SYNERGY NANO

Designed Specifically For Environmental Test Chambers

A TWO-CHANNEL 1/4 DIN PROCESS CONTROLLER

Technical Manual

For One and Two Channel Systems

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Revision History

Rev.	Date	Revision
-	December 3, 2008	Preliminary

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1.0 INTRODUCTION

Welcome to the Synergy Nano 1/4 DIN touch screen control system designed and manufactured by Tidal Engineering Corporation. The Synergy Nano incorporates the latest software developments in environmental test chamber control, with a user-friendly touch-screen interface that makes programming and diagnostics tasks simple and easy.

The 2-channel, multi-processor based controller is the newest addition to Tidal's award-winning Synergy Series of hardware and software expressly engineered to enhance the performance of a broad range of test chambers. Exhibiting unparalleled integration and connectivity, the instrument is designed to retrofit easily into nearly every ¼ DIN controller-equipped test chamber and oven.

In addition to the Synergy Nano, Tidal's Synergy Series is comprised of the Synergy Micro controller, Synergy Web Server Software, Synergy Manager Software for control and monitoring of multiple environmental chambers, and Synergy UUT (Unit-Under-Test) thermocouple module. The Synergy Series uniquely provides networking capabilities for office and factory automation as well as test and measurement protocols and standards.

The Synergy Series is ideal for a wide range of applications since the Synergy Nano and the full sized Synergy Micro share the same Synergy Controller software; the user and programming interface are identical. This provides the benefit of lower training, engineering and support costs to the OEM and end user alike. This scalability is unique in the industry.

Offering OEMs, test labs, and re-builders/re-furbishers the ultimate in cost-effective integration of control, logging and connectivity features, the instrument is singularly appropriate for use in the broadest spectrum of environmental testing applications including temperature, humidity, vibration, altitude, HALT (Highly Accelerated Life Testing)/HASS (Highly Accelerated Stress Screening), thermal shock, and thermal vacuum testing processes. The Synergy Nano is ideal for use in chambers or ovens when controlled environments are essential for the testing, screening, and calibration of mission-critical systems and components. Among those industries in which the instrument can be confidently employed are electronic systems, semiconductors, aerospace, automotive, medical, and pharmaceutical. It most frequently replaces Watlow F4 and 942, Yokogawa, Partlow 1462, and BlueM Pro-550 environmental chamber controllers.

Utilizing the robust feature set of Microsoft® Windows® CE .NET operating system, and boasting a 320 x 240 (color LCD) touch screen, the one-pound, 3.78" W x 3.78" H x 3.94" D Synergy Nano takes complete command of chambers' conditioning systems. Its logic automatically selects heating/cooling modes as required, and controls programming of process variables versus time. The Synergy Nano moreover gives operators the facility to program up to six custom events outputs to accommodate user applications and optional features. While two of the instrument's control channels can function for temperature control in temperature shock applications, one can be programmed to control temperature while the second manages humidity, altitude, or vibration. Temperature is measured using a platinum RTD or thermocouple, whereas electronic transducers easily accommodate other process inputs. The controller also comes loaded with diverse sophisticated communications capabilities including RS-232, 10/100 Base-T Ethernet, and LabVIEW drivers. Units are shipped standard with 1 GB on-board Flash and 64 MB SDRAM for data logging, alarm logging and storage, along with a USB host port. Furthermore, the Synergy Nano supports program recipes with an unlimited number of set points, auto start, hold, and jump loop steps, besides six event outputs. The instrument is provided in four output configurations: DC open-collector, solid state relays, mechanical relays, and an expanded configuration that provides such enhanced features as GPIB and up to 32 outputs. Built-in remote control/monitoring, a USB bar code reader, and GPIB (IEEE 488) is optionally offered.

Eight Screen Navigation keys provide immediate access to total system control. You can easily switch between an array of setup, programming, and diagnostic screens. While entering information on one screen, you can switch to another screen to view a setting or parameter, and then return to the previous one. Navigation and control buttons on every screen permit instant access to chamber functions and options. Color real-time data graphing displays important trend information. The versatility and the simplicity built into the new Synergy Controller makes it truly 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 2.7.9. 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 and newest features.

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

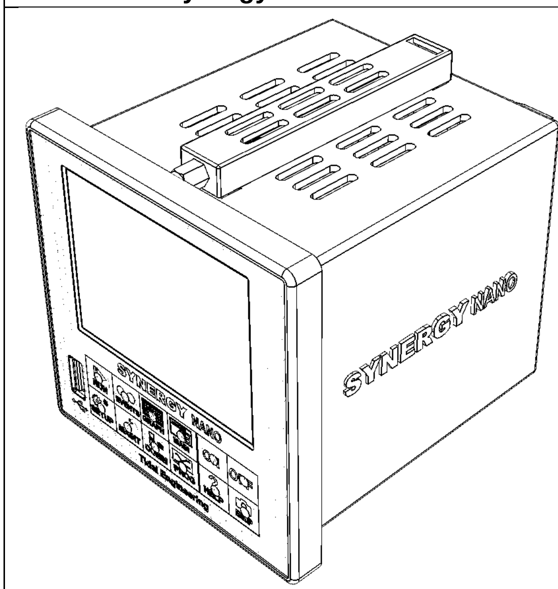
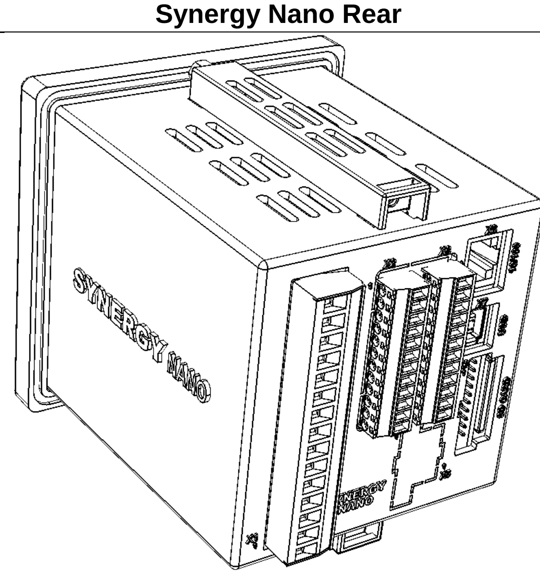
Controller Configurations

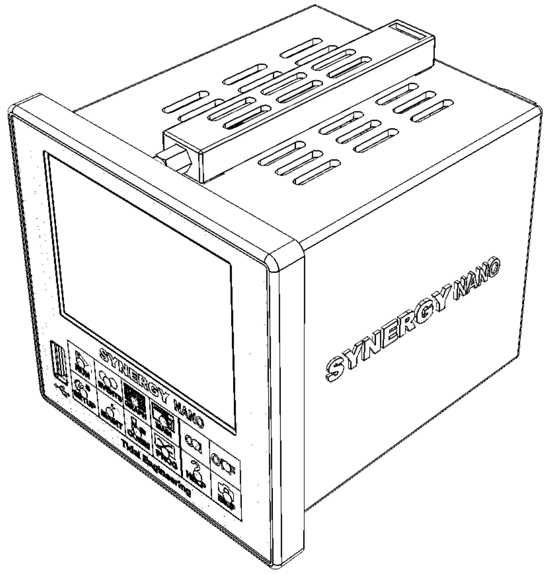
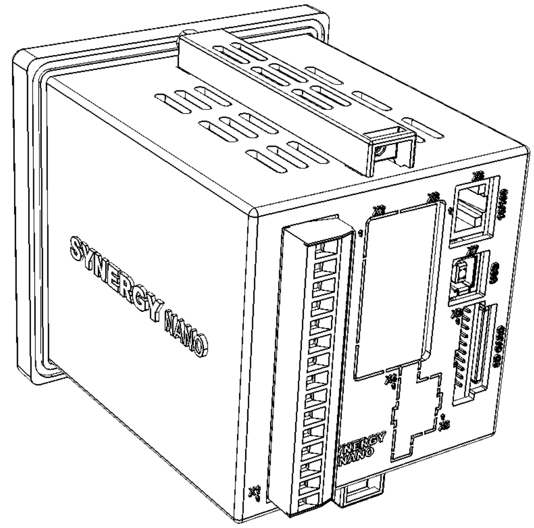
There are four Synergy Nano configurat6ions. With them and the previous four other configurations there are a total of eight Synergy Controller configurations. This technical manual covers the Synergy Nano Configurations. The Synergy V, Synergy Compact, Synergy Micro and Synergy Micro V are covered in the Synergy Controller technical manual however; images of these other configurations are shown in the table on the page after next for reference.

The Synergy Nano N1, N2, N3 are virtually identical, the only difference between them is in the output configuration (transistor, SSR, relay) of their six main outputs. The fourth configuration, Nano Plus is significantly different than the other three in that it utilizes the Synergy Olympic board for input and output and thus can support more chamber functions than the three stand-alone models. More significantly, however, is that the Nano Plus can easily retrofit into VersaTenn applications since it supports the same output wiring scheme. The unique features of each Nano configuration are listed in the table below along with an icon for each. Features that aren't supported by all four configurations are identified in this document with the icons in the margins that indicate configurations supported.

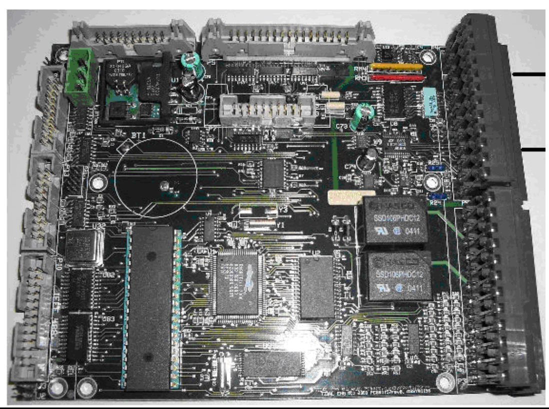
Type	Synergy Nano 1	Synergy Nano 2	Synergy Nano 3	Synergy Nano +
Icon	N1	N2	N3	N+
P/Ns	TE1858-1	TE1858-2	TE1858-3	TE1858-4
Processor	ARM	ARM	ARM	ARM
Main Outputs	(6) Transistors Open Collector	(6) SSRs Solid State Relays	(6) Relays Mechanical Relays	Expanded Olympic Board
Ethernet	10/100 BaseT	10/100 BaseT	10/100 BaseT	10/100 BaseT
OS	5.0	5.0	5.0	5.0

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

N1 N2 N3	**Synergy Nano Front**	**Synergy Nano Rear**
		

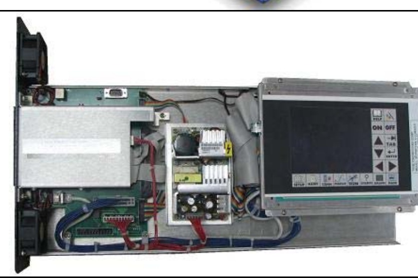
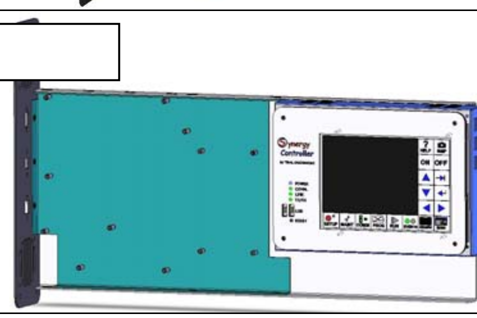
	Synergy Nano Plus Front	Synergy Nano Plus Rear
		

Synergy Nano Plus Olympic Board



The following table identifies the four Synergy configurations covered by the Synergy Controller Technical Manual.

Type	Synergy Compact	Synergy Micro	Synergy V	Synergy Micro V
Icon	C	M	V	M
P/Ns	TE1530, TE1666	TE1704-1, TE1704-3	TE1364	TE1704-5
Processor	x86	ARM	x86	ARM
Floppy Drive	Yes	No	Yes	No
Ethernet	10/100 BaseT	10 BaseT	10/100 BaseT	10 BaseT
OS	2.11 and 4.2	5.0	2.11 and 4.2	5.0

C	**Synergy Compact** 
M	**Synergy Micro** 
V	**Synergy V** 
M	**Synergy Micro V** 

Synergy Nano Chamber Type Applications

The Synergy Nano can control many test chamber types including one and two channel systems. Standard configuration s are predefined at the factory. These include:

Synergy Nano Configurations	Description
Nano Temperature Only	Temperature Only Chambers
Nano Temperature/Temperature	Thermal Shock Chamber
Nano Temperature/Humidity	Temperature/Humidity Chambers
Nano Temperature/Pressure	Altitude and Space Chambers
Nano Temperature/Vibration	HALT/HASS Chambers
Nano Pressure	Altitude and Space Chambers

Synergy Micro and Synergy Nano Plus Chamber Type Applications *

The Synergy Controller and the Synergy Nano Plus can control one, two, three and four channel systems. These include:

Synergy Nano Configurations	Description
Generic Temperature Only	Temperature Only Chambers
Generic Temperature/Temperature	Thermal Shock Chamber
Generic Temperature/Humidity	Temperature/Humidity Chambers
Generic Temperature/Humidity Single Stage	Temperature/Humidity Chambers with Single Compr.
Generic Temperature/Pressure	Altitude and Space Chambers
Generic Temperature/Humidity/Pressure	Altitude Chambers
Generic Temperature/Humidity/Vibration	HALT/HASS Chambers
Generic Temperature/Vibration	HALT/HASS Chambers
Generic Pressure	Altitude and Space Chambers

Important Warnings!

Make sure you completely understand the operations and functions of the Synergy Controller before you begin operating 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 on the test chamber and will void your 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.

1.1 Company Information and Assistance

Congratulations on purchasing the Synergy Nano control system. The Synergy Nano and Synergy Micro Controllers are designed by Tidal Engineering to control the next generation of new environmental test chambers. They can be used as drop in retrofit controllers for legacy Watlow F4 and VersaTenn controllers. The Synergy controllers are applicable to various industrial applications including refrigeration devices for blood storage, cold chain management and other temperature and regulatory sensitive applications.

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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Important! 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 component should fail, it is recommended that only OEM approved parts 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

Channels

1 or 2
1 thru 4 (Nano Plus Only)

Process Variables

- Temperature
- Humidity
- Altitude
- Vibration

LCD

Type: Color 320 X 240
Backlight: LED, 50,000 Hours
Touch screen: Resistive

Communications

10/100 BaseT Ethernet
Telnet, FTP and WebTouch Servers
RS - 232 Communications
IEEE 488 (Optional)

Storage

1 GB On Board Flash
Removable USB Flash Disk
64 MB SDRAM
Universal Serial Bus (USB)
For USB Flash Memory for Program and Log File and Export, Also for Bar Code Scanner, USB Mouse and USB Keyboard

Programming

Windows-friendly program file names Step Types:
- Set Point, Jump Loop, Auto Start, Hold, Stop
Number of programs:
- Only limited by onboard storage

Software Features

Real Time clock with battery backup.
Automatic resume after power failure
Software configurable chamber type

Analog Inputs – (2) Universal and (2) process

RTD
Temp. Range: -200° C to 630° C
Accuracy: +/- 0.05 Ohms
Type 100 or 500 Ohm Pt., JIS or DIN
T/C
T/C Accuracy: +/- 1° C
Types E, B, J, K, R, S, and T
Process
Resolution: 16 Bits
0-5 VDC, 0-10 VDC
4-20 mA

Analog Outputs

Number of Analog Outputs: 2
Range: 0-5 VDC Standard, 4-20 mA Optional
Accuracy: +/- 0.5 mv
Resolution: 12 bits
Analog Output Functions:
Channel 1 & 2
Setpoint, Actual, Heat PID, Cool PID

Main Outputs

Number of Main Outputs: 6
DC Outputs: Model TE1858-1
0 – 5 VDC Open Collector
Relay Outputs: Model TE1858-2
Contact Rating: 1 A, 250 VAC
SSR Outputs: Model TE1858-3
Contact Rating: 1 A, 250 VAC

DC Outputs (6)

0 – 5 VDC

Event Outputs (6)

0 – 5 VDC, for TE1151-6, TE1708-6,TE1616-6 Cards

Digital Inputs

Number of Digital Inputs: 5
Up to 16 Digital Inputs **(Nano Plus Only)**
Ground: TRUE
Open Circuit: FALSE
Voltage Range: - 0.5 to +5.5 VDC

Data Logging

Interval:
1 Second to 60 Minutes
Data:
Process Variables
Setpoints,
PID variables
UUT T-Type thermocouple

Alarm Types

Low Program Memory
Low Space Storage Card
Temp-Guard External Monitor
Open Sensor Ch 1
Open Sensor Ch 2
High Process Limit
Low Process Limit
High Deviation Limit
Low Deviation Limit
User Programmable Alarms
Internal communications failure

Power Requirements:

100 to 240 VAC, 47 to 63 Hz
8-24 VDC (Optional)
10 Watts

Operating Conditions:

Temperature: 10° C to 30° C
Humidity: 0 to 90% RH, Non-condensing

Size and Weight:

3.78” W X 3.78” H X 3.94” D, 1.5 lbs.

Compliance:

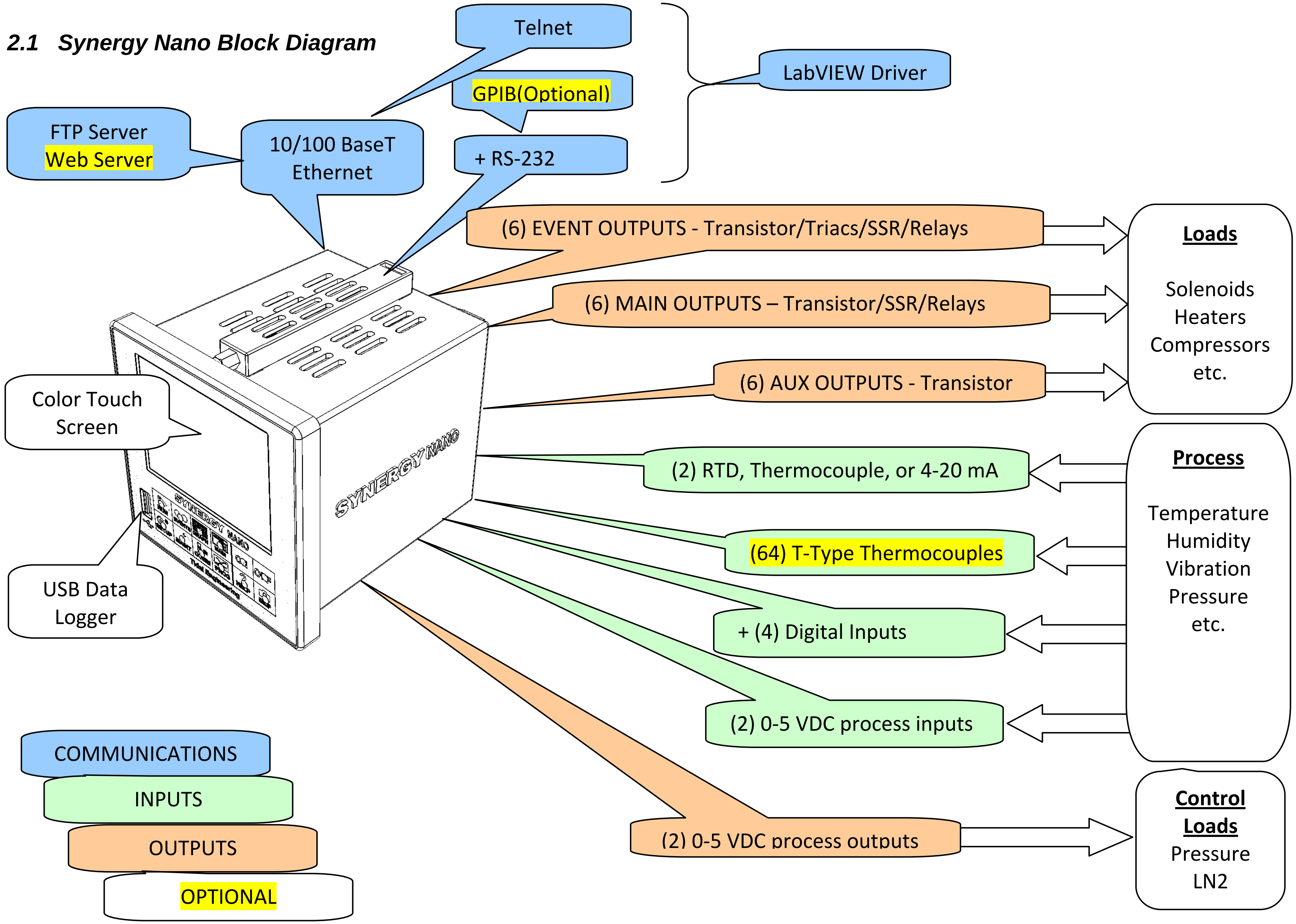
Touch Safe Terminals
CE
EN 61010-1
EN 61326
IP-65 and Nema 4X

Synergy Nano Controller and Options Part Numbers:

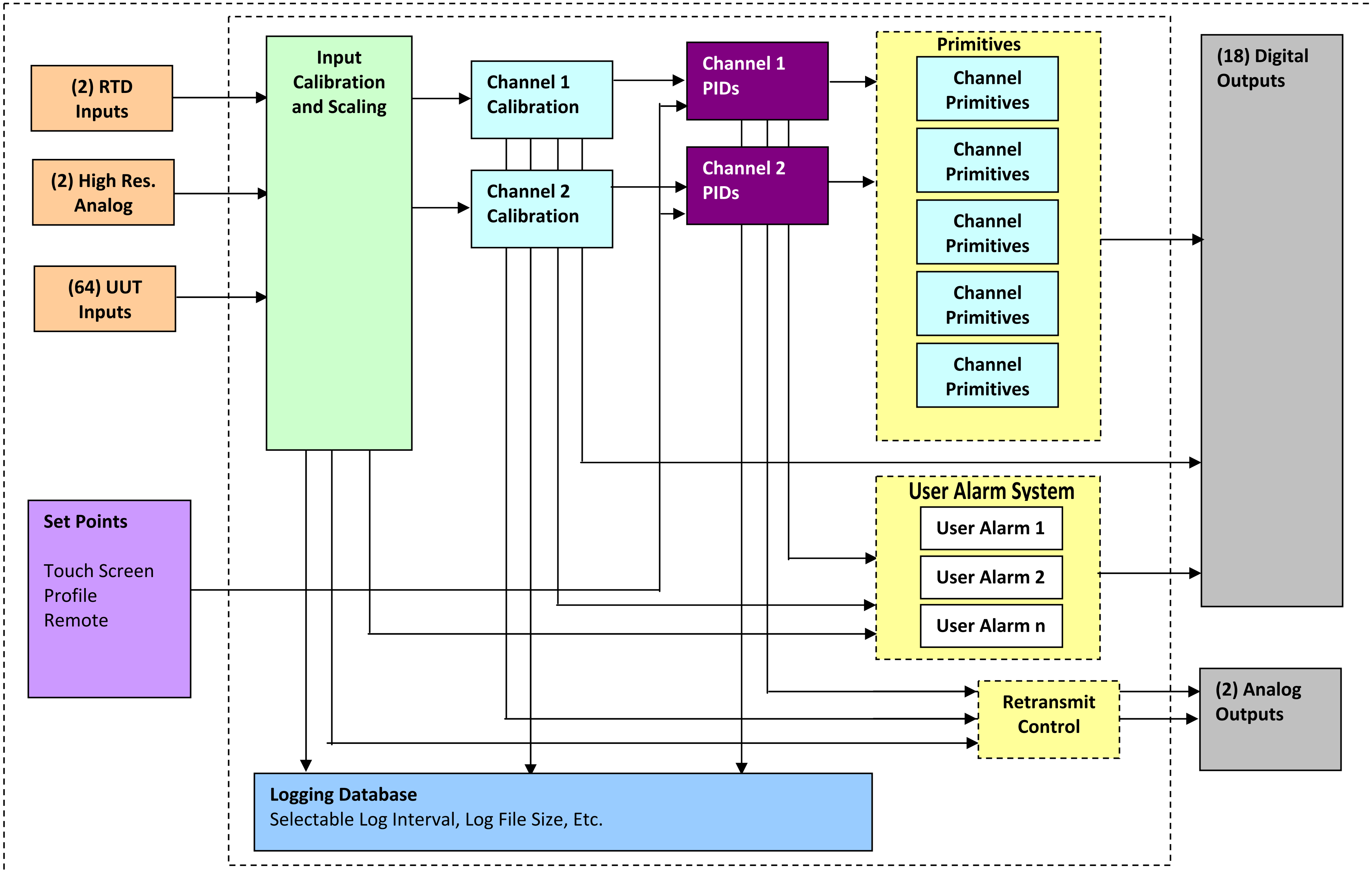
TE1858-1: DC Outputs
TE1858-2: Relay Outputs
TE1858-3: SSR Outputs
TE1858-4: Nano Plus Expanded Mode
RTD Process inputs (2),
0-5VDC Process inputs (4)
Outputs (32)
Digital Inputs (16)
TE1566: Synergy Lab Manager Software
TE1299-16: Synergy UUT Thermocouple Monitor
TE1151-6: Triac Output Board, 6 Channel
TE1616-6: Universal Output Board, 6 Channel
TE1708-6: Relay Output Board, 6 Channel
TE1865: Synergy LabVIEW Driver
TE1643: Synergy488 GPIB opt

The Synergy Nano and the other Synergy Controllers are flexible multi-channel control systems designed to handle virtually all temperature control applications, supporting programming, logging, remote control and alarming. The block diagrams in the following section identify the major data processing components of the controller and their relationships.

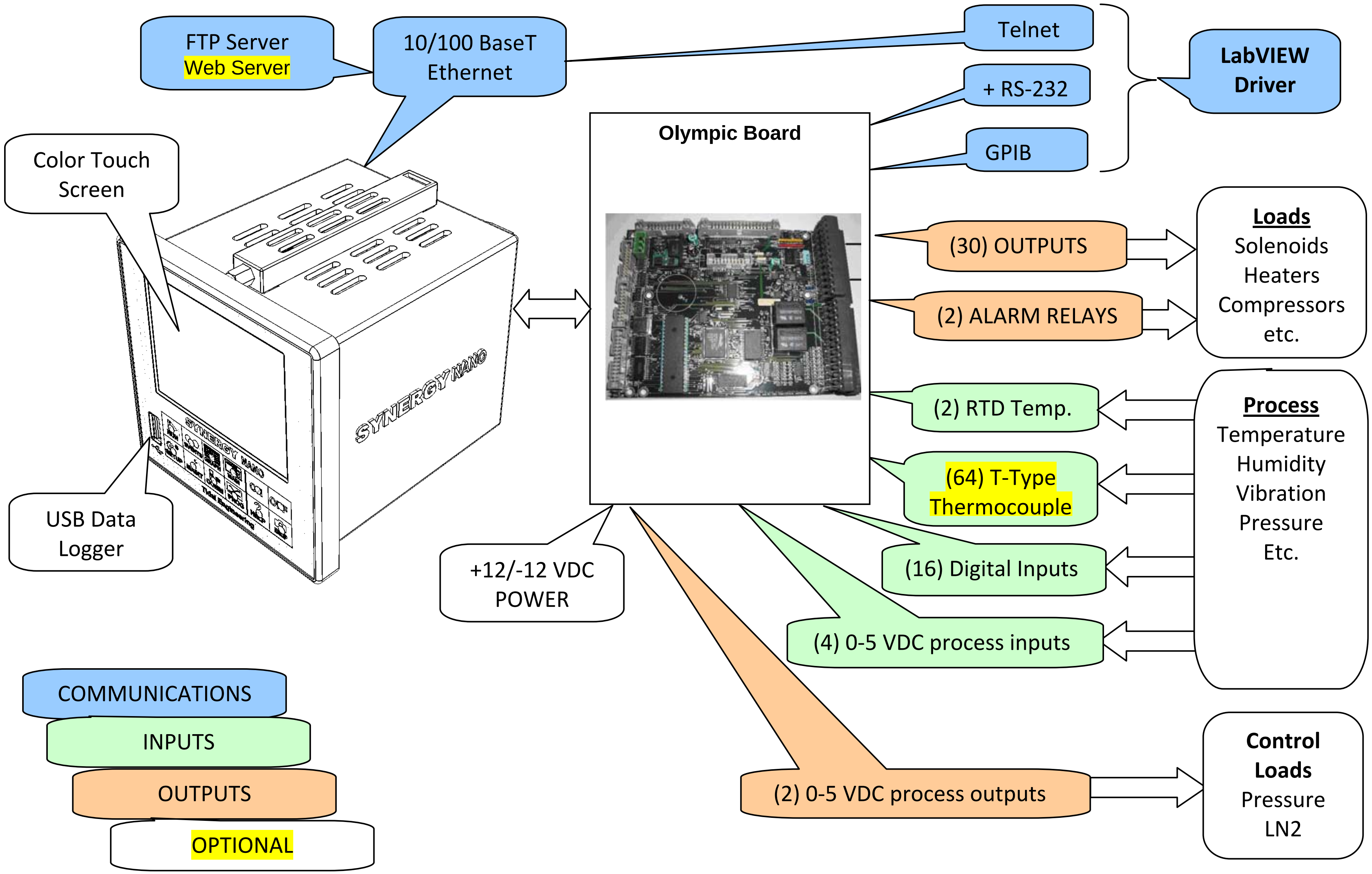
2.1 Synergy Nano Block Diagram



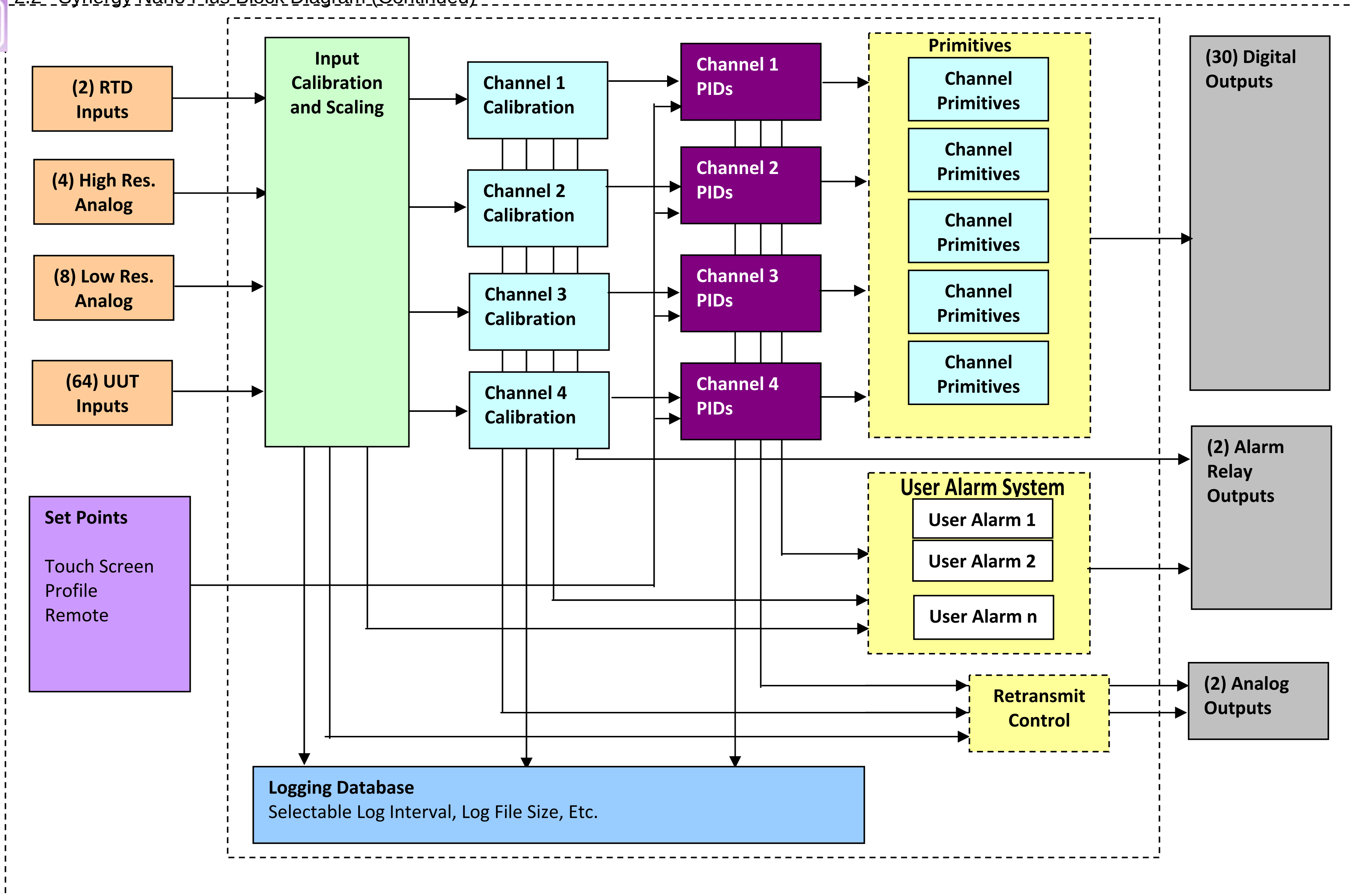
2.1 Synergy Nano Block Diagram (Continued)

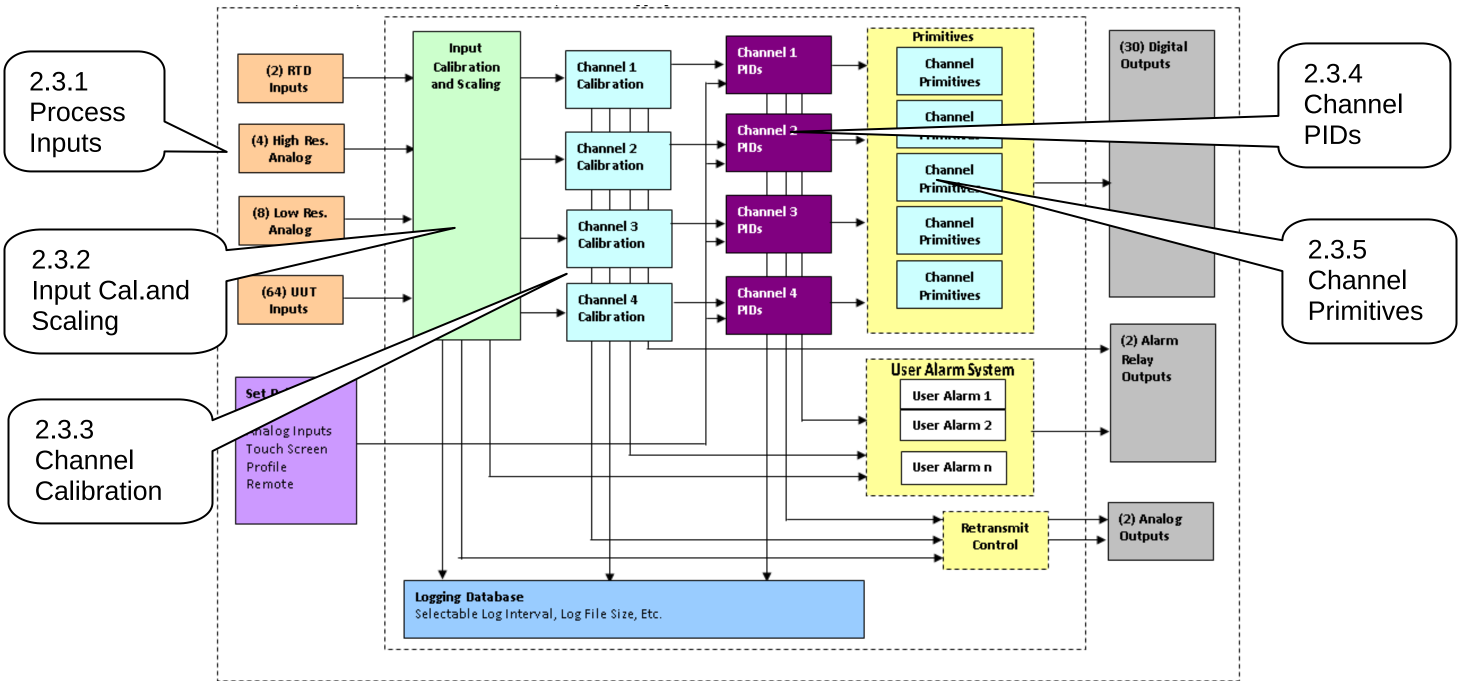


2.2 Synergy Nano Plus Block Diagram



2.2 Synergy Nano Plus Block Diagram (Continued)





2.3.1 Process Inputs

The Synergy Nano has multiple process inputs. These are listed in the table below.

Synergy Nano

Inputs	Channels	Application
T/C, RTD channels	2	Temperature Measurements
High Resolution 0-5VDC channels, 16-Bit	2	Humidity, temperature and other process variables. 0.0001 Volt resolution
UUT Temperature Inputs T-Type Thermocouples	64 max	Temperature Measurements

Synergy Nano Plus

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.

2.3.2 Input Calibration and Scaling

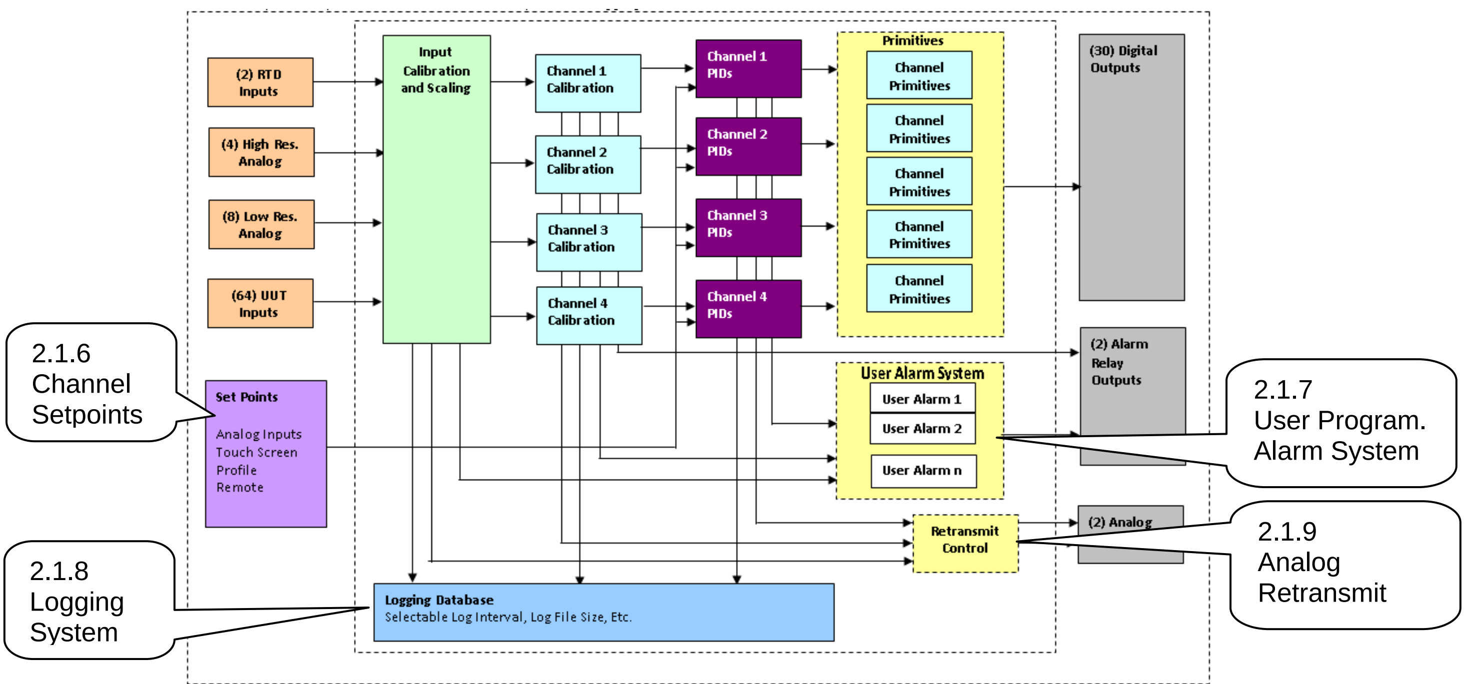
Each Input can be calibrated for the physical measurement, Ohms, Volts or Degrees C.
Each Input can also be scaled to appropriate engineering units. (See the Calibration section)

2.3.3 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.

2.3.4 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.

2.3.5 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.



2.3.6 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.

2.3.7 User Programmable Alarm System
The user programmable alarm system can be programmed 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.

2.3.8 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.

2.3.9 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 CHAMBER SAFETY

The Synergy Controller offers multiple built-in alarms to protect the chamber 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 chamber 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.

3.1 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.

3.2 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.

3.3 Secondary Controller Alarms

Redundant protective mechanisms such as a TempGard limit controller should be use 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.

3.4 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.

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. All Tidal Engineering products are 100 percent functionally tested. Additional testing may include visual inspections. Specifications are based on characterization of tested sample units; each production unit isn't tested over temperature and voltage. 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.

Make sure you completely understand the operation and function of 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.

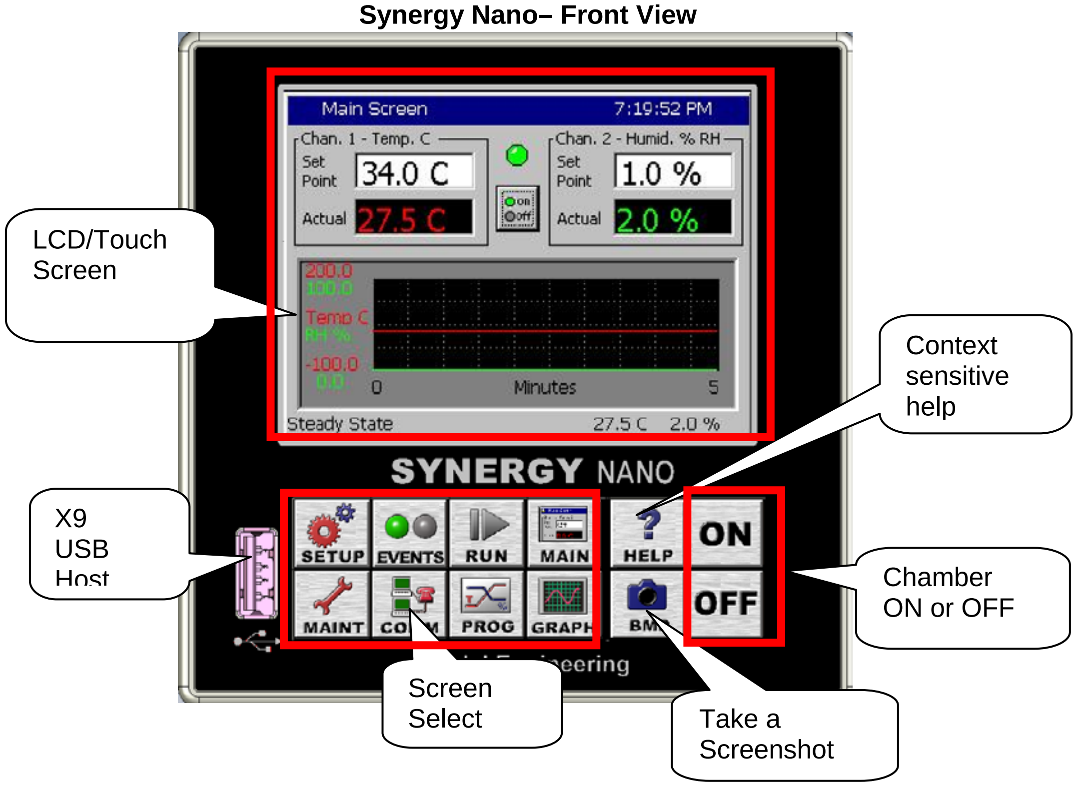
4.0 FRONT PANEL AND CONTROLS

4.1 Synergy Nano Interface Panel Layout

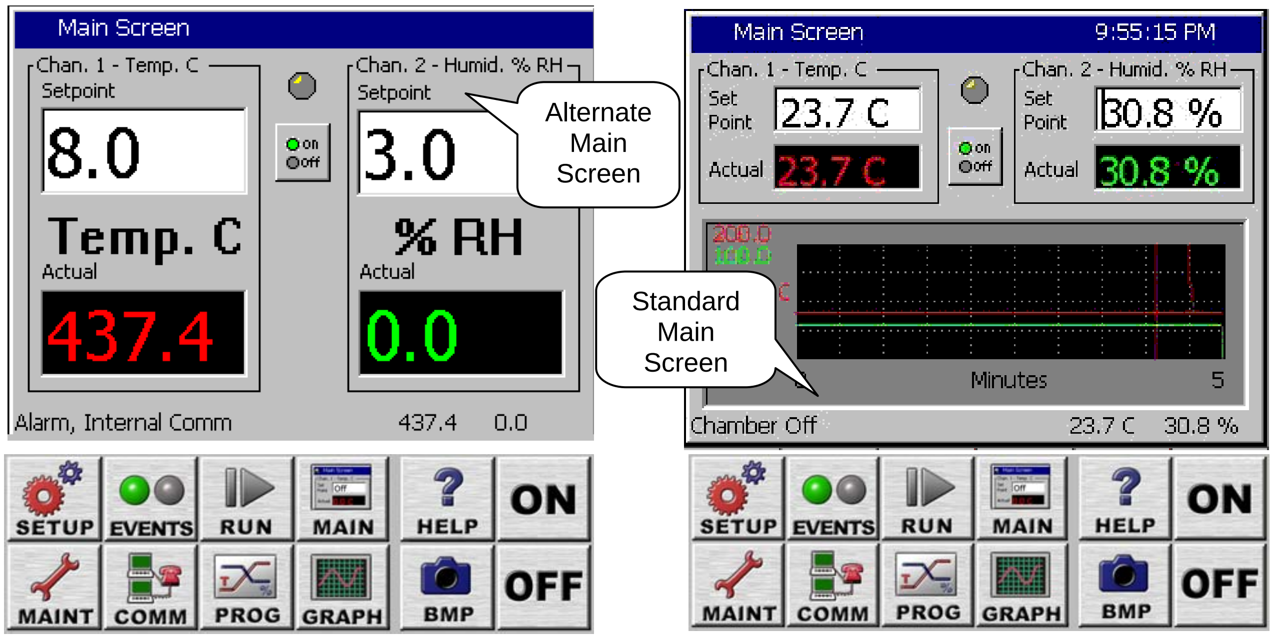
The Synergy Nano features a stainless steel and blue anodize finish as shown below.

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

Synergy Nano– Front View



4.2 Front Panel Operator Interface



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		
L - Values	About	Ethernet			Digital Inputs		w/ Small Graphic Display
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							

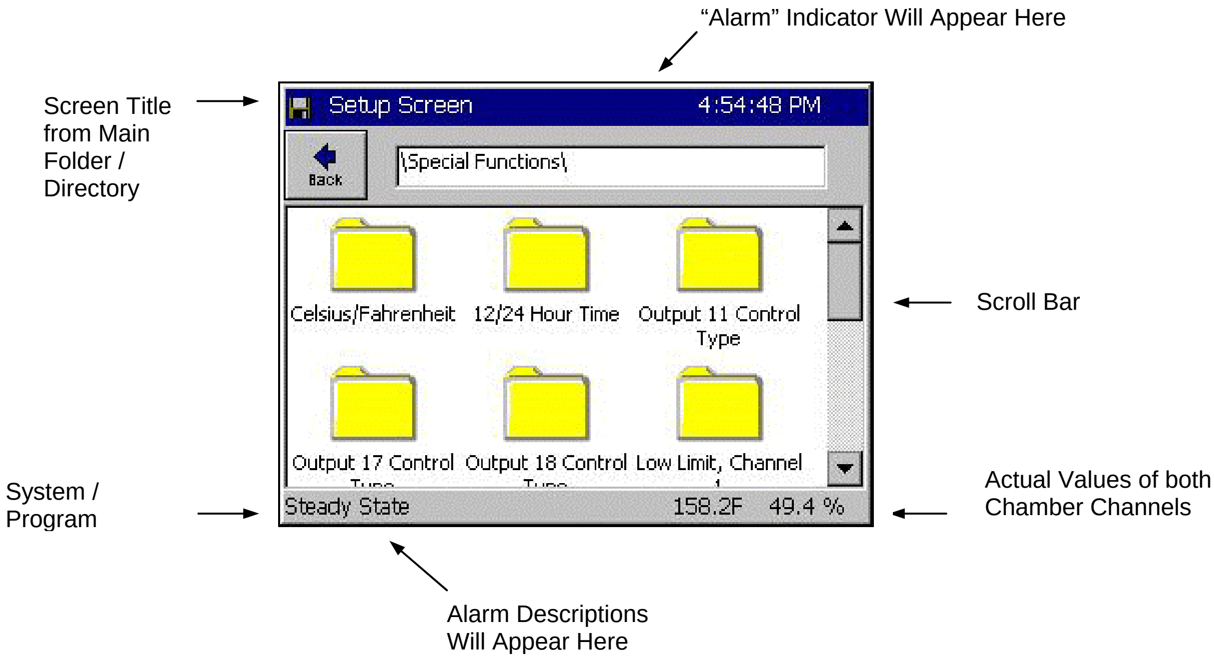
Note: Green cells highlight new folders in this Synergy Nano software release.

4.3 Touch Screen

The Synergy Nano offers the latest touch screen technology. By incorporating Soft Keys and state-of-the-art multi-tasking capabilities of Windows CE™, the Synergy Nano provides a unique, friendly and powerful user interface. Note: See the Maintenance section regarding touch screen calibration.

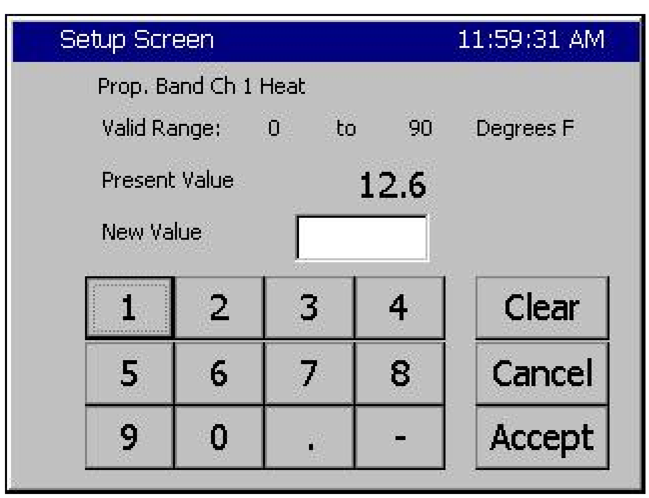
4.4 LCD Screen

Synergy Nano 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 Nano display. The title bar at the top and the status bar at the bottom of the window are found on most screens.



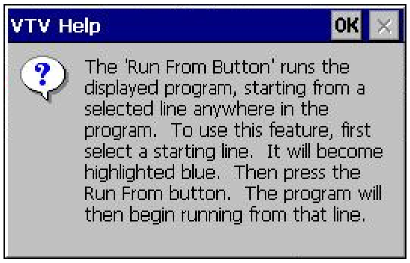
Keypad Screen Example:

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



4.5 Function Keys

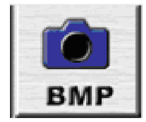
Help Key:



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.

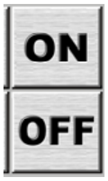
Screen Capture Key:



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.

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.

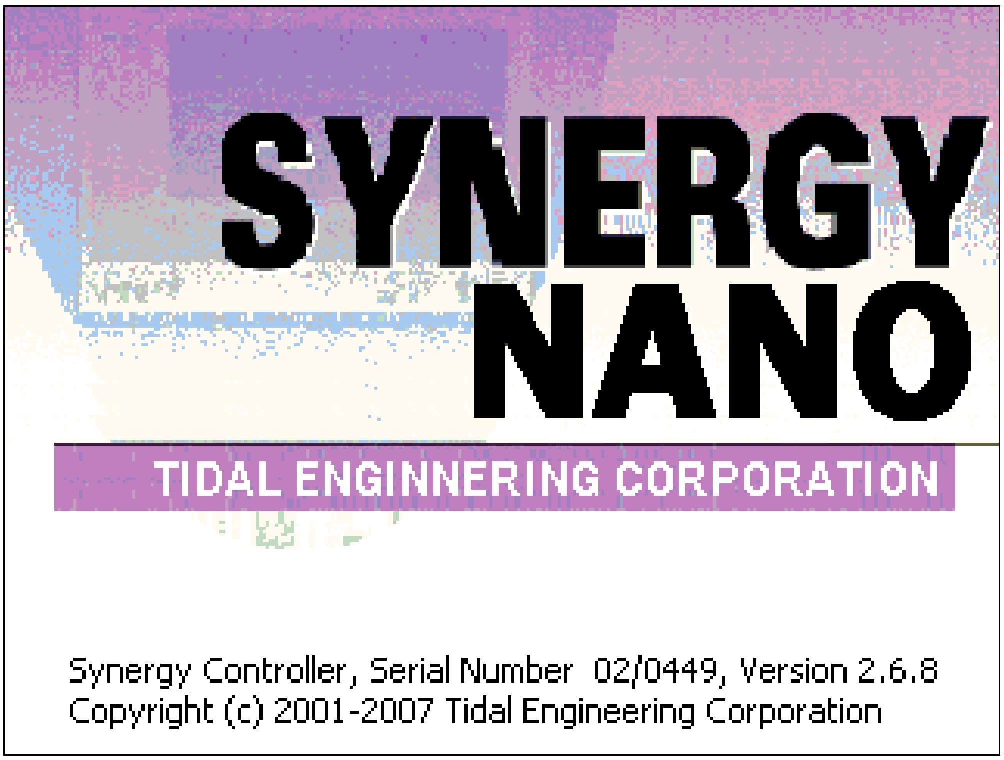
As shown in the table above, the SETUP, MAINT (Maintenance), COMM (Communications), and EVENTS keys direct you to a set of folders. Touching the desired folder opens sub-folders or the appropriate editor screens. The PROGRAM, RUN, GRAPH, and MAIN keys immediately direct you to editor screens to perform a task. To return to the previous screen, press the ***Back*** button located in the upper left corner. If you have navigated through a series of sub-folders you can back to the original directory or folder by pressing the ***Back*** button repeatedly. Remember, you can always switch directly to another navigation screen by pressing the desired Screen Navigation Key.

4.6 *Synergy Nano Power-Up Splash Screen*

When power is applied to the chamber, the Synergy Nano touch-screen displays boot-up progress. Upon a successful boot-up, a Synergy Nano splash screen will appear. (See figure below) followed by the Main screen.

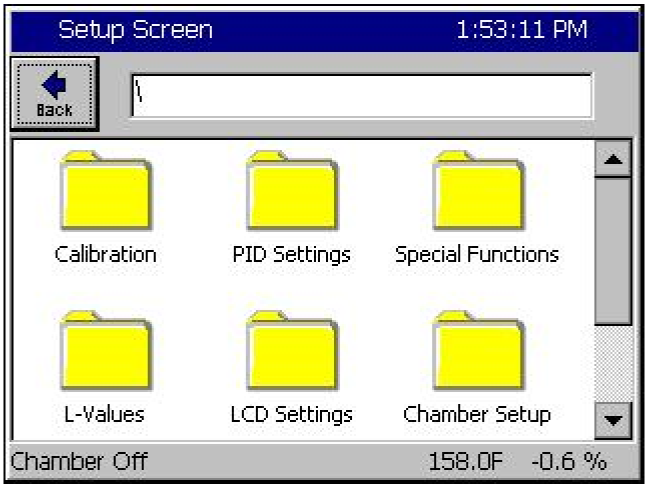
Any errors or alarms encountered during the diagnostics routine will be displayed. See [Section 7.2 Maintenance: Alarm Functions] for a description of the alarm functions.

Synergy Nano Splash Screen



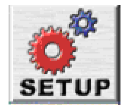
5.0 NAVIGATION SCREENS - A Brief Overview

This section shows each of the eight main navigation screens and includes a brief summary of each. This section serves as a quick reference guide. For expanded information on each screen, go to the corresponding manual section.



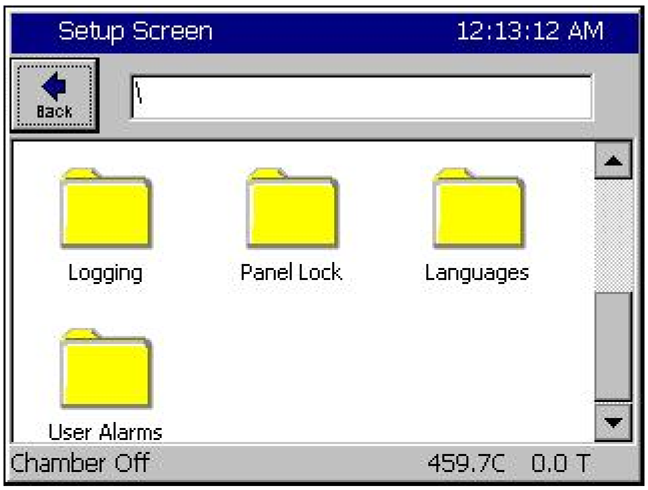
SETUP Screen

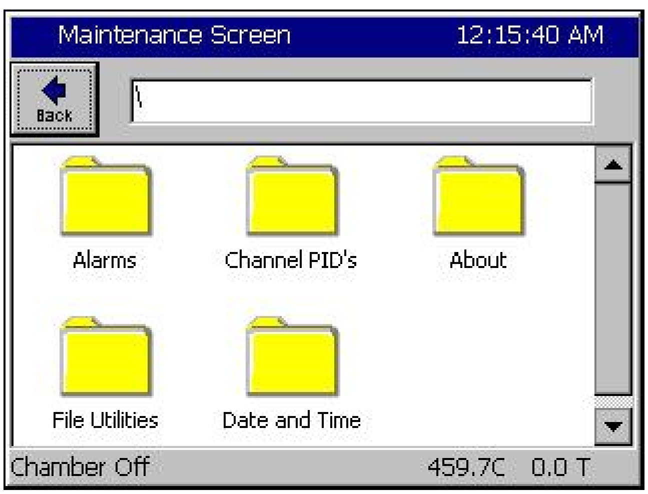
Provides access to ten different Setup folders. Scroll down to view the last three folders.



- Calibration
- PID Settings
- Special Functions
- L - Values
- LCD Settings
- Chamber Setup
- Logging
- Panel Lock
- Languages
- User (Programmable) Alarms

Details are in Section 6.0 Setup.



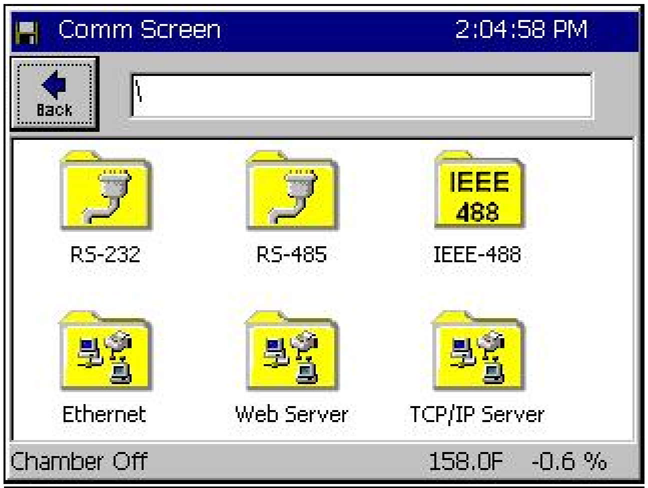


MAINTENANCE Screen

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

Details are in Section 7.0 Maintenance.

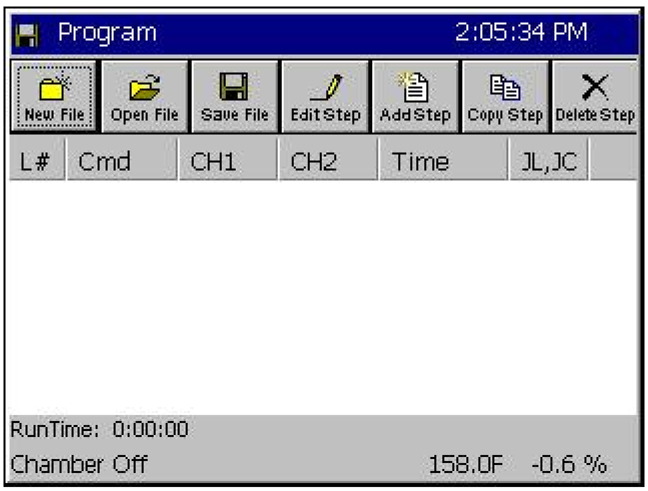


COMMUNICATIONS Screen

Provides access to six different Communications folders.

- RS - 232
- RS - 485
- IEEE 488
- Ethernet
- Web Server
- TCP / IP Server

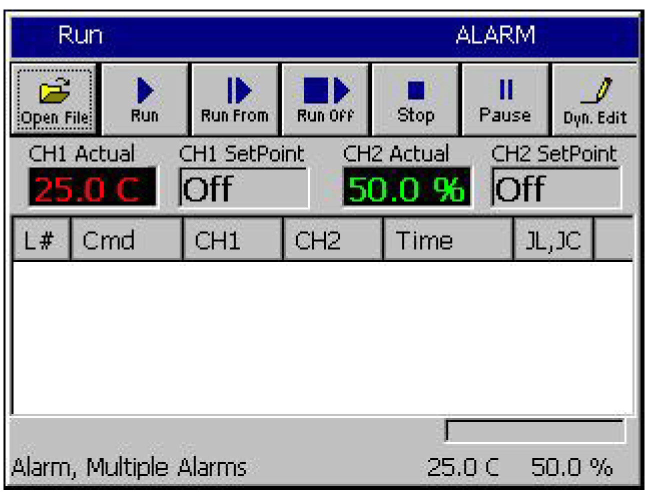
Details are in Section 8.0 Communications.



PROGRAM Screen

- Load, create, copy and save program files
- Edit, add, copy, and delete program steps

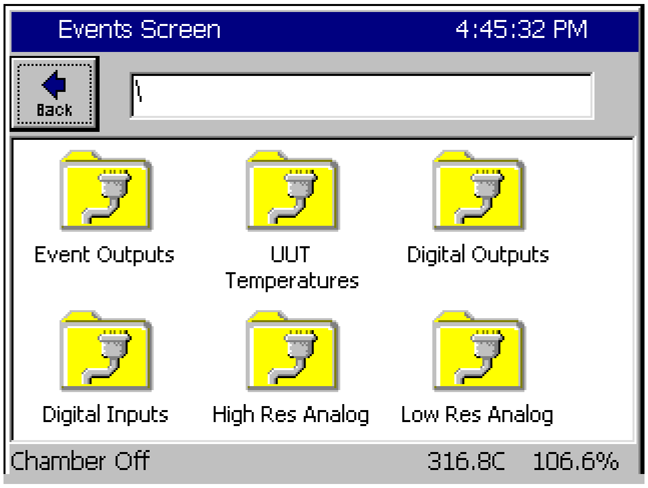
Details are in Section 9.0 Programming the Synergy Nano.



RUN Screen

- Open File
- Run, stop, and pause program
- Run program from a selected step
- Run program with outputs off
- Includes Dynamic Editing of jump loops while program is running

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

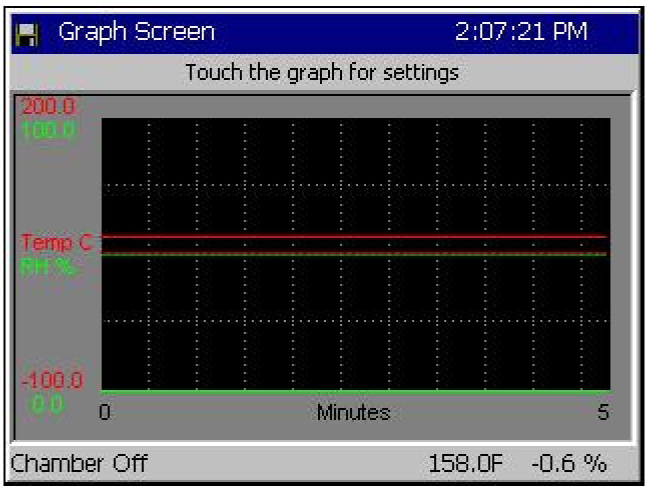


EVENTS Screen

Provides access to four different Events folders.

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

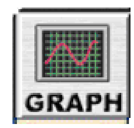
Details are in Section 11.0 Events Directory.



GRAPH Screen

Screen Information:

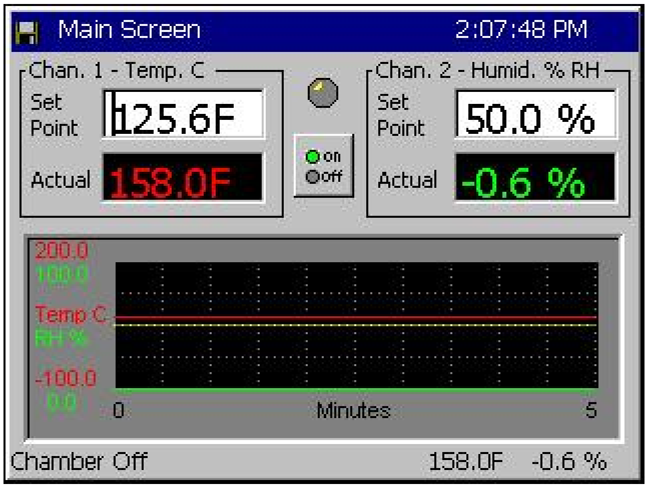
- Graph channel actual and setpoint values over time.

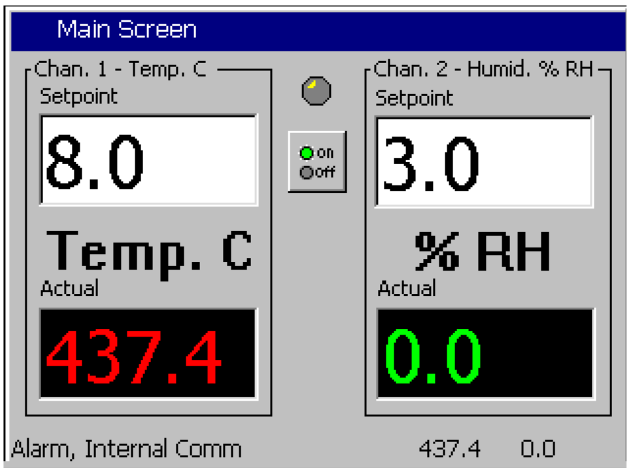


Control Features:

- 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.

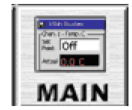
Details are in Section 12.0 Graph Screen.





MAIN Screen

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



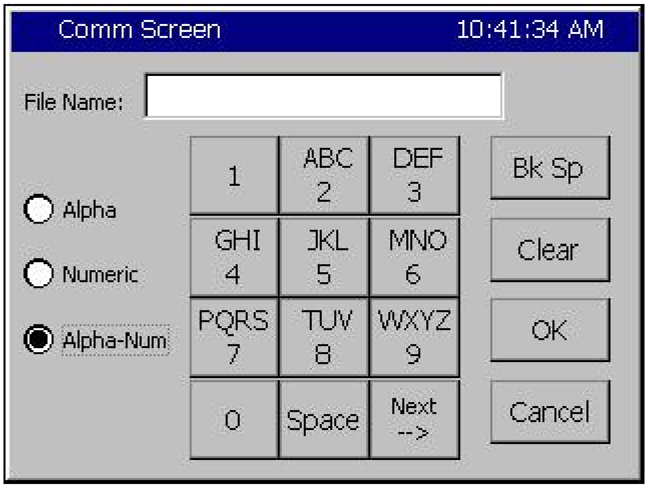
Screen Information:

- Actual values for each chamb 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 Nano 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 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 AND CONFIGURATION

Within the Setup Directory there are eight folders (directories) with multiple sub-folders and screen editors for easy access to all of the controller setup parameters. The Setup Directory Table that immediately follows in Section 6.1 shows the hierarchy of folders, sub-folders and screen editors.

Individual Directory Tables are provided for each of the eight main folders that show the same type of hierarchy. These Directory Tables provide a quick reference to the information contained in the Synergy Nano. Sample screens follow some of the directory tables to show the sequence of operation of certain functions. Some are shown for your reference. Below is a list of all Sub-Directory Tables within the main Setup Directory.

Sub-Directory Table Number and Title

6.1: Setup Directory Table
6.2: Calibration
6.3: PID Settings
6.4: Special Functions
6.5: L - Values
6.6: Settings List
6.7: Device Primitives
6.8: LCD Settings
6.9: Chamber Setup
6.10: Output Mappings
6.11: Logging
6.12: Logging Sequence of Operation
6.13: Panel Lock
6.14: Languages

Important Notice

Most of the parameters in the Setup Directory are preset at the factory. Under most circumstances these parameters should not be changed. They are shown and described in the tables for reference only. Some are default settings within the controller itself, or may not even apply to your chamber. Changes to some of the parameters may effect your chamber operation and void your warranty. Please call the chamber manufacturer with any questions you may have.

The Synergy Nano is a flexible multi-channel control system designed to handle virtually all temperature control applications, supporting programming, logging, remote control and alarming. The block diagram in Section 2.1 identifies the major data processing components 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.

6.1 Setup Directory

SETUP DIRECTORY: FOLDERS, SUB-FOLDERS, & SCREEN EDITORS								
Calibration	**PID Settings**	**Special Functions**	**L - Values**	**LCD Settings**	**Chamber Setup**	**Logging**	**Panel Lock**	**Lang.**
(Sub-folders)	(Sub-folders)	(Sub-folders)	(Sub-folders)	(Sub-folders)	Screen Editor	(Sub-folders)	Screen Editor	Screen Editor
Calibration Ch n	PID Ch 1	Celsius / Fahrenheit	**1L1** Ch 1	LCD Brightness	Chamber Type	Setup		Language
Calibration Ch 2	PID Ch 2	12 / 24 Hour Time	**1L2** Ch 1			Data		
Calibration Ch 3	PID Ch 3	Output 11 Ctrl. Type	**1L3** Ch 1			Clear History		
Altitude Value		Output 17 Ctrl. Type	**1CTY** Ch 1 Chamber			Export History		
Guaranteed Soak		Output 18 Ctrl. Type	**2L1** Ch 2					
Input								
		Select Alarm Type	**2L2** Ch 2					
		Low Limit, Ch n	**2L3** Ch 2					
		High Limit, Ch n	**2CTY** Ch 2 Chamber					
		Analog Retrans. 1	**L3** Ch1 Main Cool Turn-on					
		Analog Retrans. 2	**L4** Ch1 Main Cool Turn-off					
			L6 Full Cool Switch Over					
			L7 Ambient Cool Turn On					
			L8 Heat Amb. Cool Turn Off					
			L9 Ramp-up Cooling					
			L11 Dehum / Vent On					
			L12 Dehum / Vent Off					
			L14 Time Delay Boost Cool					
			L15 Turn Off Delay Compressor					
			LEV1 Drier / Dehum Coil					

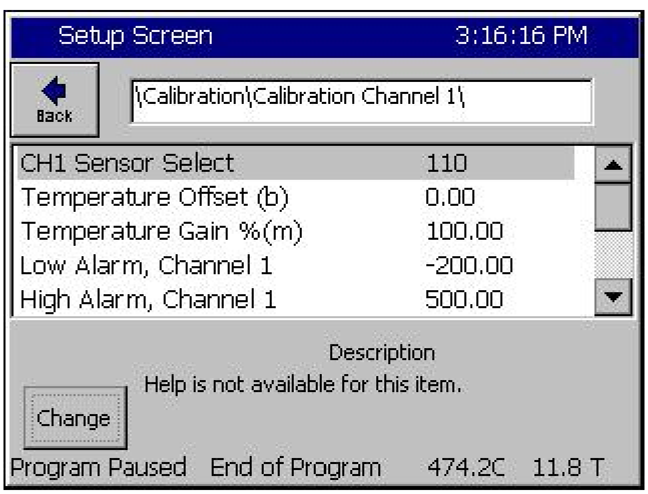
Calibration Ch 2	Items in grey may not be available depending on the chamber configuration. For example, a single channel configuration won't have a Channel 2 Calibration folder

.

6.2 *Calibration*

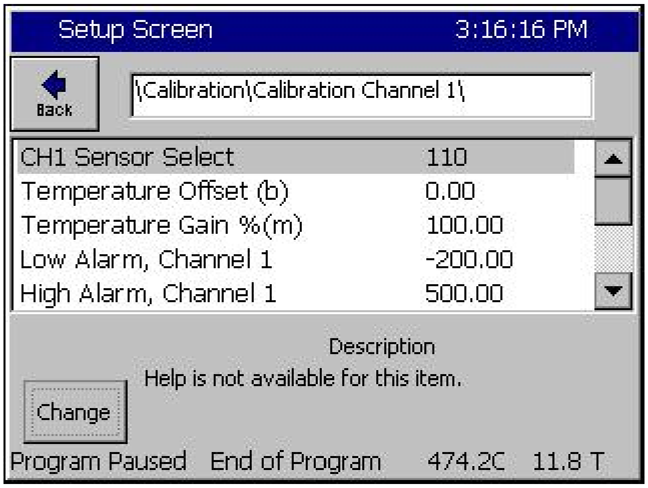
6.2.1 Channel Calibration

CALIBRATION \ SETUP DIRECTORY SUB-FOLDERS & SCREEN EDITORS				
❑ **Calibration Ch. 1 thru 4**	❑ **Altitude Value**	❑ **Guaranteed Soak**	❑ **Input**	
(Screen Editor)	(Screen Editor)	(Screen Editor)	(Screen Editor)	
♦ Sensor Select ♦ Offset (b) ♦ Gain %(m) ♦ Low Alarm, Channel 1 ♦ High Alarm, Channel 1 ♦ Ignore Alarm when Off ♦ Deviation High Alarm ♦ Deviation Low Alarm ♦ Deviation Alarm Enable	<u>Keypad Editor</u> Select 0 for normal scaling or 10, 11 or 12 for Granville-Philips exponential scaling.	<u>Keypad Editor</u> Select Guaranteed Soak Value	♦ High Res ♦ Low Res ♦ UUT	



<u>Channel Calibration</u>

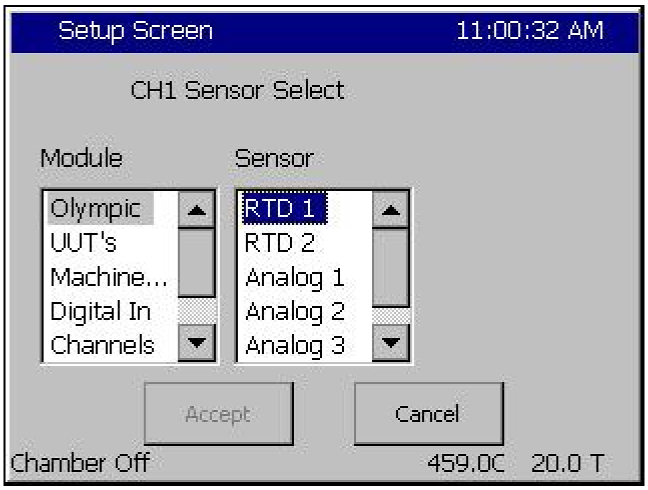
- ♦ This screen is used to select the Channel Sensor, set the Channel specific calibration (use Input calibration for normal calibration) and set channel alarms.



Channels Sensor Selection

- Sensor Select
  This parameter determines which controller input is used for channel feedback.

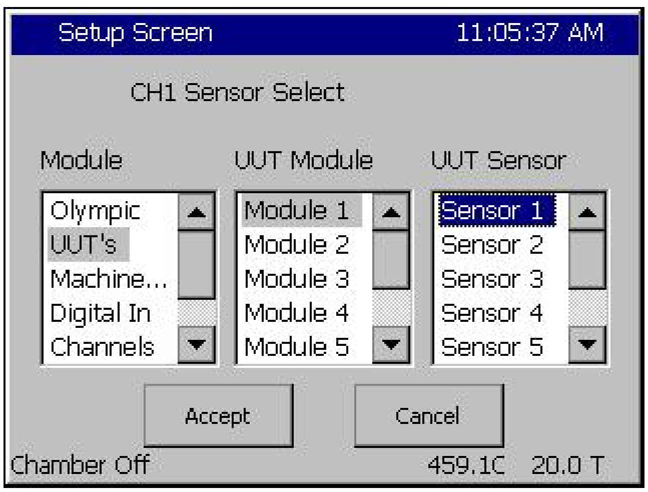
- Select CHn Sensor Select parameter and press change where “n” is the channel number.



Channels Sensor Selection

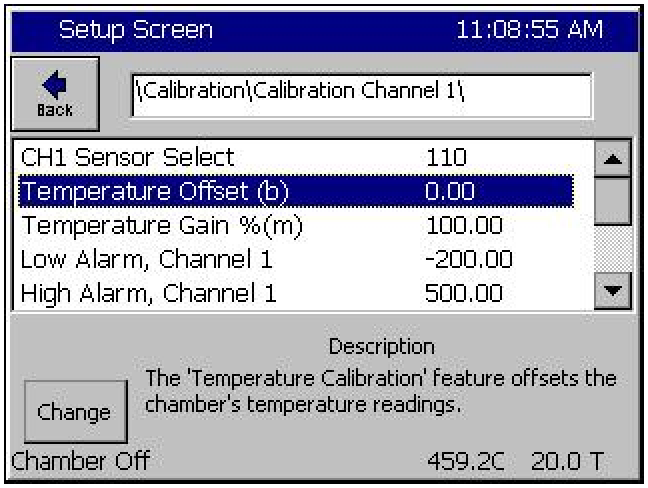
- To select the Channel Sensor, first select the Module from the list at the left.

- Next select the particular sensor on the Module.



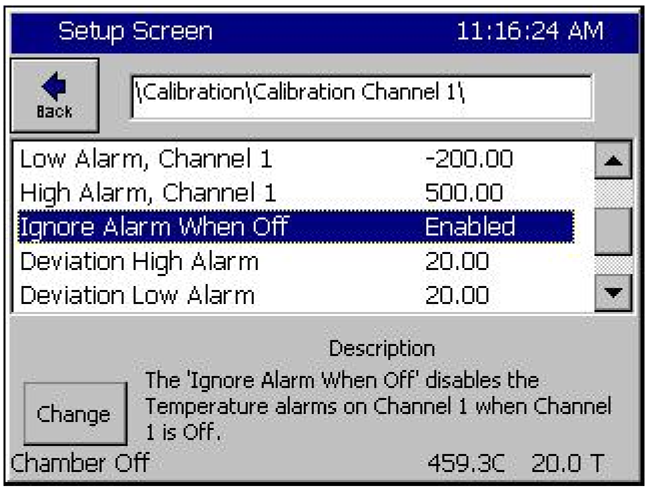
Channels Sensor Selection

- For UUT modules, Select the UUT Module and then the Sensor.



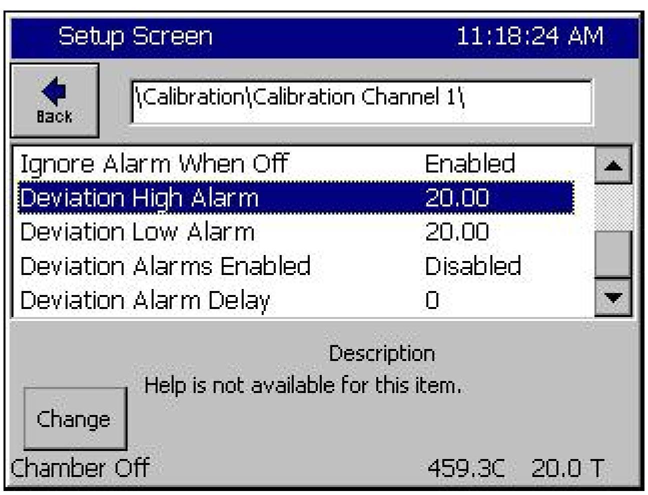
Channel Calibration

- Adjust the Channel Offset (b) and Gain %(m) to accommodate channel specific sensor errors such as those caused by the sensor placement. General sensor calibration should be setup using Input Calibration screens shown in the next section.
- To adjust the Channel Calibration parameters, select the parameter, press Change and enter the new value in the number pad.



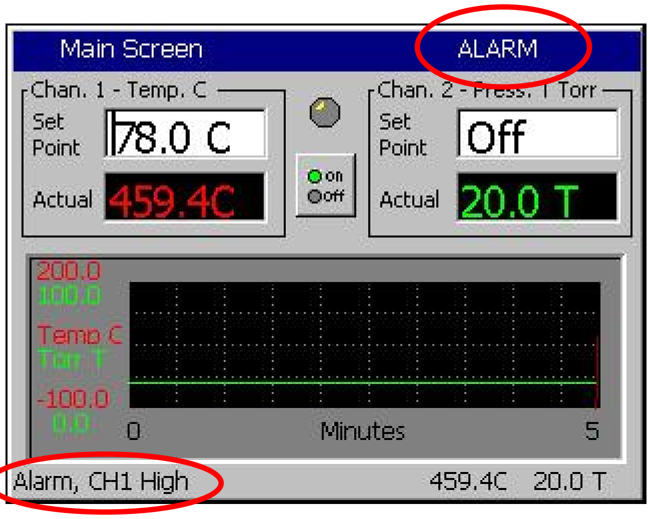
Channel Absolute Alarms

- The Synergy Nano provides High and Low limit Alarms.
- To adjust the absolute Low Alarm limit, select Low Alarm, Channel n, press Change and enter the new value in the number pad. (n is the channel)
- To adjust the absolute High Alarm limit, select High Alarm, Channel n, press Change and enter the new value in the number pad. (n is the channel)
- The Absolute Alarm limits can be disabled automatically when the Channel is off using the Ignore Alarm When Off parameter.



Channel Deviation Alarms

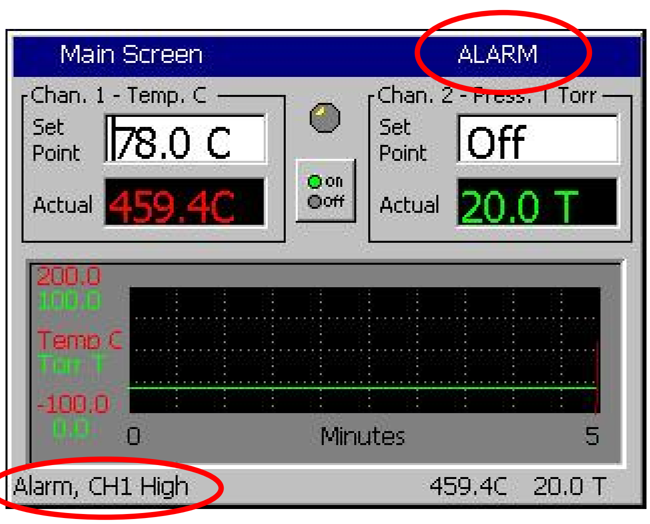
- The Synergy Nano offers Deviation Alarm Limits.
- To adjust the Deviation Low Alarm limit, select Deviation Low Alarm, press Change and enter the new value in the number pad.
- To adjust the Deviation High Alarm limit, select Deviation High Alarm, press Change and enter the new value in the number pad.
- The Deviation Alarm limits can be disabled or delayed using the Deviation Alarms Enabled and Deviation Alarm Delay parameters.



Channel Alarm Notification

- When any channel alarm limit or deviation limit is exceeded the Synergy Nano'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



Channel Alarm Notification

- When any Channel alarm limit or deviation is reached the Synergy Nano's conditioning outputs shut down and the following indications are activated.
- "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

6.2.2 Altitude Calibration

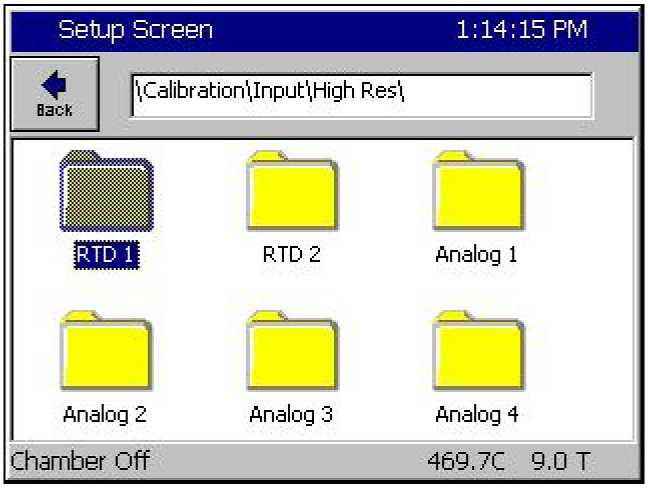
- **Altitude Value:** The altitude value is set to 0 for normal scaling or 10, 11 or 12 for Granville-Philips exponential scaling. A Registration Key may be required to access this feature. See additional details in the Altitude/Space Chamber Setup section.

6.2.3 Guaranteed Soak

- **Guaranteed Soak:** 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

- **Input Calibration:** Each controller input is calibrated and scaled from this folder and its sub-folders. The Raw calibration is used to calibrate the physical 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.
- **For RTD** n .Refer to the Section 6.1 Block Diagram



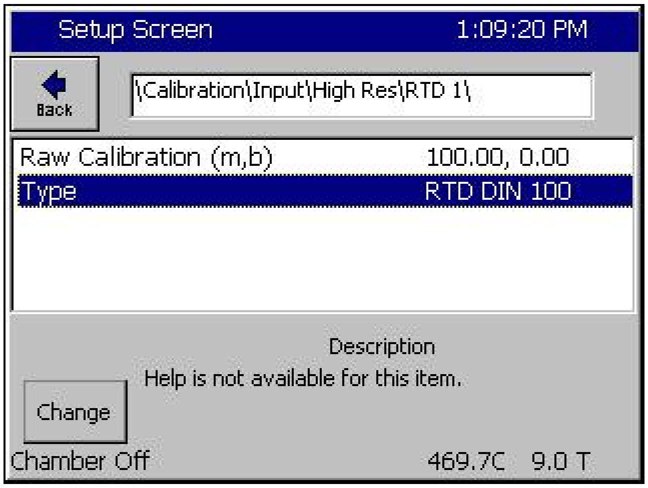
Hi Res Input Calibration

- Input Select
- This screen is used to select one of six high resolutions inputs.

6.2.4.1 RTD Calibration

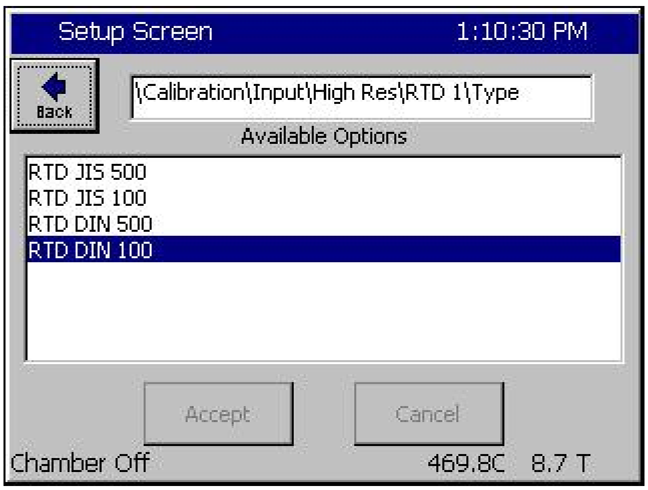
The Synergy Nano chamber accepts up to two Platinum RTD (Resistance Temperature Detector) sensors. RTDs are one of the most linear, stable and reproducible temperature sensors available. Over the years, both American and European RTD standards have been developed to ensure that RTDs are interchangeable 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.

Each of the Synergy Nano's RTDs can be set for four types; RTD JIS 500, RTD JIS 100, RTD DIN 500 or RTD DIN 100. In early software versions, the RTD curve was set globally so one RTD curve was used for both sensors.



RTD Calibration

- This screen is used to enter an offset and gain for the raw data in Ohms. This can be used to compensate for a difference in the reading due to sensor position, wiring, etc.
- Select Type and press Change to select the RTD Sensor type from the list.



RTD Calibration

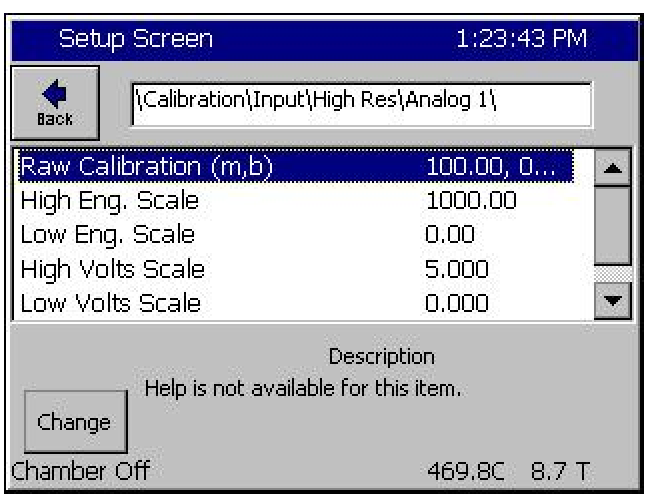
- Sensor Type
- This screen is used to select the RTD Type from the following list.

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

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

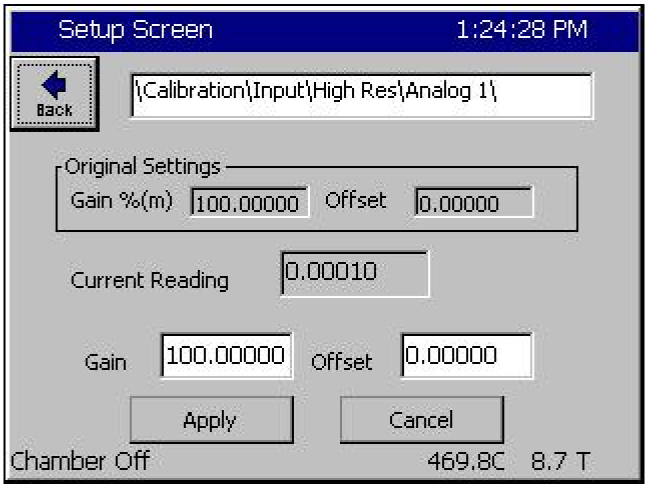
6.2.4.2 Analog Voltage Calibration

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 Nano converts inputs from C to F and vice versa.



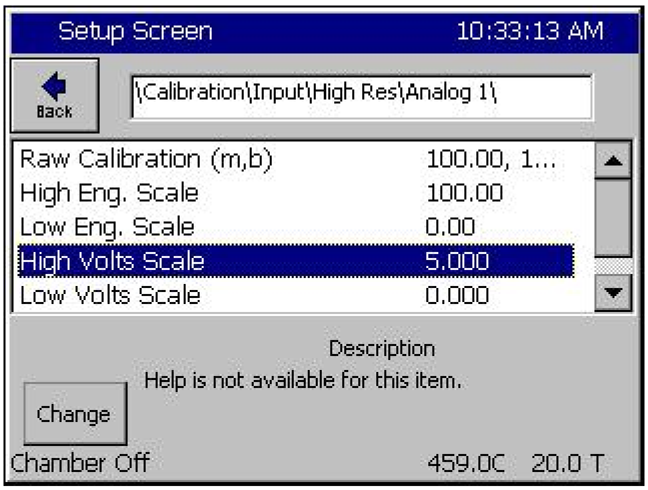
Calibration Hi Res Analog 1 thru 4

- This screen is used to enter Raw Calibration data, Voltage and Engineering scales.
- Select Raw Calibration then press ***Change*** button



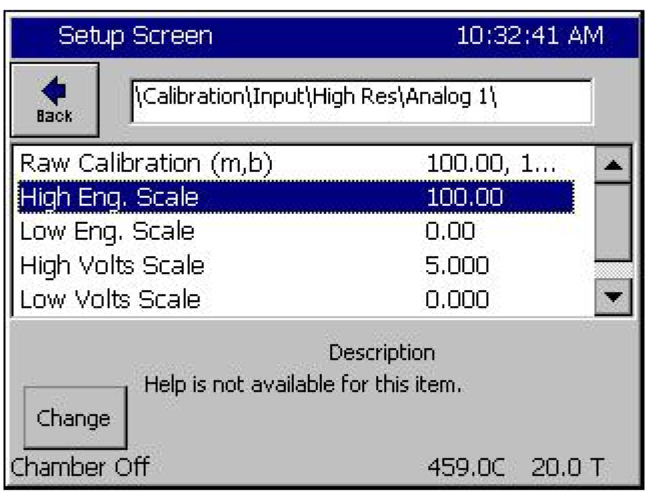
Raw Calibration

- This screen is used to enter an offset and gain for the input voltage. This calibration can be used to compensate for a difference in the reading due to Olympic board tolerance, sensor error, etc.
- Select the Gain or Offset text box to open the number pad and enter the value, then press Accept.
- The Current Reading field displays the Voltage with the current values of Gain and Offset applied. The Gain and Offset values are discarded if Cancel is pressed and saved if Apply is pressed.



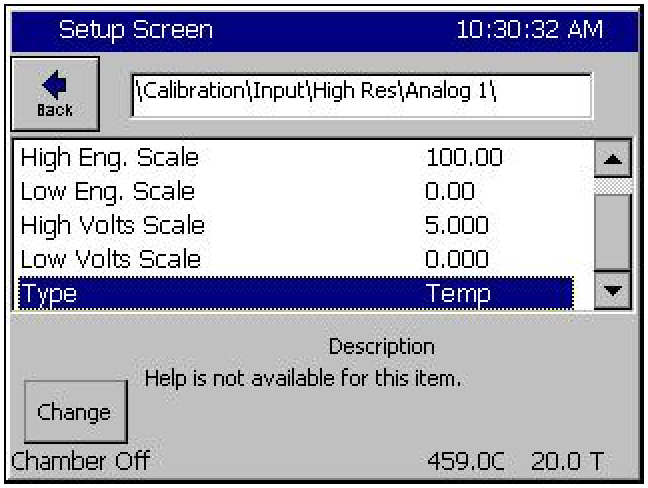
Voltage Scale

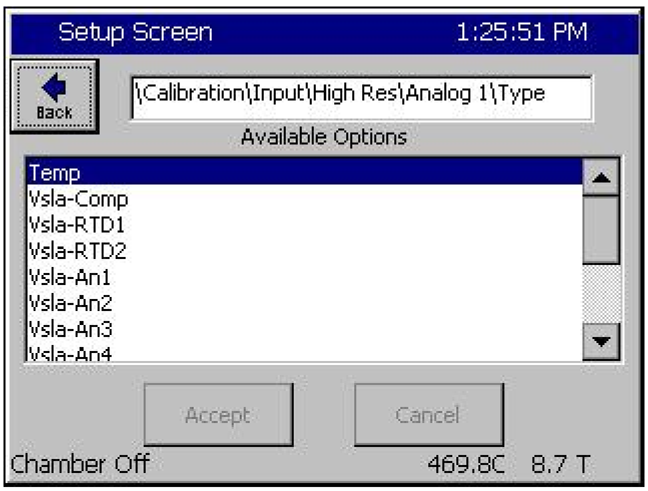
- High and Low Voltage Scale parameters provided the flexibility to use 0-5VDC, 4-20mA or other sensor output ranges.
- Set the High Voltage Scale to the full scale output of the sensor
.
- Set the Low Voltage Scale to the Zero scale output of the sensor
.
- Highlight the parameter and Pres the Change button to adjust these parameters.

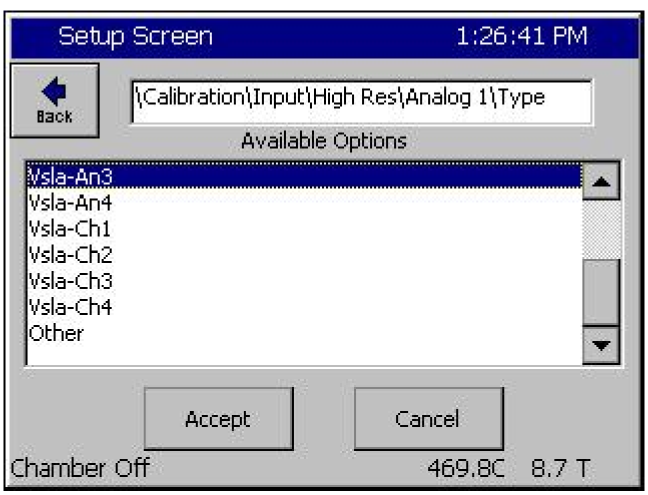


Engineering Scale

- High and Low Engineering Scale parameters provide the flexibility to scale the sensor data to engineering units.
- Set the High Engineering Scale to the full scale output of the sensor
.
- Set the Low Engineering Scale to the Zero scale output of the sensor
.
- Highlight the parameter and press the Change button to adjust these parameters.
- For Example, for a Vaisala sensor set the Low Scale to 0 and the High Scale to 100%. For altitude applications, the High Engineering Scale is typically 1000 Torr.







- <u>Sensor Type</u>

- Set the Sensor type from the list.
- Temperature Input Types automatically scale the value for logging and display when the Units of measure for the controller are changed from C to F and vice versa.
- Analog Inputs can be set for Vaisala sensors that require temperature compensation. Use the Type to select which temperature reading to use. Temperature compensated Vaisala sensor and other sensor types are also supported.

<u>Sensor Type</u>

- Temp (Temperature)
- Vsla-Comp
  Temperature compensated Vaisala sensor.
- Vsla-RTD1
  Un-Compensated Vaisala sensor with compensation temperature read from RTD1.
- Vsla-RTD2
  Un-Compensated Vaisala sensor with compensation temperature read from RTD2.

<u>Calibration Channels 1 thru 4</u>

- Vsla-AN1
  Un-Compensated Vaisala sensor compensated with Analog 1 temperature reading.
- Vsla-CH1
  Un-Compensated Vaisala sensor with compensation temperature read from Channel 1.
- Select the Type from the list and press Accept or Cancel.

