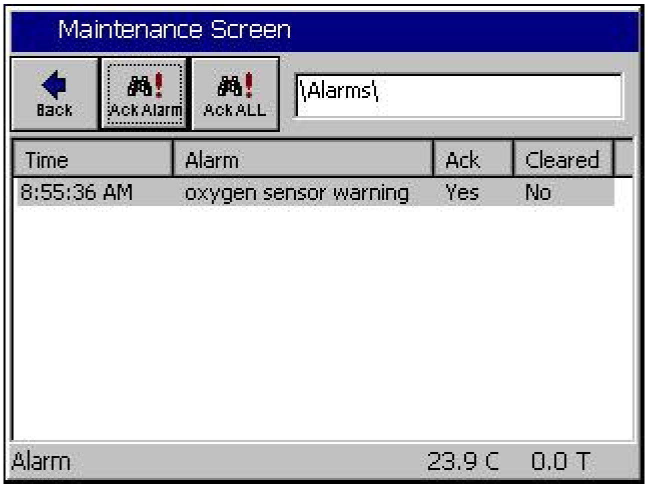
The Synergy Controller can be configurable to many language formats. Please contact Tidal Engineering for more information.

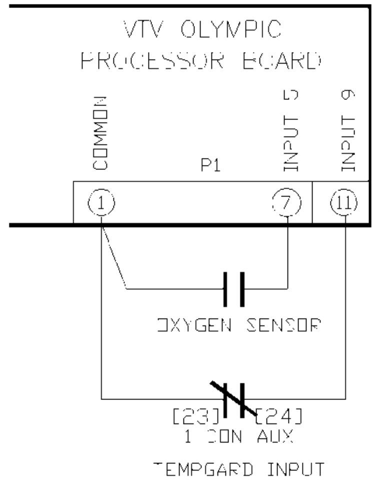
Note: The Espanol setting is for demo purposes only.

6.13 User Programmable Alarm System

The Synergy Controller’s user programmable alarm system can create customer specific alarms and warnings and special factory applications. The user can create alarms for RTD temperatures, UUT temperatures as well as voltage inputs, digital inputs and auxiliary sensors such as Oxygen, pressure, etc. For special applications, the chamber manufacturer or retrofit installer can program an alarm relay to operate a system function. This section explains the user alarm setup procedures using two examples.

The User Alarm screen operates as a wizard like the profile wizard screen. This means that the setup instructions are provided along with the entry fields and the user enters information and presses next or back as required until the alarm is entered. The result alarm can be programmed to appear in the Alarm window if required as shown below. The diagram below right shows the electrical connection for the corresponding user alarm.





There are 102 inputs/variables that can be monitored for user alarm conditions (see the table below)
The Input options are:

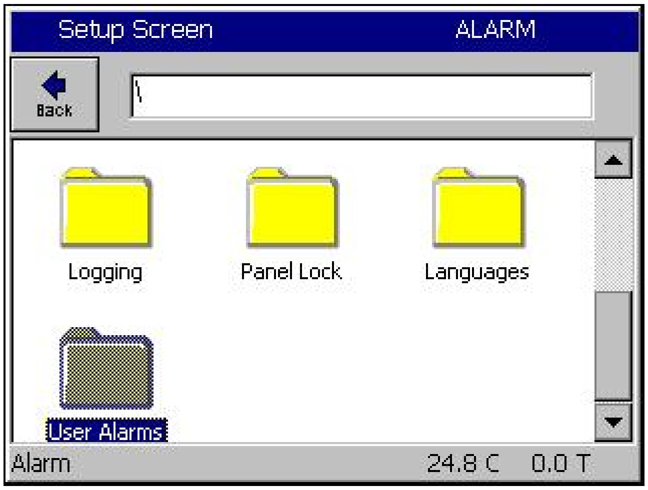
Module	First Selection	Second Sel.	Choices
Olympic Board	RTD1&2, Analog 1-4	N/A	6
UUT Module Inputs	UUT Module	Sensor	64
Machine Inputs	Low Resolution Channels 1 thru 8	N/A	8
Digital Inputs	Inputs 1 thru 16	N/A	16
Channels	Channels 1 thru 4	N/A	4
Setpoints	Setpoints 1 thru 4	N/A	4

There are four Comparison options available.

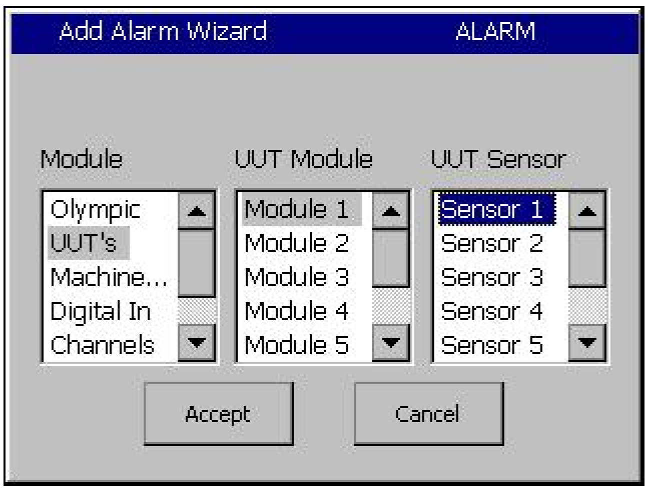
Comparison	Application
Input Open	Digital Inputs only
Input Closed	Digital Inputs only
Greater than Threshold	All inputs except Digital, Raw or Scaled.
Less than Threshold	All inputs except Digital, Raw or Scaled.

The User Alarm Wizard steps are as follows:

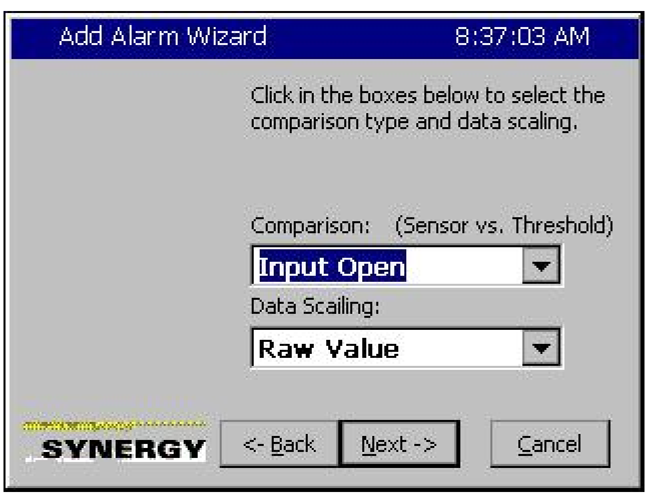
1. Open the Setup Screen and browse to the User Alarms folder.
2. Select the Sensor, Setpoint or Channel.
3. Define the comparison type and the scaling, i.e. Input Open, Closed, Greater than (>), etc.
4. Select the Alarm Threshold. (Not required for Digital Inputs).
5. Assign a name for the alarm. This name appears in the alarm screen when the alarm occurs and in the User Alarm list.
6. Select the desired alarm responses.
7. Confirm your choices to finish.



Open the Setup Screen and browse to the User Alarms folder



Select the Sensor, Setpoint or channel.



Define the comparison type and the scaling,

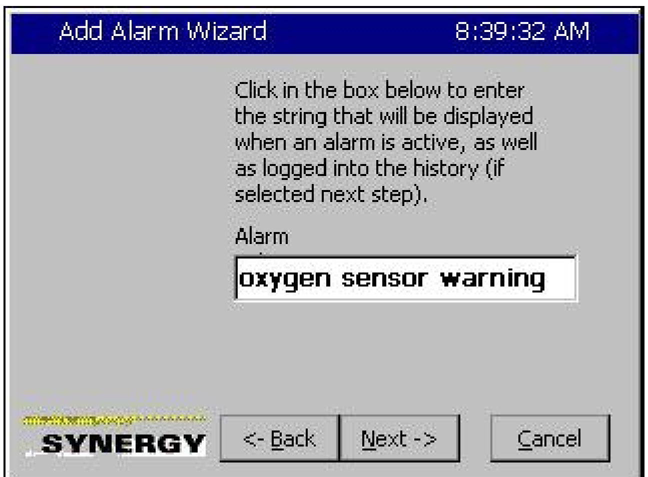
The Comparison choices are:

1. Input Open.
2. Input Closed.
3. Greater than. >
4. Less than. >

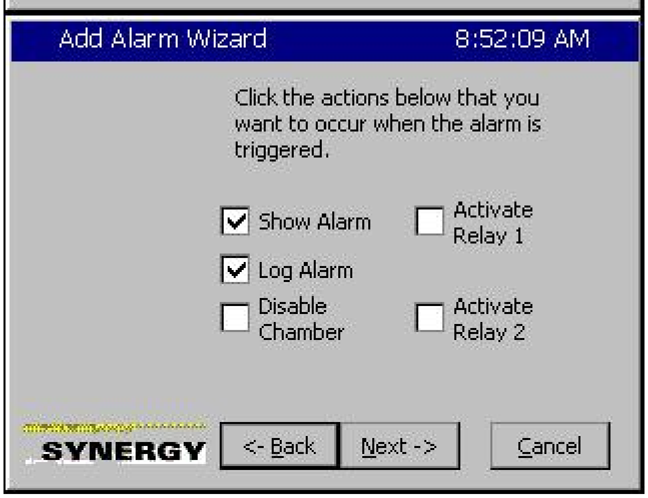
The Data Scaling choices are:

1. Raw Value.
2. Scaled Value.

Select the Alarm Threshold.
This step is not required for Digital Inputs.



Enter a name for the alarm. This name appears in the alarm screen when the alarm occurs and in the alarm list.

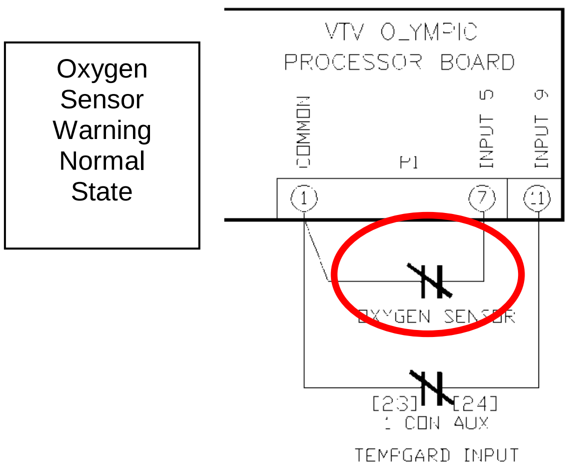


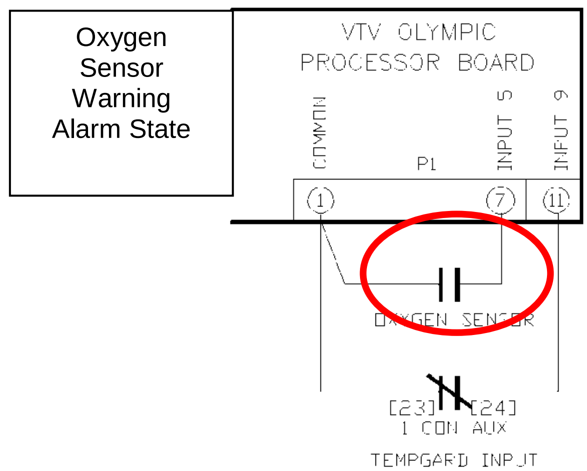
Select the desired alarm response.
The Options are :

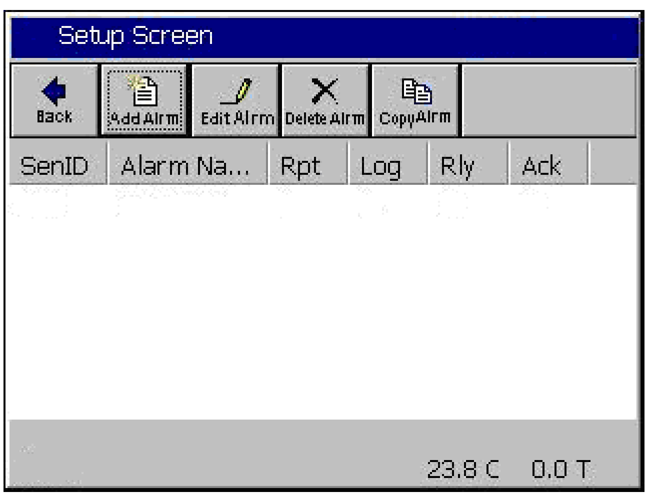
1. Show Alarm.
2. Log Alarm.
3. Disable Chamber.
4. Activate Alarm Relay 1.
5. Activate Alarm Relay 2.

Confirm your choices and finish.

User Alarm Example 1:
Create an alarm that senses Digital Input 5 and Displays “Oxygen Sensor Warning” when the input is Open.

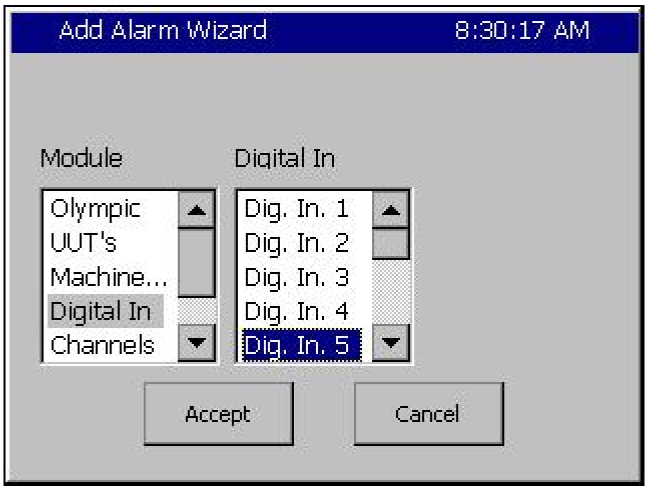




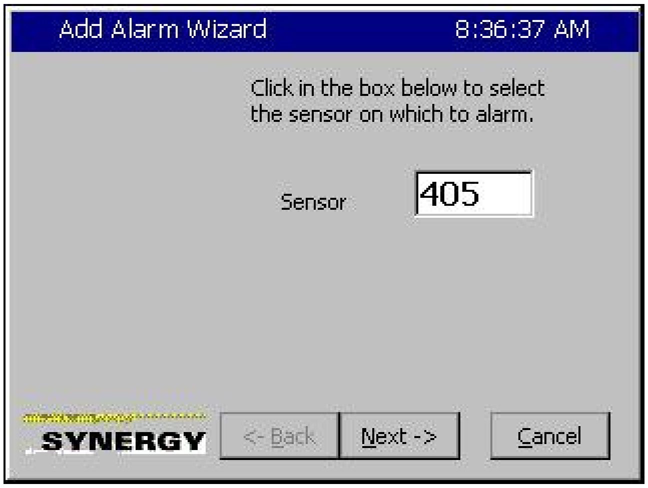


Open the User Alarm folder and press the Add Alarm button on the Setup screen shown at left.

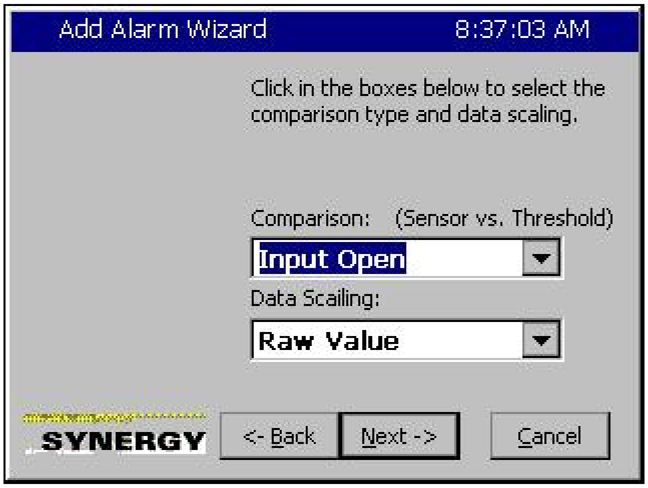
Press the Sensor text box as shown at left to start the Sensor Selection process.



Select Digital Input 5 as shown in the figure at left and then press accept.



The wizard displays the code for this sensor. Press Next -> to continue.



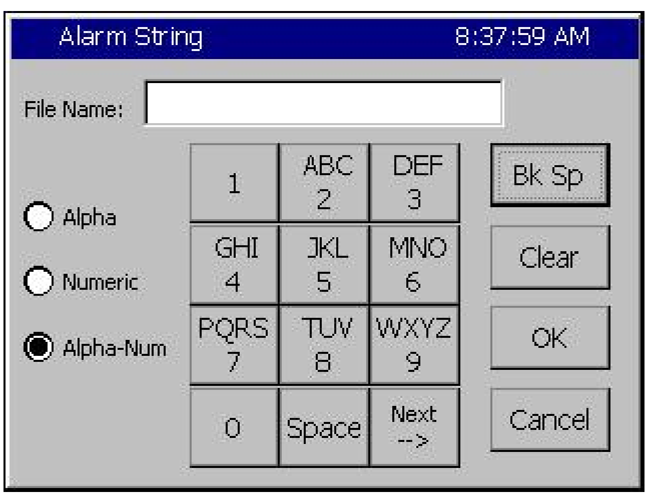
Select the Comparison from the drop down window. In this case Input Open.

Note: Data Scaling doesn't apply for digital inputs

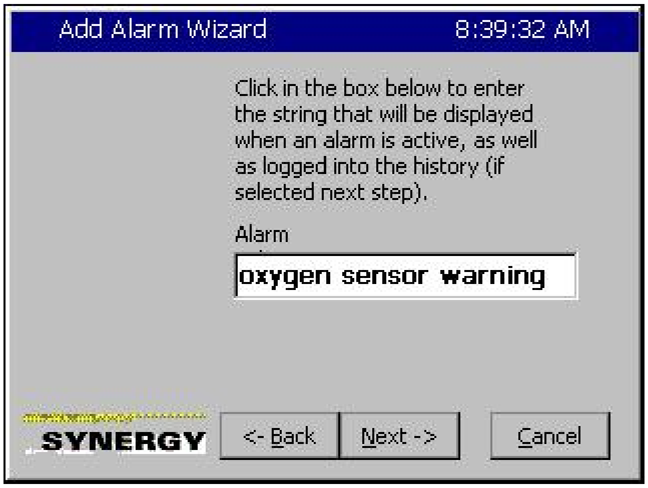
Then press Next ->.

Enter a name for this alarm.

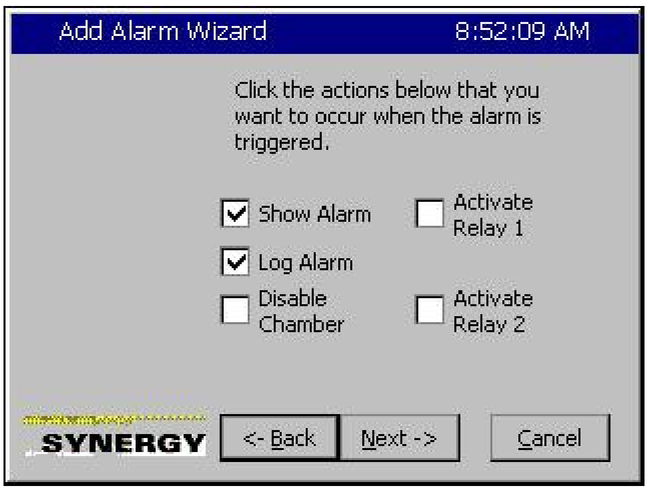
Press the text box to open the Alpha Numeric Keypad.



Enter the name for this alarm.



Then press Next ->.

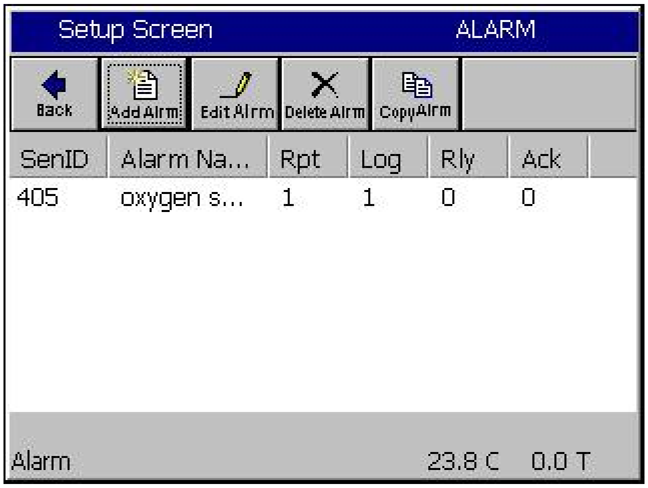


Select the Alarm Actions.

In this case, the “Show Alarm” and “Log Alarm” options are selected.

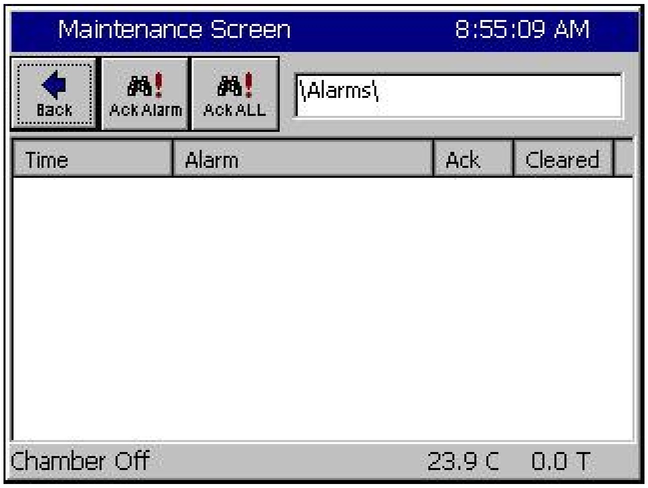
Then press Next ->.

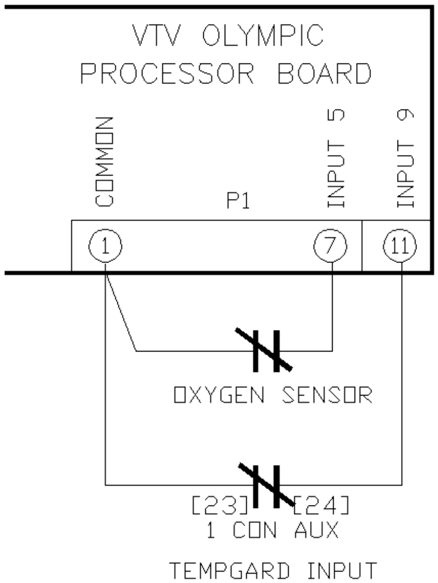
Confirm your choices and press Finish to complete the Alarm entry process.



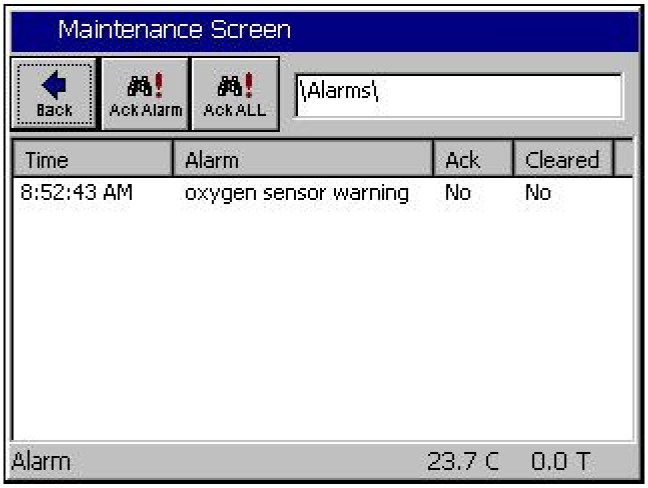
The User Alarm Setup screen shows the new entry.

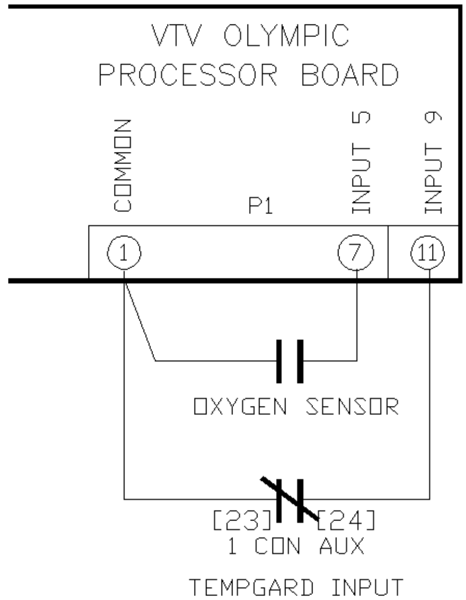
In operation, the Alarm Screen in the Maintenance folder indicates a normal state when the Input is closed as shown in the figures below:





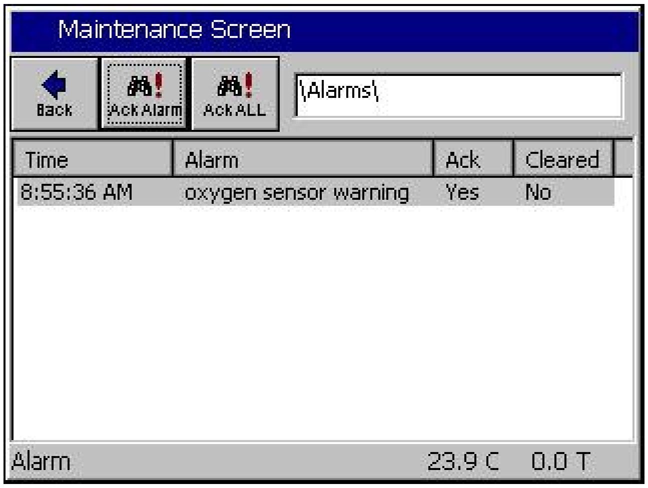
The Alarm Screen in the Maintenance folder Indicates the alarm condition when the Input is open as shown in the figure below:

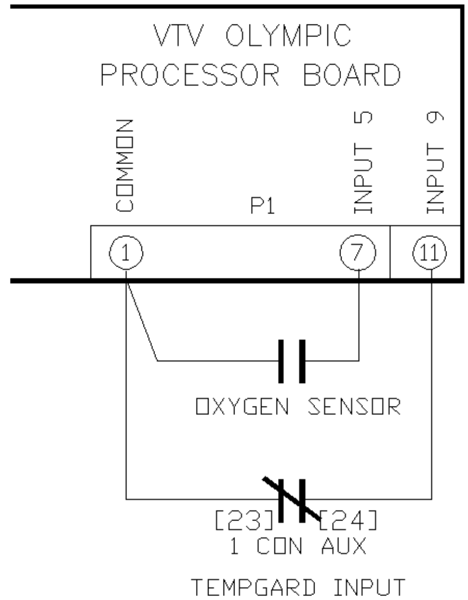




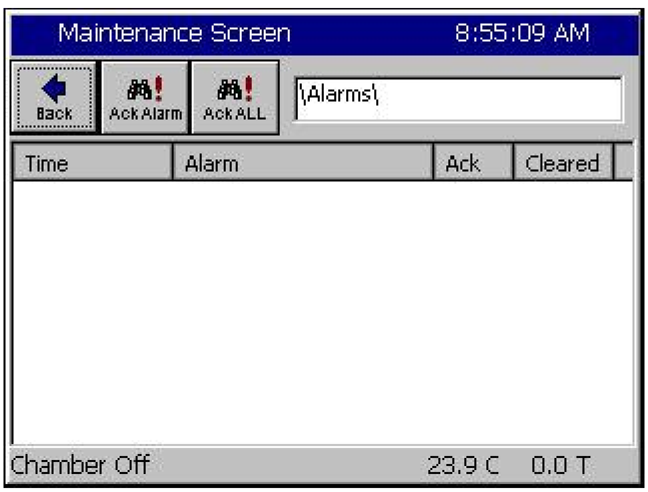
User alarms in the Maintenance/Alarm screen are cleared and acknowledged like built-in High and Low limit alarms. The alarm entry indicates ***Yes*** in the ***Ack*** column after an alarm is acknowledged. The alarm indicates ***Yes*** in the ***Cleared*** column after it has been cleared, i.e. the alarm condition is no longer present. As with built-in alarms, user alarms can be acknowledged before or after they have cleared but the alarm is removed from the list only after the alarm condition has cleared and it has been acknowledged by the operator.

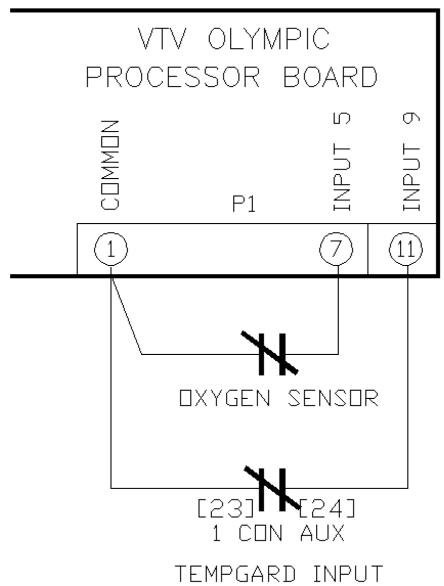
For example, in the screenshot below, the Alarm has been acknowledged but the alarm condition still exists.



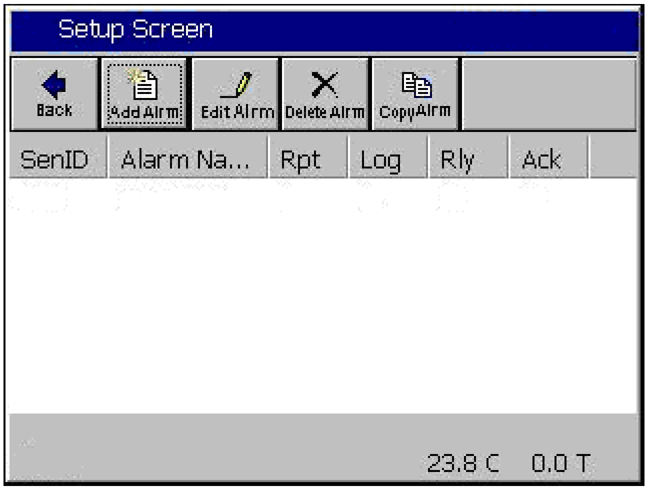


Once the Alarm has been acknowledged and the alarm condition has cleared the alarm entry is removed from the list as shown below.

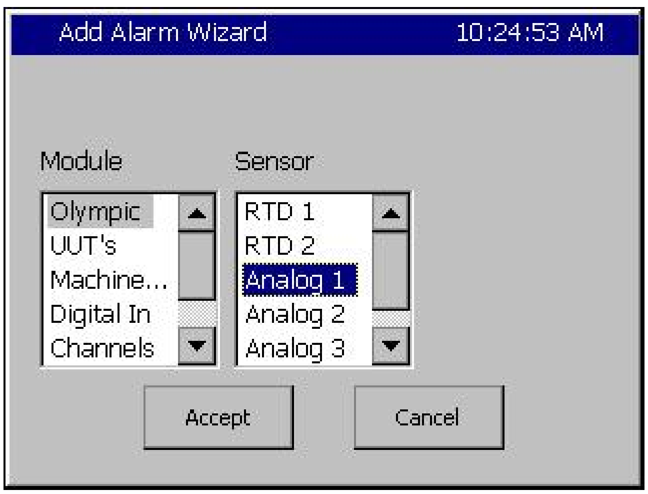




Example 2
At low atmospheric pressures, the heaters in most altitude chambers are turned off so they don't overheat when convection cooling capacity is reduced. In this example we will create an alarm that senses Hi Res Input 3 (Torr) and opens Relay 2 when the value is less than 30 Torr. This alarm is named "Heater Safety Shutoff" and displays "Heater Safety Shutoff" when the threshold is reached.



Open the User Alarm folder and press the ***Add Alarm*** button on the Setup screen shown at left.



Select the ***Olympic*** Module and ***Analog 1***, the Hi Resolution Analog input.

This screen shows the Sensor code for the Olympic Module and Analog input 1.

Since we want the alarm to trigger when the pressure is less than 30 Torr, we select the

Less Then comparison type. We also select the ***Scaled Value*** for Data scaling because we want to check the scaled Torr value as opposed to the Raw 0-5 Volt input value.

Then we press Next-> to continue.

Next we enter the Alarm Threshold.

Press the ***Alarm Threshold*** text box to open the number pad.

Enter the Alarm Threshold and press ***Accept*** to continue.

Confirm the Alarm Threshold.

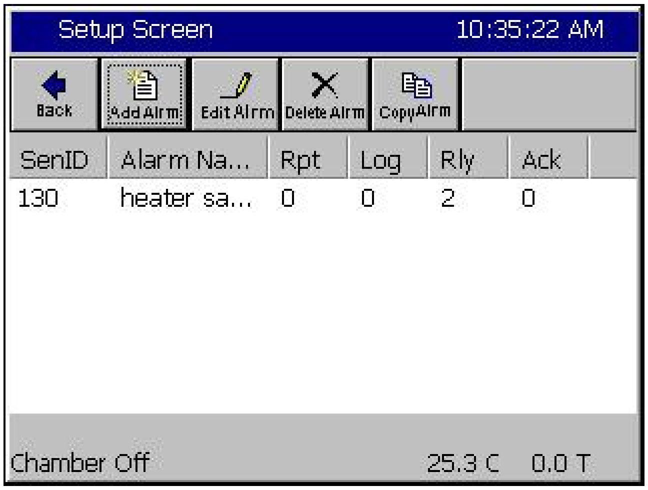
Then we press Next-> to continue.

Here we enter the Alarm response.

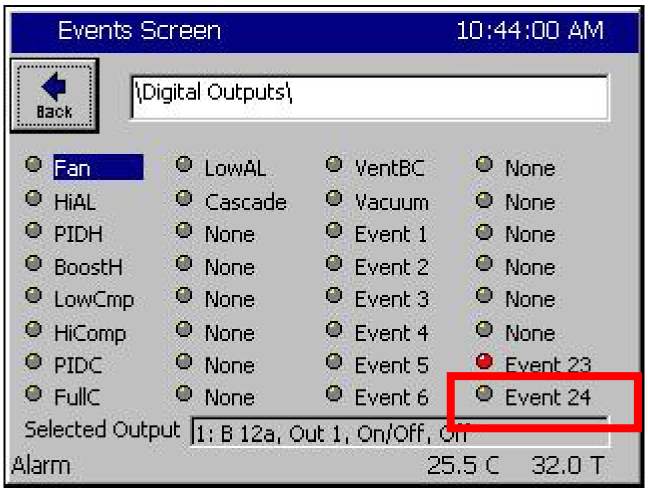
In this case we only want to Activate Relay 2.

Then we press Next-> to continue.

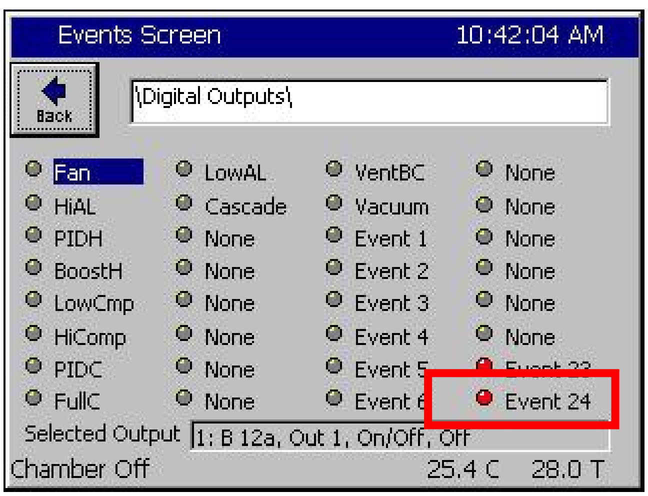
And finally, we confirm our settings and then press ***Finish***.



The User Alarm Setup screen lists our new alarm as shown at left.



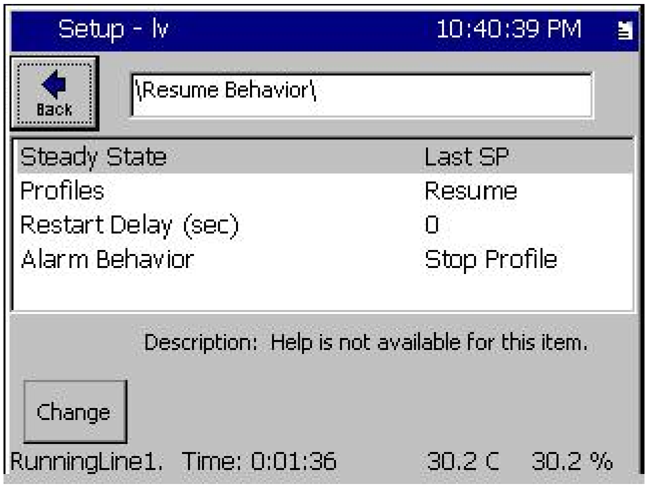
In operation, when the Torr value is greater than 30 Torr, as shown here, Relay 2 (Event 24) is Activated (Grey).



When the Torr value is less than 30 Torr, as shown here, Relay 2 (Event 24) is normal (Red).

Note that as we specified, this alarm only operates Relay 2. It doesn't appear in the title bar, in the alarm screen or in the log file.

6.14 Resume Behavior



The Resume Behavior parameters control the behavior after the controller power is restored.

Steady State parameter controls the behavior when the controller power is lost while the controller is on and in Steady State mode.

Profiles parameter controls the behavior when the controller power is lost while the controller is running a Program.

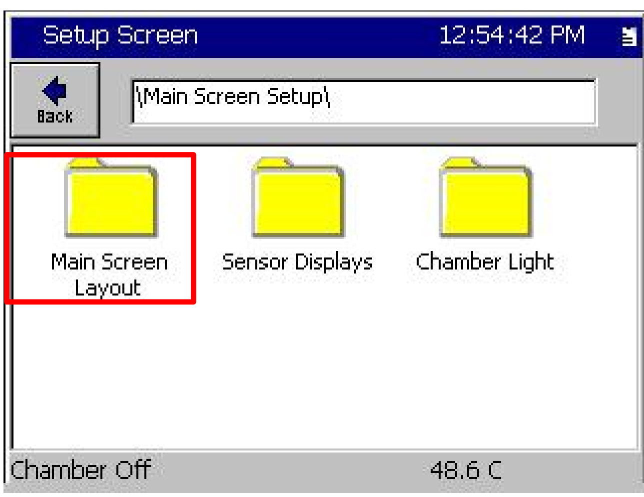
Restart Delay parameter is used to delay the chamber restart to limit the current inrush if a facility operates multiple chambers.

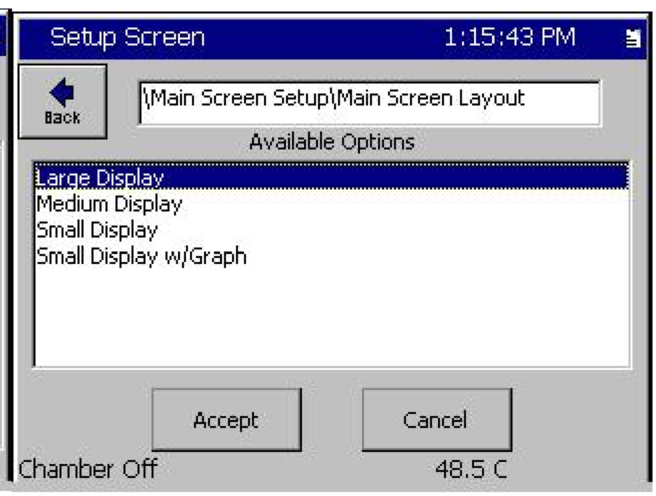
6.15 Main Screen Setup

Main Screen Setup options include:

- **Large, Medium, and Small Channel Text sizes.**
- **Process Graph**
- **Sensor Readings; up to 8 additional display sensors on the Main Screen.**
- **Optional Chamber Light Switch.**

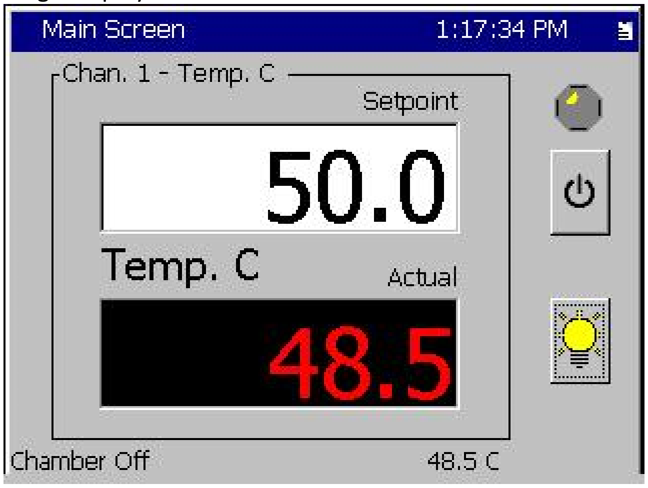
6.15.1 Channel Displays



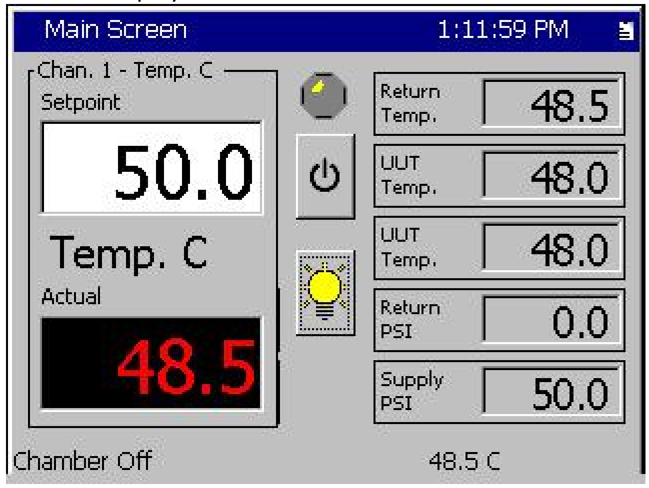


Large, Medium, Small Channel Text sizes

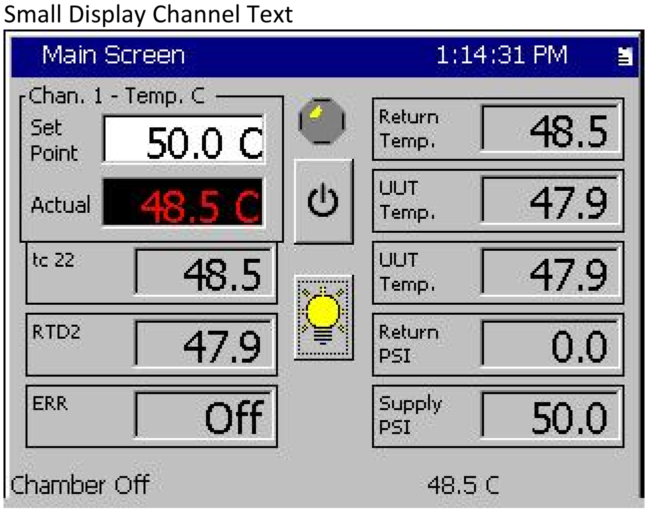
Large Display Channel Text



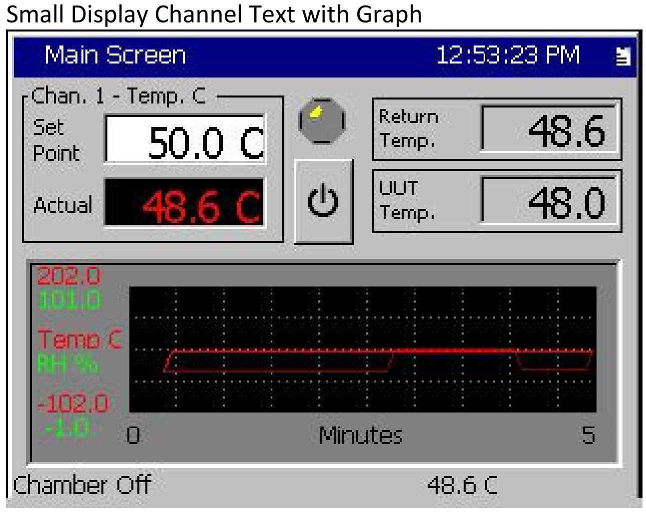
Medium Display Channel Text



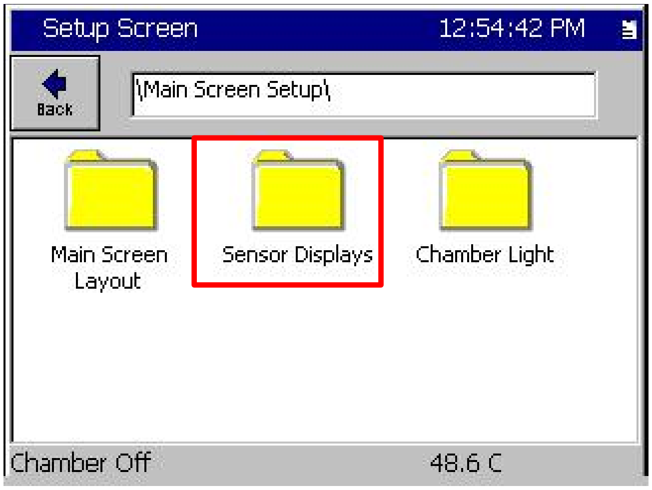
Small Display Channel Text

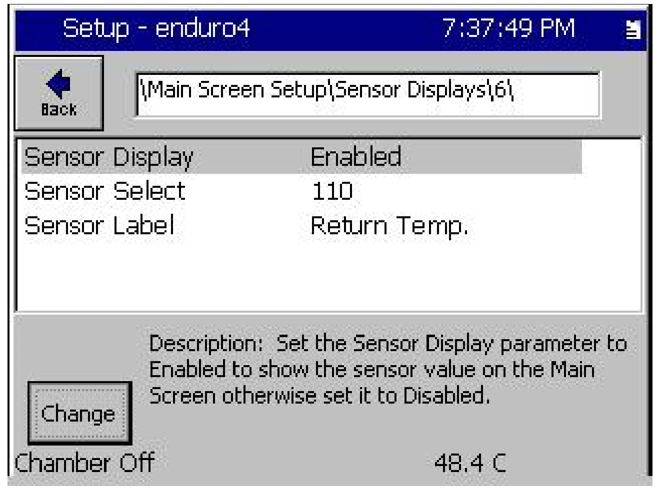


Small Display Channel Text with Graph

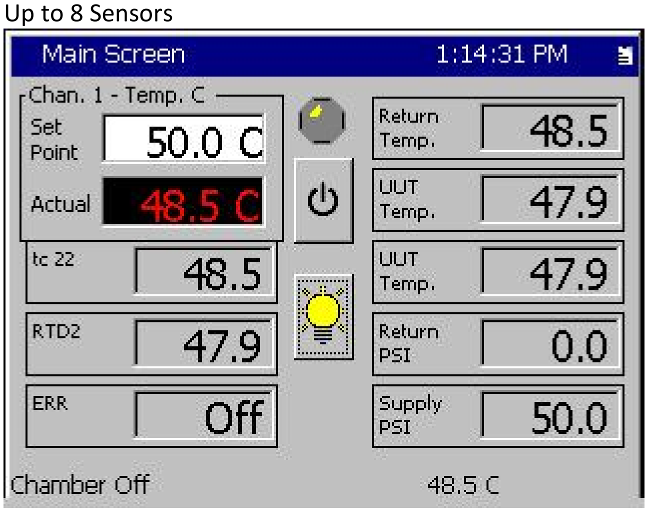


6.15.2 Sensor Displays

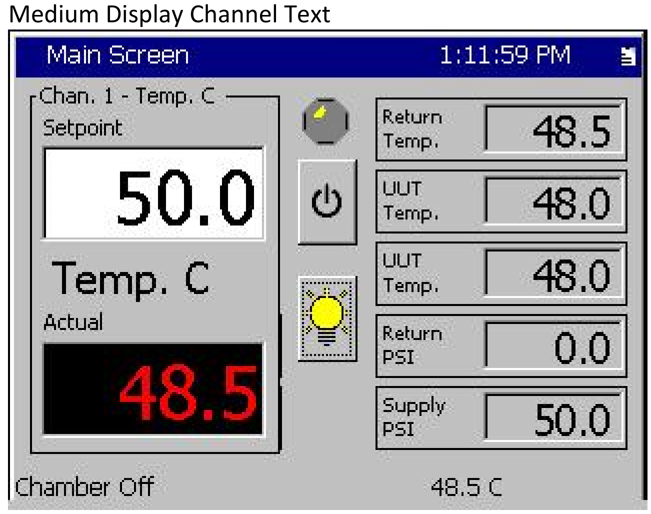


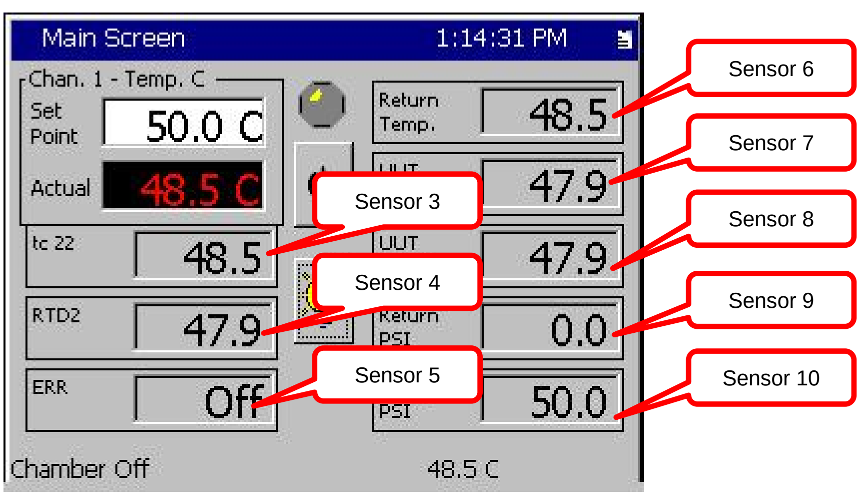


Up to 8 Sensors



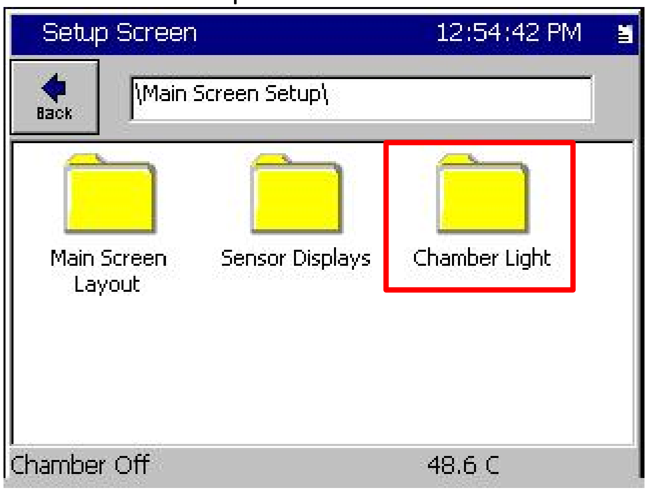
Medium Display Channel Text



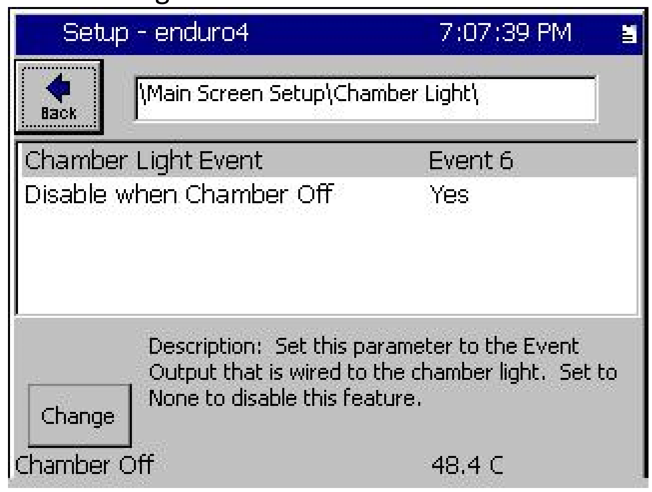


6.15.3 Chamber Light

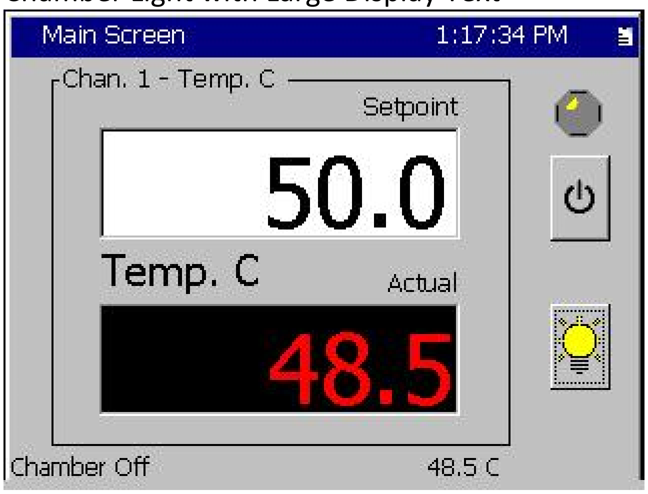
Main Screen Setup Folder



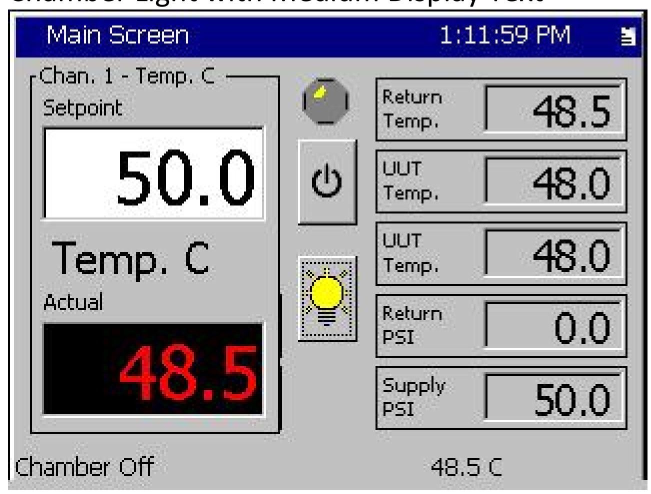
Chamber Light Folder



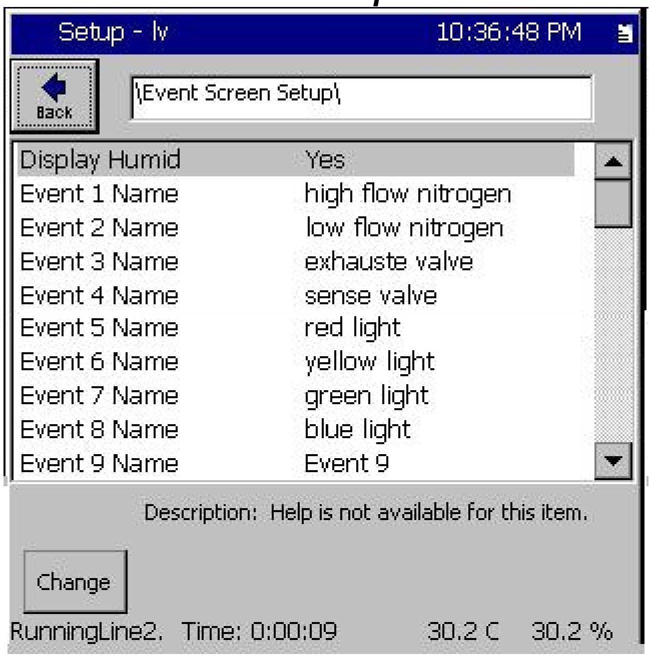
Chamber Light with Large Display Text



Chamber Light with Medium Display Text



6.16 Event Screen Setup



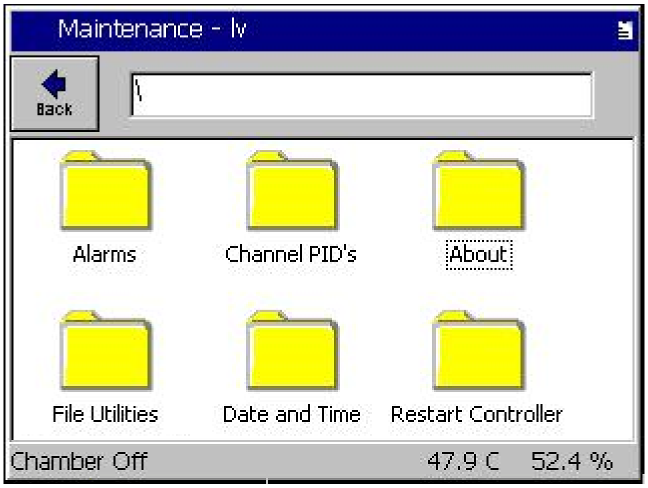
Event Screen parameters that pertain to Humidity control features can be hidden, allowing Event 7, Event 8, and Event 9 to be displayed.

The Event Screen can be customized to display user-friendly names rather than just the Event number. These names would typically be based on the functions that the events control.

7.0 MAINT SCREEN

7.1 Operator Interface

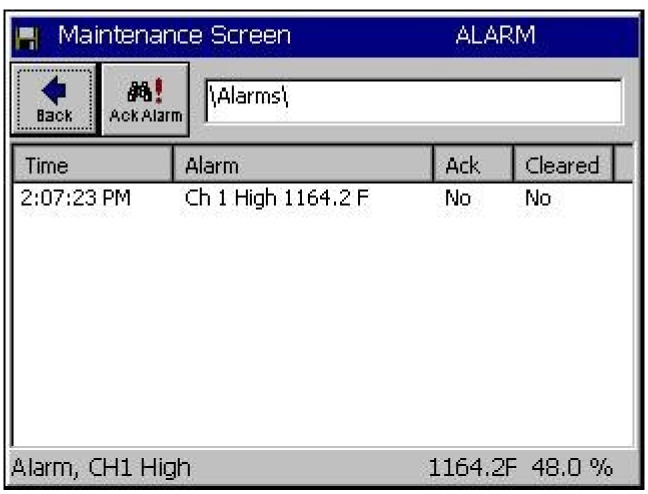
The Maintenance Directory provides a set of utilities used during the operation and maintenance of the chamber.



Maintenance Screen

Press the ***MAINT*** button to access the following functions.

- ♦ **Alarms** (View and Clear Alarms)
- ♦ **Channel PIDs** (PID variables in real-time)
- ♦ **About** (Versions and Serial Numbers)
- ♦ **File Utilities** (Copy Files, Export History)
- ♦ **Date and Time** (Set)
- ♦ **Restart Controller**



Alarms

The alarm screen displays current Synergy Controller alarm conditions. Access this screen to view and clear a chamber alarm. When an alarm occurs, the following attributes are listed.

- ♦ Time of Alarm
- ♦ Alarm Type
- ♦ Ack: (User acknowledgement).
- ♦ Cleared: (Indicates if the alarm condition has cleared).

The word ALARM will flash in the upper right corner of all screens while an alarm condition exists.

Select an alarm and press the ***Ack Alarm*** button to acknowledge it. This will set the **Ack** column value to ***Yes***. When the Alarm condition clears the **Cleared** column will automatically be set to ***Yes***. When both the Ack and Cleared column read Yes (When the user has acknowledged the alarm and the alarm condition has cleared), the alarm is removed from the list. Specific alarms are covered in greater detail in the following section. Alarms always create an entry in the log file.

7.2 Alarm Functions

This section contains information on: Low Storage Alarms, Low Memory Alarms and Alarm Actions (Relays, Alarm Indications, and Outputs). Note: Alarm Relays are normally energized.

SYNERGY CONTROLLER ALARMS AND ACTIONS					
		ALARM RESPONSES			
#	Alarm Name	Alarm Relay 1	Alarm Relay 2	Alarm On Screen Flashes	All Outputs Turn OFF
1	Low Space Storage Card (Flash)	Closed	Closed	YES	No
2	Low Program Memory (RAM)	Closed	Closed	YES	No
3	Temp-guard	Closed	Closed	YES	No
4	Open Sensor Ch1 (RTD 1)	OPEN	Closed	YES	YES
5	Open Sensor RTD 2	Closed	Closed	No	No
6	Voltage Sensor Ch 2 (Humidity)	Closed	OPEN	YES	YES
7	Voltage Sensor	Closed	Closed	No	No
8	Voltage Sensor	Closed	Closed	No	No
9	Voltage Sensor	Closed	Closed	No	No
10	Hi Temperature	OPEN	Closed	YES	YES
11	Low Temperature	OPEN	Closed	YES	YES
12	Hi Humidity	Closed	OPEN	YES	YES
13	Lo Humidity	Closed	OPEN	YES	YES
14	Internal Comm. (Bad Data)	Closed	Closed	No	No
15	Internal Comm. (Connection)	OPEN	Closed	YES	YES
16	Olympic Board Reset	Closed	Closed	YES	No

Synergy Controller Low Program Memory & Low Storage Alarms

There are two types of local storage on the Synergy Controller: Storage Card (Flash) and RAM. The Storage Card holds all the application programs, programs, and log files. RAM is used exclusively by the Operating System (OS) and Synergy Controller software. The Synergy Controller monitors both storage areas for low memory.

Low Program Memory Alarm

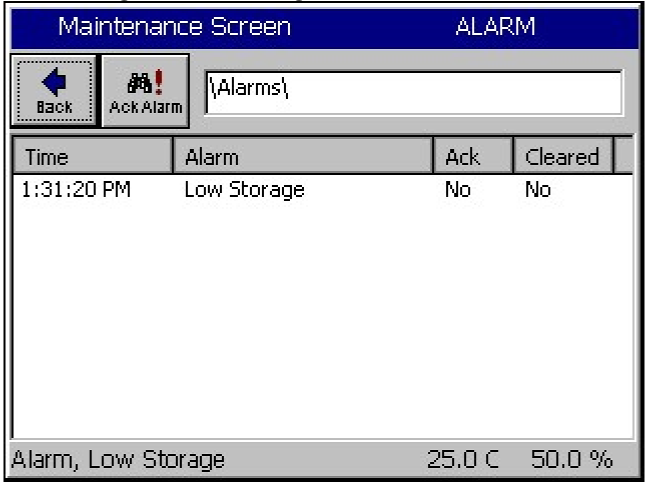
In the event that the RAM memory runs low, the Synergy Controller operating system will no longer run efficiently. If a Low Program Memory condition exists a pop up window warns "The Synergy Controller is running low on memory. Please reboot at your earliest convenience" and the Maintenance Alarm screen will display the message “Low Program Memory”. Reboot the Synergy Controller to clear this error.

Low Storage Alarm

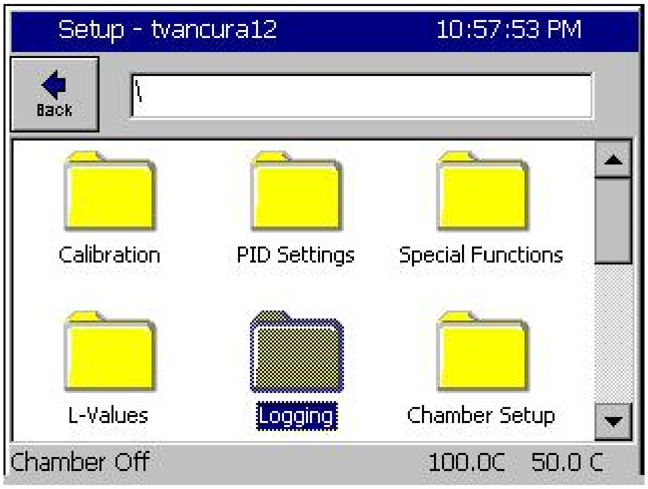
The Synergy Controller monitors the space remaining on the Storage Card Flash memory device, and generates an alarm condition when the space remaining is less than 160K. When this occurs, you can clear the log file, export screenshots or remove programs from the Storage Card to free up Storage Memory to correct this condition.

A Low Storage Alarm can occur when the log file has grown too large. When your chamber is properly setup the Synergy Controller will log until the file gets to a specified maximum size and then begin overwriting the oldest records, thus limiting it to the specified size. The maximum size specified for the log file should be less than the physical space available. Step-by-step instructions for clearing the alarm and adjusting the chamber settings to prevent this alarm from reoccurring are illustrated below.

Removing a Low Storage Alarm Condition

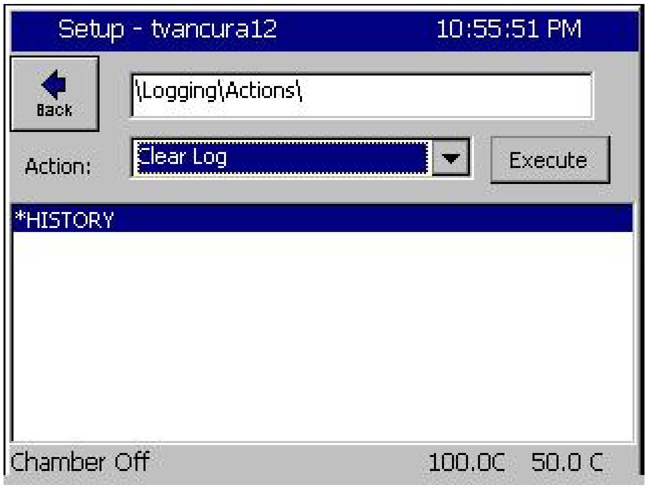


When an alarm occurs, the word “ALARM” flashes in the title bar of the Synergy Controller screen. To determine if your alarm condition is a Low Storage alarm, go to the *Maintenance\Alarms* folder and read the alarm description.



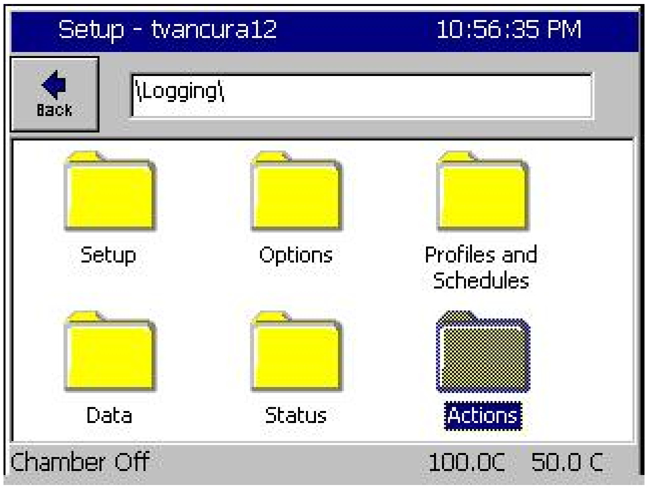
To clear the alarm condition, export the logging history data and clear the file according to the following steps:

Go to Setup Screen folder and scroll down to select the Logging folder.

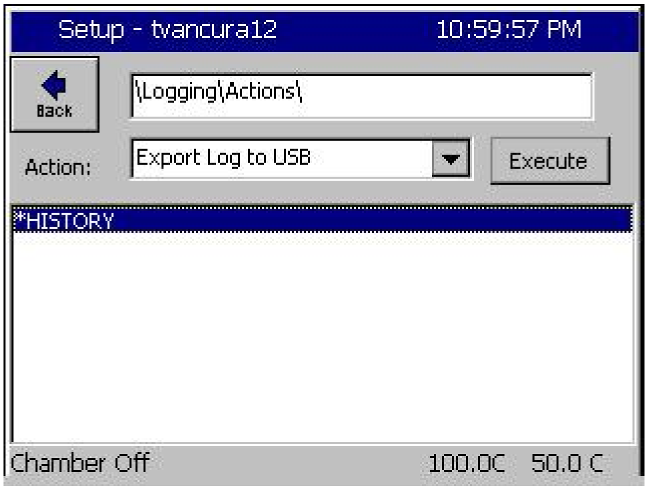


Select Export History if you would like to save the history file. This step can be skipped if you don't need the data in the log file. See Section 7.1 Maintenance: Operator Interface for more information on exporting history files.

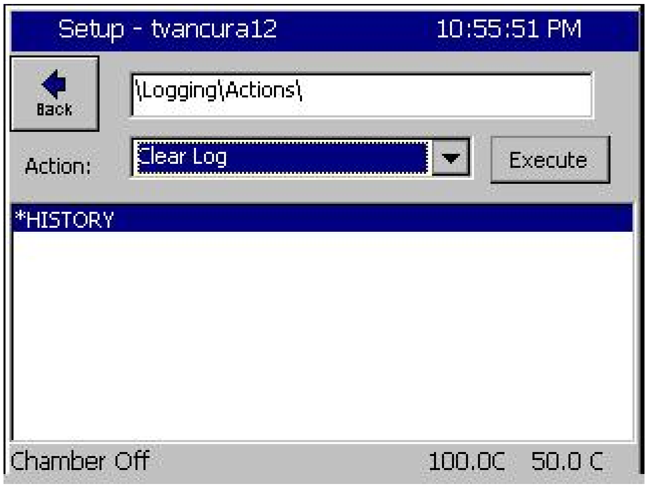
WARNING: Once deleted, logging data cannot be recovered.
Go to the Setup Screen and select the *Logging\Clear History* folder. Press the ***Clear History*** button to delete the current history file and free its space on the Storage Card. The chamber should now be free of the Low Storage alarm condition



Open the Actions Folder.



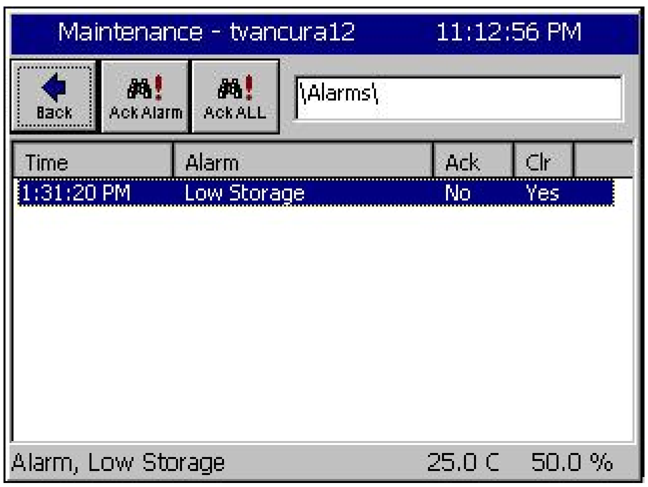
Select Export Log to USB to save the history file. This step can be skipped if you don't need the data in the log file. See Section 7.1 Maintenance: Operator Interface for more information on exporting history files.



Select Clear Log and press the Execute.

WARNING: Once deleted, logging data cannot be recovered.

The chamber should now be free of the Low Storage alarm condition

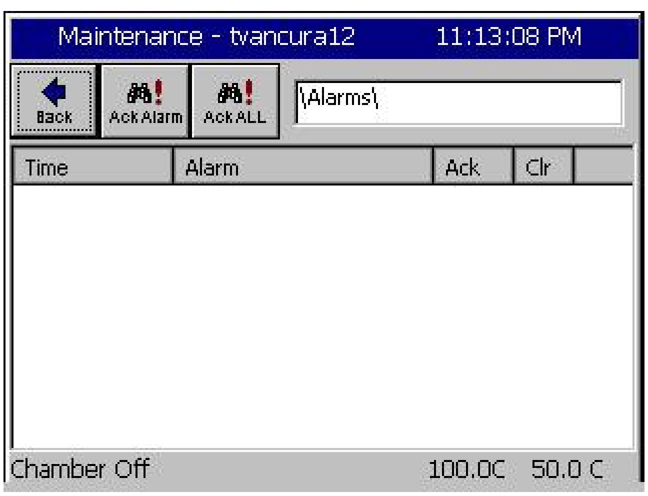


Acknowledge the Low Storage Alarm Condition.

Once you have cleared the alarm condition, you can acknowledge the alarm to remove it from the Alarms folder list.

To acknowledge the Low Storage alarm, go to the Maintenance Screen and select the Alarms folder. The Low Storage alarm should say “Yes” in the Cleared Column.

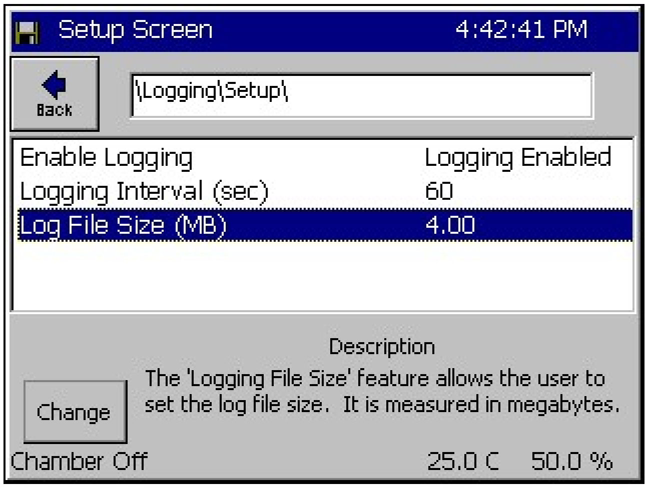
Press the ***Ack Alarm*** button. The Alarm condition is now acknowledged and cleared and is removed from the list.



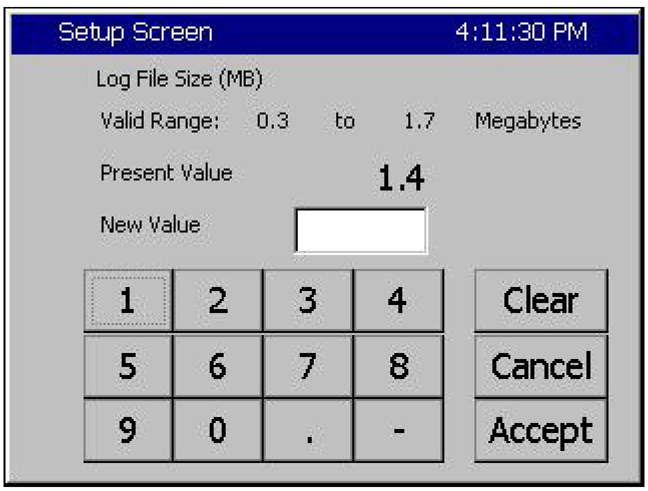
This “alarm acknowledge” procedure ensures that the user sees the alarm event before it is cleared.

Preventing the Low Storage Alarm condition

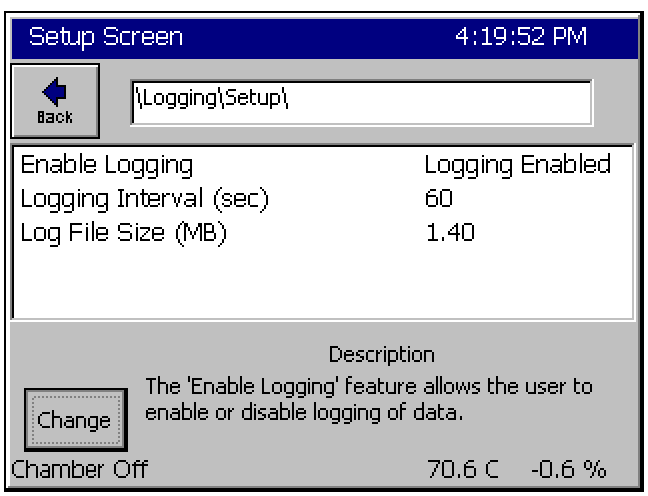
You can eliminate the recurrence of a Low Storage Alarm Condition by adjusting the Log File Size to a value less than the space available on the Synergy Controller Storage Card. Follow the steps below:



Go to the Setup screen and select the *Logging\Setup* folder. Select Log File Size and press the ***Change*** button.



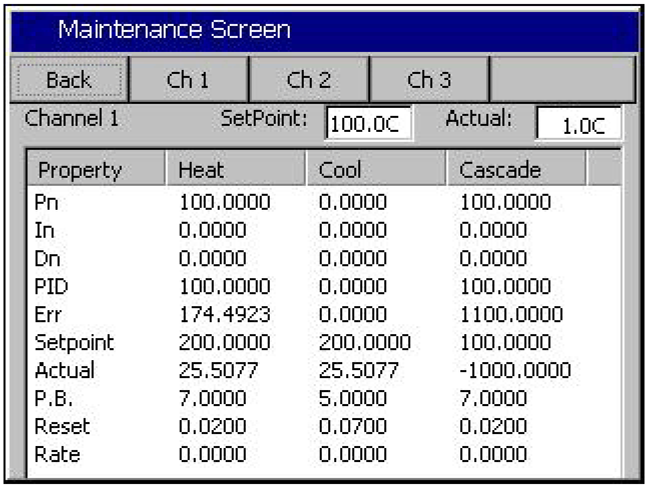
The Synergy Controller determines the upper limits of the valid range automatically. Change the Log File Size to a number below the maximum value. In this case 1.40 MB is a valid value.



The maximum Log File Size is now set to 1.40 MB. Now the chamber will not generate a Low Storage Alarm condition. If the history file reaches the Log File Size limit in the Logging Setup folder, new logging information is added to the file and the oldest data is removed in a FIFO (First In First Out) basis.

7.3 Channel PIDs

The Channel PIDs screen shows a third column when cascade mode is enabled for the channel. All columns show values for the following parameters: Pn, In, Dn, PID, Err, Setpoint, Actual, P.B., Reset and Rate.



Property	Heat	Cool	Cascade
Pn	100.0000	0.0000	100.0000
In	0.0000	0.0000	0.0000
Dn	0.0000	0.0000	0.0000
PID	100.0000	0.0000	100.0000
Err	174.4923	0.0000	1100.0000
Setpoint	200.0000	200.0000	100.0000
Actual	25.5077	25.5077	-1000.0000
P.B.	7.0000	5.0000	7.0000
Reset	0.0200	0.0700	0.0200
Rate	0.0000	0.0000	0.0000

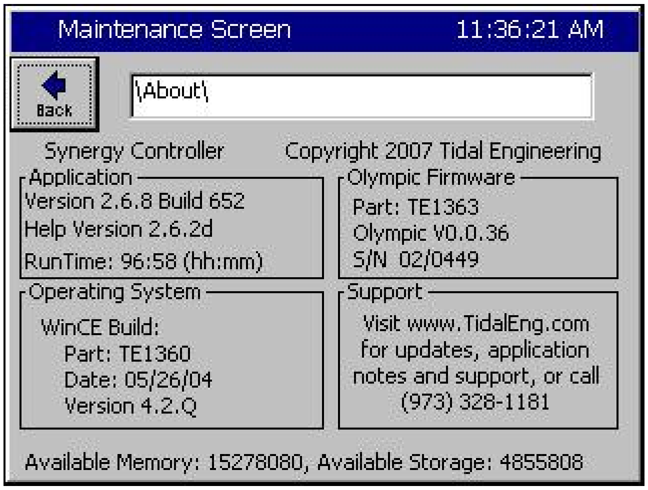
The Setpoint and Actual numbers in the cascade column are the desired setpoint, and actual temperature of the product inside the chamber.

- Setpoint & Actual values under Heating and Cooling is air temperature.
- Setpoint value under Heating and Cooling is the calculated air temperature setpoint from the Cascade PID loop.
- Cascade PID parameters: Pn, In, Dn, PID values range from -100 to +100%.

  Note: -100% corresponds to the Cascade Low Limit temperature
  Note: +100% corresponds to the Cascade High Limit temperature

The values in the Heating & Cooling columns range from 0 to 100%See Section 6.11 Setup: Logging for information on Data Logging Capacity calculations.

7.4 About Screen



<u>About</u>

This screen displays information regarding the versions of the software, firmware and hardware on your Synergy Controller.

The Application frame displays the Synergy Controller software version. Synergy Controller owners can periodically check with Tidal Engineering for software upgrades. The Help Version refers to the context sensitive help available from the touch panel.

The Operating System frame contains Tidal Engineering's part number, build date and version number of the Windows Embedded Compact operating system running on the controller.

The Olympic Firmware frame identifies the serial number of the controller. The serial number is in the format "xx/YYWW"; for example 02/0105. The Tidal Engineering part number for the Olympic Board firmware is also displayed. The Olympic board is the Synergy Controller's Input/Output processor board. It acquires analog and digital inputs and controls the outputs that drive the chamber components. The Serial Number on the Olympic Board is required for technical support and for software registration keys that enable the Web Server, Cascade and Pressure Control and Printing features.

The support frame contains contact information. Tidal Engineering Corporation designs and manufactures the Synergy Controller. Contact Tidal Engineering for technical support.

Memory capacity and usage is shown at the bottom of the About Screen. If the available memory is low the Synergy Controller will generate an alarm. Low memory issues are uncommon and can usually be resolved by rebooting the Synergy Controller. Available Storage is the space available on the Storage Card for logging.

7.5 File Utilities

Tidal Engineering periodically releases software upgrades for the Synergy Controller's operating system and application. These upgrades are available from Tidal Engineering (www.tidaleng.com).

This section describes procedures for upgrading the Synergy Controller's software.

7.5.1 Software Upgrade Procedures

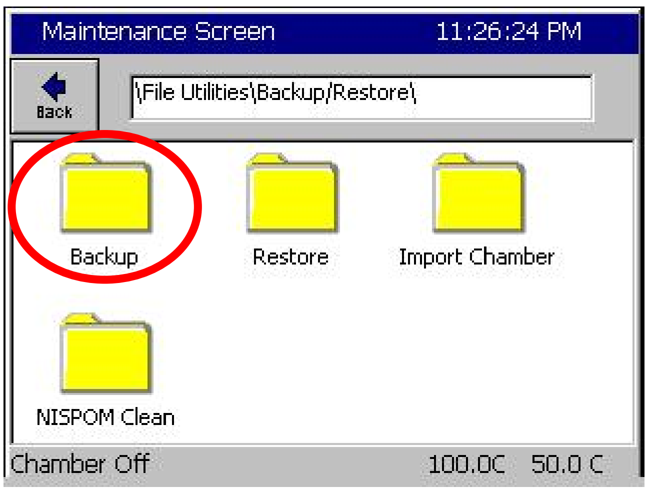
The Synergy Micro 2 upgrade is delivered in a compressed format and is installed using a USB Flash Disk.

The delivered file name contains the Version and Build number.
For example: SYNERGY_MICRO_2_VERSION_3_0_7_Build_893u is version 3.0.7 Build 893u.

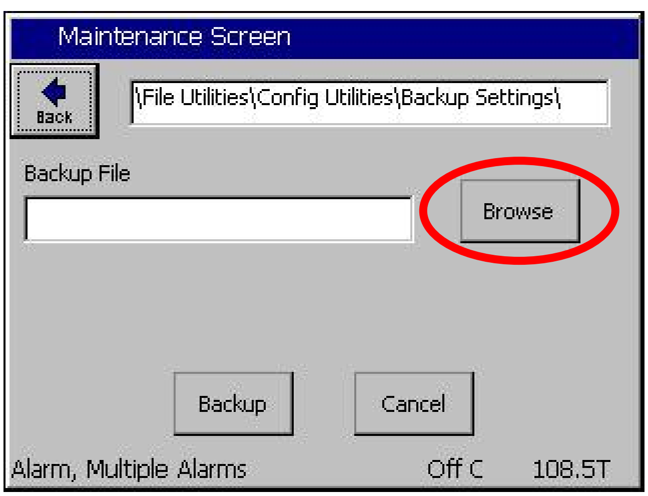
The Synergy Controller Configuration Backup and Restore features should be used to backup settings before performing the upgrade. In addition, you may want to manually record your Cascade and Web Server registration keys, if your chamber employs those features, as well as the Chamber Type so these can be restored after the installation.

To install the upgrade:
1. Backup settings and record registrations and chamber configuration.
2. Install the new software.
3. Load chamber configuration and restore non-standard settings and registration keys.

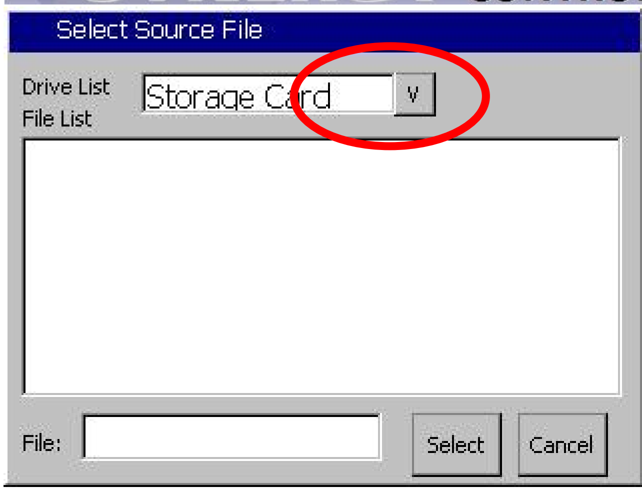
Step 1. Backup Settings



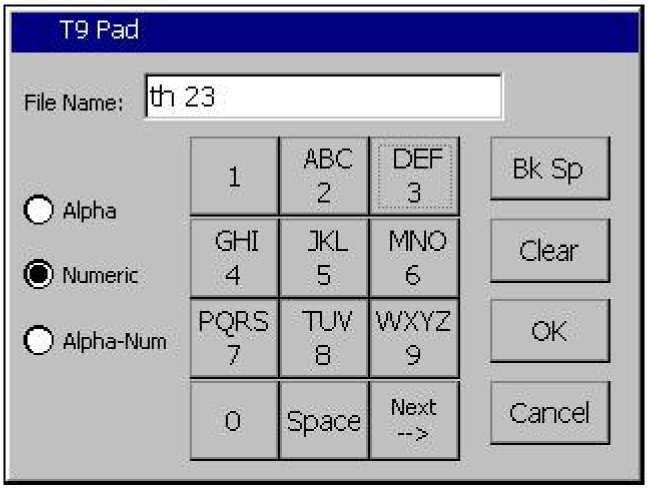
Browse to the Maintenance Screen **\File Utilities\Config Utilities** folder and open the **Backup Settings Folder**.



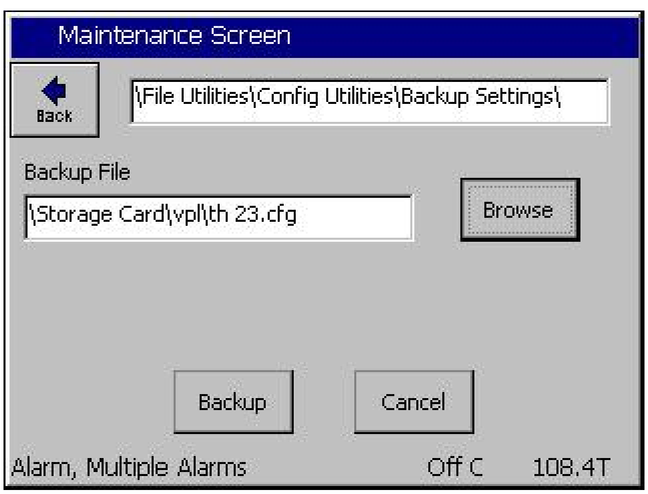
From the Maintenance Screen **\File Utilities\Config Utilities\Backup Settings** folder Press the **Browse** button.



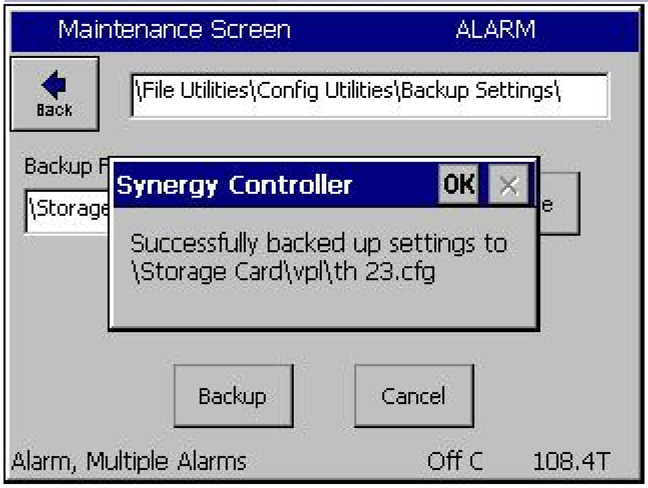
Then select either the Storage Card or the USB Hard Disk from the Drive List and. Then press the **File:** Text Box



Enter the File Name using the T9 Pad. Then press **OK**.



Confirm the file name that appears in the **Backup File** text box and then press Backup.

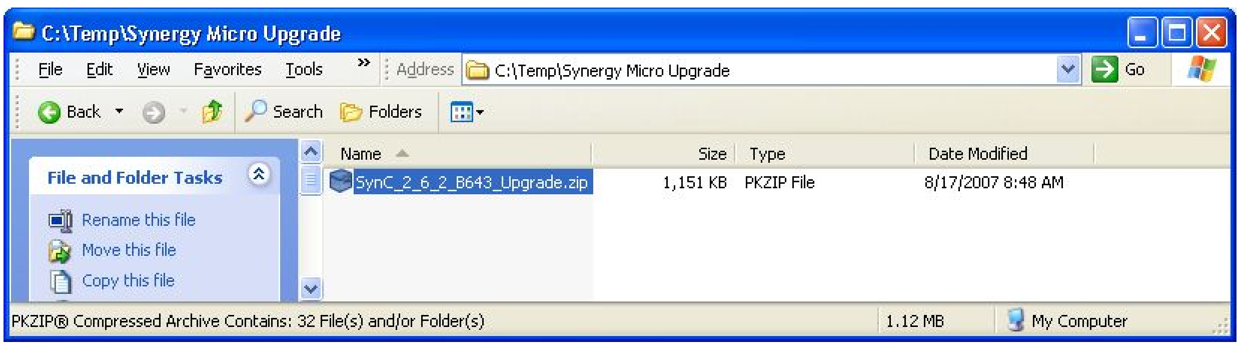


The controller will confirm that the settings were backed up successfully as shown at the left.

Acknowledge the window by pressing ***OK***.

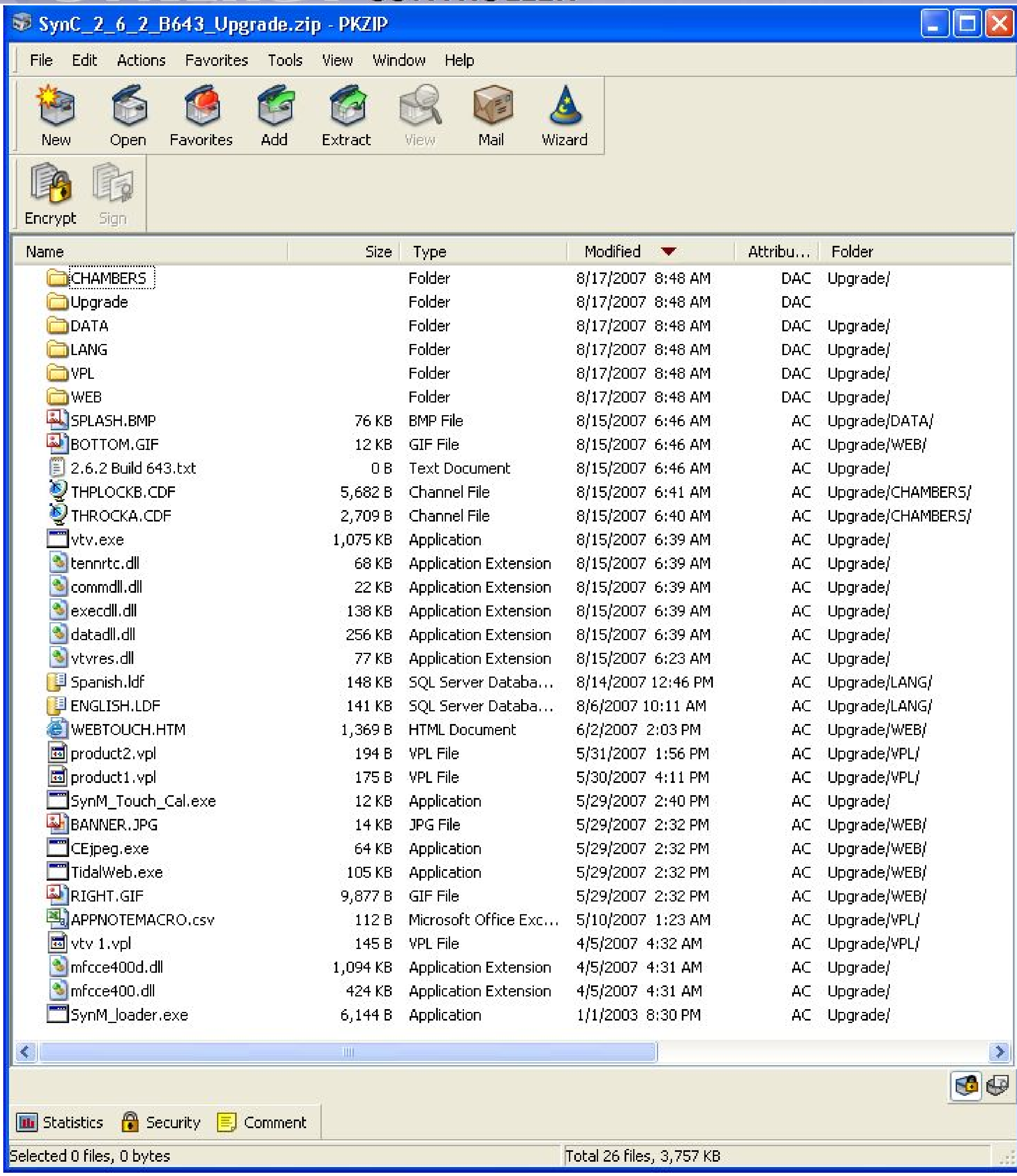
Step 2. Install the New Software

Copy the zip file to a temporary directory on your PC.

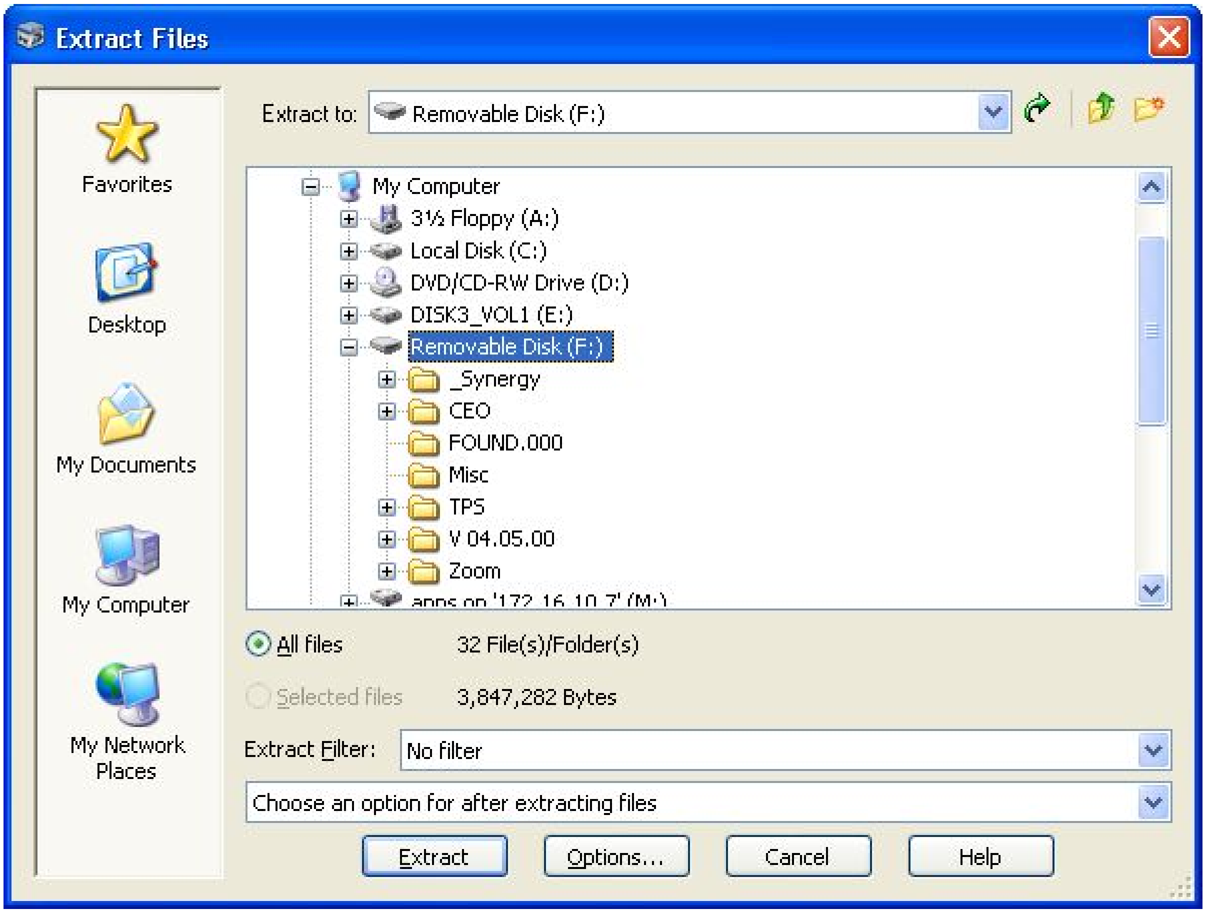


Place a USB Flash Disk key in the USB port on your PC.

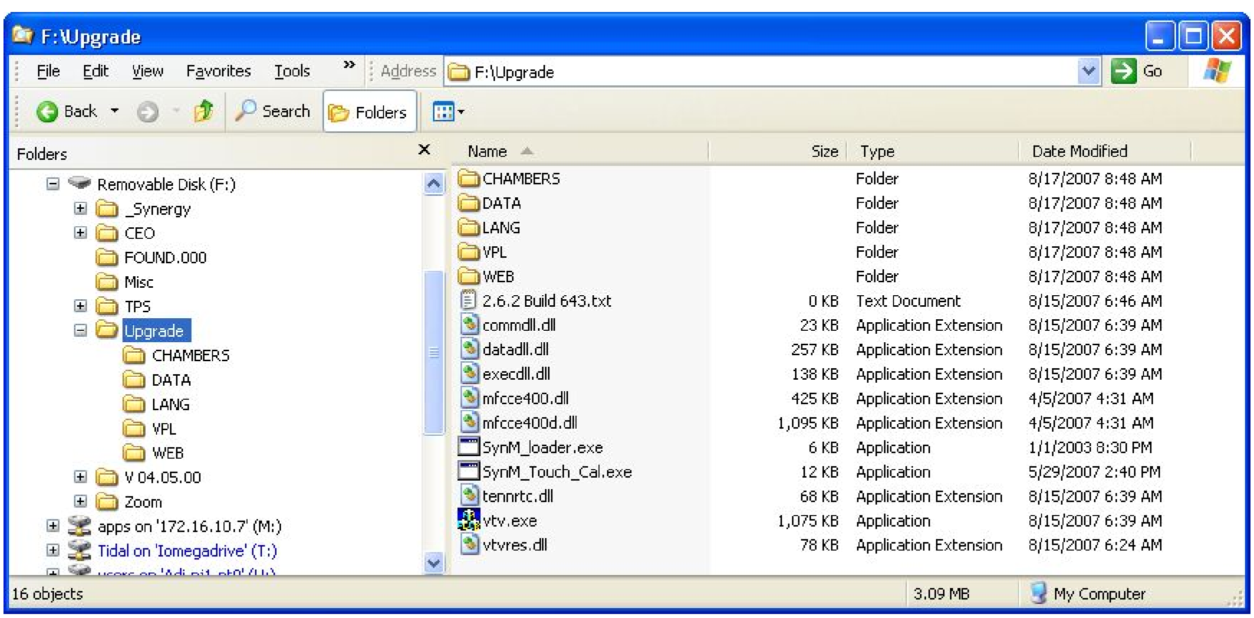
Double click the zip file (note that your screen may look different than the screen below if you have a different zip program installed on your PC)

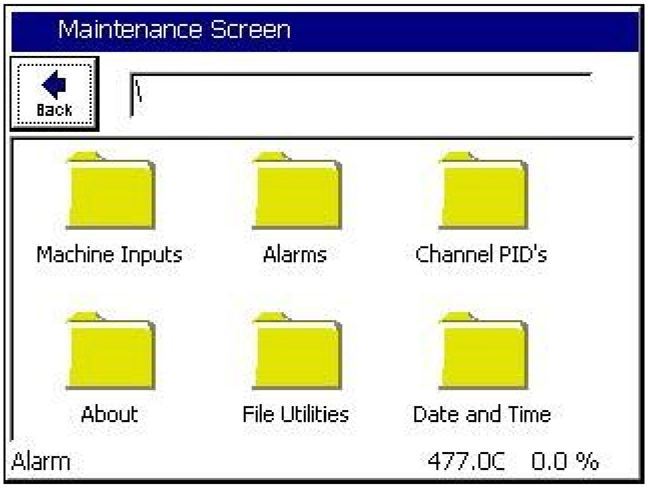

SynC_2_6_2_B643_Upgrade.zip - PKZIP
File Edit Actions Favorites Tools View Window Help
New Open Favorites Add Extract View Mail Wizard
Encrypt Sign
Name Size Type Modified Attribu... Folder
CHAMBERS Folder 8/17/2007 8:48 AM DAC Upgrade/
Upgrade Folder 8/17/2007 8:48 AM DAC
DATA Folder 8/17/2007 8:48 AM DAC Upgrade/
LANG Folder 8/17/2007 8:48 AM DAC Upgrade/
VPL Folder 8/17/2007 8:48 AM DAC Upgrade/
WEB Folder 8/17/2007 8:48 AM DAC Upgrade/
SPLASH.BMP 76 KB BMP File 8/15/2007 6:46 AM AC Upgrade/DATA/
BOTTOM.GIF 12 KB GIF File 8/15/2007 6:46 AM AC Upgrade/WEB/
2.6.2 Build 643.txt 0 B Text Document 8/15/2007 6:46 AM AC Upgrade/
THPLOCKB.CDF 5,682 B Channel File 8/15/2007 6:41 AM AC Upgrade/CHAMBERS/
THROCKA.CDF 2,709 B Channel File 8/15/2007 6:40 AM AC Upgrade/CHAMBERS/
vtv.exe 1,075 KB Application 8/15/2007 6:39 AM AC Upgrade/
tennrtc.dll 68 KB Application Extension 8/15/2007 6:39 AM AC Upgrade/
commdll.dll 22 KB Application Extension 8/15/2007 6:39 AM AC Upgrade/
execdll.dll 138 KB Application Extension 8/15/2007 6:39 AM AC Upgrade/
datadll.dll 256 KB Application Extension 8/15/2007 6:39 AM AC Upgrade/
vtvres.dll 77 KB Application Extension 8/15/2007 6:23 AM AC Upgrade/
Spanish.ldf 148 KB SQL Server Databa... 8/14/2007 12:46 PM AC Upgrade/LANG/
ENGLISH.LDF 141 KB SQL Server Databa... 8/6/2007 10:11 AM AC Upgrade/LANG/
WEBTOUCH.HTM 1,369 B HTML Document 6/2/2007 2:03 PM AC Upgrade/WEB/
product2.vpl 194 B VPL File 5/31/2007 1:56 PM AC Upgrade/VPL/
product1.vpl 175 B VPL File 5/30/2007 4:11 PM AC Upgrade/VPL/
SynM_Touch_Cal.exe 12 KB Application 5/29/2007 2:40 PM AC Upgrade/
BANNER.JPG 14 KB JPG File 5/29/2007 2:32 PM AC Upgrade/WEB/
CEjpeg.exe 64 KB Application 5/29/2007 2:32 PM AC Upgrade/WEB/
TidalWeb.exe 105 KB Application 5/29/2007 2:32 PM AC Upgrade/WEB/
RIGHT.GIF 9,877 B GIF File 5/29/2007 2:32 PM AC Upgrade/WEB/
APPNOTEMACRO.csv 112 B Microsoft Office Exc... 5/10/2007 1:23 AM AC Upgrade/VPL/
vtv 1.vpl 145 B VPL File 4/5/2007 4:32 AM AC Upgrade/VPL/
mfcce400d.dll 1,094 KB Application Extension 4/5/2007 4:31 AM AC Upgrade/
mfcce400.dll 424 KB Application Extension 4/5/2007 4:31 AM AC Upgrade/
SynM_loader.exe 6,144 B Application 1/1/2003 8:30 PM AC Upgrade/
Statistics Security Comment
Selected 0 files, 0 bytes
Total 26 files, 3,757 KB

Select ***Extract Files*** and browse to the USB Flash Disk on your PC as shown below. In this example the drive is named **"Removable Disk (F:)"**

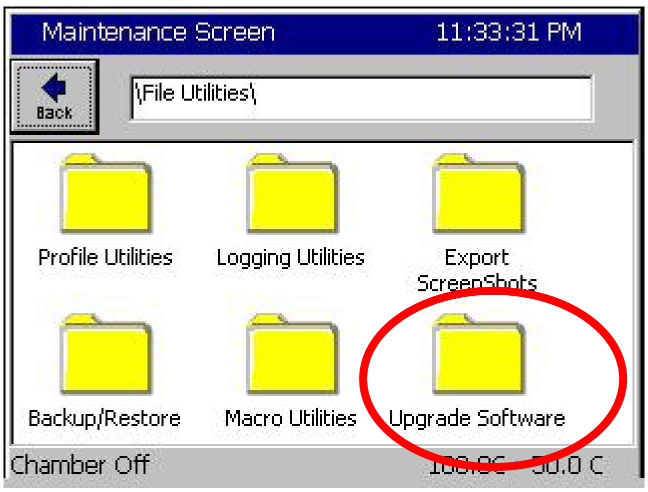


After the files are extracted you will see the Upgrade directory on your USB key as shown below.

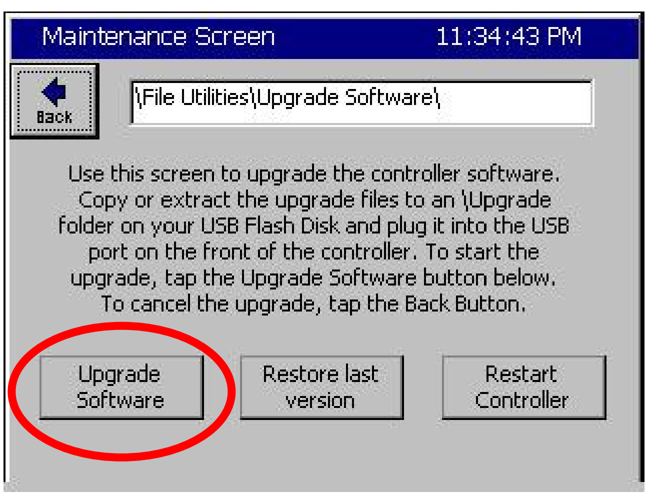




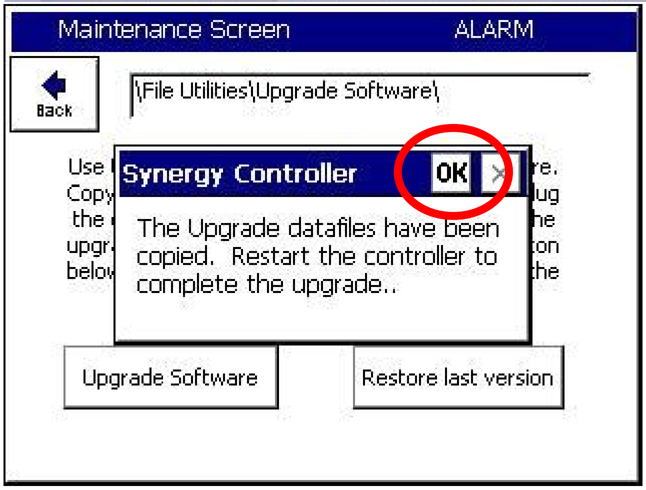
Place the USB Flash disk in the Synergy Micro’s USB port and browse to the **Maintenance Screen**.