Vaisala Temperature Compensation

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

The Synergy Nano uses the Vaisala recommended temperature compensation algorithm. 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 + a1 * T
Gain compensation: B = b0 + b1 * T

The compensated RH value is:

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

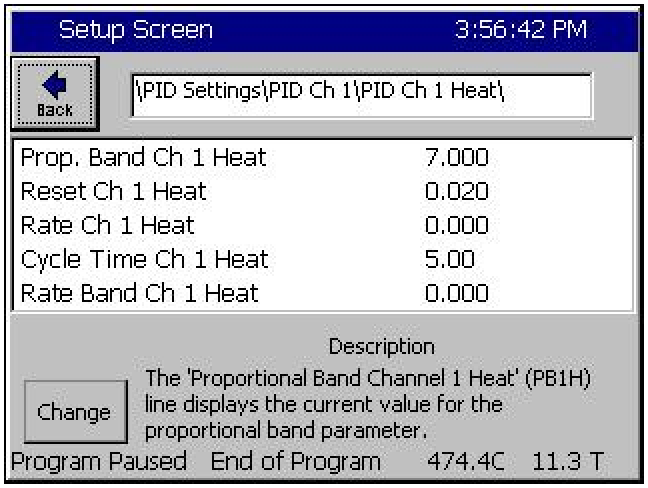
6.3 PID

The Synergy Nano implements multiple PID algorithms (PID is the abbreviation for Proportional, Integral, and Derivative). The Synergy Nano PID algorithms are designed to automatically adjust the output variables to hold the process variable at the setpoint with a minimum of oscillation and error.

PID \ SETUP DIRECTORY SUB-FOLDERS		
❑ **PID Channel 1**	❑ **PID Channel 2**	❑ **PID Channel 3**
(Sub-folders)	(Sub-folders)	(Sub-folders)
❑ PID Ch1 Heating ❑ Dead Band, Channel 1 Temp. ❑ PID Ch1 Cool ❑ Cascade	❑ PID Ch2 Humidify ❑ Dead Band, Channel 2 Humidity ❑ PID Ch2 Dehumidify	❑ PID Ch3 Pressure ❑ Dead Band, Channel 3 Pressure ❑ PID Ch3 Vacuum
Sub-folders & Screen Editors		
❑ **PID Ch1 Heating**	❑ **PID Ch2 Humidify**	❑ **PID Ch3 Pressure**
(Screen Editor)	(Screen Editor)	(Screen Editor)
♦ Prop. Band Heating ♦ Reset Channel 1 Heating ♦ Rate Channel 1 Heating ♦ Cycle Time for Ch1 Heating ♦ Rate Band for Ch1 Heating	♦ Prop. Band for Ch2 Humidify ♦ Reset for Channel 2 Humidify ♦ Rate for Channel 2 Humidify ♦ Cycle Time for Ch2 Humidify ♦ Rate Band for Ch2 Humidify	♦ Prop. Band for Ch3 Pressure ♦ Reset for Channel 3 Pressure ♦ Rate for Channel 3 Pressure ♦ Cycle Time for Ch3 Pressure ♦ Rate Band for Ch3 Pressure
❑ **Dead Band, Ch1 Temp.**	❑ **Dead Band, Ch2 Humidity**	❑ **Dead Band, Ch3 Pressure**
(Screen Editor)	(Screen Editor)	(Screen Editor)
Keypad Editor Select value	Keypad Editor Select value	Keypad Editor Select value
❑ **PID Ch1 Cooling**	❑ **PID Ch2 Dehumidify**	❑ **PID Ch3 Vacuum**
(Screen Editor)	(Screen Editor)	(Screen Editor)
♦ Proportional Band for Channel 1 ♦ Reset Channel 1 Cooling ♦ Rate Channel 1 Cooling ♦ Cycle Time for Chan. 1 Cooling ♦ Rate Band for Chan. 1 Cooling	♦ Prop. Band for Ch2 Dehumidify ♦ Reset for Channel 2 Dehumidify ♦ Rate for Channel 2 Dehumidify ♦ Cycle Time for Ch2 Dehumidify ♦ Rate Band for Ch2 Dehumidify	♦ Prop. Band for Ch3 Vacuum ♦ Reset for Channel 3 Vacuum ♦ Rate for Channel 3 Vacuum ♦ Cycle Time for Ch3 Vacuum ♦ Rate Band for Ch3 Vacuum
❑ **Cascade ***		
(Sub-folders)		
❑ Enabled ❑ Settings ❑ PIDs * See following table for Cascade subfolders.		

6.3.1 PID Tuning

Synergy Nano utilizes high performance and flexible PID algorithms for up to 4 channels. The control system can provide precise and fast test chamber control. 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.

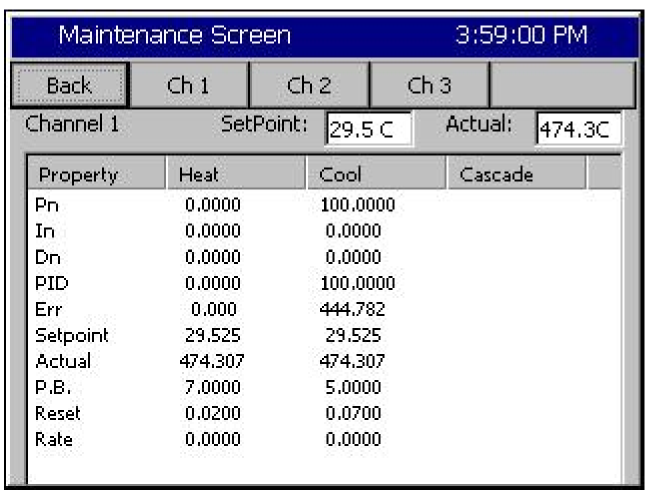


Optimum test chamber performance criteria depend on the application and can be summarized as follows:

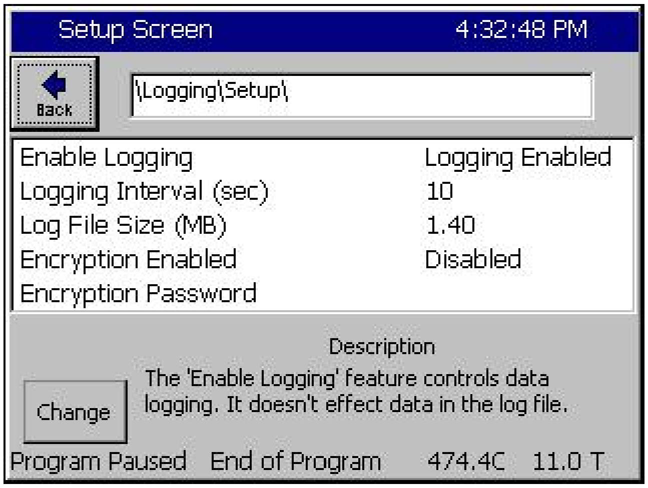
1. Minimum over-shoot.
2. Minimum transition time
3. Minimum energy.

The later being important when LN2 or electricity consumption is the primary concern.

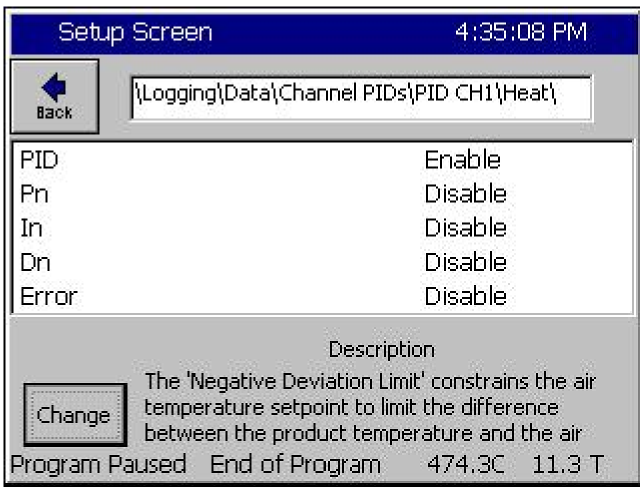
The Synergy Nano is tuned as required using the built-in tools that include the on-screen PID monitor (See screen shot below) and the history log file.

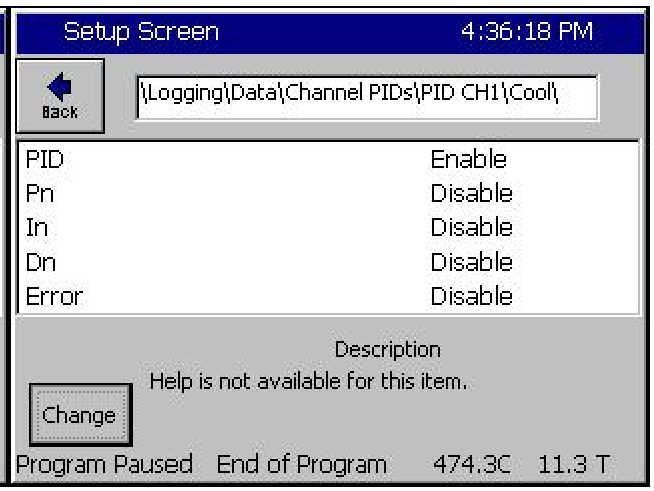


To gather data to help in the tuning process, a 10 second logging interval is recommended as shown below.



In addition, the Heat and Cool PID value logging should be enabled for all the channels of interest.



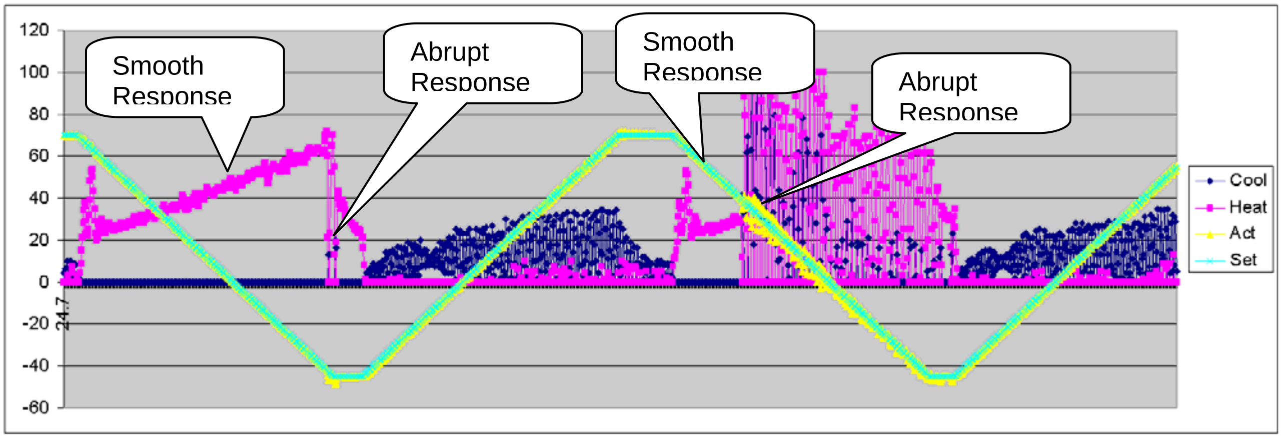


Tuning versus Control System Issues

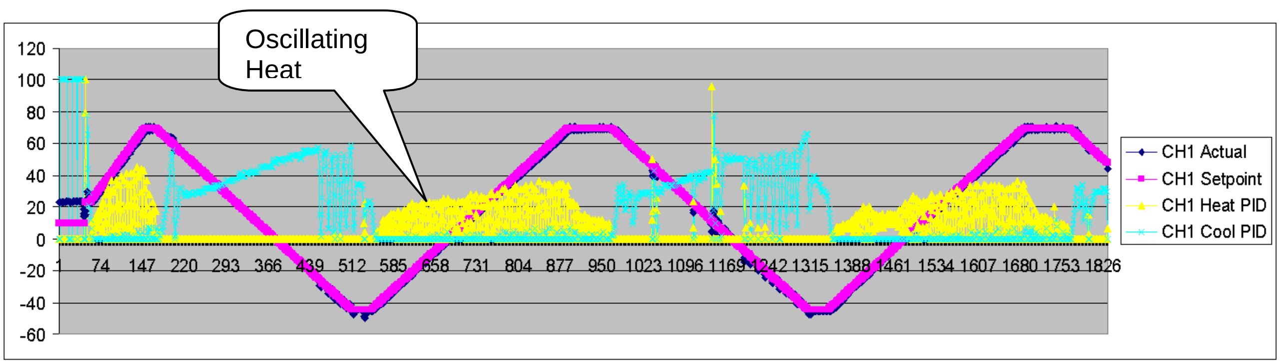
Control system non-linearities, refrigeration and other issues can disrupt chamber performance and can appear to be PID tuning problems.

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

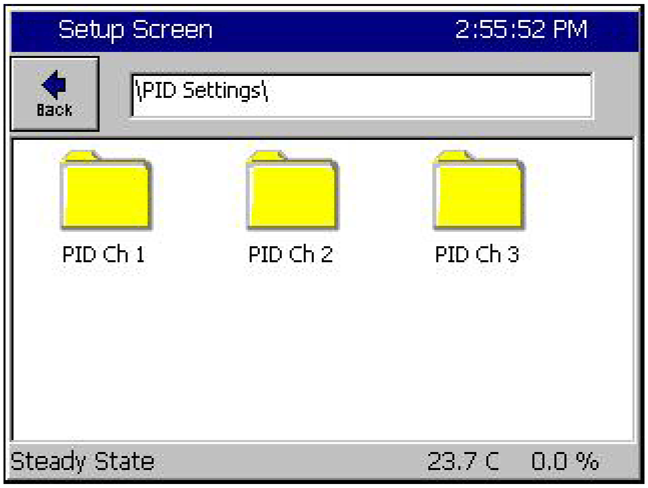


On the other hand, the heating control loop is unstable in the following chart. This was correcting by increasing the Heat Proportional band for 7 to 14.

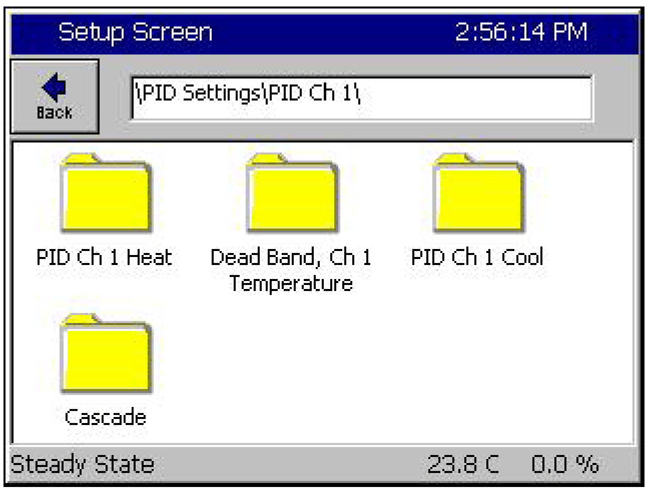


Maintenance Screen Description

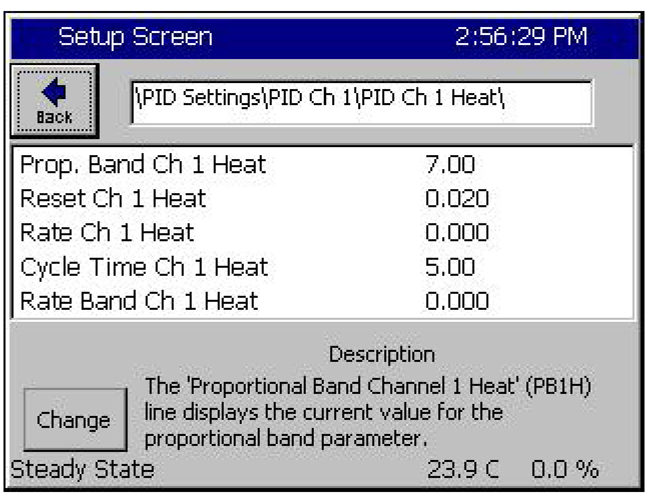
The PID Settings screen is used to edit the constants that control the PID algorithms. In general, PID adjustment should only be performed by a qualified technician. If you would like to know more about PIDs we have included a brief tutorial below. For more information on PID control refer to a resource book dedicated to the subject.



To modify your PID settings, navigate to *Setup \ PID Settings*. Then select the desired channels PID folder.



Select the Heat PID, Cool PID or Dead Band folder.

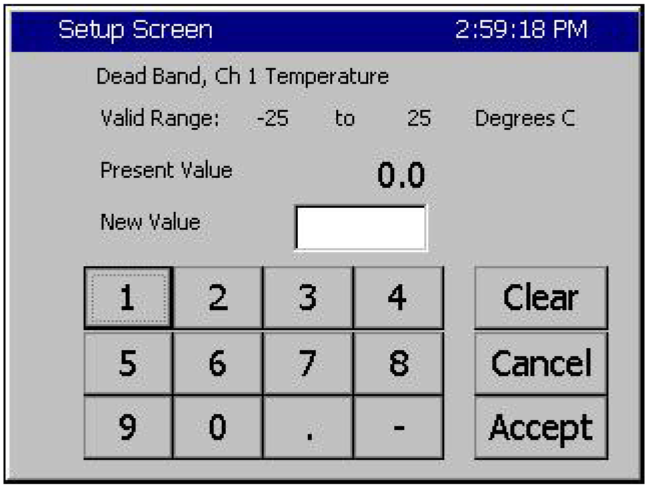


Within the Heat or Cool PID folders are settings for:

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

These settings are discussed in greater detail on the following pages.

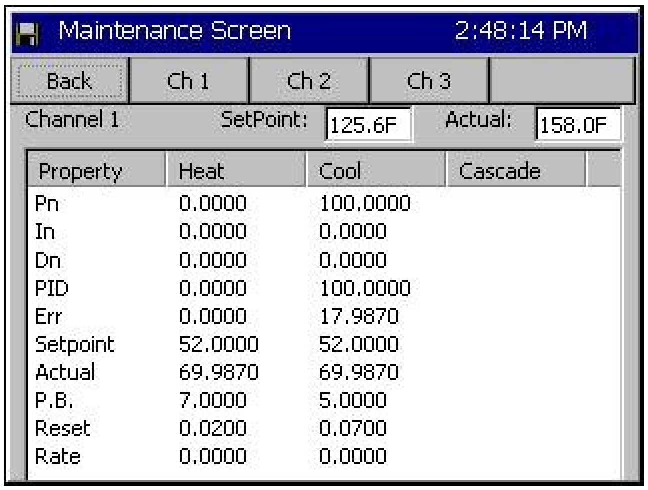
n is the Channel of interest.



Within the Dead Band folder is a Key Pad editor for modifying the Dead Band setting.

This setting is discussed in greater detail on the following pages.

You can monitor the performance of your PID settings using the Channel PIDs screen in the Maintenance directory.



Channel PIDs

Select each channel with the top buttons to view the following values.

- Pn
- In
- Dn
- PID
- Err
- Last Err
- Delta Err
- P.B
- Reset
- Rate

PID

As mentioned previously, PID stands for Proportional, Integral, and Derivative and is a popular control algorithm. PID controllers are used to regulate a process variable (temperature, humidity, etc) at a setpoint. The setpoint is the desired level of the process variable. The control variable is equal to the output of the controller. The output of a PID controller changes in response to a change 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 setpoint and actual value.

Error = setpoint – actual value (measurement)

Proportional Band

The proportional band is the range of error that forces the output from 1 to 100%. In the proportional band, the proportional controller output is proportional to the error. Decreasing the proportional band increases the controller gain; however, increasing the controller gain can make the process less stable.

If error < the proportional band
*Proportional Output = (error)*100/(proportional band)*
Else
Proportional Output = 100%.

Integral – In

With integral action, the integral portion of the controller output is proportional to the integral of the error. Integral action is used to eliminate the steady state error of a strictly proportional control. Increasing the reset (the integral gain) can destabilize the response, 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.

Rate Constant

The Rate is used to scale the rate of change with time and controls the calculation of the derivative. The derivative aids in canceling out the oscillation that normally occurs with PID calculations. It, in effect, tries to put toughs in the line when the calculations are causing crests and tries to put crests in the line when the calculations are causing troughs. The derivative acts like a large mass, it doesn't want to move. A higher Rate increases this mass and makes the program run slow and smooth. A low Rate allows the temperature to change faster but causes more instability.

Cycle Time Constant

Cycle Time controls the time period of the proportional cycle. The output goes through one on and off cycle each period. Faster Cycle times reduce the size of steps on the output but may put more strain on the output devices such as valves. Slow cycle times may increase the size of steps but can also increase the life span of certain chamber hardware.

Rate Band Constant

Rate Band is not currently used.

Cascade Control

CASCADE \ PID \ SETUP DIRECTORY		
❑ **Enabled**	❑ **Settings**	❑ **PIDs**
(Screen Editor)	(Screen Editor)	(Screen Editor)
♦ Enabled ♦ Disabled	♦ Sensor Select ♦ Cascade High Limit ♦ Cascade Low Limit ♦ Cascade High Deviation ♦ Cascade Low Deviation	♦ Prop. Band ♦ Reset ♦ Rate ♦ Cycle Time ♦ Rate Band

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 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 Nano, 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.

6.4 Special Functions

SPECIAL FUNCTIONS \ SETUP DIRECTORY SUB-FOLDERS & SCREEN EDITORS		
❑ **Celsius / Fahrenheit**	❑ **12 / 24 Hour Time**	❑ **Output 11 Control Type**
(Screen Editor)	(Screen Editor)	(Screen Editor)
♦ Celsius ♦ Fahrenheit	♦ 12 Hour Time ♦ 24 Hour Time	♦ ON / OFF Control Mode ♦ Time Proportioning Control
❑ **Output 17 Control Type**	❑ **Output 18 Control Type**	❑ **Low Limit, Channel 1**
(Screen Editor)	(Screen Editor)	(Screen Editor)
♦ Vacuum - When measuring in Torr ♦ Purge	♦ Vent - When measuring in feet of altitude ♦ Boost Cool	Keypad Editor Select value
❑ **High Limit Channel 1**	❑ **Low Limit Channel 2**	❑ **High Limit Channel 2**
(Screen Editor)	(Screen Editor)	(Screen Editor)
Keypad Editor Select value	Keypad Editor Select value	Keypad Editor Select value
❑ **Temperature RTD Curve Deleted starting Version 2.6.8**	❑ **Vaisala Temperature Compensation Deleted starting Version 2.6.8**	
(Screen Editor)	(Screen Editor)	
♦ JIS ♦ DIN (See Input Calibration for RTD Curve selection)	♦ On ♦ Off (See Input Calibration for Vaisala selection)	
❑ **Analog Retransmit 1**	❑ **Analog Retransmit 2**	
(Screen Editor)	(Screen Editor)	
♦ Off ♦ Channel 1,2,3 Actual ♦ Channel 1,2,3 Setpoint ♦ Channel 1,2,3 Heat PID ♦ Channel 1,2,3 Cool PID Selection for the 0-5V output	♦ Off ♦ Channel 1,2,3 Actual ♦ Channel 1,2,3 Setpoint ♦ Channel 1,2,3 Heat PID ♦ Channel 1,2,3 Cool PID Selection for the 0-5V output	

Celsius / Fahrenheit

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

12 / 24 Hour Time

The 12/24 Hour Time setting sets the Synergy Nano's time display to either am/pm format or 24 hour format. The setting is global. All time data is automatically converted including currently loaded program files.

Output 11 Control Type

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 ramping.

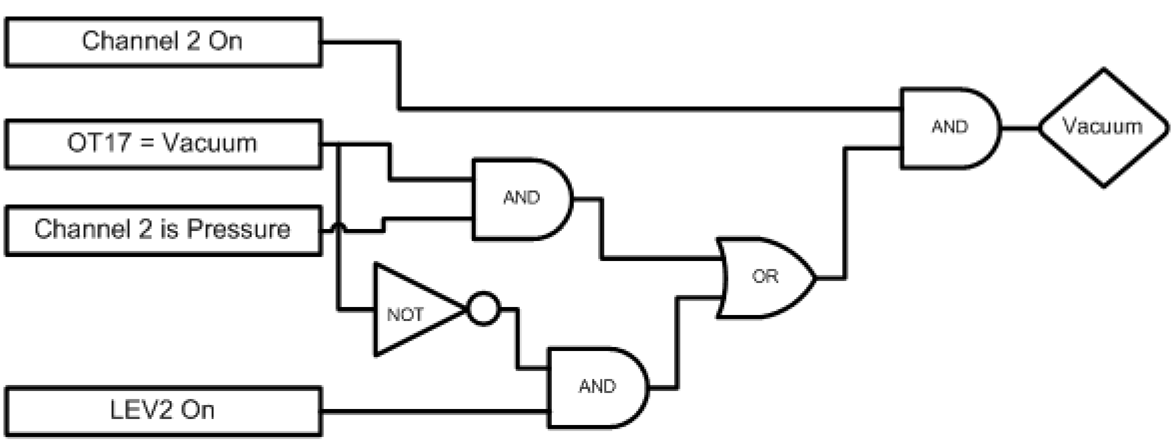
Time Proportioning mode can be changed in a program on a step-by-step basis by selecting the OT11 checkbox when creating a program step (see Section 9.0 Programming the Synergy Nano).

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)

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 the Purge mode. Use vacuum when channel 2 units are in Torr.

Output 17 (Vacuum) Logic Diagram

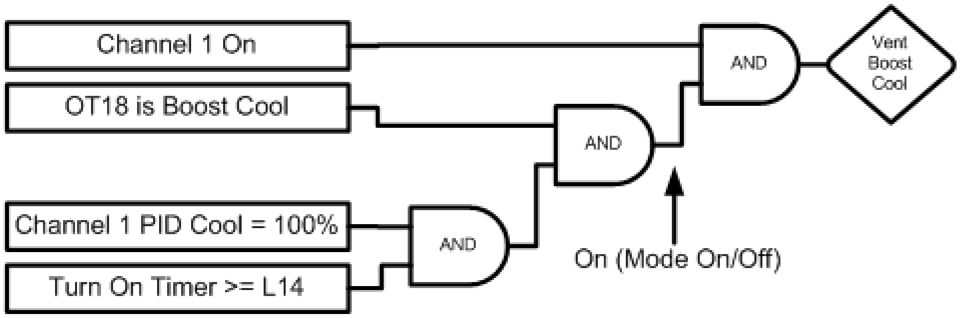


OT17 – Output 17 Control Type	Selects the control logic for the Vacuum device. Can be either Vacuum or Purge
LEV 2	Controls Vacuum device when OT17 is set to Purge

Output 18 Control Type

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%	

Low Limit, Channel 1 and 2

This parameter sets the lowest value a user can enter for the channel, whether temperature, humidity or pressure. This is not the alarm setting and does not affect alarm setpoint. See Section 7.2 Maintenance: Alarm Functions for more alarm information.

High Limit Channel 1 and 2

This parameter sets the highest value a user can enter for the channel, whether temperature, humidity or pressure. This is not the alarm setting and does not affect alarm setpoint. See the section on Alarms in the manual for more alarm information.

Temperature RTD Curve (removed starting Version 2.6.8)

Your Synergy Nano chamber accepts Platinum RTD (Resistance Temperature Detector) sensors.

Starting in Version 2.6.8, the RTD Temperature Curve setting is determined from the SETUP/Calibration/Input/RTD screens separately for each sensor.

Vaisala Temperature Compensation (removed starting Version 2.6.8)

Your Synergy Nano chamber accepts Vaisala Relative Humidity sensors in temperature compensated and uncompensated versions.

Starting in Version 2.6.8, the Vaisala compensation is made from the SETUP/Calibration/Input/Analog Input Screens.

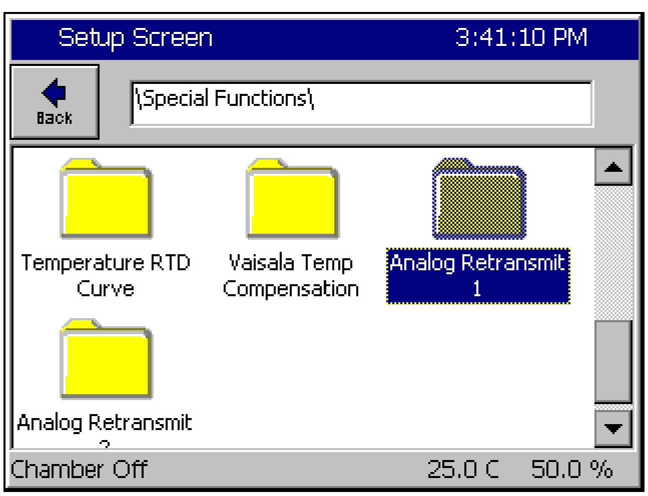
Analog Retransmit 1 and 2

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

The Synergy Nano 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.

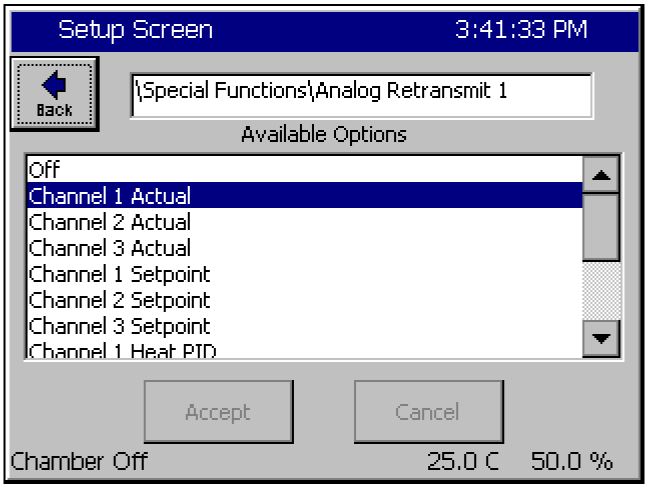
The following section will guide you through the setup for graphing and for custom external heat and cool systems.



<u>Analog Retransmit 1 Folder</u>

To configure the outputs, press the ***SETUP*** button on the Synergy Nano 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.



Data Output Selection

Select the desired output variable and press the ***Accept*** button.

To output a second variable repeat this process with the Analog Retransmit 2 folder.

Retransmit Output Scaling

The Synergy Nano analog retransmit outputs are 0 to 5 Volts DC. The optional TE1803 isolator/converter can scale the output to 4-20mA. The options and scaling for the analog retransmit outputs are listed in the table below. Note: Channel 2 actual output is set to 0.0 when channel 2 is set to off.

Data Options	**Scaling**
Off	0
Channel 1 Actual	-250C to +250C
Channel 2 Actual	0 to 100%
Channel 3 Actual	0 to 100%
Channel 1 Setpoint	-250C to +250C
Channel 2 Setpoint	0 to 100%
Channel 3 Setpoint	0 to 100%
Channel 1 Heat PID	0 to 100%
Channel 1 Cool PID	0 to 100%
Channel 2 Heat PID	0 to 100%
Channel 2 Cool PID	0 to 100%
Channel 3 Heat PID	0 to 100%
Channel 3 Cool PID	0 to 100%

Connections

See the Installation section for wiring information.

The analog retransmit outputs are accurate to +/-0.2% with loads to 1K ohms. The analog retransmit output can drive loads down to 200 ohms and maintain +/-0.5% accuracy.

Mapping Output for Custom Heat & Cool Systems

The Synergy Nano's analog retransmit outputs can be used to control the environmental chambers heat or cool processes when an external steam valve (heat), chilled water system (cool), or LN2 cooling is used. For these systems, map the Channel 1 Heat PID to the external steam valve and the Channel 1 Cool PID to the chilled water system. Use can use the TE1803 converter to drive 4-20 mA valves from the retransmit outputs if necessary. Wiring of the Synergy Nano should only be performed by a qualified technician. See Installation Section 17 for additional information.

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 Nano and Synergy Nano 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

6.5 L - Values

L – VALUES \ SETUP DIRECTORY

SUB-FOLDERS & SCREEN EDITORS

❑ **1L1 Ch1 Main Cooling Turn-On**	❑ **1L2 Ch1 Main Cooling Turn-Off**	❑ **1L3 Ch1 Setpoint Transfer Setting**	❑ **1CTY Ch1 Chamber Type**
(Screen Editor)	(Screen Editor)	(Screen Editor)	(Screen Editor)
Keypad Editor Select value	Keypad Editor Select value	Keypad Editor Select value	♦ CAP-Tube System ♦ Agree Logic ♦ Burn-In Logic ♦ Std. XV System Logic
❑ **2L1 Ch2 Main Cooling Turn-On**	❑ **2L2 Ch2 Main Cooling Turn-Off**	❑ **2L3 Ch2 Setpoint Transfer Setting**	❑ **2CTY Ch2 Chamber Type**
(Screen Editor)	(Screen Editor)	(Screen Editor)	(Screen Editor)
Keypad Editor Select value	Keypad Editor Select value	Keypad Editor Select value	♦ CAP-Tube System ♦ Agree Logic ♦ Burn-In Logic ♦ Std. XV System Logic
❑ **L3 Ch1 Main Cooling Turn-On**	❑ **L4 Ch1 Main Cooling Turn-Off**	❑ **L6 Full Cooling Switch-Over**	❑ **L7 Ambient Cooling Turn-On**
(Screen Editor)	(Screen Editor)	(Screen Editor)	(Screen Editor)
Keypad Editor Select value	Keypad Editor Select value	Keypad Editor Select value	Keypad Editor Select value
❑ **L8 Heat Ambient Cooling Turn-Off**	❑ **L9 Ramp-up Cooling**	❑ **L11 Dehumidify / Vent On**	❑ **L12 Dehumidify / Vent Off**
(Screen Editor)	(Screen Editor)	(Screen Editor)	(Screen Editor)
Keypad Editor Select value	Keypad Editor Select value	Keypad Editor Select value	Keypad Editor Select value
❑ **L14 Time Delay Boost Cool**	❑ **L15 Compressor Turn-Off Delay**	❑ **LEV1 Drier / Dehumidify Coil**	
(Screen Editor)	(Screen Editor)	(Screen Editor)	
Keypad Editor Select value	Keypad Editor Select value	♦ Dehumidify Coil ♦ Drier	

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.

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 that enables artificial load device. (-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
Temperature value that enables artificial load device. (-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)

L3 Ch1 Main Cooling Turn-On
Percent cooling value that turns on the low stage compressor. (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
The temperature value that turns off the cooling compressor while 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
Specifies use of Drier device or the Dehumidify Coil device. (Dehumidify Coil, Drier). When equipped with a drier, the chamber will typically be capable of achieving a lower humidity.

6.6 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	

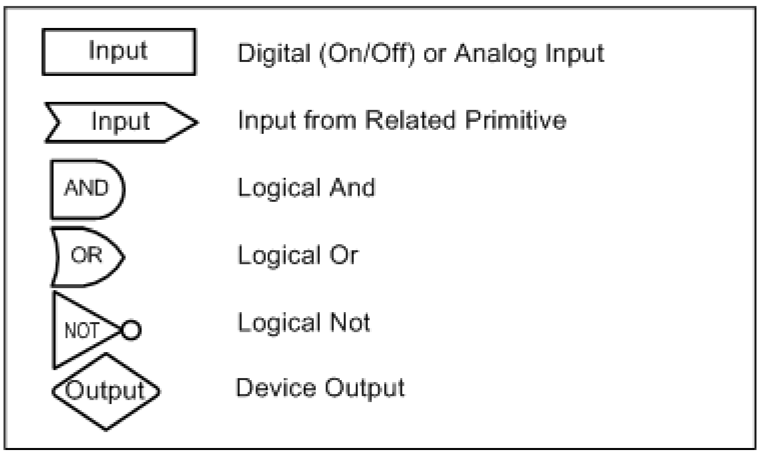
6.7 Device Primitives and Logic Flow Charts

The following flow charts explain the function and the logic that drives each output device. Note that chambers don't have every device. For example, Temp-Only chambers will not have humidity related 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.

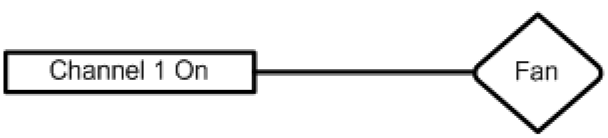
Note: The output from each device is dependent upon the chamber configuration. See Section 6.10 Setup: Output Mappings by Chamber Type to determine the controller's outputs in your specific configuration.

Device Primitives Key



<u>Fan Device</u>

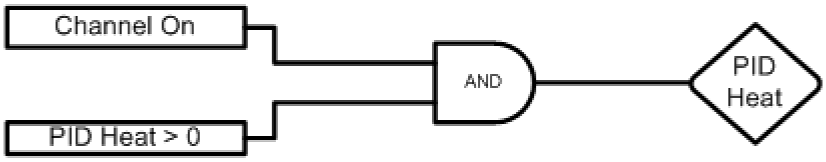
Drives the Fan. This output is on whenever the chamber is running.



Output is On/Off	

PID Heat

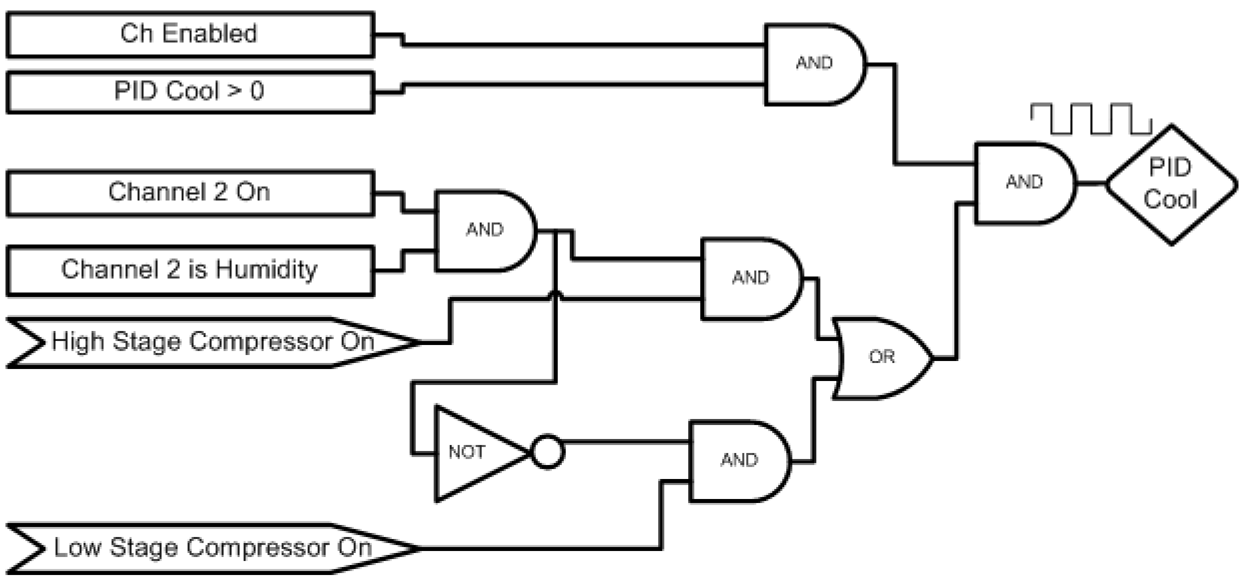
Time Proportioning output that controls the heaters.



Output is Time Proportioning		
Affected By:	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

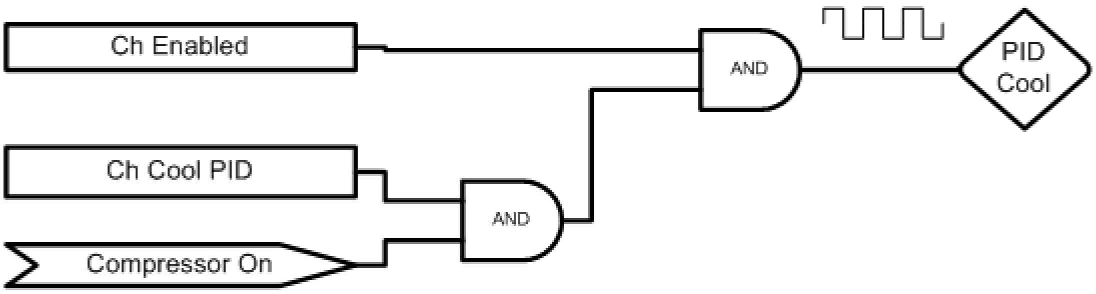
This is a time proportioning output that energizes the cool solenoid permitting refrigerant flow to the Evaporator Coil.



Output is Time Proportioning		
Affected By:	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)

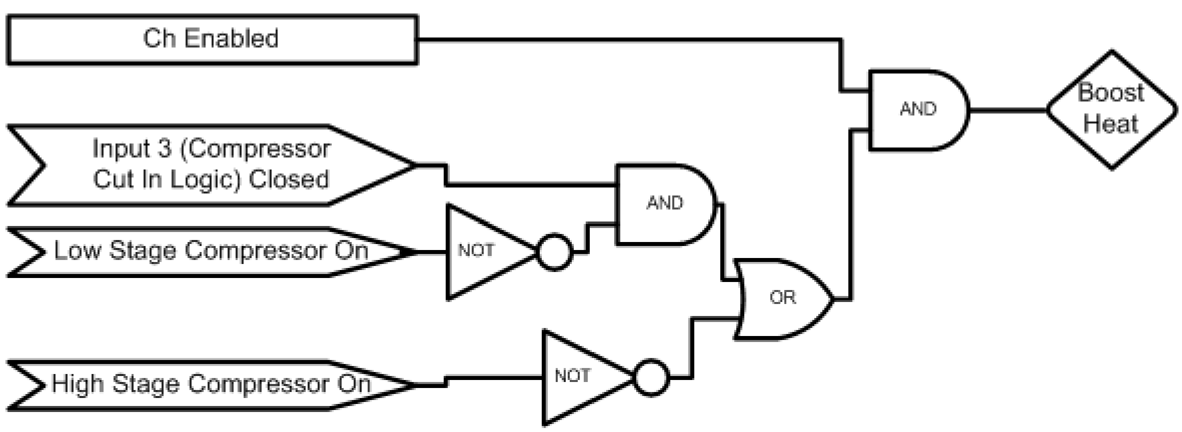
This is a time proportioning output that energizes the cool solenoid permitting refrigerant flow to the Evaporator Coil. This logic is only used on Temp Only and Temp-Temp (thermal shock) configurations.



Output is Time Proportioning		
Affected By:	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

Provides extra heating capabilities when cooling compressors are off.

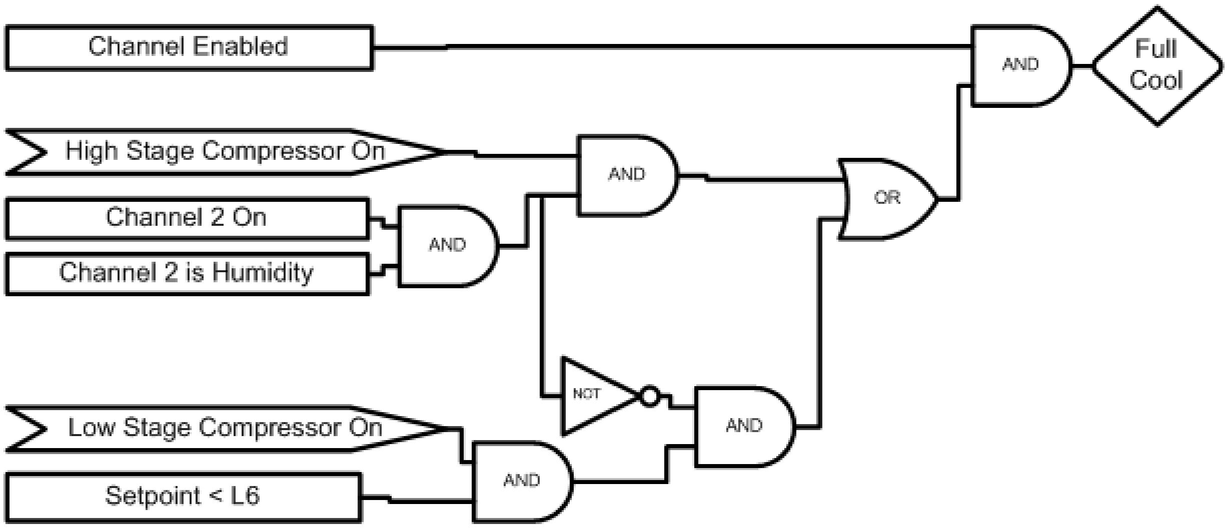


Output is On/Off	
Compressor Cut In Logic (Input 3)	When closed, selects Compressor Cut In Logic. Uses a pressure switch.

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

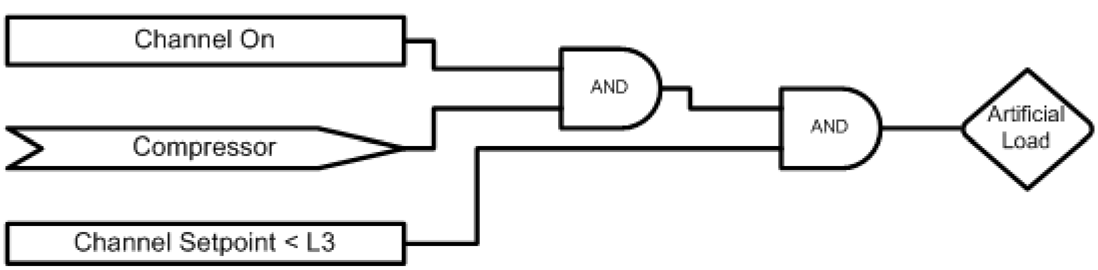
This output will turn on at low temperatures and enable full cooling capabilities. When this output is off only reduced cooling is available. This results in more precise control at higher temperatures.



Output is On/Off	
L6 Full Cooling Switch Over	The temperature at which full cooling switches on

Artificial Load

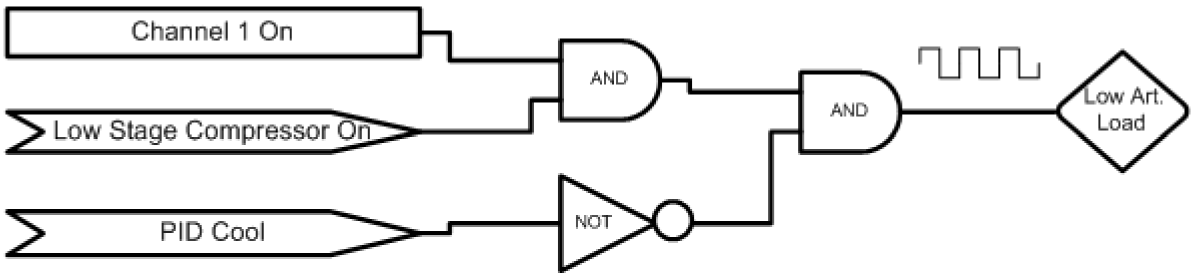
Artificial Load is turned on when the cooling solenoid is off to prevent the compressor from overheating.



Output is On/Off	
xL3 Ch x Setpoint Transfer Setting	Temperature at which to enable artificial load device

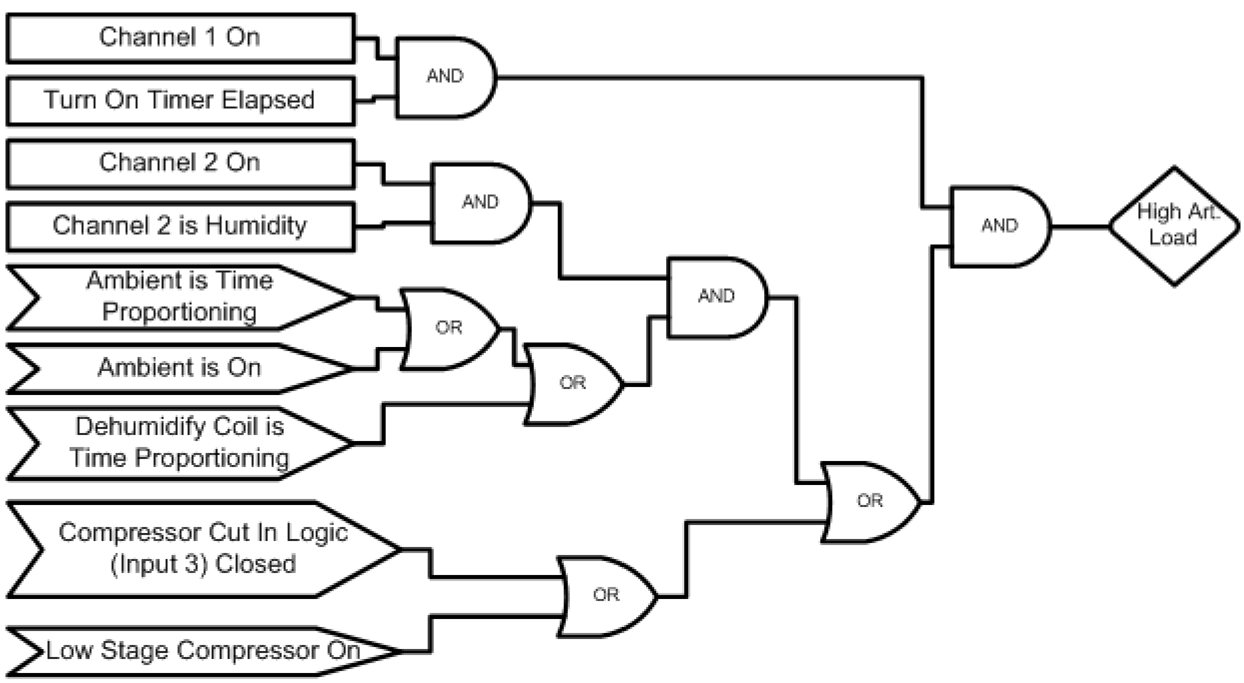
Low Artificial Load

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		
Affected By:	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

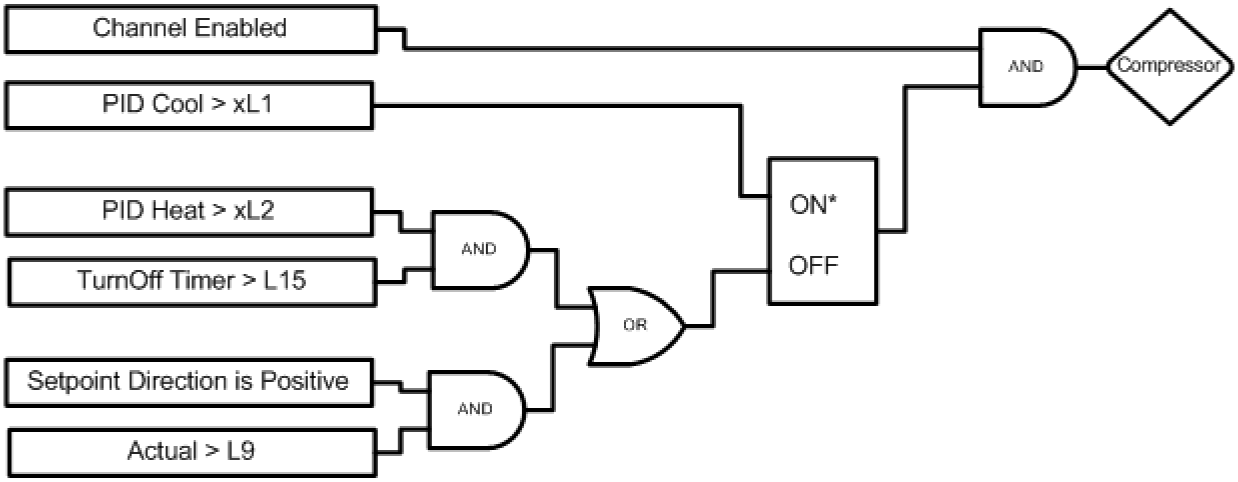
High Artificial Load



Output is On/Off	
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

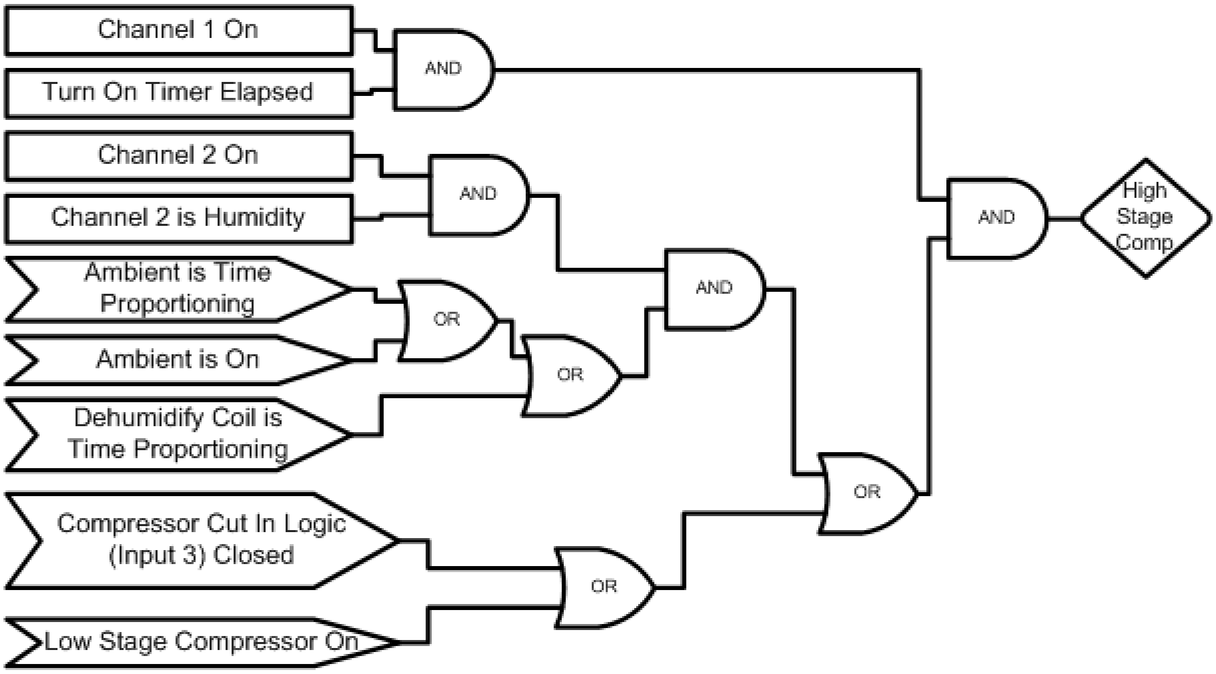
This output turns on a compressor.



Output is On/Off	
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
Setpoint direction is Positive only when ramping a setpoint in a profile	
* Denotes which signal has priority if both are true	

Full Cool

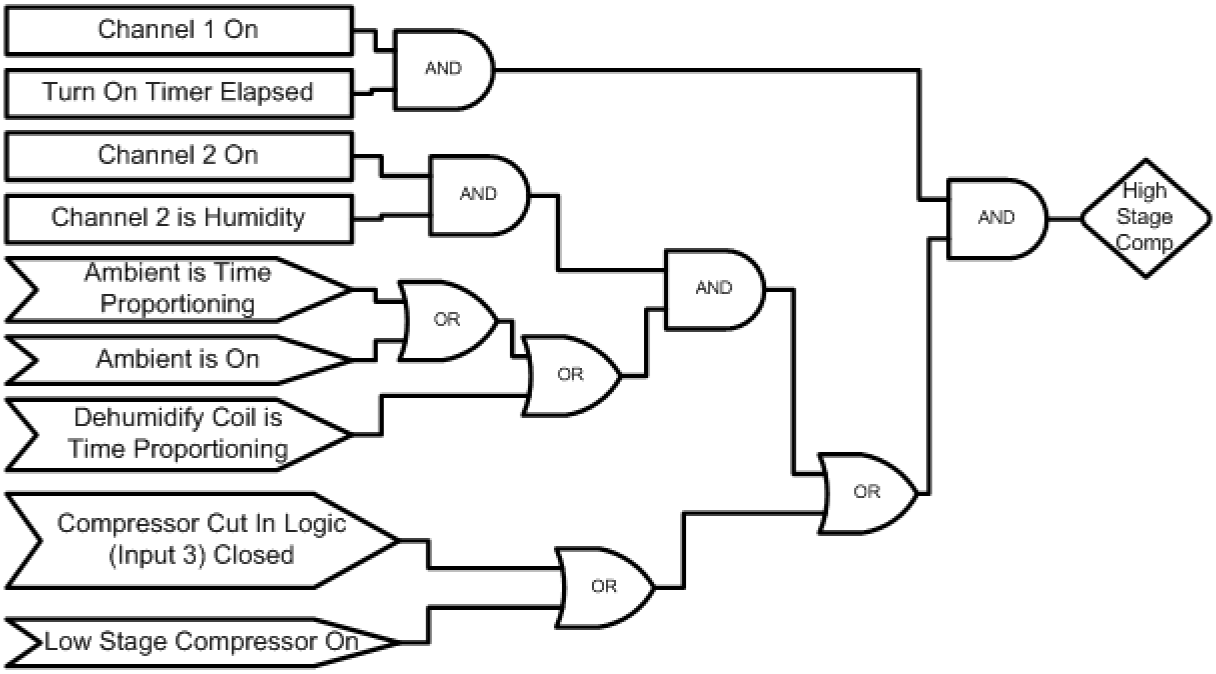
This output energizes the Full Suction solenoid permitting maximum refrigerant flow from the evaporator coil back to the compressor. This allows maximum cooling capacity when low temperatures are required.



Output is On/Off	
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
The Turn Off Timer is reset when Channel 1 PID Cool > 0%	
* Denotes which signal has priority if both are true	

High Stage Compressor

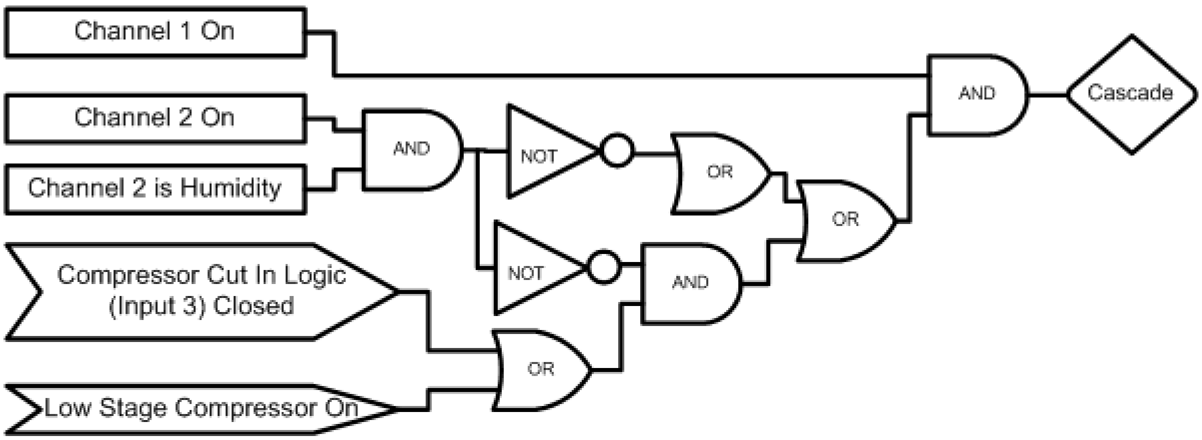
This output energizes the high stage compressor.



Output is On/Off	
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.	

Cascade Condenser

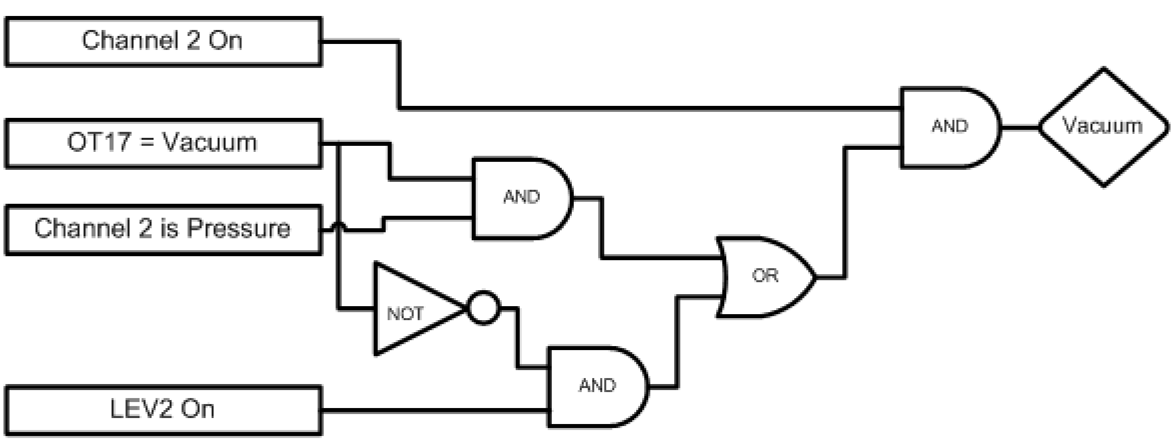
This output turns on whenever cooling is needed. It energizes the solenoid that feeds liquid refrigerant to the evaporator coil.



Output is On/Off	
Compressor Cut In Logic (Input 3)	When closed, selects Compressor Cut In Logic. Uses a pressure switch.

Vacuum

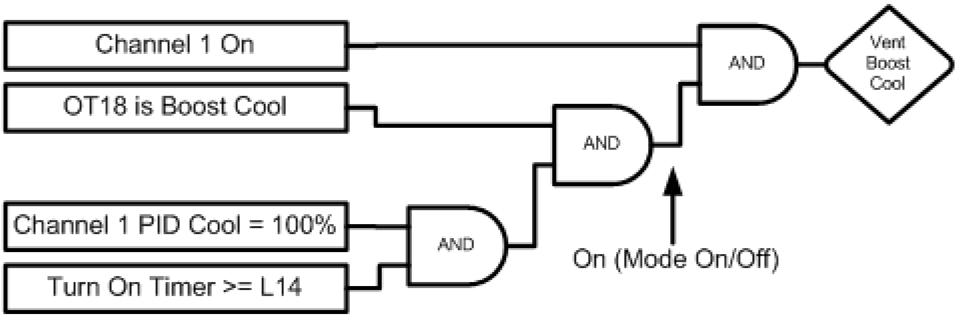
This output controls the vacuum device on altitude chambers.



Output is On/Off	
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

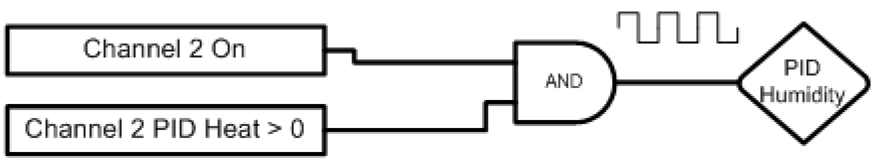
This output specifies to use either Vent or Boost Cool.



Output is On/Off	
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
Turn On Timer is reset when Channel 1 PID Cool < 100%	

PID Humidify

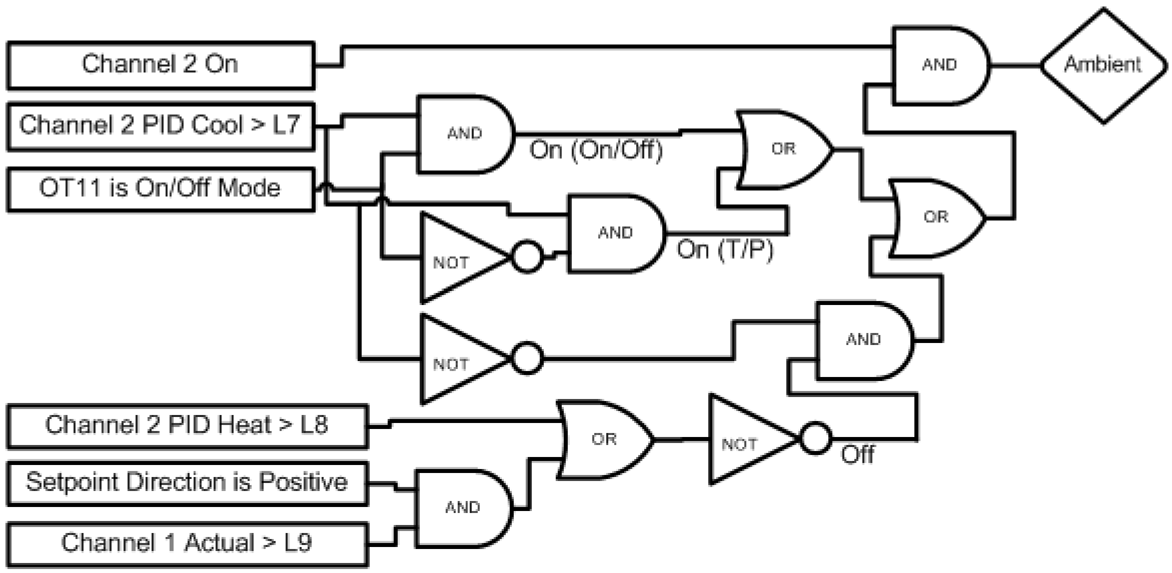
This output energizes the humidity generator and controls water vapor injection into the chamber.



Output is Time Proportioning		
Affected By:	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

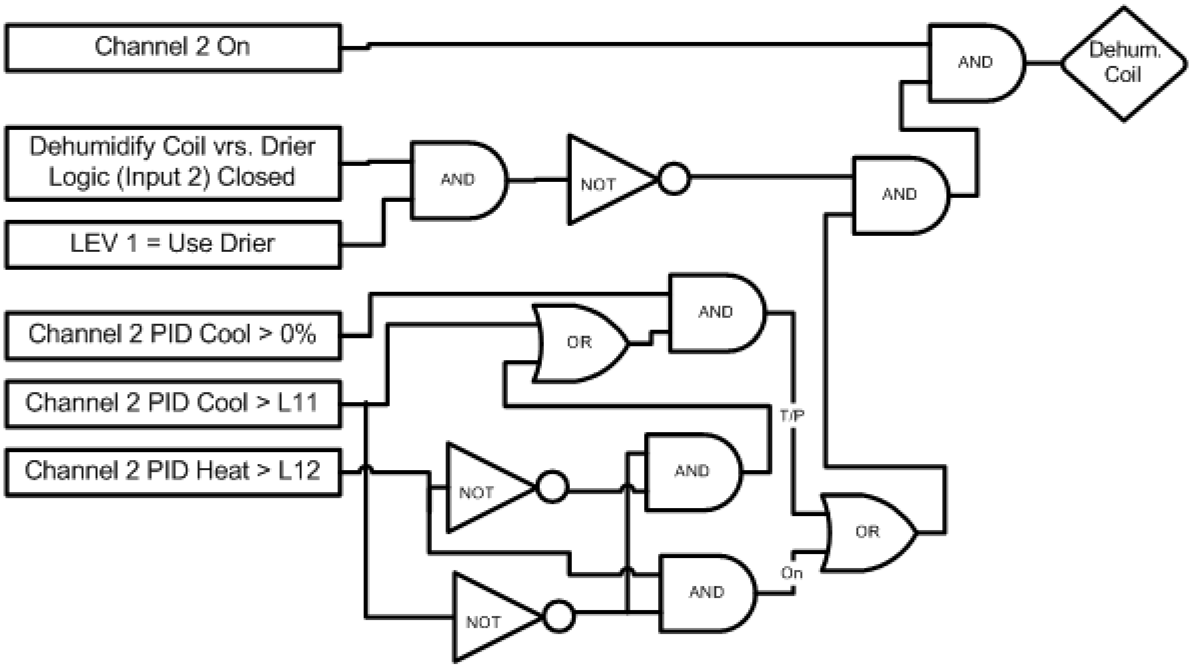
This output is used when cooling is required with humidity control



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	
Affected By:	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

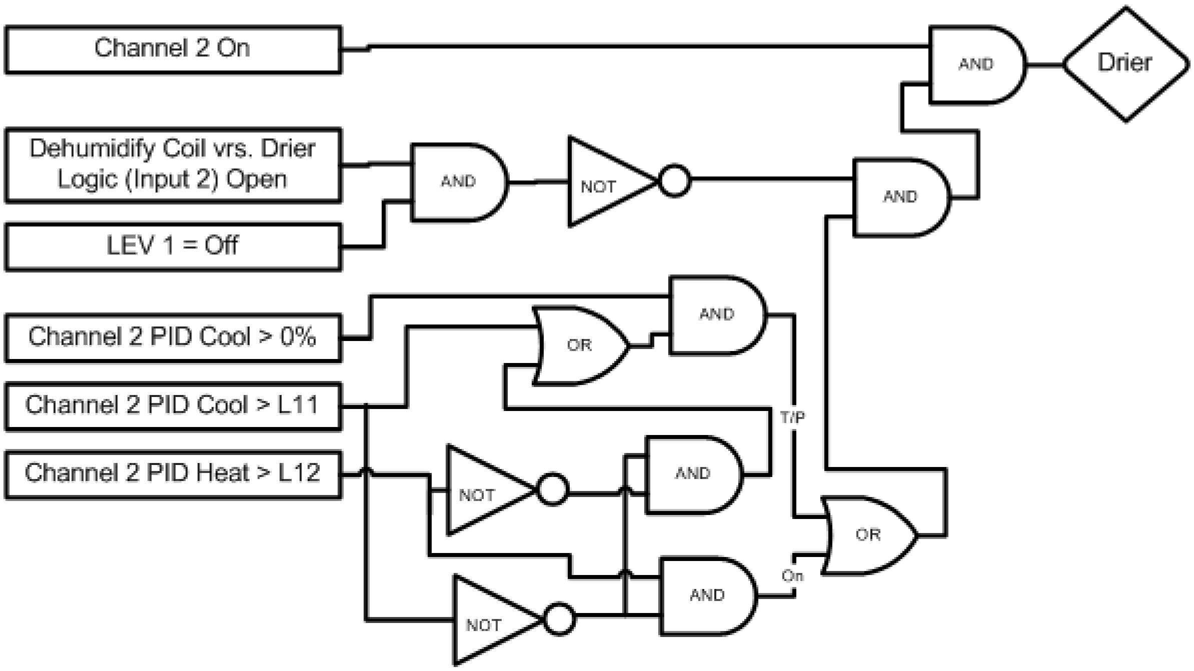
This output operates the dehumidify coil for dehumidification.



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.	
Affected By:	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

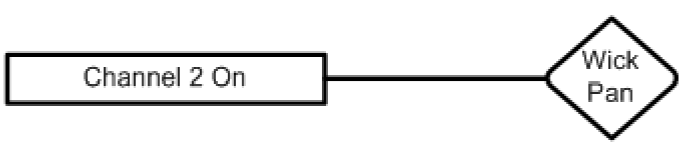
This output controls the Air Drier for dehumidification.



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.	
Affected By:	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.



6.8 LCD Settings

LCD Brightness adjust is not available on the Synergy Nano

6.9 Chamber Setup

The Chamber Setup Directory is used for factory setup. The chamber type specified in the Synergy Nano 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.

CHAMBER SETUP \ SETUP DIRECTORY SYNERGY NANO	
Chamber Type Screen	
(Screen Editor)	
Nano Temperature Only	
Nano Temperature/Temperature *	
Nano Temperature/Humidity *	
Nano Temperature/Pressure *	
Nano Temperature/Vibration	

CHAMBER SETUP \ SETUP DIRECTORY SYNERGY NANO	
Chamber Type Screen	
(Screen Editor)	
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	

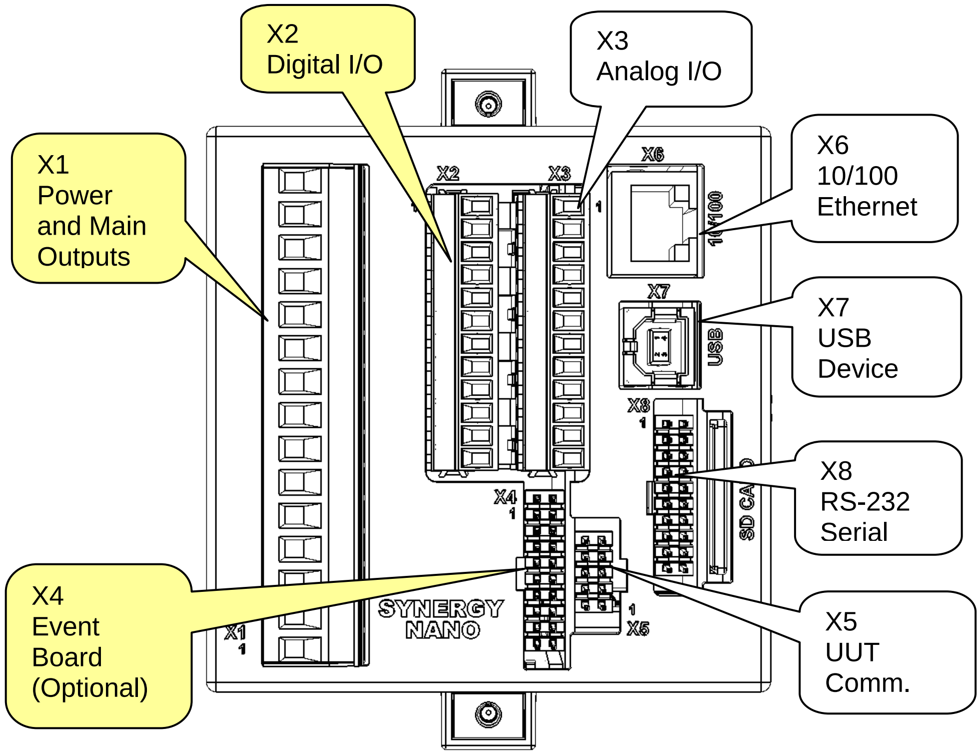
The Chambers Types in the list above that are identified with * support VersaTenn retrofit fit applications.

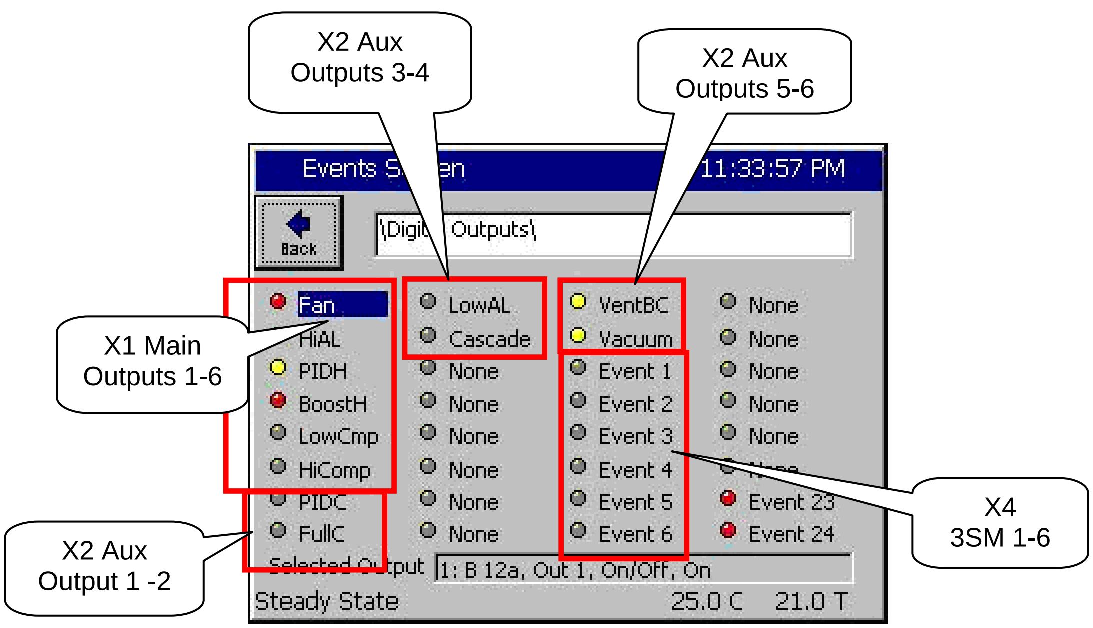
WARNING: Incorrect Chamber Type settings may cause severe damage to your chamber.

Synergy Nano Chamber Output Mapping

The Synergy Nano 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 Nano is installed on a chamber with a VersaTenn, VersaTenn II or VersaTenn III.





Synergy Nano Plus Chamber Output Mapping

The Synergy Nano 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 Nano 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

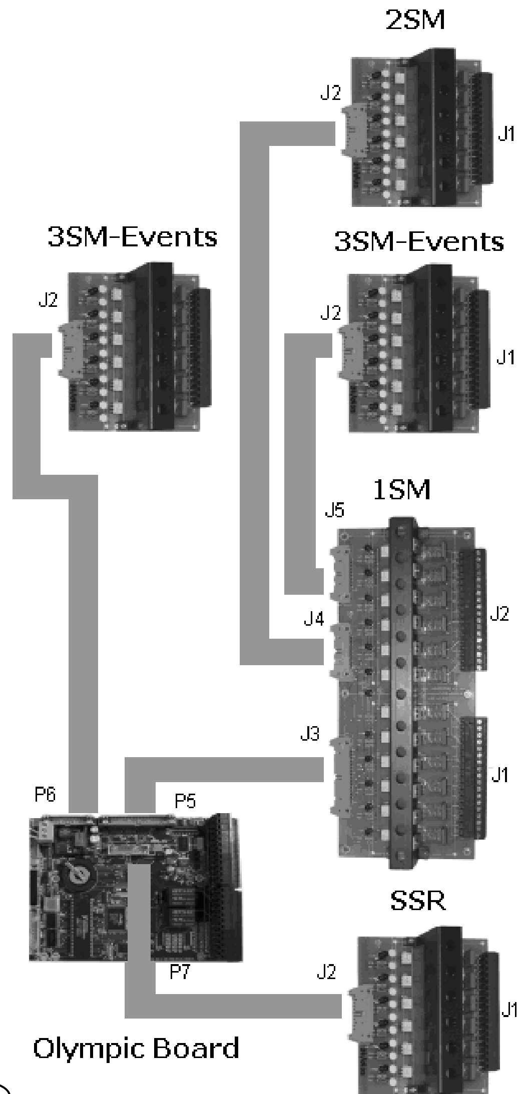
The Olympic board drives all of the outputs for the chamber thru solid state switches called Switching Modules (SM). In some cases there is more than one way to connect a specific output. This provides flexibility when wiring the chamber to support new and retrofit installations. The figure at the right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

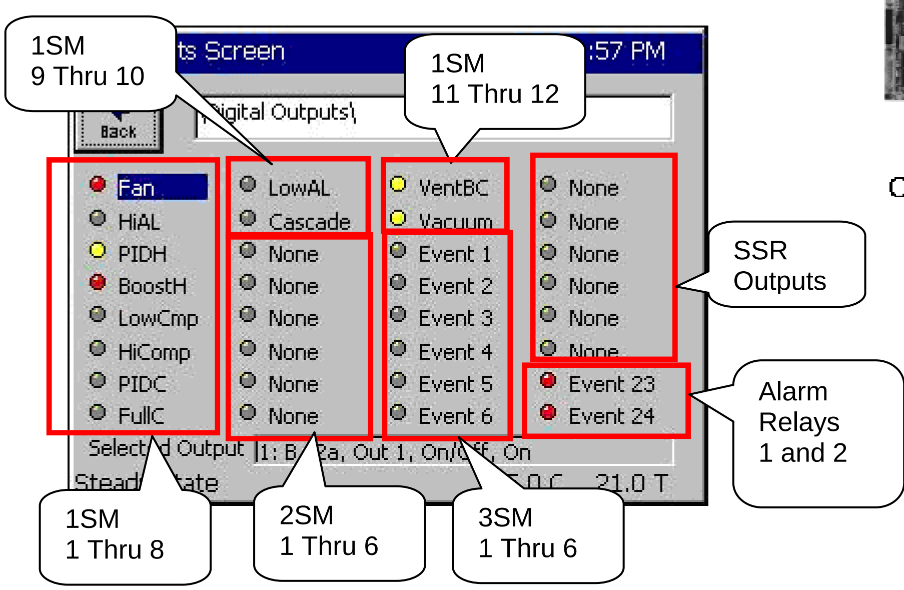
In addition, some chamber definitions provide the same function to more than one output. This is referred to as mirroring.

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.



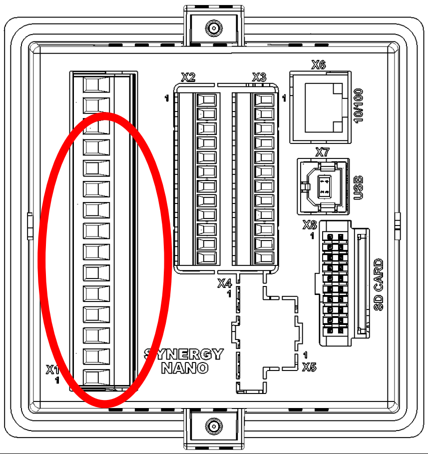
6.10 Synergy Nano Output Mappings by Chamber Type

The following sections identify the output mappings for each chamber configuration.

6.10.1 Synergy Nano Temperature Only

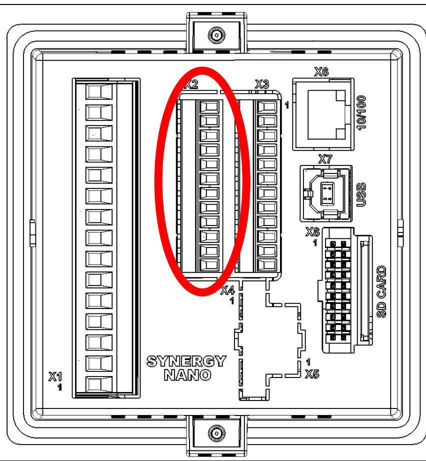
Nano Temperature Only

Main Outputs – X1



Channel	Digital Output	Device
1 (Pin1-Pin2)	1	Heat
2 (Pin3-Pin4)	2	Cool
3 (Pin5-Pin6)	3	Boost Cool
4 (Pin7-Pin8)	4	Dryer GN2
5 (Pin9-Pin10)	5	Fan
6 (Pin11-Pin12)	6	Not Used

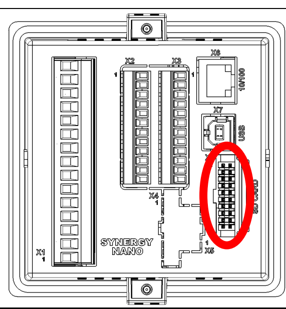
Aux Outputs – X2

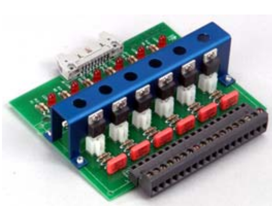


Channel	Digital Output	Device
1 (Pin11-Pin1)	7	Heat
2 (Pin11-Pin2)	8	Cool
3 (Pin11-Pin3)	9	Boost Cool
4 (Pin11-Pin4)	10	Dryer GN2
5 (Pin11-Pin5)	11	Fan
6 (Pin11-Pin6)	12	Not Used

* X2 Pin 11 can provide the +5VDC source for these outputs

Event Outputs – X8

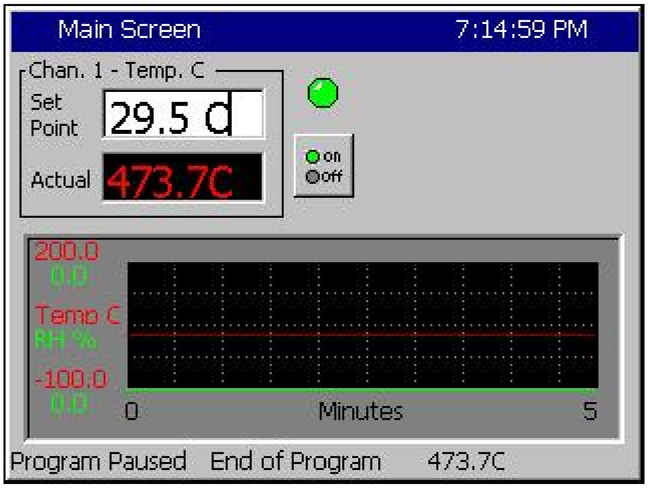




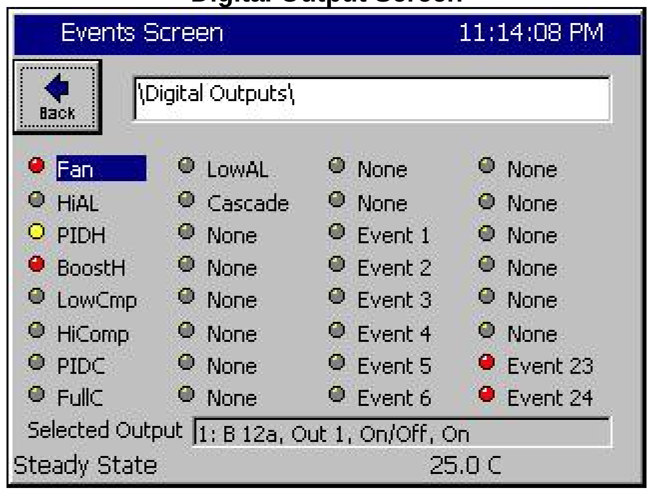
Channel	Digital Output	Device
1	13	Event 1
2	14	Event 2
3	15	Event 3
4	16	Event 4
5	17	Event 5
6	18	Event 6

Nano 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**
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.

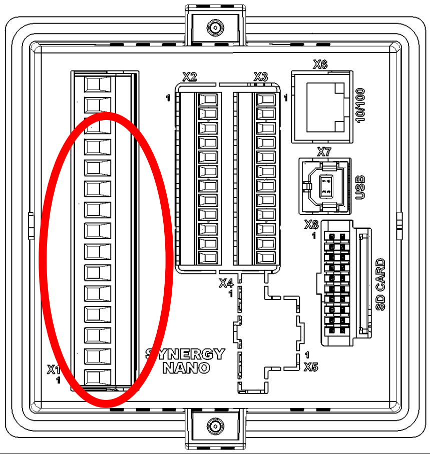
Alarms

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
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

6.10.2 Synergy Nano Temperature/Humidity

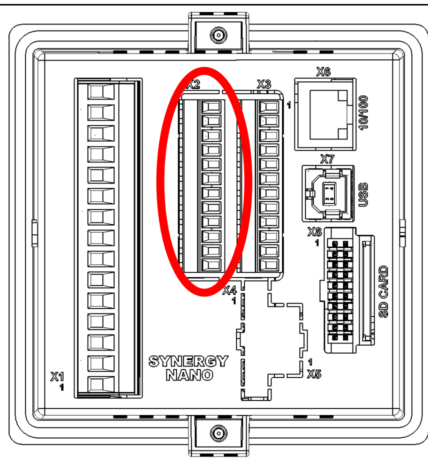
Nano Temperature Humidity

Main Outputs – X1



Channel	Digital Output	Device
1 (Pin1-Pin2)	1	Heat
2 (Pin3-Pin4)	2	Cool
3 (Pin5-Pin6)	3	Boost Cool
4 (Pin7-Pin8)	4	Dryer GN2
5 (Pin9-Pin10)	5	Fan
6 (Pin11-Pin12)	6	Not Used

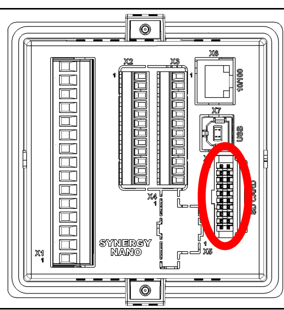
Aux Outputs – X2

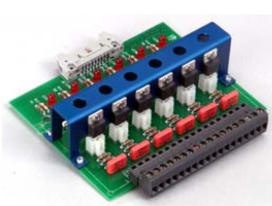


Channel	Digital Output	Device
1 (Pin11-Pin1)	7	Heat
2 (Pin11-Pin2)	8	Cool
3 (Pin11-Pin3)	9	Boost Cool
4 (Pin11-Pin4)	10	Dryer GN2
5 (Pin11-Pin5)	11	Fan
6 (Pin11-Pin6)	12	Not Used

* X2 Pin 11 can provide the +5VDC source for these outputs

Event Outputs – X8

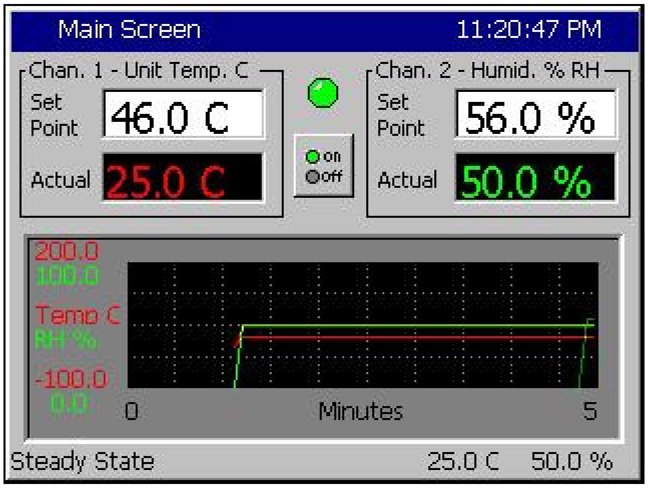




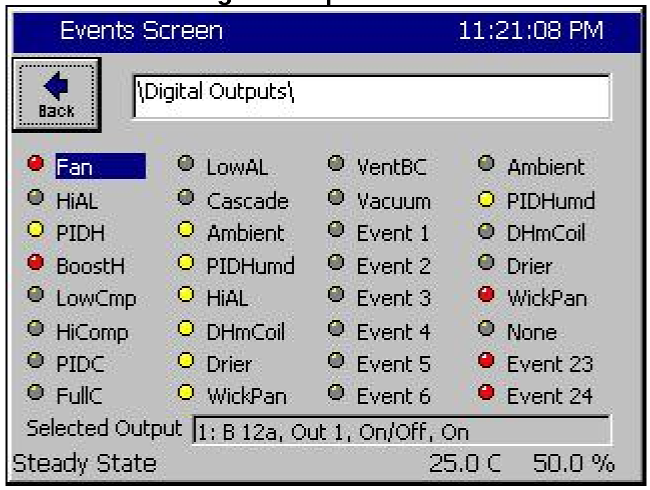
Channel	Digital Output	Device
1	13	Event 1
2	14	Event 2
3	15	Event 3
4	16	Event 4
5	17	Event 5
6	18	Event 6

Nano Temperature Humidity Main Screen

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.

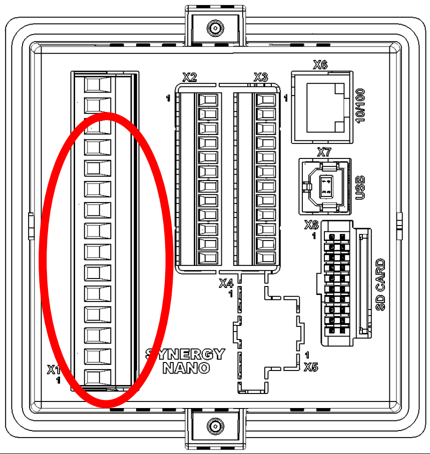
Alarms

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

6.10.3 Synergy Nano Temperature/Temperature, Two Zone Thermal Shock

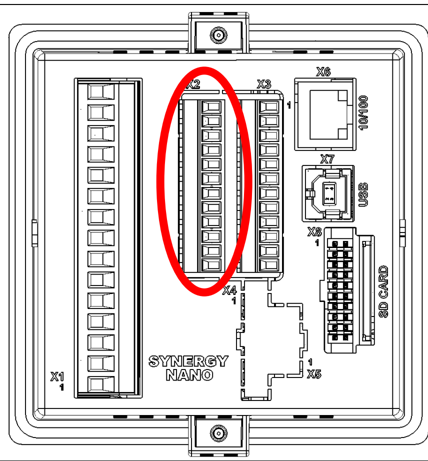
Nano Thermal Shock

Main Outputs – X1



Channel	Digital Output	Device
1 (Pin1-Pin2)	1	Heat
2 (Pin3-Pin4)	2	Cool
3 (Pin5-Pin6)	3	Boost Cool
4 (Pin7-Pin8)	4	Dryer GN2
5 (Pin9-Pin10)	5	Fan
6 (Pin11-Pin12)	6	Not Used

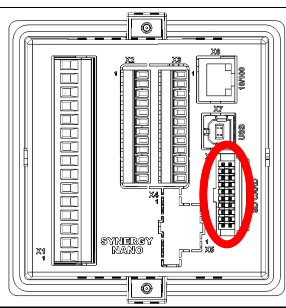
Aux Outputs – X2

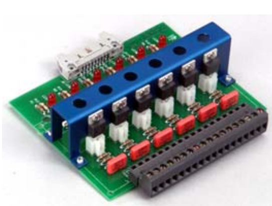


Channel	Digital Output	Device
1 (Pin11-Pin1)	7	Heat
2 (Pin11-Pin2)	8	Cool
3 (Pin11-Pin3)	9	Boost Cool
4 (Pin11-Pin4)	10	Dryer GN2
5 (Pin11-Pin5)	11	Fan
6 (Pin11-Pin6)	12	Not Used

* X2 Pin 11 can provide the +5VDC source for these outputs

Event Outputs – X8

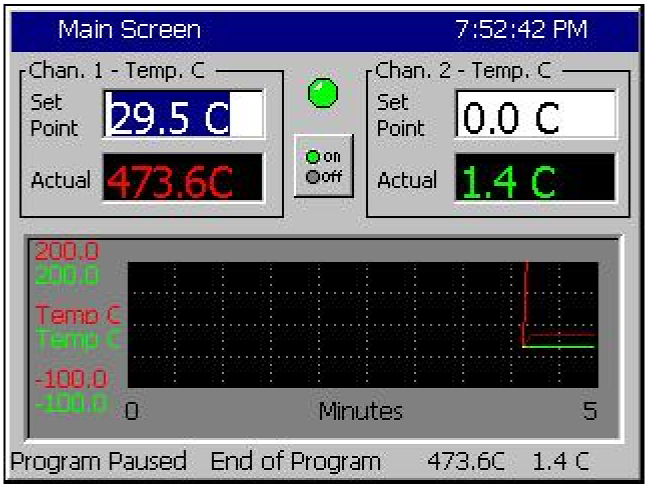




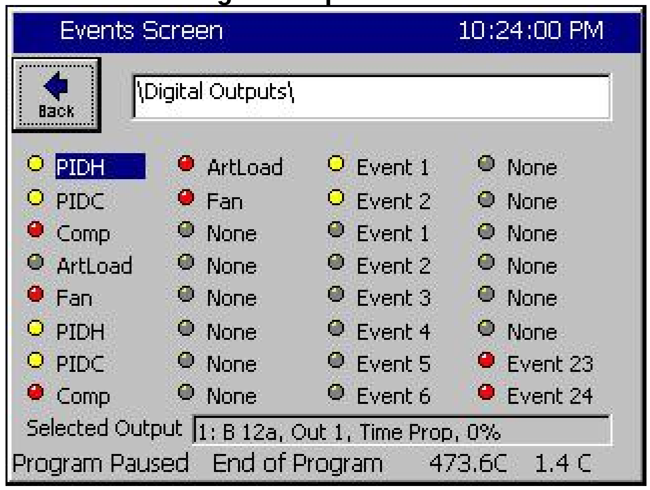
Channel	Digital Output	Device
1	13	Event 1
2	14	Event 2
3	15	Event 3
4	16	Event 4
5	17	Event 5
6	18	Event 6

Nano Temp/Temp (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.

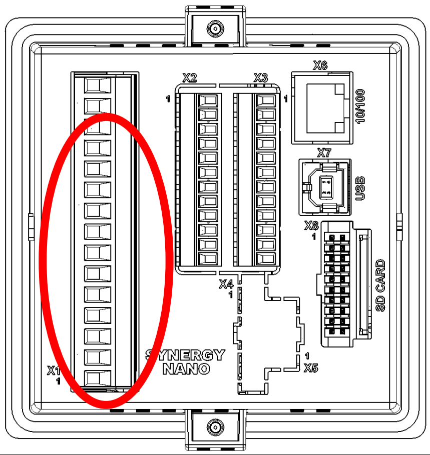
Alarms

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

6.10.4 Synergy Nano Temperature/Pressure (Altitude or Thermal Vacuum)

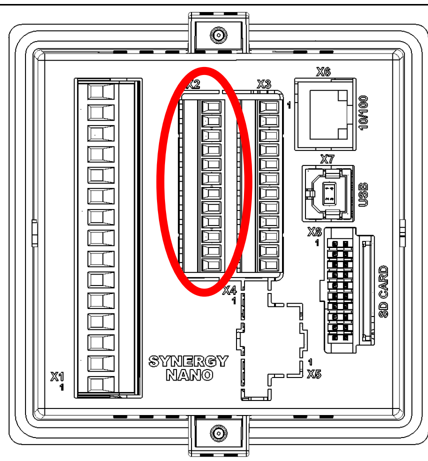
Nano Temperature Pressue

Main Outputs – X1



Channel	Digital Output	Device
1 (Pin1-Pin2)	1	Heat
2 (Pin3-Pin4)	2	Cool
3 (Pin5-Pin6)	3	Boost Cool
4 (Pin7-Pin8)	4	Dryer GN2
5 (Pin9-Pin10)	5	Fan
6 (Pin11-Pin12)	6	Not Used

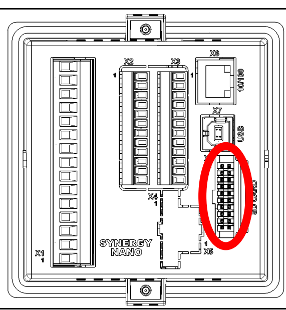
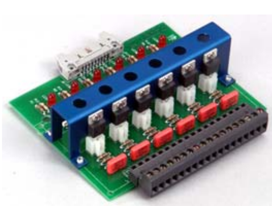
Aux Outputs – X2



Channel	Digital Output	Device
1 (Pin11-Pin1)	7	Heat
2 (Pin11-Pin2)	8	Cool
3 (Pin11-Pin3)	9	Boost Cool
4 (Pin11-Pin4)	10	Dryer GN2
5 (Pin11-Pin5)	11	Fan
6 (Pin11-Pin6)	12	Not Used

* X2 Pin 11 can provide the +5VDC source for these outputs

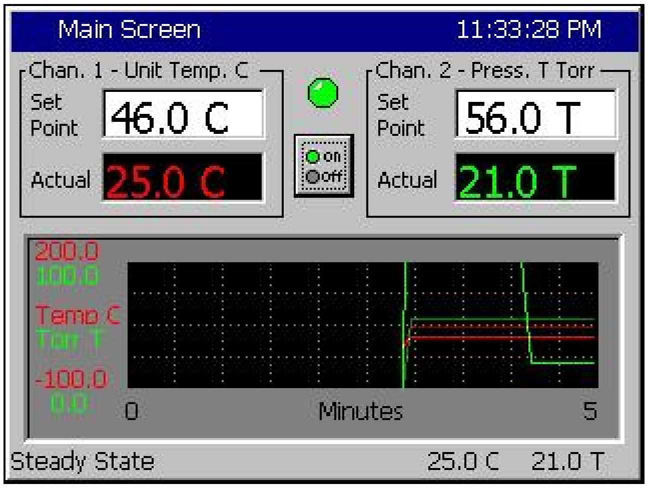
Event Outputs – X8

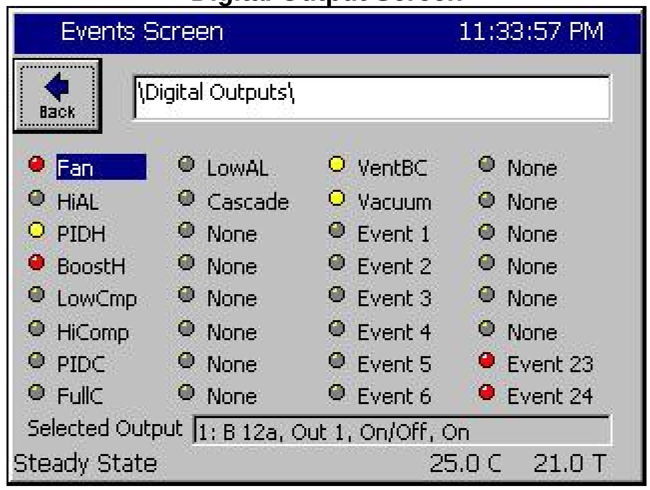
Channel	Digital Output	Device
1	13	Event 1
2	14	Event 2
3	15	Event 3
4	16	Event 4
5	17	Event 5
6	18	Event 6

Nano Temperature/Pressure Main Screen

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

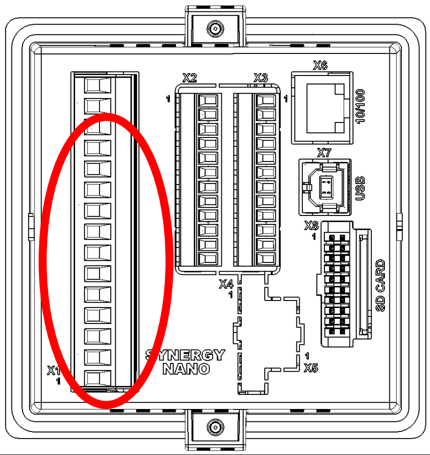
Name	Sensor	Sensor Code	Default Threshold	Report	Log	K1	K2
Hi Alarm Ch 1	RTD1	110	> 500 C	Yes	Yes	Yes	No
Low Alarm Ch 1	RTD1	110	< -200C	Yes	Yes	Yes	No
Hi Alarm Ch 2	Analog1	130	1010T	Yes	Yes	Yes	No
Low Alarm Ch 2	Analog1	130	-10T	Yes	Yes	Yes	No
Bad Sensor Ch 1	RTD1	110	< 10 Ohm	Yes	Yes	Yes	No
Bad Sensor 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

See Section 15.0 Space and Altitude Chambers for additional setup information.

6.10.5 Synergy Nano Temperature Vibration (HALT/HASS)

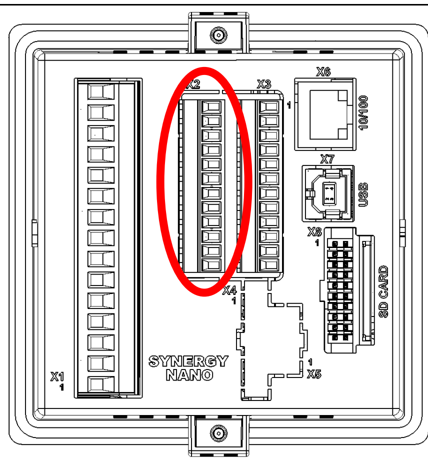
Nano Temperature Vibration

Main Outputs – X1



Channel	Digital Output	Device
1 (Pin1-Pin2)	1	Heat
2 (Pin3-Pin4)	2	Cool
3 (Pin5-Pin6)	3	Boost Cool
4 (Pin7-Pin8)	4	Dryer GN2
5 (Pin9-Pin10)	5	Fan
6 (Pin11-Pin12)	6	Not Used

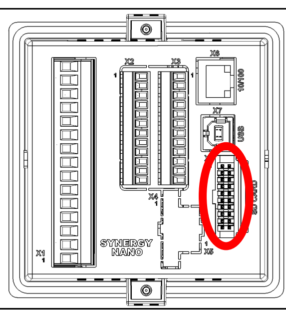
Aux Outputs – X2

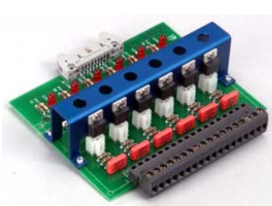


Channel	Digital Output	Device
1 (Pin11-Pin1)	7	Heat
2 (Pin11-Pin2)	8	Cool
3 (Pin11-Pin3)	9	Boost Cool
4 (Pin11-Pin4)	10	Dryer GN2
5 (Pin11-Pin5)	11	Fan
6 (Pin11-Pin6)	12	Not Used

* X2 Pin 11 can provide the +5VDC source for these outputs

Event Outputs – X8

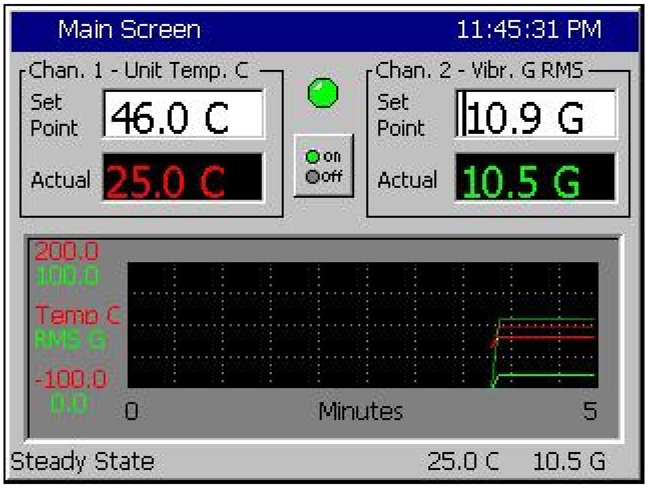




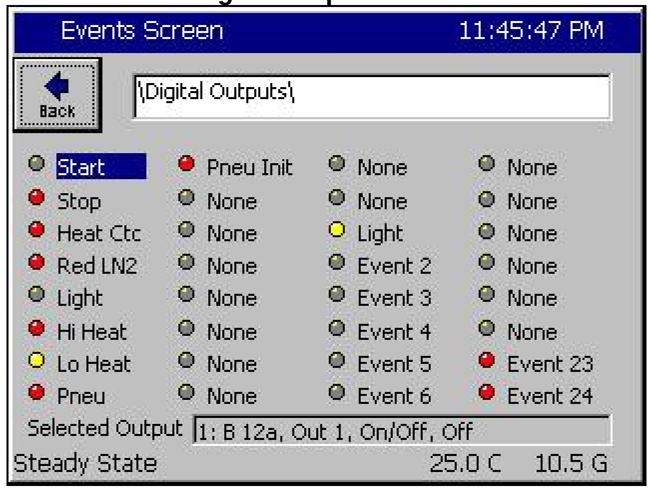
Channel	Digital Output	Device
1	13	Event 1
2	14	Event 2
3	15	Event 3
4	16	Event 4
5	17	Event 5
6	18	Event 6

Nano Temperature/Vibration Main Screen

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

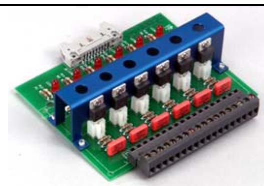
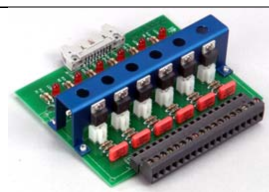
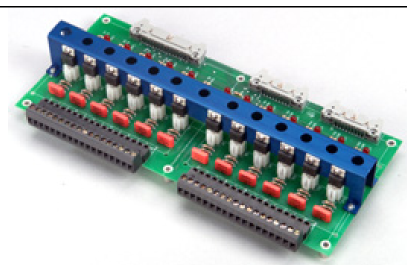
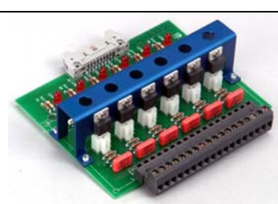
Name	**Sensor**	**Sensor Code**	**Default Threshold**	**Report**	**Log**	**K1**	**K2**
Hi Alarm Ch 1	RTD1	110	> 500 C	Yes	Yes	Yes	No
Low Alarm Ch 1	RTD1	110	< -200C	Yes	Yes	Yes	No
Hi Alarm Ch 2	Analog1	130	104 Grms	Yes	Yes	Yes	No
Low Alarm Ch 2	Analog1	130	0 Grms	Yes	Yes	Yes	No
Bad Sensor Ch 1	RTD1	110	< 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.

6.11 *Synergy Nano Plus Output Mappings by Chamber Type*

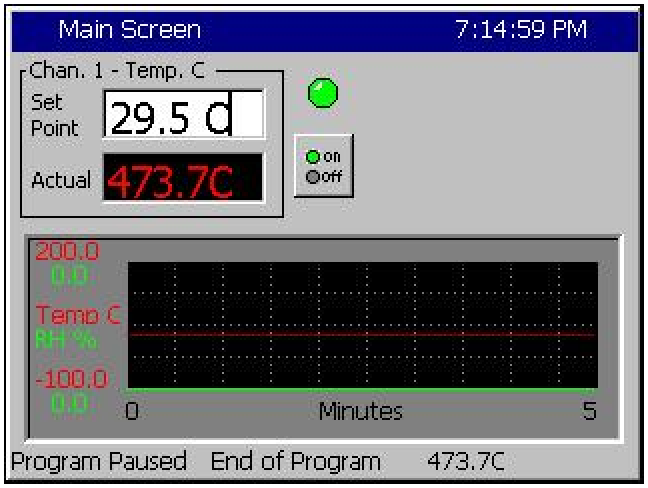
The following sections identify the output mappings for each chamber configuration.

6.11.1 Generic Temperature Only

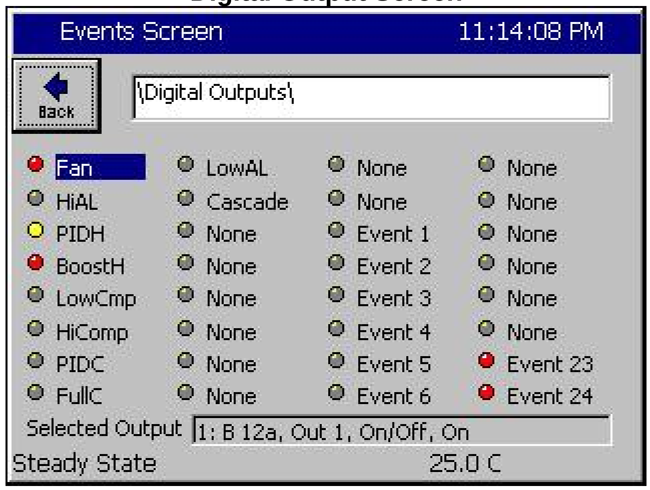
Generic Temperature Only			
2SM Outputs			
TE1151-6	SM Channel	Digital Output	Device
	6	16	Not Used
	5	15	Not Used
	4	14	Not Used
	3	13	Not Used
	2	12	Not Used
	1	11	Not Used
3SM Event Outputs			
TE1151-6	SM Channel	Digital Output	Device
	6	24	Event 6
	5	23	Event 5
	4	22	Event 4
	3	21	Event 3
	2	20	Event 2
	1	19	Event 1
1SM Outputs			
TE1151-12	SM Channel	Digital Output	Device
	12	18	Not Used
	11	17	Not Used
	10	10	Cascade
	9	9	Low Artificial Load
	8	8	Full Cool
	7	7	PID Cool
	6	6	High Compressor
	5	5	Low Compressor
	4	4	Boost Heat
	3	3	PID Heat
	2	2	Hi Artificial Load
	1	1	Fan
SSR Outputs			
TE1151-6	SM Channel	Digital Output	Device
	6	30	
	5	29	Not Used
	4	28	Not Used
	3	27	Not Used
	2	26	Not Used
	1	25	Not Used

Generic 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

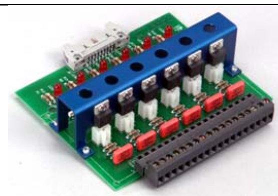
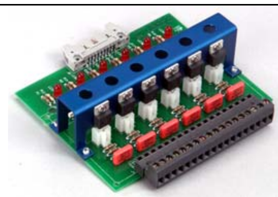
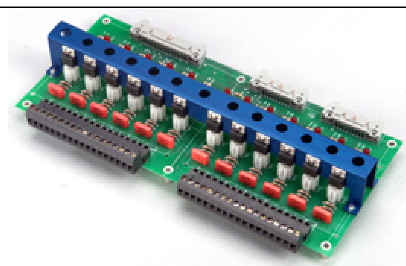
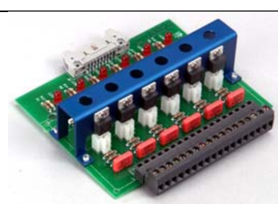
Digital Inputs

Name	Input	Function when Closed
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

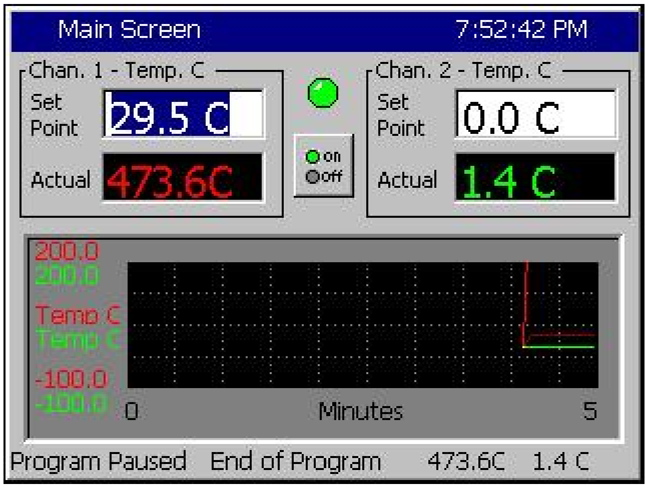
Name	Sensor	Sensor Code	Default Threshold	Report	Log	K1	K2
Hi Alarm Ch 1	RTD1	110	> 500 C	Yes	Yes	Yes	No
Low Alarm Ch 1	RTD1	110	< -200C	Yes	Yes	Yes	No
Bad Sensor Ch 1	RTD1	110	< 10 Ohm	Yes	Yes	Yes	No
Bad Sensor Ch 1	RTD1	110	> 330 Ohm	Yes	Yes	Yes	No
TempGard	Digital Input 9	409	Open	Yes	Yes	No	No

6.11.2 Generic Temperature/Temperature, Dual Thermal Shock

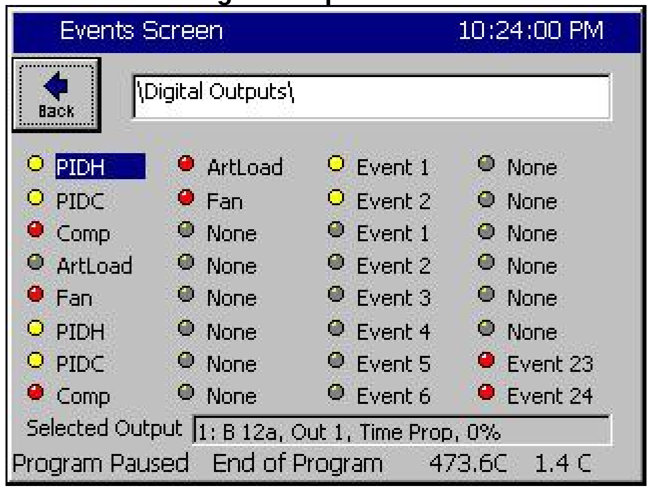
Generic Temp/Temp, Dual Thermal Shock			
2SM Outputs			
TE1151-6	SM Channel	Digital Output	Device
	6	16	Not Used
	5	15	Not Used
	4	14	Not Used
	3	13	Not Used
	2	12	Not Used
	1	11	Not Used
3SM Event Outputs			
TE1151-6	SM Channel	Digital Output	Device
	6	24	Event 6
	5	23	Event 5
	4	22	Event 4
	3	21	Event 3
	2	20	Event 2
	1	19	Event 1
1SM Outputs			
TE1151-12	SM Channel	Digital Output	Device
	12	18	Event 2
	11	17	Event 1
	10	10	Fan
	9	9	Artificial Load
	8	8	Compressor
	7	7	PID Cool
	6	6	PID Heat
	5	5	Fan
	4	4	Artificial Load
	3	3	Compressor
	2	2	PID Cool
	1	1	PID Heat
SSR Outputs			
TE1151-6	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 Temp/Temp (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

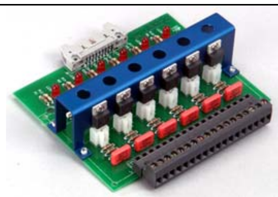
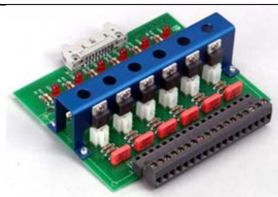
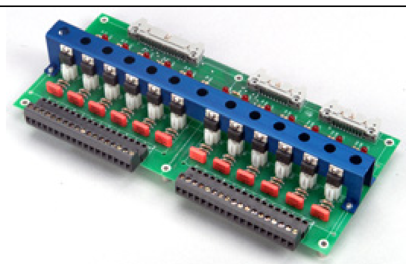
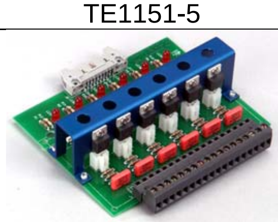
Name	Input	Function when Closed
TempGard	Input 9	None, TempGard Alarm displays in Alarm Folder and Log File.

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

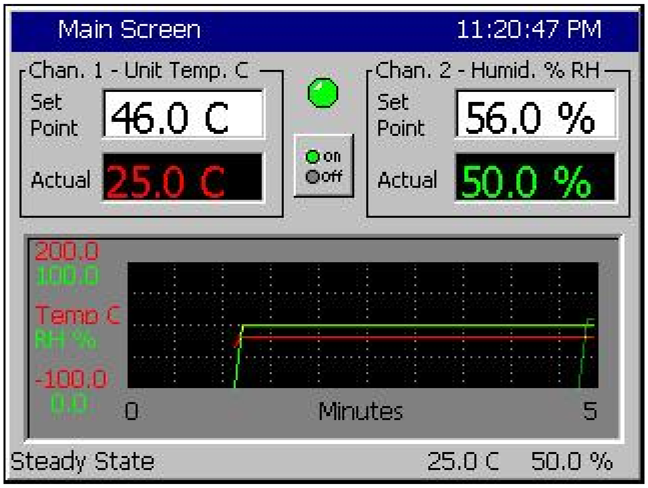
This Generic Temp/Temp configuration supports VersaTenn Thermal Shock retrofits.

6.11.3 Generic Temperature/Humidity

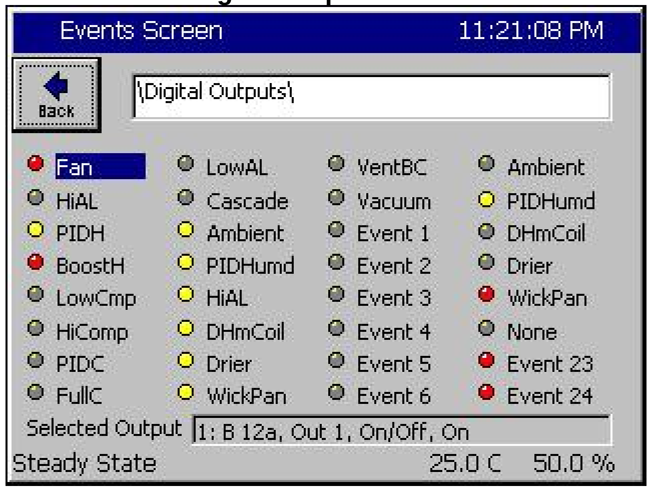
Generic Temperature/Humidity			
2SM Outputs			
TE1151-6	SM Channel	Digital Output	Device
	6	16	Wickpan
	5	15	Drier
	4	14	Dehumidify Coil
	3	13	Hi Al
	2	12	PID Humidify
	1	11	Ambient
3SM Event Outputs			
TE1151-6	SM Channel	Digital Output	Device
	6	24	Event 6
	5	23	Event 5
	4	22	Event 4
	3	21	Event 3
	2	20	Event 2
	1	19	Event 1
1SM Outputs			
TE1151-12	SM Channel	Digital Output	Device
	12	18	Vacuum
	11	17	Vent BC
	10	10	Cascade
	9	9	Low Artificial Load
	8	8	Full Cool
	7	7	PID Cool
	6	6	High Compressor
	5	5	Low Compressor
	4	4	Boost Heat
	3	3	PID Heat
	2	2	High Artificial Load
	1	1	Fan
SSR Outputs			
TE1151-5	SSR Channel	Digital Output	Device
			
	5	29	Wickpan
	4	28	Drier
	3	27	Dehumidify Coil
	2	26	PID Humidify
	1	25	Ambient

Generic Temperature Humidity Main Screen

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

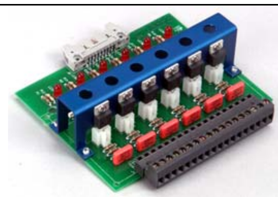
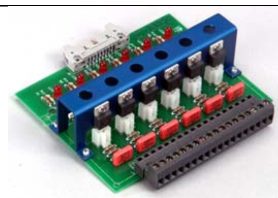
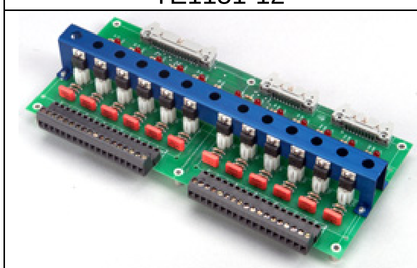
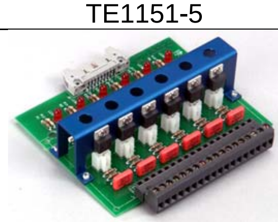
Name	Input	Function when Closed
Ambient Lock Out	Input 1	Disables Ambient Coil when Dehumidify Coil is on.
Drier Logic	Input 2	Enables Drier when LEV1 (Use Drier) is active.
Compressor Cut in Logic	Input 3	Boost Heat, High Artificial Load, High Stage Compressor, Cascade Condenser (See Section 6.7 Device 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

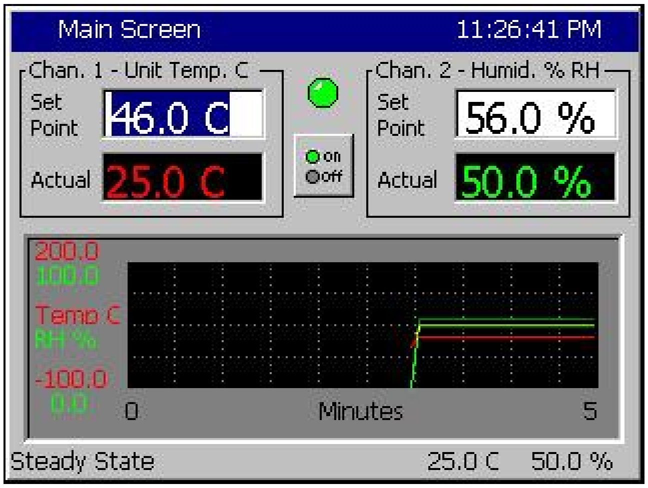
This Generic Temperature/Humidity configuration supports VersaTenn retrofits.

6.11.4 Generic Temperature/Humidity Single Stage

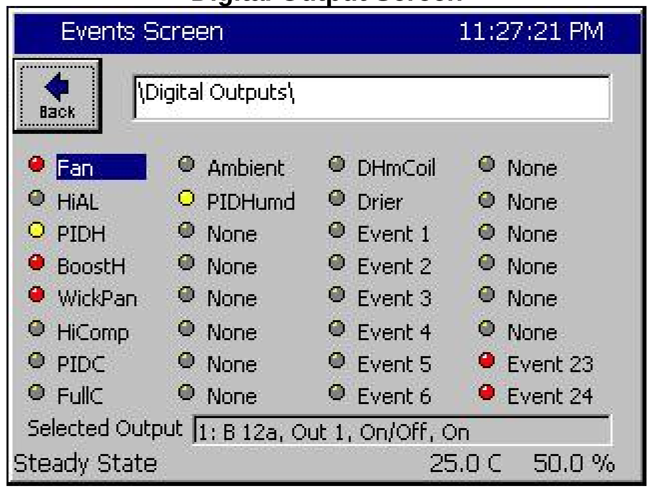
Generic Temperature/Humidity Single Stage			
2SM Outputs			
TE1151-6	SM Channel	Digital Output	Device
	6	30	Not Used
	5	29	Not Used
	4	28	Not Used
	3	27	Not Used
	2	26	Not Used
	1	25	Not Used
3SM Event Outputs			
TE1151-6	SM Channel	Digital Output	Device
	6	24	Event 6
	5	23	Event 5
	4	22	Event 4
	3	21	Event 3
	2	20	Event 2
	1	19	Event 1
1SM Outputs			
TE1151-12	SM Channel	Digital Output	Device
	12	18	Drier
	11	17	Dehumidify Coil
	10	10	PID Humidity
	9	9	Ambient
	8	8	Full Cool
	7	7	PID Cool
	6	6	High Compressor
	5	5	Wickpan
	4	4	Boost Heat
	3	3	PID Heat
	2	2	High Artificial Load
	1	1	Fan
SSR Outputs			
TE1151-5	SSR 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/Humidity Single Stage Main Screen

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

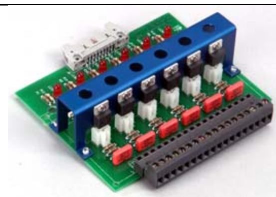
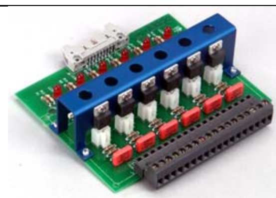
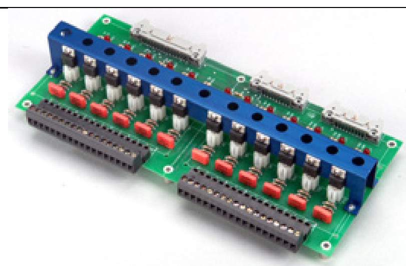
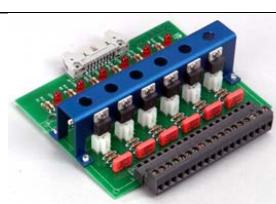
Digital Inputs

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

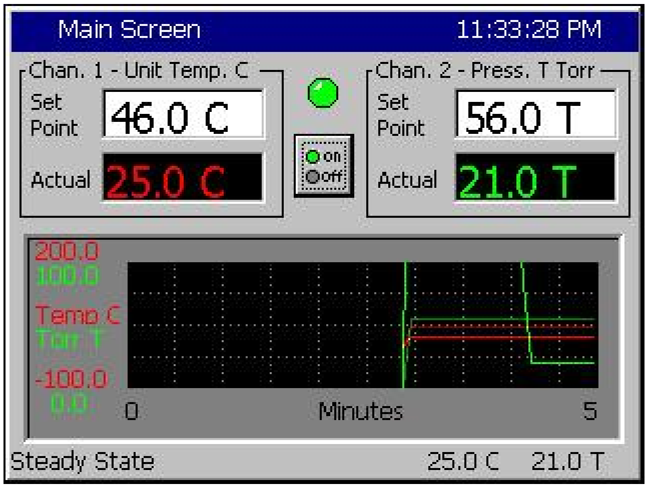
Name	Sensor	Sensor Code	Default Threshold	Report	Log	K1	K2
Hi Alarm Ch 1	RTD1	110	> 500 C	Yes	Yes	Yes	No
Low Alarm Ch 1	RTD1	110	< -200C	Yes	Yes	Yes	No
Hi Alarm Ch 2	Analog1	130	104%	Yes	Yes	Yes	No
Low Alarm Ch 2	Analog1	130	-10%	Yes	Yes	Yes	No
Bad Sensor Ch 1	RTD1	110	< 10 Ohm	Yes	Yes	Yes	No
Bad Sensor 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

6.11.5 Generic Temperature/Pressure, Altitude and Space

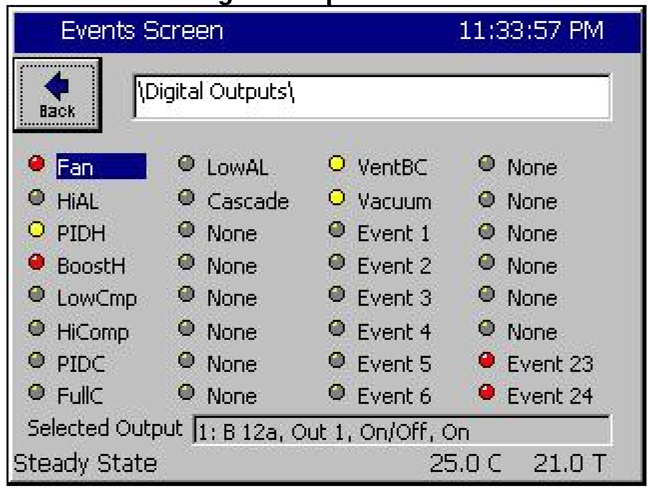
Generic Temperature/Pressure, Altitude & Space			
2SM Outputs			
TE1151-6	SM Channel	Digital Output	Device
	6	30	Not Used
	5	29	Not Used
	4	28	Not Used
	3	27	Not Used
	2	26	Not Used
	1	25	Not Used
3SM Event Outputs			
TE1151-6	SM Channel	Digital Output	Device
	6	24	Event 6
	5	23	Event 5
	4	22	Event 4
	3	21	Event 3
	2	20	Event 2
	1	19	Event 1
1SM Outputs			
TE1151-12	SM Channel	Digital Output	Device
	12	18	Vacuum
	11	17	Vent BC
	10	10	Cascade
	9	9	Low Artificial Load
	8	8	Full Cool
	7	7	PID Cool
	6	6	High Compressor
	5	5	Low Compressor
	4	4	Boost Heat
	3	3	PID Heat
	2	2	High Artificial Load
	1	1	Fan
SSR Outputs			
TE1151-5	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/Pressure Main Screen

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.

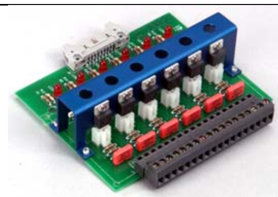
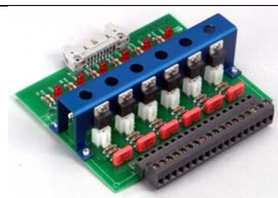
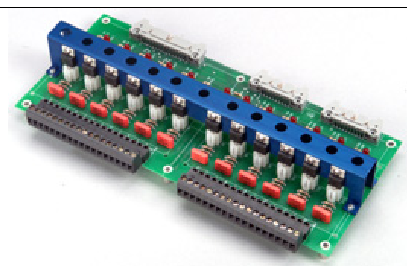
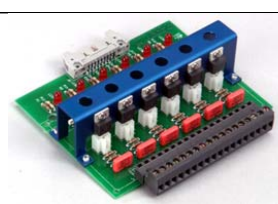
Alarms

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
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

See Section 15.0 Space and Altitude Chambers for additional setup information.

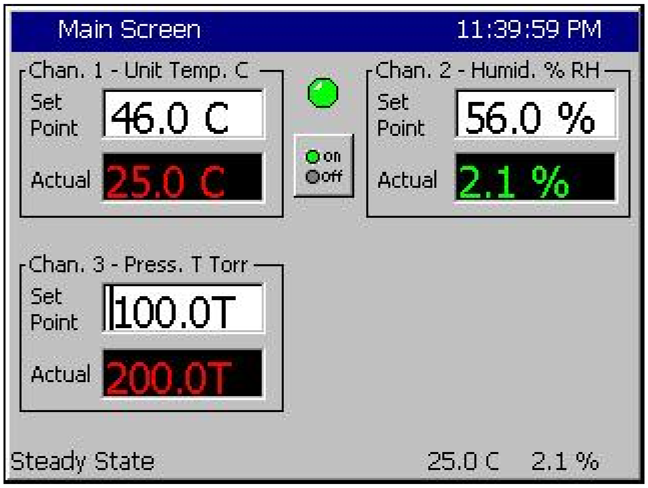
This Generic Temperature/Pressure configuration supports VersaTenn Altitude Chamber retrofits.

6.11.6 Generic Temperature/Humidity/Pressure, Altitude

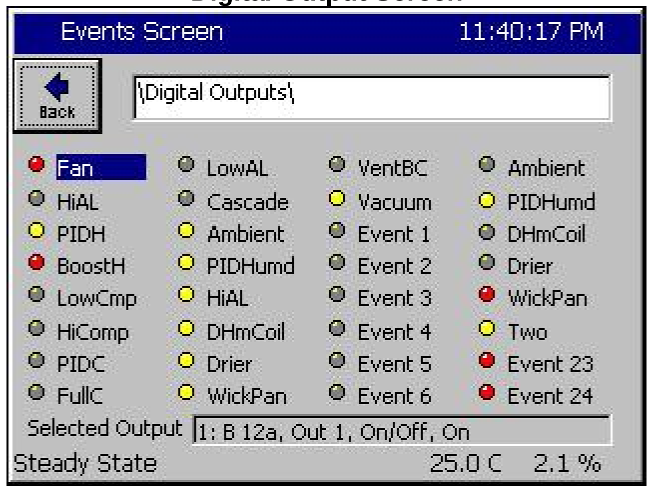
Generic Temperature/Humidity/Pressure ,Altitude			
2SM Outputs			
TE1151-6	SM Channel	Digital Output	Device
	6	16	Wickpan
	5	15	Drier
	4	14	Hi Al
	3	13	Dehumidify Coil
	2	12	PID Humidity
	1	11	Ambient
3SM Event Outputs			
TE1151-6	SM Channel	Digital Output	Device
	6	24	Event 6
	5	23	Event 5
	4	22	Event 4
	3	21	Event 3
	2	20	Event 2
	1	19	Event 1
1SM Outputs			
TE1151-12	SM Channel	Digital Output	Device
	12	18	Vacuum
	11	17	Vent BC
	10	10	Cascade
	9	9	Low Artificial Load
	8	8	Full Cool
	7	7	PID Cool
	6	6	High Compressor
	5	5	Low Compressor
	4	4	Boost Heat
	3	3	PID Heat
	2	2	High Artificial Load
	1	1	Fan
SSR Outputs			
TE1151-5	SM Channel	Digital Output	Device
	6	30	Two
	5	29	Wick Pan
	4	28	Drier
	3	27	Dehumidify Coil
	2	26	PID Humidity
	1	25	Ambient

Generic Temperature/Humidity/Pressure Main Screen

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.

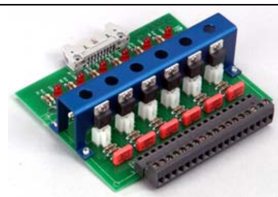
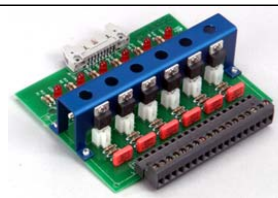
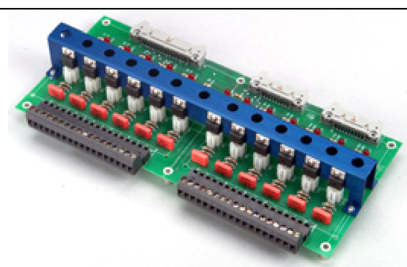
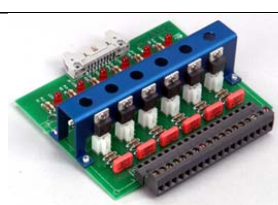
Alarms

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
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

See Section 15.0 Space and Altitude Chambers for additional setup information.

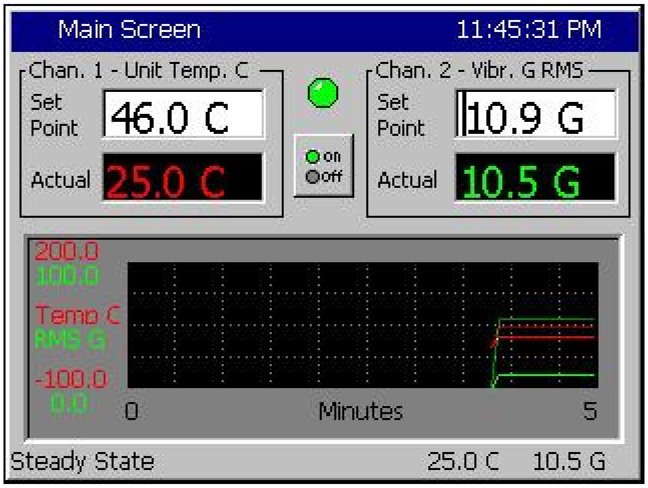
This Generic Temp/Humidity/Pressure configuration supports VersaTenn Altitude Chamber retrofits.

6.11.7 Generic Temperature/Vibration

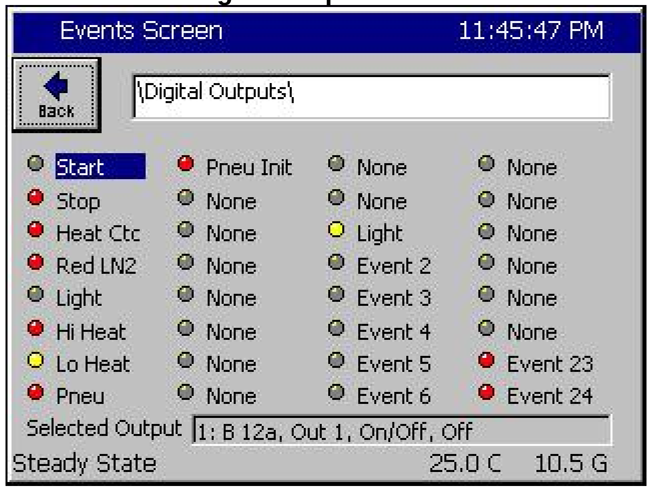
Generic Temperature/Vibration (HALT/HASS)			
2SM Outputs			
TE1151-6	SM Channel	Digital Output	Device
	6	30	Not Used
	5	29	Not Used
	4	28	Not Used
	3	27	Not Used
	2	26	Not Used
	1	25	Not Used
3SM Event Outputs			
TE1151-6	SM Channel	Digital Output	Device
	6	24	Event 6
	5	23	Event 5
	4	22	Event 4
	3	21	Event 3
	2	20	Event 2
	1	19	Event 1
1SM Outputs			
TE1151-12	SM Channel	Digital Output	Device
	12	18	Not Used
	11	17	Not Used
	10	10	Not Used
	9	9	Pneumatic Initiate
	8	8	Pneumatic Enable
	7	7	Lo Heat
	6	6	High Heat
	5	5	Light
	4	4	Redundant LN2
	3	3	Heat Contactor
	2	2	Stop
	1	1	Start
SSR Outputs			
TE1151-5	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/Vibration Main Screen

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

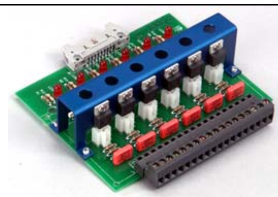
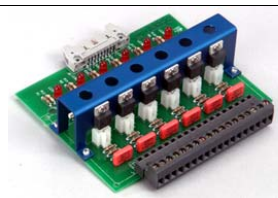
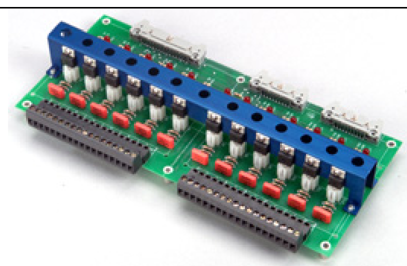
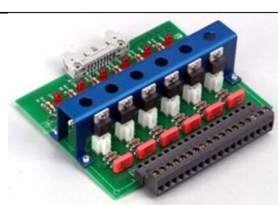
Name	Input	Function when Closed
TempGard	Input 9	None, TempGard Alarm displays in Alarm Folder and Log File.

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

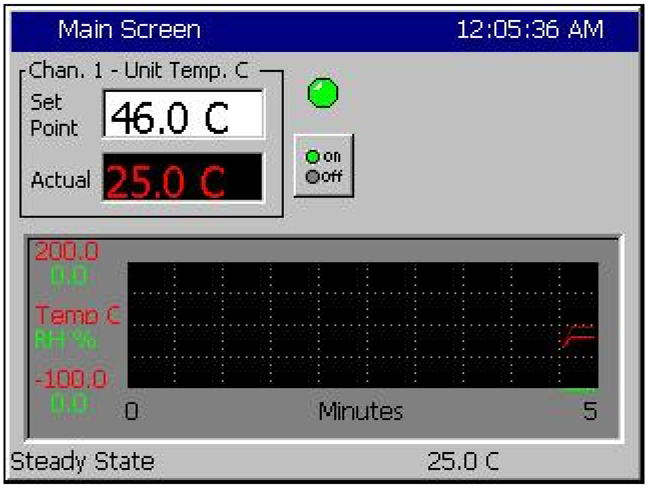
This Generic Temperature/Vibration configuration supports QualMark HALT/HASS Chamber retrofits.

6.11.8 Retro Temp Only

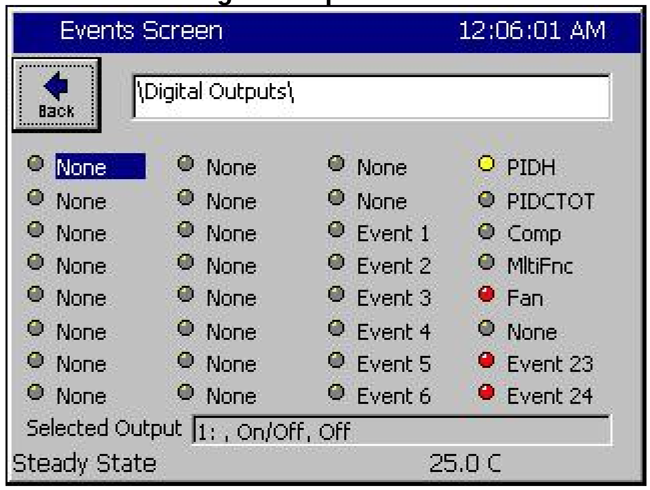
Retro Temp Only			
2SM Outputs			
TE1151-6	SM Channel	Digital Output	Device
	6	6	Not Used
	5	5	Not Used
	4	4	Not Used
	3	3	Not Used
	2	2	Not Used
	1	1	Not Used
3SM Event Outputs			
TE1151-6	SM Channel	Digital Output	Device
	6	24	Event 6
	5	23	Event 5
	4	22	Event 4
	3	21	Event 3
	2	20	Event 2
	1	19	Event 1
1SM Outputs			
TE1151-12	SM Channel	Digital Output	Device
	12	18	Not Used
	11	17	Not Used
	10	10	Not Used
	9	9	Not Used
	8	8	Not Used
	7	7	Not Used
	6	6	Not Used
	5	5	Not Used
	4	4	Not Used
	3	3	Not Used
	2	2	Not Used
	1	1	Not Used
SSR Outputs			
TE1151-5	SM Channel	Digital Output	Device
	6	30	Not Used
	5	29	Fan
	4	28	Multifunction
	3	27	Compressor
	2	26	PID Cool
	1	25	PID Heat

Retro Temp Only Main Screen

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.

6.12 Logging

The Synergy Nano'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 or history can be exported to removable memory for use as test documentation.

LOGGING \ SETUP DIRECTORY
SUB-FOLDERS

❑ **Setup**	❑ **Data**
(Screen Editor)	(Sub-folders)
♦ Enable / Disable Logging ♦ Logging Interval (sec): Keypad Editor ♦ Log File Size (MB): Keypad Editor	❑ Channel Readings ❑ Channel Setpoints ❑ Channel PIDs ❑ Machine Values ❑ UUT Values

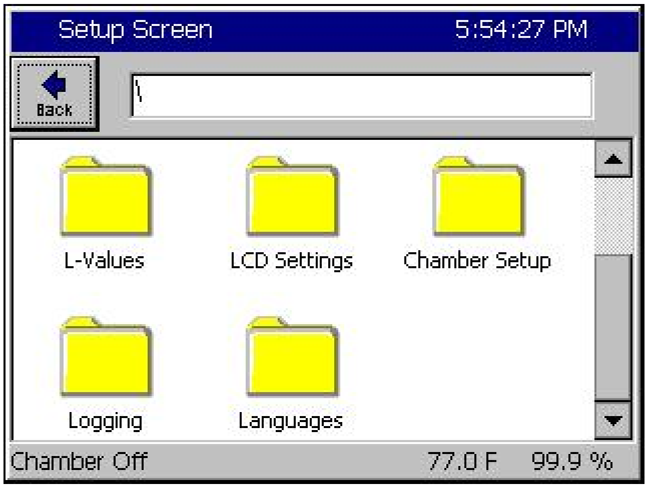
Sub-folders & Screen Editors

	❑ **Channel Readings**
	(Screen Editor)
	♦ CH n Actual: Enable / Disable
	❑ **Channel Setpoints**
	(Screen Editor)
	♦ CH n Setpoint: Enable / Disable
	❑ **Cascade**
	(Screen Editor)
	♦ CH n Actual: Enable / Disable ♦ CH n Setpoint: Enable / Disable ♦ Cascade PID CHn: Enable / Disable
	❑ **Channel PIDs**
	(Sub-folders)
	❑ PID CH n: Heat / Cool: Enable / Disable
	❑ **Machine Values**
	(Screen Editor)
	♦ Sensor 1 thru 8: Enable / Disable
	❑ **UUT Values**
	(Screen Editor)
	♦ UUT 1 thru 8: Enable / Disable

6.12.1 Logging Setup

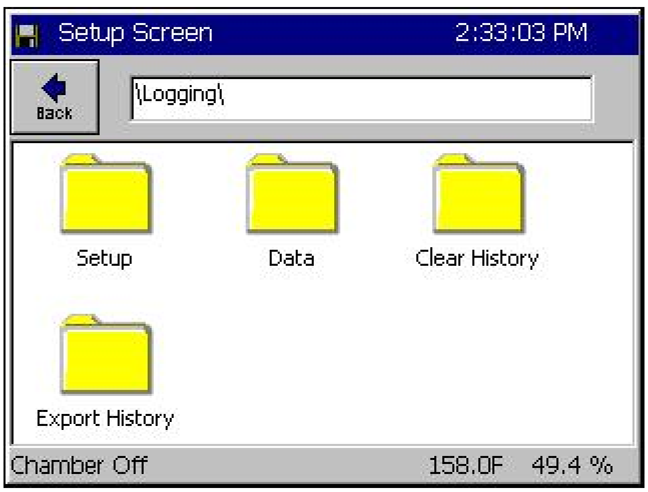
This section describes the Log system setup options and steps.

Note: Before starting a test that requires logging you may 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.

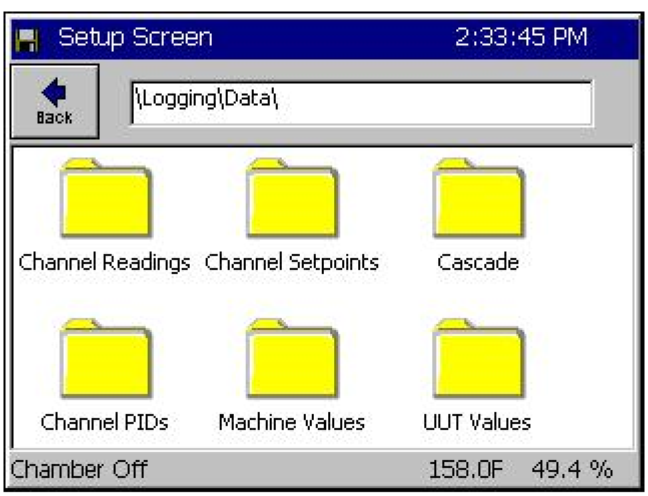


Step #1:

From the main setup directory, select the Logging folder.



Select the Data folder.

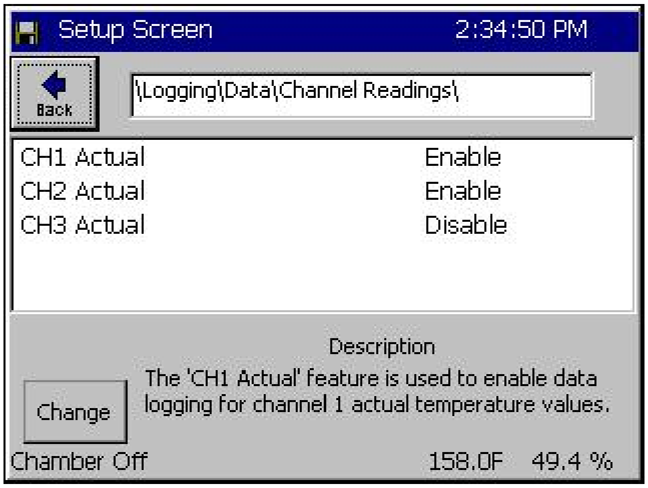


The screen at the left appears. The following data is available for logging.

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

Example Log Printout:

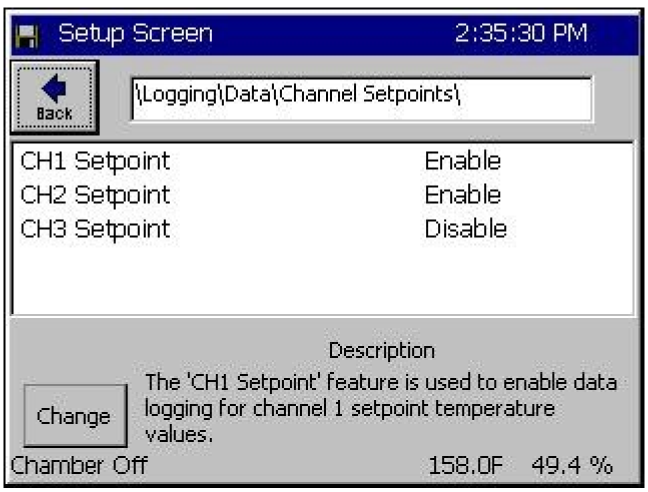
```
Date and Time,       CH1Actual, CH2Actual, CH1Setpoint, CH2Setpoint
02/23/2001 11:33:56, 24.9,      48.0,      25.0         50.0
02/23/2001 11:34:56, 24.9,      50.0,      25.0         50.0
02/23/2001 11:35:56, 25.0,      51.8,      25.0         50.0
```



<u>Step #2:</u> <u>Select the Channel Readings Folder</u>

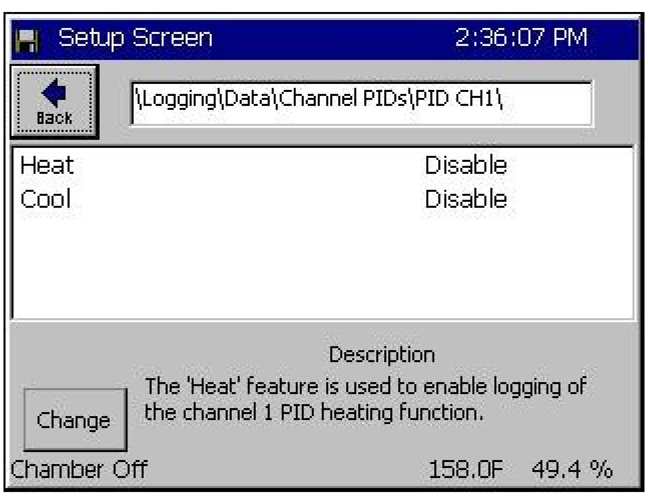
Use this screen to select the process values for each selected channel for logging. Select the channel, press the ***Change*** button, and select Enable in the screen that follows.

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



<u>Step #3:</u> <u>Select the Channel Setpoints Folder</u>

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

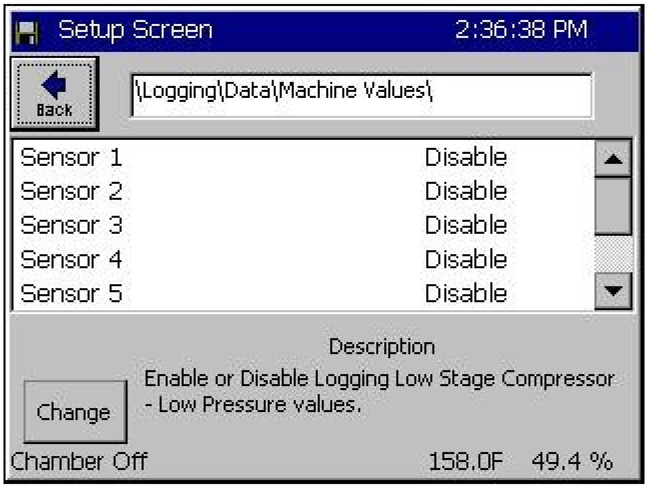


<u>Step #4:</u> <u>Select the Channel PIDs Folder</u>

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.



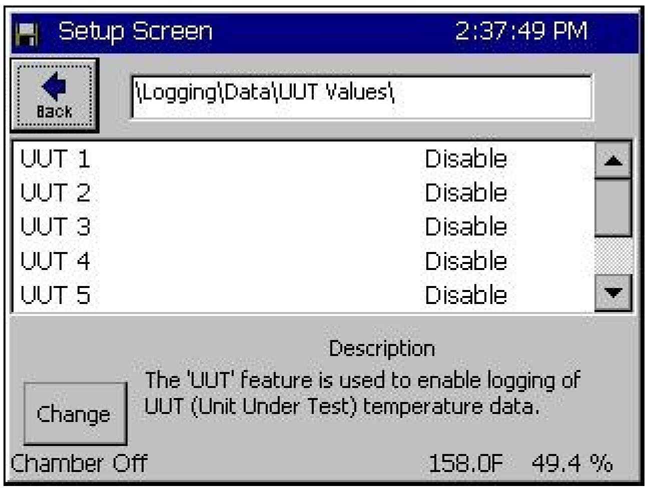
Step #5: Select the Machine Values Folder

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 Machine Inputs screen of the Maintenance directory.

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.



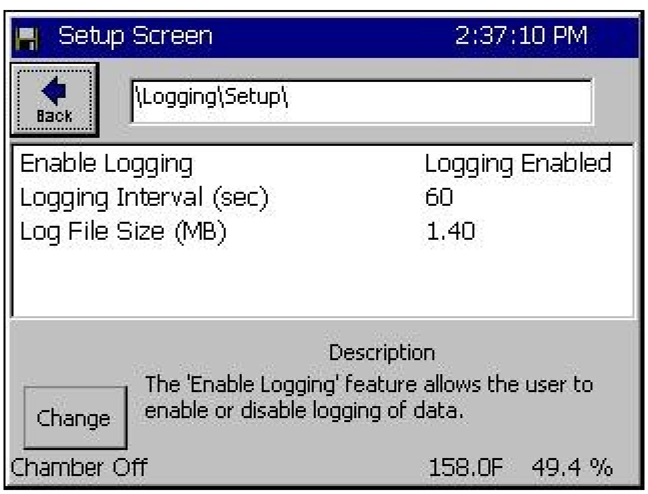
Step #6: Select the UUT Values Folder

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.

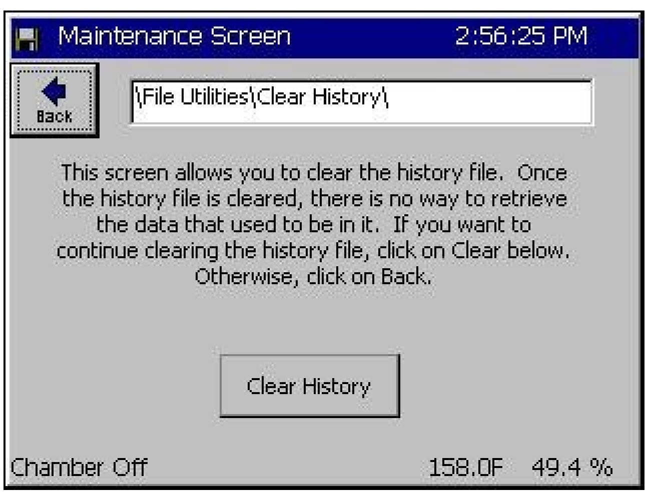
Export History for Logging Operation

To Export History, navigate to the *Logging\Export History* folder and press the ***Browse*** button to select the USB Hard Disk. Then press the ***Export*** button to export the current history file out to the removable storage device.

Export History Window

The export process is monitored in the Export History Status window. First the Synergy Nano 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 Nano 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.

Once inserted, the new disk is automatically detected.

After detection, the Synergy Nano continues exporting the remainder of the history file.

You will need to repeat the process with additional disks if the history file requires it.

The Synergy Nano will indicate when the export history file is complete. Press the ***OK*** button to acknowledge completion of the transfer to return to the Export History window.

Synergy Nano Data Logging Capacity Calculations

As described above, the Synergy Nano 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 and used in a test report or for system troubleshooting as explained in the previous section. Calculations below estimate the Synergy Nano'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.

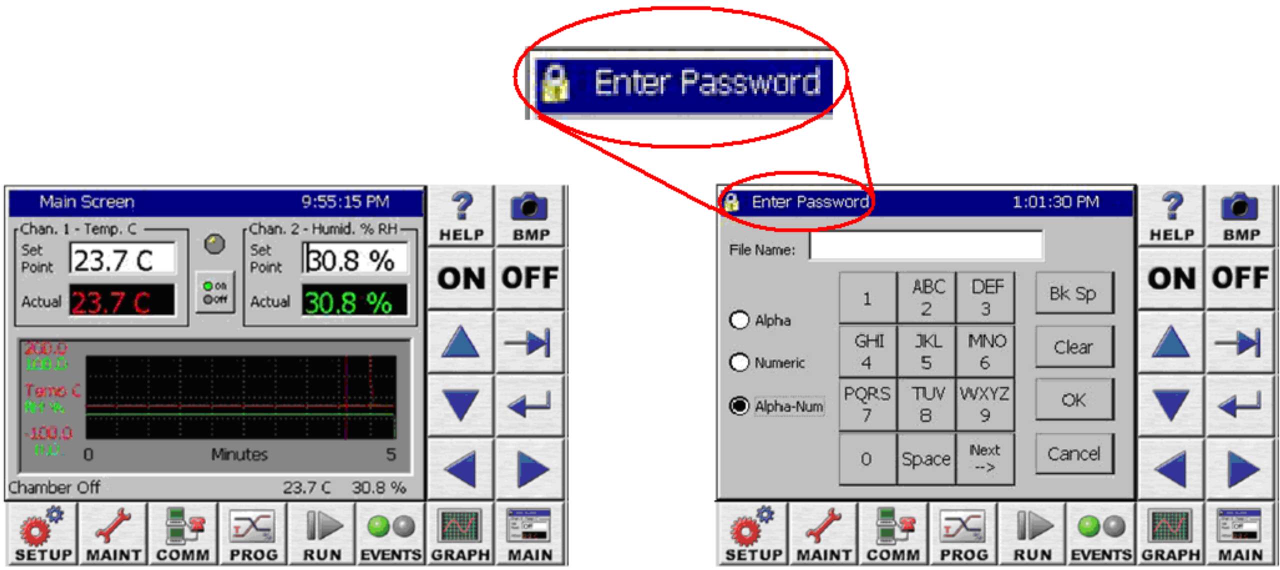
Hours = Samples/Sample Rate
Hours = 63,550/60
Hours = 1,059

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 Nano 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 50% 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.

6.13 Panel Lock



The Synergy Controller features enhanced security starting in software version 2.8.5. User access to specific controller areas can be restricted appropriately for each user function.

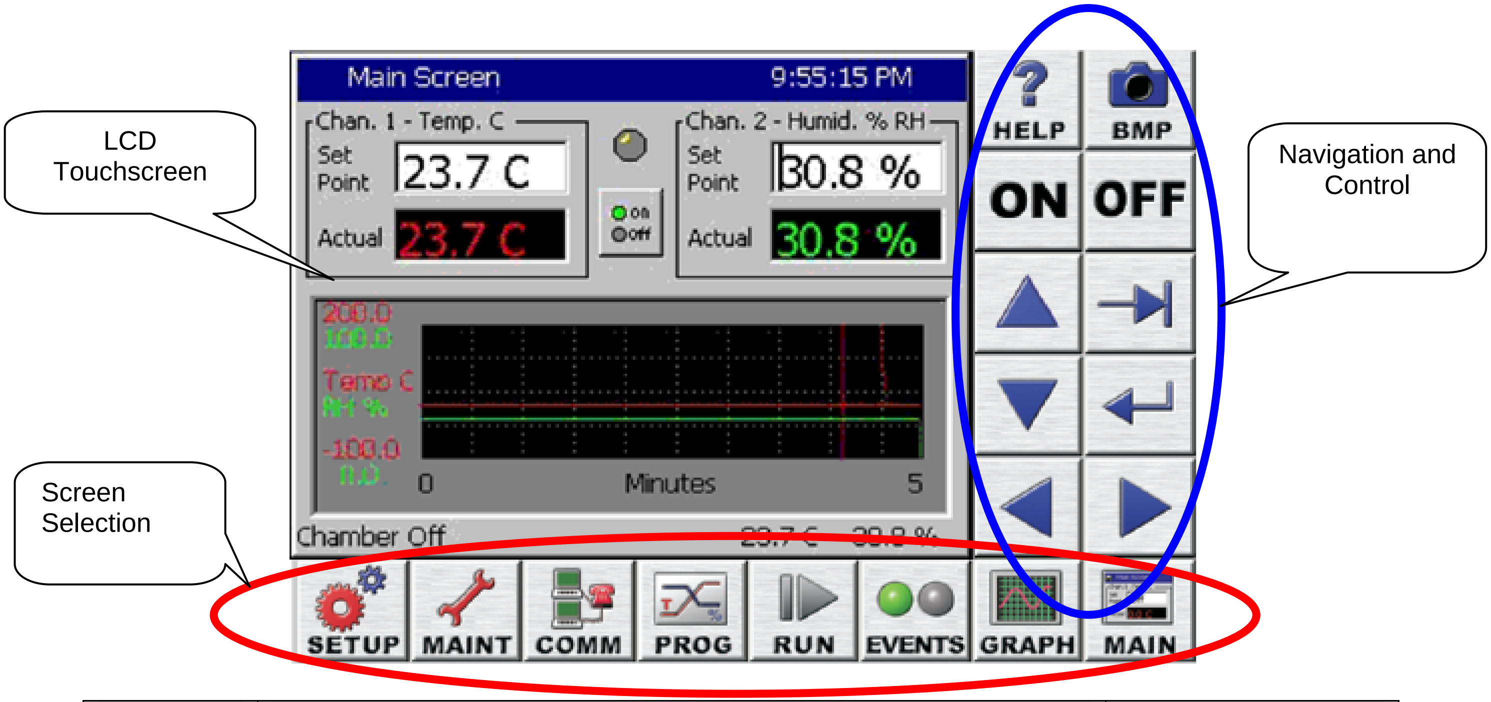
The enhanced Panel Lock feature provides 5 levels of access security:

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

Note that these enhanced security features may not be available on all controllers. Contact the factory to find out if your controller supports this feature. Controller upgrades are available.

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

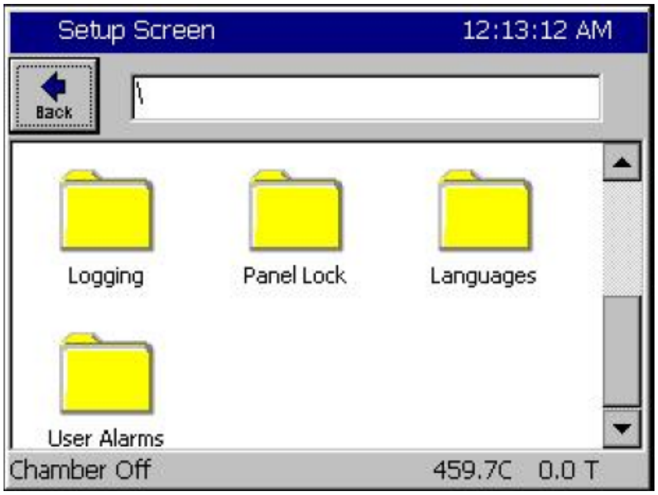
To setup the Panel Lock feature follow these steps:

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".

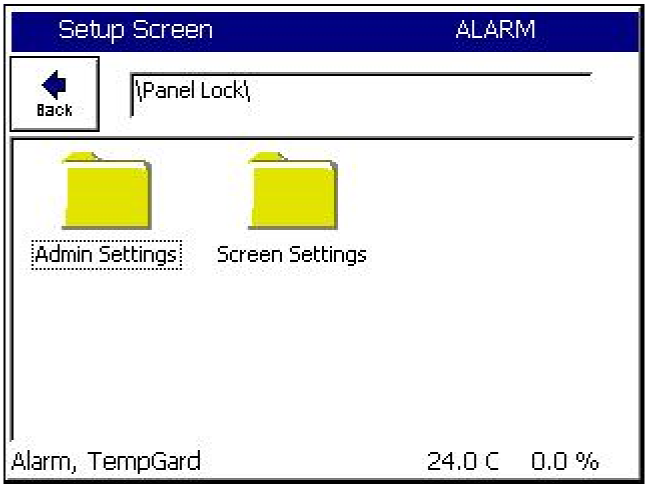
Once locked, access to your controller is now restricted.

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.

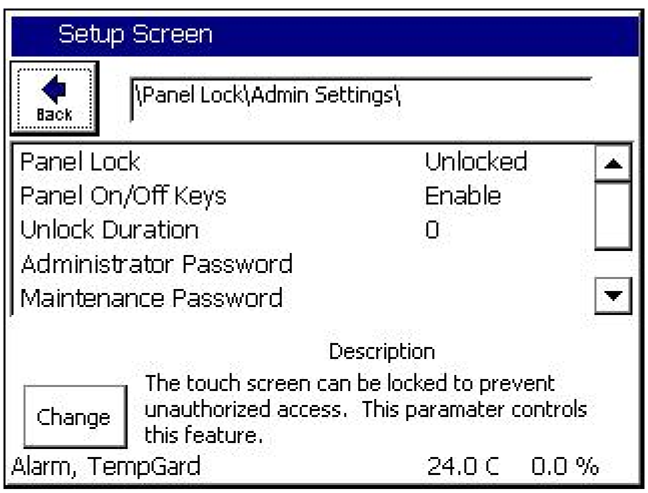


In the \Panel Lock\ folder there are two subfolders; Admin Settings and Screen Settings as shown below.

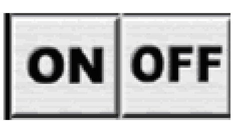


The \Panel Lock\Admin Settings\ folder is used to enable the Panel Lock feature and control Panel Lock options and passwords. The panel lock options control the function of Panel Lock in two ways:

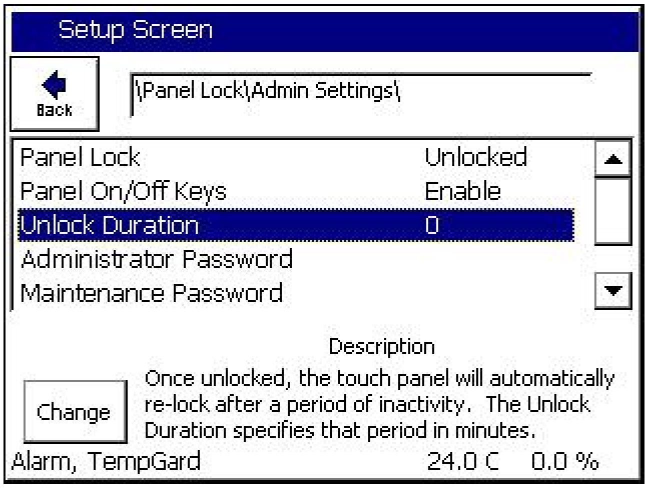
1. Panel On/Off Keys Enable/Disable.
2. Unlock Timer Duration



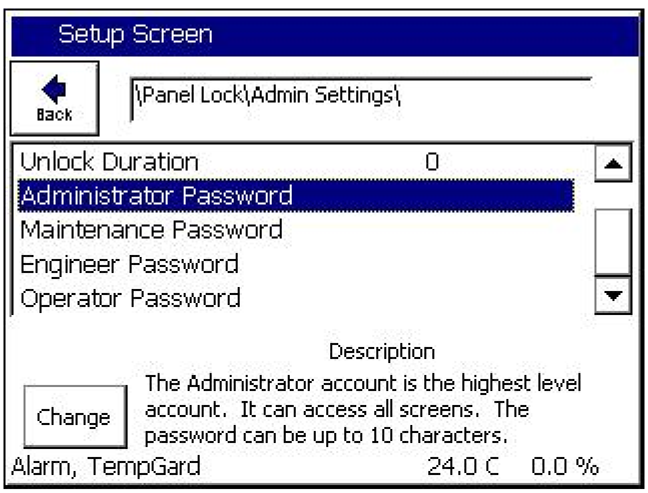
1. Panel On/Off Keys, when set to Enable, allow the use of the ON/OFF keys on the controller when the panel is locked. Enabled is the recommend setting for safety reasons.



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.

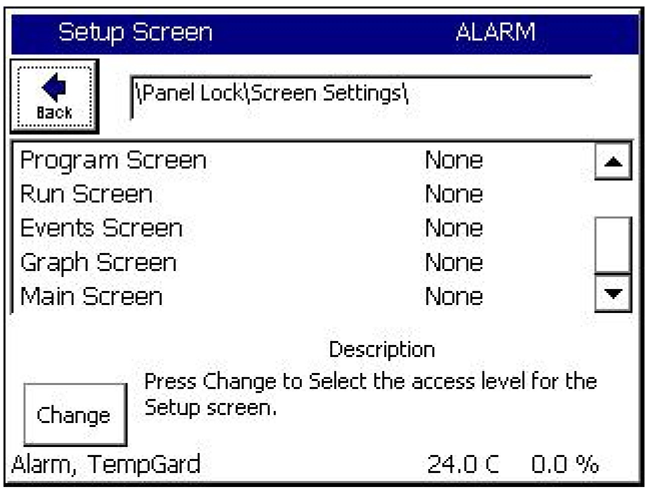


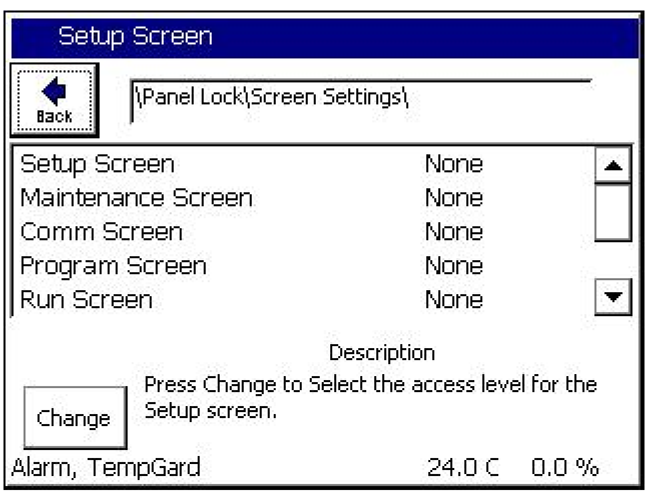
The \Panel Lock\Screen Settings\ folder is used to assign the user level for each screen. The suggested user levels are listed in the table below.

Default User Levels

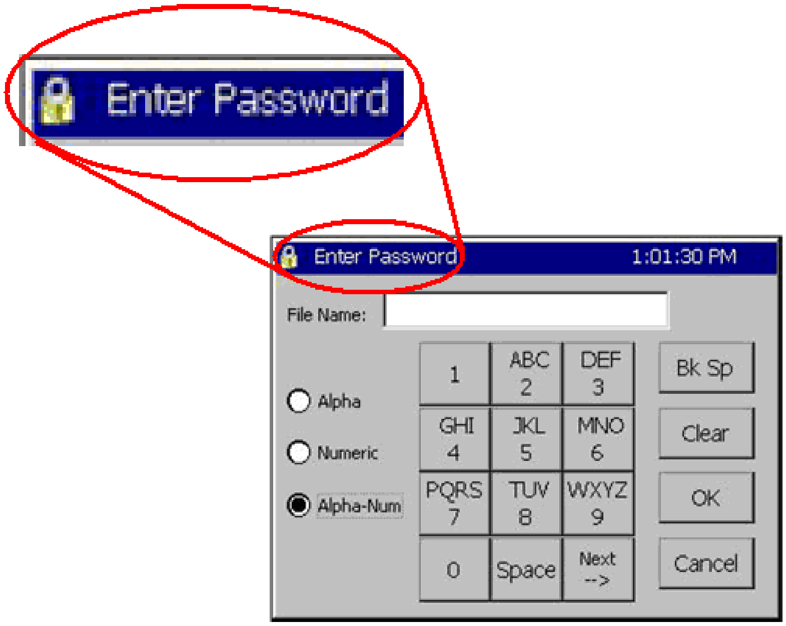
Screen	Default Access
SETUP	Administrator
MAINT	Maintainer
COMM	Engineer
PROG	Engineer
RUN	Operator
EVENTS	Operator
GRAPH	Unrestricted
MAIN	Operator

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.

Panel Lock remains locked after cycling power. Note that the Panel Lock feature only locks the panel. All TCP/IP, RS-232 and IEEE 488 communications are unaffected by Panel Lock.

6.14 Languages

LANGUAGES \ SETUP DIRECTORY SCREEN EDITOR	
Languages Screen	
(Screen Editor)	
♦ ENGLISH ♦ ESPANOL	

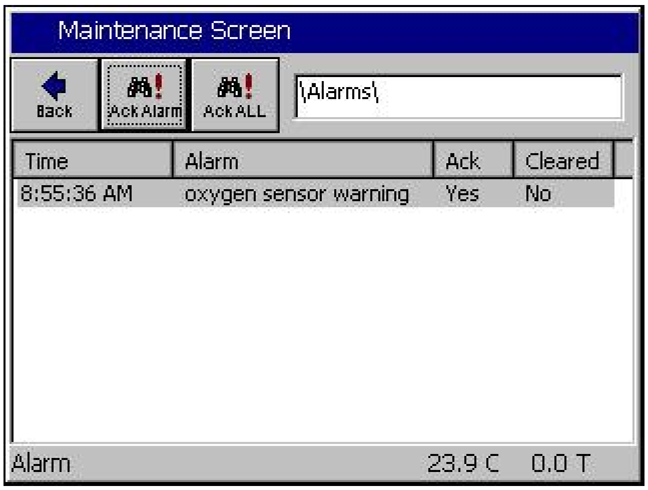
The Synergy Nano can be configurable to many language formats. Please contact Tidal Engineering for more information.

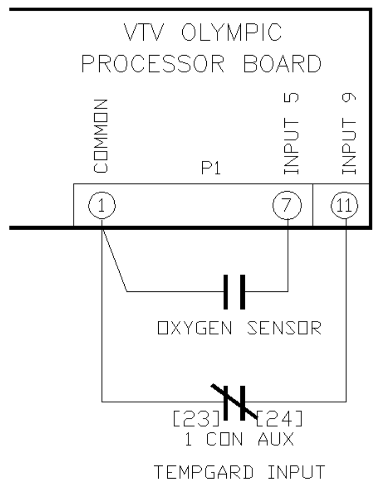
Note: The Espanol setting is for demo purposes only.

6.15 User Programmable Alarm System

The Synergy Nano'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:

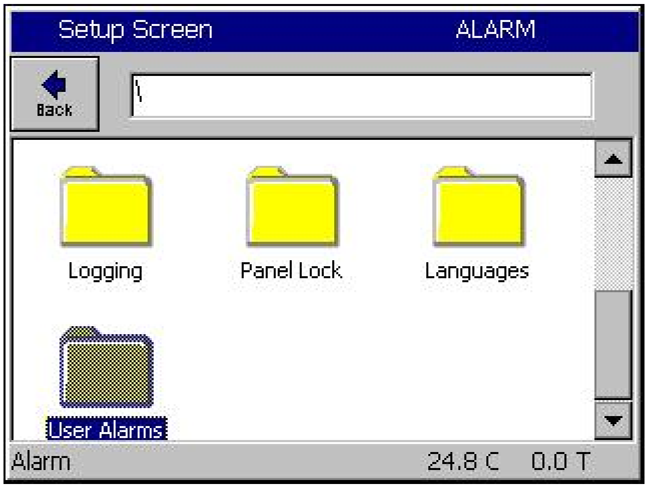
Module	First Selection	Second Sel.	Choices
Olympic Board	RTD1&2, Analog 1-4	N/A	6
UUT Module Inputs	UUT Module	Sensor	64
Machine Inputs	Low Resolution Channels 1 thru 8	N/A	8
Digital Inputs	Inputs 1 thru 16	N/A	16
Channels	Channels 1 thru 4	N/A	4
Setpoints	Setpoints 1 thru 4	N/A	4

There are four Comparison options available.

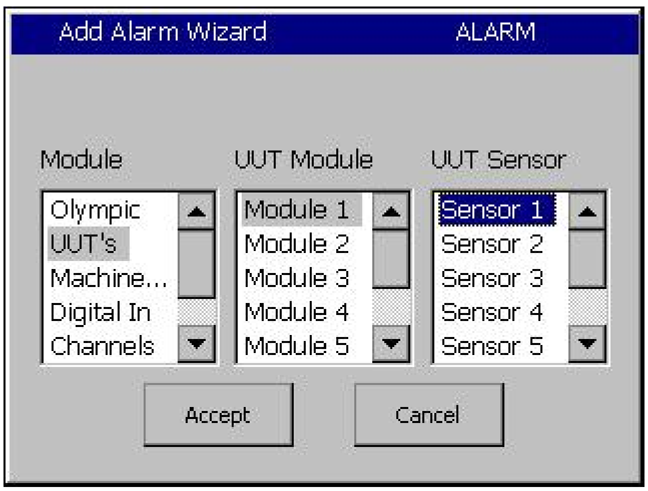
Comparison	Application
Input Open	Digital Inputs only
Input Closed	Digital Inputs only
Greater than Threshold	All inputs except Digital, Raw or Scaled.
Less than Threshold	All inputs except Digital, Raw or Scaled.

The User Alarm Wizard steps are as follows:

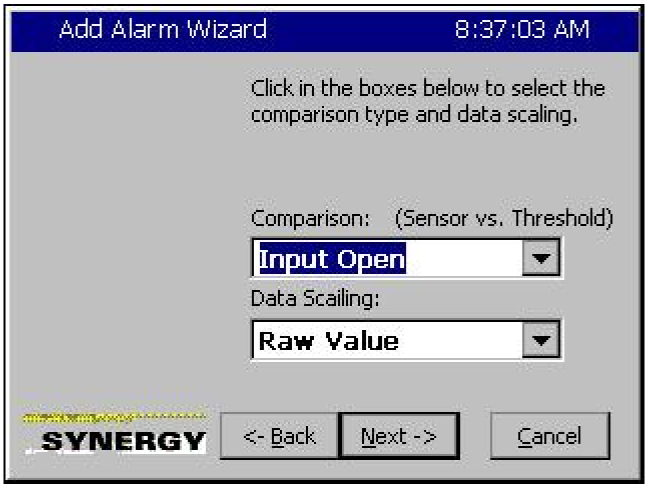
1. Open the Setup Screen and browse to the User Alarms folder.
2. Select the Sensor, Setpoint or Channel.
3. Define the comparison type and the scaling, i.e. Input Open, Closed, Greater than (>), etc.
4. Select the Alarm Threshold. (Not required for Digital Inputs).
5. Assign a name for the alarm. This 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.



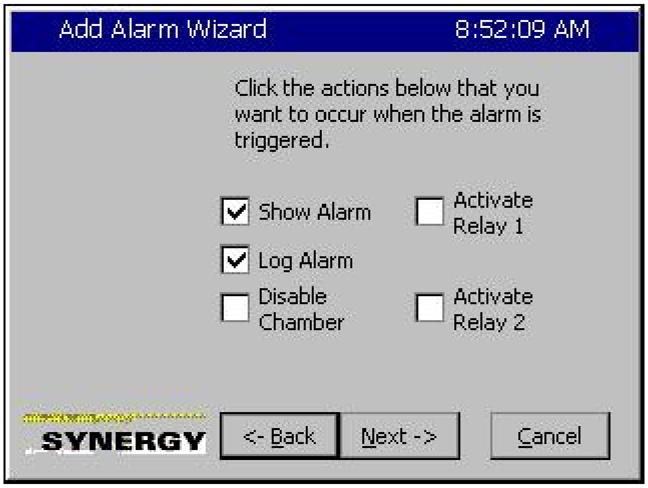
Define the comparison type and the scaling,

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.



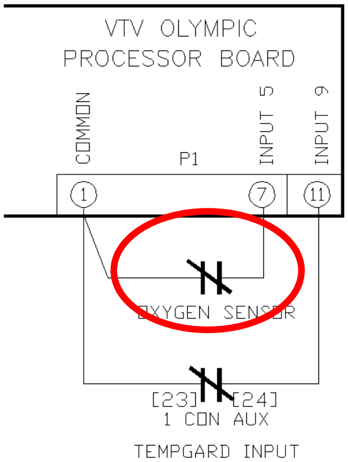
Select the desired alarm response.
The Options are :

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

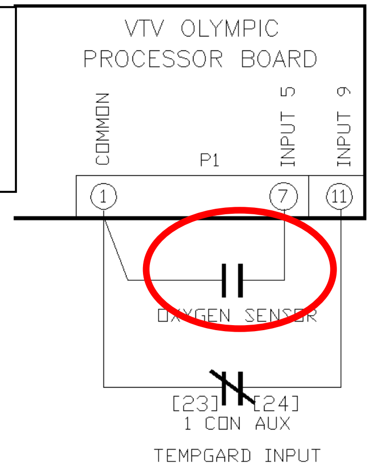
Confirm your choices and finish.

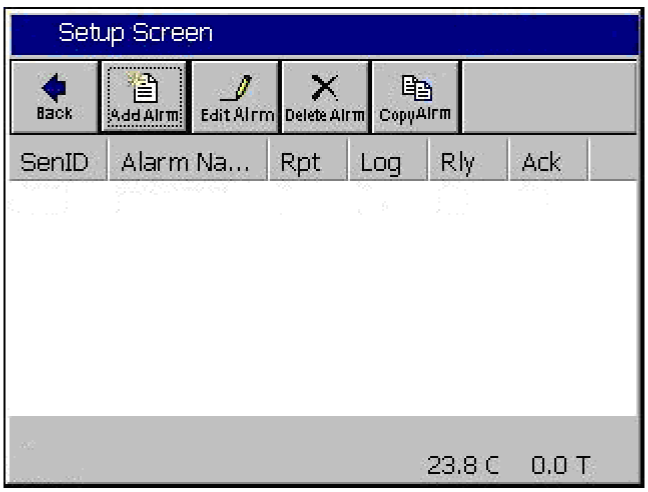
User Alarm Example 1:
Create an alarm that senses Digital Input 5 and Displays "Oxygen Sensor Warning" when the input is Open.

Oxygen Sensor Warning Normal State



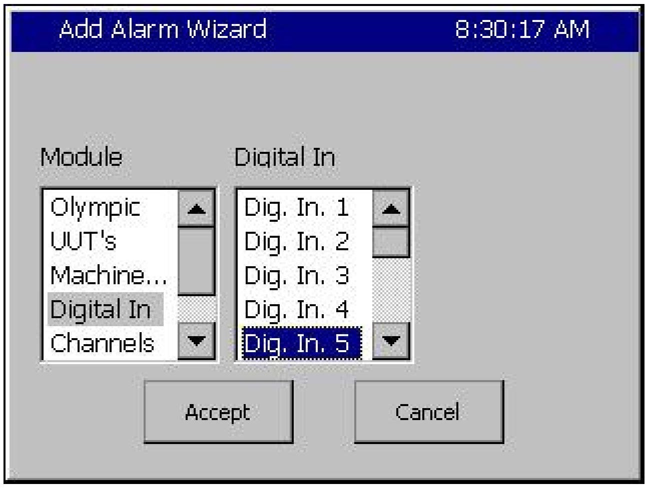
Oxygen Sensor Warning Alarm State



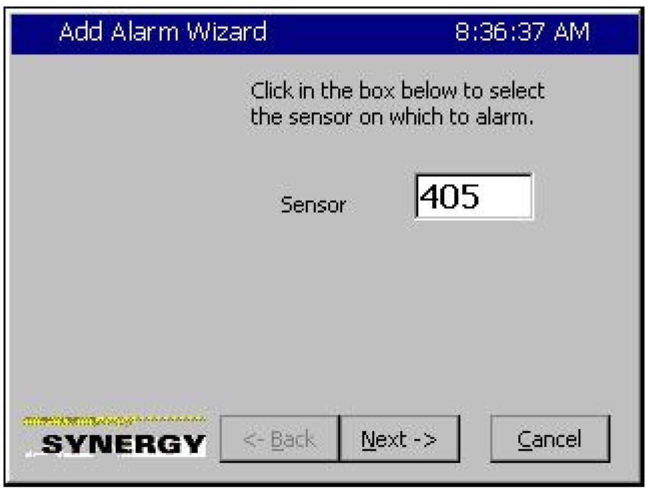


Open the User Alarm folder and press the Add Alarm button on the Setup screen shown at left.

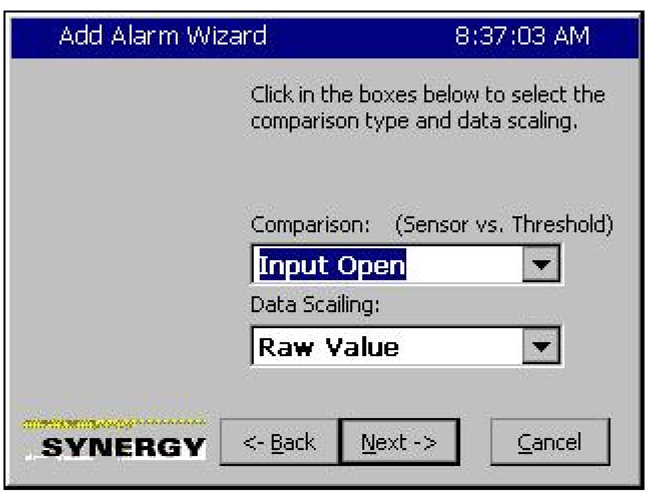
Press the Sensor text box as shown at left to start the Sensor Selection process.



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.



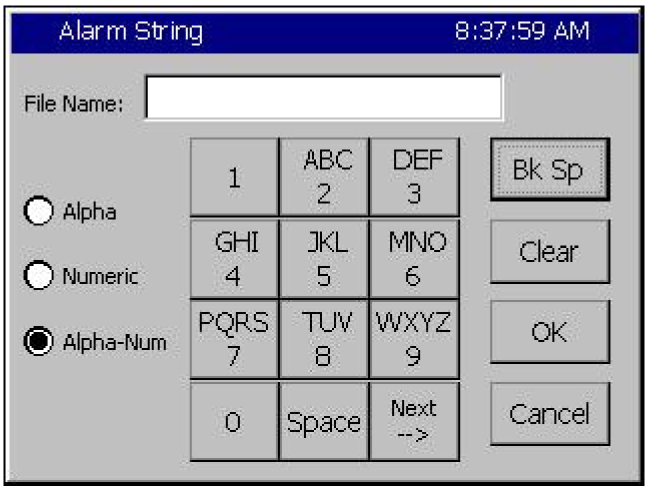
Select the Comparison from the drop down window. In this case Input Open.

Note: Data Scaling doesn't apply for digital inputs

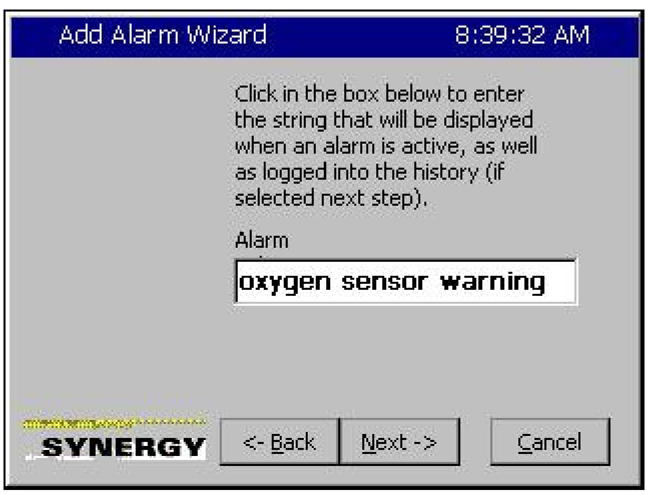
Then press Next ->.

Enter a name for this alarm.

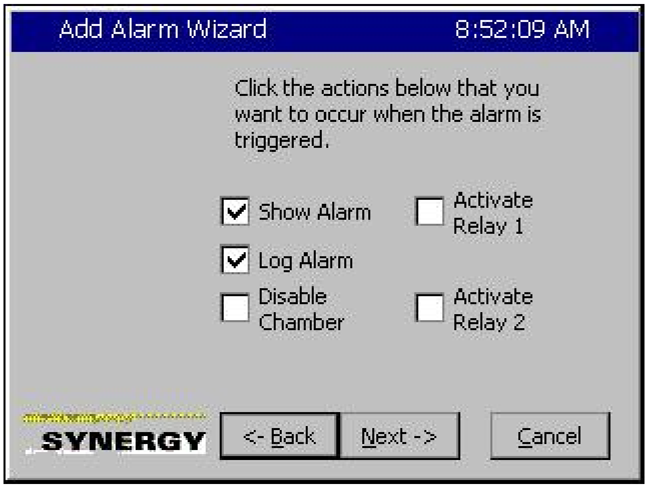
Press the text box to open the Alpha Numeric Keypad.



Enter the name for this alarm.



Then press Next ->.

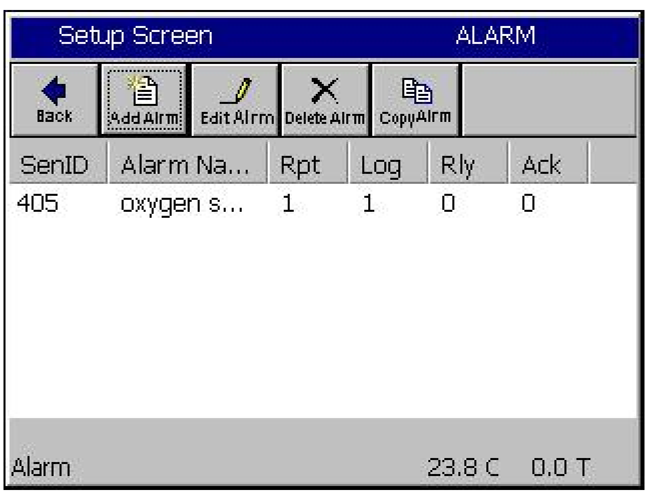


Select the Alarm Actions.

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

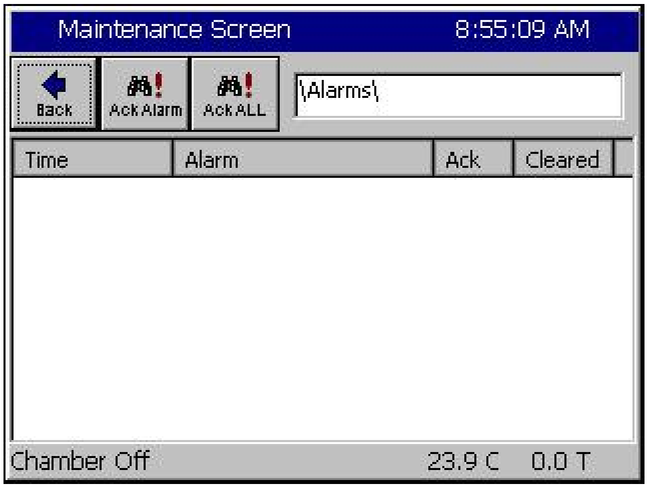
Then press Next ->.

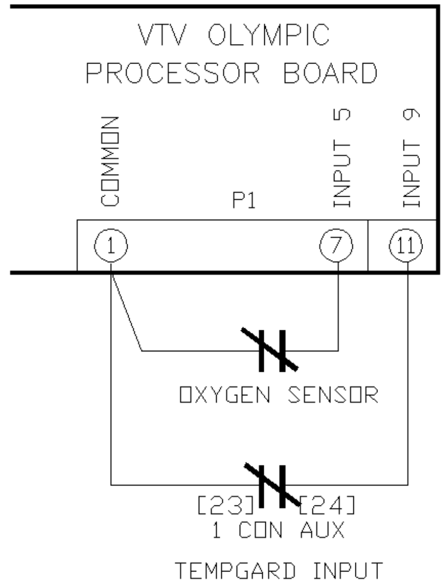
Confirm your choices and press Finish to complete the Alarm entry process.



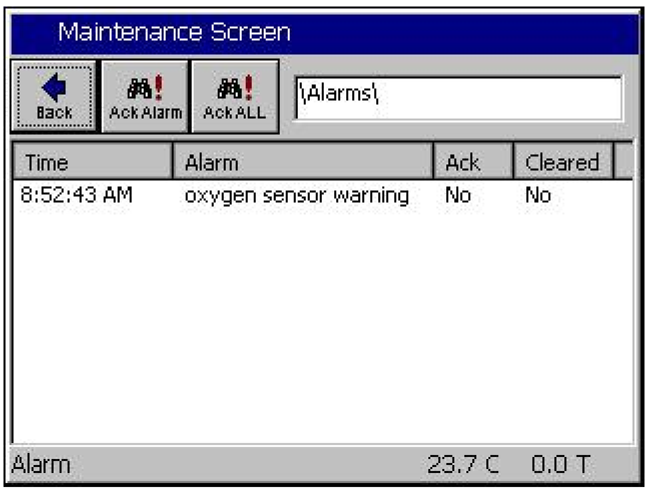
The User Alarm Setup screen shows the new entry.

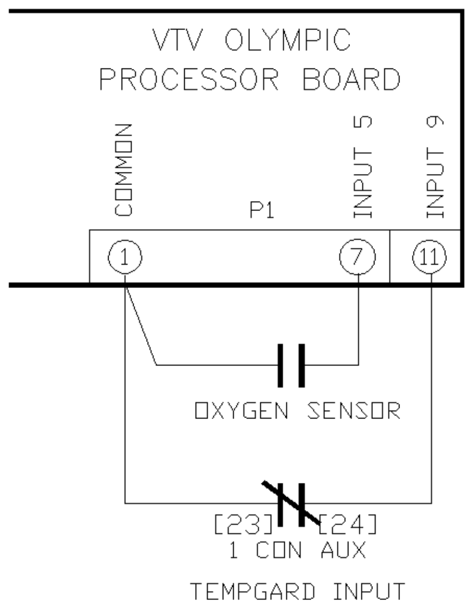
In operation, the Alarm Screen in the Maintenance folder indicates a normal state when the Input is closed as shown in the figures below:





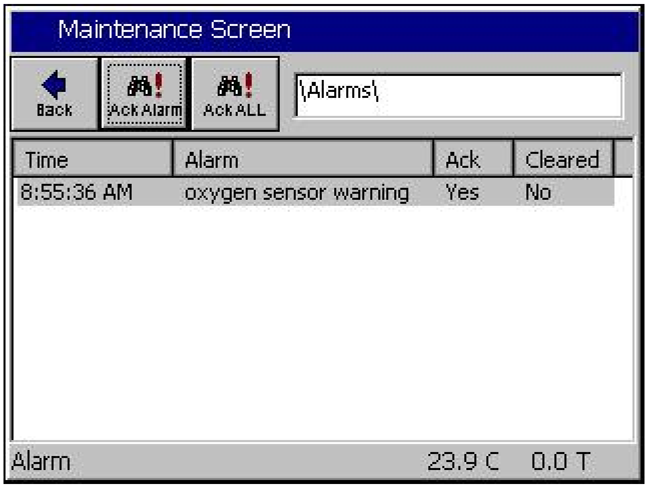
The Alarm Screen in the Maintenance folder Indicates the alarm condition when the Input is open as shown in the figure below:

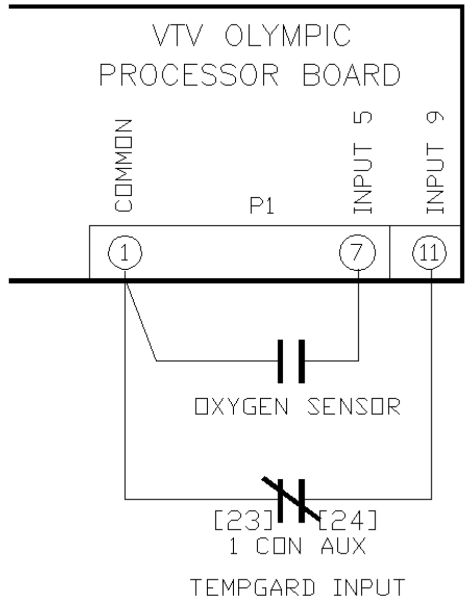




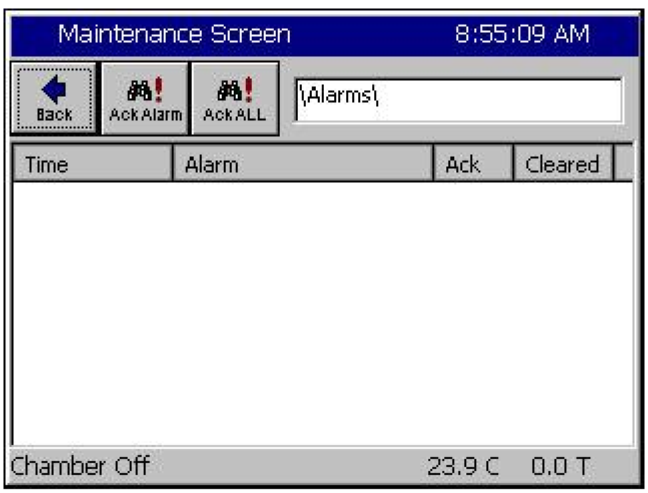
User alarms in the Maintenance/Alarm screen are cleared and acknowledged like built-in High and Low limit alarms. The alarm entry indicates ***Yes*** in the ***Ack*** column after an alarm is acknowledged. The alarm indicates ***Yes*** in the ***Cleared*** column after it has been cleared, i.e. the alarm 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.