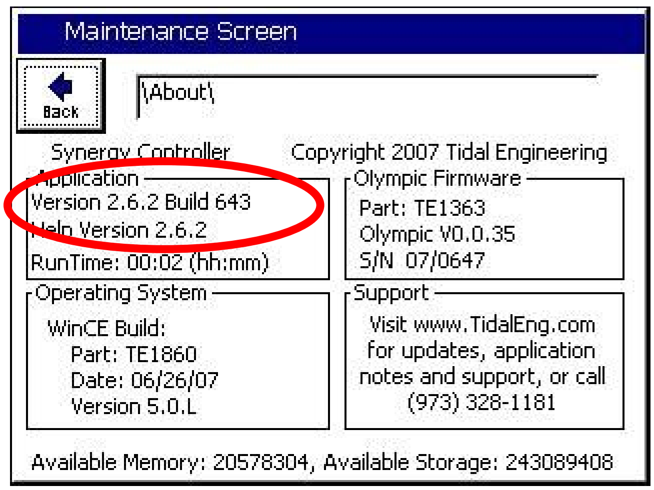
Open the **File Utilities** Folder and press the **Upgrade Software** folder.



Make sure the USB Flash Disk is in the Controller's USB port and press the **Upgrade Software** button. It may take a minute or more to copy the files and then a message box will appear to tell you to **Restart the controller to complete the upgrade**.



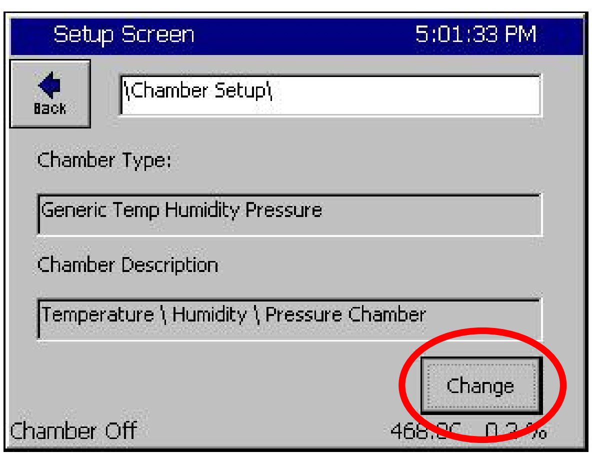
Press the ***OK*** box and restart the controller.



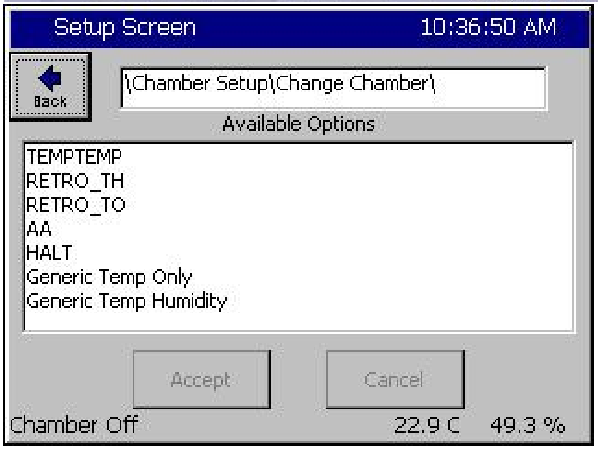
Go to the **Maintenance Screen** and open the **About** folder to verify the appropriate Version number as shown at left.

Step 3. Configure the Controller

When the chamber restarts, the controller may indicate that the current chamber type differs from the last chamber type. Press ***OK*** to acknowledge the message. The Dialog will ask if you would like to discard the old settings and load the current settings. Answer YES here as well



Then Go to the Setup Screen and open the Chamber Setup Folder. Press ***Change*** and select the Chamber Option from the list.

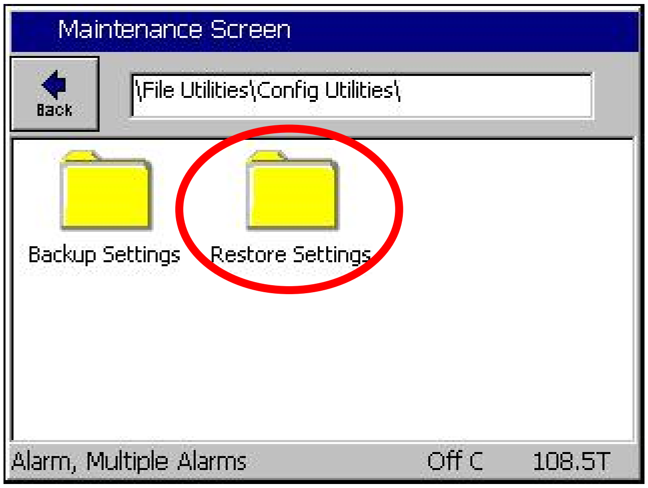


Then press ***Accept.***

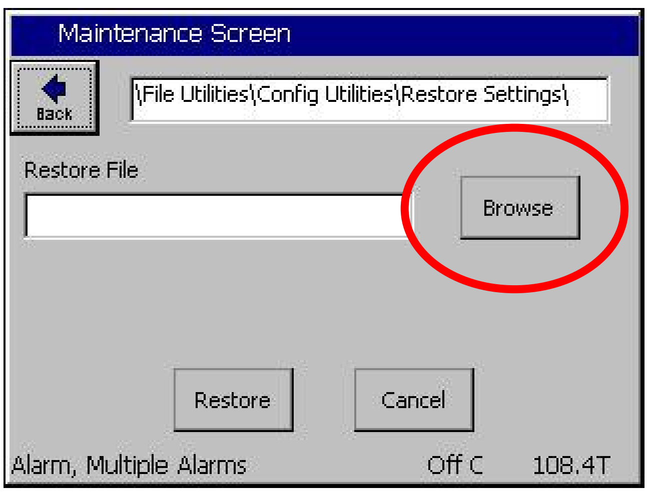
Next, Reset the Controller or Cycle power. When the chamber restarts, the controller will indicate that the current chamber type differs from the last chamber type. This is OK. Press OK to acknowledge that message. You will then be asked if you would like to discard the old settings and load the current settings. Press YES on this window

Restore Settings

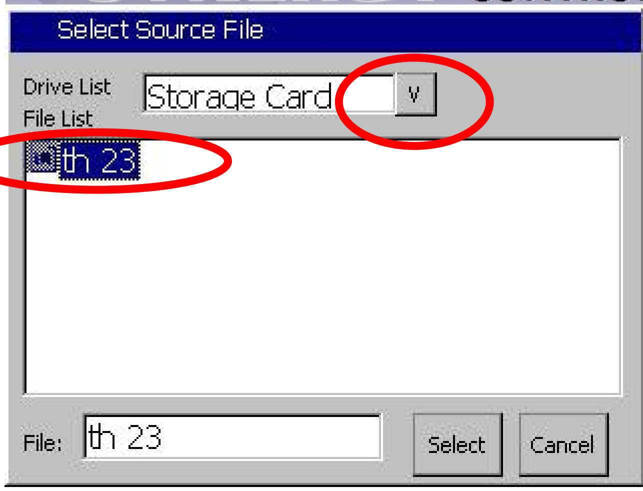
In this section we will restore the settings from the backup.



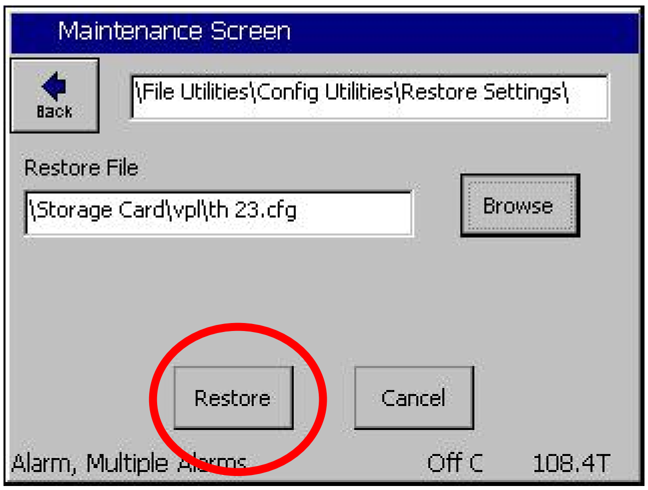
Browse to the Maintenance Screen **\File Utilities\Config Utilities** folder and open the Backup Settings Folder. Then press the Restore Settings Folder.



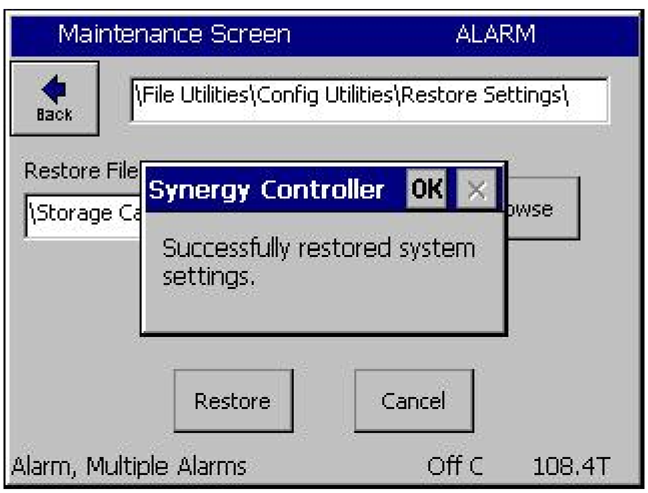
Press the Browse button.



Then select either the Storage Card or the USB Hard Disk from the Drive List. Then select the appropriate file from the list and press Select.



Confirm the File Name that appears in the Restore File text box and then press ***Restore***.



The Controller will confirm that the settings were restored.

Next, enter registration keys recorded earlier.

The Synergy Micro 2 application upgrade is now complete.

Synergy Controller Setting List

Description	Command	Value
Chamber Configuration		
Registration Keys (optional)		
Web Server Registration Key		
Cascade Registration Key		
Pressure Registration Key		
Note: These alphanumeric keys were provided if you purchased these features. If you do not have them, they are available from your service representative.		
Communications (optional)		
RS-485		
RS-485 Mode		
Station Address		
Number of UUTs		
Note: These RS-485 settings are important for UUT Thermocouple Modules.		
IEEE-488		
IEEE 488 Address		
Ethernet		
IP Address Selection		
Ethernet Address		
Ethernet Subnet Mask		
Ethernet Gateway		
Web Server		
Web Server On/Off		
Web Server Login Name		
Web Server Password		
Web Server Address		
TCP/IP Server		
TCP/IP Server On/Off		

Note: Record the settings listed in the table above including your Cascade and Web Server registration keys (if your chamber employs those features) and the Chamber Type before installing your new software. These settings aren't restored by the Config. Restore utility.

Synergy Controller Settings List

Description	Command	Value
Calibration		
Channel 1		
Ch1 Calibration	CAL1	
Ch1 Alarm Low Limit	A1L	
Ch1 Alarm High Limit	A1H	
Channel 2		
Ch2 Calibration	CAL2	
Ch2 Alarm Low Limit	A2L	
Ch2 Alarm High Limit	A2H	
Altitude	ALT	
Guaranteed Soak	GS	
PID Values		
Channel 1		
Proportional Band, Ch1 Heating	PB1H	
Reset, Ch1 Heating	RS1H	
Rate, Ch1 Heating	RT1H	
Cycle Time, Ch1 Heating	CT1H	
Rate Band, Ch1 Heating	RB1H	
Dead Band, Ch1	DB1	
Proportional Band, Ch1 Cooling	PB1C	
Reset, Ch1 Cooling	RS1C	
Rate, Ch1 Cooling	RT1C	
Cycle Time, Ch1 Cooling	CT1C	
Rate Band, Ch1 Cooling	RB1C	
Channel 2		
Proportional Band, Ch2 Heating	PB2H	
Reset, Ch2 Heating	RS2H	
Rate, Ch2 Heating	RT2H	
Cycle Time, Ch2 Heating	CT2H	
Rate Band, Ch2 Heating	RB2H	
Dead Band, Ch2	DB2	
Proportional Band, Ch2 Cooling	PB2C	
Reset, Ch2 Cooling	RS2C	
Rate, Ch2 Cooling	RT2C	
Cycle Time, Ch2 Cooling	CT2C	
Rate Band, Ch2 Cooling	RB2C	

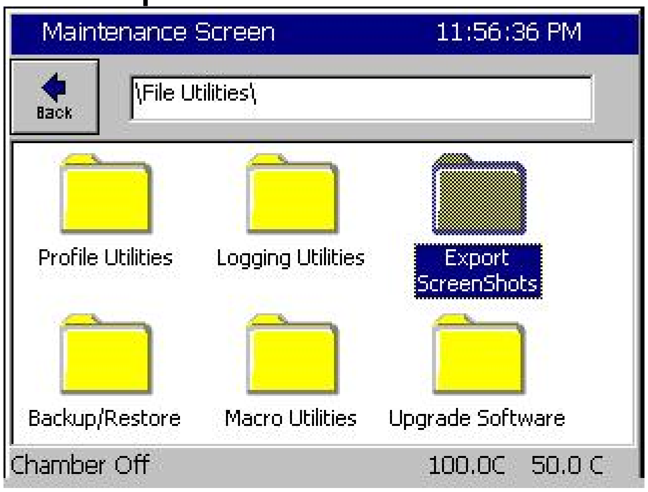
Synergy Controller Setting List - Continued

Description	Command	Value
PID Values (cont)		
Cascade		
Cascade CH1 Enabled	CAS1_ENABLED	
Channel 1 Cascade Sensor	CSS1	
CH 1 Cascade High Limit	C1HL	
CH 1 Cascade Low Limit	C1LL	
CH1 Cascade Prop. Band	CPB1H	
CH1 Cascade Reset	CRS1H	
CH1 Cascade Rate	CRT1H	
CH1 Cascade Rate Band	CRB1H	
L-Values		
1L1 Ch1 Main Cooling Turn-On	1L1	
1L2 Ch1 Main Cooling Turn-Off	1L2	
1L3 Ch1 Setpoint Transfer Setting	1L3	
1CTY Ch1 Chamber Type	1CTY	
2L1 Ch2 Main Cooling Turn-On	2L1	
2L2 Ch2 Main Cooling Turn-Off	2L2	
2L3 Ch2 Setpoint Transfer Setting	2L3	
2CTY Ch2 Chamber Type	2CTY	
L3 Ch1 Main Cooling Turn-On	L3	
L4 Ch1 Main Cooling Turn-Off	L4	
L6 Ch1 Full Cooling Switch Over	L6	
L7 Ambient Cooling Turn-On	L7	
L8 Heat Ambient Cooling Turn-Off	L8	
L9 Ramp-Up Cooling	L9	
L11 Dehumidify / Vent On	L11	
L12 Dehumidify / Vent Off	L12	
L14 Time Delay Boost Cool	L14	
L15 Compressor Turn-Off Delay	L15	
LEV1	LEV1	

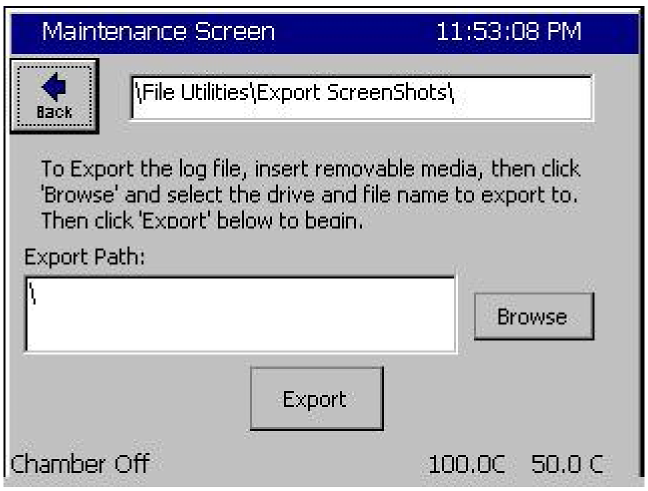
Synergy Controller Settings List - Continued

Description	Command	Value
Special Functions		
Celsius / Fahrenheit	CF	
Output 11 Control Type	OT11	
Output 17 Control Type	OT17	
Output 18 Control Type	OT18	
Ch1 Low Range	R1L	
Ch1 High Range	R1H	
Ch2 Low Range	R2L	
Ch2 High Range	R2H	
Ch 1 RTD Type	RTD	
Vaisala Compensation Enabled	VCMP	
Analog Retransmit 1	OUT_420_1	
Analog Retransmit 2	OUT_420_2	
Registration Keys (optional)		
Web Server Registration Key		
Cascade Registration Key		
Pressure Registration Key		
*Note: These alphanumeric keys were provided if you purchased these features. If you do not have them, they are available from your service representative.		
Communications (optional)		
RS-485		
RS-485 Mode		
Station Address		
Number of UUTs		
*Note: The RS-485 settings are important for UUUT Thermocouple Modules.		
IEEE-488		
IEEE 488 Address		
Ethernet		
IP Address Selection		
Ethernet Address		
Ethernet Subnet Mask		
Ethernet Gateway		
Web Server		
Web Server On/Off		
Web Server Login Name		
Web Server Password		
Web Server Address		
TCP/IP Server		
TCP/IP Server On/Off		

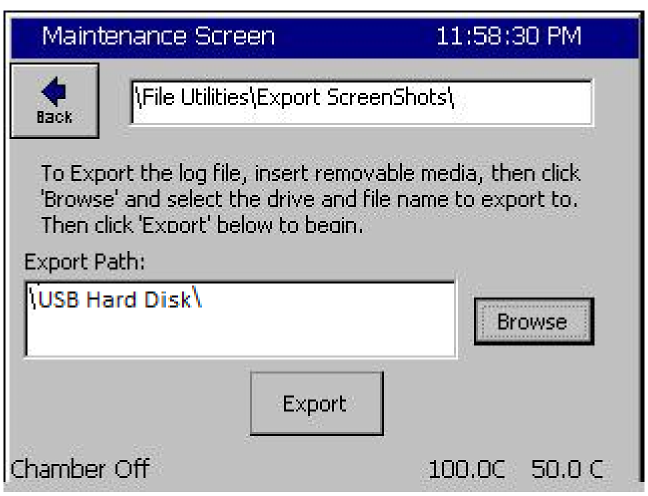
7.5.2 Export Screenshots



Select the Export Screenshots folder.



Tap Browse.



Select the USB Flash Disk and tap Export.

7.5.3 Logging

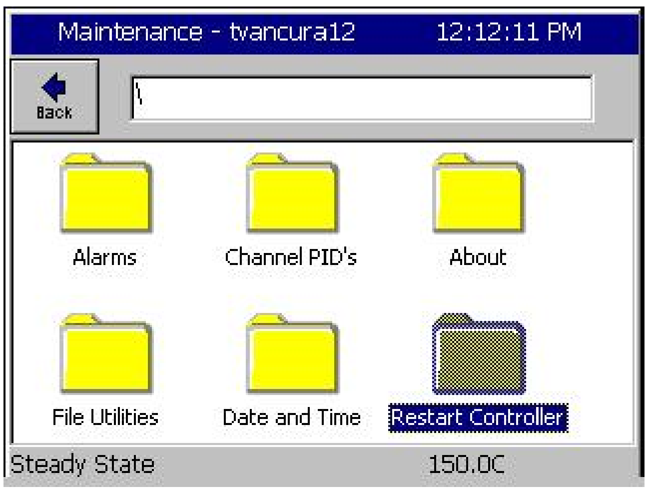
See Logging features in Section 6.0 Setup.

7.6 Date and Time

Date and Time

Adjust the date and time and press the ***Apply*** button.

7.7 Restart



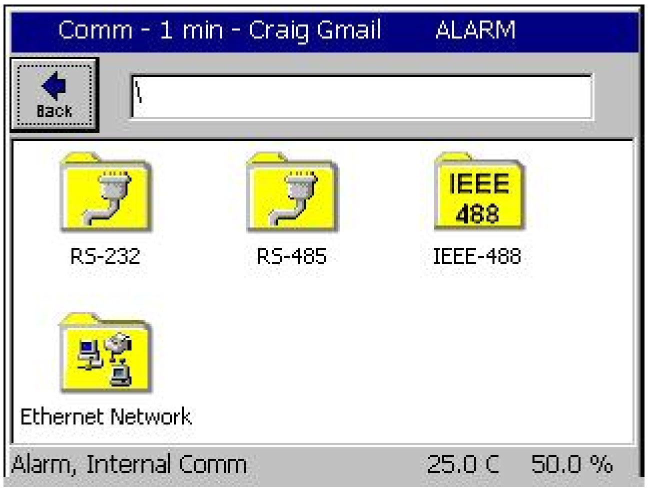
Restart Controller

It is necessary to restart the controller during some chamber setup procedures. This can be done by cycling power to the controller or by using the Restart button in the Maintenance screen as shown on the left.

8.0 COMM SCREEN

The Synergy Controller supports an extensive command that can be used to control and monitor the chamber. For Example, to query the temperature of the chamber, send the query "? C1". The chamber will respond with "25.0 C". To view the complete Synergy Controller's command set go to Appendix A Synergy Controller Communications Command Set.

8.1 Communications Folder

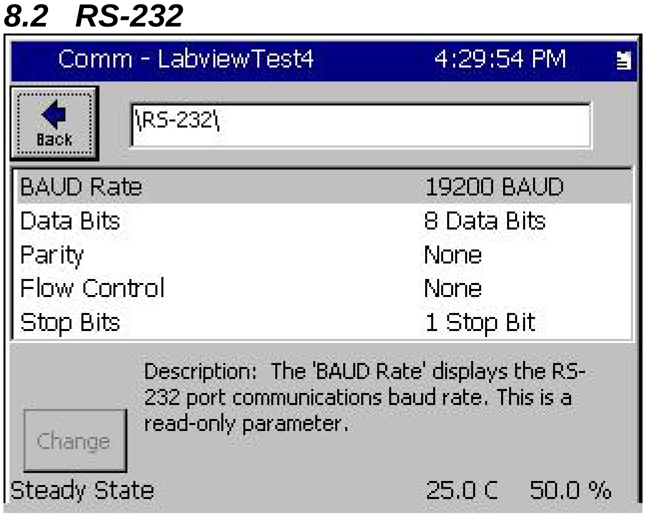


<u>Communications Folder</u>

Select the following communication functions.

- RS - 232
- RS - 485
- IEEE - 488
- Ethernet Network

8.2 RS-232

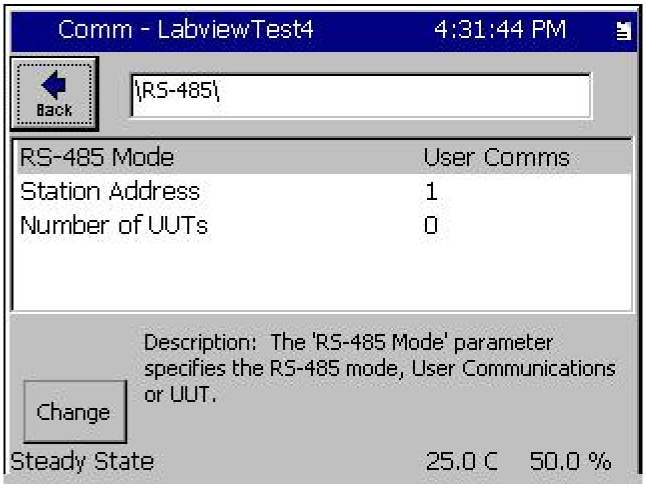


<u>RS - 232</u>

RS-232 communications are standard on all Synergy Controller configurations. The settings shown at left are read only and cannot be changed.

The RS–232 port may be used with third party test and measurement software such as LabVIEW, Tidal Engineering's Synergy Manager or Tidal Engineering's SimpleComm. The Synergy Manager PC based monitor and control software and SimpleComm are discussed in Section 17.4 Communications: Software Applications.

8.3 RS-485

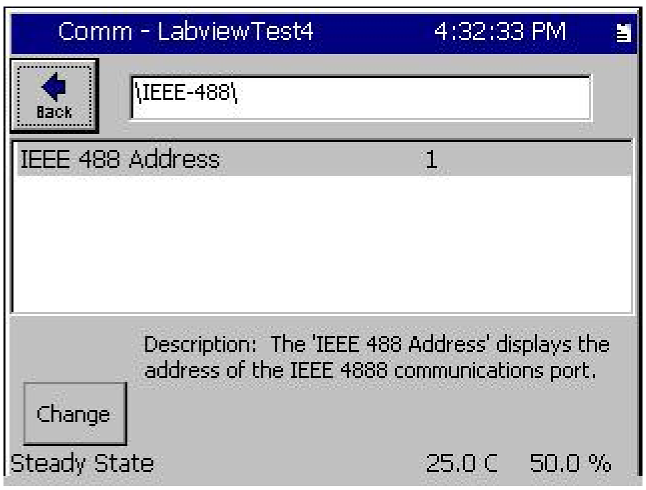


RS – 485

When the RS-485 Mode is set to User Comms the RS – 485 port may be used with third party test and measurement software such as LabVIEW, Tidal Engineering's Synergy Manager or Tidal Engineering's SimpleComm.

When the RS-485 Mode is set to UUT sensors, the RS-485 port monitors Synergy UUT thermocouple modules. UUT Modules are discussed in detail in Section 14.4 UUT Module.

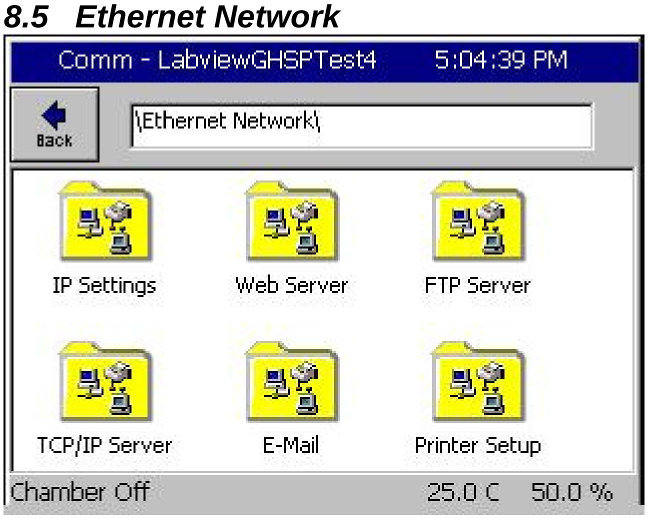
8.4 IEEE 488 / GPIB



IEEE 488/ GPIB

The IEEE 488 port may be used with third party test and measurement software such as LabVIEW, Tidal Engineering's Synergy Manager or Tidal Engineering's SimpleComm.

8.5 Ethernet Network



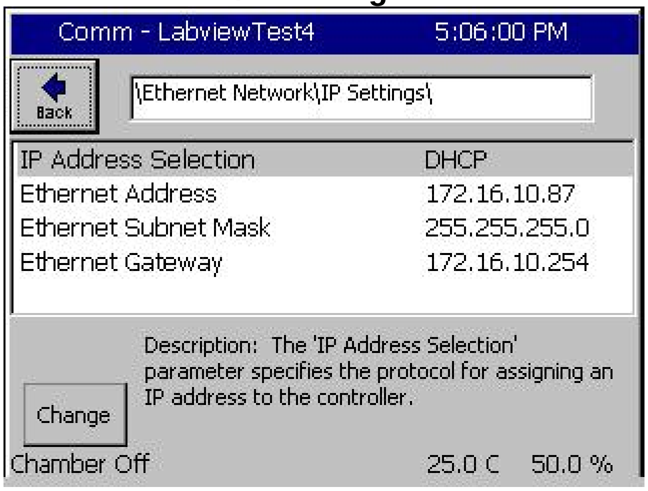
Ethernet Network

The Ethernet Network interface support s a number of powerful communications tools.

- WebTouch Remote™ Web Server
- FTP Server
- E-mail
- Network Printing

In addition, the Ethernet Network interface may be used with third party test and measurement software such as LabVIEW, Tidal Engineering's Synergy Manager or Tidal Engineering's SimpleComm. The Synergy Manager PC based monitor and control software and SimpleComm are discussed in Section 17 Communications: Software Applications.

8.5.1 Ethernet\IP Settings



Ethernet

These Ethernet settings are used to connect to the chamber over your local network LAN, or the Internet.

Set the IP Address Selection to DHCP if your network uses a DHCP server to dynamically assign IP Addresses. If your network does not have a DHCP server or you want to manually set the IP Address of your controller, set the IP Address Selection setting to Static IP. Then enter the Ethernet Address, Subnet Mask and Gateway addresses. You network administrator should be able to provide you with these addresses.

Note: The numbers shown at left are examples and may not work on your network.

8.5.2 WebTouch Remote ™

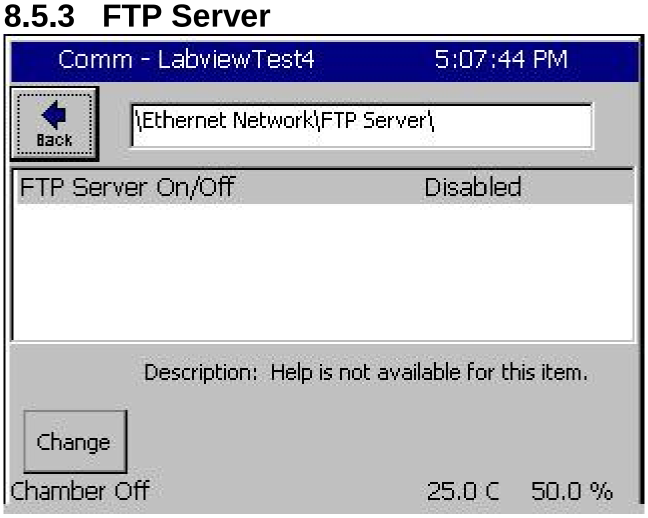
Web Server

The web server allows you to remotely control, monitor and run diagnostics on chambers over the web using Microsoft's Internet Explorer web browser.

See the following section Synergy Controller Web Server for more information on communicating over the Web. See Section 8.3 Communications: Software Applications. For more information on communication over Ethernet - TCP/IP.

Note: The numbers shown are examples only.

8.5.3 FTP Server

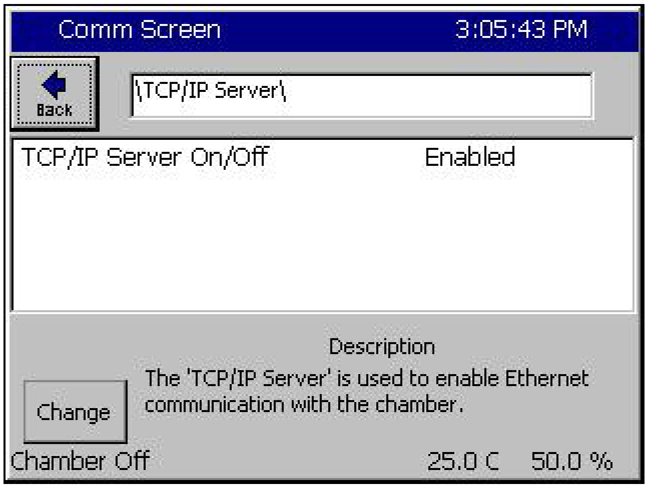


FTP Server

This parameter controls the Synergy Controller's FTP server. With the FTP server, chamber profiles AKA recipes (VPL files) can be copied to and from the controller, deleted from the controller or renamed, thru a Local Area Network (LAN). In addition the history log file can be retrieved from the controller.

AppNote 45 - Using the Synergy Controller's FTP server.

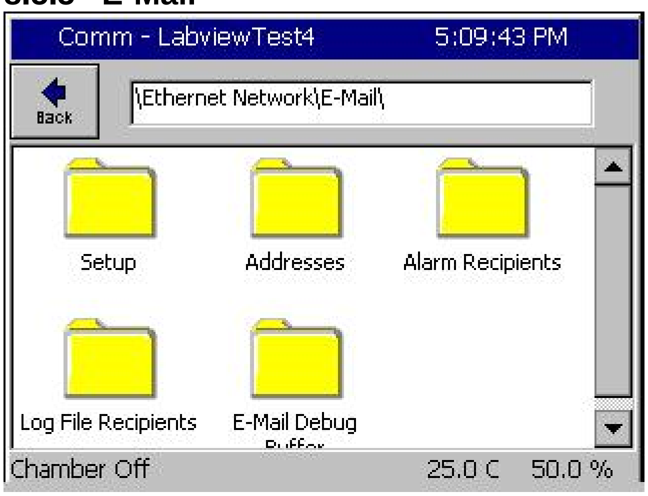
8.5.4 TCP/IP Server



TCP / IP Server

The TCP/IP Server supports remote control over TCP/IP using a simple terminal emulator such as HyperTerminal or the Synergy Controller's Synergy Manager software.

8.5.5 E-Mail

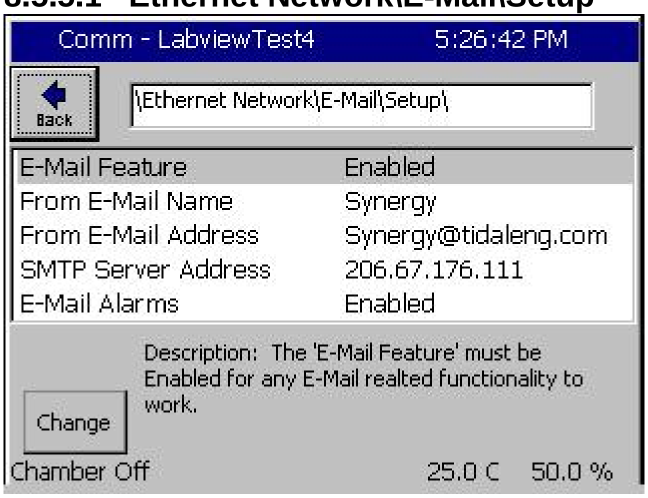


E-Mail

The Synergy Controller's e-mail feature sends alarm, test results plots, and log file e-mails automatically to desktop computers and mobile phones and tablets.
E-Mail is supported on the software application Version 3.0.7 Build 893B and newer.
Contact the Tidal Engineering if you are interested in a software upgrade.

This Synergy Controller application note Describes these e-mail features and provides instructions and examples for setup.
AppNote 84 - Synergy Controller E-Mail Feature

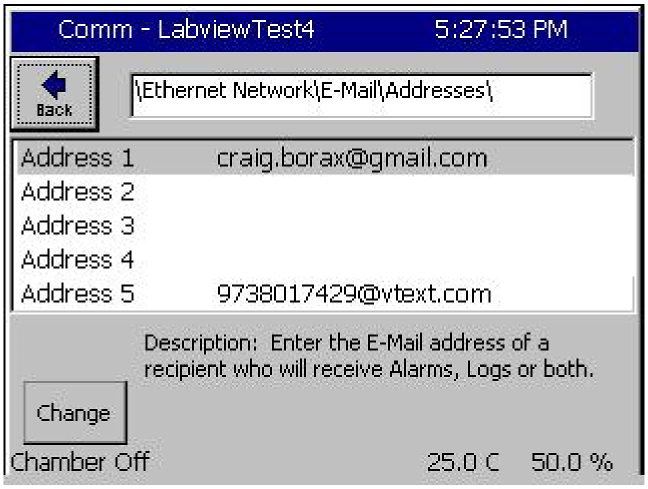
8.5.5.1 Ethernet Network\E-Mail\Setup



E-Mail

Set E-Mail Feature to Enabled
From E-Mail Name
From E-mail Address
SMTP Server Address (Check with e-mail provider)

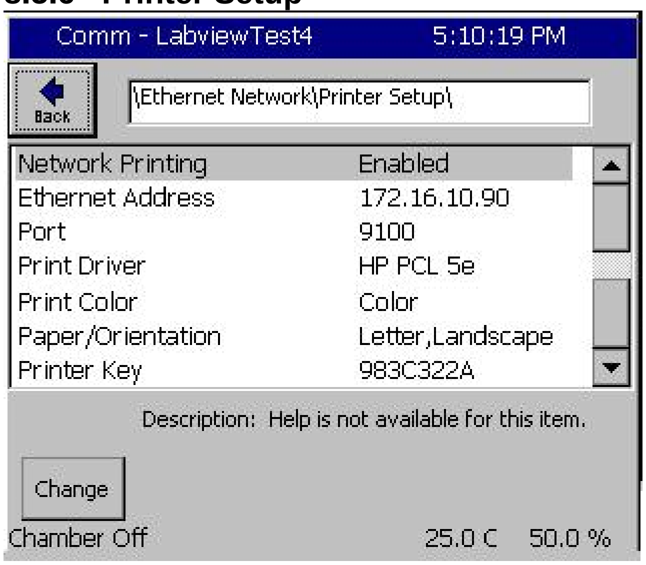
8.5.5.2 Ethernet Network\E-Mail\Addresses



E-Mail

Enter up to five E-Mail addresses or Cell Phone numbers as shown on the left.

8.5.6 Printer Setup



Printer Setup

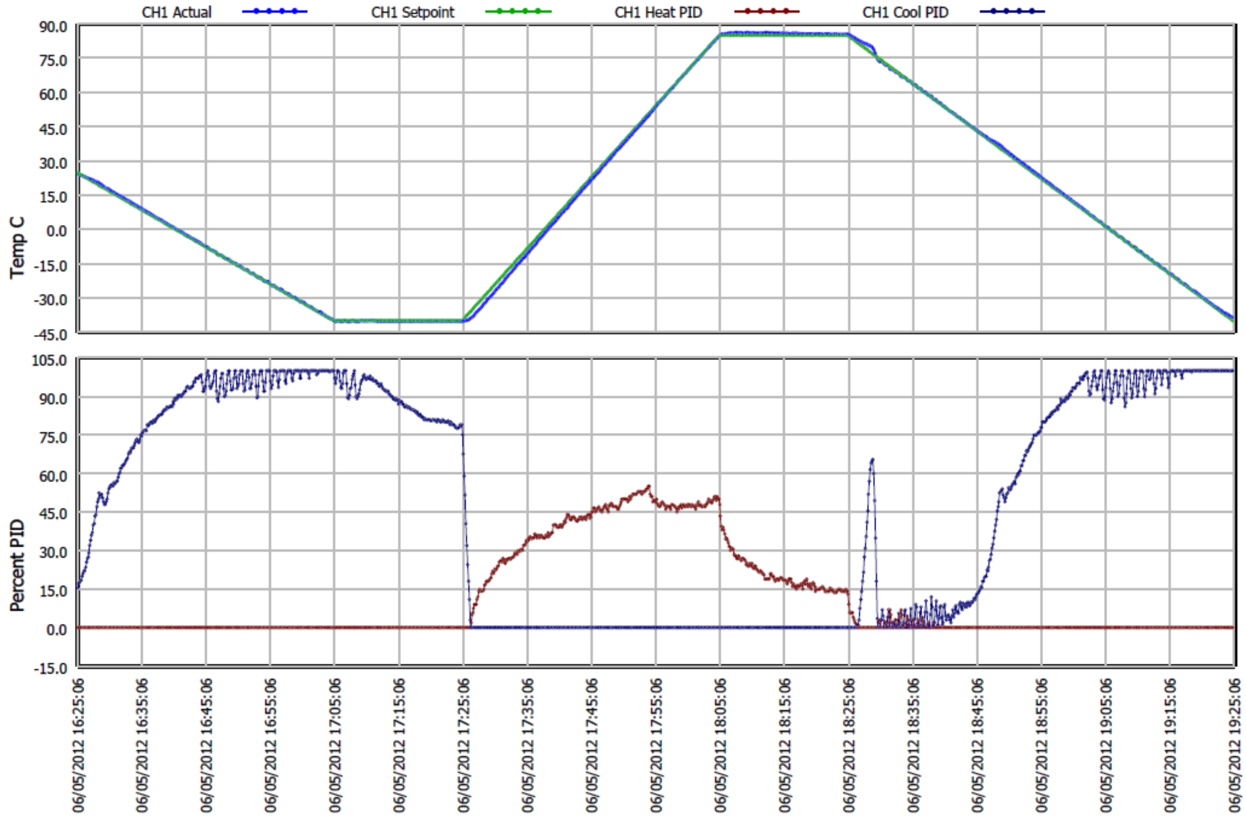
Setup the Network Printer parameter as shown on the left according to y our printer.

See Application note 84

Application Note 84

CONTROLLER: MICRO 2
SN: 06/0750
VERSION_3_0_4_Build871

Date: 06/05/2012
btrc-benchmaster test full cool 85c 06-05-2012 16.25.06
-40C to +85C Test Cycle
UIN: BENCHMASTER CHAMBER

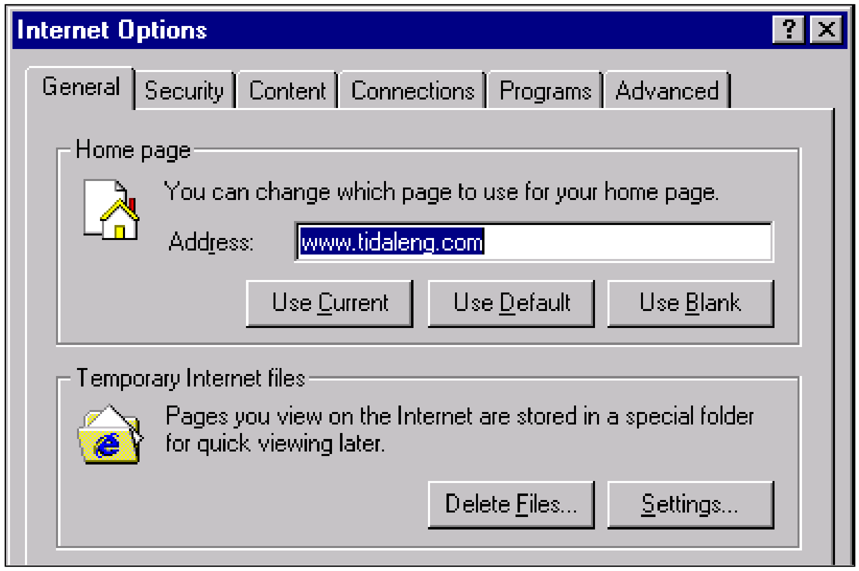


Name________________ Signature_____________________ Date_________________

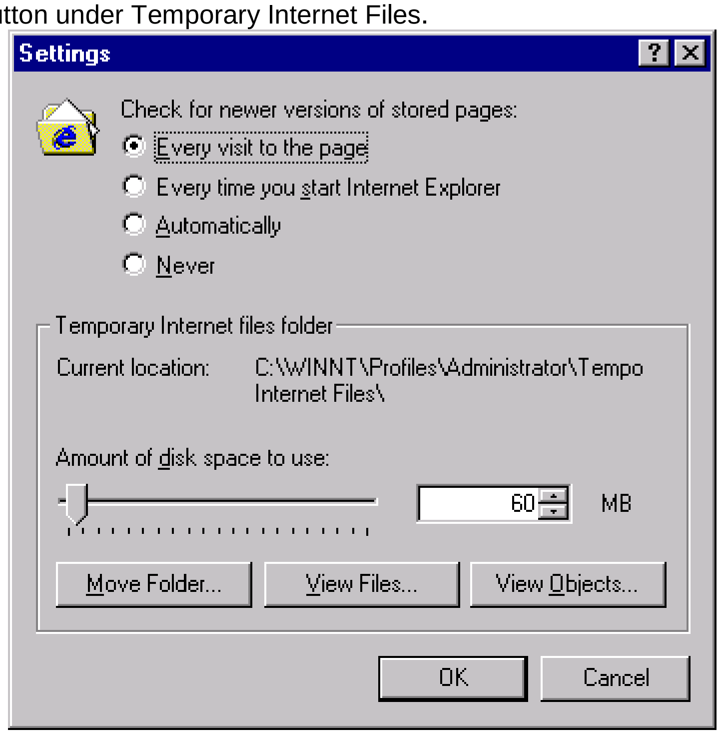
Synergy(tm) Controller Plotted: 06/05/2012 19:26:13 www.TidalEng.com Printer IP Address: \plt35B5.tmp

Configuring Internet Explorer

The web server works seamlessly with Microsoft Internet Explorer version 5.0 and higher. You must, however, adjust the default settings in Internet Explorer. Open Internet Explorer and from the Tools menu, select Internet Options.



Press the **Settings...** button under Temporary Internet Files.



In the Settings screen, select the "Every visit to the page" option. Press OK to save the configuration.

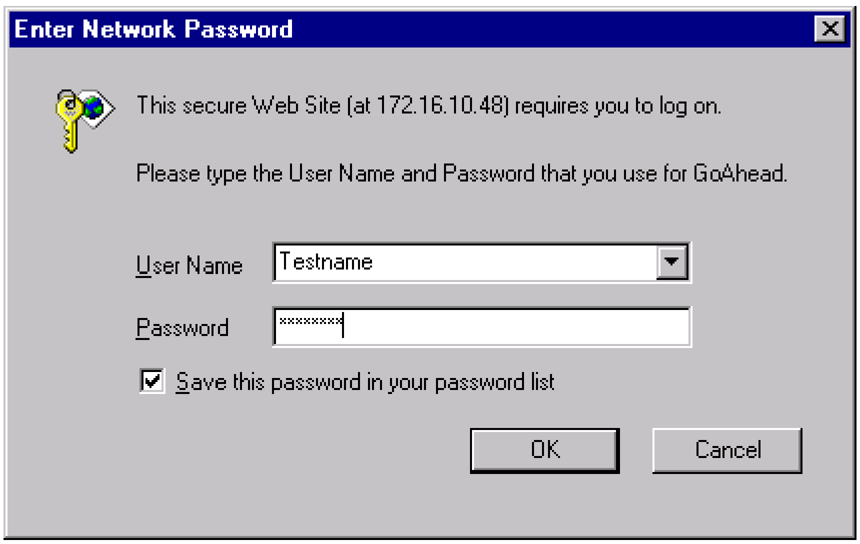
Caution: The Synergy Controller may work unpredictably if this setting is not changed. Mouse clicks on the Browser window will be sent to the controller but the screen images will not update. Buttons and functions may, therefore, be pressed unintentionally.

Accessing the Synergy Controller via the Web

To access the controller via the web, open Internet Explorer and type your controller's IP address in the address bar. You can find the controller's IP address in the Web Server folder under the ***COMM*** button.

For example, if the Web Server Address on the controller is 170.23.10.10 then type "170.23.10.10" in Internet Explorer's address bar.

After entering the address, press Enter to navigate to your controller. The next screen you will see is the Internet Explorer Network Password screen.



Enter the user name and password you specified in the Web Server Folder on the controller. You may want to check the Save Box to save the name and password in your computers password list. If you don't save the password you will be prompted for a password each time you open a new session. After you have successfully logged in, you will see the web interface exactly as it appears on the controller.

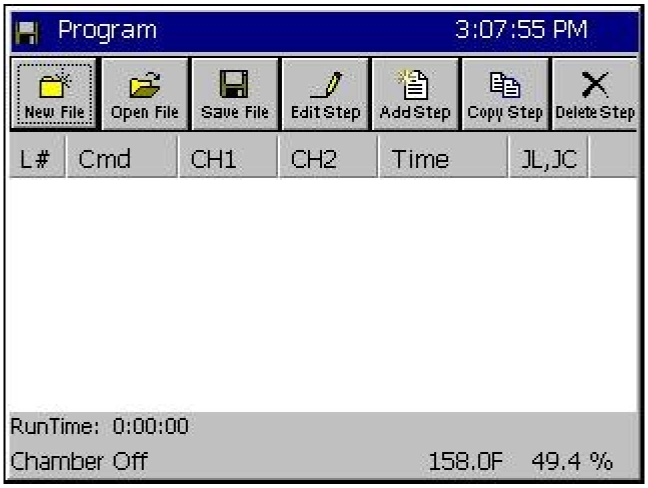
Note: If you enter the incorrect password, shutdown the Internet Explorer window and re-start it. Otherwise Internet Explorer will not ask for the password again.

Using the Web Interface

The Synergy Controller Web Interface virtually identical to the Synergy Controller Touch Screen interface. It displays the same buttons as on the physical controller and the main screen is identical to the touch screen on the Synergy Controller. Use the mouse pointer as you would use your finger on the touch screen. At each click, the screen accepts your command and automatically refreshes. If you want to refresh the screen, without initiating any action, click on the blue title bar, which is neutral area and will have no effect on the operation of the chamber.

9.0 PROG SCREEN

The Synergy Controller provides a powerful and easy to use program editor for creating sophisticated multi-channel profiles of Temperature, Humidity, Altitude, etc. versus time. These programs, also known as profiles or recipes, are created from the Program Screen.

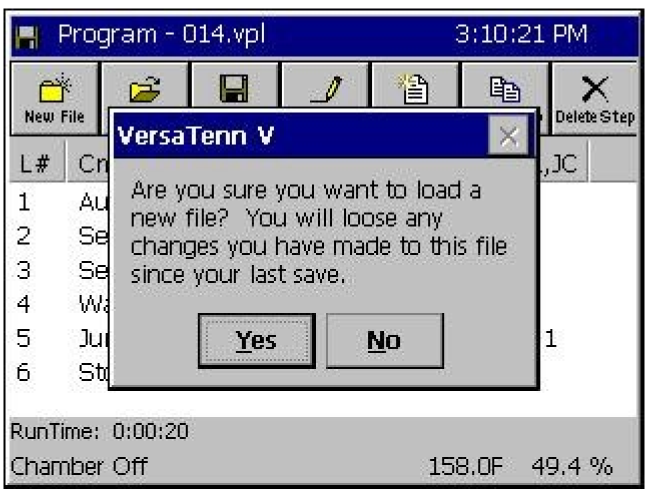


<u>Program Screen</u>

The Program Screen provides seven simple function buttons and displays a listing of the program steps that make up the profile. The following command buttons are explained with example screens that follow.

- New File (Clears current program)
- Open File (From Storage Card, or USB)
- Save File (To Storage Card, or USB)
- Edit Step (Edit Step Wizard assists you)
- Add Step (Add Step Wizard assists you)
- Copy Step (Part of Edit Step Wizard)
- Delete Step

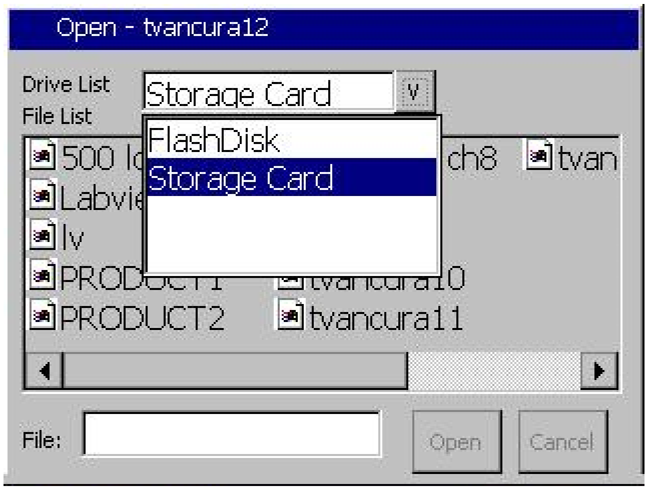
9.1 Loading a File from Storage Card or USB Hard Disk



Press the ***Open File*** button to load a file from the Storage Card or USB Hard Disk.

The warning dialog window shown at left will appear if a file is already opened.

Note: You can also load a file from the **Run** screen but programs can only be edited from the Program screen.



- Drop down the Drive List to select the drive as shown at left.

Note: The FlashDisk is the Processor’s internal Flash memory. The Storage Card is the Synergy Controller’s SD Flash memory.

- Select the desired file from the File List that appears.
- Press the ***Open*** button. The Program screen will open with the listing of your program. Open the ***Run*** screen to start running your program. See Section 10 for details.

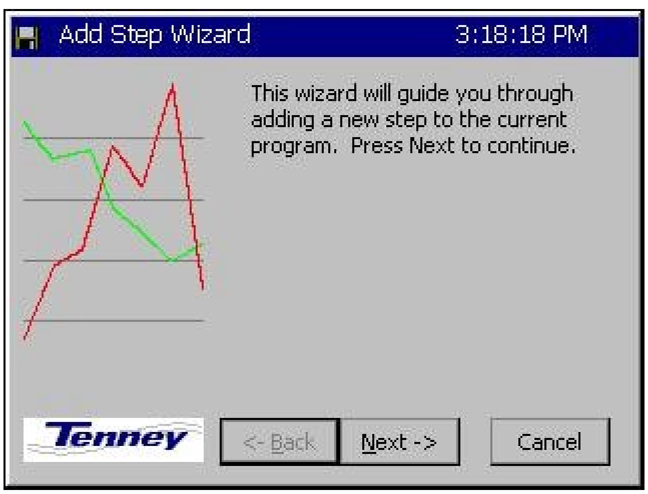
9.2 Creating a New Program

The **Add Step Wizard** is Synergy Controller’s step-by-step guide for adding and inserting program steps. Each function is defined with on-screen instructions. You may cancel the **Add Step Wizard** at any time and return to the main Program screen.

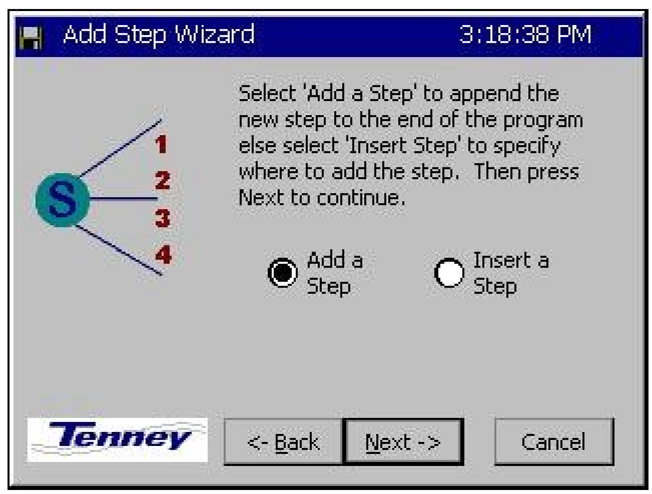
To create a new program, first press the ***New File*** button. If a file is already open, a window will appear as shown above in Section 9.1. To add a setpoint step, press the ***Add Step*** button and proceed as shown below in the **Add Step Wizard** demonstration.

Add Step Wizard Walkthrough:

1. Start →

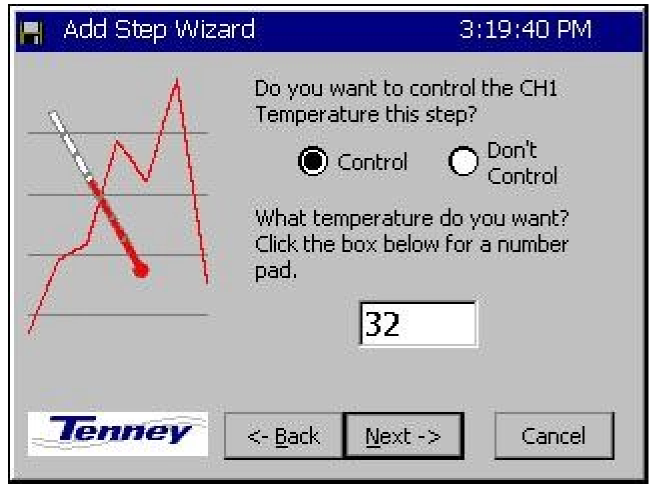


2. Select Add Step or Insert Step →



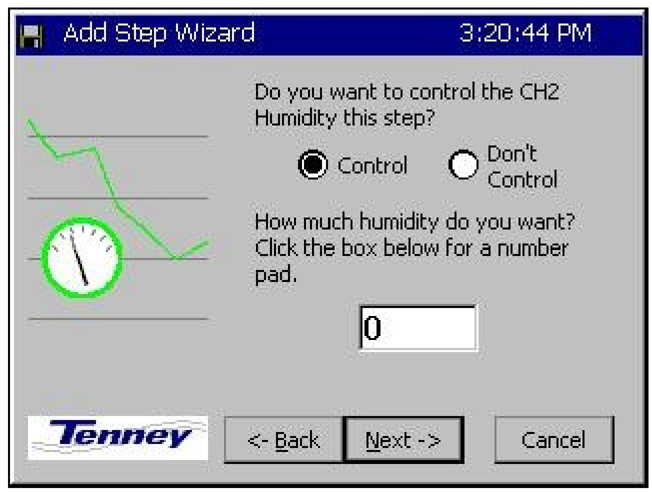
3. Select Step Type →

4. Temperature Control →



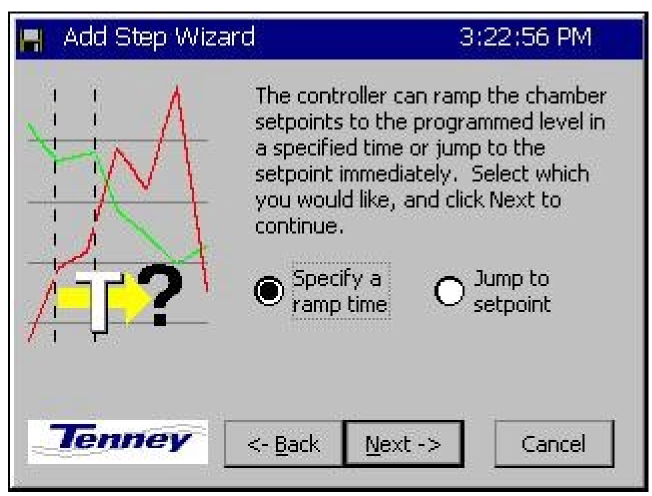
4. Enter Temperature Setpoint & Press Accept →

5. Humidity Control →

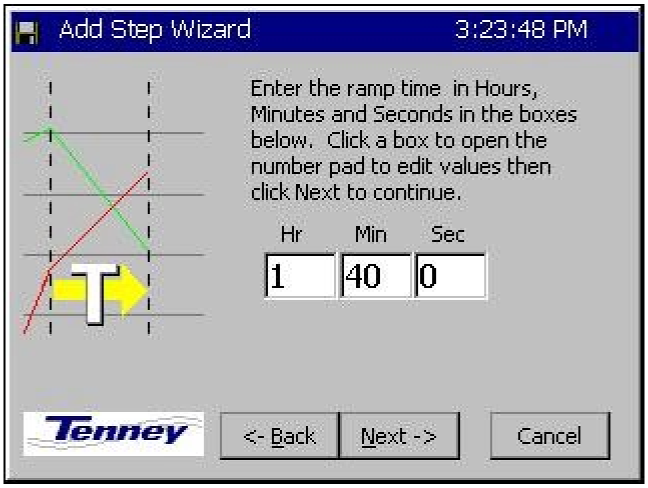


6. Enter Humidity Setpoint and Press Accept →

7. Specify a Ramp Time or Jump to Setpoint →



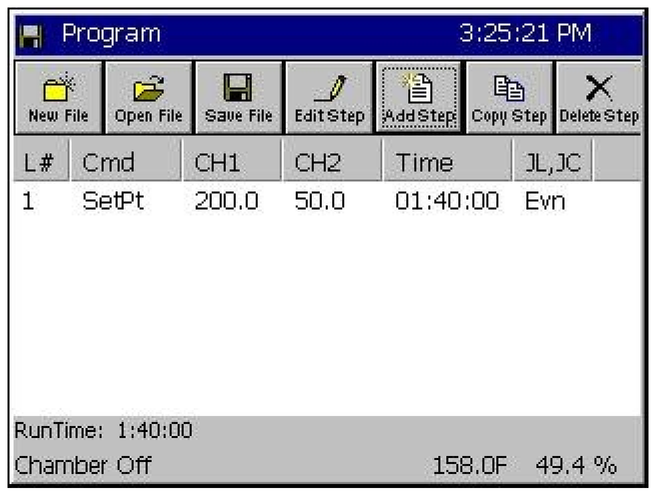
8. Enter Ramp Time →



9. Turn On / Off Events & External Outputs →

10. Finish →

11. View Completed Step.



After pressing the ***Finish*** button, the program screen displays your new step. Verify your entry and continue adding, inserting, or copying steps as necessary to complete your program.

Press the ***Save File*** button when you are through creating your program.

Notes

Step 3 Note: You may want a Stop step at the end of your program. If you do not include a stop step at the end of a program the controller will shut down the chamber when the program completes.

Step 9 Note: During humidity control, turn on OT11 TPM to change Output 11 (Ambient Coil) from On/Off control to Time Proportioned control.

9.3 Step Type Descriptions

The Synergy Controller can be used to create complex temperature and humidity profiles. It supports five different step types; each step type has a specific function. These five steps are: Setpoint, Jump Loop, Waitfor, Auto Start and Stop. The step type is selected in the Select Step Type screen of the **Add Step Wizard**, as seen in step #3 above. Each step is described in detail below.

- **Setpoint:** The Setpoint step is used to ramp the chamber from one setpoint to another or to soak at a setpoint for a specific time period. Setpoints can be used to change events or logical values.

  Some fields are required in a setpoint step and some are not. Temperature setpoint is always required, even if it is the same as the previous step. Channel 2, 3 or 4, if present, can be set, or turned off and not controlled.

  If a ramp time is desired it can be entered. If no time is entered, the setpoint will immediately go to the desired setting and the profile will continue. If a ramp time is set, the setpoint will ramp linearly from the starting point to the desired setpoint throughout the step. For example, if the user wants to ramp the temperature ten degrees in ten minutes, the chamber will drive the temperature one degree higher every minute.

  Output Events are programmable for each step. These events can be enabled or disabled with every setpoint step if some user function or hardware is connected to one or more event outputs. Events are evaluated at the beginning of every step. If an event is set on for a step, it is enabled at the beginning of the step and maintained for the duration of the step.

  The last set of options in a Setpoint step is located on the events screen. They are Use Drier, LEV2, and OT11. Use Drier enables the drier device (if available) on temperature/humidity chambers instead of the default dehumidify coil. When equipped with a drier device the chamber will typically be capable of achieving a lower humidity. OT11 changes the output logic for the ambient coil between On/Off logic and Time Proportioning logic. LEV2 controls the Purge device (if available and enabled through OT17). Enabling it will enable the purge device, disabling it will disable the purge device. See the L-Value Section 6.5 of the manual for more information regarding these control features.

- **Jump Loop:** The Jump-loop step is used to repeat parts of a profile. A Jump-loop step requires two parameters; the target step for the loop, and the number of times to jump. The target step must always be before the jump step because the controller cannot jump forward; it will only jump back in the profile. The jump count specifies how many times to loop back over the steps. The count can be anywhere from one to two hundred fifty five, or negative one. Negative one specifies an infinite loop; it will continue jumping back to the specified step until the profile is stopped manually. Specify the required number of cycles less one when specifying the jump loop count since the steps will always be executed once before the first jump.

- **Wait For:** The Waitfor step holds program execution until the specified conditions are met. Those conditions can be setpoints, a time interval or external digital inputs.

  Waitfor steps can wait on one or more channels values. When executing a Waitfor step, the program will not advance until the actual value (temperature, humidity, etc.) for that channel goes above or below the Waitfor value. The direction the actual must travel is determined at the very start of the step. If the actual value is less than the Waitfor value when the step begins, then the step will wait until the actual value is greater than the Waitfor value. If the actual value is greater than the Waitfor value when the step begins, then the step will wait for the actual value to be less than or equal to the Waitfor value.

  Waitfor steps can also wait for a specified time. If the time in hours, minutes and seconds are specified in the Waitfor step, then the controller will hold on the step for that time after all other conditions are met. The timer will not start counting down until all of the specified channel values are reached, and any specified digital inputs are reached. Once the conditions are met, the Waitfor time will count down and then the controller will continue to the next step.

  As mentioned above Waitfor steps can also wait for any of the controller's sixteen digital inputs. Digital inputs can be wired to the Synergy Controller to indicate one or more user states, such as a unit-under-test power up during a test. The controller can be set to ignore the input (Don't care), or to wait for the input to be on or off (closed or open). Only digital inputs that are not ignored are checked. By default, all inputs are ignored unless specified.

- **Auto Start:** The Auto Start step is used to automatically start the chamber. The profile can either start in a relative time (i.e. ten hours and five minutes from when the program is started) or at an absolute day and time (i.e. Tuesday, November 4th, 2003 at 7:30 AM). When you add an Auto Start step to a profile you specify a relative or absolute time.

- **Stop:** The Stop step is used at the end of a profile to specify what to do at the end of a profile. The chamber can either shut down and turn off all the outputs (the chamber will gradually return to ambient conditions), or the chamber can go into steady state and run until manually stopped. If the chamber returns to steady state mode, the last setpoints of the profile will be used as the steady state setpoints.

- **Pause:** The Pause step is used to put the Program in thee Paused State. The chamber will continue to run in the Paused state indefinitely. To continue to the next step the Operator can press the Run button or the Run command can be from a computer interface.

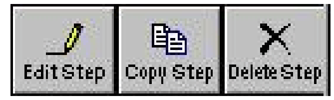
Synergy Manager can be used to create profiles for the Synergy Controller on your PC where they can be viewed graphically, stored and archived. Synergy Manager is Tidal Engineering's PC application designed to program, monitor and control multiple environmental test chambers. Synergy Manager can save profiles in the Synergy Controller VPL format so they can be copied to and then run on the controller. The full version of Synergy Manager can be used to transfer programs to the controller thru a network as well as thru GPIB and RS-232 connections. See the Synergy Manager section of this technical manual or the Synergy Manager technical manual for more details. Synergy Manager is available for download from www.tidaleng.com/download.htm.

9.4 Synergy Controller Program Sheet

FILE # ________ **For Chamber Types:** Temp.-only, Temp. / Humidity, Temp. / Temp., & Temp. / Pressure

STEP No.	STEP Type	Setpoint(s)		Time			Events X = ON						Dryer	Copy Step	Jump Loop		WAITFOR			AUTOSTART			STOP	
		Temp	Hum. / Temp. / Press.										0 or 1						Time				Stop or Hold	
		SP1	SP2	Hrs	Min	S	1	2	3	4	5	6			JS	JC	Temp	Hum	Hrs: Min: Sec	Day	Hr	Min		
1																								
2																								
3																								
4																								
5																								
6																								
7																								
8																								
9																								
10																								
11																								
12																								
13																								
14																								

9.5 Copying, Editing and Deleting a Step



To Copy, edit or delete a step, press the appropriate button at the top of the Program screen. The **Edit Step Wizard** will guide the user through each of these functions

- **Copy Step:** Select the step you wish to copy. The Wizard will ask whether you wish to copy this step at the end of the program or insert the copy somewhere within the program. To insert the step within the program select the step where you want the step inserted.

- **Edit Step:** Select the step you wish to edit. The **Edit Step Wizard** will guide through step editing. Step editing is the same procedure used by the **Add Step Wizard**.

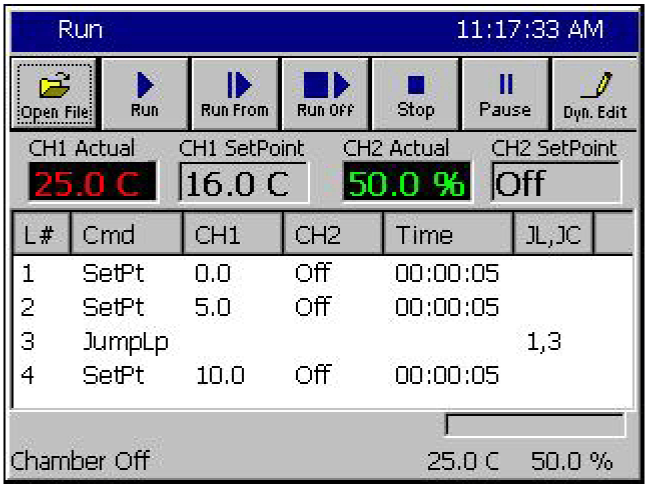
- **Delete Step:** The Wizard will ask you if you are sure you wish to delete the current step.

9.6 Saving a Program

To Save your program, press the ***Save File*** button at the top of the Program screen. The Save As function with a Drive List / File List screen will appear.

- Press the ***Save File*** button at the top of the Program screen. The Drive List / File List screen will appear.
- Select the Drive List from the drop-down menu. You can save the program to the Storage Card or to the USB Hard Disk.
- To enter a new file name, press the File entry text box at the bottom of the screen. The T9 alphanumeric keypad appears. Enter the desired program name and press the ***OK*** button.

10.0 RUN SCREEN



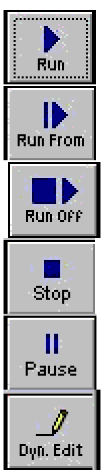
Press the ***RUN*** Screen button to open the Run screen. From the Run screen you can, Start, Stop and Pause a program.

If a file is loaded, it will appear in the Program screen will appear in the Run screen when the Run screen is opened.

10.1 Loading a Program

Open File: Press this button to load a file from the Storage Card or USB Hard Disk. The procedure is described in Section 9.1 Programming the Synergy: Loading a File. Simply select the desired file from the Drive List / File List screen that appears.

10.2 Program Control



Run: Press the ***Run*** button to start the loaded program at the first step.

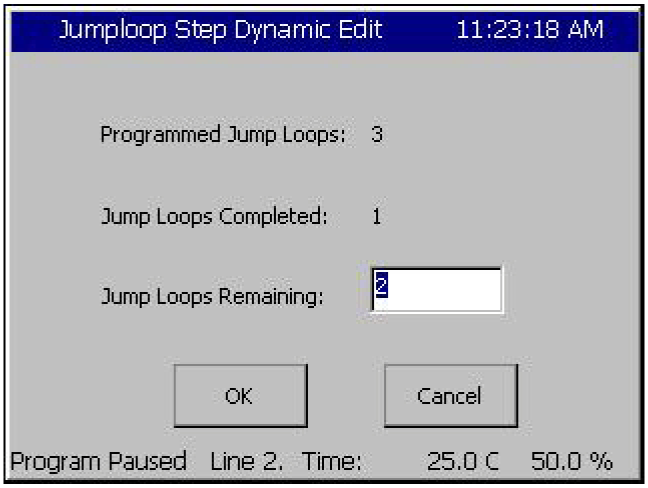
Run From: Use this button to start the program from a step other than the first step. Click on the desired step to select it and press the ***Run From*** button.

Run Off: Use this button to run your program with the chamber outputs OFF. You can watch the setpoint values change as the program runs to verify the program performs as expected.

Stop: Stops program execution.

Pause: Pauses program execution. The chamber will continue to run at the current setpoints.

Dyn. Edit: Dynamic Edit is used to edit the jump loop count while the program is paused.



Dynamic Edit

To dynamically edit a Jump Loop the program must be running and currently within the target loop. Press the ***Pause*** button to pause the program. Highlight the desired Jump Loop step then press the ***Dyn. Edit*** button.

Press the **Jump Loops Remaining** text box to open a numeric keypad and enter the new number of jump loops to perform and press ***OK***.

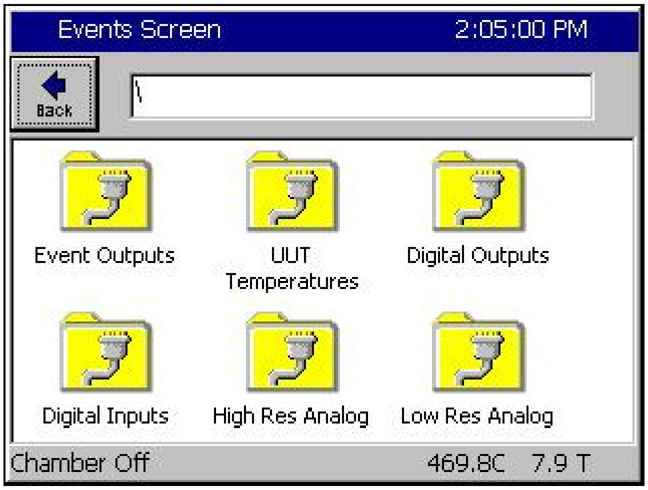
Press ***Run*** or ***Run Off*** to resume running the program.

Note: Enter –1 to exit the loop.

Note: If the chamber loses power while running a program, the Synergy Controller is designed to resume the program when power is restored. It will continue in the same step is was in when the power failed. If the step was time based, such as a Waitfor or a Setpoint step, all timers are reset to zero and the Synergy Controller resumes the profile at the beginning of the step.

11.0 EVENTS SCREEN

The Events Screen provides access to the controller's Inputs and Outputs.



Events Screen

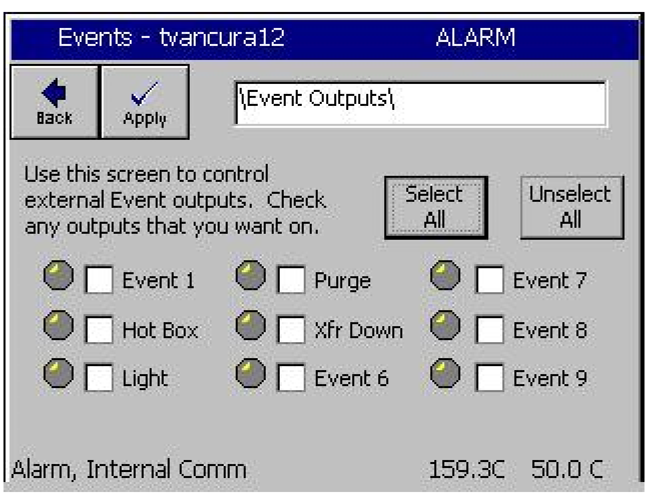
The Events Screen contains the folders for six Event status folders including the Event Output folder. These folders are as follows:

- Events Outputs
- UUT Temperatures
- Digital Outputs
- Digital Inputs
- High Resolution Analog Inputs
- Low Resolution Analog Inputs

11.1 Event Outputs

All Synergy Controllers provide the option to control none users on/off outputs called Event Outputs or Events. These Events can be controlled both in steady state mode and when running programs. In some cases all of the Event Outputs are available for customer applications and in some cases one or more Event Outputs are assigned to factory installed features like humidity channel control, GN2 Purge or Chamber Light. For example, test engineers can use these Event Outputs to enable/disable power to the Unit-Under-Test (UUT) for certain portions of a profile, enable LN2 solenoids or operate some special test equipment.

Each Event Output can be controlled while the chamber is running in manual mode or programmatically from the program. See the Programming Section 9.0 of this manual for additional information regarding the Setpoint Step. The On/Off state of each Event can be monitored in the *Events\Event Output* folder. The LED is red when the event is On and gray when it is Off.



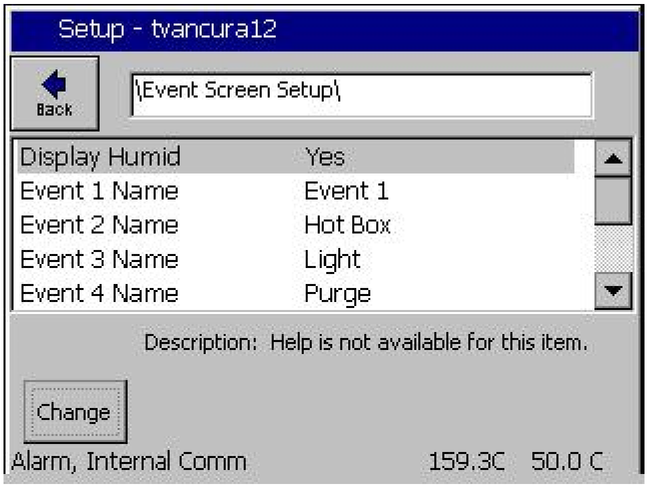
Event Outputs

In the Manual (Steady State) mode, Events 1 thru 9, the Drier, and LEV 2 can be switched On and Off. When Event 1 thru 9 is pressed, a checkmark appears in the box. Press **Apply** to apply the state of each Event check box to the outputs. .

Select All and **Unselect All** buttons are provided for Events 1 thru 9.

In the Run Mode, this screen serves as a status screen. The LED indicators turn red when the Event is On and grey when the Event is Off.

11.1.1 Event Outputs Setup

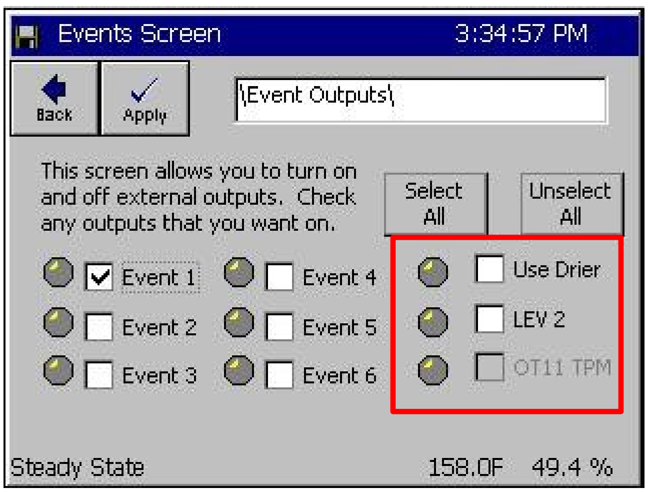


<u>Event Screen Setup</u>

The Event Screen Setup Folder is used to configure the Event Outputs Screen as follows:

1. Display Humidity Channel Event Outputs
2. Assign User friendly Event names to each Event Output. See Section 6 for more details.

11.1.2 Humidity Channel Event Outputs



The Humidity Channel Event Outputs are:

- **Use Drier**
- **LEV 2**
- **OT11 TPM**

♦ **Use Drier**

The User Drier feature is used to change the dehumidification method. The Chamber defaults to Dehumidify Coil. Select the **Use Drier** method to achieve very low humidity.

The Use Drier mode is controlled by the settings in each Setpoint Step while the chamber is running a program. To monitor the On/Off state of the Drier, go to the *Events\Event Output* folder and observe the LED indicator next to the Use Drier label. The light is red when the drier is active, gray when it is inactive. To change the default dehumidification method for steady state operation go to the LEV1 folder under *Setup\L-Values\LEV1* and select the desired default method: Drier or Dehumidify Coil.

- **LEV 2**

  LEV2 (Logic Event 2) controls the vacuum device. When enabled it activates the vacuum device even if OT17 is set to Purge.

  You may select the LEV 2 method while the chamber is running in manual mode or in the **Add Step Wizard** using the Setpoint step. To monitor the On/Off state of LEV 2, go to the ***Events\Event Output*** folder and observe the LED light next to the **LEV 2** label. The light is red when the **LEV 2** is activate, gray when inactivate. Note that the default LEV 2 setting is always off.

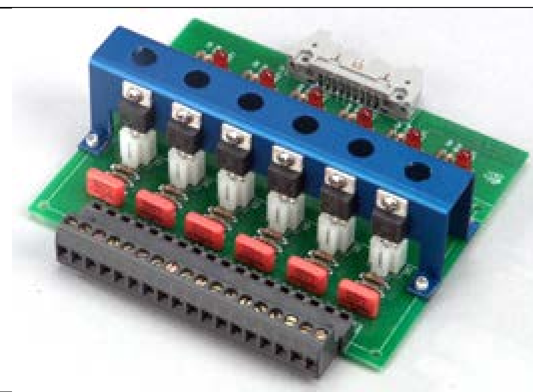
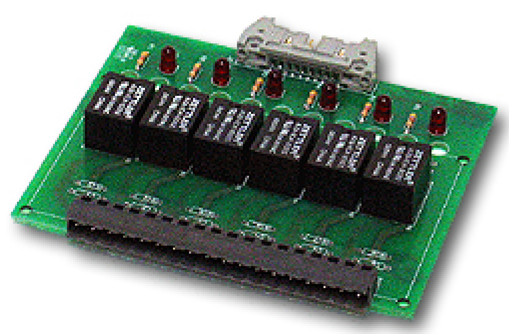
- **OT11 TPM (Ambient Cooling Time Proportioning vs. On/Off Mode)**

  The OT11 TPM feature is used to change the Ambient Cooling Coil control mode. The chamber defaults to On/Off control mode. When OT11 TPM is selected, the controller switches to the time proportioning mode.

  OT11 TPM can be monitored from within the Event Outputs folder. The setting can also be specified for each Setpoint step. To monitor the state of the **OT11 TPM** setting, go to the ***Events\Event Output*** folder and observe the LED indicator next to the OT11 TPM label. The light is red when the time proportioning mode is active, gray when it is inactive. To change the default **OT11 TPM** setting for Steady State mode, go to the OT11 folder under *Setup\Special Functions\OT11* and select the desired default method: On/Off Control Mode or Time Proportioning Control Mode.

11.1.3 Event Output Board Options

Tidal Engineering offers two types of event output boards: standard AC output (TE1151-6), and relay output (TE1708-6). Each of these connects to the Olympic board or to the 2SM board with a 20 position ribbon cable. Schematic diagrams and wiring instructions for these are included in the Installation Section 17.0.

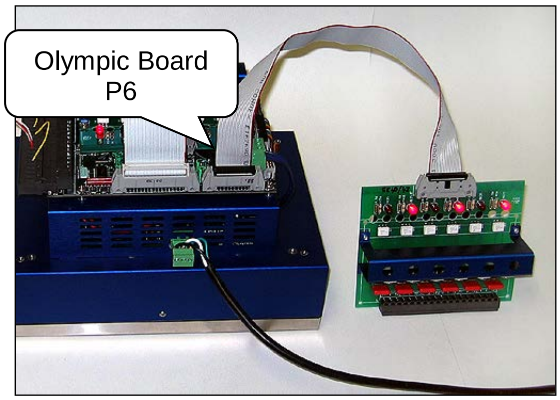
Triac Output Board, 6 Channel P/N TE1151-6 • Control up to twelve (6) 3 Ampere AC loads • 110 - 220 VAC • Each output can also drive an external Triac for larger loads.	
Relay Output Board, 6 Channel P/N TE1708-6 • Control up to six (6) 3-Ampere AC loads, • 110 - 220 VAC. • Each output is Form C with both a normally open and normally closed contact.	

11.1.4 Event Output Board Connections

The event board connects interchangeably to either of two Synergy outputs, the 20-pin P6 connector on the Olympic board or alternatively to the J5 connector on the 1SM 12 channel output board.

To connect the event board directly to the Synergy Controller:

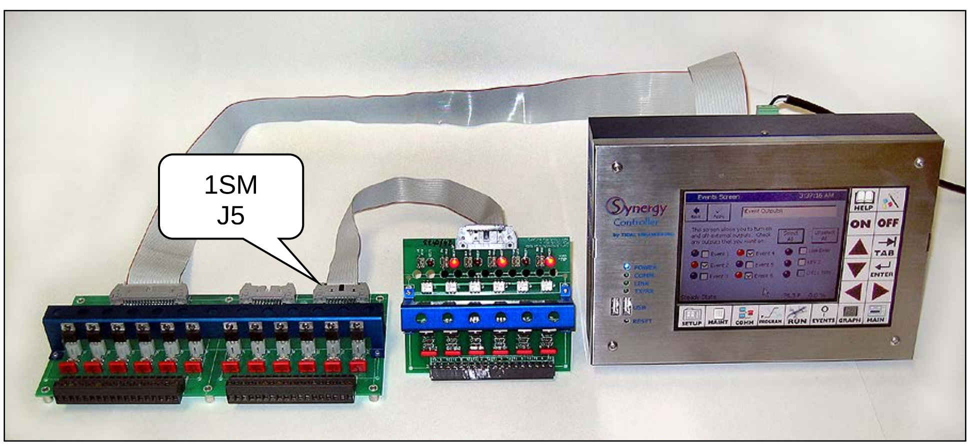
1. Connect one end of the 20 pin cable to the 20 pin connector (J2) on the event output board.
2. Connect the other end of the 20 pin cable to the 20 pin connector on the back of the Synergy Controller (P6). See the figure below.



Event Board Connected Directly to Synergy Controller

To connect the event board to the Synergy Controller via the 12 channel 1SM output board:

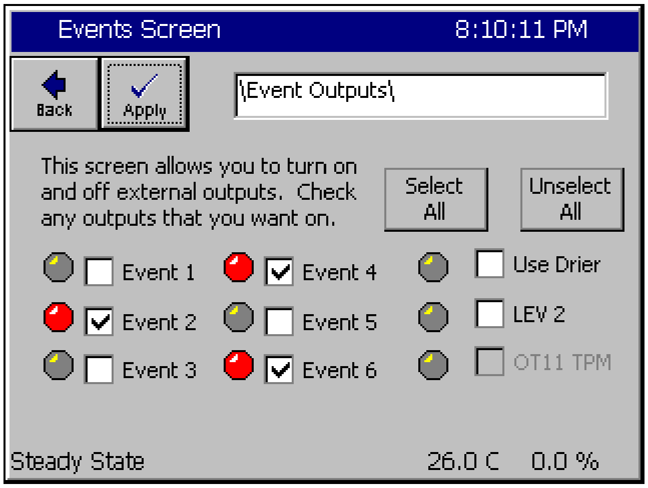
1. Connect one end of the 20 pin cable to the 20 pin connector (J2) on the event output board.
2. Connect the other end of the cable to the 20 pin connector (J5) on 12 channel 1SM output board.

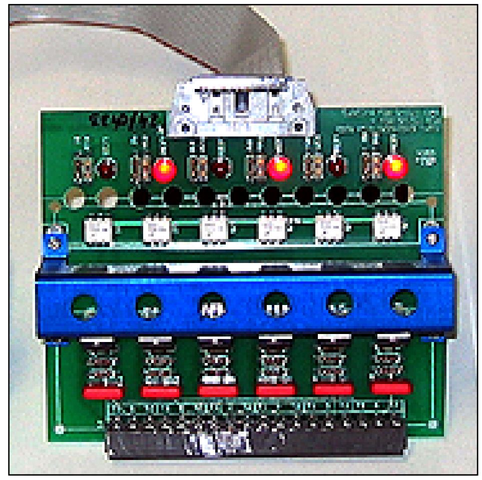


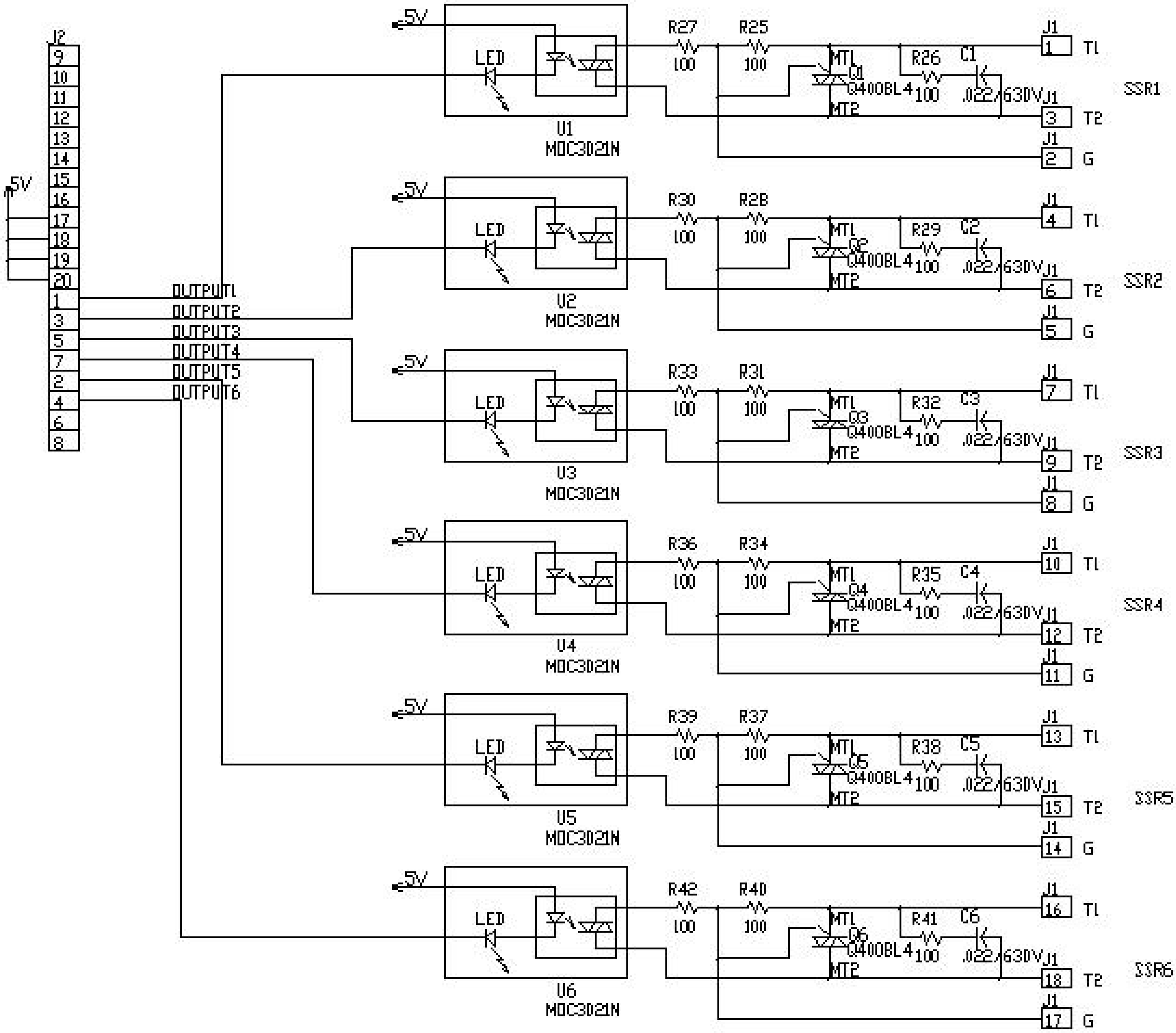
Event Board Connected via 12 Channel 1SM Output Board

Synergy Controller Event Setup Instructions
There are several ways to control the events on the Synergy Controller. You can control them locally through the touch panel, through remote software such as the Synergy Manager software or within a chamber profile. The instructions that follow describe how to test the event output board by operating the Synergy Controller locally) from the touch screen) in Manual Mode.

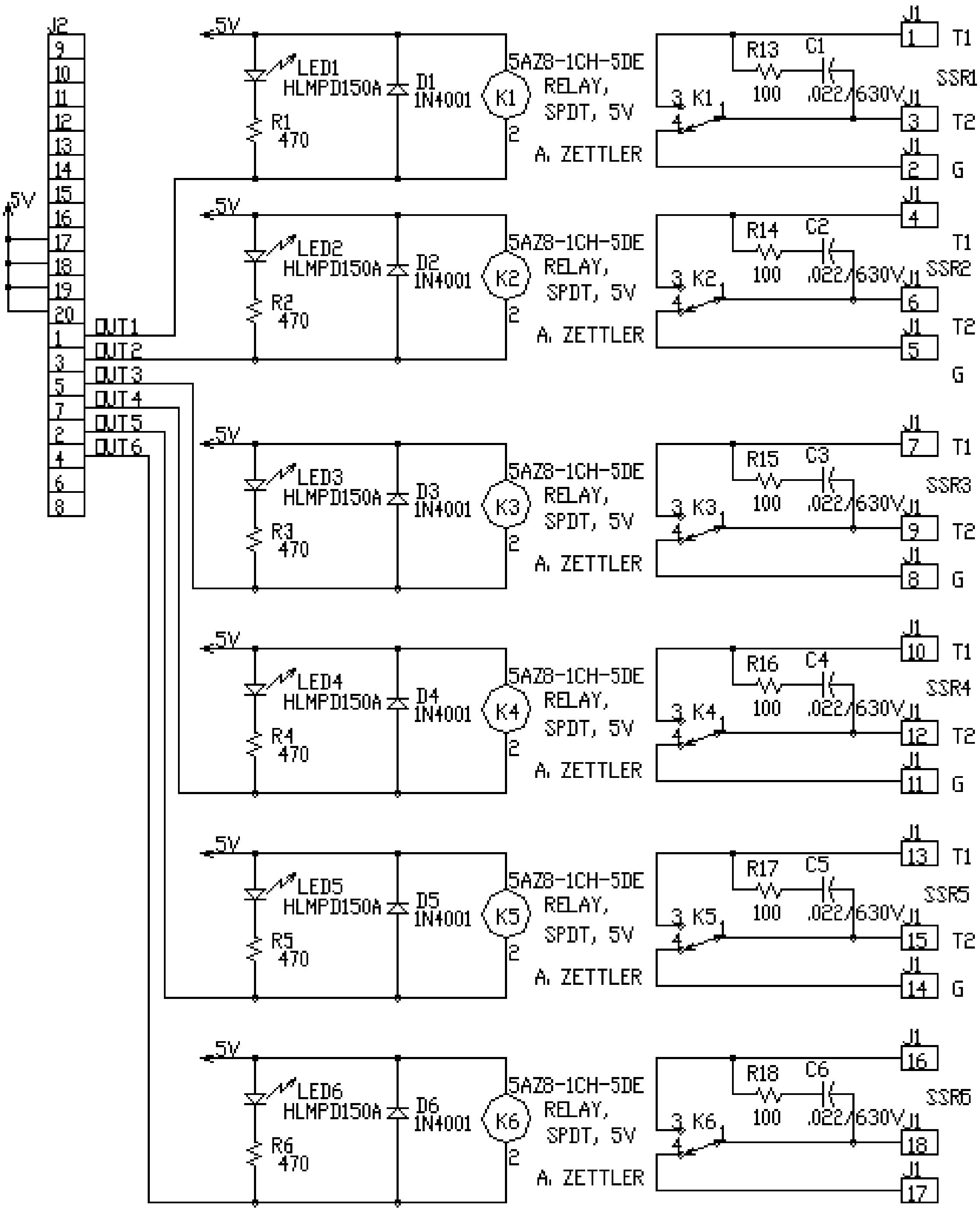
Example 1: Turn on Events 2, 4 and 6.







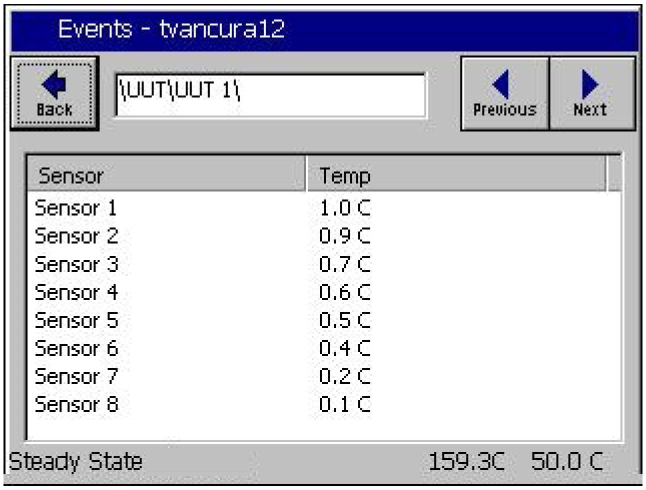
TE1151-6 Triac Output Board Schematic



TE1708-6 Relay Board Schematic

11.2 UUT Temperatures

The UUT Module (Unit-Under-Test) is a 16-channel thermocouple data acquisition unit. Developed to expand the input capabilities of the Synergy Controller, the UUT module captures and logs data from the test. Up to four modules can be attached to the Synergy Controller for a total of 64 thermocouple inputs. The UUT data can optionally be logged and the log file may be used for analysis, graphing and reporting. The Synergy Controller's UUT window, shown below, displays the temperature readings from the UUT module.

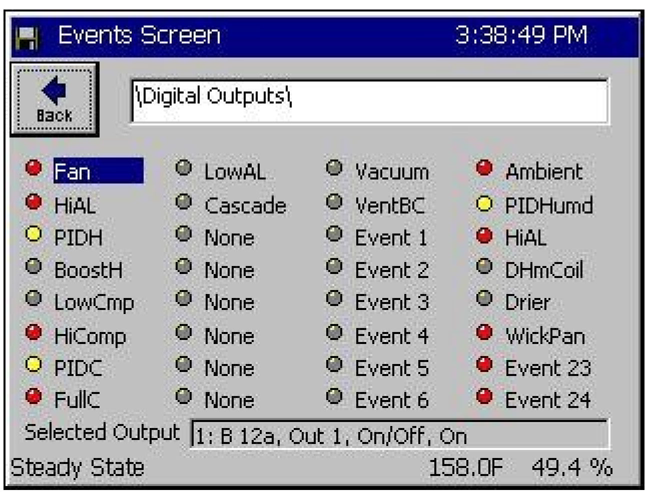


UUT Temperatures

See Section 13.0 UUT Module (Unit Under Test) Data Acquisition for a more detailed discussion of the UUT module and its capabilities.

Browse to the **/Calibration/Input /UUT** folder in the Setup screen to calibrate these inputs.

11.3 Digital Outputs



Digital Outputs

The Digital Outputs Screen displays the status of the 32 Digital Outputs of the controller. LEDs indicate the status of each output.

- Grey LED: Output Off (On/Off type)
- Red LED: Output On (On/Off type)
- Yellow LED: Time (Proportioning Type)

The information bar at the bottom indicates the output designation and the status of the selected output.

The Digital Outputs window displays the on/off/time proportioning states of the controller's digital outputs. These outputs control the chamber's devices such as compressors and heaters. This screen also displays the event states, alarm states and the percent heating and cooling requested from the heating and cooling devices.

Additional information concerning each output is displayed in the text box at the bottom of the screen when the output is selected. The text box displays the output designation numbers(s) and the status of the output.

Percentage output values between 101 and 199 indicate that an output is set to instantaneously mirror the indicated output. For example, if an output's time proportioning value is 112% then it is mirroring output 12. Percentage outputs between 201 and 199 indicate that an output is the complement of the indicated output. For example, if an output's time proportioning value is 218% the output is instantaneously the opposite of output 18.

Information on the Selected Output is displayed in the text box at the bottom of the screen. Highlight an item (Fan, HiAl, PIDH…) by pressing the output label and view the selected output properties below: for example "1: B12a, Out 1, On/Off, On"

The output information is displayed in the following format: "A1 : A2, A3, A4, A5"
Where:

- A1: The location of the output as displayed on the screen 1-31 moving up to down, left to right.
- A2: The output board the device is connected to. The boards are referred to as 12a for the 12 output board, 6a and 6b for sequential 6 output boards. The terms 12a, 6a, 6b correspond to the traditional method of labeling these boards 1SM, 2SM and 3SM, respectively.
- A3: The output the highlighted device uses on the board specified above.
- A4: The output type, such as On/Off or Time Proportioning.
- A5: The current state of the output: On, Off or percent output (for example: 22%)

Chamber Output Mapping

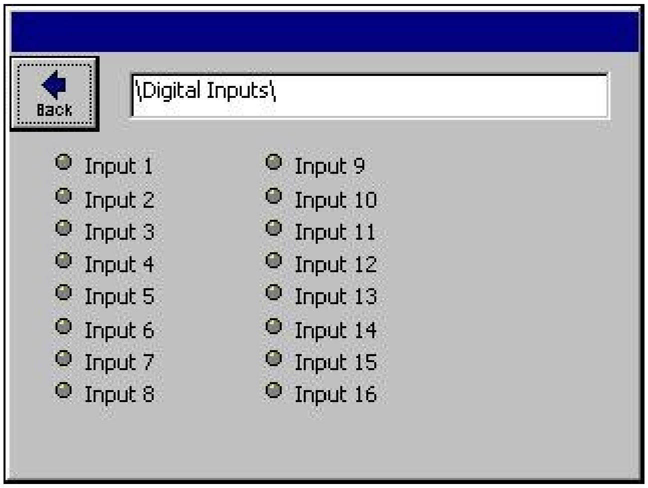
The Synergy Controller supports multiple chambers types. Each chamber type has q unique device output mapping. For example, Output 1 drives the chamber fan on Temp-Humidity and Temp-Only chambers. In Temp-Temp chambers Output 10 drives the fan device.

The output maps for each chamber type are listed in Section 15 .

11.4 Digital Inputs

The Digital Input Screen displays the status of inputs from up to 16 switch closures. Waitfor steps can be programmed to wait for a digital input state before it continues the program.

The Digital Inputs are located on connectors P1 and P3 on the Olympic board. See Section 17.0. Pin 1 on P1 is ground. Pins 3 – 12 correspond to Digital Inputs 1 to 10. Digital Input 9 (Pin 11) is a TempGard Alarm on chambers that have a TempGard alarm. If the chamber does not have a TempGard alarm, Input 9 must be shorted to ground (pin 1). Use the Olympic Board Diagram in Section 17.0 as a reference guide.



Digital Inputs

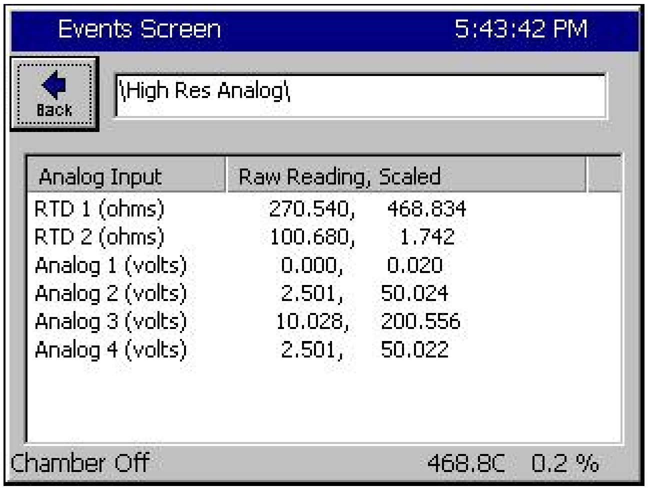
LEDs show status of the controller's 16 Digital Inputs.

- Grey LED: Input Off
- Red LED: Input On

Example Digital Input Application

To turn on a test device in the middle of a test, the test engineer wants to wait for the device to finish powering up before continuing with the program. To achieve this, he uses both Events and Digital Inputs. First he uses Event 1 to drive the test unit power supply. Next he waits for the Digital Input 1 to signal the unit under test to continue the program. The advantage of the Waitfor in this application is that it doesn't matter how long the startup process takes, it could take 1, 5 or 10 minutes or be different each time.

11.5 High Resolution Analog Inputs



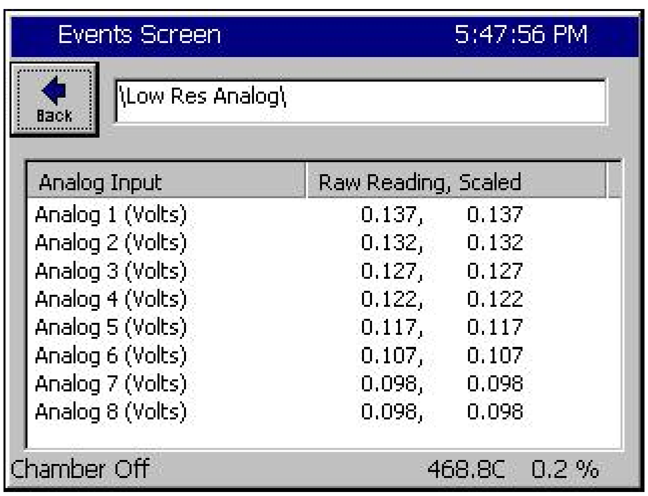
<u>High Resolution Analog Inputs</u>

- RTD 1
- RTD 2
- Analog 1 (Volts)
- Analog 2 (Volts)
- Analog 3 (Volts)
- Analog 4 (Volts)

High Resolution Analog input Screen monitors the signals from process sensors or machine monitors. The Synergy Controller displays both the Raw Reading (Volts) and the Scaled value.

Browse to the **/Calibration/Input/High Res** folder in the Setup screen to set the scaling for these inputs.

11.6 Low Resolution Analog Inputs



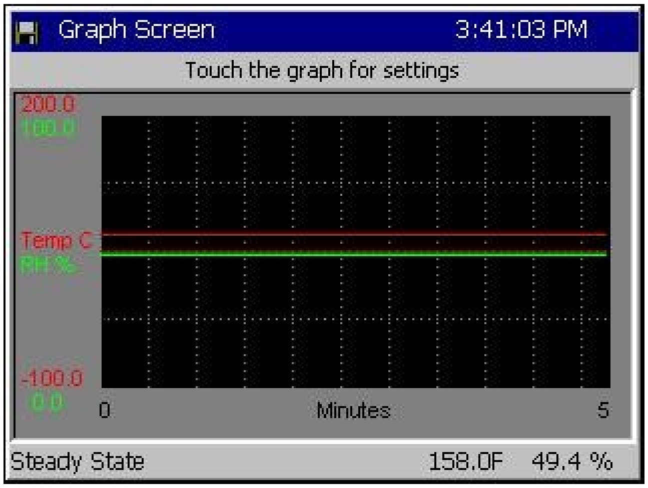
<u>Low Resolution Analog Inputs</u>

- Analog 1 (Volts)
- Analog 2 (Volts)
- Analog 3 (Volts)
- Analog 4 (Volts)
- Analog 5 (Volts)
- Analog 6 (Volts)
- Analog 7 (Volts)
- Analog 8 (Volts)

Low Resolution Analog input Screen monitors the signals from process sensors or machine monitors. The Synergy Controller displays both the Raw Reading (Volts) and the Scaled value.

Browse to the **/Calibration/Input /Low Res** folder in the Setup screen to set the scaling for these inputs.

12.0 GRAPH SCREEN

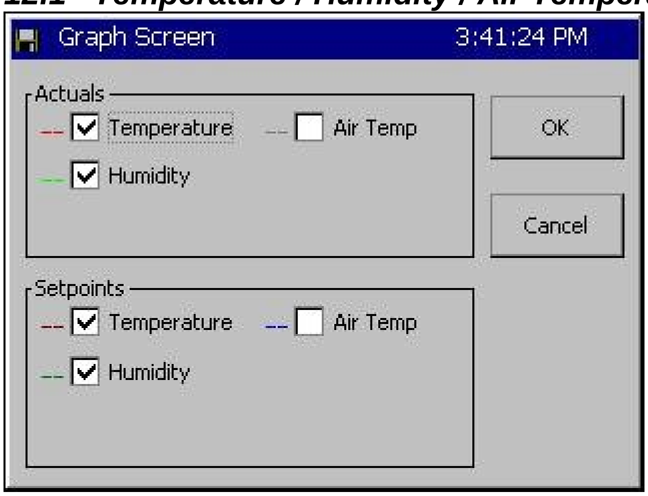


Graph Screen

Touch the screen to adjust the graph settings. Line colors are defined in the screen below.

The settings for the Graph can be changed from the Graph Settings folder in the Setup Screen.

12.1 Temperature / Humidity / Air Temperature



Graph Options

Select the individual checkboxes to display specified graph lines.

- Temperature – displays the air temperature inside the chamber.
- Humidity – displays the humidity inside the chamber.

When the cascade control is enabled the graph features map as follows:

- Temperature - displays the temperature of the Unit-Under-Test in the chamber.
- Humidity - displays the humidity inside the chamber.
- Air Temperature - displays the air temperature inside the chamber

13.0 MAIN SCREEN

The Synergy Controller can run complex programs as described in the previous sections. In addition, it can also operate at steady state conditions, i.e. manual operation. This section explains the screens and procedures that are used to quickly setup and run your chamber at steady state conditions.

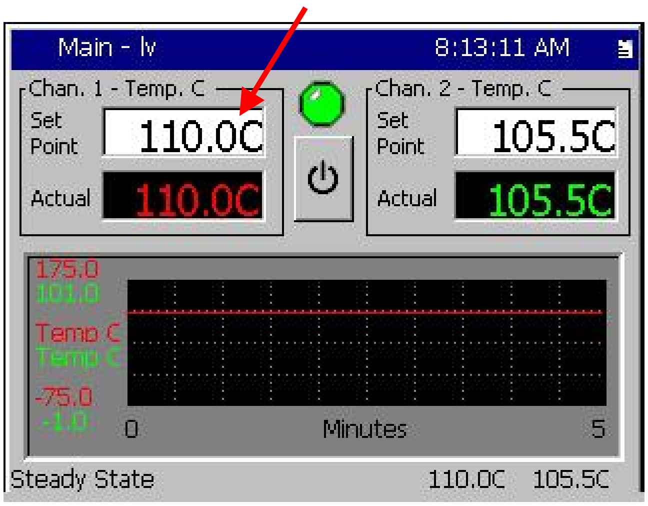
The Main screen can be customized in a variety of ways. This section covers Main screen configuration options for:

- Process Graph Option
- Channel text size
- Chamber light button options.
- Sensor displays for additional test variables.

13.1 Steady State Operation

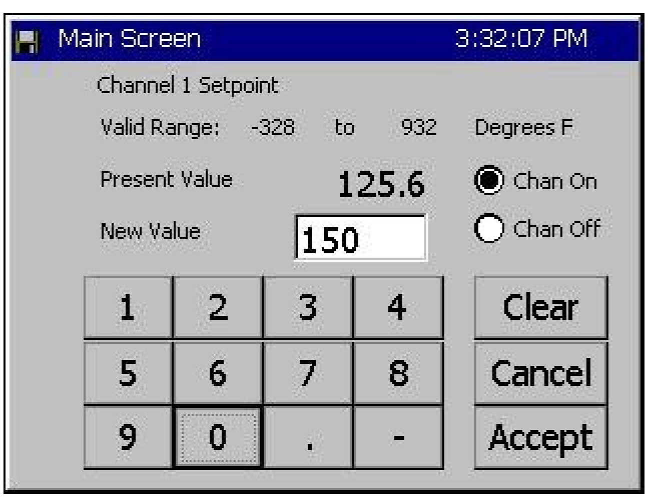
The MAIN screen opens when the controller is powered-up. Steady state set points are accessed from this screen. The chamber can also be turned ***On*** and ***Off*** from this screen.

13.1.1 Entering a set point



Press the ***MAIN*** Navigation Screen button.

- Press the **Setpoint** text entry box for Channel 1 to enter a setpoint. The keypad screen appears as shown below.
- Enter setpoints for the other channels or set them off with the **Chan Off** radio button as required.



The keypad shows the **Valid Range** and the **Present Value** for the setpoint.

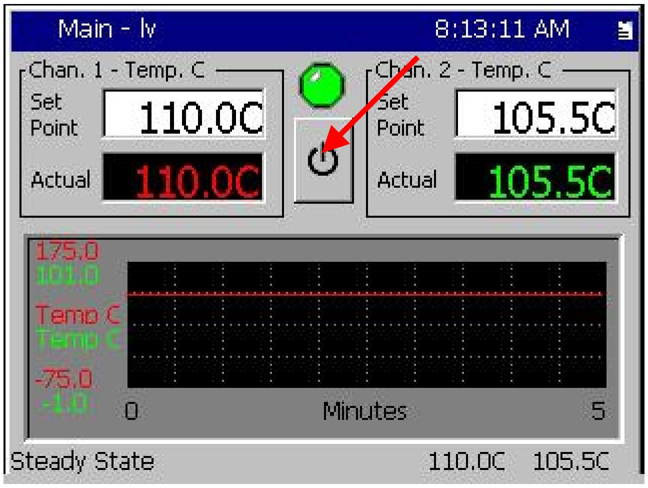
- Select **Chan On**.
- Enter the New Value. Press ***Accept***

The Main screen will appear with your new setpoint.

Important Note

Channel 1 is the primary channel and must always be on when the chamber is on. The Synergy Controller will turn off Channel 2 if Channel 1 is turned off. You can however turn off Channel 2 (for example Humidity). To turn off channel 2, select the Chan Off option.

13.1.2 Turn the chamber On



Press the ***MAIN*** Navigation Screen button.

- ♦ Press the **on/off** button to toggle the chamber state. The current state of the chamber is indicated by the LED indicator above the on/off button.

 Gray indicates that the chamber is Off.

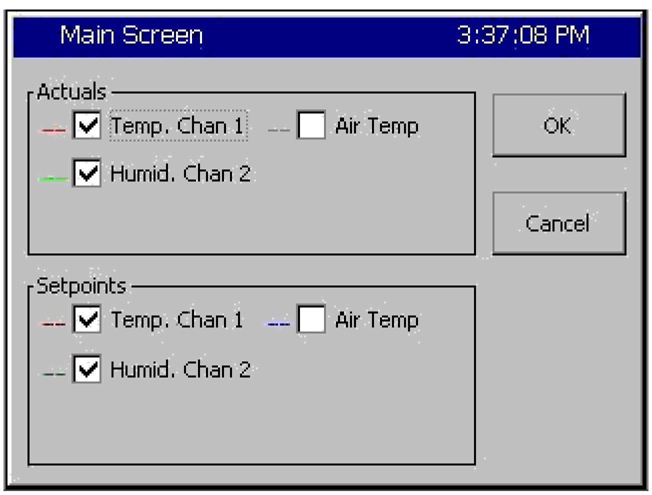
 Green indicates that the chamber is On

13.2 Main Screen Setup

- The Process Graph is optional
- The size of the channel text can be adjusted.
- A chamber light button can be displayed to control an Event assigned to the chamber light.
- Additional sensor values can be arranged on the Main screen to show additional test variables.

13.2.1 Main Screen Graph Setup

The Main Screen can display a small graph of the process and set point data.



Press the ***MAIN*** Navigation Screen button. To modify the data displayed on the graph press on the graph. The graph settings window will open with the following graph data selection options:

Actuals (process data)

- ♦ Temperature Actual
- ♦ Humidity Actual
- ♦ Air Temperature Actual (Cascade)

Setpoints

- ♦ Temperature Setpoint
- ♦ Humidity Setpoint
- ♦ Air Temperature Setpoint (Cascade)

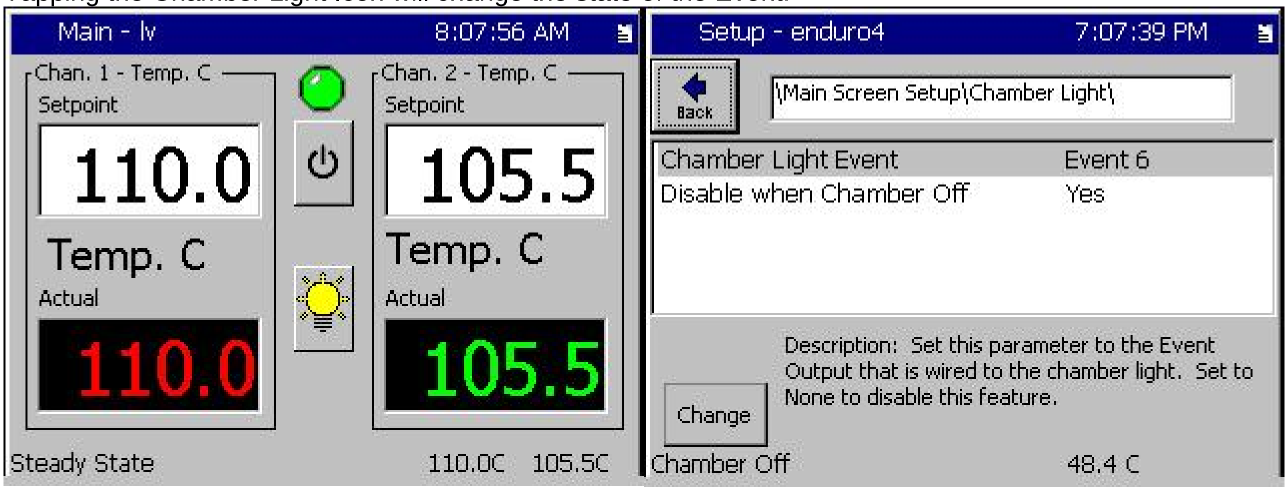
The time scale and vertical axes are configurable from the Graph Settings folder on the Setup screen. In addition, the Graph can be switched off to allow room for larger channel values or additional Display Sensor points.

A larger full-screen version of the graph is always available on the Graph Screen. For more information on the graph screen see Section 12.0 Graph Screen.

Note: Cascade enabled chambers provide additional options on the Main screen for viewing the two process variables associated with the Cascade controlled temperature channel. The channel data toggles between the product temperature and the air temperature for a cascade channel when the Actual (process) variable is pressed. For more information see Section 14.0 Cascade Temperature Control.

13.2.2 Chamber Light

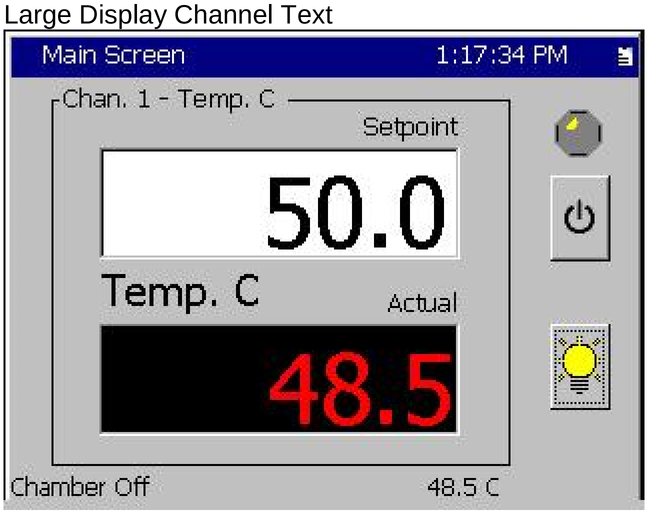
The chamber light can be assigned to an Event output and displayed on the MAIN screen as shown below. Tapping the Chamber Light Icon will change the state of the Event.



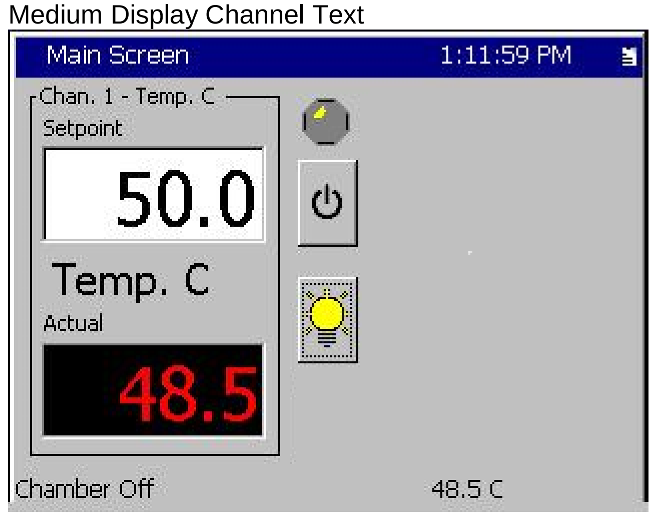
13.2.3 Channel Text

Three Channel text size options are available for the MAIN screen as shown below.

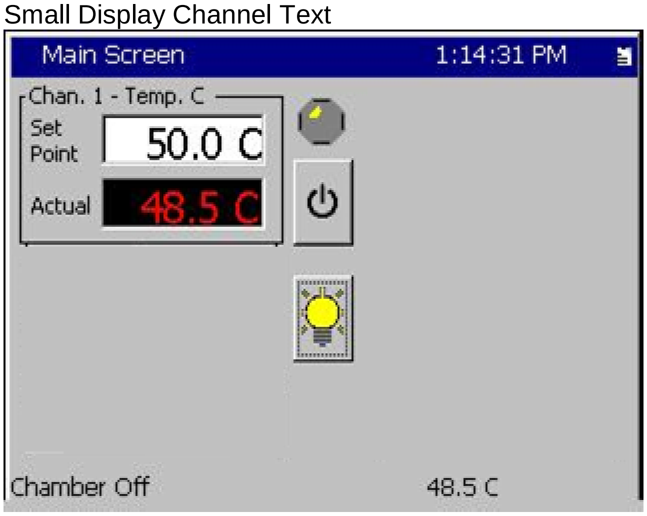
Large Display Channel Text



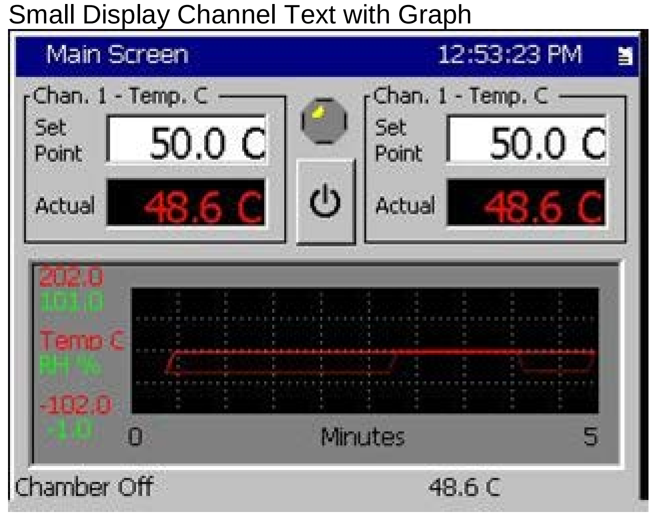
Medium Display Channel Text



Small Display Channel Text

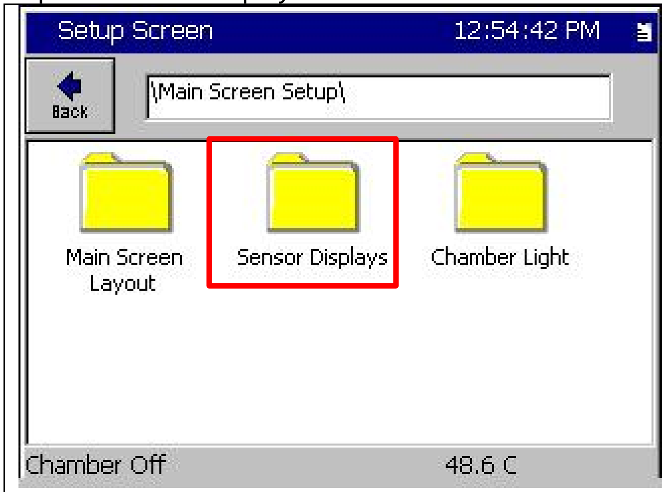


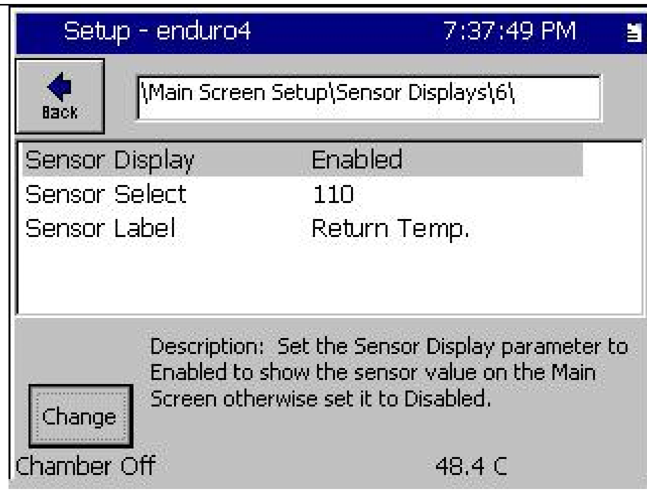
Small Display Channel Text with Graph



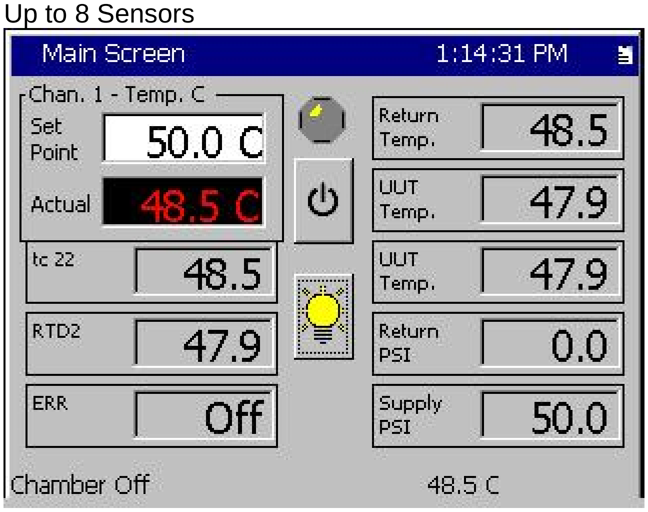
13.2.3 Sensor Displays

Additional sensor values can be displayed on the Main screen for UUT test and other variables.
Up to 8 Sensor Displays can be shown on the Main screen as shown below:

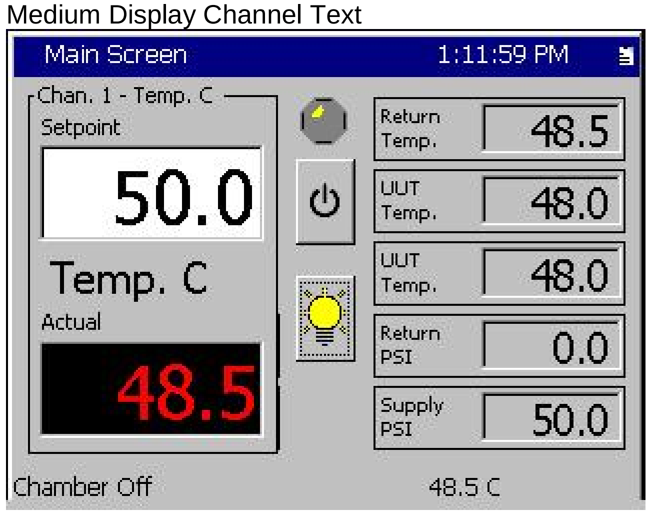


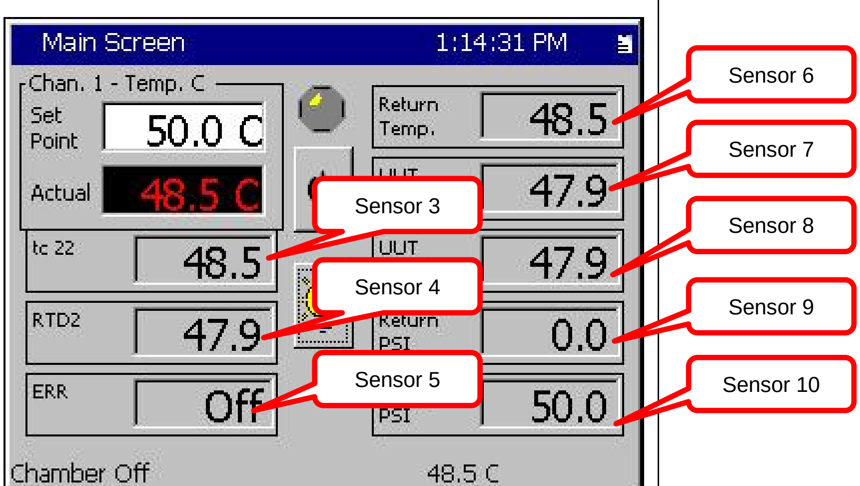


Up to 8 Sensors



Medium Display Channel Text



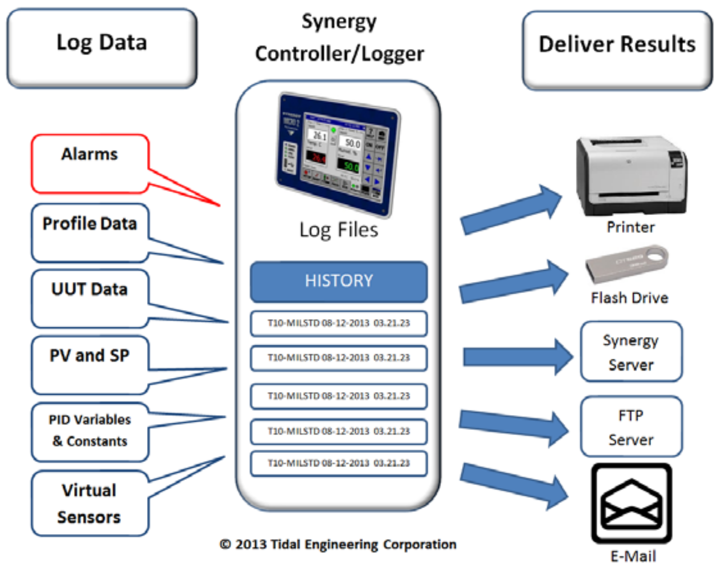


14.0 DATA ACQUISITION AND LOGGING

The Synergy Controller combines the functions of a chamber controller and a data logger. The Synergy Controller's built in data logger is key to many powerful features.

This section explains the Synergy Controller's Logging system features and applications.

Synergy Controllers capture a variety of data and "Deliver" it in multiple formats and protocols as represented in the figure below:



The logging system captures alarms and chamber control performance data as well as UUT Thermocouple data:

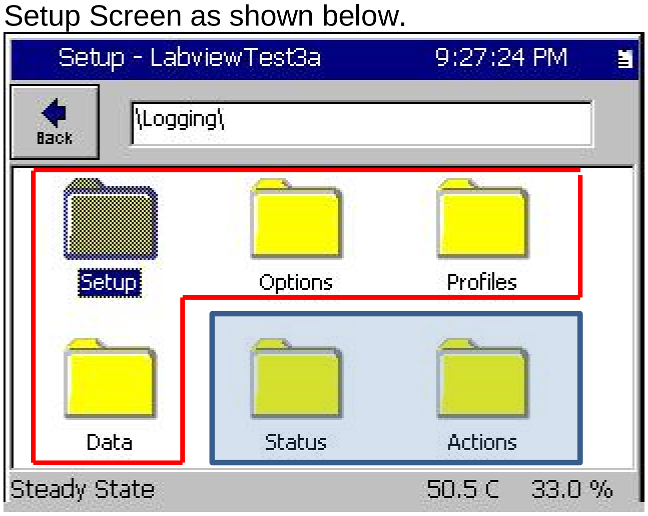
- Alarms
- Profile Test data
- UUT Data Acquisition
- Chamber control performance
- Other Sensors

And "Delivers" these results

- Network Plotting to Color Printers
- USB Flash Drive
- Synergy Server
- FTP Server
- E-Mail of CSV logs and PDF plots

14.1 Data Logging Setup

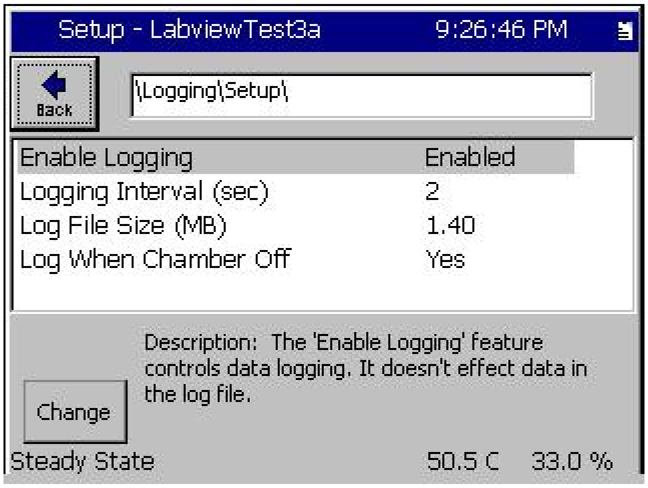
The logging system is controlled by a number of parameters arranged in a set of folders in the Setup Screen as shown below.



The Synergy Controller's logging system is fully programmable and is configured from the following four sub-folders in the **Logging** folder of the **Setup** screen as shown below and at left.

Setup
Options
Profiles
Data

Note that the last two folders in this Logging folder are used to monitor the logging Status and control the clearing and delivery of the log files.
Status
Actions



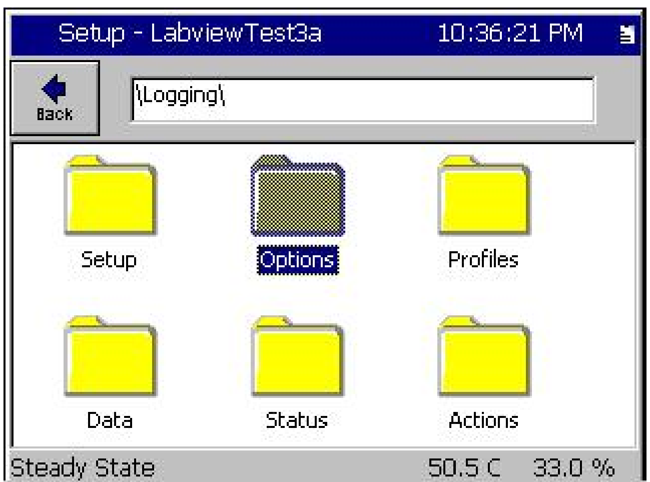
\Logging\Setup Folder Parameters

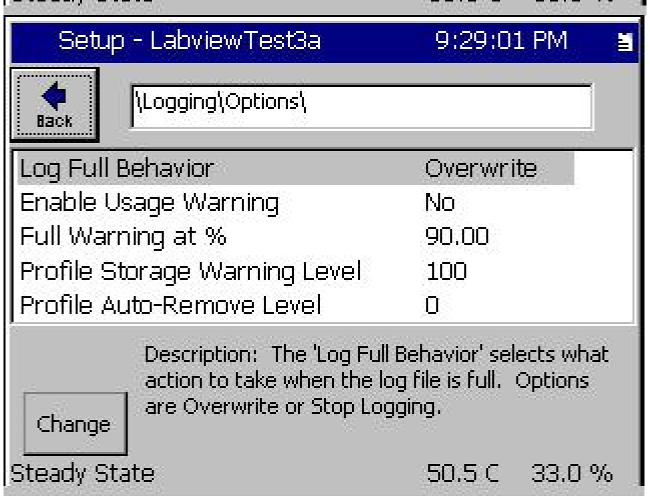
Enable Logging Enables and Disables logger. Note that the logger will always capture message records even if logging is Disabled.
For example: alarms, profile start/stop, etc.

Logging Interval (Sec) this parameter sets the interval between log entries in seconds.

Log File Size (MB) Maximum log file size. Note that when the log file reaches this limit the logger can be programed to stop logging or delete the oldest records. See the **Options** folder.

Log When Chamber Off Set this parameter to Yes to log when the chamber is Off otherwise interval logging will not occur when the chamber is off.





\Logging\Options Parameters

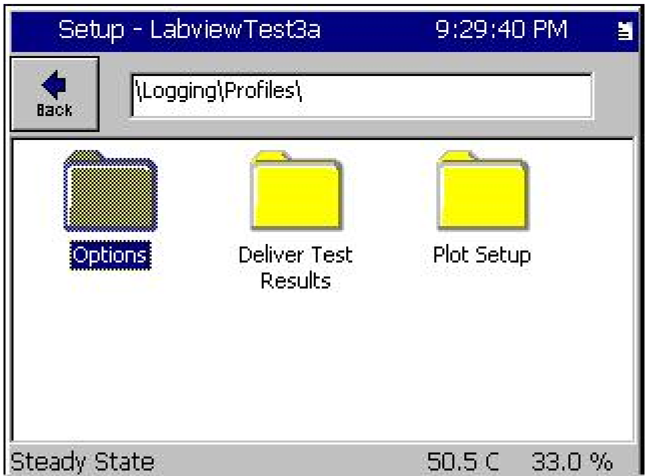
Log Full Behavior The controller can be programmed to stop logging or overwrite the oldest records when log file size reaches the **Log File Size** limit.

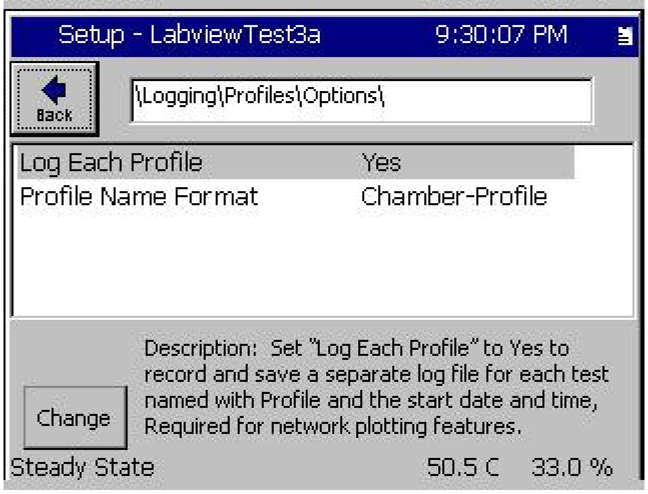
Enable Usage Warning parameter controls whether a warning dialog is generated when the **Full Warning Percentage** level is reached.

Full Warning Percentage parameter sets the Usage Warning percentage.

Profile Storage Warning Level The controller can be programed to display a warning when the number of profiles exceeds this level. Set to 0 to disable this feature.

Profile Auto-Remove Level The controller will automatically remove the oldest records when number of test results profiles exceeds this level.





\Logging\Profiles

Log Each Profile This parameter enables profile logging. Enable this parameter to log individual profiles so they can be delivered thru the network; i.e. via e-mail, to network printers, to the Synergy and FTP Servers, as well as via download from the front mounted USB port with a USB flash drive.

Profile Naming Format Selects either the Profile file name format or the Chamber -Profile file name format.

Note that time and date information is always included in the Profile file name so that each profile log can be uniquely identified.

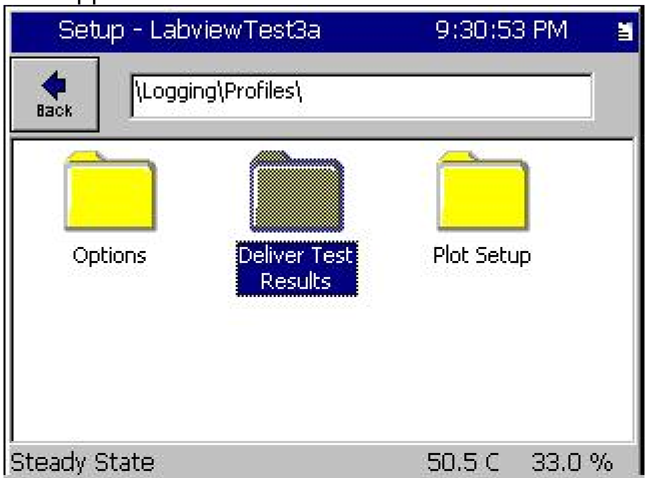
Profile Name example:
LabviewTest3a 10-01-2013 22.46.26.txt

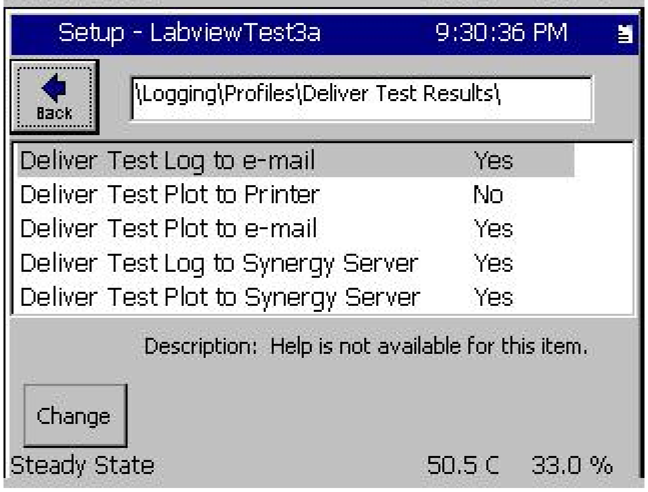
Chamber Name -Profile Name example:
th1-LabviewTest3a 10-01-2013 22.46.26.txt

Where th1 is the chamber name and LabviewTest3a is the test profile (program) name.

14.1.1 "Deliver Test Results" Automatic Test Data Delivery

See Appendix 19 for more information





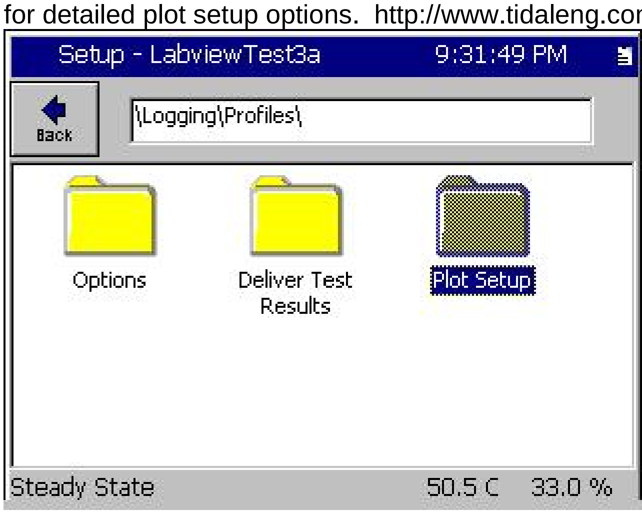
\Logging\Profiles\Deliver Test Results

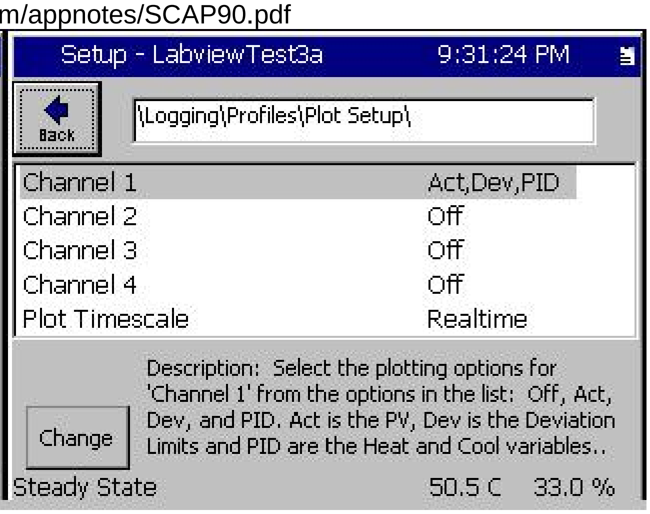
The controller can be set to automatically deliver test results in chart (plot) and Log format thru the network as follows:

Deliver Test Log to e-mail
Deliver Test Plot to Printer
Deliver Plot to e-mail
Deliver Test Log to Synergy Server
Deliver Test Plot to Synergy Server

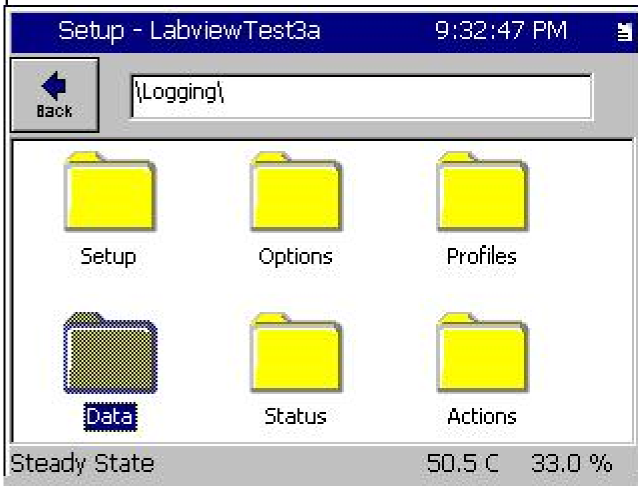
Set each parameter to enable one or more of these five automatic test data delivery methods.

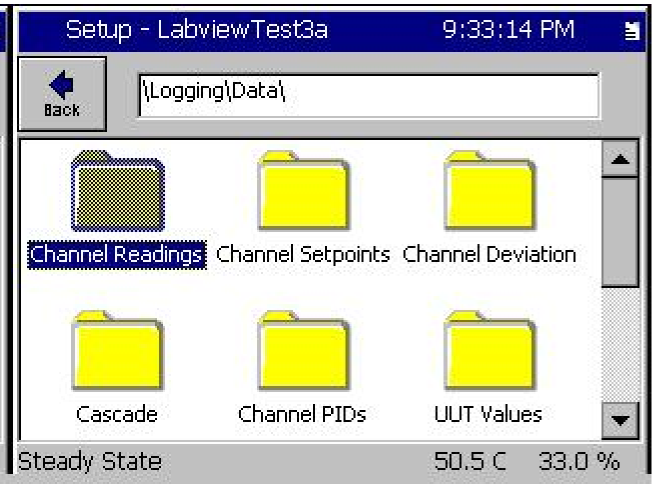
Set the Plot formatting for each channel and the Plot Time scale as shown below. See Application Note 90 for detailed plot setup options. http://www.tidaleng.com/appnotes/SCAP90.pdf



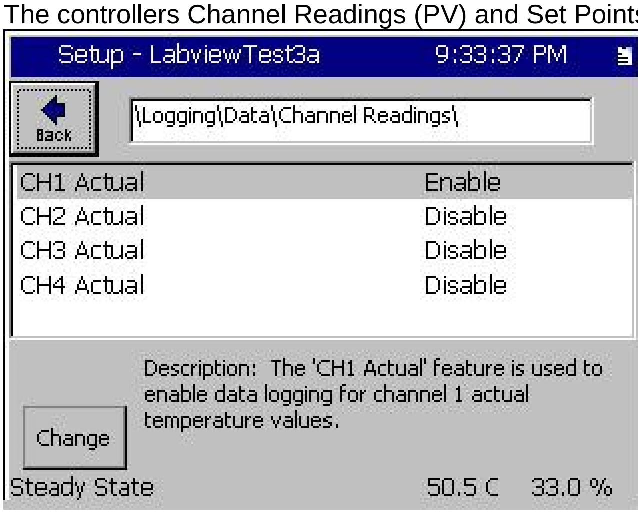


Open the **\Logging\Data** Folder in the Setup Screen and adjust the Enable/Disable value for all the data parameters.

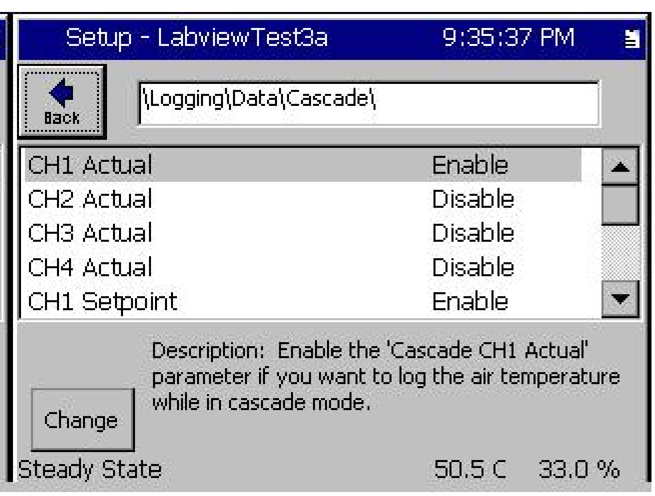




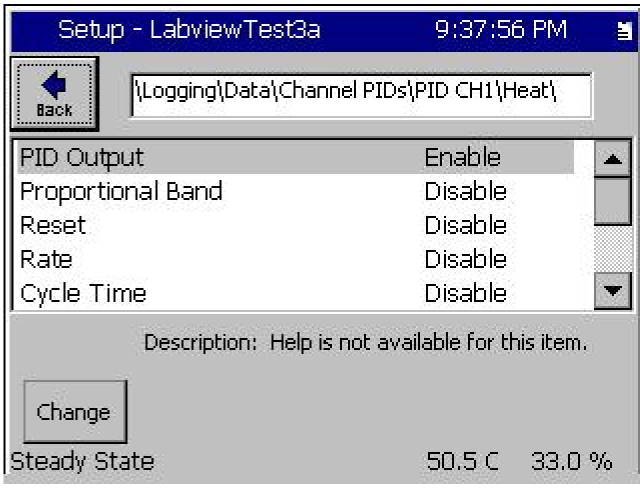
The controllers Channel Readings (PV) and Set Points (SP) can be enabled individually as required.



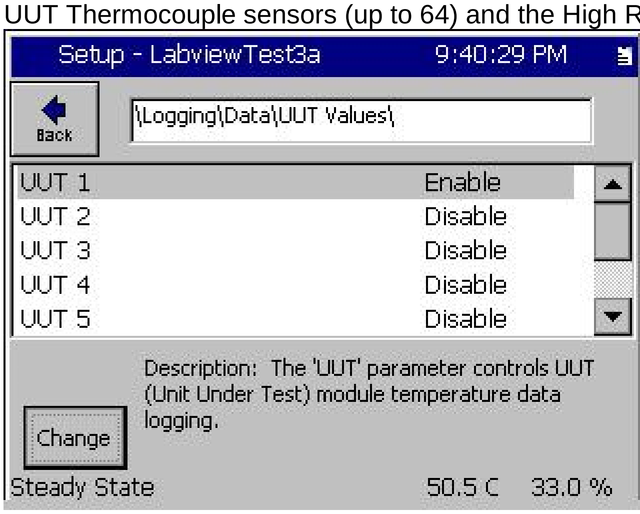
The Channel Deviation Limits and Cascade Control variables for each channel can be enabled as required. The Deviation Limits provide a visual reference for the test specification limits. See Setup\Calibration\Channel n



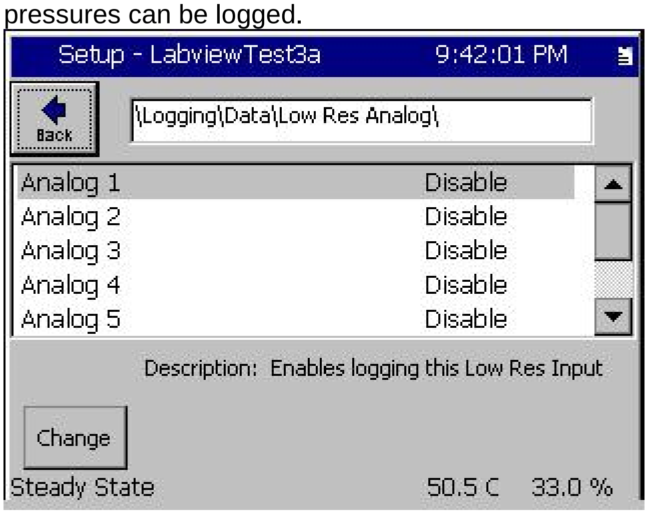
The Heat and Cool Variable s and Constants for each channel can be logged to help with tuning.



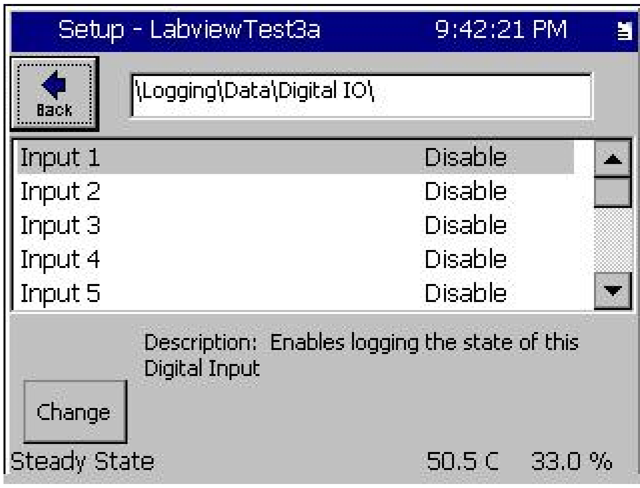
UUT Thermocouple sensors (up to 64) and the High Resolution Analog inputs can be logged.

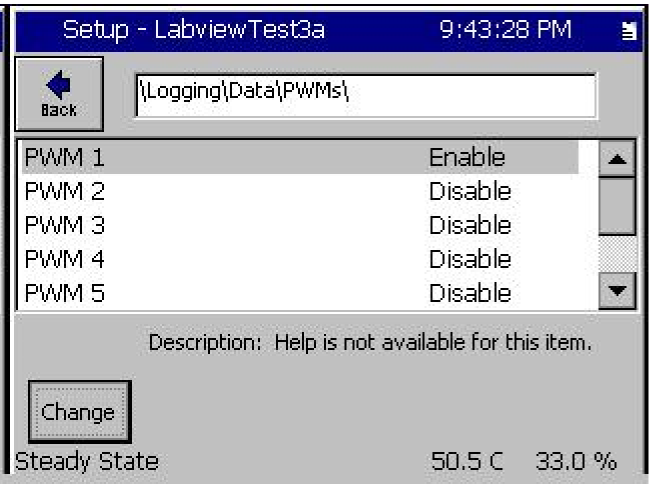


Low Resolution Analog inputs on the full sized controllers which are typically used to monitor compressor pressures can be logged.



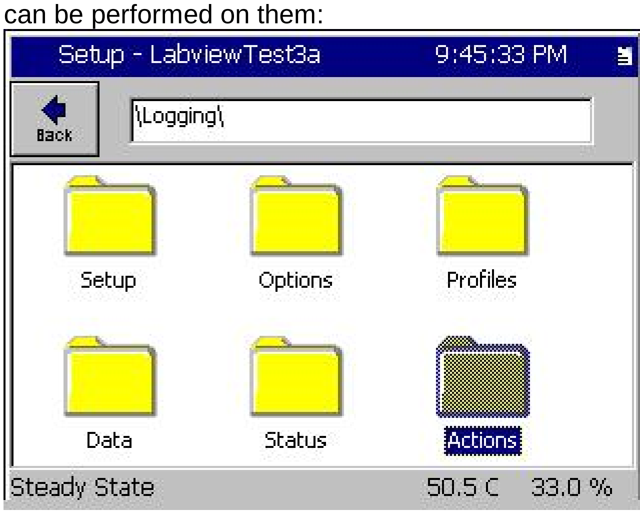
Digital Inputs and PWM outputs can be logged.





Logging Actions

The Logging Actions screen lists the test results stored on the controller and provides a set of actions that can be performed on them:



Logging Status

The Logging Status screen provides information about the History Log file (continuous) and the current profile log if there is one.

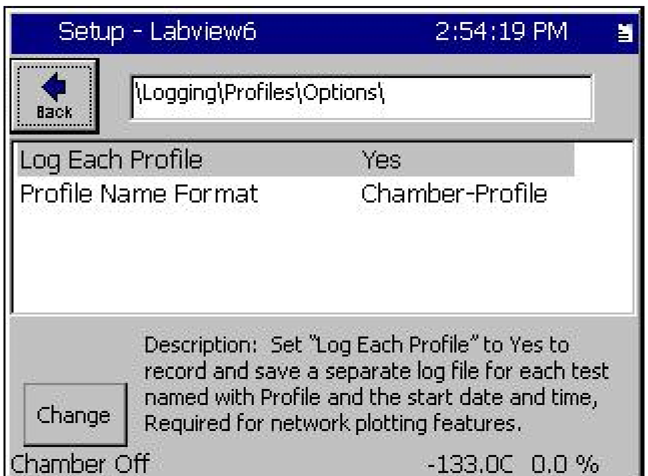
14.1.2 Profile Logging

As described earlier, one of the significant Synergy Controller logging system features introduced in version 3.0.x is “Profile Logging”; i.e. the ability to log each test separately and create a uniquely identifiable test results file. Many of the latest Synergy Controller innovations utilize this capability.

These features include:

- E-Mail Delivery, (see Application note
- Network Plotting / Printing, (see Application note
- Synergy Server, (see Application note 99
- FTP, (see Application note
- USB Flash Drive Export, (see Application note

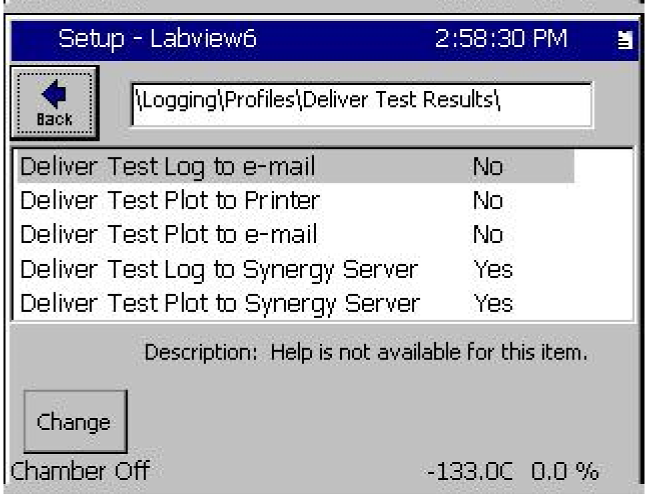
Setup for Automatic E-Mails



To E-Mail profile logs automatically, first set the Logging system to **Log Each Profile.**

Then select the Profile Name Format to set the naming convention for the profile log file.

Note: See Synergy Controller AppNote 90 - Synergy Controller Network Printing Feature for additional setup information



Then set the **Deliver Test Results** options.

14.1.3 Logging Commands

The logging system can be setup from the touch screen as described in the previous Logging Setup section of this application note. In addition, the logging system can also be setup and adjusted remotely, or with command file (.CFG), or a Bar Code Macro file. The command syntax for the Logging system is as follows:

Command	Function	Example
CLEARHIST	Clear's the History Log File	= clearhist 1
COPYHISTTOFTP 1	Copies the log database to the file "history.txt" in the Controller's FTP directory.	= copyhisttoftp 1 File: history.txt
COPYHISTTOFTP 3 "name"	Copies the log database to the file "name.txt" in the Controller's FTP directory.	= copyhisttoftp 3 "test" File: test.txt
COPYHISTTOFTP 7 "name"	Copies the log database to the file "name_MM-DD-YYYY.txt" in the Controller's FTP directory.	= copyhisttoftp 7 "test" File: test_07-09-2009.txt
COPYHISTTOFTP 15 "name"	Copies the log to the file in the controller's FTP directory: "name_MM-DD-YYYY_HH.MM.SS.txt	= copyhisttoftp 7 "test" File: test_07-09-2009_02.20.05.txt
LOGGING_ENABLED	Enables/Disables Interval logging	= LOGGING_ENABLED 1
LOGGING_INTERVAL	Sets the Logging Interval in seconds	= LOGGING_INTERVAL 1
LOG_FILE_SIZE	Sets the Log file size in M Bytes.	= LOG_FILE_SIZE 1.4
LOG_WHILE_OFF	Controls whether the controller continues to log when the chamber is off	= LOG_WHILE_OFF 0
LOG_CHn_ACT	Controls whether the controller logs the Channel n Actual (Process Variable)	= LOG_CH1_ACT 1
LOG_CHn_SP	Controls whether the controller logs the Channel n Setpoint	= LOG_CH1_SP 1
LOG_DEVALMS_CHn	Controls whether the controller logs the Channel n Deviation Alarms	= LOG_DEVALMS_CH1 1
LOG_CHn_HEAT	Controls whether the controller logs the Channel n Heat output	= LOG_CH1_HEAT 1
LOG_CHn_COOL	Controls whether the controller logs the Channel n Cool output	= LOG_CH1_COOL 1
LOG_CH1_HEAT_PB	Controls whether the controller logs the Channel n Heat Proportional Band constant	= LOG_CH1_HEAT_PB 1
LOG_CH1_COOL_PB	Controls whether the controller logs the Channel n Cool Proportional Band constant.	= LOG_CH1_COOL_PB 1
LOG_LOW_n	Controls whether the controller logs the nth Low Res Analog Input.	= LOG_MACHINE1 0
LOG_UUTn	Controls whether the controller logs the nth UUT Module.	= LOG_UUT1 0
LOG_HIGH_n	Controls whether the controller logs the nth High Resolution Analog Input.	= LOG_HIGH_1 0
LOG_TCn	Controls whether the controller logs the nth Thermocouple Input.	= LOG_TC1 1
LOG_TCnCJ	Controls whether the controller logs the nth Thermocouple Cold Junction sensor.	= LOG_TC1CJ 0
LOG_OUTPUTS	Controls whether the controller logs the Outputs	= LOG_OUTPUTS 1
LOG_DIO_n	Controls whether the controller logs Digital Input n	= LOG_OUTPUTS

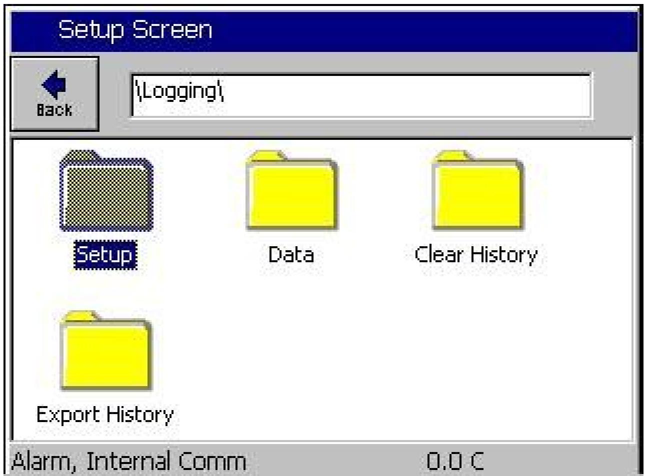
14.2 Logging Applications

The Synergy Controller/Logger captures and delivers test data for test reports. In addition, the Synergy Controller logging system is also useful for controller tuning and fault analysis.

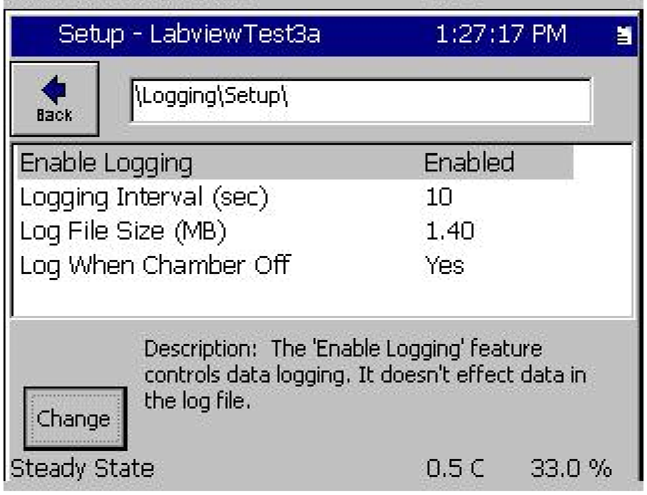
14.2.1 Controller Tuning and Troubleshooting

The controller can chart control parameters to provide insight into the performance of PID tuning and controller settings. The following section explains how to setup the logging system and run a test to benchmark the system performance for analysis.

As an example, to setup the controller logging system to capture PID tuning information:



Go to the Setup Screen and open the SETUP \Logging\Setup folder.

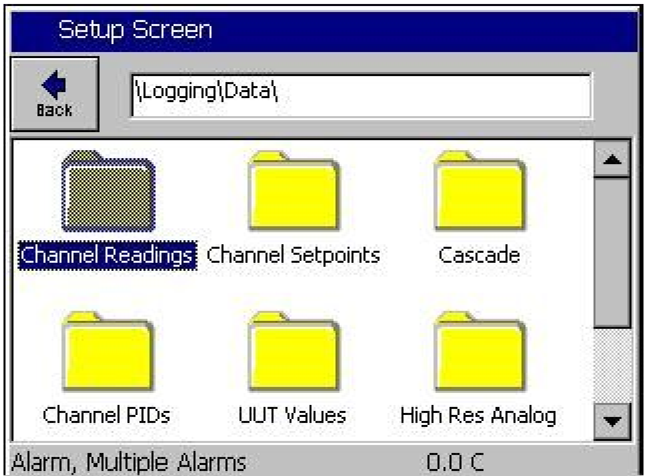


Enable Logging Set to Enabled

Logging Interval (sec) set the Logging Interval to 10 Seconds.

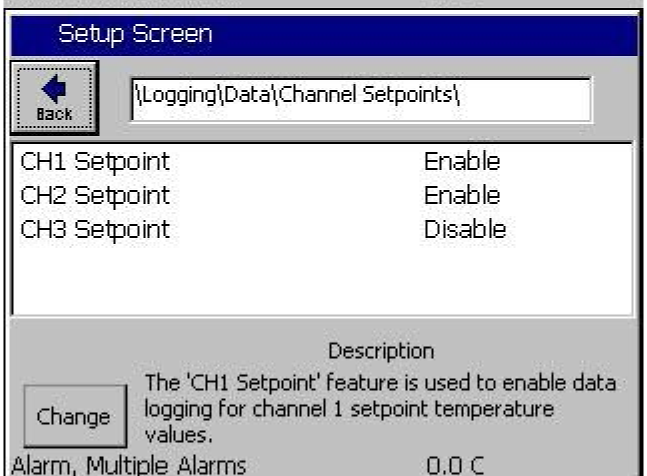
Logging File Size (MB) set from 1.4 MB to 100MB (8MB Recommended).

Log When Chamber Off Set this parameter to Yes if you want the logger to run all the time. Note that Profile Logs will only be generated when the chamber is on and a profile is running. The Parameter only applies to the **History** file; i.e. the continuous log.



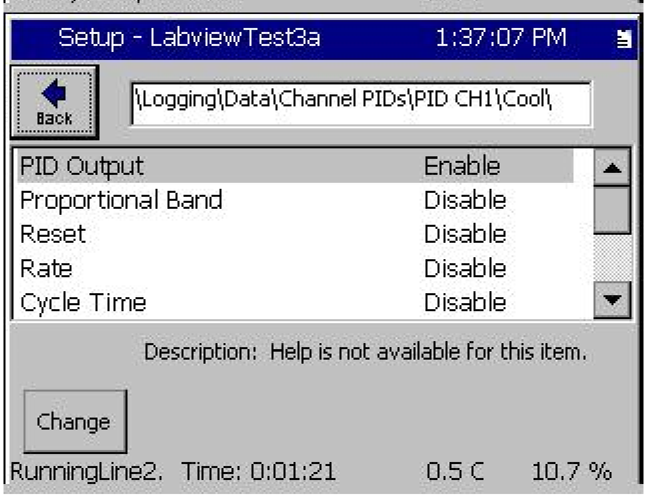
Open the SETUP\Logging\Data\ Folder and select Channel Readings.

Enable Channel 1 Actual and Channel 2 Actual (Select the item and press the "Change" Button)



Channel 1 Setpoint Enable
Channel 2 Setpoint as required
Channel 3 Setpoint as required

Note that this folder may have up to four Setpoints listed.

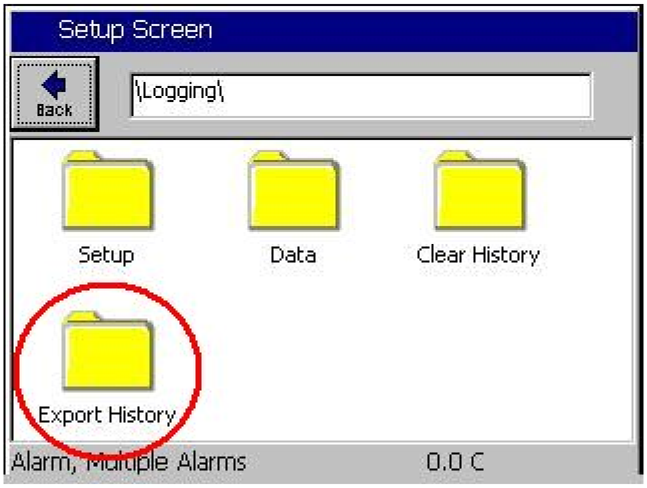


PID Output Enable PID Output Logging for CH1, Cool and Heat folder.

These constants can optionally be logged
Proportional Band a PID Constant
Reset This is also a PID Constant

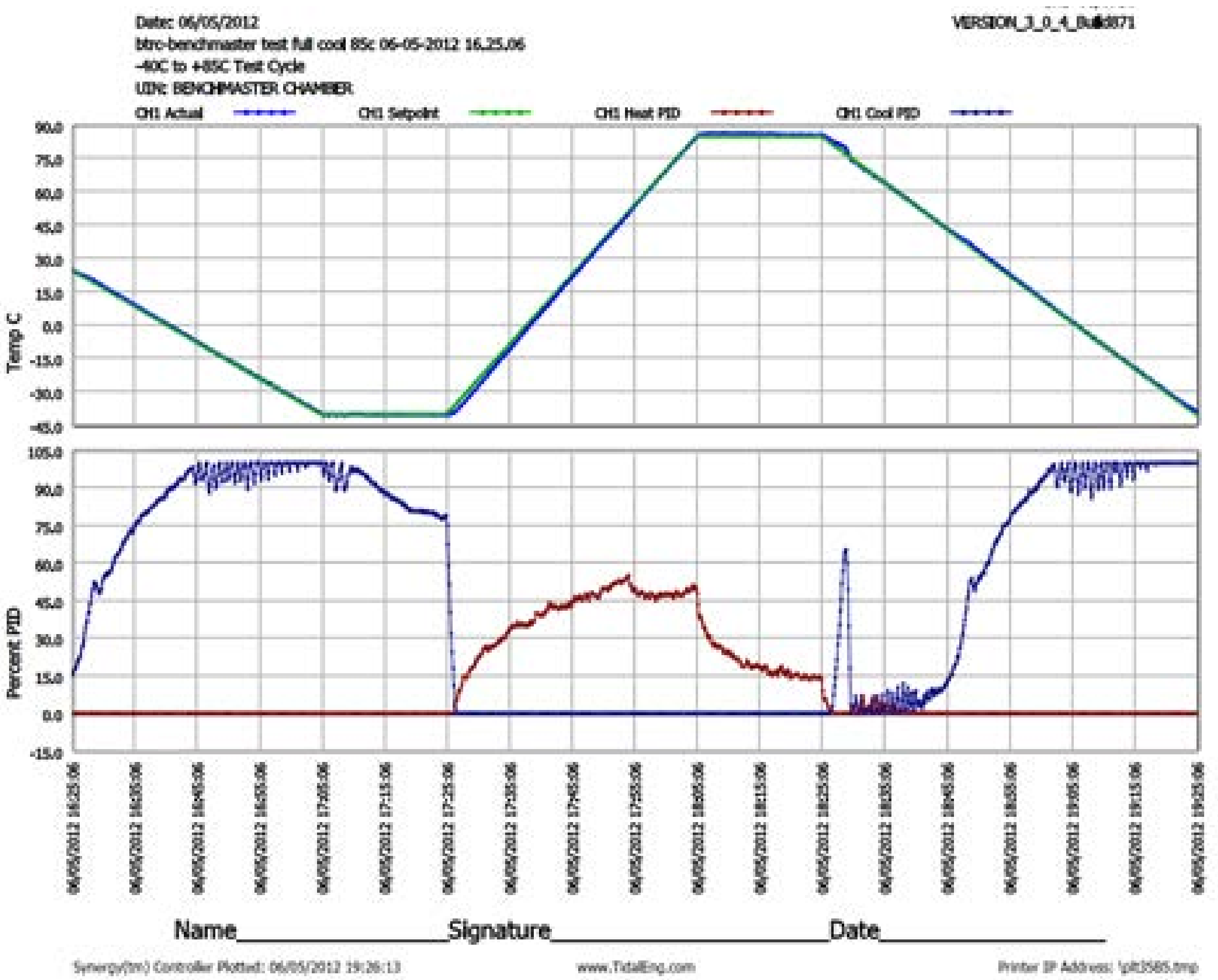
Once the logging settings are adjusted, run the chamber with a representative profile that includes the test conditions required for the application.

Note that PID variables **Cycle Time, Pn, In, Dn** and **Error** can also be logged but are not required logged for tuning applications



After the run, export the log file to a USB Flash drive from the SETUP\Logging\ Export History Folder on the Setup screen.

To plot the test results, import the log file into Excel and chart it or use the controller's plotting feature to generate a PDF plot or send a plot directly to the printer.



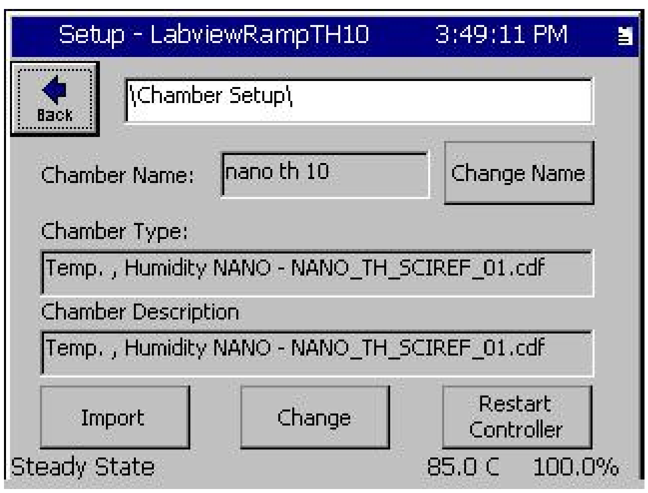
14.3 Log File Format

The log file Comma Separated Variable (CSV) format consists of a Log File Header, one or more field headers, interval records, and message records.

The **Log File Header** identifies the chamber, the software version, additional general information about the chamber, the controller, the test, time and date, etc. These parameters are identified in the table below:

Parameters	Example
Chamber Name:	nano th 10
Application Version:	3.0.7 Build 893b
Help Version:	3.0.5
Operating System Version:	5.0.C
Olympic Version:	V3.0.48
Serial Number:	12/1203
RunTime:	14:32 (hh:mm)
Chamber Definition:	Temp. , Humidity NANO - NANO_TH_SCIREF_01.cdf
Log Used:	22 of 1400 KB
IP Address	http://172.16.10.99
Date, Time:	08/30/2013, 20:54:19

Note that the chamber name in the first parameter is setup in the screen shown below:



The header record identifies the field names. For example:

```
Date and Time, Record Type, Temperature Units, CH1 Actual, CH2 Actual, CH1 Setpoint, CH2 Setpoint
```

Heading field parameters

Parameters	Value
Date and Time	MM/DD/YYYY HH:MM:SS in 24 Hour time
Record Type	I for Interval, M for Message
Temperature Units	C or F for Centigrade of Fahrenheit
Data Headings	CH1 Actual,CH2 Actual,CH1 Setpoint,CH2 Setpoint

Interval records consist of periodic samples of the enabled Data fields.

Example Interval Record

Date and Time							Message
08/30/2013 12:46:14	I	C	85.0	100.0	85.0	85.0	
08/30/2013 12:47:14	I	C	85.0	100.0	85.0	85.0	
08/30/2013 12:48:14	I	C	85.0	100.0	85.0	85.0	

Message records are other records that are generated based on alarm conditions, profile start or stop, Bar code scans, controller startup, etc. Message records recorded whether Logging is Enabled of not.

Example Message Record

Date and Time							Message
08/30/2013 12:45:52	M	C	85.0	100.0	85.0	85.0	Stop Running Profile LVTH10.vpl

Here is an example of a log file with just Alarm records:

Log Header

```
Chamber Name:
  BTRC
Application Version:
  3.0.7 Build 893b
Help Version:
  3.0.5
Operating System Version:
  5.0.C
Olympic Version:
  V3.0.48
Serial Number:
  12/1203
RunTime:
  06:15 (hh:mm)
Chamber Definition:
  Temp. , Humidity NANO - NANO_TH_SCIREF_01.cdf
Log Used:
  0 of 1400 KB
IP Address:
  http://172.16.10.99
Date, Time:
  08/27/2013, 16:55:52

(c)2012 Tidal Engineering Corporation, www.tidaleng.com
```

Field Header

```
Date and Time,Record Type,Temperature Units,CH1 Actual,CH2 Actual,CH1 Setpoint,CH2 Setpoint
```

Message Records

```
08/27/2013 16:54:39,M,C,500.0,100.0,500.0,30.0,Ch 1 High  500.00 C
08/27/2013 16:55:07,M,C,500.0,100.0,500.0,30.0,Ch 1 High  500.00 C
```

Here is an example of a Profile log file with Interval and Message records. Note that the log file ends with the “Stop Running Profile “ Message Record .

Log Header

```
Chamber Name:
  nano th 10
Application Version:
  3.0.7 Build 893b
Help Version:
  3.0.5
Operating System Version:
  5.0.C
Olympic Version:
  V3.0.48
Serial Number:
  12/1203
RunTime:
  14:31 (hh:mm)
Chamber Definition:
  Temp. , Humidity NANO - NANO_TH_SCIREF_01.cdf
Log Used:
  22 of 1400 KB
IP Address:
  http://172.16.10.99
Date, Time:
  08/30/2013, 20:53:46

(c)2012 Tidal Engineering Corporation, www.tidaleng.com
```

Field Header

```
Date and Time,Record Type,Temperature Units,CH1 Actual,CH2 Actual,CH1 Setpoint,CH2 Setpoint
```

Message Record

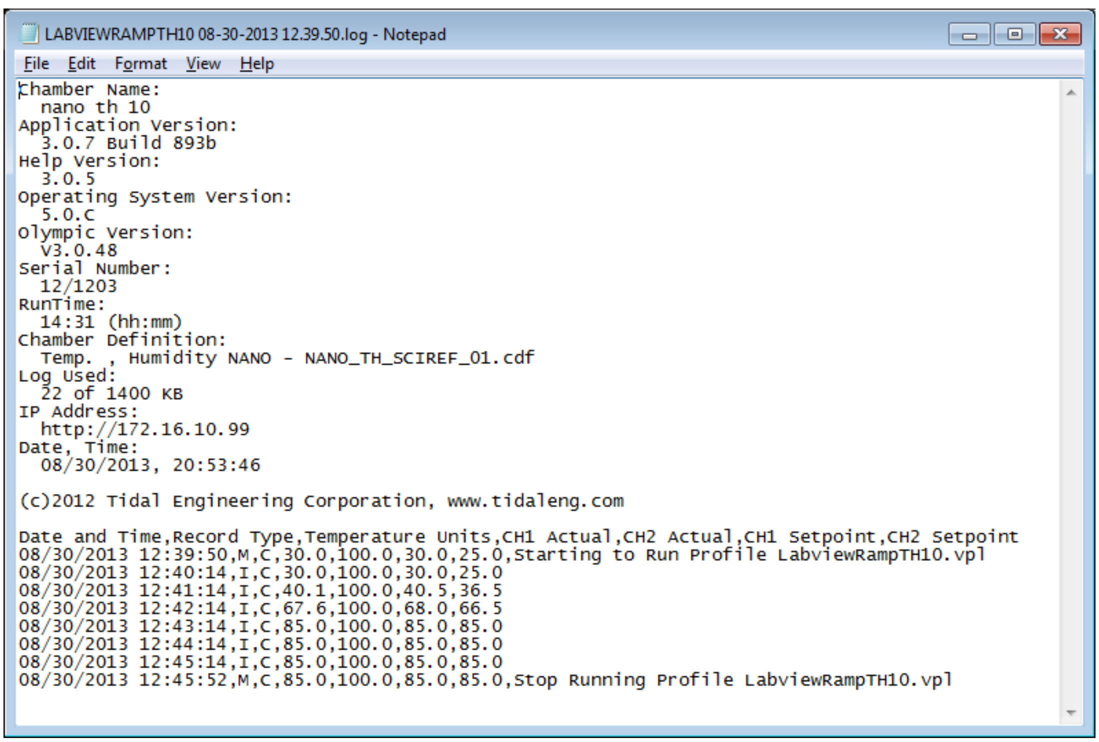
```
08/30/2013 12:39:50,M,C,30.0,100.0,30.0,25.0,Starting to Run Profile LabviewRampTH10.vpl
```

Interval Records

```
08/30/2013 12:40:14,I,C,30.0,100.0,30.0,25.0
08/30/2013 12:41:14,I,C,40.1,100.0,40.5,36.5
08/30/2013 12:42:14,I,C,67.6,100.0,68.0,66.5
08/30/2013 12:43:14,I,C,85.0,100.0,85.0,85.0
08/30/2013 12:44:14,I,C,85.0,100.0,85.0,85.0
08/30/2013 12:45:14,I,C,85.0,100.0,85.0,85.0
```

Message Record

```
08/30/2013 12:45:52,M,C,85.0,100.0,85.0,85.0,Stop Running Profile LabviewRampTH10.vpl
```




```
Chamber Name:
  nano th 10
Application Version:
  3.0.7 Build 893b
Help Version:
  3.0.5
Operating System Version:
  5.0.C
Olympic Version:
  V3.0.48
Serial Number:
  12/1203
RunTime:
  14:31 (hh:mm)
Chamber Definition:
  Temp. , Humidity NANO - NANO_TH_SCIREF_01.cdf
Log Used:
  22 of 1400 KB
IP Address:
  http://172.16.10.99
Date, Time:
  08/30/2013, 20:53:46

(c)2012 Tidal Engineering Corporation, www.tidaleng.com

Date and Time,Record Type,Temperature Units,CH1 Actual,CH2 Actual,CH1 Setpoint,CH2 Setpoint
08/30/2013 12:39:50,M,C,30.0,100.0,30.0,25.0,Starting to Run Profile LabviewRampTH10.vpl
08/30/2013 12:40:14,I,C,30.0,100.0,30.0,25.0
08/30/2013 12:41:14,I,C,40.1,100.0,40.5,36.5
08/30/2013 12:42:14,I,C,67.6,100.0,68.0,66.5
08/30/2013 12:43:14,I,C,85.0,100.0,85.0,85.0
08/30/2013 12:44:14,I,C,85.0,100.0,85.0,85.0
08/30/2013 12:45:14,I,C,85.0,100.0,85.0,85.0
08/30/2013 12:45:52,M,C,85.0,100.0,85.0,85.0,Stop Running Profile LabviewRampTH10.vpl
```

Here is an example of a History log file with Interval and Message records. Note that the log file continues past the "Stop Running Profile " Message Record .

Log Header

```
Chamber Name:
  nano th 10
Application Version:
  3.0.7 Build 893b
Help Version:
  3.0.5
Operating System Version:
  5.0.C
Olympic Version:
  V3.0.48
Serial Number:
  12/1203
RunTime:
  14:32 (hh:mm)
Chamber Definition:
  Temp. , Humidity NANO - NANO_TH_SCIREF_01.cdf
Log Used:
  22 of 1400 KB
IP Address:
  http://172.16.10.99
Date, Time:
  08/30/2013, 20:54:19

(c)2012 Tidal Engineering Corporation, www.tidaleng.com
```

Field Header

```
Date and Time,Record Type,Temperature Units,CH1 Actual,CH2 Actual,CH1 Setpoint,CH2 Setpoint
```

Message Record

```
08/30/2013 12:39:50,M,C,30.0,100.0,30.0,25.0,Starting to Run Profile LabviewRampTH10.vpl
```

Interval Records

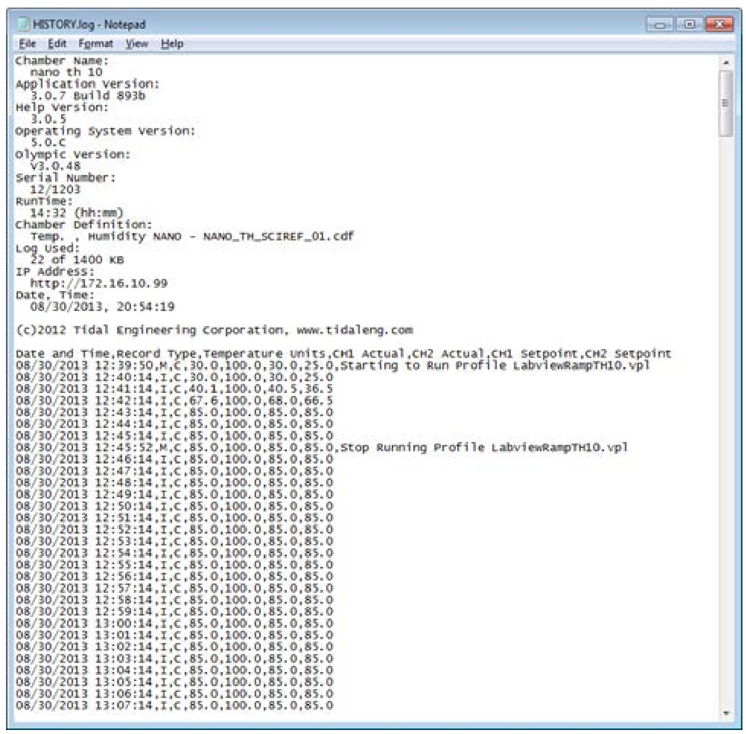
```
08/30/2013 12:40:14,I,C,30.0,100.0,30.0,25.0
08/30/2013 12:41:14,I,C,40.1,100.0,40.5,36.5
08/30/2013 12:42:14,I,C,67.6,100.0,68.0, 66.5
08/30/2013 12:43:14,I,C,85.0,100.0,85.0,85.0
08/30/2013 12:44:14,I,C,85.0,100.0,85.0,85.0
08/30/2013 12:45:14,I,C,85.0,100.0,85.0,85.0
```

Message Record

```
08/30/2013 12:45:52,M,C,85.0,100.0,85.0,85.0,Stop Running Profile LabviewRampTH10.vpl
```

Interval Records

```
08/30/2013 12:46:14,I,C,85.0,100.0,85.0,85.0
08/30/2013 12:47:14,I,C,85.0,100.0,85.0,85.0
08/30/2013 12:48:14,I,C,85.0,100.0,85.0,85.0
08/30/2013 12:49:14,I,C,85.0,100.0,85.0,85.0
08/30/2013 12:50:14,I,C,85.0,100.0,85.0,85.0
08/30/2013 12:51:14,I,C,85.0,100.0,85.0,85.0
08/30/2013 12:52:14,I,C,85.0,100.0,85.0,85.0
08/30/2013 12:53:14,I,C,85.0,100.0,85.0,85.0
08/30/2013 12:54:14,I,C,85.0,100.0,85.0,85.0
08/30/2013 12:55:14,I,C,85.0,100.0,85.0,85.0
08/30/2013 12:56:14,I,C,85.0,100.0,85.0,85.0
08/30/2013 12:57:14,I,C,85.0,100.0,85.0,85.0
08/30/2013 12:58:14,I,C,85.0,100.0,85.0,85.0
08/30/2013 12:59:14,I,C,85.0,100.0,85.0,85.0
08/30/2013 13:00:14,I,C,85.0,100.0,85.0,85.0
08/30/2013 13:01:14,I,C,85.0,100.0,85.0,85.0
```



HISTORY.log - Notepad

File Edit Format View Help

```
Chamber Name:
  nano th 10
Application Version:
  3.0.7 Build 893b
Help Version:
  3.0.5
Operating System Version:
  5.0.C
Olympic Version:
  V3.0.48
Serial Number:
  12/1203
RunTime:
  14:32 (hh:mm)
Chamber Definition:
  Temp. , Humidity NANO - NANO_TH_SCIREF_01.cdf
Log Used:
  22 of 1400 KB
IP Address:
  http://172.16.10.99
Date, Time:
  08/30/2013, 20:54:19

(c)2012 Tidal Engineering Corporation, www.tidaleng.com

Date and Time,Record Type,Temperature Units,CH1 Actual,CH2 Actual,CH1 Setpoint,CH2 Setpoint
08/30/2013 12:39:50,M,C,30.0,100.0,30.0,25.0,Starting to Run Profile LabviewRampTH10.vpl
08/30/2013 12:40:14,I,C,30.0,100.0,30.0,25.0
08/30/2013 12:41:14,I,C,40.1,100.0,40.5,36.5
08/30/2013 12:42:14,I,C,67.6,100.0,68.0,66.5
08/30/2013 12:43:14,I,C,85.0,100.0,85.0,85.0
08/30/2013 12:44:14,I,C,85.0,100.0,85.0,85.0
08/30/2013 12:45:14,I,C,85.0,100.0,85.0,85.0
08/30/2013 12:45:52,M,C,85.0,100.0,85.0,85.0,Stop Running Profile LabviewRampTH10.vpl
08/30/2013 12:46:14,I,C,85.0,100.0,85.0,85.0
08/30/2013 12:47:14,I,C,85.0,100.0,85.0,85.0
08/30/2013 12:48:14,I,C,85.0,100.0,85.0,85.0
08/30/2013 12:49:14,I,C,85.0,100.0,85.0,85.0
08/30/2013 12:50:14,I,C,85.0,100.0,85.0,85.0
08/30/2013 12:51:14,I,C,85.0,100.0,85.0,85.0
08/30/2013 12:52:14,I,C,85.0,100.0,85.0,85.0
08/30/2013 12:53:14,I,C,85.0,100.0,85.0,85.0
08/30/2013 12:54:14,I,C,85.0,100.0,85.0,85.0
08/30/2013 12:55:14,I,C,85.0,100.0,85.0,85.0
08/30/2013 12:56:14,I,C,85.0,100.0,85.0,85.0
08/30/2013 12:57:14,I,C,85.0,100.0,85.0,85.0
08/30/2013 12:58:14,I,C,85.0,100.0,85.0,85.0
08/30/2013 12:59:14,I,C,85.0,100.0,85.0,85.0
08/30/2013 13:00:14,I,C,85.0,100.0,85.0,85.0
08/30/2013 13:01:14,I,C,85.0,100.0,85.0,85.0
08/30/2013 13:02:14,I,C,85.0,100.0,85.0,85.0
08/30/2013 13:03:14,I,C,85.0,100.0,85.0,85.0
08/30/2013 13:04:14,I,C,85.0,100.0,85.0,85.0
08/30/2013 13:05:14,I,C,85.0,100.0,85.0,85.0
08/30/2013 13:06:14,I,C,85.0,100.0,85.0,85.0
08/30/2013 13:07:14,I,C,85.0,100.0,85.0,85.0
```

14.4 UUT Thermocouple Data Acquisition Module Option

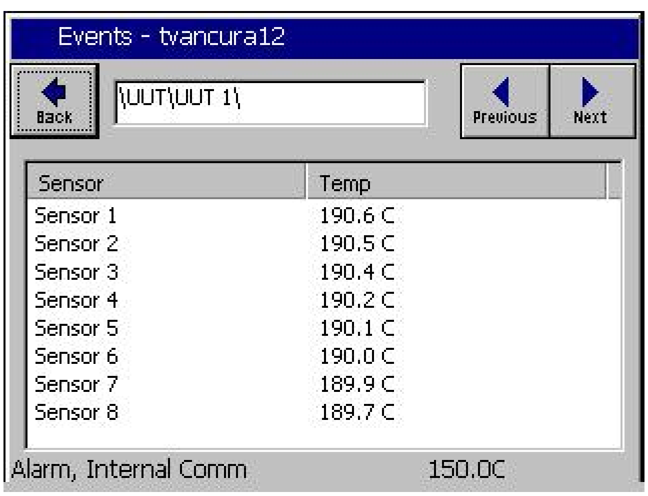
The UUT Module (Unit-Under-Test) is a 16-channel T-Type thermocouple data acquisition unit. Developed to expand the input capabilities of the Synergy Controller, each UUT module allows system operators to capture and log temperature data from the unit-under-test and other pertinent test temperatures. Up to four modules can be attached to the Synergy Controller providing up to 64 T-Type thermocouple inputs. The UUT data can optionally be logged and the log file may be used for analysis, graphing and reporting.

UUT Module Applications

The UUT module can be used to monitor and record multiple air temperatures and multiple product temperatures. The controller can also control from any one of the UUT Sensor inputs.

UUT modules are particularly useful when testing products with a large thermal mass whose temperature is slow to change. When used in conjunction with the Synergy Controller's Cascade control feature, the user can program the chamber to ramp to temperature setpoints and **Waitfor** product temperature instead of the chambers air temperature.

UUT Module



UUT Temperatures

For UUT Modules 1 thru 8, the EVENTS\UUT screen shows actual temperature readings of Sensors 1 thru 8 for each UUT.

Select UUT 1 thru UUT 8 with ***Next*** or ***Previous*** buttons.

As mentioned above, these sensors may be logged. See Section 6.11 Setup: Logging.

UUT Module Setup Procedure

This is the installation and setup procedure for one or more UUT (Unit-Under-Test) modules. If a UUT module is already installed in your chamber, go to Step 9 in this Procedure for instructions for viewing your thermocouple temperature readings on the Synergy Controller touch-screen. Refer to the UUT Module – Board and Connector Layout Drawing at the end of this section.

UUT Module Specifications

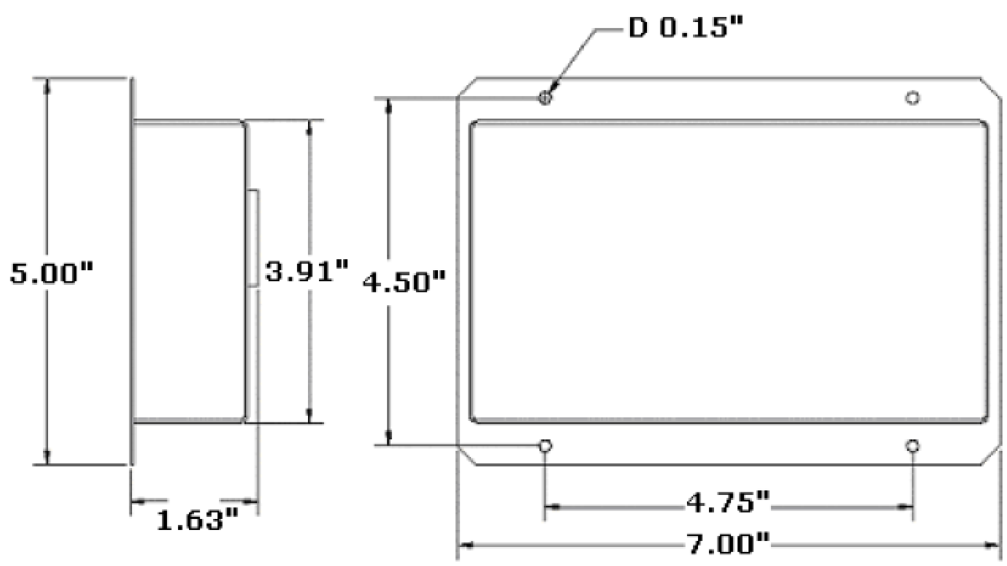
- Up to four UUT Modules can be used with the Synergy Controller.
- Each module can accept up to 16 thermocouple inputs for a total of 64 inputs.
- The UUT module uses Type T Thermocouples.
- RS-485 Data Communications are used to communicate with each UUT Module.

Hardware Connections

Disconnect power to the test chamber before starting. Lock-out / Tag-out your power source.

Follow the steps below to configure the UUT Module and to make necessary connections.

- Power Supply Cord: Black 2-wire cord with plug-in transformer, connected to Terminal Block P1.
- RS-485 Interconnect 9-conductor ribbon cable, connected to Connector P6.



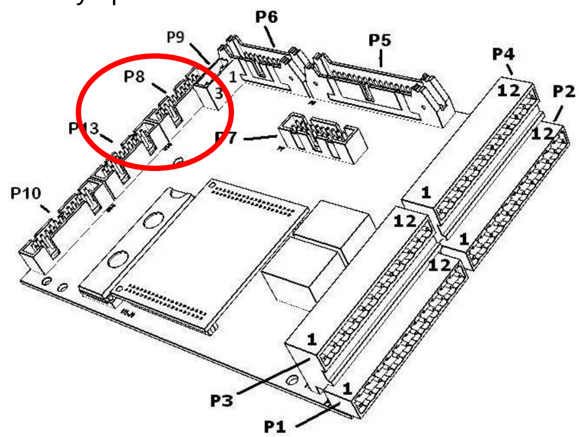
UUT Module Mechanical Drawing

14.4.1 Setup Procedure

1. Locate the small square selector switch on the UUT Module labeled Address Switch. Turn the dial on the switch to the proper Module Address setting indicated in the table shown on the right.

MODULE NO	SETTING
Module 1	1
Module 2	3
Module 3	5
Module 4	7

2. Locate the 9-pin male plug on the ribbon cable plugged into Olympic board P8.



3. Connect the 9-pin male connector from the ribbon cable to the RS-485 9-pin female connector located on the UUT module.

4. Connect your T-Type Thermocouple input wires to the appropriate terminal blocks P2 thru P4 on the UUT Module. Consult the Thermocouple Connection Tables on the UUT Module drawing for proper terminations.

5. Be careful to route the thermocouple wires and the power supply cord safely through the appropriate opening to avoid pinching.

6. Plug in the UUT Module wall power transformer to a 120 Volt outlet.

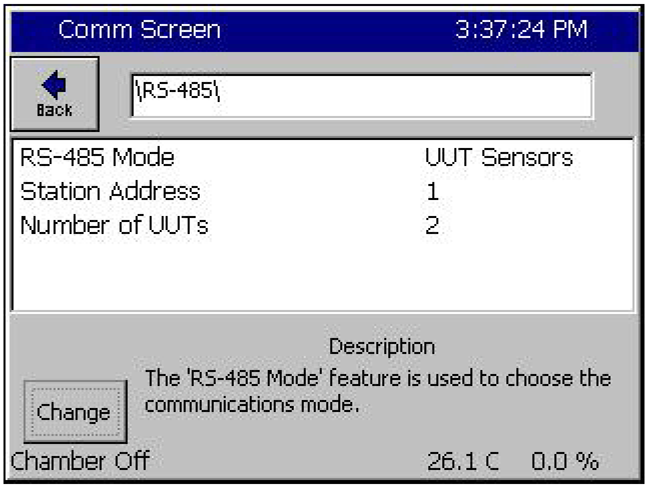
   Verify that the green LED on the UUT Module is illuminated. It should be on steadily.

   Notes:
   -The table at the right shows the board power supply connections to the P1 connector.
   -The additional RS – 485 terminals labeled COMM shown in the table on the right are not required for normal wiring since the DB-9 connector provides these connections.

BOARD PWR SUPPLY and RS-485 CONNECTION TABLE P1 CONNECTOR	
DESIGNATION	**TERMINAL**
Board GND.	P1 - 1
Board POWER	P1 - 2
COMM RX – **Note 1**	P1 - 3
COMM TX +	P1 - 4
COMM TX -	P1 - 5
COMM RX +	P1 - 6

7. Turn on power to your test chamber. Once the Synergy Controller completes the boot-up procedure, press the ***COMM*** Navigation key. Open the RS-485 folder to arrive at the screen below.

   Configure RS-485 Mode and Station Address to the values displayed in the screen below by pressing on each item. Make the changes in the screens that follow. Configure the Number of UUTs using the chart on the right.



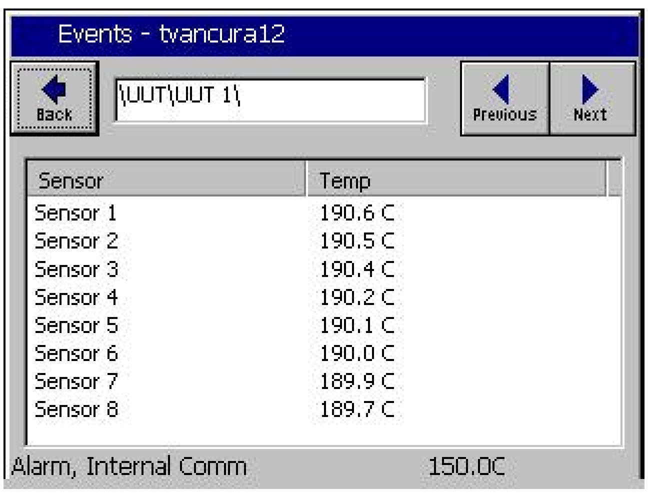
Number of Thermocouples	**Number of UUTs** Value to be Entered
1 - 16	2
1 - 32	4
1 - 48	6
1 - 64	8

8. Cycle power to the chamber but leave the UUT power supply plugged in to the 120 V outlet.

   After the Synergy Controller boots up successfully, verify that the green LED on the UUT Module is blinking. This indicates that data communications have been established between the Synergy Controller and the UUT Module.

   Important Note: When you have more than one UUT Module, verify that the green LED blinks on each module. Each module is queried sequentially as the Synergy Controller gathers the temperature data from each of the modules.

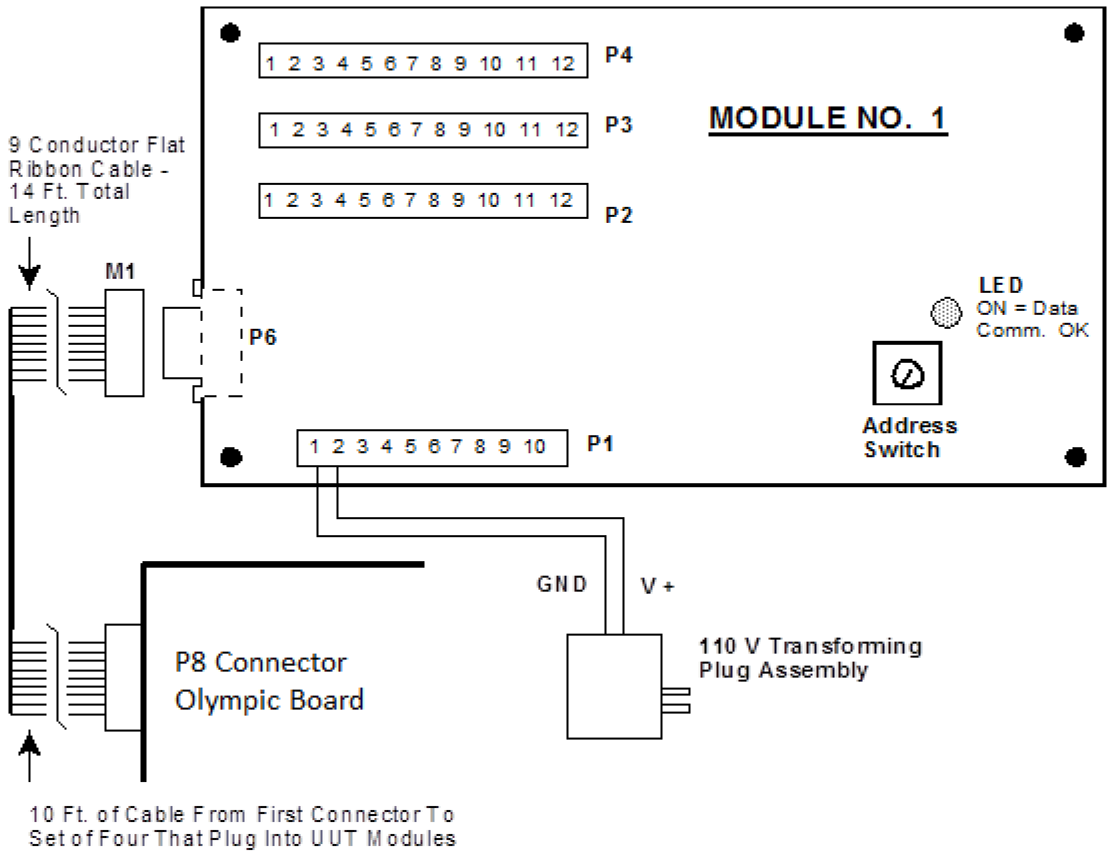
9. **Verify thermocouple temperature readings.** Press the ***EVENTS*** Navigation key on the Synergy Controller. Open the UUT Temperature folder to display the screen below



- Remember that each UUT Module can accept up to 16 T/C inputs.
- Each screen displays 8 sensors labeled Sensor 1 thru Sensor 8. You can view all 16 inputs of a module with 2 screens.
- Press the ***Next*** button to view the next set of eight sensors for the first UUT Module. The path display changes from UUT1 to UUT2. The UUT2 screen will show the readings for actual sensors No.'s 9 – 16.
- To view sensor inputs for UUT Modules. 2, 3 and 4, continue pressing the ***Next*** button. UUT Module No. 2 data will be displayed by UUT3 / UUT4, module by No. 3 UUT5 / UUT6, etc.

Important Note: If your screen shows "x.x" for sensor "Temp", go back to Step 7 and verify the Number of UUTs entered. X.x indicates that the module isn't being monitored by the Synergy Controller.

UUT MODULE - Board and Connector Layout



TC1 – TC10 THERMOCOUPLE CONNECTION TABLE		
SENSOR	+ Term.	- Term.
TC1	P2 - 5	P2 - 6
TC2	P2 - 7	P2 - 8
TC3	P2 - 9	P2 - 10
TC4	P2 - 11	P2 - 12
TC5	P3 - 1	P3 - 2
TC6	P3 - 3	P3 - 4
TC7	P3 - 5	P3 - 6
TC8	P3 - 7	P3 - 8
TC9	P3 - 9	P3 - 10
TC10	P3 - 11	P3 - 12

TC11 - TC16 THERMOCOUPLE CONNECTION TABLE		
SENSOR	+ Term.	- Term.
TC11	P4 - 1	P4 - 2
TC12	P4 - 3	P4 - 4
TC13	P4 - 5	P4 - 6
TC14	P4 - 7	P4 - 8
TC15	P4 - 9	P4 - 10
TC16	P4 - 11	P4 - 12

RS – 485 COMM. CONNECTION TABLE - P6 CONNECTOR	
DESIGNATION	TERMINAL
COMM RX -	P6 - 1
COMM TX +	P6 - 2
COMM TX -	P6 - 3
NO CONN.	P6 - 4
GND.	P6 - 5
NO CONN.	P6 - 6
NO CONN.	P6 - 7
POWER	P6 - 8
COMM RX +	P6 - 9

14.5 Alarm Logging

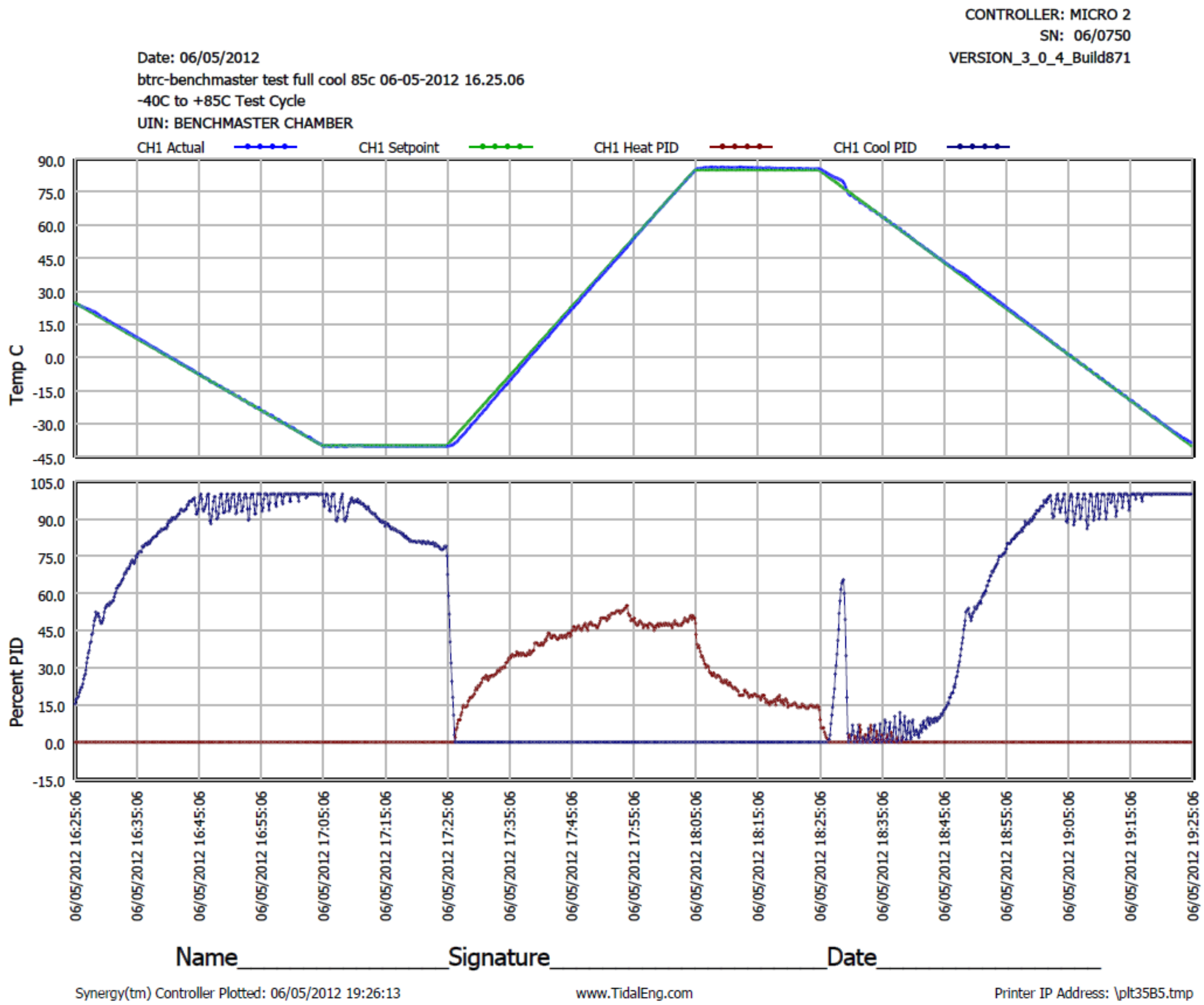
The Synergy Controller logger captures Alarms even if logging is disabled.

When an alarm occurs it generates a message record.

For example “Ch 1 High 500.00 C” is in the last field of the record as shown below:

```
08/27/2013 16:54:39,M,C,500.0,100.0,500.0,30.0,Ch 1 High  500.00 C
08/27/2013 16:55:07,M,C,500.0,100.0,500.0,30.0,Ch 1 High  500.00 C
```

Note the record type field following the Date/Time record contains M in the records above.



15.0 INSTALLATION AND TROUBLESHOOTING

The Synergy Controller is designed for both new equipment and retrofit applications. This section provides an overview of the controller installation process.

Note that some of these steps are simplified for VersaTenn, VersaTenn II and VersaTenn III retrofits since those systems will already have the output boards installed. These steps are noted as such.

The Synergy Controller is engineered as a drop-in replacement for Tenney VersaTenn III controllers, employing virtually identical electrical, mechanical, and physical interfaces. Available with either a front or flush mounted 320 x 240 (color STN) touch screen, the multi-channel Synergy Controller makes the retrofit process fast and easy.

Detailed chamber specific retrofit installation instructions are available for some chambers at www.tidaleng.com.

Dangerous voltages are present in this equipment. Disconnect electrical service of source and tag circuit out before servicing or replacing components.

15.1 Installation Check List

The Synergy Controller installation consists of the six steps summarized here:

1. Configuration selection; Select the appropriate configuration for your test chamber, i.e. Temperature/Humidity, Temperature/Pressure, etc.
2. Mount the controller and the other components.
3. Wire the controller, output boards, etc.
4. Setup the controller.
5. Test alarm systems.
6. Verify control system performance for transient and steady state testing.

15.2 Chamber Configuration Selection

To begin the installation process, select the configuration appropriate for your test chamber, i.e. Temperature/Humidity, Temperature/Pressure, etc. See Section 15.4 for a list of standard configurations. Consult the factory for custom configurations.

15.3 Controller Setup

Once the Synergy Controller and output boards are mounted and wired check the tightness of all connections. Then apply power to the system and configure the controller. To configure the controller:

1. Startup the controller and select the chamber type from the Setup/Chamber setup folder.
2. Check the Input calibration for all inputs and the sensor selection for each channel. Change as necessary.
3. Setup the channel alarms and any other alarms (see the Section 3.0 - Safety)
4. Setup Logging; Log interval, log data, log enable. (See the Section 6.11 - Logging)
5. Enter the WebTouch Remote, Cascade Control and Pressure Control Registration keys as necessary.

15.4 Generic Chamber Types

The following sections identify the output mappings for the generic chamber definitions; i.e. standard chamber definitions built in to the controller.

1. Generic Temperature Only
2. Generic Temperature/Temperature
3. Generic Temperature/Humidity
4. Generic Temperature/Humidity Single Stage
5. Generic Temperature/Pressure
6. Generic Temperature/Humidity/Pressure
7. Generic Temperature/Vibration
8. Retro Temperature Only

Custom configurations can be created upon request at Tidal Engineering, one of our OEMs or one of the Synergy Certified service organizations.

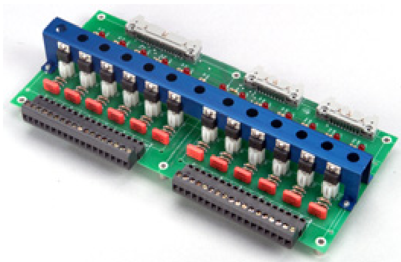
Custom configurations are useful for a number of reasons; here are some examples:

1. Reordering the outputs facilitates wiring in a retrofit application.
2. Adding functionally for staged heating or staged cooling.
3. Adding logic to handle new features or to control additional refrigeration components; i.e. pump down.
4. Add additional Light, Sand, Dust, Wind, Pressure channels.

15.4.1 Generic Temperature Only

Generic Temperature Only

TE1151-12



1SM Outputs

SM Channel	Digital Output	Device
1	1	Fan
2	2	Hi Artificial Load
3	3	PID Heat
4	4	Boost Heat
5	5	Low Compressor
6	6	High Compressor
7	7	PID Cool
8	8	Full Cool
9	9	Low Artificial Load
10	10	Cascade
11	17	Not Used
12	18	Not Used

TE1151-6

2SM Outputs

SM Channel	Digital Output	Device
1	11	Not Used
2	12	Not Used
3	13	Not Used
4	14	Not Used
5	15	Not Used
6	16	Not Used

TE1151-6

3SM Event Outputs

SM Channel	Digital Output	Device
1	19	Event 1
2	20	Event 2
3	21	Event 3
4	22	Event 4
5	23	Event 5
6	24	Event 6

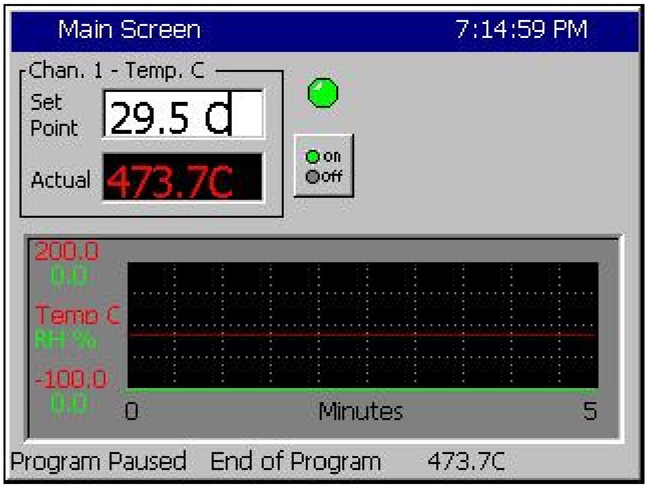
TE1151-6

SSR Outputs

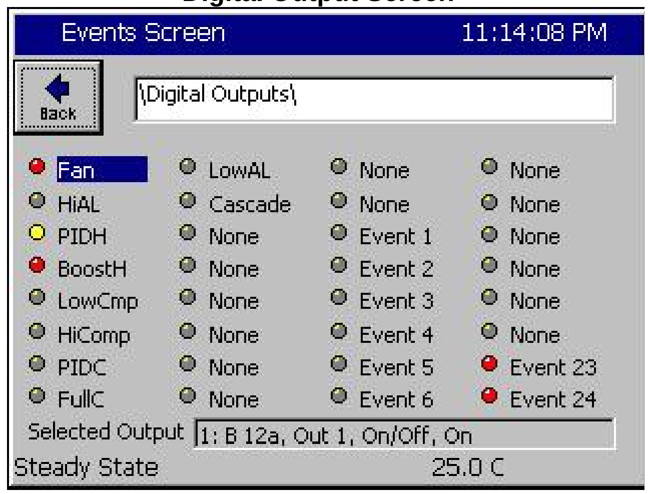
SM Channel	Digital Output	Device
6	30	Not Used
5	29	Not Used
4	28	Not Used
3	27	Not Used
2	26	Not Used
1	25	Not Used

Generic Temperature Only

Main Screen



Digital Output Screen



Channels

Inputs	Channel 1	Channel 2	Channel 3	Channel 4
Type				
Sensor				
High Volt Scale				
Low Volt Scale				
High Eng. Scale				
Low Eng. Scale				

Digital Inputs

Name	Input	Function when Closed
Compressor Cut in Logic	Input 3	Boost Heat, High Artificial Load, High Stage Compressor, Cascade Condenser (See Section 6.7 Device Primitives etc.)
Burn-in Logic	Input 4	Enables Low Stage Compressor and Full Cool with LEV1.
AGREE Chamber Logic	Input 5	Locks out Low Stage Compressor and enables High Stage Compressor and Full Cool with LEV1
TempGard	Input 9	None, TempGard Alarm displays in Alarm Folder and Log File.