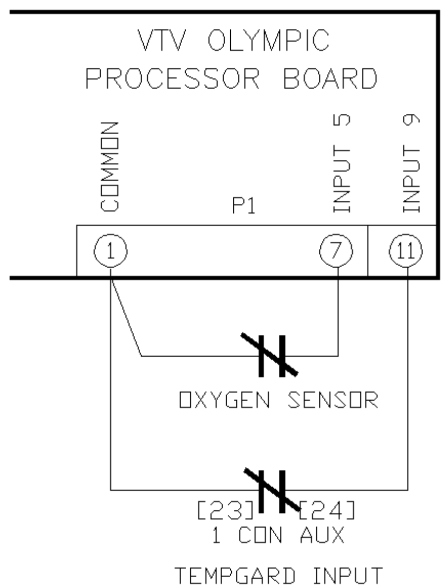
For example, in the screenshot below, the Alarm has been acknowledged but the alarm condition still exists.



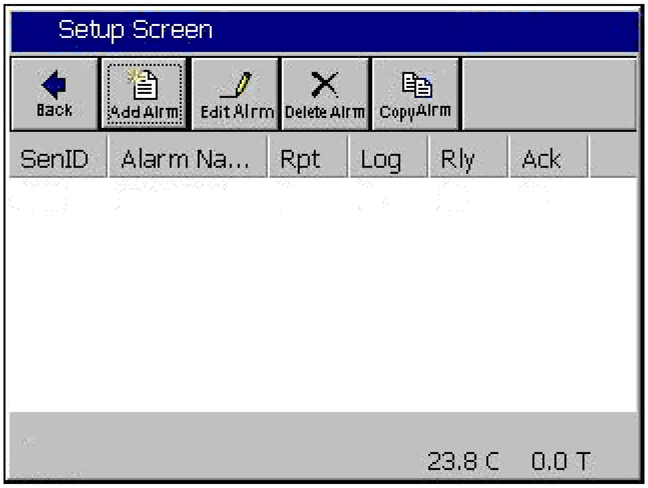


Once the Alarm has been acknowledged and the alarm condition has cleared the alarm entry is removed from the list as shown below.

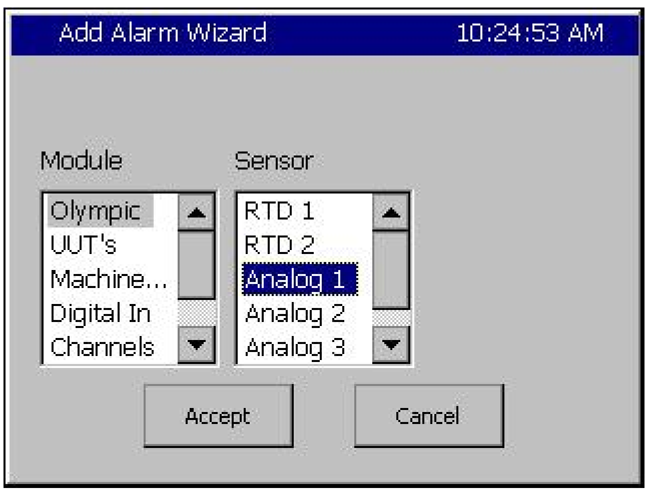




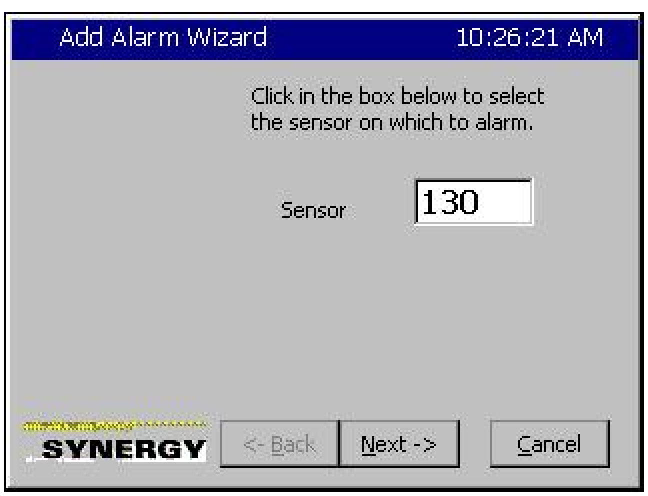
Example 2
At low atmospheric pressures, the heaters in most altitude chambers are turned off so they don't overheat when convection cooling capacity is reduced. In this example we will create an alarm that senses Hi Res Input 3 (Torr) and opens Relay 2 when the value is less than 30 Torr. This alarm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

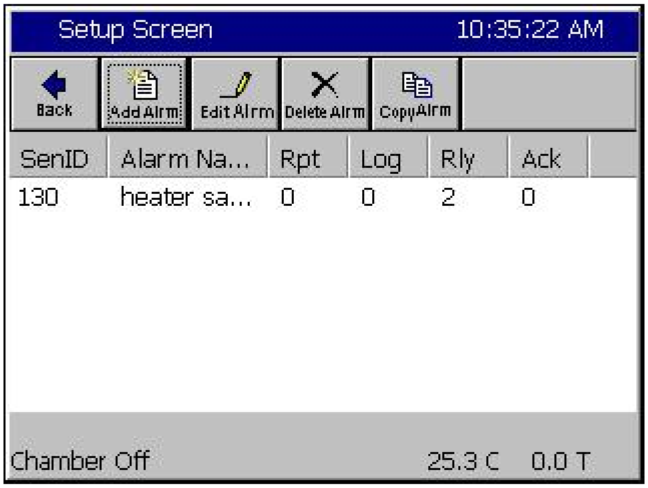
Then we press Next-> to continue.

Here we enter the Alarm response.

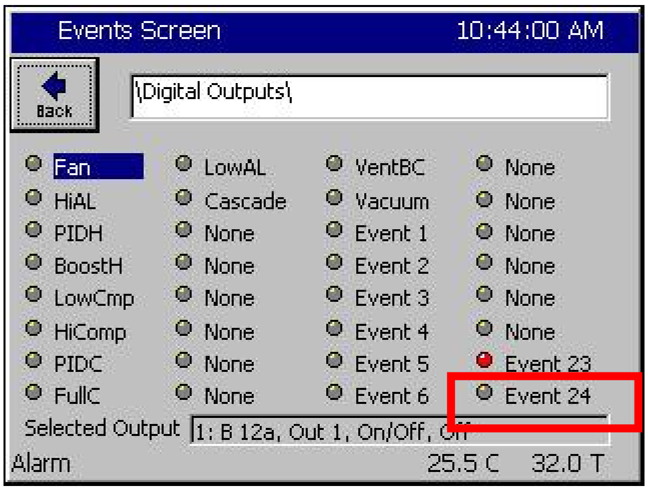
In this case we only want to Activate Relay 2.

Then we press Next-> to continue.

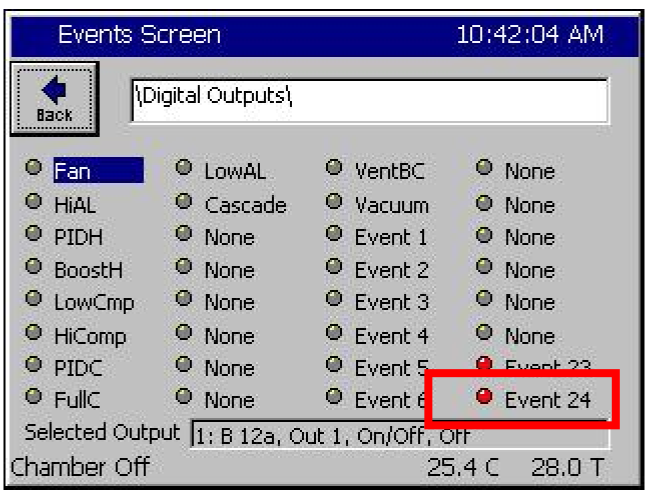
And finally, we confirm our settings and then press ***Finish***.



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.

7.0 MAINTENANCE DIRECTORY

Machine Inputs	Alarms	Channel PIDs	About	File Utilities	Date and Time

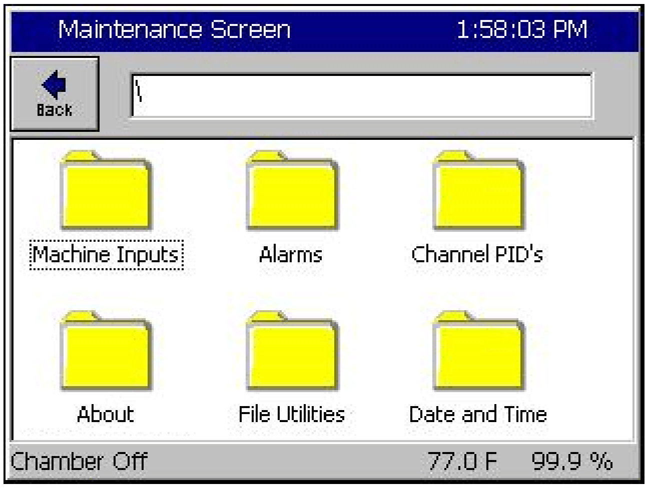
Sub-folders & Screen Editors

❑ Machine Inputs	❑ Alarms	❑ Channel PIDs
(Screen Editor)	(Screen Editor)	(Screen Editor)
PSI Values ♦ Low Stage Compressor - Low Press ♦ Low Stage Compressor - High Press ♦ High Stage Compressor - Low Press ♦ High Stage Compressor - High Press Note: Disregard “Temperature - Bad Sensor” if sensors aren’t connected	Clear Alarm Screen Lists the following: ♦ Time ♦ Alarm ♦ Ack ♦ Cleared Select an alarm and press the *Ack Alarm* button at top of the screen to acknowledge the alarm. The entry will be removed from the list when the alarm condition is eliminated.	Select Ch1, Ch2, or Ch3 to show the Heat / Cool and Humidify / Dehumidify PID Values. The values displayed are: ♦ Pn, In, Dn, PID, Err, Last Err, Delta Err, P.B., Reset, Rate The screen also shows Setpoint and Actual values for each channel selected.

❑ About	❑ File Utilities	❑ Date and Time
(Screen Editor)	(Sub-folders)	(Screen Editor)
♦ Software Revision Information Screen and unit Serial Number	❑ Copy Files ❑ Delete Files ❑ Rename Files ❑ Export History ❑ Clear History ❑ Export Screenshots ❑ Upgrade Software	♦ Select / view date and time
	❑ **Copy Files** Screen Editor: Enter or select Source File & Destination File	
	❑ **Delete Files** Screen Editor: Enter or select file to delete	
	❑ **Rename Files** Screen Editor: Enter or select Original & New File Name	
	❑ **Export History** Screen Editor: Export the current history file	
	❑ **Clear History** Screen Editor: Clear the current history file.	
	❑ **Export Screen Shots** Wizard used to export screenshots.	

7.1 Operator Interface

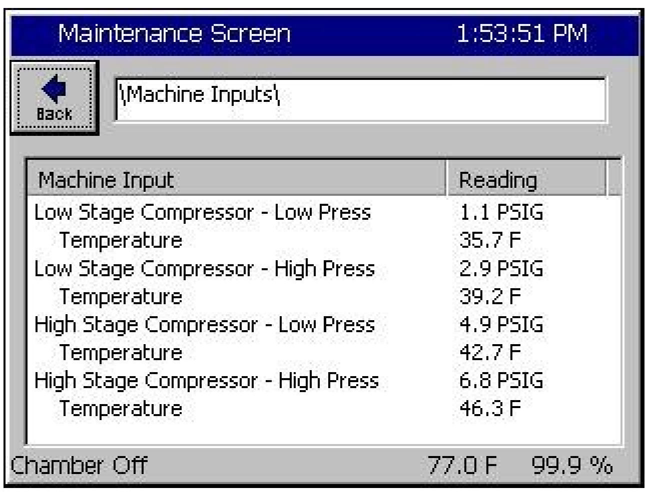
The Maintenance Directory provides a set of utilities that are used for the operation and maintenance of the chamber. Go to Section 7.2 Maintenance: Alarm Functions for specific information on Alarms.



Maintenance Directory

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

- **Machine Inputs** (Compressor Pressures)
- **Alarms** (Clearing an Alarm)
- **Channel PIDs** (PID variables in real-time)
- **About Synergy Nano**
- **File Utilities** (Copy Files, Export History)
- **Date and Time** (Adjust)



Machine Inputs #1 thru #8

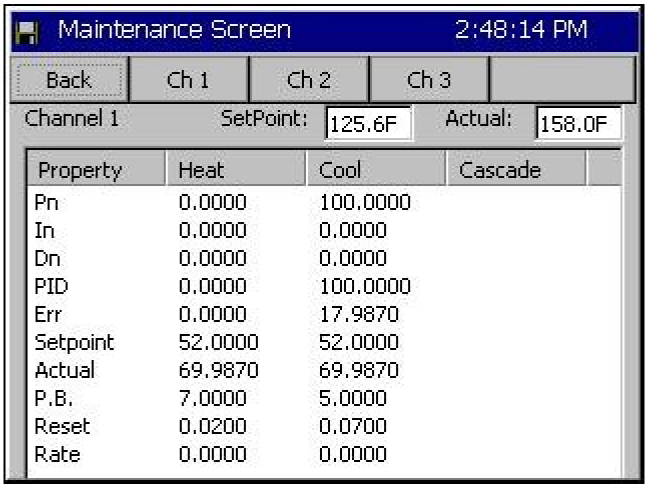
If your chamber is equipped to monitor machine inputs*, this screen displays the Low and High compressor's suction and discharge pressures in PSIG. See Low Res Inputs in the Calibration and Events screens.

* These temperature and pressure "Machine Inputs" transducers are optional. Disregard ***Bad Sensor Readings*** message when sensors are not connected.

To log the Machine Inputs, see Section 6.11 Setup: Logging.

Date and Time

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

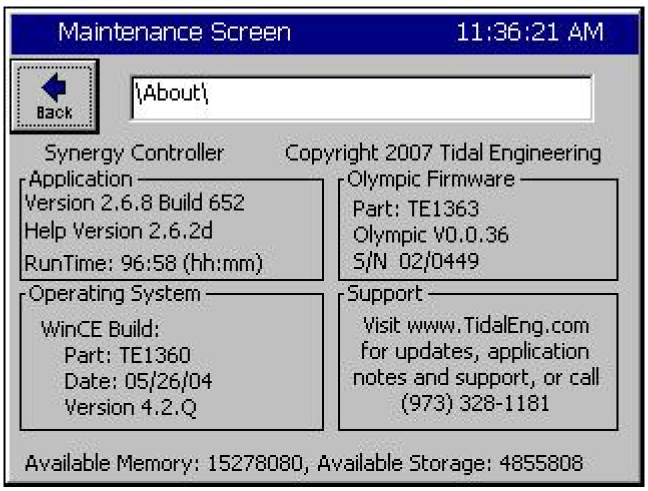


Channel PIDs

Select a channel with the buttons on the top row of this screen to view the following live PID data:

- Pn
- In
- Dn
- PID
- Err
- Last Err
- Delta Err
- P.B.
- Reset
- Rate

PID stands for Proportional Integral Derivative. The Maintenance PID screen can be used to monitor the PID algorithm for tuning and performance monitoring. To adjust the PID settings, see Section 6.3 Setup: PID Settings in this manual. In general, only a qualified technician should adjust PID settings. If you would like to know more about Synergy Nano PIDs we have included a brief discussion in Section 6.3 Setup: PID Settings.



About

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

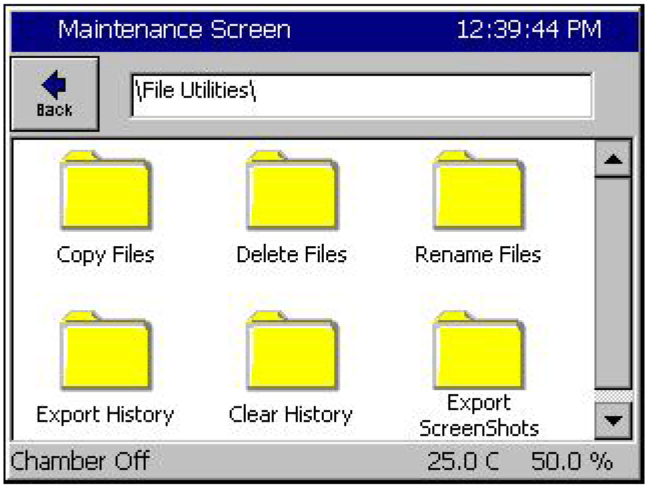
The Application frame displays the Synergy Nano software version. We recommend you periodically check with Tidal Engineering for software upgrade information. The Help Version refers to the context sensitive help available from the touch panel.

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

The Olympic Firmware frame identifies the serial number of your controller. The serial number is in the format "xx/YYWW"; for example 02/0105. Tidal Engineering's part number for the Olympic Board firmware is also displayed. The Olympic board is the Synergy Nano's Input/Output interface. It acquires analog and digital inputs and controls the outputs to the chamber machinery and is described in Section 17. The Serial Number on the Olympic Board is required for service related inquiries and for software registration keys to enable the Web Server and the Cascade Control features.

The support frame contains contact information. Tidal Engineering Corporation designs and manufactures the Synergy Nano. Contact Tidal Engineering for technical issues specifically related to the controller. Contact your chamber manufacturer for chamber issues.

Memory capacity and usage is shown at the bottom of the About Screen. If the available memory is too low the Synergy Nano will generate an alarm. Low memory issues are uncommon and can usually be resolved by rebooting the Synergy Nano. This setting is for system memory and does not represent Storage Card space available or used by logging. .

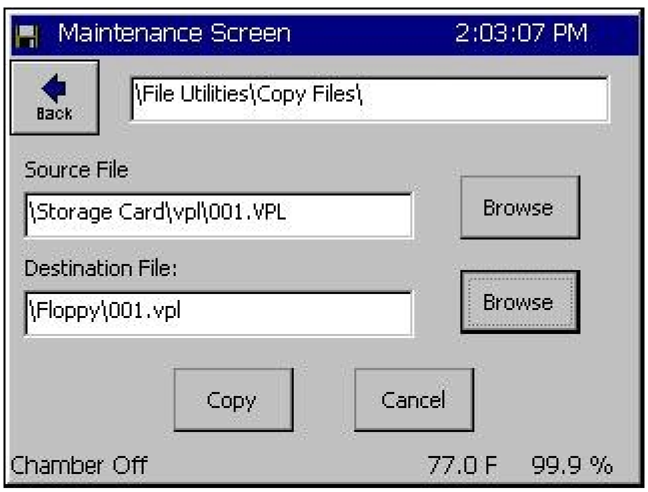


File Utilities

This directory is used to.

- Copy Files
- Delete Files
- Rename Files
- Export History
- Clear History
- Export Screen Shots

Note: Descriptions of each sub-folder under the File Utilities folder follow below.

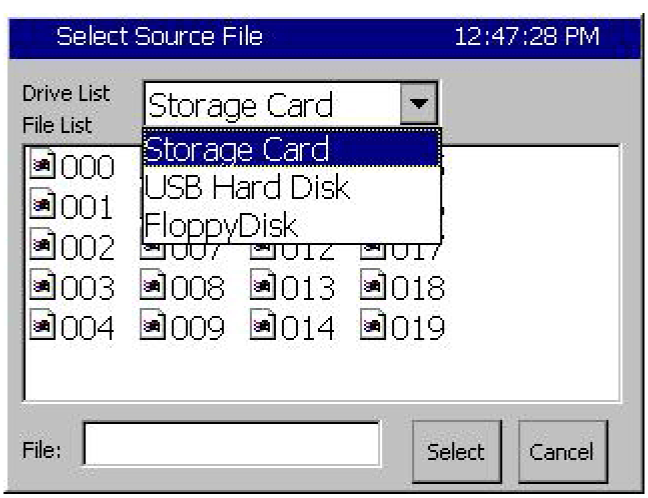


Copy Files

Enter the Source File and the Destination File and press the ***Copy*** button.

You can press the ***Browse*** button to view the list of drives available.

The Drive List screen is shown below.



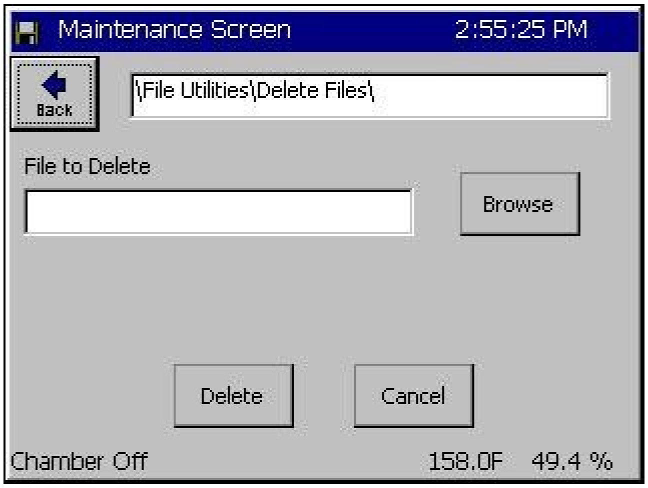
Select Source & Destination File

This Drive List appears when the ***Browse*** button is pressed. The Synergy Nano may take a few seconds to poll for available storage media before displaying this screen.

Storage Card: 8, 16, 32 or 256 MB flash.
USB Hard Disk: removable USB storage.

Select your source and destination drive. Press the ***Select*** button for each. The Copy Files screen shown above will reappear.

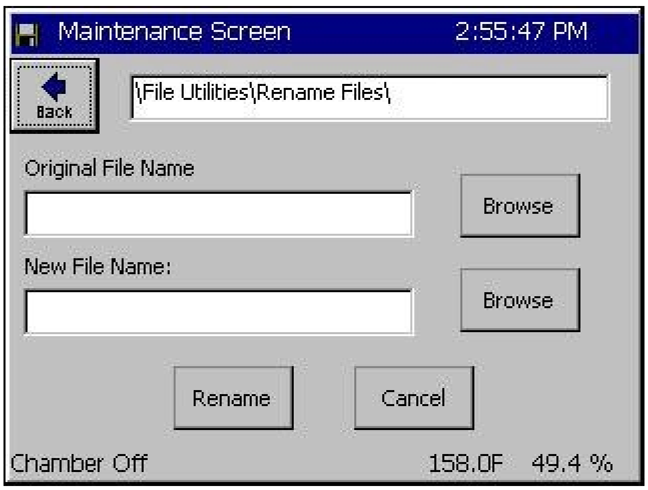
Press the ***Copy*** button.



Delete Files

Select and delete the desired file.

You can press the ***Browse*** button to view the list of drives available. Follow the directions as described above in the section named Select Source & Destination File.



Rename Files

Enter the original and new file names.

You can press the ***Browse*** button to view the list of drives available. Follow the directions as described above in the section named Select Source & Destination File.

Export History for Logging Operation

Press either radio button to select the storage media: Floppy Disk or USB Hard Disk. Then press the ***Export*** button to export the current history file out to the storage medium.

Note: the Export History and Clear History features are also available in the *Setup\Logging* folder.

Export History Window

The export process is monitored in the Export History Status window. First the Synergy Nano will prompt for a USB Hard Disk. If your storage media is not installed, do so now and press the ***OK*** button.

Once the media is detected the Synergy Nano will automatically export the file. When the export is complete the successful export prompt will be displayed. Close the window by pressing the ***OK*** button. Your export history file is automatically named “exphst00.txt”.

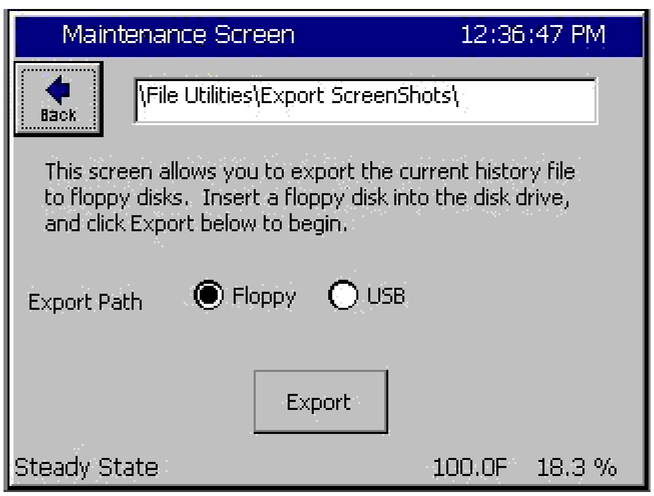
Reference the logging Section 6.11 Setup: Logging for more information.

Clear History for Logging Operation

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

Reference the logging Section 6.11 Setup: Logging for more information.

Note: the Export History and Clear History features are also available in the *Setup\Logging* folder.

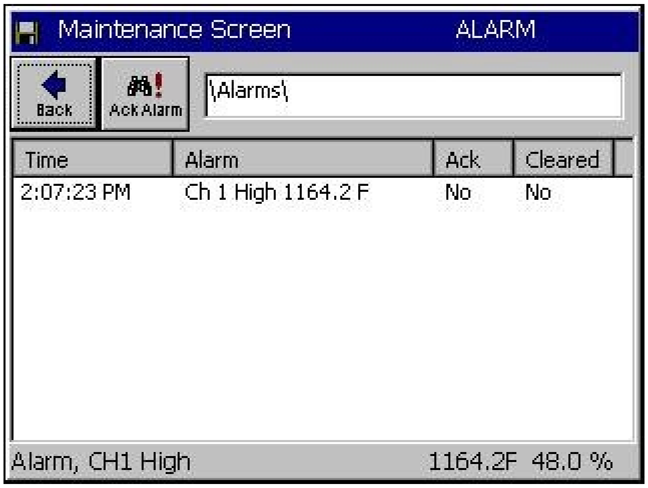


Export Screen Shot

The ***Screen Capture*** key on the Navigation panel takes a bitmap picture of the current screen. Press the key to capture a screenshot and save it to memory.

To export the bitmap, go to the *MAINT\File Utilities\Export Screenshot* screen at the left, select your export path (storage media) and press the ***Export*** button.

The export process is monitored in the Export Screen Shot Status window like the Export History Status window. The exported screen shot files are automatically named sequentially SS0001.bmp, SS0002.bmp, SS0003.bmp...



Alarms

The alarm screen displays any Synergy Nano 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 of alarm.
- 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.

Press the ***Ack Alarm*** button to acknowledge an alarm. 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.

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 NANO 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 Nano Low Program Memory & Low Storage Alarms

There are 2 types of local storage on the Synergy Nano: Storage Card (Flash) and RAM. The Storage Card holds all the application programs, user chamber programs and log files. RAM is used exclusively by the operation system and Synergy Nano software. The Synergy Nano monitors both storage areas for low memory.

Low Program Memory Alarm

In the event that the RAM memory runs low, the Synergy Nano operating system will no longer run efficiently. If a Low Program Memory condition exists a pop up window warns "The Synergy Nano 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 Nano to clear this error.

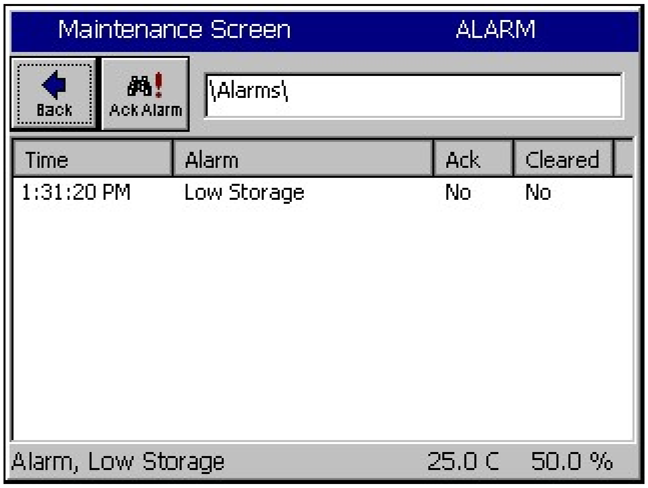
Note: Synergy Nano applications before version 2.0.0 had an issue that caused Low Program Memory Alarms. This issue was fixed in 2.0.0 and later versions. Contact Tidal Engineering for upgrade information if your controller software version is earlier than 2.0.0.

Low Storage Alarm

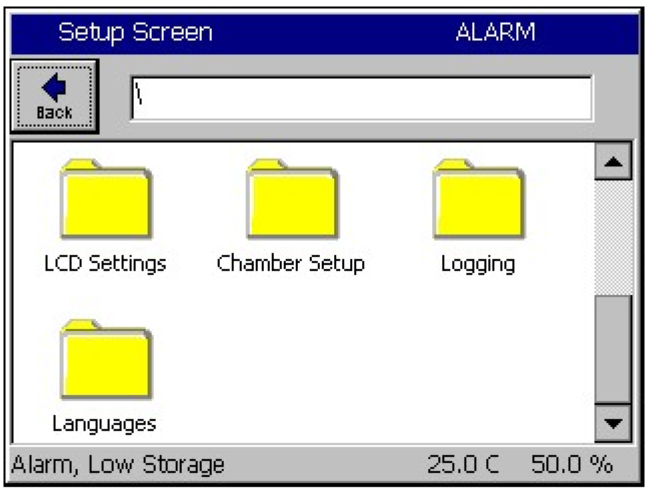
The Synergy Nano monitors the space remaining on the Storage Card Flash memory device, and generates an alarm condition when the space remaining is less than 160K. When this occurs, you can clear the log file, export screenshots or remove programs from the Storage Card to free up Storage Memory to correct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

A Low Storage Alarm can occur when the log file has grown too large. When your chamber is properly setup the Synergy Nano 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 then 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

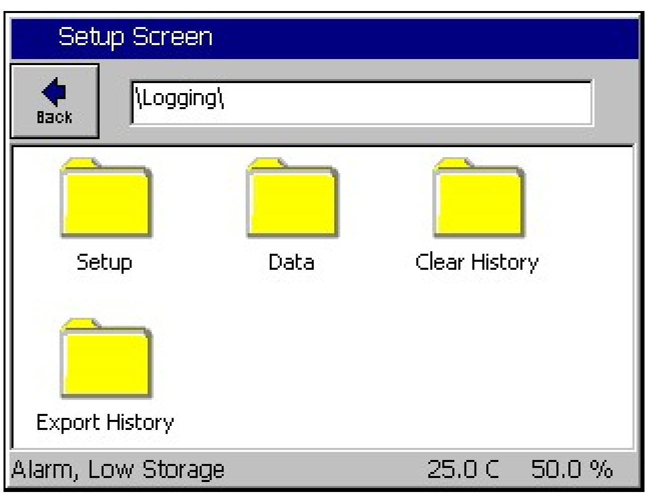


When an alarm occurs, the word “Alarm” flashes in the title bar of the Synergy Nano control panel. To determine if your alarm condition is a Low Storage alarm, go to the *Maintenance\Alarms* folder and read the alarm description.



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

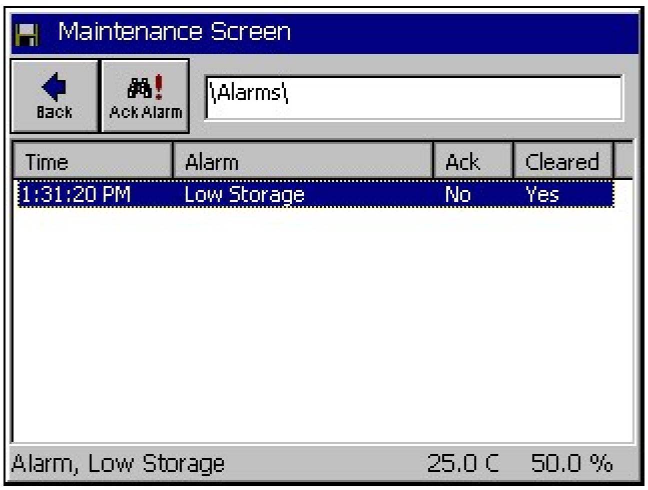
Go to Setup Screen folder and scroll down to select the Logging folder.



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

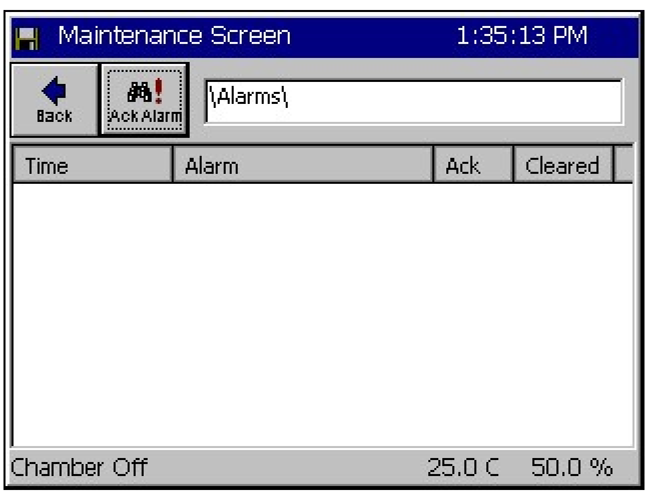


Acknowledge the Low Storage Alarm Condition.

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.

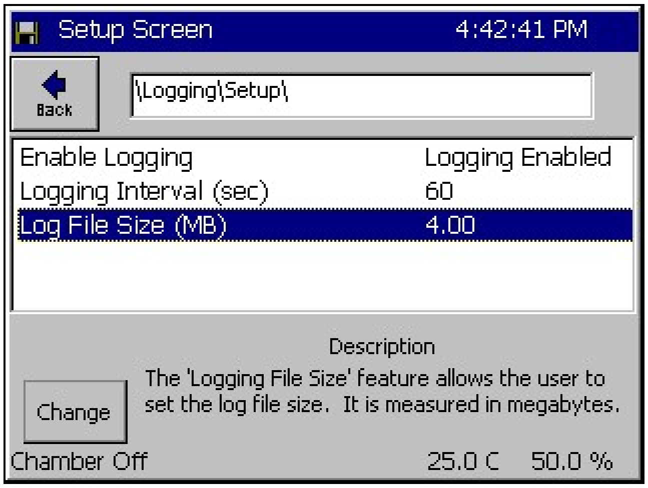
Note: This “alarm acknowledge” procedure ensures that the user sees the alarm event before it is cleared.



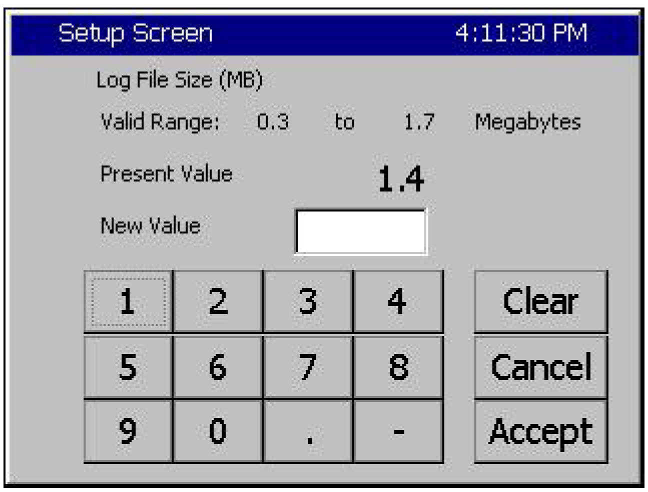
Press the ***Ack Alarm*** button. The Alarm condition is now acknowledged and cleared and is removed from the list.

Preventing the Low Storage Alarm condition

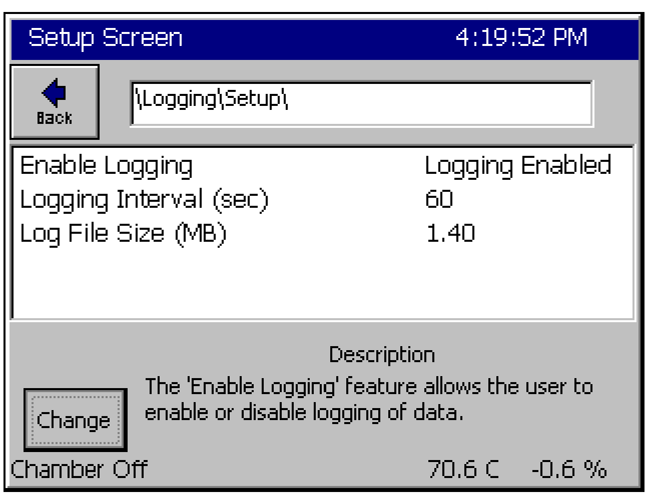
You can eliminate the recurrence of a Low Storage Alarm Condition by adjusting the Log File Size to a value less than the space available on the Synergy Nano Storage Card. Follow the steps below:



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



The Synergy Nano determines the upper limits of the valid range automatically. Change the Log File Size to a number below the maximum value.

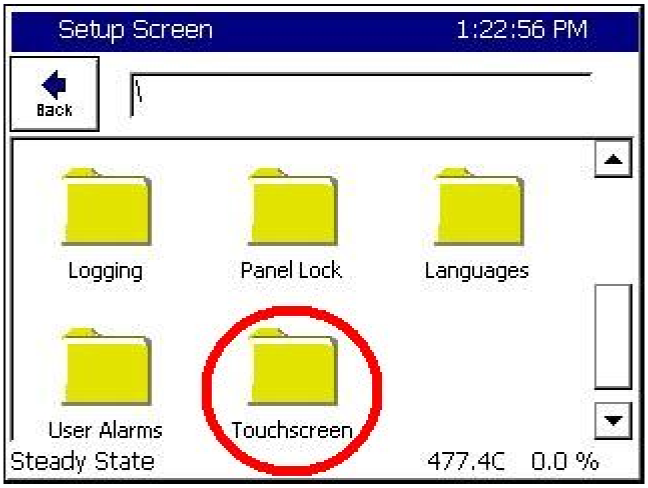


The maximum Log File Size is now set to 1.40 MB. Now the chamber will not generate a Low Storage Alarm condition. If the history file reaches the Log File Size limit in the Logging Setup folder, new logging information is added to the file and the oldest data is removed in a FIFO (First In First Out)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

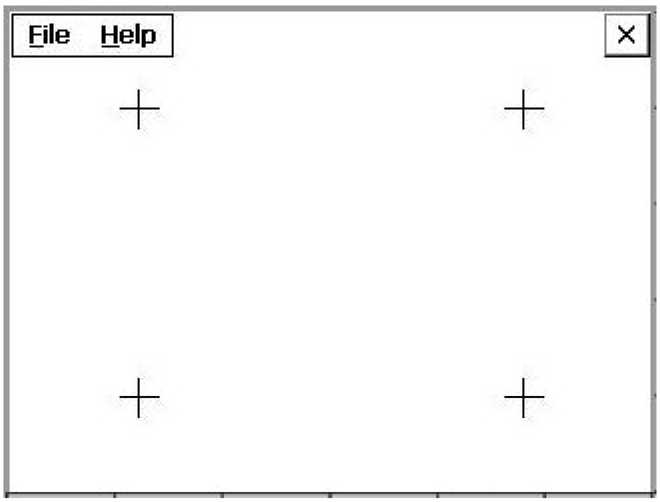
See Section 6.11 Setup: Logging for information on Data Logging Capacity calculations.

7.3 Touch Screen Calibration

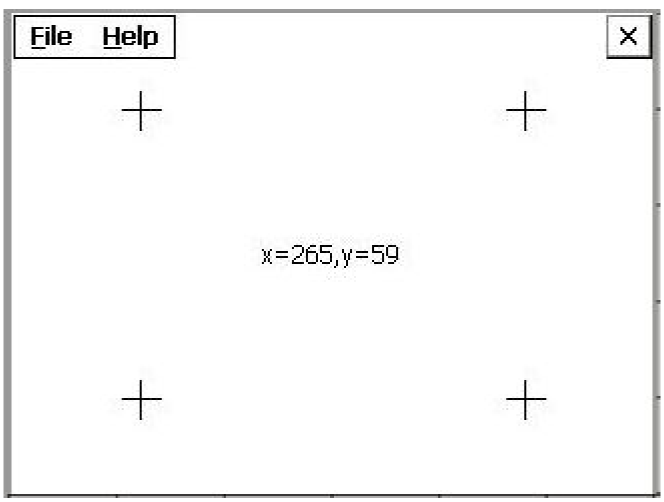
This section describes the procedures for calibrating the Synergy Nano's touch screen.



To calibrate the Synergy Micro touch screen, navigate to the Setup Screen and open the **Touch screen** folder. The following application screen will appear.



Press the 4 crosshairs with a stylus in any order, the coordinates of the press will be displayed in the center of the screen.



After pressing the four crosshairs press the coordinates in the middle of the screen.

This will apply the new touch screen calibration.

Repeat the calibration, pressing the 4 coordinates again. The mouse cursor should follow the cursor touch more closely on this pass.

To exit the touch calibration program, open the File menu and select Exit from the menu.

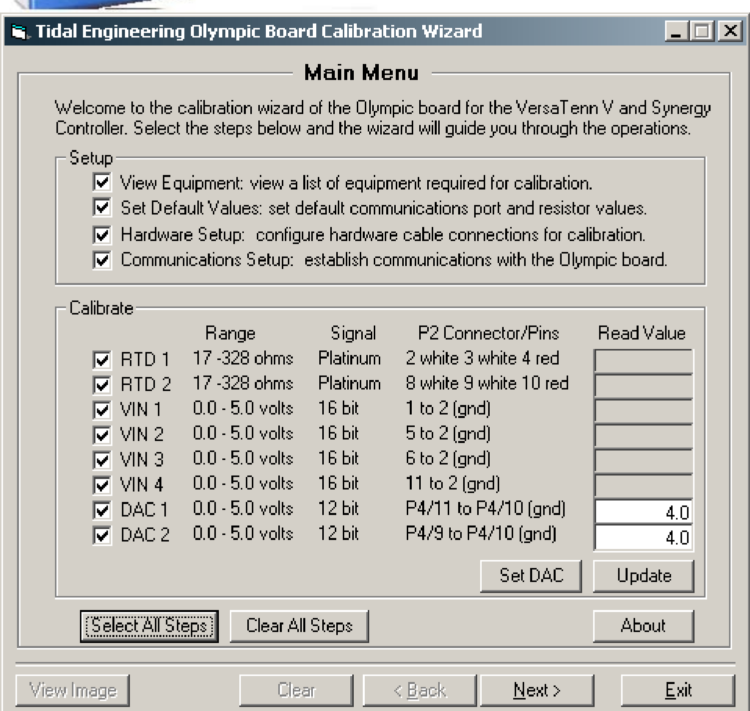
The new touch screen calibration data will be saved.

7.4 Olympic Board Calibration Utility

The Synergy Nano's Olympic board is the interface to the environmental test chamber's hardware including output devices such as compressors and input devices such as temperature sensors. The Olympic Board Calibration Utility is used to perform a software calibration of the Olympic board's analog inputs and outputs to known values. The current Synergy Nano software version also provides gain and offset calibration for each input.

The Olympic Calibration Utility is available from Tidal Engineering. You will receive the software installation file on a CD. To install the software on your PC, insert the CD and double-click on the setup.exe file. The utility is Wizard Based so calibration is a simple step-by-step process and the operator simply follows the instructions on the screen. The Olympic Calibration Utility is available at no charge from Tidal Engineering.

The Synergy Nano's Olympic board

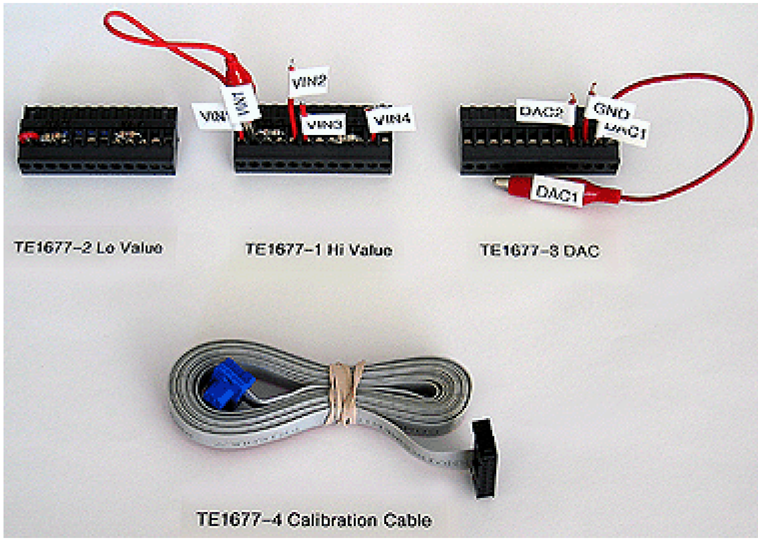


The Olympic Board Calibration Utilities Main Menu is displayed on the left.

To install the software on your PC double-click on the setup.exe file. The utility is Wizard Based so calibration is a simple step-by-step process and the operator simply follows the instructions on the screen.

Required hardware list:

- ♦ Windows based PC
- ♦ Voltmeter or digital multimeter, preferably 6 digits
- ♦ High value resistor (255 ohm nominal) and Lo value resistor (62 ohm nominal) *
- ♦ Serial Cable
- ♦ Gender chamber for serial cable
- ♦ Voltage source 4.0/1.0 volts (optional) – the Olympic board's DAC 1 output may be used to provide a source voltage.



* Tidal Engineering offers a Calibration Kit (PN TE1677) to assist with Synergy Nano calibration. The kit contains several hardware calibration connectors and communication cables as indicated above by an asterisk. The kit also contains a calibration cable for easy serial communications and a DAC connector pre-wired for calibration without a voltage source.

7.5 Synergy Nano Software Upgrade Procedures

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

This section describes procedures for upgrading the Synergy Nano's software. There are two procedures; the first one is for Synergy Micro configurations and the second one is for Synergy Compact and Synergy V configurations.

Warning: The Synergy Micro software upgrade process can disable a Synergy V or Synergy Compact unit. If this occurs, contact the factory for a utility to correct this.

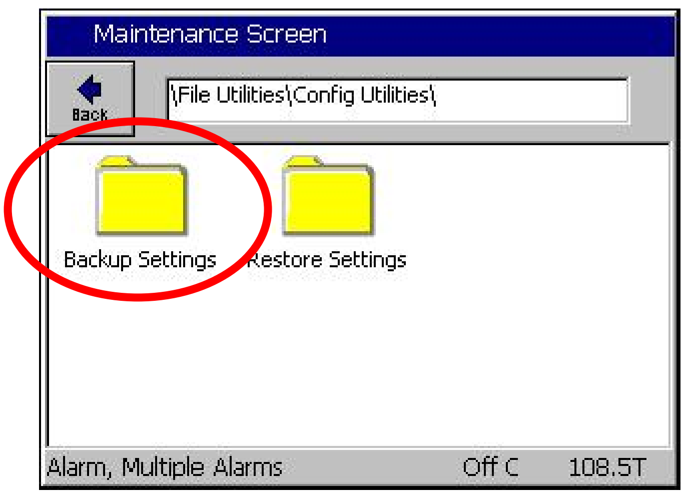
The Synergy Micro upgrade is delivered in a compressed format and is installed using a USB Flash Disk.

The delivered file name contains the Version and Build number.
For example: SynM_2.6.5_646_Upgrade.zip is version 2.6.5 Build 646.

The Synergy Nano Configuration Backup and Restore features should be used to backup any non-standard settings before performing the upgrade. In addition, you should manually record the entries in the table below including 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.

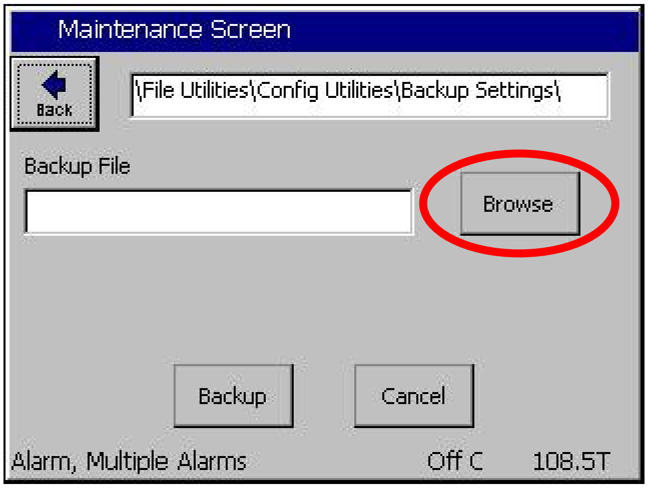
To install the upgrade:
1. Backup Non-Standard settings and record registrations and chamber configuration.
2. Install the new software.
3. Load chamber configuration and restore non-standard settings and registration keys.

Step 1. Backup Settings

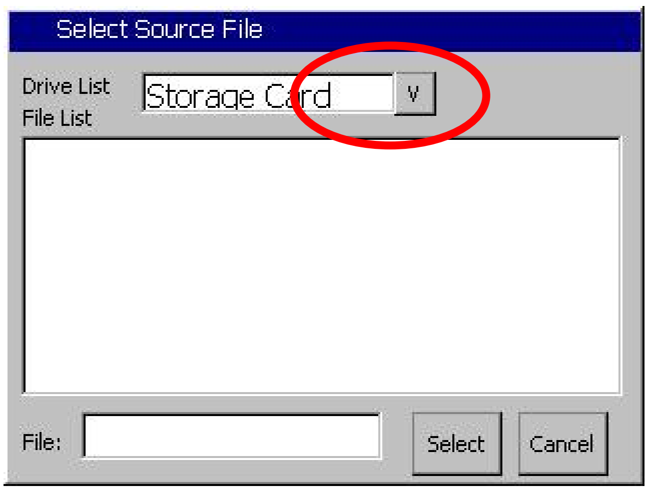


For Versions 2.6.X and newer, Browse to the Maintenance Screen **\File Utilities\Config Utilities** folder and open the **Backup Settings Folder**.

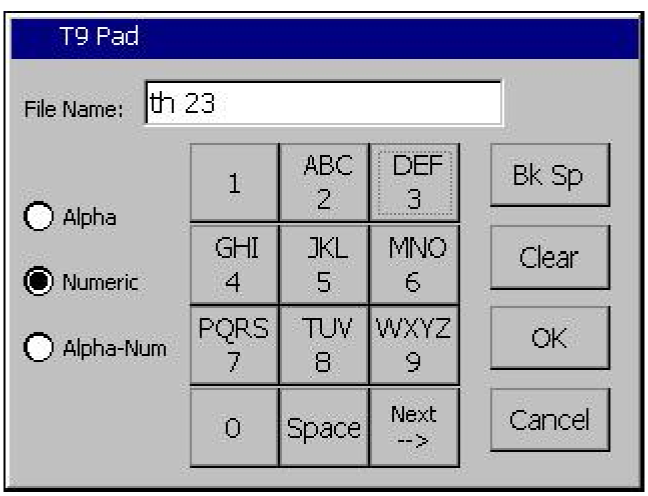
For older versions that don't have the Backup Settings feature, either record the settings manually or use SimpleComm to download the settings. See Section 8.3 for a discussion of that procedure.



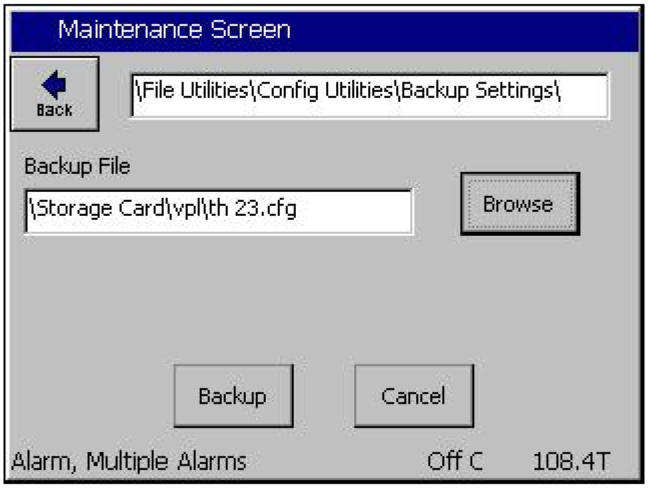
From the Maintenance Screen **\File Utilities\Config Utilities\Backup Settings** folder Press the **Browse** button.



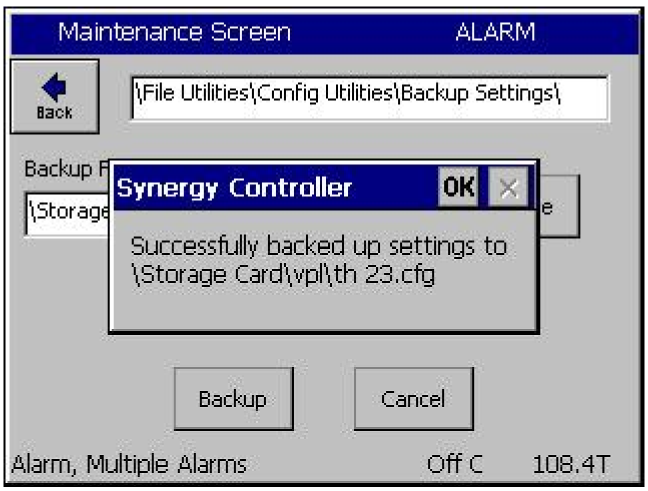
Then select either the Storage Card or the USB Hard Disk from the Drive List and. Then press the **File:** Text Box



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.

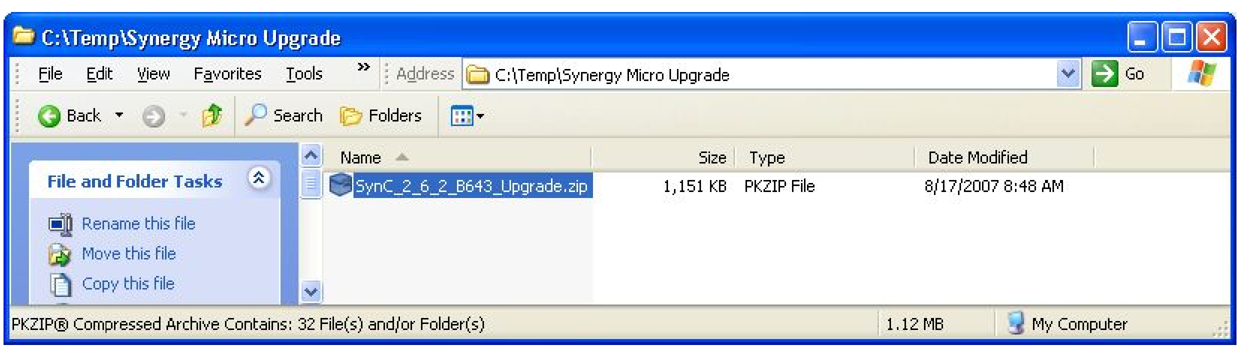


The controller will confirm that the settings were backed up successfully as shown at the left.

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

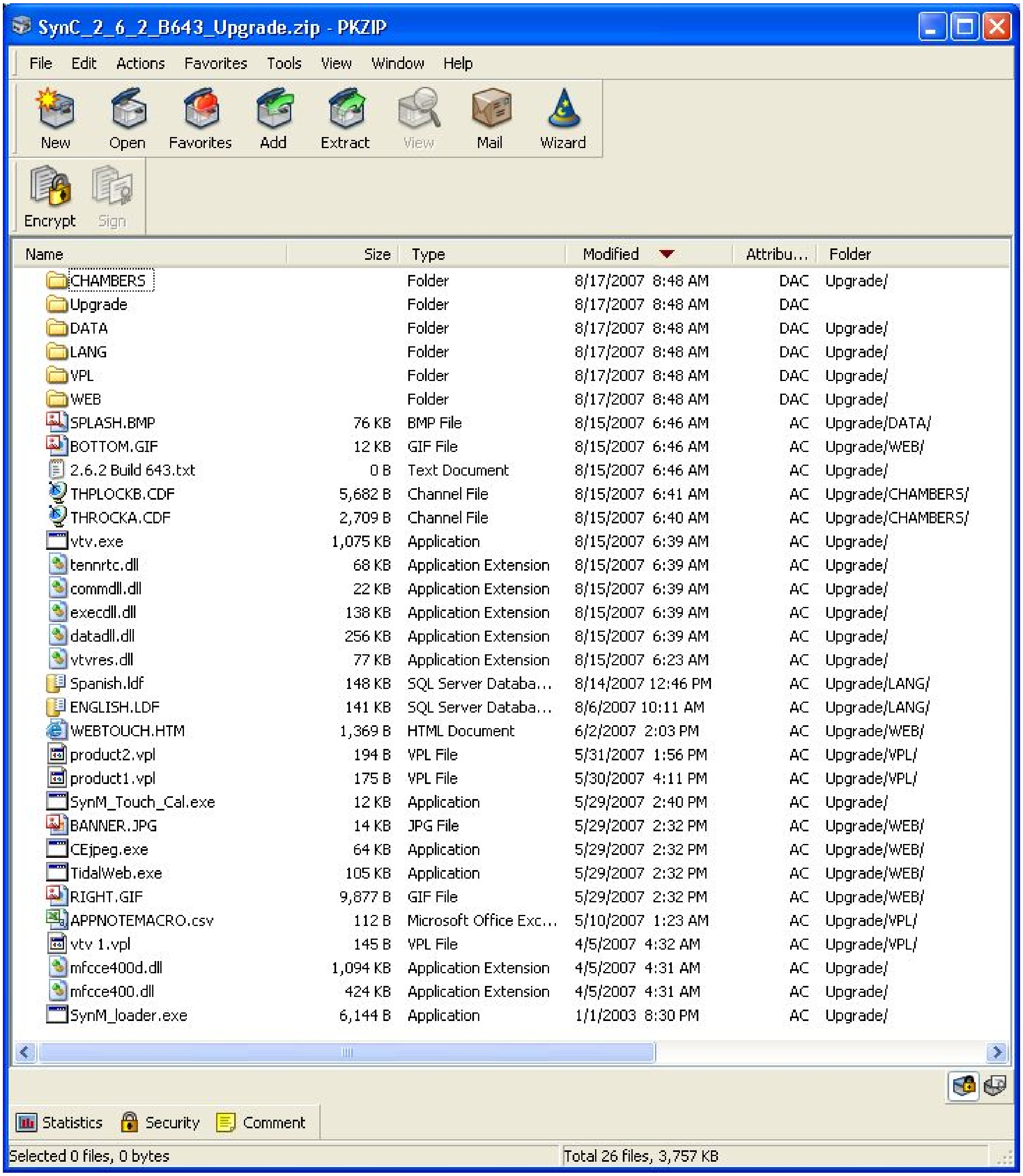
Step 2. Install the New Software

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

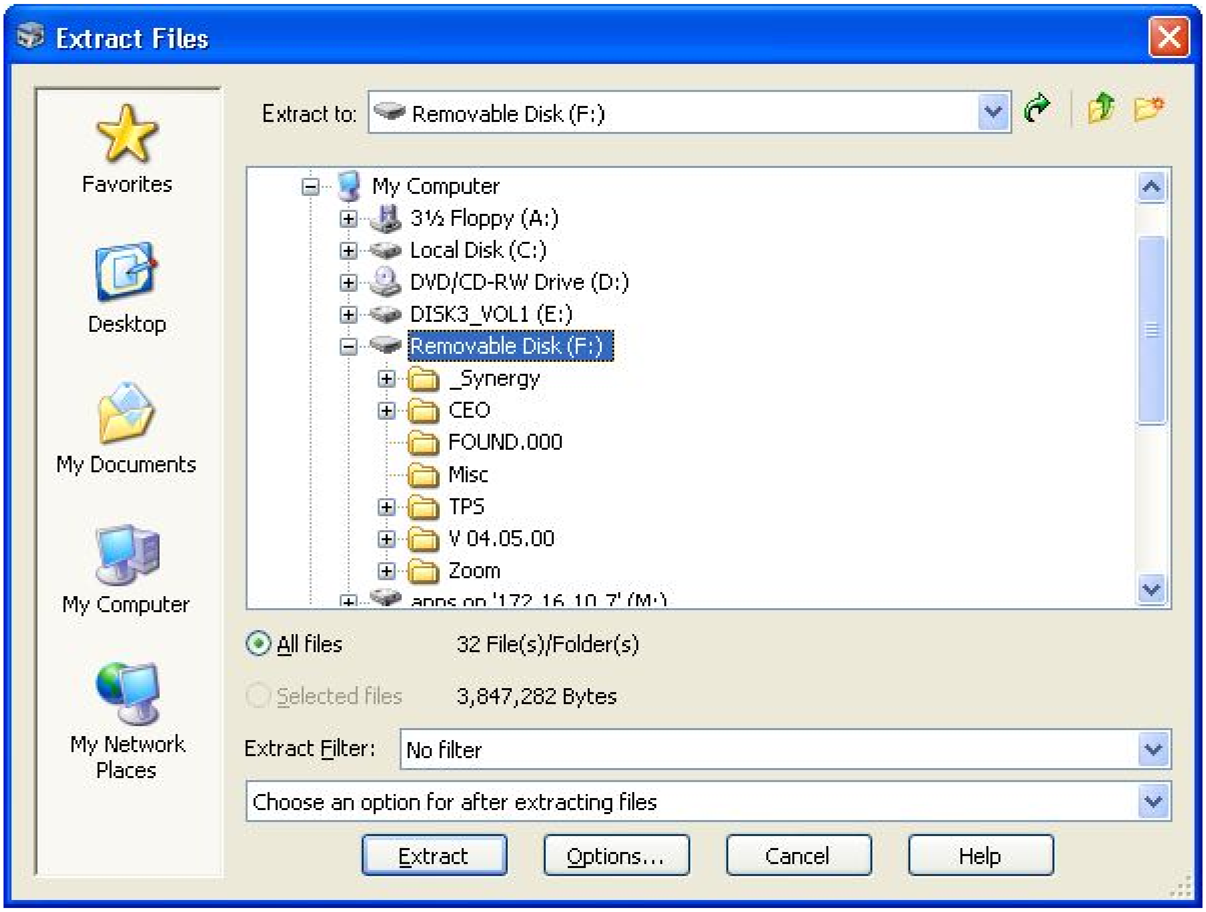


Place a USB Flash Disk key in the USB port on your PC.

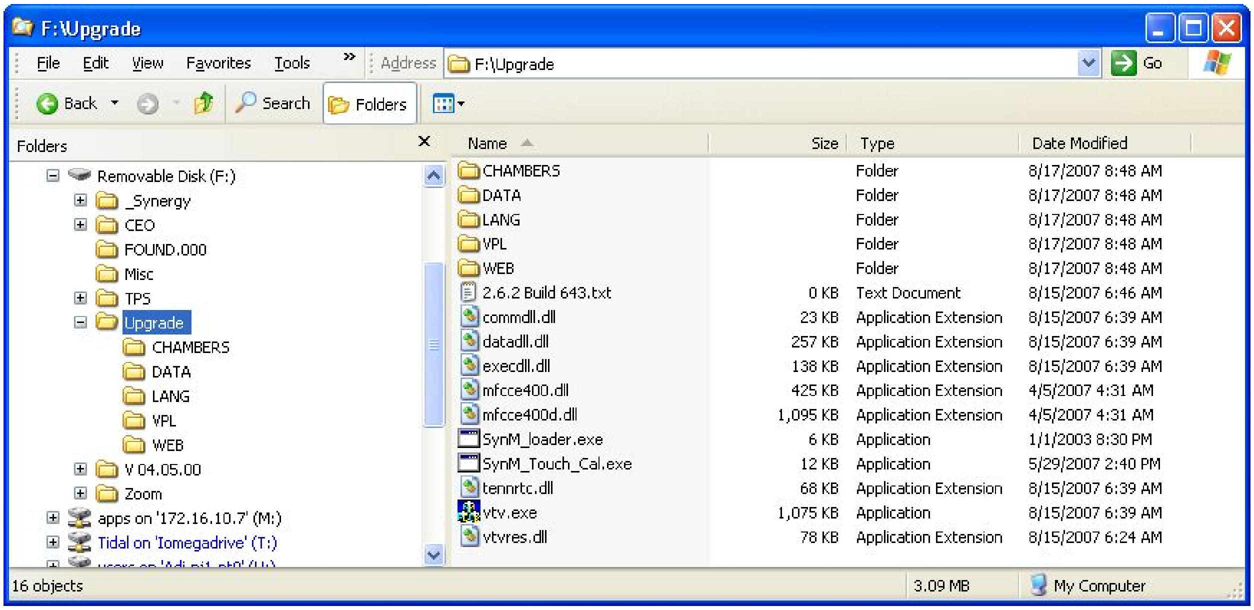
Double click the zip file (note that your screen may look different than the screen below if you have a different zip program installed on your PC)

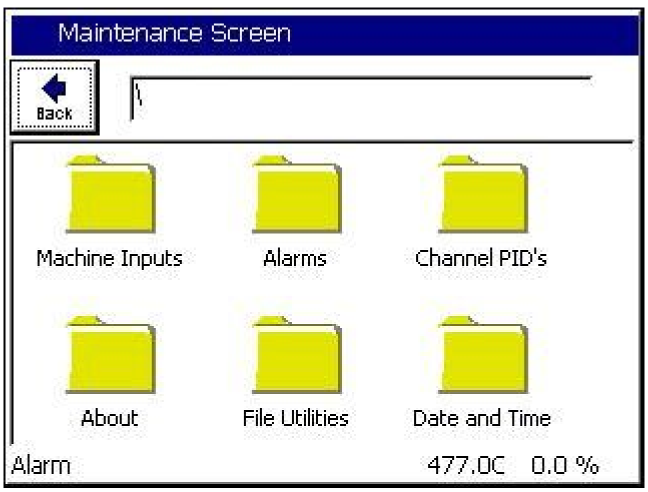


Select ***Extract Files*** and browse to the USB Flash Disk on your PC as shown below. In this example the drive is named **"Removable Disk (F:)"**

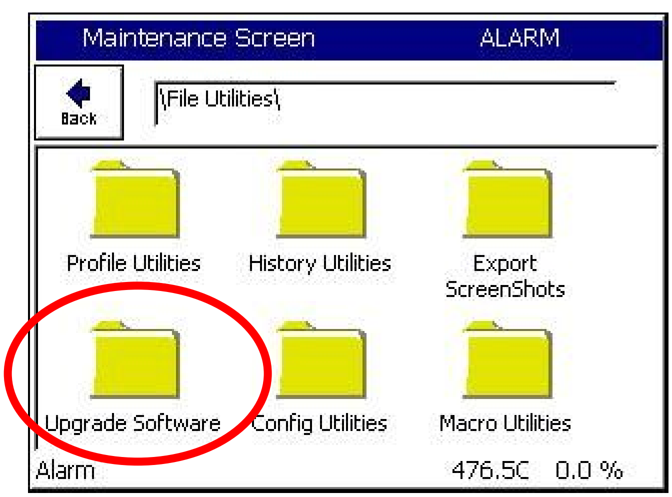


After the files are extracted you will see the Upgrade directory on your USB key as shown below.

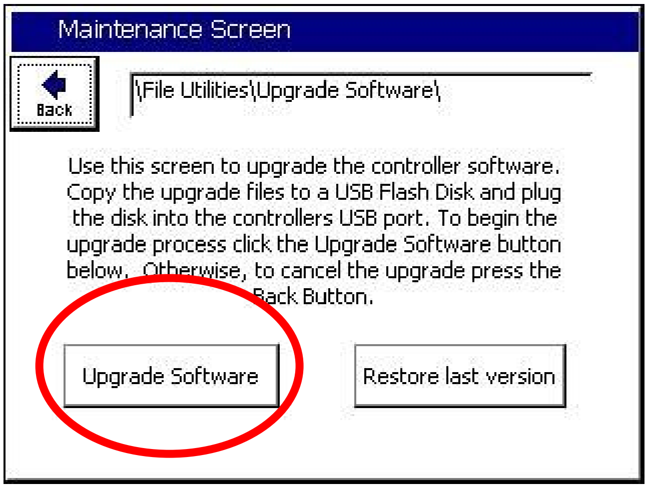




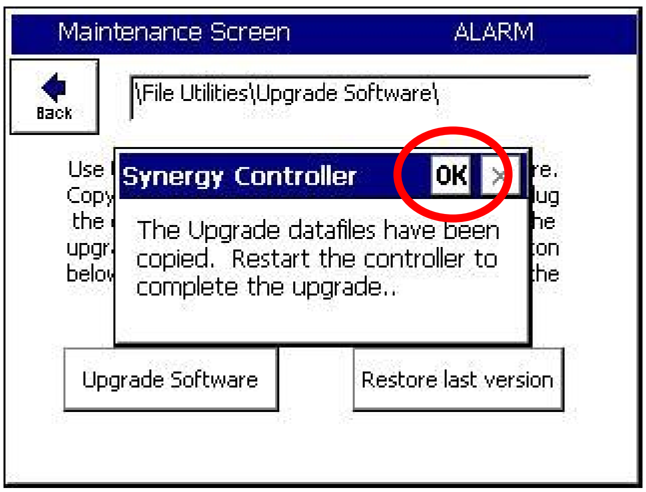
Place the USB Flash disk in the Synergy Micro's USB port and browse to the **Maintenance Screen**.



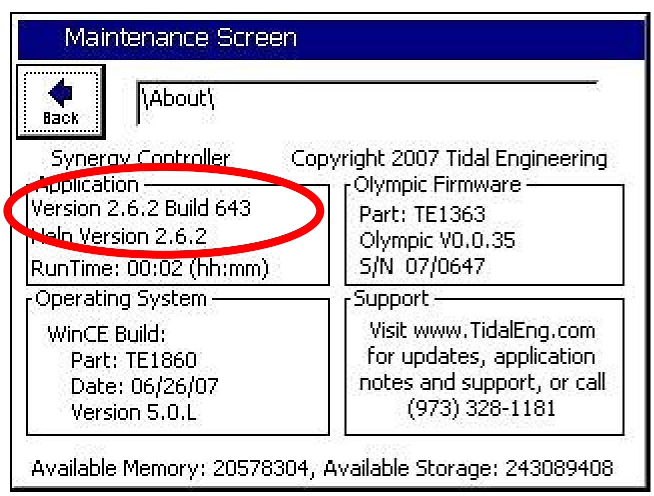
Open the **File Utilities** Folder and press the **Upgrade Software** folder.



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**.



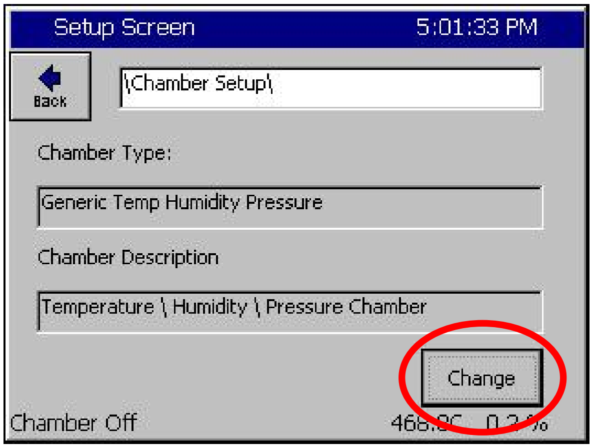
Press the ***OK*** box and restart the controller.



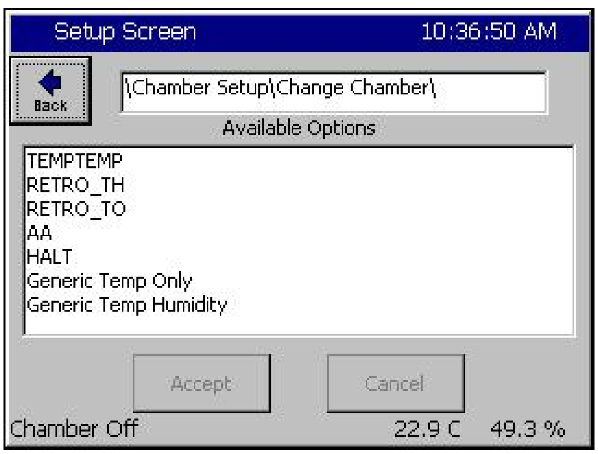
Go to the **Maintenance Screen** and open the **About** folder to verify the appropriate Version number as shown at left.

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. You will then be asked 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.

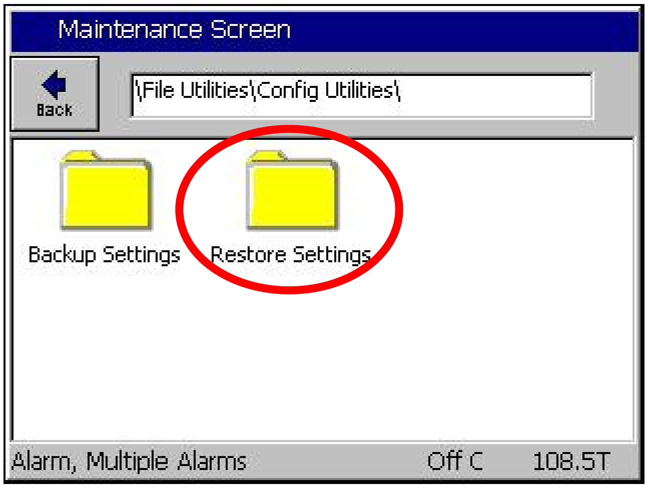


Then press ***Accept***

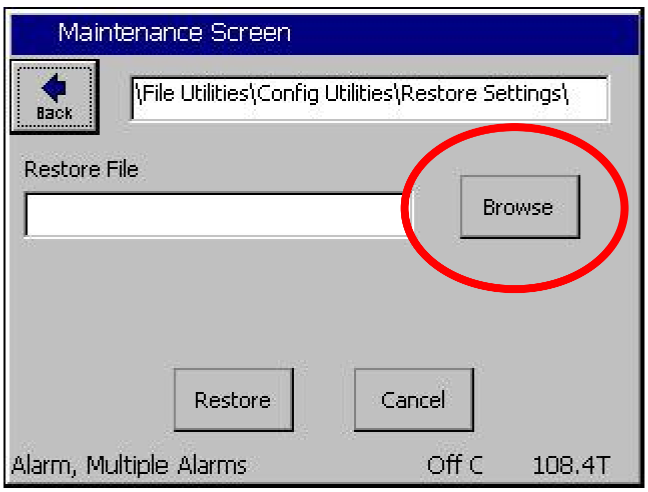
Next, Reset the Controller or Cycle power. When the chamber restarts, the controller will indicate that the current chamber type differs from the last chamber type. This is OK. Press ***OK*** to acknowledge that message. You will then be asked if you would like to discard the old settings and load the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

Restore Settings

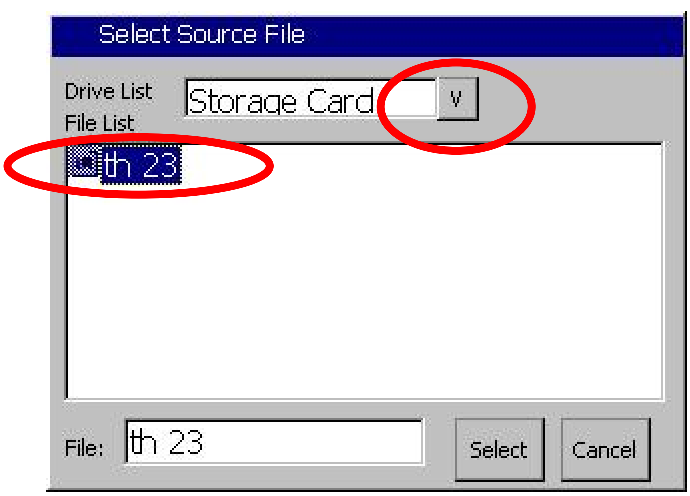
In this section we will restore the settings from the backup.



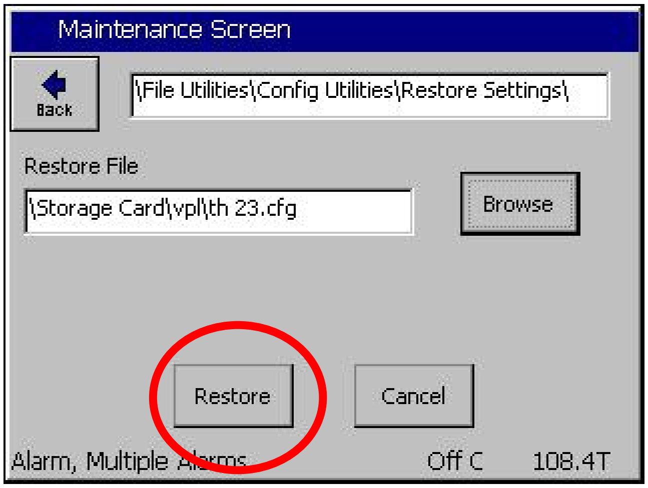
Browse to the Maintenance Screen **\File Utilities\Config Utilities** folder and open the Backup Settings Folder. Then press the Restore Settings Folder.



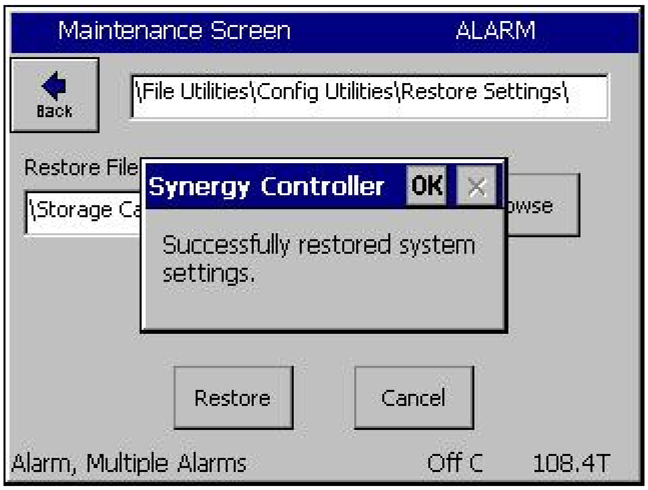
Press the Browse button.



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 application upgrade is now complete.

Synergy Nano 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.

7.6 Clean Dat Utility

The Clean Dat utility removes all the chamber data (dat) files from your Synergy Controller. After the Clean Dat program runs and the system reset, all of the controller settings are reset to their default values. You may want to use the Clean Dat Utility if your controller won't boot. Deleting the dat files may resolve the issue.

Before you run the Clean Dat utility make sure to record all of the settings (PID, Special Functions, LValues, etc) for the controller. See the Settings List in Section 6.6 within the Setup chapter of this manual for a helpful table that you can use to record your chamber settings. Alternatively you can use Tidal Engineering's SimpleComm communications application to record the settings via Ethernet or Serial Communications and restore them after you run the Clean Dat utility. The SimpleComm application is discussed elsewhere in this manual and is available on the Resource CDROM and on Tidal Engineering's website. Running the Clean Dat utility will NOT delete your chamber's profile program files (files you created using the Program Screen).

To clean your dat files:
1. Insert the Synergy Controller Clean disk into the USB drive on your chamber.
2. Either reset the controller or cycle the power on the chamber.
3. The Clean Dat will run when the controller reboots and will delete the data files.
4. When complete, and the USB light stays off, remove the USB from the drive.

7.7 LCD Backlight Lamp Replacement

Synergy Nano employs a color LCD touch screen control panel with LED Backlight. These LED backlights are not replaceable. The LCD's are available form the factory if the LED backlight should fail.

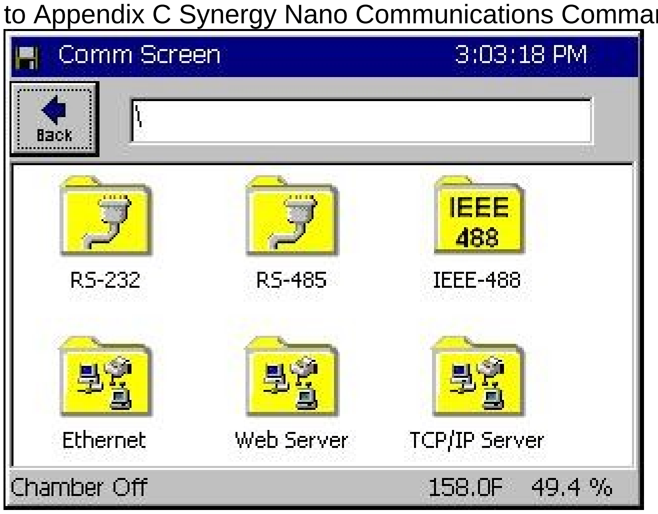
8.0 COMMUNICATIONS DIRECTORY

8.1 Operator Interface

COMMUNICATIONS DIRECTORY (COMM) FOLDERS					
RS - 232	**RS - 485**	**IEEE - 488**	**Ethernet**	**Web Server**	**TCP/ IP Server**

Sub-folders & Screen Editors		
❑ **RS – 232**	❑ **RS - 485**	❑ **IEEE - 488**
(Screen Editor)	(Screen Editor)	(Screen Editor)
♦ BAUD Rate ♦ Data Bits ♦ Parity ♦ Flow Control Note: These parameters are Read-Only.	♦ RS - 485 Mode ♦ Station Address ♦ Number of UUTs	♦ IEEE Address
❑ **Ethernet**	❑ **Web Server**	❑ **TCP / IP Server**
(Screen Editor)	(Screen Editor)	(Screen Editor)
♦ IP Address Selection ♦ Ethernet Address ♦ Ethernet Subnet Mask ♦ Ethernet Gateway	♦ Web Server On / Off ♦ Web Server Login Name ♦ Web Server Password ♦ Web Server Address ♦ Web Server Key	♦ TCP / IP Server On / Off

The Synergy Nano supports an extensive command set for complete control and monitor capabilities. For Example, to query the temperature of the chamber, send the query “? C1”. The chamber will respond with 25.0 C if the chamber is at room temperature. To view the Synergy Nano’s complete command set go to Appendix C Synergy Nano Communications Command Set.

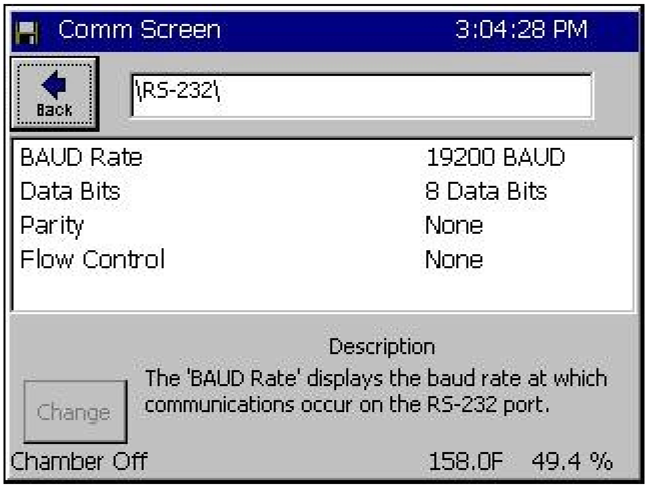


<u>Communications Directory</u>

Select the following communication functions.

- ♦ RS - 232
- ♦ RS - 485
- ♦ IEEE - 488
- ♦ Ethernet
- ♦ Web Server (Optional)
- ♦ TCP / IP Server

8.1.1 RS-232

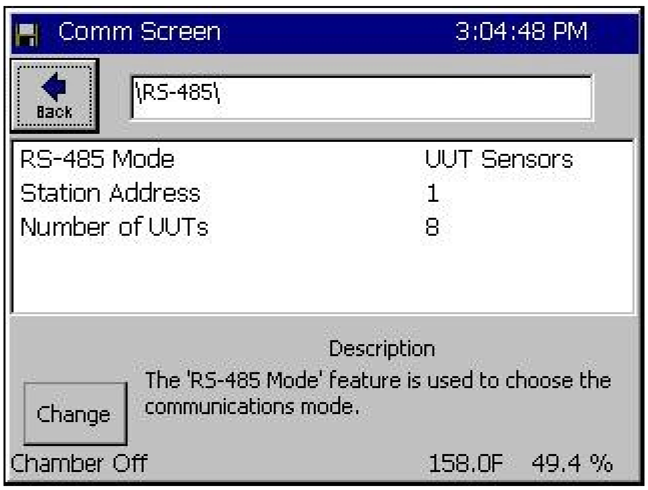


<u>RS - 232</u>

RS-232 communications are standard on all Synergy Nano 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 8.3 Communications: Software Applications.

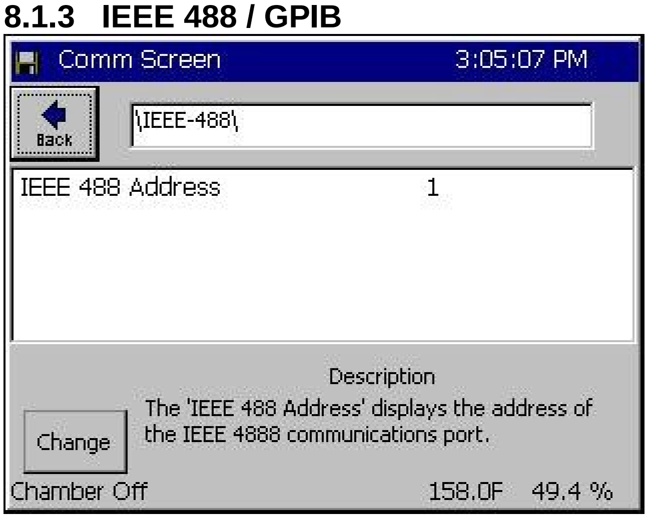
8.1.2 RS-485



<u>RS – 485</u>

The Synergy Nano's RS-485 port monitors Synergy UUT thermocouple modules. UUT Modules are discussed in detail in Section 13.0 UUT Module.

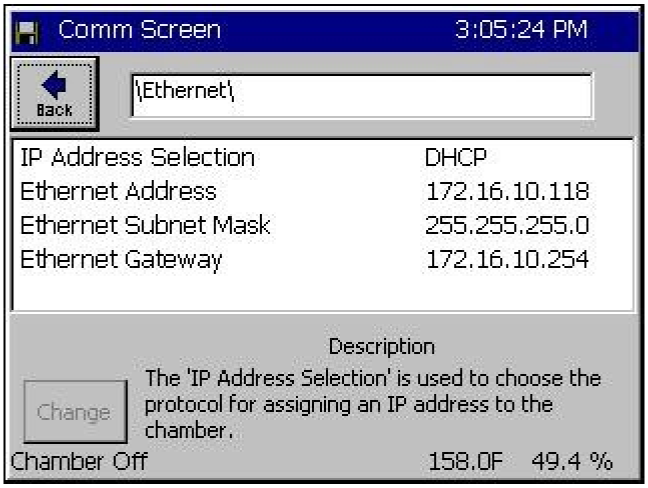
8.1.3 IEEE 488 / GPIB



<u>IEEE – 488/ GPIB</u>

The IEEE 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 8.3 Communications: Software Applications.

8.1.4 Ethernet



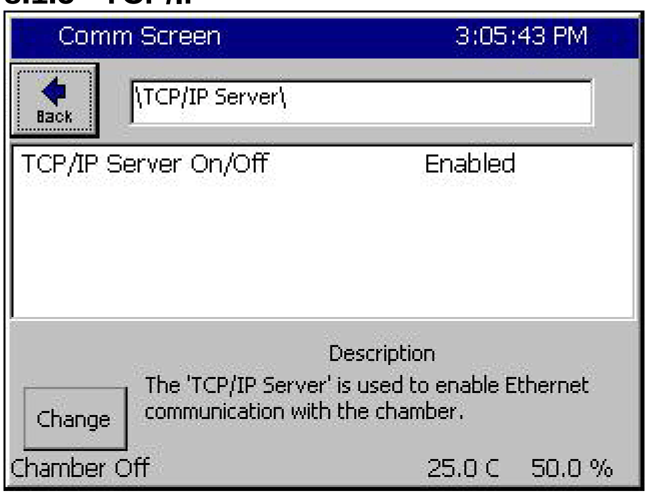
<u>Ethernet</u>

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 to have your network's DHCP server dynamically assign an available IP Address for you controller. If you do not have a DHCP server or want to manually set the IP Address of your controller, set the IP Address Selection setting to Static IP. Then enter the Ethernet Address, your 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.

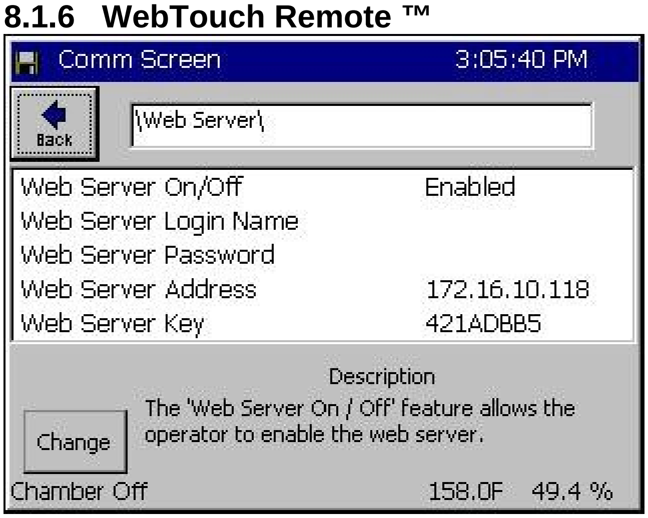
8.1.5 TCP/IP



<u>TCP / IP Server</u>

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

8.1.6 WebTouch Remote ™



<u>Web Server</u>

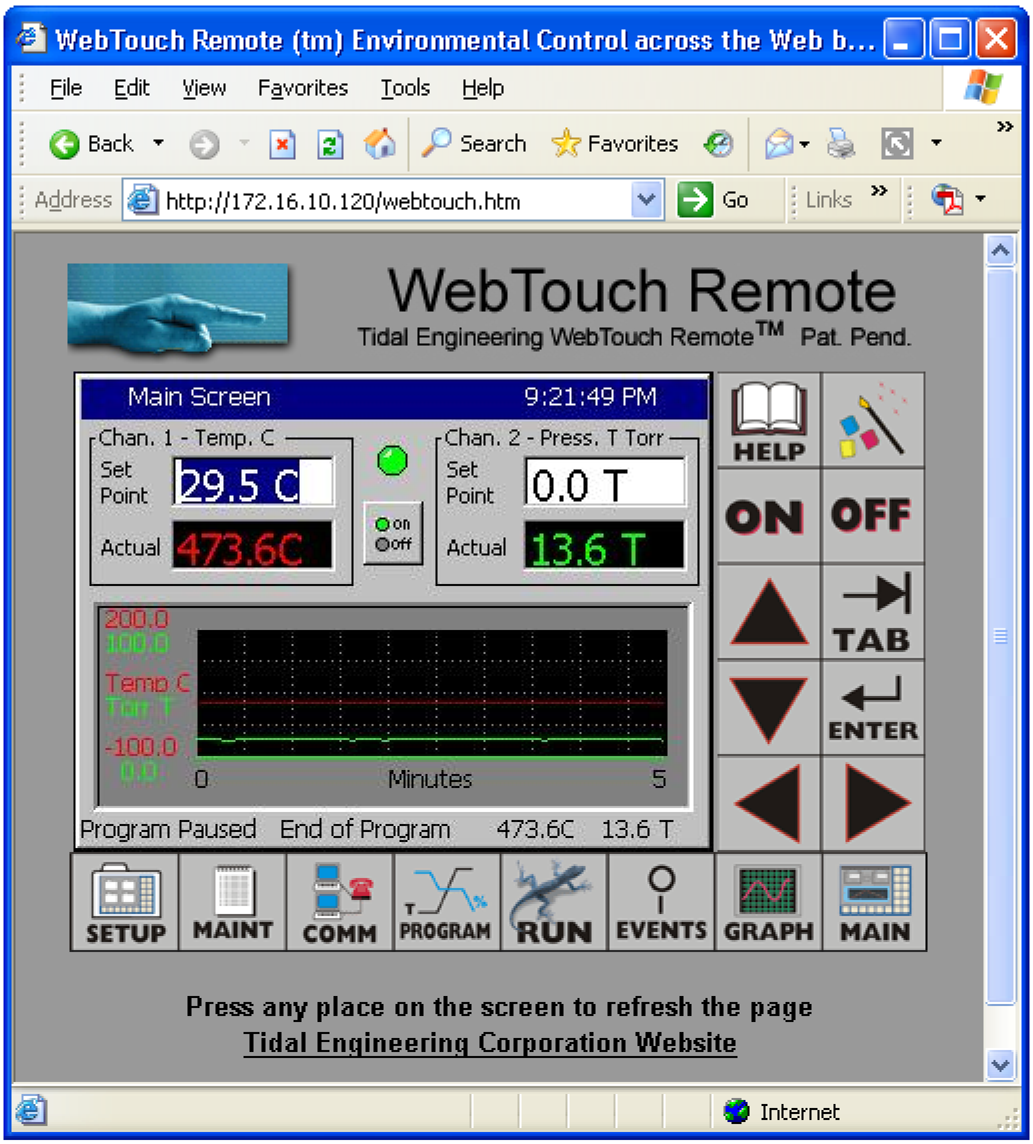
The web server allows you to remotely control, monitor and run diagnostics on chambers over the web using Microsoft's Internet Explorer web browser.

See the following section Synergy Nano 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.

8.2 Web Touch Remote™ - Synergy Nano Web Server

The Synergy Nano can be monitored and controlled over 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.



Configuring the Synergy Nano 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 Nano'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 Nano Web Server can be used on an office or factory network to provide remote access and control. The Synergy Nano 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 Nanos can be setup with a small router to connect directly to a PC.

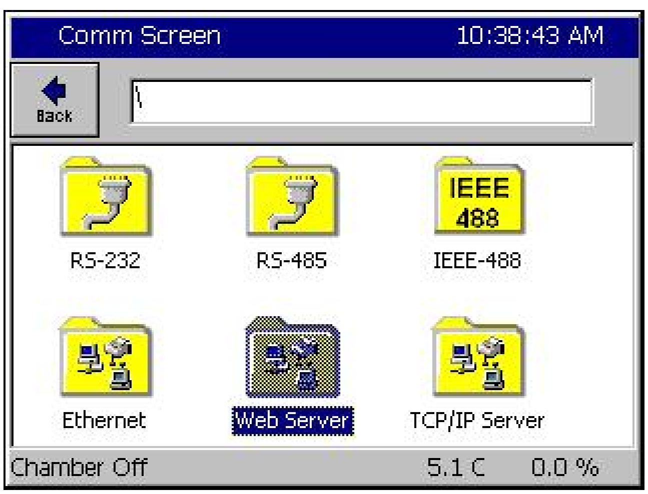
IP Configuration by DHCP

Each Synergy Nano must be configured with a unique IP address. DHCP does this configuration automatically. A device 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

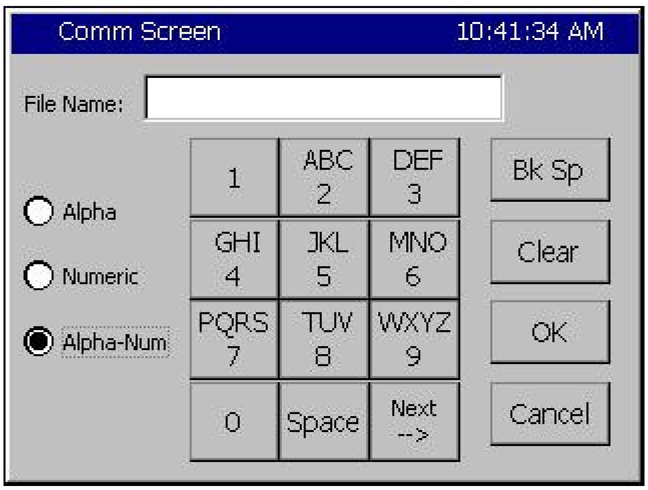
DHCP servers are available on most office and factory network servers. Contact your network administrator to verify that a DHCP server is available and enabled. The Synergy Nano will display the address it was assigned in the *COMM\Ethernet* screen. If the address is not 0.0.0.0 than it has been assigned 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.



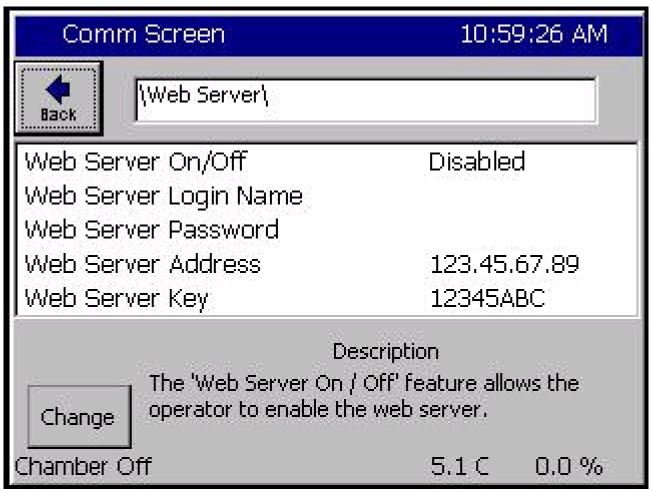
Input the registration code you received from Tidal Engineering Corporation using the keypad.

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 Nano will display a message box indicating that the web server key was successfully registered.

Press ***OK*** to proceed to the Web Server Settings page.