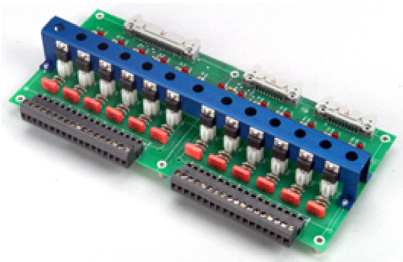
Alarms

Name	Sensor	Sensor Code	Default Threshold	Report	Log	K1	K2
Hi Alarm Ch 1							
Low Alarm Ch 1							
Bad Sensor Ch 1							
Bad Sensor Ch 1							
TempGard							

15.4.2 Generic Temperature/Temperature, Dual Thermal Shock

Generic Temp/Temp, Dual Thermal Shock

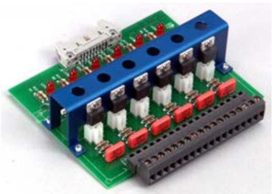
TE1151-12



1SM Outputs

SM Channel	Digital Output	Device
1	1	PID Heat
2	2	PID Cool
3	3	Compressor
4	4	Artificial Load
5	5	Fan
6	6	PID Heat
7	7	PID Cool
8	8	Compressor
9	9	Artificial Load
10	10	Fan
11	17	Event 1
12	18	Event 2

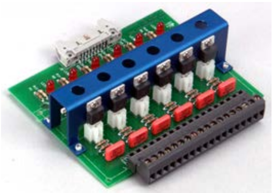
TE1151-6



2SM Outputs

SM Channel	Digital Output	Device
1	11	Not Used
2	12	Not Used
3	13	Not Used
4	14	Not Used
5	15	Not Used
6	16	Not Used

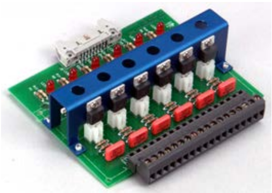
TE1151-6



3SM Event Outputs

SM Channel	Digital Output	Device
1	19	Event 1
2	20	Event 2
3	21	Event 3
4	22	Event 4
5	23	Event 5
6	24	Event 6

TE1151-6

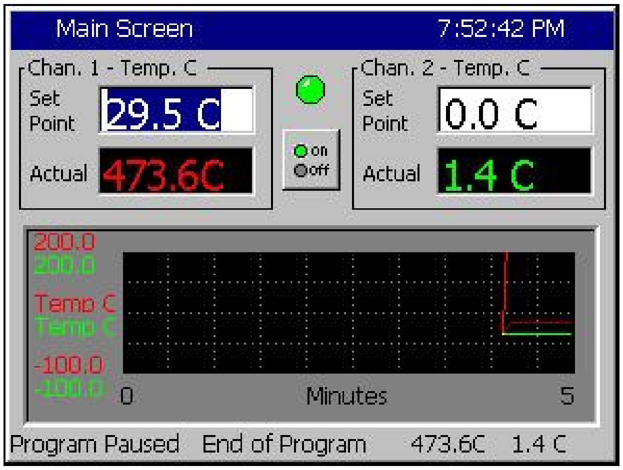


SSR Outputs

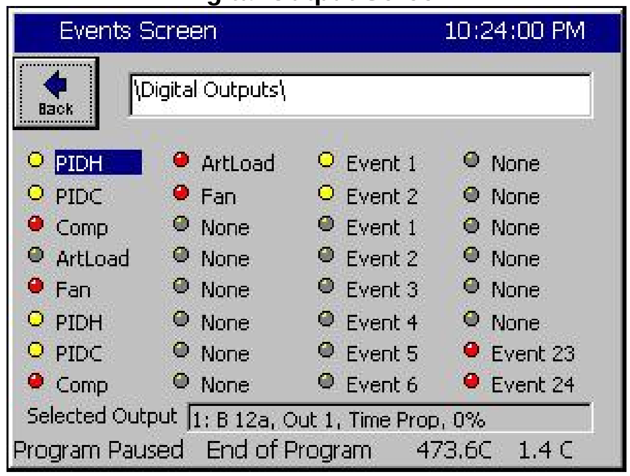
SM Channel	Digital Output	Device
1	25	Not Used
2	26	Not Used
3	27	Not Used
4	28	Not Used
5	29	Not Used
6	30	Not Used

Generic Temp/Temp, Dual Thermal Shock

Main Screen



Digital Output Screen



Channels

Inputs	Channel 1	Channel 2	Channel 3	Channel 4
Type	Temperature	Temperature	N/A	N/A
Sensor	RTD1	RTD2	N/A	N/A
High Volt Scale	N/A	N/A	N/A	N/A
Low Volt Scale	N/A	N/A	N/A	N/A
High Eng. Scale	N/A	N/A	N/A	N/A
Low Eng. Scale	N/A	N/A	N/A	N/A

Digital Inputs

Name	Input	Function when Closed
TempGard	Input 9	None, TempGard Alarm displays in Alarm Folder and Log File.

Alarms

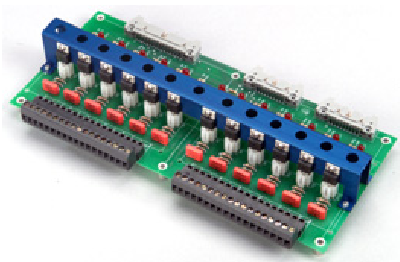
Name	Sensor	Sensor Code	Default Threshold	Report	Log	K1	K2
Hi Alarm Ch 1	RTD1	110	> 500 C	Yes	Yes	Yes	No
Low Alarm Ch 1	RTD1	110	< -200C	Yes	Yes	Yes	No
Hi Alarm Ch 2	RTD2	120	> 500 C	Yes	Yes	Yes	No
Low Alarm Ch 2	RTD2	120	< -200C	Yes	Yes	Yes	No
Bad Sensor Ch 1	RTD1	110	< 10 Ohm	Yes	Yes	Yes	No
Bad Sensor Ch 1	RTD1	110	> 330 Ohm	Yes	Yes	Yes	No
Bad Sensor Ch 2	RTD2	120	< 10 Ohm	Yes	Yes	Yes	No
Bad Sensor Ch 2	RTD2	120	> 330 Ohm	Yes	Yes	Yes	No
TempGard	Digital Input 9	409	Open	Yes	Yes	No	No

This Generic Temp/Temp configuration supports VersaTenn Thermal Shock retrofits.

15.4.3 Generic Temperature/Humidity

Generic Temperature/Humidity

TE1151-12



1SM Outputs

SM Channel	Digital Output	Device
1	1	Fan
2	2	High Artificial Load
3	3	PID Heat
4	4	Boost Heat
5	5	Low Compressor
6	6	High Compressor
7	7	PID Cool
8	8	Full Cool
9	9	Low Artificial Load
10	10	Cascade
11	17	Vent BC
12	18	Vacuum

TE1151-6

2SM Outputs

SM Channel	Digital Output	Device
1	11	Ambient
2	12	PID Humidify
3	13	Hi Al
4	14	Dehumidify Coil
5	15	Drier
6	16	Wickpan

TE1151-6

3SM Event Outputs

SM Channel	Digital Output	Device
1	19	Event 1
2	20	Event 2
3	21	Event 3
4	22	Event 4
5	23	Event 5
6	24	Event 6

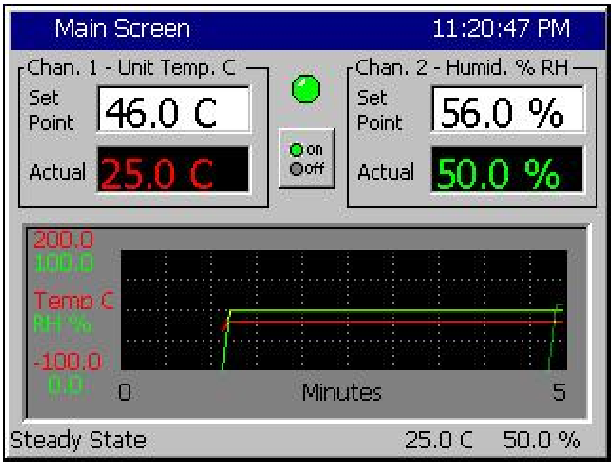
TE1151-5

SSR Outputs

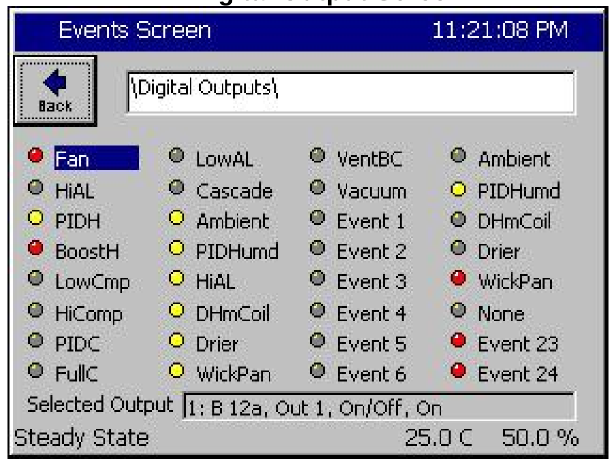
SSR Channel	Digital Output	Device
1	25	Ambient
2	26	PID Humidify
3	27	Dehumidify Coil
4	28	Drier
5	29	Wickpan

Generic Temperature/Humidity

Main Screen



Digital Output Screen



Channels

Inputs	Channel 1	Channel 2	Channel 3	Channel 4
Type	Temperature	Humidity	N/A	N/A
Sensor	RTD1	Analog 1	N/A	N/A
High Volt Scale	N/A	5VDC	N/A	N/A
Low Volt Scale	N/A	0VDC	N/A	N/A
High Eng. Scale	N/A	100%	N/A	N/A
Low Eng. Scale	N/A	0%	N/A	N/A

Digital Inputs

Name	Input	Function when Closed
Ambient Lock Out	Input 1	Disables Ambient Coil when Dehumidify Coil is on.
Drier Logic	Input 2	Enables Drier when LEV1 (Use Drier) is active.
Compressor Cut in Logic	Input 3	Boost Heat, High Artificial Load, High Stage Compressor, Cascade Condenser (See Section 6.7 Device Primitives etc.)
Burn-in Logic	Input 4	Enables Low Stage Compressor and Full Cool with LEV1.
AGREE Chamber Logic	Input 5	Locks out Low Stage Compressor and enables High Stage Compressor and Full Cool with LEV1
TempGard	Input 9	None, TempGard Alarm displays in Alarm Folder and Log File.

Alarms

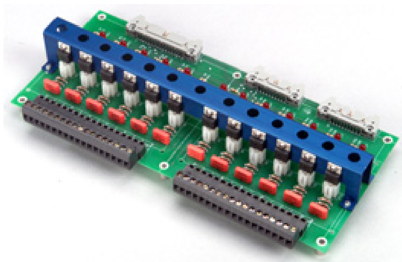
Name	Sensor	Sensor Code	Default Threshold	Report	Log	K1	K2
Hi Alarm Ch 1	RTD1	110	> 500 C	Yes	Yes	Yes	No
Low Alarm Ch 1	RTD1	110	< -200C	Yes	Yes	Yes	No
Hi Alarm Ch 2	Analog1	130	104%	Yes	Yes	Yes	No
Low Alarm Ch 2	Analog1	130	-10%	Yes	Yes	Yes	No
Bad Sensor Ch 1	RTD1	110	< 10 Ohm	Yes	Yes	Yes	No
Bad Sensor Ch 1	RTD1	110	> 330 Ohm	Yes	Yes	Yes	No
Bad Sensor Ch 2	Analog1	130	< -.1 Vdc	Yes	Yes	Yes	No
Bad Sensor Ch 2	Analog1	130	> 5.25 Vdc	Yes	Yes	Yes	No
TempGard	Digital Input 9	409	Open	Yes	Yes	No	No

This Generic Temperature/Humidity configuration supports VersaTenn retrofits.

15.4.4 Generic Temperature/Humidity Single Stage

Generic Temperature/Humidity Single Stage

TE1151-12



1SM Outputs

SM Channel	Digital Output	Device
1	1	Fan
2	2	High Artificial Load
3	3	PID Heat
4	4	Boost Heat
5	5	Wickpan
6	6	High Compressor
7	7	PID Cool
8	8	Full Cool
9	9	Ambient
10	10	PID Humidity
11	17	Dehumidify Coil
12	18	Drier

TE1151-6

2SM Outputs

SM Channel	Digital Output	Device
1	11	Not Used
2	12	Not Used
3	13	Not Used
4	14	Not Used
5	15	Not Used
6	16	Not Used

TE1151-6

3SM Event Outputs

SM Channel	Digital Output	Device
1	19	Event 1
2	20	Event 2
3	21	Event 3
4	22	Event 4
5	23	Event 5
6	24	Event 6

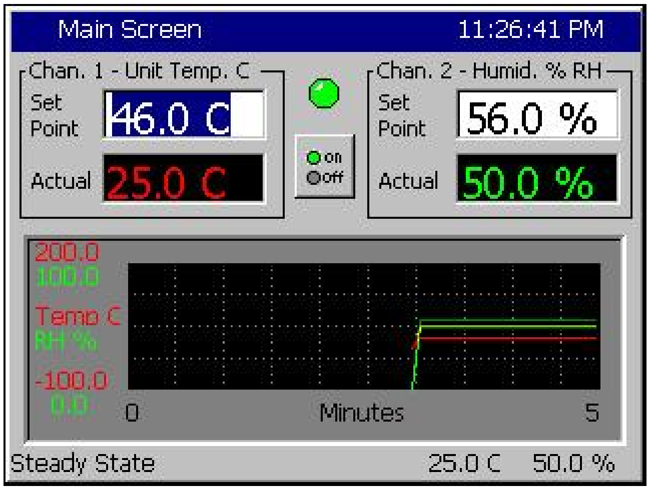
TE1151-5

SSR Outputs

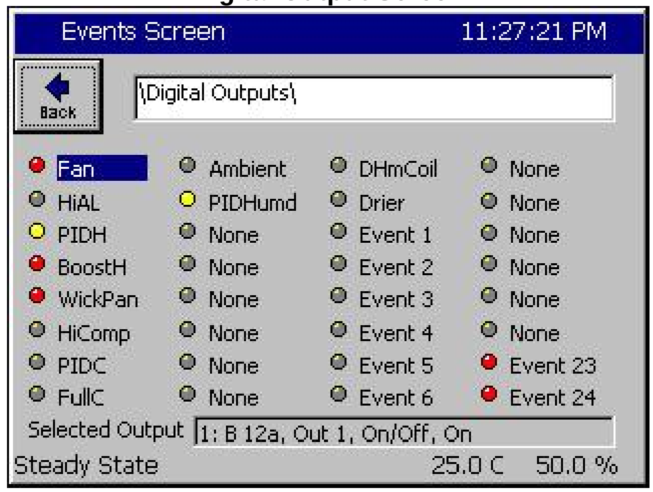
SSR Channel	Digital Output	Device
1	25	Not Used
2	26	Not Used
3	27	Not Used
4	28	Not Used
5	29	Not Used
6	30	Not Used

Generic Temperature/Humidity Single Stage

Main Screen



Digital Output Screen



Channels

Inputs	Channel 1	Channel 2	Channel 3	Channel 4
Type	Temperature	Humidity	N/A	N/A
Sensor	RTD1	Analog 1	N/A	N/A
High Volt Scale	N/A	5VDC	N/A	N/A
Low Volt Scale	N/A	0VDC	N/A	N/A
High Eng. Scale	N/A	100%	N/A	N/A
Low Eng. Scale	N/A	0%	N/A	N/A

Digital Inputs

Name	Input	Function when Closed
Ambient Lock Out	Input 1	Disables Ambient Coil when Dehumidify Coil is on.
Drier Logic	Input 2	Enables Drier when LEV1 (Use Drier) is active.
Compressor Cut in Logic	Input 3	Boost Heat, High Artificial Load, High Stage Compressor, Cascade Condenser (See Section 6.7 Device Primitives etc.)
Burn-in Logic	Input 4	Enables Low Stage Compressor and Full Cool with LEV1.
AGREE Chamber Logic	Input 5	Locks out Low Stage Compressor and enables High Stage Compressor and Full Cool with LEV1
TempGard	Input 9	None, TempGard Alarm displays in Alarm Folder and Log File.

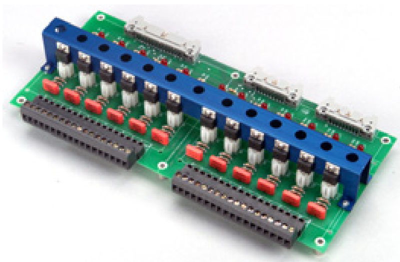
Alarms

Name	Sensor	Sensor Code	Default Threshold	Report	Log	K1	K2
Hi Alarm Ch 1	RTD1	110	> 500 C	Yes	Yes	Yes	No
Low Alarm Ch 1	RTD1	110	< -200C	Yes	Yes	Yes	No
Hi Alarm Ch 2	Analog1	130	104%	Yes	Yes	Yes	No
Low Alarm Ch 2	Analog1	130	-10%	Yes	Yes	Yes	No
Bad Sensor Ch 1	RTD1	110	< 10 Ohm	Yes	Yes	Yes	No
Bad Sensor Ch 1	RTD1	110	> 330 Ohm	Yes	Yes	Yes	No
Bad Sensor Ch 2	Analog1	130	< -.1 Vdc	Yes	Yes	Yes	No
Bad Sensor Ch 2	Analog1	130	> 5.25 Vdc	Yes	Yes	Yes	No
TempGard	Digital Input 9	409	Open	Yes	Yes	No	No

15.4.5 Generic Temperature/Pressure, Altitude and Space

Generic Temperature/Pressure, Altitude & Space

TE1151-12



1SM Outputs

SM Channel	Digital Output	Device
1	1	Fan
2	2	High Artificial Load
3	3	PID Heat
4	4	Boost Heat
5	5	Low Compressor
6	6	High Compressor
7	7	PID Cool
8	8	Full Cool
9	9	Low Artificial Load
10	10	Cascade
11	17	Vent BC
12	18	Vacuum

TE1151-6

2SM Outputs

SM Channel	Digital Output	Device
1	25	Not Used
2	26	Not Used
3	27	Not Used
4	28	Not Used
5	29	Not Used
6	30	Not Used

TE1151-6

3SM Event Outputs

SM Channel	Digital Output	Device
1	19	Event 1
2	20	Event 2
3	21	Event 3
4	22	Event 4
5	23	Event 5
6	24	Event 6

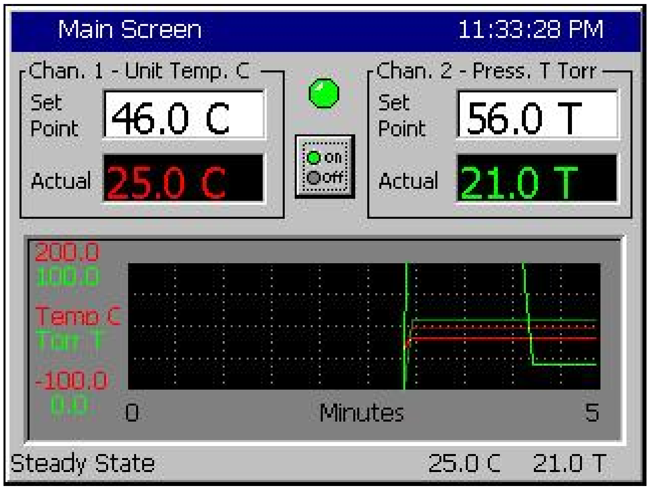
TE1151-5

SSR Outputs

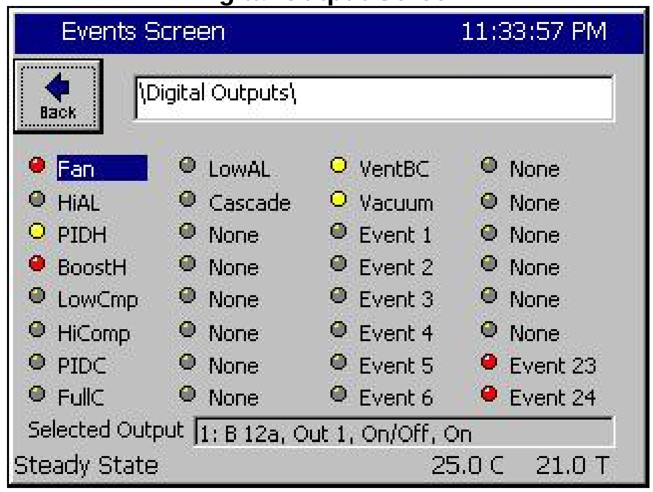
SM Channel	Digital Output	Device
1	25	Not Used
2	26	Not Used
3	27	Not Used
4	28	Not Used
5	29	Not Used
6	30	Not Used

Generic Temperature/Pressure, Altitude & Space

Main Screen



Digital Output Screen



Channels

Inputs	Channel 1	Channel 2	Channel 3	Channel 4
Type	Temperature	Pressure	N/A	N/A
Sensor	RTD1	Analog 1	N/A	N/A
High Volt Scale	N/A	5VDC	N/A	N/A
Low Volt Scale	N/A	0VDC	N/A	N/A
High Eng. Scale	N/A	1000 Torr	N/A	N/A
Low Eng. Scale	N/A	0 Torr	N/A	N/A

Digital Inputs

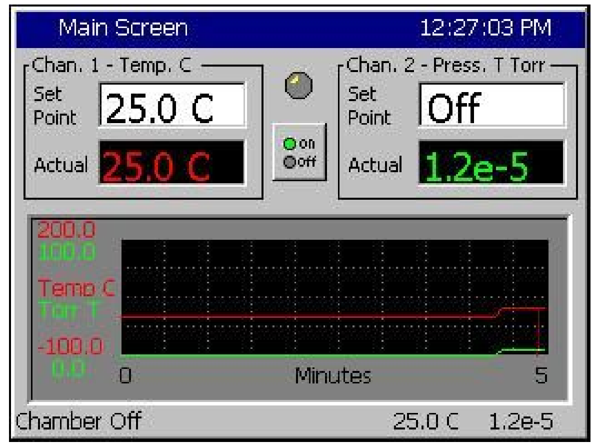
Name	Input	Function when Closed
Ambient Lock Out	Input 1	Disables Ambient Coil when Dehumidify Coil is on.
Drier Logic	Input 2	Enables Drier when LEV1 (Use Drier) is active.
Compressor Cut in Logic	Input 3	Boost Heat, High Artificial Load, High Stage Compressor, Cascade Condenser (See Section 6.7 Device Primitives etc.)
Burn-in Logic	Input 4	Enables Low Stage Compressor and Full Cool with LEV1.
AGREE Chamber Logic	Input 5	Locks out Low Stage Compressor and enables High Stage Compressor and Full Cool with LEV1
TempGard	Input 9	None, TempGard Alarm displays in Alarm Folder and Log File.

Alarms

Name	Sensor	Sensor Code	Default Threshold	Report	Log	K1	K2
Hi Alarm Ch 1	RTD1	110	> 500 C	Yes	Yes	Yes	No
Low Alarm Ch 1	RTD1	110	< -200C	Yes	Yes	Yes	No
Hi Alarm Ch 2	Analog1	130	1010T	Yes	Yes	Yes	No
Low Alarm Ch 2	Analog1	130	-10T	Yes	Yes	Yes	No
TempGard	Digital Input 9	409	Open	Yes	Yes	No	No

See Section 15.0 Space and Altitude Chambers for additional setup information.
This Generic Temperature/Pressure configuration supports VersaTenn Altitude Chamber retrofits.

22.1 Space Chamber Setup



The Synergy Controller supports space chamber applications also known as Thermal Vacuum chambers using Granville Philips ION Vacuum gauges. In space chamber applications pressure is displayed and logged in scientific notation. This application note explains the setup procedure for Space Chamber applications and provides examples.

CAUTION! : The Analog inputs on the controller will be damaged if the 10 V Granville Philips output is attached without a voltage divider.

The setup consists of the following 5 steps:

1. Wire the Granville Philips Ion Vacuum pressure transducer to the controller.

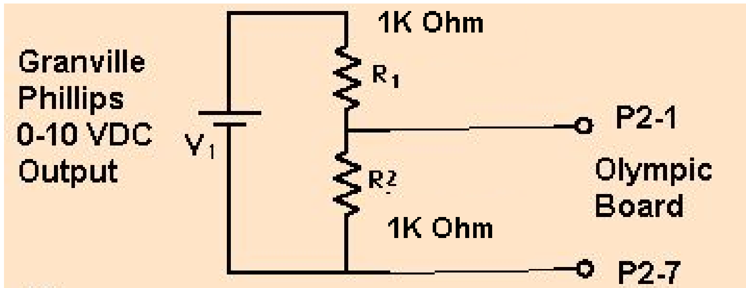
2. Setup the chamber for the appropriate configuration; i.e. Generic Temperature /Pressure, Generic Temperature/Humidity/Pressure, etc.

3. Setup the Hi Res input calibration for the pressure input.

4. Select the channel sensor for the pressure input.

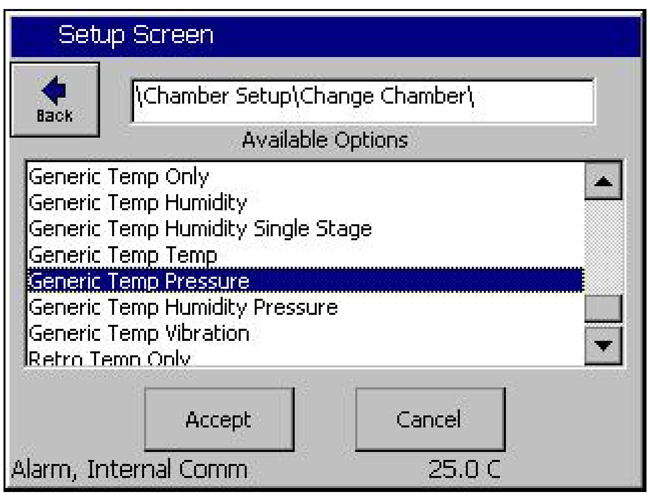
5. Setup the Altitude calibration for the Granville Philips emission setting.

Step 1. Wire the Granville Philips 10 Volt output thru a 2:1 voltage divider (1K/1K Ohm) as shown below. Alternatively, Analog 2, 3 or 4 can be used. A precision 1% metal film resistor suitable for this application is the Panasonic ERO-S2PHF1001 available from Digikey.

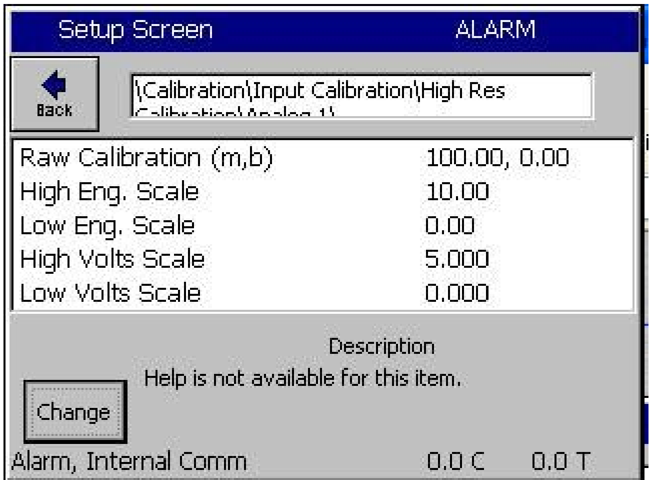


Signal	Olympic Board Connector-Pin	Reference
Analog Input 1 (See Note)	P2-1	P2-7
Analog Input 2	P2-5	P2-7
Analog Input 3	P2-6	P2-7
Analog Input 4	P2-11	P2-7

Note: High Resolution Analog 1 should always be connected to a sensor or shorted to Analog Common otherwise the open sensor detection circuitry (present on Analog 1 only) will negatively affect the accuracy of the other inputs.



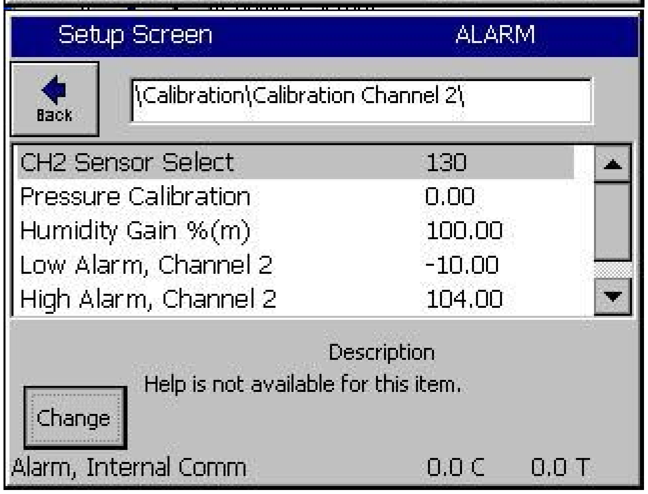
Step 2. Select the appropriate chamber setup from the Chamber Setup folder and reboot as instructed. For example, the Temperature Pressure selection is shown at left.



Step 3. Setup the Hi Res input calibration for the input used as shown at the left.

SETUP/Calibration/Input calibration/Hi Res./Analog 1 (P2-1 to P2-7)

Set High Eng. Scale to 10 Volts
Set Low Eng. Scale to 0 Volts
Set High Volts Scale to 5 Volts
Set Low Volts Scale to 0 Volts

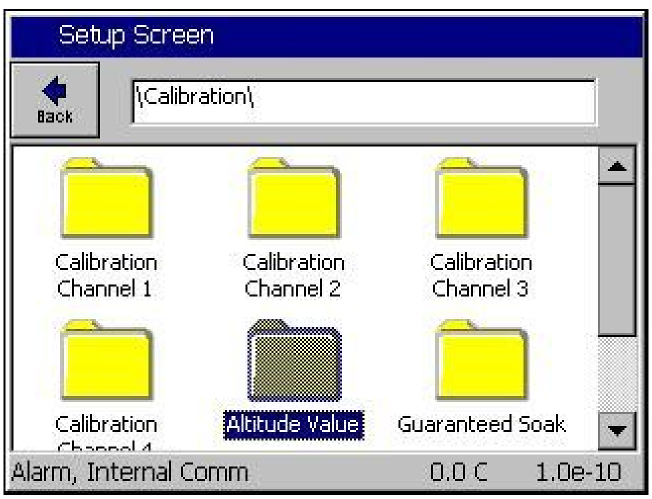


Step 4. Select the channel sensor

SETUP\Calibration\Calibration Channel 2

Select Analog 1 for sensor:

CH2 Sensor Select code 130



Step 5. Setup the Altitude calibration constant based on the Granville Philips ION gauge emission setting as follows:

n = 12 for 10 mA
n = 11 for 1 mA
n = 10 for 0.1 mA

SETUP/Calibration/Altitude Value

See the Granville Philips technical manual for additional setup information. The Calibration page is attached below for reference.

A Registration Key may be required to access this feature. Contact the factory.

The UHV electrometer option (307016) switches in a preamplifier as pressure decreases at an ion (collector) current of 10^{-10} A. For example, this corresponds to a pressure of 10^{-9} Torr with 10 mA emission current. When this switching occurs, there will be a brief (about 2 s duration) drop in the analog output signal. After the electrometer has settled out, the signal is, again, proportional to the common logarithm of pressure as shown by the UHV ONLY area of Figure 2-4.

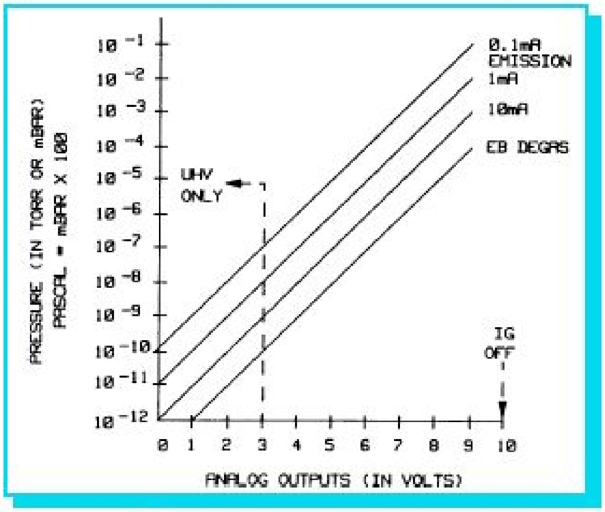


Figure 2-4 *Ion Gauge Pressure Analog Output.*

A standard 1/8 in. miniature phono jack connector and plug are supplied.

The characteristics of this type of analog output voltage are ideal for applications requiring closed loop control. The voltage signal is smooth and continuous throughout all the decades of pressure measurement. This format is useful for computerized data acquisition because a simple equation (finding the common antilogarithm) may be programmed to calculate pressure from the voltage output.

The equation is:

$$P = 10^{(V-n)}$$

Where V = analog output voltage;

n = 12 for the 10 mA emission current range;

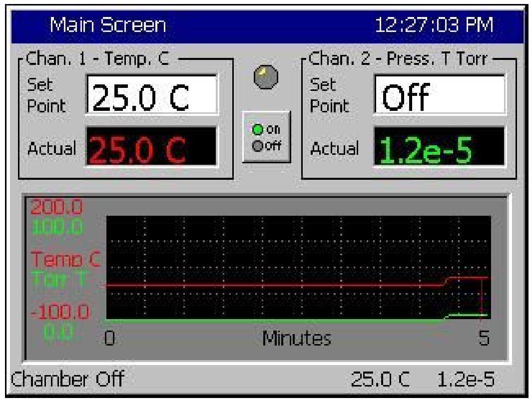
n = 11 for the 1 mA emission current range;

n = 10 for the 0.1 mA emission current range.

For example, if emission current is set to the 1 mA range and the analog output voltage is 3.25 volts, the pressure (in units selected) may be determined by raising 10 to the power (V-11) or

$$P = 10^{(3.25-11)} = 1.8 \times 10^{-8} \text{ (Torr, for example)}$$

The Pressure display on Channel 2 is in scientific notation as shown below. Note that the Pressure Set Point has no effect on Thermal Vacuum chambers since pressure is not controlled.



Pressure is recorded in the log file in Torr in scientific notation.

To verify setup and calibration verify the values in the following table.

Output in Torr is 10^((Vhires*2)-n)

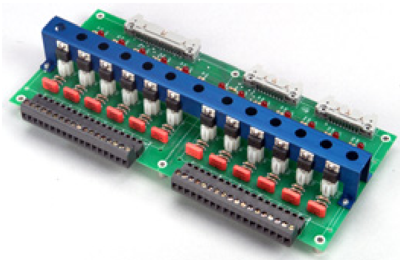
n, Altitude Setting	V hi-res Volts DC	Display
12	5.0	1.0e-2
11	5.0	1.0e-1
10	5.0	1.0e-0
12	0.0	1.0e-12
11	0.0	1.0e-11
10	0.0	1.0e-10
12	2.1	1.6e-8
11	2.1	1.6e-7
10	2.1	1.6e-6

22.2 Altitude Chamber Setup

15.4.6 Generic Temperature/Humidity/Pressure, Altitude

Generic Temperature/Humidity/Pressure ,Altitude

TE1151-12



1SM Outputs

SM Channel	Digital Output	Device
1	1	Fan
2	2	High Artificial Load
3	3	PID Heat
4	4	Boost Heat
5	5	Low Compressor
6	6	High Compressor
7	7	PID Cool
8	8	Full Cool
9	9	Low Artificial Load
10	10	Cascade
11	17	Vent BC
12	18	Vacuum

TE1151-6

2SM Outputs

SM Channel	Digital Output	Device
1	11	Ambient
2	12	PID Humidity
3	13	Dehumidify Coil
4	14	Hi Al
5	15	Drier
6	16	Wickpan

TE1151-6

3SM Event Outputs

SM Channel	Digital Output	Device
1	19	Event 1
2	20	Event 2
3	21	Event 3
4	22	Event 4
5	23	Event 5
6	24	Event 6

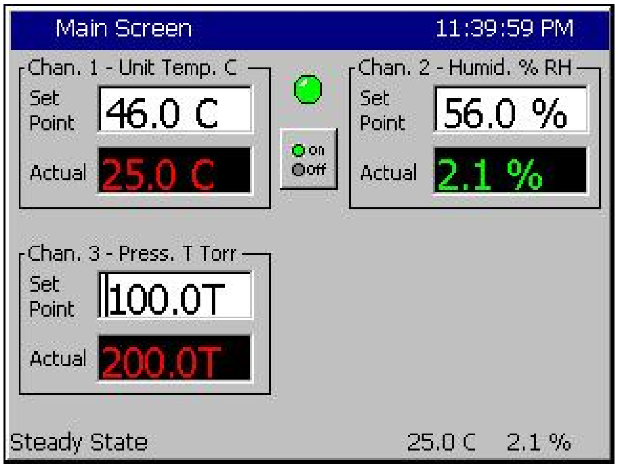
TE1151-5

SSR Outputs

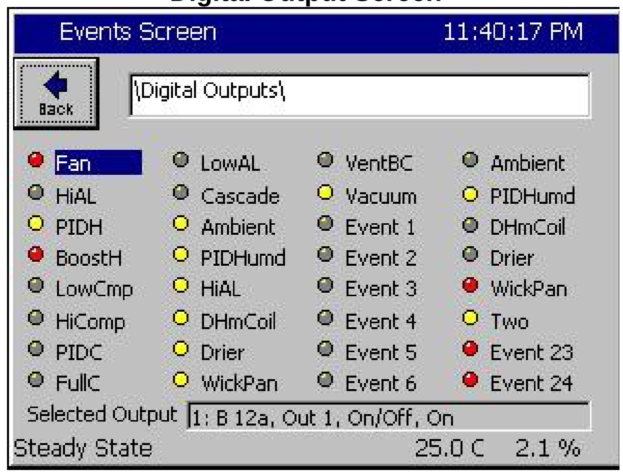
SM Channel	Digital Output	Device
1	25	Ambient
2	26	PID Humidity
3	27	Dehumidify Coil
4	28	Drier
5	29	Wick Pan
6	30	Two

Generic Temperature/Humidity/Pressure ,Altitude

Main Screen



Digital Output Screen



Channels

Inputs	Channel 1	Channel 2	Channel 3	Channel 4
Type	Temperature	Humidity	Pressure	N/A
Sensor	RTD1	Analog 1	Analog 2	N/A
High Volt Scale	N/A	5VDC	5VDC	N/A
Low Volt Scale	N/A	0VDC	0VDC	N/A
High Eng. Scale	N/A	100%	1000 Torr	N/A
Low Eng. Scale	N/A	0%	0 Torr	N/A

Digital Inputs

Name	Input	Function when Closed
Ambient Lock Out	Input 1	Disables Ambient Coil when Dehumidify Coil is on.
Drier Logic	Input 2	Enables Drier when LEV1 (Use Drier) is active.
Compressor Cut in Logic	Input 3	Boost Heat, High Artificial Load, High Stage Compressor, Cascade Condenser (See Section 6.7 Device Primitives etc.)
Burn-in Logic	Input 4	Enables Low Stage Compressor and Full Cool with LEV1.
AGREE Chamber Logic	Input 5	Locks out Low Stage Compressor and enables High Stage Compressor and Full Cool with LEV1
TempGard	Input 9	None, TempGard Alarm displays in Alarm Folder and Log File.

Alarms

Name	Sensor	Sensor Code	Default Threshold	Report	Log	K1	K2
Hi Alarm Ch 1	RTD1	110	> 500 C	Yes	Yes	Yes	No
Low Alarm Ch 1	RTD1	110	< -200C	Yes	Yes	Yes	No
Hi Alarm Ch 2	Analog1	130	104%	Yes	Yes	Yes	No
Low Alarm Ch 2	Analog1	130	-10%	Yes	Yes	Yes	No
Hi Alarm Ch 3	Analog2	140	1010 Torr	Yes	Yes	Yes	No
Low Alarm Ch 3	Analog2	140	-10 Torr	Yes	Yes	Yes	No
TempGard	Digital Input 9	409	Open	Yes	Yes	No	No

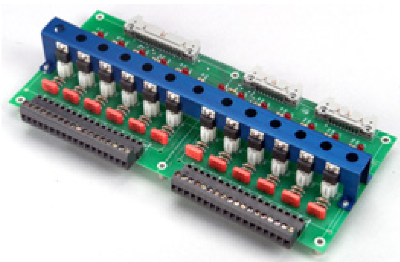
See Section 15.0 Space and Altitude Chambers for additional setup information.

This Generic Temp/Humidity/Pressure configuration supports VersaTenn Altitude Chamber retrofits.

15.4.7 Generic Temperature/Vibration

Generic Temperature/Vibration (HALT/HASS)

TE1151-12



1SM Outputs

SM Channel	Digital Output	Device
1	1	Start
2	2	Stop
3	3	Heat Contactor
4	4	Redundant LN2
5	5	Light
6	6	High Heat
7	7	Lo Heat
8	8	Pneumatic Enable
9	9	Pneumatic Initiate
10	10	Not Used
11	17	Not Used
12	18	Not Used

TE1151-6

2SM Outputs

SM Channel	Digital Output	Device
1	25	Not Used
2	26	Not Used
3	27	Not Used
4	28	Not Used
5	29	Not Used
6	30	Not Used

TE1151-6

3SM Event Outputs

SM Channel	Digital Output	Device
1	19	Event 1
2	20	Event 2
3	21	Event 3
4	22	Event 4
5	23	Event 5
6	24	Event 6

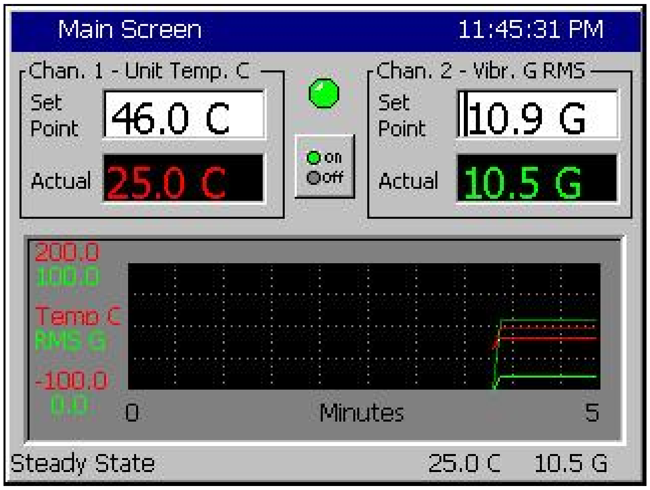
TE1151-5

SSR Outputs

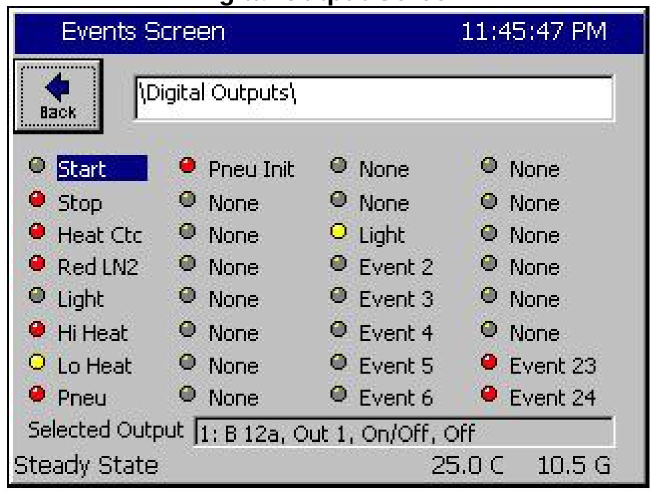
SM Channel	Digital Output	Device
1	25	Not Used
2	26	Not Used
3	27	Not Used
4	28	Not Used
5	29	Not Used
6	30	Not Used

Generic Temperature/Vibration (HALT/HASS)

Main Screen



Digital Output Screen



Channels

Inputs	Channel 1	Channel 2	Channel 3	Channel 4
Type	Temperature	Vibration	N/A	N/A
Sensor	RTD1	Analog 1	N/A	N/A
High Volt Scale	N/A	5VDC	N/A	N/A
Low Volt Scale	N/A	0VDC	N/A	N/A
High Eng. Scale	N/A	100 Grms	N/A	N/A
Low Eng. Scale	N/A	0 Grms	N/A	N/A

Digital Inputs

Name	Input	Function when Closed
TempGard	Input 9	None, TempGard Alarm displays in Alarm Folder and Log File.

Alarms

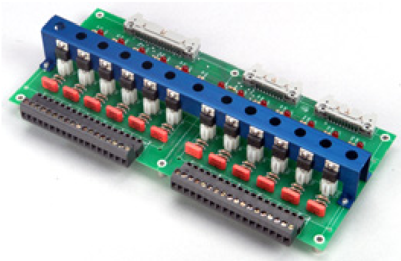
Name	Sensor	Sensor Code	Default Threshold	Report	Log	K1	K2
Hi Alarm Ch 1	RTD1	110	> 500 C	Yes	Yes	Yes	No
Low Alarm Ch 1	RTD1	110	< -200C	Yes	Yes	Yes	No
Hi Alarm Ch 2	Analog1	130	104 Grms	Yes	Yes	Yes	No
Low Alarm Ch 2	Analog1	130	0 Grms	Yes	Yes	Yes	No
Bad Sensor Ch 1	RTD1	110	< 10 Ohm	Yes	Yes	Yes	No
Bad Sensor Ch 1	RTD1	110	> 330 Ohm	Yes	Yes	Yes	No
Bad Sensor Ch 2	Analog1	130	< -.1 Vdc	Yes	Yes	Yes	No
Bad Sensor Ch 2	Analog1	130	> 5.25 Vdc	Yes	Yes	Yes	No
TempGard	Digital Input 9	409	Open	Yes	Yes	No	No

This Generic Temperature/Vibration configuration supports QualMark HALT/HASS Chamber retrofits.

15.4.8 Retro Temperature Only

Retro Temperature Only

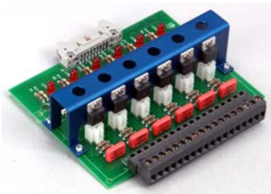
TE1151-12



1SM Outputs

SM Channel	Digital Output	Device
1	1	Not Used
2	2	Not Used
3	3	Not Used
4	4	Not Used
5	5	Not Used
6	6	Not Used
7	7	Not Used
8	8	Not Used
9	9	Not Used
10	10	Not Used
11	17	Not Used
12	18	Not Used

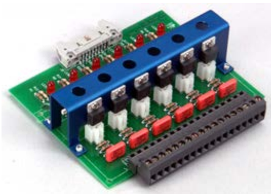
TE1151-6



2SM Outputs

SM Channel	Digital Output	Device
1	1	Not Used
2	2	Not Used
3	3	Not Used
4	4	Not Used
5	5	Not Used
6	6	Not Used

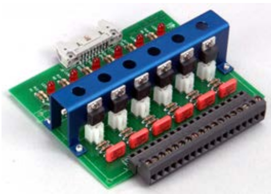
TE1151-6



3SM Event Outputs

SM Channel	Digital Output	Device
1	19	Event 1
2	20	Event 2
3	21	Event 3
4	22	Event 4
5	23	Event 5
6	24	Event 6

TE1151-5

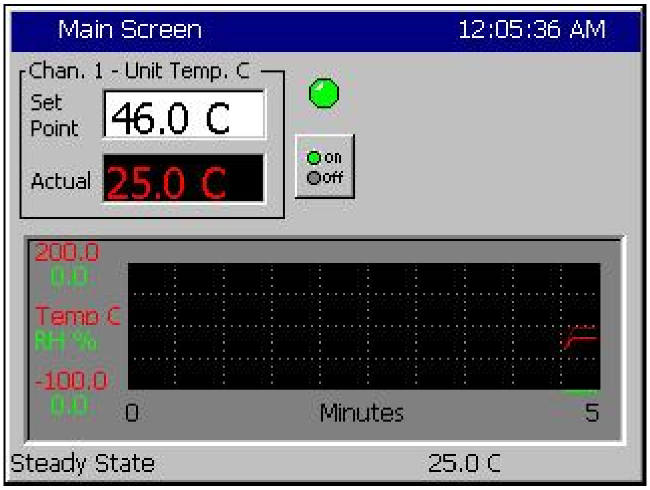


SSR Outputs

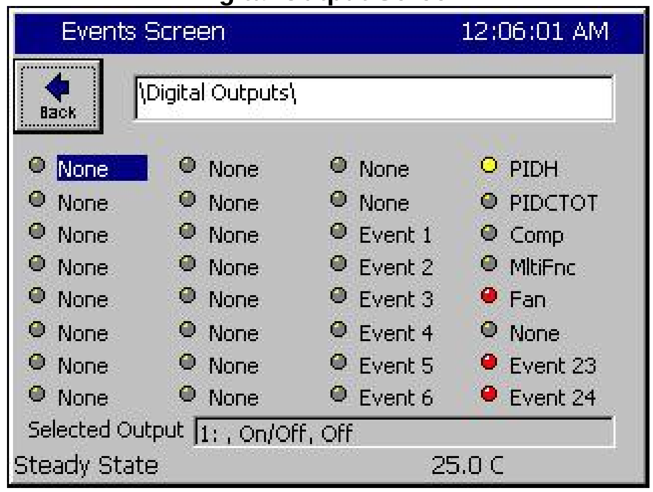
SM Channel	Digital Output	Device
1	25	PID Heat
2	26	PID Cool
3	27	Compressor
4	28	Multifunction
5	29	Fan
6	30	Not Used

Retro Temp Only

Main Screen



Digital Output Screen



Channels

Inputs	Channel 1	Channel 2	Channel 3	Channel 4
Type	Temperature	N/A	N/A	N/A
Sensor	RTD1	N/A	N/A	N/A
High Volt Scale	N/A	N/A	N/A	N/A
Low Volt Scale	N/A	N/A	N/A	N/A
High Eng. Scale	N/A	N/A	N/A	N/A
Low Eng. Scale	N/A	N/A	N/A	N/A

Digital Inputs

Name	Input	Function when Closed
TempGard	Input 9	None, TempGard Alarm displays in Alarm Folder and Log File.

Alarms

Name	Sensor	Sensor Code	Default Threshold	Report	Log	K1	K2
Hi Alarm Ch 1	RTD1	110	> 500 C	Yes	Yes	Yes	No
Low Alarm Ch 1	RTD1	110	< -200C	Yes	Yes	Yes	No
Bad Sensor Ch 1	RTD1	110	< 10 Ohm	Yes	Yes	Yes	No
Bad Sensor Ch 1	RTD1	110	> 330 Ohm	Yes	Yes	Yes	No
TempGard	Digital Input 9	409	Open	Yes	Yes	No	No

This Retro Temp Only configuration supports VersaTenn retrofits.

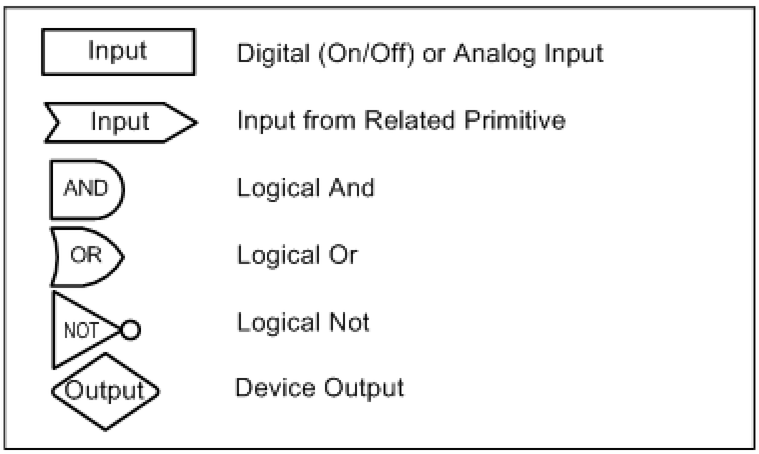
15.5 Device Primitives and Logic Flow Charts

The following flow charts explain the function of each device primitive; i.e. the logic that controls each type of device. Note that all chambers don't have every device. For example, Temperature -Only chambers don't have humidity specific devices such as the Wick Pan. These flow charts have extensive references to the L-Values described in the previous sections.

You can monitor the state of each output and the performance based upon the L-Value settings by going to the *Events\Digital Outputs* screen while the chamber is running. For more information on the Digital Outputs screen, go to Section 11.3 Events: Digital Outputs.

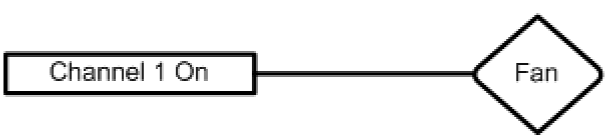
Note: The output from each device is dependent on the chamber configuration. See Section 6.10 Setup: Output Mappings by Chamber Type to determine the controller's outputs in your specific configuration.

Device Primitives Key



<u>Fan Device</u>

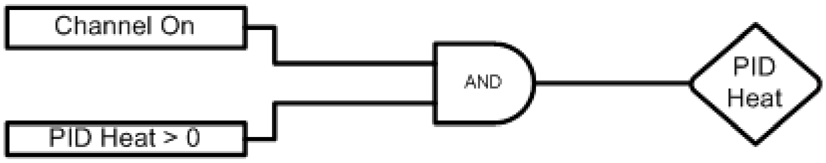
This output is on whenever the chamber is running. It can also serve as System Enable.



Output is On/Off	

PID Heat

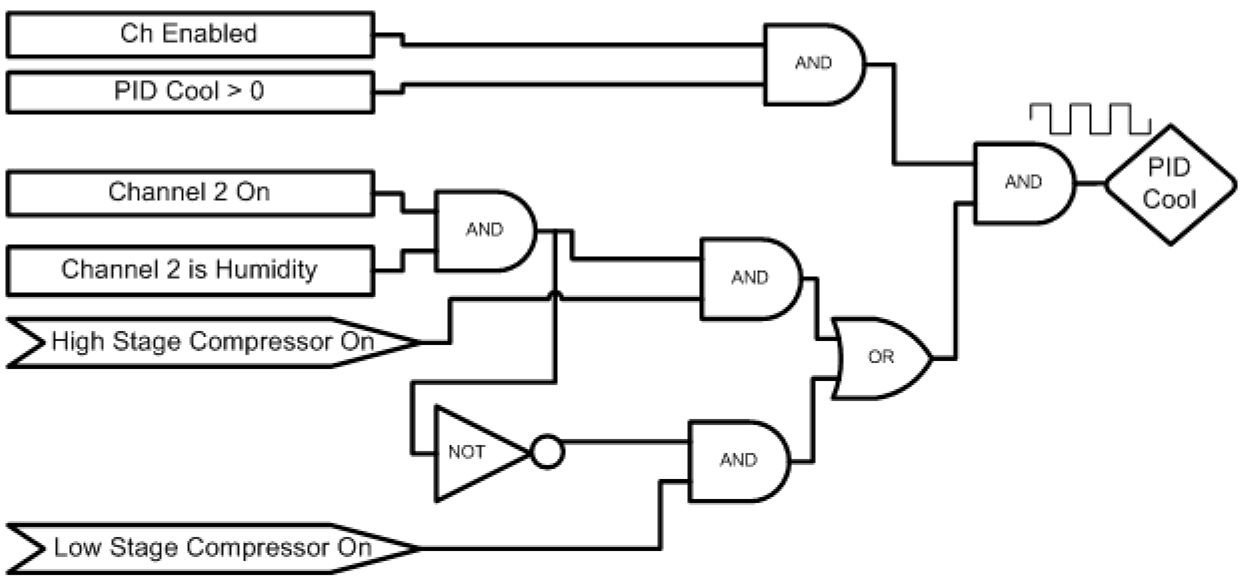
Time Proportioning output that controls the heaters.



Output is Time Proportioning		
Control Parameters	**Default Value:**	**Range:**
Channel 1 Proportional Band	7	0 - 50 Degrees C
Reset for Channel 1 Heating	0.02	0 - 9.9 Repeats/minute
Rate for Channel 1 Heating	0	0 - 9.9 Minutes
Cycle Time for Channel 1 Heating	5	1 - 60 Seconds
Rate Band for Channel 1 Heating	0	0 - 7 Seconds

PID Cool

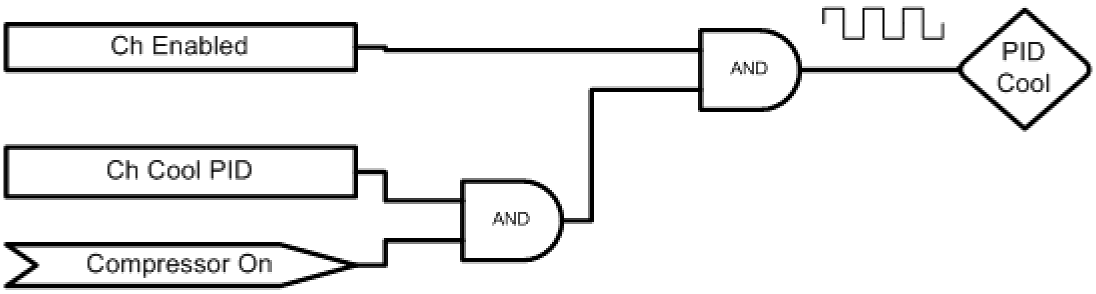
This is a time proportioning output that energizes the cool solenoid permitting refrigerant flow to the Evaporator Coil.



Output is Time Proportioning		
Control Parameters	**Default Value:**	**Range:**
Channel 1 Proportional Band	7	0 - 50 Degrees C
Reset for Channel 1 Cooling	0.02	0 - 9.9 Repeats/minute
Rate for Channel 1 Cooling	0	0 - 9.9 Minutes
Cycle Time for Channel 1 Cooling	5	1 - 60 Seconds
Rate Band for Channel 1 Cooling	0	0 - 7 Seconds

PID Cool (Temp Only, Temp-Temp Configuration)

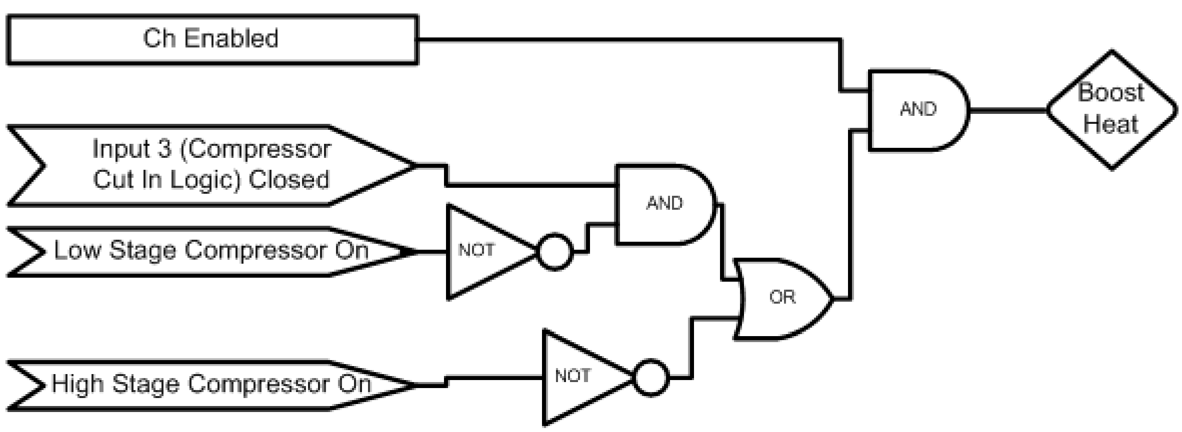
This is a time proportioning output that energizes the cool solenoid permitting refrigerant flow to the Evaporator Coil. This logic is only used on Temp Only and Temp-Temp (thermal shock) configurations.



Output is Time Proportioning		
Control Parameters	**Default Value:**	**Range:**
Channel 1 Proportional Band Cooling	5	0 - 50 Degrees C
Reset for Channel 1 Cooling	0.07	0 - 9.9 Repeats/minute
Rate for Channel 1 Cooling	0	0 - 9.9 Minutes
Cycle Time for Channel 1 Cooling	7	1 - 60 Seconds
Rate Band for Channel 1 Cooling	0	0 - 7 Seconds

Boost Heat

This primitive provides extra heating capacity when refrigeration compressors are off.

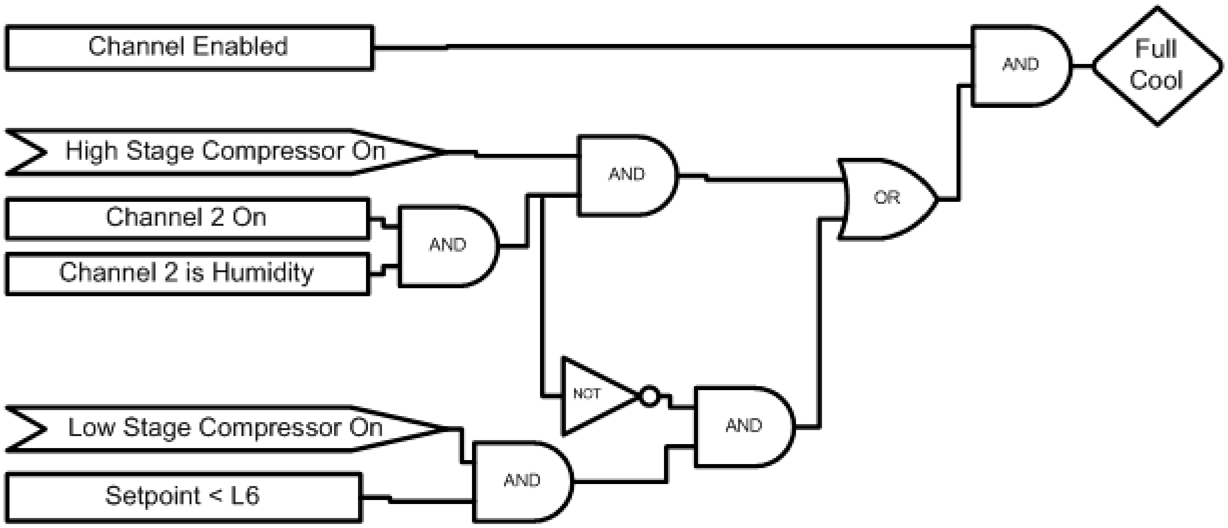


Output is On/Off		
Control Parameters	**Default Value:**	**Range:**
Compressor Cut In Logic (Input 3)	When closed, selects Compressor Cut In Logic. Uses a pressure switch.	

Note:
The Boost Heat output must be wired in series with the PID Heat output and not wired to control the Boost Heaters directly.

Full Cool Device

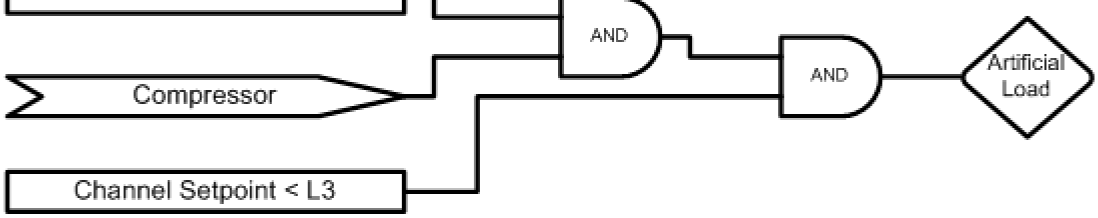
This output will turn on at low temperatures and enable full cooling capabilities. When this output is off only reduced cooling is available. This results in more precise control at higher temperatures.



Output is On/Off		
Control Parameters	**Default Value:**	**Range:**
L6 Full Cooling Switch Over	The temperature at which full cooling switches on	

Artificial Load

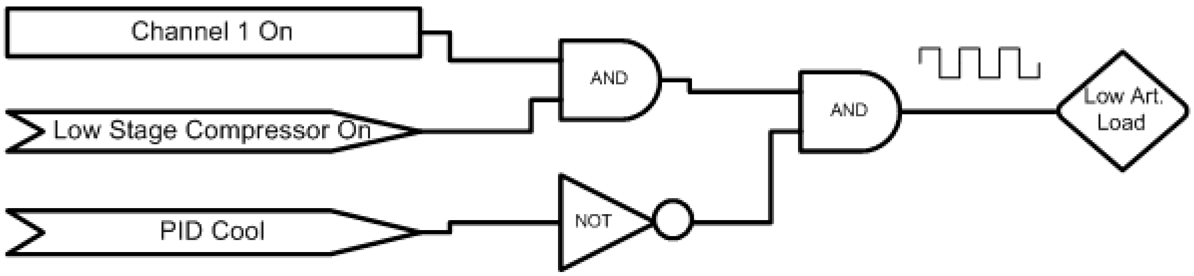
Artificial Load is turned on when the cooling solenoid is off to prevent the compressor from overheating.



Output is On/Off		
Control Parameters	**Default Value:**	**Range:**
xL3 Ch x Setpoint Transfer Setting	Temperature at which to enable artificial load device	

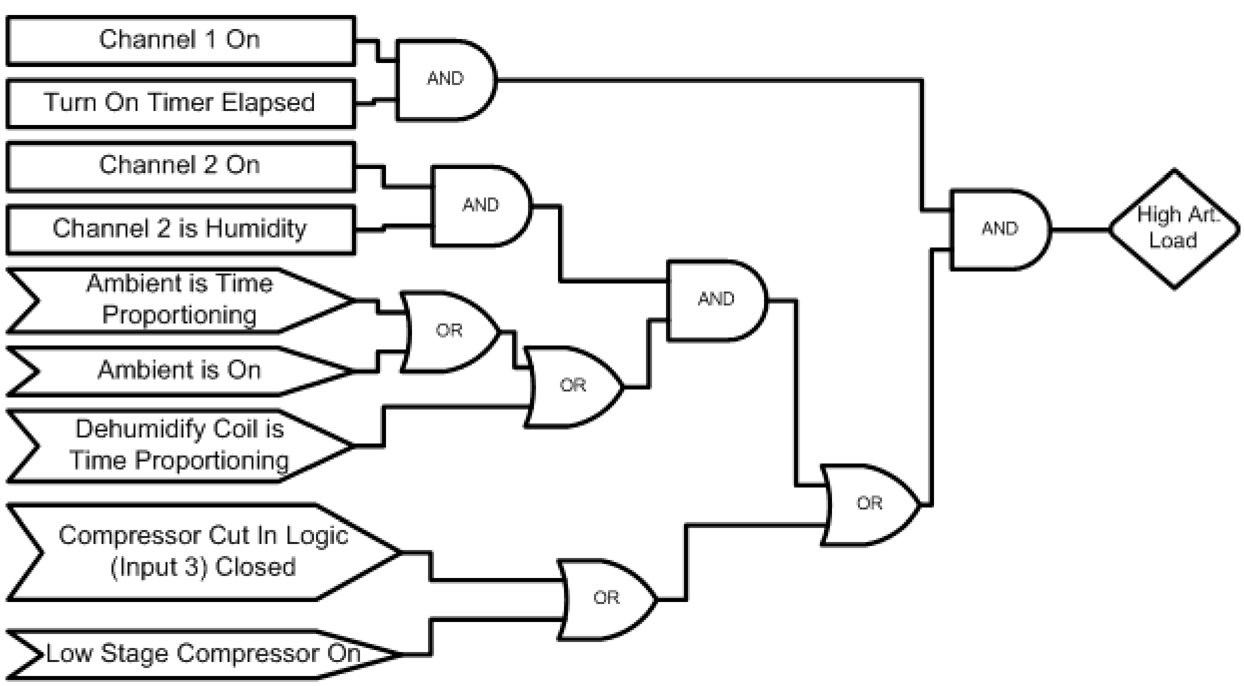
Low Artificial Load

This output energizes the Artificial Loading bypass solenoid to provide refrigerant flow to the compressor when operating with temperature control only.



Output is Time Proportioning the inverse of the PID Cool output		
Control Parameters	**Default Value:**	**Range:**
Channel 1 Proportional Band Cooling	5	0 - 50 Degrees C
Reset for Channel 1 Cooling	0.07	0 - 9.9 Repeats/minute
Rate for Channel 1 Cooling	0	0 - 9.9 Minutes
Cycle Time for Channel 1 Cooling	7	1 - 60 Seconds
Rate Band for Channel 1 Cooling	0	0 - 7 Seconds

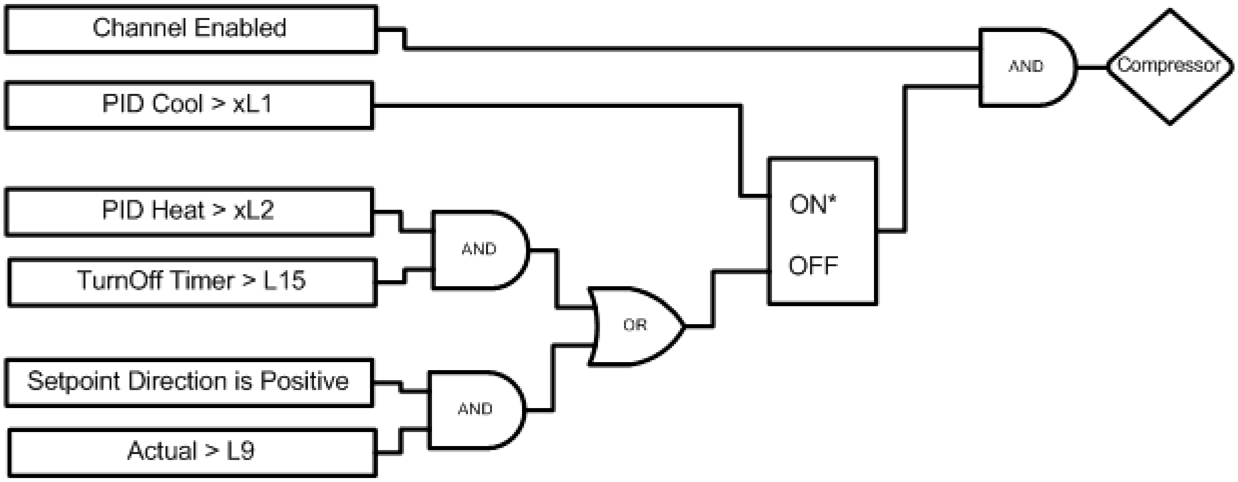
High Artificial Load



Output is On/Off		
Control Parameters	**Default Value:**	**Range:**
Compressor Cut In Logic (Input 3)	When closed, selects Compressor Cut In Logic. Uses a pressure switch	
There is a one-minute turn on timer that is reset while the compressor is off.		
Output mirrors the High Stage Compressor		

Compressor

This output turns on a compressor.

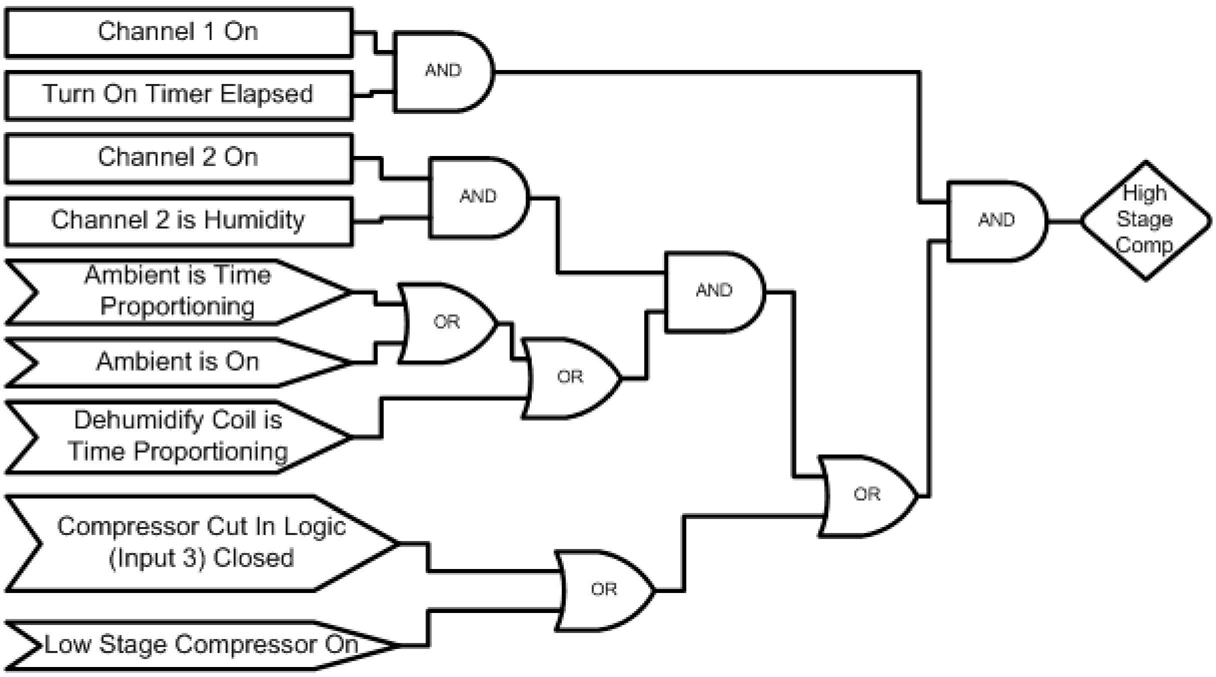


Output is On/Off		
Control Parameters	**Default Value:**	**Range:**
xL1 Channel x Main Cooling Turn On	Cooling output required to turn on channel x cooling	
xL2 Channel x Main Cooling Turn Off	Heat output required to turn off channel x main cooling	
L9 Ramp Up Cooling	Temperature at which to turn off the cooling compressor while heating	
L15 Compressor	Delay in minutes required before turning off the compressor	

Notes:
Setpoint direction is Positive only when ramping a setpoint in a profile
* Denotes which signal has priority if both are true

Full Cool

This output energizes the Full Suction solenoid permitting maximum refrigerant flow from the evaporator coil back to the compressor. This allows maximum cooling capacity when low temperatures are required.

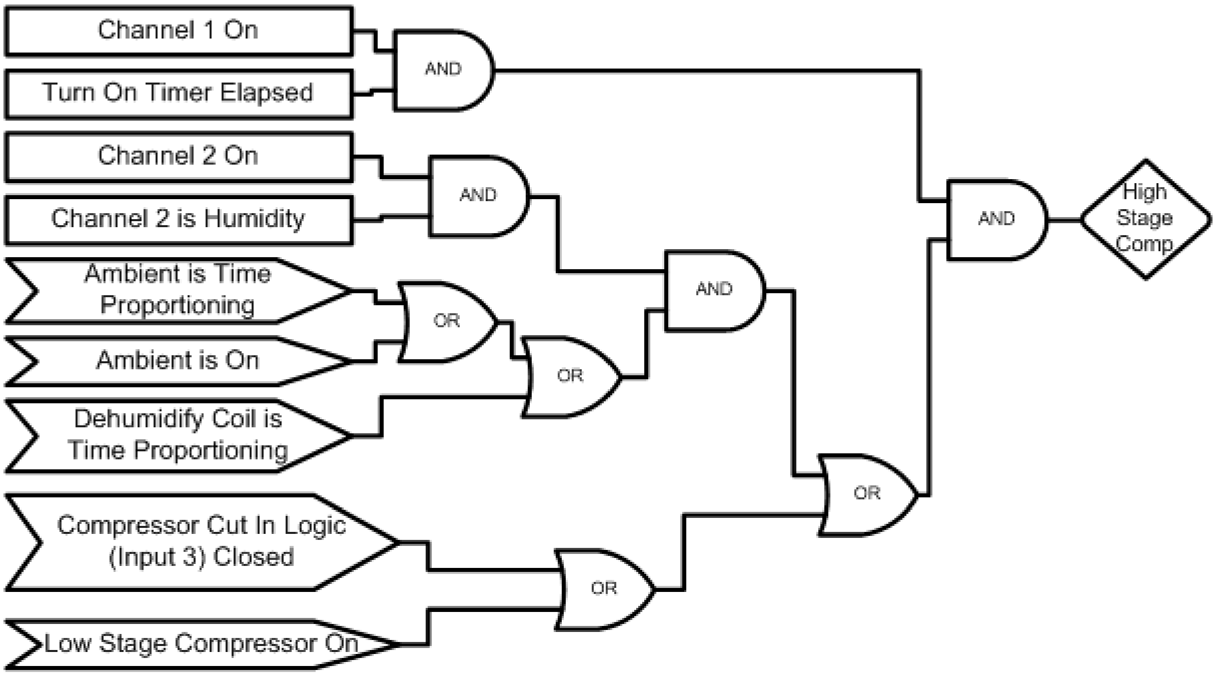


Output is On/Off		
Control Parameters	**Default Value:**	**Range:**
L3 Channel 1 Main Cooling Turn On	Percent cooling required to turn on the cooling low stage compressor	
L4 Channel 1 Main Cooling Turn Off	Percent heat required before turning off the low stage compressor	
L9 Ramp Up Cooling	Temperature at which to turn off the cooling compressor while heating	
L15 Compressor Turn Off Delay	Delay in minutes required before turning off a compressor	

Notes:
The Turn Off Timer is reset when Channel 1 PID Cool > 0%
* Denotes which signal has priority if both are true

High Stage Compressor

This output energizes the high stage compressor.

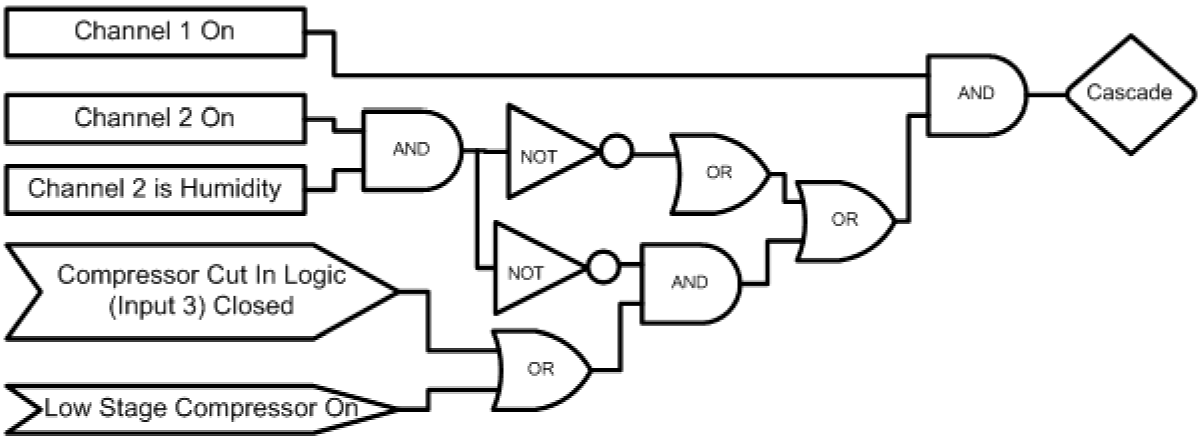


Output is On/Off		
Control Parameters	**Default Value:**	**Range:**
Compressor Cut In Logic (Input 3)	When closed, selects Compressor Cut In Logic. Uses a pressure switch	

Notes:
There is a one-minute turn on timer that is reset while the compressor is off.

Cascade Condenser

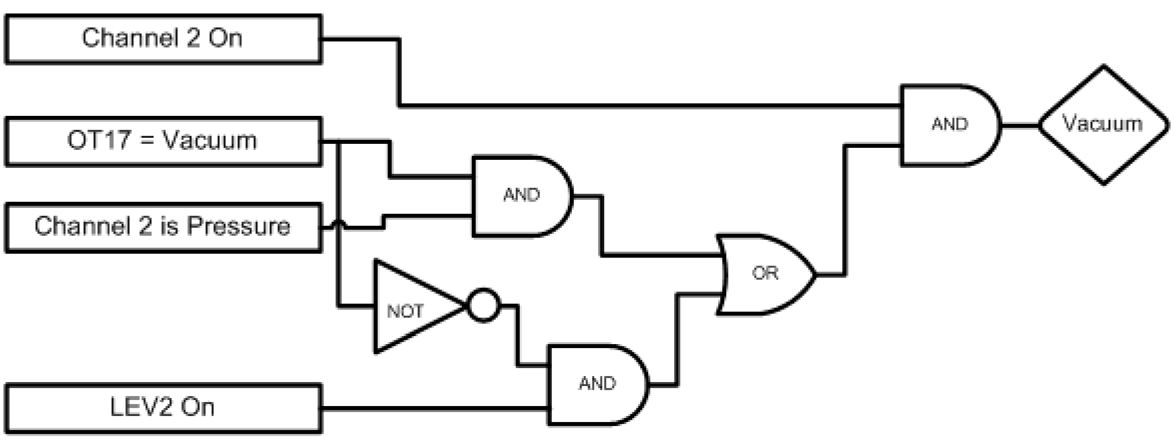
This output turns on whenever cooling is needed. It energizes the solenoid that feeds liquid refrigerant to the evaporator coil.



Output is On/Off		
Control Parameters	**Default Value:**	**Range:**
Compressor Cut In Logic (Input 3)	When closed, selects Compressor Cut In Logic. Uses a pressure switch.	

Vacuum

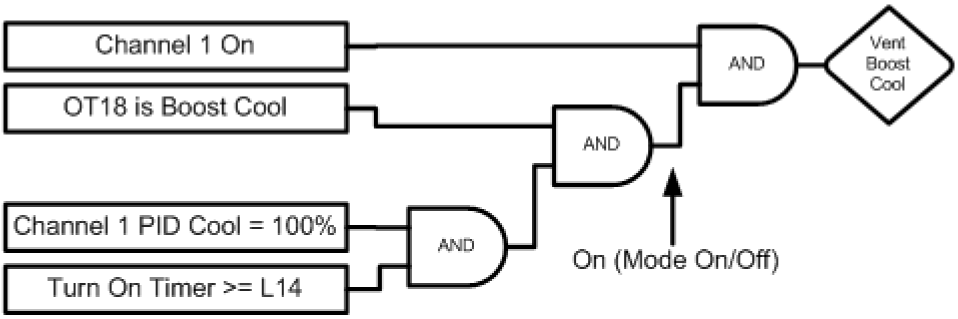
This output controls the vacuum device on altitude chambers.



Output is On/Off		
Control Parameters	**Default Value:**	**Range:**
OT17 – Output 17 Control Type	Selects the control logic for the Vacuum device. Can be either Vacuum or Purge	
LEV 2	Controls Vacuum device when OT17 is set to Purge	

Vent – Boost Cool

This output specifies to use either Vent or Boost Cool.

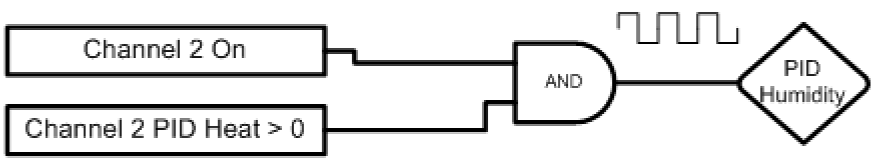


Output is On/Off		
Control Parameters	**Default Value:**	**Range:**
OT18	Selects the Control logic for the Vent – Boost Cool device	
L14 Time Delay Boost Cool	Time delay (in seconds) required before Boost Cool is enabled	

Notes:
Turn On Timer is reset when Channel 1 PID Cool < 100%

PID Humidify

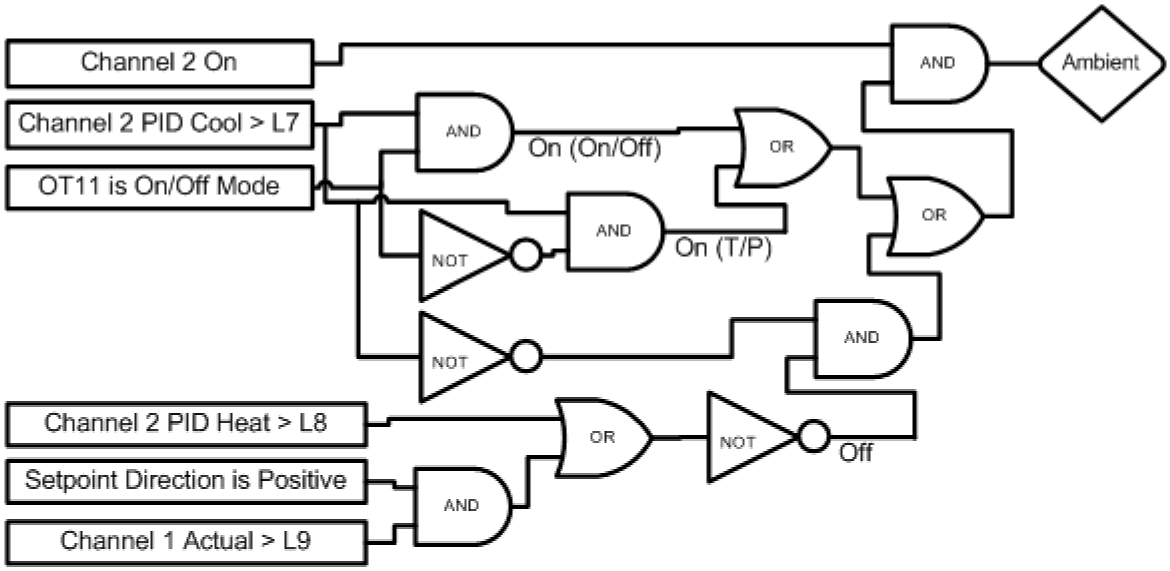
This output energizes the humidity generator and controls water vapor injection into the chamber.



Output is Time Proportioning		
Control Parameters	**Default Value:**	**Range:**
Channel 2 Proportional Band Heating	42	0 - 50 Degrees C
Reset for Channel 2 Heating	0.02	0 - 9.9 Repeats/minute
Rate for Channel 2 Heating	0	0 - 9.9 Minutes
Cycle Time for Channel 2 Heating	1	1 - 60 Seconds
Rate Band for Channel 2 Heating	0	0 - 7 Seconds

Ambient Device

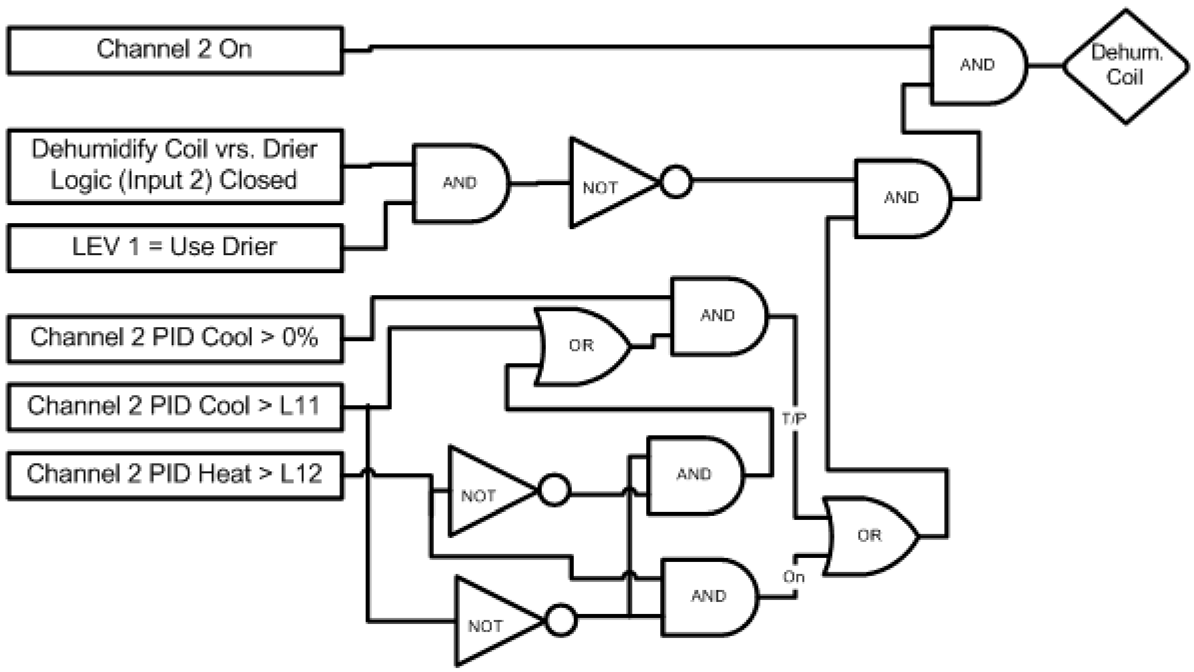
This output is used when cooling is required with humidity control



Output is either Time Proportioning or On/Off		
L7 Ambient Cooling Turn On	Percent cooling required to turn on the cooling compressor	
L8 Heat Ambient Cooling Turn Off	Percent heat required to turn off the cooling compressor	
L9 Ramp Up Cooling	Temperature at which the cooling compressor is turned off while heating	
Control Parameters	**Default Value:**	**Range:**
Channel 2 Proportional Band Heating	42	0 - 50 Degrees C
Reset for Channel 2 Heating	0.02	0 - 9.9 Repeats/minute
Rate for Channel 2 Heating	0	0 - 9.9 Minutes
Cycle Time for Channel 2 Heating	1	1 - 60 Seconds
Rate Band for Channel 2 Heating	0	0 - 7 Seconds
Channel 2 Proportional Band Cooling	40	0 - 50 Degrees C
Reset for Channel 2 Cooling	0.1	0 - 9.9 Repeats/minute
Rate for Channel 2 Cooling	0	0 - 9.9 Minutes
Cycle Time for Channel 2 Cooling	7	1 - 60 Seconds
Rate Band for Channel 2 Cooling	0	0 - 7 Seconds

Dehumidify Coil

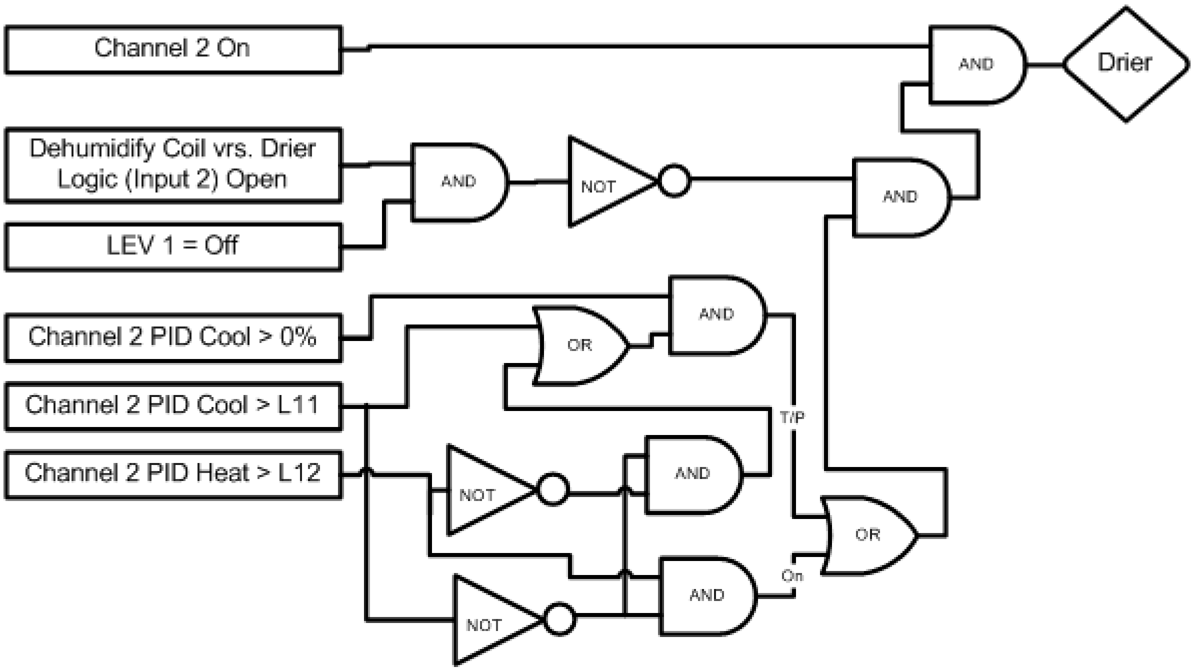
This output operates the dehumidify coil for dehumidification.



Output is either Time Proportioning or On/Off		
L11 Dehumidify On	Percent dehumidify required to enable dehumidify device	
L12 Dehumidify Off	Percent humidity required to turn off dehumidify device	
LEV 1	Selects the Drier Device when Input 2 is closed, otherwise the Dehumidify Coil is selected.	
Dehumidify Coil vs. Drier Logic (Input 2)	When closed and when LEV 1 is set to Use Drier, disables the dehumidify coil and uses the Drier device instead.	
Control Parameters	**Default Value:**	**Range:**
Channel 2 Proportional Band Cooling	40	0 - 50 Degrees C
Reset for Channel 2 Cooling	0.1	0 - 9.9 Repeats/minute
Rate for Channel 2 Cooling	0	0 - 9.9 Minutes
Cycle Time for Channel 2 Cooling	7	1 - 60 Seconds
Rate Band for Channel 2 Cooling	0	0 - 7 Seconds

Drier Device

This output controls the Air Drier for dehumidification.

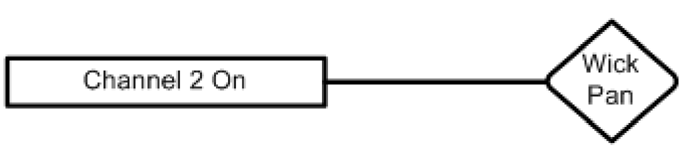


Output is either Time Proportioning or On/Off	
L11 Dehumidify On	Percent dehumidify required to enable dehumidify device
L12 Dehumidify Off	Percent humidity required to turn off dehumidify device
LEV 1	Selects whether to use the Dehumidify Coil or the Drier Device (Drier requires the Input 2 to be open)
Dehumidify Coil vs. Drier Logic (Input 2)	When closed selects using the Dehumidify Coil. When open, and when LEV 1 is set to Use Drier, it will disable the dehumidify coil and use the Drier device instead.

Control Parameters	**Default Value:**	**Range:**
Channel 2 Proportional Band Cooling	40	0 - 50 Degrees C
Reset for Channel 2 Cooling	0.1	0 - 9.9 Repeats/minute
Rate for Channel 2 Cooling	0	0 - 9.9 Minutes
Cycle Time for Channel 2 Cooling	7	1 - 60 Seconds
Rate Band for Channel 2 Cooling	0	0 - 7 Seconds

Wick Pan

This output is on whenever channel 2 is on.



15.6 Controller and Component Mounting

15.6.1 Controller Mounting

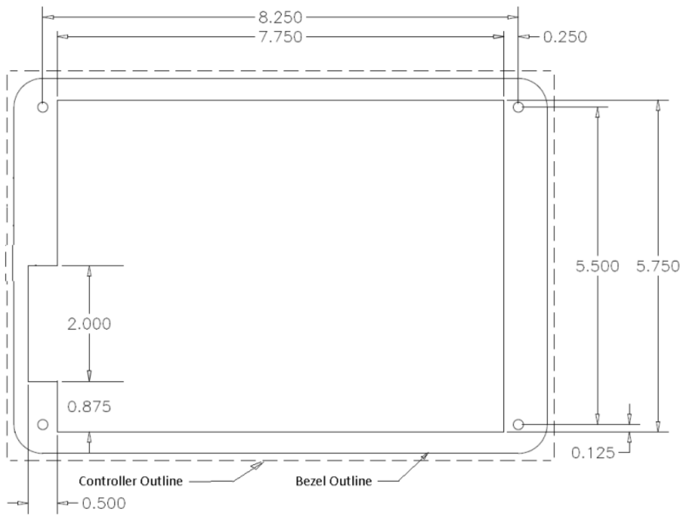
The Synergy Controller is typically mounted from behind the panel as shown in the figure below. The bezel P/N TE1576 is installed on the front of the panel and four 10-32 screws secure the bezel through the panel to the controller. The panel cutout is shown in the figure below. An alternative front mounting arrangement is also possible with the use of the bezel P/N TE1536.

Synergy Micro 2 Installation

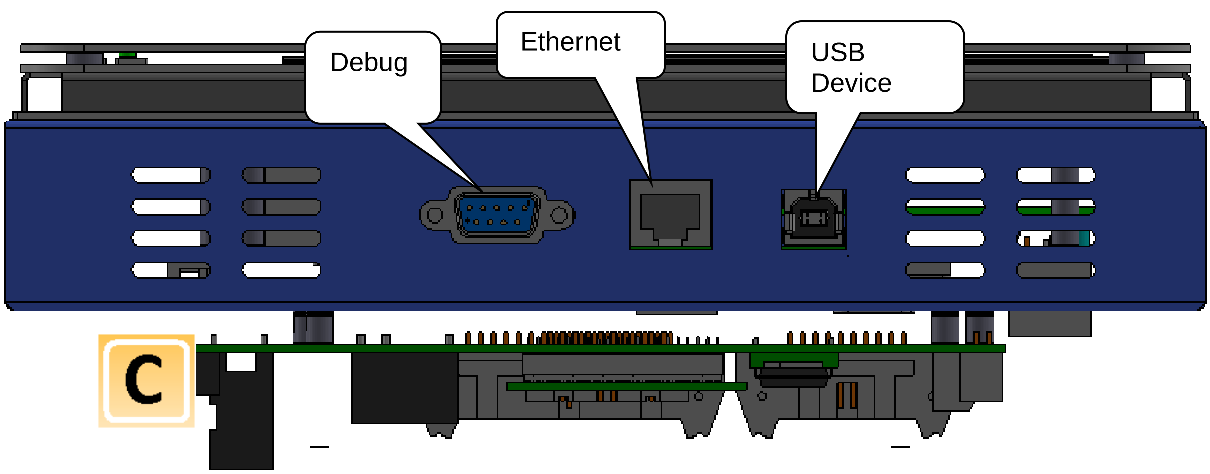
Installing the new Synergy Controller

1. Place the Synergy Controller bezel on the Synergy Controller on the front panel from behind the panel.
2. Install four 8-32 X 1/2" mounting screws from inside the chamber into the four threaded holes in the back of the controller (Item A).

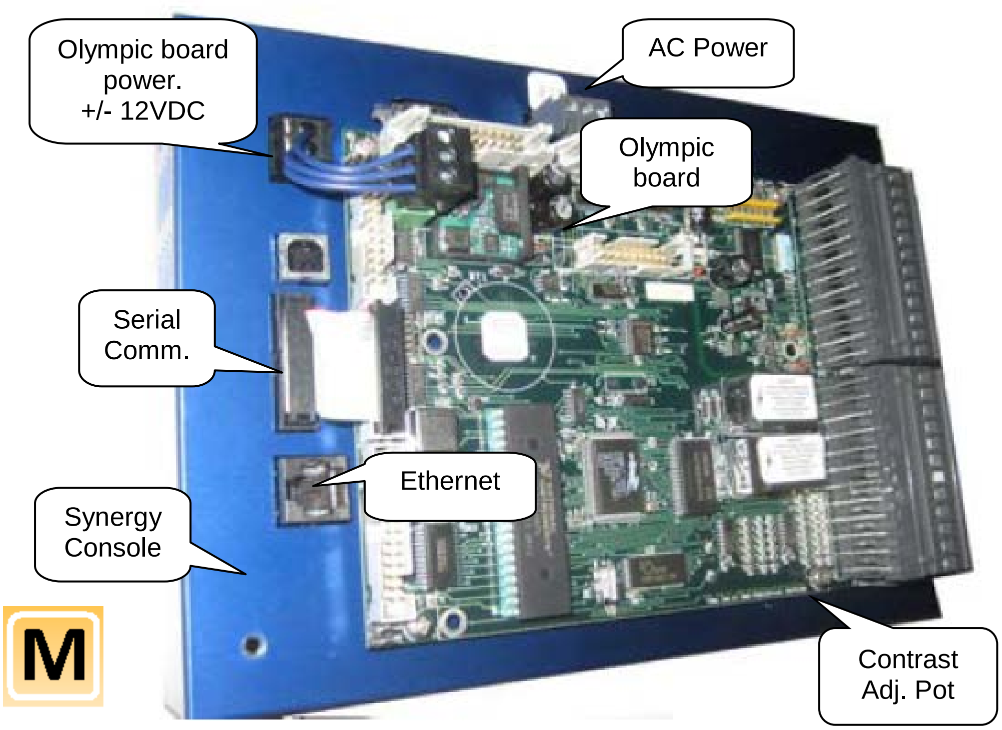
Synergy Controller Panel Cutout



Auxiliary connections for the controller are made behind the panel. These include Ethernet and in some cases, keyboard, mouse and VGA ports. The figures below show the auxiliary connections for the Synergy Compact and the Synergy Micro configurations.



Auxiliary Connections

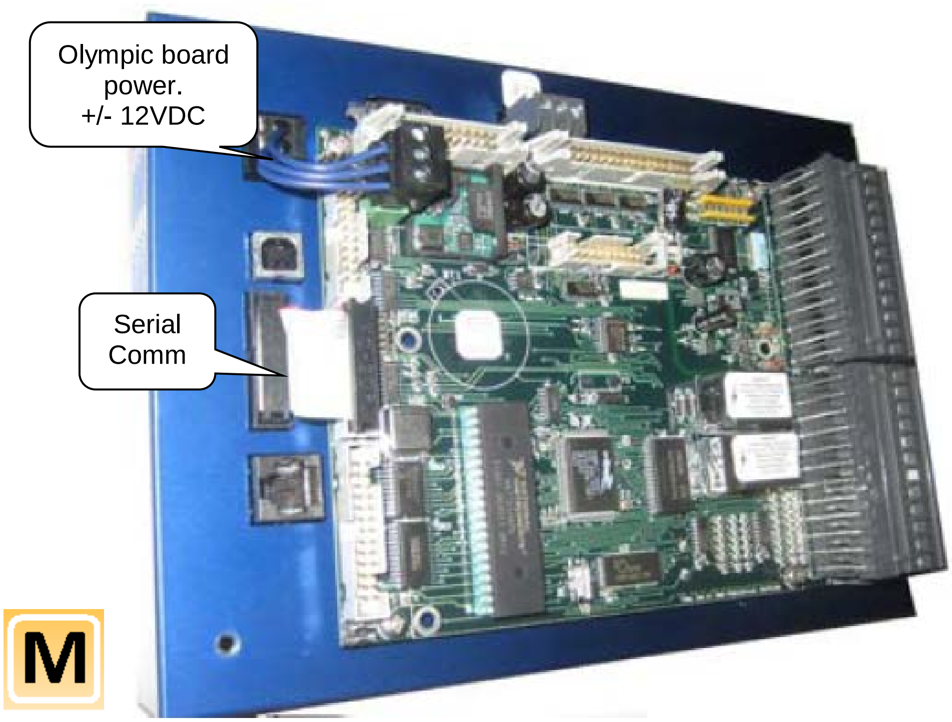


Synergy Micro and Micro 2 Auxiliary Connections

15.6.2 Olympic Board Mounting

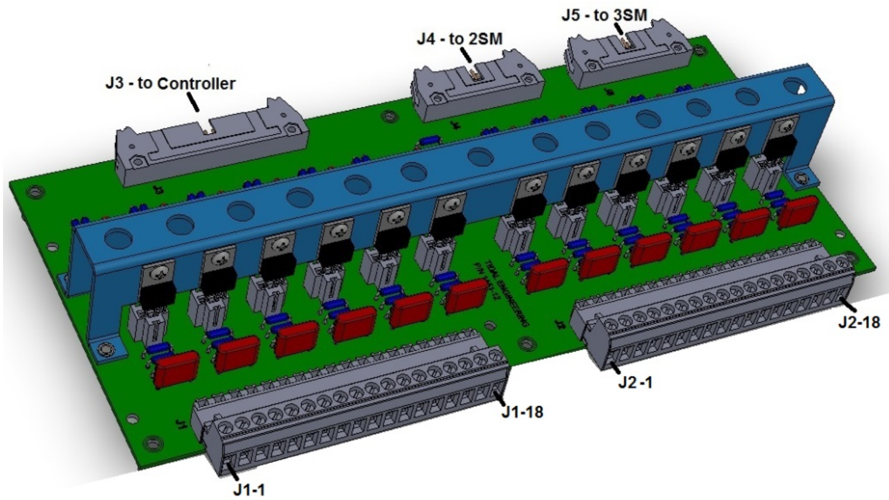
The Synergy Controller is designed to work in split systems where the Synergy Controller Console is mounted on the front of the equipment within reach of the operator and the Olympic I/O Controller is in the control box in close proximity to the sensor and power controller wiring.

Two cables connections are required between the Synergy Controller Console and the Olympic board; these are serial communications and power. These are identified in the figure below.

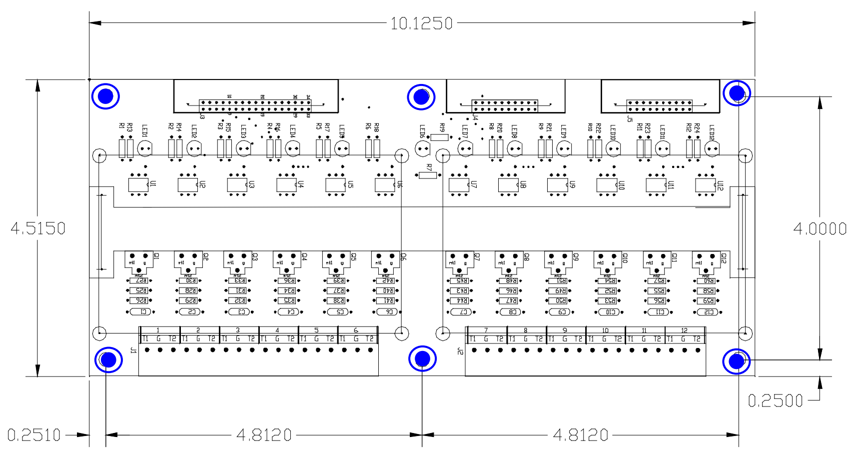


Splitting the system provides both operator convenience and wiring convenience. In certain applications the touch screen may be required to be remote from the chamber and not mounted on the chamber. This can be required when the equipment must operate in an explosion-proof area. A fiber-optic extender kit (P/N TE1972) can be used to separate the Synergy Console and the Olympic board by distances up to 50 feet. Separation distances up to several kilometers are supported by special order. Consult the factory for more information.

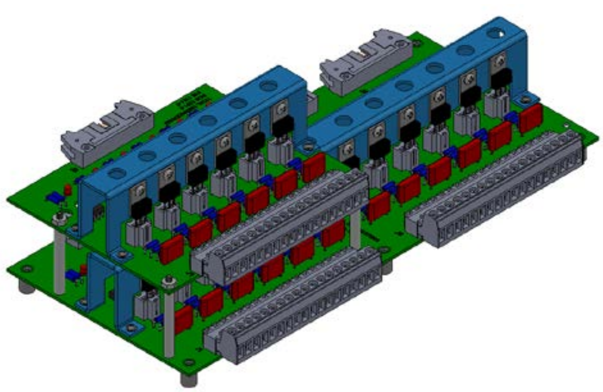
15.6.3 Triac Board Mounting

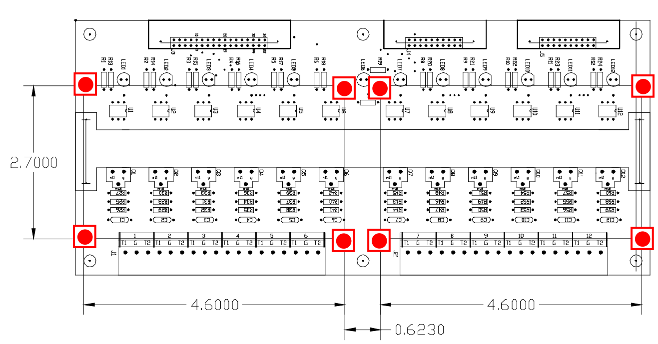


The Output or Triac boards are used to switch power to the AC loads of the chamber machinery. The 12-Channel Triac board (P/N TE1151-12) should be mounted to a panel inside the electronics enclosure. The figure below identifies the mounting hole locations for the 12-Channel board in blue .



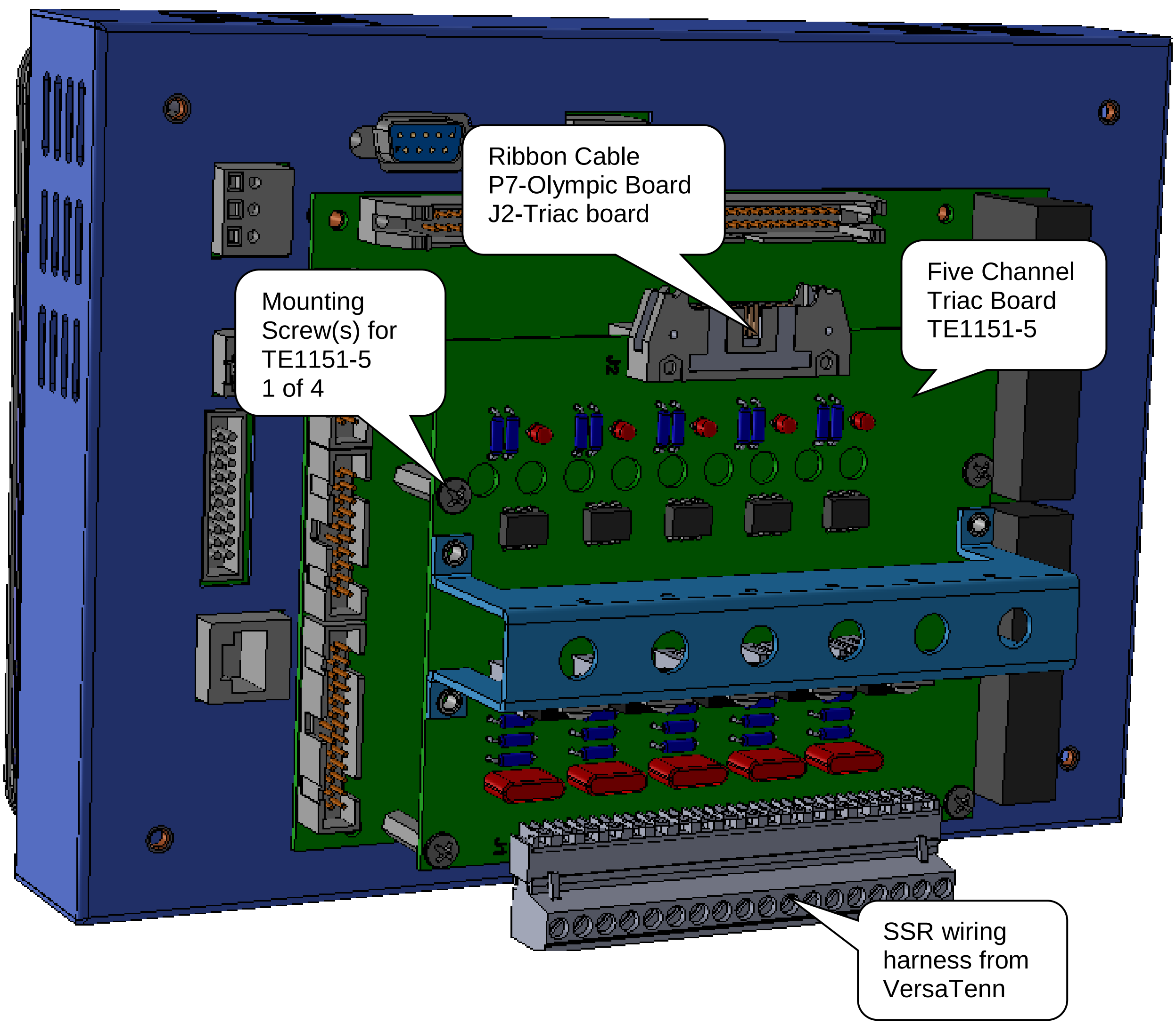
Provisions for stacking two 6-Channel Triac boards (P/N TE1151-6) on the 12-Channel unit are provided. These two boards are the 2SM and 3SM boards from the 6.10 chamber configuration list. The eight holes in the figure below for this purpose are indicated in red .





15.6.4 5-Channel Triac Board Mounting for Retrofit Installations

As noted previously, the Synergy Controller is designed to be a drop-in replacement for various generations of VersaTenn controllers. The 5-Channel Triac board (P/N TE1151-5) emulates the VersaTenn's SSR outputs to simplify this process. This output board mounts to the Olympic board on the back of the controller in the same arrangement as the SSR outputs on the back of the VersaTenn III controller. The figure below shows the 5-Channel board on the back of the controller. Note that the SSR outputs listed in the Chamber Configuration Section, 6.10, are the outputs available on this 5-Channel Triac board.

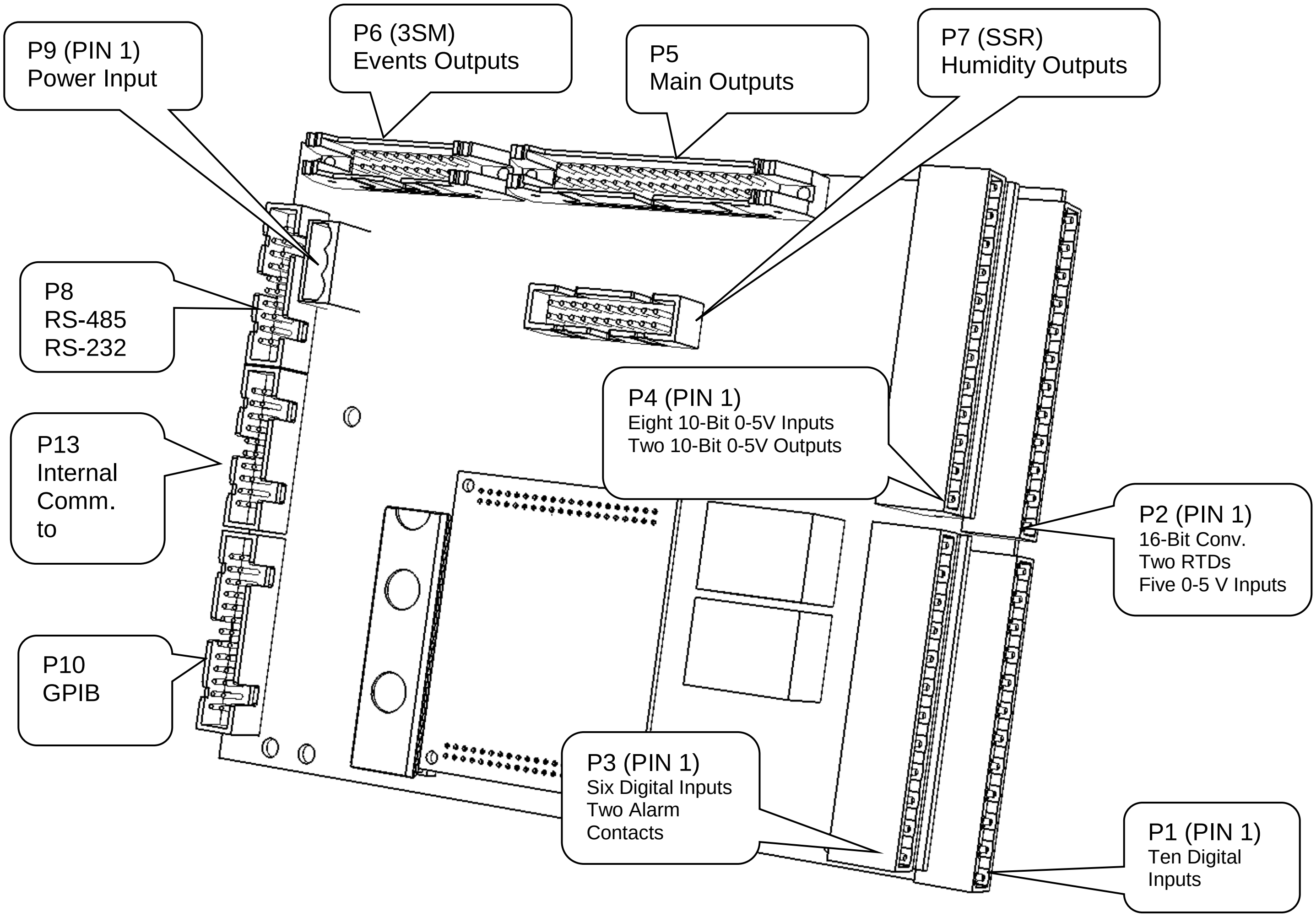


15.7 System Wiring

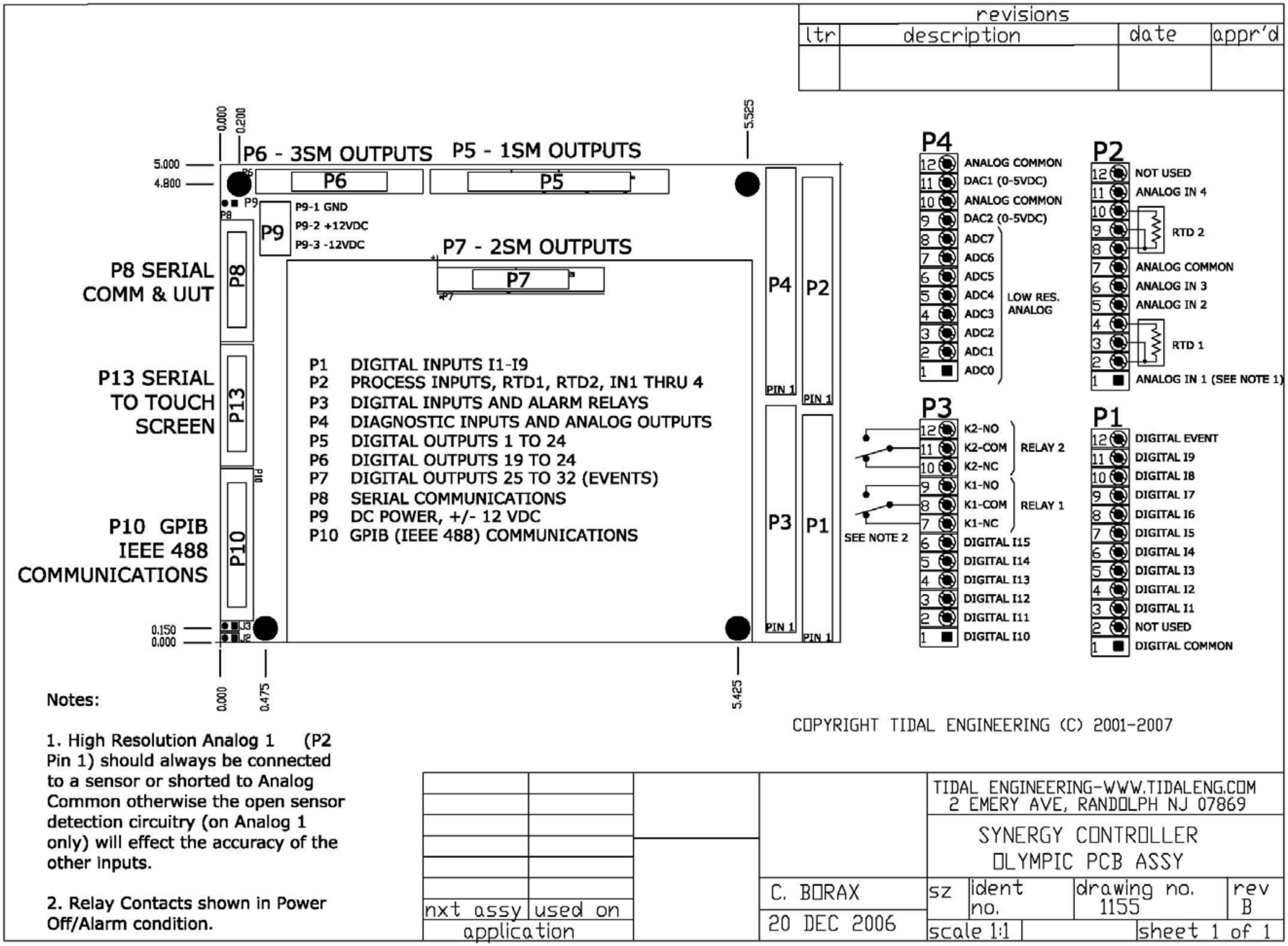
This part of the technical manual describes the Synergy Controller wiring including sensors, AC power, and AC outputs, retransmit outputs and communications.

Most of the Synergy Controller input and output wiring is made at the Olympic board. The following image of the Olympic Board identifies the connectors on the board and their principle functions. In addition a connection diagram follows that identifies the detailed pinout of the P1 thru P4 input/ output connectors.

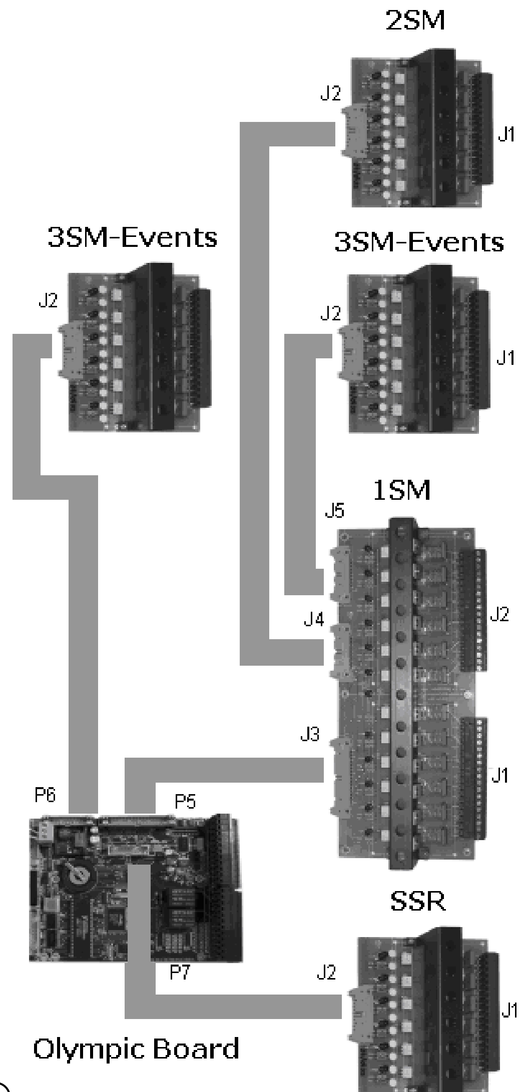
Olympic Board



Olympic Board Connection Diagram



15.7.1 Switching Module Configuration



The Olympic board drives all of the outputs for the chamber thru solid state switches called Switching Modules (SM). In some cases there is more than one way to connect a specific output. This provides flexibility when wiring the chamber to support new and retrofit installations. The figure at the right shows the different the ways Olympic board can be connected to the various SM boards.

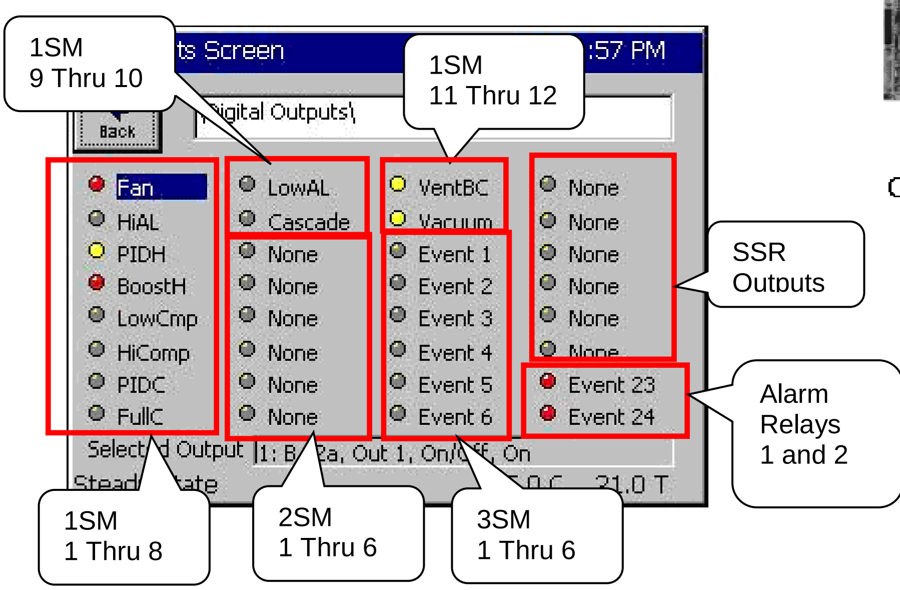
For example, note that the 3SM-Event outputs can be connected two ways; directly to the Olympic board P6 connector or thru the 1SM- J5 connector as shown at the right

In addition, some chamber definitions provide the same function to more than one output. This is referred to as mirroring.

For example, in the Generic Temperature Humidity configuration the “Humidify” output is available on 2SM-2 and SSR-2. The SSR outputs emulate the VersaTenn III SSR outputs which simplifies VersaTenn controller retrofits. To further support retrofits, the 5-Channel output board is wired to emulate the wiring of the VersaTenn III SSR outputs.

Installation section 17.0 describes the SSR outputs for retrofit configurations in greater detail.

The Screenshot below shows the position of each switching module on the EVENTS/Digital Output Screen.



15.7.2 RTD Sensor Inputs

The Synergy Controller supports two 3-wire RTD inputs. Four RTD types are supported, DIN 100, DIN 500, JIS 100 and JIS 500. These sensors connect to the Olympic board P2 connector according to the table shown below. These sensors can be used for air temperature or product temperatures.

RTD Sensor Connection Table

Signal	Value	Olympic Board Connector-Pins		
		White	White	Red
RTD1	100/500 Ohm pt.	P2-2	P2-3	P2-4
RTD2	100/500 Ohm pt.	P2-8	P2-8	P2-10

15.7.3 High Resolution Analog Inputs

The Synergy Controller supports four high resolution 0-5VDC process inputs. These can be Temperature inputs (scaled F to C), Vaisala temperature compensated and un-Compensated humidity inputs and other types including pressure. These voltage sensors connect to the Olympic board P2 connector according to the table shown below. Precision 250 ohm resistors are available to convert these voltage inputs to 4-20 mA inputs. For more information see the 4-20mA Sensor Wiring Section 17.3.3 below.

High resolution Analog Input Table, 5 VDC Max

Signal	Olympic Board Connector-Pin	Reference
Analog Input 1	P2-1	P2-7
Analog Input 2	P2-5	P2-7
Analog Input 3	P2-6	P2-7
Analog Input 4	P2-11	P2-7

15.7.4 Low Resolution Analog Inputs

The Synergy Controller supports eight low resolution 0-5VDC process inputs. These can be used for compressor pressure and other system and non-critical measurements. These voltage sensors connect to the Olympic board P2 connector according to the table shown below. 4-20 mA sensors can be accommodated by wiring precision 250 ohm resistors in parallel with the input. Four of these resistors are included in the accessories kit. For more information see the section below.

Low resolution Analog Input Table, 5 VDC Max

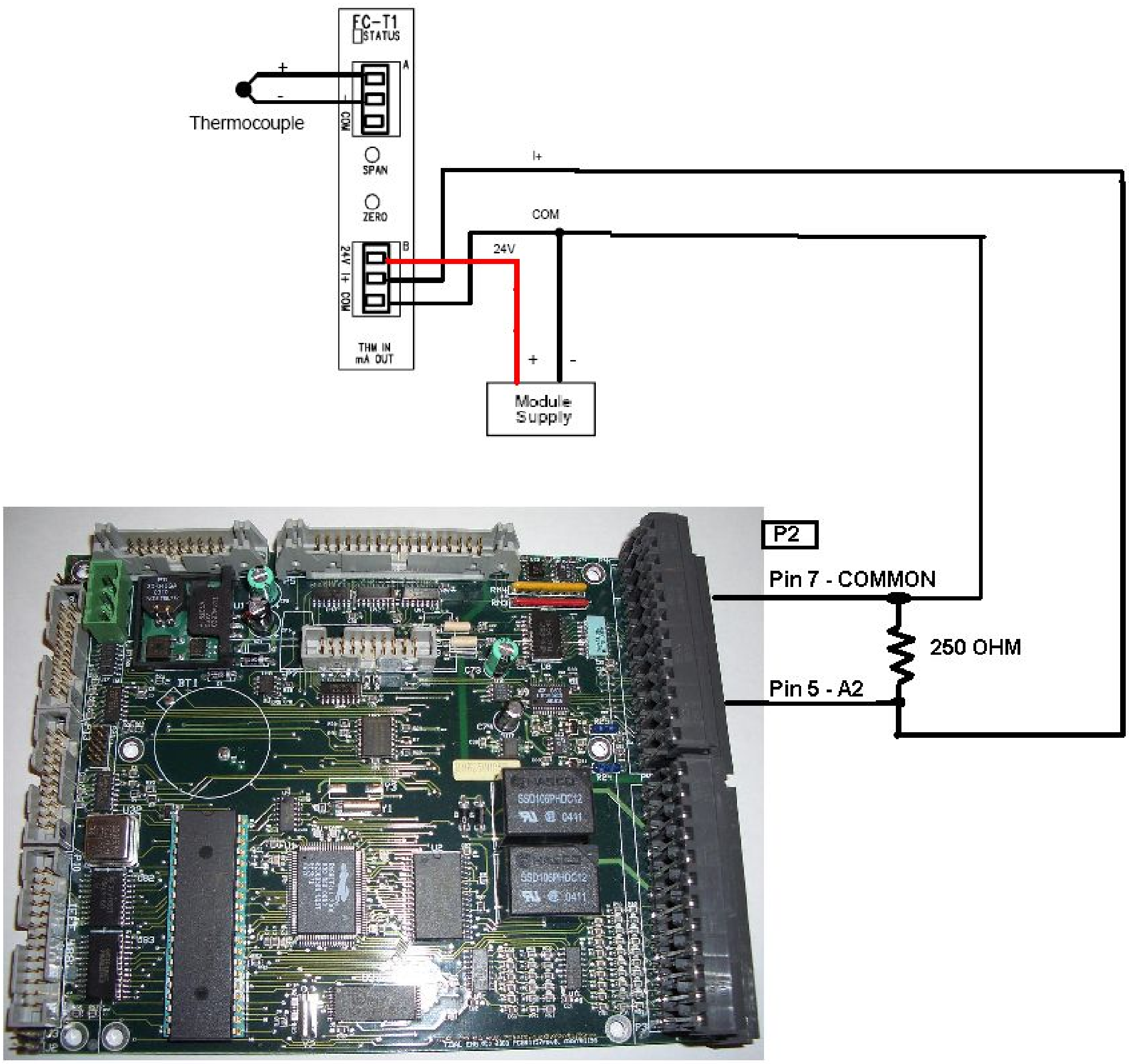
Sensor Function	Voltage Range	Connection	COM
Analog Input 1	0-5 VDC	P4-pin 1	P4- Pin 10
Analog Input 2	0-5 VDC	P4-pin 2	P4- Pin 10
Analog Input 3	0-5 VDC	P4-pin 3	P4- Pin 10
Analog Input 4	0-5 VDC	P4-pin 4	P4- Pin 10
Analog Input 5	0-5 VDC	P4-pin 5	P4- Pin 10
Analog Input 6	0-5 VDC	P4-pin 6	P4- Pin 10
Analog Input 7	0-5 VDC	P4-pin 7	P4- Pin 10
Analog Input 8	0-5 VDC	P4-pin 8	P4- Pin 10

15.7.5 4-20mA Sensor Wiring

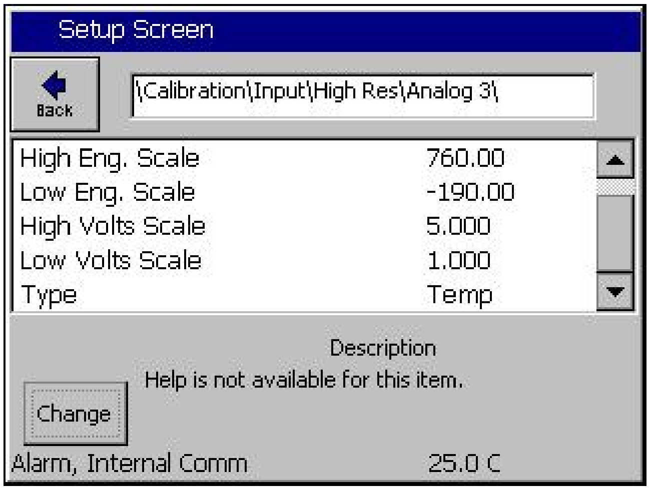
The Synergy Controller can accommodate up to four precision 4-20 mA transducers and up to eight low resolution 4-20 mA transducers. A precision 250 ohm resistor is required for each transducer. This section explains the wiring and setup procedure and provides examples.

CAUTION! : The analog inputs on the controller will be damaged if the 4-20 mA signal is attached without a 250 Ohm Resistor.

1. Hook up your signal conditioner or transducer as shown in the connection figure below. Note that this figure illustrates the use of hi-res analog input 2 however any of the 12 analog inputs can be used with 4-20 mA sensors.



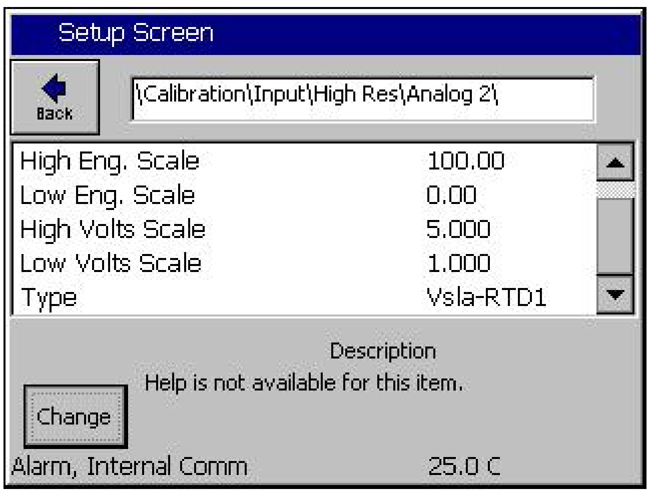
Setup the calibration the High Volts Scale for 5.0 VDC and Low Volts Scale for 1.0 VDC. Then set the Engineering Scale for the specific sensor and scaling. Take a look at the input calibration screen for the two examples below.



Example 1

J type thermocouple signal conditioner. The output is -190 C for 4 mA (Low Scale) and 760 C for 20mA (High Scale). The input type is set to Temperature (Temp) as shown at left.

Note that the High and Low Engineering scale should be set in the current temperature units of the controller. In this example the signal conditioner range is specified in C so the controller must be set in units of C when entering these values



Example 2

Humidity Sensor, the signal conditioner output is 4 mA for 0% RH and 20mA for 100% RH. The sensor type is set to Vsla-RTD1, an uncompensated Vaisala humidity sensor compensated with the temperature reading from RTD1.

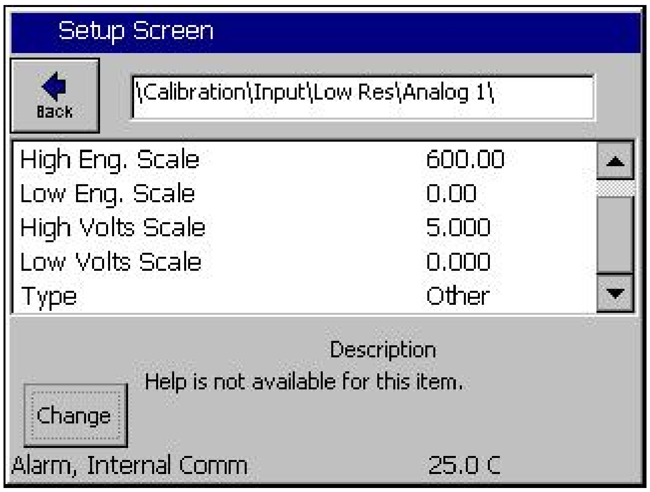
For additional information regarding calibration see the Setup section 6.0 of this manual.

17.3.4 Low Resolution Sensor Wiring

Low resolution sensors including refrigeration pressure transducers can be connected to P4 as follows (see P4 in the Olympic Board photo below): A typical transducer configuration for a cascade refrigeration system is listed in the table below.

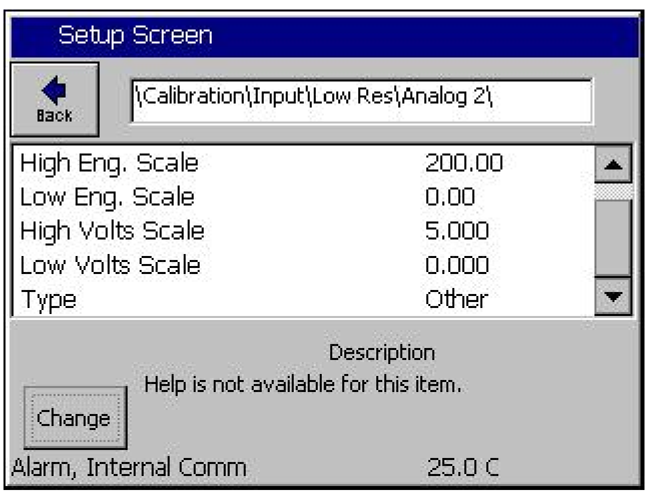
Sensor Function	Range	Voltage Range	Connection	COM
Low stage, Discharge Pressure	0-600PSI	0-5 VDC	P4-pin 1	P4- Pin 10
Low stage, Suction Pressure	0-200PSI	0-5 VDC	P4-pin 2	P4- Pin 10
Low stage, Oil Pressure	0-200PSI	0-5 VDC	P4-pin 3	P4- Pin 10
High stage, Discharge Pressure	0-600PSI	0-5 VDC	P4-pin 4	P4- Pin 10
High stage, Suction Pressure	0-200PSI	0-5 VDC	P4-pin 5	P4- Pin 10
High stage, Oil Pressure	0-200PSI	0-5 VDC	P4-pin 6	P4- Pin 10

Pressure scaling is setup in the Low Res Input Calibration Setup screen as shown below:



Example 1

In this example the low stage compressor discharge pressure is monitored on Input 1. The high engineering scale is set to 600; i.e. 600 PSI.



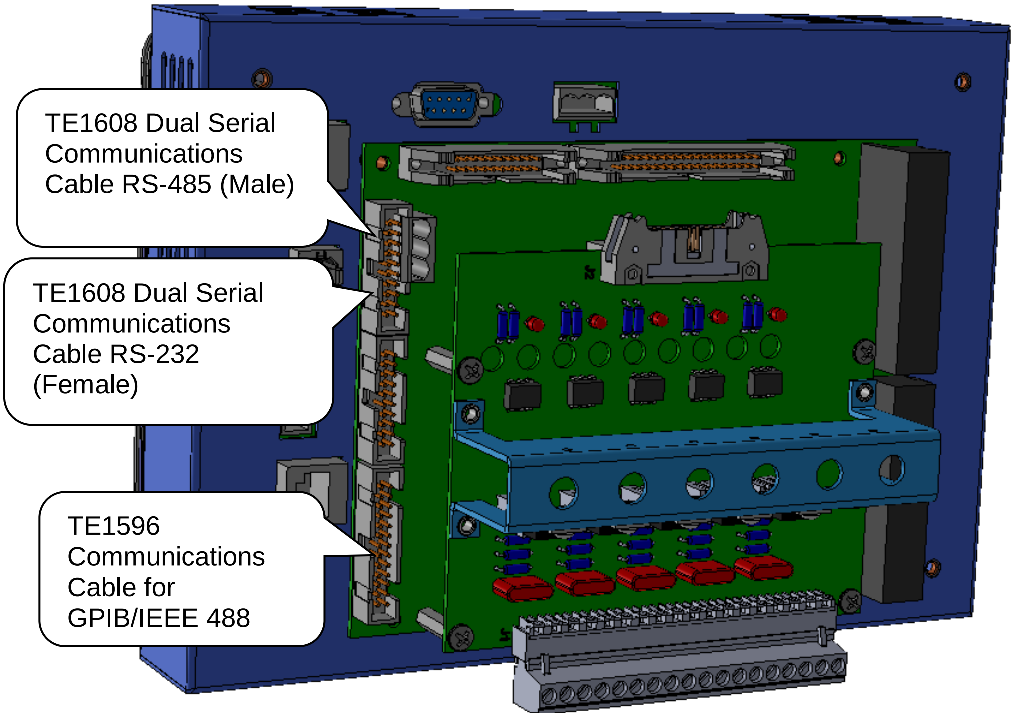
Example 2

In this example the low stage compressor suction pressure is monitored on Input 2. The high engineering scale is set to 200; i.e. 200 PSI.

The Low Resolution inputs can be viewed in the Events/Low Res screen. These inputs can be used as the input for a programmable alarm in addition to be used as the sensor for a control channel.

15.7.6 Communications Wiring: GPIB, RS-232 and RS-485

The Synergy Controller supports GPIB/IEEE 488, RS-232 and RS-485 communications through the Olympic board. The figure below shows the connectors and cable wiring for these. For information on the communications protocol supported by these ports see Synergy Controller Communications Section 18 of this manual. In addition, see the Communications screen for communications parameters. Note that the RS-485 port can be used as a slave communications port for computer control as well as a master port for UUT sensor monitoring. See the UUT Section 13.0 of the manual for information on UUT module setup.



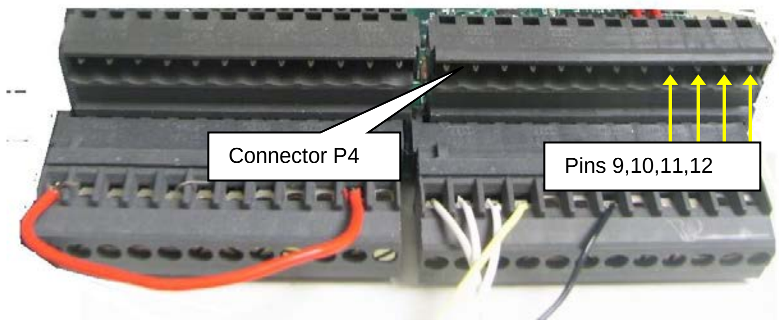
TE1596, GPIB/IEEE 488 Communications Cable	TE1608, Dual Communications Cable RS-232 /RS-485
	

15.7.7 Retransmit Outputs

Wire retransmit outputs to the chart recorder or control valves as necessary. Use 4-20 mA converters as required. See Section 6.4 Special Functions for setup details. The following table displays the connector and pin numbers for the Synergy Controller's two analog retransmit outputs. Below the table is an image of the Olympic Board connector P4, pins 9-12.

Analog Retransmit Connections Table

Signal	**Connector & Pin Number**
Analog Retransmit 1	P4-Pin 11
Return	P4-Pin 12
Analog Retransmit 2	P4-Pin 9
Return	P4-Pin 10



TE1803 Converter

The TE1803 is a DIN rail or side mount, selectable input/output signal conditioner with 1500 VDC isolation between input and output, and 1500 VDC isolation between 24-volt power and input/output. The field configurable output types allow a wide ranging capability for 0-5 V, 0-10 V, 0-20 mA and 4-20 mA signals.

TE1803 provides isolation and converts the Synergy Controller and Synergy Controller Olympic board retransmits signals from 5VDC Full Scale to 4- 20 mA, 0-10 VDC or 0-5VDC.

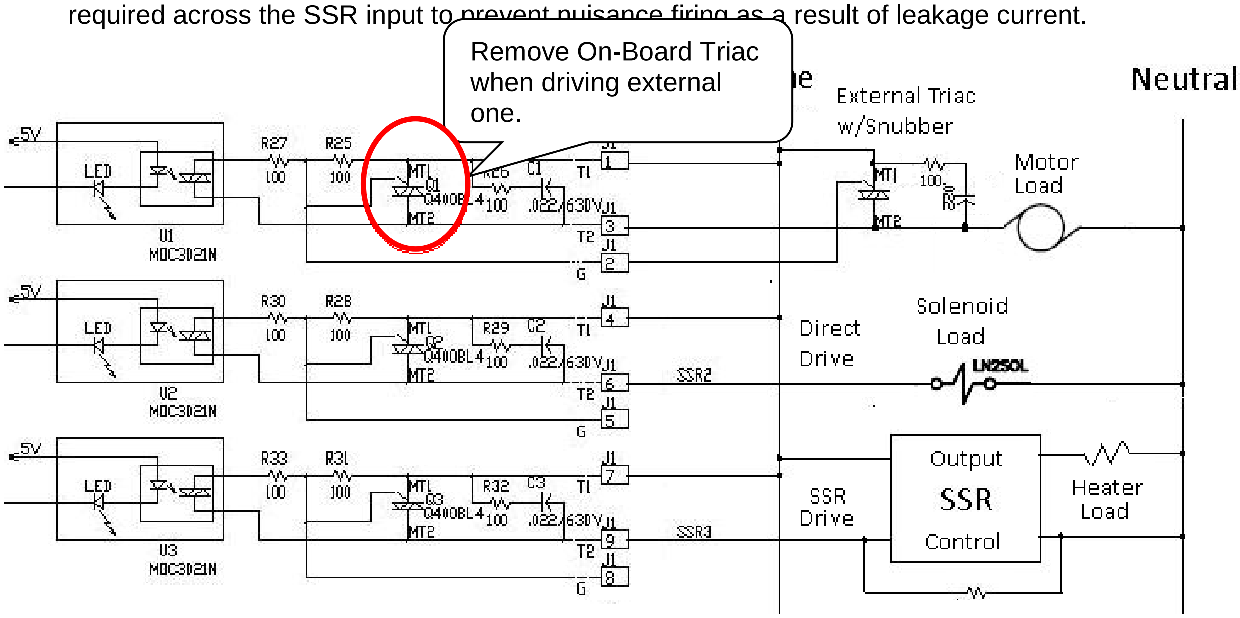
For more information about the converter visit http://www.tidaleng.com/appnotes/VTVAN20-RetransmitSignalConverterRevA.pdf

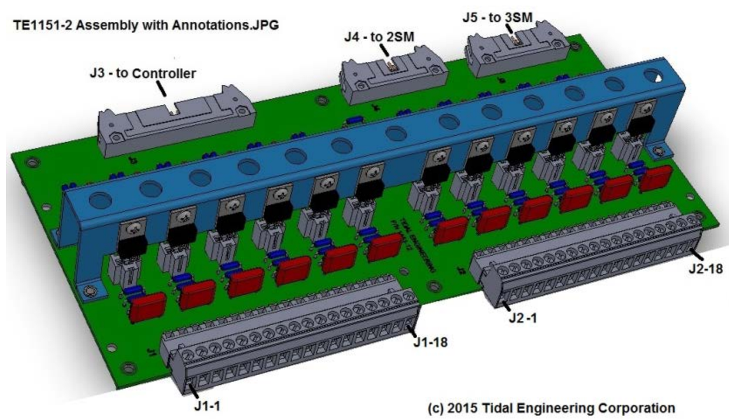
15.7.8 Triac Outputs

Synergy Controller output boards are multi-channel Triac controlled solid state relays are designed to handle the environmental test chamber's heaters, compressors, blowers and solenoids. These outputs handle small to medium current AC loads directly. The Synergy Controller output boards are designed to drive external Triacs for larger loads such as compressors and heaters. In addition, to driver larger loads, the Triac outputs can operate intermediary mechanical and solid state relays.

The figure below shows three output configurations for a Triac board:

1. Driving an external Triac to control an AC motor load. When an external Triac is driven, an additional QuenchArc(tm) snubber (resistor-capacitor network) is required across the Triac input to prevent nuisance firing as a result dV/dT switching noise.
2. Driving a small solenoid load directly.
3. Driving a Solid State Relay (SSR) module. When driving an SSR, an additional load resistor is required across the SSR input to prevent nuisance firing as a result of leakage current.





15.7.9 Alarm Outputs

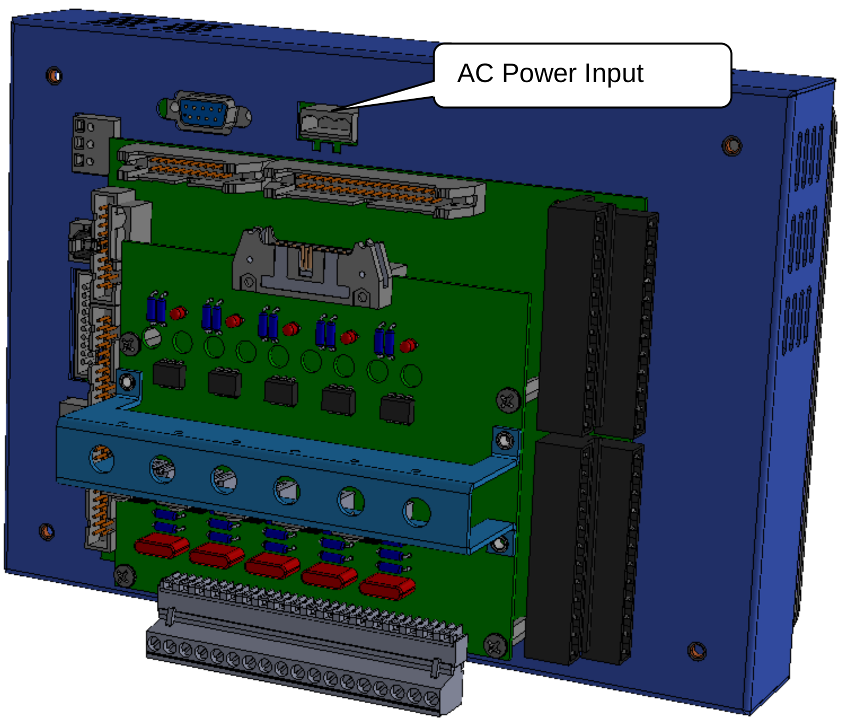
The Synergy Controllers K1 Alarm Relay operates when a standard alarm occurs. The K1 alarm should be wired to disable the main contactor when the relay operates. In addition, the K2 Alarm relay can be programmed to operate from the User Programmable alarm system. See the Setup section for more information concerning the User Programmable Alarm System.

Alarm Connection Table

Signal	Connector & Pin Number
K1-NC	P3-Pin 7
K1-Common	P3-Pin 8
K1-NO	P3-Pin 9
K2-NC	P3-Pin 10
K2-Common	P3-Pin 11
K2-NO	P3-Pin 12

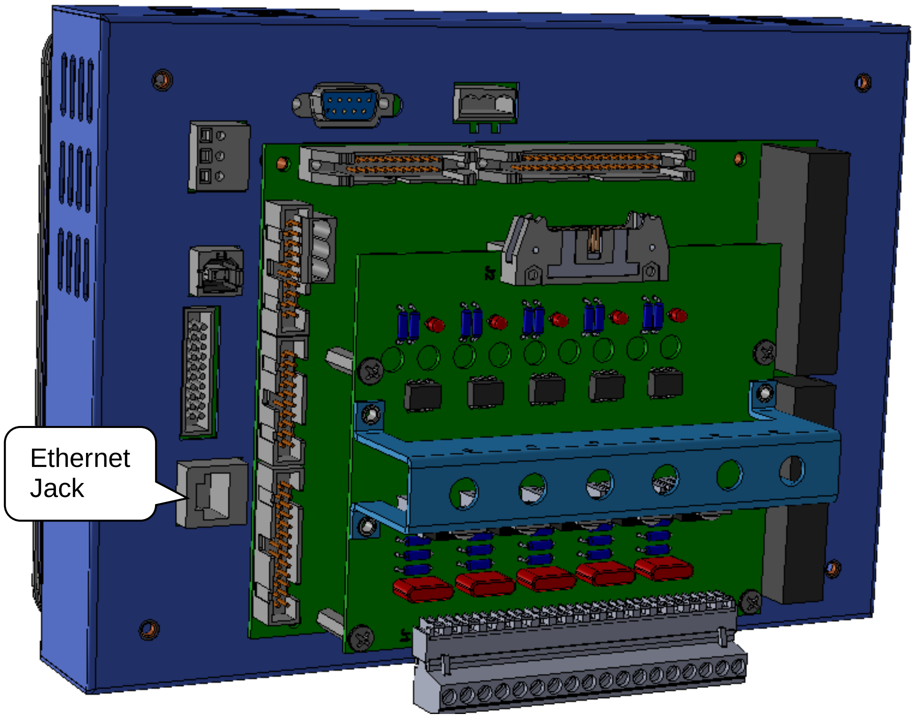
15.7.10 AC Power

Connect the AC power input, Line, Neutral and Ground to the input power plug as shown in the figure below. The wiring of this connector is designed to be identical to the VersaTenn III wiring to simplify retrofit.



15.7.11 Ethernet Connection

Connect the RJ-45 patch cable from the Ethernet jack on the back of the Synergy Micro to a bulkhead mounted Ethernet jack.



15.8 Alarm System Test

After installation and setup, all alarm should be tested to verify that test chamber shut down occurs and power is removed from heaters, compressor, etc. when any sensor is disconnected. Verify that test chamber shut down occurs when the secondary limit controller alarm limits are reached. (See the Section 3.0 - Safety)

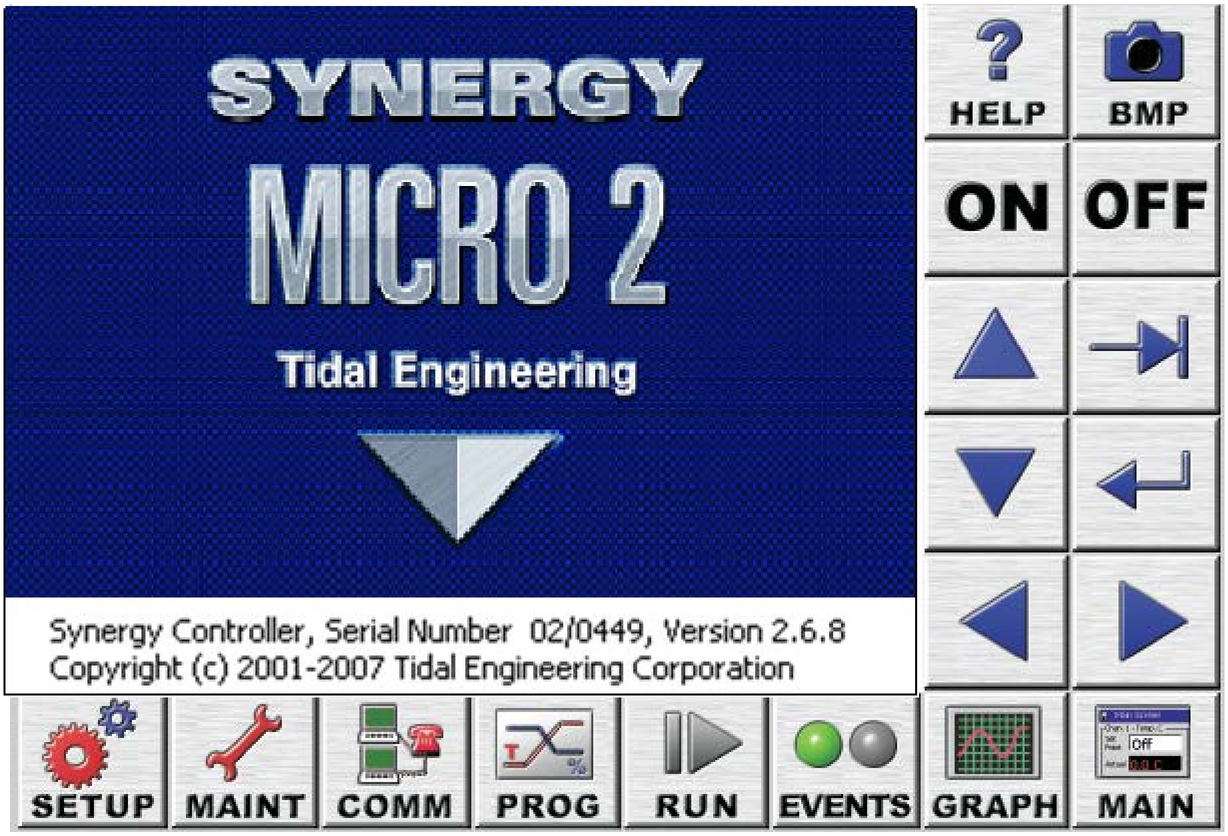
15.9 Control System Verification

Verify control system performance for transient and steady state control. Tune the PID settings as necessary. (See Section 6.3 – PID) Consult the factory for additional assistance with chamber tuning.

15.10 Controller Splash Screen

When power is applied to the chamber, the Synergy Controller touch-screen displays boot-up progress. Upon a successful boot-up, a Synergy Controller splash screen will appear. (See figure below) followed by the Main screen.

Synergy Controller Splash Screen


SYNERGY
MICRO 2
Tidal Engineering
Synergy Controller, Serial Number 02/0449, Version 2.6.8
Copyright (c) 2001-2007 Tidal Engineering Corporation
HELP
BMP
ON
OFF
SETUP
MAINT
COMM
PROG
RUN
EVENTS
GRAPH
MAIN

16.0 CONTROLLER TUNING AND CALIBRATION

16.1 PID Tuning

Synergy Controller implements high performance PID algorithms for up to 4 channels. The PID tuning parameters are shown in the following screenshot. Tuning parameters are available for each half of the split Push/Pull, Heat/Cool system. In addition, Cascade (Product temperature) control features are available to improve test speed and accuracy when the product temperature must be controlled explicitly.

PID

PID is the abbreviation for Proportional, Integral, and Derivative and is a popular control algorithm. PID controllers are used to regulate the process variable (temperature, humidity, etc.) at a setpoint. The control variable is the output of the controller and it changes in response to changes in process value or setpoint.

PID Output = Proportional + Integral + Derivative

The Proportional Band, Reset and Rate constants control the calculation of the PIDs.

P	*Proportional Band = 100/gain*	
I	*Integral = 1/reset*	*(units of time)*
D	*Derivative = rate*	*(units of time)*

Error – Err

Error is the difference between the Set Point (SP) and actual Process Values (PV).

Error = SP – PV

Proportional Band (PB)

The Proportional Band (PB) is the range of error that drives the output from 0 to 100%. When the error is within the Proportional Band, the P output term is proportional to the error. Decreasing the proportional band increases the controller gain. (Tuning note: increasing the controller gain can make the process faster but less stable.)

If the Error < the Proportional Band
  *Proportional Output = (error)*100/(proportional band)*
Else
  Proportional Output = 100%.

Integral – In

With integral action, the "I" portion of the controller output is proportional to the integral of the error. Integral action will eliminate any steady state error of a strictly proportional control. (Tuning Note: Increasing the reset (the integral gain) can destabilize the controller, decreasing the reset can stabilize and slow the system response.)

Integral Output = $\int$*(100/proportional band * Reset * Error)*

Derivative – Dn

The derivative portion of the controller output is proportional to the rate of change of the error.

*Derivative Output = 100/(proportional band) * Rate * d(error) / dt*

Proportional Output – Pn

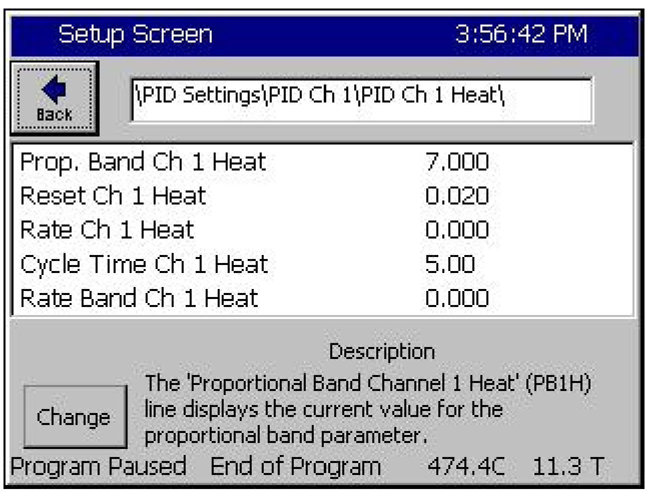
Proportional output is the difference between setpoint and actual value divided by the proportional band. As an example: if the proportional band is 10 and the actual temperature is 90C and the setpoint is 100 then the Pn term is 100%. When the actual value reaches 95 degrees the Pn term is at 50%, at 99C the Pn term is 10%, at 100C the Pn term is 0%.

Reset Constant

Reset controls the integration error. The larger this value the faster the integration term will change. Increasing reset adds gain to the system. A lower Reset slows the controller response and increases stability.

Cycle Time Constant

Cycle Time controls the time period of the proportional cycle. The output goes through one on -off cycle each cycle. Shorter cycle times reduce the size of steps on the output but increases wear on output devices such as valves. Longer cycle times increase the size of steps but also increases the life span of certain chamber hardware.

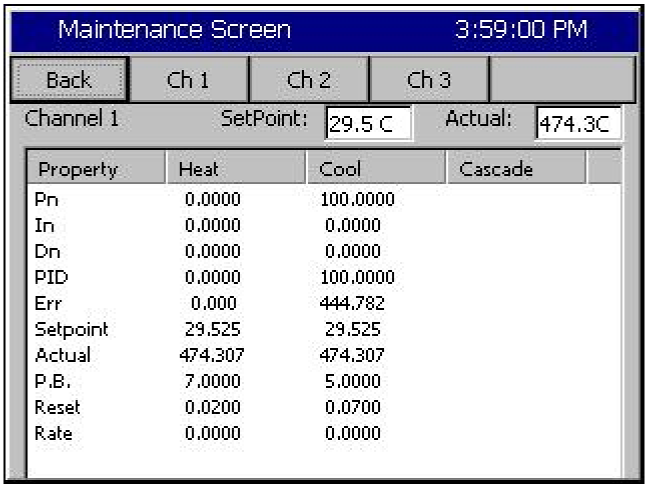


Optimum test chamber performance criteria depend on the application and can be summarized as follows:

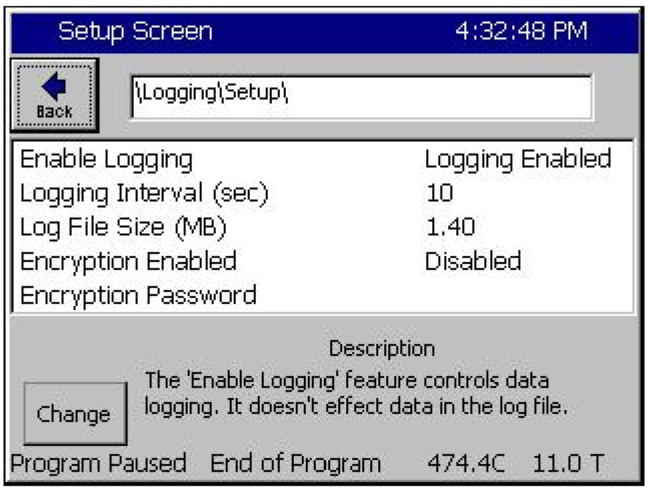
1. Minimum over-shoot.
2. Minimum transition time
3. Minimum energy.

The latter being important when LN2 or electricity consumption is the primary concern.

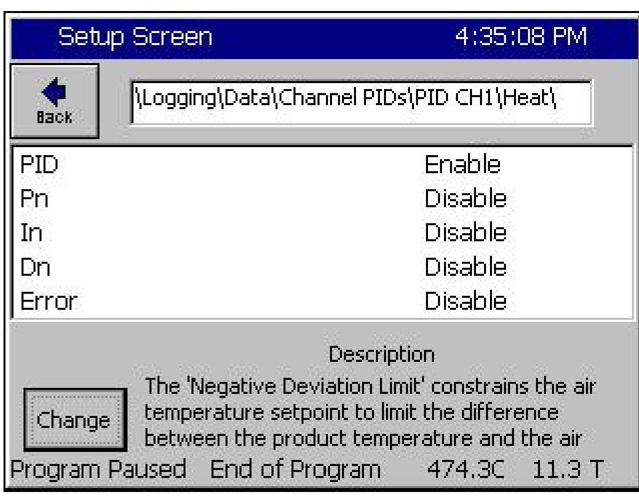
The Synergy Controller is tuned as required using the built-in tools that include the on-screen PID monitor (See screen shot below) and the history log file.

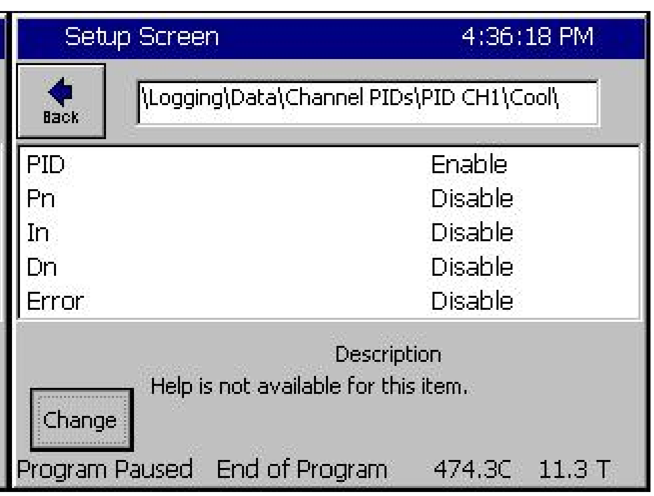


To gather data to help in the tuning process, a 10 second logging interval is recommended as shown below.



In addition, the Heat and Cool PID value logging should be enabled for all the channels of interest.



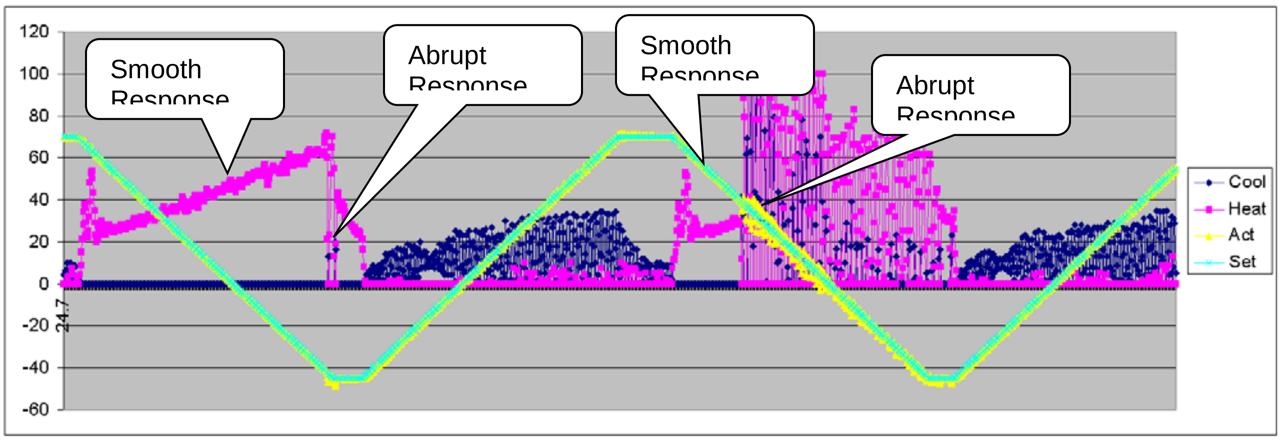


Tuning versus Control System Issues

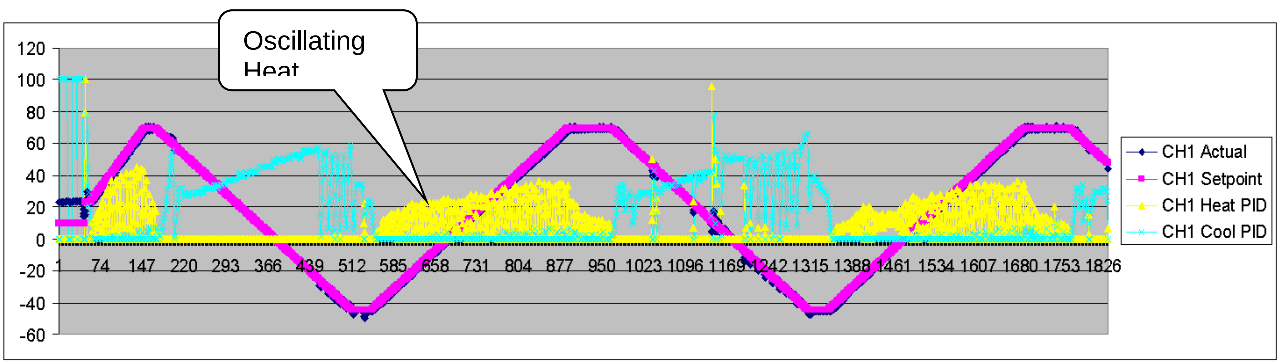
Control system nonlinearities, refrigeration problems, and other issues can disrupt chamber performance and can appear to be PID tuning problems.

The following chart shows the log file of a control system issue that wasn't caused by PID tuning. In this case, the boost cooling system was turning on during the linear portion of a cooling ramp and causing major perturbations in the control system as a result of the changing system gain.

The following chart shows the log file of this issue. In this plot, the actual (Act) temperature in yellow shows significant fluctuations



On the other hand, the heating control loop is unstable in the following chart. This was correcting by increasing the Heat Proportional band for 7 to 14.



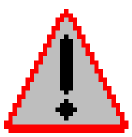
16.2 Cascade (Part) Temperature Control

Cascade is a control method that uses two control loops and two sensors to provide better performance than can be achieved with a single loop. The outer control loop provides the setpoint for the second inner control loop. With this method, the product temperature reaches its setpoint more quickly than with single loop control, while minimizing overshoot.

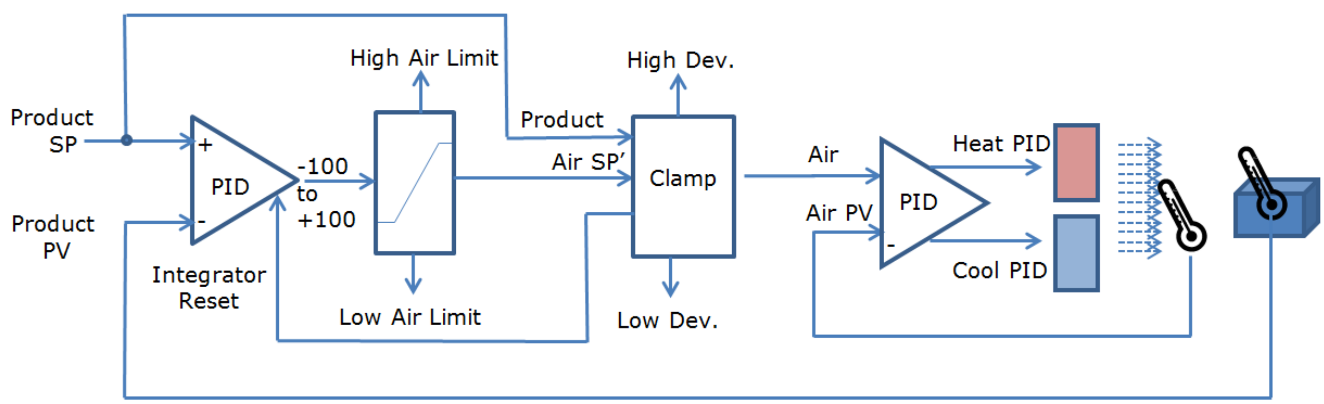
Single loop control compares the temperature of the discharge air of the conditioning section to a temperature setpoint, and adjusts the heating / cooling systems accordingly. Note that temperature is the process variable used in the following discussion of the Cascade Control feature and although temperature is the most commonly controlled variable in cascade applications, other process variable can be controlled to advantage with this feature.

In Cascade control the outer loop senses the temperature of the unit-under-test or a remote sense point that requires control. The inner loop controls the air temperature. An error signal is calculated and then processed by the PID algorithm for the outer loop. An output power level signal is produced ranging from –100% to +100%, which is converted linearly to a temperature setpoint using the set point low limit and set point high limit temperature settings. This temperature setpoint is sent to the inner loop.

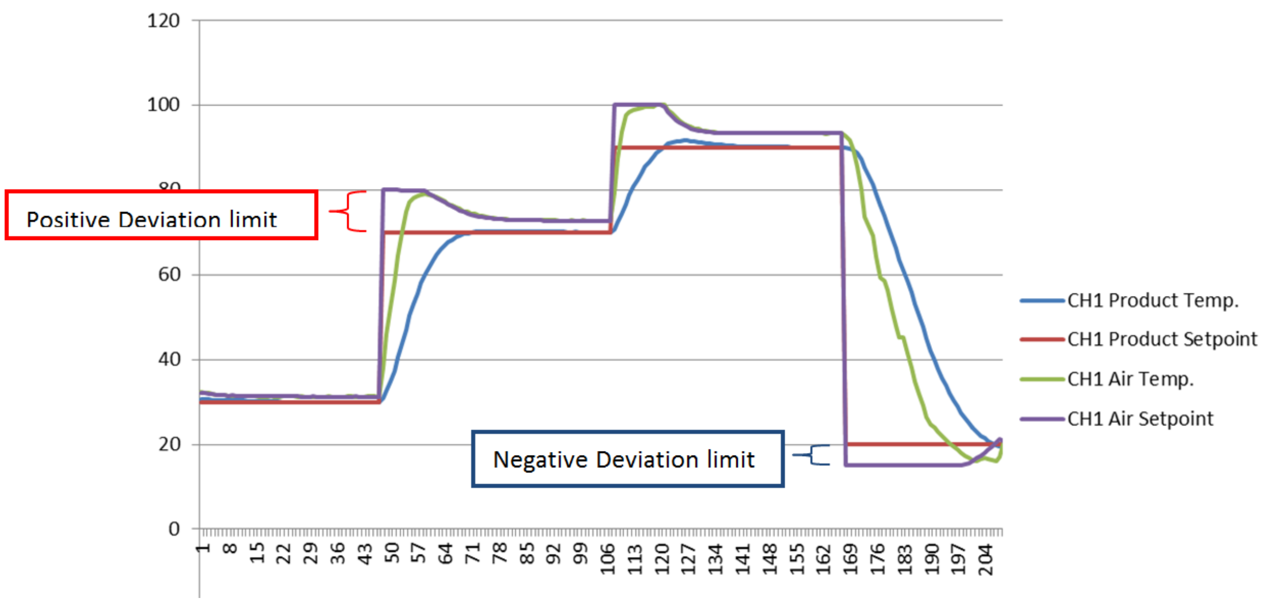
The inner loop monitors the discharge air from the conditioning system and compares it to the temperature set point generated by the outer loop. An error signal is generated and then adjusted by the Heat and Cool PIDs. An output power level signal ranging from 0 to 100% is produced and sent to the heating and cooling systems.



Warning: Careful consideration should be paid to the Cascade Control setup since the chamber air temperature will often go to these the limits. This will always occur if the product sensor isn't connected properly. A secondary limit controller set appropriately should always be used to prevent damage to the chamber and/or to the unit-under-test (product) in the event of controller or primary sensor failure. Cascade High Limit should be always be set to the maximum allowable air temperature for the chamber and product.

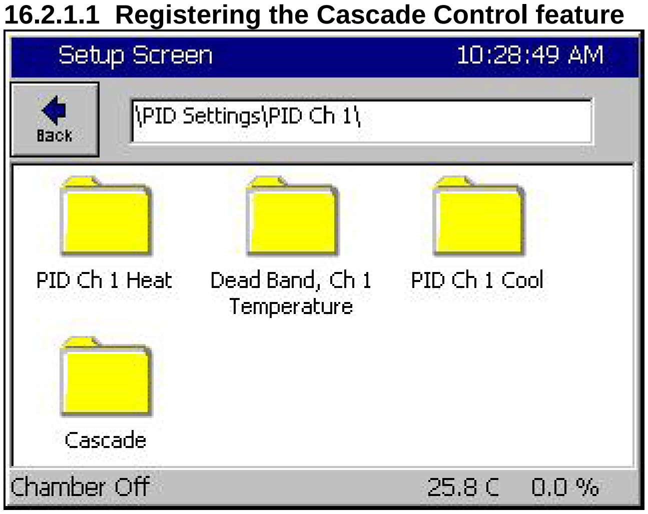


The graph below shows the speed and control advantages of Synergy's Cascade Control feature. Note that the Air Temperature forces a faster product (UUT) temperature change by providing a greater delta t.



16.2.1 Cascade Control Setup

16.2.1.1 Registering the Cascade Control feature



The cascade feature requires a registration key. To register your cascade control feature, select the cascade folder.

If your cascade control is not registered you will encounter the screen on the left. Press the Registration Key text box to open the alphanumeric keypad. Enter your registration number. The cascade registration number is available from Tidal Engineering or your chamber manufacturer.

16.2.2 Configuring Cascade Software

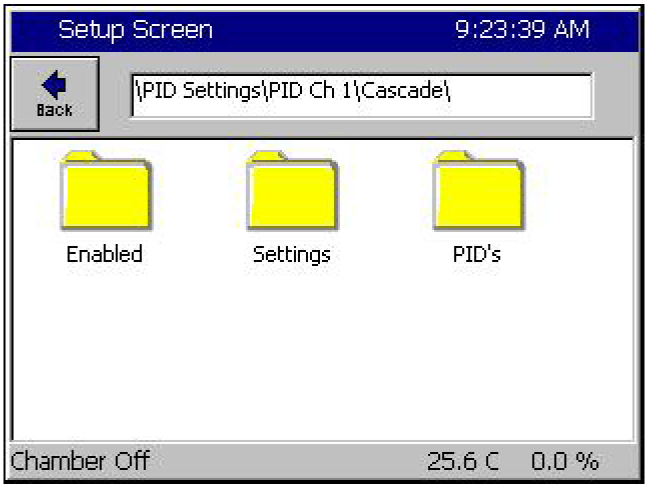
16.2.2.1 General

Several settings and parameter options control the Cascade loop. In addition, the air temperature loop PID constants will usually require additional tuning, especially with the Cascade Proportional Band setting. The PID / Parameter Option Chart below shows the recommended and default settings for Cascade algorithm.

PID / Parameter Option Chart

PID	Parameter	Recommended	Default
Cascade	Enabled	Enabled	Disabled
Cascade	Sensor Select	As required	120, RTD2
Cascade	High Limit (Temp)	200	200
Cascade	Low Limit (Temp)	-100	-100
Cascade	Positive Deviation Limit	5	5
Cascade	Negative Deviation Limit	5	5
Cascade	Proportional Band	7.0	7.0
Cascade	Reset	0.02	0.02
Cascade	Rate	0.00	0.00
Cascade	Rate Band	0.00	0.00
Heat	Proportional Band	14.0	7.0
Cool	Proportional Band	10.0	5.0

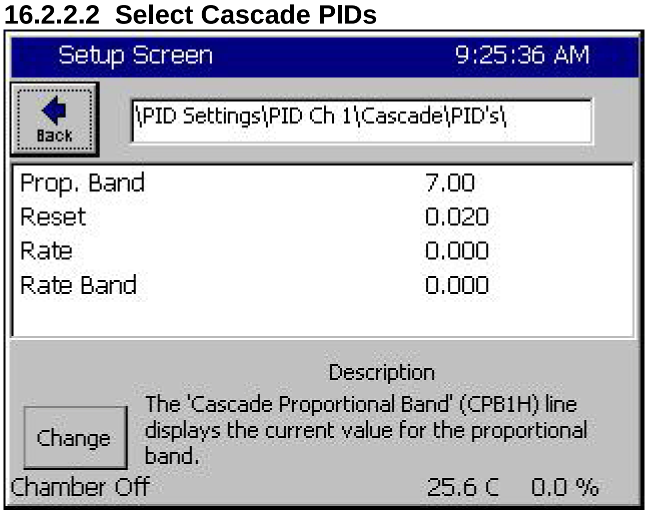
In order to view and change the Cascade PID / Parameter settings, press the ***SETUP*** Screen Navigation key and go to the screen below. For Inner Loop settings, go to the *PID Settings\PID Ch1\Heat or Cool* folder.



<u>Cascade Setup Folder</u>

- **PID Folder:** Cascade PID loop settings. (Sect. 3.2)
- **Settings Folder:** High and Low Air Temperature Limits and the Sensor Selection.
- **Enabled Folder:** Enable and disable the cascade feature.

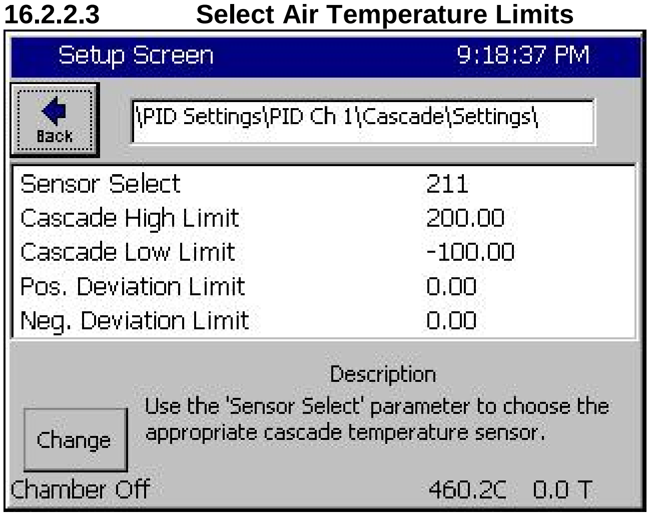
16.2.2.2 Select Cascade PIDs



Open the PIDs folder in the screen above to view the screen shown on the left. Use this screen to view and change the Proportional Band and Reset settings.

Note: Rate and Rate Band settings aren't used.

16.2.2.3 Select Air Temperature Limits



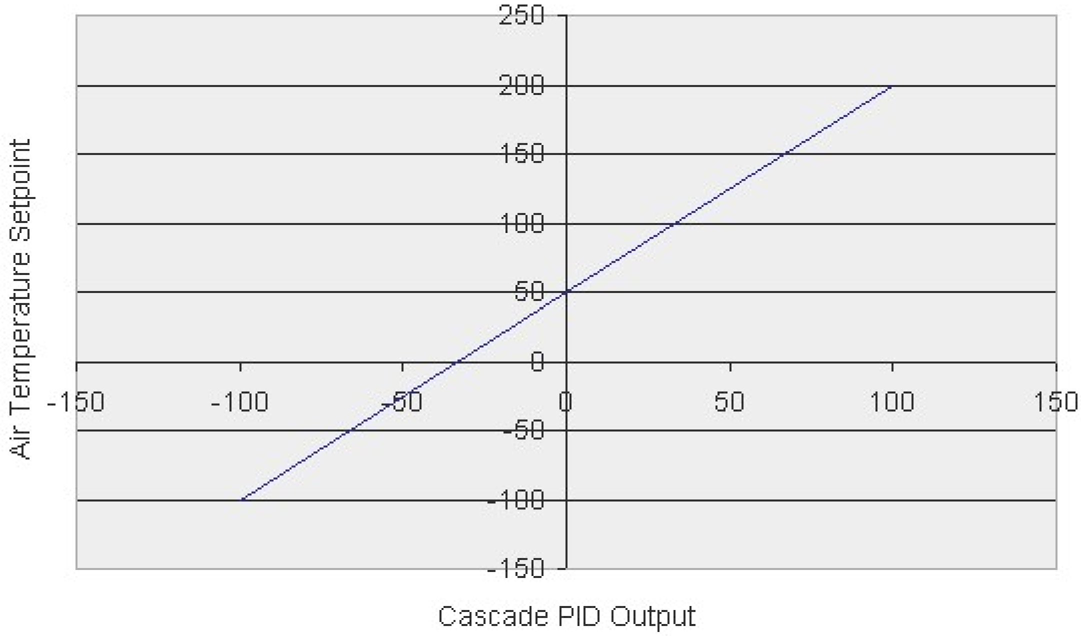
Select the Settings Folder from the Setup\PID Settings\Cascade screen. In the Settings screen shown, 'Cascade Low Limit' and 'Cascade High Limit' are the minimum and maximum air temperatures that the controller will use to achieve the desired product temperature. These parameters default to -100 C and +200 C, respectively but should be changed to values dictated by the chamber and product under test.

The chart below shows a graph of air temperature setpoint versus PID output for the default values.

Warning!
The ranges set for Cascade High Limit and Cascade Low Limit must be within the range of the sensor used, which is described in the Select Cascade Sensor section. RTDs have a greater temperature range than the Synergy Controller's UUT thermocouple sensor. The UUT module Type T thermocouple range is as follows: Low Value = -100 deg. C and High Value = +400 deg. C.

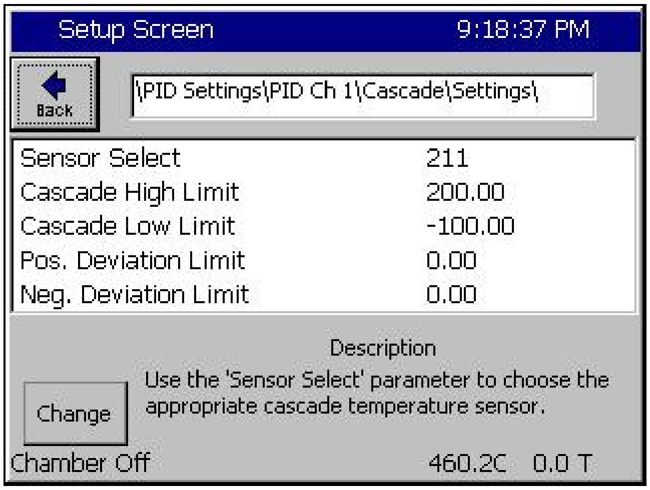
Warning!
Set the ‘Cascade Low Limit’ and ‘Cascade High Limit’ carefully. Be certain they are within the capabilities of the chamber and the product under test. These are the minimum and maximum air temperatures that the controller will use.

Default Air Temperature Limits versus Cascade Output Percentage



16.2.2.4 Select Cascade Sensor

The Synergy Cascade control feature can use various input sensors to measure the product temperature. The desired sensor is selected in the Settings screen shown below.



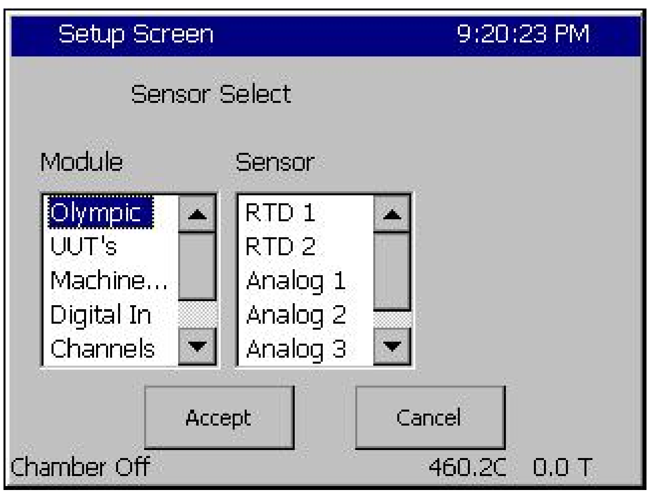
To select a product sensor to monitor the product in Cascade, click on **Sensor Select** and press the ***Change*** button.

Note: The **Sensor Select** field displays the Sensor Select Number Code, which represents the current sensor selected (211 in this example).

The code is explained below.

The sensor select screen shown below is used to determine the code.

The Sensor Select screen displays two or three columns depending on the selected module. In the left most column, you can specify the module; either the Olympic processor board or a UUT module.



<u>Olympic Board Sensor</u>

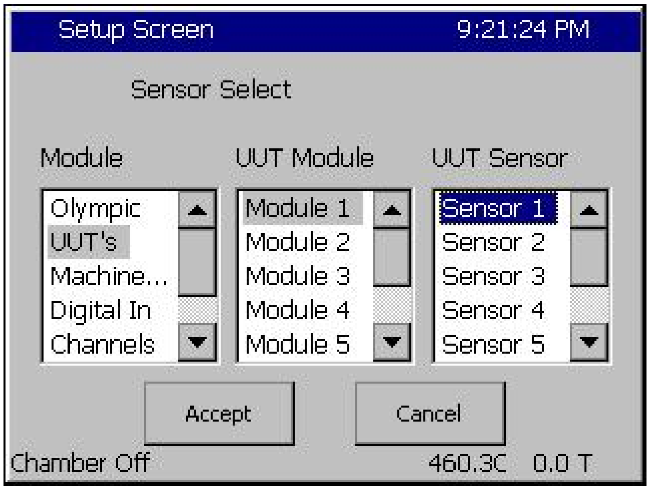
When you select Olympic board in the first column, you can then select the sensor to monitor.

Press the ***Accept*** button when finished.

The Sensor Select Number Code will appear in the Settings screen shown above. This code is derived from the Olympic Board Sensor Code Chart shown below.

Olympic Board Sensor Code Chart

Sensor	Value	Description
RTD 1	110	Platinum 100 ohm RTD (Normally Chamber Air Temperature)
RTD 2	120	Platinum 100 ohm RTD (Normally not used in stand. chamber configurations)
Analog 1	130	0 to 5 Volt DC Signal (Normally Humidity sensor in T/H units)
Analog 2	140	0 to 5 Volt DC Signal (Normally not used in standard chamber configurations)
Analog 3	150	0 to 5 Volt DC Signal (Normally not used in standard chamber configurations)
Analog 4	160	0 to 5 Volt DC Signal (Normally not used in standard chamber configurations)



UUT Module Sensor

When the UUT Module is selected, you can then select which UUT module (second column), and then the specific sensor on that module (third column).

Press the ***Accept*** button when finished.

The Sensor Select Number Code will appear in the Settings screen shown on the previous page. This code is derived from the UUT Module Sensor Code Chart shown below.

Important:

To use the UUT Module Sensor for cascade control, you must have the UUTs enabled. To enable UUTs, go to the *Comm\RS-485* folder, and change the RS-485 Mode from User Comms to UUT Sensors. You must also set the Number of UUTs to the appropriate setting. See Section 13 for additional details.

UUT Module Sensor Code Chart

The Synergy Controller can accommodate up to four UUT modules, with up to sixteen sensors on each module.

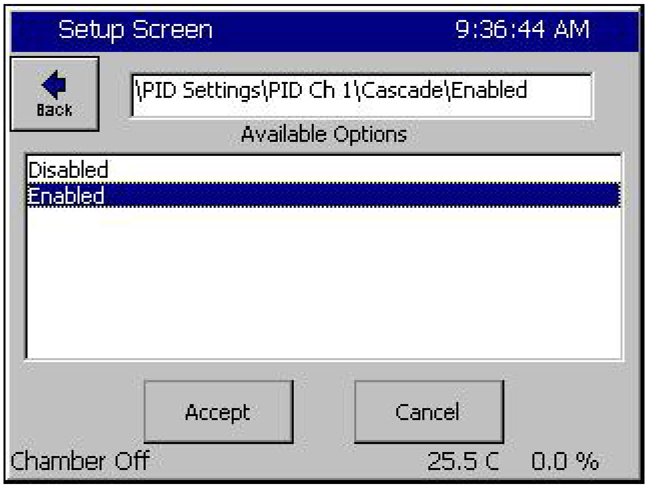
	UUT 1	**UUT 2**	**UUT 3**	**UUT 4**	**UUT 5**	**UUT 6**	**UUT 7**	**UUT 8**
Sensor 1	211	221	231	241	251	261	271	281
Sensor 2	212	222	232	242	252	262	272	282
Sensor 3	213	223	233	243	253	263	273	283
Sensor 4	214	224	234	244	254	264	274	284
Sensor 5	215	225	235	245	255	265	275	285
Sensor 6	216	226	236	246	256	266	276	286
Sensor 7	217	227	237	247	257	267	277	287
Sensor 8	218	228	238	248	258	268	278	288

Note: Since UUT modules have 16 sensors they respond to two sequential addresses. For example, a 16 Channel UUT module configured with an address of 1 will respond as UUT 1 and UUT 2. Sensors 1 thru 8 on the module will be reported as UUT 1, Sensors 1 thru 8. Sensors 9 to 16 on the module will be reported as UUT 2, Sensors 1 thru 8.

16.2.3 Using Cascade Mode

16.2.3.1 Enable Cascade Mode

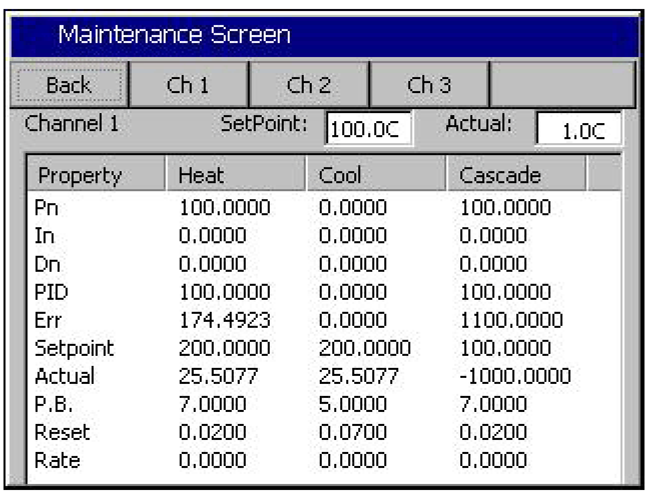
To enable Cascade mode, press the ***SETUP*** Screen Navigation Key and proceed to the Enabled folder shown below (*PID Settings\PID Ch 1\Cascade\Enabled*)



Change the Enabled item's value to Enabled (Disabled is the default value).

16.2.3.2 Maintenance \ Channel PIDs Screen

The Channel PIDs screen shows a third column when cascade mode is enabled for the channel. All columns show values for the following parameters: Pn, In, Dn, PID, Err, Setpoint, Actual, P.B., Reset and Rate.



The Setpoint and Actual numbers in the cascade column are the desired setpoint, and actual temperature of the product inside the chamber.

- Setpoint & Actual values under Heating and Cooling is the air temperature.
- Setpoint value under Heating and Cooling is the calculated air temperature setpoint from the Cascade PID loop.
- Cascade PID parameters: Pn, In, Dn, PID values range from -100 to +100%.

  Note: -100% corresponds to the Cascade Low Limit temperature
  Note: +100% corresponds to the Cascade High Limit temperature

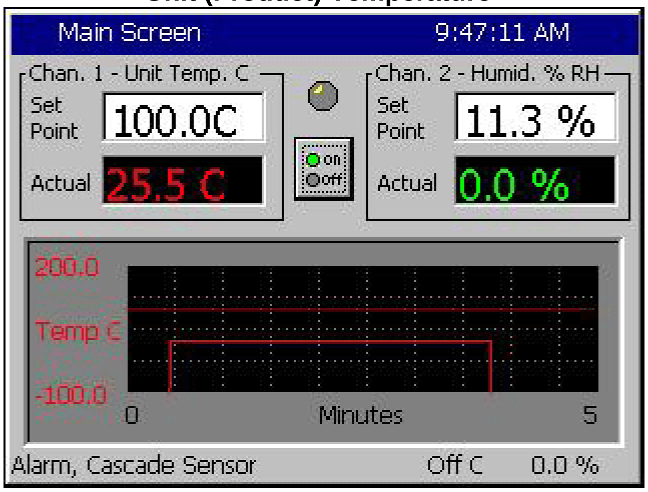
- The values in the Heating & Cooling columns range from 0 to 100%

16.2.3.3 Main Screen Product / Air Temperature Display

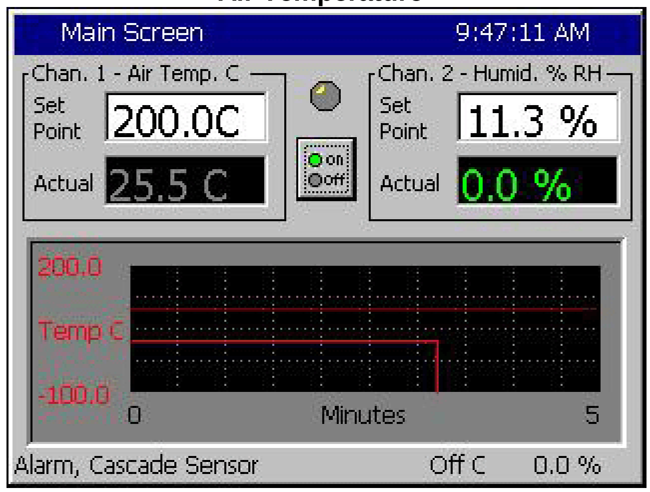
In the cascade mode, you can alternately display the setpoint / actual values of the product and air temperature. Press the Actual temperature display box to toggle between the two modes.

When you switch modes, the color of the text in the Actual box will change from Red for the product to light blue for the air temperature. The label in the frame around Channel 1 will also change accordingly as shown below.

Unit (Product) Temperature

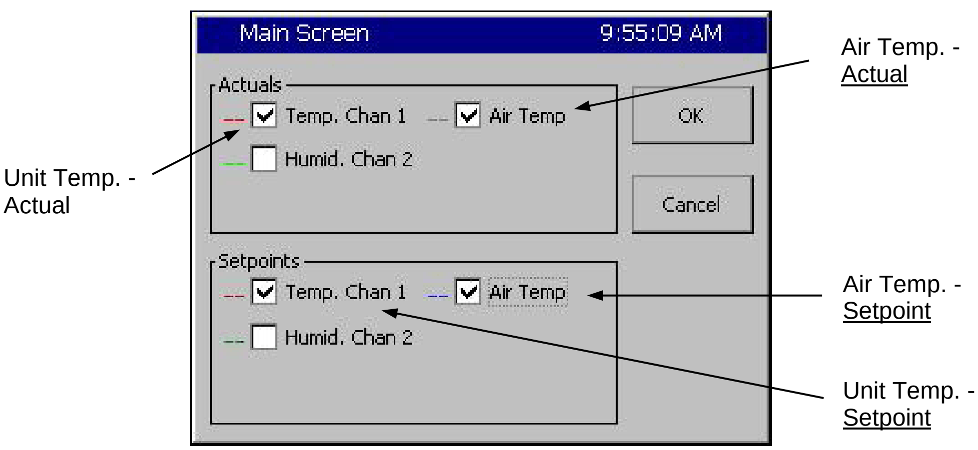


Air Temperature



16.2.3.4 Graph Screen – Selecting Product / Air Temperature Graphing

The Graph Screen can chart the product temperature and the air temperature in cascade mode. Press anywhere on the Graph. The screen below will appear from either display.

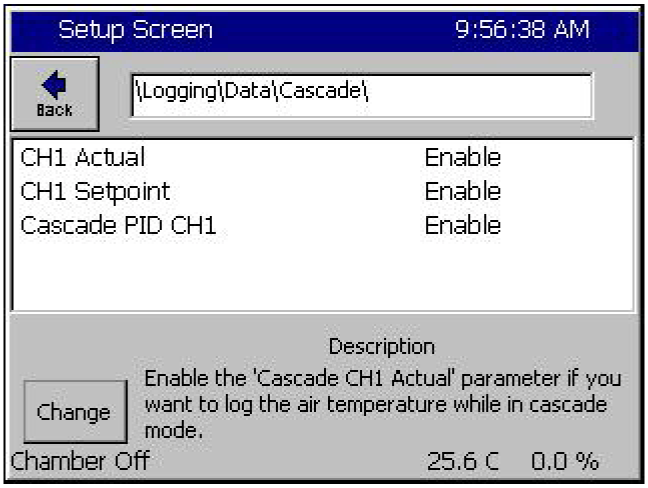


Select **Air Temp.** in the ***Actuals*** and ***Setpoints*** frames to graph the actual air temperature and air temperature setpoint. The actual air temperature will appear as a light blue line, and the air temperature setpoint will appear as a dark blue line.

Select **Temperature** within the ***Actuals*** and ***Setpoints*** frames to graph the actual Unit temperature and Unit (Product) temperature setpoint. The actual unit temperature will appear as a light red, line, and the unit temperature setpoint will appear as a dark red line.

16.2.3.5 Logging

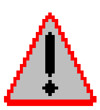
In Cascade mode, you can log the Product Setpoints and Actual values, the Air Temperature Setpoint and Actual values, and the Cascade PID values. When you are in cascade mode, logging the Channel 1 Actual and Channel 1 Setpoint values will log the product readings. To log actual air temperature, open the Setup screen and go to the *Logging\Data\Cascade* folder. Enable logging for CH1 Actual and CH1 Setpoint. Cascade PID CH1 in that folder is the Cascade loop PID value.



16.2.3.6 Chamber Operation

All Synergy Controller features are available with Cascade mode enabled. Test programs are unaffected except in cascade mode, the temperatures setpoint is the product setpoint as opposed to the air temperature setpoint. Steady-state setpoints also work with Cascade enabled.

16.2.3.7 Safety

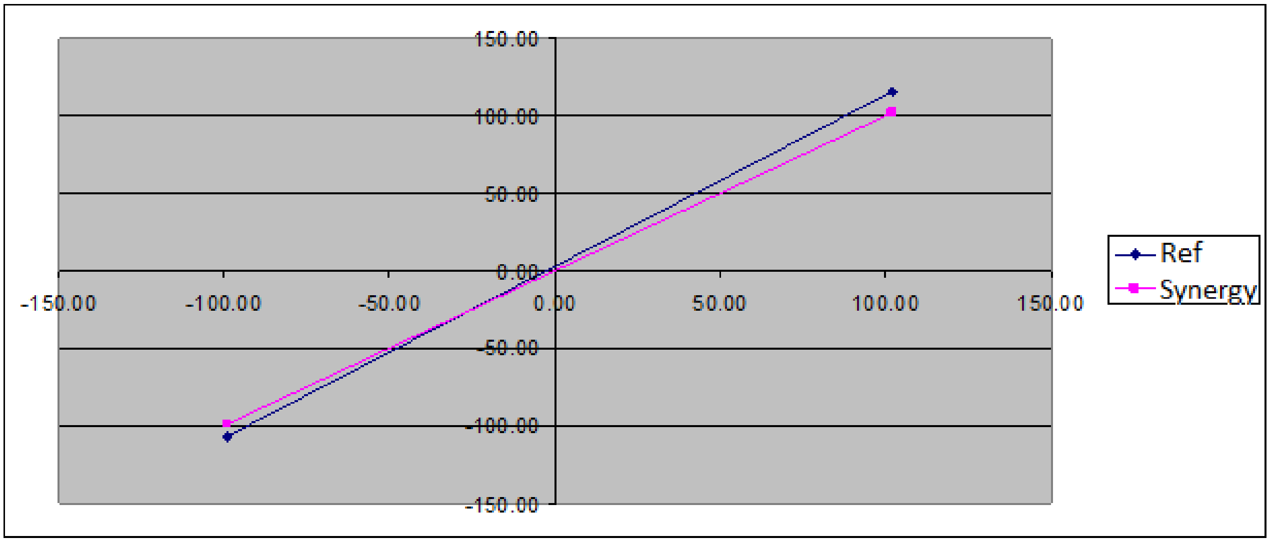


WARNING:
Careful consideration should be paid to the Cascade Control setup since the air temperature will go the limits if the product sensor isn’t connected properly. A secondary limit controller set appropriately should always be used to prevent damage to the chamber or to the unit-under-test in the event of controller or primary sensor failure. Cascade High Limit should be always be set the maximum allowable air temperature.

16.3 Two-Point Calibration

This Synergy Controller application note describes the gain (span) and offset calculations for a two point calibration.

Specifically, when two reference values are known, and compared against the Synergy controller readings, the calculations in this spreadsheet can be used to correct the errors at these points. The two reference points and the two controller points represent two lines in the graph below.



Open Excel and load the file for this application note:

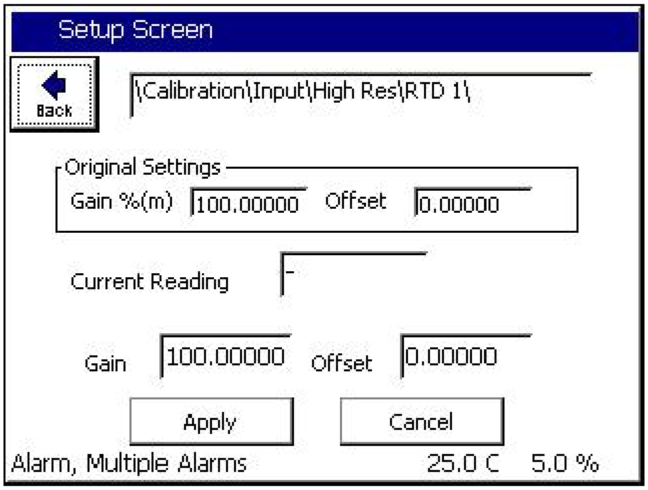
Synergy Controller 2-Point Calibration Calculations REV B.xls

Synergy Controller 2-Point Calibration Calculations Rev B.xls										
1	Note the current Gain (Span) and Offset values for the input then set the Gain to 100% and the offset to 0.									
2	Fill in the Synergy Controller and Reference Values (from Calibrator) in the Yellow boxes below for the two calibration points									
3	Read the new Gain and Offset in green on the right and enter them for the input.									
	Corrected values show the value expected after the new gain and offset are entered.									
		Synergy Controller	Reference	Corrected Value						
	Point 1	101.10	102.00	102.00						
	Point 2	-100.00	-99.00	-99.00						
						New Gain	New Offset			
						99.95%	0.950273496			
Note:	Gain values under 98% or over 102% percent may indicate an issue with the sensor, the setup, or the controller.									
	Consult Tidal Engineering if values outside this range are calculated by the spreadsheet.									

$$\text{Gain} = (\text{ReferencePt1} - \text{ReferencePt2})/(\text{ControllerPt1} - \text{ControllerPt2})$$

$$\text{Offset} = (\text{ReferencePt2} - (\text{ControllerPt2} * \text{Gain}))$$

For example, RTD inputs are calibrated in the Setup\Calibration\Input screen in units of Ohms as shown below:



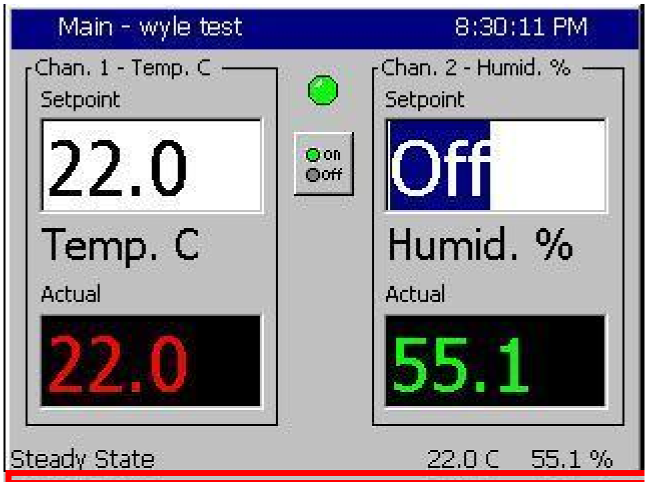
16.4 End to End Calibration

For End-to-End temperature Calibration, a reference temperature reading is compared against the Synergy Controller reading. This takes into account and corrects for both sensor and controller characteristics.

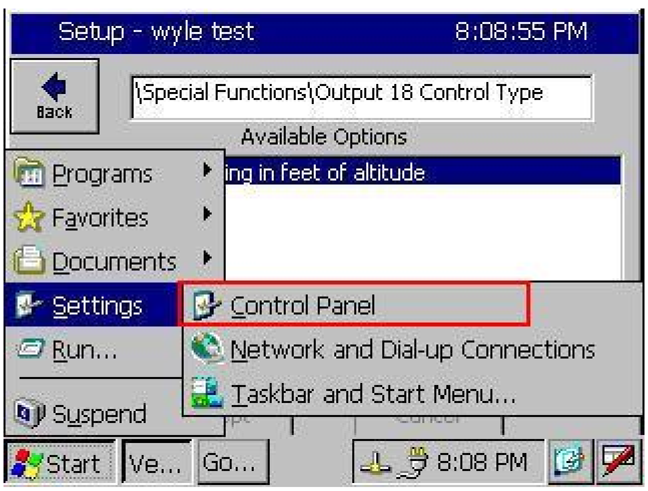
The same two point calibration formulas work for End to End Calibration.

16.5 Touch Screen Calibration

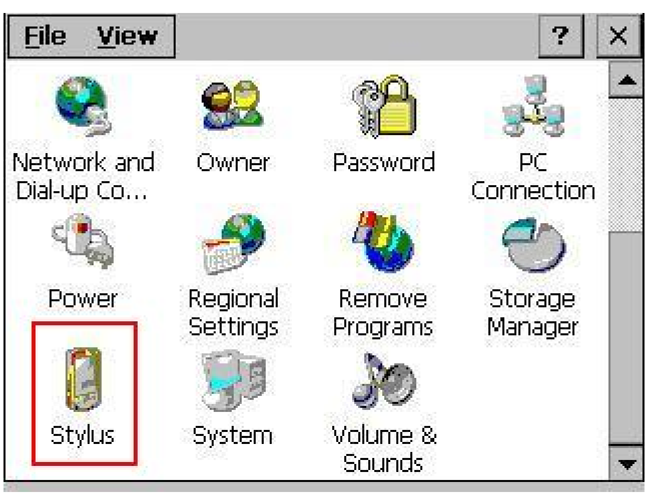
This section describes the procedure for calibrating the Synergy Micro 2 touch screen. Touch screen calibration procedures for Synergy Micro, Synergy Compact, and Synergy V configurations are included in the Rev F Technical Manual. This procedure requires a USB Keyboard and a Stylus.



Activate the Windows Task bar by pressing the stylus in the bottom 1/16' of the touch screen. See the area in red in the screen shot at the let

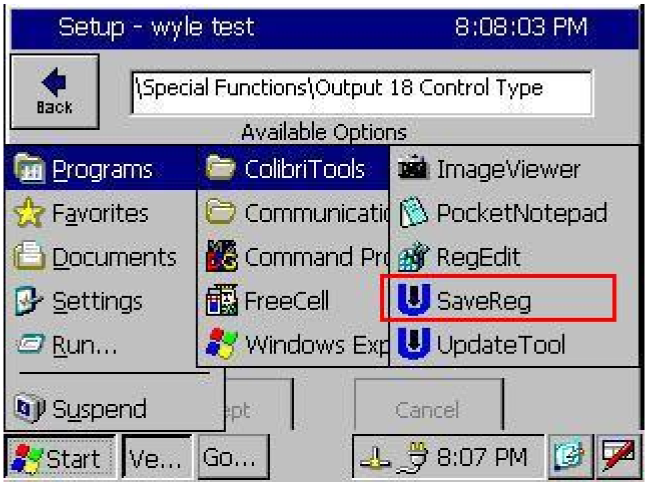


Press the Start Button and Browse to the Control Panel as shown at left.



Press the Stylus Icon and follow the steps to calibrate the touch screen.

When finished, plug the USB Keyboard into the USB Host port on the front of the controller and hit the Enter key when instructed.



After the touch screen is calibrated, browse the SaveReg program as shown at left and to save the registry into Flash Memory. If the calibration is performed and the SaveReg command is not executed, the calibration will be lost the next time the controller is rebooted.