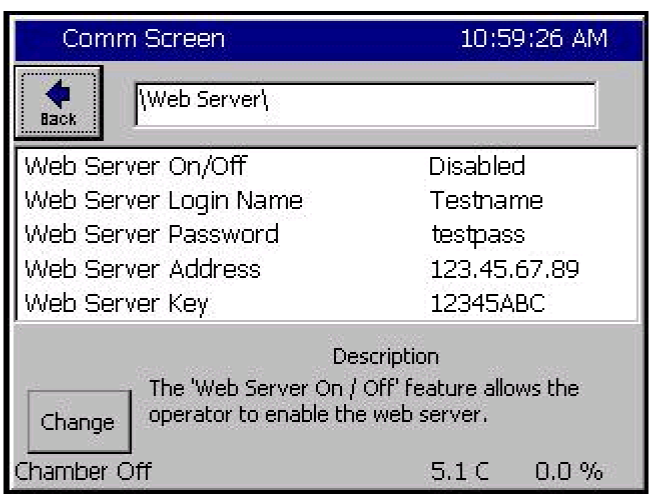


Once you have successfully registered the web server, you can now enable the Web Server.

You should also set a Login Name, and set a Password before you connect to the Synergy Nano.

First change the Web Server On/Off value to Enabled. .

Press the ***Back*** button to return to the settings window.



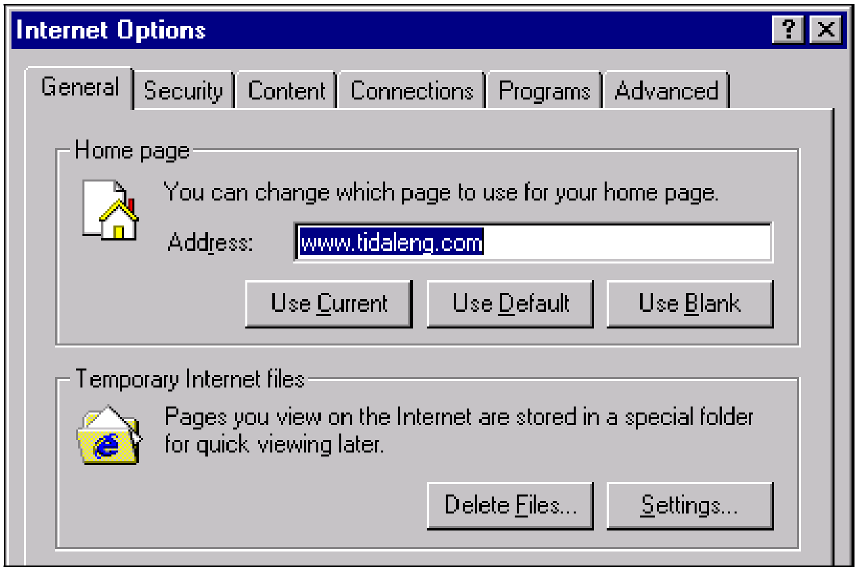
Network Security

In today's Internet environment, network security is often a concern. The Synergy WebTouch Remote 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 Nano remotely via your web browser.

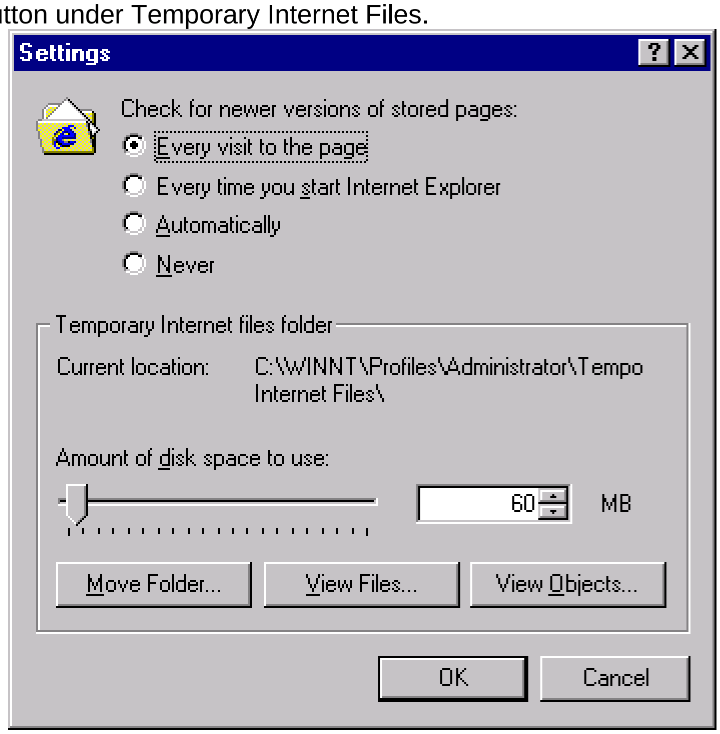
The unit's web server is now ready for use.

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.

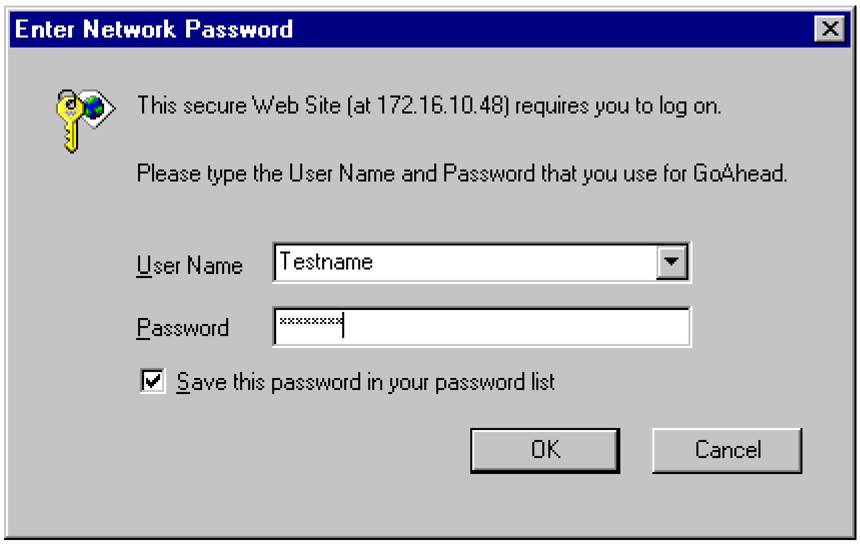
Caution: The Synergy Nano may work unpredictably if this setting is not changed. Mouse clicks on the Browser window will be sent to the controller but the screen images will not update. Buttons and functions may, therefore, be pressed unintentionally.

Accessing the Synergy Nano 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 Nano Web Interface virtually identical to the Synergy Nano 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 Nano. 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.

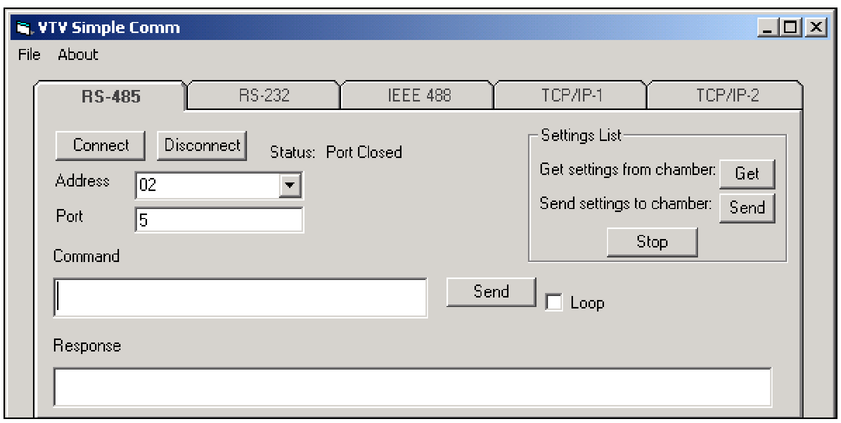
8.3 Software Applications and Networks

Tidal Engineering has developed several software packages designed to interact 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 within a factory setting.

8.3.1 SimpleComm Communications Software

The Tidal Engineering SimpleComm application is an all in one communications package designed to be used with Synergy Nano environmental chambers. It provides a simple interface for sending and receiving commands over: RS-485, RS-232, IEEE 488 and TCP/IP.

The Synergy Nano supports over 130 unique commands, allowing for complete control and monitoring of your chamber from remote locations. You can find the Synergy Nano command set at the end of this manual in Appendix C Synergy Communications Command Set or on Tidal Engineering's website www.tidalengineering.com. Navigate to the Synergy Nano page and look under the general information section for the Synergy Nano Communications Commands Acrobat Reader 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 Nano page and are linked to under the Downloads section.



Installing SimpleComm

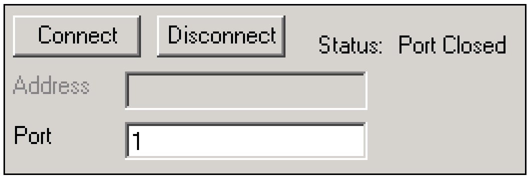
Insert the setup disk in the CD drive of your PC. Through your windows explorer, find the D drive (where D is your CD drive) and double click on the setup.exe file. Alternatively, you may select Start / Run from your desktop. Type "D:\setup" and hit Enter. Follow the directions on the screen.

Connecting SimpleComm

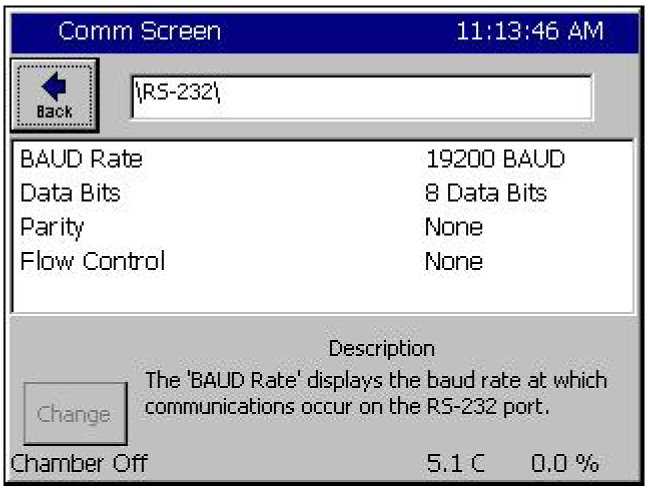
The method of connection depends on the desired mode of communications. RS-485 and RS-232 use serial cables, IEEE 488 uses a 488 cable and TCP/IP used network cables such as CAT5. Obviously the PC running SimpleComm must be connected to the chamber.

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.



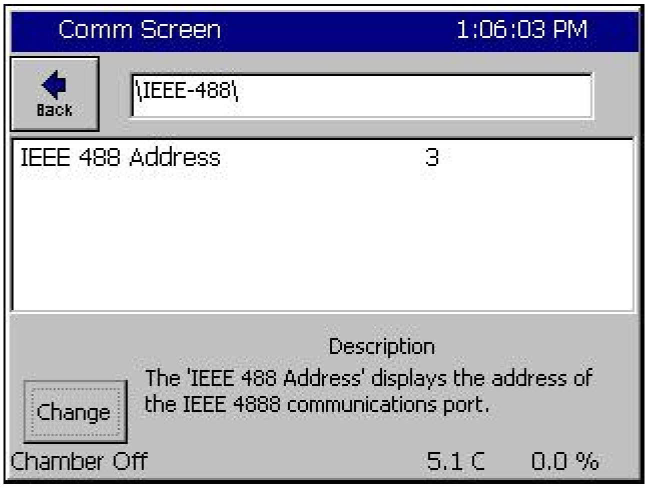
The Synergy Nano's RS-232 port settings are hard-coded to: 19200 baud rate, no parity, 8 data bits and 1 stop bit. RS-232 does not need address settings.

Once the settings are complete, press the SimpleComm's **Connect** button. The status label will read: port open.

IEEE 488

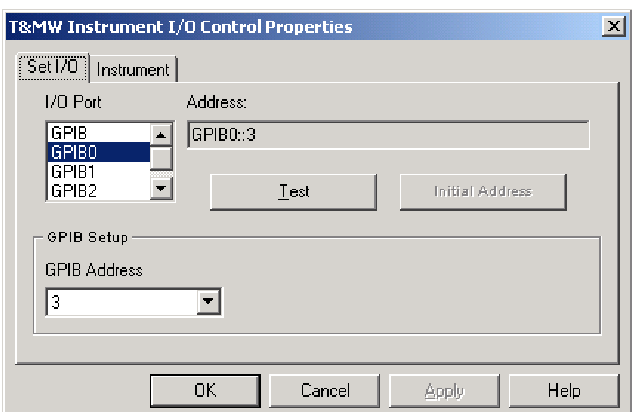
The Synergy Nano Plus supports IEEE 488 directly, the other Synerbgy Nano configurations require the option Synergy488 adapter. The following screens and setup information pertain to the Synergy Nano Plus. To communicate over IEEE 488, you will need an IEEE 488 communications card installed in your PC. Plug a 488 cable into the PC's port and connect the other end to the IEEE 488 port on the chamber.

In the SimpleComm Utility, select the IEEE 488 tab and set the port number to the same port number specified on your GPIB controller.

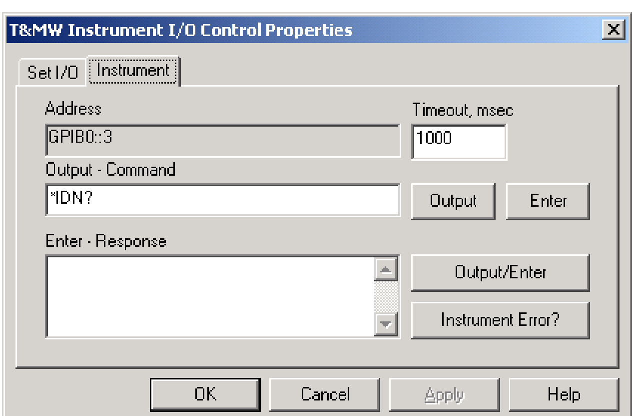


Next, set SimpleComm's 488 address to the address of the Synergy Nano.

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.



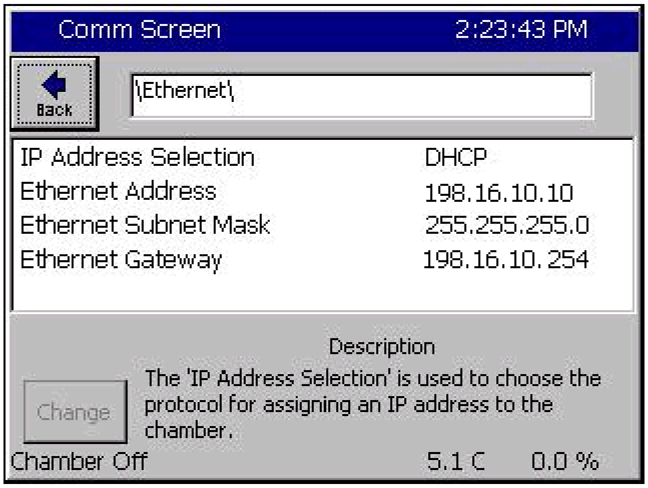
To view IEEE specific controls in the SimpleComm utility, press the **Properties** button. From this window you may view and set the GPIB port and address.



You can test the IEEE connection by pressing the Test button. This test sends the *IDN? Command to the Synergy Nano. The response will be displayed in the response test box. If there is no response it will display an error message.

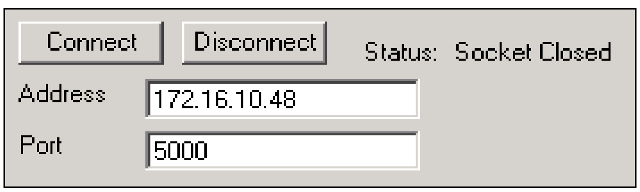
TCP/IP

To communicate over TCP/IP, connect your PC to your LAN. You must also connect your chamber to your LAN. The Synergy Nano either requires a DHCP router to dynamically assign it an IP address or your network administrator can assign you an available Static IP Address.

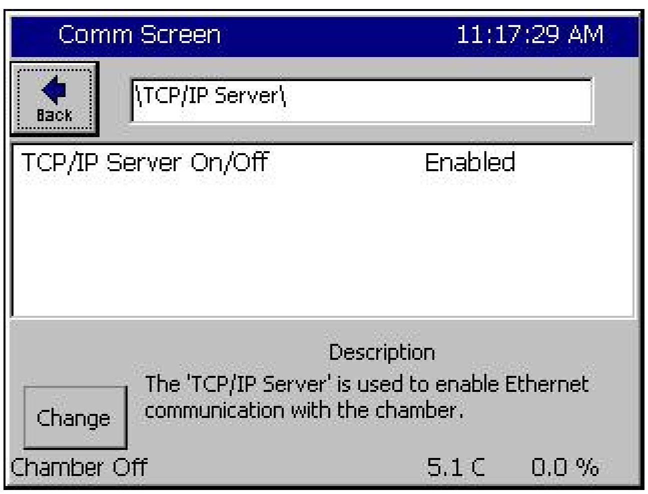


Once assigned the IP Address will appear in the Ethernet folder of the Synergy Nano.

Note: The numbers shown are examples only.



Set SimpleComm's IP Address to the address displayed on the Synergy Nano. The port for the chamber is 5000; always set SimpleComm's port to 5000.



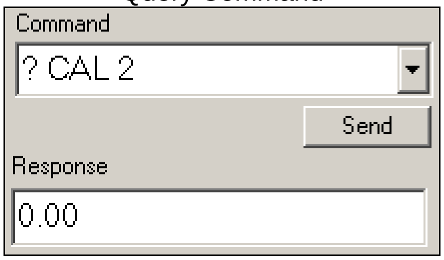
To enable the TCP/IP communications on the chamber, go to the TCP/IP Server folder and set it to Enabled.

Once the settings are complete, press SimpleComm's Connect button. Upon successful connections the status label will read "Socket Connected".

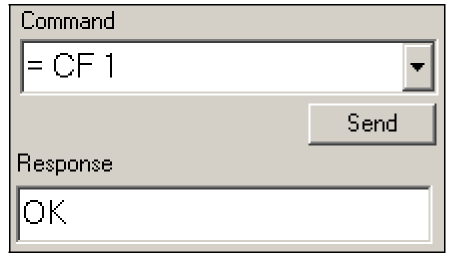
Sending and Receiving Commands

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 are preceded with a "?" and all set commands are preceded with an "=".

Query Command



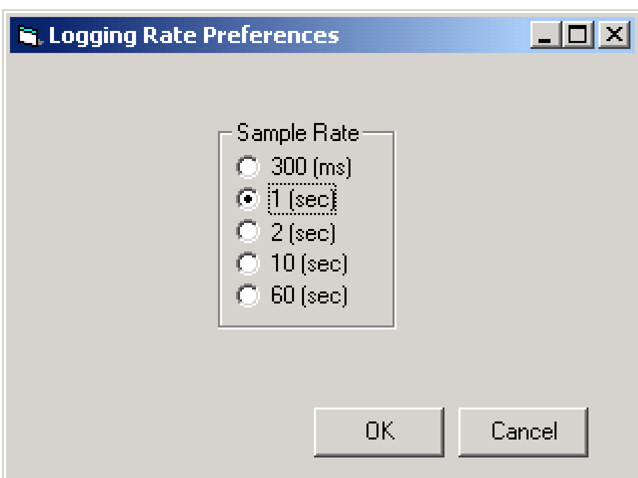
Set Command



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 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.



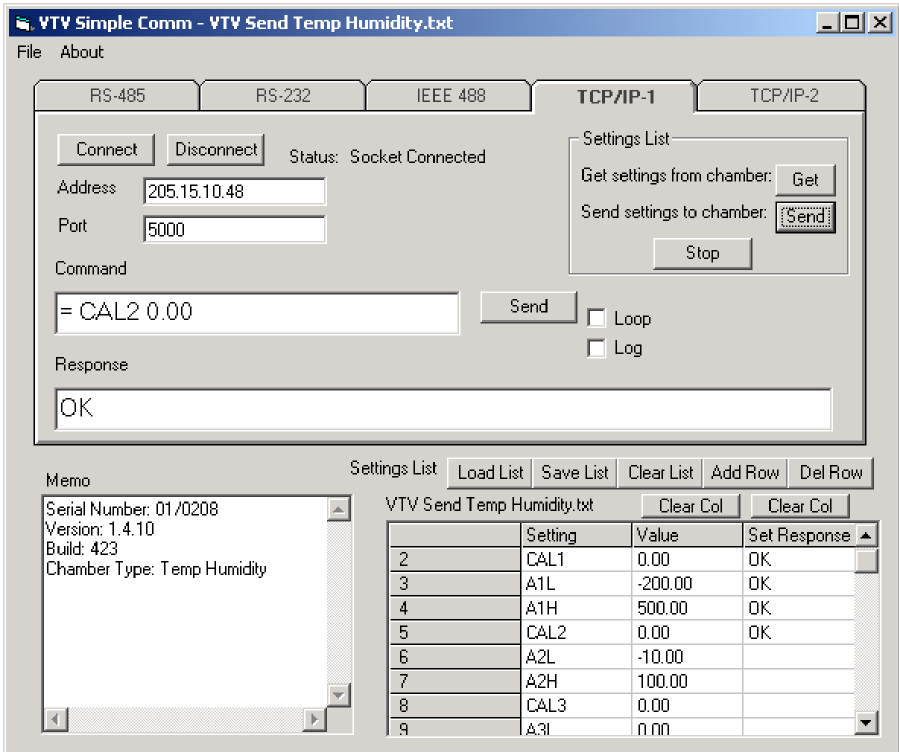
To change the sample rate, select File from the file menu and then select Preferences. Select the sample rate you desire and press OK. The default sample rate is 1 second.

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 Nano 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 of a chamber, load a Settings List that contains a ser commands and their corresponding values. 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 scale 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 2000 or higher. If you are using Windows 95, 98, ME or NT we recommend you do not overwrite any system files if asked during installation.

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
```

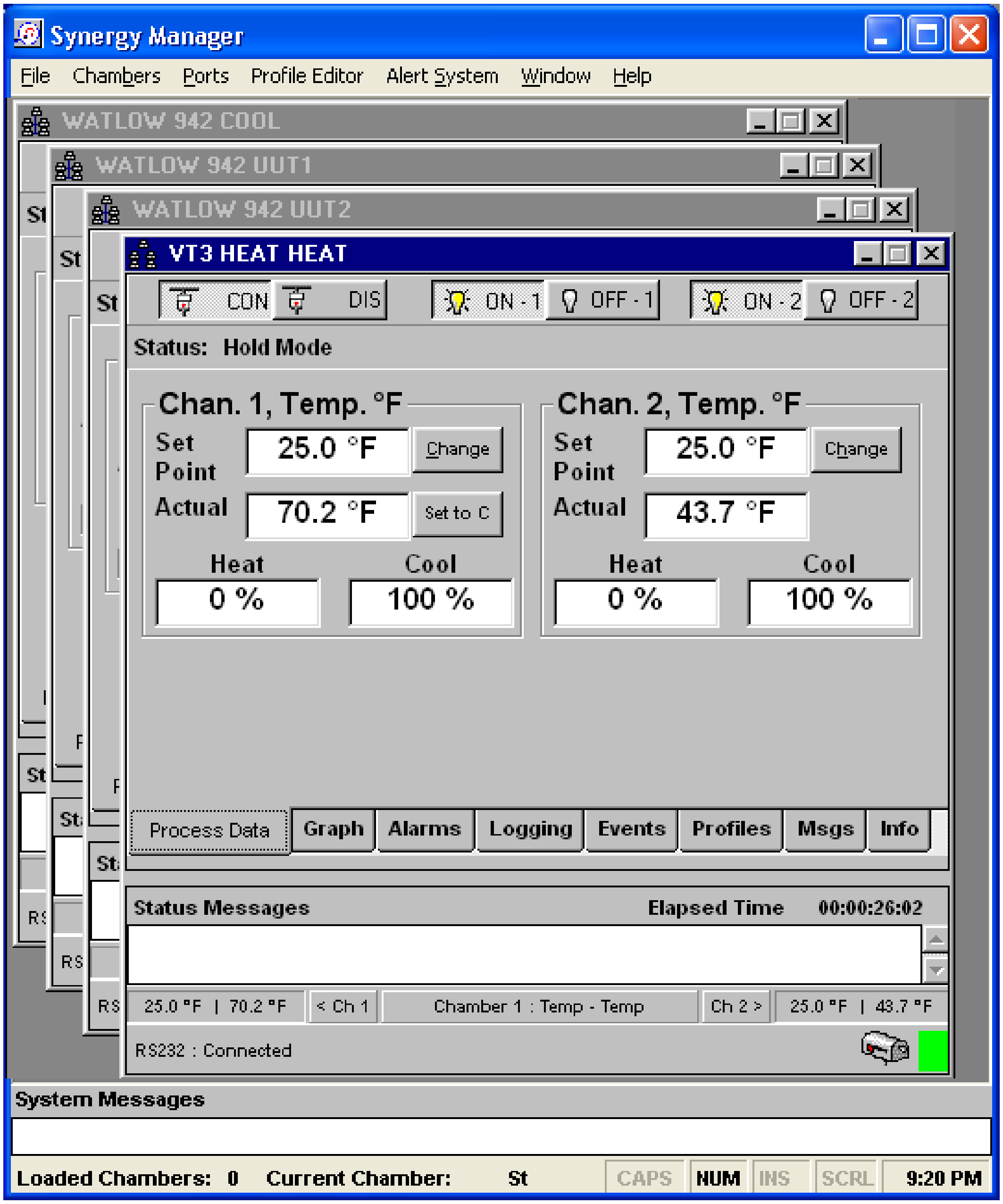
Receiving with GPIB

```
	' 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
```

8.3.2 Synergy Manager PC Based Chamber Control Software



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 more than one Environmental Chamber Window can be used at a time. Synergy Manager provides centralized remote programming, monitoring and control of multiple controllers simultaneously. Synergy Manager supports several process controllers including the Synergy Nano.

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:

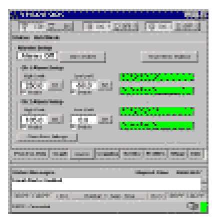
- Interactive remote control and monitoring.
- Alarm reporting and notification via Email or Fax.
- User-friendly profile program editor.
- Controller specific profile download.
- Importing and exporting of Synergy Nano profiles via USB Flash Diskk.
- Logging, printing and graphing of process data, and External UUT process Data (Synergy Nano 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.
- Dsplays 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

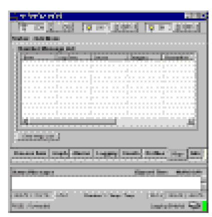

Graph


Alarms


Logging


Events

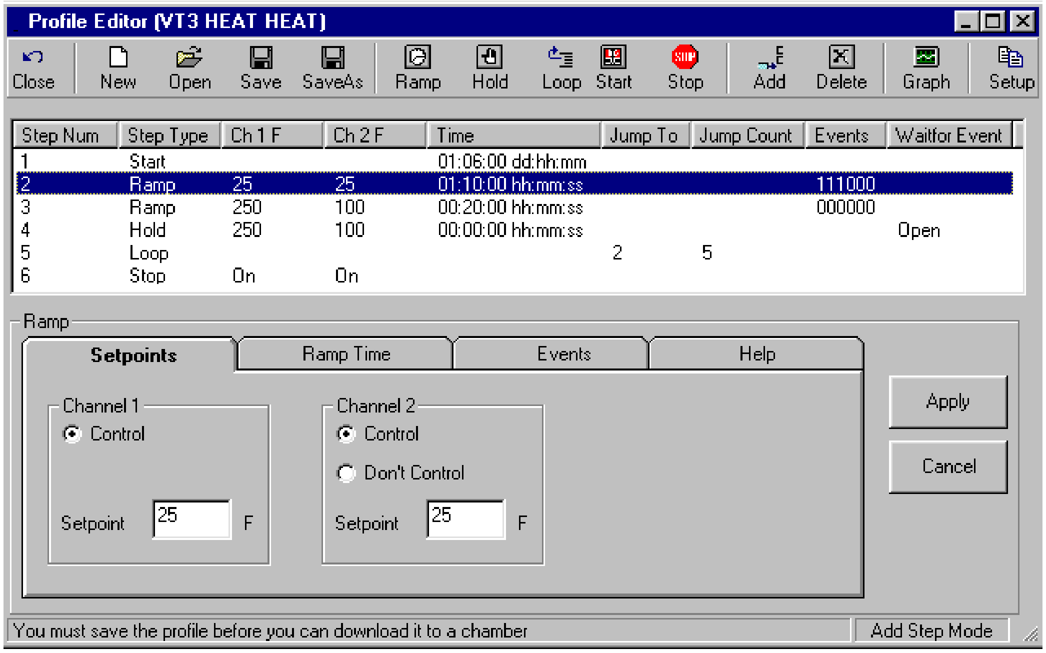

Profiles


Messages

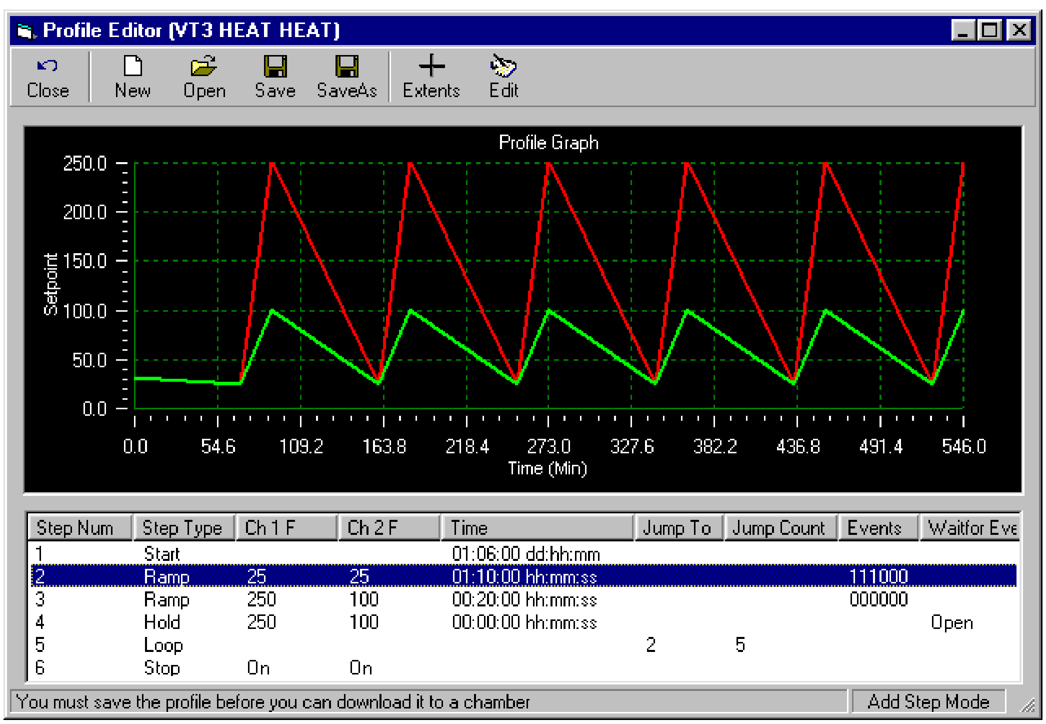

Information

- **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.

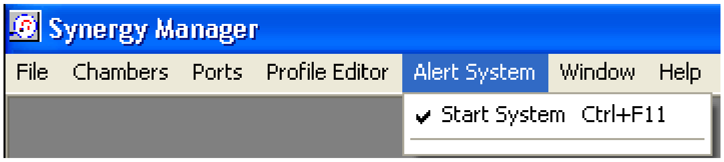
Profile Editor: Write profiles once and run anywhere



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 Nano can load profiles created by Synergy Manager via any supported communications method or through the 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, Microsoft 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.

External 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

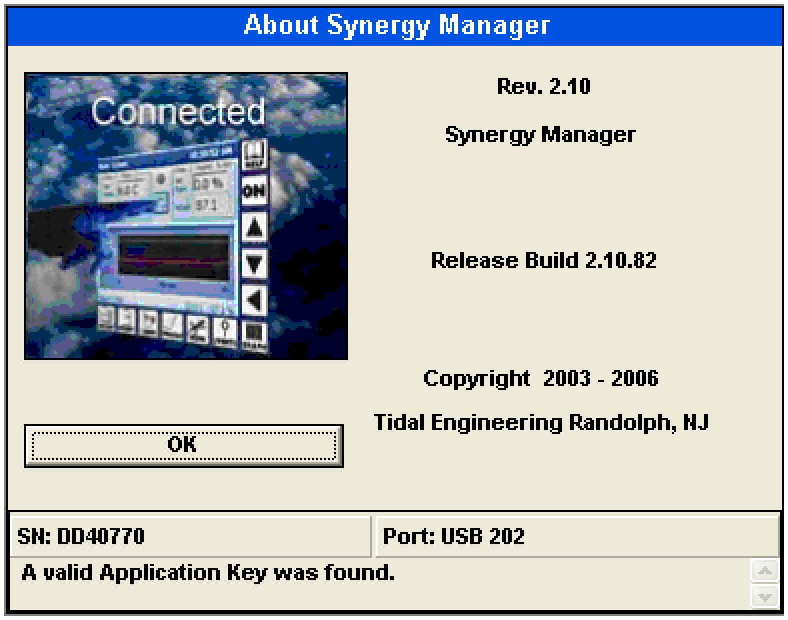
* For Windows™ 95, Operating system must support USB ports, OSR2 version is needed.

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

If 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 Nanos 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.*

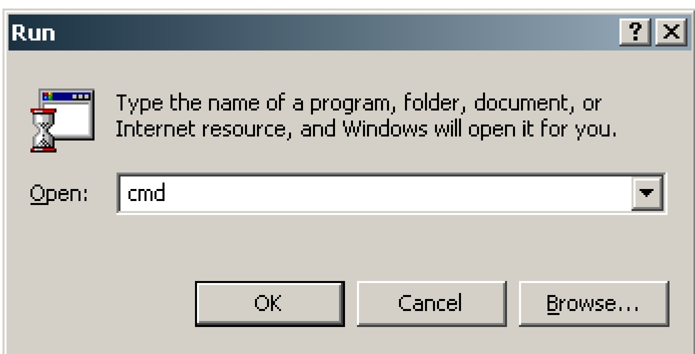
Note: The features listed are valid for Synergy Manager Version 1.25.x.

8.3.3 Ethernet MAC Address

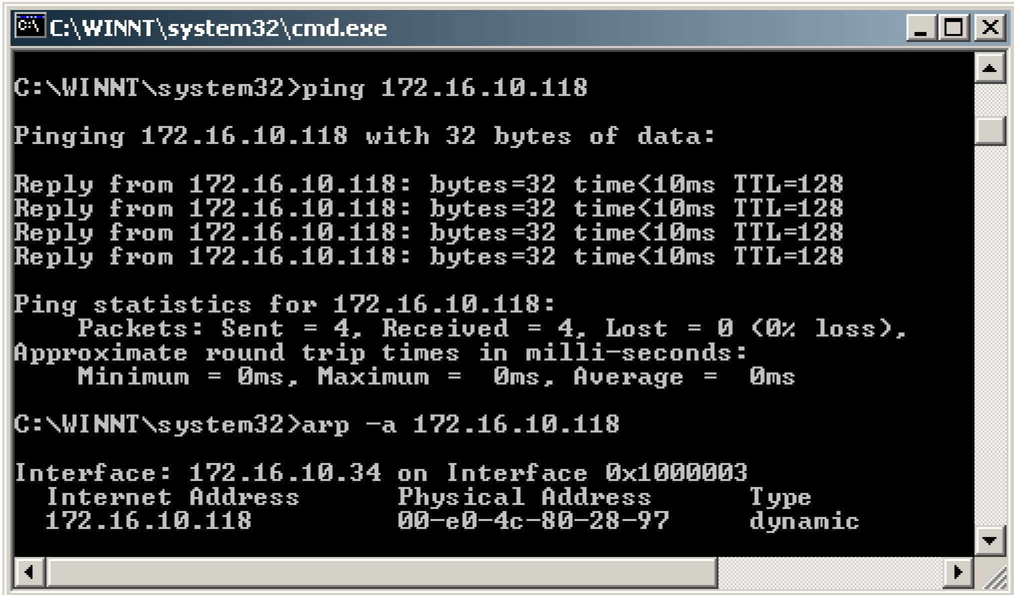
If your network employs a DHCP server you may find that your chamber has been assigned a different IP Address when the DHCP server IP lease expires. Your network administrator can assign a specific and persistent IP Address to your chamber if he has the Synergy Nano's MAC Address, an identification number that uniquely identifies your controller. You can determine the Synergy Nano'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 Nano unit to your network and apply power.
2. Determine the IP address of the Synergy Nano 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.



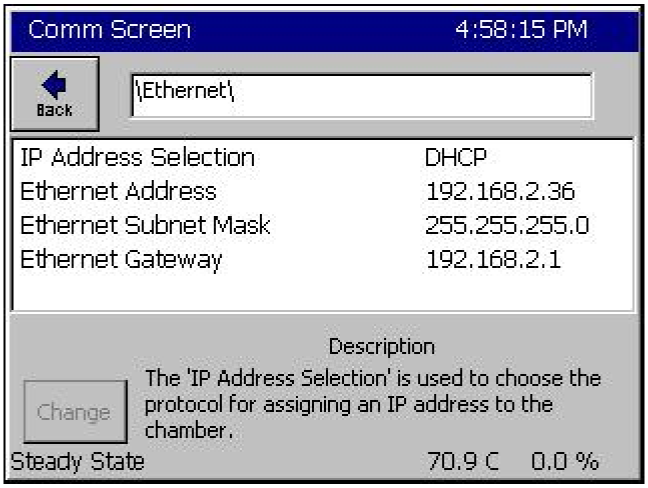
5. Verify the network connection to the Synergy Nano by typing "ping ###.###.###.###" where the # signs represent the Synergy Nano unit's IP Address.
6. In the Command window type "arp –a ###.###.###.###", again replacing the # signs with the Synergy Nano's IP Address.
7. The "arp" command will respond with the Internet Address and the Physical Address (MAC Address) of the Synergy Nano 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 Nano to Your Network

Plug a network patch cable into your Synergy Nano and the other end into your hub or router. Make sure it is powered on then boot your Synergy Nano. If your Synergy Nano is set to DHCP it should be assigned an address automatically.

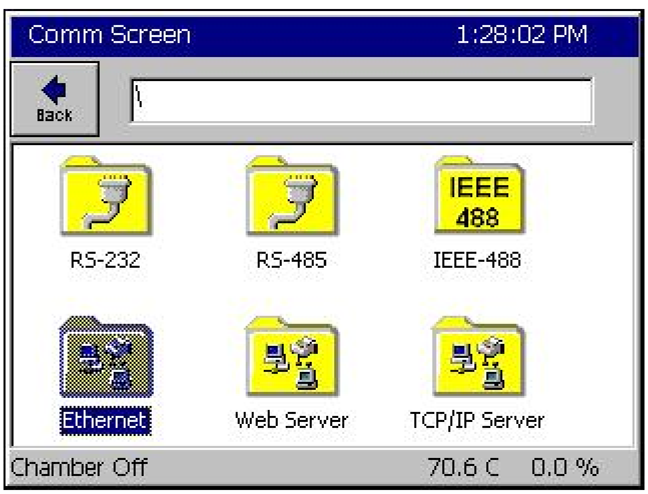


Verify DHCP IP Addressing

To confirm that the Synergy Nano 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 Nano over Ethernet.

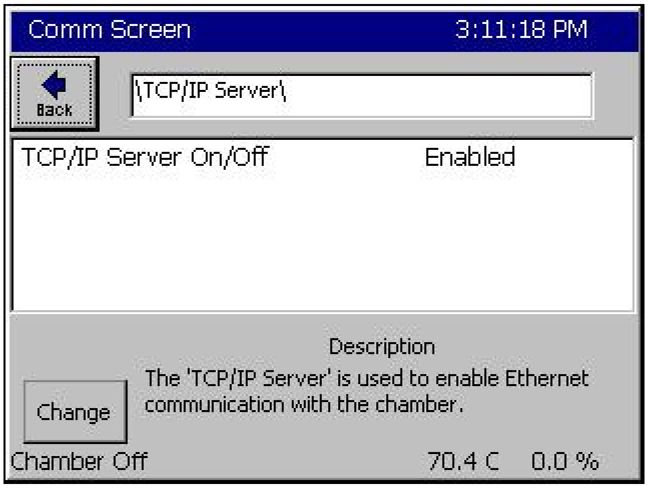
If the addresses are blank or 0.0.0.0 then the Synergy Nano did not obtain an IP address from the DHCP router. If this is the case, review the previous sections to make sure you have set up the DHCP router properly. If that doesn't solve the problem, verify the settings with your network administrator.



Synergy Nano TCP/IP Server Setup

To set up the Synergy Nano for ASCII commands over TCP/IP, press the ***COMM*** button at the bottom of the Synergy Nano'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 Nano is now configured to accept ASCII commands over TCP/IP.

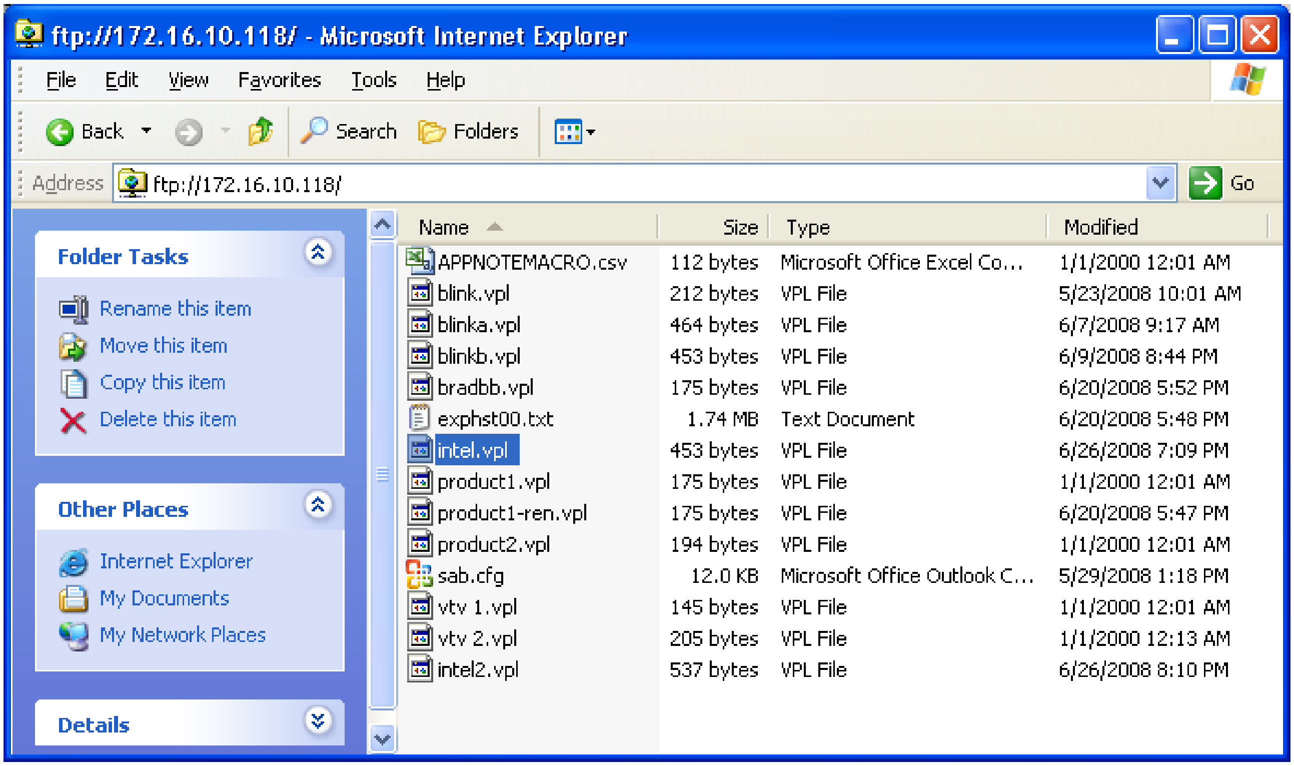
Note: The Web Server is enabled separately from the TCP/IP Server. To enable the Web Server please review Section 8.1.7 Communications: Operator Interface: Web earlier in this manual.

Communicating over TCP/IP

Your Synergy Nano 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 Nano, please review the Trouble Shooting entries earlier in this section.

8.3.4 Synergy FTP Server



Introduction

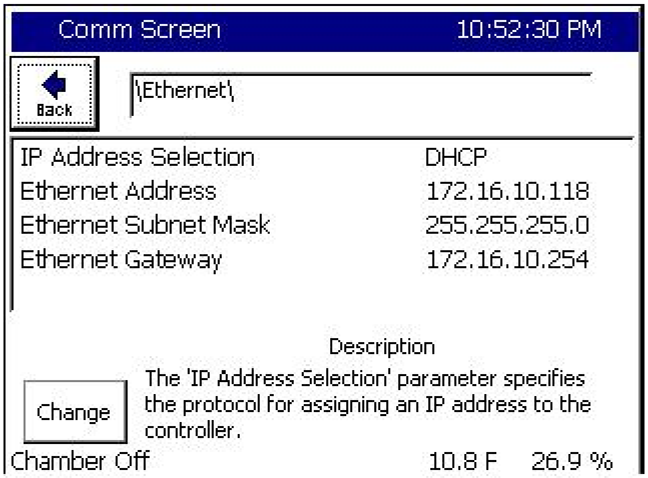
This Synergy Controller features an FTP server. With the FTP server feature, chamber profiles or recipes (VPL files) can be copied to and from the controller, deleted from the controller or renamed, all over the network. In addition the history log file can be retrieved from the controller over the network.

FTP is a file transfer protocol for exchanging and manipulating files over any TCP-based computer network. A FTP client may connect to a FTP server to manipulate files on that server. Note that the Synergy Controller FTP feature described here may not be available on all controllers. Contact the factory to find out if your controller supports this feature. Controller upgrades are available.

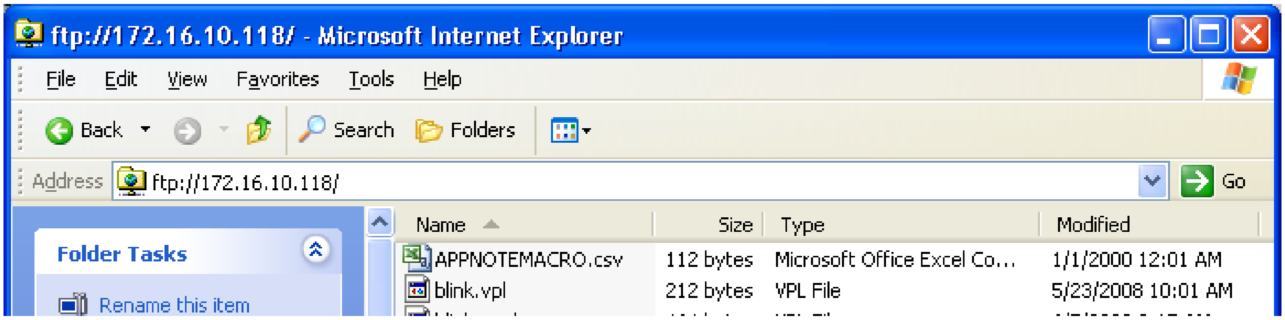
Accessing the Synergy Controllers' FTP Server
The FTP server can be accessed both using an FTP client such as Internet Explorer (IE) or programmatically. The examples below use the first method.

Accessing the controller's FTP server programmatically is beyond the scope of this application note however many application environments support this capability including .NET and LabVIEW. In Microsoft .NET 2.0 for example, you can now programmatically access FTP servers using the FtpWebRequest and FtpWebResponse managed classes.

To access the Synergy Controllers FTP server using IE, first configure the controller network properties from the COMM Screen's Ethernet folder as shown below:



Then type the Controller's IP address in the format ftp://172.16.10.118 in the browser's address bar and press enter. The controller's public directory will be displayed as shown below.



The public directory contains the following file types:

1. Controller Profiles. These use the .VPL file extension
   for example: product1.vpl

   The Controller Profiles are the programs or recipes that control the chamber's process variables such as temperature vs. time profile.

2. Configuration files. These use the .CFG filename extension.
   for example: sab.cfg

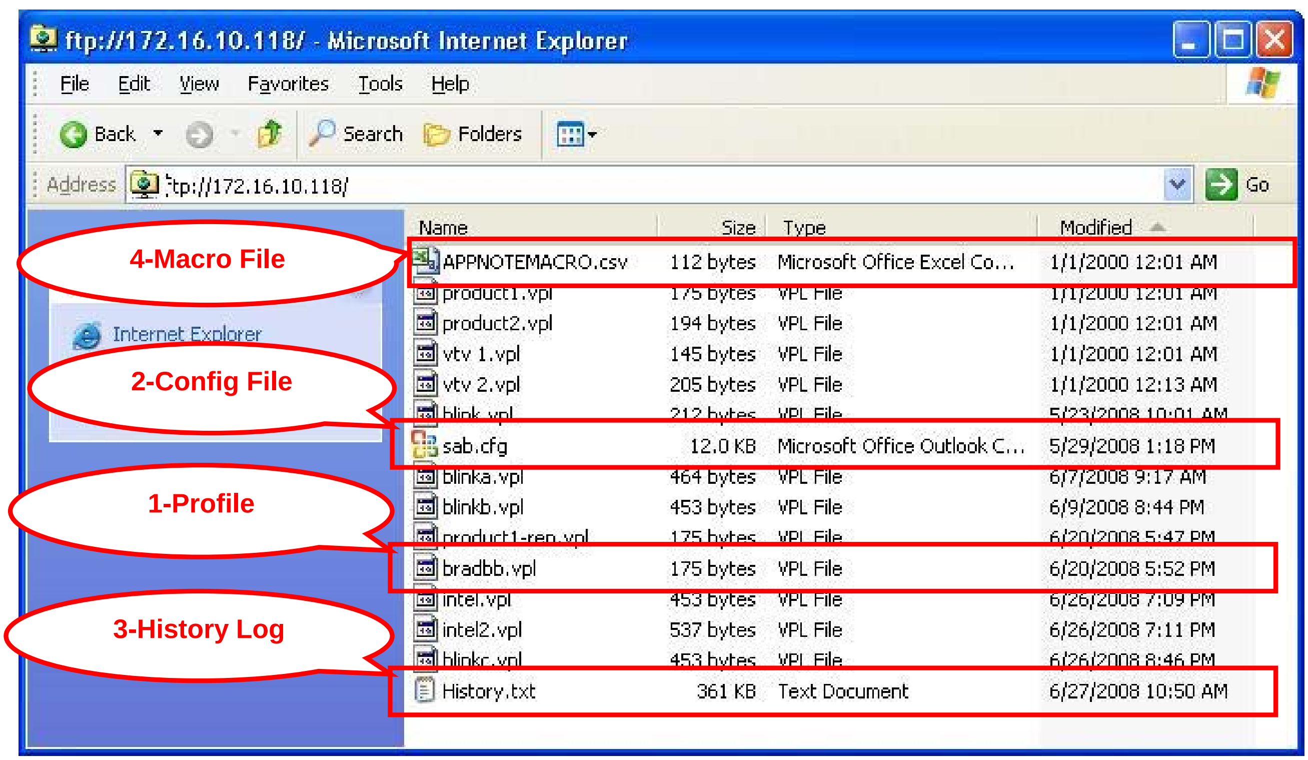
   A Configuration file is a database of the chamber's setup and calibration that can be backed-up and restored using the appropriate folders in MAINTenance screen.

3. History Log file. This uses the .TXT filename extension.
   for example: History.txt

   The History Log file is a CSV formatted ASCII file that contains the log data specified in the Log Setup folder as well as Alarm and Profile event history.

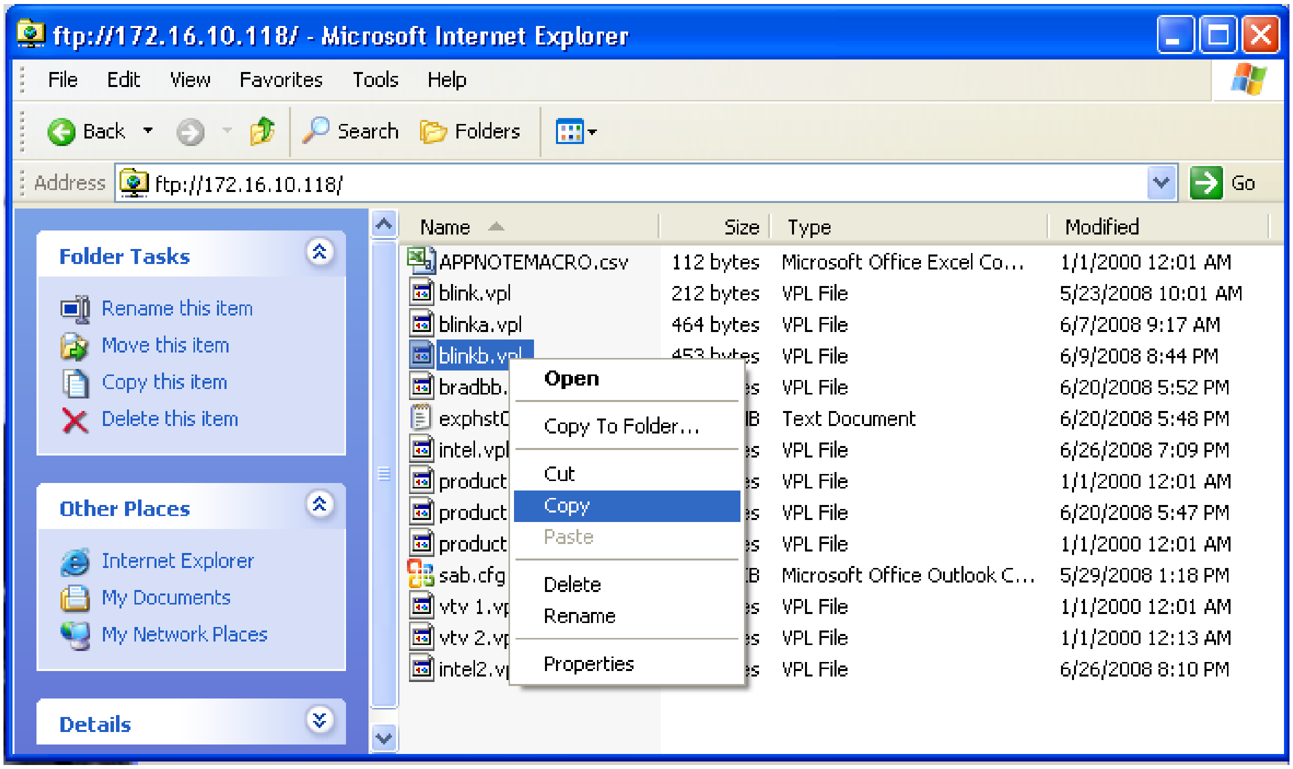
4. Macro file. This file uses the .CSV extension.
   for example: APPNOTEMACRO.CSV

   The Macro file is a CSV formatted ASCII file that contains the controllers MACRO definitions which can be triggered using the controller's Bar Code Reader feature.

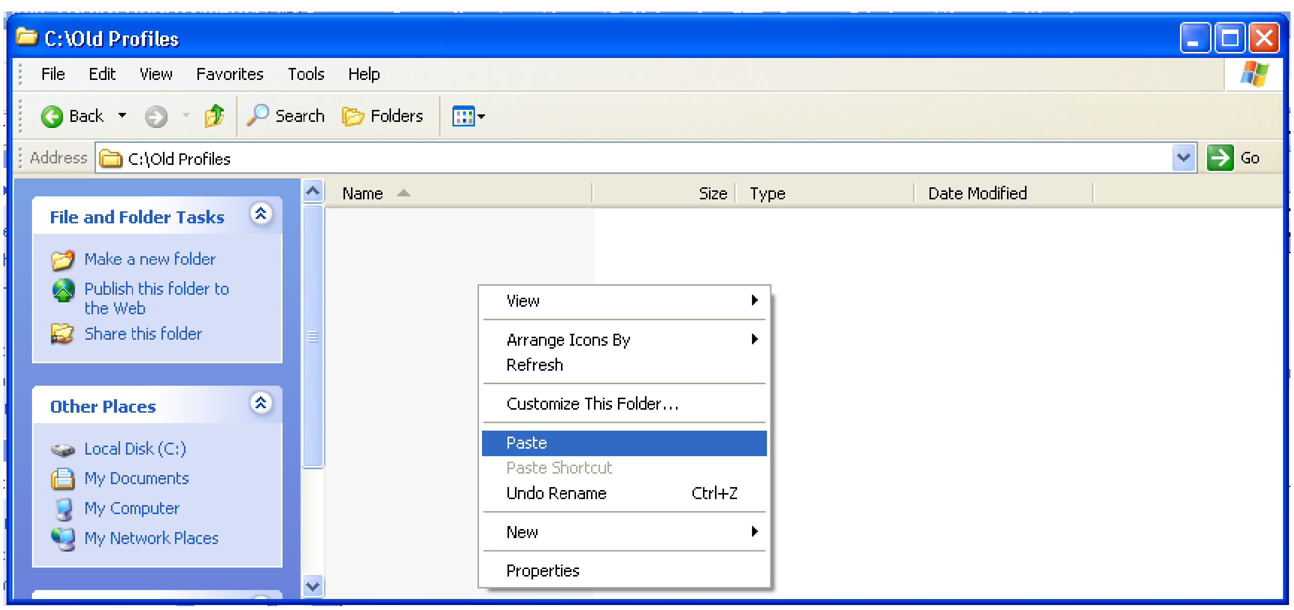


Using the FTP server to transfer VPL files from the controller to the PC

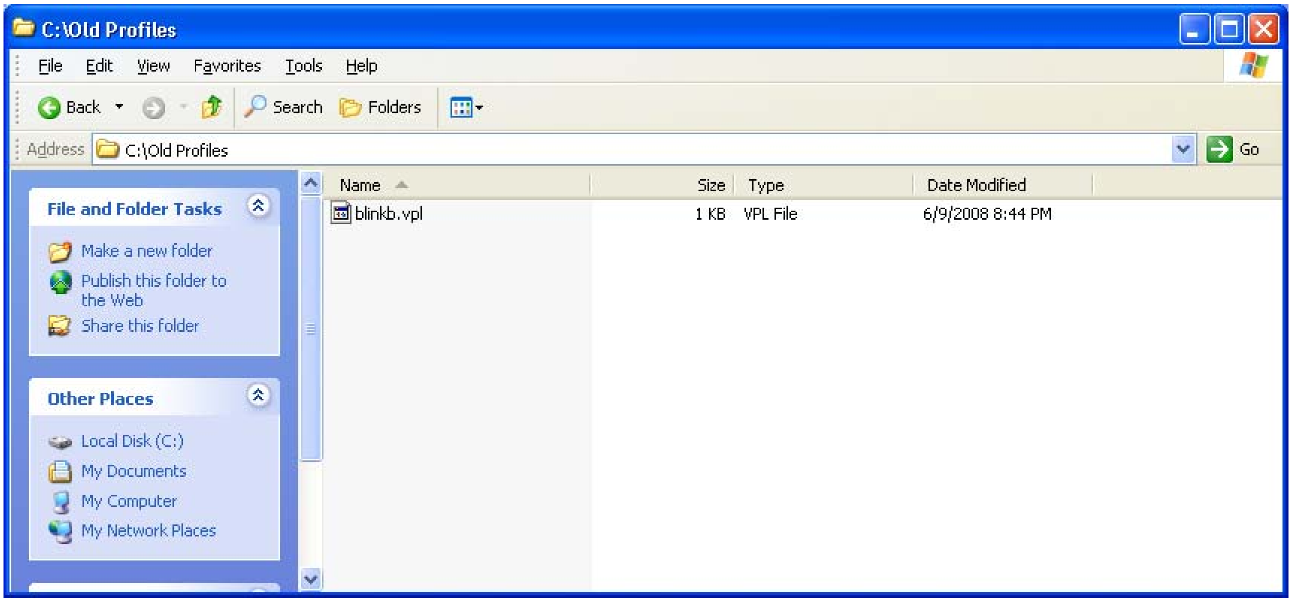
The FTP server can be used to copy VPL files from the controller to another computer on the network. To copy VPL files, Click on the file of interest in the FTP client with the right mouse. The file menu will appear. Select Copy as shown below.



Then browse to the destination folder on the PC, Right Click and select Paste as shown below.

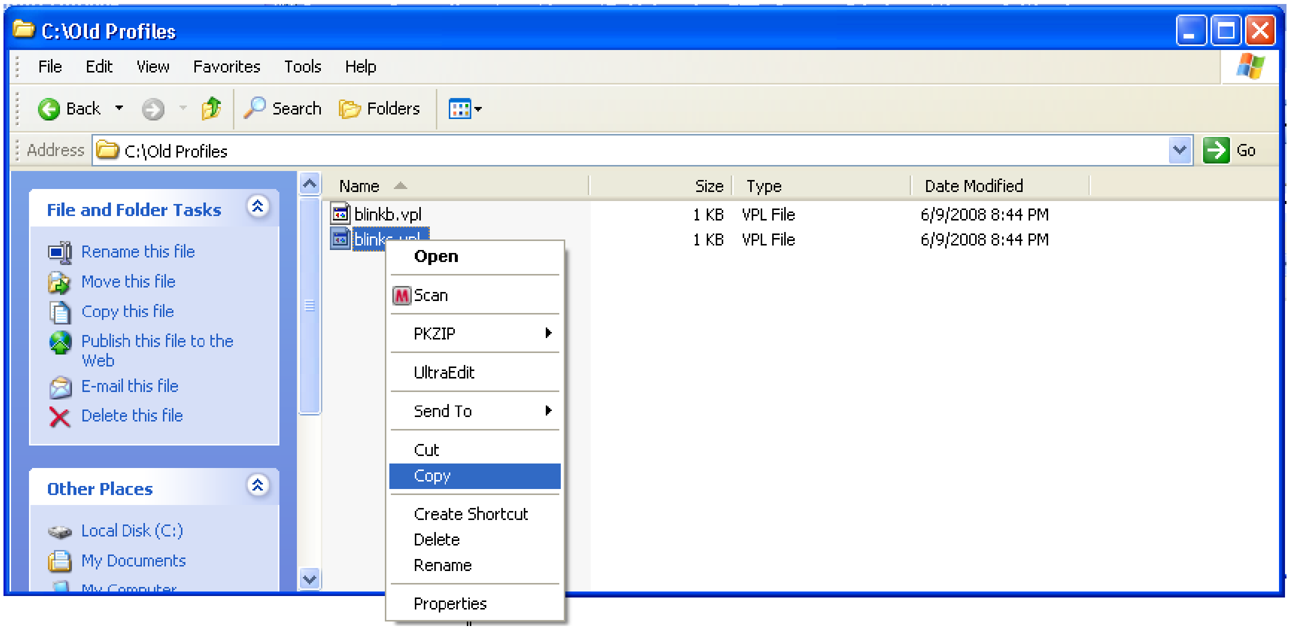


The copied file will appear in the folder on the PC as shown below.

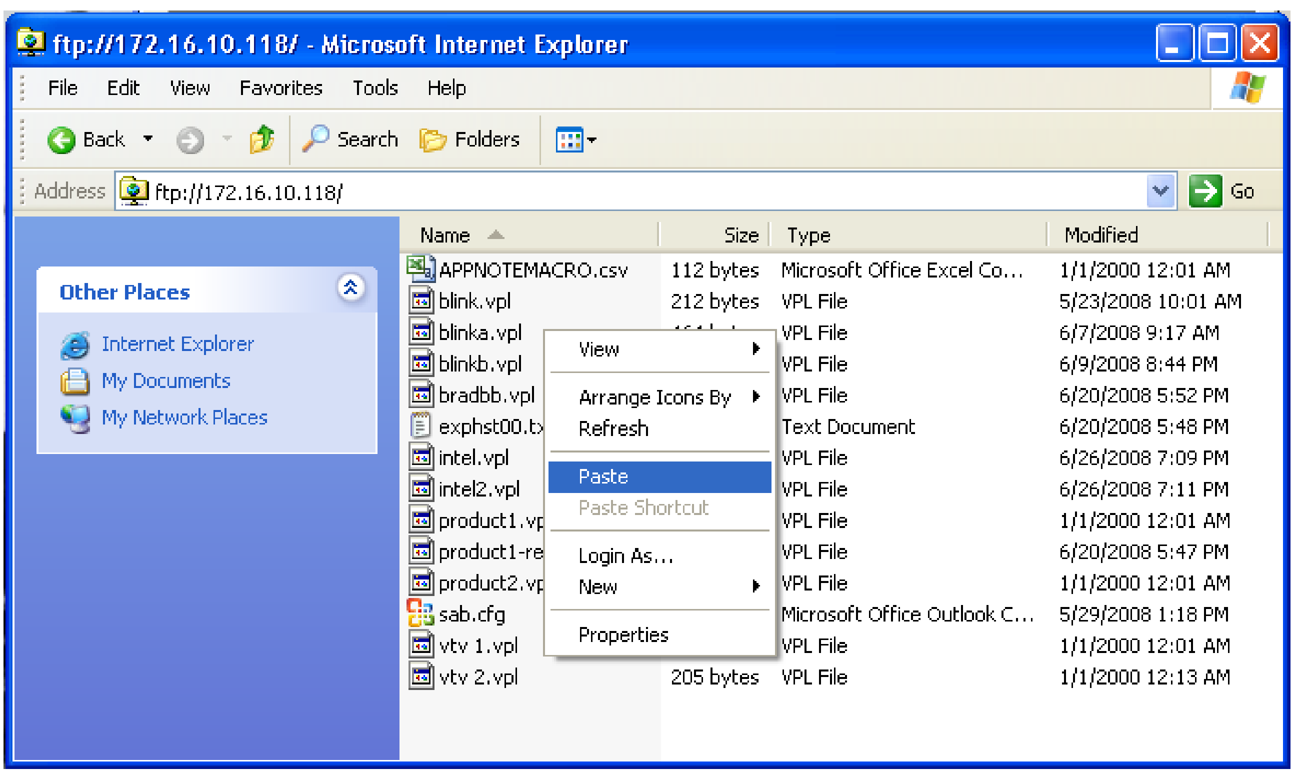


Using the FTP server to transfer VPL files from the PC to the Controller

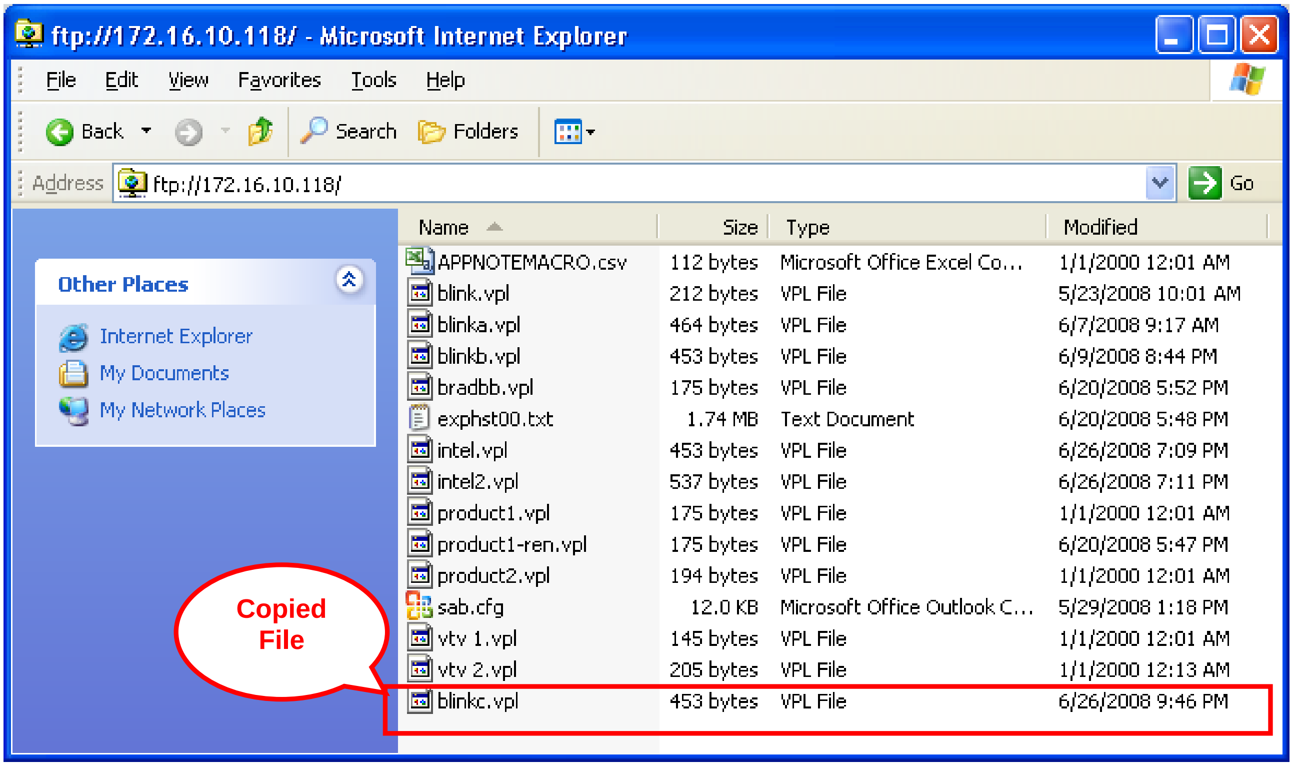
The FTP server can be used to copy controller profiles (VPL files) from the PC to the Controller thru the network as follows: Browse to the source folder on the PC, Right Click on the source file and select Copy from the menu as shown below.



Then browse to the FTP client, Right Click in the file area and select Paste from the menu.



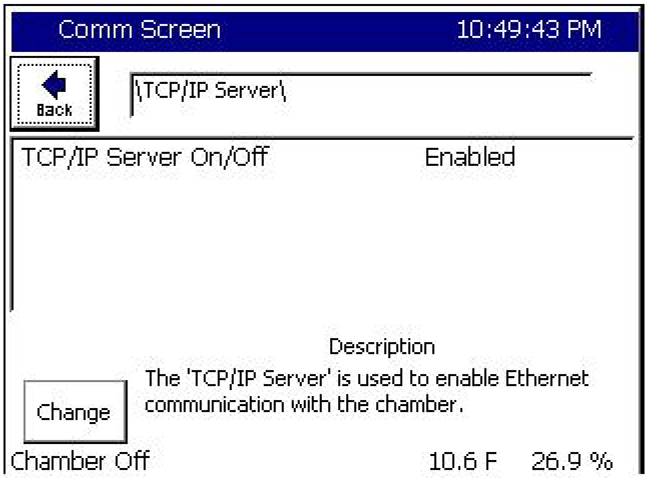
Now the new file can be seen in the FTP client window, the IE browser in this case, as shown below. Note that you may have to press F5 or select the View/Refresh menu to refresh the file list to see the newly copied file.


ftp://172.16.10.118/ - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Folders
Address ftp://172.16.10.118/ Go
Other Places
Internet Explorer
My Documents
My Network Places
Copied File
Name Size Type Modified
APPNOTEMACRO.csv 112 bytes Microsoft Office Excel Co... 1/1/2000 12:01 AM
blink.vpl 212 bytes VPL File 5/23/2008 10:01 AM
blinka.vpl 464 bytes VPL File 6/7/2008 9:17 AM
blinkb.vpl 453 bytes VPL File 6/9/2008 8:44 PM
bradbb.vpl 175 bytes VPL File 6/20/2008 5:52 PM
exphst00.txt 1.74 MB Text Document 6/20/2008 5:48 PM
intel.vpl 453 bytes VPL File 6/26/2008 7:09 PM
intel2.vpl 537 bytes VPL File 6/26/2008 7:11 PM
product1.vpl 175 bytes VPL File 1/1/2000 12:01 AM
product1-ren.vpl 175 bytes VPL File 6/20/2008 5:47 PM
product2.vpl 194 bytes VPL File 1/1/2000 12:01 AM
sab.cfg 12.0 KB Microsoft Office Outlook C... 5/29/2008 1:18 PM
vtv 1.vpl 145 bytes VPL File 1/1/2000 12:01 AM
vtv 2.vpl 205 bytes VPL File 1/1/2000 12:13 AM
blinkc.vpl 453 bytes VPL File 6/26/2008 9:46 PM

Retrieve the Controller's history log file using the FTP server

The FTP server can be used to retrieve the history log file from the controller. Retrieving the history log file from the controller uses the same procedure described previously for copying a controller profile from the controller. The only difference is that the log database is not stored on the public directory and is copied there using a controller command.

There are two communication commands that control the history log file and history database. These commands can be sent using Telnet as well as using GPIB and RS-232. The controller's Telnet interface is used in these examples. This interface is enabled from the COMM screen's TCP/IP Server folder as shown below.



History commands are available to clear the history database and to copy the history log file to the VPL folder.

The Clear History command deletes all of the data in the history database on the controller.
The command syntax is:

= clearhist 1

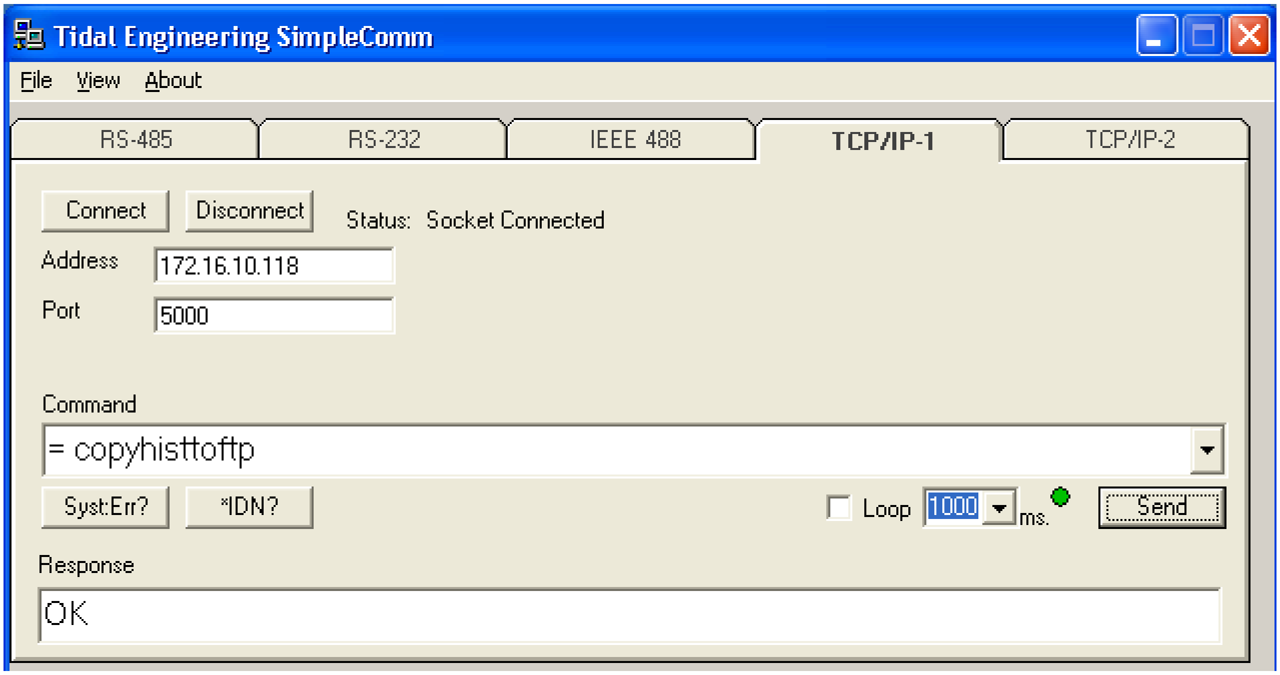
The Copy History command copies the history database to the public folder as History.txt so it can be downloaded via FTP.

The command syntax is:

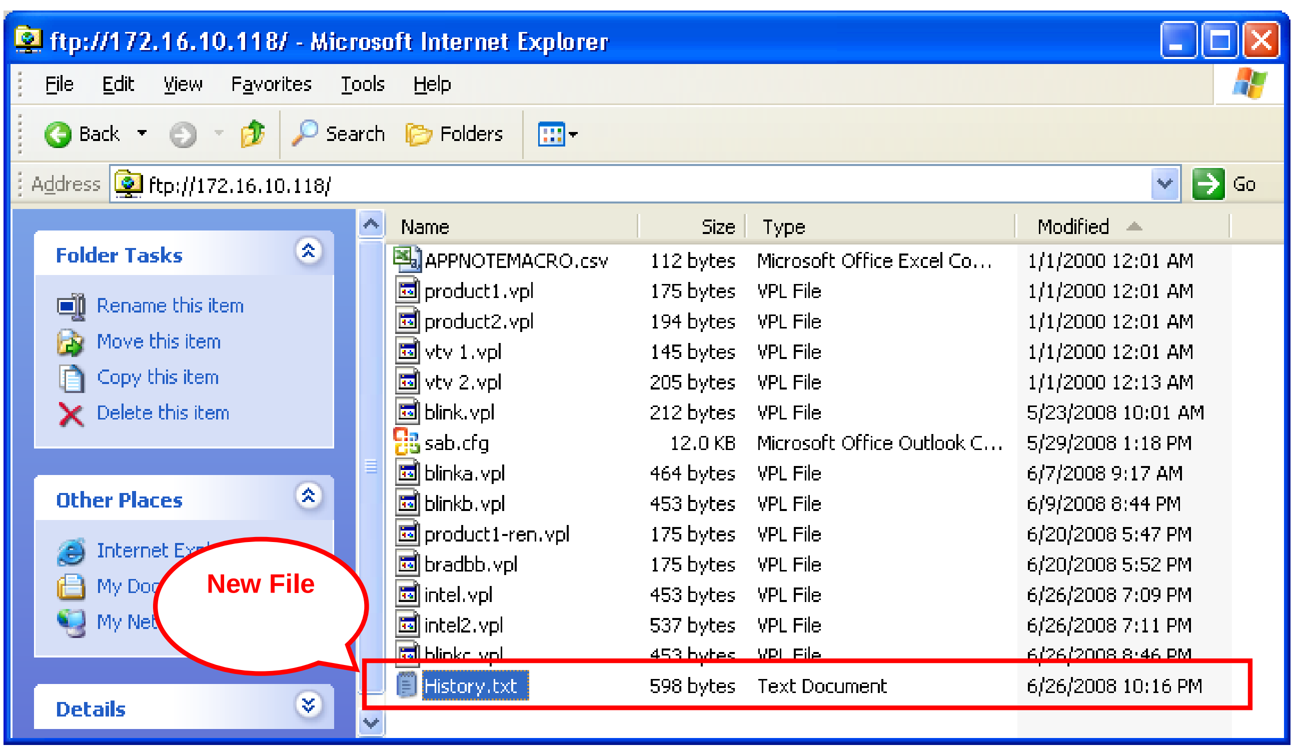
= copyhisttoftp

The following examples demonstrate the use of these commands. Note that the free SimpleComm terminal program available from www.TidalEng.com is used in these examples to send the History commands using Telnet.

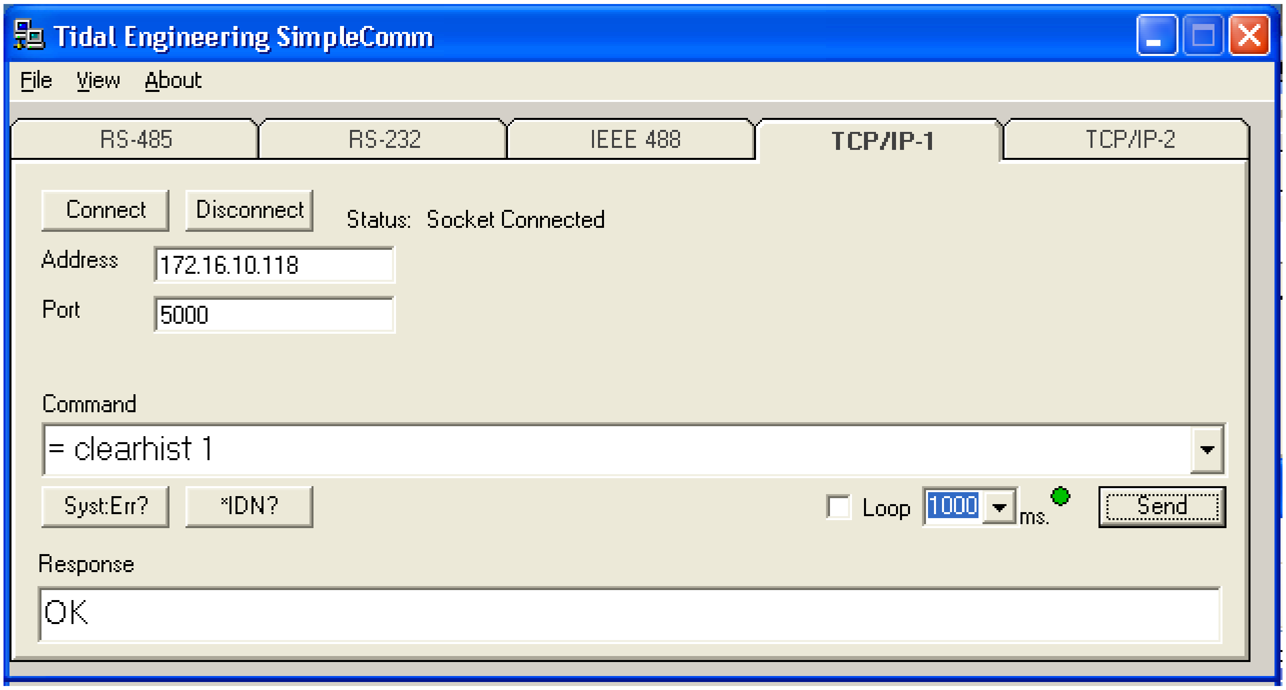
To create the history log file History.txt and copy it to the public directory, Type the command, "= copyhisttoftp" in the Command text box and press the Send button as shown below: Note that the Controller Responds with "OK".



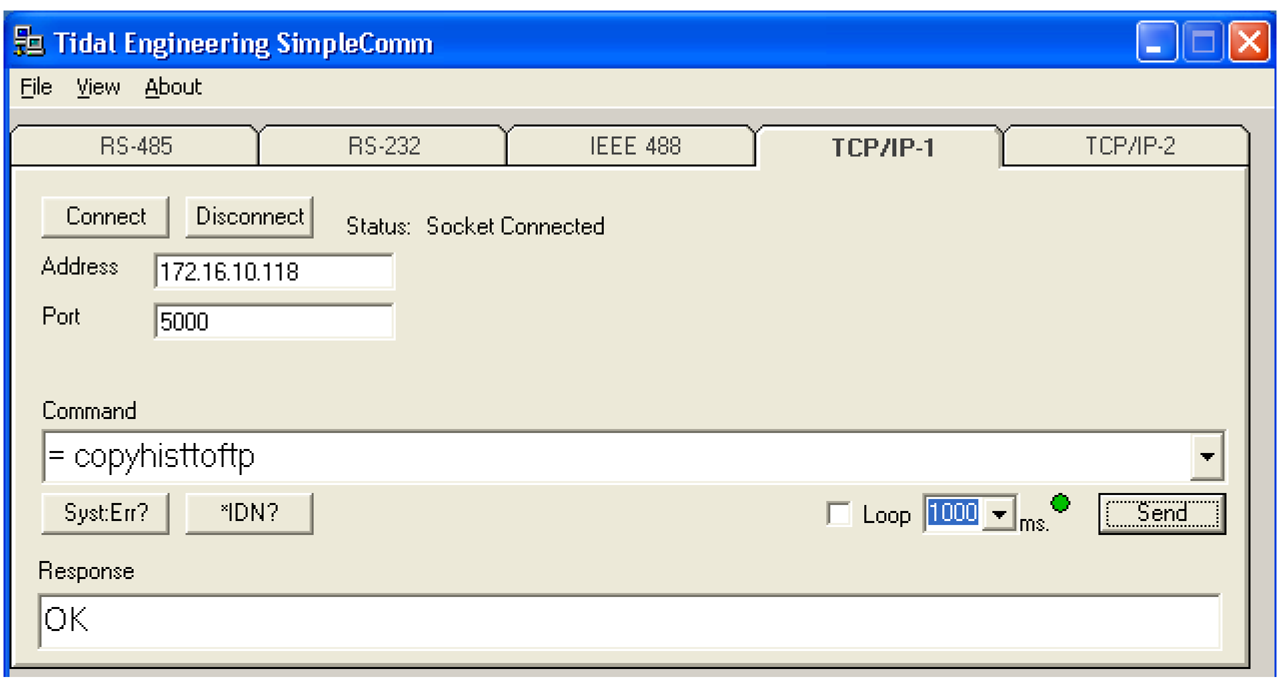
Now the file History.txt can be seen in the FTP client as shown below. Note that you may have to press F5 or select the View/Refresh menu in the FTP client to refresh the file list to see the new file.



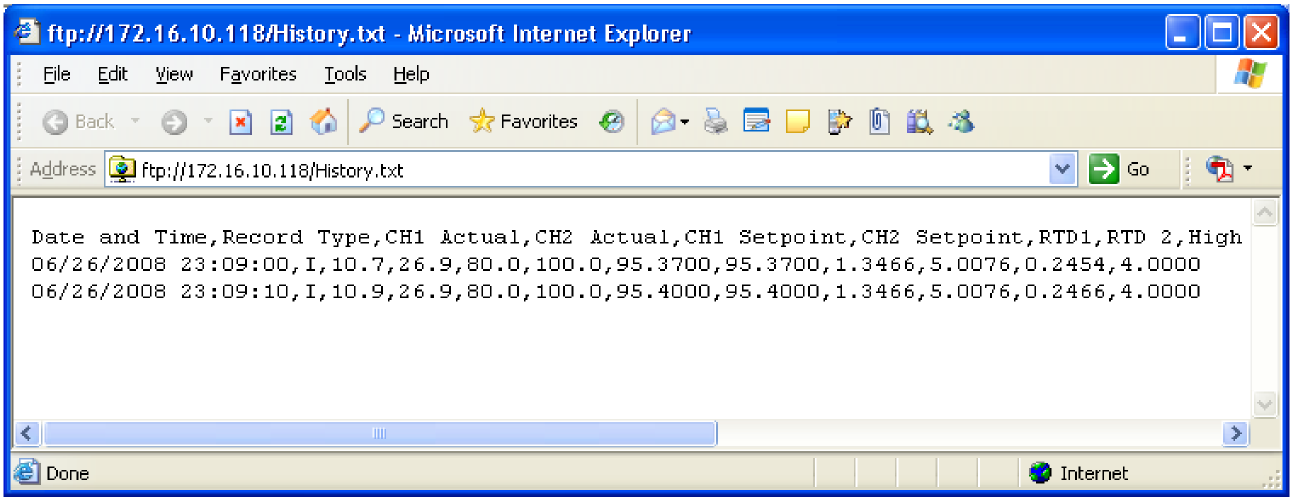
To clear the history database, type the command, “= clearhist 1” in the Command text box and press the Send button as shown below:
(Note that this command doesn’t effect the History.txt file in the public directory)



To examine the history database contents, type the command, “= copyhisttoftp” in the Command text box and press the Send button. This will export the history database to the History.txt file.

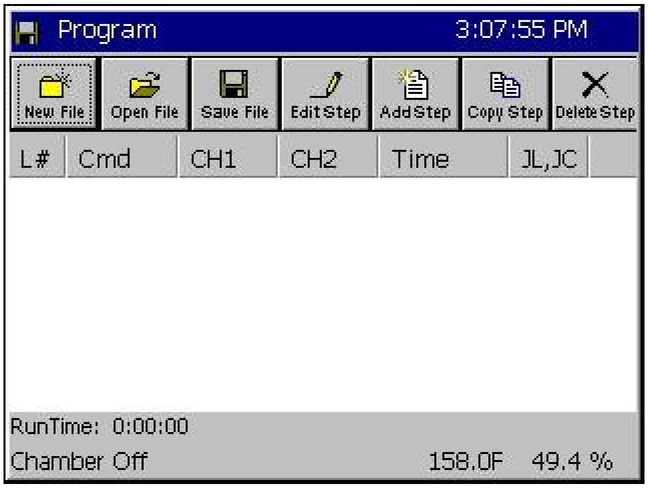


Now you can examine the History.txt file as shown below. Note that it only contains new records.



9.0 PROGRAMMING THE SYNERGY NANO

The Synergy Nano provides a powerful and easy to use program editor that can be used to create sophisticated multi-channel profiles of Temperature, Humidity, etc. versus time. These programs also known as profiles or recipes are created using the Program Screen.



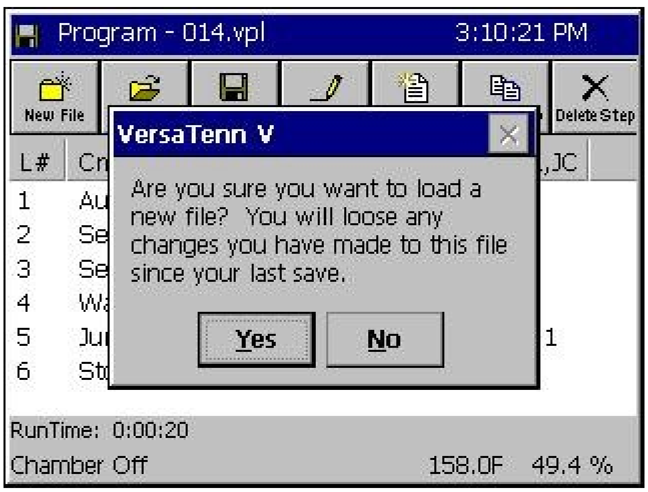
Program Screen

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 Floppy*)
- Save File (To Storage Card, or Floppy*)
- Edit Step (Edit Step Wizard assists you)
- Add Step (Add Step Wizard assists you)
- Copy Step (Part of Edit Step Wizard)
- Delete Step

*Floppy on Synergy V and Compact only.

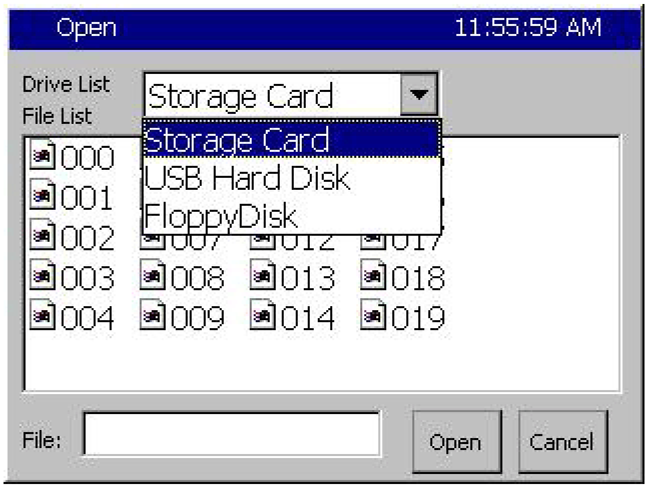
9.1 *Loading a File: From Storage Card, USB Hard Disk or Floppy*



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

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 you can't add or edit profiles from the Run screen.



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

Note: The Storage Card is the Synergy Nano's internal Flash memory.

- Select the desired file from the File List that appears.
- Press the ***Open*** button. The Program screen will appear with the listing of your file. Open the ***Run*** screen to start running your program. See Section 9.7 Programming the Synergy Nano: Running a Program for details.

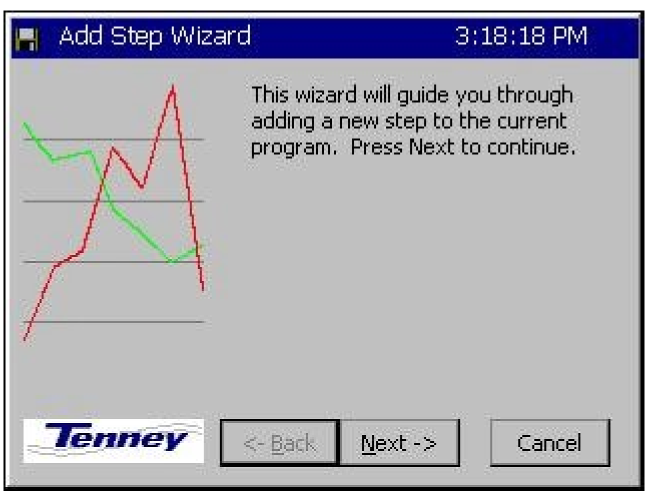
9.2 Creating a New Program: Add Step Wizard Feature

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

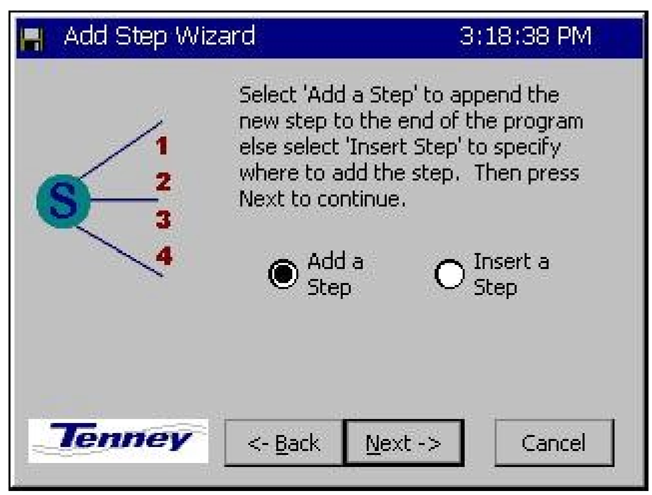
To create a new program, first press the ***New File*** button. If a file is already open, a window will appear as shown above in Section 9.1. For the purpose of demonstration, to add a setpoint step, press the ***Add Step*** button and proceed as shown below in the **Add Step Wizard** demonstration.

Add Step Wizard Walkthrough:

1. Start →

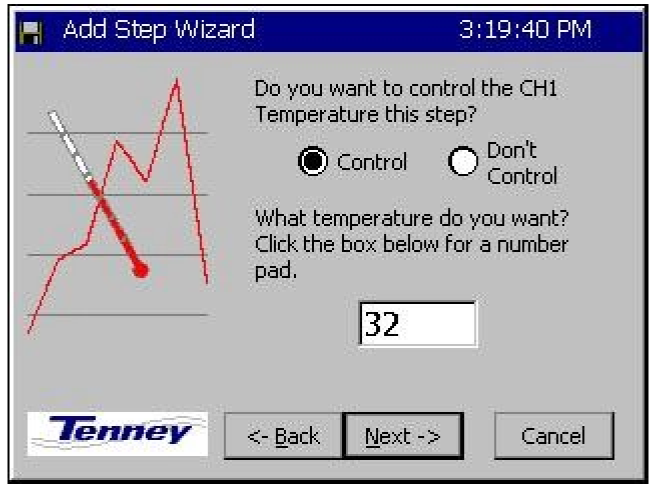


2. Select Add Step or Insert Step →



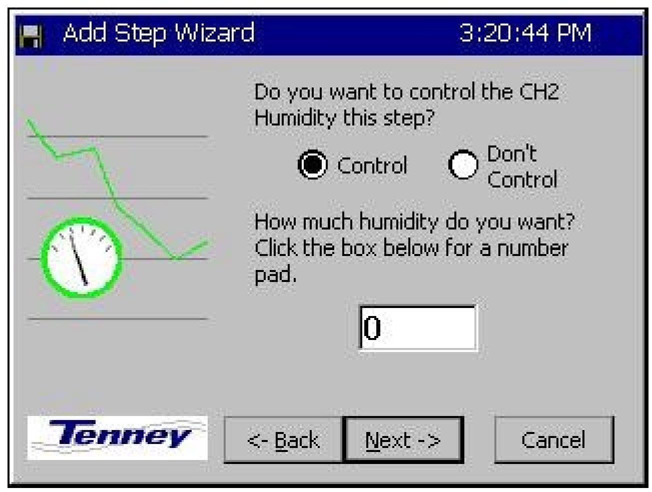
3. Select Step Type →

4. Temperature Control →



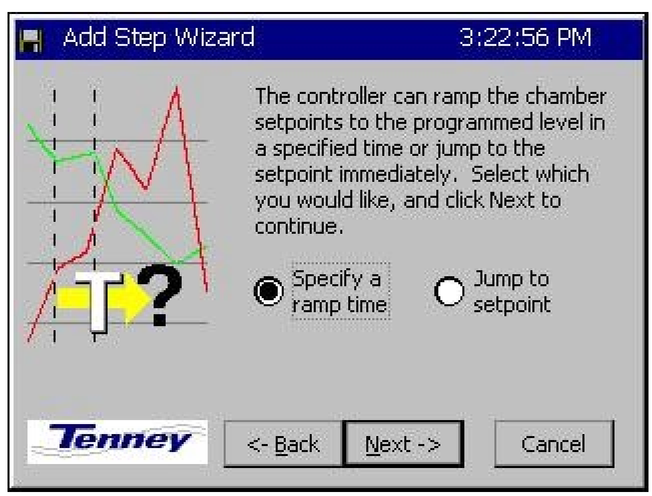
4. Enter Temperature Setpoint & Press Accept →

5. Humidity Control →

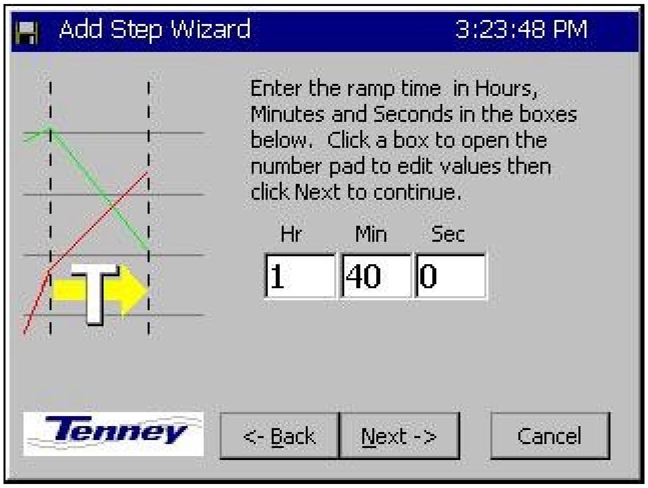


6. Enter Humidity Setpoint and Press Accept →

7. Specify a Ramp Time or Jump to Setpoint →



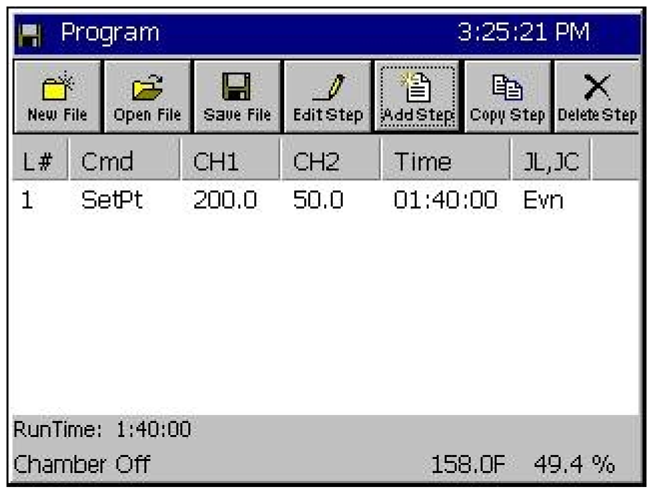
8. Enter Ramp Time →



9. Turn On / Off Events & External Outputs →

10. Finish →

11. View Completed Step.



After pressing the ***Finish*** button, the program screen displays your entry. 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.

Important 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 Feed) from On/Off control to Time Proportioned control.

9.3 Step Type Descriptions

The Synergy Nano 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. The Waitfor 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 then the Waitfor value when the step begins, then the step will wait until the actual value is greater then the Waitfor value. If the actual value is greater then the Waitfor value when the step begins, then the step will wait for the actual value to be less then 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 Nano 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.

Synergy Manager can be used to create profiles for the Synergy Nano on your PC where they can be viewed graphically, stored centrally 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 Nano 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 your 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.

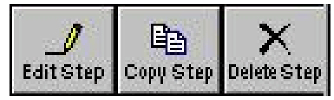
9.4 Synergy Nano Program Sheet

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 SP1	Hum. / Temp. / Press. SP2	Hrs	Min	S	1	2	3	4	5	6	0 or 1		JS	JC	Temp	Hum	Time Hrs: Min: Sec	Day	Hr	Min	Stop or Hold	
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, first 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 if you wish to insert this step somewhere within the program. To insert the step within the program select the step that you want it inserted before.

- **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**.

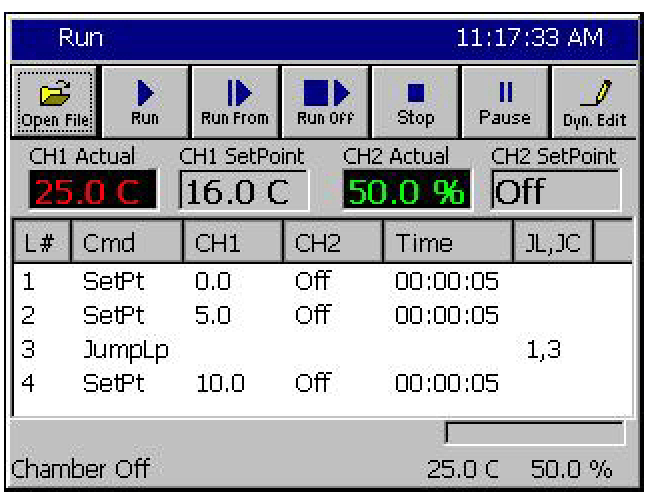
- **Delete Step:** The Wizard will ask you if you are sure you wish to delete the current step. If you wish to delete a different step within the program, answer No, select the step, and then press the ***Delete*** button again.

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.

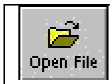
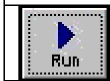
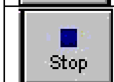
- Press the ***Save File*** button at the top of the Program screen. The Drive List / File List screen will appear.
- Select the Drive List from the drop-down menu. You can save the program to the Storage, the Floppy Drive*, or USB Hard Disk. (*Floppy option is available on Synergy Compact and Synergy V units)
- 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.

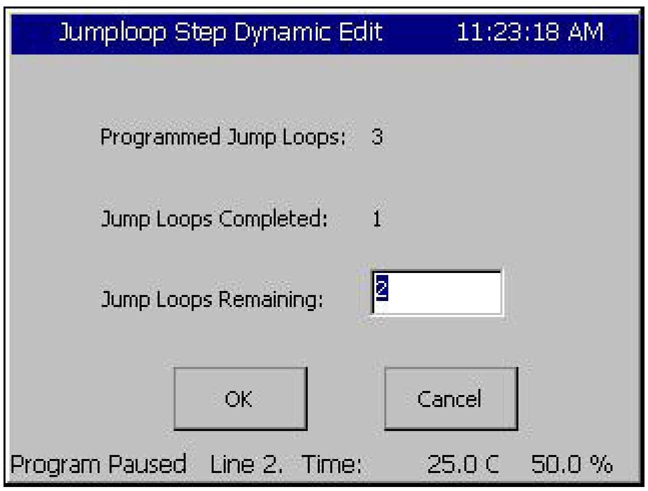
9.7 Running a Program



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

Any file loaded in the Program screen will appear in the Run screen when the Run screen is opened.

	**Open File:** Press this button to load a file from the Storage Card, USB Hard Disk or Floppy Drive. The procedure is identical to the one 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.
	**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 allows the user to edit the jump loop count while the program is running.



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 Nano 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 Nano resumes the profile at the beginning of the step.

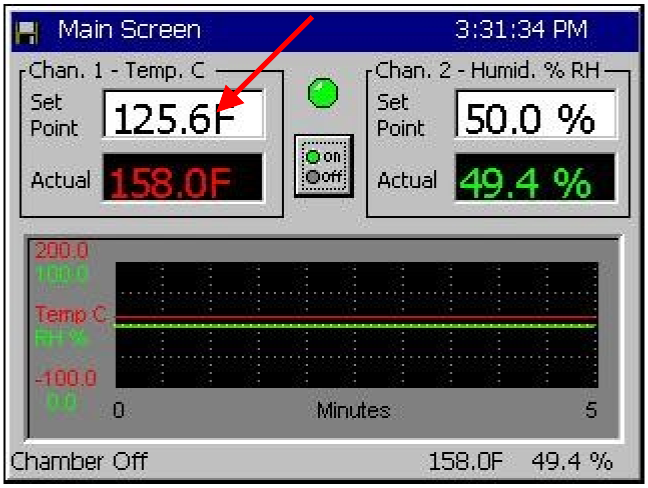
10.0 STEADY STATE OPERATION

The Synergy Nano can run complex programs as described in the previous sections. It can also operate at steady state conditions, i.e. manual operation. This section explains the screens and procedures you can use to quickly setup and run your chamber for steady state operation.

10.1 Main Screen

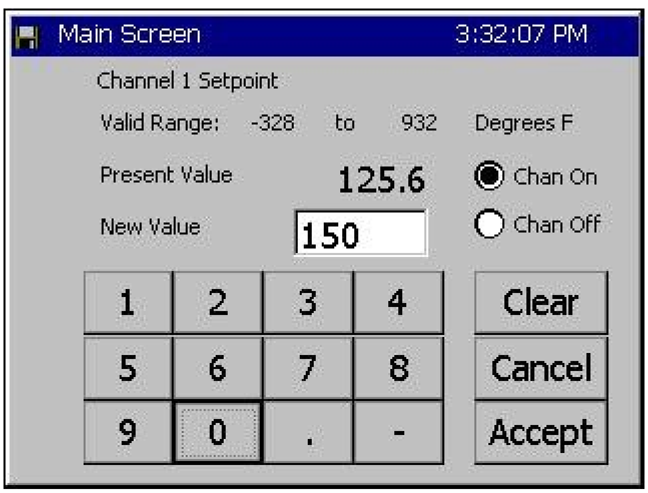
The MAIN screen appears after the controller is powered-up. Steady state set points are accessed from this screen. The chamber can also be turned ***On*** and ***Off*** from this screen.

10.2 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 as required for the test.



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

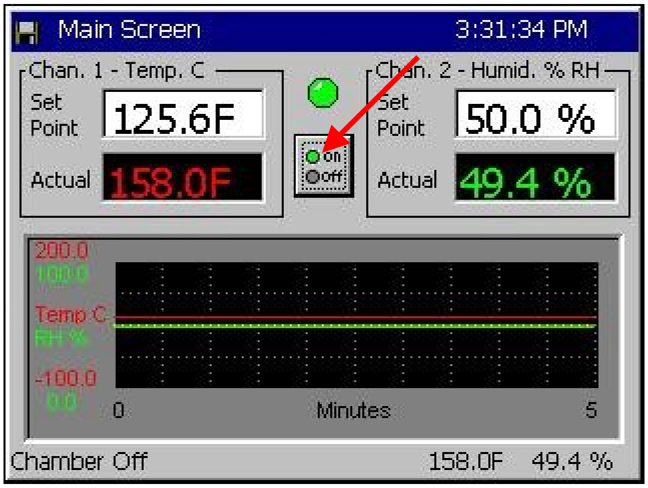
- Select **Chan On**.
- Enter the New Value. Press ***Accept***

The Main screen will appear with your new setpoint.

Important Note

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

10.2 Turn the chamber On



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

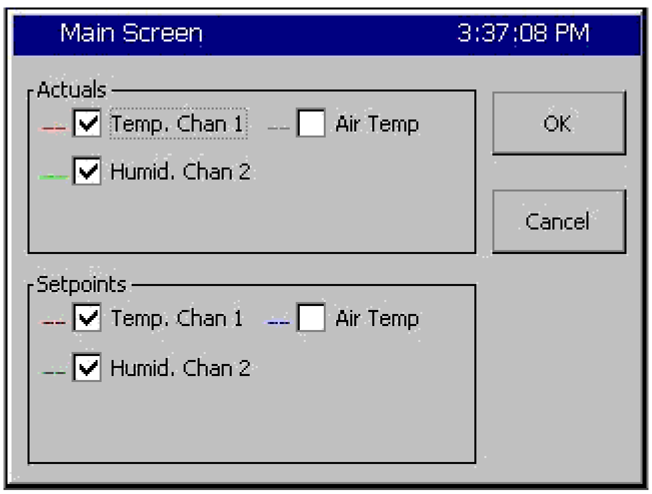
- Press the **on/off** button to toggle the chamber on or off. The current state of the chamber is indicated by the simulated LED above the on/off button.

 Gray indicates that the chamber is Off.

 Green indicates that the chamber is On

10.3 Main Screen Graph Setup

The Main Screen displays a small qualitative 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

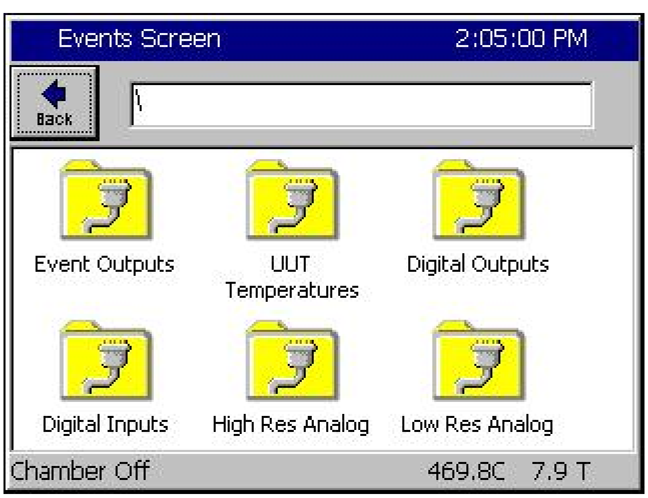
- Temperature Setpoint
- Humidity Setpoint
- Air Temperature Setpoint (Cascade)

A larger full-screen version of the graph is 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.

11.0 EVENTS SCREEN

EVENTS SCREEN			
❑ **Event Outputs**	❑ **UUT Temperatures**	❑ **Digital Outputs**	❑ **Digital Inputs**
(Screen Editor)	(Screen Editor)	(Screen Editor)	(Screen Editor)
When the Synergy Nano is in Manual operation mode, the following outputs can be controlled (turned On and Off) from this screen. ♦ Event 1 thru 6 ♦ Use Drier ♦ LEV2 ♦ Output 11 mode In Program mode, these outputs are under control of the program and can't be adjusted manually; they are updated in real-time according to the running profile. In the Program mode, the status of these outputs can be monitored. The LED is Red when active/On. Output 11 TPM (Time Proportioned Mode) can also be monitored however this output is controlled from the Setup screen in Manual mode.	<u>Status Screen</u> For UUT Temperature monitoring, UUT 1 thru UUT 8, this screen shows actual temperature readings of Sensors 1 thru 8 for each UUT module. Select UUT 1 thru UUT 8 with *Next* or *Previous* buttons.	<u>Status Screen</u> The Synergy Nano's 32 Digital Outputs are listed on this Digital Outputs screen. Each output in use for the configuration is named and the associated LED indicates its status. 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.	<u>Status Screen</u> LEDs show status of the 16 Digital Inputs. Note: Input 9 is the TempGard input.

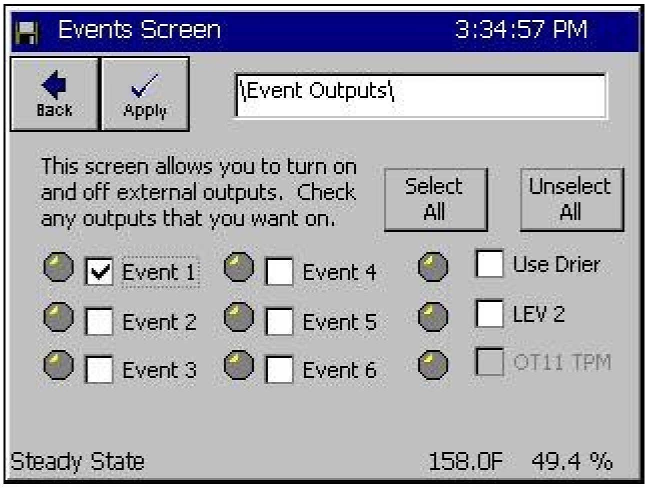


<u>Events Directory</u>

The Events Directory displays the subfolders for the six Event status screens including the event output control screen.

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

11.1 Event Outputs Screen



Event Outputs

In the Manual operation mode only, Events 1 thru 6, the Drier, and LEV 2 can be turned On or Off. When the item is pressed, a checkmark appears in the box. Press **Apply** to apply the state of the Event check boxes to their outputs. i.e. enable the checked outputs and disable the unchecked outputs.

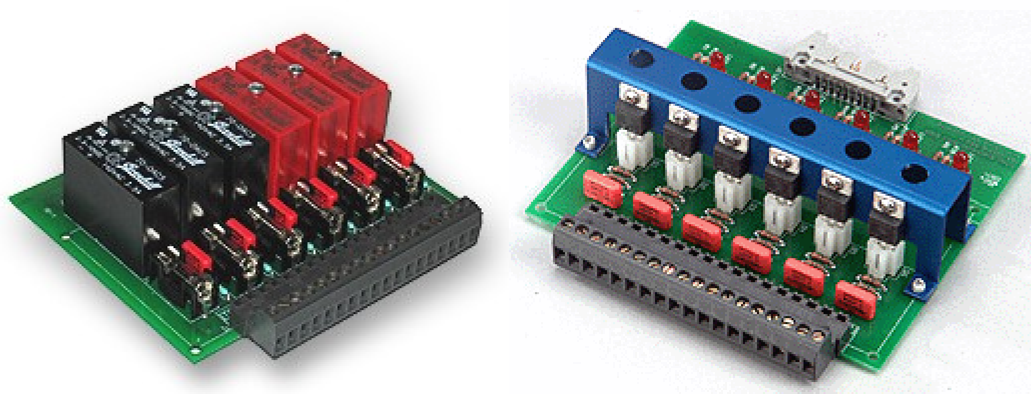
Select All and **Unselect All** buttons are provided for Events 1 thru 6.

In the Run Mode, this screen serves as a status screen. The LEDs illuminate when each Event is On.

- **Events**

Synergy Nanos offer six user-controlled on/off outputs that can be controller while running in steady state and when running programs. These on/off outputs are referred to as Events and they can be used for customer applications as well as for special factory installed control features. For example, test engineers can use these outputs to enable/disable power to the product for certain portions of a profile, enable LN2 solenoids or operate some special test equipment.

Each Event can be controlled while the chamber is running in manual mode or programmatically from the profile. 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 active and gray when it is inactive.



Event Boards

Events are covered in greater detail later in this section along with a description of the available Event boards and their wiring.

- **Use Drier**

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

The Use Drier state controlling the dehumidification method is controlled by the profile 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 programmatically from within 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.

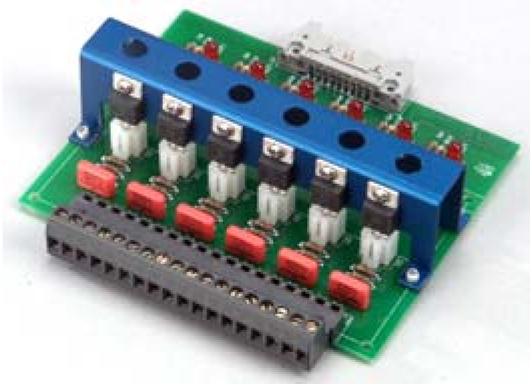
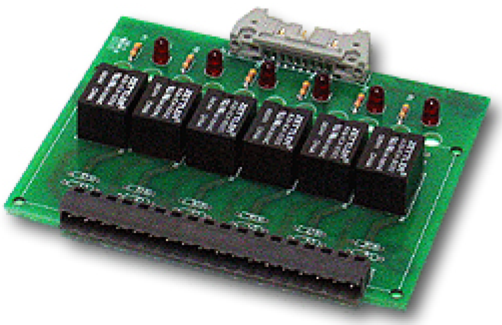
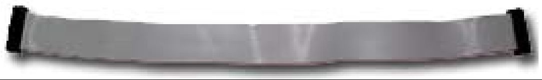
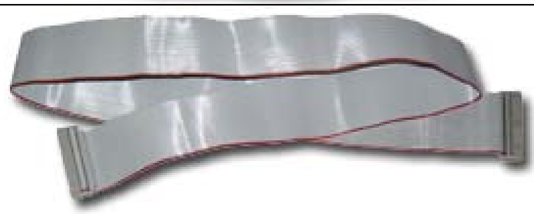
- **OT11 TPM**

The OT11 TPM feature is used to change the output 11 control mode. The chamber defaults to On/Off control mode. When you select OT11 TPM, the controller temporarily switches to the time proportioning mode.

Output OT11 TPM (Time Proportioning Mode) can be monitored from within the Events screen. You may change the setting programmatically from within the 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 globally change the default **OT11 TPM** setting for Steady Stat 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.

Event Board Options

Tidal Engineering Corporation offers three types of event output boards: standard AC output (TE1151-6), universal output (TE1616-6) 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 for these are included in this section and wiring instructions are included in the Installation Section 17.0.

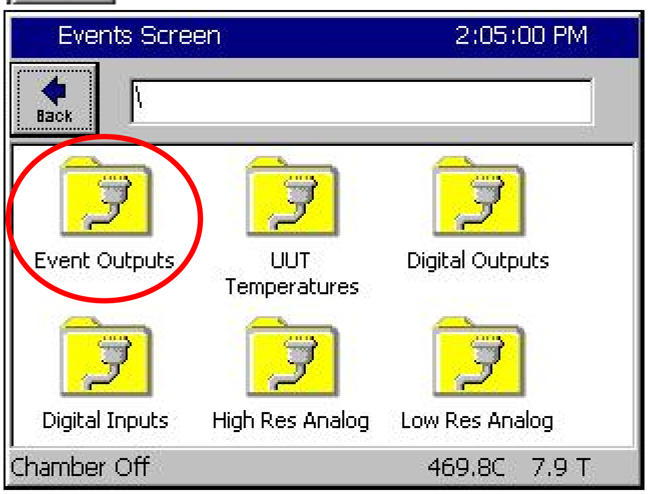
Description	Product Image
Triac Output Board, 6 Channel P/N TE1151-6 • Control up to twelve (6) 3 Ampere AC loads • 110 - 220 VAC • Each output can also drive an external Triac for larger loads.	
Relay Output Board, 6 Channel P/N TE1708-6 • Control up to six (6) 3-Ampere AC loads, • 110 - 220 VAC. • Each output is Form C with both a normally open and normally closed contact.	
Universal Event Board, 6 Channel P/N TE1616-6 • This unit is interchangeable with the standard 6-Channel Triac Output board but its outputs can configure for DC loads as well as AC loads. This Event board is configured by installing standard OPTO22 output modules in the sockets. These modules are available separately • AC Output modules are available for 140 and 280 VAC and 3.5 Amps. • DC Output modules are available for 60 VDC and 3.5 Amps.	
20 Pin Cable P/N TE1722-20-6ft	
34 Pin Cable P/N TE1722-34-6ft	

Synergy Nano Event Setup Instructions

There are several ways to control the events on the Synergy Nano. 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 Nano locally) from the touch screen) in Manual Mode.

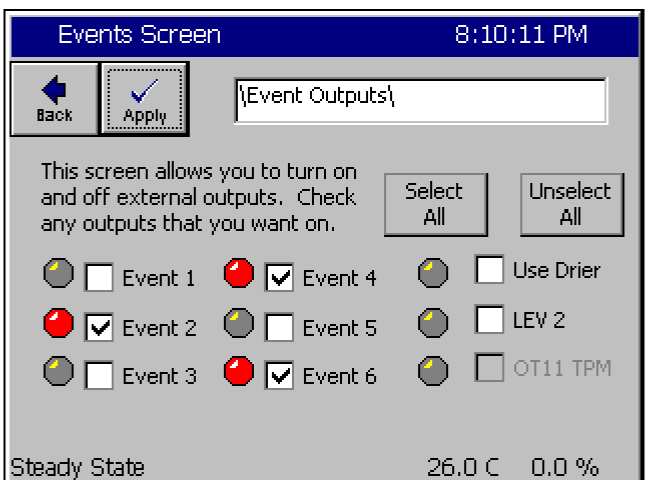
First, press the ***On*** button on the right navigation panel of the Synergy Nano.

Next press the ***Events*** button on the lower navigation panel on the Synergy Nano.



Events Folder

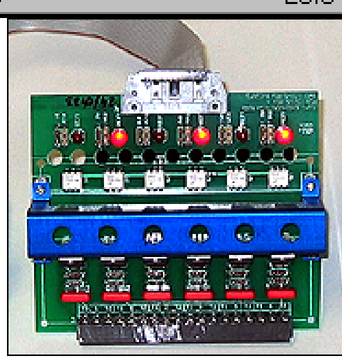
Select the Events Output folder on the touch screen.



Example 1

Check the desired outputs to turn on and press the ***Apply*** button.

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



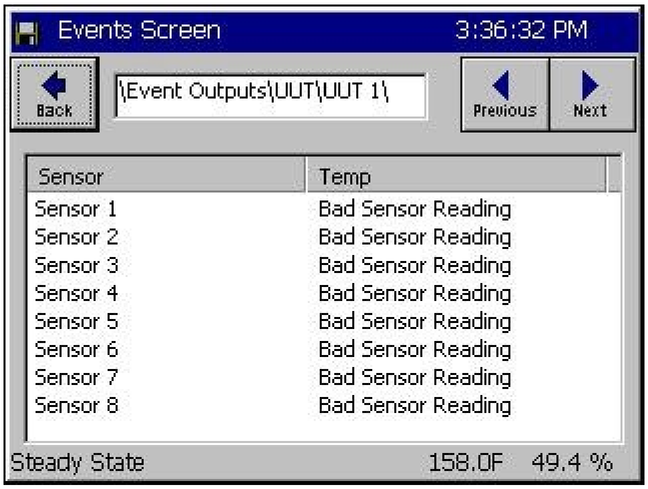
Events 2, 4 and 6 On

When outputs 2, 4 and 6 are selected and turned on the event board LEDs 2, 4 and 6 are lit.

11.2 UUT Temperature Module (Unit-Under-Test)

UUT Introduction

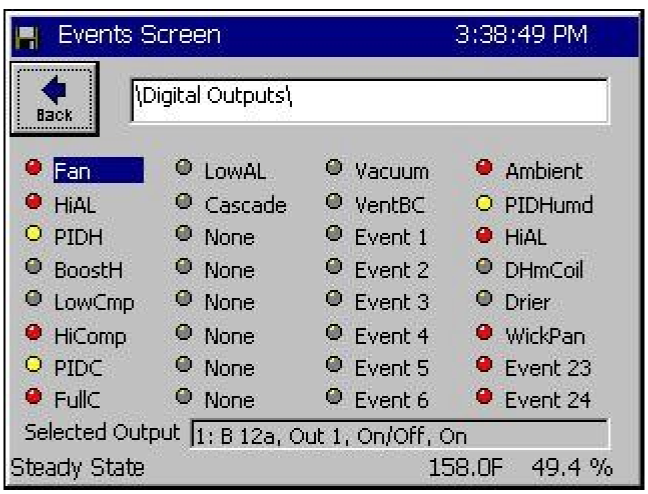
The UUT Module (Unit-Under-Test) is a 16-channel thermocouple data acquisition unit. Developed to expand the input capabilities of the Synergy Nano, the UUT module captures and logs data from the test. Up to four modules can be attached to the Synergy Nano providing up to 64 thermocouple inputs. The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

11.3 Digital Outputs



Digital Outputs

LEDs indicate the status of 32 Digital Outputs.

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

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 mechanical 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.

Percentage output values between 101 and 199 indicate that an output is set to instantaneously mirror the indicated output. For example, say Output 3's time proportioning value is 112%. Output 3 is actually mirroring output 12. Percentage outputs between 201 and 199 indicate that an output is the complement of the indicated output. For example, Output 3's time proportioning value is 218%. Output 3 is thus 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 associated label. The Selected Output displayed above reads: “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

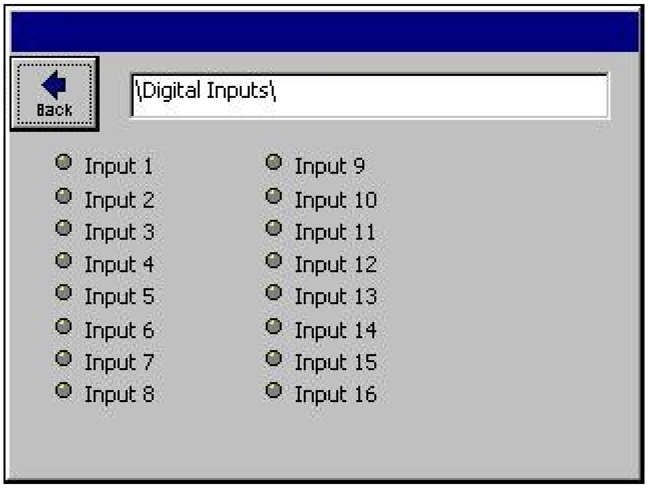
The Synergy Nano supports multiple chambers types. Each chamber type has unique device output mappings. For example, Output 1 drives the chamber fan device on Temp-Humidity and Temp-Only chambers, but in Temp-Temp chambers Output 10 drives the fan device.

The output maps for each chamber type are listed in Section 6.9 Setup: Chamber Setup.

Device Primitives and Logic Flow

The following flow charts illustrate the function of each output and the logic that drives each output device. Please note that some chambers may not have all the described devices. For example, Temp-Only chambers will not have humidity related devices such as the Wick Pan. These flow charts have extensive references to L-Values. For more information on L-Values, see Section 6.5 Setup: L-Values.

11.4 Digital Inputs



Digital Inputs

LEDs show status of the controllers 16 Digital Inputs.

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

Description

Digital inputs are used to monitor on-off signals from outside devices such as test units or chamber machinery. The Synergy Nano displays the on/off state of an input in the Digital Inputs window. Waitfor steps can be programmed to wait for a digital input state to change before it continues the program.

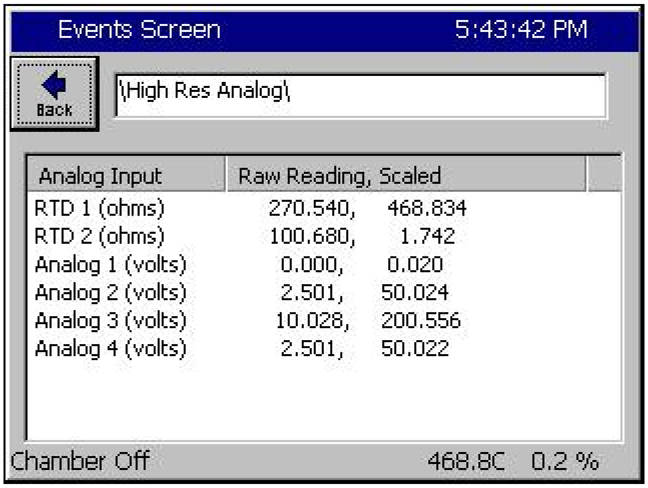
The Digital Inputs are located on connectors P1 and P3 on the Olympic board. See Section 17.0. Pin 1 on P7 is ground. Pins 3 – 12 correspond to Digital Inputs 1 to 10. Digital Input 9 (Pin 11) is a TempGard Alarm on chambers that have a TempGard alarm. If the chamber does not have a TempGard alarm, Input 9 must be shorted to ground (pin 1). Use the Olympic Board Diagram in Section 17.0 as a reference guide.

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 chamber 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 connects the power up complete output signal from the unit under test to Digital Input 1.

When the program runs, it ramps to temperature and then activates Event 1 to start the power up sequence for the test unit. The Waitfor step is programmed to wait for Digital Input 1 to turn on. The chamber program holds its state until the power up sequence is complete and the signal from Digital Input 1 arrived. 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. At the point the signal comes in on Digital Input 1 the chamber program can continue since the test unit is powered and running.

11.5 High Resolution Analog Inputs



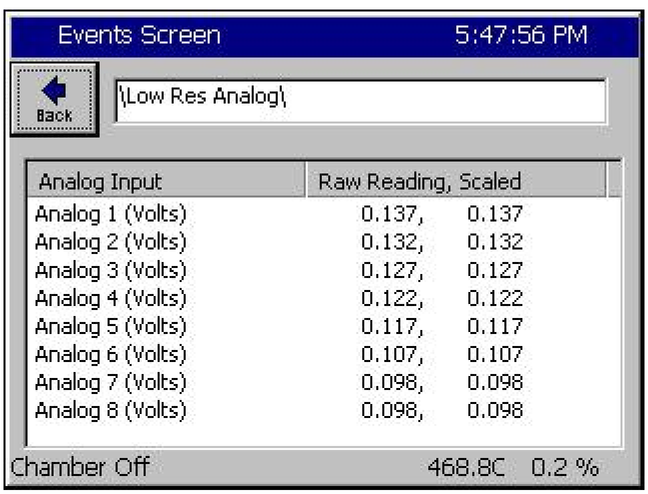
<u>High Resolution Analog Inputs</u>

- RTD 1
- RTD 2
- Analog 1
- Analog 2
- Analog 3
- Analog 4

Description

High Resolution Analog input Screen is used to monitor signals from process sensors. The Synergy Nano displays the Raw value and the Scaled value.

11.6 Low Resolution Analog Inputs



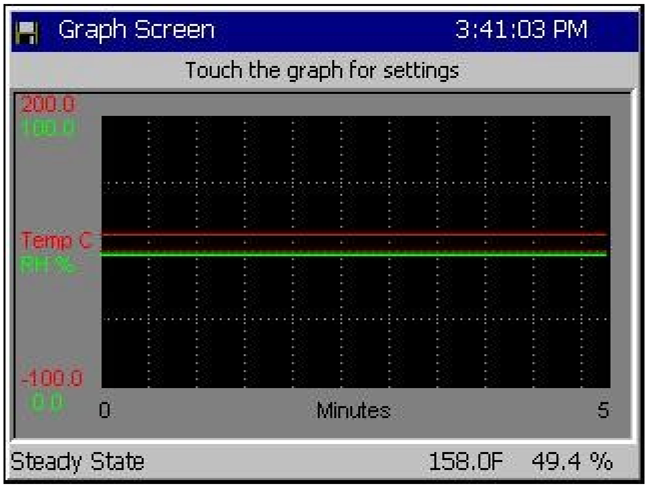
<u>Low Resolution Analog Inputs</u>

- Analog 1
- Analog 2
- Analog 3
- Analog 4
- Analog 5
- Analog 6
- Analog 7
- Analog 8

Description

Low Resolution Analog input Screen is used to monitor signals from process sensors or machine monitors. The Synergy Nano displays the Raw value and the scaled value.

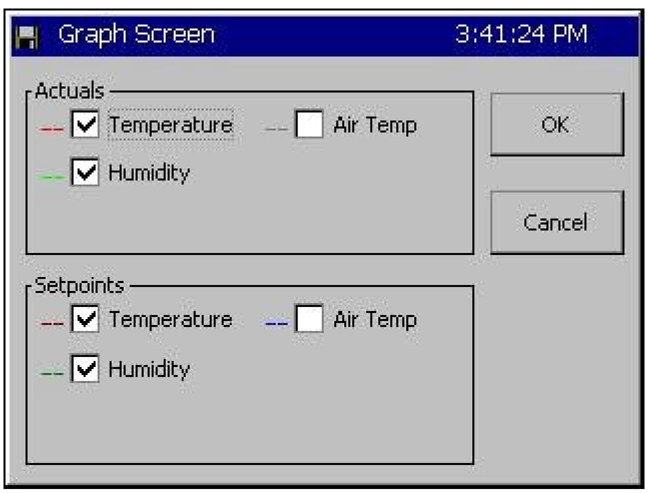
12.0 GRAPH SCREEN



Graph Screen

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

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 UUT MODULE, UNIT UNDER TEST DATA ACQUISITION

13.1 UUT Overview

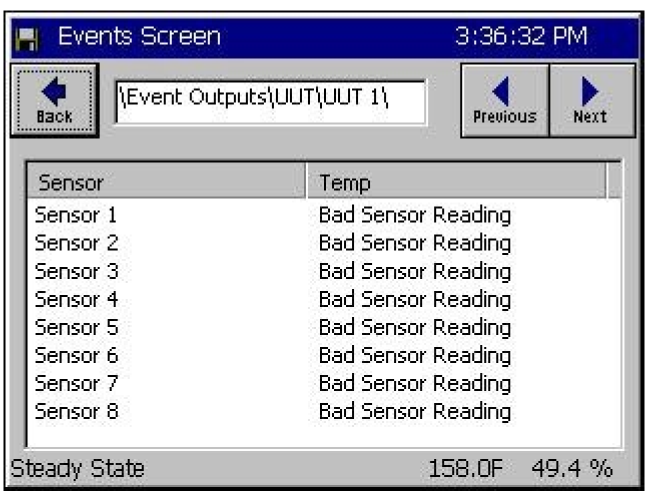
The UUT Module (Unit-Under-Test) is a 16-channel thermocouple data acquisition unit. Developed to expand the input capabilities of the Synergy Nano, each UUT module allows system operators to capture and log temperature data from the unit-under-test and other pertinent test temperatures. Up to four modules can be attached to the Synergy Nano 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 Uses

The UUT module can be used to monitor and record multiple air temperatures and multiple product temperatures and can control from any one of these.

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 Nano'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, this screen shows actual temperature readings of Sensors 1 thru 8 for each UUT.

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

These values may be logged. See Section 6.11 Setup: Logging.

UUT Module Setup Procedure

This is the installation and set up 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 on how to view your thermocouple temperature readings on the Synergy Nano 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 Nano.
- 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.

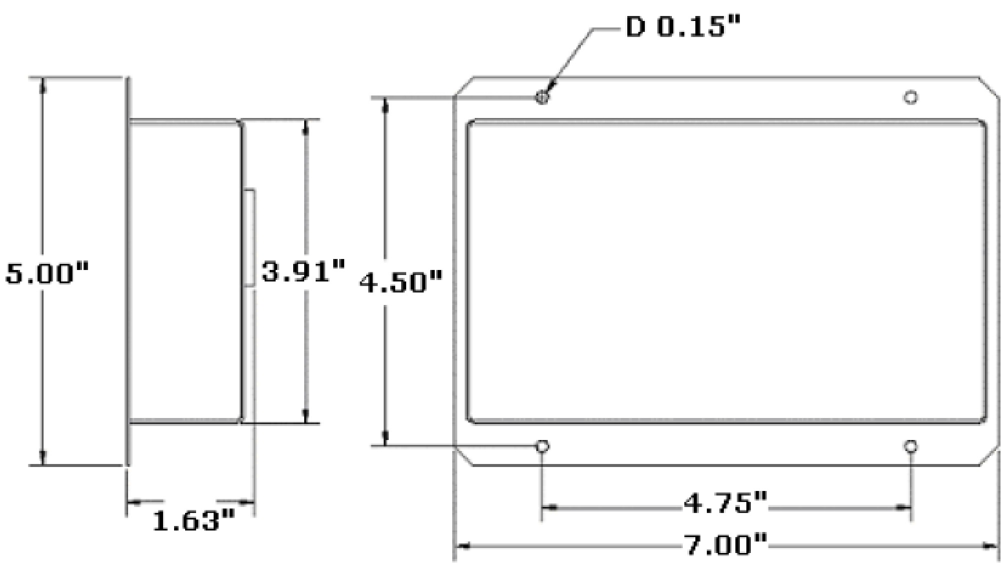
Hardware Connections

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.

Once the items above have been removed, you will note the following cables that are connected to the UUT Module.

- 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

13.2 Setup Procedure

1. Set up the UUT Module Address. 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.

16 CHANNEL MODULE ADDRESS SWITCH SELECTION	
MODULE NO	**SETTING**
Module 1	1
Module 2	3
Module 3	5
Module 4	7

2. Locate the RS-485 9-pin female plug, which is either plugged into the back of the RS-485 port on the Data Communications panel, or is hanging freely behind the panel (for chambers not ordered with RS-485).

   Note: For chambers not initially supplied with an RS-485 port, look for the ribbon cable connected to the RS-232 port. This ribbon cable is split and has a nine pin female RS-485 plug connected to one side of the cable (and hanging freely).

3. Locate the RS-485 Interconnect 9-conductor ribbon cable connected to the UUT Module. There are four additional 9-pin male connectors attached throughout the length of this rolled-up cable. These are labeled M1 thru M4 on the UUT Module drawing. Connect one of the 9-pin male connectors from this Interconnect ribbon cable to the RS-485 9-pin female connector located in Step 2.

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.

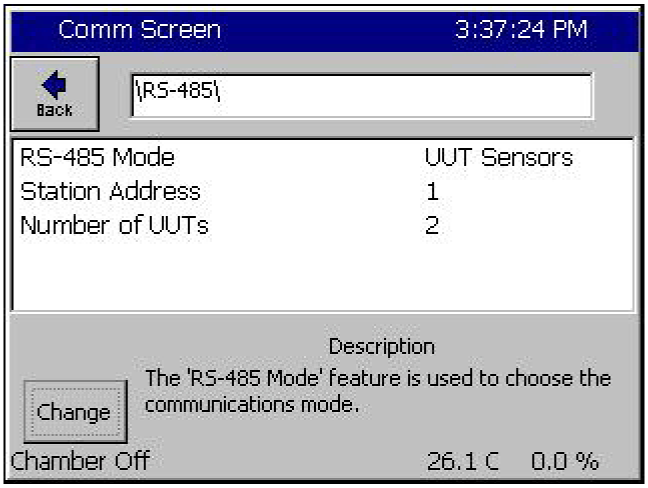
   Verify that the green LED on the UUT Module is illuminated. It should be on steadily.

   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 Nano 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.



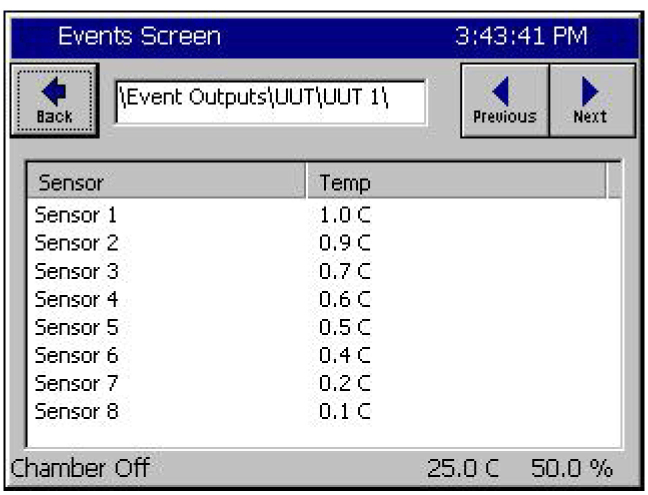
Number of Thermocouples	**Number of UUTs** Value to be Entered
1 - 16	2
1 - 32	4
1 - 48	6
1 - 64	8

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

   After the Synergy Nano 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 Nano 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 Nano gathers the temperature data from each of the modules.

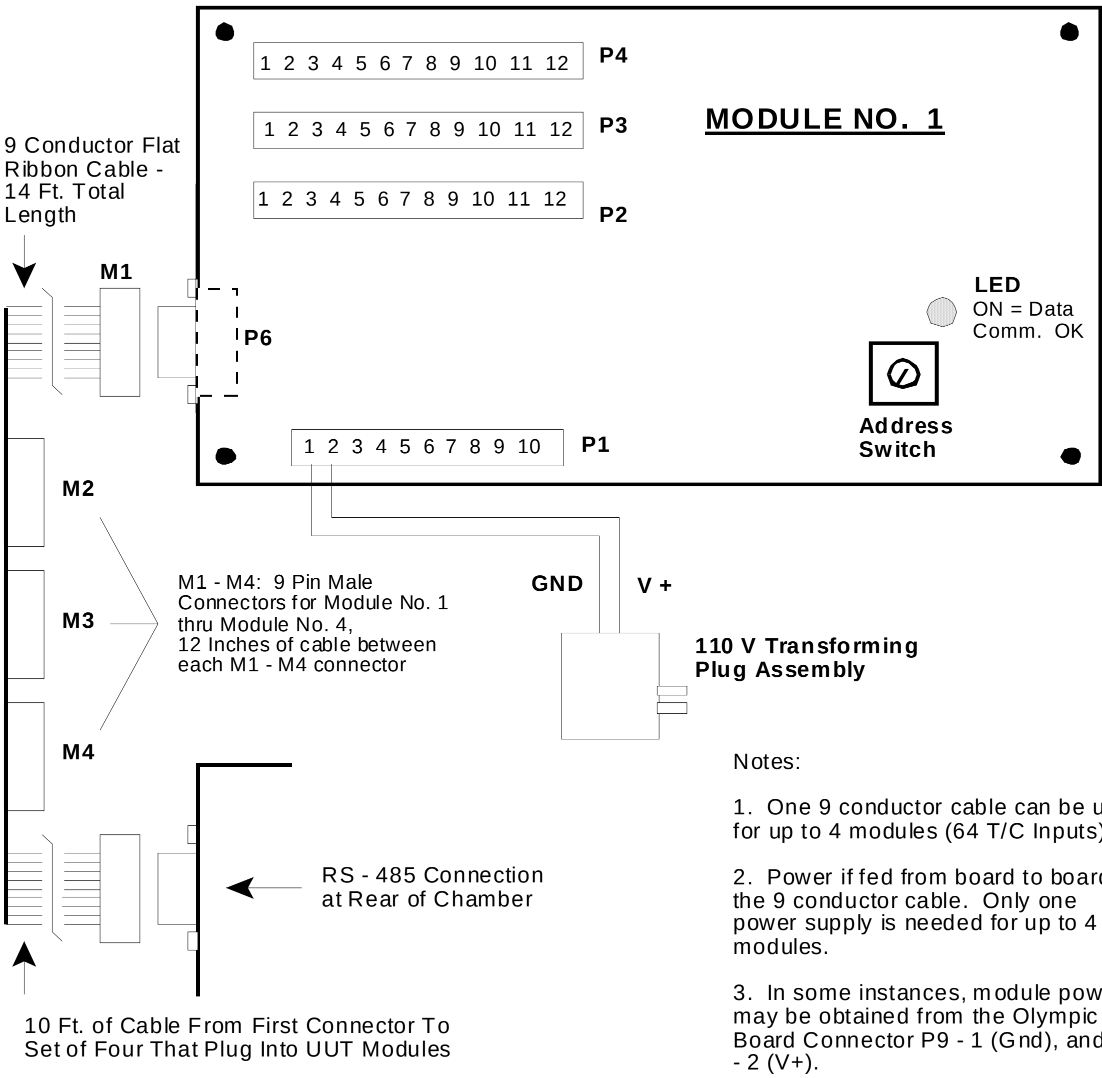
9. **Verify thermocouple temperature readings.** Press the ***EVENTS*** Navigation key on the Synergy Nano. Open the UUT Temperature folder to display the screen below



- 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 Nano.

UUT MODULE - Board and Connector Layout



Notes:

1. One 9 conductor cable can be used for up to 4 modules (64 T/C Inputs).

2. Power if fed from board to board via the 9 conductor cable. Only one power supply is needed for up to 4 modules.

3. In some instances, module power may be obtained from the Olympic Board Connector P9 - 1 (Gnd), and P9 - 2 (V+).

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

14.0 CASCADE TEMPERATURE CONTROL

Cascade is a control method that uses two control loops and sensors to provide better performance than can be achieved with one loop. One control loop provides the setpoint for a second loop. With this method, the product temperature reaches its setpoint more quickly than with single loop control, while minimizing overshoot.

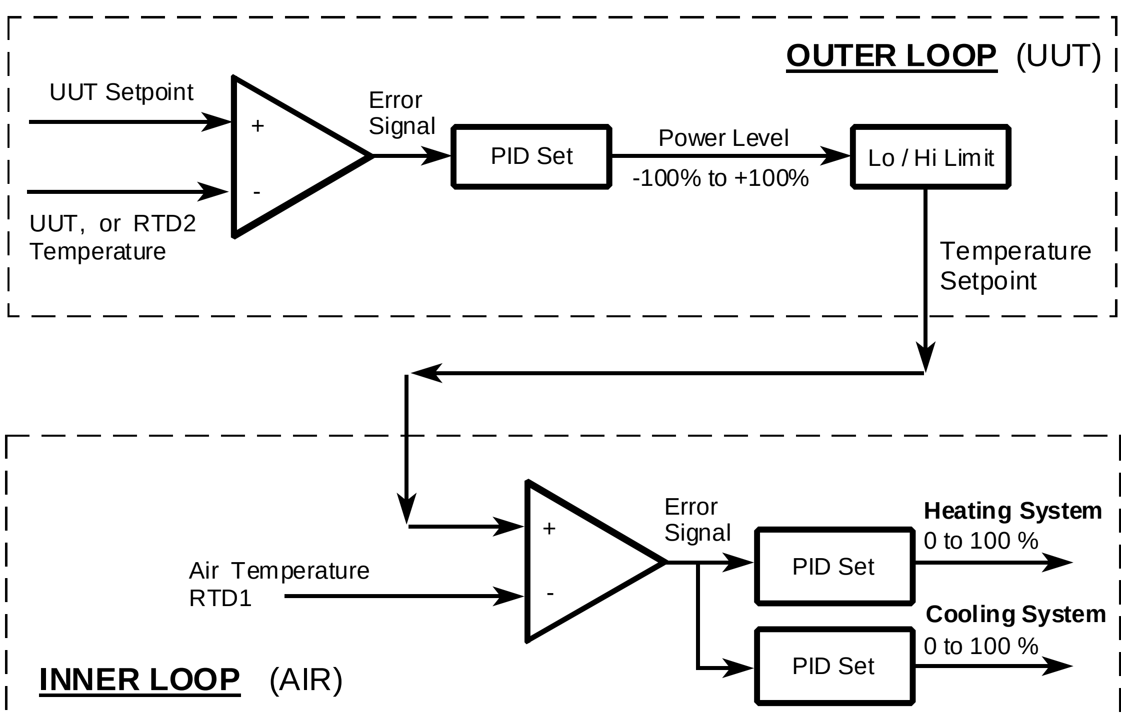
Single loop control compares the temperature of the discharge air of the conditioning section to a temperature setpoint, and adjusts the heating / cooling systems accordingly.

In Cascade control the outer loop is dedicated to the unit-under-test. The inner loop controls the air temperature. The outer loop monitors the unit-under-test temperature and compares it to the unit-under-test setpoint. An error signal is generated and then adjusted by the PID set up 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.

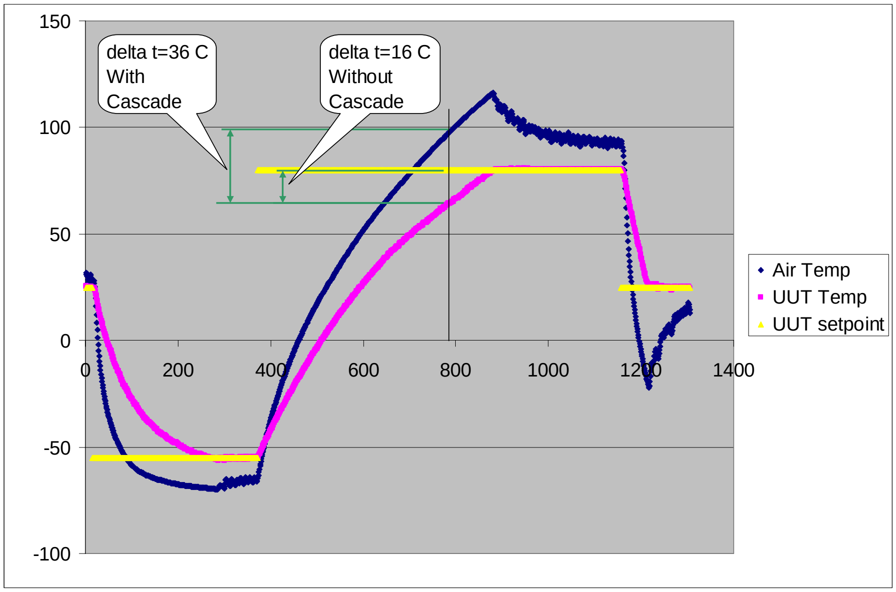
The inner loop monitors the discharge air from the conditioning system and compares it to the temperature set point generated by the outer loop. An error signal is generated and then adjusted by the Heat and Cool PIDs. An output power level signal ranging from 0 to 100% is produced and sent to the heating 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.

CASCADE CONTROL

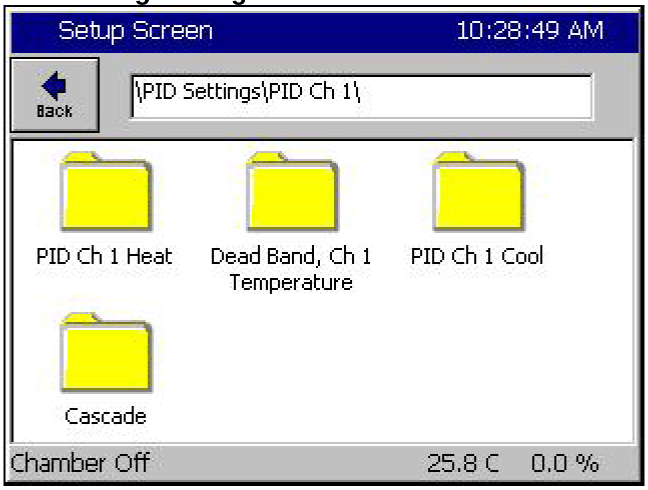


The graph below shows the speed and control advantages of Synergy's Cascade Control feature. Note that the Air Temperature forces a faster product (UUT) temperature change by providing a greater delta t.



14.1 Cascade Control Setup

14.1.1 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 this screen. Press the Registration Key text box to open the alphanumeric keypad. Enter your registration number here. The cascade registration number is available from Tidal Engineering or your chamber manufacturer.

14.2 Configuring Cascade Software

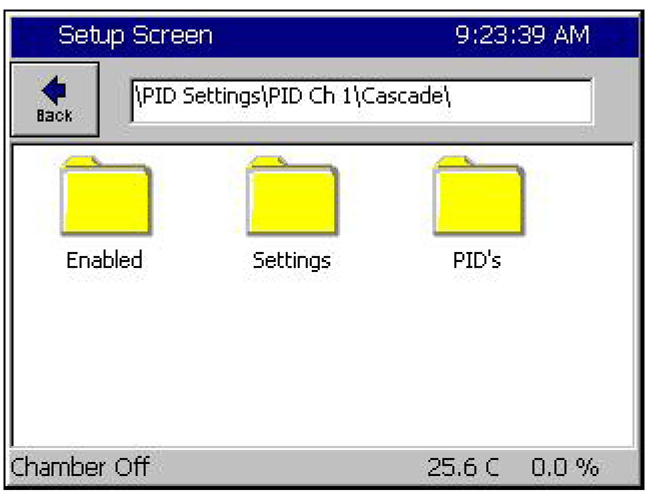
14.2.1 General

Several settings and parameter options should be configured before using Cascade software. This is especially important when you are switching between single loop control and cascade control. In addition your PIDs 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	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

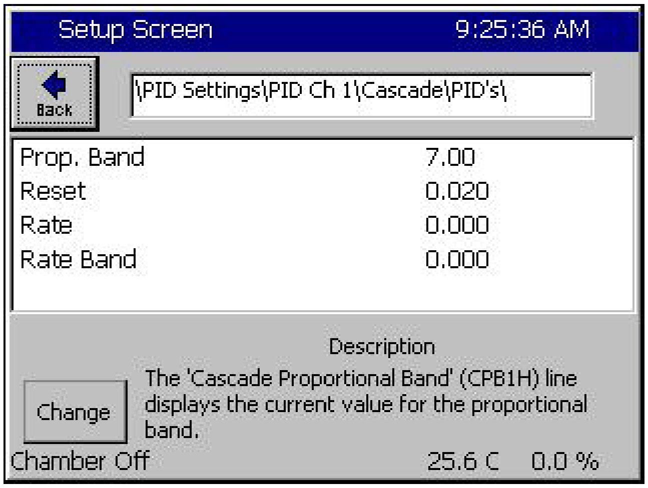
In order to view and change the Cascade PID / Parameter settings, press the ***SETUP*** Screen Navigation key and go to the screen below. For Inner Loop settings, go to the *PID Settings\PID Ch1\Heat or Cool* folder.



Cascade Setup Folder

- **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.

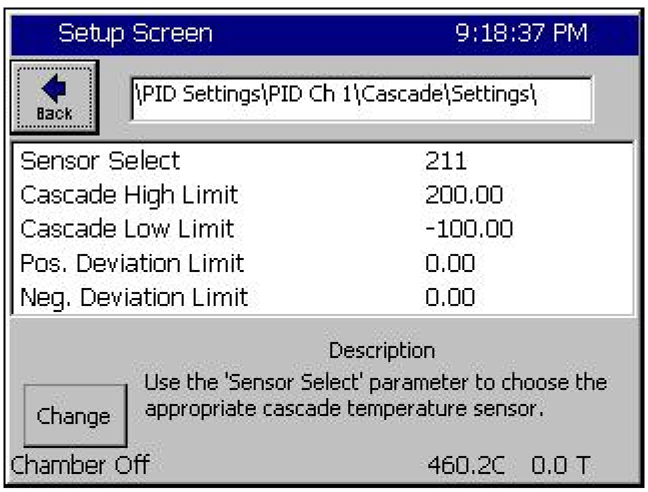
14.2.2 Select Cascade PIDs



Select 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.

14.2.3 Select Air Temperature Limits



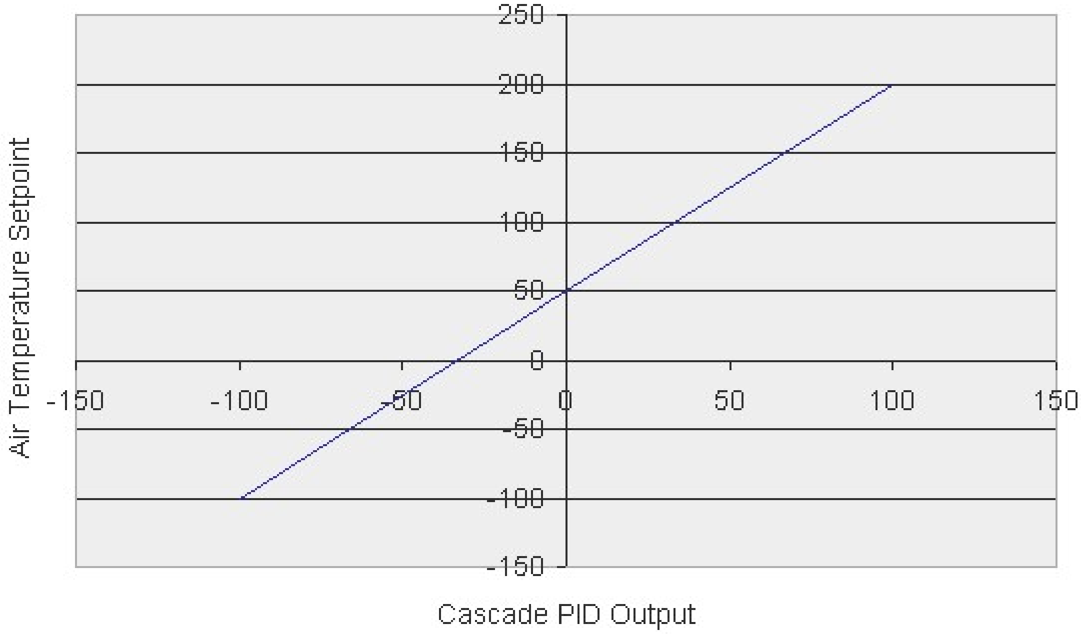
Select the Settings Folder from the Setup\PID Settings\Cascade screen. In the Settings screen shown, 'Cascade Low Limit' and 'Cascade High Limit' are the minimum and maximum air temperatures that the controller will use to achieve the desired product temperature. These parameters default to -100 C and +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 Nano'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.

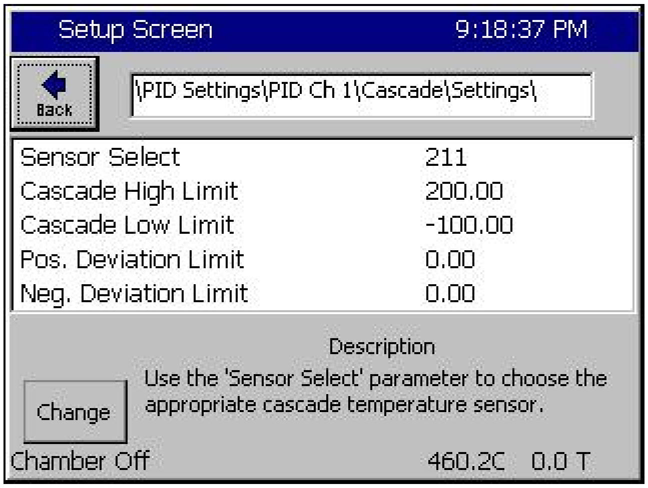
Warning!
Set the 'Cascade Low Limit' and 'Cascade High Limit' carefully. Be certain they are within the capabilities of the chamber and the product under test. These are the minimum and maximum air temperatures that the controller will use.

Default Air Temperature Limits versus Cascade Output Percentage



14.2.4 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.



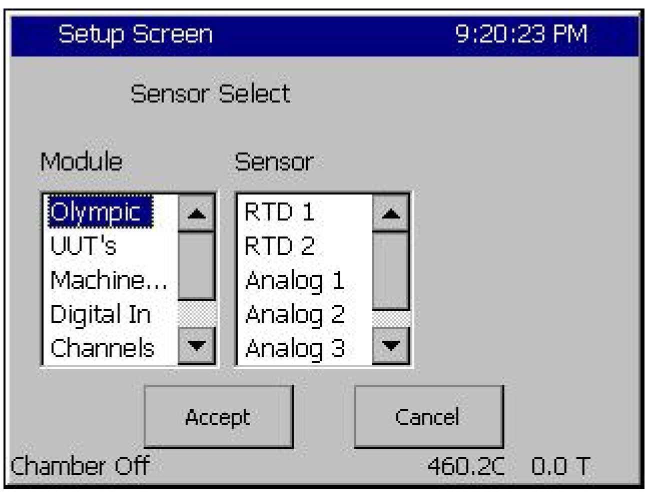
To select a product sensor to monitor the product in Cascade, click on **Sensor Select** and press the ***Change*** button.

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>

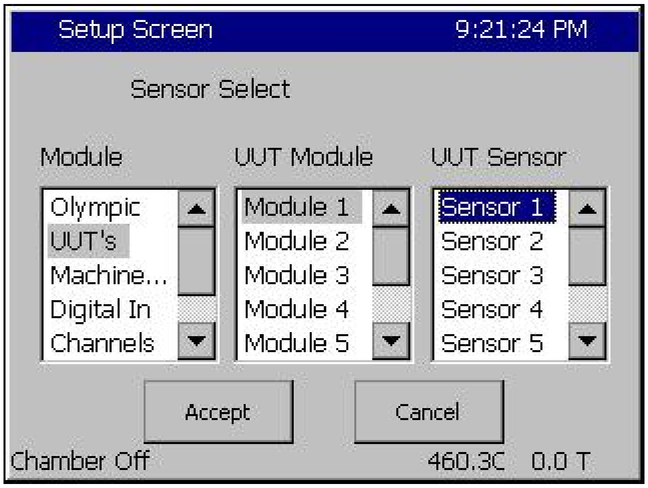
When you select Olympic board in the first column, you can then select the sensor to monitor.

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 Nano can accommodate up to four UUT modules, with up to sixteen sensors on each module.

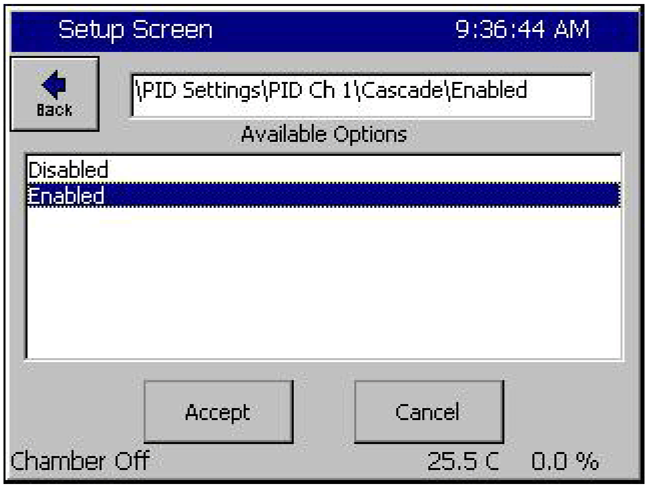
	UUT 1	**UUT 2**	**UUT 3**	**UUT 4**	**UUT 5**	**UUT 6**	**UUT 7**	**UUT 8**
Sensor 1	211	221	231	241	251	261	271	281
Sensor 2	212	222	232	242	252	262	272	282
Sensor 3	213	223	233	243	253	263	273	283
Sensor 4	214	224	234	244	254	264	274	284
Sensor 5	215	225	235	245	255	265	275	285
Sensor 6	216	226	236	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.

14.3 *Using Cascade Mode*

14.3.1 Enable Cascade Mode

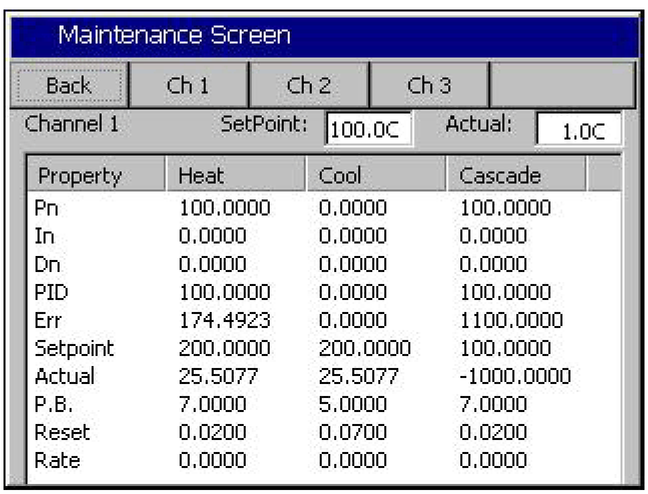
To enable Cascade mode, press the ***SETUP*** Screen Navigation Key and proceed to the Enabled folder shown below (*PID Settings\PID Ch 1\Cascade\Enabled*)



Change the Enabled item's value to Enabled (Disabled is the default value).

14.3.2 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

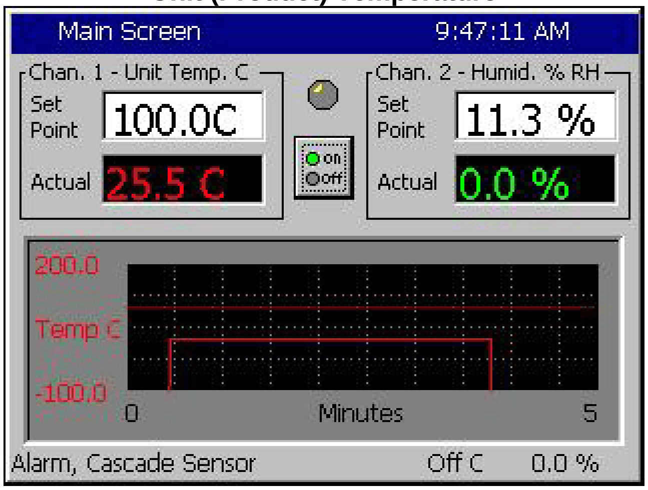
- The values in the Heating & Cooling columns range from 0 to 100%

14.3.3 Main Screen Product / Air Temperature Display

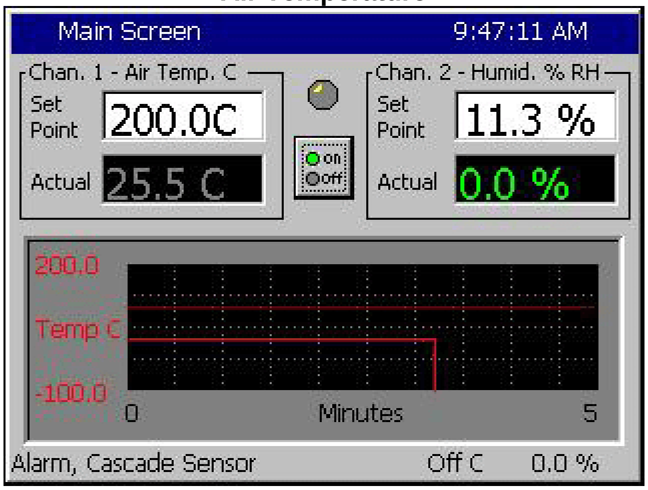
In the cascade mode, you can alternately display the setpoint / actual values of the product and air temperature. Press the Actual temperature display box to toggle between the two modes.

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

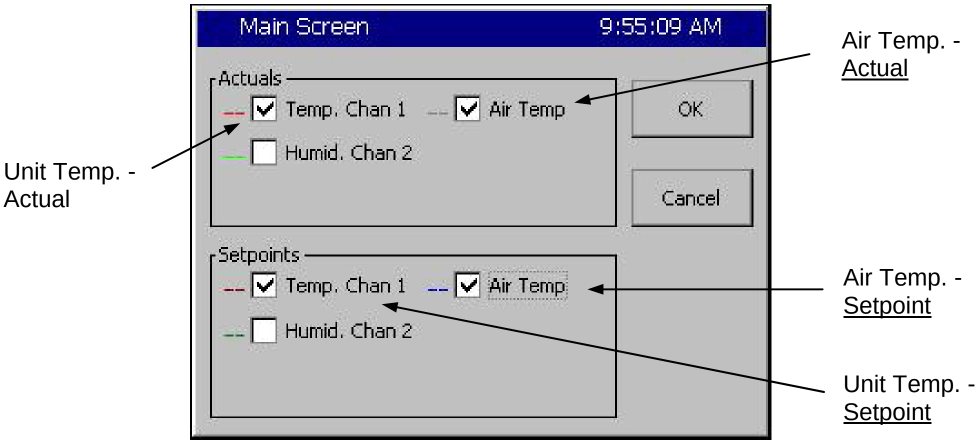


Air Temperature



14.3.4 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.

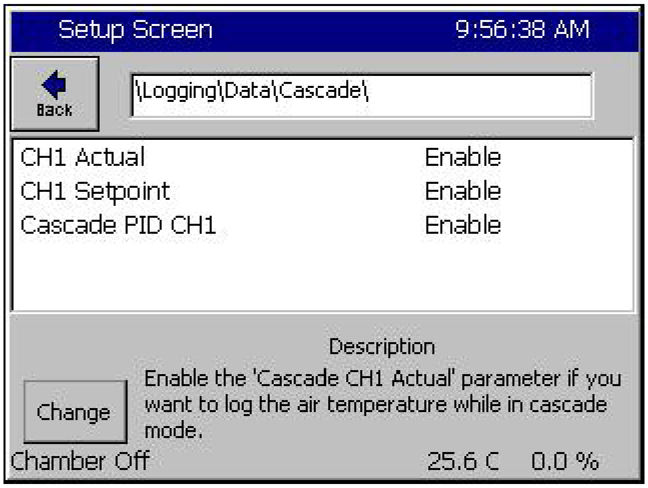