17.0 APPENDIX A COMMUNICATIONS

17.1 Frequently Used Commands

Setpoints and Process Variable Commands	**Syntax**	**Example**	**Response**
Query Channel Process Variable	? Cn where n is the channel	? C1	25.0
Query Temperature (Chan.1)	? C1	? C1	25.0
Query Humidity (Chan.2)	? C2	? C2	50.0
Set Temperature Setpoint (Chan.1)	= SP1 n	= SP1 25.0	OK
Query Temperature Setpoint (Chan.1)	? SP1	? SP1	25.0
Set Humidity Setpoint (Chan. Chan.2)	= SP2 n	= SP2 50.0	OK
Query Humidity Setpoint (Channel 2)	? SP2	? SP2	50.0
On/Off Commands	**Syntax**	**Example**	**Response**
Turn Chamber ON	= ON	= ON	OK
Query Chamber ON state	? ON	? ON	0 or 1
Turn Chamber OFF	= OFF	= OFF	OK
Event Output Commands	**Syntax**	**Example**	**Response**
Set Event Output n ON	= EVENTS n, 1	= EVENTS 1, 1	OK
Set Event Output n OFF	= EVENTS n, 0	= EVENTS 1, 0	OK
Query State of Event Outputs	? EVENTS	? EVENTS	00FF0003
Program Commands	**Syntax**	**Example**	**Response**
Query Program State	? RUN PROFILE_STATE		
Load a Program	= FILEOPEN 1 “program-name”	= FILEOPEN 1 "Product1"	OK
Start a Program	= RUN	= RUN	OK
Start a Program at a specific line	= RUNFROM n	= RUNFROM 2	OK
Query Program state	? RUN 1= Run, 2 = Pause, 3 = Steady State	? RUN	1
Alarm Commands	**Syntax**	**Example**	**Response**
Check Status of Alarms	? ALM	? ALM	1,0,00000800
Acknowledge Alarms	= ACKALM	= ACKALM	OK

17.2 Synergy Controller Command Set

SYNERGY COMMUNICATION COMMAND SET

Tidal Engineering Corporation © 2001-2015
File: SYNERGY COMMUNICATION COMMANDS VERSION 4.0.0.xls
Date: 28 August 2015

Notes:
1. Many commands support a RANGE, MIN and MAX queries which return the High and Low range allowed for the command. Ex: ? CAL1 RANGE returns -50.000,50.000
2. The Asterisk "*" is used in the Synergy Controller command set as a place holder for the channel number. * is the channel number = 1,2, 3 or 4
3. The Number Sign "#" is used in the Synergy Controller command set as a place holder for an index. Ex. HIGH#_GAIN where # is the High Resolution Input 1 - 6

Description	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
Control Commands					
Ch * Setpoint	SP* Set	= SP* X.X	Range = R*L to R*H or OFF	= SP1 100.7	OK
	SP* Query	? SP*		? SP1	100.7
Ch * Actual	C* Query	? C*	Range =R*L to R*H or OFF	? C1	25.0
Ch * Sensor Select	CH*Sensor Set	= CH*SENSOR ARG1	ARG1 - ID of the Sensor. 100 - 999.	= CH1SENSOR 110	OK
	CH* Sensor Query	? CH*SENSOR	See the user manual for numeric codes.	? CH1SENSOR	110
Ch * Cooling Output	1LO Query	? *LO	0 - 100 %	? 1LO	0.0
Ch * Heating Output	1HI Query	? *HI	0 - 100 %	? 1HI	100.0
Ch * Heat Prop. Band	PB*H Set	= PB*H ARG1	0 to 50 C 0 to 90 F	= PB1H 10	OK
	PB*H Query	? PB*H	0 to 50 C 0 to 90 F	? PB1H	10.00
Ch * Heat Reset	RS*H Set	= RS*H ARG1	0 - 09.999 Repeats / Minute	= RS1H .02	OK
	RS*H Query	? RS*H	0 - 09.999 Repeats / Minute	? RS1H	0.020
Ch * Heat Rate	RT*H Set	= RT*H ARG1	0 - 09.999 Minutes	= RT1H	OK
	RT*H Query	? RT*H	0 - 09.999 Minutes	? RT1H	1.000
Ch * Heat Cycle Time	CT*H Set	= CT*H ARG1	1 - 60 Seconds	= CT1H 5	OK
	CT*H Query	? CT*H	1 - 60 Seconds	? CT1H	5.00
Ch * Heat Rate Band	RB*H Set	= RB*H ARG1	0 - 7 Seconds	= RB1H 4	OK
	RB*H Query	? RB*H	0 - 7 Seconds	? RB1H	4.000
Ch * Dead Band	DB* Set	= DB* ARG1	-25 to 25 C -45 to 45 F	= DB1 5	OK
	DB* Query	? DB*	-25 to 25 C -45 to 45 F	? DB1	5.00
Ch * Cool Prop Band	PB*C Set	= PB*C ARG1	0 to 50 C 0 to 90 F	= PB1C 10	OK
	PB*C Query	? PB*C	0 to 50 C 0 to 90 F	? PB1C	10.00

Description	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
Ch * Cool Reset	RS*C Set	= RS*C ARG1	0 - 09.999 Repeats / Minute	= RS1C .700	OK
	RS*C Query	? RS*C	0 - 09.999 Repeats / Minute	? RS1C	0.070
Ch * Cool Rate	RT*C Set	= RT*C ARG1	0 - 09.999 Minutes	= RT1C 1	OK
	RT*C Query	? RT*C	0 - 09.999 Minutes	? RT1C	1.000
Ch * Cool Cycle Time	CT*C Set	= CT*C ARG1	1 - 60 Seconds	= CT1C 7	OK
	CT*C Query	? CT*C	1 - 60 Seconds	? CT1C	7.00
Ch * Cool Rate Band	RB*C Set	= RB*C ARG1	0 - 7 Seconds	= RB1C 4	OK
	RB*C Query	? RB*C	0 - 7 Seconds	? RB1C	4.000
Ch * Cascade Enabled	CAS*_ENABLED Set	= CAS*_ENABLED ARG1	0 - Disabled, 1 - Enabled	= CAS1_ENABLED 1	OK
	CAS*_ENABLED Query	? CAS*_ENABLED	0 - Disabled, 1 - Enabled	? CAS1_ENABLED	1
Ch * Cascade Sensor	CSS* Set	= CSS* ARG1	ARG1 - ID of the Sensor. 100 - 999.	= CSS1 120	OK
	CSS* Query	? CSS*	See the user manual for numeric codes.	? CSS1	120
Ch * Cascade High Limit	C*HL Set	= C*HL ARG1	- 200 to 500 C -326 to 932 F	= C1HL 200	OK
	C*HL Query	? C*HL	- 200 to 500 C -326 to 932 F	? C1HL	200.00
Ch * Cascade Low Limit	C*LL Set	= C*LL ARG1	- 200 to 500 C -326 to 932 F	= C1LL -100	OK
	C*LL Query	? C*LL	- 200 to 500 C -326 to 932 F	? C1LL	-100.00
Ch * Cascade Prop. Band	CPB*H Set	= CPB*H ARG1	0 to 400 C 0 to 752 F	= CPB1H 10	OK
	CPB*H Query	? CPB*H	0 to 400 C 0 to 752 F	? CPB1H	
Ch * Cascade Reset	CRS*H Set	= CRS*H ARG1	0 - 09.99 Repeats / Minute	? CRS1H	OK
	CRS*H Query	? CRS*H	0 - 09.99 Repeats / Minute	? CRS1H	1.000
Ch * Cascade Rate	CRT*H Set	= CRT*H ARG1	0 - 09.99 Minutes	= CRT1H 1	OK
	CRT*H Query	? CRT*H	0 - 09.99 Minutes	? CRT1H	1.000
Ch * Cascade Rate Band	CRB*H Set	= CRB*H ARG1	0 - 09.99 Minutes	= CRB1H 4	OK
	CRB*H Query	? CRB*H	0 - 09.99 Minutes	? CRB1H	4.000
Ch * Cascade Pos. Deviation Limit	C*HMAXDELTA Set	= C*HMAXDELTA ARG1	ARG1: 0-50C, 0 - 90F	= C1HMAXDELTA 10	OK
	C*HMAXDELTA Query	? C*HMAXDELTA	0-50C, 0 - 90F	? C1HMAXDELTA	10.0
Ch * Cascade Neg. Deviation Limit	C*LMAXDELTA Set	= C*LMAXDELTA ARG1	ARG1: 0-50C, 0 - 90F	= C1LMAXDELTA 20	OK
	C*LMAXDELTA Query	? C*LMAXDELTA	0-50C, 0 - 90F	? C1LMAXDELTA	20.0
Ch * Heat PID	PID*H Query	? PID*H	0 - 100 %	? PID1H	0.0
Ch * Cool PID	PID*C Query	? PID*C	0 - 100 %	? PID1C	100.0
Ch * Cascade PID	CPID* Query	? CPID*	0 - 100 %	? CPID1	100.0
Ch * Low Limit	R*L Set	= R*L ARG1	- 200 to 500 C -326 to 932 F	= R1L -200	OK

Description	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
	R*L Query	? R*L	- 200 to 500 C -326 to 932 F	? R1L	-200
Ch * High Limit	R*H Set	= R*H ARG1	- 200 to 500 C -326 to 932 F	= R1H 500	OK
	R*H Query	? R*H	- 200 to 500 C -326 to 932 F	? R1H	500
Chamber On	On Set	= ON	No Parameters	= ON	OK
	On Query	? On	0 - Off, 1 - On	? On	0
Chamber Off	OFF Set	= OFF	No Parameters	= OFF	OK
Guaranteed Soak	GS Set	= GS ARG1	0 to 50 C,0 to 90 F	= GS 10	OK
	GS Query	? GS	0 to 50 C, 0 to 90 F	? GS	10.00
Output 11 Control Type	OT11 Set	= OT11 ARG1	ARG1: 0 - On / Off Control Mode 1 - Time Prop. Control Mode	= OT11 0	OK
	OT11 Query	? OT11	0 - On / Off Control Mode 1 - Time Prop. Control Mode	? OT11	0
Output 17 Control Type	OT17 Set	= OT17 ARG1	ARG1: 0 - Vacuum, 1 - Purge	= OT17 1	OK
	OT17 Query	? OT17	0 - Vacuum, 1 - Purge	? OT17	1
Output 18 Control Type	OT18 Set	= OT18 ARG1	ARG1: 0 - Vent, 1 - Boost Cool	= OT18 1	OK
	OT18 Query	? OT18	0 - Vent, 1 - Boost Cool	? OT18	1
1L1 Ch1 Main Cooling Turn-On	1L1 Set	= 1L1 ARG1	0 to 100 %	= 1L1 50	OK
	1L1 Query	? 1L1	0 to 100 %	? 1L1	50.00
1L2 Ch1 Main Cooling Turn-Off	1L2 Set	= 1L2 ARG1	0 to 100 %	= 1L2 20	OK
	1L2 Query	? 1L2	0 to 100 %	? 1L2	20.00
1L3 Ch1 Setpoint Transfer Setting	1L3 Set	= 1L3 ARG1	-100 to 100 C, -148 to 212 F	= 1L3 10	OK
	1L3 Query	? 1L3	-100 to 100 C, -148 to 212 F	? 1L3	10.00
1CTY Ch1 Chamber Type	1CTY Set	= 1CTY ARG1	ARG1: 0 - CAP - Tube System 1 - Agree Logic 2 - Burn In Logic 3 - Standard XV Sys Logic	= 1CTY 1	OK
	1CTY Query	? 1CTY	0 - CAP - Tube System 1 - Agree Logic 2 - Burn In Logic 3 - Standard XV Sys Logic	? 1CTY	0
2L1 Ch2 Main Cooling Turn-On	2L1 Set	= 2L1 ARG1	-100 to 100 %	= 2L1 50	OK
	2L1 Query	? 2L1	-100 to 100 %	? 2L1	50.00
2L2 Ch2 Main Cooling Turn-	2L2 Set	= 2L2 ARG1	-100 to 100 %	= 2L2 20	OK

Description	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
Off	2L2 Query	? 2L2	-100 to 100 %	? 2L2	50.00
2L3 Ch2 Setpoint Transfer Setting	2L3 Set	= 2L3 ARG1	-100 to 100 C, -148 to 212 F	= 2L3 10	OK
	2L3 Query	? 2L3	-100 to 100 C, -148 to 212 F	? 2L3	50.00
2CTY Ch2 Chamber Type	2CTY Set	= 2CTY ARG1	ARG1: 0 - CAP - Tube System 1 - Agree Logic 2 - Burn In Logic 3 - Standard XV Sys Logic	= 2CTY 1	OK
	2CTY Query	? 2CTY	0 - CAP - Tube System 1 - Agree Logic 2 - Burn In Logic 3 - Standard XV Sys Logic	? 2CTY	0
L3 Ch1 Main Cooling Turn-On	L3 Set	= L3 ARG1	0 - 100 %	= L3 20	OK
	L3 Query	? L3	0 - 100 %	? L3	20.00
L4 Ch1 Main Cooling Turn-Off	L4 Set	= L4 ARG1	0 - 100 %	= L4 20	OK
	L4 Query	? L4	0 - 100 %	? L4	20.00
L6 Full Cooling Switch-Over	L6 Set	= L6 ARG1	-100 to 100 C -148 to 212 F	= L6 20	OK
	L6 Query	? L6	-100 to 100 C -148 to 212 F	? L6	20.00
L7 Ambient Cooling Turn-On	L7 Set	= L7 ARG1	0 - 100 %	= L7 10	OK
	L7 Query	? L7	0 - 100 %	? L7	10.00
L8 Heat Ambient Cooling Turn-Off	L8 Set	= L8 ARG1	0 - 100 %	= L8 80	OK
	L8 Query	? L8	0 - 100 %	? L8	80.00
L9 Ramp-up Cooling	L9 Set	= L9 ARG1	-100 to 100 C -148 to 212 F	= L9 50	OK
	L9 Query	? L9	-100 to 100 C -148 to 212 F	? L9	50.00
L11 Dehumidify / Vent On	L11 Set	= L11 ARG1	0 - 100 %	= L11 20	OK
	L11 Query	? L11	0 - 100 %	? L11	20.00
L12 Dehumidify / Vent Off	L12 Set	= L12 ARG1	0 - 100 %	= L12 10	OK
	L12 Query	? L12	0 - 100 Seconds	? L12	10.00
L14 Time Delay Boost Cool	L14 Set	= L14 ARG1	0 - 60 Seconds	= L14 10	OK
	L14 Query	? L14	0 - 60 %	? L14	10.00
L15 Compressor Turn-Off Delay	L15 Set	= L15 ARG1	0 - 5 Minutes	= L15 2	OK
	L15 Query	? L15	0 - 5 Minutes	? L15	2
LEV1 Drier / Dehumidify Coil	LEV1 Set	= LEV1	ARG1: 0 - Dehumidify Coil, 1 - Drier	=LEV1 1	OK
	LEV1 Query	? LEV1	ARG1: 0 - Dehumidify Coil, 1 - Drier	? LEV1	1

Description	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
Event Output Control (Single Event)	EVENTS Set	= EVENTS	ARG1: Event # (1-6) ARG2: 0 - Disabled, 1 - Enabled	= EVENTS 1 1	OK
	EVENTS Query	? EVENTS	ARG1: Event # (1-6)	? EVENTS 1	1
Event Output Query (All Six Events plus Relays)	EVENTS Query	? EVENTS	Returns a 32 Bit hex number. Each bit represents an event Bit 1 = Event 1 Bit 2 = Event 2 Bit 3 = Event 3 Bit 4 = Event 4 Bit 5 = Event 5 Bit 6 = Event 6 Bit 23 = Relay 1 Bit 24 = Relay 2	? EVENTS	00C00001
Waitfor Tolerance	WF*_TOL Set	=WF*_TOL ARG1	-50 to 50 C (-90 to 90 F), -50 to 50%	=WF1_TOL 5	OK
	WF*_TOL Query	? WF*_TOL	-50 to 50 C (-90 to 90 F), -50 to 50%	? WF1_TOL	5
Remote Start	REMOTE_START_ENABLED Set	= REMOTE_START_ENABLED ARG1	ARG1: 0 - Disabled, 1 - Enabled	= REMOTE_START_ENABLED 1	OK
	REMOTE_START_ENABLED Query	? REMOTE_START_ENABLED	0 - Disabled, 1 - Enabled	? REMOTE_START_ENABLED	1

Description	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
Remote Start Digital Input	REMOTE_START_DIN Set	= REMOTE_START_DIN ARG1	ARG1: 0 - Digital Input 1 1 - Digital Input 2 2 - Digital Input 3 3 - Digital Input 4 4 - Digital Input 5 5 - Digital Input 6 6 - Digital Input 7 7 - Digital Input 8 8 - Digital Input 9 9 - Digital Input 10 10 - Digital Input 11 11 - Digital Input 12 12 - Digital Input 13 13 - Digital Input 14 14 - Digital Input 15 15 - Digital Input 16	= REMOTE_START_DIN 1	OK
	REMOTE_START_DIN Query	? REMOTE_START_DIN	0 - 15	?REMOTE_START_DIN	1
Remote Stop Digital Input	REMOTE_STOP_DIN Set	= REMOTE_STOP_DIN ARG1	ARG1: 0 - Digital Input 1 1 - Digital Input 2 2 - Digital Input 3 3 - Digital Input 4 4 - Digital Input 5 5 - Digital Input 6 6 - Digital Input 7 7 - Digital Input 8 8 - Digital Input 9 9 - Digital Input 10 10 - Digital Input 11 11 - Digital Input 12 12 - Digital Input 13 13 - Digital Input 14 14 - Digital Input 15 15 - Digital Input 16	= REMOTE_STOP_DIN 1	OK
	REMOTE_STOP_DIN Query	? REMOTE_STOP_DIN	0 - 15	? REMOTE_STOP_DIN	1
Resume Profile - Start Delay	RSM_DELAY Set	= RSM_DELAY ARG1	ARG1 - 0 - 3600 Seconds	= RSM_DELAY 60	OK
	RSM_DELAY Query	? RSM_DELAY Query	0 - 3600 Seconds	? RSM_DELAY	60
Register Cascade Key	REG_KEY_CAS Set	= REG_KEY_CAS ARG1	ARG1: "Cascade License Key"	= REG_KEY_CAS "License Key"	OK

Description	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
	REG_KEY_CAS Query	? REG_KEY_CAS	Cascade License Key	? REG_KEY_CAS	"License Key"
Register Pressure Key	REG_KEY_PRES Set	= REG_KEY_PRES ARG1	ARG1: "Pressure License Key"	= REG_KEY_PRES "License Key"	OK
	REG_KEY_PRES Query	? REG_KEY_PRES	Pressure License Key	? REG_KEY_PRES	"License Key"
Customer Chamber Name	CUSTCHAMBERNAME Set	= CUSTCHAMBERNAME ARG1	ARG1: "Custom Chamber Name"	= CUSTCHAMBERNAME "My Chamber"	OK
	CUSTCHAMBERNAME Query	? CUSTCHAMBERNAME	Custom Chamber Name	? CUSTCHAMBERNAME	My Chamber
CH * Air Actual (changes based on Cascade Mode)	AIR* Query	? AIR*	If CH* Cascade = Off, CH* Actual If CH* Cascade = On, CH* Cascade Actual	? AIR1	25.5
	CC* Query	? CC*	If CH* Cascade = Off, CH* Actual If CH* Cascade = On, CH* Product Actual	? CC1	25.5
CH * Air Setpoint (changes based on Cascade Mode)	AIRSP* Query	? AIRSP*	If CH* Cascade = Off, CH* Setpoint If CH* Cascade = On, CH* Cascade Setpoint	? AIRSP1	25.5
	CSP* Query	? CSP*	If CH* Cascade = Off, CH* Setpoint If CH* Cascade = On, CH* Product Setpoint	? CSP1	25.5
Retransmit # Source	OUT_420_#V2 Set	= OUT_420_#V2 ARG1	# - 1 or 2 ARG1: 110 - 1299 See Technical Manual for complete list	= OUT_420_1V2 710	OK
	OUT_420_#V2 Query	? OUT_420_#V2		? OUT_420_1V2	710
			System Commands		
Storage Card Info	SCINFO Query	? SCINFO	returns storage card free	? SCINFO	Total: 8128512, Free: 1826816
RAM Info	MEMINFO Query	? MEMINFO	Returns total system RAM and available RAM	? MEMINFO	Unknown, Total Physical: 20242432, Available Physical: 14848000, RAM
Software Revision	*IDN Query	*IDN ?	Returns Revision Info: Make, Model, Serial number, Version	*IDN?	Tidal Engineering, Synergy Controller,Serial-13/0137,Version 2.6.8
Olympic Board Version	OVERSION Query	? OVERSION	Olympic board Version and Serial Number	? OVERSION	Olympic V0.0.35, 13/0137

Description	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
Execute Macro	EXECMACRO Set	= EXECMACRO ARG1	ARG1 - Name of a macro	= EXECMACRO Macro1	OK
Function Key Activate	FK Set	= FK ARG1	ARG1 3 - Setup Screen 4 - Maintenance Screen 5 - Comm Screen 6 - Program Screen 7 - Run Screen 8 - Events Screen 9 - Graph Screen 10 - Main Screen	= FK 10	OK
Get Controller Runtime	GETCONTRUNTIME Query	? GETCONTRUNTIME	Returns total Days, Hours and Minutes the controller has been operational	? GETCONTRUNTIME	10 DAYS, 5 HOURS, 6 MINUTES
Synergy Main Screen Display	LARGESETPOINTS	= LARGESETPOINTS ARG1	ARG1: 0 - Small (Default for Micro) 1 - Large (Default for Nano)	= LARGESETPOINTS 1	OK
Reset Watchdog Timer	WDPING Set	= WDPING ARG1	ARG1: Comm Method 0 - All Watchdog Timers 1 - RS232 Timer 2 - RS485 Timer 3 - RS488 Timer 4 - Ethernet Timer	= WDPING 4	OK
Watchdog Setpoint	C*A	= C*A	The channel setpoint when the Watchdog Timer triggers this action.	= C1A 25	OK
		? C*A		? C1A	25.0
Watchdog Setpoints	WDSETPOINTS Set	= WDSETPOINTS ARG1 ARG2 ARG3 ARG4	ARG1 - Channel 1 Setpoint ARG2 - Channel 2 Setpoint ARG3 - Channel 3 Setpoint ARG4 - Channel 4 Setpoint	= WDSETPOINTS 25.0 50.0 0.0 0.0	OK
	WDSETPOINTS Query			? WDSETPOINTS	25.0, 50.0, 0.0, 0.0
Watchdog Timer	WDTIMER Set	= WDTIMER ARG1 ARG2 ARG3	ARG1 - Comm Port: 0 - Any 1 - RS232 2 - RS485 3 - IEEE 488 4 - EthernetARG2 - Timeout: 0 - 604800 Seconds	= WDTIMER 0 60 4	OK

Description	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
			ARG3 - Action: Bit 1 - No Action Bit 2 - Stop Chamber Bit 3 - Restart Comms Bit 4 - Goto Watchdog Setpoints		
	WDTIMER Query	? WDTIMER ARG1	Shows Watchdog Timer Status ARG1 - Comm Port Returns 5 Values First - Comm Port Second - WD Timeout in Seconds Third - Action 0 - 8 Fourth - State: 0 = normal 1 = WD Alarm Fifth - Current Idle Timer in Seconds	? WDTIMER 0	WDTIMER 0 60 4 0 0.0
Digital Output Query Queries the state of a specific digital output on the controller.	DO Query	? DO	Returns: Output Number Mode 0 = On/Off 1 = Time Proportioning Output If On/Off Mode 0 - Off 1 - On If Time Proportioning 0 - 100% 100 - 200% - Inverse another output 200 - 300% - Mirrored another output	? DO 1	1: M=0, O=0
RSM_STEADY Controls the behavior of the controller in Steady State after a power failure.	RSM_STEADY Set	= RSM_STEADY ARG1	ARG1 0 = Chamber Off 1 = Last Setpoint(s) 2 = Watchdog Setpoint(s)	= RSM_STEADY 2	OK
	RSM_STEADY Query	? RSM_STEADY	Returns: 0 = Chamber Off 1 = Last Setpoint(s) 2 = Watchdog Setpoint(s)	? RSM_STEADY	2

Description	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
RSM_PROFILE Controls the behavior of the controller running a profile after a power failure.	RSM_PROFILE Set	= RSM_PROFILE ARG1	ARG1 0 = Chamber Off 1 = Resume Profile 2 = Watchdog Setpoint(s)	= RSM_PROFILE 2	OK
	RSM_PROFILE Query	? RSM_PROFILE	Returns: 0 = Chamber Off 1 = Resume Profile 2 = Watchdog Setpoint(s)	? RSM_PROFILE	2
Force Digital Input State	DIF Set	= DIF ARG1 ARG2	ARG1: Inputs 1 - 16 ARG2: "Open', "Close", or no ARG2 to Clear		
	DIF Query	? DIF			
Toggle Digital Input State	DIT Set	= DIT ARG1 ARG2	ARG1: Inputs 1 - 16 ARG2: "Open', "Close", or no ARG2 to Clear		
	DIT Query	? DIT			
Chamber Time	TIME Query	? TIME		? TIME	0.729236111
Event # Name	EVENT#_NAME Set	= EVENT#_NAME "ARG1"	# - Event Number 1 - 9 ARG1: String with Event Name	= EVENT1_NAME "Light"	OK
	EVENT#_NAME Query	? EVENT#_NAME		? EVENT1_NAME	Light
Retransmit when Chamber Off	420_#_ENAOFF Set	= 420_#_ENAOFF ARG1	ARG1: 0 - Disabled, 1 - Enabled	= 420_1_ENAOFF 1	OK
	420_#_ENAOFF Query	? 420_#_ENAOFF	0 - Disabled, 1 - Enabled	? 420_1_ENAOFF	1
Profile Alarm Behavior	PROFILE_ALM_BEHAVIOR Set	= PROFILE_ALM_BEHAVIOR ARG1	ARG1: 0 -Stop Profile, 1 - Pause Profile	= PROFILE_ALM_BEHAVIOR 1	OK
	PROFILE_ALM_BEHAVIOR Query	? PROFILE_ALM_BEHAVIOR		? PROFILE_ALM_BEHAVIOR	1
Event Screen Display Humidity	EVENT_SHOW_HUMID Set	= EVENT_SHOW_HUMID ARG1	ARG1: 0 - Disabled, 1 - Enabled	= EVENT_SHOW_HUMID 1	OK
	EVENT_SHOW_HUMID Query	? EVENT_SHOW_HUMID		? EVENT_SHOW_HUMID	1
Analog Programming CH* Enabled	ANLGCH*_ENA Set	= ANLGCH*_ENA ARG1	ARG1: 0 - No, 1 - Yes	= ANLGCH1_ENA 1	OK
	ANLGCH*_ENA Query	? ANLGCH*_ENA	0 - No, 1 - Yes	? ANLGCH1_ENA	1

Description	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
Analog Programming CH* Sensor	ANLGCH*_INP Set	= ANLGCH*_INP ARG1	ARG1: 110 //for RTD1 120 //for RTD1 130 //for ANALOG 1 140 //for ANALOG 2 150 //for ANALOG 3 160 //for ANALOG 4 170 //for Nano TC 1 180 //for Nano TC 2 See Technical Manual for complete list	= ANLGCH1_INP 140	OK
	ANLGCH*_INP Query	? ANLGCH*_INP	110 - 999 See Technical Manual for complete list	? ANLGCH1_INP	140
Barcode Scanner Lockout	SCANNER_LOCKOUT Set	= SCANNER_LOCKOUT ARG1	ARG1: 0 - Disabled, 1 - Enabled	= SCANNER_LOCKOUT 1	OK
	SCANNER_LOCKOUT Query	? SCANNER_LOCKOUT	0 - Disabled, 1 - Enabled	? SCANNER_LOCKOUT	1
Analog Programming CH* Enabled	ANLGCH*_ENA Set	= ANLGCH*_ENA ARG1	ARG1: 0 - No, 1 - Yes	= ANLGCH1_ENA 1	OK
	ANLGCH*_ENA Query	? ANLGCH*_ENA	0 - No, 1 - Yes	? ANLGCH1_ENA	1
Analog Programming CH* Sensor	ANLGCH*_INP Set	= ANLGCH*_INP ARG1	ARG1: 110 //for RTD1 120 //for RTD1 130 //for ANALOG 1 140 //for ANALOG 2 150 //for ANALOG 3 160 //for ANALOG 4 170 //for Nano TC 1 180 //for Nano TC 2 See Technical Manual for complete list	= ANLGCH1_INP 140	OK
	ANLGCH*_INP Query	? ANLGCH*_INP	110 - 999 See Technical Manual for complete list	? ANLGCH1_INP	140
Barcode Scanner Lockout	SCANNER_LOCKOUT Set	= SCANNER_LOCKOUT ARG1	ARG1: 0 - Disabled, 1 - Enabled	= SCANNER_LOCKOUT 1	OK
	SCANNER_LOCKOUT Query	? SCANNER_LOCKOUT	0 - Disabled, 1 - Enabled	? SCANNER_LOCKOUT	1
Data Acquisition Commands					
Enable/Disable UUT Monitoring	UUT Set	= UUT ARG1 ARG2	ARG1 = UUT # (1 - 8) ARG2 = 0/1 (Enable / Disable)	= UUT 1 1	OK

Description	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
	UUT Query	? UUT ARG1	Range: ARG1 = UUT # (1 - 8). Response: 0/1 (Enabled / Disabled)	? UUT 1	0
UUT Readings	UUTR Query	? UUTR ARG1	Range: ARG1 = UUT # (1 - 8). Response: comma delimited string with 8 UUT temperature readings If a sensor is not enabled, all values returned will be 400.0 C or 752.0 F. C / F	? UUTR 1	33.8,33.5,33.3,33.1,32.9,32.7,32.4,32.2
Digital Input Readings	DI Query	? DI	4 digit hex number for the 16 Digital Input readings	? DI	FEFF
Low Res Analog Raw Readings	MIRAW Query	? MIRAW	Comma delimited string with 8 voltage readings from the Low Res Analog Input sensors	? MIRAW	1.25,1.2,1.3,1.3,1.24,1.25,1.2
High Res Analog Raw Readings	CIRAW Query	? CIRAW	Comma delimited string returning the readings from the two RTD inputs and 4 High Res voltage inputs.	? CIRAW	133.325,92.354,2.523,1.254,2.536,2.541
Query SENSOR Scaled Value	SENSOR Query	? SENSOR ARG1	ARG1: 110 //for RTD1 120 //for RTD1 130 //for ANALOG 1 140 //for ANALOG 2 150 //for ANALOG 3 160 //for ANALOG 4 170 //for Nano TC 1 180 //for Nano TC 2 See Technical Manual for complete list	? SENSOR 110	25.0
Query RAW SENSOR Raw Value	RAW SENSOR Query	? RAWSENSOR ARG1	ARG1 110 //for RTD1 120 //for RTD1 130 //for ANALOG 1 140 //for ANALOG 2 150 //for ANALOG 3 160 //for ANALOG 4 170 //for Nano TC 1 180 //for Nano TC 2 See Technical Manual for complete list	? RAWSENSOR 110	103.0
High Res Analog Scaled Readings	CI Query	? CI	Comma delimited string returning the readings from the two RTD inputs and 4 High Res voltage inputs.	? CI	12.974,-1000.000,30.392,30.396,111.110,0.010

Description	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
			Calibration Commands		
Channel Offset Calibration	CAL* Set	= CAL* ARG1	-50 to 50 C (-90 to 90 F), -50 to 50%	= CAL1 10.0	OK
	CAL* Query	? CAL*	-50 to 50 C (-90 to 90 F), -50 to 50%	? CAL1	10.00
Channel Gain Calibration	GAIN* Set	= GAIN* ARG1	50 - 150%	= GAIN1 90	OK
	GAIN* Query	? GAIN*	50 - 150%	? GAIN1	90.00
UUT Sensor Calibration Gain	UUTms_GAIN Set	= UUTms_GAIN ARG1	Range: ARG1 = 80 to 120 % Range: m = 1 thru 8 (Module) Range: s = 1 thru 8 (Sensor)	= UUT88_GAIN 100.0	OK
	UUTms_GAIN Query	? UUTms_GAIN	Same as Set Command	? UUT88_GAIN	100.0
UUT Sensor Calibration Offset	UUTms_OFFSET Set	= UUTms_OFFSET ARG1	(C) Range ARG1 = -100 to 100 C (F) Range ARG1 = -180 to 180 F Range: m = 1 thru 8 (Module) Range: s = 1 thru 8 (Sensor)	= UUT88_OFFSET 2.0	OK
	UUTms_OFFSET Query	? UUTms_OFFSET	Same as Set Command	? UUT88_OFFSET	2.0
High Res Analog Calibration Gain	HIGH#_GAIN Set	= HIGH#_GAIN ARG1	# - High Res Input number 1 - 6 ARG1: 25-200% Gain	= HIGH1_GAIN 105	OK
	HIGH#_GAIN Query	? HIGH#_GAIN	# - High Res Input number 1 - 6	? HIGH1_GAIN	105
High Res Analog Calibration Offset	HIGH#_OFF Set	= HIGH#_OFF ARG1	# - High Res Input number 1 - 6 ARG1: -100 to 100 units	= HIGH1_OFF 5	OK
	HIGH#_OFF Query	? HIGH#_OFF	# - High Res Input number 1 - 6	? HIGH1_OFF	5
High Res Analog High Voltage Range	HIGH#_HIGHVOLTS Set	= HIGH#_HIGHVOLTS ARG1	# - High Res Analog Input number 3 - 6 ARG1: Upper Volt range of the attached sensor 0 - 5.25V	= HIGH3_HIGHVOLTS 5	OK
	HIGH#_HIGHVOLTS Query	? HIGH#_HIGHVOLTS	# - High Res Analog Input number 3 - 6	? HIGH3_HIGHVOLTS	5.0
High Resolution Analog Low Voltage Range	HIGH#_LOWVOLTS Set	= HIGH#_LOWVOLTS ARG1	# - High Res Analog Input number 3 - 6 ARG1: Lower Volt range of the attached sensor 0 - 5.25V	= HIGH3_LOWVOLTS .25	OK
	HIGH#_LOWVOLTS Query	? HIGH#_LOWVOLTS	# - High Res Analog Input number 3 - 6	? HIGH3_LOWVOLTS	.25
High Resolution Analog High Engineering Units	HIGH#_HIGHEU Set	= HIGH#_HIGHEU ARG1	# - High Res Analog Input number 3 - 6 ARG1: Upper scaled value of the attached sensor -500 - 5000 units	= HIGH3_HIGHEU 100	OK

Description	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
	HIGH#_HIGHEU Query	? HIGH#_HIGHEU	# - High Res Analog Input number 3 - 6	? HIGH3_HIGHEU	100.0
High Resolution Analog Low Engineering Units	HIGH#_LOWEU Set	= HIGH#_LOWEU ARG1	# - High Res Analog Input number 3 - 6 ARG1:Lower value of the attached sensor -500 - 5000 units	= HIGH3_LOWEU 0	OK
	HIGH#_LOWEU Query	? HIGH#_LOWEU	# - High Res Analog Input number 3 - 6	? HIGH3_LOWEU	0.0
High Resolution Analog Input Type	HIGH#_TYPE	= HIGH#_TYPE	# - A High Res RTD Input 1 - 2 ARG1: 0 - JIS 500 1 - JIS 100 2 - DIN 500 3 - DIN 100 # - A High Res Analog Input 3 - 6 ARG1: 0 - Temperature 1 - Vaisala Compensated 2 - Vaisala Compensate w/RTD1 3 - Vaisala Compensate w/RTD2 4 - Vaisala Compensate w/Analog 1 5 - Vaisala Compensate w/Analog 2 6 - Vaisala Compensate w/Analog 3 7 - Vaisala Compensate w/Analog 4 8 - Vaisala Compensate w/Channel 1 9 - Vaisala Compensate w/Channel 2 10 - Vaisala Compensate w/Channel 3 11 - Vaisala Compensate w/Channel 4 12 - Other 13 - Altitude - Kft 14 - Altitude - Torr	= HIGH1_TYPE 1	OK
	HIGH#_TYPE Query	? HIGH#_TYPE	# - A High Res Input 1 - 6	? HIGH1_TYPE	1
Celsius / Fahrenheit Display	CF Set	= CF ARG1	ARG1: 0 - Celsius, 1 - Fahrenheit	= CF 0	OK
	CF Query	? CF	0 - Celsius, 1 - Fahrenheit	? CF	0
Wet Bulb Sensor Select ID	WETB_SENID Set	= WETB_SENID ARG1	ARG1 - ID of the Sensor. 100 - 999.	= WETB_SENID 120	OK
	WETB_SENID Query	? WETB_SENID	ID of the Sensor. 100 - 999.	? WETB_SENID	120

Description	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
Dry Bulb Sensor Select ID	DRYB_SENID Set	= DRYB_SENID ARG1	ARG1 - ID of the Sensor. 100 - 999.	= DRYB_SENID 110	OK
	DRYB_SENID Query	? DRYB_SENID	ID of the Sensor. 100 - 999.	? DRYB_SENID	110
Wet Bulb/Dry Bulb Altitude Compensation in Torr	WBDB_ALT Set	= WBDB_ALT ARG1	ARG1: 0 - 5000 Torr	= WBDR_ALT 760	OK
	WBDB_ALT Query	? WBDB_ALT	0 - 5000 Torr	? WBDB_ALT	760
Thermocouple Filtering Enable	TC_FILTER Set	= TC_FILTER ARG1	ARG1: 0 = Disabled 1 = Enabled	= TC_FILTER 1	OK
	TC_FILTER Query	? TC_FILTER	0 = Disabled 1 = Enabled	? TC_FILTER	1
Thermocouple # Gain	TC#_GAIN Set	= TC#_GAIN ARG1	ARG1 - 25-200%	= TC1_GAIN 105	OK
	TC#_GAIN Query	? TC#_GAIN	25 - 200%	? TC1_GAIN	105
Thermocouple # Offset	TC#_OFF Set	= TC#_OFF ARG1	ARG1: -1000.00 to 1000.00 uV	= TC1_OFF 0.001	OK
	TC#_OFF Query	? TC#_OFF	-1000.00 to 1000.00 uV	? TC1_OFF	0.01
Thermocouple # Type	TC#_TYPE Set	= TC#_TYPE ARG1	ARG1: 0 - B Type 1 - E Type 2 - J Type 3 - K Type 4 - R Type 5 - S Type 6 - T Type	= TC1_TYPE 6	OK
	TC#_TYPE Query	? TC#_TYPE		? TC1_TYPE	6
Retransmit # High Engineering Units	OUT#_HIGHEU Set	= OUT#_HIGHEU ARG1	# is 1 for Retransmit 1, 2 for Retransmit 2 ARG1 -500 - 5000 units	= OUT1_HIGHEU 500	OK
	OUT#_HIGHEU Query	? OUT#_HIGHEU	-500 - 5000 units	? OUT1_HIGHEU	500.0
Retransmit # Low Engineering Units	OUT#_LOWEU Set	= OUT#_LOWEU ARG1	# is 1 for Retransmit 1, 2 for Retransmit 2 ARG1 -500 - 5000 units	= OUT1_LOWEU -100	OK
	OUT#_LOWEU Query	? OUT#_LOWEU	-500 - 5000 units	? OUT1_LOWEU	-100.0
Retransmit # High Volts	OUT#_HIGHV Set	= OUT#_HIGHV ARG1	# is 1 for Retransmit 1, 2 for Retransmit 2 ARG1 0.0 - 5.250 Volts	= OUT1_HIGHV 5	OK
	OUT#_HIGHV Query	? OUT#_HIGHV	0.0 - 5.250 Volts	? OUT1_HIGHV	5.000
Retransmit # Low Volts	OUT#_LOWV Set	= OUT#_LOWV ARG1	# is 1 for Retransmit 1, 2 for Retransmit 2ARG1 0.0 - 5.250 Volts	= OUT1_LOWV 0	OK

Description	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
	OUT#_LOWV Query	? OUT#_LOWV	0.0 - 5.250 Volts	? OUT1_LOWV	0.000
Retransmit # Source	OUT_420_# Set	= OUT_420_# ARG1	# is 1 for Retransmit 1, 2 for Retransmit 2 ARG1: 0 - Off 1 - Ch 1 Actual 2 - CH 2 Actual 3 - CH 3 Actual 4 - CH 1 Setpoint 5 - CH 2 Setpoint 6 - CH 3 Setpoint 7 - CH 1 Heat PID 8 - CH 1 Cool PID 9 - CH 2 Heat PID 10 - CH 2 Cool PID 11 - CH 3 Heat PID 12 - CH 3 Cool PID 13 - CH 1 Cascade Air 14 - CH 2 Cascade Air 15 - CH 3 Cascade Air	= OUT_420_1 1	OK
	OUT_420_# Query	? OUT_420_#	0 - 15	? OUT_420_1	1
Low Resolution Analog Input Gain	LOW#_GAIN Set	= LOW#_GAIN ARG1	# is Low Res Analog Input 1 - 8 ARG1- 25.0 - 200.0 %	= LOW1_GAIN 105	OK
	LOW#_GAIN Query	? LOW#_GAIN	25.0 - 200.0 %	? LOW1_GAIN	105.00
Low Resolution Analog Input Offset	LOW#_OFF Set	= LOW#_OFF ARG1	# is Low Res Analog Input 1 - 8 ARG1 -100.0 - 100.0 Volts	= LOW1_OFF .25	OK
	LOW#_OFF Query	? LOW#_OFF	-100 - 100 Volts	? LOW1_OFF	0.250
Low Resolution Analog Input High Engineering Units	LOW#_HIGHEU Set	= LOW#_HIGHEU ARG1	# is Low Res Analog Input 1 - 8 ARG1 -9999.0 - 9999.0 units	= LOW1_HIGHEU 100	OK
	LOW#_HIGHEU Query	? LOW#_HIGHEU	-9999.0 - 9999.0 units	? LOW1_HIGHEU	100.00
Low Res Analog Input # Low Engineering Units	LOW#_LOWEU Set	= LOW#_LOWEU ARG1	# is Low Res Analog Input 1 - 8 ARG1 -9999.0 - 9999.0 units	= LOW1_LOWEU -100	OK
	LOW#_LOWEU Query	? LOWW_LOWEU	-9999.0 - 9999.0 units	? LOW1_LOWEU	-100.00
Low Resolution Analog Input High Volts Scale	LOW#_HIGHVOLTS Set	= LOW#_HIGHVOLTS ARG1	# is Low Res Analog Input 1 - 8 ARG1 0.000 - 5.250 Volts	= LOW1_HIGHVOLTS 4.5	OK
	LOW#_HIGHVOLTS Query	? LOW#_HIGHVOLTS	0.000 - 5.250 Volts	? LOW1_HIGHVOLTS	4.500
Low Resolution Analog Input Low Volts Scale	LOW#_LOWVOLTS Set	= LOW#_LOWVOLTS ARG1	# is Low Res Analog Input 1 - 8 ARG1 0.000 - 5.250 Volts	= LOW1_LOWVOLTS 1	OK
	LOW#_LOWVOLTS Query	? LOW#_LOWVOLTS	0.000 - 5.250 Volts	? LOW1_LOWVOLTS	1.000

Description	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
Low Resolution Analog Input Type	LOW#_TYPE Set	= LOW#_TYPE ARG1	# is Low Res Analog Input 1 - 8 ARG1: 0 - Temperature 1 - Vaisala Compensated 2 - Vaisala Compensate RTD1 3 - Vaisala Compensate RTD2 4 - Vaisala Compensate Analog 1 5 - Vaisala Compensate Analog 2 6 - Vaisala Compensate Analog 3 7 - Vaisala Compensate Analog 4 8 - Vaisala Compensate Channel 1 9 - Vaisala Compensate Channel 2 10 - Vaisala Compensate Channel 3 11 - Vaisala Compensate Channel 4 12 - Other 13 - Altitude - Kft 14 - Altitude Torr	= LOW1_TYPE 8	OK
	LOW#_TYPE Query	? LOW#_TYPE	0 - 14	? LOW1_TYPE	8
Cold Junction Gain	CJTC#_GAIN Set	= CJTC#_GAIN ARG1	# is Cold Junction 1 or Cold Junction 2 ARG1 25% - 200%	= CJTC1_GAIN 105	OK
	CJTC#_GAIN Query	? CJTC#_GAIN	25% - 200%	? CJTC1_GAIN	105.00
Cold Junction Offset	CJTC#_OFF Set	= CJTC#_OFF ARG1	# is Cold Junction 1 or Cold Junction 2 ARG1 -0.100 - 0.100 mV	= CJTC1_OFF 0.1	OK
	CJTC#_OFF Query	? CJTC#_OFF	-0.100 - 0.100 mV	? CJTC1_OFF	0.100
Virtual Pressure Standard Pressure Sensor ID	VP_STDALT_SENID Set	= VP_STDALT_SENID ARG1	ARG1: 110 //for RTD1 120 //for RTD1 130 //for ANALOG 1 140 //for ANALOG 2 150 //for ANALOG 3 160 //for ANALOG 4 170 //for Nano TC 1 180 //for Nano TC 2 See Technical Manual for complete list	= VP_STDALT_SENID 130	OK

Description	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
	VP_STDALT_SENID Query	? VP_STDALT_SENID	110 - 999 See Technical Manual for complete list	? VP_STDALT_SENID	130
Virtual Pressure High Altitude Sensor ID	VP_HIALT_SENID Set	= VP_HIALT_SENID ARG1	ARG1: 110 //for RTD1 120 //for RTD1 130 //for ANALOG 1 140 //for ANALOG 2 150 //for ANALOG 3 160 //for ANALOG 4 170 //for Nano TC 1 180 //for Nano TC 2 See Technical Manual for complete list	= VP_HIALT_SENID ARG1	OK
	VP_HIALT_SENID Query	? VP_HIALT_SENID	110 - 999 See Technical Manual for complete list	? VP_HIALT_SENID	140
Virtual Pressure Transfer Pressure	VP_TRANS_PRESS Set	= VP_TRANS_PRESS ARG1	ARG1: 0 - 1200	= VP_TRANS_PRESS 100	OK
	VP_TRANS_PRESS Query	? VP_TRANS_PRESS	0 - 1200	? VP_TRANS_PRESS	100
Virtual Pressure Transfer Hysteresis	VP_TRANS_HYST Set	= VP_TRANS_HYST ARG1	ARG1: 0 - 1200	= VP_TRANS_HYST 100	OK
	VP_TRANS_HYST Query	? VP_TRANS_HYST	0 - 1200	? VP_TRANS_HYST	100
Thermocouple # Filter Type	TC#_FLT_TYPE Set	= TC#_FLT_TYPE ARG1	# - Thermocouple 1 or 2 ARG1: 0 - No Filter 1 - IIR Filter 2 - Median Filter 3 - IIR+Median 4 - Median+IIR	= TC1_FLT_TYPE 0	OK
	TC#_FLT_TYPE Query	? TC#_FLT_TYPE	Filter type 0 - 4	? TC1_FLT_TYPE	0
Thermocouple # IIR Filter Max Delta	TC#_FLT_MAXD Set	= TC#_FLT_MAXD ARG1	# - Thermocouple 1 or 2 ARG1 : 0 - 1 millivolts	= TC1_FLT_MAXD 0.1	OK
	TC#_FLT_MAXD Query	? TC#_FLT_MAXD	0 - 1 millivolts	? TC1_FLT_MAXD	0.1
Thermocouple # IIR Filter Weight	TC#_FLT_WT Set	= TC#_FLT_WT ARG1	# - Thermocouple 1 or 2 ARG1: 0 - 100 Percent	= TC1_FLT_WT 33	OK
	TC#_FLT_WT Query	? TC#_FLT_WT	0 - 100 Percent	? TC1_FLT_WT	33
Thermocouple # IIR Median Filter Samples	TC#_FLT_SMPLS Set	= TC#_FLT_SMPLS ARG1	# - Thermocouple 1 or 2 ARG1: 0 - 19	= TC1_FLT_SMPLS 5	OK
	TC#_FLT_SMPLS Query	? TC#_FLT_SMPLS	0 - 19	? TC1_FLT_SMPLS	5

Description	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
Thermocouple # Cold Junction Filter Type	TC#CJ_FLT_TYPE Set	= TC#CJ_FLT_TYPE ARG1	# - Thermocouple 1 or 2 ARG1: 0 - No Filter 1 - IIR Filter 2 - Median Filter 3 - IIR+Median 4 - Median+IIR	= TC1CJ_FLT_TYPE 0	OK
	TC#CJ_FLT_TYPE Query	? TC#CJ_FLT_TYPE	Filter type 0 - 4	? TC1CJ_FLT_TYPE	0
Thermocouple # Cold Junction IIR Filter Max Delta	TC#CJ_FLT_MAXD Set	= TC#CJ_FLT_MAXD ARG1	# - Thermocouple 1 or 2 ARG1 : 0 - 100 Degrees C	= TC1CJ_FLT_MAXD 5	OK
	TC#CJ_FLT_MAXD Query	? TC#CJ_FLT_MAXD	0 - 100 Degrees C	? TC1CJ_FLT_MAXD	5
Thermocouple # Cold Junction IIR Filter Weight	TC#CJ_FLT_WT Set	= TC#CJ_FLT_WT ARG1	# - Thermocouple 1 or 2 ARG1: 0 - 100 Percent	= TC1CJ_FLT_WT 33	OK
	TC#CJ_FLT_WT Query	? TC#CJ_FLT_WT	0 - 100 Percent	? TC1CJ_FLT_WT	33
Thermocouple # Cold Junction IIR Median Filter Samples	TC#CJ_FLT_SMPLS Set	= TC#CJ_FLT_SMPLS ARG1	# - Thermocouple 1 or 2 ARG1: 0 - 19	= TC1CJ_FLT_SMPLS 5	OK
	TC#CJ_FLT_SMPLS Query	? TC#CJ_FLT_SMPLS	0 - 19	? TC1CJ_FLT_SMPLS	5
Wet bulb Input IIR Filter Enabled	WBIN_FLT_ENABLED Set	= WBIN_FLT_ENABLED ARG1	ARG1: 0 - Disabled, 1 - Enabled	= WBIN_FLT_ENABLED 1	OK
	WBIN_FLT_ENABLED Query	? WBIN_FLT_ENABLED	0 - Disabled, 1 - Enabled	? WBIN_FLT_ENABLED	1
Wet bulb Input IIR Filter Max Delta	WBIN_FLT_MAXD Set	= WBIN_FLT_MAXD ARG1	ARG1 : 0 - 100	= WBIN_FLT_MAXD 5	OK
	WBIN_FLT_MAXD Query	? WBIN_FLT_MAXD	0 - 100	? WBIN_FLT_MAXD	5
Wet bulb Input IIR Filter Weight	WBIN_FLT_WT Set	= WBIN_FLT_WT ARG1	ARG1: 0 - 100 Percent	= WBIN_FLT_WT 33	OK
	WBIN_FLT_WT Query	? WBIN_FLT_WT	0 - 100 Percent	? WBIN_FLT_WT	33
Dry bulb Input IIR Filter Enabled	DBIN_FLT_ENABLED Set	= DBIN_FLT_ENABLED ARG1	ARG1: 0 - Disabled, 1 - Enabled	= DBIN_FLT_ENABLED 1	OK
	DBIN_FLT_ENABLED Query	? DBIN_FLT_ENABLED	0 - Disabled, 1 - Enabled	? DBIN_FLT_ENABLED	1
Dry bulb Input IIR Filter Max Delta	DBIN_FLT_MAXD Set	= DBIN_FLT_MAXD ARG1	ARG1 : 0 - 100	= DBIN_FLT_MAXD 5	OK
	DBIN_FLT_MAXD Query	? DBIN_FLT_MAXD	0 - 100	? DBIN_FLT_MAXD	5
Dry bulb Input IIR Filter Weight	DBIN_FLT_WT Set	= DBIN_FLT_WT ARG1	ARG1: 0 - 100 Percent	= DBIN_FLT_WT 33	OK
	DBIN_FLT_WT Query	? DBIN_FLT_WT	0 - 100 Percent	? DBIN_FLT_WT	33
Wet bulb / Dry bulb Output IIR Filter Enabled	WDBOUT_FLT_ENABLED Set	= WDBOUT_FLT_ENABLED ARG1	ARG1: 0 - Disabled, 1 - Enabled	= WDBOUT_FLT_ENABLED 1	OK
	WDBOUT_FLT_ENABLED Query	? WDBOUT_FLT_ENABLED	0 - Disabled, 1 - Enabled	? WDBOUT_FLT_ENABLED	1

Description	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
Wet bulb / Dry bulb Output IIR Filter Max Delta	WDBOUT_FLT_MAXD Set	= WDBOUT_FLT_MAXD ARG1	ARG1 : 0 - 100	= WDBOUT_FLT_MAXD 5	OK
	WDBOUT_FLT_MAXD Query	? WDBOUT_FLT_MAXD	0 - 100	? WDBOUT_FLT_MAXD	5
Wet bulb / Dry bulb Output IIR Filter Weight	WDBOUT_FLT_WT Set	= WDBOUT_FLT_WT ARG1	ARG1: 0 - 100 Percent	= WDBOUT_FLT_WT 33	OK
	WDBOUT_FLT_WT Query	? WDBOUT_FLT_WT	0 - 100 Percent	? WDBOUT_FLT_WT	33
Select Virtual Kft Sensor	VIRTKFTSEN Set	= VIRTKFTSEN ARG1	ARG1: 110 //for RTD1 120 //for RTD1 130 //for ANALOG 1 140 //for ANALOG 2 150 //for ANALOG 3 160 //for ANALOG 4 170 //for Nano TC 1 180 //for Nano TC 2 See Technical Manual for complete list	= VIRTKFTSEN 140	OK
	VIRTKFTSEN Query	? VIRTKFTSEN	110 - 999 See Technical Manual for complete list	? VIRTKFTSEN	140
Logging Commands					
Enable Logging	LOGGING_ENABLED Set	= LOGGING_ ENABLED ARG1	ARG1: 0 - Disabled, 1 - Enabled	= LOGGING_ ENABLED 1	OK
	LOGGING_ENABLED Query	? LOGGING_ ENABLED	0 - Disabled, 1 - Enabled	? LOGGING_ ENABLED	1
Logging Interval	LOGGING_INTERVAL Set	= LOGGING_ INTERVAL ARG1	0 to 3600 Seconds	= LOGGING_ INTERVAL 60	OK
	LOGGING_INTERVAL Query	? LOGGING_ INTERVAL	0 to 3600 Seconds	? LOGGING_ INTERVAL	60
Enable Logging when Chamber is Off	LOG_WHILE_OFF Set	= LOG_WHILE_OFF ARG1	ARG1: 0 - Disabled 1 - Enabled	= LOG_WHILE_OFF 1	OK
	LOG_WHILE_OFF Query	? LOG_WHILE_OFF	0 - Disabled 1 - Enabled	? LOG_WHILE_OFF	1
Log File Size	LOG_FILE_SIZE Set	= LOG_FILE_SIZE ARG1	0.25 - 5 MB	= LOG_FILE_SIZE 1.4	OK
	LOG_FILE_SIZE Query	? LOG_FILE_SIZE	0.25 - 5 MB	? LOG_FILE_SIZE	1.40
Log Ch* Actual	LOG_CH*_ACT Set	= LOG_CH*_ACT ARG1	ARG1: 0 - Don't Log, 1 - Log	= LOG_CH1_ACT 1	OK

Description	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
	LOG_CH*_ACT Query	? LOG_CH*_ACT	0 - Don't Log, 1 - Log	? LOG_CH1_ACT	1
Log Ch* Setpoint	LOG_CH*_SP Set	= LOG_CH*_SP ARG1	ARG1: 0 - Don't Log, 1 - Log	= LOG_CH1_SP 1	OK
	LOG_CH*_SP Query	? LOG_CH*_SP	0 - Don't Log, 1 - Log	? LOG_CH1_SP	1
Log CH* Cascade Act	LOG_CAS_CH*_ACT Set	= LOG_CAS_CH*_ACT ARG1	ARG1: 0 - Don't Log, 1 - Log	= LOG_CAS_CH1_ACT 1	OK
	LOG_CAS_CH*_ACT Query	? LOG_CAS_CH*_ACT	0 - Don't Log, 1 - Log	? LOG_CAS_CH1_ACT	1
Log CH* Cascade SP	LOG_CAS_CH*_SP Set	= LOG_CAS_CH*_SP ARG1	ARG1: 0 - Don't Log, 1 - Log	= LOG_CAS_CH1_SP 1	OK
	LOG_CAS_CH*_SP Query	? LOG_CAS_CH*_SP	0 - Don't Log, 1 - Log	? LOG_CAS_CH1_SP	1
Log CH* Cascade PID	LOG_CAS_CH*_PID Set	= LOG_CAS_CH*_PID ARG1	ARG1: 0 - Don't Log, 1 - Log	= LOG_CAS_CH1_PID 1	OK
	LOG_CAS_CH*_PID Query	? LOG_CAS_CH*_PID	0 - Don't Log, 1 - Log	? LOG_CAS_CH1_PID	1
Log High Resolution Analog Input	LOG_HIGH_# Set	= LOG_HIGH_# ARG1	# - A Number from 1 to 6 ARG1: 0 - Logging Off, 1 - Logging On	= LOG_HIGH_1 1	OK
	LOG_HIGH_# Query	? LOG_HIGH_#	# - A Number from 1 to 6 0 - Logging Off, 1 - Logging On	? LOG_HIGH_1	1
Log Low Resolution Analog Input	LOG_LOW_# Set	= LOG_LOW_# ARG1	# - A Number from 1 to 8ARG1: 0 - Logging Off, 1 - Logging On	= LOG_LOW_1 1	OK
	LOG_LOW_# Query	? LOG_LOW_#	# - A Number from 1 to 8 0 - Logging Off, 1 - Logging On	? LOG_LOW_1	1
Log UUT Modules	LOG_UUT# Set	= LOG_UUT# ARG1	# - Module Number from 1 to 8 ARG1: 0 - Logging Off, 1 - Logging On	= LOG_UUT1 1	OK
	LOG_UUT# Query	? LOG_UUT#	# - Module Number from 1 to 8 0 - Logging Off, 1 - Logging On	? LOG_UUT1	1
Log Digital IO Inputs	LOG_DIO_# Set	= LOG_DIO_# ARG1	# - Digital Input Number from 1 to 16 ARG1: 0 - Logging Off, 1 - Logging On	= LOG_DIO_1 1	OK
	LOG_DIO_# Query	? LOG_DIO_#	# - Digital Input Number from 1 to 16 0 - Logging Off, 1 - Logging On	? LOG_DIO_1	1

Description	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
Log Outputs Enabled	LOG_OUTPUTS Set	= LOG_OUTPUTS ARG1	ARG1: 0 - Logging Off, 1 - Logging On	= LOG_OUTPUTS 1	OK
	LOG_OUTPUTS Query	? LOG_OUTPUTS	0 - Logging Off, 1 - Logging On	? LOG_OUTPUTS	1
Log PID Channel * Heat PID	LOG_CH*_HEAT_PID Set	= LOG_CH*_HEAT_PID ARG1	ARG1: 0 - Logging Off, 1 - Logging On	= LOG_CH1_HEAT_PID 1	OK
	LOG_CH*_HEAT_PID Query	? LOG_CH*_HEAT_PID	0 - Logging Off, 1 - Logging On	? LOG_CH1_HEAT_PID	1
Log PID Channel * Heat PN	LOG_CH*_HEAT_PN Set	= LOG_CH*_HEAT_PN ARG1	ARG1: 0 - Logging Off, 1 - Logging On	= LOG_CH1_HEAT_PN 1	OK
	LOG_CH*_HEAT_PN Query	? LOG_CH*_HEAT_PN	0 - Logging Off, 1 - Logging On	? LOG_CH1_HEAT_PN	1
Log PID Channel * Heat IN	LOG_CH*_HEAT_IN Set	= LOG_CH*_HEAT_IN ARG1	ARG1: 0 - Logging Off, 1 - Logging On	= LOG_CH1_HEAT_IN 1	OK
	LOG_CH*_HEAT_IN Query	? LOG_CH*_HEAT_IN	0 - Logging Off, 1 - Logging On	? LOG_CH1_HEAT_IN	1
Log PID Channel * Heat DN	LOG_CH*_HEAT_DN Set	= LOG_CH*_HEAT_DN ARG1	ARG1: 0 - Logging Off, 1 - Logging On	= LOG_CH1_HEAT_DN 1	OK
	LOG_CH*_HEAT_DN Query	? LOG_CH*_HEAT_DN	0 - Logging Off, 1 - Logging On	? LOG_CH1_HEAT_DN	1
Log PID Channel * Heat Error	LOG_CH*_HEAT_ERR Set	= LOG_CH*_HEAT_ERR ARG1	ARG1: 0 - Logging Off, 1 - Logging On	= LOG_CH1_HEAT_ERR 1	OK
	LOGD_CH*_HEAT_ERR Query	? LOG_CH*_HEAT_ERR	0 - Logging Off, 1 - Logging On	? LOG_CH1_HEAT_ERR	1
Log PID Channel * Heat Cycle Time	LOG_CH*_HEAT_CT Set	= LOG_CH*_HEAT_CT ARG1	ARG1: 0 - Logging Off, 1 - Logging On	= LOG_CH1_HEAT_CT 1	OK
	LOG_CH*_HEAT_CT Query	? LOG_CH*_HEAT_CT	0 - Logging Off, 1 - Logging On	? LOG_CH1_HEAT_CT	1
Log PID Channel * Heat Proportional Band	LOG_CH*_HEAT_PB Set	= LOG_CH*_HEAT_PB ARG1	ARG1: 0 - Logging Off, 1 - Logging On	= LOG_CH1_HEAT_PB 1	OK
	LOG_CH*_HEAT_PB Query	? LOG_CH*_HEAT_PB	0 - Logging Off, 1 - Logging On	? LOG_CH1_HEAT_PB	1
Log PID Channel * Heat Rate Band	LOG_CH*_HEAT_RB Set	= LOG_CH*_HEAT_RB ARG1	ARG1: 0 - Logging Off, 1 - Logging On	= LOG_CH1_HEAT_RB 1	OK
	LOG_CH*_HEAT_RB Query	? LOG_CH*_HEAT_RB	0 - Logging Off, 1 - Logging On	? LOG_CH1_HEAT_RB	1
Log PID Channel * Heat Reset	LOG_CH*_HEAT_RS Set	= LOG_CH*_HEAT_RS ARG1	ARG1: 0 - Logging Off, 1 - Logging On	= LOG_CH1_HEAT_RS 1	OK

Description	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
	LOG_CH*_HEAT_RS Query	? LOG_CH*_HEAT_RS	0 - Logging Off, 1 - Logging On	? LOG_CH1_HEAT_RS	1
Log PID Channel * Heat Rate	LOG_CH*_HEAT_RT Set	= LOG_CH*_HEAT_RT ARG1	ARG1: 0 - Logging Off, 1 - Logging On	= LOG_CH1_HEAT_RT 1	OK
	LOG_CH*_HEAT_RT Query	? LOG_CH*_HEAT_RT	0 - Logging Off 1 - Logging On	? LOG_CH1_HEAT_RT	1
Log PID Channel # Cool PID	LOG_CH*_COOL_PID Set	= LOG_CH*_COOL_PID ARG1	ARG1: 0 - Logging Off 1 - Logging On	= LOG_CH1_COOL_PID 1	OK
	LOG_CH*_COOL_PID Query	? LOG_CH*_COOL_PID	0 - Logging Off 1 - Logging On	? LOG_CH1_COOL_PID	1
Log PID Channel # Cool PN	LOG_CH*_COOL_PN Set	= LOG_CH*_COOL_PN ARG1	ARG1: 0 - Logging Off 1 - Logging On	= LOG_CH1_COOL_PN 1	OK
	LOG_CH*_COOL_PN Query	? LOG_CH*_COOL_PN	0 - Logging Off 1 - Logging On	? LOG_CH1_COOL_PN	1
Log PID Channel # Cool IN	LOG_CH*_COOL_IN Set	= LOG_CH*_COOL_IN ARG1	0 - Logging Off 1 - Logging On	= LOG_CH1_COOL_IN 1	OK
	LOG_CH*_COOL_IN Query	? LOG_CH*_COOL_IN	0 - Logging Off 1 - Logging On	? LOG_CH1_COOL_IN	1
Log PID Channel # Cool DN	LOG_CH*_COOL_DN Set	= LOG_CH*_COOL_DN ARG1	0 - Logging Off 1 - Logging On	= LOG_CH1_COOL_DN 1	OK
	LOG_CH*_COOL_DN Query	? LOG_CH*_COOL_DN	0 - Logging Off 1 - Logging On	? LOG_CH1_COOL_DN	1
Log PID Channel # Cool Error	LOG_CH*_COOL_ERR Set	= LOG_CH*_COOL_ERR ARG1	0 - Logging Off 1 - Logging On	= LOG_CH1_COOL_ERR 1	OK
	LOG_CH*_COOL_ERR Query	? LOG_CH*_COOL_ERR	0 - Logging Off 1 - Logging On	? LOG_CH1_COOL_ERR	1
Log PID Channel * Cool Cycle Time	LOG_CH*_COOL_CT Set	= LOG_CH*_COOL_CT ARG1	ARG1: 0 - Logging Off 1 - Logging On	= LOG_CH1_COOL_CT 1	OK
	LOG_CH*_COOL_CT Query	? LOG_CH*_COOL_CT	0 - Logging Off 1 - Logging On	? LOG_CH1_COOL_CT	1
Log PID Channel * Cool Proportional Band	LOG_CH*_COOL_PB Set	= LOG_CH*_COOL_PB ARG1	ARG1: 0 - Logging Off 1 - Logging On	= LOG_CH1_COOL_PB 1	OK
	LOG_CH*_COOL_PB Query	? LOG_CH*_COOL_PB	0 - Logging Off, 1 - Logging On	? LOG_CH1_COOL_PB	1
Log PID Channel * Cool Rate Band	LOG_CH*_COOL_RB Set	= LOG_CH*_COOL_RB ARG1	ARG1: 0 - Logging Off, 1 - Logging On	= LOG_CH1_COOL_RB 1	OK

Description	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
	LOG_CH*_COOL_RB Query	? LOG_CH*_COOL_RB	0 - Logging Off, 1 - Logging On	? LOG_CH1_COOL_RB	1
Log PID Channel * Cool Reset	LOG_CH*_COOL_RS Set	= LOG_CH*_COOL_RS ARG1	ARG1: 0 - Logging Off, 1 - Logging On	= LOG_CH1_COOL_RS 1	OK
	LOG_CH*_COOL_RS Query	? LOG_CH*_COOL_RS	0 - Logging Off, 1 - Logging On	? LOG_CH1_COOL_RS	1
Log PID Channel * Cool Rate	LOG_CH*_COOL_RT Set	= LOG_CH*_COOL_RT ARG1	ARG1: 0 - Logging Off, 1 - Logging On	= LOG_CH1_COOL_RT 1	OK
	LOG_CH*_COOL_RT Query	? LOG_CH*_COOL_RT	0 - Logging Off, 1 - Logging On	? LOG_CH1_COOL_RT	1
Cleary History Database	CLEARHIST	= CLEARHIST	0 - Don't Clear, 1 - Clear	= CLEARHIST	OK
Copy History Database to FTP Directory	COPYHISTTOFTP	= COPYHISTTOFTP ARG1	ARG1: 0 - Don't Copy, 1 - COPY	= COPYHISTTOFTP 1	OK
Log Deviation Alarm Limits	LOG_DEVALMS_CH* Set	= LOG_DEVALMS_CH* ARG1	ARG1: 0 - Disabled, 1 - Enabled	= LOG_DEVALMS_CH1 1	OK
	LOG_DEVALMS_CH* Query	? LOG_DEVALMS_CH*	0 - Disabled, 1 - Enabled	? LOG_DEVALMS_CH1	1
Log Full Action	LOGFULL_ACTION Set	= LOGFULL_ACTION ARG1	ARG1: 0 - Overwrite 1 - Stop Logging	= LOGFULL_ACTION 1	OK
	LOGFULL_ACTION Query	? LOGFULL_ACTION	0 - Overwrite, 1 - Stop Logging	? LOGFULL_ACTION	1
Log Usage Warning Enable	LOGFULL_WARNING Set	= LOGFULL_WARNING ARG1	ARG1: 0 - No, 1 - Yes	= LOGFULL_WARNING 1	OK
	LOGFULL_WARNING Query	? LOGFULL_WARNING	0 - No, 1 - Yes	? LOGFULL_WARNING	1
Log Usage Warning Percentage	LOGFULL_WARN_PERCENT Set	= LOGFULL_WARN_PERCENT ARG1	ARG1: 1% - 100%	= LOGFULL_WARN_PERCENT 80	OK
	LOGFULL_WARN_PERCENT Query	? LOGFULL_WARN_PERCENT	1% - 100%	? LOGFULL_WARN_PERCENT	80%
Profile Warning Count	PROF_MAX_COUNT Set	= PROF_MAX_COUNT ARG1	ARG1: 1 - 100 Profiles	= PROF_MAX_COUNT 25	OK
	PROF_MAX_COUNT Query	? PROF_MAX_COUNT	1 - 100	? PROF_MAX_COUNT	25
Profile Auto-Remove Count	PROF_REMOVE_COUNT Set	= PROF_REMOVE_COUNT ARG1	ARG1: 0 - 100 Profiles	= PROF_REMOVE_COUNT 30	OK
	PROF_REMOVE_COUNT Query	? PROF_REMOVE_COUNT	0 - 100	?PROF_REMOVE_COUNT	30
Enable Logging Per Profile	LOG_PER_PROFILE Set	= LOG_PER_PROFILE ARG1	ARG1: 0 - No, 1 - Yes	= LOG_PER_PROFILE 1	OK
	LOG_PER_PROFILE Query	? LOG_PER_PROFILE	0 - No, 1 - Yes	? LOG_PER_PROFILE	1

Description	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
Log PWMs	LOG_PWM# Set	= LOG_PWM# ARG1	# - PWM Output 1 - 8 ARG1: 0 - Logging Off, 1 - Logging On	= LOG_PWM1 1	OK
	LOG_PWM# Query	? LOG_PWM#	0 - Logging Off, 1 - Logging On	? LOG_PWM1	1
Log Thermocouple # Cold Junction	LOG_TC#CJ Set	= LOG_TC#CJ ARG1	# - Thermocouple 1 or 2 ARG1: 0 - Logging Off, 1 - Logging On	= LOG_TC1CJ 1	OK
	LOG_TC#CJ Query	? LOG_TC#CJ	0 - Logging Off, 1 - Logging On	? LOG_TC1CJ	1
Log PID Channel * Cascade PID	LOG_CH*_CAS_PID Set	= LOG_CH*_CAS_PID ARG1	ARG1: 0 - Logging Off, 1 - Logging On	= LOG_CH1_CAS_PID 1	OK
	LOG_CH*_CAS_PID Query	? LOG_CH*_CAS_PID	0 - Logging Off, 1 - Logging On	? LOG_CH1_CAS_PID	1
Log PID Channel * Cascade PN	LOG_CH*_CAS_PN Set	= LOG_CH*_CAS_PN ARG1	ARG1: 0 - Logging Off, 1 - Logging On	= LOG_CH1_CAS_PN 1	OK
	LOG_CH*_CAS_PN Query	? LOG_CH*_CAS_PN	0 - Logging Off, 1 - Logging On	? LOG_CH1_CAS_PN	1
Log PID Channel * Cascade IN	LOG_CH*_CAS_IN Set	= LOG_CH*_CAS_IN ARG1	ARG1: 0 - Logging Off, 1 - Logging On	= LOG_CH1_CAS_IN 1	OK
	LOG_CH*_CAS_IN Query	? LOG_CH*_CAS_IN	0 - Logging Off, 1 - Logging On	? LOG_CH1_CAS_IN	1
Log PID Channel * Cascade DN	LOG_CH*_CAS_DN Set	= LOG_CH*_CAS_DN ARG1	ARG1: 0 - Logging Off, 1 - Logging On	= LOG_CH1_CAS_DN 1	OK
	LOG_CH*_CAS_DN Query	? LOG_CH*_CAS_DN	0 - Logging Off, 1 - Logging On	? LOG_CH1_CAS_DN	1
Log PID Channel * Cascade Error	LOG_CH*_CAS_ERR Set	= LOG_CH*_CAS_ERR ARG1	ARG1: 0 - Logging Off, 1 - Logging On	= LOG_CH1_CAS_ERR 1	OK
	LOGD_CH*_CAS_ERR Query	? LOG_CH*_CAS_ERR	0 - Logging Off, 1 - Logging On	? LOG_CH1_CAS_ERR	1
Log PID Channel * Cascade Proportional Band	LOG_CH*_CAS_PB Set	= LOG_CH*_CAS_PB ARG1	ARG1: 0 - Logging Off, 1 - Logging On	= LOG_CH1_CAS_PB 1	OK
	LOG_CH*_CAS_PB Query	? LOG_CH*_CAS_PB	0 - Logging Off, 1 - Logging On	? LOG_CH1_CAS_PB	1
Log PID Channel * Cascade Rate Band	LOG_CH*_CAS_RB Set	= LOG_CH*_CAS_RB ARG1	ARG1: 0 - Logging Off, 1 - Logging On	= LOG_CH1_CAS_RB 1	OK
	LOG_CH*_CAS_RB Query	? LOG_CH*_CAS_RB	0 - Logging Off, 1 - Logging On	? LOG_CH1_CAS_RB	1
Log PID Channel * Cascade Reset	LOG_CH*_CAS_RS Set	= LOG_CH*_CAS_RS ARG1	ARG1: 0 - Logging Off, 1 - Logging	= LOG_CH1_CAS_RS 1	OK

Description	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
			On		
	LOG_CH*_CAS_RS Query	? LOG_CH*_CAS_RS	0 - Logging Off, 1 - Logging On	? LOG_CH1_CAS_RS	1
Log PID Channel * Cascade Rate	LOG_CH*_CAS_RT Set	= LOG_CH*_CAS_RT ARG1	ARG1: 0 - Logging Off, 1 - Logging On	= LOG_CH1_CAS_RT 1	OK
	LOG_CH*_CAS_RT Query	? LOG_CH*_CAS_RT	0 - Logging Off 1 - Logging On	? LOG_CH1_CAS_RT	1
Log Machine Inputs	LOG_MACHINE# Set	= LOG_MACHINE# ARG1	# - Machine Input Number from 1 to 8 ARG1: 0 - Logging Off, 1 - Logging On	= LOG_MACHINE1 1	OK
	LOG_MACHINE# Query	? LOG_MACHINE#	0 - Logging Off, 1 - Logging On	? LOG_MACHINE1	1
Log Thermocouple	LOG_TC# Set	= LOG_TC# ARG1	# - Thermocouple 1 or 2 ARG1: 0 - Logging Off, 1 - Logging On	= LOG_TC1 1	OK
	LOG_TC# Query	? LOG_TC#	0 - Logging Off, 1 - Logging On	? LOG_TC1	1
Profile Log Name Format	PROFILE_NAME_FMT Set	= PROFILE_NAME_FMT ARG1	ARG1: 0 - [Profile Name] - [Time Stamp] 1 - [Chamber Name] [Profile Name] - [Time Stamp]	= PROFILE_NAME_FMT 1	OK
	PROFILE_NAME_FMT Query	? PROFILE_NAME_FMT	0 - 1	? PROFILE_NAME_FMT	1
Profile Commands					
Run	Run Query	? RUN	Returns: 0 - Stop 1 - Run 2 - Pause 3 - Steady State	? RUN	0
Pause Program	HOLD Set	= HOLD	No Parameters	= HOLD	OK
Resume Program	RSUM Set	= RSUM	No Parameters	= RSUM	OK
Run From	RUNFROM Set	= RUNFROM ARG1	Range = Step 1 - Last Step	= RUNFROM 5	OK
Stop and Hold	STOPHOLD Set	= STOPHOLD	No Parameters	= STOPHOLD	OK
Run Profile with outputs Off	RUNOFF Set	= RUNOFF 1	Constant Parameter 1	= RUNOFF 1	OK
Create a New File	FILENEW Set	= FILENEW	No Arguments	= FILENEW	
Save a downloaded file	FILESAVE Set	= FILESAVE	ARG1 = Filename to save to	= FILESAVE MyProfile	

Description	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
Open a downloaded file	FILEOPEN Set	= FILEOPEN 1 "file name"	ARG1 = Filename to save to	= FILEOPEN MyProfile	
Set information regarding the profile being downloaded. **Use immediately after a FILENEW command**	VTVINFO Set	= VTVINFO ARG1 ARG2 ARG3 ARG4 This is only for use in saved files.	ARG1 - Major Version # of file. Is 1 ARG2 - Minor Version # of file. Is 0 ARG3 - Revision Version # of file. Is 0 ARG4: 0 - File is saved in C 1 - File is saved in F	= VTVINFO 1 0 0 0	
Program Step	STP	= STP File # Step # STEPTYPE ARG4 ARGn	See File, Step, Step Type, etc. parameters below	= STP 1 1 0	
FILE #	See Program Step	N/A	Constant Parameter 1	N/A	
STEP #	See Program Step	N/A	Range 1-255	N/A	
STEPTYPE	See Program Step	N/A	0 = Setpoint 1 = Jumploop 2 = Waitfor 3 = Autostart 4 = Stop 5 = Link		
SETPOINT	See Steptype	ARG4 ARG5 … ARG31	ARG4 = CH1 SP X 10ARG5 = CH2 SP X 10ARG6 = Ramp Hours X 10ARG7 = Ramp Minutes X 10ARG8 = Ramp Seconds X 10ARG9 - 14 = Event 1 - 6 (10=on, 0 = off)ARG15 - 16 = 0 (Not Used) ARG17 = CH3 SP X 10 (-10000 = off) ARG18 = CH4 SP X 10 (-10000 = off) ARG19 - 28 = 0 (Not Used) ARG29 = LEV1 (10=on, 0 = off) ARG30 = LEV2 (10=on, 0 = off) ARG31 = OT11 **NOTE: ARG 4 thru ARG 31 are X10**	10 (CH1= 1.0 Deg.)600 (CH2= 60.0 Deg.)10 (1.0 Hours)225 (22.5 Minutes)0 (0 Seconds)10 0 0 0 10 0 (on,off,off,off,on,off)0 0 (Not Used) -10000 (CH3= Off) -10000 (CH4= Off) 0 0 0 0 0 0 0 0 0 0 (Not Used) 0 (LEV1= Off) 10 (LEV2= On) 10 (OT11= Time Prop.)	OK
JUMPLOOP	See Steptype	ARG4 ARG5	ARG4 = Jump Step X 10 ARG5 = Jump Count X 10 (-10 = infinite) **NOTE: ARG 4 thru ARG 5 are X10**	200 (Jump to Line 20) 150 (Jump 15 times)	OK

Description	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
WAITFOR	See Steptype	ARG4 ARG5 ... ARG26	ARG4 = Wait CH1 Actual ARG5 = Wait CH2 Actual ARG6 = Wait Hours ARG7 = Wait Minutes ARG8 = Wait External Event ARG9 = Wait CH3 Actual ARG10 = Wait CH4 Actual ARG11 = Wait Seconds ARG12 - 27 = Wait on Input 1-16 **NOTE: ARG 4 thru ARG 12 are X10**	10 (CH1= 1.0 Deg.) 600 (CH2= 60.0 Deg.) 10 (1.0 Hours) 225 (22.5 Minutes) 0 (Don't Wait) -10000 (CH3= Don't Wait) -10000 (CH4=Don't Wait) 110 (11 Seconds) 10 0 10 0 0 0 0 0 0 0 (Wait for Input 1 and Input 3)	OK
AUTOSTART	See Steptype	ARG4 ARG5 ARG6 ARG7 ARG8	ARG4 = AutoStart Day ARG5 = AutoStart Hour ARG6 = AutoStart Minute ARG7 = AutoStart Month ARG8 = AutoStart Year **NOTE: ARG 4 thru ARG 8 are X10**	30 (Day =3) 210 (Hour = 21) 220 (Minute = 22) 60 (Month = 6, June) 20090 (Year = 2009)	OK
STOP	See Steptype	ARG4	ARG4: 0 - Outputs Off 10 - Outputs On		OK
Allow Multiple Stop Steps in a Profile	PRG_MULT_STOPS Set	= PRG_MULT_STOPS ARG1	ARG1: 0 - Disabled, 1 - Enabled	= PRG_MULT_STOPS 0	OK
	PRG_MULT_STOPS Query	? PRG_MULT_STOPS	0 - Disabled, 1 - Enabled	? PRG_MULT_STOPS	0
Alarm Commands					
Ch * Low Alarm	A*L Set	= A*L ARG1	-200 to 500 C -326 to 932 F	= A1L -200	OK
	A*L Query	? A*L	-200 to 500 C -326 to 932 F	? A1L	-200
Ch * High Alarm	A*H Set	= A*H ARG1	-200 to 500 C -326 to 932 F	= A2H 500	OK
	A*H Query	? A*H	-200 to 500 C -326 to 932 F	? A2H	500
Ch * Alarm Enabled While Off	IGNORE_CH*_ALM Set	= IGNORE_CH*_ALM ARG1	ARG1: 0 - Outputs Off, 1 - Outputs On	= IGNORE_CH1_ALM 1	OK
	IGNORE_CH*_ALM Query	? IGNORE_CH*_ALM ARG1	0 - Outputs Off, 1 - Outputs On	? IGNORE_CH1_ALM	1
Ch * Deviation High Alarm	A*DH Set	= A*DH ARG1	ARG1: 0 - 500C	= A1DH 20	OK
	A*DH Query	? A*DH	0 - 500C	? A1DH	20.0
Ch * Deviation Low Alarm	A*DL Set	= A*DL ARG1	ARG1: 0 - 500C	= A1DL 10	OK
	A*DL Query	? A*DL	0 - 500C	? A1DL	10.0
Ch * Deviation Alarms Enable	A*DE Set	= A*DE ARG1	ARG1: 0 - Disabled, 1 - Enabled	= A1DE 1	OK

Description	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
	A*DE Query	? A*DE	0 - Disabled, 1 - Enabled	? A1DE	1
Ch * Deviation Alarm Delay	A*DT Set	= A*DT ARG1	ARG1: 0 - 7200 Seconds	= A1DT 3600	OK
	A*DT Query	? A*DT	0-7200 Seconds	? A1DT	3600
User Alarm Add	ALMADD Set	= ALMADD ARG1 ARG2 … ARG17 "ARG18"	ARG1 - Order Number, Alarms are checked lowest to highestARG2 - Turn On Delay in SecondsARG3 - Turn Off Delay in SecondsARG4 - Log Alarm 0 - False 1 - TrueARG5 - Disable Chamber 0 - False 1 - TrueARG6 - String Format 0 - Plain Text 1 - Insert ValueARG7 - Sensor ID 100 - 999 ARG8 - Comparison Type 0 = < (float) 1 = > (float) 2 = Input Open 3 = Input Closed ARG9 - Alarm Threshold Value ARG10 - Alarm Channel ARG11 - Alarm Relay 0 - No Relay Activated 1 - Channel 1 Relay 2 - Channel 2 Relay 3 - Channel 1 and Channel 2 Relay	= ALMADD 501 0 0 1 1 0 110 1 100.0 1 1 1 0 1 1 1 20680 "User High Alarm"	OK

Description	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
			ARG12 - Show Alarm 0 - False 1 - True ARG13 - Alarm Type 0 - Channel Reading 1 - Sensor Connect 2 - Raw Reading ARG14 - Use Scaled Input Value 0 - False 1 - True ARG15 - Require User Acknowledge 0 - False 1 - True ARG16 - Always set to 1 ARG17 - Alarm Classification 20680 - User Generated Critical Alarm 20681 - User Generated Warning 20682 - User Generated Information ARG18 - Alarm String to display and log		
Alarm System Initialization	ALMINIT Set	= ALMINIT	Initialized the Alarm system. This command should be sent after adding additional user alarms	= ALMINIT	OK
Remove User Alarm	ALMREMOVE Set	= ALMREMOVE ARG1 ARG2	ARG1 - Sensor ID 100 - 1000 ARG2 - Alarm Order Number	= ALMREMOVE 110 501	OK
Acknowledge All Alarms	ACKALM Set	= ACKALM ARG1	ARG1 - Always 1 to reset the alarms Number of active alarms, 32 bit hex number representing types of alarms.	= ACKALM 1	0, 00000001
Show Active Alarms	SHOWACTALM Query	? SHOWACTALM	Shows all active alarms. Number of active alarms, 32 bit hex number representing types of alarms.	? SHOWACTALM	0, 00000001
Show Alarm Status	ALM Query	? ALM	Shows alarm states Returns 3 values: %i, %i, %8.8X First: Number of Alarms, both active & inactive Second: Number of active alarms Third: 32 bit hex number with each bit representing a different alarm	? ALM	0, 0, 00000000

Description	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
			Bit 1 - Comm Port / Olympic board unavailable Bit 2 - Bad Sensor connect 1 Bit 3 - Bad Sensor connect 2 Bit 4 - Bad Sensor connect 3 Bit 5 - Bad Sensor connect 4 Bit 6 - Bad Sensor connect 5 Bit 7 - Bad Sensor connect 6 Bit 8 - Olympic Board Reset Bit 9 - Storage Space Low Bit 10 - Program Memory Low Bit 11 - Watlow Alarm Bit 12 - CH1 High Alarm Bit 13 - CH1 Low Alarm Bit 14 - CH2 High Alarm Bit 15 - CH2 Low Alarm Bit 16 - CH3 High Alarm Bit 17 - CH3 Low Alarm Bit 18 - PID Thread Crashed Bit 19 - Bad Sensor Reading		
CH * Alarm Delay	A*T Set	= A*T ARG1	ARG1: 0 - 72000 Seconds	=A1T 60	OK
	A*T Query	? A*T	0 - 72000 Seconds	? A1T	60
			E-Mail Commands		
Email Enabled	EMAIL_ENABLED Set	= EMAIL_ENABLED ARG1	ARG1: 0 - Disabled, 1 - Enabled	= EMAIL_ENABLED 1	OK
	EMAIL_ENABLED Query	? EMAIL_ENABLED	0 - Disabled, 1 - Enabled	? EMAIL_ENABLED	1
Email Sender Name	EMAIL_SENDER Set	= EMAIL_SENDER ARG1	ARG1: "Sender Name"	= EMAIL_SENDER "Sender Name"	OK
	EMAIL_SENDER Query	? EMAIL_SENDER	Sender Name	? EMAIL_SENDER	Sender Name
Email Sender Address	EMAIL_ADDR Set	= EMAIL_ADDR ARG1	ARG1: "Sender Email Address"	= EMAIL_ADDR "sender@domain.com"	OK
	EMAIL_ADDR Query	? EMAIL_ADDR	Sender Email Address	? EMAIL_ADDR	sender@domain.com
Email SMTP Server	SMTP_SERVER Set	= SMTP_SERVER ARG1	ARG1: "SMTP Server IP"	= SMTP_SERVER "1.2.3.4"	OK
	SMTP_SERVER Query	? SMTP_SERVER	SMTP Server IP	? SMTP_SERVER	1.2.3.4
Email Alarms	EMAIL_ALARMS Set	= EMAIL_ALARMS ARG1	ARG1: 0 - Disabled, 1 - Enabled	= EMAIL_ALARMS 1	OK
	EMAIL_ALARMS Query	? EMAIL_ALARMS	0 - Disabled, 1 - Enabled	? EMAIL_ALARMS	1
Email Addresses	EML_ADDR_# Set	= EML_ADDR_# ARG1	# - A number for user 1 - 5 ARG1: "Recipient Email Address"	= EML_ADDR_1 "recipient1@domain.com"	OK
	EML_ADDR_# Query	? EML_ADDR_#	Recipient Email Address	? EML_ADDR_1	recipient@domain.com

Description	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
Email Alarm to User	EML_ALM_USER#_ENA Set	= EML_ALM_USER#_ENA ARG1	# - A number for user 1 - 5 ARG1: 0 - Disabled, 1 - Enabled	= EML_ALM_USER1_ENA 1	OK
	EML_ALM_USER#_ENA Query	? EML_ALM_USER#_ENA	0 - Disabled, 1 - Enabled	? EML_ALM_USER1_ENA	1
Email Log to User	EML_LOG_USER#_ENA Set	= EML_LOG_USER#_ENA ARG1	# - A number for user 1 - 5 ARG1: 0 - Disabled, 1 - Enabled	= EML_LOG_USER1_ENA 1	OK
	EML_LOG_USER#_ENA Query	? EML_LOG_USER#_ENA	0 - Disabled, 1 - Enabled	? EML_LOG_USER1_ENA	1
Auto-Email Profile Logs	LOG_EMAIL_RESULTS Set	= LOG_EMAIL_RESULTS ARG1	ARG1: 0 - No, 1 - Yes	= LOG_EMAIL_RESULTS 1	OK
	LOG_EMAIL_RESULTS Query	? LOG_EMAIL_RESULTS	0 - No, 1 - Yes	? LOG_EMAIL_RESULTS	1
Auto-Email Profile Plot	EMAIL_PROF_PLOT Set	= EMAIL_PROF_PLOT ARG1	ARG1: 0 - Disabled, 1 - Enabled	= EMAIL_PROF_PLOT 1	OK
	EMAIL_PROF_PLOT Query	? EMAIL_PROF_PLOT	0 - Disabled, 1 - Enabled	? EMAIL_PROF_PLOT	1

Main Screen Setup Commands					
Main Screen Switch Event	CHSWT_EVENT Set	= CHSWT_EVENT ARG1	ARG1: 0 - None 1 - 9 - Event 1 - 9	= CHSWT_EVENT 6	OK
	CHSWT_EVENT Query	? CHSWT_EVENT		?CHSWT_EVENT	6
Main Screen Switch Enabled when Chamber Off	CHSWT_ENA_OFF Set	= CHSWT_ENA_OFF ARG1	ARG1: 0 - Disabled, 1 - Enabled	= CHSWT_ENA_OFF 1	OK
	CHSWT_ENA_OFF Query	? CHSWT_ENA_OFF		? CHSWT_ENA_OFF	1
Main Screen Switch Disabled during Profile	CHSWT_DISABLE_PROFILE Set	= CHSWT_DISABLE_PROFILE ARG1	ARG1: 0 - Disabled, 1 - Enabled	= CHSWT_DISABLE_PROFILE 1	OK
	CHSWT_DISABLE_PROFILE Query	? CHSWT_DISABLE_PROFILE		? CHSWT_DISABLE_PROFILE	1
Main Screen Switch Top Label - Switch On	CHSWT_TOPON_LABEL Set	= CHSWT_TOPON_LABEL ARG1	ARG1: String with label text	= CHSWT_TOPON_LABEL "Top On"	OK
	CHSWT_TOPON_LABEL Query	? CHSWT_TOPON_LABEL		? CHSWT_TOPON_LABEL	Top On
Main Screen Switch Top Label - Switch Off	CHSWT_TOPOFF_LABEL Set	= CHSWT_TOPOFF_LABEL ARG1	ARG1: String with label text	= CHSWT_TOPOFF_LABEL "Top Off"	OK
	CHSWT_TOPOFF_LABEL Query	? CHSWT_TOPOFF_LABEL		? CHSWT_TOPOFF_LABEL	Top Off
Main Screen Switch Bottom Label - Switch On	CHSWT_BOTTOMON_LABEL Set	= CHSWT_BOTTOMON_LA	ARG1: String with label text	= CHSWT_BOTTOMON_LABEL "Bottom On"	OK

Description	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
		BEL ARG1			
	CHSWT_BOTTOMON_LABEL Query	? CHSWT_BOTTOMON_LABEL		? CHSWT_BOTTOMON_LABEL	Bottom On
Main Screen Switch Bottom Label - Switch Off	CHSWT_BOTTOMOFF_LABEL Set	= CHSWT_BOTTOMOFF_LABEL ARG1	ARG1: String with label text	= CHSWT_BOTTOMOFF_LABEL "Bottom Off"	OK
	CHSWT_BOTTOMOFF_LABEL Query	? CHSWT_BOTTOMOFF_LABEL		? CHSWT_BOTTOMOFF_LABEL	Bottom Off
Main Screen Switch Graphic	CHSWT_GRAPHIC Set	= CHSWT GRAPHIC ARG1	ARG1: 0 - Switch Up when On, 1 - Switch Down when On	= CHSWT_GRAPHIC 0	OK
	CHSWT_GRAPHIC Query	? CHSWT_GRAPHIC		? CHSWT_GRAPHIC	0
Chamber Light Disable during Profile	CHLIGHT_DISABLE_PROFILE Set	= CHLIGHT_DISABLE_PROFILE ARG1	ARG1: 0 - Disabled, 1 - Enabled	= CHLIGHT_DISABLE_PROFILE 0	OK
	CHLIGHT_DISABLE_PROFILE Query	? CHLIGHT_DISABLE_PROFILE		? CHLIGHT_DISABLE_PROFILE	0
Chamber Light Event ID	CHLIGHT_EVT Set	= CHLIGHT_EVT ARG1	ARG1: 0 - None 1 - Event 1 2 - Event 2 3 - Event 3 4 - Event 4 5 - Event 5 6 - Event 6	= CHLIGHT_EVT 1	OK
	CHLIGHT_EVT Query	? CHLIGHT_EVT	Event 1 - 6	? CHLIGHT_EVT	1
Chamber Light Enabled while chamber is Off	CHLIGHT_ENA_OFF Set	= CHLIGHT_ENA_OFF ARG1	ARG1: 0 - No, 1 - Yes	= CHLIGHT_ENA_OFF 0	OK
	CHLIGHT_ENA_OFF Query	? CHLIGHT_ENA_OFF	0 - No, 1 - Yes	? CHLIGHT_ENA_OFF	0
Main Screen Layout	MAINSCR_LAYOUT Set	= MAINSCR_LAYOUT ARG1	ARG1: 0 - Large Display 1 - Medium Display 2 - Small Display 3 - Small Display with Graph	= MAINSCR_LAYOUT 3	OK
	MAINSCR_LAYOUT Query	? MAINSCR_LAYOUT		? MAINSCR_LAYOUT	3

Description	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
Display Sensor Adds a sensor to the Main Screen for display only.	DISPLAYSNSR Set	= DISPLAYSNSR ARG1 ARG2 ARG3	ARG1 1 - First Display Channel 2 - Second Display Channel ARG2 0 - Disabled 1 - Enabled ARG3 ID of the Sensor 100 - 999	= DISPLAYSNSR 1 1 120	OK
Display Channel # Enable	DSPCH#_ENABLE Set	= DSPCH#_ENABLE ARG1	# - Display Channels 1 - 10 ARG1: 0 - Disabled, 1 - Enabled	= DISPCH1_ENABLE 1	OK
	DSPCH#_ENABLE Query	? DSPCH#_ENABLE	0 - Disabled, 1 - Enabled	? DISPCH1_ENABLE	1
Display Channel # Sensor	DSPCH#_SENSOR Set	= DSPCH#_SENSOR ARG1	# - Display Channels 1 - 10 ARG1: 110 - 999 See Technical Manual for complete list	= DISPCH1_SENSOR 110	OK
	DSPCH#_SENSOR Query	? DSPCH#_SENSOR		? DISPCH1_SENSOR	110
Display Channel # Label	DSPCH#_LABEL Set	= DSPCH#_LABEL "ARG1"	# - Display Channels 1 - 10 ARG1: String with label text	= DSPCH6_LABEL "RTD1"	OK
	DSPCH#_LABEL Query	? DSPCH#_LABEL		? DSPCH6_LABEL	RTD1
Network Printing Setup Commands					
Enable Network Printing	PRINTING_ENABLED Set	= PRINTING_ENABLED ARG1	ARG1: 0 - Disabled, 1 - Enabled	= PRINTING_ENABLED 1	OK
	PRINTING_ENABLED Query	? PRINTING_ENABLED	0 - Disabled, 1 - Enabled	? PRINTING_ENABLED	1
Printer TCP/IP Address	PRINTER_ETHER_ADDR Set	= PRINTER_ETHER_ADDR ARG1	ARG1: "TCP/IP Address of Printer"	= PRINTER_ETHER_ADDR "192.168.1.200"	OK
	PRINTER_ETHER_ADDR Query	? PRINTER_ETHER_ADDR	TCP/IP Address of Printer	? PRINTER_ETHER_ADDR	192.168.1.200
Printer TCP/IP Port	PRINTER_ETHER_PORT Query	? PRINTER_ETHER_PORT	TCP/IP Port of Printer	? PRINTER_ETHER_PORT	9100
Print in Color	PRINTER_COLOR Set	= PRINTER_COLOR ARG1	ARG1: 0 - Black and White 1 - Color	= PRINTER_COLOR 1	OK
	PRINTER_COLOR Query	? PRINTER_COLOR	0 - Black and White, 1 - Color	? PRINTER_COLOR	1

Description	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
Print Paper Size and Orientation	PRINTER_PAPER Set	= PRINTER_PAPER ARG1	ARG1: 0 - Letter, Portrait 1 - Letter, Landscape 2 - Legal, Portrait 3 - Legal, Landscape	= PRINTER_PAPER 2	OK
	PRINTER_PAPER Query	? PRINTER_PAPER	0 - 3	? PRINTER_PAPER	2
Auto Print Profile Plot	PLOT_PROFILEPRINT Set	= PLOT_PROFILEPRINT ARG1	ARG1: 0 - No, 1 - Yes	= PLOT_PROFILEPRINT 1	OK
	PLOT_PROFILEPRINT Query	? PLOT_PROFILEPRINT	0 - No, 1 - Yes	? PLOT_PROFILEPRINT	1
CH* Plot Selection	PLOT_SELECT_CH* Set	= PLOT_SELECT_CH* ARG1	ARG1: 0 - Off 1 - Actual 2 - Actual, Deviation 3 - Actual, Deviation, PID 4 - Actual, Setpoint, PID	= PLOT_SELECT_CH1 3	OK
	PLOT_SELECT_CH* Query	? PLOT_SELECT_CH*	0 - 4	? PLOT_SELECT_CH1	3
Plot Heading Left Column	PLOT_HDR_L# Set	= PLOT_HDR_L# ARG1	# - Line Number 1 - 6 ARG1: "Left Header String"	= PLOT_HDR_L1 " Left Header Line 1"	OK
	PLOT_HDR_L# Query	? PLOT_HDR_L#	Left Header String	? PLOT_HDR_L1	Left Header Line 1
Plot Heading Center Column	PLOT_HDR_C# Set	= PLOT_HDR_C# ARG1	# - Line Number 1 - 6 ARG1: "Center Header String"	= PLOT_HDR_C2 "Center Header Line 2"	OK
	PLOT_HDR_C# Query	? PLOT_HDR_C#	Center Header String	? PLOT_HDR_C2	Center Header Line 2
Plot Heading Right Column	PLOT_HDR_R# Set	= PLOT_HDR_R# ARG1	# - Line Number 1 - 6 ARG1: "Right Header String"	= PLOT_HDR_R1 " Right Header Line 1	OK
	PLOT_HDR_R# Query	? PLOT_HDR_R#	Right Header String	? PLOT_HDR_R1	Right Header Line 2
Plot Footer Left Column	PLOT_FTR_L# Set	= PLOT_FTR_L# ARG1	# - Line Number 1 - 6 ARG1: "Left Footer String"	= PLOT_FTR_L1 "Left Footer Line 1"	OK
	PLOT_FTR_L# Query	? PLOT_FTR_L#	Left Footer String	? PLOT_FTR_L1	Left Footer Line 1
Plot Footer Center Column	PLOT_FTR_C# Set	= PLOT_FTR_C# ARG1	# - Line Number 1 - 6 ARG1: "Center Footer String"	= PLOT_FTR_C2 " Center Footer Line 2"	OK
	PLOT_FTR_C# Query	? PLOT_FTR_C#	Center Footer String	PLOT_FTR_C1	Center Footer Line 2
Plot Footer Right Column	PLOT_FTR_R# Set	= PLOT_FTR_R# ARG1	# - Line Number 1 - 6 ARG1: "Right Footer String"	= PLOT_FTR_R1 " Right Footer Line 1"	OK
	PLOT_FTR_R# Query	? PLOT_FTR_R#	Right Footer String	? PLOT_FTR_R1	Right Footer Line 1
Register Plot Key	REG_KEY_PLOT Set	= REG_KEY_PLOT ARG1	ARG1: "Plotting License Key"	= REG_KEY_PLOT "License Key"	OK
	REG_KEY_PLOT Query	? REG_KEY_PLOT	Plotting License Key	? REG_KEY_PLOT	"License Key"
			Communication Commands		

Description	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
IEEE 488 Address	488_ID Set	= 488_ID ARG1	ARG1: Address 1 - 30	= 488_ID 2	OK
	488_ID Query	? 488_ID	Address 1 - 30	? 488_ID	2
Ethernet Address Type	ETHER_ADDRESS_TYPE Set	= ETHER_ADDRESS_TYPE ARG1	ARG1: 0 - DHCP 1 - Static IP	= ETHER_ADDRESS_TYPE 0	OK
	ETHER_ADDRESS_TYPE Query	? ETHER_ADDRESS_TYPE	0 - DHCP, 1 - Static IP	? ETHER_ADDRESS_TYPE	0
TCP/IP Address	ETHERNET_ADDRESS Set	= ETHERNET_ADDRESS ARG1	ARG1: "IP Address"	= COMM_ETHERNET_ADDRESS "192.168.0.10"	OK
	ETHERNET_ADDRESS Query	? ETHERNET_ADDRESS	IP Address	? COMM_ETHERNET_ADDRESS	192.168.0.10
TCP/IP Subnet	ETHER_SUBNET Set	= ETHER_SUBNET ARG1	ARG1: "Subnet"	= ETHER_SUBNET "255.255.255.0"	OK
	ETHER_SUBNET Query	? ETHER_SUBNET	Subnet	? ETHER_SUBNET	255.255.255.0
TCP/IP Gateway	ETHER_GATEWAY Set	= ETHER_GATEWAY ARG1	ARG1: "Gateway"	= ETHER_GATEWAY "192.168.0.1"	OK
	ETHER_GATEWAY Query	? ETHER_GATEWAY	Gateway	? ETHER_GATEWAY	192.168.0.1
Register Web Key	REG_KEY_WEB Set	= REG_KEY_WEB ARG1	ARG1: "Web Server License Key"	= REG_KEY_WEB "License Key"	OK
	REG_KEY_WEB Query	? REG_KEY_WEB	Web Server License Key	? REG_KEY_WEB	"License Key"
Start/Stop Web Server	WEB_RUN Set	= WEB_RUN ARG1	ARG1: 0 - Disabled, 1 - Enabled	= WEB_RUN 1	OK
	WEB_RUN Query	? WEB_RUN	0 - Disabled, 1 - Enabled	? WEB_RUN	1
Webserver User name	WEB_NAME Set	= WEB_NAME ARG1	ARG1: "Login Name"	= WEB_NAME "User"	OK
	WEB_NAME Query	? WEB_NAME	Login Name	? WEB_NAME	User
Webserver Password	WEB_PASSWORD Set	= WEB_PASSWORD ARG1	ARG1: "Login Password"	= WEB_PASSWORD "Pass"	OK
	WEB_PASSWORD Query	? WEB_PASSWORD	Login Password	? WEB_PASSWORD	Pass
Start/Stop Ethernet Server	ETHER_RUN Set	= ETHER_RUN ARG1	ARG1: 0 - Disabled, 1 - Enabled	= ETHER_RUN 1	OK
	ETHER_RUN Query	? ETHER_RUN	0 - Disabled, 1 - Enabled	? ETHER_RUN	1
Start/Stop FTP Server	FTP_RUN Set	= FTP_RUN ARG1	ARG1: 0 - Disabled, 1 - Enabled	= FTP_RUN 1	OK
	FTP_RUN Query	? FTP_RUN	0 - Disabled, 1 - Enabled	? FTP_RUN	1
Synergy Server Enabled	SYNSRV_ENABLE Set	= SYNSRV_ENABLE ARG1	ARG1: 0 - Disabled, 1 - Enabled	= SYNSRV_ENABLE 1	OK
	SYNSRV_ENABLE Query	? SYNSRV_ENABLE	0 - Disabled, 1 - Enabled	? SYNSRV_ENABLE	1

Description	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
Synergy Server IP Address	SYNSRV_ADDR Set	= SYNSRV_ADDR "ARG1"	ARG1: String containing IP Address of the Synergy Server	= SYNSRV_ADDR "10.0.0.10"	OK
	SYNSRV_ADDR Query	? SYNSRV_ADDR		? SYNSRV_ADDR	10.0.0.10
Synergy Server Port	SYNSRV_PORT Set	= SYNSRV_PORT "ARG1"	ARG1: Port Number of the Synergy Server	= SYNSRV_PORT 80	OK
	SYNSRV_PORT Query	? SYNSRV_PORT		? SYNSRV_PORT	80
Synergy Server Registration Key	REG_SYNSRG_KEY Set	= REG_SYNSRG_KEY "ARG1"	ARG1: "Synergy Server License Key"	= REG_SYNSRG_KEY "License Key"	OK
	REG_SYNSRG_KEY Query	? REG_SYNSRG_KEY	Synergy Server License Key	REG_SYNSRG_KEY	License Key
Deliver Test Log to Synergy Server	COPYLOGTOSYNSRV Set	= COPYLOGTOSYNSRV ARG1	ARG1: 0 - Disabled, 1 - Enabled	= COPYLOGTOSYNSRV 1	OK
	COPYLOGTOSYNSRV Query	? COPYLOGTOSYNSRV	0 - Disabled, 1 - Enabled	? COPYLOGTOSYNSRV	1
Deliver Test Plot to Synergy Server	COPYPLOTTOSYNSRV Set	= COPYPLOTTOSYNSRV ARG1	ARG1: 0 - Disabled, 1 - Enabled	= COPYPLOTTOSYNSRV 1	OK
	COPYPLOTTOSYNSRV Query	? COPYPLOTTOSYNSRV	0 - Disabled, 1 - Enabled	? COPYPLOTTOSYNSRV	1
Graph Commands					
CH * Graph High Limit	G_CH*_HIGH Set	= G_CH*_HIGH ARG1	ARG1: -200 - 5000	= G_CH1_HIGH 500	OK
	G_CH*_HIGH Query	? G_CH*_HIGH	-200 to 5000	? G_CH1_HIGH	500
CH * Graph Low Limit	G_CH*_LOW Set	= G_CH*_LOW ARG1	ARG1: -200 - 5000	= G_CH1_LOW -50	OK
	G_CH*_LOW Query	? G_CH*_LOW	-200 to 5000	? G_CH1_LOW	-50
CH1 Graph Cascade High Limit	G_CAS1_HIGH Set	= G_CAS1_HIGH ARG1		= G_CAS1_HIGH 100	OK
	G_CAS1_HIGH Query	? G_CAS1_HIGH		? G_CAS1_HIGH	100
CH1 Graph Cascade Low Limit	G_CAS1_LOW Set	= G_CAS1_LOW ARG1		= G_CAS1_LOW -10	OK
	G_CAS1_LOW Query	? G_CAS1_LOW		? G_CAS1_LOW	-10
Graph Display Time	GRAPH_TIME Set	= GRAPH_TIME ARG1	ARG1: 0 - 5 Minutes 1 - 10 Minutes 2 - 20 Minutes 3 - 40 Minutes 4 - 1 Hour 5 - 2 Hours 6 - 5 Hours 7 - 10 Hours 8 - 20 Hours 9 - 40 Hours 10 - 60 Hours	= GRAPH_TIME 1	OK
	GRAPH_TIME Query	? GRAPH_TIME	0 to 10	? GRAPH_TIME	1

Description	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
Plot Timescale	PLOT_TIMESCALE Set	= PLOT_TIMESCALE ARG1	ARG1: 0 - Real Time, 1 - Relative Time	= PLOT_TIMESCALE 1	OK
	PLOT_TIMESCALE Query	? PLOT_TIMESCALE	0 - Real Time, 1 - Relative Time	? PLOT_TIMESCALE	1
			Logic Function Commands		
PWM Output Source	PWM#SRC Set	= PWM#SRC ARG1	# - A Number from 1 to 8 ARG1: 0 - Off 1 - CH1 Actual 2 - CH2 Actual 3 - CH3 Actual 4 - CH1 Setpoint 5 - CH2 Setpoint 6 - CH3 Setpoint 7 - CH1 Heat PID 8 - CH1 Cool PID 9 - CH2 Heat PID 10 - CH2 Cool PID 11 - CH3 Heat PID 12 - CH3 Cool PID 13 - CH1 Cascade Air 14 - CH2 Cascade Air 15 - CH3 Cascade Air 16 - CH1 Full PID 17 CH2 Full PID 18 - CH3 Full PID	= PWM1SRC 1	OK
	PWM#SRC Query	? PWM#SRC	0 - 18	? PWM1SRC	1
PWM High Engineering Value	PWM#ENGMAX Set	= PWM#ENGMAX ARG1	# - A Number from 1 to 8 ARG1: -200 - 5000	= PWM1ENGMAX 200	OK
	PWM#ENGMAX Query	? PWM#ENGMAX	-200 to 5000	? PWM1ENGMAX	200
PWM Low Engineering Value	PWM#ENGMIN Set	= PWM#ENGMIN ARG1	# - A Number from 1 to 8 ARG1: -200 - 5000	= PWM1ENGMIN -100	OK
	PWM#ENGMIN Query	? PWM#ENGMIN	-200 to 5000	? PWM1ENGMIN	-100
PWM High Duty Cycle	PWM#DUTYMAX Set	= PWM#DUTYMAX ARG1	# - A Number from 1 to 8 ARG1: 0% - 100%	= PWM1DUTYMAX 95	OK
	PWM#DUTYMAX Query	? PWM#DUTYMAX	0% - 100%	? PWM1DUTYMAX	95
PWM Low Duty Cycle	PWM#DUTYMIN Set	= PWM#DUTYMIN ARG1	# - A Number from 1 to 8 ARG1: 0% - 100%	= PWM1DUTYMIN 5	OK
	PWM#DUTYMIN Query	? PWM#DUTYMIN	0% - 100%	? PWM1DUTYMIN	5

Description	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
PWM Cycle Time	PWM#CYCLE Set	= PWM#CYCLE ARG1	# - A Number from 1 to 8 ARG1: 0 - 60 Seconds	= PWM1CYCLE 7	OK
	PWM#CYCLE Query	? PWM#CYCLE	0 - 60 Seconds	? PWM1CYCLE	7
ON/Off Retransmit Source	ONOFF#_SRC Set	= ONOFF#_SRC ARG1	# - A Number from 1 to 8 ARG1: 0 - Off 1 - CH1 Actual 2 - CH2 Actual 3 - CH3 Actual 4 - CH1 Setpoint 5 - CH2 Setpoint 6 - CH3 Setpoint 7 - CH1 Heat PID 8 - CH1 Cool PID 9 - CH2 Heat PID 10 - CH2 Cool PID 11 - CH3 Heat PID 12 - CH3 Cool PID 13 - CH1 Cascade Air 14 - CH2 Cascade Air 15 - CH3 Cascade Air 16 - CH1 Full PID 17 - CH2 Full PID 18 - CH3 Full PID	= ONOFF1_SRC 4	OK
	ONOFF#_SRC Query	? ONOFF#_SRC	0 - 18	? ONOFF1_SRC	4
On/Off Retransmit High Eng. Threshold	ONOFF#_ENGMAX Set	= ONOFF#_ENGMAX ARG1	# - A Number from 1 to 8 ARG1: -200 - 5000	= ONOFF1_ENGMAX 50	OK
	ONOFF#_ENGMAX Query	? ONOFF#_ENGMAX	-200 to 5000	? ONOFF1_ENGMAX	50
On/Off Retransmit Low Eng. Threshold	ONOFF#_ENGMIN Set	= ONOFF#_ENGMIN ARG1	# - A Number from 1 to 8 ARG1: -200 - 5000	= ONOFF1_ENGMIN 20	OK
	ONOFF#_ENGMIN Query	? ONOFF#_ENGMIN	-200 to 5000	? ONOFF1_ENGMIN	20
On/Off Retransmit Hysteresis	ONOFF#_HYST Set	= ONOFF#_HYST ARG1	# - A Number from 1 to 8 ARG1: -200 - 5000	= ONOFF1_HYST 5	OK
	ONOFF#_HYST Query	? ONOFF#_HYST	-200 to 5000	? ONOFF1_HYST	5
On/Off Retransmit Active State	ONOFF#_ACTST Set	= ONOFF#_ACTST ARG1	ARG1: 0 - Off, 1 - On	= ONOFF1_ACTST 1	OK
	ONOFF#_ACTST Query	? ONOFF#_ACTST	0 - Off, 1 - On	? ONOFF1_ACTST	1