Select **Air Temp.** in the ***Actuals*** and ***Setpoints*** frames to graph the actual air temperature and air temperature setpoint. The actual air temperature will appear as a light blue line, and the air temperature setpoint will appear as a dark blue line.

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.

14.3.5 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.



14.3.6 Chamber Operation

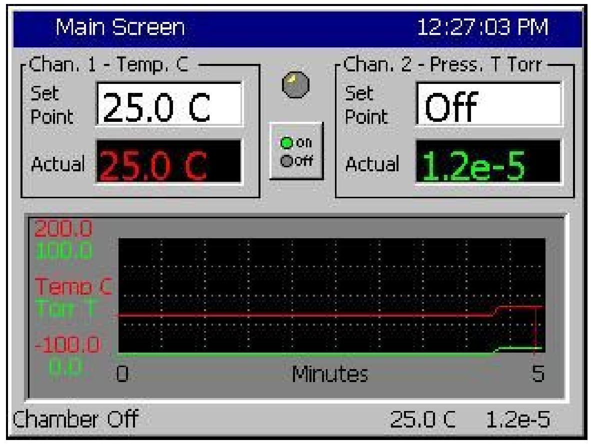
All Synergy Nano features are available with Cascade mode enabled. Test programs are unaffected except in cascade mode, the temperatures setpoint is used as the product setpoint as opposed to the air temperature. Steady-state setpoints also work with Cascade enabled.

14.3.7 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.

15.0 SPACE AND ALTITUDE CHAMBERS

15.1 Space Chamber Setup



The Synergy Nano 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 section explains the setup procedure for Space Chamber applications and provides examples. This section of the manual refers to the Synergy Nano Plus Olympic board wiring but the other Synergy Nano configurations support this application as well.

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.

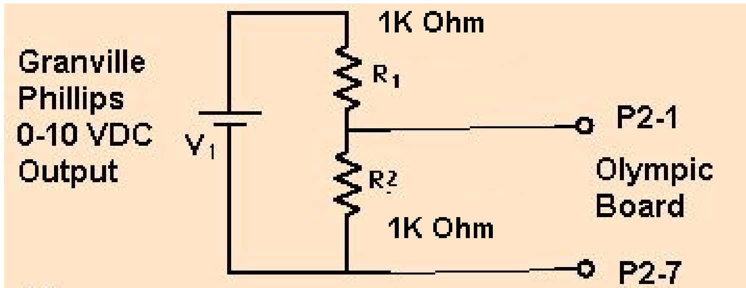
2. Setup the chamber for the appropriate configuration; i.e. Generic Temperature /Pressure, Generic Temperature/Humidity/Pressure, etc.

3. Setup the Hi Res input calibration for the pressure input.

4. Select the channel sensor for the pressure input.

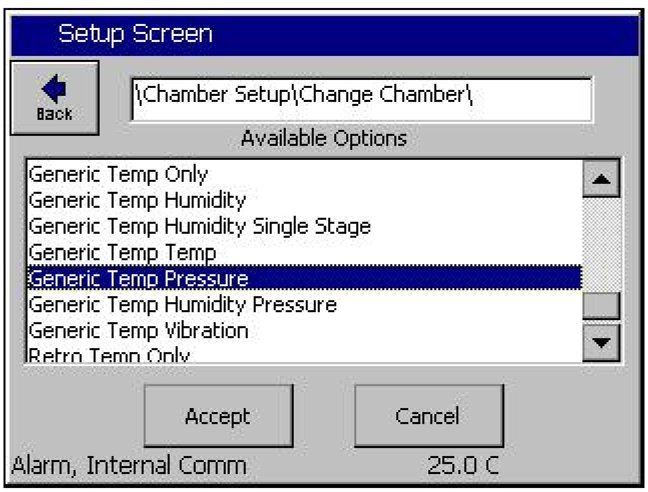
5. Setup the Altitude calibration for the Granville Philips emission setting.

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.

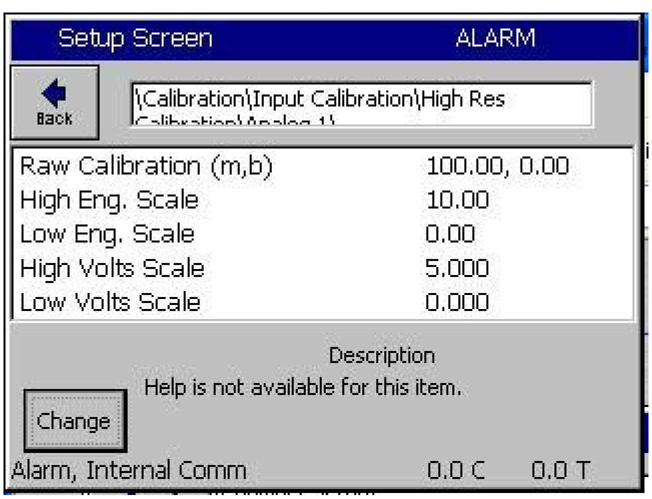


Signal	Olympic Board Connector-Pin	Reference
Analog Input 1 (See Note)	P2-1	P2-7
Analog Input 2	P2-5	P2-7
Analog Input 3	P2-6	P2-7
Analog Input 4	P2-11	P2-7

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.



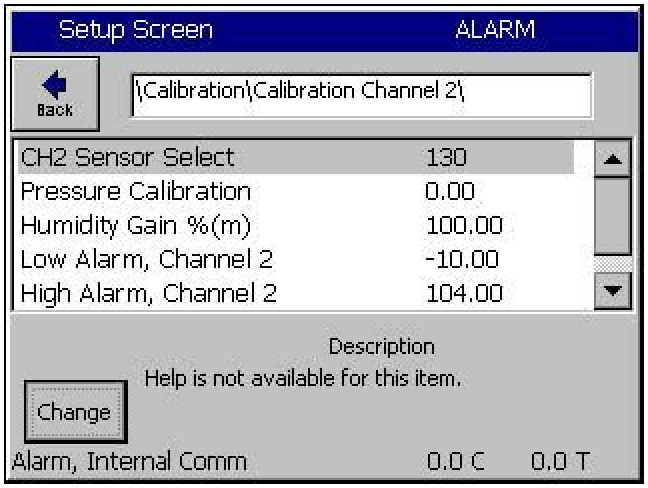
Step 2. Select the appropriate chamber setup from the Chamber Setup folder and reboot as instructed. For example, the Temperature Pressure selection is shown at left.



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

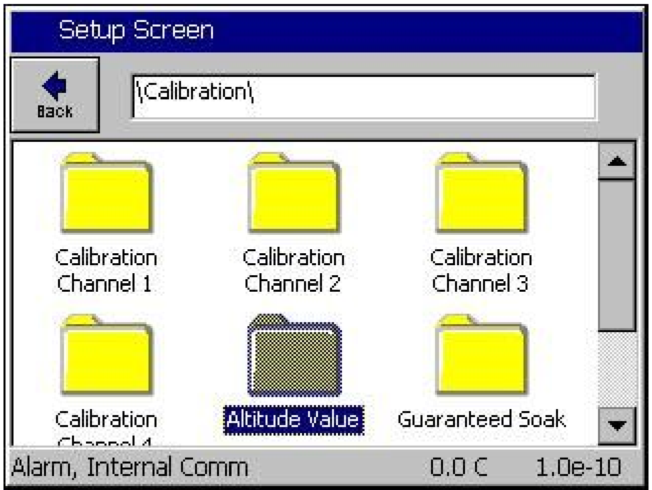


Step 4. Select the channel sensor

SETUP\Calibration\Calibration Channel 2

Select Analog 1 for sensor:

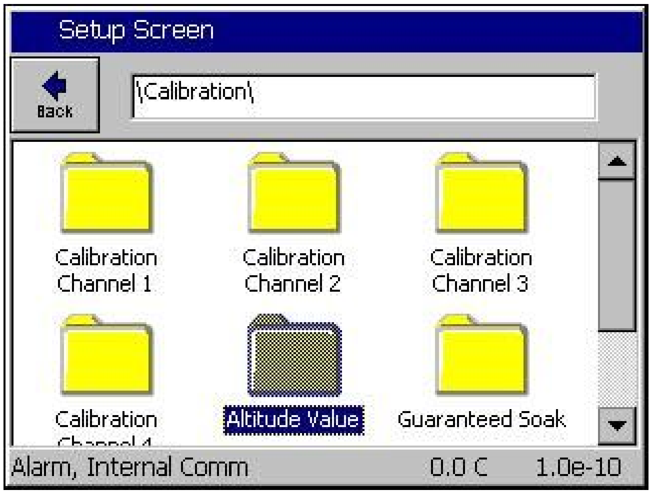
CH2 Sensor Select code 130



Step 5. Setup the Altitude calibration

A Registration Key may be required to access this feature. Contact the factory.

A Registration Key may be required to access this feature. Contact the factory.



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.

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.

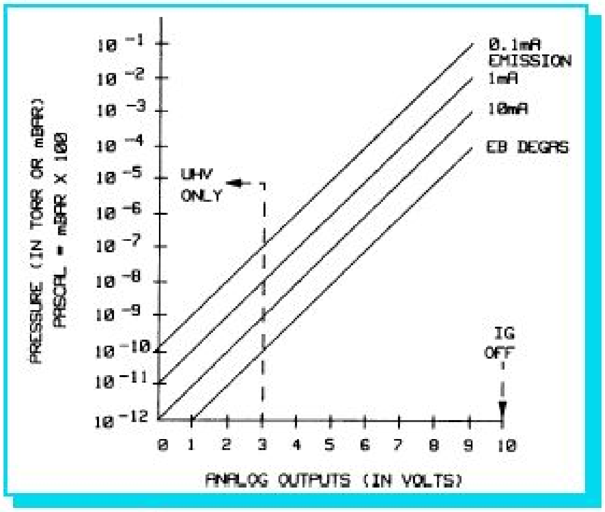


Figure 2-4 *Ion Gauge Pressure Analog Output.*

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:

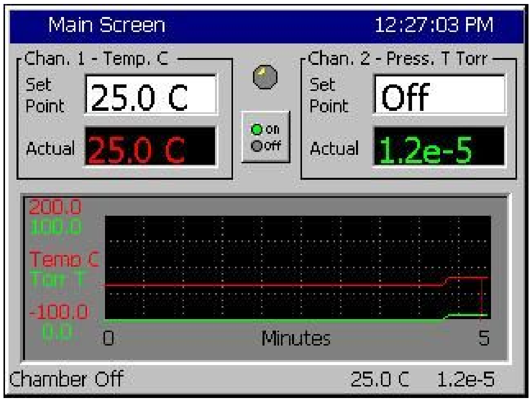
$P = 10^{(V-n)}$

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

$P = 10^{(3.25-11)} = 1.8 \times 10^{-8}$ (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

15.2 Altitude Chamber Setup

For conventional Altitude chambers (0-1000 Torr) the Synergy Controller can display the pressure value in units of Torr or Kft.

The setup consists of the following 5 steps:

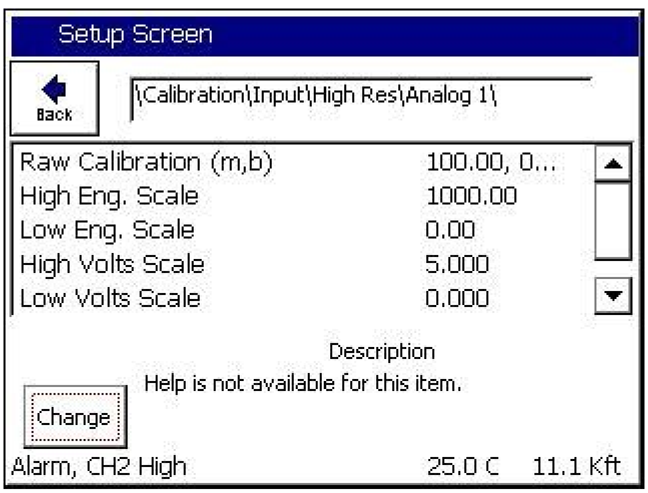
1. Connect pressure transducer to the controller.

2. Setup the chamber for the appropriate configuration; i.e. Generic Temperature /Pressure, Generic Temperature/Humidity/Pressure, etc.

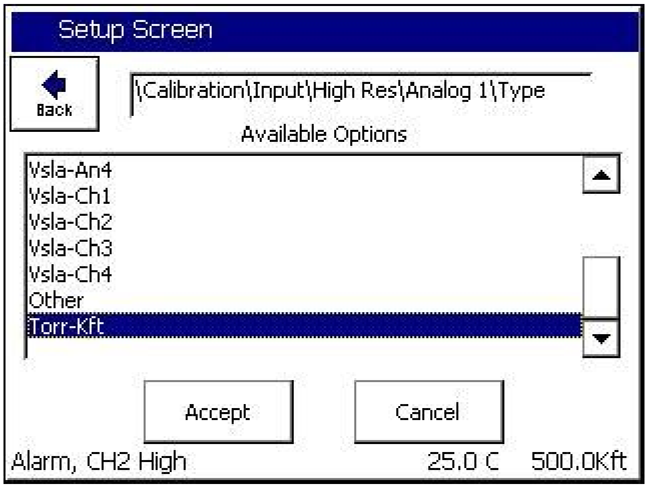
3. Setup the Hi Res input calibration for the pressure input. Adjust the Calibration\Input\High Res\Analog1\ Folder and adjust to the appropriate High Engineering and Low Engineering Scale for your transducer output in Torr.

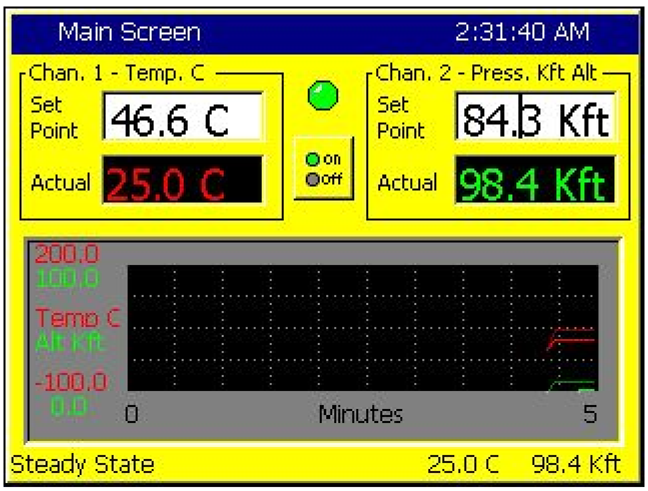
4. Select the channel sensor for the pressure input.

5. Setup the Altitude calibration to 0.



To display pressure in Kft scroll to the bottom of the screen and set the Type to Torr-Kft as shown below:





Voltage	Press. Torr	Calc Kft	Synergy Kft
0.001	0.2	115.08	115
0.01	2	98.42	98.4
0.1	20	72.61	72.6
1	200	32.61	32.6
2	400	16.71	16.7
2.5	500	11.13	11.1
3	600	6.39	6.4
4	800	-1.43	-1.4
5	1000	-7.79	-7.8

16.0 SYNERGY NANO MACROS AND BAR CODE SCANNERS

16.1 Synergy Nano Macros

The Synergy Nano features a powerful macro capability. A macro is a list of Synergy communication commands in a user look-up table that the controller executes when the code for the macro is typed on a keyboard or received from a barcode scanner. Though commands can be entered thru the keyboard interface, the full power of the macro capability is realized when a bar code scanner is used to enter the commands

16.2 Using a Bar Code Scanner with a Synergy Nano

Synergy Controller with
Hand Held Products Bar Code Scanner

OCR-A
Labeled Part

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 Nano offers the advantages of bar code scanning to environmental test engineers, operators and managers. The Synergy Nano’s powerful macro capability automatically selects and starts 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.

16.3 Equipment

The Hand Help Products ImageTeam 4800 OCR scanner can be used 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.

16.4 Installation

Installing the barcode scanner is straightforward.

Connecting the Barcode Scanner

1. Connect the USB cable to the handle of the ImageTeam 4800 and screw on the retainer clip.
2. Connect the USB connector to the Synergy Nano. .

For Synergy Nano the ImageTeam bar code scanner USB interface is used.

Once the barcode scanner is connected, continue configuring the barcode scanner as follows.

Configuring the Barcode scanner

Follow the steps below to configure the ImageTeam 4800 for use with the Synergy Nano 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. 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

Add the Carriage Return Suffix when using the PS/2 Keyboard interface. This setting appends the Carriage Return to the barcode data. Skip this section when using the USB interface.

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 Nano.

16.5 Barcode Interface Specifications

This is the specification for the barcode scanner setup for use with barcode scanners.

The format required by the Synergy Nano 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 Nano.

16.5 Controller Setup

No changes are required to any settings on the Synergy Nano 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.

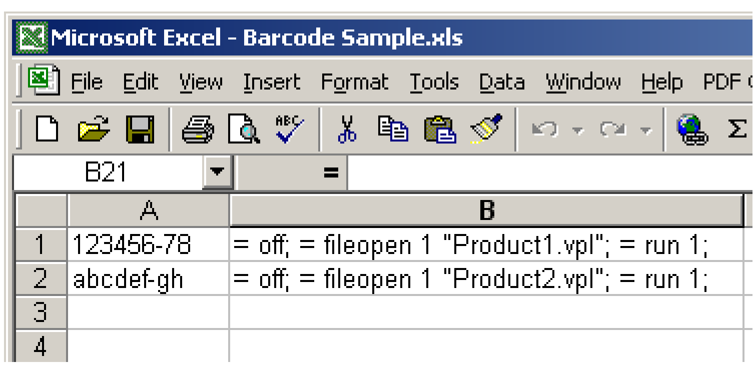
Macro File Format

The Macro file used by the Synergy Nano 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 Nano 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 Nano when the macro is executed.



	A	B
1	123456-78	= off; = fileopen 1 "Product1.vpl"; = run 1;
2	abcdef-gh	= off; = fileopen 1 "Product2.vpl"; = run 1;
3		
4		

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.

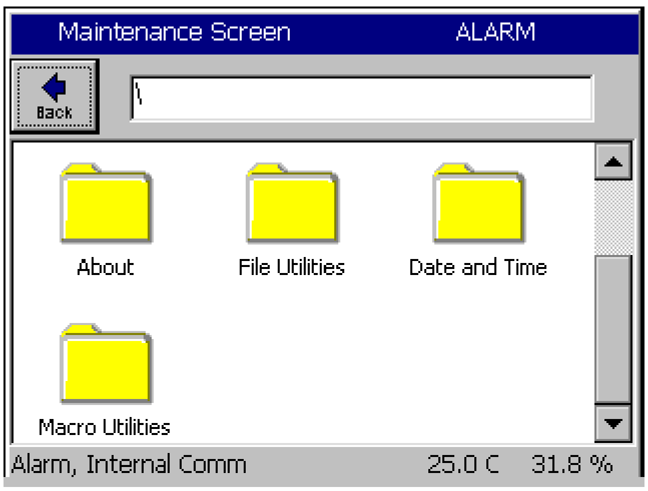
Once you have completed your macro file in Excel, click on File/Save As, enter a file name, and set the Save As type to CSV (Comma Delimited)(*.csv) and save the file.

Saving the file as type CSV

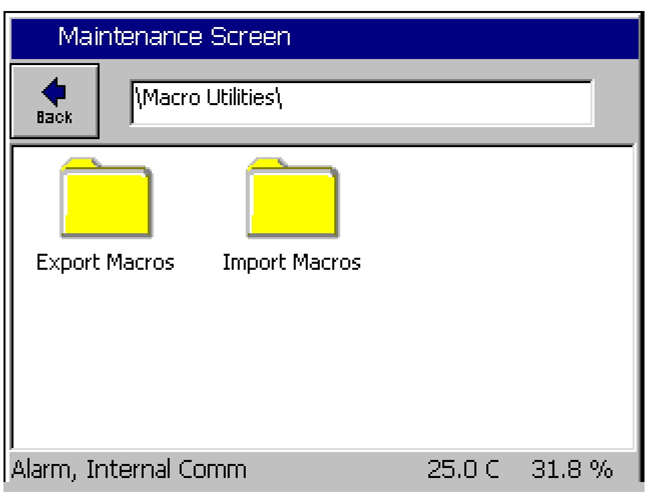
Importing the Macro File

The Synergy Nano can import the .csv macro file from a USB Hard Disk. 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.

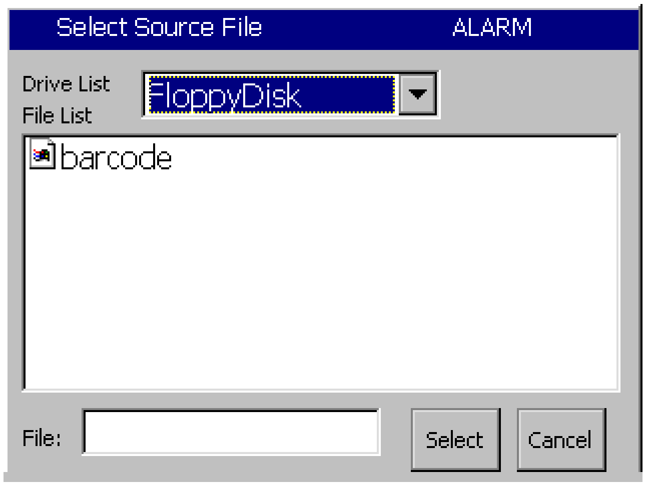


To Import the macro file, click on Maintenance on the front panel, scroll down and click on Macro Utilities.

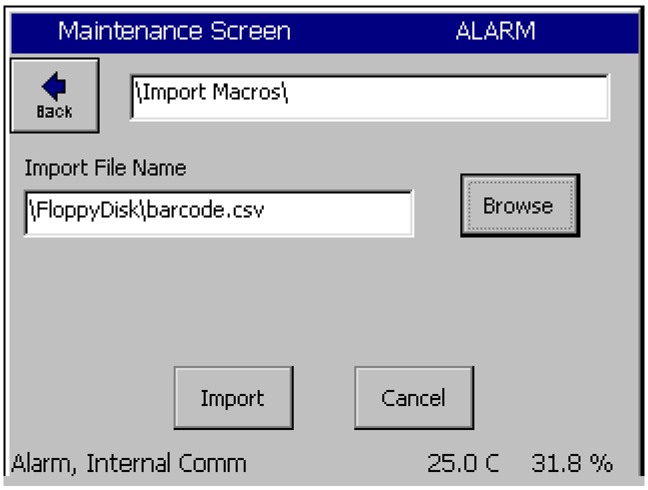


Click on the Import Macros folder.

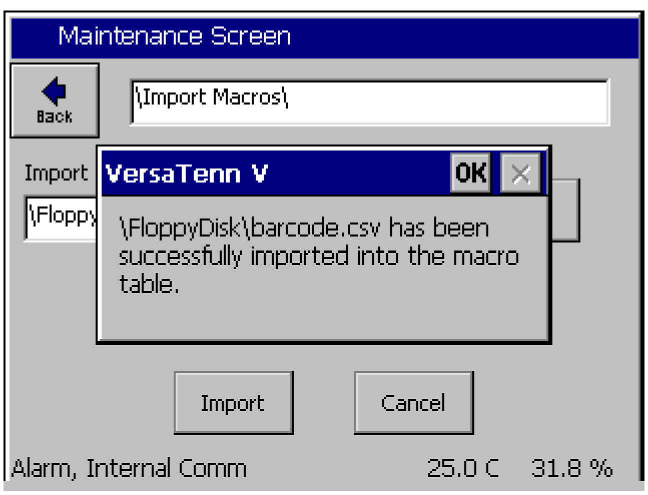
The import screen will appear. Click on Browse and then select the file you want to import, and then click the Select button.



Select the drive and the file name



Then click the Import button.



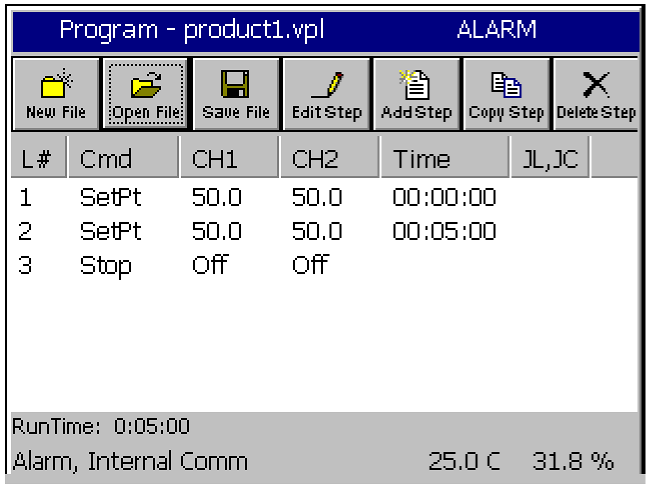
A message box will then let us know if the import was successful or not.

Now that the file is imported, we can now use the barcode scanner.

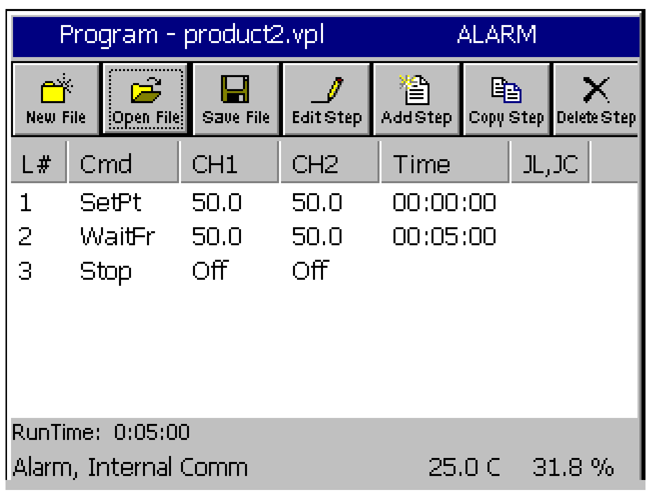
16.6 Testing and Troubleshooting

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.

123456-78

Test Label 1

ABCDEF-GH

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 Nano 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 Nano

If the scanner is functioning correctly, the next step is to test the macro feature of the Synergy Nano. Plug a standard PS/2 keyboard into the Synergy Nano. 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 Nano and try running it again.

17.0 INSTALLATION AND WIRING DIAGRAMS

The Synergy Nano is designed for both new equipment and retrofit applications. This section provides an overview of the controller installation process. The Synergy Nano 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 all alarm systems.
6. Verify control system performance for transient and steady state testing.

Note that some of these steps are simplified for some retrofits when those systems already have the output boards installed. These steps are noted as such.

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.

17.1 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 6.10 for a list of standard configurations for the Synergy Nano and Section 6.11 for a list of standard configurations for the Synergy Nano Plus. Consult the factory for custom configurations.

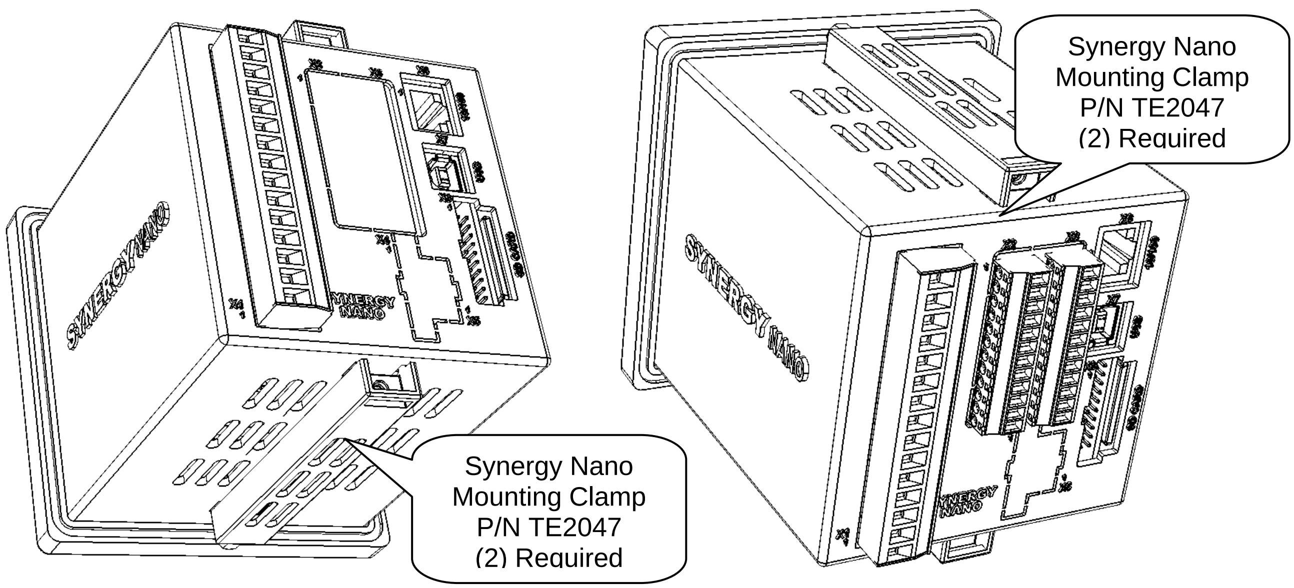
Details of wiring for the Synergy Nano are covered in Section 17.3 and for the Synergy Nano Plus in Section 17.4.

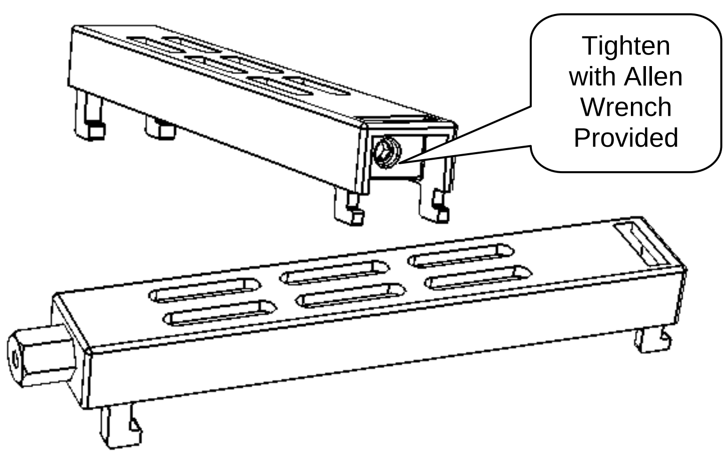
17.2 Controller Mounting

The Synergy Nano is ¼ DIN form factor which makes the retrofit process fast and easy.

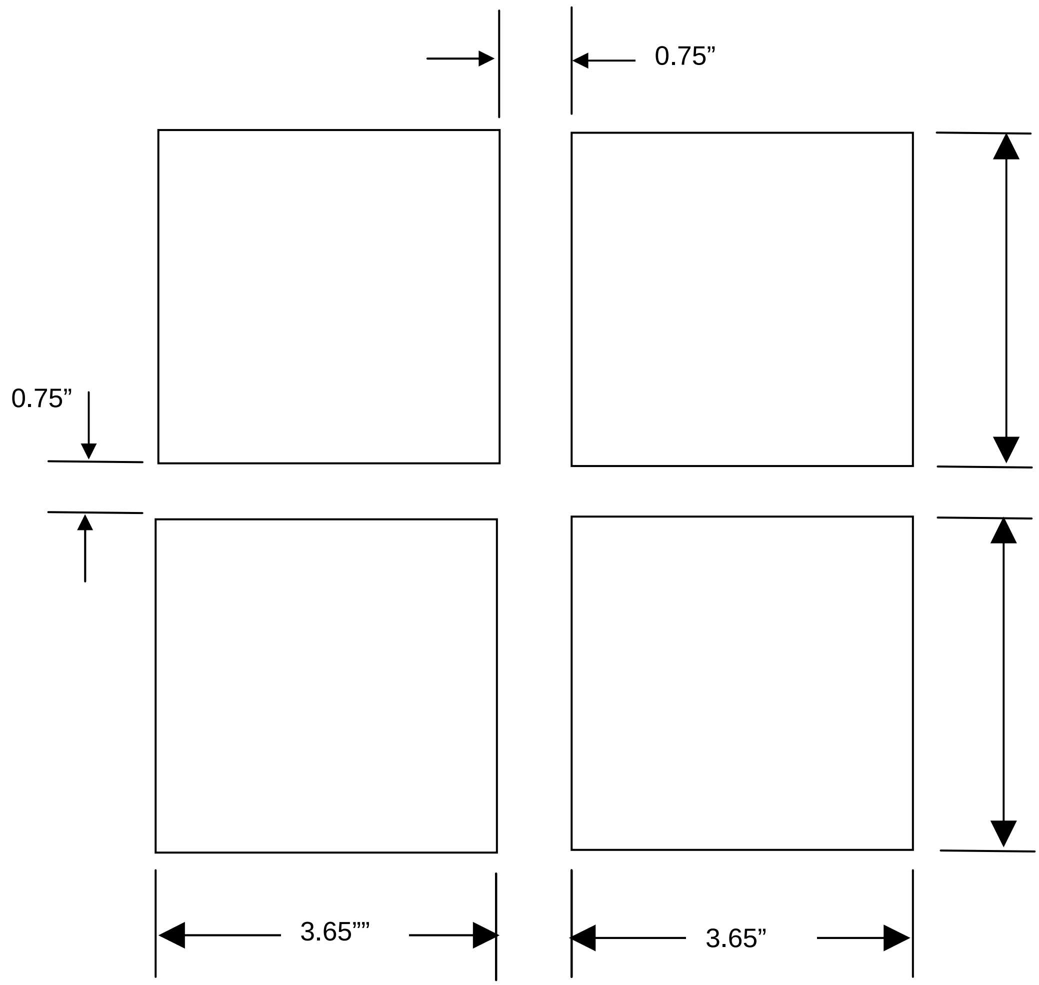
17.2.1 Controller Mounting

The Synergy Nano is mounted from the front of the panel as shown in the figure below. Two clamps (P/N TE2047) are installed on the top and bottom of the controller to secure it in the panel. 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.





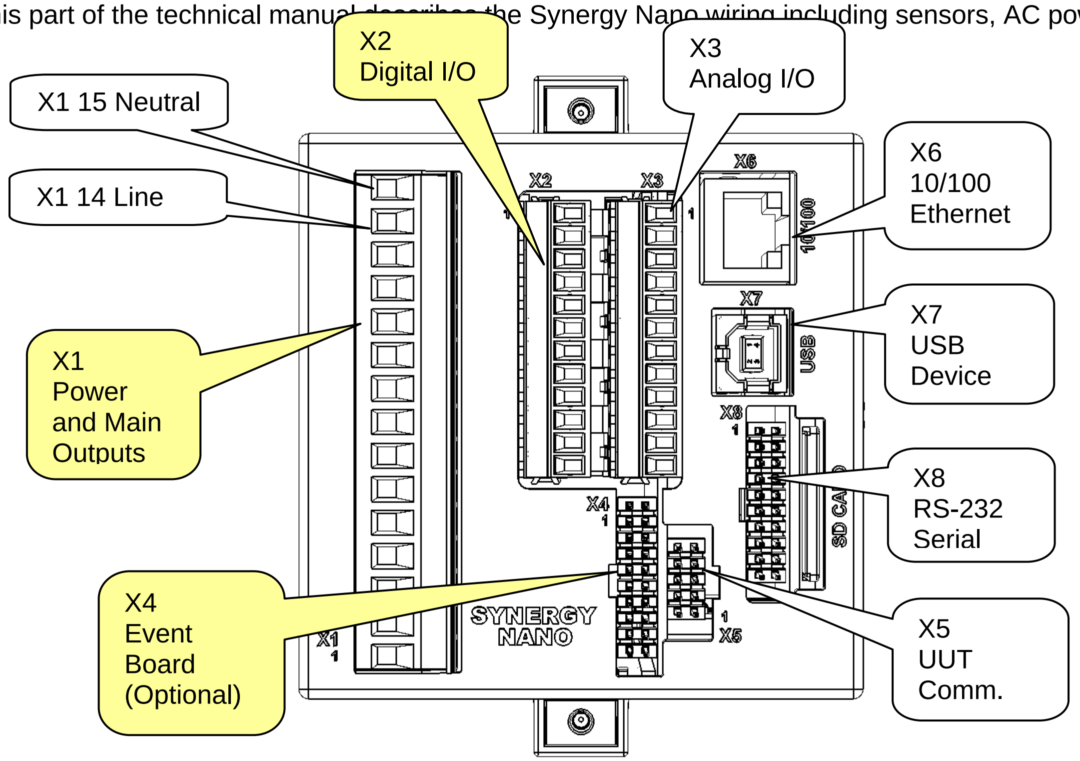
Synergy Nano Panel Cutout



17.3 Synergy Nano Wiring

This part of the technical manual describes the Synergy Nano wiring including sensors, AC power, AC outputs, retransmit outputs and communications. All connections for the controller are made behind the panel as shown bellow.

This part of the technical manual describes the Synergy Nano wiring including sensors, AC power



Input Power is connected to the X1 connector as shown above.

X1-Power and Main Outputs

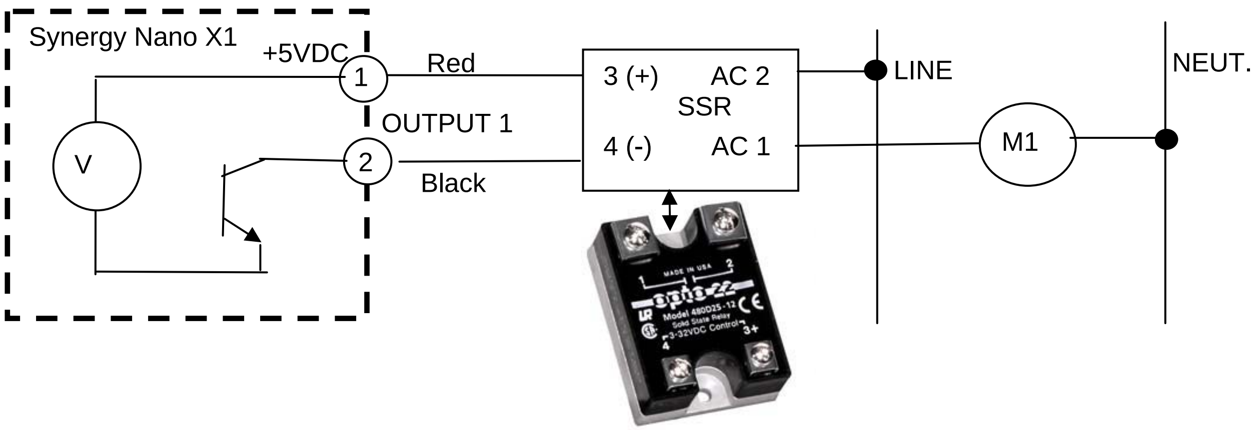
Pin	TE1858-1,2,3 and 4
13	Not Used
14	Line
15	Neutral

The Synergy Nano is available with three types of main outputs. These are shown in the table below;

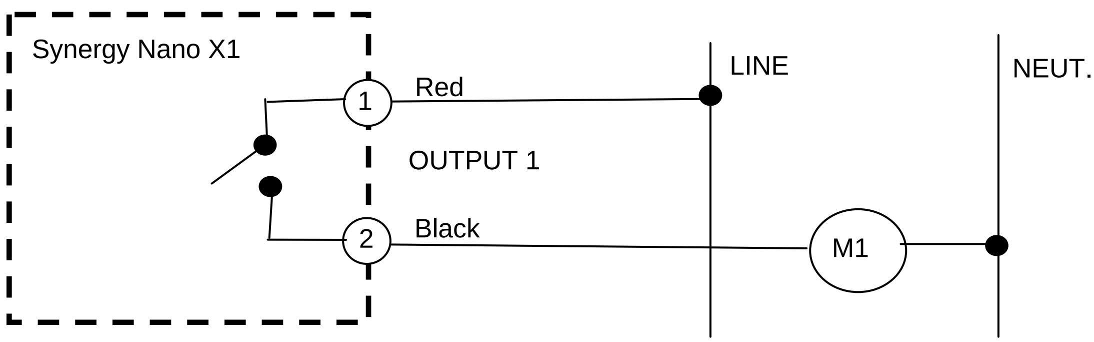
Main Outputs

TE1858-1	Logic Outputs to drive external SSR's
TE1858-2	Relay Outputs
TE1858-3	SSR Outputs
TE1858-4	Synergy Nano Controller Expanded outputs

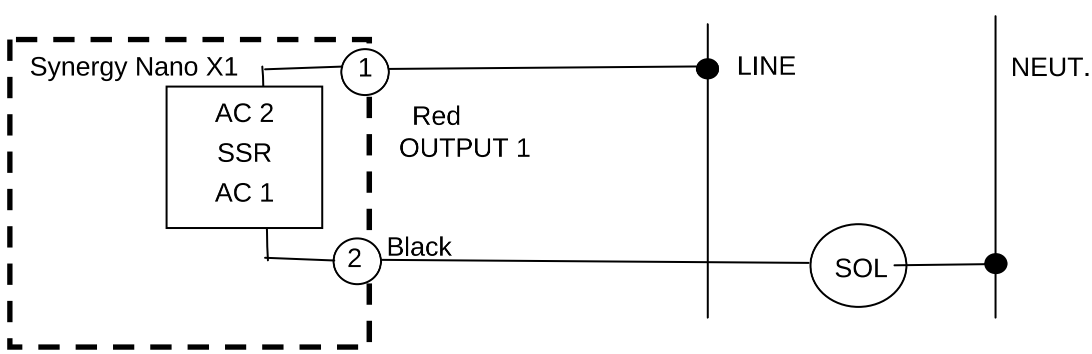
N1 The Synergy Nano TE1858-1 configuration features transistor (Open Collector) 5 VDC, 5 mA outputs. These outputs can drive Solid State Relays (SSR) units from Opto22, Grayhill etc. A wiring example of the SSR connection is shown below.



N2 The Synergy Nano TE1858-2 configuration features Relay outputs. A wiring example of the Relay connection is shown below. These contacts are rated at 1.5 AAC Continuous, 8 APK, 120/240 VAC



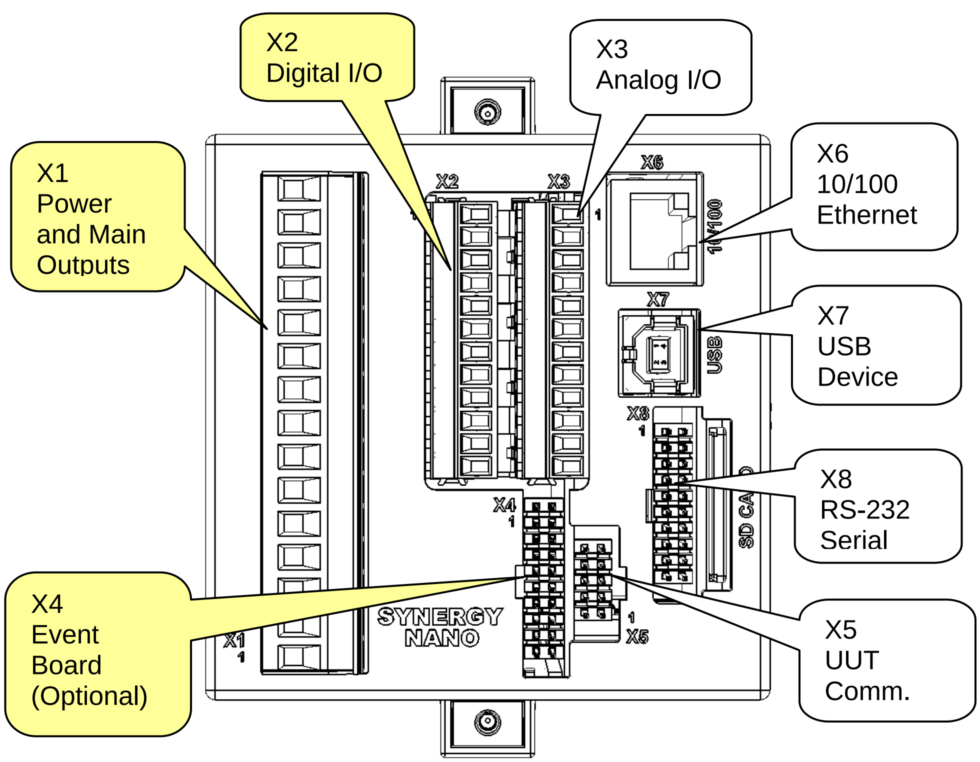
N3 The Synergy Nano TE1858-3 configuration features SSR outputs. A wiring example of the SSR connection is shown below. These contacts are rated at 1.0 AAC Continuous, 8 APK, 120/240 VAC.



The following table identified the X1 wiring configuration for all four Synergy Nano configurations.

X1-Power and Main Outputs

Pin	TE1858-1 Logic Outputs	TE1858-2 & 3 AC Outputs	TE1858-4 Nano Plus Expanded
1	+5V	Output 1	Not Used
2	Output 1	Output 1	Not Used
3	+5V	Output 2	Not Used
4	Output 2	Output 2	Not Used
5	+5V	Output 3	Not Used
6	Output 3	Output 3	Not Used
7	+5V	Output 4	Not Used
8	Output 4	Output 4	Not Used
9	+5V	Output 5	Not Used
10	Output 5	Output 5	Not Used
11	+5V	Output 6	Not Used
12	Output 6	Output 6	Not Used

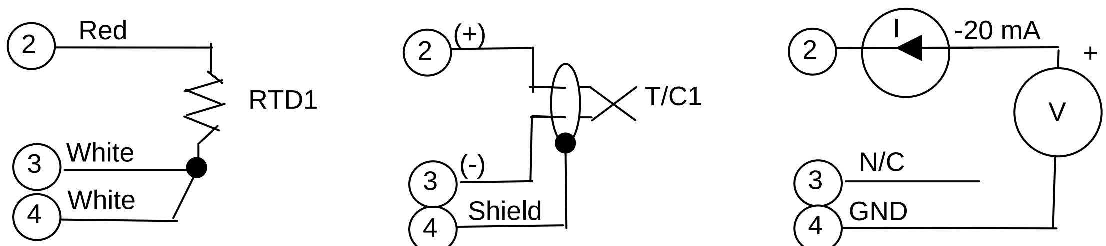


X3-Analog I/O (X3 is not used on TE1858-4 expanded controller)

Pin	TE1858-1,2,3	Signal
1	Analog Input 1	Precision 0 to +5Volts process input
2	RTD1-Red	100 or 500 Ohm RTD
3	RTD1-White	100 or 500 Ohm RTD
4	RTD1-White	Analog Common
5	Analog Input 2	Precision 0 to +5Volts process input
6	RTD2-Red	100 or 500 Ohm RTD
7	RTD2-White	100 or 500 Ohm RTD
8	RTD2-White	Analog Common
9	Retransmit 1	0-5 VDC
10	Retransmit 2	0-5 VDC
11	Not Used	Not Used
12	Not Used	Not Used

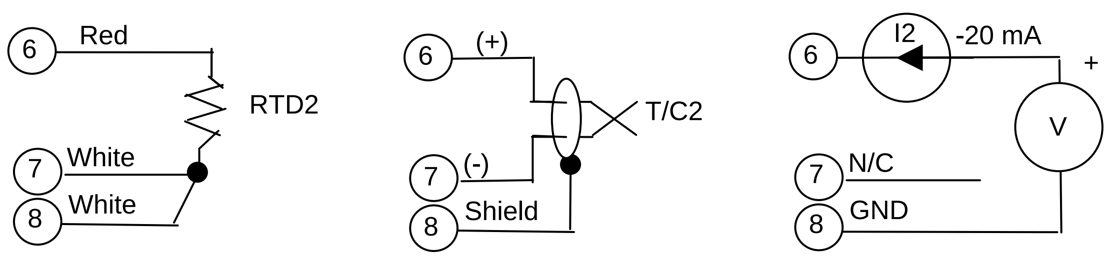
17.3.1 Input Sensor Wiring

The Synergy Nano supports four types of RTDs, eight Thermocouple types, T, S, J, B, K, R and various 4-20 mA transducers. These sensors connect to the Synergy Nano X3 connector according to the tables shown below. These sensors are typically used for air temperature or product temperature.



RTD1, T/C1, I1 (4-20mA)

Pin	RTD	T/C	I1 (4-20mA)	Signal
2	RTD1-Red	T/C+	I+	+
3	RTD1-White	T/C-	N/C	-
4	RTD1-White	Shield (optional)	I-	Analog Common



RTD2, T/C2, I2 (4-20mA)

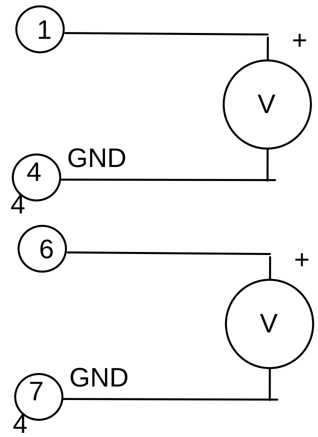
Pin	RTD2	T/C2	I2 (4-20mA)	Signal
6	RTD2-Red	T/C2+	I2+	+
7	RTD2-White	T/C2-	N/C	-
8	RTD2-White	Shield (optional)	I2-	Analog Common

17.3.1 Process Input Wiring

The Synergy Nano supports two process voltage inputs. These inputs connect to the Synergy Nano X3 connector according to the tables shown below. These sensors are typically used for air temperature or product temperature.

V1

Pin	Signal	Signal
1	V+	V+
4	V-	V-

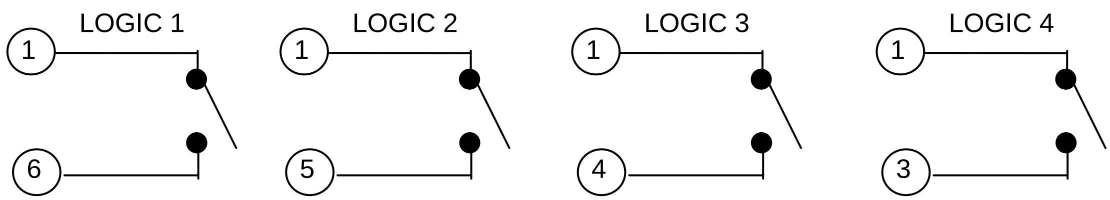


V2

Pin	Signal	Signal
6	V+	V+
9	V-	V-

X2-Aux Outputs and Digital Inputs(X2 is not used on TE1858-4 expanded)

Pin	TE1858-1,2,3	TE1858-1,2,3 Signal
1	Common	Common for logic inputs
2	+5 Volt Source	For Solid State Relays, 50 mA
3	Logic Input 4	0-5 VDC or Contact Closure. X2-12 common
4	Logic Input 3	0-5 VDC or Contact Closure. X2-12 common
5	Logic Input 2	0-5 VDC or Contact Closure. X2-12 common
6	Logic Input 1	0-5 VDC or Contact Closure. X2-12 common
7	DC Output 6	Open Collector. X2-11 provided +5Volt source
8	DC Output 5	Open Collector. X2-11 provided +5Volt source
9	DC Output 4	Open Collector. X2-11 provided +5Volt source
10	DC Output 3	Open Collector. X2-11 provided +5Volt source
11	DC Output 2	Open Collector. X2-11 provided +5Volt source
12	DC Output 1	Open Collector. X2-11 provided +5Volt source



17.4 Synergy Nano Analog I/O

X3-Analog I/O (X3 is not used on TE1858-4 expanded controller)

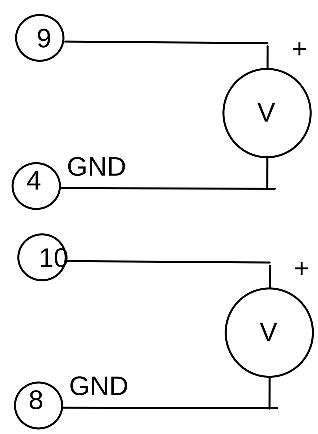
Pin	TE1858-1,2,3	Signal
1	Analog Input 1	Precision 0 to +5Volts process input
2	RTD1-Red	100 or 500 Ohm RTD
3	RTD1-White	100 or 500 Ohm RTD
4	RTD1-White	Analog Common
5	Analog Input 2	Precision 0 to +5Volts process input
6	RTD2-Red	100 or 500 Ohm RTD
7	RTD2-White	100 or 500 Ohm RTD
8	RTD2-White	Analog Common
9	Retransmit 1	0-5 VDC
10	Retransmit 2	0-5 VDC
11	Not Used	
12	Not Used	

17.4.2 Synergy Nano 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 Nano's two analog retransmit outputs.

Retransmit 1

Pin	Signal
9	V+, (0 – 5 VDC)
4	V-

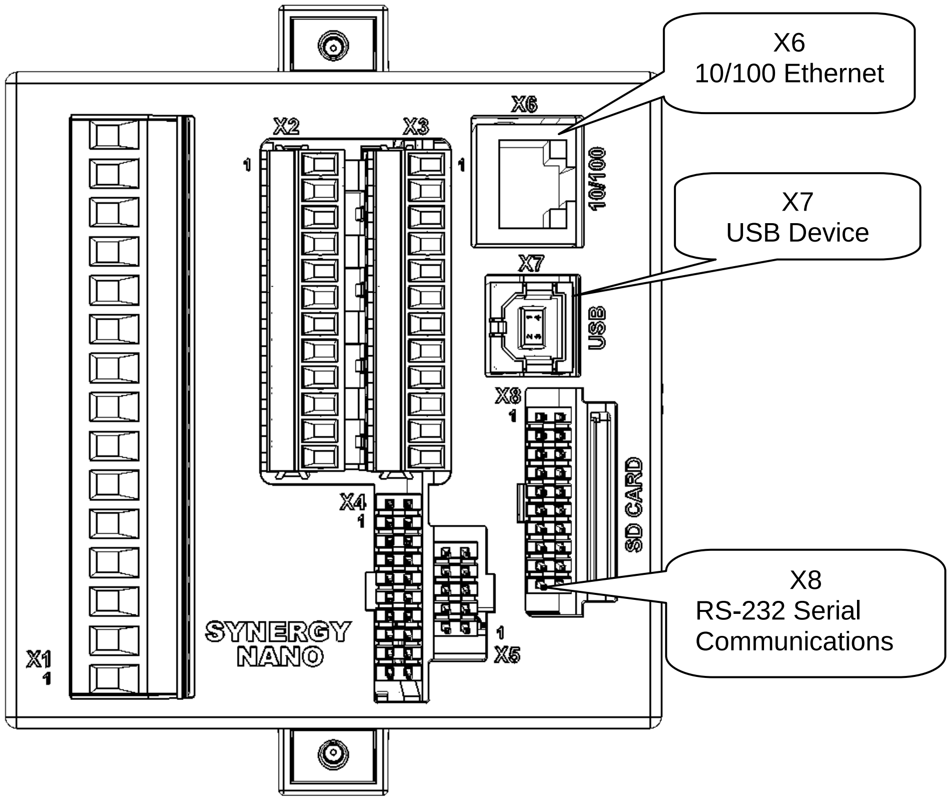


Retransmit 2

Pin	Signal
10	V+, (0 – 5 VDC)
8	V-

17.5 Synergy Nano Communications

The Synergy Nano included Ethernet and RS-232 Communications. The Synergy Nano also works with the optional Synergy488 GPIB board (P/N TE1588-1). The figure below identifies the Synergy Nano connections involved with communication.



- Synergy Nano 10/100 BaseT Ethernet port X6.
- Synergy Nano RS-232 port X8
- Optional GPIB Communications Adapter
- Optional UUT Data logging (RS-485) X5

17.5.1 Ethernet Connection

The X6 connection on the back of the Synergy Nano provides the RJ-45 connection for 10/100 BaseT networks.

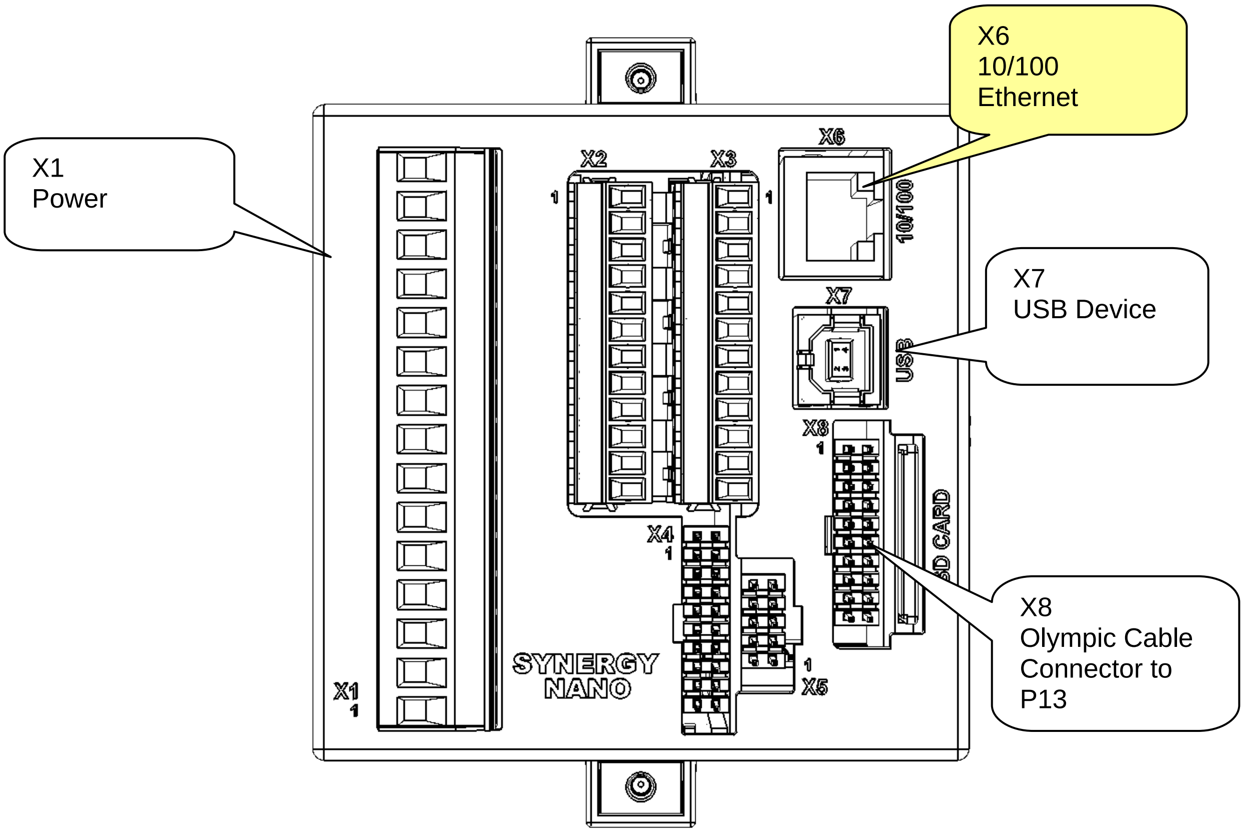
In most applications, a bulkhead mounted Ethernet cable provides a convenient method to provide access to the Ethernet port from the outside of the equipment. The bulkhead mounted Ethernet jack (P/N TE1770-03C) is shown below.

	
Typical Installation	P/N TE1770-06C

Alternatively, a standard CAT5 Ethernet cable can be used to connect the Synergy Nano to a Network port or an Ethernet Switch or Hub.

A crossover CAT5 Cable (P/N TE1776-06C) can also be use to connect directly to the Ethernet port on a PC or Laptop.

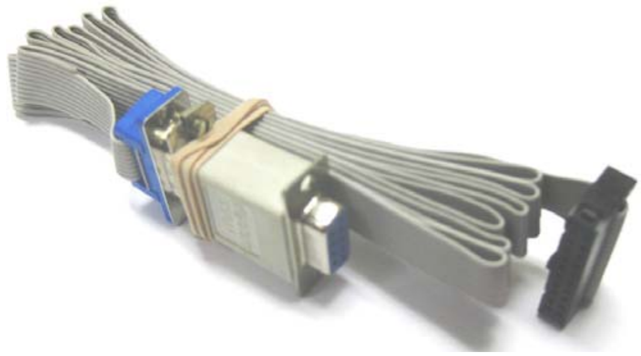
	
Crossover TE1776-06C	Patch Cable TE1775-06C


X6
10/100
Ethernet
X1
Power
X7
USB Device
X8
Olympic Cable
Connector to
P13
X2
X3
X4
X5
X1
10/100
USB
SD CARD
SYNERGY
NANO

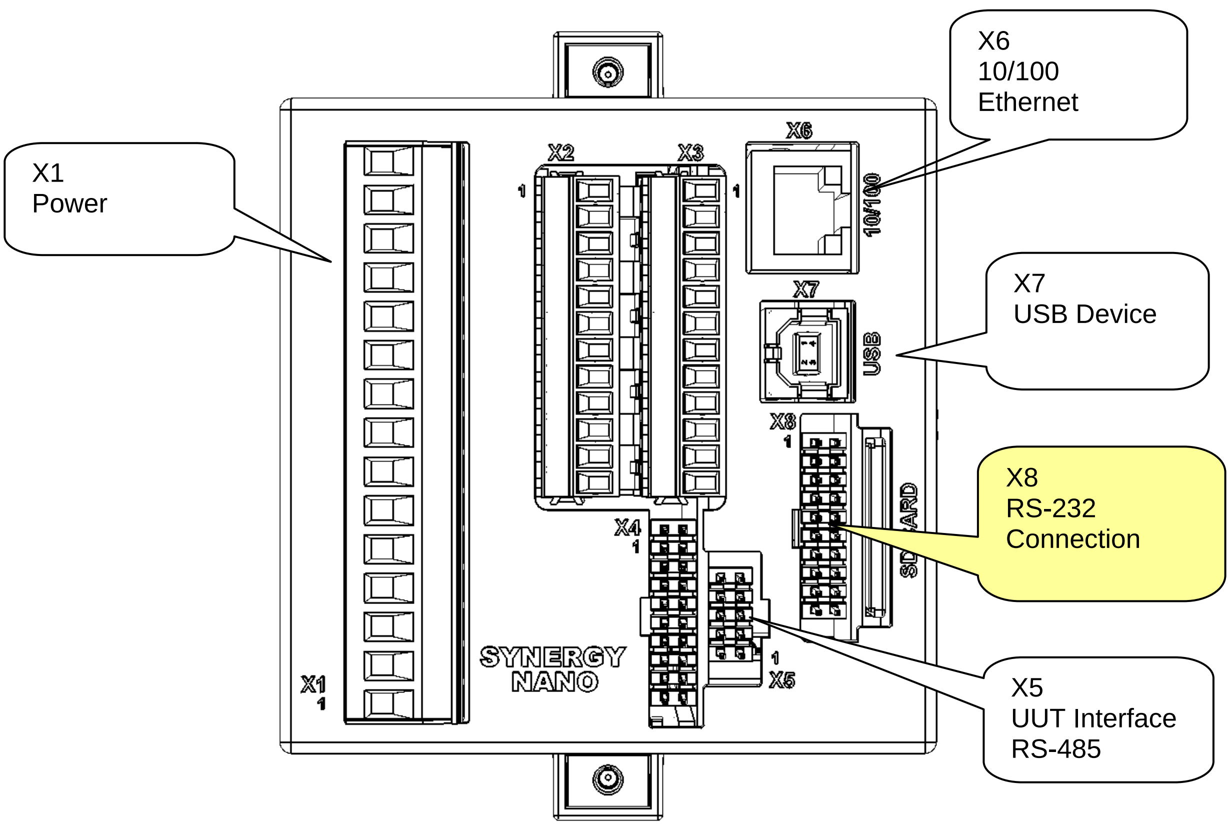
17.5.2 RS-232 Connection

The Synergy Nano offers an RS-232 Serial port for communications on the X8 connector. Note that the X8 connector is also used for the Olympic board connection for the Synergy Nano Plus configuration which is described in a later section of this technical manual. RS-232 communications go thru the Olympic board in the Synergy Nano Plus configuration.

The TE1608-1 Cable is supplied for RS-232 communications. Note that this cable includes a Null Modem adapter which is required.

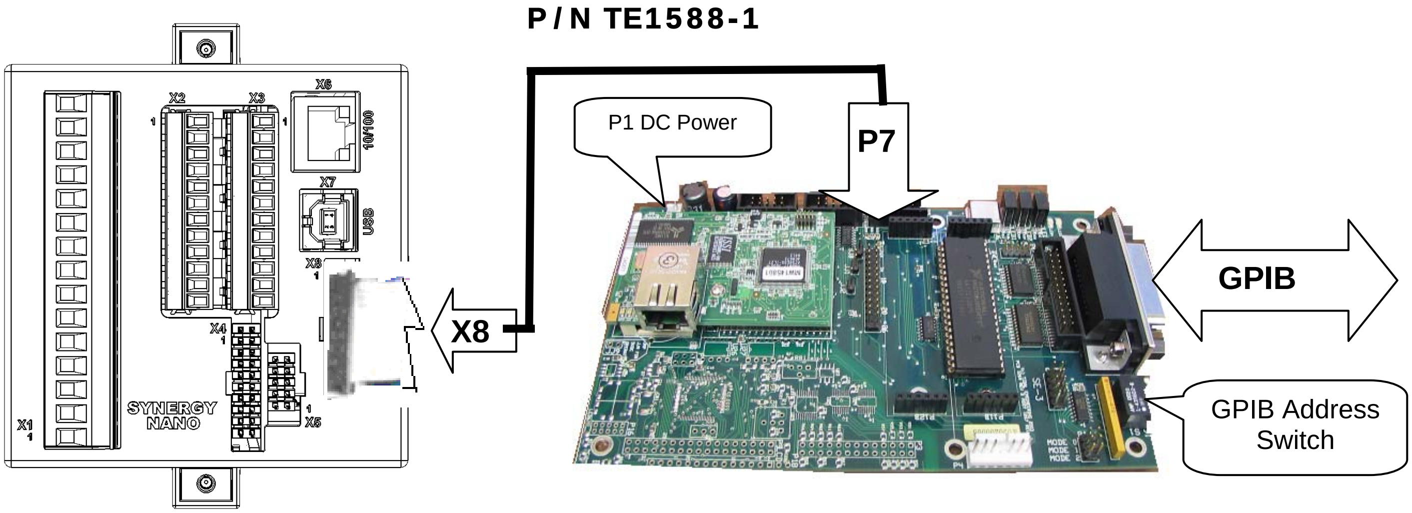


TE1608-1



17.5.3 GPIB Connection

The Synergy Nano's optional GPIB feature uses the Synergy488, TE1588-1 card. See the unit in the figure below.

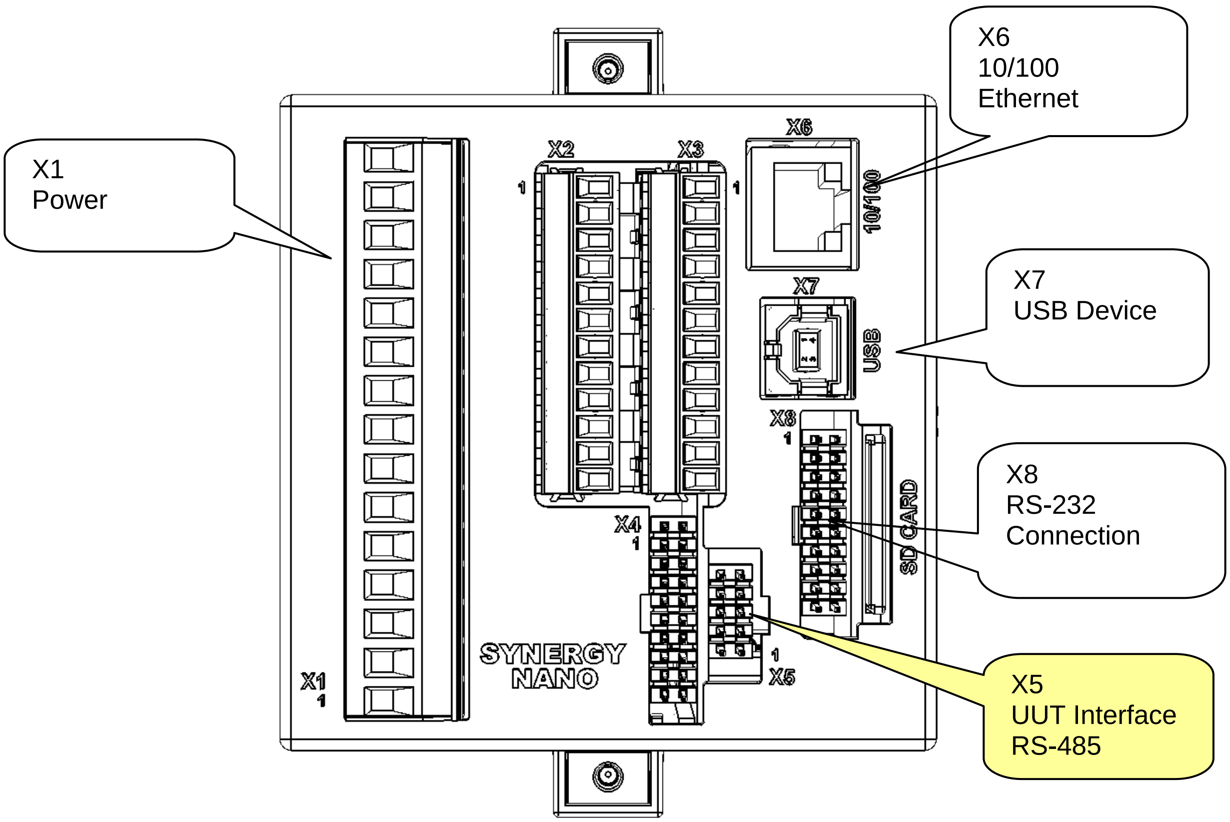


17.5.4 RS-485 UUT Connection

In addition to the Synergy Nano's built-in temperature and process inputs, the Synergy Nano provides the capacity to log up to an additional 64 T-type thermocouples. Up to four UUT Modules (P/N TE1299-16) may be connected to the Synergy Nano thru it's RS-485 port on connector X5.

The power supply, cabling and connectors required for the TE1299-16 are included with the option.

TE1299-16 UUT Module (for 16 T-type Thermocouples)



17.6 Synergy Nano Plus Wiring

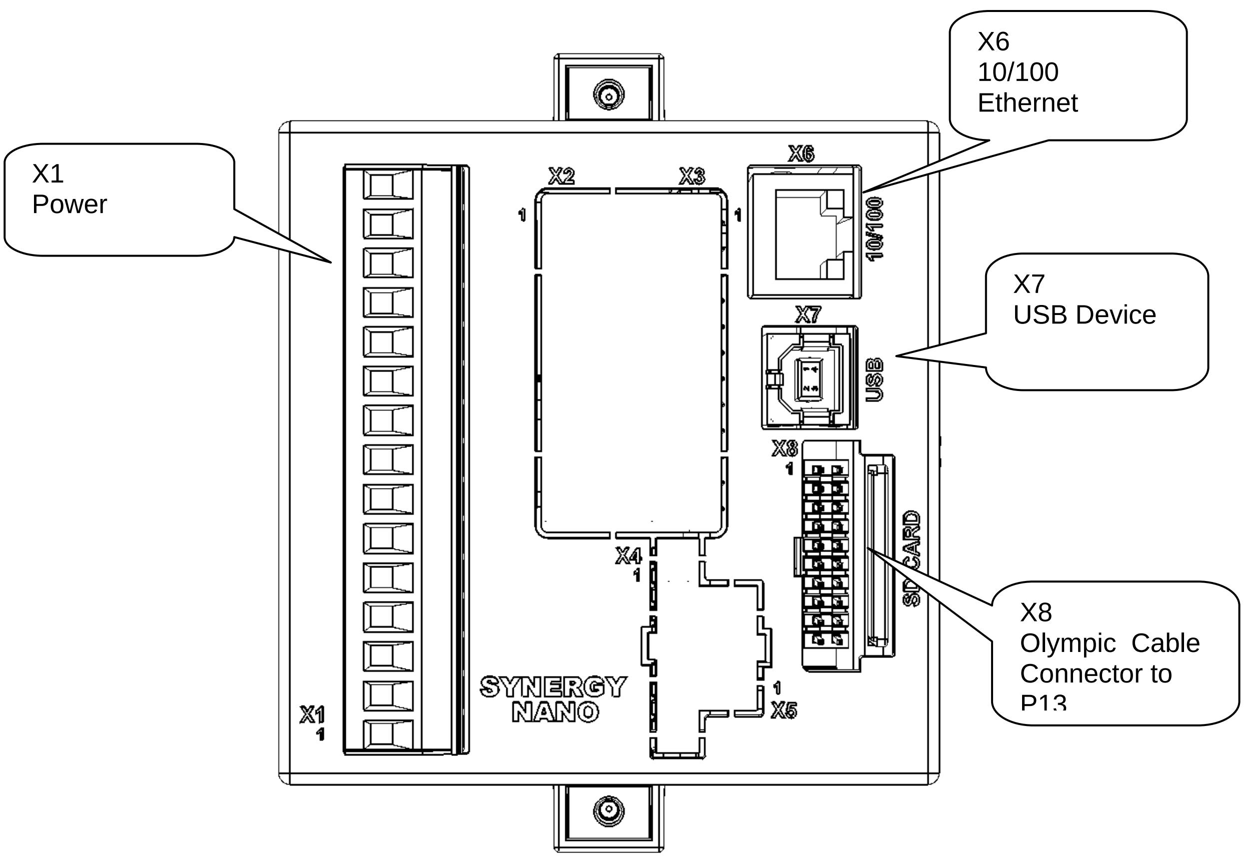
17.4.1 Olympic Board Mounting

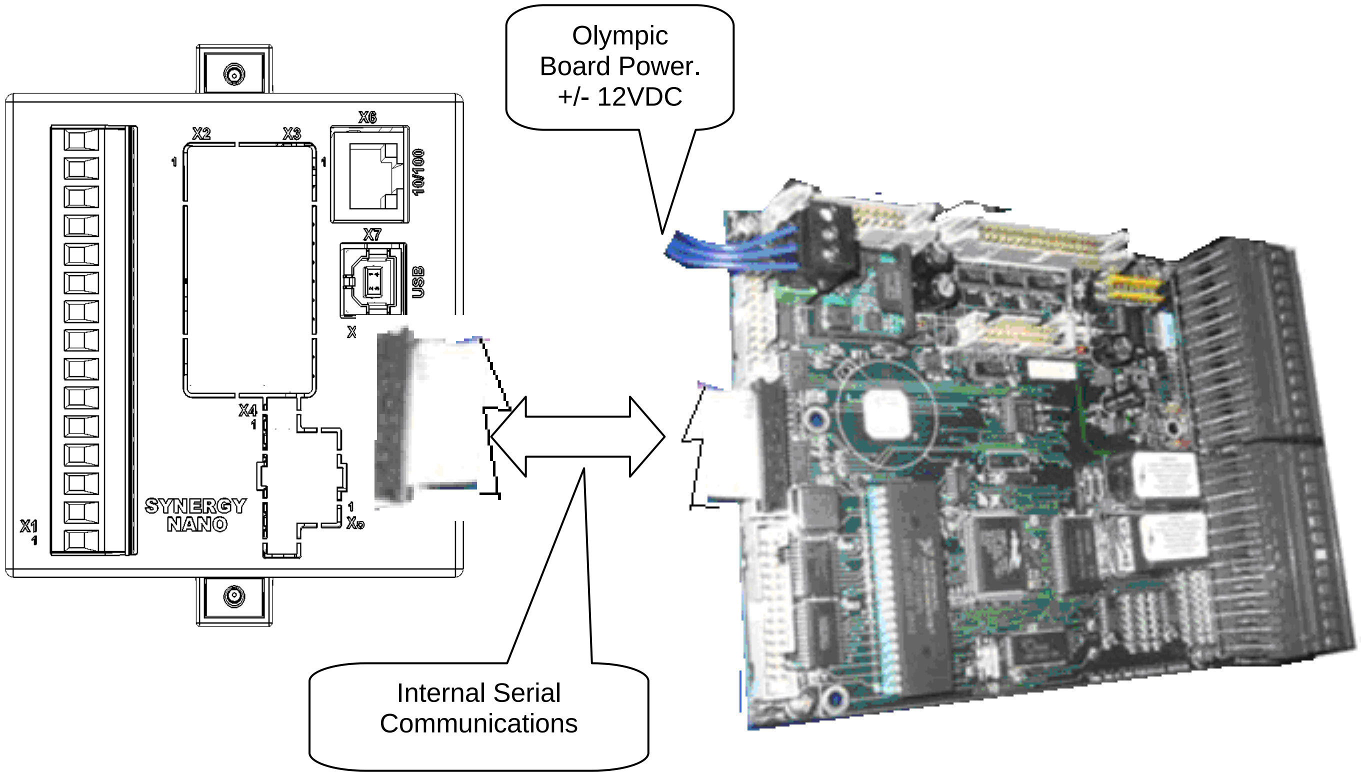
The Synergy Nano Plus is designed to work in split systems where the Synergy Nano is mounted on the front of the equipment within reach of the operator and the Olympic I/O Controller is in the control box in close proximity to the sensor and power controller wiring.

One ribbon cable connection is required between the Synergy Nano and the Olympic board; this is a serial communications cable. A +/- 12 VDC power supply is also required for the Olympic board as 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 Nano 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.

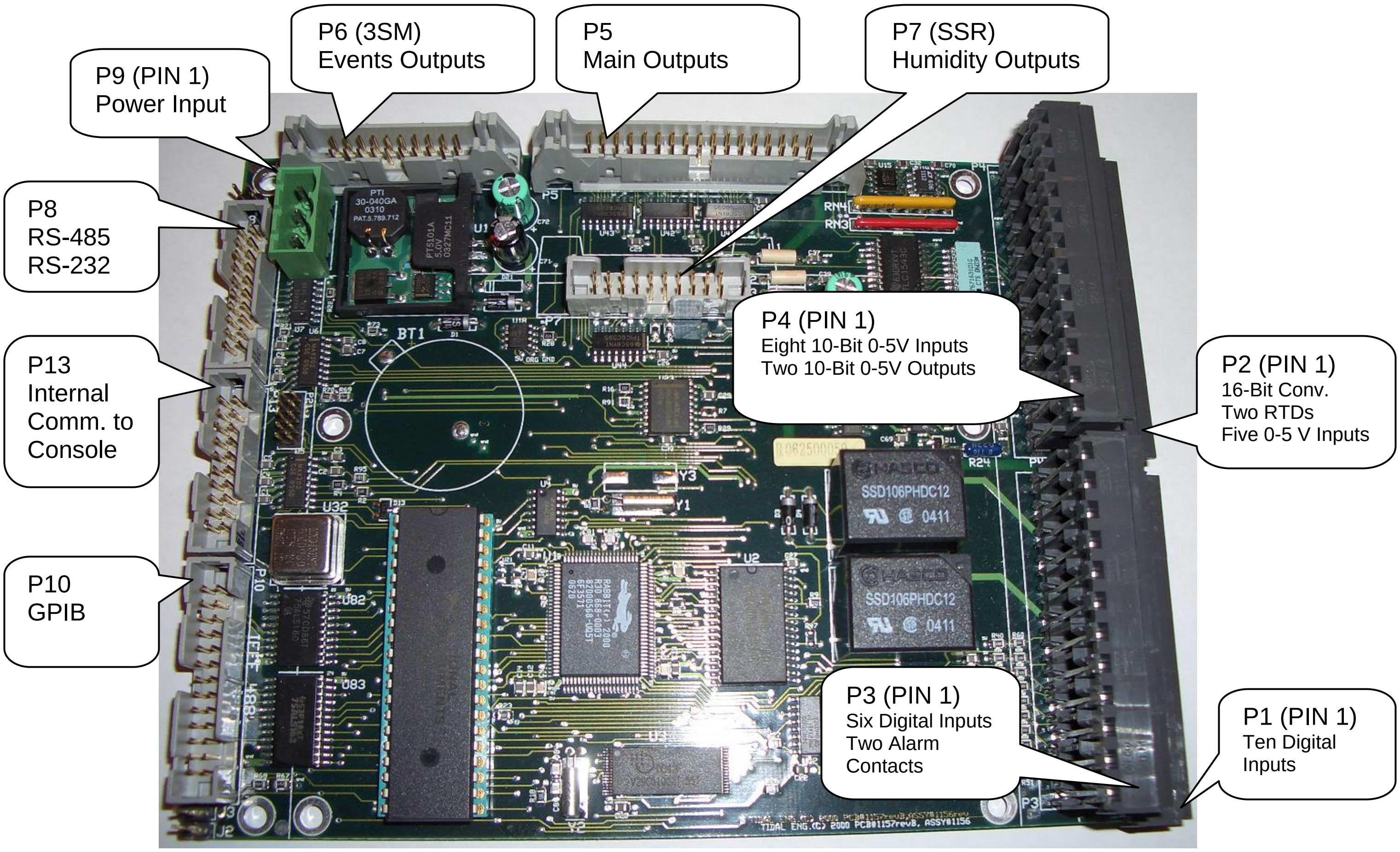
Synergy Nano Plus Rear View
Expanded Configuration




Olympic
Board Power.
+/- 12VDC
X2
X3
X6
10/100
X7
USB
X4
X1
SYNERGY
NANO
Internal Serial
Communications

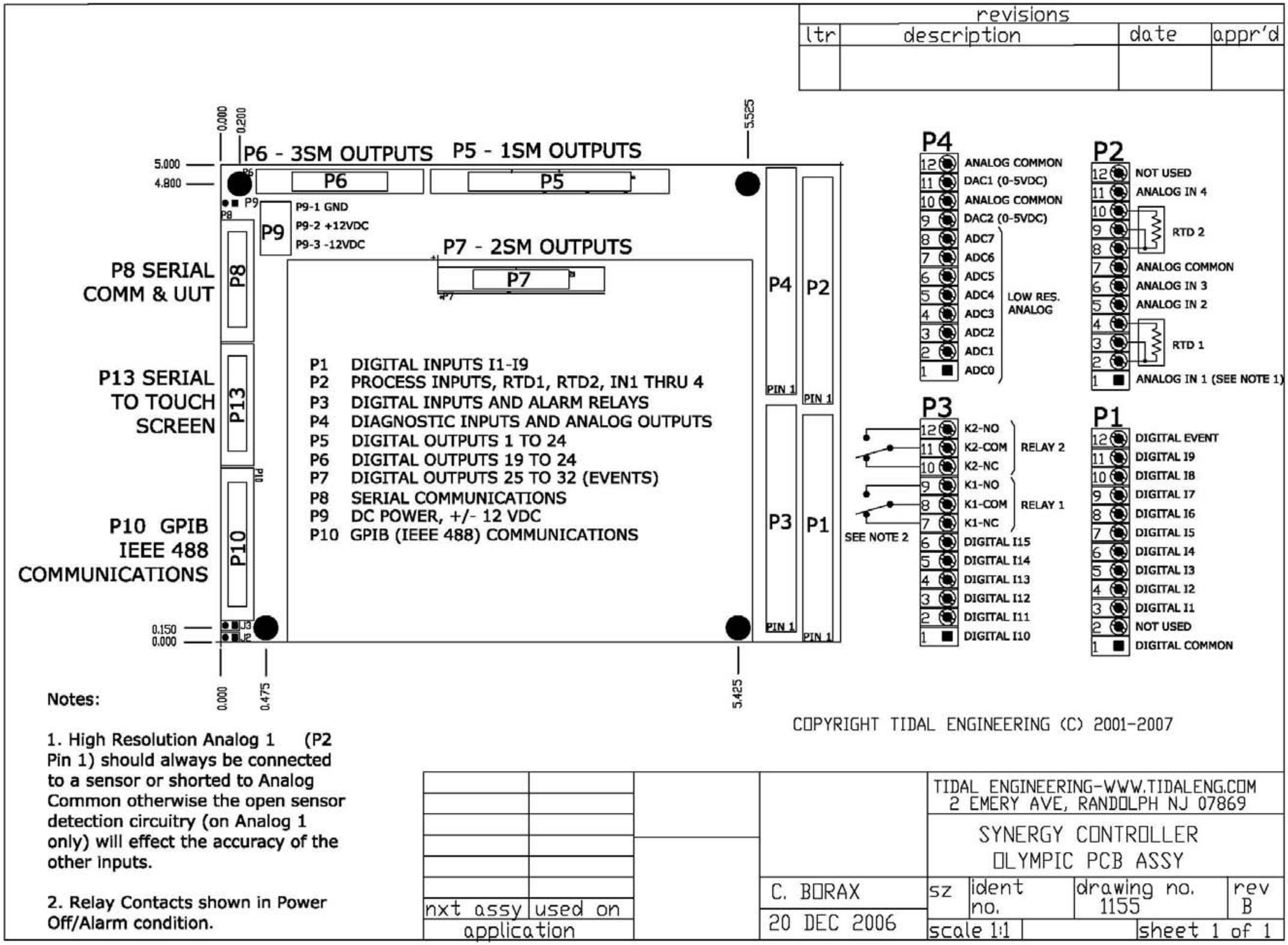
Most of the Synergy Nano Plus input and output wiring is made at the Olympic board. The following image of the Olympic Board identifies the connectors on the board and their principal functions. In addition a connection diagram follows that identifies the detailed pin-out of the P1 thru P4 input/output connectors.

Olympic Board



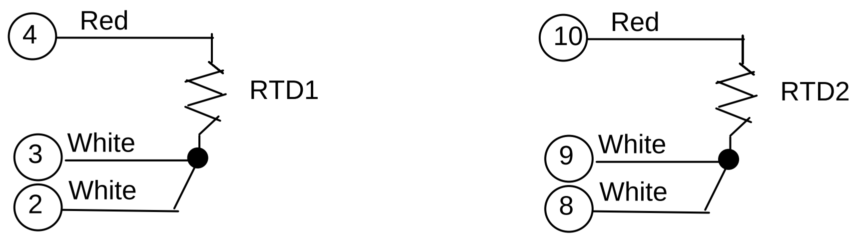
Note: The Boost Heat output must be wired in series with the PID Heat output and not wired to control the Boost Heaters directly.

Olympic Board Connection Diagram



17.4.6 RTD Sensor Wiring

The Synergy Nano Plus 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	P2-9	P2-10

17.4.7 Voltage Sensor Wiring

The Synergy Nano 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

The Synergy Nano 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. Precision 250 ohm resistors are available to use these voltage inputs with 4-20 mA sensors. 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

17.4.8 4-20mA Sensor Wiring

The Synergy Nano Plus 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.

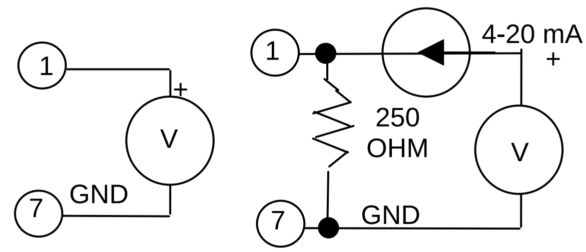
CAUTION! : The voltage inputs on the controller will be damaged if the 4-20 mA signal is attached without a 250 Ohm Resistor.

17.4.9 Process Input Wiring

The Synergy Nano Plus supports four process voltage inputs. These inputs connect to the Olympic board P2 connector according to the tables shown below. These inputs can be used for any sensors including air temperature, product temperature, Vibration (GRMS), Pressure (Altitude), etc. These process inputs can also be used with 4-20 mA transducers using the supplied precision 250 Ohm resistor (TE1924).

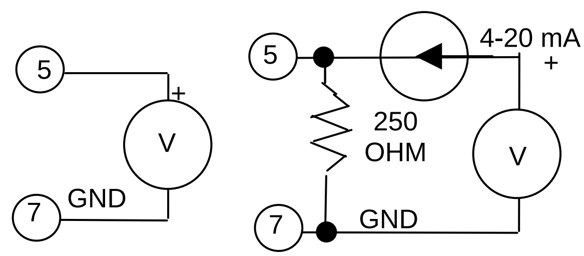
Analog 1

Pin	Signal	Signal
1	V+	0 - 5VDC
7	V-	GND



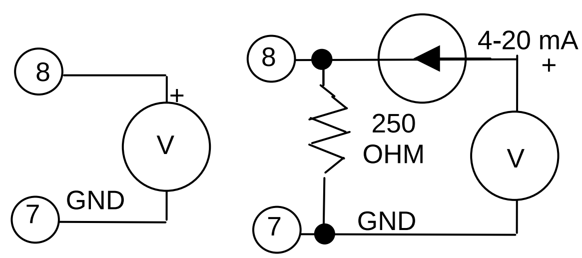
Analog 2

Pin	Signal	Signal
5	V+	0 - 5VDC
7	V-	GND



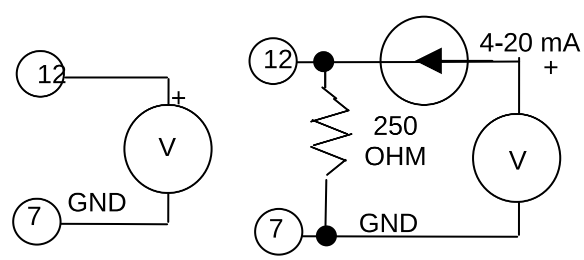
Analog 3

Pin	Signal	Signal
8	V+	0 - 5VDC
7	V-	GND

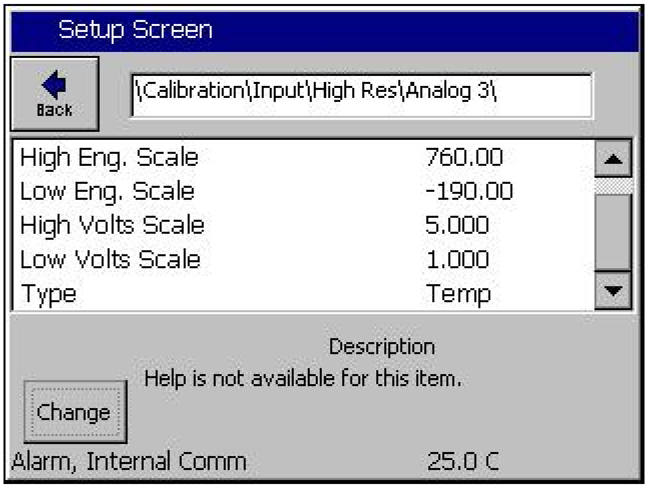


Analog 4

Pin	Signal	Signal
12	V+	0 - 5VDC
7	V-	GND



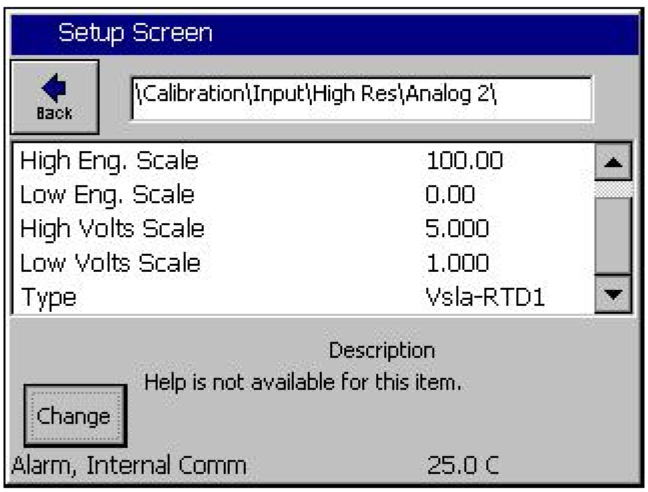
Setup the calibration the High Volts Scale for 5.0 VDC and Low Volts Scale for 1.0 VDC. Then set the Engineering Scale for the specific sensor and scaling. Take a look at the input calibration screen for the two examples below.



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.

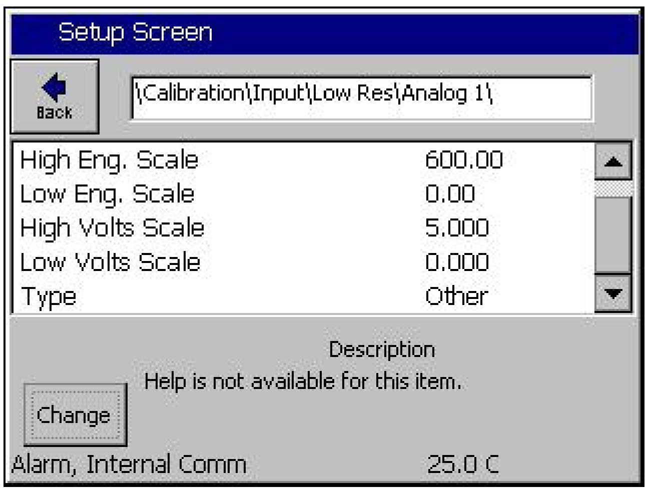
For additional information regarding calibration see the Setup section 6.0 of this manual.

17.4.10 Low Resolution Sensor Wiring

The refrigeration pressure transducers should 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. Note that the Low Resolution inputs are not limited to pressure measurement and can be used for any transducer compatible with the 5VDC full scale or 4-20 mA signal conditioners.

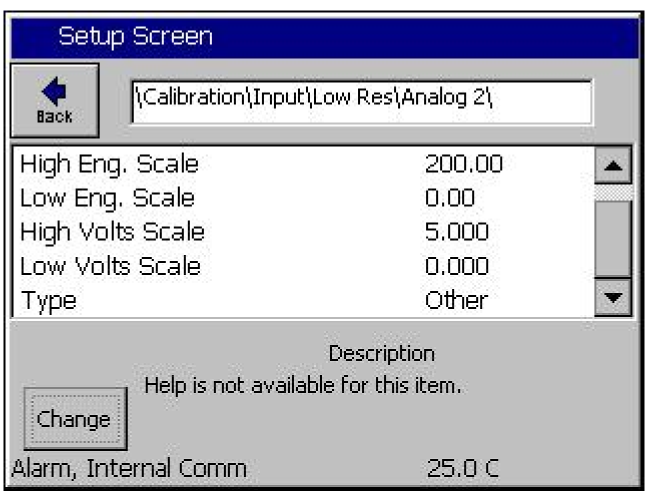
Sensor Function	Range	Voltage Range	Connection	COM
Low stage, Discharge Pressure	0-600PSI	0-5 VDC	P4-pin 1	P4- Pin 10
Low stage, Suction Pressure	0-200PSI	0-5 VDC	P4-pin 2	P4- Pin 10
Low stage, Oil Pressure	0-200PSI	0-5 VDC	P4-pin 3	P4- Pin 10
High stage, Discharge Pressure	0-600PSI	0-5 VDC	P4-pin 4	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 for 600 PSI.



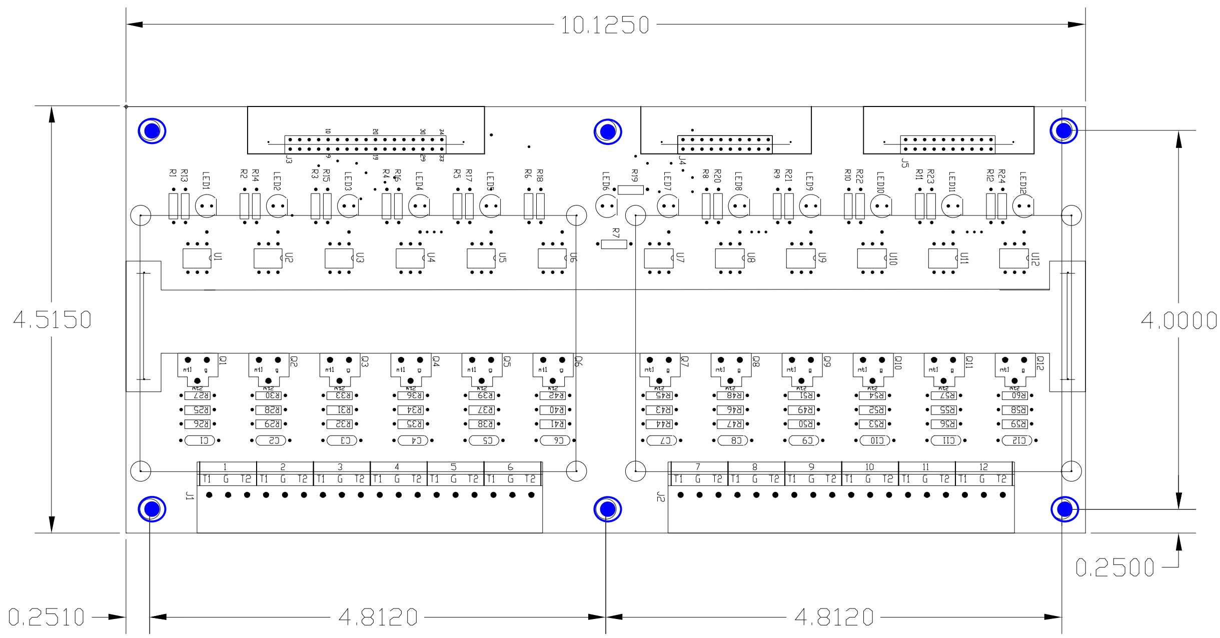
Example 2

In this example the low stage compressor suction pressure is monitored on Input 2. The high engineering scale is set to 200 for 200 PSI.

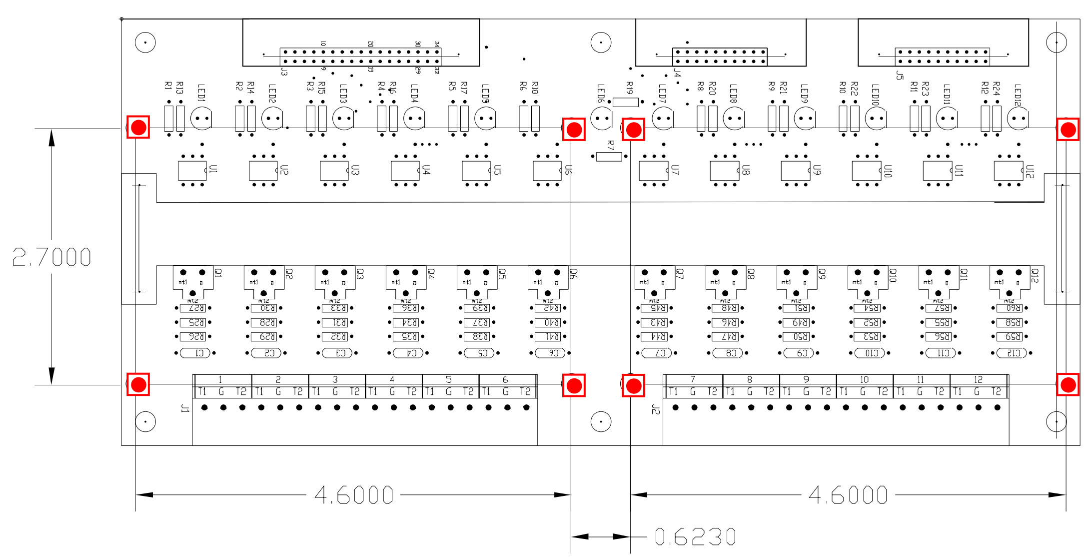
The Low Resolution inputs can be viewed in the Events/Low Res screen. These inputs can be used as the input for a programmable alarm in addition to be used as the sensor for a control channel.

17.4.2 12-Channel Triac Board Mounting

Triac output boards are used with the Synergy Nano Plus 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 .

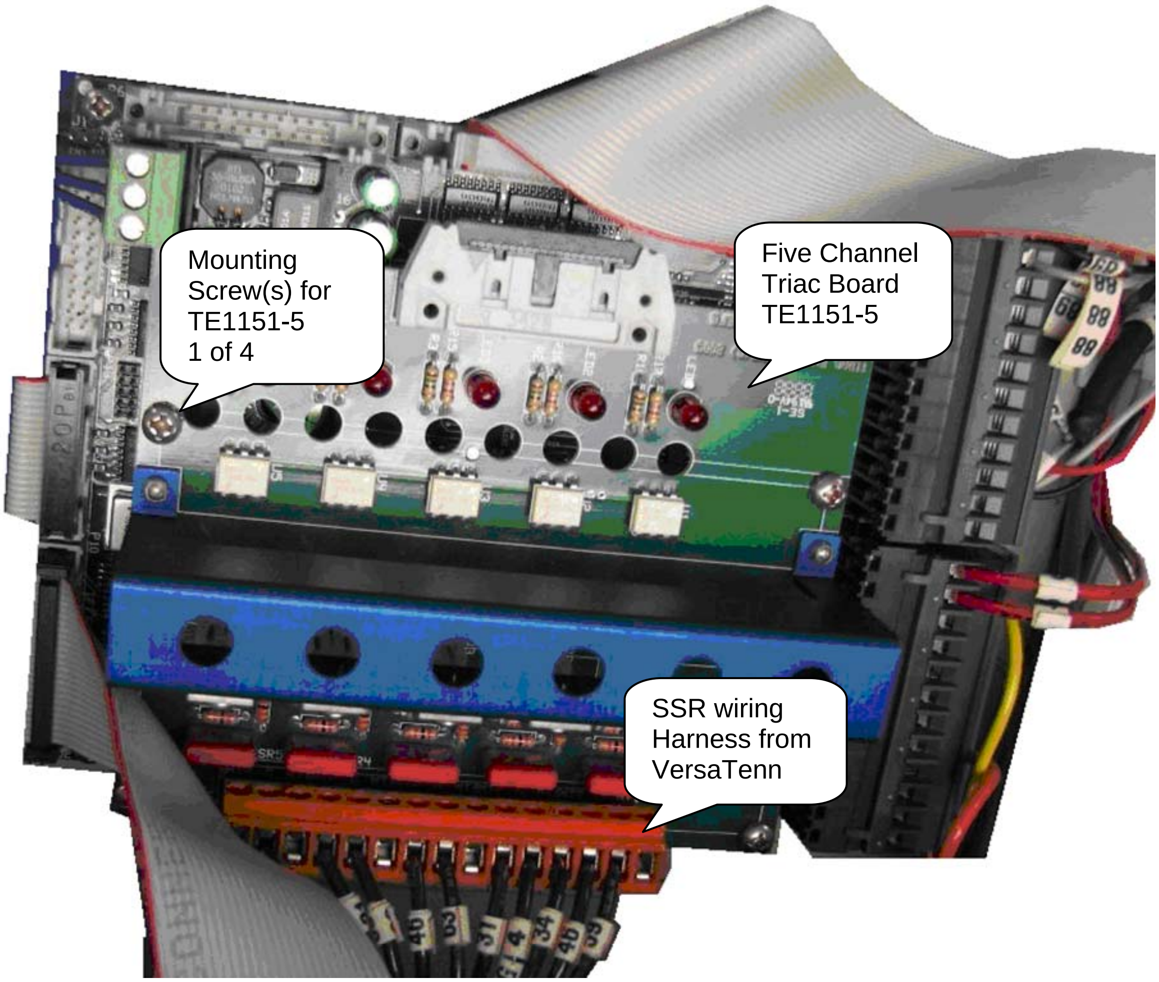


Provisions for stacking two 6-Channel Triac boards (P/N TE1151-6) on the 12-Channel unit are provided. These two boards are the 2SM and 3SM boards from the 6.10 chamber configuration list. The eight holes in the figure below for this purpose are indicated in red .



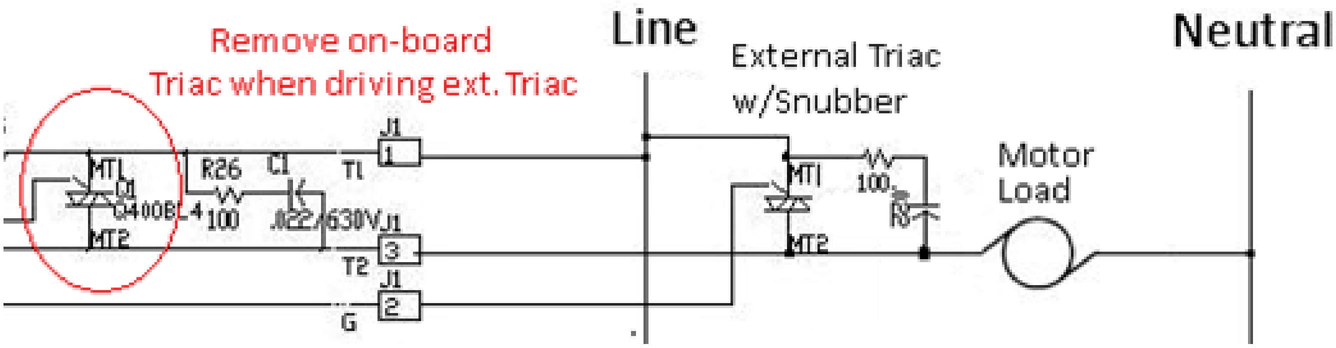
17.4.4 -Channel Triac Board Mounting for Retrofit Installations

The Synergy Nano 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. Note that the SSR outputs listed in the Chamber Configuration Section, 6.10, are the outputs available on this 5-Channel Triac board.



TE1151-6 Triac output board

The Triac output board can drive 6 small AC loads. It can also drive 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. And finally, the Triac output can drive an external high current Triac as shown below.



17.4.5 Retransmit Outputs

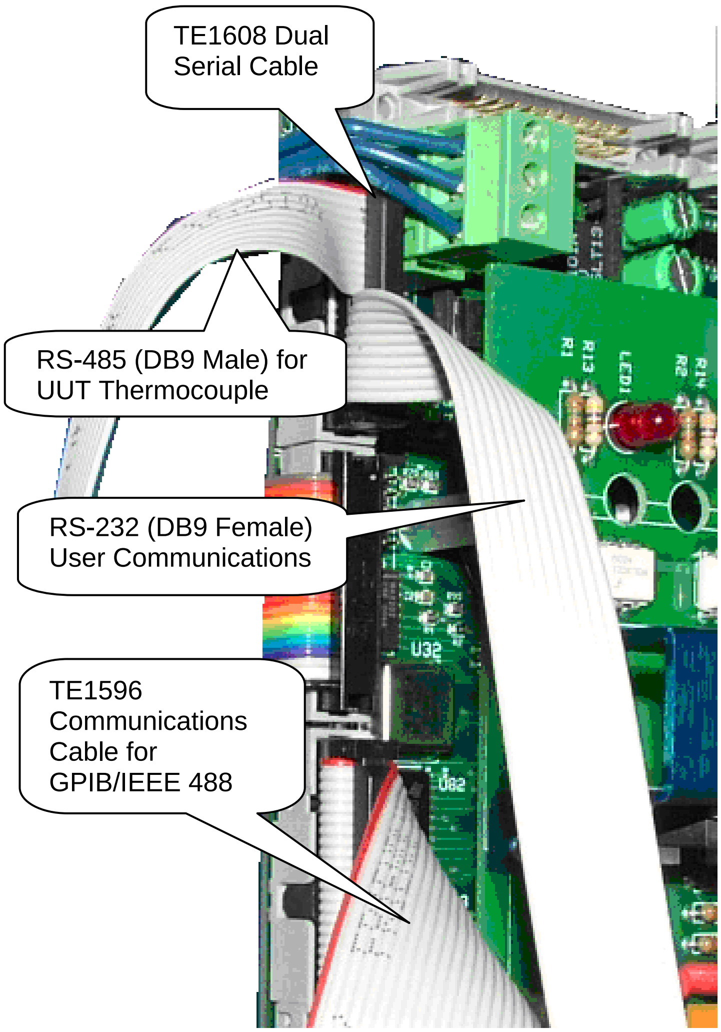
Wire retransmit outputs to the chart recorder or control valves as necessary. Use 4-20 mA converters as required. See Section 6.4 Special Functions for setup details. The following table displays the connector and pin numbers for the Synergy Nano's two analog retransmit outputs. Below the table is an 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

17.6.1 Synergy Nano Plus: GPIB, RS-232 and RS-485 Communications Wiring

The Synergy Nano Plus 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 Nano 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.



TE1608, Dual Communications Cable RS-232 /RS-485

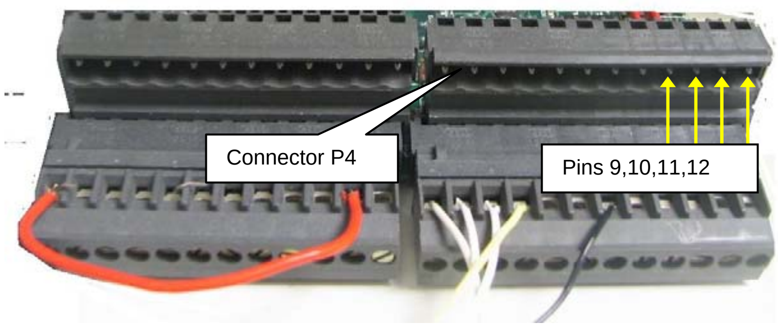
TE1596, GPIB/IEEE 488 Communications Cable

17.6.2 Synergy Nano Plus 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 Nano'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

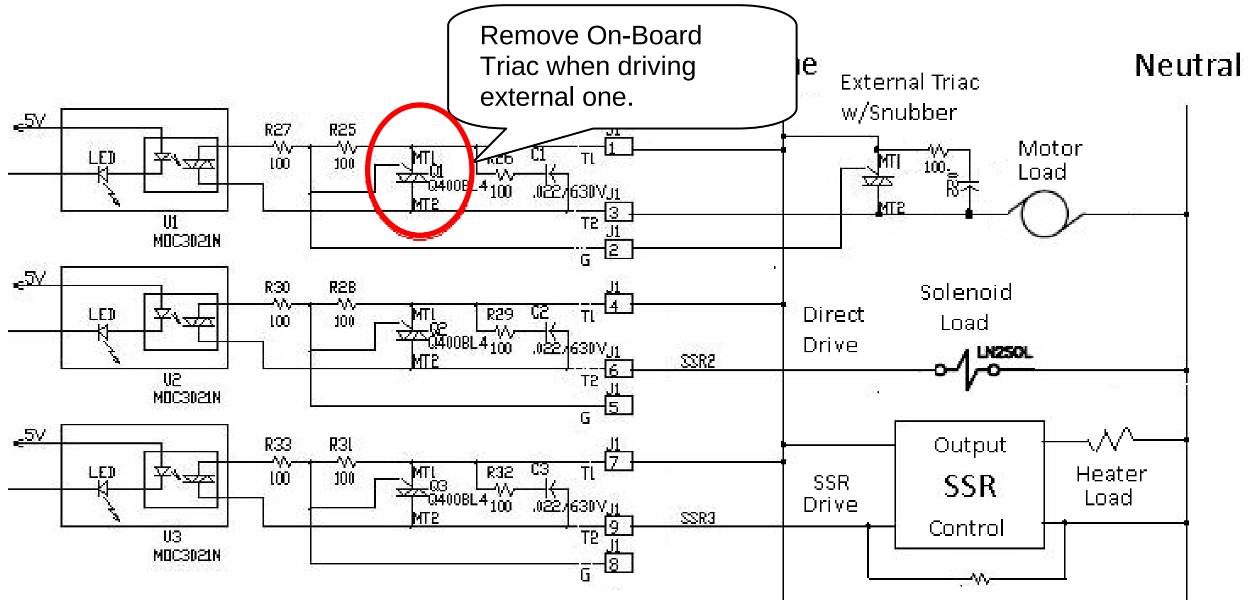


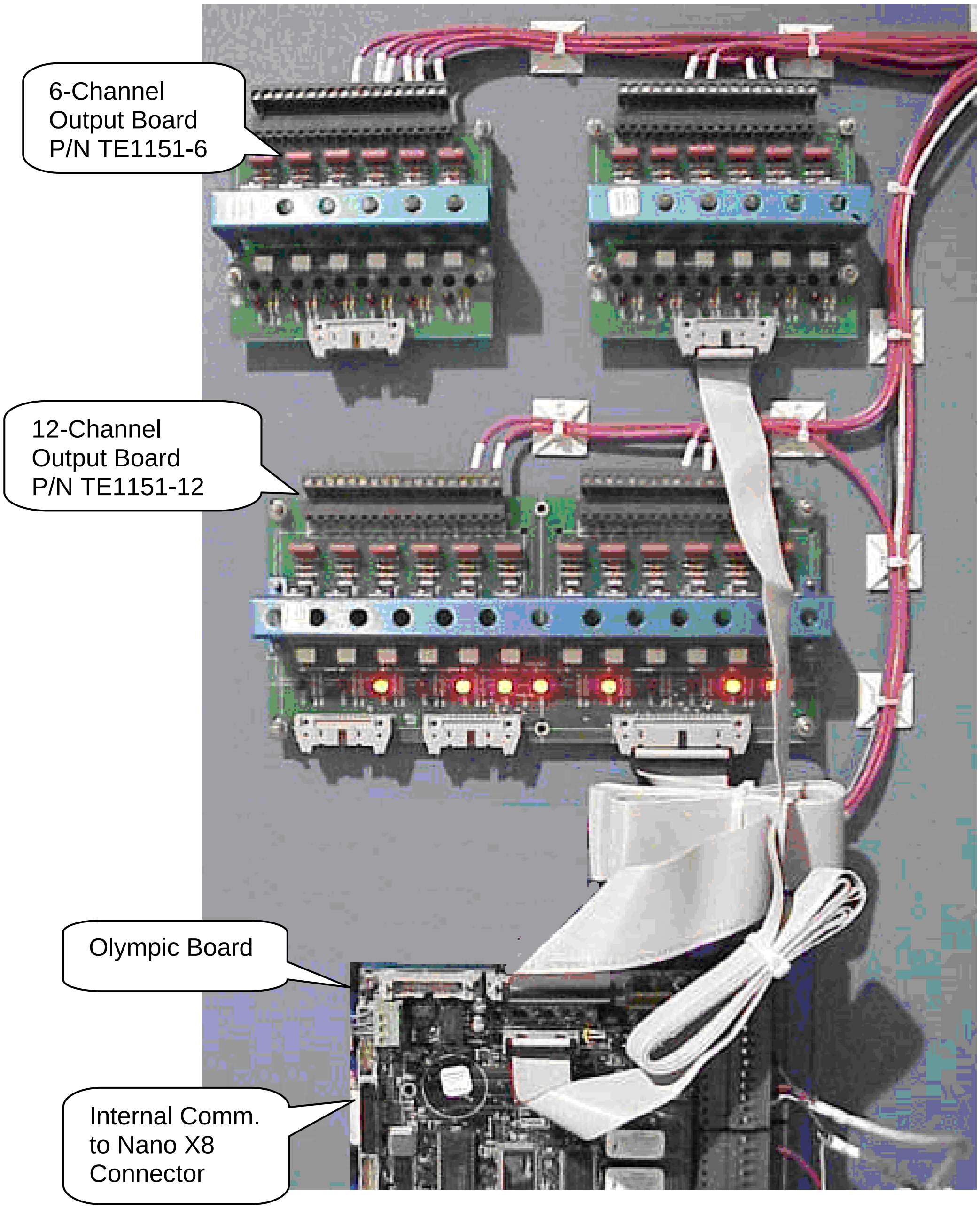
17.6.3 Synergy Nano Plus Triac Outputs

Synergy Nano output boards are multi-channel Triac controlled solid state relays that control the environmental test chamber's the heaters compressors, blowers and solenoids. These outputs handle small to medium current AC loads directly. The Synergy Nano output boards are also designed to drive external Triacs for larger outputs 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: These are:

1. Drive an external Triac to control an AC motor load. When an external Triac is driven, an additional QuenchArc snubber (resistor capacitor) network is required across the Triac input to prevent nuisance firing as a result dV/dT switching noise.
2. Drive a small solenoid load directly.
3. Drive 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.


Remove On-Board Triac when driving external one.
External Triac w/Snubber
Neutral
Motor Load
Solenoid Load
Direct Drive
LN2SOL
Output SSR Control
SSR Drive
Heater Load
U1 MOC3021N
U2 MOC3021N
U3 MOC3021N
SSR2
SSR3


6-Channel
Output Board
P/N TE1151-6
12-Channel
Output Board
P/N TE1151-12
Olympic Board
Internal Comm.
to Nano X8
Connector

17.6.4 Synergy Nano Plus Alarm Outputs

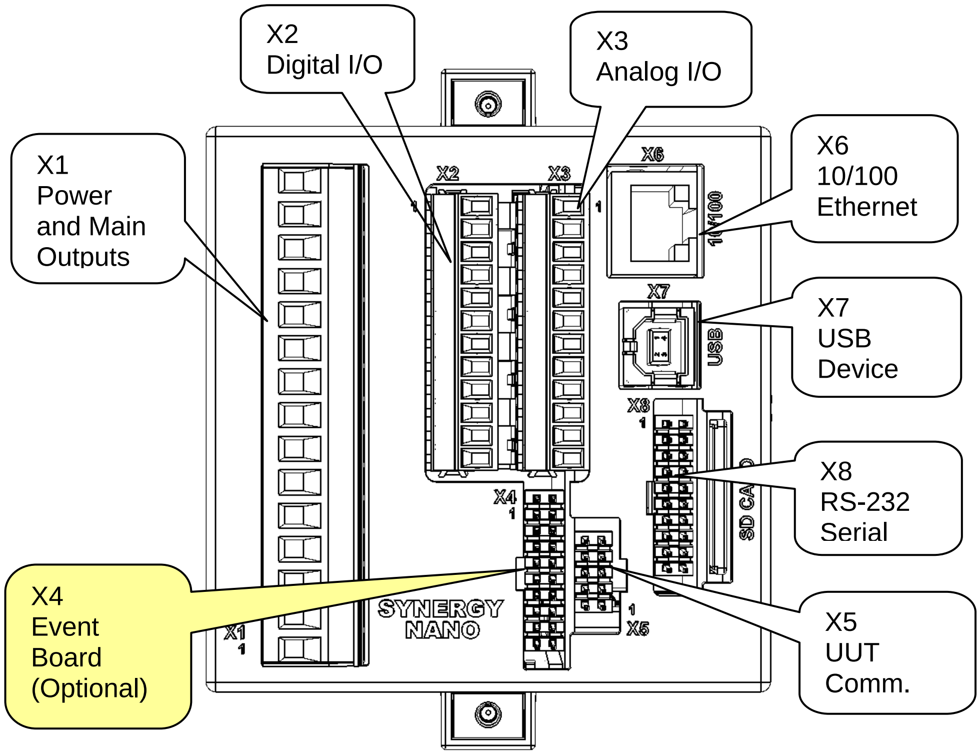
The Synergy Nano Plus's K1 Alarm Relay operates when a standard alarm occurs. The K1 alarm should be wired to disable the main contactor when the relay operates. In addition, the K2 Alarm relay can be programmed to operate from the User Programmable alarm system. See the Setup section for more information 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

17.7 Event Output Board Wiring

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



To connect the event board to the Synergy Nano:

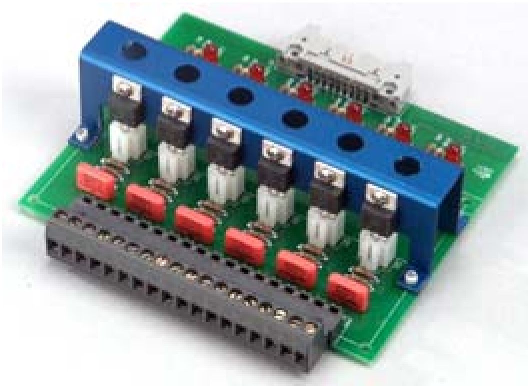
1. Connect one end of the 20 pin cable to the 20 pin connector (J2) on the event output board.
2. Connect the other end of the 20 pin cable to the 20 pin connector on the back of the Synergy Nano (X4). See the figure below.

Event Board Connected Directly to Synergy Nano

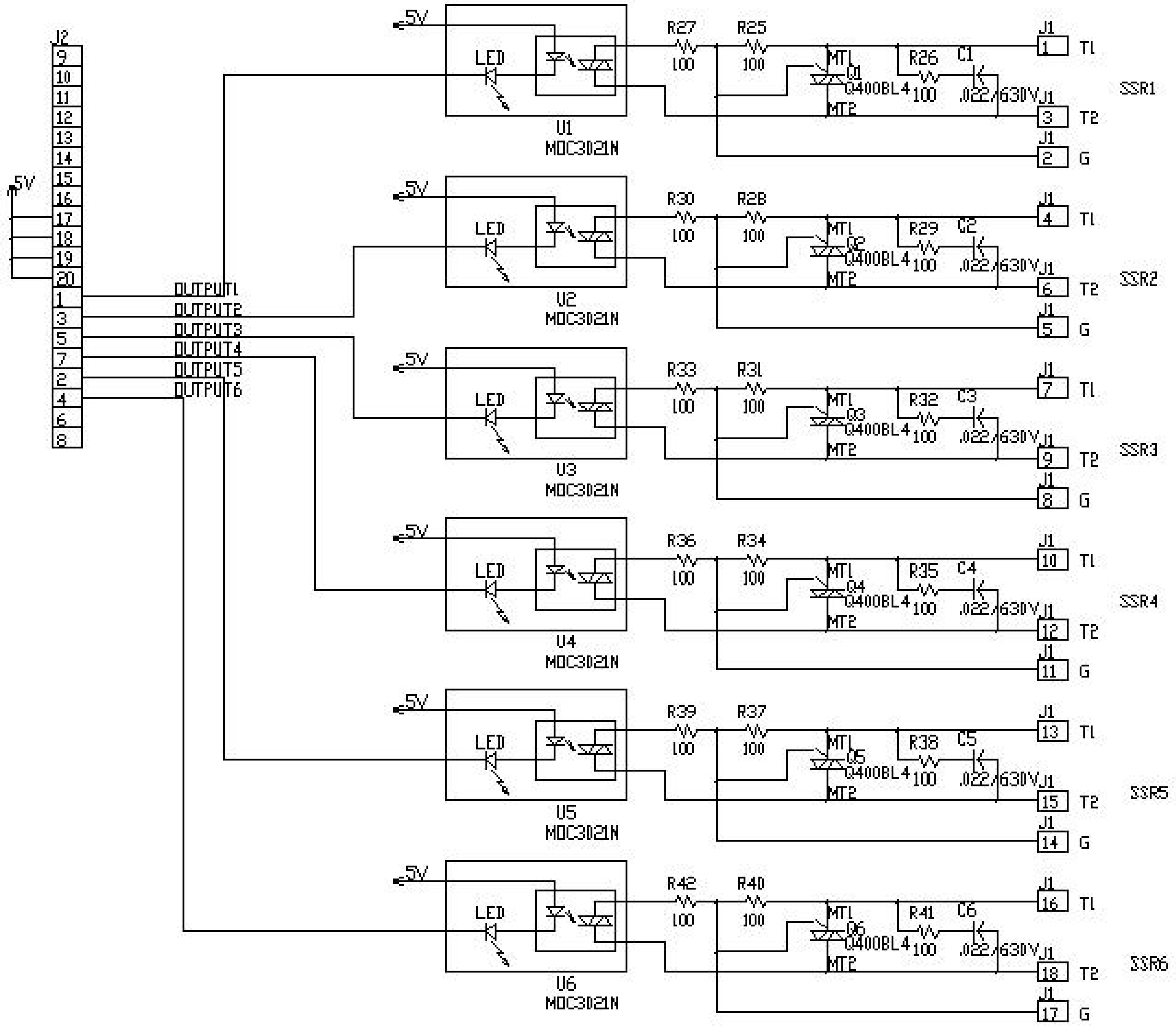
To connect the event board to the Synergy Nano via the 12 channel 1SM output board:

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.

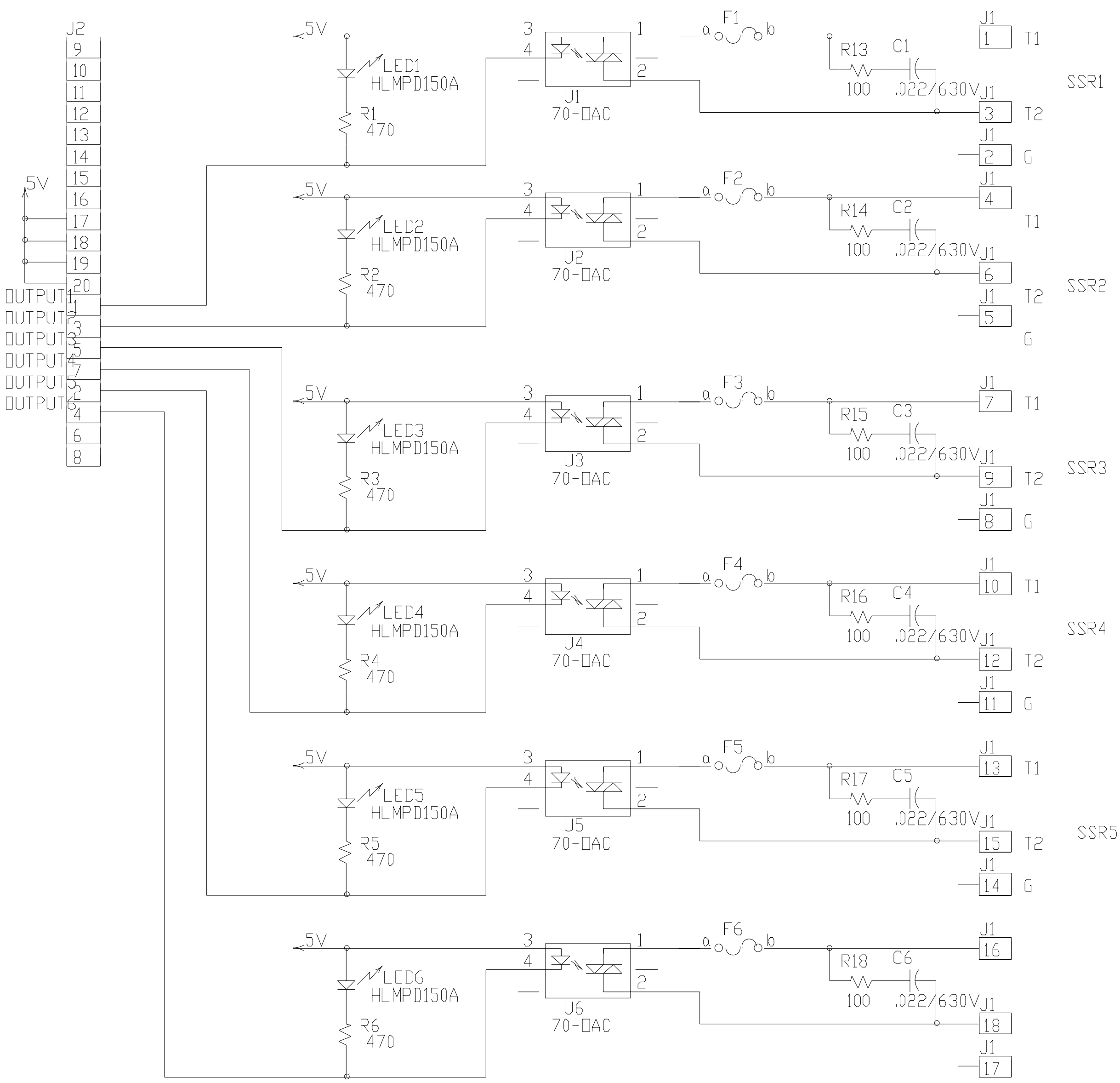
Event Board Connected via 12 Channel 1SM Output Board

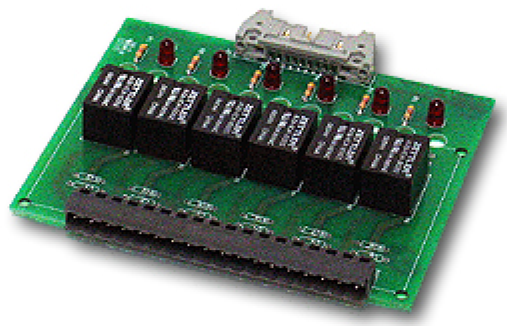


TE1151-6 Triac Output Board Schematic

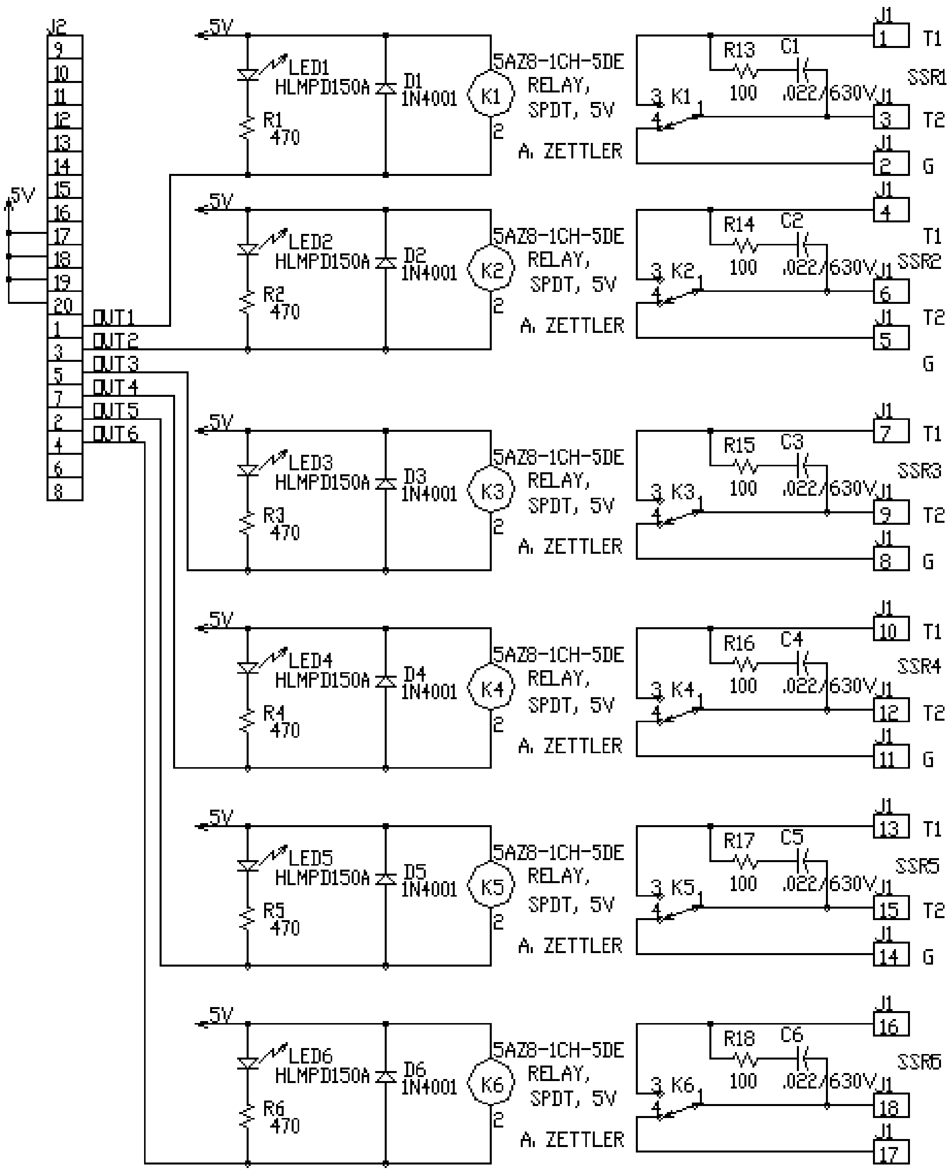


TE1616-6 Universal Event Board Schematic





TE1708-6 Relay Board Schematic



17.8 Controller Setup

Once the Synergy Nano 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.

17.9 Alarm System Test

Test all alarm systems. 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)

17.10 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.

18.0 SYNERGY NANO COMMUNICATIONS

18.1 Synergy Nano Command Set

File: SYNERGY COMM CMDS REV 2.6.10
Visit www.tidaleng.com to look for and download the most recent command set.

Description	Command Root	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
Setpoint 1	SP1	SP1 Set	= SP1 X.X	Range = R1L - R1H C / F	= SP1 100.7	OK
		SP1 Query	? SP1	Range = R1L - R1H C / F	? SP1	100.7
Setpoint 2	SP2	SP2 Set	= SP2 X.X	Range = R2L - R2H C / F / %RH	= SP2 75	OK
		SP2 Query	? SP2	Range = R2L - R2H C / F / %RH	? SP2	75.0
Setpoint 3	SP3	SP3 Set	= SP3 X.X	Range = R3L - R3H C / F / %RP	= SP3 Off	OK
		SP3 Query	? SP3	Range = R3L - R3H C / F / %RP	? SP3	Off
Channel 1 Actual	C1	C1 Query	? C1	Range = R1L - R1H C / F	? C1	25.0
Channel 2 Actual	C2	C2 Query	? C2	Range = R2L - R2H C / F / %RH	? C2	50.0
Channel 3 Actual	C3	C3 Query	? C3	Range = R3L - R3H C / F / %RP	? C3	Off
Chamber On	ON	On Set	= ON	OK	= ON	OK
		On Query	? On	1 if On, 0 if Off	? On	0
Chamber Off	OFF	OFF Set	= OFF	OK	= OFF	OK
		Run Query	? RUN	Returns: 0 - Stop 1 - Run 2 - Pause 3 - Steady State	? RUN	0
Pause Program	HOLD	HOLD Set	= HOLD	OK	= HOLD	OK
Resume Program	RSUM	RSUM Set	= RSUM	OK	= RSUM	OK
Run From	RUNFROM	RUNFROM Set	= RUNFROM	Range = Step 1 - Last Step	= RUNFROM 5	OK
Software Revision	*IDN	*IDN Query	*IDN ?	Returns Revision Info: Make, Model, Serial #, Version	*IDN?	Tidal Engineering, Synergy Controller,Serial-13/0137,Version 2.6.8
Enable/Disable UUT Monitoring	UUT	UUT Set	= UUT ARG1 ARG2	ARG1 = UUT # (1 - 8) ARG2 = 0/1 (Enable / Disable)	= UUT 1 1	OK

Description	Command Root	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
constants						
		UUT Query	? UUT ARG1	Range: ARG1 = UUT # (1 - 8). Response: 0/1 (Enabled / Disabled)	? UUT 1	0
UUT Readings	UUTR	UUTR Query	? UUT 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
Olympic Board Version	OVERSION	OVERSION Query	? OVERSION	Olympic board Version and Serial Number	? OVERSION	Olympic V0.0.35, 13/0137
Digital Input Readings	DI	DI Query	? DI	4 digit hex number for the 16 Digital Input readings	? DI	FEFF
Machine Input Readings	MI	MI Query	? MI	Comma delimited string with the 8 Machine Input Readings LP,T,HP,T,LP,T,HP,T	? MI	1.1 PSIG,2.1 C,2.9 PSIG,4.0 C,4.9 PSIG,6.0 C,6.8 PSIG,7.9 C
Low Res Analog Raw Readings	MIRAW	MIRAW Query	? MIRAW	Comma delimited string with 8 voltage readings from the Machine Input sensors	? MIRAW	1.25,1.2,1.3,1.3,1.24,1.25,1.2
High Res Analog Raw Readings	CIRAW	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
Ch1 Cooling Output	1LO	1LO Query	? 1LO	1 - 100 %	? 1LO	0.0
Ch1 Heating Output	1HI	1HI Query	? 1HI	1 - 100 %	? 1HI	100.0
Ch2 Cooling Output	2LO	2LO Query	? 2LO	1 - 100 %	? 2LO	0.0
Ch2 Heating Output	2HI	2HI Query	? 2HI	1 - 100 %	? 2HI	100.0
Ch3 Cooling Output	3LO	3LO Query	? 3LO	1 - 100 %	? 3LO	0.0
Ch3 Heating Output	3HI	3HI Query	? 3HI	1 - 100 %	? 3HI	100.0
Ch1 Sensor Select	CH1SENSOR	CH1Sensor Set	= CH1SENSOR ARG1	ARG1 - ID of the Sensor. 100 - 999.	= CH1SENSOR 110	OK
		CH1 Sensor Query	? CH1SENSOR	See the user manual for numeric codes.	? CH1SENSOR	110
Calibration Ch 1	CAL1	CAL1 Set	= CAL1 ARG1	-50 to 50 C -90 to 90 F	= CAL1 10.0	OK

Description	Command Root	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
		CAL1 Query	? CAL1	-50 to 50 C -90 to 90 F	? CAL1	10.00
Low Alarm, Ch 1	A1L	A1L Set	= A1L ARG1	-200 to 500 C -326 to 932 F	= A1L -200	OK
		A1L Query	? A1L	-200 to 500 C -326 to 932 F	? A1L	-200
High Alarm, Ch 1	A1H	A1H Set	= A1H ARG1	-200 to 500 C -326 to 932 F	= A1H 500	OK
		A1H Query	? A1H	-200 to 500 C -326 to 932 F	? A1H	500
Ch 1 Alarm Enabled While Off	IGNORE_CH1_ALM	IGNORE_CH1_ALM Set	= IGNORE_CH1_ALM ARG1	ARG1: 0 - Outputs Off 1 - Outputs On	= IGNORE_CH1_ALM 1	OK
		IGNORE_CH1_ALM Query	? IGNORE_CH1_ALM ARG1	0 - Outputs Off 1 - Outputs On	? IGNORE_CH1_ALM	1
Ch 1 Gain	GAIN1	GAIN1 Set	= GAIN1 ARG1	82 - 120%	= GAIN1 90	OK
		GAIN1 Query	? GAIN1	83 - 120%	? GAIN1	90.00
Ch 1 Deviation High Alarm	A1DH	A1DH Set	= A1DH ARG1	ARG1: 0 - 500C	= A1DH 20	OK
		A1DH Query	? A1DH	0 - 500C	? A1DH	20.0
Ch 1 Deviation Low Alarm	A1DL	A1DL Set	= A1DL ARG1	ARG1: 0 - 500C	= A1DL 10	OK
		A1DL Query	? A1DL	0 - 500C	? A1DL	10.0
Ch 1 Deviation Alarms Enabled	A1DE	A1DE Set	= A1DE ARG1	ARG1: 0 - Disabled 1 - Enabled	= A1DE 1	OK
		A1DE Query	? A1DE	0 - Disabled 1 - Enabled	? A1DE	1
Ch 1 Deviation Alarm Delay	A1DT	A1DT Set	= A1DT ARG1	ARG1: 0 - 7200 Seconds	= A1DT 3600	OK
		A1DT Query	? A1DT	0 - 7200 Seconds	? A1DT	3600
Ch2 Sensor Select	CH2SENSOR	CH2Sensor Set	= CH2SENSOR ARG1	ARG1 - ID of the Sensor. 100 - 999.	= CH2SENSOR 130	OK
		CH2 Sensor Query	? CH2SENSOR	See the user manual for numeric codes.	? CH2SENSOR	130
Calibration Ch 2	CAL2	CAL2 Set	= CAL2 ARG1	-50 to 50 C -90 to 90 F -50 to 50 %RH	= CAL2 10.0	OK
		CAL2 Query	? CAL2	-50 to 50 C -90 to 90 F -50 to 50 %RH	? CAL2	10.00

Description	Command Root	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
Low Alarm, Ch 2	A2L	A2L Set	= A2L ARG1	- 200 to 500 C -326 to 932 F -10 to 105 %RH	= A2L -10	OK
		A2L Query	? A2L	- 200 to 500 C -326 to 932 F -10 to 105 %RH	? A2L	-10.00
High Alarm, Ch 2	A2H	A2H Set	= A2H ARG1	- 200 to 500 C -326 to 932 F -10 to 105 %RH	= A2H 104	OK
		A2H Query	? A2H	- 200 to 500 C -326 to 932 F -10 to 105 %RH	? A2H	104.00
Ch 2 Alarm Enabled While Off	IGNORE_CH2_ALM	IGNORE_CH2_ALM Set	= IGNORE_CH2_ALM ARG2	ARG1: 0 - Outputs Off 1 - Outputs On	= A2ENABLED_WHILE_OFF 1	OK
		A2ENABLED_WHILE_OFF Query	? IGNORE_CH2_ALM ARG2	0 - Outputs Off 1 - Outputs On	? IGNORE_CH2_ALM	1
Ch 2 Gain	GAIN2	GAIN2 Set	= GAIN2 ARG1	80 - 120%	= GAIN1 90	OK
		GAIN2 Query	? GAIN2	81 - 120%	? GAIN1	90.00
Ch 2 Deviation High Alarm	A2DH	A2DH Set	= A2DH ARG1	ARG1: 0 - 500C	= A2DH 20	OK
		A2DH Query	? A2DH	0 - 500C	? A2DH	20.0
Ch 2 Deviation Low Alarm	A2DL	A2DL Set	= A2DL ARG1	ARG1: 0 - 500C	= A2DL 10	OK
		A2DL Query	? A2DL	0 - 500C	? A2DL	10.0
Ch 2 Deviation Alarms Enabled	A2DE	A2DE Set	= A2DE ARG1	ARG1: 0 - Disabled 1 - Enabled	= A2DE 1	OK
		A2DE Query	? A2DE	0 - Disabled 1 - Enabled	? A2DE	1
Ch 2 Deviation Alarm Delay	A2DT	A2DT Set	= A2DT ARG1	ARG1: 0 - 7200 Seconds	= A2DT 3600	OK
		A1DT Query	? A2DT	0 - 7200 Seconds	? A2DT	3600
Ch3 Sensor Select	CH3SENSOR	CH3Sensor Set	= CH3SENSOR ARG1	ARG1 - ID of the Sensor. 100 - 999.	= CH3SENSOR 140	OK
		CH3 Sensor Query	? CH3SENSOR	See the user manual for numeric codes.	? CH3SENSOR	140
Calibration Ch 3	CAL3	CAL3 Set	= CAL3 ARG1	-50 to 50 %RP	= CAL3 10.0	OK
		CAL3 Query	? CAL3	-50 to 50 %RP	? CAL3	10.00
Low Alarm,	A3L	A3L Set	= A3L ARG1	0 to 1000 %RP	= A3L -10	OK

Description	Command Root	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
Ch 3						
		A3L Query	? A3L	0 to 1000 %RP	? A3L	-10.00
High Alarm, Ch 3	A3H	A3H Set	= A3H ARG1	0 to 1000 %RP	= A3H 110	OK
		A3H Query	? A3H	0 to 1000 %RP	? A3H	110.00
Ch 3 Alarm Enabled While Off	IGNORE_CH3_ALM	IGNORE_CH3_ALM Set	= IGNORE_CH3_ALM ARG3	ARG1: 0 - Outputs Off 1 - Outputs On	= IGNORE_CH3_ALM 1	OK
		IGNORE_CH3_ALM Query	? IGNORE_CH3_ALM ARG3	0 - Outputs Off 1 - Outputs On	? IGNORE_CH3_ALM	1
Ch 3 Gain	GAIN3	GAIN3 Set	= GAIN3 ARG1	50 - 150 %	= GAIN3 60	OK
		GAIN3 Query	? GAIN3	50 - 150 %	? GAIN3	60.00
Ch 3 Deviation High Alarm	A3DH	A3DH Set	= A3DH ARG1	ARG1: 0 - 500 units	= A3DH 20	OK
		A3DH Query	? A3DH	0 - 500 units	? A3DH	20.0
Ch 3 Deviation Low Alarm	A3DL	A3DL Set	= A3DL ARG1	ARG1: 0 - 500 units	= A3DL 10	OK
		A3DL Query	? A3DL	0 - 500 units	? A3DL	10.0
Ch 3 Deviation Alarms Enabled	A3DE	A3DE Set	= A3DE ARG1	ARG1: 0 - Disabled 1 - Enabled	= A3DE 1	OK
		A3DE Query	? A3DE	0 - Disabled 1 - Enabled	? A3DE	1
Ch 3 Deviation Alarm Delay	A3DT	A3DT Set	= A3DT ARG1	ARG1: 0 - 7300 Seconds	= A3DT 3600	OK
		A1DT Query	? A3DT	0 - 7300 Seconds	? A3DT	3600
High Res Analog Gain	HIGH#_GAIN	HIGH#_GAIN Set	= HIGH#_GAIN ARG1	# - A High Res Input 1 - 6 ARG1: 25-200% Gain	= HIGH#_GAIN 105	OK
		HIGH#_GAIN Query	? HIGH#_GAIN	# - A High Res Input 1 - 6	? HIGH#_GAIN	105
High Res Analog Offset	HIGH#_OFF	HIGH#_OFF Set	= HIGH#_OFF ARG1	# - A High Res Input 1 - 6 ARG1: -100 to 100 units	= HIGH#_OFF 5	OK
		HIGH#_OFF Query	? HIGH#_OFF	# - A High Res Input 1 - 6	? HIGH#_OFF	5

Description	Command Root	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
High Res Analog High Volts	HIGH#_HIGHVOLTS	HIGH#_HIGHVOLTS Set	= HIGH#_HIGHVOLTS ARG1	# - A High Res Analog Input 3 - 6 ARG1: Upper Volt range of the attached sensor 0 - 5.25V	= HIGH#_HIGHVOLTS 5	OK
		HIGH#_HIGHVOLTS Query	? HIGH#_HIGHVOLTS	# - A High Res Analog Input 3 - 6	? HIGH#_HIGHVOLTS	5.0
High Res Analog Low Volts	HIGH#_LOWVOLTS	HIGH#_LOWVOLTS Set	= HIGH#_LOWVOLTS ARG1	# - A High Res Analog Input 3 - 6 ARG1: Lower Volt range of the attached sensor 0 - 5.25V	= HIGH#_LOWVOLTS .25	OK
		HIGH#_LOWVOLTS Query	? HIGH#_HIGHVOLTS	# - A High Res Analog Input 3 - 6	? HIGH#_LOWVOLTS	.25
High Res Analog High Engineering Units	HIGH#_HIGHEU	HIGH#_HIGHEU Set	= HIGH#_HIGHEU ARG1	# - A High Res Analog Input 3 - 6 ARG1: Upper scaled value of the attached sensor -500 - 5000 units	= HIGH#_HIGHEU 100	OK
		HIGH#_HIGHEU Query	? HIGH#_HIGHVOLTS	# - A High Res Analog Input 3 - 6	? HIGH#_HIGHEN	100.0
High Res Analog Low Engineering Units	HIGH#_LOWEU	HIGH#_LOWEU Set	= HIGH#_LOWEU ARG1	# - A High Res Analog Input 3 - 6 ARG1: Lower scaled value of the attached sensor -500 - 5000 units	= HIGH#_LOWEU 0	OK
		HIGH#_LOWEU Query	? HIGH#_HIGHVOLTS	# - A High Res Analog Input 3 - 6	? HIGH#_LOWEU	0.0
Altitude Value	ALT	ALT Set	= ALT ARG1	0 to 5000 %RP	= ALT 10	OK
		ALT Query	? ALT	0 to 5000 %RP	? ALT	10.00
Guaranteed Soak	GS	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
Prop. Band, Ch 1 Heat	PB1H	PB1H Set	= PB1H ARG1	0 to 50 C 0 to 90 F	= PB1H 10	OK
		PB1H Query	? PB1H	0 to 50 C 0 to 90 F	? PB1H	10.00
Reset, Ch 1 Heat	RS1H	RS1H Set	= RS1H ARG1	0 - 09.999 Repeats / Minute	= RS1H .02	OK
		RS1H Query	? RS1H	0 - 09.999 Repeats / Minute	? RS1H	0.020
Rate, Ch 1 Heat	RT1H	RT1H Set	= RT1H ARG1	0 - 09.999 Minutes	= RT1H	OK
		RT1H Query	? RT1H	0 - 09.999 Minutes	? RT1H	1.000
Cycle Time, Ch 1 Heat	CT1H	CT1H Set	= CT1H ARG1	1 - 60 Seconds	= CT1H 5	OK
		CT1H Query	? CT1H	1 - 60 Seconds	? CT1H	5.00

Description	Command Root	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
Rate Band, Ch 1 Heat	RB1H	RB1H Set	= RB1H ARG1	0 - 7 Seconds	= RB1H 4	OK
		RB1H Query	? RB1H	0 - 7 Seconds	? RB1H	4.000
Dead Band, Ch 1	DB1	DB1 Set	= DB1 ARG1	-25 to 25 C -45 to 45 F	= DB1 5	OK
		DB1 Query	? DB1	-25 to 25 C -45 to 45 F	? DB1	5.00
Prop Band, Ch 1 Cool	PB1C	PB1C Set	= PB1C ARG1	0 to 50 C 0 to 90 F	= PB1C 10	OK
		PB1C Query	? PB1C	0 to 50 C 0 to 90 F	? PB1C	10.00
Reset, Ch 1 Cool	RS1C	RS1C Set	= RS1C ARG1	0 - 09.999 Repeats / Minute	= RS1C .700	OK
		RS1C Query	? RS1C	0 - 09.999 Repeats / Minute	? RS1C	0.070
Rate, Ch 1 Cool	RT1C	RT1C Set	= RT1C ARG1	0 - 09.999 Minutes	= RT1C 1	OK
		RT1C Query	? RT1C	0 - 09.999 Minutes	? RT1C	1.000
Cycle Time, Ch 1 Cool	CT1C	CT1C Set	= CT1C ARG1	1 - 60 Seconds	= CT1C 7	OK
		CT1C Query	? CT1C	1 - 60 Seconds	? CT1C	7.00
Rate Band, Ch 1 Cool	RB1C	RB1C Set	= RB1C ARG1	0 - 7 Seconds	= RB1C 4	OK
		RB1C Query	? RB1C	0 - 7 Seconds	? RB1C	4.000
Cascade CH1 Enabled **	CAS1_ ENABLED		= CAS1_ENABLED ARG1	ARG1: 0 - Disabled 1 - Enabled	= CAS1_ENABLED 1	OK
			? CAS1_ENABLED	0 - Disabled 1 - Enabled	? CAS1_ENABLED	1
Channel 1 Cascade Sensor **	CSS1	CSS1 Set	= CSS1 ARG1	ARG1 - ID of the Sensor. 100 - 999.	= CSS1 120	OK
		CSS1 Query	? CSS1	See the user manual for numeric codes.	? CSS1	120
CH 1 Cascade High Limit **	C1HL	C1HL Set	= C1HL ARG1	- 200 to 500 C -326 to 932 F	= C1HL 200	OK
		C1HL Query	? C1HL	- 200 to 500 C -326 to 932 F	? C1HL	200.00
CH 1 Cascade Low Limit **	C1LL	C1LL Set	= C1LL ARG1	- 200 to 500 C -326 to 932 F	= C1LL -100	OK
		C1LL Query	? C1LL	- 200 to 500 C -326 to 932 F	? C1LL	-100.00
CH1 Cascade Prop. Band **	CPB1H	CPB1H Set	= CPB1H ARG1	0 to 400 C 0 to 752 F	= CPB1H 10	OK
		CPB1H Query	? CPB1H	0 to 400 C 0 to 752 F	? CPB1H	

Description	Command Root	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
CH1 Cascade Reset **	CRS1H	CRS1H Set	= CRS1H ARG1	0 - 09.99 Repeats / Minute	? CRS1H	OK
		CRS1H Query	? CRS1H	0 - 09.99 Repeats / Minute	? CRS1H	1.000
CH1 Cascade Rate **	CRT1H	CRT1H Set	= CRT1H ARG1	0 - 09.99 Minutes	= CRT1H 1	OK
		CRT1H Query	? CRT1H	0 - 09.99 Minutes	? CRT1H	1.000
CH1 Cascade Rate Band **	CBR1H	CRB1H Set	= CRB1H ARG1	0 - 09.99 Minutes	= CRB1H 4	OK
		CRB1H Query	? CRB1H	0 - 09.99 Minutes	? CRB1H	4.000
CH1 Cascade Positive Deviation Limit	C1HMAXDELTA	C1HMAXDELTA Set	= C1HMAXDELTA ARG1	ARG1: 0-50C, 0 - 90F	= C1HMAXDELTA 10	OK
		C1HMAXDELTA Query	? C1HMAXDELTA	0-50C, 0 - 90F	? C1HMAXDELTA	10.0
CH1 Cascade Negative Deviation Limit	C1LMAXDELTA	C1LMAXDELTA Set	= C1LMAXDELTA ARG1	ARG1: 0-50C, 0 - 90F	= C1LMAXDELTA 20	OK
		C1LMAXDELTA Query	? C1LMAXDELTA	0-50C, 0 - 90F	? C1LMAXDELTA	20.0
Prop. Band, Ch 2 Heat	PB2H	PB2H Set	= PB2H ARG1	0 to 50 %RH	= PB2H 42	OK