Description	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
Selector Primitive Source	SELECTOR#_SRC Set	= SELECTOR#_SRC ARG1	# - Selector Primitive 1 - 8 ARG1: 110 - 1299 See Technical Manual for complete list	= SELECTOR1_SRC 1211	OK
	SELECTOR#_SRC Query	? SELECTOR#_SRC		? SELECTOR1_SRC	1211
Selector Primitive Set Point	SELECTOR#_SP Set	= SELECTOR#_SP ARG1	ARG1: -999.0 - 9999.0	= SELECTOR1_SP 25	OK
	SELECTOR#_SP Query	? SELECTOR#_SP		? SELECTOR1_SP	25
Selector Primitive Hysteresis	SELECTOR#_HYST Set	= SELECTOR#_HYST ARG1	ARG1: -999.0 - 9999.0	= SELECTOR1_HYST 1.5	OK
	SELECTOR#_HYST Query	? SELECTOR#_HYST		? SELECTOR1_HYST	1.5
Selector Primitive Function 1	SELECTOR#_FUNC1 Set	= SELECTOR#_FUNC1 ARG1	# - Selector Primitive 1 - 8 ARG1: 110 - 1299 See Technical Manual for complete list	= SELECTOR1_FUNC1 1001	OK
	SELECTOR#_FUNC1 Query	? SELECTOR#_FUNC1		? SELECTOR1_FUNC1	1001
Selector Primitive Function 2	SELECTOR#_FUNC2 Set	= SELECTOR#_FUNC2 ARG1	# - Selector Primitive 1 - 8 ARG1: 110 - 1299 See Technical Manual for complete list	= SELECTOR1_FUNC2 1003	OK
	SELECTOR#_FUNC2 Query	? SELECTOR#_FUNC2		? SELECTOR1_FUNC2	1003
Logic Primitive Function 1	LOGIC#_FUNC1 Set	= LOGIC#_FUNC1 ARG1	# - Logic Primitive 1 - 16 ARG1: 110 - 1299 See Technical Manual for complete list	= LOGIC1_FUNC1 1001	OK
	LOGIC#_FUNC1 Query	? LOGIC#_FUNC1		? LOGIC1_FUNC1	1001
Logic Primitive Function 2	LOGIC#_FUNC2 Set	= LOGIC#_FUNC2 ARG1	# - Logic Primitive 1 - 16 ARG1: 110 - 1299 See Technical Manual for complete list	= LOGIC1_FUNC2 1002	OK
	LOGIC#_FUNC2 Query	? LOGIC#_FUNC2		? LOGIC1_FUNC2	1002
Logic Primitive Function 3	LOGIC#_FUNC3 Set	= LOGIC#_FUNC3 ARG1	# - Logic Primitive 1 - 16 ARG1: 110 - 1299 See Technical Manual for complete list	= LOGIC1_FUNC3 1003	OK
	LOGIC#_FUNC3 Query	? LOGIC#_FUNC3		? LOGIC1_FUNC3	1003

Description	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
Logic Primitive Function 4	LOGIC#_FUNC4 Set	= LOGIC#_FUNC4 ARG1	# - Logic Primitive 1 - 16 ARG1: 110 - 1299 See Technical Manual for complete list	= LOGIC1_FUNC4 1004	OK
	LOGIC#_FUNC4 Query	? LOGIC#_FUNC4		? LOGIC1_FUNC4	1004
Logic Primitive Function Type	LOGIC#_TYPE Set	= LOGIC#_TYPE ARG1	# - Logic Primitive 1 - 16 ARG1: 0 - AND 1 - OR 2 - NAND 3 - NOR	= LOGIC1_TYPE 2	OK
	LOGIC#_TYPE Query	? LOGIC#_TYPE		? LOGIC1_TYPE	2
Logic Primitive Activation (ON) Delay	LOGIC#_ONT Set	= LOGIC#_ONT ARG1	# - Logic Primitive 1 - 16 ARG1: 0 - 3600 Seconds	= LOGIC1_ONT 30	OK
	LOGIC#_ONT Query	? LOGIC#_ONT		? LOGIC1_ONT	30
Logic Primitive Deactivation (OFF) Delay	LOGIC#_OFFT Set	= LOGIC#_OFFT ARG1	# - Logic Primitive 1 - 16 ARG1: 0 - 3600 Seconds	= LOGIC1_OFFT 30	OK
	LOGIC#_OFFT Query	? LOGIC#_OFFT		? LOGIC1_OFFT	30
Logic Primitive Enable when Controller Off	LOGIC#_ENA_OFF Set	= LOGIC#_ENA_OFF ARG1	# - Logic Primitive 1 - 16 ARG1: 0 - Disabled, 1 - Enabled	= LOGIC1_ENA_OFF 1	OK
	LOGIC#_ENA_OFF Query	? LOGIC#_ENA_OFF		? LOGIC1_OFFT	1
On/Off Retransmit Activation (ON) Delay	ONOFF#_ONT Set	= ONOFF#_ONT ARG1	# - On/Off Retransmit 1 - 8 ARG1: 0 - 3600 Seconds	= ONOFF1_ONT 60	OK
	ONOFF#_ONT Query	? ONOFF#_ONT		? ONOFF1_ONT	60
On/Off Retransmit Deactivation (OFF) Delay	ONOFF#_OFFT Set	= ONOFF#_OFFT ARG1	# - On/Off Retransmit 1 - 8 ARG1: 0 - 3600 Seconds	= ONOFF1_OFFT 60	OK
	ONOFF#_OFFT Query	? ONOFF#_OFFT		? ONOFF1_OFFT	60
On/Off Retransmit Enable when Controller Off	ONOFF#_ENA_OFF Set	= ONOFF#_ENA_OFF ARG1	# - On/Off Retransmit 1 - 8 ARG1: 0 - Disabled, 1 - Enabled	= ONOFF1_ENA_OFF 1	OK
Panel Lock Commands					
Panel Lock Enable	PL_ENABLED Set	= PL_ENABLED ARG1	ARG1: 0 - Unlocked, 1 - Locked	= PL_ENABLED 1	OK
	PL_ENABLED Query	? PL_ENABLED	0 - Unlocked, 1 - Locked	? PL_ENABLED	1
Panel Lock Enable On/Off Button	PL_ENABLE_ONOFF Set	= PL_ENABLE_ONOFF ARG1	ARG1: 0 - Disabled, 1 - Enabled	= PL_ENABLE_ONOFF 1	OK
	PL_ENABLE_ONOFF Query	? PL_ENABLE_ONOFF	0 - Disabled, 1 - Enabled	? PL_ENABLE_ONOFF	1

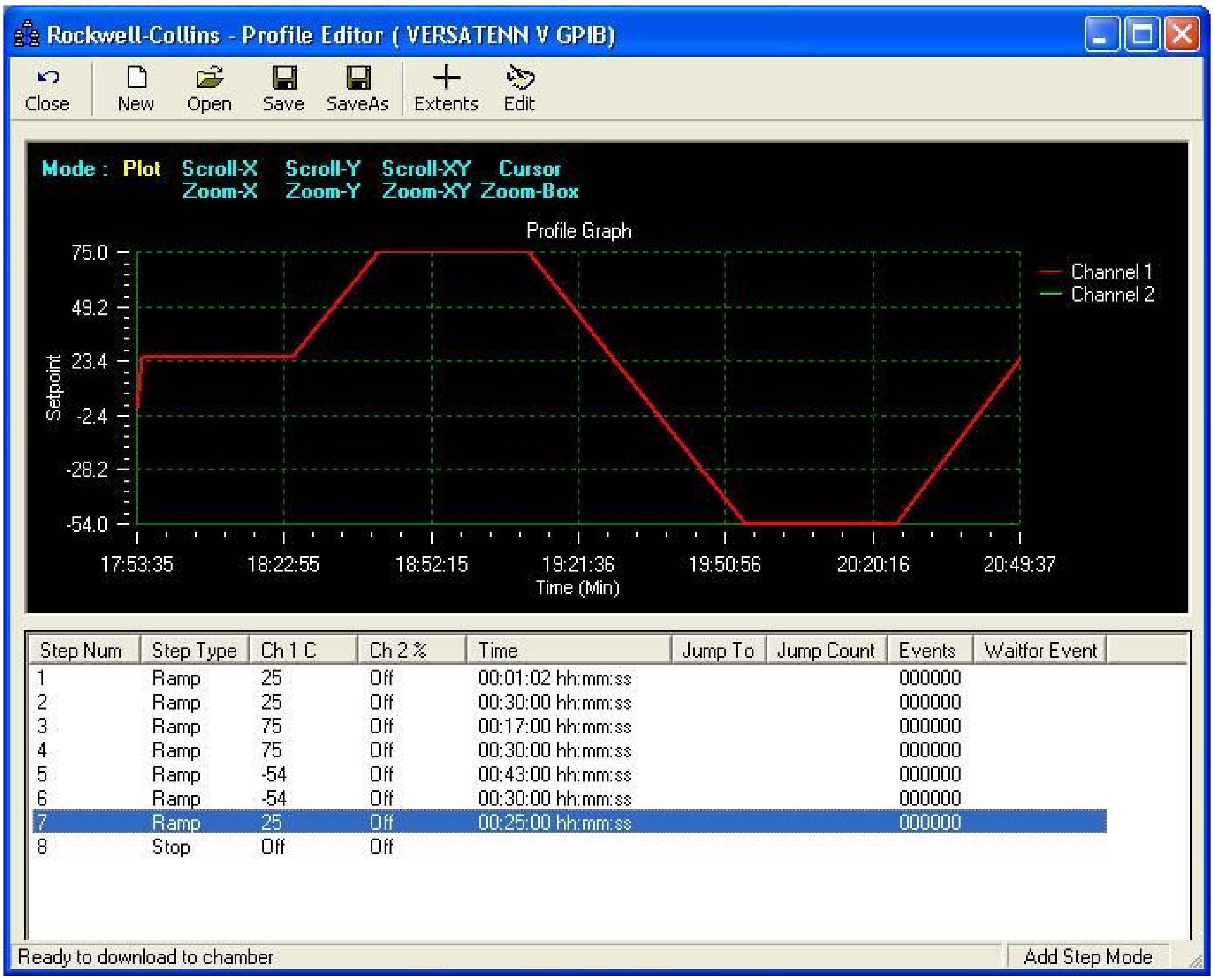
Description	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
Panel Lock Enable Screen Switching	PL_ENABLE_SCR_SWITCHING Set	= PL_ENABLE_SCR_SWITCHING ARG1	ARG1: 0 - Disabled, 1 - Enabled	= PL_ENABLE_SCR_SWITCHING 1	OK
	PL_ENABLE_SCR_SWITCHING Query	? PL_ENABLE_SCR_SWITCHING	0 - Disabled, 1 - Enabled	? PL_ENABLE_SCR_SWITCHING	1
Panel Lock Unlock Duration	PL_UNLOCK_DURATION Set	= PL_UNLOCK_DURATION ARG1	ARG1 - 0 - 60 Seconds	= PL_UNLOCK_DURATION 30	OK
	PL_UNLOCK_DURATION Query	? PL_UNLOCK_DURATION	0 - 60 Seconds	? PL_UNLOCK_DURATION	30
Panel Lock Admin Password	PL_ADMIN_PASS Set	= PL_ADMIN_PASS Arg1	ARG1: "Admin Password"	= PL_ADMIN_PASS "Admin"	OK
	PL_ADMIN_PASS Query	? PL_ADMIN_PASS	Admin Password	? PL_ADMIN_PASS	Admin
Panel Lock Maintenance Password	PL_MAINT_PASS Set	= PL_MAINT_PASS Arg1	ARG1: "Maintenance Password"	= PL_MAINT_PASS "Maint"	OK
	PL_MAINT_PASS Query	? PL_MAINT_PASS	Maintenance Password	? PL_MAINT_PASS	Maint
Panel Lock Engineer Password	PL_ENG_PASS Set	= PL_ENG_PASS Arg1	ARG1: "Engineer Password"	= PL_ENG_PASS "Eng"	OK
	PL_ENG_PASS Query	? PL_ENG_PASS	Engineer Password	? PL_ENG_PASS	Eng
Panel Lock Operator Password	PL_OPER_PASS Set	= PL_OPER_PASS Arg1	ARG1: "Operator Password"	= PL_OPER_PASS "Oper"	OK
	PL_OPER_PASS Query	? PL_OPER_PASS	Operator Password	? PL_OPER_PASS	Oper
Panel Lock Setup Screen Access	PL_SETUP_SCR Set	= PL_SETUP_SCR ARG1	ARG1: - Access to screen when locked 0 - Administrator can access screen 1 - Maintenance can access screen 2 - Engineer can access screen 3 - Operator can access screen 4 - No one can access screen	= PL_SETUP_SCR 4	OK
	PL_SETUP_SCR Query	? PL_SETUP_SCR	Setup Screen Access	? PL_SETUP_SCR	4
Panel Lock Maintenance Screen Access	PL_MAINT_SCR Set	= PL_MAINT_SCR ARG1	ARG1:same as Panel Lock Setup Screen Access	= PL_MAINT_SCR 4	OK
	PL_MAINT_SCR Query	? PL_MAINT_SCR	Maintenance Screen Access	? PL_MAINT_SCR	4
Panel Lock Communications Screen Access	PL_COMM_SCR Set	= PL_COMM_SCR ARG1	ARG1:same as Panel Lock Setup Screen Access	= PL_COMM_SCR 4	OK
	PL_COMM_SCR Query	? PL_COMM_SCR	Communications Screen Access	? PL_COMM_SCR	4
Panel Lock Program Screen	PL_PROG_SCR Set	= PL_PROG_SCR ARG1	ARG1:same as	= PL_PROG_SCR 4	OK

Description	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
Access	PL_PROG_SCR Query	? PL_PROG_SCR	Panel Lock Setup Screen Access	? PL_PROG_SCR	4
Panel Lock Run Screen Access	PL_RUN_SCR Set	= PL_RUN_SCR ARG1	ARG1:same as	= PL_RUN_SCR 4	OK
	PL_RUN_SCR Query	? PL_RUN_SCR	Panel Lock Setup Screen Access	? PL_RUN_SCR	4
Panel Lock Events Screen Access	PL_EVENTS_SCR Set	= PL_EVENTS_SCR ARG1	ARG1:same as	= PL_EVENTS_SCR 4	OK
	PL_EVENTS_SCR Query	? PL_EVENTS_SCR	Panel Lock Setup Screen Access	? PL_EVENTS_SCR	4
Panel Lock Graph Screen Access	PL_GRAPH_SCR Set	= PL_GRAPH_SCR ARG1	ARG1:same as	= PL_GRAPH_SCR 4	OK
	PL_GRAPH_SCR Query	? PL_GRAPH_SCR	Panel Lock Setup Screen Access	? PL_GRAPH_SCR	4
Panel Lock Main Screen Access	PL_MAIN_SCR Set	= PL_MAIN_SCR ARG1	ARG1:same as	= PL_MAIN_SCR 4	OK
	PL_MAIN_SCR Query	? PL_MAIN_SCR	Panel Lock Setup Screen Access	? PL_MAIN_SCR	4
			RAMPING COMMANDS		
Ramp Setpoint Target	SP#TARGET Query	? SP#TARGET	# - Channel 1 - 4	? SP1TARGET	25.0
Setpoint Ramp Enabled	RAMP#EN Set	= RAMP#EN ARG1	# - Channel 1 - 4 ARG1: 0 - Disabled, 1 - Enabled	= RAMP1EN 1	OK
	RAMP#EN Query	? RAMP#EN		? RAMP1EN	1
Setpoint Ramp Rate	RAMP#RATE Set	= RAMP#RATE ARG1	# - Channel 1 - 4 ARG1: 0 - 500 units	= RAMP1RATE 1.5	OK
	RAMP#RATE Query	? RAMP#RATE		? RAMP1RATE	1.5
Setpoint Ramp Query Response	RAMP#QRY Set	= RAMP#QRY ARG1	# - Channel 1 - 4 ARG1: 0 - Instantaneous, 1 - Target	= RAMP1QRY 1	OK
	RAMP#QRY Query	? RMP#QRY		? RAMP1QRY	1
			END		

17.3 Profile Creation and Control Commands

The Synergy Controller supports over 160 commands for remote control and monitoring. These commands include remote program creation, remote program save and remote program recall as well as program control. This application note describes the commands you can use to programmatically create a profile on the Synergy Controller, save it and run it.

The profile used for this example is shown below in the Synergy Manager Profile Editor.



This example refers to the National Instruments IEEE 488 write syntax, specifically ibwrt, but Ethernet and RS-232 communications can be used as well.

Create a profile on the controller:

```
1.   ibwrt("= FileNew 0")
2.   ibrd("OK.")
3.   ibwrt("= VTVINFO 1 0 0 0")
4.   ibrd("OK.")
5.   ibwrt("= STP 2 1 0 250.0 -10000 0 10 20 0 0 0 0 0 0 0 0 -10000")
6.   ibrd("OK.")
7.   ibwrt("= STP 2 2 0 250.0 -10000 0 300 0 0 0 0 0 0 0 0 0 -10000”
8.   ibrd("OK.")
9.   ibwrt("= STP 2 3 0 750.0 -10000 0 170 0 0 0 0 0 0 0 0 0 -10000”)
10.  ibrd("OK.")
11.  ibwrt("= STP 2 4 0 750.0 -10000 0 300 0 0 0 0 0 0 0 0 0 -10000")
12.  ibrd("OK.")
13.  ibwrt("= STP 2 5 0 -540.0 -10000 0 430 0 0 0 0 0 0 0 0 0 -10000")
14.  ibrd("OK.")
15.  ibwrt("= STP 2 6 0 -540.0 -10000 0 300 0 0 0 0 0 0 0 0 0 -10000")
16.  ibrd("OK.")
17.  ibwrt("= STP 2 7 0 250.0 -10000 0 250 0 0 0 0 0 0 0 0 -10000"
18.  ibrd("OK")
19.  ibwrt("= STP 2 8 4 0"
20.  ibrd("OK.")
```

Save the profile on the controller as "rockwell-collins".

```
21.  ibwrt("= FileSave 0 "rockwell-collins")    //Saves to Storage card
22.  ibrd("OK")
```

Open the profile on the controller as "rockwell-collins".

```
23.  ibwrt("= FileOpen 1 "rockwell-collins")    //1 on the console
```

Stop a profile but keep the chamber running.

```
24.  ibwrt("= StopHold")
```

Run the profile on the controller starting with Step 2.

```
25.  ibwrt("= RunFrom 2")
```

Synergy Controller Step Syntax.

Program Step	STP	STP	= STP File # Step # STEPTYPE ARG4 ARGn	= STP 1 1 0
SETPOINT	N/A	See Steptype	ARG4 ARG5 ... ARG30	ARG4 = CH1 SP ARG5 = CH2 SP ARG6 = Ramp Hours ARG7 = Ramp Minutes ARG8 = Ramp Seconds ARG9 - 14 = Event 1 - 6 ARG15 - 16 = 0 ARG17 = CH3 SP ARG18 - 27 = 0 ARG28 = LEV1 ARG29 = LEV2 ARG30 = OT11

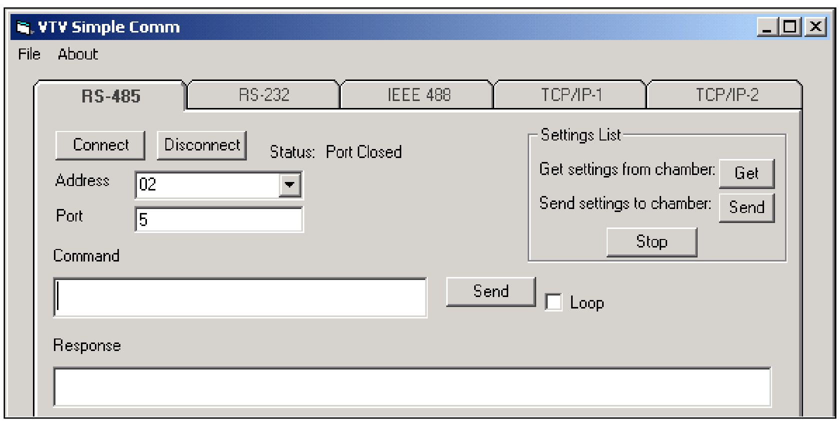
17.4 Software Applications and Networks

Tidal Engineering has developed several software packages designed to work with environmental chambers over various communication protocols. Section 8.3 Communications: Software Applications introduces these software packages and illustrates several methods for configuring communication networks.

17.4.1 SimpleComm Communications Software

The Tidal Engineering SimpleComm application is an all in one communications package designed to be used with Synergy Controller environmental chambers. It provides a simple terminal interface for sending and receiving commands over: RS-485, RS-232, IEEE 488 and TCP/IP.

The Synergy Controller supports over 130 unique commands, allowing for complete control and monitoring of your chamber from a remote location. You can find the Synergy Controller command set at the beginning of this section or on the Tidal Engineering website www.tidalengineering.com. Navigate to the Synergy Controller page and look under the general information section for the Synergy Controller Communications Commands PDF file. The Communications Command Set is a table of all the available communication commands. The source code for the SimpleComm utility is also available on the web site for users who would like to develop their own Visual Basic based communications programs. The source files are located on the Synergy Controller page and are linked to under the Downloads section.



Installing SimpleComm

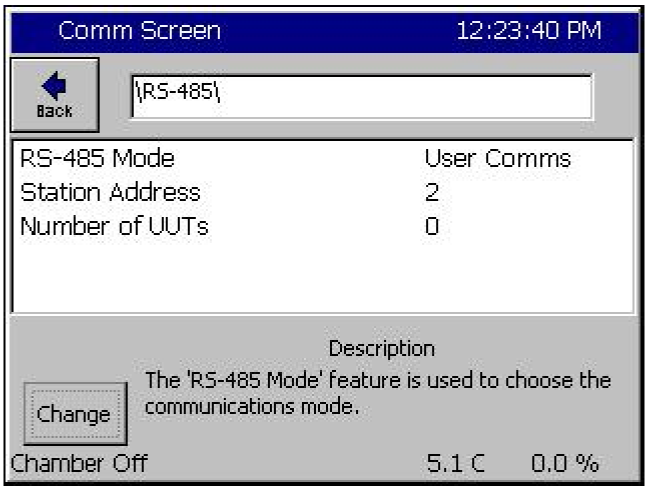
Insert the setup disk in the CD drive of your PC. Through your windows explorer, find the D drive (where D is your CD drive) and double click on the setup.exe file. Alternatively, you may select Start / Run from your desktop. Type “D:\setup” and hit Enter. Follow the directions on the screen.

Connecting SimpleComm

The method of connection depends on the desired mode of communications. RS-485 and RS-232 use serial cables, IEEE 488 uses a 488 cable and TCP/IP used network cables such as CAT5. .

RS-485
To communicate over RS-485, plug a serial cable into the serial port on your PC and connect the other end to the serial port on the chamber.

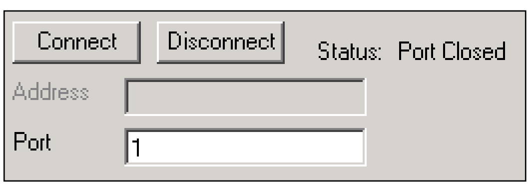
On the SimpleComm, select the RS-485 tab and set the port number to the same port number specified on your PC. To determine the port settings on the PC, go to Start/Settings/System, select the hardware tab, select Device Manager and expand the Ports icon.



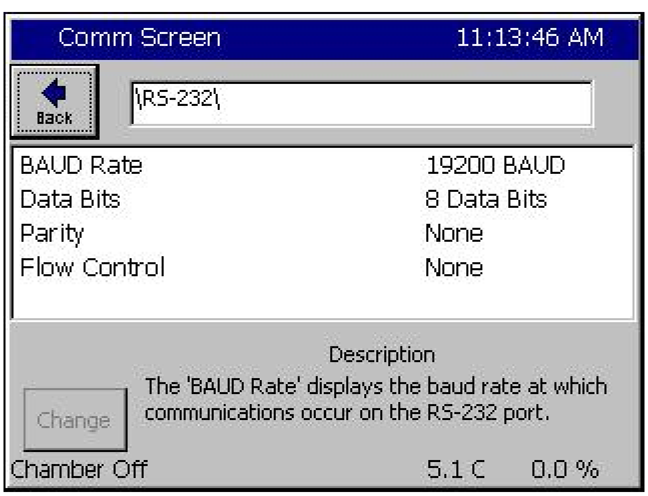
The Synergy Controller's RS-485 port settings are hard-coded to: 9600 baud rate, no parity, 8 data bits and 1 stop bit. Next, set SimpleComm's 485 address to the same address as the Synergy Controller. The RS-485 Mode must be set to User Comms, if it reads UUT Sensors, change the setting.

Once the settings are complete, press the SimpleComm's **Connect** button. The status label will read: port open.

RS-232
To communicate over RS-232, plug a serial cable into your PC and connect the other end to the serial port on the chamber.



On the SimpleComm, select the RS-232 tab and set the port number to the same port number specified on your PC. To determine the port settings on the PC, go to Start/Settings/System, select the hardware tab, select Device Manager and expand the Ports icon.

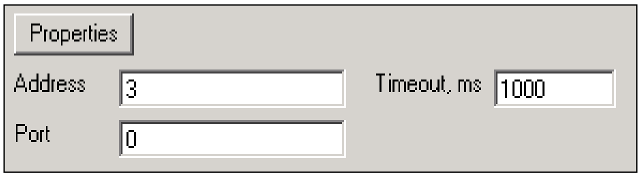


The Synergy Controller's RS-232 port settings are hard-coded to: 19200 baud rate, no parity, 8 data bits and 1 stop bit. RS-232 does not need address settings.

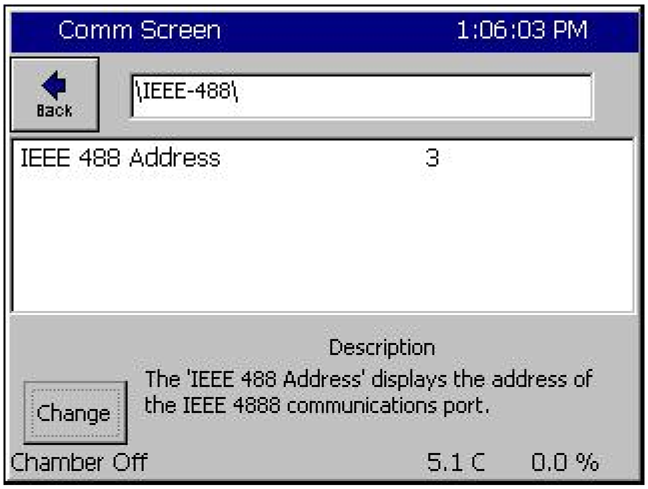
Once the settings are complete, press the SimpleComm's **Connect** button. The status label will read: port open.

IEEE 488

To communicate over IEEE 488, you will need an IEEE 488 communications card installed in your PC and an a IEEE 488 cable connected between the chamber and the PC.

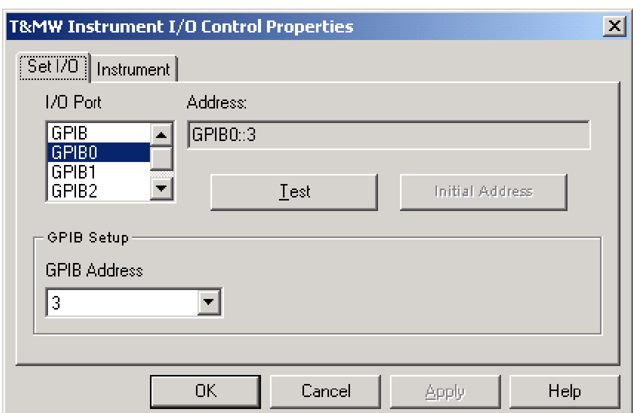


In the SimpleComm Utility, select the IEEE 488 tab and set the port number to the same port number specified on your GPIB controller.

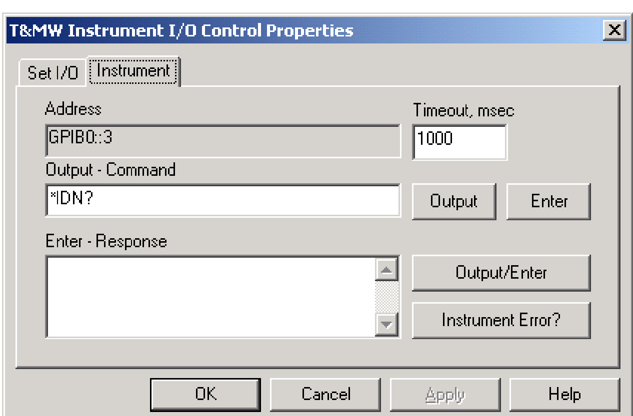


Next, set SimpleComm's 488 address to the address of the Synergy Controller.

The default Timeout is set to 1 second (1000 ms). The default sample rate for the IEEE 488 is 4 times per second. SimpleComm will query the chamber 4 times per second until the timeout period is reached. IEEE 488 has no connect buttons; connections are made on an as needed basis. If a communication attempt fails, a text box message will notify the user of the error.



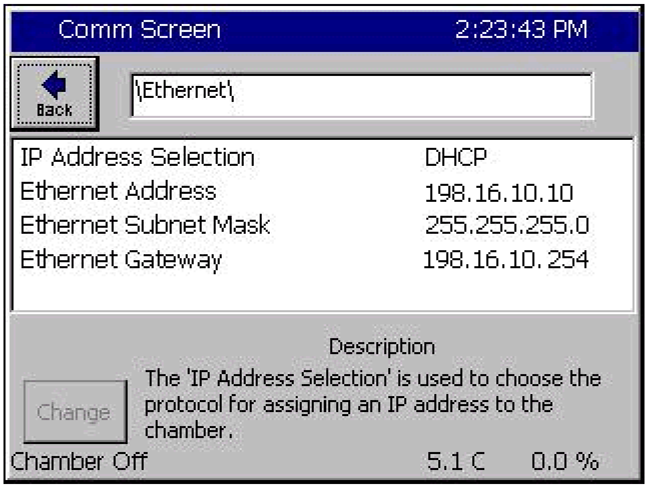
To view IEEE specific controls in the SimpleComm utility, press the **Properties** button. From this window you may view and set the GPIB port and address.



You can test the IEEE connection by pressing the Test button. This test sends the *IDN? Command to the Synergy Controller. The response will be displayed in the response test box. If there is no response it will display an error message.

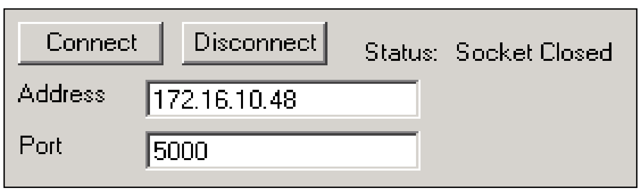
TCP/IP

To communicate over TCP/IP, connect your PC to your LAN. You must also connect your chamber to your LAN. The Synergy Controller either requires a DHCP router to dynamically assign it an IP address or your network administrator can assign you an available Static IP Address.

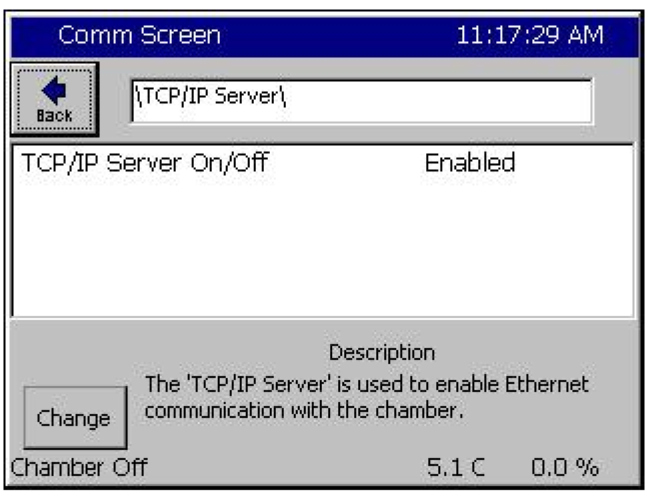


Once assigned, the IP Address will appear in the Ethernet folder of the Synergy Controller.

Note: The numbers shown are examples only.



Set SimpleComm's IP Address to the address displayed on the Synergy Controller. The port for the chamber is 5000; always set SimpleComm's port to 5000.



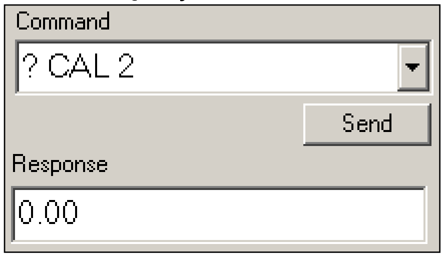
To enable the TCP/IP communications on the chamber, go to the TCP/IP Server folder and set it to Enabled.

Once the settings are complete, press SimpleComm's Connect button. Upon successful connections the status label will read "Socket Connected".

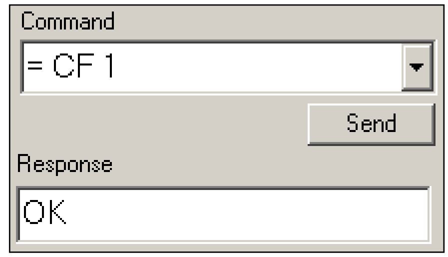
Sending and Receiving Commands

To send individual commands using the SimpleComm utility first confirm that you are connected. Next type the command into the Command text box, then either hit Enter or press the Send button. The reply from the chamber will be displayed in the Response text box. All query commands should be preceded by a "?" and all set commands are preceded with an "=".

Query Command



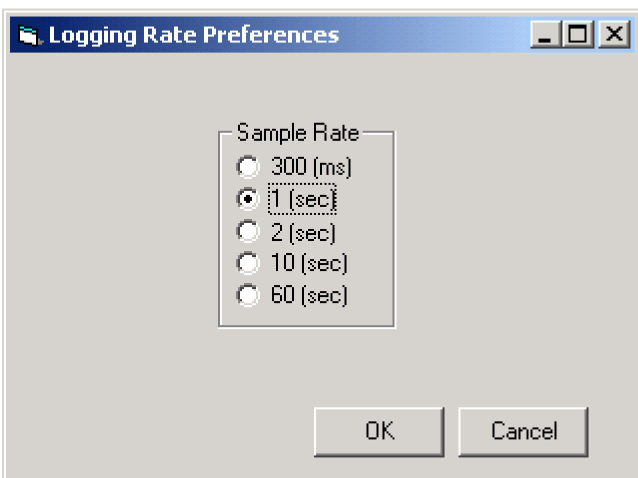
Set Command



The RS-485 commands require an address. Commands over RS-485 are preceded by a greater than symbol and the address, ">02 ? CAL2" and all responses are similarly preceded, "<02 0.00". SimpleComm automatically formats RS-232 command so the operator can simply enter the basic command string. SimpleComm automatically prefixes both the address to the text entered in the Commands text box and strips the address from the text it displays in the Response text box.

Sending and Receiving Command Loops

To send an individual command multiple times, such as when monitoring the temperature "? C1", select the Loop check box shown in the preceding image. The command string will be sent once a second as long as the loop box remains checked. The response box will display each reply as it is received.



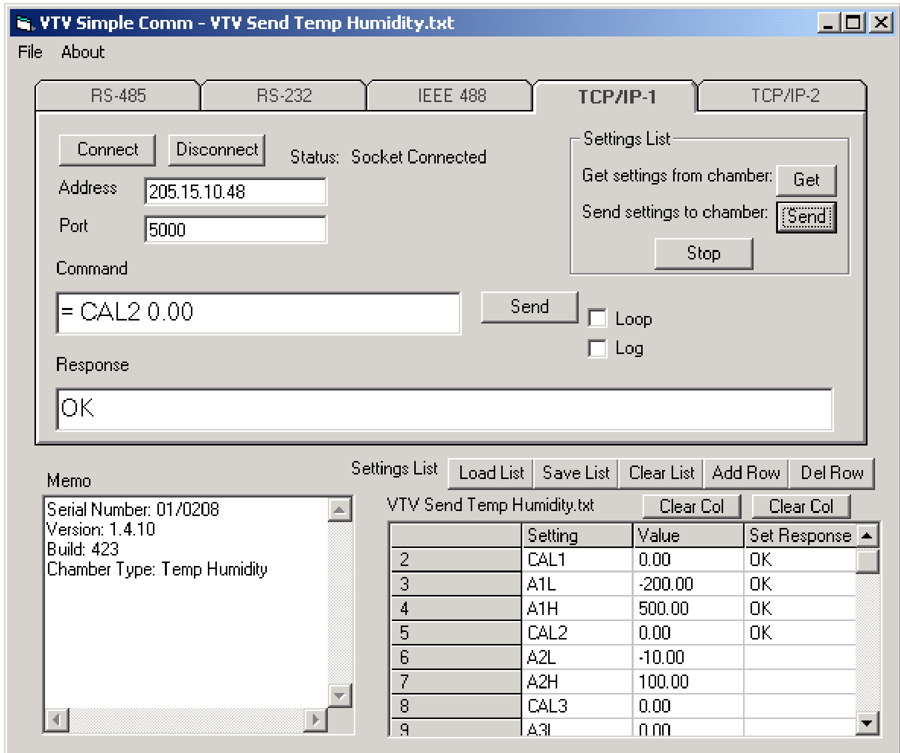
To change the sample rate, select File from the file menu and then select Preferences. Select the sample rate you desire and press OK. The default sample rate is 1 second.

TCP/IP has an additional logging feature that logs all responses to the looped queries to a file called log.txt. It is located in the SimpleComm's root directory. Neither looping nor logging will function while you are sending or getting a Settings List.

Settings Lists

Settings Lists are snapshots of a chamber's current configuration. They can be used to set a chamber to a pre-configured state. If you have multiple chambers and would like them all set to the same state, you can configure one chamber and get all its parameter values and save them to a Settings List. You can then use this list to send these values up to the other chambers, quickly setting them all to the same configuration. Settings Lists are simple text files and can be edited in notepad if desired. Commented lines must be preceded by a double back-slash. When loaded, the comments will be displayed in the Memo field.

Note that the Config Save and Restore feature in the Synergy Controller Maintenance/File Utility folder can produce a settings list as well. See the Maintenance folder for more information.



Loading, Editing and Saving Lists

To open a Settings List press the Load List button. Select a file and press OK. The name of the loaded file is displayed on the title bar. The contents of the list appear in the Settings List data grid. The Settings column holds the commands. The Value column holds the values for the commands. The Set Response column holds the chamber's responses from set commands.

To edit an item in the list, double click on the cell. The text is displayed in bold font when it is editable. Type in your changes then hit Enter. If you don't press Enter your changes will not be saved. If you need to add a row to the end of the list, press the Add Row button. If you need to delete a row from the list, select the row and press the Del Row button. You can add to the Memo field by clicking in the Memo box and typing additional lines.

You can clear the entire list, including commands, by pressing the Clear List button. Alternatively you can clear selected columns by pressing the Del Col button. When you are done editing the Settings List, save it by pressing the Save List button.

Retrieving Data

To retrieve the current configuration of a chamber, load a Settings List that contains the applicable set of commands. The commands do not require the query "?" or set "=" operators. Once loaded, clear the Value and Set Response columns if necessary. Make sure you are connected and press the Get button. SimpleComm will query the chamber one command at a time until it has gone through the entire list. After each query is sent to the chamber, SimpleComm will wait until it receives a response before moving on to the next query. As each response arrives it is placed in the corresponding cell in the Value column. When the entire list has been transferred a popup window will state that the transfer is complete.

Get Settings Example:

\\Serial Number: 06/0201
\\Version: 1.4.10
CF
CAL1
A1L

Sending Data

To send a saved configuration to a chamber, load a Settings List. Once loaded, clear the Value and Set Response columns if necessary. Make sure you are connected and press the Send button. SimpleComm will send the chamber one command and value at a time until it has gone through the entire list. After each set command is sent to the chamber, SimpleComm will wait until it receives an OK response before trying to send the next value. As each OK response arrives it is placed in the corresponding cell in the Set Response column. When the entire list has been transferred a popup window will state that the transfer is complete.

Send Settings Example:

```
\\Serial Number: 06/0201
\\Version: 1.4.10
CF 0
CAL1 0.00
A1L 200.00
```

If you need to stop the data transfer process while it is actively sending and receiving data, press the Stop button.

Important Note:

Make sure that you always have the chamber set to the same temperature units for downloading and uploading operations. If you download from a chamber in Centigrade mode, then upload to a chamber that is in Fahrenheit, you will have numerous incorrect settings.

Visual Basic Source Code

Tidal Engineering provides the source code for the SimpleComm as a reference guide for developers. We recommend that you use Visual Basic 6.0 or higher and Windows 7 or higher.

Before you install the source code, you must install the SimpleComm application, which contains a TMW GPIB component that is needed to run the program in Visual Studio. To install the source code, download the files from the Tidal Engineering web site. Double click on the Setup.exe file and follow the installation directions. Start Visual Studio and open the Visual Basic Project file: SimpleComm.vbp. The source code and forms are fully editable.

Communications Source Code

There are several key selections of code that form the backbone of communication over serial ports, TCP/IP and GPIB. The selections are discussed below and are broken into three areas: Settings & Connecting, Sending Data and Receiving Data. These sections of code can be cut and pasted into your own programs, thus adding quick and simple communication routines to your applications.

Visual Basic Code: Setting & Connecting

Setting & Connecting with RS 232 & RS 485

```
'If you're not connected, then connect
If (Not MSComm1(Index).PortOpen) Then
    ' Set the Comm Port number to the value in the Comm Port text box
    MSComm1(Index).CommPort = Val(txtPort(Index).Text)
    ' Set Baud Rate and Parity
    MSComm1.Settings = "9600,N,8,1" 'RS 485
    MSComm1.Settings = "19200,N,8,1" 'RS 232
    ' Open the port
    MSComm1(Index).PortOpen = True
    MSComm1(Index).InputLen = 0
    MSComm1(Index).RThreshold = 1
End If
```

Setting & Connecting with GPIB

```
' Set the timeout to the value in the timeout box (milliseconds)
TMWControl1.TimeOut = Trim(Str(Val(txtTimeout488.Text)))
' Set the address to the value in the address box final address will appear as: GPIB0::1::INSTR
TMWControl1.address = "GPIB" & Trim(Str(Val(txtPort(Index).Text))) & "::" &
Trim(Str(Val(txtAddress(Index).Text))) '& "::INSTR"
```

Setting & Connecting with TCP/IP

```
' If you're not connected, then connect
If tcpClient1.State <> sckConnected Then
    ' IP address "###.###.###.###" Set the address to the value in the address box
    tcpClient1.RemoteHost = txtAddress(Index).Text
    ' Set the port to the value in the port box
    tcpClient1.RemotePort = txtPort(Index).Text
    ' Close it first – just in case
    While tcpClient1.State <> sckClosed
        tcpClient1.Close
    Wend
    ' Connect
    tcpClient1.Connect
End If
```

Visual Basic Code: Sending

Sending with Serial Ports

```
‘ If your not connected, tell the user
If (Not MSComm1(Index).PortOpen) Then
    MsgBox ("The RS 485 port is not connected.  Please connect and try again.")
End If
' Clear buffer
a$ = MSComm1(Index).Input
txtIn(Index).Text = ""
‘ Send the command in the command text box
MSComm1(Index).Output = txtOut(Index).Text & vbCr
' The 485 send requires a ">" and the address such as "02" in the string.  Use:
‘ MSComm1(Index).Output = ">" & cboAddress485.Text & " " & txtOut.Text & vbCr
```

Sending with GPIB

```
‘ Create a global variable to hold a timer counter
Global GPIBResult as Integer
‘ Send the command in the command text box
TMWControl1.Output (txtOut(Index).Text & vbCr)
```

Sending with TCP/IP

```
' If tcp/ip1 is not connected, close it and tell the user
If tcpClient1.State <> sckConnected Then
    'IP address "###.###.###.###"
    ‘ Set the address to the value in the address box
    tcpClient1.RemoteHost = txtAddress(Index).Text
    ‘ Set the port to 5000
    tcpClient1.RemotePort = 5000
    While tcpClient1.State <> sckClosed
        tcpClient1.Close
    Wend
    MsgBox ("TCP/IP1 is not connected.  Please connect and try again.")
End If
' If tcp/ip1 is connected,
‘ Send the command in the command text box
If tcpClient1.State = sckConnected Then
    tcpClient1.SendData txtOut(Index).Text & vbCr
End If
```

Visual Basic Code: Receiving

Receiving with Serial Ports

```
‘ MSComm1 is the name of the Microsoft Comm component
Private Sub MSComm1_OnComm(Index As Integer)
	Select Case MSComm1(Index).CommEvent
	Case comEvSend			' SThreshold # of characters in transmit buffer.
	Case comEvEOF			' An EOF character was found in the input stream
	Case comEvReceive		‘ Received RThreshold # of chars
		‘ Receive the data and write the result in the response text box
		txtIn(Index).Text = txtIn(Index) & MSComm1(Index).Input
	End Select
End Sub
```

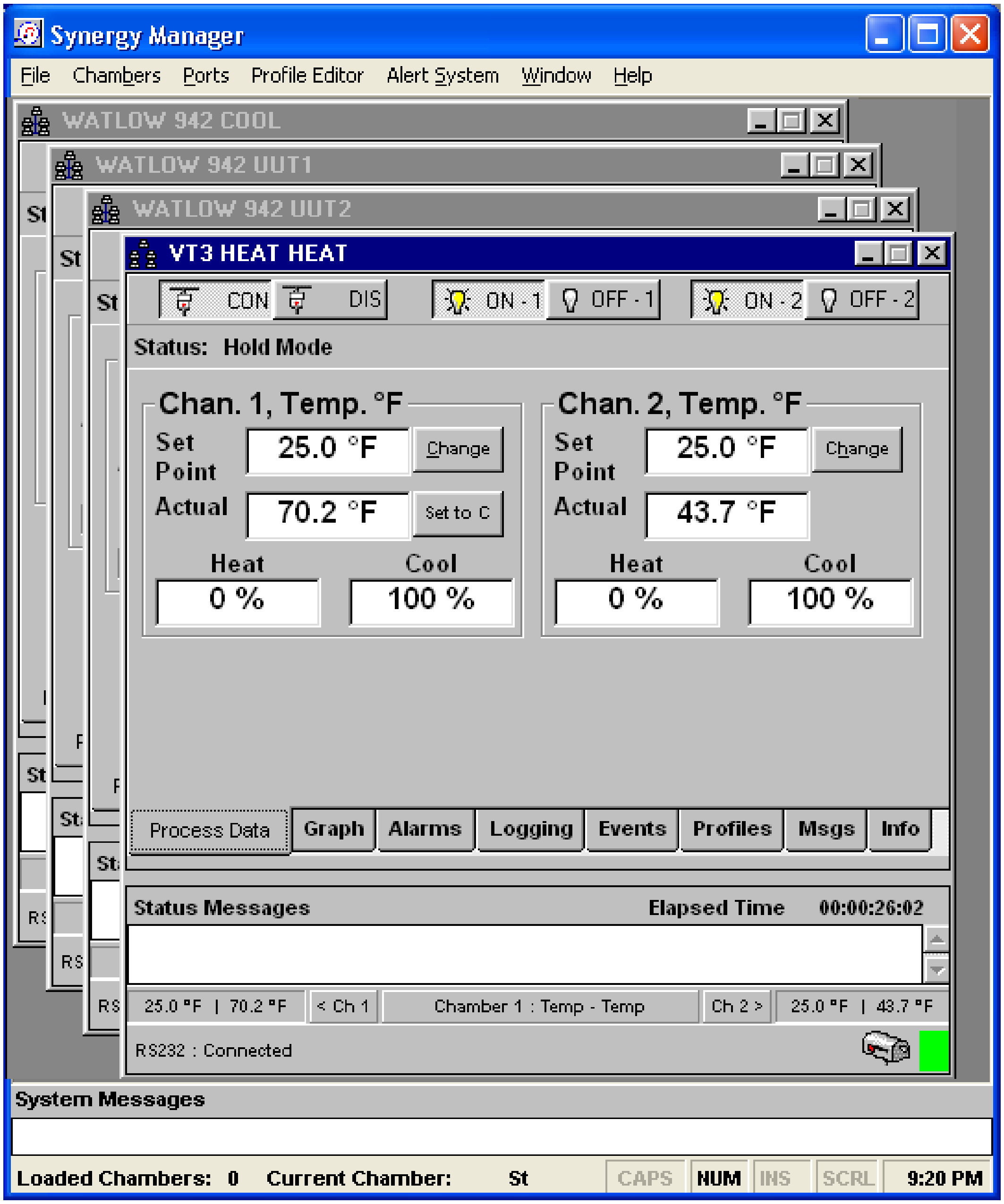
Receiving with GPIB

```
	' The GPIB control has no receive event, it must be queried for a response.
	' timerGPIB counts down from 2 to 0, decrementing in the Timer1 function.
	‘ Timer1 fires every 250 milliseconds This allows us to check for a response 4 times a second.
	timerGPIB = 2
	GPIBResult = "" 'tracks GPIB reply - see Timer1 function
	' While loop will exit after receives a reply or times out - see Timer1 function
	While timerGPIB > 0
		DoEvents
	Wend
	‘ If we don’t receive a reply in 1 second, time out
	If GPIBResult = "" Then 'no reply
		txtIn(Index).Text = "Timeout: " & TMWControl1.TimeOut/1000 & "seconds."
	Else	‘ Write the reply to the response text box
		txtIn(Index).Text = GPIBResult 'GPIB value
	End If

	‘--- Timer1 function: fires every 250 ms ---
	‘ Timer1 queries 4 times per second and jumps out of while loop once every 1 second
	If timerGPIB > 0 Then
		' Check for a response to the previous Send query
		TMWControl1.Enter result$
		' If we receive a result we break the previous Do Events loop
		If result$ <> "" Then
			‘Set global variable to response value
			GPIBResult = result$
			timerGPIB = 0
			‘ Breaks out of previous While loop and records response
		Else
			' Increment timerGPIB
			timerGPIB = timerGPIB – 1
		End If
	End If
```

Receiving with TCP/IP

```
‘ tcpClient1 is the name of the Microsoft TCP Client component
Private Sub tcpClient1_DataArrival(ByVal bytesTotal As Long)
	Dim strData As String
	' Get data
	tcpClient1.GetData strData
	‘ Write the response in the response test box
	txtIn(3).Text = Replace(strData, vbCrLf, "", 1, -1, vbBinaryCompare)
End Sub
```

17.4.2 Synergy Manager, Chamber Control Software for Desktop PC



Introduction

Synergy Manager is a software application designed for the Microsoft Windows™ family of PC Operating Systems. Synergy Manager utilizes a Multi-Document Interface (MDI) familiar to Windows™ software applications so multiple Environmental Chamber Windows can be opened simultaneously. Synergy Manager provides centralized remote programming, monitoring and control of multiple controllers simultaneously. Synergy Manager supports several process controllers including the Synergy Controller.

This section covers the capabilities of the Synergy Manager and describes the installation process. For a detailed user manual contact Tidal Engineering Corporation or download the User Manual from Tidal Engineering at www.tidaleng.com. Application upgrades and the latest manuals can be downloaded from the site.

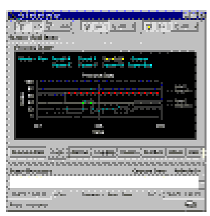
The major features provided by Synergy Manager are:

- Interactive remote control and monitoring.
- Alarm reporting and notification via Email or Fax.
- User-friendly profile program editor.
- Controller specific profile download.
- Importing and exporting of Synergy Controller profiles via USB Hard Disk
- Logging, printing and graphing of process data, and External UUT process Data (Synergy Controller only).
- Exporting of logging history data via an ASCII comma separated values (CSV) file for easy import into Microsoft Excel or any analysis package that accepts comma separated values (CSV) file format.
- Displays user manual via the Synergy Manager Help menu utilizing Acrobat software.
- Supports up to sixteen (16) standard PC serial ports (ports must be recognized by supported OS and contiguous (1 thru 16)).
- Software protection via external hardware Rev. 1.20 and higher (See 'External Hardware Dongle Key').

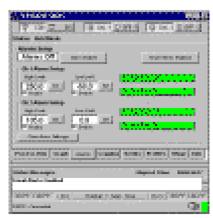
Data Control & Observation

Each individual chamber control window has eight data tabs at the bottom. Each of these tabs covers a different category of data control and observation. As a collection, the eight data tabs present a complete, real-time, view of the state of each chamber.

Process Data



Graph

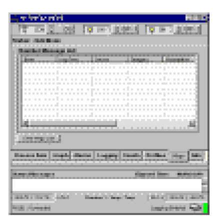


Alarms

Logging

Events

Profiles

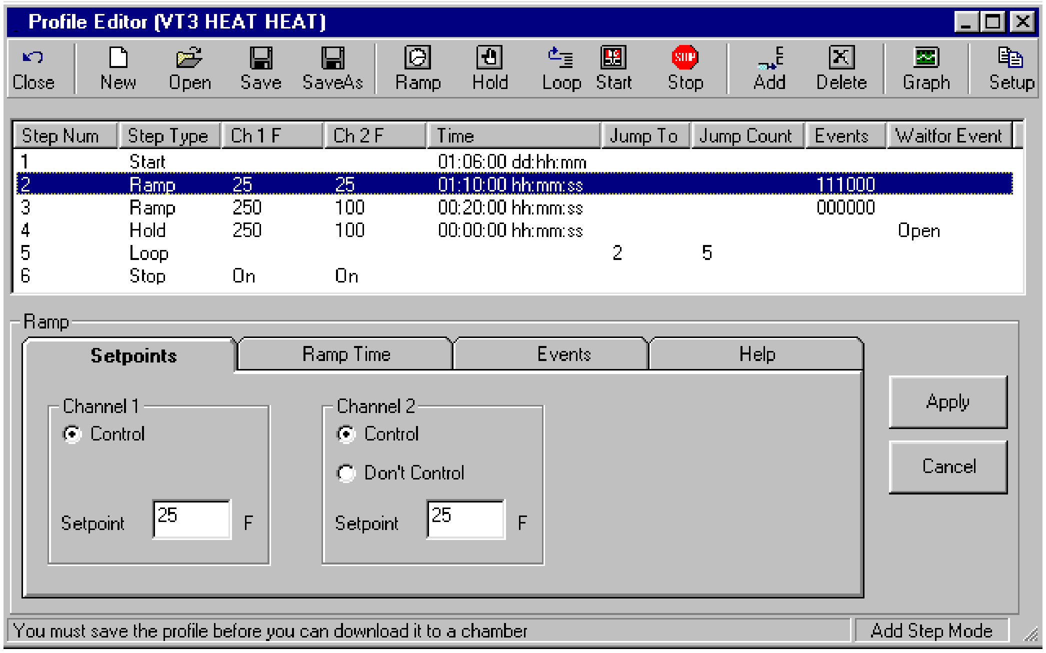


Messages

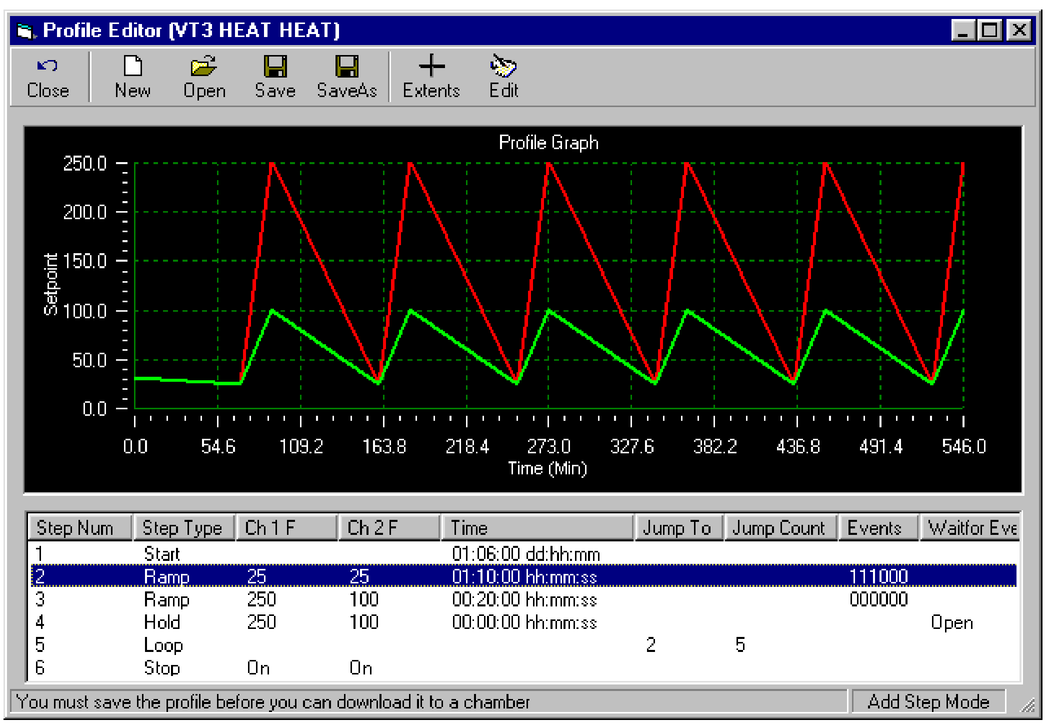
Information

- **Process Data** - displays setpoints and actual temperature and humidity data.
- **Graphs** - displays setpoint and actual temperature and humidity data on a line graph.
- **Alarms** - sets and monitors process alarms such as maximum allowed temperatures.
- **Logging** - logs setpoint and actual temperature and humidity data and PID values to a text file.
- **Events** - displays status of events, dipswitch settings and logical inputs.
- **Profiles** - allows users to create and download test profiles to a chamber.
- **Messages** - displays a list of all application and chamber error messages.
- **Info** - displays diagnostic chamber and communication protocol data and settings.

Profile Editor: Write profiles once and run anywhere



With Synergy Manager, users can create test profiles directly on their PC. LED based controllers are often difficult to use for test profile creation. Their limited display capabilities lead to cryptic labels and confusing navigation. Using the Synergy Manager's graphic windows interface simplifies the test profile creation process. Every step is clearly displayed in one window. Step creation and data editing is one mouse click away. Profiles are generic and may be downloaded to any of the supported chambers. The Synergy Controller can load profiles created by Synergy Manager via any supported communications method or through a USB Hard Disk. After creating a test profile in the Profile Editor, you can view it in graph format by pressing the Graph button. The resulting graph displays the entire test run, including jump loops. With graphical analysis you can more clearly see exactly what your profile will do.



Email and Fax Alert System

In addition to monitoring and control, the Synergy Manager employs a highly configurable Alert Notification System. Once enabled, any specified recipients are notified of all errors and alarms via email or fax.

The alarms are separated into eight categories. The user can assign a different priority to each category. For example, you might want all chamber alarms to have a high priority and be emailed immediately upon the sounding of the alarm. However, for communications errors that may be caused by transient noise on the line, you may want to have set as a low priority. All low priority errors would then be compiled in a general report that is mailed out once a week. The exact definition of each priority level is also user definable: high, medium or low priority items can be specified as sent immediately, once an hour, once a day or once a week, at any specified time.

Hardware Requirements

The minimum hardware requirements for Synergy Manager are as follows:

- A Pentium 233 MHz or better
- 128 MB ram plus 32 MB for each simultaneous chamber session
- 80 MB hard disk space
- One serial port
- One National Instruments GPIB IEEE interface (Optional)
- One 10/100 Ethernet card using TCP/IP (Optional)
- One USB external hardware Dongle (Parallel port type needed for NT 4.0) (see ‘External Hardware Dongle’).
- Printer (Optional)
- Fax Modem (Optional)
- Microsoft Windows™ PC Operating systems:
  - Microsoft Windows™ 95
  - Microsoft Windows™ 98
  - Microsoft Windows™ 98 Special Edition
  - Microsoft Windows™ NT 4.0 Service Pack 6a
  - Microsoft Windows™ 2000 Service Pack 2
  - Microsoft Windows™ XP Service Pack 1 (use latest available Service Pack)

Note: For Windows™ 95, operating system must support USB ports (OSR2 version is needed) if a USB Dongle is to be used.

Software Installation

Synergy Manager Software installation uses InstallShield installation software. Please read this section in its entirety before attempting installation.

1. First close all running programs.
2. Uninstall any previous versions of Synergy Manager including ‘Monitor Only’ versions before installing this new version. Previous versions of this software are not compatible.
3. Insert the installation CD into the proper drive and navigate to drive root folder. If necessary unzip program files into a temporary folder before proceeding to next step.
4. Do not insert the Dongle key until application has been properly installed.
5. Run the Synergy Manager Setup program (LinkTenn32_Setup.exe) file from the run option of the start menu.
6. Follow the installation instructions on the screen.

Important: Do not insert USB Dongle key before Synergy Manager has been properly installed. If the USB Dongle key is inserted before application has been properly installed, Windows™ operating systems may assign the wrong software driver to the USB Dongle key. This will prevent Synergy Manager from recognizing the USB Dongle even though it is inserted, and thus cause Synergy Manager to run in 'Monitor Mode Only'

Notes: The latest revision of the 'Synergy Manager User Manual' can be found in the Support folder of the installation CD and can also be downloaded from the Tidal Engineering website (www.tidaleng.com).

For Microsoft Windows™ 2000 users: If the Synergy Manager setup program warns that it is about to replace a newer file with an older one, select the response that will cancel the installation of the older version of the file, keeping the newer one.

For Microsoft Windows™ XP, Microsoft Windows™ 2000 and Microsoft Windows™ NT 4.0, user must have administrator's privileges to install this software (Rev. 1.20 and up).

During the install process it may be necessary for the setup program to reboot the PC to allow updated files to be used during installation. This is normal and it is handled automatically by setup program, just follow on screen instructions.

Hardware Dongle Key

Synergy Manager Software utilizes an external hardware Dongle key to provide software registration and protection. The Dongle comes in two versions: a USB model and parallel port model with the USB model as the standard. The Dongle Key chart below indicates which model to use with what PC operating system.

External Dongle Key Chart	
Supported PC Operating System	Dongle Key Type
Microsoft Windows™ 95 *	USB* or Parallel
Microsoft Windows™ 98	USB or Parallel
Microsoft Windows™ 98 Special Edition	USB or Parallel
Microsoft Windows™ NT 4.0 Service Pack 6a	Parallel Only, NO USB SUPPORT PROVIDED
Microsoft Windows™ 2000 Service Pack 2 or latest available	USB or Parallel
Microsoft Windows™ XP Service Pack 1,or latest available	USB or Parallel

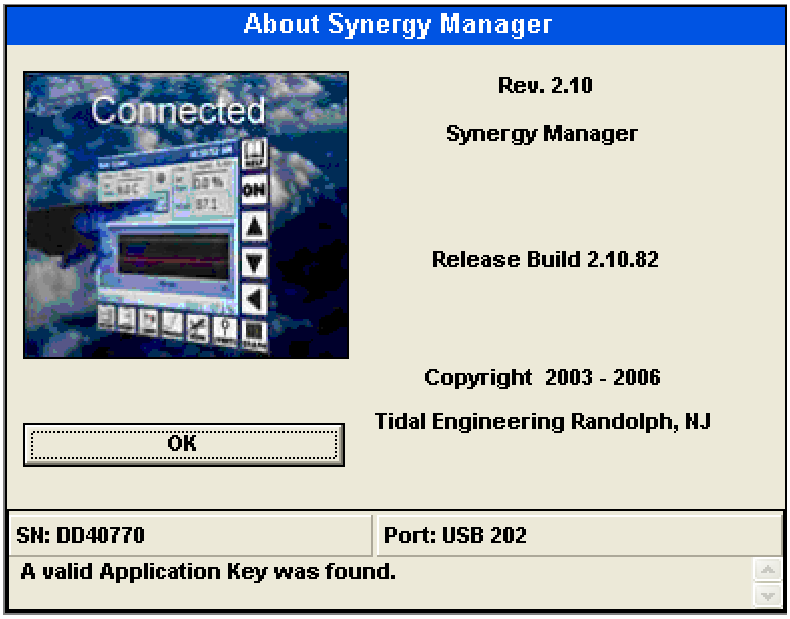
* For Windows™ 95, Operating system must support USB ports, OSR2 version is needed.

Synergy Manager Monitor Only mode

If Synergy Manager is started without Dongle key, the Synergy Manager Title bar will indicate that Synergy Manager is in 'Monitor Only Mode' as shown in the graphic below. Additionally, the About box will not display the Serial Number.

The Dongle key must be inserted before starting Synergy Manager, inserting Dongle key after Synergy Manager has started will not change the mode of operation.

Synergy Manager Title bar without Dongle Key Inserted.



The About Box without Dongle Key inserted.

Please see ‘Feature Matrix’ for information on which Synergy Manager features are not supported in ‘Monitor Only Mode’.

Synergy Manager Normal Full Feature mode

When Synergy Manager is started with Dongle key inserted, the title bar will be similar to that shown in the graphic below. This is Full Feature Mode. The ‘About Box’ will indicate the status of key search and display Dongle key Serial Number similar to that shown in the graphic below.

The Dongle key must not be removed once application has been started.

Synergy Manager Title bar with Dongle Key Inserted.

The About Box with Dongle Key inserted.

Supported Controllers

Synergy Manager currently supports these process controllers with the software / firmware hardware revision levels shown in following table. The table also lists the communication methods supported for each controller and the protocol form. GPIB communications support for the controllers listed is provided by ICS Electronics' 4804A / 09A GPIB to Serial Interface and Tidal Engineering's Synergy488 Module except for Synergy Controllers which offer built-in support GPIB communications.

Ethernet support for VT3, P1460, W942, and WF4 provided by Tidal Engineering's Synergy488 Module (ASCII).

Supported Controllers Table

Controller Type	Short Name	Communication Method	Protocol or Flow Control
VersaTenn 3	VT3	RS232	Xon/Xoff
		IEEE-488	GPIB
		Synergy488 TCP/IP	TCP/IP
VersaTenn 4	VT4	RS232	Modbus
		IEEE-488	GPIB
Synergy/ VersaTenn V	VT5	RS232	None
		IEEE-488	GPIB
		Ethernet-TCP/IP	TCP/IP
Watlow 942	W942	RS232	Xon/Xoff
		IEEE-488	GPIB
		Synergy488 TCP/IP	TCP/IP
Watlow F4	WF4	RS232	Modbus
		IEEE-488	GPIB
		Synergy488 TCP/IP	TCP/IP
Thermotron 4800	T4800	RS232	RTS Hardware Handshaking
Partlow 1460/1462	P1460	RS232	Modbus/RS485
		RS485	Modbus/RS485
		IEEE-488	GPIB
		Synergy488 TCP/IP	TCP/IP
Yokogawa 550/750	Y750	RS232	PC Link No Checksum
		RS485	PC Link No Checksum
		Synergy488 GPIB/IEEE-488	GPIB
		Synergy488 TCP/IP	TCP/IP

Feature Matrix

The Feature Matrix chart lists the controller features supported by Synergy Manager. Synergy Manager has two modes of operation: Monitor Only and Normal/Full Feature. Please see sections ‘Synergy Manager Monitor Only’ and ‘Synergy Manager Normal Mode’. The highlighted rows in the table are not supported by the ‘Monitor Only’ version of Synergy Manager.

SYNERGY MANAGER FEATURE MATRIX									
	SUPPORTED CONTROLLERS								
FEATURE	**VT3**	**VT4**	**VT5**	**W942**	**WF4**	**T4800**	**P1460**	**Y750**	**FEATURE DESCRIPTION**
Data									
*SP1 **	*R/W*	*R/W*	*R/W*	*R/W*	*R/W*	*R/W*	*R/W*	*Yes*	*Channel 1 Set Point*
*SP2 **	*R/W*	*R/W*	*R/W*	*NA*	*R/W*	*R/W*	*NA*	*Yes*	*Channel 2 Set Point*
C1	R	R	R	R	R	R	R	R	Channel 1 Process Variable
C2	R	R	R	NA	R	R	NA	R	Channel 2 Process Variable
Temp. Mode	*R/W*	*R/W*	*R/W*	*R/W*	*R/W*	*R*	*NA*	*NA*	*Celsius and Fahrenheit*
Settings									
Heat/Cool	R	R	R	NA	R	R	R	R	PID Display
Hum/Dehumidify	R	R	R	NA	R	R	NA	R	PID Display
*Events **	*R/W*	*R/W*	*R/W*	*R/W*	*R/W*	*R/W*	*R*	*R/W*	*Event Outputs*
Alarms	R	R	R	R	R	R	R	R	Controllers Alarms
Limit Check	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Limit Check Setup
Deviation Check	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Deviation Check Setup
Saving Check	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Check Setup Saving
Logging									
Graph/Zoom	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Graph process & setpoint data
Process	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Log process and set point data
Export Logs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Save Log data to CSV Files
UUT Data	NA	NA	Yes	NA	NA	NA	NA	NA	Logging of External UUT data
Controller Mode									
Temp Only	NA	NA	NA	Yes	NA	Yes	Yes	NA	Temperature Only Mode
Temp / Temp	Yes	NA	Yes	NA	NA	Yes	NA	NA	Temp. Temp. Mode
Temp / Hum	Yes	Yes	Yes	NA	Yes	Yes	NA	Yes	Temperature Humidity Mode
Temp / Press	Yes	NA	NA	NA	NA	NA	NA	NA	Temperature Pressure Mode
Profiles									
Profile Creation	Yes	Yes	Yes	Yes	Yes	NA	Yes	Yes	Create controller profile
*Profile Download **	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*NA*	*Yes*	*Yes*	*Download to controller*
*Profile Control **	*Yes*	*NA*	*Yes*	*Yes*	*Yes*	*NA*	*Yes*	*Yes*	*Start and Stop profiles*
*Profile Download **	*2*	*2*	*File*	*2*	*1*	*NA*	*2*	*1*	*Profile Download Location*
Communications									
GPIB	Yes	Yes	Yes	Yes	Yes	NA	Yes	NA	IEEE 488 Communications
RS232	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Serial Communications
RS485	NA	NA	NA	NA	NA	NA	Yes	Yes	RS485 Serial Communications.
TCP/IP (Ethernet)	NA	NA	Yes	NA	NA	NA	NA	NA	Network Communications
Synergy488 GPIB	Yes	Yes	NA	Yes	Yes	NA	Yes	Yes	IEEE 488 Communications
Synergy488 TCPIP	Yes	NA	NA	Yes	Yes	NA	Yes	Yes	Network Communications
Synergy488 RS232	Yes	NA	NA	Yes	Yes	NA	Yes	Yes	Serial Communications
Email / Fax Alert									
*Email **	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*		*Email Alerts*
*Fax **	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*		*Fax Alerts*

FEATURE MATRIX KEY	
R	Parameter is Read Only
R/W	Parameter can be both Read and Write
Yes	Feature is available for this controller
NA	Feature is not available for this controller, or controller does not support it.
*Italics **	*Feature is not available in 'Monitor Only Mode', feature has no control, is Read only or disabled.*

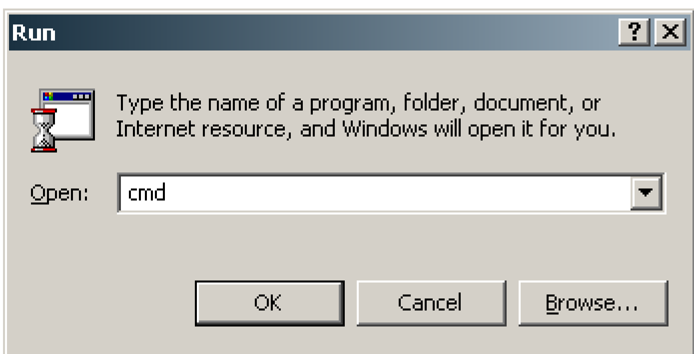
Note: The features listed are valid for Synergy Manager Version 1.25.x.

17.4.3 Ethernet MAC Address

If your network employs a DHCP server you may find that your chamber has been assigned a different IP Address when the DHCP server IP lease expires. Your network administrator can assign a specific and persistent IP Address to your chamber if he has the Synergy Controller's MAC Address, an identification number that uniquely identifies your controller. You can determine the Synergy Controller's MAC address using the "arp" command in the Command widow on any PC that is on the same network as the controller.

To use the "arp" command follow these steps:

1. Connect your Synergy Controller unit to your network and apply power.
2. Determine the IP address of the Synergy Controller unit by pressing the ***COMM*** button and navigate to the Ethernet folder. The IP Address property is displayed. Note the IP Address.
3. Open a Command window on the desktop by going to the Start button on the lower left of the desktop and select Run from the menu.
4. Enter the letters "cmd" in the open window. Then press OK.

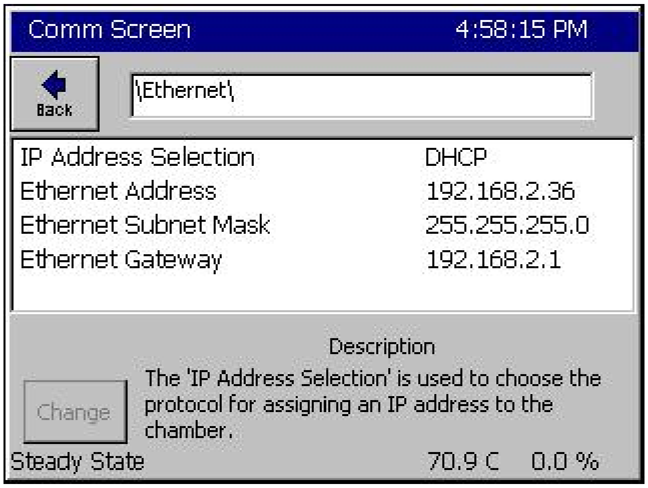


5. Verify the network connection to the Synergy Controller by typing "ping ###.###.###.###" where the # signs represent the Synergy Controller unit's IP Address.
6. In the Command window type "arp –a ###.###.###.###", again replacing the # signs with the Synergy Controller's IP Address.
7. The "arp" command will respond with the Internet Address and the Physical Address (MAC Address) of the Synergy Controller unit. The MAC address of the unit tested for this manual is 00-E0-4C-80-28-97 as shown below.

```
C:\WINNT\system32\cmd.exe

C:\WINNT\system32>ping 172.16.10.118

Pinging 172.16.10.118 with 32 bytes of data:

Reply from 172.16.10.118: bytes=32 time<10ms TTL=128
Reply from 172.16.10.118: bytes=32 time<10ms TTL=128
Reply from 172.16.10.118: bytes=32 time<10ms TTL=128
Reply from 172.16.10.118: bytes=32 time<10ms TTL=128

Ping statistics for 172.16.10.118:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum =  0ms, Average =  0ms

C:\WINNT\system32>arp -a 172.16.10.118

Interface: 172.16.10.34 on Interface 0x1000003
  Internet Address      Physical Address      Type
  172.16.10.118         00-e0-4c-80-28-97     dynamic
```

Connecting the Synergy Controller to Your Network

Plug a network patch cable into your Synergy Controller and the other end into your hub or router. Make sure it is powered on then boot your Synergy Controller. If your Synergy Controller is set to DHCP it should be assigned an address automatically.

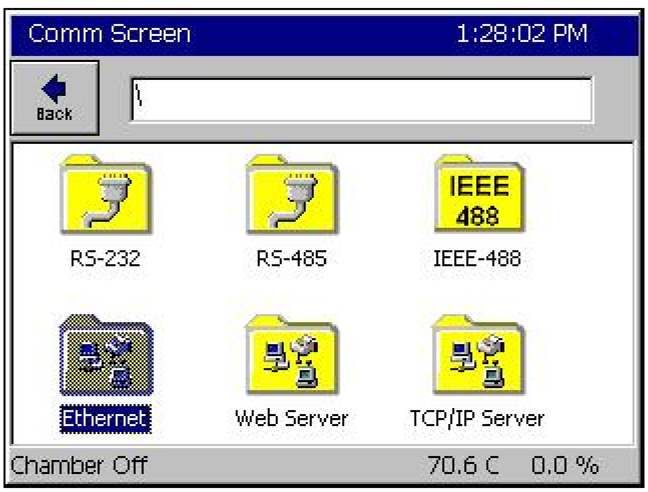


Verify DHCP IP Addressing

To confirm that the Synergy Controller was assigned an address, press the ***COMM*** button on the controller touch screen and select the Ethernet folder icon. You should see a screen similar to the one below. Verify that each field contains non-zero numbers.

The address in the Ethernet Address field is the IP Address of the controller. Use this address when connecting to the Synergy Controller over Ethernet.

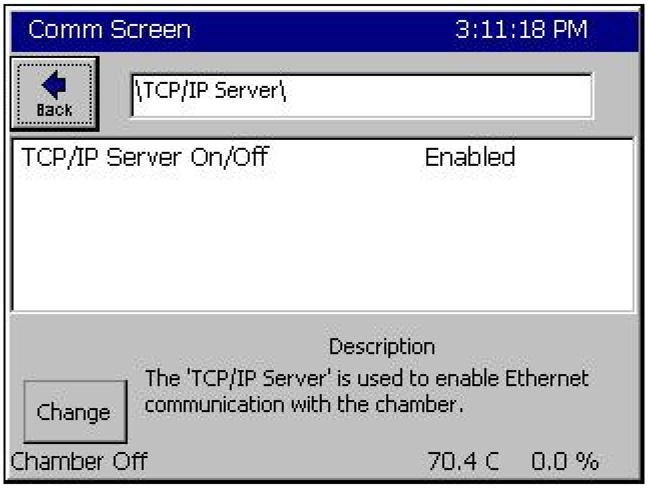
If the addresses are blank or 0.0.0.0 then the Synergy Controller did not obtain an IP address from the DHCP router. If this is the case, review the previous sections to make sure you have set up the DHCP router properly. If that doesn't solve the problem, verify the settings with your network administrator.



Synergy Controller TCP/IP Server Setup

To set up the Synergy Controller for ASCII commands over TCP/IP, press the ***COMM*** button at the bottom of the Synergy Controller's touch screen. The Comm Screen window will appear.

Select the TCP/IP Server folder icon.



TCP/IP Server Settings

Confirm that the TCP/IP Server On/Off field is set to Enabled. If it is not enabled, press the ***Change*** button and enable it. Your Synergy Controller is now configured to accept ASCII commands over TCP/IP.

Note: The Web Server is enabled separately from the TCP/IP Server. To enable the Web Server please review Section 8.1.7 Communications: Operator Interface: Web earlier in this manual.

Communicating over TCP/IP

Your Synergy Controller is now networked. To connect over TCP/IP you can use a Web Browser, a communications program such as Tidal Engineering's Synergy Manager or SimpleComm or a third party telnet program. See Section 8.3 Communications: Software Applications regarding these utilities.

If you are having troubles connecting to you Synergy Controller, please review the Trouble Shooting entries earlier in this section.

18.0 APPENDIX B SETTINGS LIST

Setup Root

- **Calibration**
  - Calibration Channel n (n=1,2,3,4)
    - "CHn Sensor Select"
    - "Temperature Offset (b)"
    - "Temperature Gain %(m)"
    - "High Alarm"
    - "Low Alarm"
    - "Ignore Alarm When Off"
    - "Channel Alarm Delay"
    - "Deviation High Alarm"
    - "Deviation Low Alarm"
    - "Deviation Alarms Enabled"
    - "Deviation Alarm Delay"
    - "Waitfor CHn Tolerance"
    - "High Limit, Channel n"
    - "Low Limit, Channel n"
  - Altitude
    - "Altitude Value"
    - "Altitude Key"
  - "Guaranteed Soak"
  - Input
    - High Res
      - RTD n (n=1,2)
        - "Type"
        - Raw Calibration (m,b)
          - "Gain"
          - "Offset"
      - Analog n (n=1,2,3,4)
        - "High Eng. Scale"
        - "Low Eng. Scale"
        - "High Volts Scale"
        - "Low Volts Scale"
        - "Type"
        - Raw Calibration (m,b)
          - "Gain"
          - "Offset"
      - Thermocouple n (n=1,2)
        - "Type"
        - Raw Calibration (m,b)
          - "Gain"
          - "Offset"
        - Cold Junction Calibration (m,b)
          - "Gain"
          - "Offset"
    - Low Res
      - Analog n (n=1,2,...8)
        - "High Eng. Scale"
        - "Low Eng. Scale"
        - "High Volts Scale"
        - "Low Volts Scale"
        - "Type"
        - Raw Calibration (m,b)
          - "Gain"

          - "Offset"
    - UUT
      - Module n (n=1,2,3..8)
        - Sensor m (m=1,2,3..8)
          - "Gain"
          - "Offset"
  - Virtual Sensors
    - Wet Bulb Dry Bulb
      - "Wet Bulb Sensor"
      - "Dry Bulb Sensor"
      - "Altitude - Torr"
      - "Wet Bulb Input Filter"
      - "Wet Bulb Filter Max Delta"
      - "Wet Bulb Filter Weight"
      - "Dry Bulb Input Filter"
      - "Dry Bulb Filter Max Delta"
      - "Dry Bulb Filter Weight"
      - "Output Filter"
      - "Output Max Delta"
      - "Output Filter Weight"
    - Virtual Kft
      - "Torr Sensor"
    - Virtual Pressure
      - "Std. Range Pres. Sensor ID"
      - "High Alt. Pres. Sensor ID"
      - "Transfer Pres. Threshold"
      - "Transfer Pres. Hysteresis"
- **PID Settings**
  - PID Ch n (n=1,2,3,4)
    - "Auto Tune" (Hidden)
    - PID Ch n Heating
      - "Prop. Band Heating"
      - "Reset Ch n Heating"
      - "Rate Ch n Heating"
      - "Cycle Time for Ch n Heating"
      - "Rate Band for Ch n Heating"
      - "PID Clamp for Ch n Heating" (Hidden)
    - PID Ch n Cooling
      - "Proportional Band for Ch n"
      - "Reset Ch n Cooling"
      - "Rate Ch n Cooling"
      - "Cycle Time for Ch n Cooling"
      - "Rate Band for Ch 1 Cooling"
    - Cascade
      - "Enable"
      - Settings
        - "Sensor Select"
        - "Cascade High Limit"
        - "Cascade Low Limit"
        - "Pos. Deviation Limit"
        - "Neg. Deviation Limit"
        - "Cascade Mode" (Hidden)
        - "Cascade Key"
      - PID's
        - "Prop. Band"
        - "Reset"

"Rate"
"Rate Band"
Product (Hidden)
"Prop. Band Ch n"
"Reset Ch n"
"Rate Ch n"

Special Functions

"Celsius/Fahrenheit"
"12/24 Hour Time"
"Output 11 Control Type"
"Output 17 Control Type"
"Output 18 Control Type"
"Select Alarm Type" (Hidden)
"Ambient, Channel 1" (Hidden)
"Ambient, Channel 2" (Hidden)
"Ambient, Channel 3" (Hidden)
"Ambient, Channel 4" (Hidden)
"Temperature RTD Curve" (Hidden)
"Vaisala Temp. Compensation" (Hidden)
Analog Retransmits
Analog Retransmit n (n=1,2)
"Analog Retransmit n"
"High Eng. Scale"
"Low Eng. Scale"
"High Volts Scale"
"Low Volts Scale"

PWM Retransmits
PWM n (n=1,2,3...8)
"Retransmit Source"
"High Eng. Scale"
"Low Eng. Scale"
"High Duty Cycle"
"Low Duty Cycle"
"Cycle Time"
On/Off Retransmits
On/Off Retransmit n (n=1,2,3...8)
"Retransmit Source"
"High Eng. Threshold"
"Low Eng. Threshold"
"Hysteresis Value"
"Active State"

"Panel Lock" (Hidden)
"Thermocouple Filtering" (Hidden)
Remote Start/Stop
"Remote Start/Stop"
"Start Input"
"Stop Input"
Analog Programming
Channel n (n=1,2,3,4)
"Programming Enabled"
"Analog Input Select"
"Allow Multiple Stop Steps"

L-Values

"1L1 Ch 1 Main Cooling Turn-On"
"1L2 Ch 1 Main Cooling Turn-Off"

"1L3 Ch 1 Setpoint Transfer Setting"
"1CTY Ch 1 Chamber Type"
"2L1 Ch 2 Main Cooling Turn-On"
"2L2 Ch 2 Main Cooling Turn-Off"
"2L3 Ch 2 Setpoint Transfer Setting"
"2CTY Ch 2 Chamber Type"
"L3 Ch 1 Main Cooling Turn-On"
"L4 Ch 1 Main Cooling Turn-Off"
"L6 Full Cooling Switch-over"
"L7 Ambient Cooling Turn-On"
"L8 Heat Ambient Cooling Turn-Off"
"L9 Ramp-Up Cooling"
"L11 Dehumidify / Vent On"
"L12 Dehumidify / Vent Off"
"L14 Time Delay Boost Cool"
"L15 Compressor Turn-off Delay"
"LEV1 Drier/Dehumid Coil"

Logging

- Setup
  - "Enable Logging"
  - "Logging Interval (sec)"
  - "Log File Size (MB)"
  - "Log When Chamber Off"
- Options
  - "Log Full Behavior"
  - "Enable Usage Warning"
  - "Full Warning at %"
  - "Profile Storage Warning Level"
  - "Profile Auto-Remove Level"
- Profiles
  - Options
    - "Log Each Profile"
    - "Auto E-Mail Profile Log"
    - "Auto Print Profile Plot"
    - "Auto E-Mail Profile Plot"
    - "Profile Name Format"
  - Plot Setup
    - "Channel 1"
    - "Channel 2"
    - "Channel 3"
    - "Channel 4"
    - "Plot Timescale"
- Data
  - Channel Readings
    - "CH1 Actual"
    - "CH2 Actual"
    - "CH3 Actual"
    - "CH4 Actual"
  - Channel Setpoints
    - "CH1 Setpoint"
    - "CH2 Setpoint"
    - "CH3 Setpoint"
  - Cascade
    - "CH1 Actual"
    - "CH2 Actual"

"CH3 Actual"
"CH4 Actual"
"CH1 Setpoint"
"CH2 Setpoint"
"CH3 Setpoint"
"CH4 Setpoint"
"Cascade PID CH1"
"Cascade PID CH2"
"Cascade PID CH3"
"Cascade PID CH4"

Channel PIDs
- PID CHn (n=1,2,3,4)
  - PID CHn Heat
    - "PID Output"
    - "Proportional Band"
    - "Reset"
    - "Rate"
    - "Cycle Time"
    - "Rate Band"
    - "Pn"
    - "In"
    - "Dn"
    - "Error"
  - PID CHn Cool
    - "PID Output"
    - "Proportional Band"
    - "Reset"
    - "Rate"
    - "Cycle Time"
    - "Rate Band"
    - "Pn"
    - "In"
    - "Dn"
    - "Error"
  - Cascade
    - "PID Output"
    - "Proportional Band"
    - "Reset"
    - "Rate"
    - "Rate Band"
    - "Pn"
    - "In"
    - "Dn"
    - "Error"

UUT Values
- "UUT 1"
- "UUT 2"
- "UUT 3"
- "UUT 4"
- "UUT 5"
- "UUT 6"
- "UUT 7"
- "UUT 8"

High Res Analog
- "RTD 1"
- "RTD 2"
- "Analog 1"

"Analog 2"
"Analog 3"
"Analog 4"
"Thermocouple 1"
"Cold Junction TC 1"
"Thermocouple 2"
"Cold Junction TC 2"
Low Res Analog
"Analog 1"
"Analog 2"
"Analog 3"
"Analog 4"
"Analog 5"
"Analog 6"
"Analog 7"
"Analog 8"
Digital IO
"Input 1"
"Input 2"
"Input 3"
"Input 4"
"Input 5"
"Input 6"
"Input 7"
"Input 8"
"Input 9"
"Input 10"
"Input 11"
"Input 12"
"Input 13"
"Input 14"
"Input 15"
"Input 16"
PWMs
"PWM 1"
"PWM 2"
"PWM 3"
"PWM 4"
"PWM 5"
"PWM 6"
"PWM 7"
"PWM 8"
"Status" (Read-Only)
"Actions"
Chamber Setup
"Chamber Name"
Graph Settings
"CH1 Low"
"CH1 High"
"CH1 Cascade Low"
"CH1 Cascade High"
"CH2 Low"
"CH2 High"
"CH3 Low"
"CH3 High"
"Graph Time"
LCD Settings

"LCD Brightness"

Panel Lock

Admin Settings

"Panel Lock"
"Panel Lock Password" (Hidden)
"Panel On/Off Keys"
"Unlock Duration"
"Enable Screen Switching" (Hidden)
"Administrator Password"
"Maintenance Password"
"Engineer Password"
"Operator Password"

Screen Settings

"Setup Screen"
"Maintenance Screen"
"Comm Screen"
"Program Screen"
"Run Screen"
"Events Screen"
"Graph Screen"
"Main Screen"

Resume Behavior

"Steady State"
"Profiles"
"Restart Delay (sec)"

Main Screen Setup

"Main Screen Layout"

Sensor Displays

Sensor n (n=1,2,3..8)

"Sensor Display"
"Sensor Select"
"Sensor Label"

Chamber Light

"Chamber Light Event"
"Disable when Chamber Off"
"Top On State Label"
"Top Off State Label"
"Bottom On State Label"
"Bottom Off State Label"
"Button Graphic"

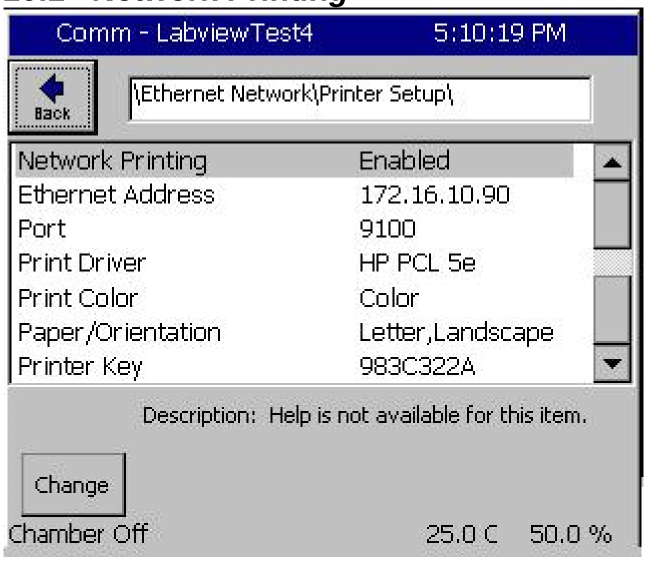
Event Screen Setup

"Display Humidity Events"
"Event 1 Name"
"Event 2 Name"
"Event 3 Name"
"Event 4 Name"
"Event 5 Name"
"Event 6 Name"
"Event 7 Name"
"Event 8 Name"
"Event 9 Name"

19.0 APPENDIX C DELIVERING RESULTS

This section provides an overview of the logging system features and applications which help the Synergy Controller “Delivers Test Results”; i.e. create individual log files for each test and deliver them automatically in either table (CSV) or chart (PDF) format over the network.

19.1 Network Printing



Printer Setup

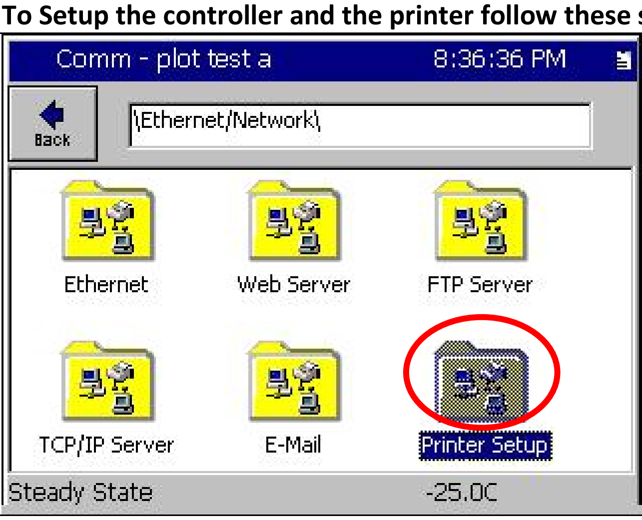
Setup the Network Printer parameter as shown on the left according to your printer.

See Application Note 84

The network plotting capabilities of the Synergy family provide documentation and reporting efficiencies that can enhance the performance of virtually any organization. These features automatically generate and plot test data to a network printer and/or to a PDF file. PDF plots can be automatically e-mailed to up to five recipients or viewed with a standard web browser using the Synergy Controller WebTouch™ Remote feature. See Synergy Controller Application Note 90 for detailed setup and examples.

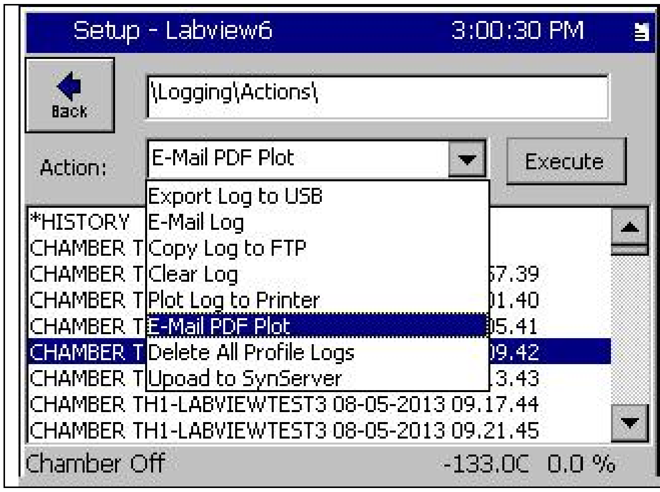
The Synergy Controller is designed to send plots to an HPCL capable printer with an Ethernet port such as the HP LaserJet Pro CP1525nw used in this example. The HP LaserJet Pro CP1525nw is a workgroup color printer that prints up to 12 ppm, with a resolution of 600 x 600 dpi. Note: This network plotting feature requires a minimum software version 3.0.2. Contact the factory to inquire about software upgrades for your Synergy Micro 2, Synergy Quattro, or Synergy Nano controller.

To Setup the controller and the printer follow these steps:



Open up the Synergy Controller **Comm** screen and browse to the **Printer Setup** folder as shown at the left.

Triggering Test Results E-Mails Manually

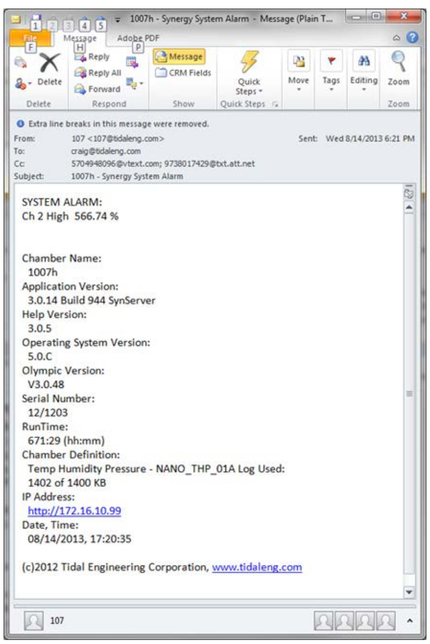


To trigger E-Mail deliveries manually, open the **Setup\Logging\Actions** folder, and pick **E-Mail Log** or E-Mail PDF Plot from the drop down selection list. Then choose the specific profile log from the list of logs and press the **Execute** button as shown at left.

Select **E-Mail Log** to deliver CSV log file test results. If Network Printing is enabled, select **E-Mail PDF Plot** to deliver formatted plots of the test results.

See Application Note 90 for Network Printing setup.

19.2 E-Mail Delivery

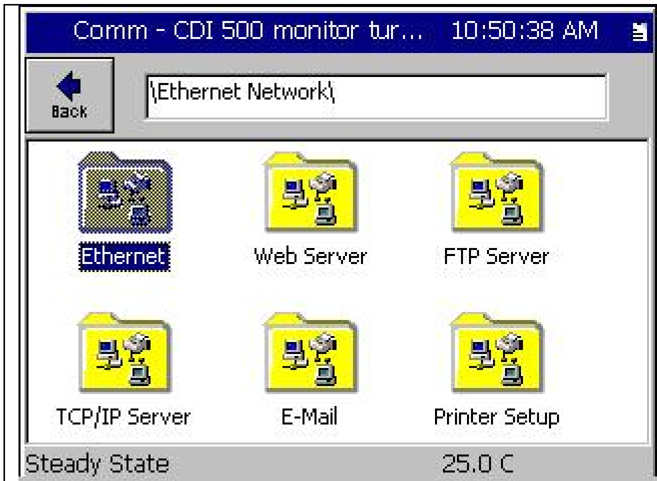
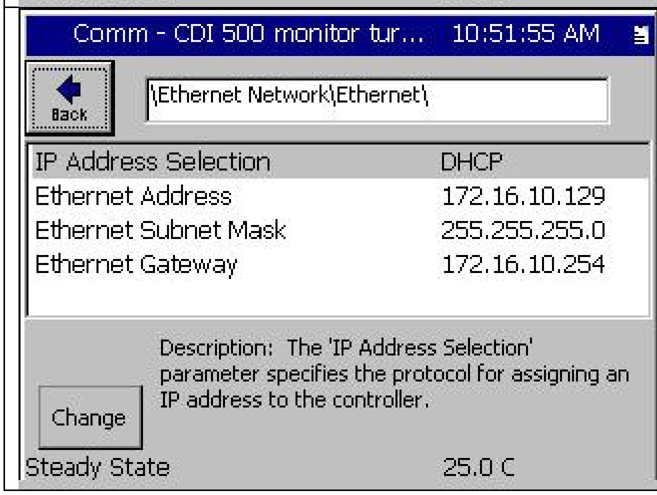


The Synergy Controller's e-mail feature sends alarm, test results plots, and log file e-mails automatically to desktop computers and mobile phones and tablets. E-Mail is supported on the Synergy Micro, Synergy Micro 2, Synergy Quattro, and the ¼ DIN Synergy Nano with software application Version 3.0.7 Build 893B and newer. Contact the Tidal Engineering if you are interested in a software upgrade.

The Synergy Controller application note 84 describes these e-mail features and provides detailed instructions and examples for setup. http://www.tidaleng.com/appnotes/SCAP84.pdf

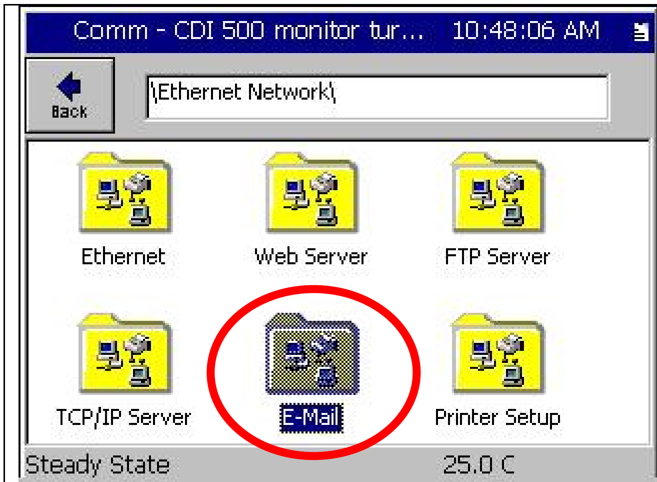
Network Setup

To send e-mail, your controller must be connected to your network and configured for an SMTP mail server. As always, the IP address of each Synergy Controller can be assigned by a DHCP server on your network if available or statically entered on the controller touch screen. See Application Note 7 for information regarding network setup.

	To begin, open the Comm Screen and browse to the **Ethernet Network** folder.
	Set the **IP Address Selection** and network properties as required.

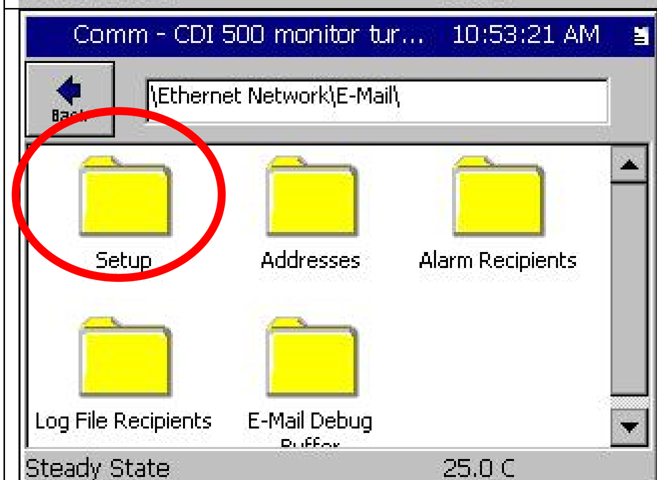
Then setup the E-Mail configuration as shown in the next section.

19.2.1 E-Mail Setup

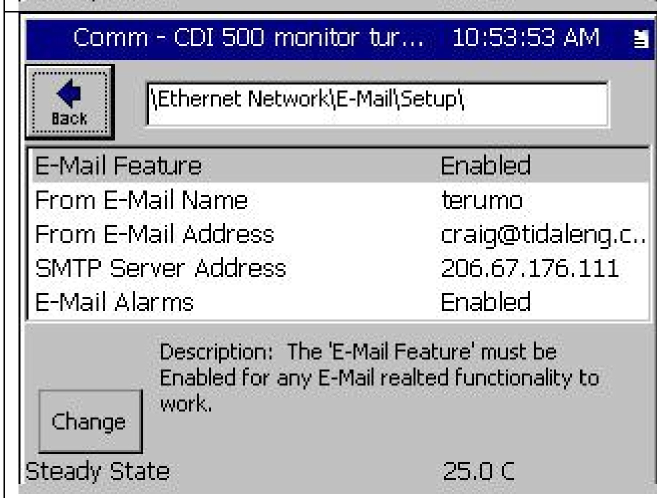


Open the **Ethernet Network** Folder in the **Comm** screen and select the E-Mail folder.

Note that some screens have been reorganized in version 3.0.7 and may be a different on older versions.



Open the **Setup** Folder as shown at left.

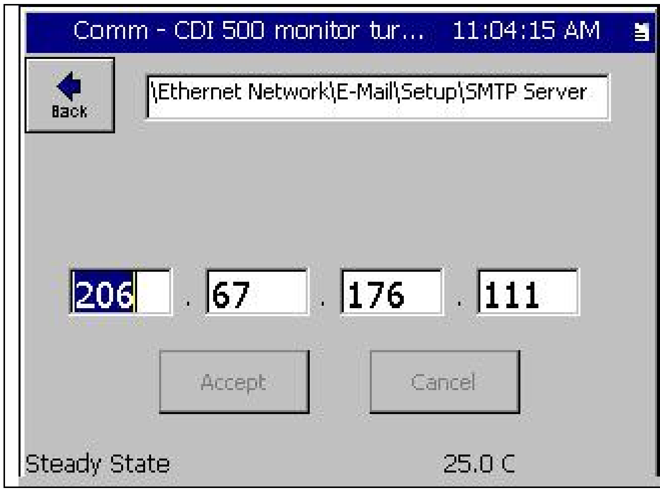


Enable the **E-Mail Feature** and set the following parameters to identify your system:

From E-Mail Name
From E-Mail Address

Note that these parameters don't usually need to be actual names or e-mail addresses. They should be set so controller messages can be identified by the recipient

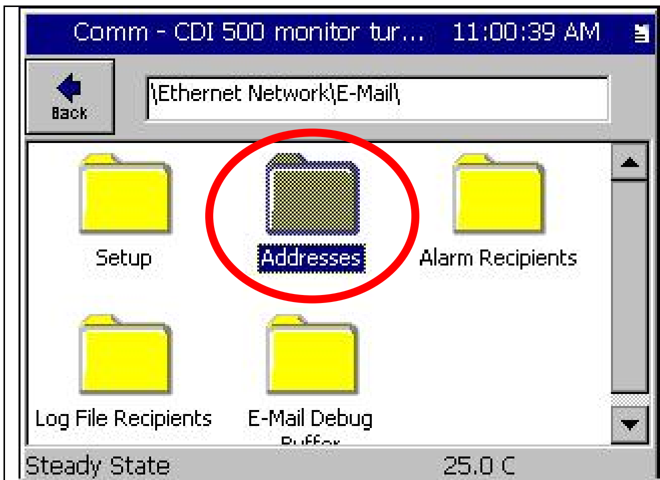
Enable the **E-Mail Alarms** parameter if you want the controller to send notifications regarding alarm conditions to your e-mail or mobile phone (text messaging)



Enter the SMTP Server Address

This address can usually be provided by your e-mail administrator.

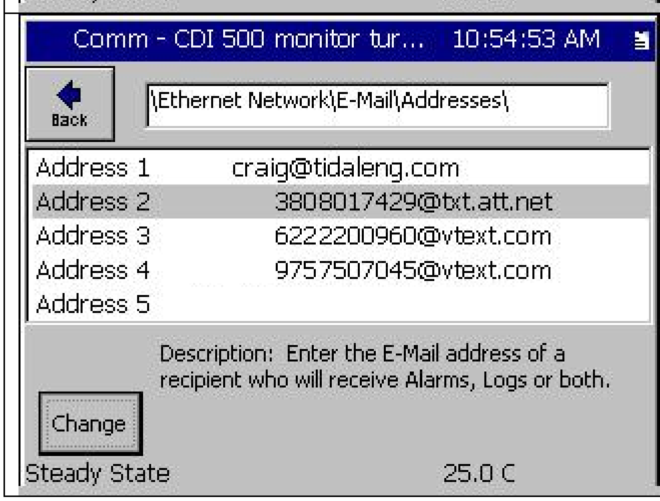
Enter the e-mail addresses.



Open the **Addresses** Folder.

Note that up to five E-Mail Addresses can be entered.

Note that each address can be set to receive Alarm messages and/or Test Data (Log Files) as required using the **Alarm Recipients** and **Log File Recipients** folders respectively.

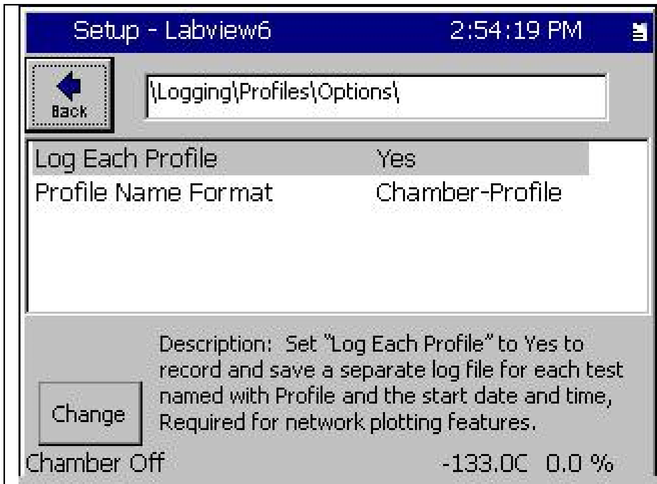


Virtually all wireless carriers can forward e-mails to a mobile phone as a text message (SMS). The e-mail address formats for telephone numbers for two popular carriers are shown in the examples below:

at&t Wireless: txt.att.net
1112223333@txt.att.net

Verizon Wireless: vtext.com
1112223333@vtext.com

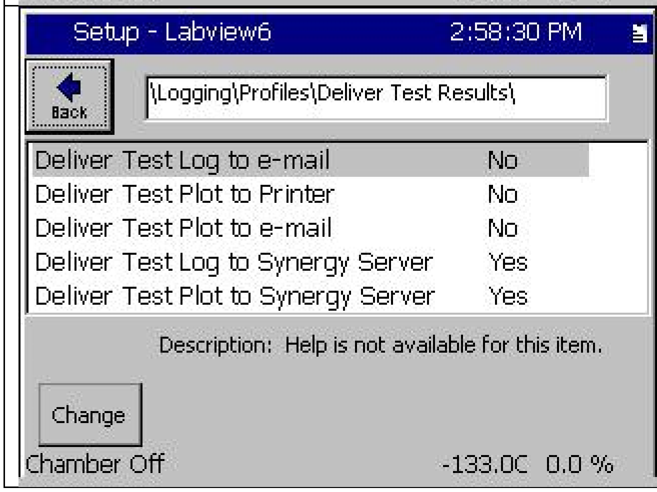
Setup for Automatic E-Mails



To E-Mail profile logs automatically, first set the Logging system to **Log Each Profile.**

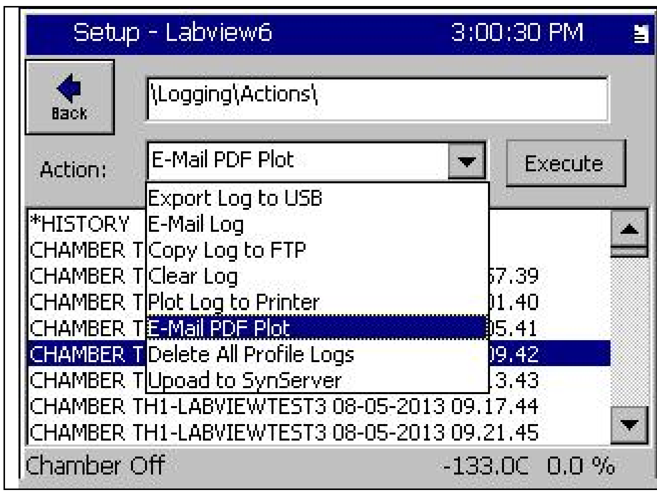
Then select the Profile Name Format to set the naming convention for the profile log file.

Note: See Synergy Controller AppNote 90 - Synergy Controller Network Printing Feature for additional setup information



Then set the **Deliver Test Results** options.

Triggering Test Results E-Mails Manually



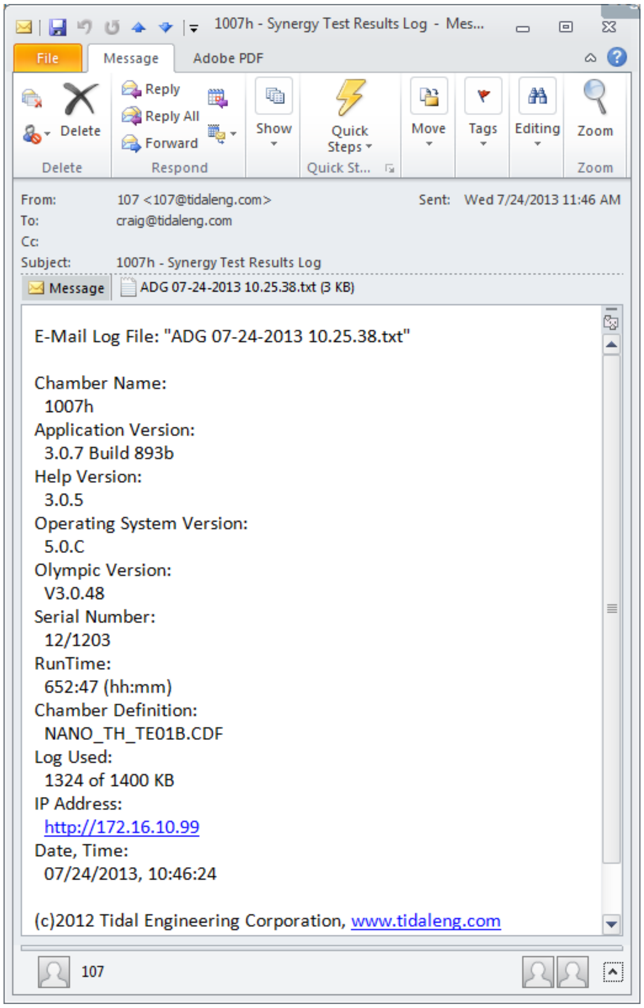
To trigger E-Mail deliveries manually, open the **Setup\Logging\Actions** folder, and pick **E-Mail Log** or E-Mail PDF Plot from the drop down selection list. Then choose the specific profile log from the list of logs and press the **Execute** button as shown at left.

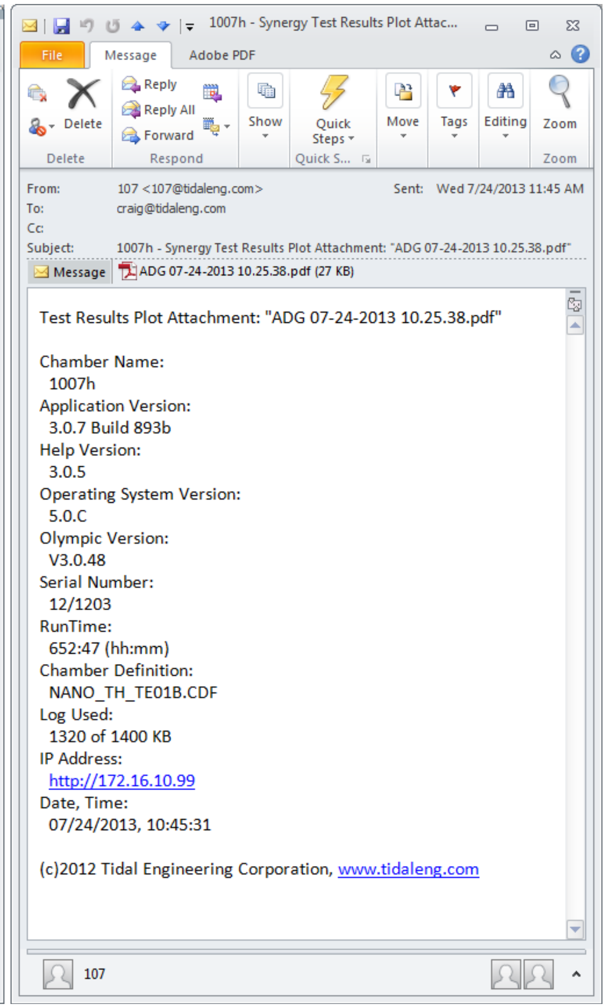
Select **E-Mail Log** to deliver CSV log file test results. If Network Printing is enabled, select **E-Mail PDF Plot** to deliver formatted plots of the test results.

See Application Note 90 for Network Printing setup.

19.2.2 E-mail Format

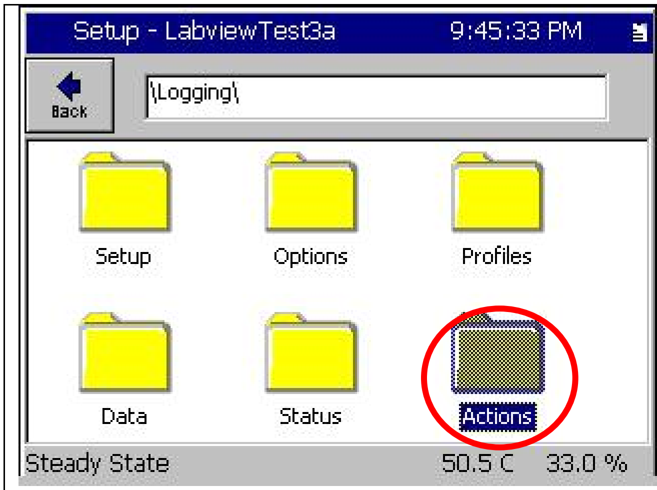
The Log File and Plot File e-mails are formatted as shown in the screenshots below. Note that controller information is included in the body of both emails for diagnostic purposes. Log file attachments are in CSV file format and Plot attachments are in PDF format.



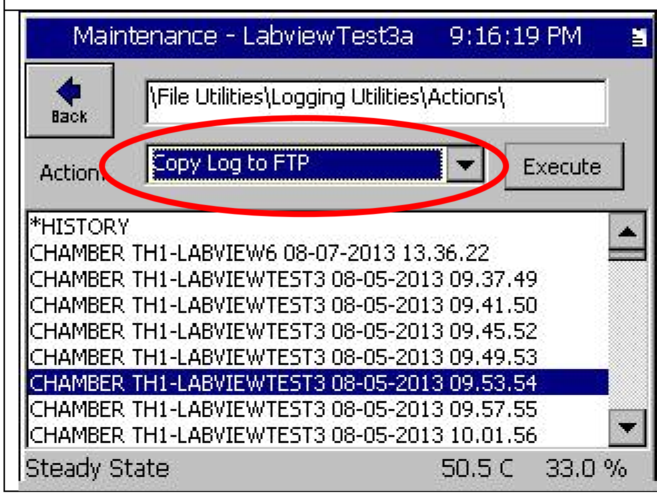


19.3 FTP Server Export

Download the following application for details for the Synergy Controller's FTP Server:
http://www.tidaleng.com/appnotes/SCAP45.pdf

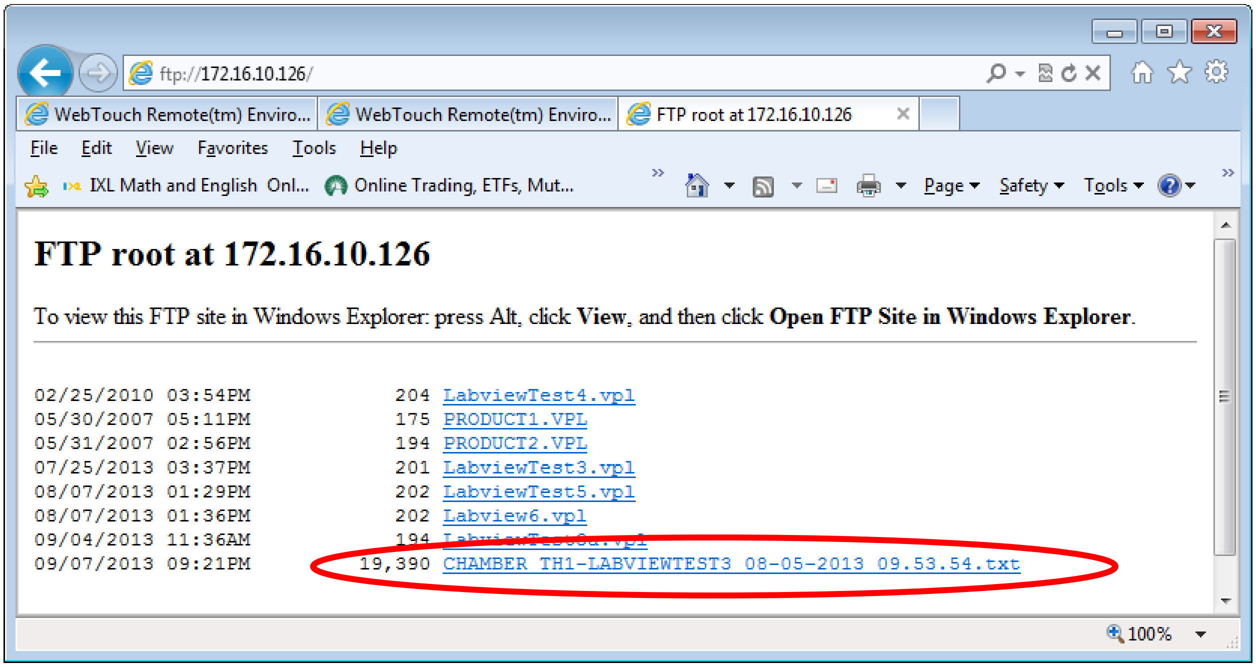
<table>
<tr>
<td>


</td>
<td>Open up the Synergy Controller Setup screen and browse to the \Logging\Actions folder as shown at the left.

Alternatively, open up the Synergy Controller Maintenance screen and browse to the \File Utilities\Logging Utilities\Actions folder as shown on the left.</td>
</tr>
<tr>
<td>


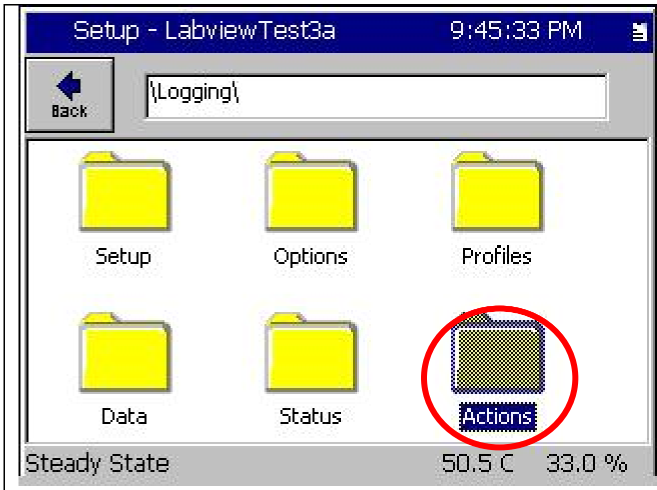
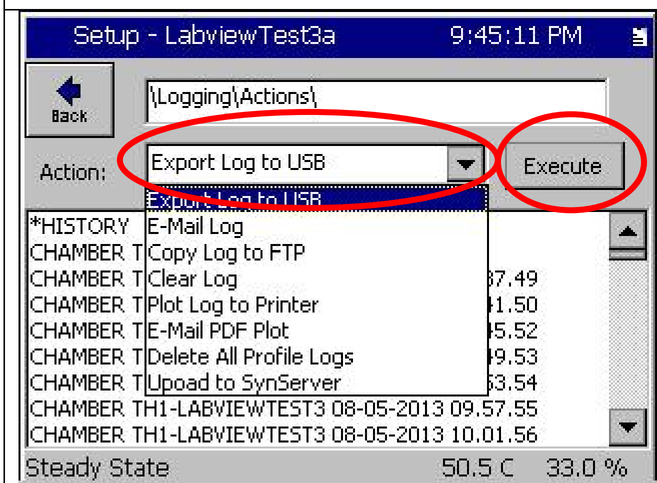
</td>
<td>Select the file (either the *HISTORY file or the Profile file), select the Copy Log to FTP from the Action drop down and press Execute</td>
</tr>
</table>

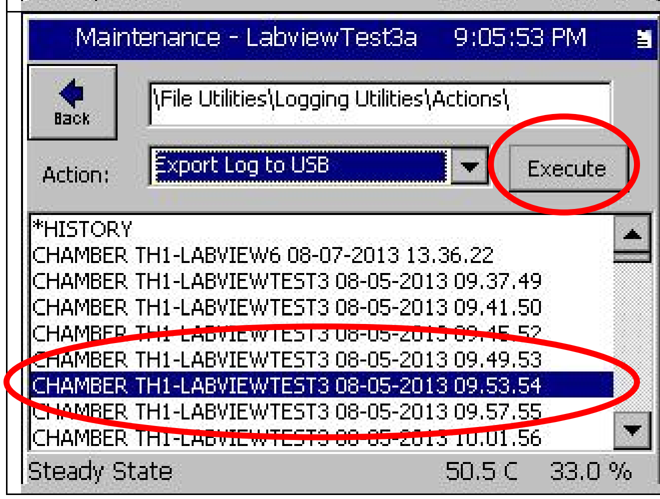
Open the FTP server on the controller using its IP address using with an FTP client like Microsoft Internet Explorer as shown below. Open the log file by clicking on it. For Microsoft Internet explorer type the url as shown in the following format example: ftp://172.16.10.126


ftp://172.16.10.126/
WebTouch Remote(tm) Enviro...
WebTouch Remote(tm) Enviro...
FTP root at 172.16.10.126
File Edit View Favorites Tools Help
IXL Math and English Onl...
Online Trading, ETFs, Mut...
Page Safety Tools
FTP root at 172.16.10.126
To view this FTP site in Windows Explorer: press Alt, click View, and then click Open FTP Site in Windows Explorer.
02/25/2010 03:54PM 204 LabviewTest4.vpl
05/30/2007 05:11PM 175 PRODUCT1.VPL
05/31/2007 02:56PM 194 PRODUCT2.VPL
07/25/2013 03:37PM 201 LabviewTest3.vpl
08/07/2013 01:29PM 202 LabviewTest5.vpl
08/07/2013 01:36PM 202 Labview6.vpl
09/04/2013 11:36AM 194
09/07/2013 09:21PM 19,390 CHAMBER TH1-LABVIEWTEST3 08-05-2013 09.53.54.txt
100%

19.4 USB Flash Drive Export

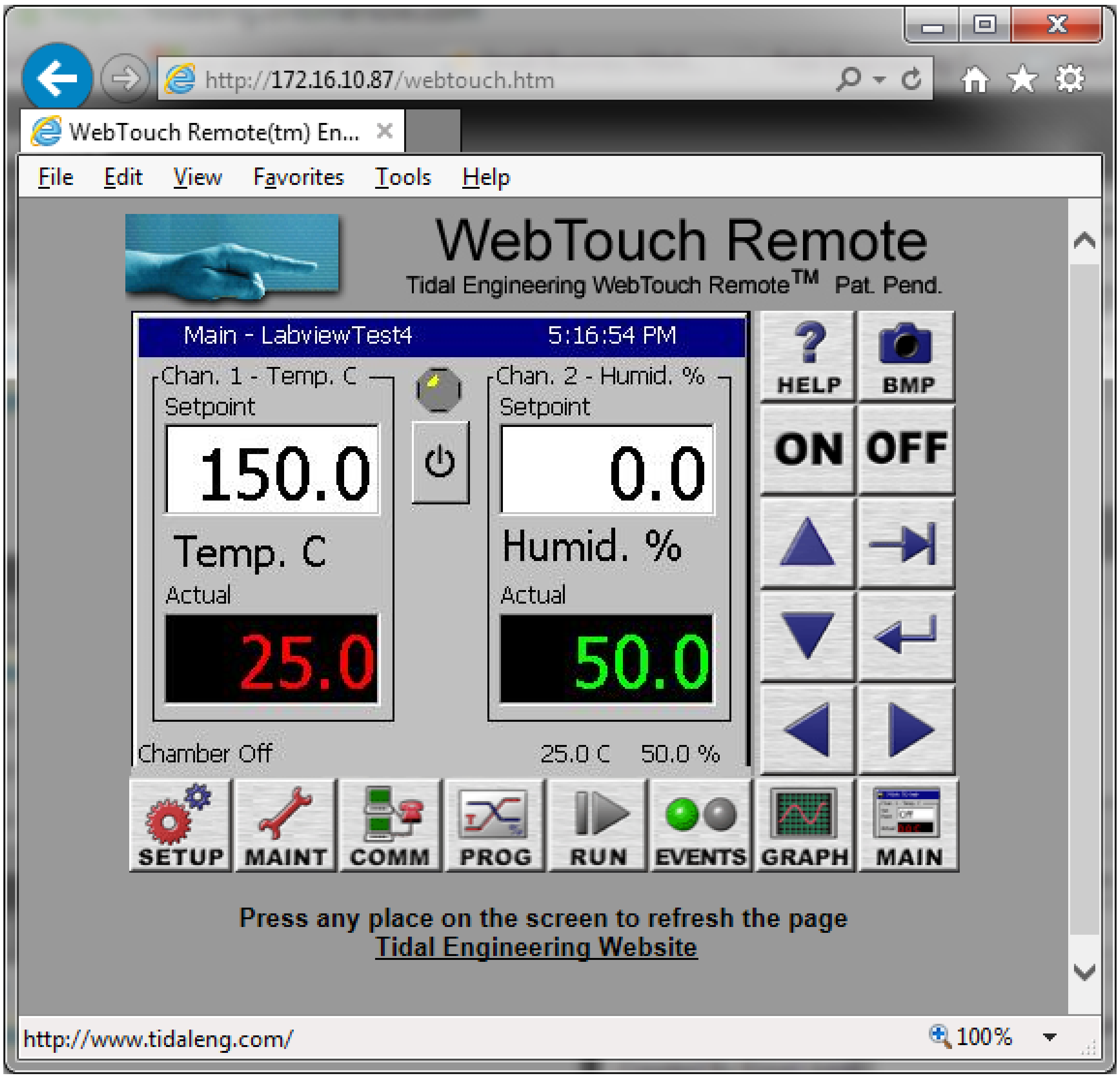
To export the log file to a USB Flash Drive, follow these steps.

<table>
<tr>
<td>
</td>
<td>Open up the Synergy Controller Setup screen and browse to the \Logging\Actions folder as shown at the left.</td>
</tr>
<tr>
<td>
</td>
<td>Place the USB Flash drive in the controller's USB port.

Select the file from the file list (either the *HISTORY file or the Profile file), select the Export Log to USB from the Action drop down and press Execute.</td>
</tr>
<tr>
<td>
</td>
<td>Alternatively, Open up the Synergy Controller Maintenance screen and browse to the \File Utilities\Logging Utilities\Actions folder as shown at the left and follow the steps listed above.</td>
</tr>
</table>

19.5 Web Touch Remote™ - Synergy Controller Web Server

The Synergy Controller can be monitored and controlled over a Local Area Network or the Internet using a standard web browser such as Microsoft's Internet Explorer (See screenshot below). Each controller has a built-in web server that uses Tidal Engineering's Web Touch™ Remote technology (Pat. Pending). This technology provides a web browser user interface that is identical to the local touch screen interface on the environmental chamber. Operators can use this feature to remotely monitor chamber settings and readings. Technicians can use this feature for remote troubleshooting. This section describes how to setup the chamber and your web browser for remote control over the World Wide Web. Tidal Web site Link http://tidaleng.com/appnotes/SCAP7.pdf



Configuring the Synergy Controller Web Server

To use the web server, you must perform a one-time set up. This setup includes registering the server, enabling the server, providing a user name and password for the server and establishing a TCP/IP connection using the Synergy Controller's Ethernet port.

Every controller has a built-in web server. To access this server, however, you must first enter a Registration Key. Contact Tidal Engineering Corporation to obtain your Registration Key.

Establishing a TCP/IP connection

The Synergy Controller Web Server can be used on an office or factory network to provide remote access and control. The Synergy Controller can also be accessed through the internet provided your network is configured for remote access (Check with your Network Administrator to see if this is possible on your network). In addition, several Synergy Controllers can be setup with a small router to connect directly to a PC.

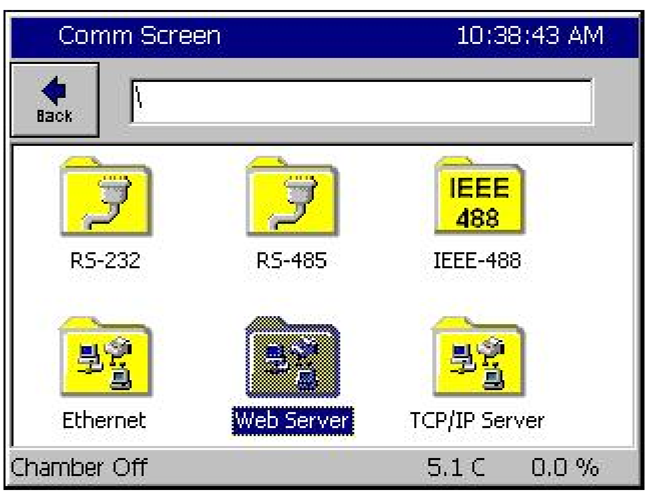
IP Configuration by DHCP

Each Synergy Controller must be configured with a unique IP address. DHCP does this configuration automatically. A computer on the network may act as a Dynamic Host Configuration Protocol (DHCP) server. A DHCP server stores a list or pool of IP addresses, along with other information (such as gateway and DNS addresses) that it may assign to the other devices on the network.

IP Configuration by DHCP using a LAN

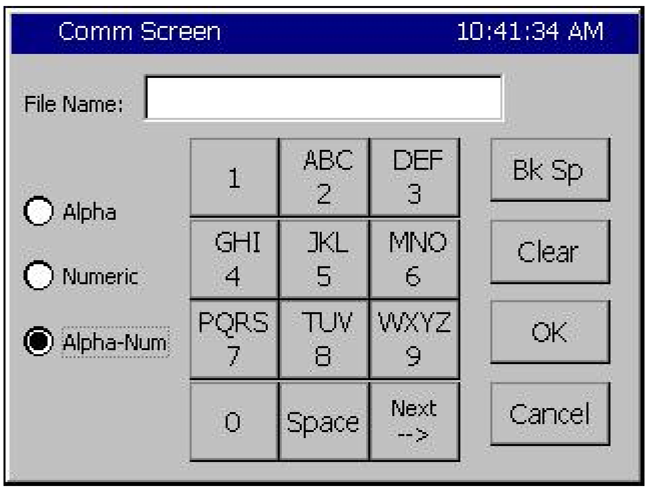
DHCP servers are available on most office and factory network servers. Contact your network administrator to verify that a DHCP server is available and enabled. The Synergy Controller will display the address it was assigned in the *COMM\Ethernet* screen. If the address is not 0.0.0.0 than it has been assigned an address by the DHCP server.

Registering the Web Server



Press the ***COMM*** button on the bottom tool bar to navigate to the Communications screen and then select the Web Server folder.

Press on the **Registration Key** text box to display the keypad.



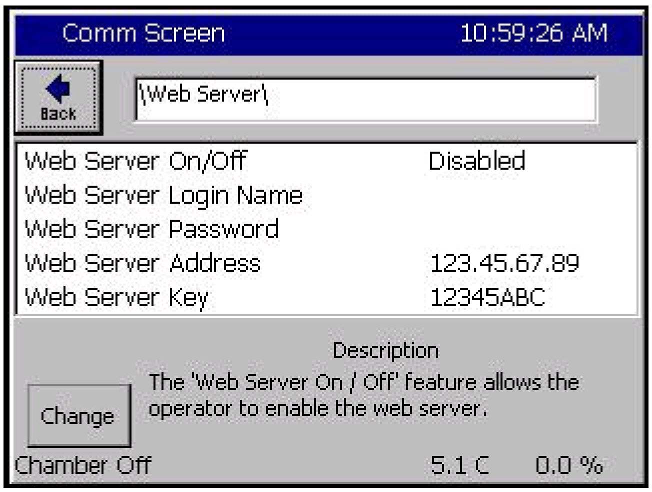
Input the registration code received from Tidal Engineering Corporation using the keypad.

When you are finished, press ***OK***. To cancel, press ***Cancel***. You will return to the previous screen and your code will appear in the Registration Key box.

Press ***Register*** to continue.

The Synergy Controller will display a message box indicating that the web server key was successfully registered.

Press ***OK*** to proceed to the Web Server Settings page.



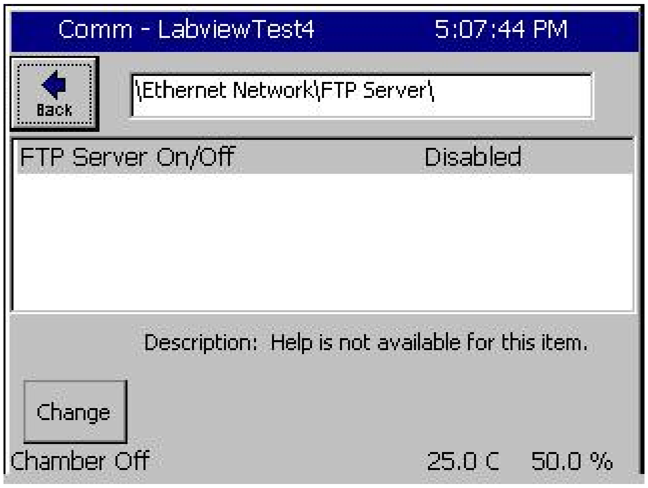
Once you have successfully registered the web server, you can now enable the Web Server.

You should also set a Login Name, and set a Password before you connect to the Synergy Controller.

First change the Web Server On/Off value to Enabled. .

Press the ***Back*** button to return to the settings window.

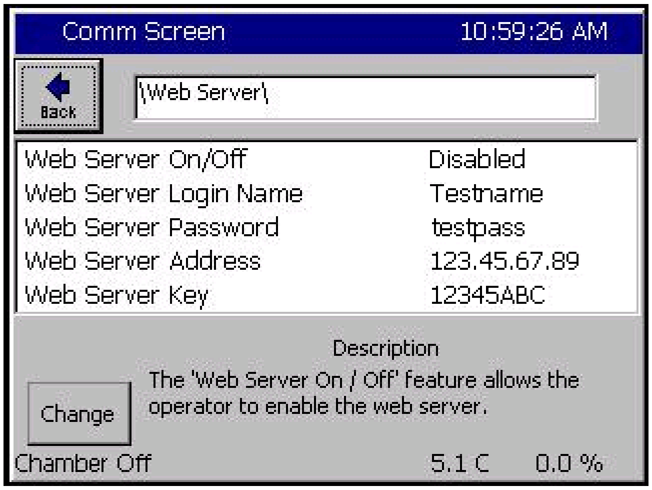
19.6 FTP Server



FTP Server

This parameter controls the Synergy Controller's FTP server. With the FTP server, chamber profiles AKA recipes (VPL files) can be copied to and from the controller, deleted from the controller or renamed, thru a Local Area Network (LAN). In addition the history log file can be retrieved from the controller.

AppNote 45 - Using the Synergy Controller's ftp server.



Network Security

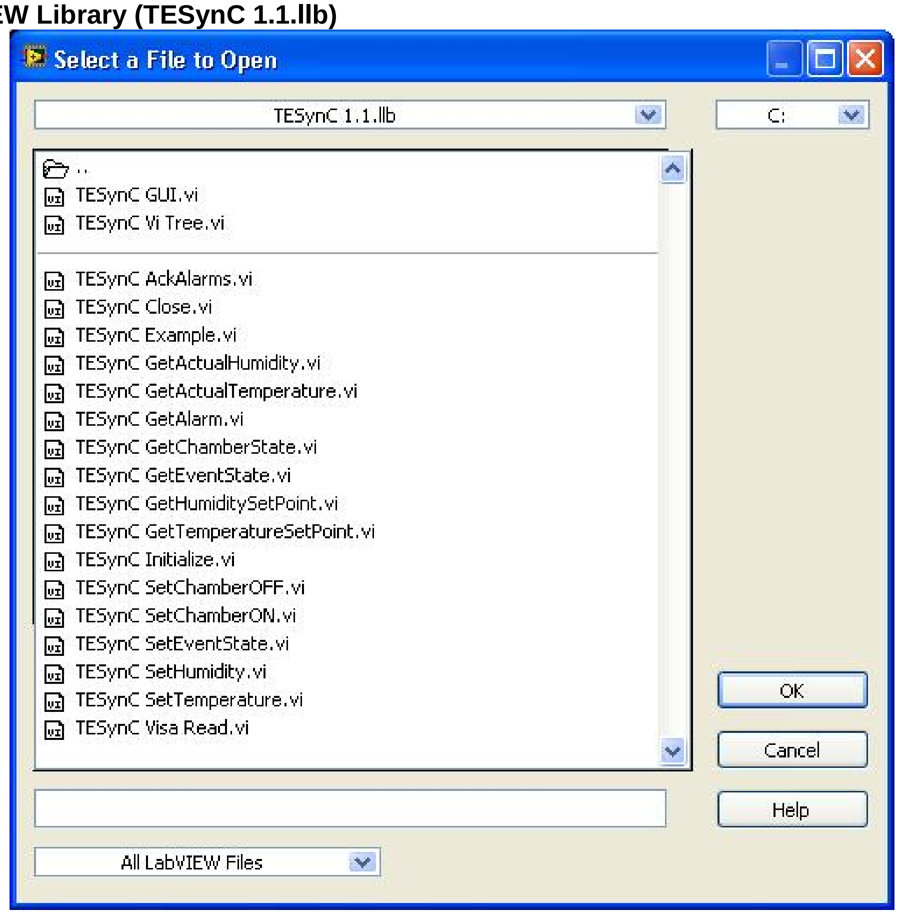
In today's Internet environment, network security is a real concern. The Synergy WebTouch Remote(tm) web server requires a username and password that is managed from the touch screen. To set the user name and password, select Web Server Login Name and press the ***Change*** button. Enter your desired Login Name on the keypad. Press ***OK*** to return to the settings window. Repeat the process for the Web Server Password. You will use this name and password when you access the Synergy Controller remotely via your web browser.

The unit's web server is now ready for use.

19.7 LabVIEW ™ Driver

The LabVIEW driver available for the Synergy Controller provides an easy way to control and monitor the instrument using GPIB (IEEE 488), Ethernet (TCP/IP) or RS-232 and speeds the development of test chamber control programs in LabVIEW. The driver was developed in LabVIEW 8.0 and can be incorporated in any application developed in LabVIEW 8.0 or higher. The driver is a LabVIEW library that contains 19 Virtual Instruments (VIs) that are specifically tailored to work with the Synergy Controller and save hours of program development time, thus greatly reducing the cost of adding chamber control to the test development process. The library also includes an *TESynC E*xample.vi and *TESynC GUI*.vi that can be used as a quick start reference.

LabVIEW Library (TESynC 1.1.llb)



LabVIEW Library Contents

The Synergy Controller LabVIEW driver contains the following Vis

Top Level VIs

- *TESynC GUI.vi*
- *TESynC VI Tree.vi*
- *TESynC VI Example.vi*

VI's to query state and parameters

- *TESynC AckAlarms.vi*
- *TESynC GetActualHumidity.vi*
- *TESynC GetActualTemperature.vi*
- *TESynC GetAlarm.vi*
- *TESynC GetChamberState.vi*
- *TESynC GetEventState.vi*
- *TESynC GetHumiditySetPoint.vi*
- *TESynC GetTemperatureSetPoint.vi*

VI's to Set state and parameters

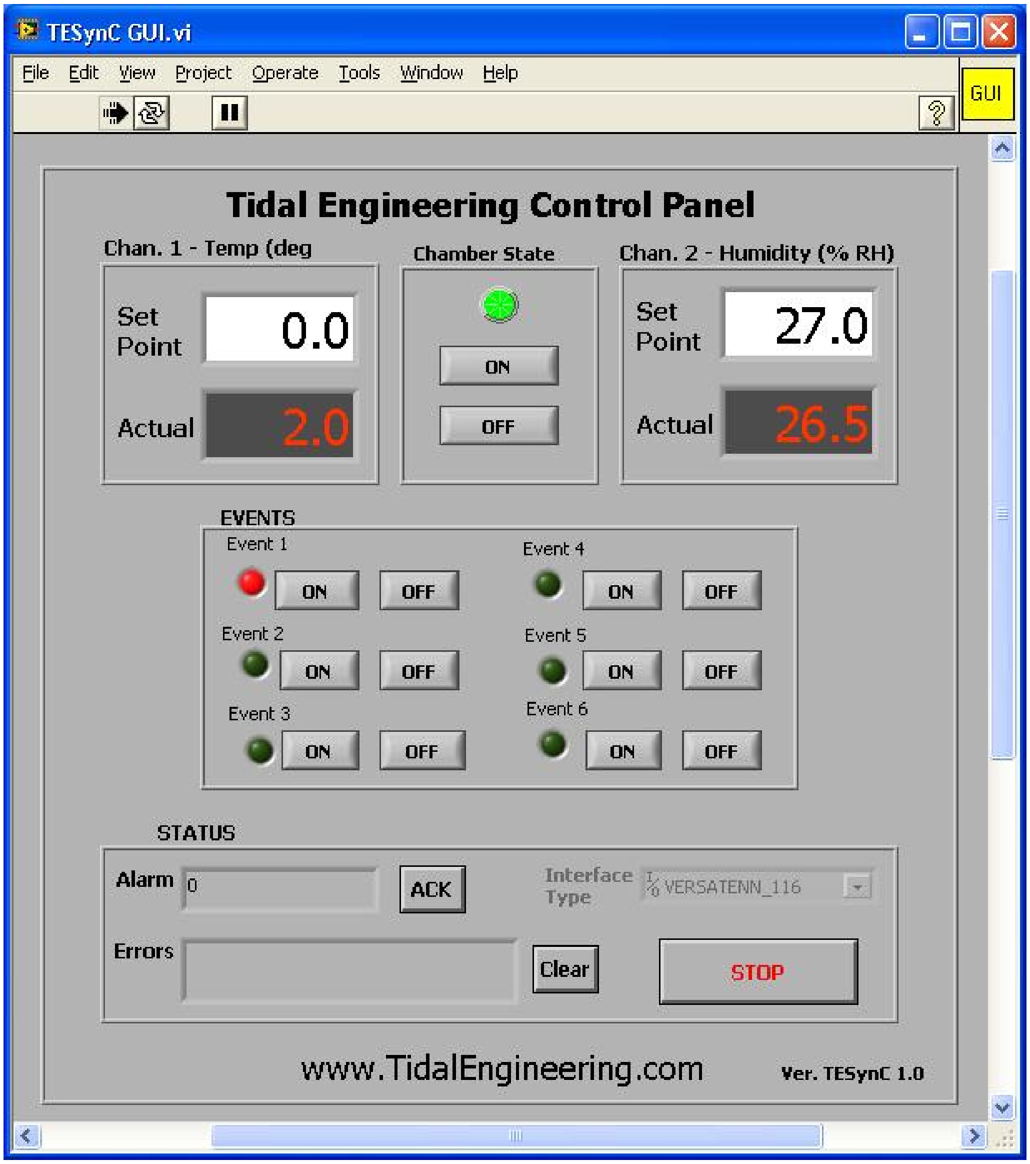
- *TESynC SetChamberOFF.vi*
- *TESynC SetChamberON.vi*
- *TESynC SetEventState.vi*
- *TESynC SetHumidity.vi*
- *TESynC SetTemperature.vi*

VI's to start and end GPIB communication

- *TESynC Initalize.vi*
- *TESynC Close.vi*
- *TESynC Visa Read.vi*
-

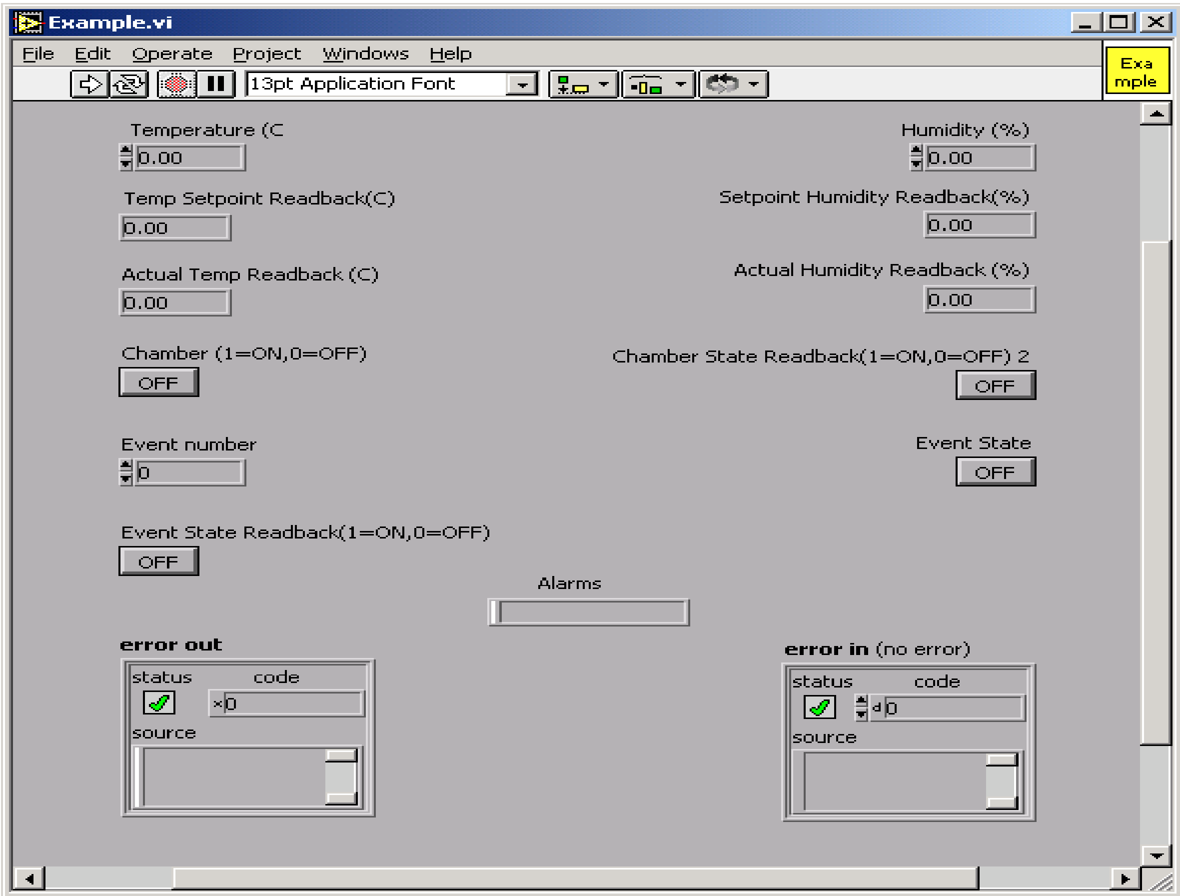
The User Interface.vi Example

The TESynC GUI.vi provides a simple control panel that can be used to quickly connect to the Synergy Controller using GPIB , Ethernet (TCP/IP) or RS-232 to verify communication and perform some basic control and monitor functions.



A Simple Example

The VIs provided in the LabVIEW driver (TESynC 1.1.llb) can be incorporated in test programs to develop custom temperature control application.



Panel View

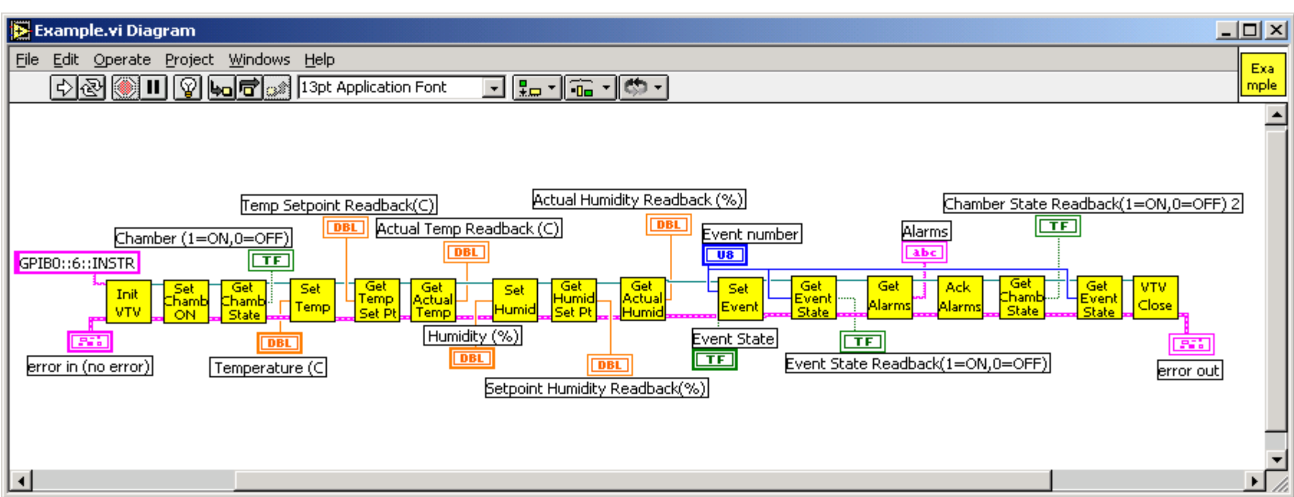
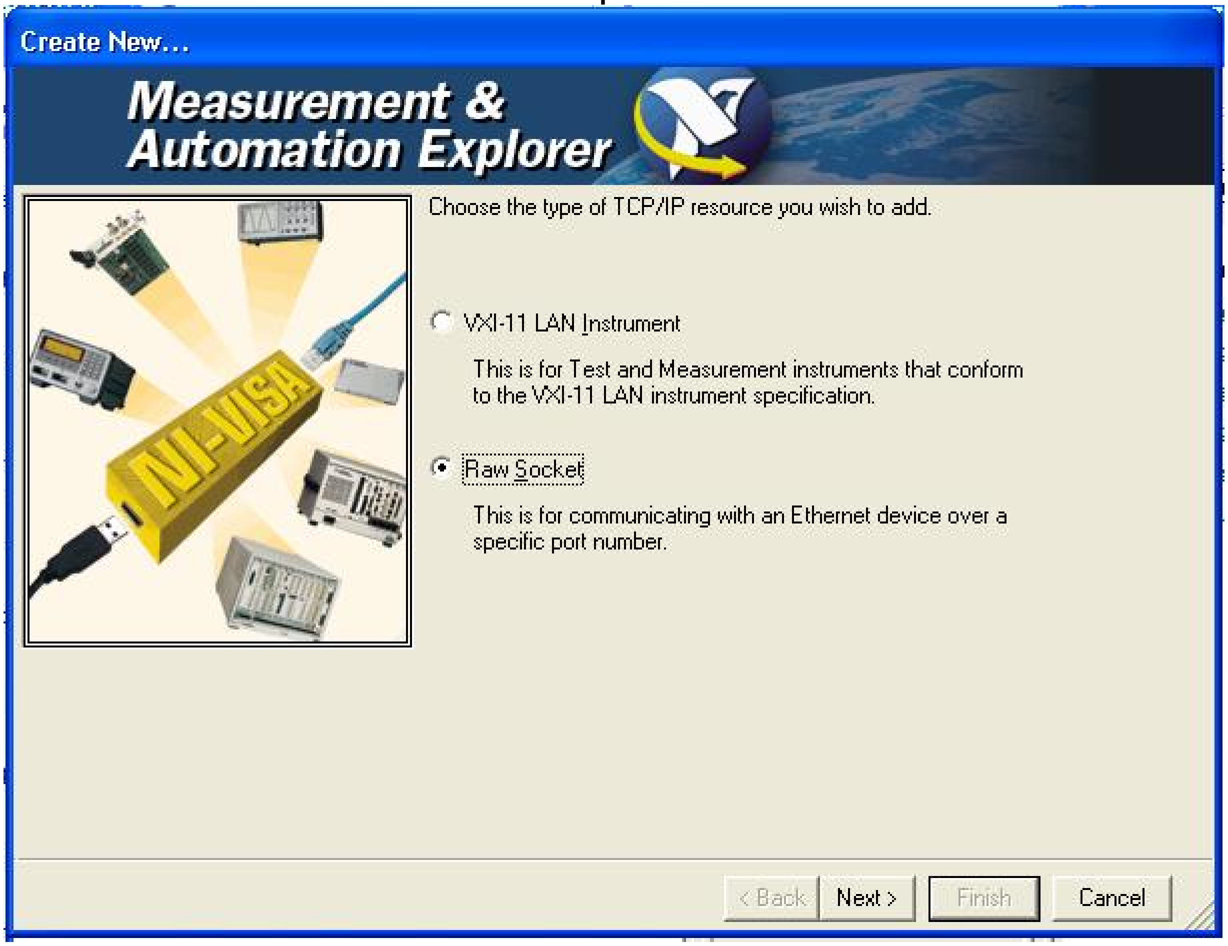
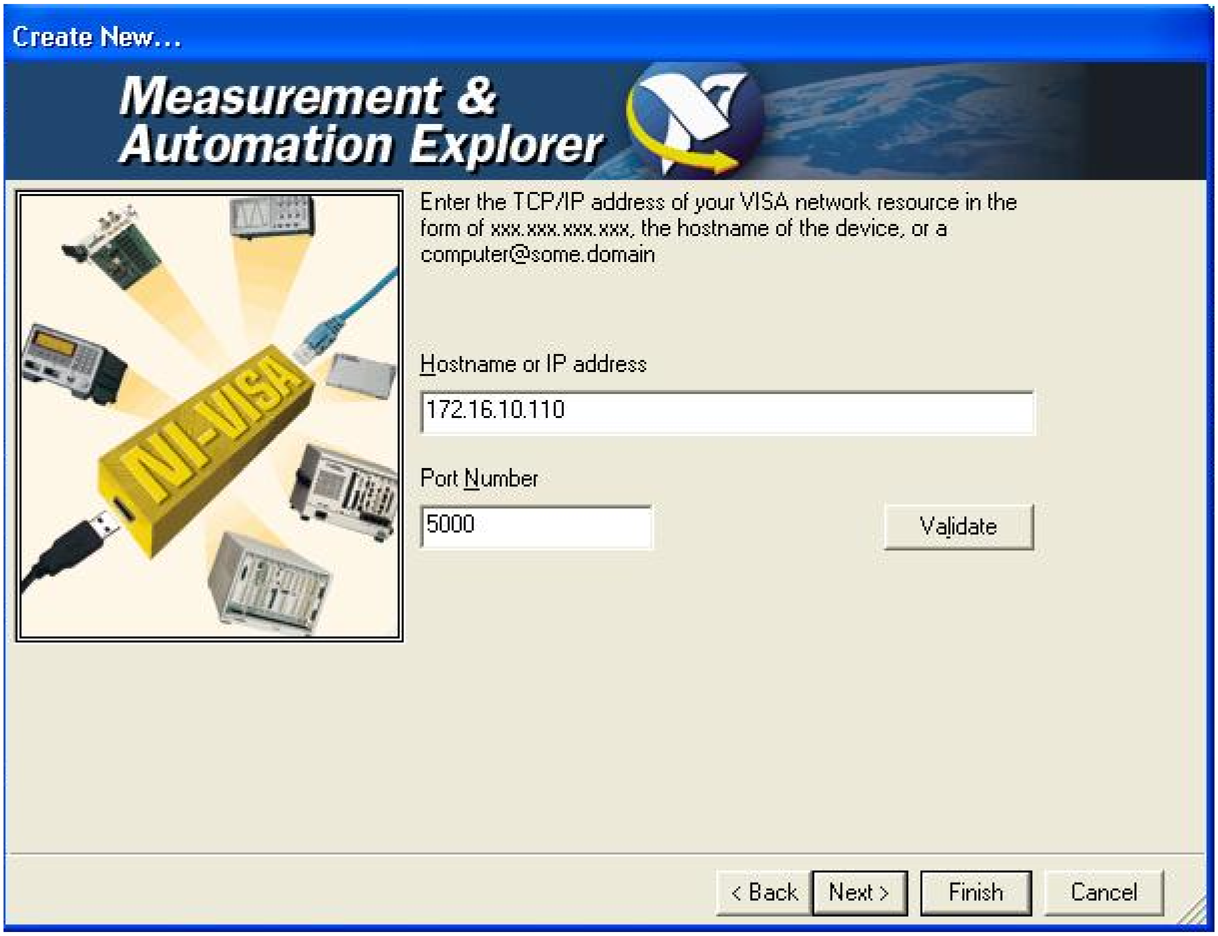


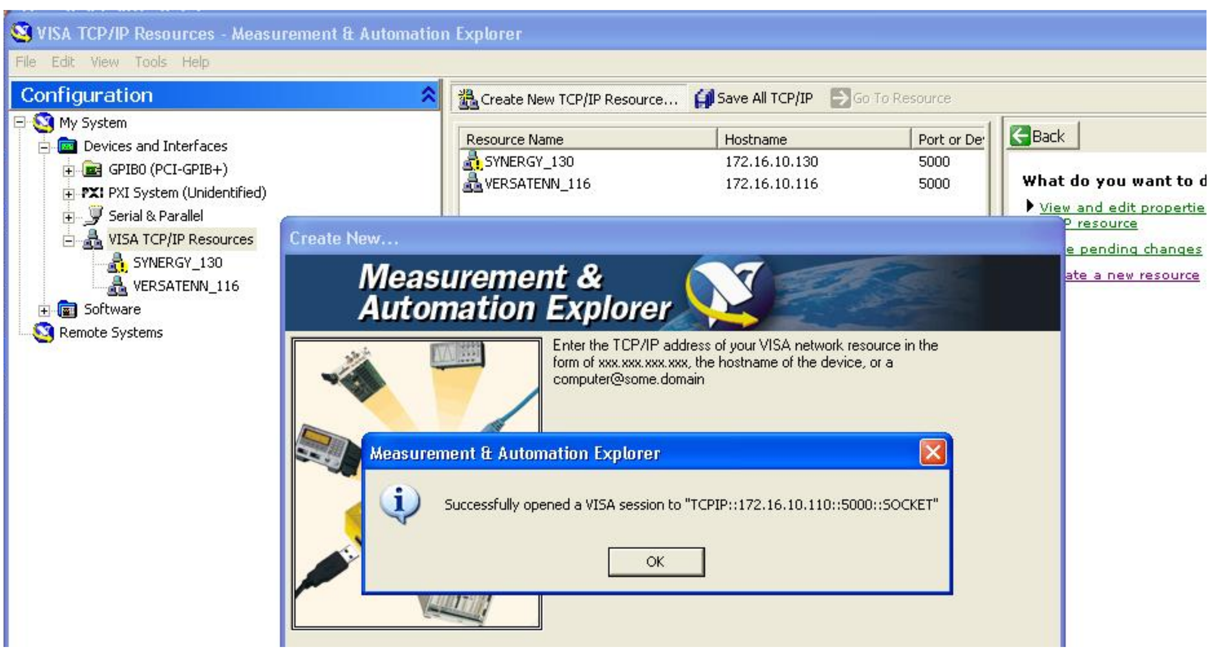
Diagram View

To create an application the user begins with the ***VTV_Initalize.vi*** and specifies the GPIB address (GPIBx::y::INSTR). The x represents the board number of the GPIB card installed in the PC and y represents the actual address of the VersaTenn temperature controller. The application must close the Visa Session, to avoid any memory related issues, by using the *VTV_Close.vi* . The other VIs can be used to customize the test application. The Measurement and Automation Explorer is used to setup a TCP/IP resource as shown below.

Setup for TCP/IP







For more information concerning the LabVIEW driver, download the technical manual from our website.

19.8 SimpleComm Examples

The following examples use screenshots to demonstrate Synergy Controller command and response with the free SimpleComm application available at www.Tidaleng.com/download.htm. See section 8.3 for detailed instructions for SimpleComm.

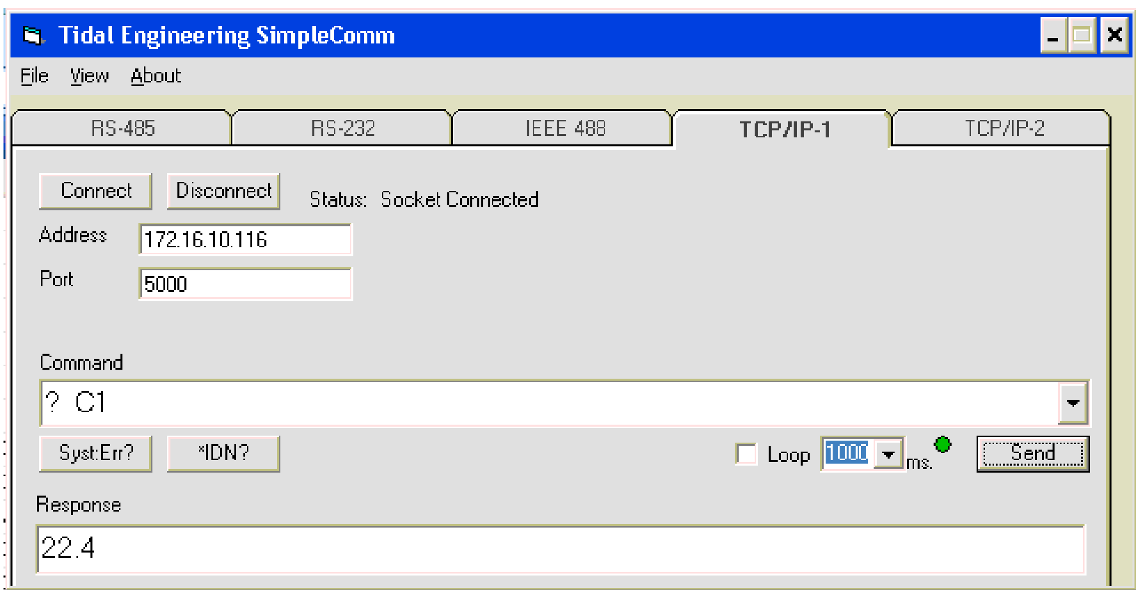
Example 1

This example demonstrates the "? C1" command which is used to query chamber temperature.

To setup this example we performed the following steps.

1. Connect the Synergy Controller to the Local Area Network (LAN) with an RJ-45 network cable.
2. Obtain the IP address of the Synergy Controller from the COMM/Ethernet Folder.
3. Enable the Synergy Controller's TCP/IP server from the COMM/TCP\IP Server folder.
4. Enter the address of the controller (From step 2) into the SimpleComm **Address** field and press **Connect** Button.
5. Enter "? C1" in the **Command** field. Note the space between "?" and "C1".

Press the **Send** button and note the temperature in **Response** field.
Note: The response is in the current units of measure for the controller.



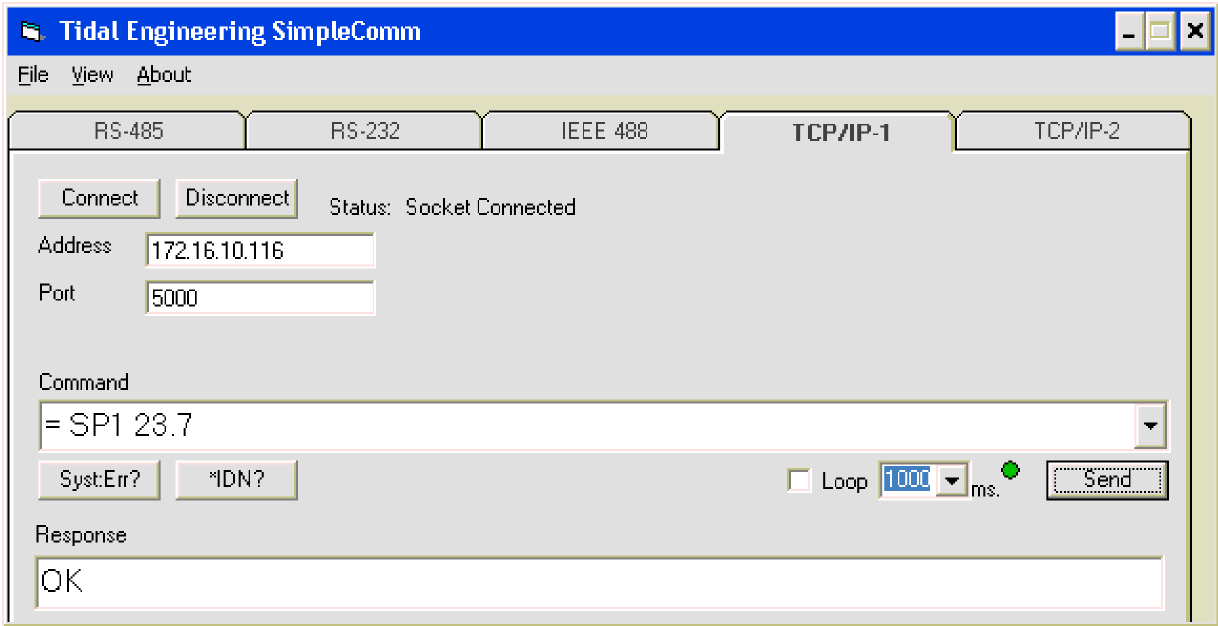
Example 2

This example demonstrates the Synergy Controller temperature setpoint command.

To setup this example we connected to the chamber as we did in Example 1, then performed the following steps.

1. Type "= SP1 23.7" in the **Command** field. Note the space between "=" and "SP1" and between "SP1" and "23.7" and don't type the quotes.

Press the **Send** button and note the OK in **Response** field. The controller responds with OK when the command is accepted.



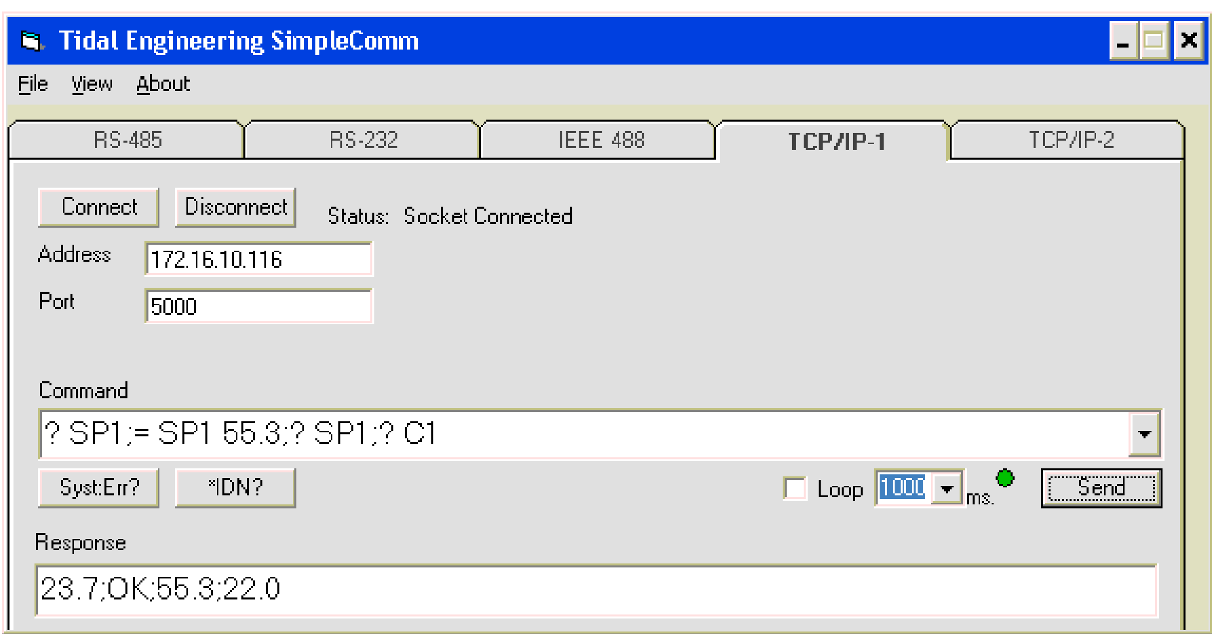
Example 3

This example demonstrates the controller's setpoint query command and multi-command capability.

To setup this example we connected to the chamber as we did in Example 1, then performed the following steps.

1. Type "? SP1;= SP1 55.3;? SP1;? C1" in the **Command** field. Note the spaces between parameters and the semicolons between commands.
2. Press the **Send** button and note the **Response** field.

6. The controller replies with the response from each command separated by a semicolon. i.e. the first response is the temperature setpoint.



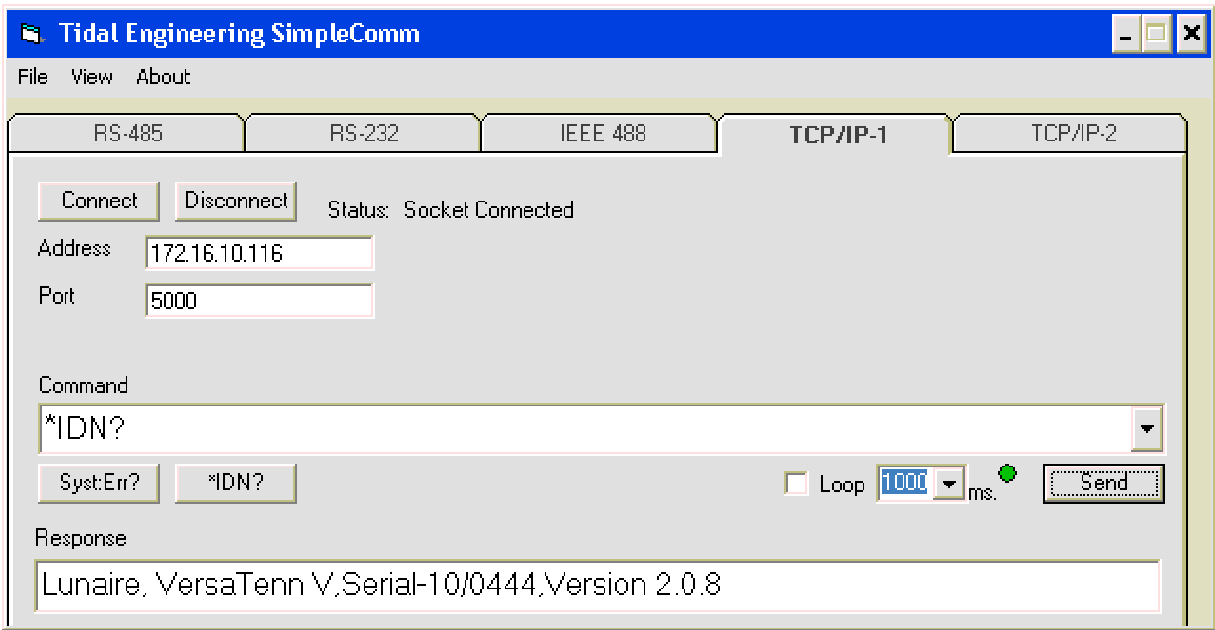
Example 4

This example demonstrates the command and response for the *IDN? query. The response contains controller information.

To setup this example we connected to the chamber as we did in Example 1, then performed the following steps.

1. Type *IDN?" in the **Command** field. Note that there are NO SPACES in this command.
2. Press the **Send** button and note the **Response** field.

Note: This query is universal for GPIB equipped instruments in accordance with the IEEE 488 standard. This command is also supported by the Synergy Controller for the TCP/IP and Serial (RS-232 and RS-485) communication.



20.0 APPENDIX D BAR CODE SCANNER SETUP

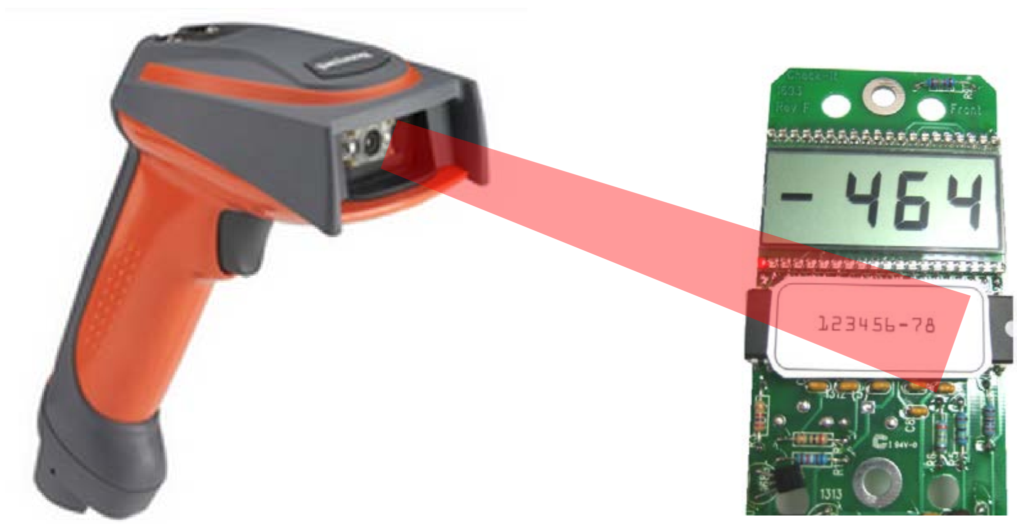
The Synergy Controller features a powerful macro capability and supports a variety of bar code scanners that together can automate complex setups for organizations working to error proof their processes.

The value of the ubiquitous “Bar Code Scanner” for speeding data entry and improving accuracy is obvious to anyone that shops at a grocery store. Synergy Controller offers the advantages of bar code scanning to engineers, operators, and managers using test chambers and process ovens. The Synergy Controller’s powerful macro capability can automatically select and start an environmental test profile simply by scanning the OCR (Optical Character Recognition) plain text label on the part. The Hand Held Products IT4800 OCR Barcode Scanner is used in this application with OCR-A text; however, virtually any bar code reader can be used.

20.1 Synergy Controller Macros

A macro is a list of Synergy communication commands in a user look-up table that the controller executes when the macro code is typed on a keyboard or received from a barcode scanner. The full power of the Synergy Controller macro capability is realized when a bar code scanner is used to trigger the macro.

20.2 Using a Bar Code Scanner with a Synergy Controller



20.3 Bar Code Scanner Equipment

The Hand Help Products ImageTeam 4800 OCR scanner can be used with a PS/2 keyboard wedge as well as with a USB interface. In addition this scanner supports OCR text as well as conventional bar codes for use in a wide range of applications. .The following specific equipment is recommended for this application:

1. Industrial Bar Code Area Imager , Hand Held Products part number: 4800SR051C
2. Hand Held Products part number: 42206161-01, USB Type A Interface.

20.4 Bar Code Scanner Installation

Connecting the Barcode Scanner

1. Connect the appropriate cable to the handle of the ImageTeam 4800 and screw on the retainer clip.

2. Connect the scanners USB cable to the Synergy Micro.

Configuring the Barcode scanner

Follow the steps below to configure the ImageTeam 4800 for use with the Synergy Controller and OCR-A fonts. If a different configuration or barcode scanner is used, see Application note 4 for alternative settings for other devices.

1. First, the barcode scanner should be reset to factory defaults. The subsequent steps adjust only those settings that differ from the factory defaults. Scan the barcode below to reset.

Standard Product Default Settings

2. Scan the "Control + ASCII Mode On" symbol. To Enable Control + ASCII mode on the barcode.

Control + ASCII Mode On

3. Skip this step for PS/2 applications. If using the Bar code reader with the USB interface, scan the following.

USB Keyboard (PC)

4. Enable the CTRL+F Prefix. This is sent before the scanner sends the barcode data.

a. Scan the "Add Prefix" symbol.

Add Prefix

b. Scan the "9" symbol.

9

c. Scan the "9" symbol.

9

d. Scan the "0" symbol.

0

e. Scan the "6" symbol.

6

f. Scan the "Save" symbol.

Save

3. Set the Prefix Delay. The scanner waits a 400ms Delay period before sending the barcode data.

   a. Scan the “Interfunction Delay” symbol.

   Interfunction Delay

   b. Scan the “9” symbol.

   9

   c. Scan the “9” symbol.

   9

   d. Scan the “Save” symbol.

   Save

4. Enable OCR-A font recognition, Scan the “OCR-A On” symbol.

   OCR-A On

The barcode scanner is now configured for use with the Synergy Controller.

20.5 Barcode Interface Specifications

This is the specification for the barcode scanner setup for use with barcode scanners.

The format required by the Synergy Controller is as follows:
[CTRL+S][400ms pause][Barcode Data][Carriage Return] [Carriage Return]

Any barcode scanner that can attach via a keyboard wedge or USB port and can be configured with the above format will work with the Synergy Controller.

20.6 Controller Setup

No changes are required to any settings on the Synergy Controller for this barcode application except to import the macro file that provides the look-up table to interpret the barcode scans and execute an action based on the barcode.

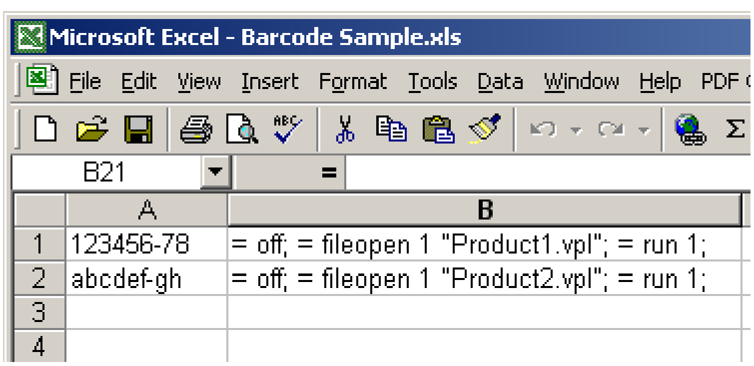
Macro File Format

The Macro file used by the Synergy Controller is a simple comma separated file easily generated within Microsoft Excel, or any other program that can save to .csv files.

The file layout consists of two columns, the barcode text (column A), and a communication command (or string of commands) to execute when that barcode text is entered (column B). The communication commands can be any valid communication commands, separated by a semicolon (;). The command string length must not exceed 900 characters. The communications command list for the Synergy Controller is available in the appendix of this technical manual and can be downloaded from www.TidalEng.com/synergy.htm

As an example, when barcode text “123456-78” is scanned we want to stop the chamber, load and run the profile “Product1.vpl”. To do this we enter 123456-78 in column A and the commands “= off; = fileopen 1 “Product1.vpl”; = run 1;” for column B. This will make sure the chamber is stopped, then load and run the profile.

Note: Obviously, the profiles that we specify in the “fileopen” command should already be loaded on the Synergy Controller when the macro is executed.



Sample Excel Macro spreadsheet

We can create as many barcode entries in the file as we need, as long as they are unique, however, we can only load one .csv file into the controller at a time, so all the barcode identifiers we need should be in that file.

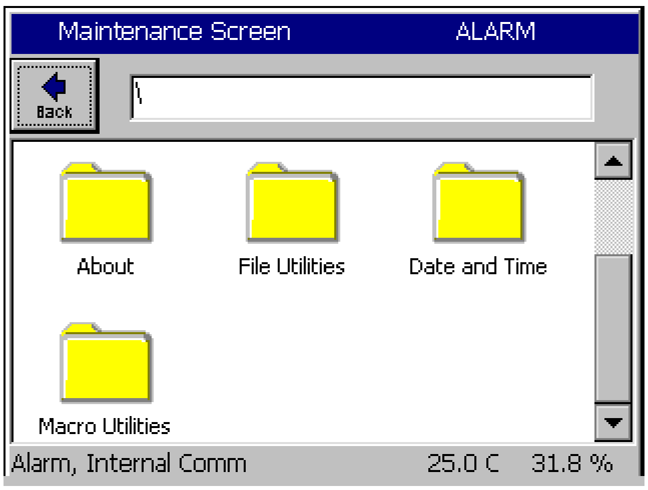
Once you have completed your macro file in Excel, click on File/Save As, enter a file name, and set the Save As type to CSV (Comma Delimited)(*.csv) and save the file.

Saving the file as type CSV

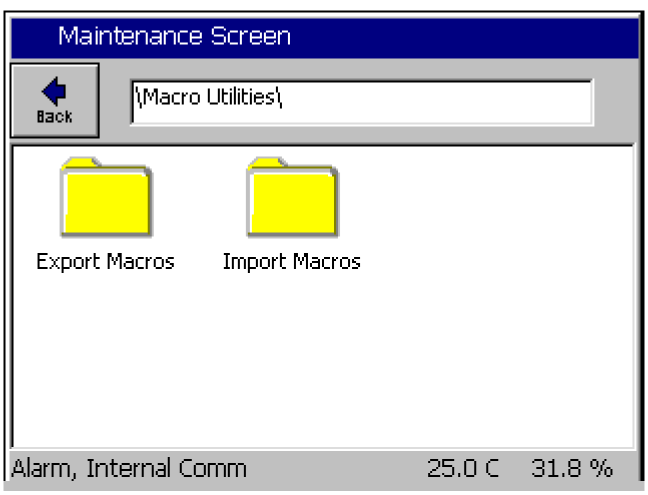
Importing the Macro File

The Synergy Controller can import the .csv macro file either from a USB Hard Disk or the FTP storage. Copy the macro file in .csv form from the PC to the root directory of a USB Hard Disk.

Note: The controller only supports one macro file, so when we import the file it does not add the contents of the file to the file loaded into the controller, it replaces the internal macro file with the one being imported.

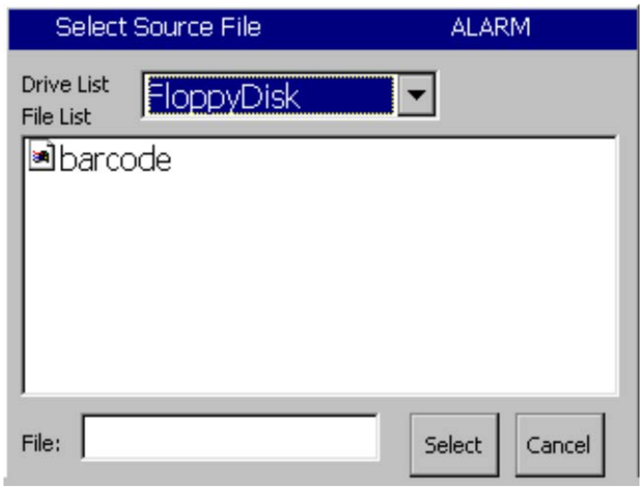


To Import the macro file, click on Maintenance on the front panel, scroll down and click on Macro Utilities.

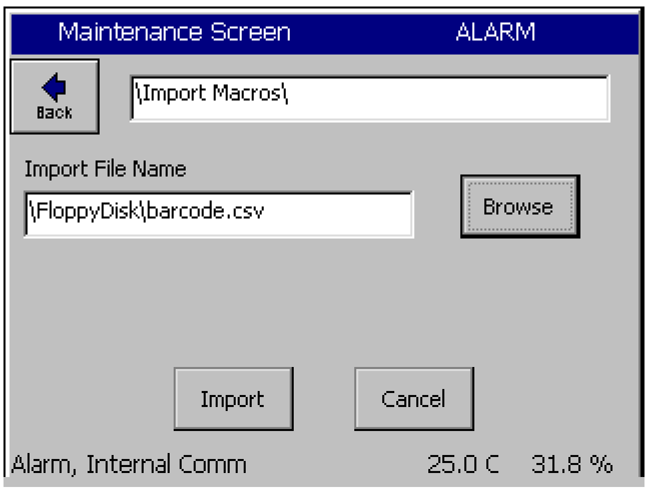


Click on the Import Macros folder.

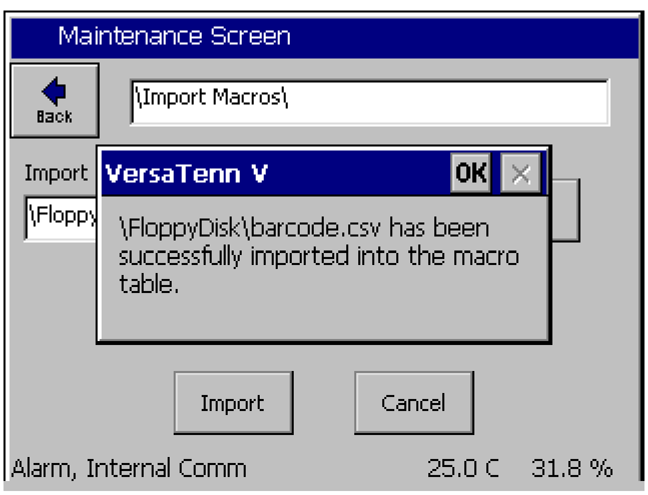
The import screen will appear. Click on Browse and then select the file you want to import, and then click the Select button.



Select the drive and the file name



Then click the Import button.



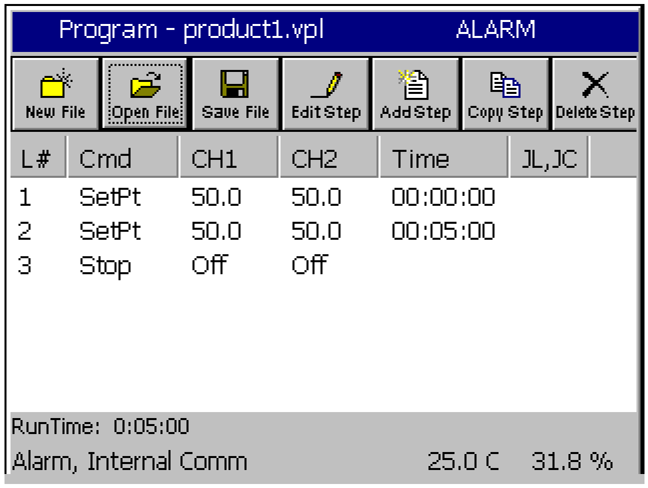
A message box will then let us know if the import was successful or not.

Now that the file is imported, we can now use the barcode scanner.

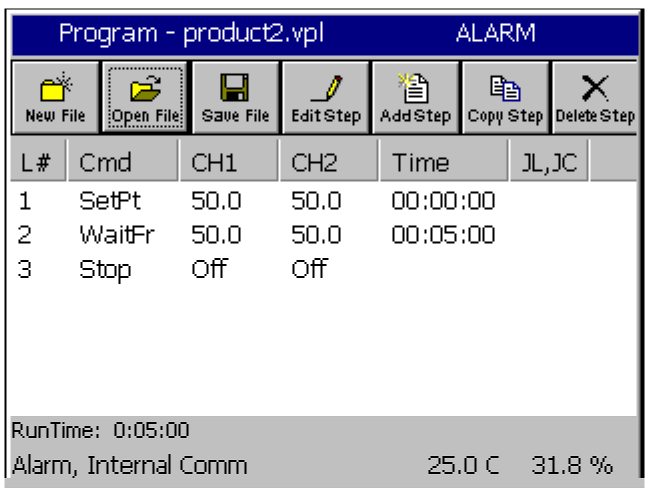
20.7 Testing and Troubleshooting

Creating Test Profiles

To create the profiles either create the example profiles as shown below or rename your own profiles as “product 1” and “product2”. As long as the programs are named product1.vpl and product2.vpl with this example macro file.



Example Profile “Product1.vpl”



Example Profile “Product2.vpl”

Testing the OCR scanner

Having followed the steps above, everything is ready and the barcode scanner should be ready to go. Printed below are two example OCR-A Test Labels that can be scanned to test the configuration. Scan each label to load and run the appropriate profile in the controller. When we scan 123456-78 the controller will load product1.vpl and start running it. When we scan ABCDEF-GH the controller will load product2.vpl and start running it.

ABCDEF-GH	Test Label 1
123456-78	Test Label 2

Test the Bar Code scanner with Log File entries

Alternatively, create a list of part numbers, employee names etc. and print it. This can be attached near the operator's station.

Date	Application
Employee RICHARD LAWRENCE	Employee Name
Employee Peter Paul	Employee ID
S/N 01/0639	Serial Number
P/N TE1299-04, S/N 01/0639	Part Number and Serial NumberTCweb16-Slave
W/O 1219080-12-87W	Work Order

Trouble Shooting

If the barcode scanner does not work with the Synergy Controller try the following troubleshooting steps.

Test the Scanner on a PC

To test the functioning of the scanner, plug it into the keyboard port on you PC. Open a text editor such as notepad. Then scan Test Label 1 on the previous page. If the scanner is functioning correctly the text “123456-78” should appear in Notepad’s Find Dialog box. The “Ctrl F” prefix will not show up in notepad. If the scanner does not output text or the output is incorrect then go back to the beginning of this manual and follow the scanner setup procedure one more time. If the problem continues to persist, consult your scanner’s user manual.

Test Macros on the Synergy Controller

If the scanner is functioning correctly, the next step is to test the macro feature of the Synergy Controller. Plug a standard PS/2 keyboard into the Synergy Controller. To run a macro press “CTRL F” then type the Macro name “123456-78” and hit enter. The macro should run successfully. If it does not run successfully, you should check your macro file on your PC for syntax accuracy and save it to a disk or USB key. Then import the macro into the Synergy Controller and try running it again.

21.0 APPENDIX E APPLICATION NOTE LIST

The following application notes are available as of this printing. Check the Tidal website for the latest.

AppNote 1 - Replacing a VersaTenn III Controller
AppNote 2 - Synergy Controller Data Logging Capacity Calculations
AppNote 3 - Retrofitting a Qualmark HALT/HASS Chamber
AppNote 4 - Configuring the Synergy Controller to Read from a Bar Code scanner
AppNote 5 - Synergy Controller vs. VersaTenn III
AppNote 7 - Synergy Controller WebTouch Remote Feature
AppNote 8 - Using SimpleComm application to communicate with the Synergy Controller
AppNote 10 - Synergy Controller Retransmit Signal Conditioner :
AppNote 20 - Using the TE1908 Single Channel Thermocouple Signal Conditioner
AppNote 25 - Using the Synergy Controller with Space Chamber applications.
AppNote 26 - Using the programmable User Alarms with the Synergy Controller
AppNote 40 - Two Point Calibration.
AppNote 45 - Using the Synergy Controller's ftp server.
AppNote 49 - Synergy Controller Security Enhancements
AppNote 56 - Using the Synergy Controller Watchdog Timers
AppNote 58 - Synergy Controller Wet-Bulb/Dry-Bulb Humidity Measurements.
AppNote 59 - Synergy Controller Wireless Network Setup.
AppNote 60 - Graphing Synergy Log Files in Microsoft Excel.
AppNote 67 - Synergy Controller Mounting Options.
AppNote 71 - Synergy Controller PWM Retransmit Feature
AppNote 72 - Synergy Controller Thermocouple Data Acquisition with Synergy UUT Modules
AppNote 74 - Synergy Controller LED Backlight Retrofit Kit
AppNote 77 - Synergy Controller Remote Start/Stop Feature
AppNote 84 - Synergy Controller E-Mail Feature
AppNote 85 - Synergy Controller Logging Features and Applications
AppNote 89 - Synergy Controller Loop-Back Setup
AppNote 90 - Synergy Controller Network Printing Feature
AppNote 91 - Synergy Controller Built-In Alarms
AppNote 95 - Synergy Controller Kft and other Pressure Display
AppNote 96 - Synergy Controller Analog Retransmit Applications
AppNote 99 - Synergy Server Feature
AppNote 102 - Synergy Certified OEM and Installer Training
AppNote 106 - Synergy Controller Cascade Loop (Part Temperature) Control Feature
AppNote 107 - Synergy Controller Programming with Python
AppNote 109 - Synergy488 Kit Setup for Synergy Nano and Synergy Quattro GPIB
AppNote 112 - General Purpose Logic Programming for OEMS and Integrators
AppNote 113 - Main Screen Display Setup Options
AppNote 116 - Synergy Controller Pressure Applications
AppNote 117 - Synergy Controller Help System Video QR Codes.
AppNote 121 - Synergy Controller Ramp Rate Control.

In addition to these application notes, detailed chamber specific retrofit installation instructions are available for some chambers. Contact us at www.Tidaleng.com with the specifics of your chamber application.

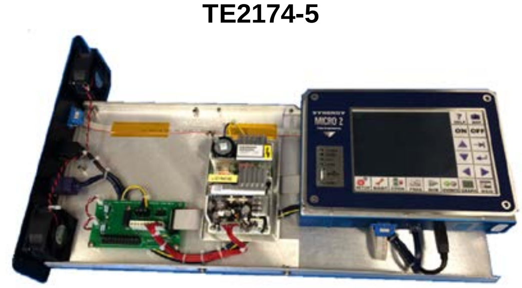
22.0 APPENDIX F PART NUMBERS

22.1 Controllers

P/N	Controller Model	Description
TE2174-1	Synergy Micro 2 Controller/Data Logger	Fourth Generation Synergy Controller. Features: Touch Screen, 100 MB Logging, WebTouch Remote, RS-232, GPIB Replaces TE1704-1 and TE1530, Included: TE2174-3 and TE2014-1
TE2174-5	Synergy Micro 2 V Controller/Data Logger Console	Same as TE2174-3 in the Console tray. Replaces TE1704-5 and VersaTenn V, P/N TE1364
TE1961-3	Synergy Quattro Controller/Data Logger	Fifth Generation version of Synergy Controller designed to replace virtually any legacy controller including the VersaTenn family for new and retrofit applications. Provides the features of Synergy Micro 2 except: - GPIB/IEEE 488 Communications (optional) - Low Resolution Analog Inputs
TE1858-1	Synergy Nano Controller w/Transistor Outputs	1/4 DIN Synergy Controller with Transistor Outputs, Color Touch Screen, USB Data Logger, 10/100 BaseT Ethernet, RS-232
TE1858-2	Synergy Nano Controller w/Relay Outputs	1/4 DIN Synergy Controller with Relay Outputs, Color Touch Screen, USB Data Logger, 10/100 BaseT Ethernet, RS-232
TE1858-3	Synergy Nano Controller w/SSR Outputs	1/4 DIN Synergy Controller with SSR Outputs, Color Touch Screen, USB Data Logger, 10/100 BaseT Ethernet, RS-232
TE1858-4	Synergy Nano Controller w/Expansion Mode Olympic Board	1/4 DIN Synergy Controller with Olympic Board Expansion, Color Touch Screen, USB Data Logger, 10/100 BaseT Ethernet, RS-232, GPIB, up to 32 Outputs

TE2174-3

TE2174-5



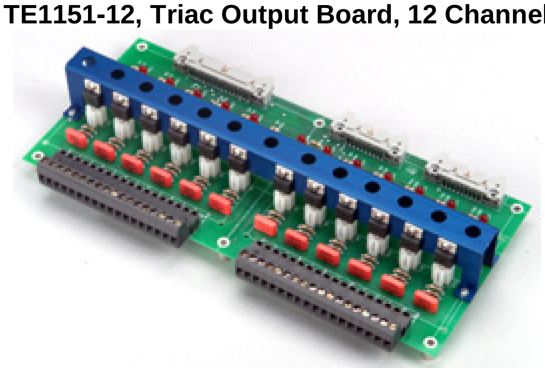
TE1961-6

TE1858-1

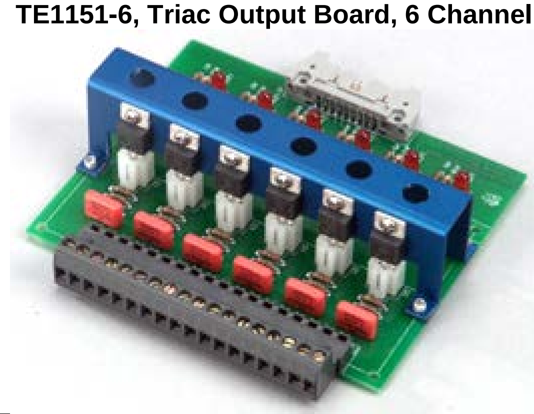
22.2 Output Board Options

P/N	Model	Description
TE1151-12	Triac Output Board, 12 Channel	Outputs: 12 Load: 6 Amps, 110 - 220 VAC. Features: Drive external triacs for larger loads
TE1151-6	Triac Output Board, 6 Channel	Control up to six (6) 6 Ampere AC loads, 110 - 220 VAC, and drive external triacs for larger loads
TE1151-5	Triac Output Board, 5 Channel	Control up to five (5) 6 Ampere AC loads, 110 - 220 VAC, For VersaTenn III Retrofit
TE1708-6	Relay Output Board, 6 Channel	Control up to six (6) 6 Ampere AC loads 110 - 220 VAC, or DC Loads, or control signals
TE2251	Synergy Quattro SSR Module	Synergy Quattro SSR Module, 5-Channel Adapts directly to VersaTenn III SSR Plug.
BTA40-800B	TRIAC 800V 40A RD-91	Used with TE1151 series to create low cost SSR that can drive compressors.

TE1151-12, Triac Output Board, 12 Channel

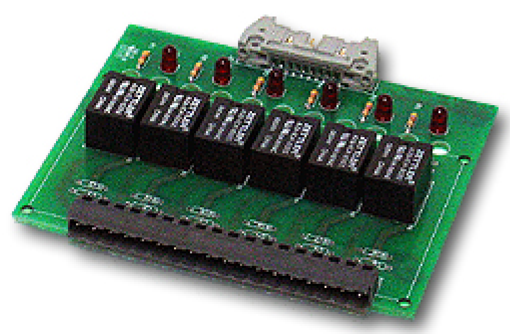


TE1151-6, Triac Output Board, 6 Channel



TE1151-5, Triac Output Board, 5 Channel

TE1708-6, Relay Output Board, 6 Channel



22.3 Software Options

P/N	Model	Description
TE1566-1	Synergy Lab Manager Software with USB Dongle	Windows Based, Multi-Chamber Monitor Program Controls the following Chambers Controller types Synergy Controller, VersaTenn, VersaTenn II, III,& V Watlow 942, F4, Thermotron T4800 Yokogawa and BlueM 550/750, Partlow 1462 Data Logging, Data Graphing Alert System Fax and e-mail notification
TE1566-2	Synergy Lab Manager Software with Parallel Port Dongle	Windows Based, Multi-Chamber Monitor Program Same as TE1566-1 with a Parallel Port Dongle
TE1567	Synergy Web Touch Remote	Operate your Synergy Controller over a network or the Internet using a standard web browser. For all Synergy Controller models
TE2013	Synergy Pressure Feature Registration.	Pressure channel for altitude and thermal vacuum (Space) chamber applications. For all Synergy models
TE2042	Synergy Cascade Feature Registration	Synergy Controller Cascade Feature Registration. For all Synergy Controller models
TE2175	Synergy Controller Printing/Plotting Feature Registration	Automatically plot test results to network printers and e-mail PDF formatted plots, without a PC.

22.4 Accessories

P/N	Model	Description
TE1813	Synergy Micro Technical Manual	Replacement Synergy Micro Technical Manual
TE1299-16	16-Chan UUT Module	16 Channel Thermocouple Data Acquisition unit for use with VTV and Synergy Environmental Test Chamber Controllers
TE1908	Single Channel Thermocouple adapter	Single Channel Thermocouple adapter for Synergy Controller. Selectable inputs include Type J, K, E, R, S, T, B, N, and C. DIN-rail mountable.
TE1988	Single Channel RTD adapter	Single Channel RTD adapter for Synergy Controller.
TE1594	RTD Temperature Sensor	RTD temperature sensor. 100 Ohm Platinum (Pt) sensor for use with Synergy Controller
TE1924	4-20 mA Terminating Resistor	Precision terminating resistor for 4-20mA, 250 ohm, 0.1% resistor. Supplied with Synergy Micro.
TE2183	Triac Leakage Suppression Resistor	Triac Leakage Suppression Resistor, 115V 4K, 6.5W
TE1803	Synergy Retransmit Conditioner	Single Channel Synergy Analog Retransmit Outputs. Isolated Output Ranges include 0-5V, 0-10V, 0-20mA, 4-20mA
TE2130	Humidity Sensor	HMM30C Humidity Sensor, Voltage or Current Output
TE2078	Synergy Remote Wiring Extension Kit	Synergy Remote wiring kit (up to 5 meters)

22.4 Accessories (Continued)

P/N	Model	Description
TE2086	Synergy RS485 Wiring Extension Kit	Synergy Remote wiring kit (up to 1000 meters)
TE1972	Synergy Fiber Optic Extender Kit	Synergy Remote wiring kit (up to 4000 meters)
TE2095	Ethernet CAT-5 Panel-Mount Cable, 6'	Ethernet CAT-5 Panel-Mount Cable, 6 Ft. Supplied with controllers
TE1608	Serial Communication Cable	RS-232/RS-485 Serial Communication Cable for User and UUT, 6 ft. Supplied with controllers.
TE1722-20-6	Ribbon Cable, 20 Position, 6 ft.	Ribbon Cable, 20 Position, 6 ft. For use with Olympic boards and 6-channel output boards. . Supplied with Controllers.
TE1722-34-6	Ribbon Cable, 34 Position, 6 ft.	Ribbon Cable, 34 Position, 6 ft. For use with 12-channel output boards. Supplied with Controllers.
TE2014-1	Synergy Micro Accessory kit	Replacement Synergy Micro Accessory kit Included with TE2174-1 and TE2174-5
TE2034	Synergy Nano Accessory kit	Replacement Synergy Nano Accessory kit Included with TE1858-1, TE1858-2, and TE1858-3
TE2129	Universal Input Limit Controller, 1/16 DIN	Universal Input Limit Controller, 1/16 DIN. Provides additional protection for test chamber and Product
TE2132	USB to RS-232 Converter	USB to RS-232 Converter for use with Synergy Manager

22.5 Spare Parts

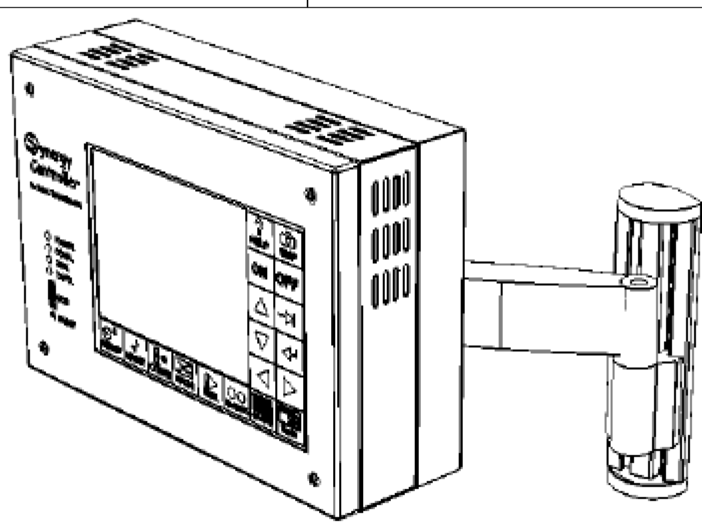
P/N	Model	Description
TE1155	Olympic Controller	Replacement Olympic Controller Compatible with all VersaTenn V and Synergy Controlers
TE2053	Replacement Floppy Drive for Synergy Compact	Replacement Floppy Drive for the Synergy Compact
TE2054	Replacement Floppy Drive for the VTV	Replacement Floppy Drive for the Synergy V and VTV
TE1660	Color LCD	Replacement LCD for Synergy and VTV, 5.7" Color With CCFT Backlight
TE1296	Resistive Touch Sensor	Replacement Resistive Touch Sensor for Synergy Micro and VersaTenn V Controllers
TE1719 OBSOLETE	Synergy Color LCD CCFT Backlight see TE2136	Replacement CCFT Backlight bulb for Synergy Micro and VTV
TE1854 OBSOLETE	Backlight Inverter see TE2136	Replacement Backlight Inverter, Synergy and VTV Controller
TE2136	Synergy LED Backlight Kit	LED Backlight Kit for Synergy Micro and VTV Includes Driver and LED Lamp. Replaces TE1719 and TE1854
TE1586	Synergy Micro Overlay	Replacement Synergy Micro Graphic Overlay
TE1787-32	Synergy 32 MB DOC	Replacement Synergy 32 MB DOC (Disk on Chip)
TE1811	Synergy / VTV Standard Power Supply	Replacement Power Supply for the Standard VersaTenn V
TE1812	Synergy / VTV Compact Power Supply	Replacement Power Supply for the Compact VersaTenn V and Synergy Controllers
TE2134	Synergy Micro and Micro 2 5VDC Power Supply	Replacement 5 VDC Power Supply for Synergy Micro and Synergy Micro 2
TE2135	Synergy Micro and Micro 2 12VDC Power Supply	Replacement 12 VDC Power Supply for Synergy Micro and Synergy Micro 2
TE1894 OBSOLETE	Synergy / VTV Processor Board See TE2174	Replacement Processor Board for VersaTenn V and Synergy Controllers
TE1914	Synergy Micro Processor Board	Replacement Processor Board for Synergy Micro
TE1895	Synergy SDRAM	Replacement SDRAM for VersaTenn V and Synergy Compact Controllers
TE1896	Synergy Repair Charge	Repair Charge for VersaTenn V and Synergy Controllers
TE1897	Synergy Calibration Charge	Calibration Charge for VersaTenn V and Synergy Controllers
TE1997-1	VersaTenn V Input Fuse	Replacement Fuse IEC FAST HIBRK 5X20MM 3.15A F3.15AH250VAC, 5 X 20 mm
TE1997-2	Synergy Compact Input Fuse	Replacement Fuse IEC FAST HIBRK 5X20MM 2.50A 2.5AH250VAC, 5 X 20 mm
TE1390	Synergy Console Fan Assembly	Replacement Synergy V Console Fan Assembly
TE1317	Synergy V Console I/O Assembly	Replacement Synergy V Console I/O Assembly

22.5 Spare Parts (Continued)

P/N	Model	Description
TE1378	Synergy V Console Connector Kit	Replacement Synergy V Console Connector Kit
TE2214	Synergy Micro 2 CPU Upgrade	Upgrades TE1704 Synergy Micro to Synergy Micro 2
TE1914	Synergy Micro Replacement CPU	Replacement Synergy Micro CPU
TE2270	Synergy Micro 2 Replacement CPU	Replacement Synergy Micro 2 CPU
TE1860-31	Power Supply Assembly for TE1858-1	Replacement Power Supply For TE1858-1
TE1860-32	Power Supply Assembly for TE1858-2	Replacement Power Supply For TE1858-2
TE1860-33	Power Supply Assembly for TE1858-3	Replacement Power Supply For TE1858-3
TE1864	Synergy Nano Overlay	Replacement Synergy Nano Overlay
TE2158	Synergy Nano LCD	Replacement Synergy Nano LCD with 4-Wire Touch
TE2198	24 VDC Power Supply	DIN Rail Mounted 24 VDC 15 Watt Power Supply For TE1908, TE1803, TE1988, etc.
TE2069	2-GB SD Card for Synergy Nano	2-GB SD Card for Synergy Nano
TE2146	2-GB SD Card for Synergy Micro 2	2-GB SD Card for Synergy Micro 2

22.6 Mounting Options

P/N	Model	Description
TE1879	Synergy Swivel Enclosure	Synergy Controller Swivel Enclosure
TE2012	Synergy Articulating Mounting Arm	Synergy Controller Articulating Mounting Arm
TE2062	Synergy Micro Panel Adapter, Envirotronics Systems Plus	Synergy Micro Panel Adapter, Envirotronics Systems Plus Dimensions: 10.25" X 9.25"
TE2065	Synergy Micro Panel Adapter , MicroTenn (II) Retrofit	Synergy Micro Panel Adapter , MicroTenn (II) Retrofit Dimensions: 9.50 X 15.25"
TE2067	Synergy Micro Panel Adapter, Thermotron 7800	Synergy Micro Panel Adapter, Thermotron 7800 with 1/32 DIN and 1/16 DIN Knockouts Dimensions: 19.00" X 7.00"
TE2076	Synergy Nano Panel Adapter, VersaTenn III Retrofit	Synergy Nano Panel Adapter, VersaTenn III Retrofit with 1/16 DIN Knockout Dimensions: 9.25" X 6.50"
TE2094-1	Synergy Nano Panel for adapter VersaTenn Retrofit	Synergy Nano Panel for adapter VersaTenn Retrofit 1/4 DIN and 1/16 DIN Knockout (6.00" X 9.00")
TE2187	Synergy Micro Panel Adapter, for VersaTenn II Retrofit	Synergy Micro Panel Adapter, for VersaTenn II Retrofit Dimensions: 12" x 9"
TE2209	Synergy Micro Panel Adapter, ESPEC Controller	Synergy Micro Panel Adapter, ESPEC Controller Dimensions: 12.5" x 11.5"
TE2077	Cable Mounting Plate, Bulkhead, Stainless Steel	Cable Mounting plate for GPIB, Ethernet, and RS-232 Supplied with Micro, Nano 4, and Synergy488. Dimensions: 1.50" X 1.50"
TE2077-4	Cable Mounting Plate, Bulkhead, Stainless Steel	Cable Mounting plate for Ethernet, and RS-232 Dimensions: 1.50" X 1.50"
TE2077-5	Cable Mounting Plate, Bulkhead, Aluminum	Filler Mounting plate for GPIB, Ethernet, and RS-232 Dimensions: 1.50" X 1.50"
TE1576	Synergy Micro Bezel	Replacement Synergy Micro Bezel This item is included with TE2174-1 and TE2174-5 Controllers
TE2188	Synergy Hardware kit	Synergy Micro Hardware kit Included with TE2174 and TE1921 Controllers
TE1921-1	Synergy Micro Briefcase Demo Unit	Synergy Briefcase Demo unit is a portable demo and training system for Synergy Micro Controller.
TE2071	Synergy Nano Briefcase Demo Unit	Synergy Briefcase Demo unit is a portable demo and training system for Synergy Nano Controller.



P/N TE2012
Synergy Controller
Articulating Mounting Arm

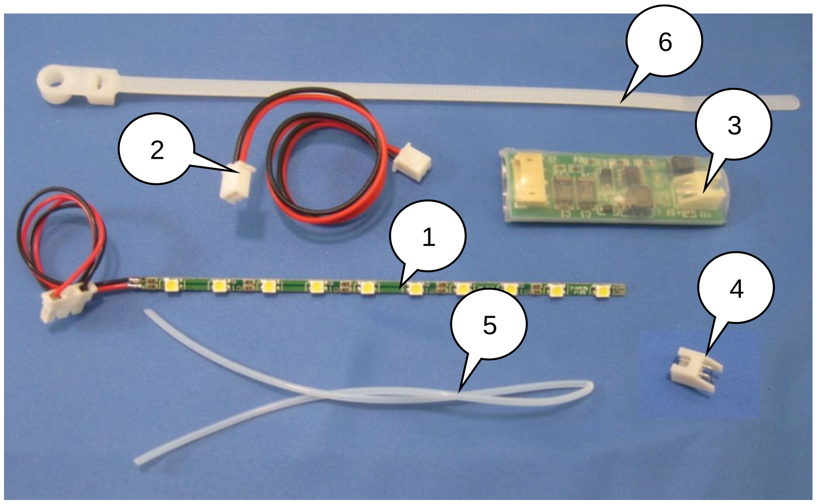
22.7 Synergy Micro 2 Accessories Kit

Item	Quantity	Part	Description
1	1	TE1576	BEZEL, Flat Stainless, Synergy Logo
2	1	120-D-111/03	AC Power Connector (120 is 5mm
3	1	311013-01	Cord 18AWG 3Cond 79" Black SJT
4	1	TE1596	GPIB Cable, 6 Feet
5	1	TE1608	RS-232/RS-485 Cable, 6 Feet
6	1	TE1722-34-6	Ribbon Cable Assembly, 34 position, 6 feet
7	2	TE1722-20-6	Ribbon Cable Assembly, 20 position, 6 feet
8	1	TE2013	Synergy USB Flash Drive, 8GB
9	4	TE1924	Precision 250 ohm, 0.1% resistor.
10	1	TE1813	Synergy Controller Technical Manual
11	1	1770-06C	CAT6 Panel-Mount Extension 6FT.
12	1	TE2077	Synergy Bulkhead Connector Panel, SS
13	1	TE1566-0	Synergy Manager (Monitor Only Version)
14	5	8C62BHSS	Screw, 8x32x 5/8 SS Butt/H Socket
15	1	15206	Hex Key driver, 3/32"
16	3	CW0054K000JE73	Triac Leakage Suppression Resistor, 4K, 6.5W
17	1	TE2149	Synergy Micro 2 Bezel Overlay

22.8 LED Backlight Upgrade

The Synergy Controller switched to an LED Backlit Liquid Crystal Display (LCD) beginning with the Synergy Micro 2. Prior versions utilized a CCFL (Cold Cathode Fluorescent Lamp) backlight. A long life Synergy LED Backlight Retrofit kit is available to retrofit CCFL lamps. This kit, P/N TE2136, utilizes Hi-Brightness white LEDs from CREE and is backward compatible with all current Synergy Controller and VersaTenn V configurations equipped with 5.7” LCDs.

The installation instructions for the LED Backlight kit are included with each kit. The instructions can also be downloaded from the Tidal Engineering website. [AppNote 74 - Synergy Controller LED Backlight Retrofit Kit]



The TE2136 kit contains: (Identified in the figure above)

1. TE2113, Synergy Micro LED Backlight Lamp Assembly
2. TE2137, Synergy Micro LED Backlight Power Cable Assembly
3. TE2121, Synergy Micro LED Backlight Driver Assembly
4. S2B-XH-A, J17, Connector, 2 POS, Right/Angle Connector
5. Teflon Sleeving, 9 inches, .(040" ID , CLR 0.065” OD, P/N TFT20018 NA005).
6. Tyrap Cable Ty (Panduit Corp, P/N PLC2S-S6-C0, CLAMP TIE STD #6SCR WR BK 7.9").
7. Synergy_Controller_App_Note_74_Synergy_LED_Backlight_Retrofit_P4

If the Synergy Controller’s lamp burns out, it may be helpful to temporarily operate the controller using one of these two methods.

1. Using the Monitor output (VGA), keyboard and mouse.
   See Section 4 (Synergy V and Compact only)

2. Using the WebTouch Remote™ Web Browser interface.
   See Section 8

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