		PB2H Query	? PB2H	0 to 50 %RH	? PB2H	42.00
Reset, Ch 2 Heat	RS2H	RS2H Set	= RS2H ARG1	0 - 09.999 Repeats / Minute	= RS2H .02	OK
		RS2H Query	? RS2H	0 - 09.999 Repeats / Minute	? RS2H	0.020
Rate, Ch 2 Heat	RT2H	RT2H Set	= RT2H ARG1	0 - 09.999 Minutes	= RT2H 1	OK
		RT2H Query	? RT2H	0 - 09.999 Minutes	? RT2H	1.000
Cycle Time, Ch 2 Heat	CT2H	CT2H Set	= CT2H ARG1	1 - 60 Seconds	= CT2H 1	OK
		CT2H Query	? CT2H	1 - 60 Seconds	? CT2H	1.00
Rate Band, Ch 2 Heat	RB2H	RB2H Set	= RB2H ARG1	0 - 7 Seconds	= RB2H 4	OK
		RB2H Query	? RB2H	0 - 7 Seconds	? RB2H	4.000
Dead Band, Ch 2	DB2	DB2 Set	= DB2 ARG1	-25 to 25 %RH	= DB2 5	OK
		DB2 Query	? DB2	-25 to 25 %RH	? DB2	5.00
Prop Band, Ch 2 Cool	PB2C	PB2C Set	= PB2C ARG1	0 to 50 %RH	= PB2C 40	OK
		PB2C Query	? PB2C	0 to 50 %RH	? PB2C	40.00

Description	Command Root	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
Reset, Ch 2 Cool	RS2C	RS2C Set	= RS2C ARG1	0 - 09.999 Repeats / Minute	= RS2C .1	OK
		RS2C Query	? RS2C	0 - 09.999 Repeats / Minute	? RS2C	0.100
Rate, Ch 2 Cool	RT2C	RT2C Set	= RT2C ARG1	0 - 09.999 Minutes	= RT2C 1	OK
		RT2C Query	? RT2C	0 - 09.999 Minutes	? RT2C	1.000
Cycle Time, Ch 2 Cool	CT2C	CT2C Set	= CT2C ARG1	1 - 60 Seconds	= CT2C 1	OK
		CT2C Query	? CT2C	1 - 60 Seconds	? CT2C	1.00
Rate Band, Ch 2 Cool	RB2C	RB2C Set	= RB2C ARG1	0 - 7 Seconds	= RB2C 4	OK
		RB2C Query	? RB2C	0 - 7 Seconds	? RB2C	4.000
Prop. Band, Ch 3 Heat	PB3H	PB3H Set	= PB3H ARG1	0-0999 %RP	= PB3H 10	OK
		PB3H Query	? PB3H	0-0999 %RP	? PB3H	10.00
Reset, Ch 3 Heat	RS3H	RS3H Set	= RS3H ARG1	0 - 09.999 Repeats / Minute	= RS3H .02	OK
		RS3H Query	? RS3H	0 - 09.999 Repeats / Minute	? RS3H	0.020
Rate, Ch 3 Heat	RT3H	RT3H Set	= RT3H ARG1	0 - 09.999 Minutes	= RT3H 1	OK
		RT3H Query	? RT3H	0 - 09.999 Minutes	? RT3H	1.000
Cycle Time, Ch 3 Heat	CT3H	CT3H Set	= CT3H ARG1	1 - 60 Seconds	= CT3H 5	OK
		CT3H Query	? CT3H	1 - 60 Seconds	? CT3H	5.00
Rate Band, Ch 3 Heat	RB3H	RB3H Set	= RB3H ARG1	1 - 7 Seconds	= RB3H 4	OK
		RB3H Query	? RB3H	1 - 7 Seconds	? RB3H	4.000
Dead Band, Ch 3	DB3	DB3 Set	= DB3 ARG1	-25 to 25 %RP	= DB3 5	OK
		DB3 Query	? DB3	-25 to 25 %RP	? DB3	5.00
Prop Band, Ch 3 Cool	PB3C	PB3C Set	= PB3C ARG1	0-0999 %RP	= PB3C 10	OK
		PB3C Query	? PB3C	0-0999 %RP	? PB3C	10.00
Reset, Ch 3 Cool	RS3C	RS3C Set	= RS3C ARG1	0 - 09.999 Repeats / Minute	= RS3C .07	OK
		RS3C Query	? RS3C	0 - 09.999 Repeats / Minute	? RS3C	0.070
Rate, Ch 3 Cool	RT3C	RT3C Set	= RT3C ARG1	0 - 09.999 Minutes	= RT3C 1	OK
		RT3C Query	? RT3C	0 - 09.999 Minutes	? RT3C	1.000
Cycle Time, Ch 3 Cool	CT3C	CT3C Set	= CT3C ARG1	1 - 60 Seconds	= CT3C 7	OK
		CT3C Query	? CT3C	1 - 60 Seconds	? CT3C	7.00

Description	Command Root	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
Rate Band, Ch 3 Cool	RB3C	RB3C Set	= RB3C ARG1	1 - 60 Seconds	= RB3C 4	OK
		RB3C Query	? RB3C	1 - 60 Seconds	? RB3C	4.000
Celsius / Fahrenheit Temp Display	CF	CF Set	= CF ARG1	ARG1: 0 - Celsius 1 - Fahrenheit	= CF 0	OK
		CF Query	? CF	0 - Celsius 1 - Fahrenheit	? CF	0
Output 11 Control Type	OT11	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	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	OT18 Set	= OT18 ARG1	ARG1: 0 - Vent 1 - Boost Cool	= OT18 1	OK
		OT18 Query	? OT18	0 - Vent 1 - Boost Cool	? OT18	1
Alarm Type	ATYP	ATYP Set	= ATYP ARG1	ARG1: 0 - Process Alarm 1 - Deviate Alarm	= ATYP 1	OK
		ATYP Query	? ATYP	0 - Process Alarm 1 - Deviate Alarm	? ATYP	1
Low Limit, Ch 1	R1L	R1L Set	= R1L ARG1	- 200 to 500 C -326 to 932 F	= R1L -200	OK
		R1L Query	? R1L	- 200 to 500 C -326 to 932 F	? R1L	-200
High Limit, Ch 1	R1H	R1H Set	= R1H ARG1	- 200 to 500 C -326 to 932 F	= R1H 500	OK
		R1H Query	? R1H	- 200 to 500 C -326 to 932 F	? R1H	500
Low Limit, Ch 2	R2L	R2L Set	= R2L ARG1	- 200 to 500 %RH	= R2L -1	OK
		R2L Query	? R2L	- 200 to 500 %RH	? R2L	-1
High Limit, Ch 2	R2H	R2H Set	= R2H ARG1	- 200 to 500 %RH	= R2H 100	OK
		R2H Query	? R2H	- 200 to 500 %RH	? R2H	100

Description	Command Root	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
RTD Curve	RTD	RTD Set	= RTD ARG1	ARG1: 0 - JIS 1 - DIN	= RTD 0	OK
		RTD Query	? RTD	0 - JIS 1 - DIN	? RTD	0
Vaisala Compensatio n	VCMP	VCMP Set	= VCMP ARG1	ARG1: 0 - On 1 - Off	= VCMP 0	OK
		VCMP Query	? VCMP	0 - On 1 - Off	? VCMP	0
1L1	1L1	1L1 Set	= 1L1 ARG1	0 - 100 %	= 1L1 50	OK
		1L1 Query	? 1L1	0 - 100 %	? 1L1	50.00
1L2	1L2	1L2 Set	= 1L2 ARG1	0 - 100 %	= 1L2 20	OK
		1L2 Query	? 1L2	0 - 100 %	? 1L2	20.00
1L3	1L3	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	1CTY	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	2L1	2L1 Set	= 2L1 ARG1	-100 - 100 %	= 2L1 50	OK
		2L1 Query	? 2L1	-100 - 100 %	? 2L1	50.00
2L2	2L2	2L2 Set	= 2L2 ARG1	-100 - 100 %	= 2L2 20	OK
		2L2 Query	? 2L2	-100 - 100 %	? 2L2	50.00
2L3	2L3	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	2CTY	2CTY Set	= 2CTY ARG1	ARG1: 0 - CAP - Tube System 1 - Agree Logic 2 - Burn In Logic 3 - Standard XV Sys Logic	= 2CTY 1	OK

Description	Command Root	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
		2CTY Query	? 2CTY	0 - CAP - Tube System 1 - Agree Logic 2 - Burn In Logic 3 - Standard XV Sys Logic	? 2CTY	0
L3	L3	L3 Set	= L3 ARG1	0 - 100 %	= L3 20	OK
		L3 Query	? L3	0 - 100 %	? L3	20.00
L4	L4	L4 Set	= L4 ARG1	0 - 100 %	= L4 20	OK
		L4 Query	? L4	0 - 100 %	? L4	20.00
		L6 Query	? L6	-100 to 100 C -148 to 212 F	? L6	20.00
L6	L6	L6 Set	= L6 ARG1	-100 to 100 C -148 to 212 F	= L6 20	OK
L7	L7	L7 Set	= L7 ARG1	0 - 100 %	= L7 10	OK
		L7 Query	? L7	0 - 100 %	? L7	10.00
L8	L8	L8 Set	= L8 ARG1	0 - 100 %	= L8 80	OK
		L8 Query	? L8	0 - 100 %	? L8	80.00
L9	L9	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	L11	L11 Set	= L11 ARG1	0 - 100 %	= L11 20	OK
		L11 Query	? L11	0 - 100 %	? L11	20.00
L12	L12	L12 Set	= L12 ARG1	0 - 100 %	= L12 10	OK
		L12 Query	? L12	0 - 100 Seconds	? L12	10.00
L14	L14	L14 Set	= L14 ARG1	0 - 60 Seconds	= L14 10	OK
		L14 Query	? L14	0 - 60 %	? L14	10.00
L15	L15	L15 Set	= L15 ARG1	0 - 5 Minutes	= L15 2	OK
		L15 Query	? L15	0 - 5 Minutes	? L15	2
LEV1	LEV1	LEV1 Set	= LEV1	ARG1: 0 - Dehumidify Coil 1 - Drier	=LEV1 1	OK
		LEV1 Query	? LEV1	ARG1: 0 - Dehumidify Coil 1 - Drier	? LEV1	1
Enable Logging	LOGGING_ ENABLED	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

Description	Command Root	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
Logging Interval	LOGGING_ INTERVAL	LOGGING_INTE RVAL Set	= LOGGING_ INTERVAL ARG1	0 to 3600 Seconds	= LOGGING_ INTERVAL 60	OK
		LOGGING_INTE RVAL Query	? LOGGING_ INTERVAL	0 to 3600 Seconds	? LOGGING_ INTERVAL	60
Log File Size	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 Ch1 Actual	LOG_CH1_ ACT	LOG_CH1_ACT Set	= LOG_CH1_ACT ARG1	ARG1: 0 - Don't Log 1 - Log	= LOG_CH1_ACT 1	OK
		LOG_CH1_ACT Query	? LOG_CH1_ACT	0 - Don't Log 1 - Log	? LOG_CH1_ACT	1
Log Ch2 Actual	LOG_CH2_ ACT	LOG_CH2_ACT Set	= LOG_CH2_ACT ARG1	ARG1: 0 - Don't Log 1 - Log	= LOG_CH2_ACT 1	OK
		LOG_CH2_ACT Query	? LOG_CH2_ACT	0 - Don't Log 1 - Log	? LOG_CH2_ACT	1
Log Ch3 Actual	LOG_CH3_ ACT	LOG_CH3_ACT Set	= LOG_CH3_ACT ARG1	ARG1: 0 - Don't Log 1 - Log	= LOG_CH3_SP 1	OK
		LOG_CH3_ACT Query	? LOG_CH3_ACT	0 - Don't Log 1 - Log	? LOG_CH3_SP	1
Log Ch1 Setpoint	LOG_CH1_ SP	LOG_CH1_SP Set	= LOG_CH1_SP ARG1	ARG1: 0 - Don't Log 1 - Log	= LOG_CH1_SP 1	OK
		LOG_CH1_SP Query	? LOG_CH1_SP	0 - Don't Log 1 - Log	? LOG_CH1_SP	1
Log Ch2 Setpoint	LOG_CH2_ SP	LOG_CH2_SP Set	#NAME?	ARG1: 0 - Don't Log 1 - Log	= LOG_CH2_SP 1	OK
		LOG_CH2_SP Query	? LOG_CH2_SP	0 - Don't Log 1 - Log	? LOG_CH2_SP	1
Log Ch3 Setpoint	LOG_CH3_ SP	LOG_CH3_SP Set	= LOG_CH3_SP ARG1	ARG1: 0 - Don't Log 1 - Log	= LOG_CH3_SP 1	OK
		LOG_CH3_SP Query	? LOG_CH3_SP	0 - Don't Log 1 - Log	? LOG_CH3_SP	1

Description	Command Root	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
Log CH1 Cascade Act **	LOG_CAS_CH1_ ACT	LOG_CAS_CH1 _ACT Set	= LOG_CAS_CH1_ACT ARG1	ARG1: 0 - Don't Log 1 - Log	= LOG_CAS_CH1_ACT 1	OK
		LOG_CAS_CH1 _ACT Query	? LOG_CAS_CH1_ACT	0 - Don't Log 1 - Log	? LOG_CAS_CH1_ACT	1
Log CH1 Cascade SP **	LOG_CAS_CH1_ SP	LOG_CAS_CH1 _SP Set	= LOG_CAS_CH1_SP ARG1	ARG1: 0 - Don't Log 1 - Log	= LOG_CAS_CH1_SP 1	OK
		LOG_CAS_CH1 _SP Query	? LOG_CAS_CH1_SP	0 - Don't Log 1 - Log	? LOG_CAS_CH1_SP	1
Log CH1 Cascade PID **	LOG_CAS_CH1_ PID	LOG_CAS_CH1 _PID Set	= LOG_CAS_CH1_PID ARG1	ARG1: 0 - Don't Log 1 - Log	= LOG_CAS_CH1_PID 1	OK
		LOG_CAS_CH1 _PID Query	? LOG_CAS_CH1_PID	0 - Don't Log 1 - Log	? LOG_CAS_CH1_PID	1
Logging High Resolution Analog Inputs	LOG_HIGH_#	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
Logging Low Resolution Analog Inputs	LOG_LOW_#	LOG_LOW_# Set	= LOG_LOW_# ARG1	# - A Number from 1 to 8 ARG1: 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
Logging Digital IO Inputs	LOG_DIO_#	LOG_DIO_# Set	= LOG_DIO_# ARG1	# - A Number from 1 to 16 ARG1: 0 - Logging Off 1 - Logging On	= LOG_DIO_1 1	OK
		LOG_DIO_# Query	? LOG_DIO_#	# - A Number from 1 to 16 0 - Logging Off 1 - Logging On	? LOG_DIO_1	1
Logging Outputs Enabled	LOG_OUTPUTS	LOG_OUTPUTS Set	= LOG_OUTPUTS ARG1	ARG1: 0 - Logging Off 1 - Logging On	= LOG_OUTPUTS 1	OK

Description	Command Root	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
		LOG_OUTPUTS Query	? LOG_OUTPUTS	0 - Logging Off 1 - Logging On	? LOG_OUTPUTS	1
Logging PID Channel # Heat PID	LOG_CH#_HEAT_PID	LOG_CH#_HEAT_PID Set	= LOG_CH#_HEAT_PID ARG1	# - A Channel from 1 to 3 ARG1: 0 - Logging Off 1 - Logging On	= LOG_CH1_HEAT_PID 1	OK
		LOG_CH#_HEAT_PID Query	? LOG_CH#_HEAT_PID ARG1	# - A Number from 1 to 3 0 - Logging Off 1 - Logging On	? LOG_CH1_HEAT_PID	1
Logging PID Channel # Heat PN	LOG_CH#_HEAT_PN	LOG_CH#_HEAT_PN Set	= LOG_CH#_HEAT_PN ARG1	# - A Channel from 1 to 3 ARG1: 0 - Logging Off 1 - Logging On	= LOG_CH1_HEAT_PN 1	OK
		LOG_CH#_HEAT_PN Query	? LOG_CH#_HEAT_PN ARG1	# - A Number from 1 to 3 0 - Logging Off 1 - Logging On	? LOG_CH1_HEAT_PN	1
Logging PID Channel # Heat IN	LOG_CH#_HEAT_IN	LOG_CH#_HEAT_IN Set	= LOG_CH#_HEAT_IN ARG1	# - A Channel from 1 to 3 ARG1: 0 - Logging Off 1 - Logging On	= LOG_CH1_HEAT_IN 1	OK
		LOG_CH#_HEAT_IN Query	? LOG_CH#_HEAT_IN ARG1	# - A Number from 1 to 3 0 - Logging Off 1 - Logging On	? LOG_CH1_HEAT_IN	1
Logging PID Channel # Heat DN	LOG_CH#_HEAT_DN	LOG_CH#_HEAT_DN Set	= LOG_CH#_HEAT_DN ARG1	# - A Channel from 1 to 3 ARG1: 0 - Logging Off 1 - Logging On	= LOG_CH1_HEAT_DN 1	OK
		LOG_CH#_HEAT_DN Query	? LOG_CH#_HEAT_DN ARG1	# - A Number from 1 to 3 0 - Logging Off 1 - Logging On	? LOG_CH1_HEAT_DN	1
Logging PID Channel # Heat Error	LOG_CH#_HEAT_ERR	LOG_CH#_HEAT_ERR Set	= LOG_CH#_HEAT_ERR ARG1	# - A Channel from 1 to 3 ARG1: 0 - Logging Off 1 - Logging On	= LOG_CH1_HEAT_ERR 1	OK
		LOGD_CH#_HEAT_ERR Query	? LOG_CH#_HEAT_ERR ARG1	# - A Number from 1 to 3 0 - Logging Off 1 - Logging On	? LOG_CH1_HEAT_ERR	1

Description	Command Root	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
Logging PID Channel # Cool PID	LOG_CH#_COOL_PID	LOG_CH#_COOL_PID Set	= LOG_CH#_COOL_PID ARG1	# - A Channel from 1 to 3 ARG1: 0 - Logging Off 1 - Logging On	= LOG_CH1_COOL_PID 1	OK
		LOG_CH#_COOL_PID Query	? LOG_CH#_COOL_PID ARG1	# - A Number from 1 to 3 0 - Logging Off 1 - Logging On	? LOG_CH1_COOL_PID	1
Logging PID Channel # Cool PN	LOG_CH#_COOL_PN	LOG_CH#_COOL_PN Set	= LOG_CH#_COOL_PN ARG1	# - A Channel from 1 to 3 ARG1: 0 - Logging Off 1 - Logging On	= LOG_CH1_COOL_PN 1	OK
		LOG_CH#_COOL_PN Query	? LOG_CH#_COOL_PN ARG1	# - A Number from 1 to 3 0 - Logging Off 1 - Logging On	? LOG_CH1_COOL_PN	1
Logging PID Channel # Cool IN	LOG_CH#_COOL_IN	LOG_CH#_COOL_IN Set	= LOG_CH#_COOL_IN ARG1	# - A Channel from 1 to 3 ARG1: 0 - Logging Off 1 - Logging On	= LOG_CH1_COOL_IN 1	OK
		LOG_CH#_COOL_IN Query	? LOG_CH#_COOL_IN ARG1	# - A Number from 1 to 3 0 - Logging Off 1 - Logging On	? LOG_CH1_COOL_IN	1
Logging PID Channel # Cool DN	LOG_CH#_COOL_DN	LOG_CH#_COOL_DN Set	= LOG_CH#_COOL_DN ARG1	# - A Channel from 1 to 3 ARG1: 0 - Logging Off 1 - Logging On	= LOG_CH1_COOL_DN 1	OK
		LOG_CH#_COOL_DN Query	? LOG_CH#_COOL_DN ARG1	# - A Number from 1 to 3 0 - Logging Off 1 - Logging On	? LOG_CH1_COOL_DN	1
Logging PID Channel # Cool Error	LOG_CH#_COOL_ERR	LOG_CH#_COOL_ERR Set	= LOG_CH#_COOL_ERR ARG1	# - A Channel from 1 to 3 ARG1: 0 - Logging Off 1 - Logging On	= LOG_CH1_COOL_ERR 1	OK
		LOG_CH#_COOL_ERR Query	? LOG_CH#_COOL_ERR ARG1	# - A Number from 1 to 3 0 - Logging Off 1 - Logging On	? LOG_CH1_COOL_ERR	1
Log Ch 3 Cool PID	LOG_CH3_ Cool	LOG_CH3_ Cool Set	= LOG_CH3_Cool ARG1	ARG1: 0 - Don't Log 1 - Log	= LOG_CH3_COOL 1	OK
		LOG_CH3_ Cool Query	? LOG_CH3_Cool	0 - Don't Log 1 - Log	? LOG_CH3_COOL	0

Description	Command Root	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
PID Channel 1 Heat *	PID1H	PID1H Query	? PID1H	1 - 100 %	? PID1H	0.0
PID Channel 1 Cool *	PID1C	PID1C Query	? PID1C	1 - 100 %	? PID1C	100.0
PID Channel 2 Heat *	PID2H	PID2H Query	? PID2H	1 - 100 %	? PID2H	0.0
PID Channel 2 Cool *	PID2C	PID2C Query	? PID2C	1 - 100 %	? PID2C	100.0
PID Channel 3 Heat *	PID3H	PID3H Query	? PID3H	1 - 100 %	? PID3H	0.0
PID Channel 3 Cool *	PID3C	PID3C Query	? PID3C	1 - 100 %	? PID3C	100.0
Acknowledge All Alarms *	ACKALM	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	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	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
				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		

Description	Command Root	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
				Bit 18 - PID Thread Crashed Bit 19 - Bad Sensor Reading		
Events	EVENTS	EVENTS Set	= EVENTS	ARG1: Event # (1-8) ARG2: 0 - Disabled 1 - Enabled	= EVENTS 1 1	OK
		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
		EVENTS Query	? EVENTS	ARG1: Event # (1-8)	? EVENTS 1	1
Storage Card Info *	SCINFO	SCINFO Query	? SCINFO	returns storage card free	? SCINFO	Total: 8128512, Free: 1826816
RAM Info	MEMINFO	MEMINFO Query	? MEMINFO	Returns total system RAM and available RAM	? MEMINFO	Unknown, Total Physical: 20242432, Available Physical: 14848000, RAM
Create a New File	FILENEW	FILENEW Set	= FILENEW	No Arguments	= FILENEW	
Saves a downloaded file	FILESAVE	FILESAVE Set	= FILESAVE	ARG1 = Filename to save to	= FILESAVE MyProfile	
Sets information regarding the profile being downloaded. Used immediately after a FILENEW command	VTVINFO	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	= STP File # Step # STEPTYPE ARG4 ARGn		= STP 1 1 0	

Description	Command Root	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
FILE #	N/A	See Program Step	N/A	Range: Anything	N/A	
STEP #	N/A	See Program Step	N/A	Range 1-255	N/A	
STEPTYPE	N/A	See Program Step	N/A	0 = Setpoint 1 = Jumploop 2 = Waitfor 3 = Autostart 4 = Stop 5 = Link		
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		
JUMPLOOP	N/A	See Steptype	ARG4 ARG5	ARG4 = Jump Step ARG5 = Jump Count		
WAITFOR	N/A	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 Seconds ARG11 - 26 = Wait on Input 1-16		
AUTOSTART	N/A	See Steptype	ARG4 ARG5 ARG6 ARG7 ARG8	ARG4 = AutoStart Day ARG5 = AutoStart Hour ARG6 = AutoStart Minute ARG7 = AutoStart Month ARG7 = AutoStart Year		
STOP	N/A	See Steptype	ARG4	ARG4: 0 - Outputs Off 1 - Outputs On		

Description	Command Root	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
Setpoint 1	SP1	SP1 Set	= SP1 X.X	Range = R1L - R1H C / F	= SP1 100.7	OK
		SP1 Query	? SP1	Range = R1L - R1H C / F	? SP1	100.7
Setpoint 2	SP2	SP2 Set	= SP2 X.X	Range = R2L - R2H C / F / %RH	= SP2 75	OK
		SP2 Query	? SP2	Range = R2L - R2H C / F / %RH	? SP2	75.0
Setpoint 3	SP3	SP3 Set	= SP3 X.X	Range = R3L - R3H C / F / %RP	= SP3 Off	OK
		SP3 Query	? SP3	Range = R3L - R3H C / F / %RP	? SP3	Off
Channel 1 Actual	C1	C1 Query	? C1	Range = R1L - R1H C / F	? C1	25.0
Channel 2 Actual	C2	C2 Query	? C2	Range = R2L - R2H C / F / %RH	? C2	50.0
Channel 3 Actual	C3	C3 Query	? C3	Range = R3L - R3H C / F / %RP	? C3	Channel 3 is Off
Chamber On	ON	On Set	= ON	OK	= ON	OK
		On Query	? On	1 if On, 0 if Off	? On	0
Chamber Off	OFF	OFF Set	= OFF	OK	= OFF	OK
Run Program	RUN	RUN Set	= RUN	OK	= RUN	OK
		Run Query	? RUN	Returns: 0 - Stop 1 - Run 2 - Pause 3 - Steady State	? RUN	0
Pause Program	HOLD	HOLD Set	= HOLD	OK	= HOLD	OK
Resume Program	RSUM	RSUM Set	= RSUM	OK	= RSUM	OK
Software Revision	*IDN	*IDN Query	*IDN ?	Returns Revision Info: Make, Model, Serial #, Version	*IDN?	Tidal Engineering, Synergy Controller,Serial-02/0449,Version 2.6.8
Enable/Disable UUT Monitoring constants	UUT	UUT Set	= UUT ARG1 ARG2	ARG1 = UUT # (1 - 8) ARG2 = 0/1 (Enable / Disable)	= UUT 1 1	OK
		UUT Query	? UUT ARG1	Range: ARG1 = UUT # (1 - 8). Response: 0/1 (Enabled / Disabled)	? UUT 1	0
UUT Readings	UUTR	UUTR Query	? UUT 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

Description	Command Root	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
Olympic Board Version	OVERSION	OVERSION Query	? OVERSION	Olympic board Version and Serial Number	? OVERSION	Olympic V0.0.36, 02/0449
Digital Input Readings	DI	DI Query	? DI	4 digit hex number for the 16 Digital Input readings	? DI	FEFF
Machine Input Readings	MI	MI Query	? MI	Comma delimited string with the 8 Machine Input Readings LP,T,HP,T,LP,T,HP,T	? MI	1.1 PSIG,2.1 C,2.9 PSIG,4.0 C,4.9 PSIG,6.0 C,6.8 PSIG,7.9 C
Ch1 Cooling Output	1LO	1LO Query	? 1LO	1 - 100 %	? 1LO	0.0
Ch1 Heating Output	1HI	1HI Query	? 1HI	1 - 100 %	? 1HI	100.0
Ch2 Cooling Output	2LO	2LO Query	? 2LO	1 - 100 %	? 2LO	0.0
Ch2 Heating Output	2HI	2HI Query	? 2HI	1 - 100 %	? 2HI	100.0
Ch3 Cooling Output	3LO	3LO Query	? 3LO	1 - 100 %	? 3LO	0.0
Ch3 Heating Output	3HI	3HI Query	? 3HI	1 - 100 %	? 3HI	100.0
Calibration Ch 1	CAL1	CAL1 Set	= CAL1 ARG1	-50 to 50 C -90 to 90 F	= CAL1 10.0	OK
		CAL1 Query	? CAL1	-50 to 50 C -90 to 90 F	? CAL1	10.00
Low Alarm, Ch 1	A1L	A1L Set	= A1L ARG1	-200 to 500 C -326 to 932 F	= A1L -200	OK
		A1L Query	? A1L	-200 to 500 C -326 to 932 F	? A1L	-200
High Alarm, Ch 1	A1H	A1H Set	= A1H ARG1	-200 to 500 C -326 to 932 F	= A1H 500	OK
		A1H Query	? A1H	-200 to 500 C -326 to 932 F	? A1H	500
Ignore Ch1 Alarm	IGNORE_CH1_ALM	IGNORE_CH1_ALM Set	= IGNORE_CH1_ALM ARG1	ARG1: 0 - Disabled 1 - Enabled	= IGNORE_CH1_ALM 1	OK
		IGNORE_CH1_ALM Query	? IGNORE_CH1_ALM	0 - Disabled 1 - Enabled	? IGNORE_CH1_ALM	1
Calibration Ch 2	CAL2	CAL2 Set	= CAL2 ARG1	-50 to 50 C -90 to 90 F -50 to 50 %RH	= CAL2 10.0	OK
		CAL2 Query	? CAL2	-50 to 50 C -90 to 90 F -50 to 50 %RH	? CAL2	10.00
Low Alarm, Ch 2	A2L	A2L Set	= A2L ARG1	- 200 to 500 C -326 to 932 F -10 to 105 %RH	= A2L -10	OK
		A2L Query	? A2L	- 200 to 500 C -326 to 932 F -10 to 105 %RH	? A2L	-10.00

Description	Command Root	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
High Alarm, Ch 2	A2H	A2H Set	= A2H ARG1	- 200 to 500 C -326 to 932 F -10 to 105 %RH	= A2H 104	OK
		A2H Query	? A2H	- 200 to 500 C -326 to 932 F -10 to 105 %RH	? A2H	104.00
Ignore Ch2 Alarm	IGNORE_CH2_ALM	IGNORE_CH2_ALM Set	= IGNORE_CH2_ALM ARG1	ARG1: 0 - Disabled 1 - Enabled	= IGNORE_CH2_ALM 1	OK
		IGNORE_CH2_ALM Query	? IGNORE_CH2_ALM	0 - Disabled 1 - Enabled	? IGNORE_CH2_ALM	1
Calibration Ch 3	CAL3	CAL3 Set	= CAL3 ARG1	-50 to 50 %RP	= CAL3 10.0	OK
		CAL3 Query	? CAL3	-50 to 50 %RP	? CAL3	10.00
Low Alarm, Ch 3	A3L	A3L Set	= A3L ARG1	0 to 1000 %RP	= A3L -10	OK
		A3L Query	? A3L	0 to 1000 %RP	? A3L	-10.00
High Alarm, Ch 3	A3H	A3H Set	= A3H ARG1	0 to 1000 %RP	= A3H 110	OK
		A3H Query	? A3H	0 to 1000 %RP	? A3H	110.00
Ignore Ch3 Alarm	IGNORE_CH3_ALM	IGNORE_CH3_ALM Set	= IGNORE_CH3_ALM ARG1	ARG1: 0 - Disabled 1 - Enabled	= IGNORE_CH3_ALM 1	OK
		IGNORE_CH3_ALM Query	? IGNORE_CH3_ALM	0 - Disabled 1 - Enabled	? IGNORE_CH3_ALM	1
Altitude Value	ALT	ALT Set	= ALT ARG1	0 to 5000 %RP	= ALT 10	OK
		ALT Query	? ALT	0 to 5000 %RP	? ALT	10.00
Guaranteed Soak	GS	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
Prop. Band, Ch 1 Heat	PB1H	PB1H Set	= PB1H ARG1	0 to 50 C 0 to 90 F	= PB1H 10	OK
		PB1H Query	? PB1H	0 to 50 C 0 to 90 F	? PB1H	10.00
Reset, Ch 1 Heat	RS1H	RS1H Set	= RS1H ARG1	0 - 09.999 Repeats / Minute	= RS1H .02	OK
		RS1H Query	? RS1H	0 - 09.999 Repeats / Minute	? RS1H	0.020
Rate, Ch 1 Heat	RT1H	RT1H Set	= RT1H ARG1	0 - 09.999 Minutes	= RT1H	OK
		RT1H Query	? RT1H	0 - 09.999 Minutes	? RT1H	1.000
Cycle Time, Ch 1 Heat	CT1H	CT1H Set	= CT1H ARG1	1 - 60 Seconds	= CT1H 5	OK
		CT1H Query	? CT1H	1 - 60 Seconds	? CT1H	5.00
Rate Band, Ch 1 Heat	RB1H	RB1H Set	= RB1H ARG1	0 - 7 Seconds	= RB1H 4	OK

Description	Command Root	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
		RB1H Query	? RB1H	0 - 7 Seconds	? RB1H	4.000
Dead Band, Ch 1	DB1	DB1 Set	= DB1 ARG1	-25 to 25 C -45 to 45 F	= DB1 5	OK
		DB1 Query	? DB1	-25 to 25 C -45 to 45 F	? DB1	5.00
Prop Band, Ch 1 Cool	PB1C	PB1C Set	= PB1C ARG1	0 to 50 C 0 to 90 F	= PB1C 10	OK
		PB1C Query	? PB1C	0 to 50 C 0 to 90 F	? PB1C	10.00
Reset, Ch 1 Cool	RS1C	RS1C Set	= RS1C ARG1	0 - 09.999 Repeats / Minute	= RS1C .700	OK
		RS1C Query	? RS1C	0 - 09.999 Repeats / Minute	? RS1C	0.070
Rate, Ch 1 Cool	RT1C	RT1C Set	= RT1C ARG1	0 - 09.999 Minutes	= RT1C 1	OK
		RT1C Query	? RT1C	0 - 09.999 Minutes	? RT1C	1.000
Cycle Time, Ch 1 Cool	CT1C	CT1C Set	= CT1C ARG1	1 - 60 Seconds	= CT1C 7	OK
		CT1C Query	? CT1C	1 - 60 Seconds	? CT1C	7.00
Rate Band, Ch 1 Cool	RB1C	RB1C Set	= RB1C ARG1	0 - 7 Seconds	= RB1C 4	OK
		RB1C Query	? RB1C	0 - 7 Seconds	? RB1C	4.000
Cascade CH1 Enabled **	CAS1_ ENABLED		= CAS1_ENABLED ARG1	ARG1: 0 - Disabled 1 - Enabled	= CAS1_ENABLED 1	OK
			? CAS1_ENABLED	0 - Disabled 1 - Enabled	? CAS1_ENABLED	1
Channel 1 Cascade Sensor **	CSS1	CSS1 Set	= CSS1 ARG1	ARG1 - ID of the Sensor. 100 - 999.	= CSS1 120	OK
		CSS1 Query	? CSS1	See the user manual for numeric codes.	? CSS1	120
CH 1 Cascade High Limit **	C1HL	C1HL Set	= C1HL ARG1	- 200 to 500 C -326 to 932 F	= C1HL 200	OK
		C1HL Query	? C1HL	- 200 to 500 C -326 to 932 F	? C1HL	200.00
CH 1 Cascade Low Limit **	C1LL	C1LL Set	= C1LL ARG1	- 200 to 500 C -326 to 932 F	= C1LL -100	OK
		C1LL Query	? C1LL	- 200 to 500 C -326 to 932 F	? C1LL	-100.00
CH 1 High Max. Delta** (Positive Deviation Limit)	CH1HMAXD ELTA	CH1HMAXDELT A Set	= CH1HMAXDELTA ARG1	0 to 50 C 0 to 90 F	= CH1HMAXDELTA 10	OK
		CH1HMAXDELT A Query	? CH1HMAXDELTA	0 to 50 C 0 to 90 F	? CH1HMAXDELTA	10
CH 1 Low Max. Delta** (Negative Deviation Limit)	CH1LMAXDE LTA	CH1LMAXDELT A Set	= CH1LMAXDELTA ARG1	0 to 50 C 0 to 90 F	= CH1LMAXDELTA 10	OK

Description	Command Root	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
		CH1LMAXDELTA Query	? CH1LMAXDELTA	0 to 50 C 0 to 90 F	? CH1LMAXDELTA	10
CH 2 High Max. Delta** (Positive Deviation Limit)	CH2HMAXDELTA	CH2HMAXDELTA Set	= CH2HMAXDELTA ARG1	0 to 50 C 0 to 90 F	= CH2HMAXDELTA 10	OK
		CH2HMAXDELTA Query	? CH2HMAXDELTA	0 to 50 C 0 to 90 F	? CH2HMAXDELTA	10
CH 2 Low Max. Delta** (Negative Deviation Limit)	CH2LMAXDELTA	CH2LMAXDELTA Set	= CH2LMAXDELTA ARG1	0 to 50 C 0 to 90 F	= CH2LMAXDELTA 10	OK
		CH2LMAXDELTA Query	? CH2LMAXDELTA	0 to 50 C 0 to 90 F	? CH2LMAXDELTA	10
CH1 Cascade Prop. Band **	CPB1H	CPB1H Set	= CPB1H ARG1	0 to 400 C 0 to 752 F	= CPB1H 10	OK
		CPB1H Query	? CPB1H	0 to 400 C 0 to 752 F	? CPB1H	
CH1 Cascade Reset **	CRS1H	CRS1H Set	= CRS1H ARG1	0 - 09.99 Repeats / Minute	? CRS1H	OK
		CRS1H Query	? CRS1H	0 - 09.99 Repeats / Minute	? CRS1H	1.000
CH1 Cascade Rate **	CRT1H	CRT1H Set	= CRT1H ARG1	0 - 09.99 Minutes	= CRT1H 1	OK
		CRT1H Query	? CRT1H	0 - 09.99 Minutes	? CRT1H	1.000
CH1 Cascade Rate Band **	CBR1H	CRB1H Set	= CRB1H ARG1	0 - 09.99 Minutes	= CRB1H 4	OK
		CRB1H Query	? CRB1H	0 - 09.99 Minutes	? CRB1H	4.000
CH1 Cascade PID value	CPID1	CPID1 Query	? CPID1	0 - 100%	? CPID1	0.0
CH2 Cascade PID value	CPID2	CPID2 Query	? CPID2	0 - 100%	? CPID2	0.0
Raw Channel Input Data	CIRAW	CIRAW Query	? CIRAW	RTD1,RTD2,ADC1,ADC2,ADC3,ADC4	? CIRAW	115.290,110.280,1.222,2.494,2.494,2.494
Raw Channel Input Data	MIRAW	MIRAW Query	? MIRAW	ADC1, ADC2, ADC3, ADC4, ADC5, ADC6, ADC7, ADC8	? MIRAW	0.1,0.1,0.1,0.1,0.1,0.1,0.1,0.1
Prop. Band, Ch 2 Heat	PB2H	PB2H Set	= PB2H ARG1	0 to 50 %RH	= PB2H 42	OK
		PB2H Query	? PB2H	0 to 50 %RH	? PB2H	42.00
Reset, Ch 2 Heat	RS2H	RS2H Set	= RS2H ARG1	0 - 09.999 Repeats / Minute	= RS2H .02	OK
		RS2H Query	? RS2H	0 - 09.999 Repeats / Minute	? RS2H	0.020

Description	Command Root	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
Rate, Ch 2 Heat	RT2H	RT2H Set	= RT2H ARG1	0 - 09.999 Minutes	= RT2H 1	OK
		RT2H Query	? RT2H	0 - 09.999 Minutes	? RT2H	1.000
Cycle Time, Ch 2 Heat	CT2H	CT2H Set	= CT2H ARG1	1 - 60 Seconds	= CT2H 1	OK
		CT2H Query	? CT2H	1 - 60 Seconds	? CT2H	1.00
Rate Band, Ch 2 Heat	RB2H	RB2H Set	= RB2H ARG1	0 - 7 Seconds	= RB2H 4	OK
		RB2H Query	? RB2H	0 - 7 Seconds	? RB2H	4.000
Dead Band, Ch 2	DB2	DB2 Set	= DB2 ARG1	-25 to 25 %RH	= DB2 5	OK
		DB2 Query	? DB2	-25 to 25 %RH	? DB2	5.00
Prop Band, Ch 2 Cool	PB2C	PB2C Set	= PB2C ARG1	0 to 50 %RH	= PB2C 40	OK
		PB2C Query	? PB2C	0 to 50 %RH	? PB2C	40.00
Reset, Ch 2 Cool	RS2C	RS2C Set	= RS2C ARG1	0 - 09.999 Repeats / Minute	= RS2C .1	OK
		RS2C Query	? RS2C	0 - 09.999 Repeats / Minute	? RS2C	0.100
Rate, Ch 2 Cool	RT2C	RT2C Set	= RT2C ARG1	0 - 09.999 Minutes	= RT2C 1	OK
		RT2C Query	? RT2C	0 - 09.999 Minutes	? RT2C	1.000
Cycle Time, Ch 2 Cool	CT2C	CT2C Set	= CT2C ARG1	1 - 60 Seconds	= CT2C 1	OK
		CT2C Query	? CT2C	1 - 60 Seconds	? CT2C	1.00
Rate Band, Ch 2 Cool	RB2C	RB2C Set	= RB2C ARG1	0 - 7 Seconds	= RB2C 4	OK
		RB2C Query	? RB2C	0 - 7 Seconds	? RB2C	4.000
Prop. Band, Ch 3 Heat	PB3H	PB3H Set	= PB3H ARG1	0-0999 %RP	= PB3H 10	OK
		PB3H Query	? PB3H	0-0999 %RP	? PB3H	10.00
Reset, Ch 3 Heat	RS3H	RS3H Set	= RS3H ARG1	0 - 09.999 Repeats / Minute	= RS3H .02	OK
		RS3H Query	? RS3H	0 - 09.999 Repeats / Minute	? RS3H	0.020
Rate, Ch 3 Heat	RT3H	RT3H Set	= RT3H ARG1	0 - 09.999 Minutes	= RT3H 1	OK
		RT3H Query	? RT3H	0 - 09.999 Minutes	? RT3H	1.000
Cycle Time, Ch 3 Heat	CT3H	CT3H Set	= CT3H ARG1	1 - 60 Seconds	= CT3H 5	OK
		CT3H Query	? CT3H	1 - 60 Seconds	? CT3H	5.00
Rate Band, Ch 3 Heat	RB3H	RB3H Set	= RB3H ARG1	1 - 7 Seconds	= RB3H 4	OK
		RB3H Query	? RB3H	1 - 7 Seconds	? RB3H	4.000
Dead Band, Ch 3	DB3	DB3 Set	= DB3 ARG1	-25 to 25 %RP	= DB3 5	OK
		DB3 Query	? DB3	-25 to 25 %RP	? DB3	5.00

Description	Command Root	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
Prop Band, Ch 3 Cool	PB3C	PB3C Set	= PB3C ARG1	0-0999 %RP	= PB3C 10	OK
		PB3C Query	? PB3C	0-0999 %RP	? PB3C	10.00
Reset, Ch 3 Cool	RS3C	RS3C Set	= RS3C ARG1	0 - 09.999 Repeats / Minute	= RS3C .07	OK
		RS3C Query	? RS3C	0 - 09.999 Repeats / Minute	? RS3C	0.070
Rate, Ch 3 Cool	RT3C	RT3C Set	= RT3C ARG1	0 - 09.999 Minutes	= RT3C 1	OK
		RT3C Query	? RT3C	0 - 09.999 Minutes	? RT3C	1.000
Cycle Time, Ch 3 Cool	CT3C	CT3C Set	= CT3C ARG1	1 - 60 Seconds	= CT3C 7	OK
		CT3C Query	? CT3C	1 - 60 Seconds	? CT3C	7.00
Rate Band, Ch 3 Cool	RB3C	RB3C Set	= RB3C ARG1	1 - 60 Seconds	= RB3C 4	OK
		RB3C Query	? RB3C	1 - 60 Seconds	? RB3C	4.000
Celsius / Fahrenheit Temp Display	CF	CF Set	= CF ARG1	ARG1: 0 - Celsius 1 - Fahrenheit	= CF 0	OK
		CF Query	? CF	0 - Celsius 1 - Fahrenheit	? CF	0
Output 11 Control Type	OT11	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	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	OT18 Set	= OT18 ARG1	ARG1: 0 - Vent 1 - Boost Cool	= OT18 1	OK
		OT18 Query	? OT18	0 - Vent 1 - Boost Cool	? OT18	1
Alarm Type	ATYP	ATYP Set	= ATYP ARG1	ARG1: 0 - Process Alarm 1 - Deviate Alarm	= ATYP 1	OK

Description	Command Root	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
		ATYP Query	? ATYP	0 - Process Alarm 1 - Deviate Alarm	? ATYP	1
Low Limit, Ch 1	R1L	R1L Set	= R1L ARG1	- 200 to 500 C -326 to 932 F	= R1L -200	OK
		R1L Query	? R1L	- 200 to 500 C -326 to 932 F	? R1L	-200
High Limit, Ch 1	R1H	R1H Set	= R1H ARG1	- 200 to 500 C -326 to 932 F	= R1H 500	OK
		R1H Query	? R1H	- 200 to 500 C -326 to 932 F	? R1H	500
Low Limit, Ch 2	R2L	R2L Set	= R2L ARG1	- 200 to 500 %RH	= R2L -1	OK
		R2L Query	? R2L	- 200 to 500 %RH	? R2L	-1
High Limit, Ch 2	R2H	R2H Set	= R2H ARG1	- 200 to 500 %RH	= R2H 100	OK
		R2H Query	? R2H	- 200 to 500 %RH	? R2H	100
RTD Curve	RTD	RTD Set	= RTD ARG1	ARG1: 0 - JIS 1 - DIN	= RTD 0	OK
		RTD Query	? RTD	0 - JIS 1 - DIN	? RTD	0
Vaisala Compensation	VCMP	VCMP Set	= VCMP ARG1	ARG1: 0 - On 1 - Off	= VCMP 0	OK
		VCMP Query	? VCMP	0 - On 1 - Off	? VCMP	0
1L1	1L1	1L1 Set	= 1L1 ARG1	0 - 100 %	= 1L1 50	OK
		1L1 Query	? 1L1	0 - 100 %	? 1L1	50.00
1L2	1L2	1L2 Set	= 1L2 ARG1	0 - 100 %	= 1L2 20	OK
		1L2 Query	? 1L2	0 - 100 %	? 1L2	20.00
1L3	1L3	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	1CTY	1CTY Set	= 1CTY ARG1	ARG1: 0 - CAP - Tube System 1 - Agree Logic 2 - Burn In Logic 3 - Standard XV Sys Logic	= 1CTY 1	OK

Description	Command Root	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
		1CTY Query	? 1CTY	0 - CAP - Tube System 1 - Agree Logic 2 - Burn In Logic 3 - Standard XV Sys Logic	? 1CTY	0
2L1	2L1	2L1 Set	= 2L1 ARG1	-100 - 100 %	= 2L1 50	OK
		2L1 Query	? 2L1	-100 - 100 %	? 2L1	50.00
2L2	2L2	2L2 Set	= 2L2 ARG1	-100 - 100 %	= 2L2 20	OK
		2L2 Query	? 2L2	-100 - 100 %	? 2L2	50.00
2L3	2L3	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	2CTY	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	L3	L3 Set	= L3 ARG1	0 - 100 %	= L3 20	OK
		L3 Query	? L3	0 - 100 %	? L3	20.00
L4	L4	L4 Set	= L4 ARG1	0 - 100 %	= L4 20	OK
		L4 Query	? L4	0 - 100 %	? L4	20.00
		L6 Query	? L6	-100 to 100 C -148 to 212 F	? L6	20.00
L6	L6	L6 Set	= L6 ARG1	-100 to 100 C -148 to 212 F	= L6 20	OK
L7	L7	L7 Set	= L7 ARG1	0 - 100 %	= L7 10	OK
		L7 Query	? L7	0 - 100 %	? L7	10.00
L8	L8	L8 Set	= L8 ARG1	0 - 100 %	= L8 80	OK
		L8 Query	? L8	0 - 100 %	? L8	80.00
L9	L9	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	L11	L11 Set	= L11 ARG1	0 - 100 %	= L11 20	OK
		L11 Query	? L11	0 - 100 %	? L11	20.00
L12	L12	L12 Set	= L12 ARG1	0 - 100 %	= L12 10	OK

Description	Command Root	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
		L12 Query	? L12	0 - 100 Seconds	? L12	10.00
L14	L14	L14 Set	= L14 ARG1	0 - 60 Seconds	= L14 10	OK
		L14 Query	? L14	0 - 60 %	? L14	10.00
L15	L15	L15 Set	= L15 ARG1	0 - 5 Minutes	= L15 2	OK
		L15 Query	? L15	0 - 5 Minutes	? L15	2
LEV1	LEV1	LEV1 Set	= LEV1	ARG1: 0 - Dehumidify Coil 1 - Drier	=LEV1 1	OK
		LEV1 Query	? LEV1	ARG1: 0 - Dehumidify Coil 1 - Drier	? LEV1	1
Enable Logging	LOGGING_ ENABLED	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	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
Log File Size	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 Ch1 Actual	LOG_CH1_ ACT	LOG_CH1_ACT Set	= LOG_CH1_ACT ARG1	ARG1: 0 - Don't Log 1 - Log	= LOG_CH1_ACT 1	OK
		LOG_CH1_ACT Query	? LOG_CH1_ACT	0 - Don't Log 1 - Log	? LOG_CH1_ACT	1
Log Ch2 Actual	LOG_CH2_ ACT	LOG_CH2_ACT Set	= LOG_CH2_ACT ARG1	ARG1: 0 - Don't Log 1 - Log	= LOG_CH2_ACT 1	OK
		LOG_CH2_ACT Query	? LOG_CH2_ACT	0 - Don't Log 1 - Log	? LOG_CH2_ACT	1

Description	Command Root	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
Log Ch3 Actual	LOG_CH3_ ACT	LOG_CH3_ACT Set	= LOG_CH3_ACT ARG1	ARG1: 0 - Don't Log 1 - Log	= LOG_CH3_SP 1	OK
		LOG_CH3_ACT Query	? LOG_CH3_ACT	0 - Don't Log 1 - Log	? LOG_CH3_SP	1
Log Ch1 Setpoint	LOG_CH1_ SP	LOG_CH1_SP Set	= LOG_CH1_SP ARG1	ARG1: 0 - Don't Log 1 - Log	= LOG_CH1_SP 1	OK
		LOG_CH1_SP Query	? LOG_CH1_SP	0 - Don't Log 1 - Log	? LOG_CH1_SP	1
Log Ch2 Setpoint	LOG_CH2_ SP	LOG_CH2_SP Set	#NAME?	ARG1: 0 - Don't Log 1 - Log	= LOG_CH2_SP 1	OK
		LOG_CH2_SP Query	? LOG_CH2_SP	0 - Don't Log 1 - Log	? LOG_CH2_SP	1
Log Ch3 Setpoint	LOG_CH3_ SP	LOG_CH3_SP Set	= LOG_CH3_SP ARG1	ARG1: 0 - Don't Log 1 - Log	= LOG_CH3_SP 1	OK
		LOG_CH3_SP Query	? LOG_CH3_SP	0 - Don't Log 1 - Log	? LOG_CH3_SP	1
Log CH1 Cascade Act **	LOG_CAS_C H1_ACT	LOG_CAS_CH1_ ACT Set	= LOG_CAS_CH1_ACT ARG1	ARG1: 0 - Don't Log 1 - Log	= LOG_CAS_CH1_ACT 1	OK
		LOG_CAS_CH1_ ACT Query	? LOG_CAS_CH1_ACT	0 - Don't Log 1 - Log	? LOG_CAS_CH1_ACT	1
Log CH1 Cascade SP **	LOG_CAS_C H1_SP	LOG_CAS_CH1_ SP Set	= LOG_CAS_CH1_SP ARG1	ARG1: 0 - Don't Log 1 - Log	= LOG_CAS_CH1_SP 1	OK
		LOG_CAS_CH1_ SP Query	? LOG_CAS_CH1_SP	0 - Don't Log 1 - Log	? LOG_CAS_CH1_SP	1
Log CH1 Cascade PID **	LOG_CAS_C H1_PID	LOG_CAS_CH1_ PID Set	= LOG_CAS_CH1_PID ARG1	ARG1: 0 - Don't Log 1 - Log	= LOG_CAS_CH1_PID 1	OK
		LOG_CAS_CH1_ PID Query	? LOG_CAS_CH1_PID	0 - Don't Log 1 - Log	? LOG_CAS_CH1_PID	1

Description	Command Root	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
Log Ch 1 Heat PID	LOG_CH1_ HEAT	LOG_CH1_ HEAT Set	= LOG_CH1_HEAT ARG1	ARG1: 0 - Don't Log 1 - Log	= LOG_CH1_HEAT 1	OK
		LOG_CH1_ HEAT Query	? LOG_CH1_HEAT	0 - Don't Log 1 - Log	? LOG_CH1_HEAT	1
Log Ch 1 Cool PID	LOG_CH1_ Cool	LOG_CH1_ Cool Set	= LOG_CH1_Cool ARG1	ARG1: 0 - Don't Log 1 - Log	= LOG_CH1_COOL 1	OK
		LOG_CH1_ Cool Query	? LOG_CH1_Cool	0 - Don't Log 1 - Log	? LOG_CH1_COOL	0
Log Ch 2 Heat PID	LOG_CH2_ HEAT	LOG_CH2_ HEAT Set	= LOG_CH2_HEAT ARG1	ARG1: 0 - Don't Log 1 - Log	= LOG_CH2_HEAT 1	OK
		LOG_CH2_ HEAT Query	? LOG_CH2_HEAT	0 - Don't Log 1 - Log	? LOG_CH2_HEAT	0
Log Ch 2 Cool PID	LOG_CH2_ Cool	LOG_CH2_ Cool Set	= LOG_CH2_Cool ARG1	ARG1: 0 - Don't Log 1 - Log	= LOG_CH2_COOL 1	OK
		LOG_CH2_ Cool Query	? LOG_CH2_Cool	0 - Don't Log 1 - Log	? LOG_CH2_COOL	0
Log Ch 3 Heat PID	LOG_CH3_ HEAT	LOG_CH3_ HEAT Set	= LOG_CH3_HEAT ARG1	ARG1: 0 - Don't Log 1 - Log	= LOG_CH3_HEAT 1	OK
		LOG_CH3_ HEAT Query	? LOG_CH3_HEAT	0 - Don't Log 1 - Log	? LOG_CH3_HEAT	0
Log Ch 3 Cool PID	LOG_CH3_ Cool	LOG_CH3_ Cool Set	= LOG_CH3_Cool ARG1	ARG1: 0 - Don't Log 1 - Log	= LOG_CH3_COOL 1	OK
		LOG_CH3_ Cool Query	? LOG_CH3_Cool	0 - Don't Log 1 - Log	? LOG_CH3_COOL	0
Log Machine Input 1	LOG_MACHI NE1	LOG_MACHINE1 Set	= LOG_MACHINE1 ARG1	ARG1: 0 - Don't Log 1 - Log	= LOG_MACHINE1 1	OK
		LOG_MACHINE1 Query	? LOG_MACHINE1	0 - Don't Log 1 - Log	? LOG_MACHINE1	0

Description	Command Root	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
Log Machine Input 2	LOG_MACHINE2	LOG_MACHINE2 Set	= LOG_MACHINE2 ARG1	ARG1: 0 - Don't Log 1 - Log	= LOG_MACHINE2 1	OK
		LOG_MACHINE2 Query	? LOG_MACHINE2	0 - Don't Log 1 - Log	? LOG_MACHINE2	0
Log Machine Input 3	LOG_MACHINE3	LOG_MACHINE3 Set	= LOG_MACHINE3 ARG1	ARG1: 0 - Don't Log 1 - Log	= LOG_MACHINE3 1	OK
		LOG_MACHINE3 Query	? LOG_MACHINE3	0 - Don't Log 1 - Log	? LOG_MACHINE3	0
Log Machine Input 4	LOG_MACHINE4	LOG_MACHINE4 Set	= LOG_MACHINE4 ARG1	ARG1: 0 - Don't Log 1 - Log	= LOG_MACHINE4 1	OK
		LOG_MACHINE4 Query	? LOG_MACHINE4	0 - Don't Log 1 - Log	? LOG_MACHINE4	0
Log Machine Input 5	LOG_MACHINE5	LOG_MACHINE5 Set	= LOG_MACHINE5 ARG1	ARG1: 0 - Don't Log 1 - Log	= LOG_MACHINE5 1	OK
		LOG_MACHINE5 Query	? LOG_MACHINE5	0 - Don't Log 1 - Log	? LOG_MACHINE5	0
Log Machine Input 6	LOG_MACHINE6	LOG_MACHINE6 Set	= LOG_MACHINE6 ARG1	ARG1: 0 - Don't Log 1 - Log	= LOG_MACHINE6 1	OK
		LOG_MACHINE6 Query	? LOG_MACHINE6	0 - Don't Log 1 - Log	? LOG_MACHINE6	0
Log Machine Input 7	LOG_MACHINE7	LOG_MACHINE7 Set	= LOG_MACHINE7 ARG1	ARG1: 0 - Don't Log 1 - Log	= LOG_MACHINE7 1	OK
		LOG_MACHINE7 Query	? LOG_MACHINE7	0 - Don't Log 1 - Log	? LOG_MACHINE7	0
Log Machine Input 8	LOG_MACHINE8	LOG_MACHINE8 Set	= LOG_MACHINE8 ARG1	ARG1: 0 - Don't Log 1 - Log	= LOG_MACHINE8 1	OK
		LOG_MACHINE8 Query	? LOG_MACHINE8	0 - Don't Log 1 - Log	? LOG_MACHINE8	0

Description	Command Root	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
Log UUT1 Readings	LOG_UUT1	LOG_UUT1 Set	= LOG_UUT1 ARG1	ARG1: 0 - Don't Log 1 - Log	= LOG_UUT1 1	OK
		LOG_UUT1 Query	? LOG_UUT1	0 - Don't Log 1 - Log	? LOG_UUT1	0
Log UUT2 Readings	LOG_UUT2	LOG_UUT2 Set	= LOG_UUT2 ARG1	ARG1: 0 - Don't Log 1 - Log	= LOG_UUT2 1	OK
		LOG_UUT2 Query	? LOG_UUT2	0 - Don't Log 1 - Log	? LOG_UUT2	0
Log UUT3 Readings	LOG_UUT3	LOG_UUT3 Set	= LOG_UUT3 ARG1	ARG1: 0 - Don't Log 1 - Log	= LOG_UUT3 1	OK
		LOG_UUT3 Query	? LOG_UUT3	0 - Don't Log 1 - Log	? LOG_UUT3	0
Log UUT4 Readings	LOG_UUT4	LOG_UUT4 Set	= LOG_UUT4 ARG1	ARG1: 0 - Don't Log 1 - Log	= LOG_UUT4 1	OK
		LOG_UUT4 Query	? LOG_UUT4	0 - Don't Log 1 - Log	? LOG_UUT4	0
Log UUT5 Readings	LOG_UUT5	LOG_UUT5 Set	= LOG_UUT5 ARG1	ARG1: 0 - Don't Log 1 - Log	= LOG_UUT5 1	OK
		LOG_UUT5 Query	? LOG_UUT5	0 - Don't Log 1 - Log	? LOG_UUT5	0
Log UUT6 Readings	LOG_UUT6	LOG_UUT6 Set	= LOG_UUT6 ARG1	ARG1: 0 - Don't Log 1 - Log	= LOG_UUT6 1	OK
		LOG_UUT6 Query	? LOG_UUT6	0 - Don't Log 1 - Log	? LOG_UUT6	0
Log UUT7 Readings	LOG_UUT7	LOG_UUT7 Set	= LOG_UUT7 ARG1	ARG1: 0 - Don't Log 1 - Log	= LOG_UUT7 1	OK
		LOG_UUT7 Query	? LOG_UUT7	0 - Don't Log 1 - Log	? LOG_UUT7	0

Description	Command Root	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
Log UUT8 Readings	LOG_UUT8	LOG_UUT8 Set	= LOG_UUT8 ARG1	ARG1: 0 - Don't Log 1 - Log	= LOG_UUT8 1	OK
		LOG_UUT8 Query	? LOG_UUT8	0 - Don't Log 1 - Log	? LOG_UUT8	0
Log Outputs	LOG_OUTPUTS	LOG_OUTPUTS Set	= LOG_OUTPUTS ARG1	ARG1: 0 - Don't Log 1 - Log	= LOG_OUTPUTS 1	OK
		LOG_OUTPUTS Query	? LOG_OUTPUTS	0 - Don't Log 1 - Log	? LOG_OUTPUTS	0
PID Channel 1 Heat *	PID1H	PID1H Query	? PID1H	1 - 100 %	? PID1H	0.0
PID Channel 1 Cool *	PID1C	PID1C Query	? PID1C	1 - 100 %	? PID1C	100.0
PID Channel 2 Heat *	PID2H	PID2H Query	? PID2H	1 - 100 %	? PID2H	0.0
PID Channel 2 Cool *	PID2C	PID2C Query	? PID2C	1 - 100 %	? PID2C	100.0
PID Channel 3 Heat *	PID3H	PID3H Query	? PID3H	1 - 100 %	? PID3H	0.0
PID Channel 3 Cool *	PID3C	PID3C Query	? PID3C	1 - 100 %	? PID3C	100.0
Acknowledge All Alarms *	ACKALM	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	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	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 Root	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		
Events	EVENTS	EVENTS Set	= EVENTS	ARG1: Event # (1-8) ARG2: 0 - Disabled 1 - Enabled	= EVENTS 1 1	OK

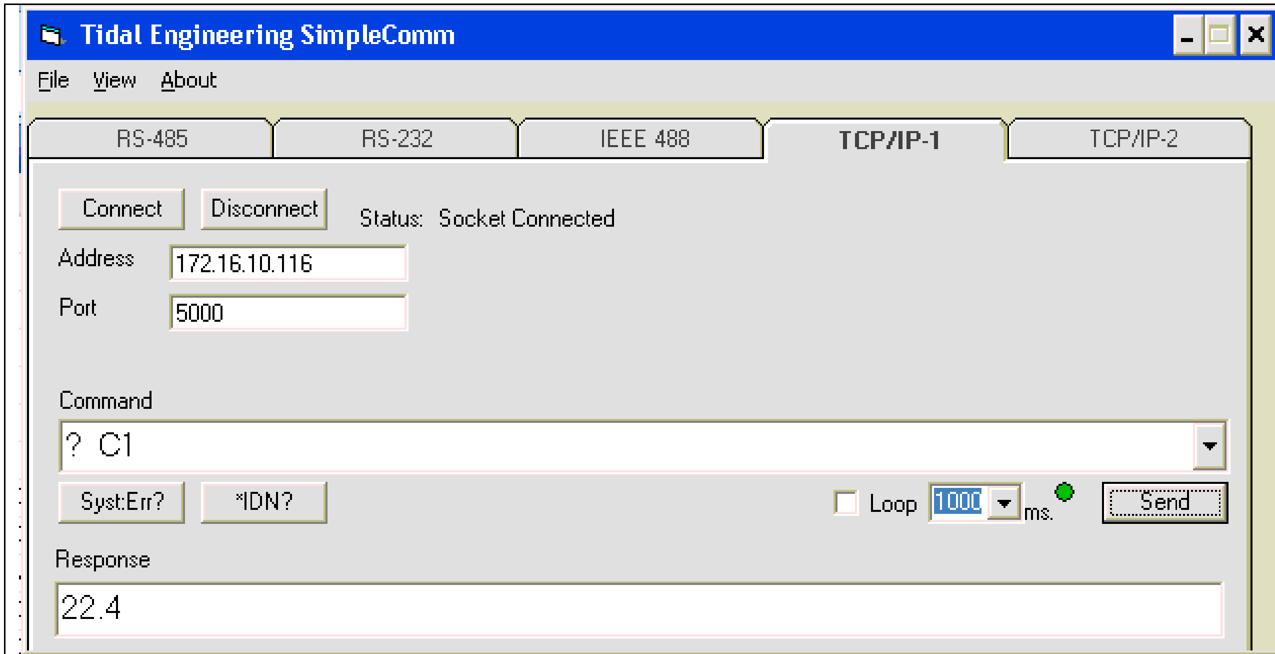
Description	Command Root	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
		EVENTS Query	? EVENTS	Returns a 32 Bit hex number. Each bit represents an event Bit 1 = Event 1 Bit 2 = Event 2 Bit 3 = Event 3 Bit 4 = Event 4 Bit 5 = Event 5 Bit 6 = Event 6 Bit 23 = Relay 1 Bit 24 = Relay 2	? EVENTS	00C00001
		EVENTS Query	? EVENTS	ARG1: Event # (1-8)	? EVENTS 1	1
Storage Card Info *	SCINFO	SCINFO Query	? SCINFO	returns storage card free	? SCINFO	Total: 8128512, Free: 1826816
RAM Info	VTVMEMINFO	VTVMEMINFO Query	? VTVMEMINFO	Returns total system RAM and available RAM	? VTVMEMINFO	Unknown, Total Physical: 20242432, Available Physical: 14848000, RAM
Create a New File	FILENEW	FILENEW Set	= FILENEW	No Arguments	= FILENEW	
Saves a downloaded file	FILESAVE	FILESAVE Set	= FILESAVE	ARG1 = Filename to save to	= FILESAVE MyProfile	
Sets information regarding the profile being downloaded. Used immediately after a FILENEW command	VTVINFO	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	

Description	Command Root	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
Program Step	STP	STP	= STP File # Step # STEPTYPE ARG4 ARGn		= STP 1 1 0	
FILE #	N/A	See Program Step	N/A	Range: Anything	N/A	
STEP #	N/A	See Program Step	N/A	Range 1-255	N/A	
STEPTYPE	N/A	See Program Step	N/A	0 = Setpoint 1 = Jumploop 2 = Waitfor 3 = Autostart 4 = Stop 5 = Link		
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		
JUMPLOOP	N/A	See Steptype	ARG4 ARG5	ARG4 = Jump Step ARG5 = Jump Count		
WAITFOR	N/A	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 Seconds ARG11 - 26 = Wait on Input 1-16		

Description	Command Root	Command Usages	Command Syntax	Range, Units	Command Example	Response Example
AUTOSTART	N/A	See Steptype	ARG4 ARG5 ARG6 ARG7 ARG8	ARG4 = AutoStart Day ARG5 = AutoStart Hour ARG6 = AutoStart Minute ARG7 = AutoStart Month ARG7 = AutoStart Year		
STOP	N/A	See Steptype	ARG4	ARG4: 0 - Outputs Off 1 - Outputs On		

18.2 SimpleComm Examples

The following examples use screenshots to demonstrate Synergy Nano command and response with the free SimpleComm application available at www.Tidaleng.com/download.htm. See section 8.3 for detailed instructions for SimpleComm.

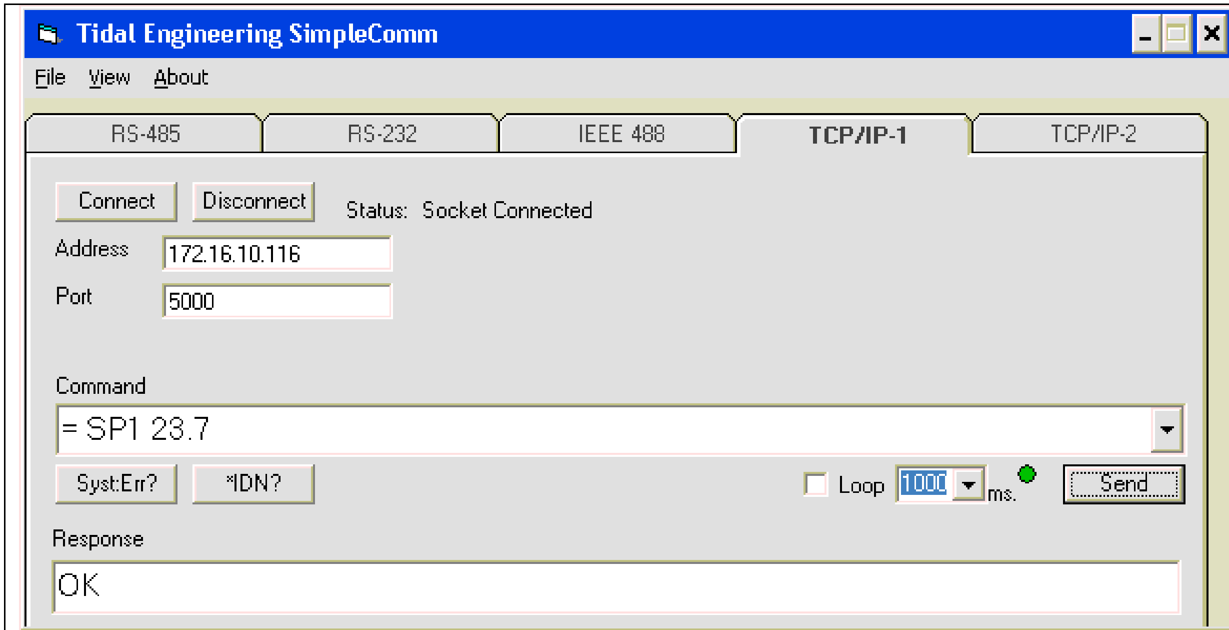


Example 1

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 Nano to the Local Area Network (LAN) with an RJ-45 network cable.
2. Obtain the IP address of the Synergy Nano from the COMM/Ethernet Folder.
3. Enable the Synergy Nano'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".
6. Press the **Send** button and note the temperature in **Response** field.
   Note: The response is in the current units of measure for the controller.

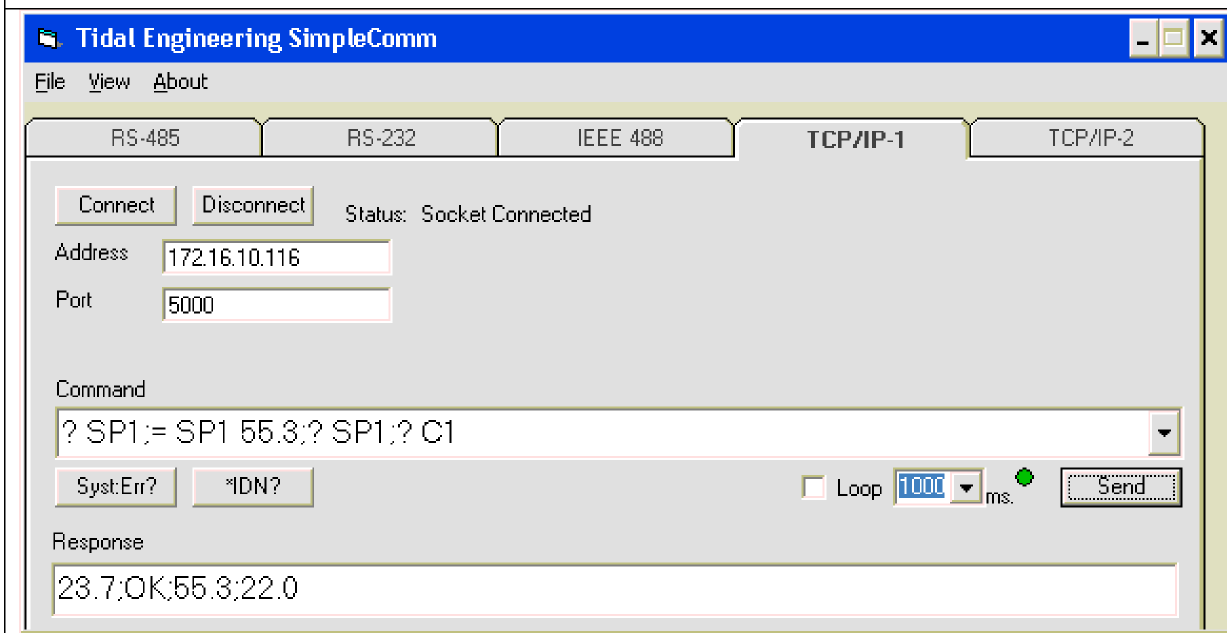


Example 2

This example demonstrates the Synergy Nano 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.
2. Press the **Send** button and note the OK in **Response** field. The controller responds with OK when the command is accepted.



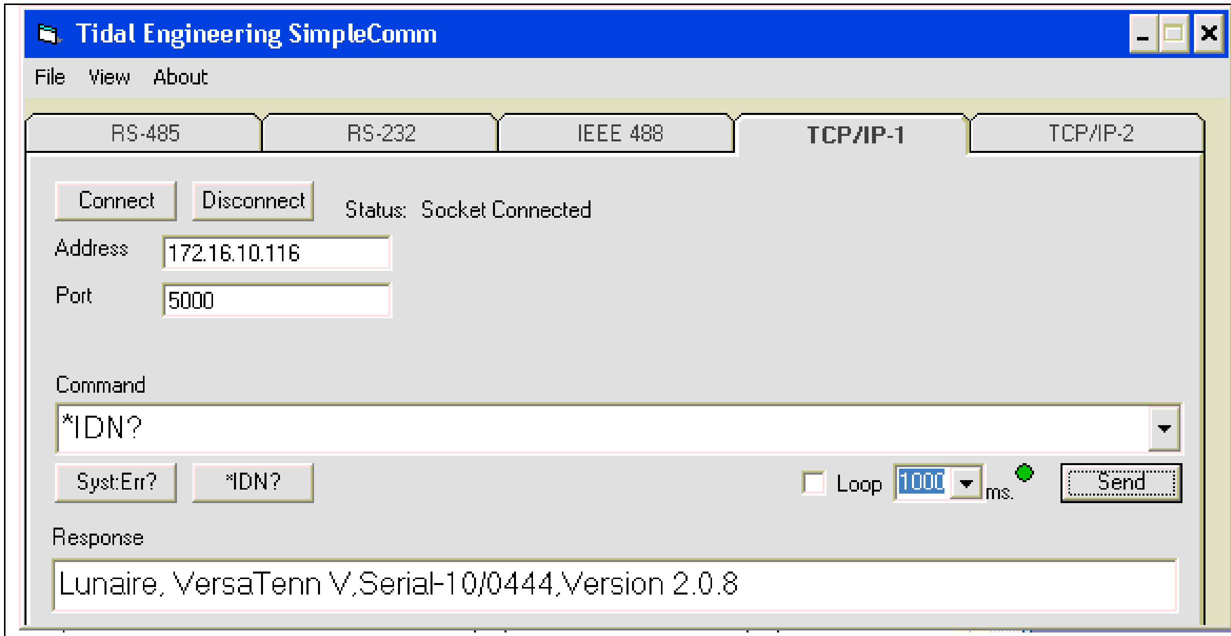
Example 3

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.

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.

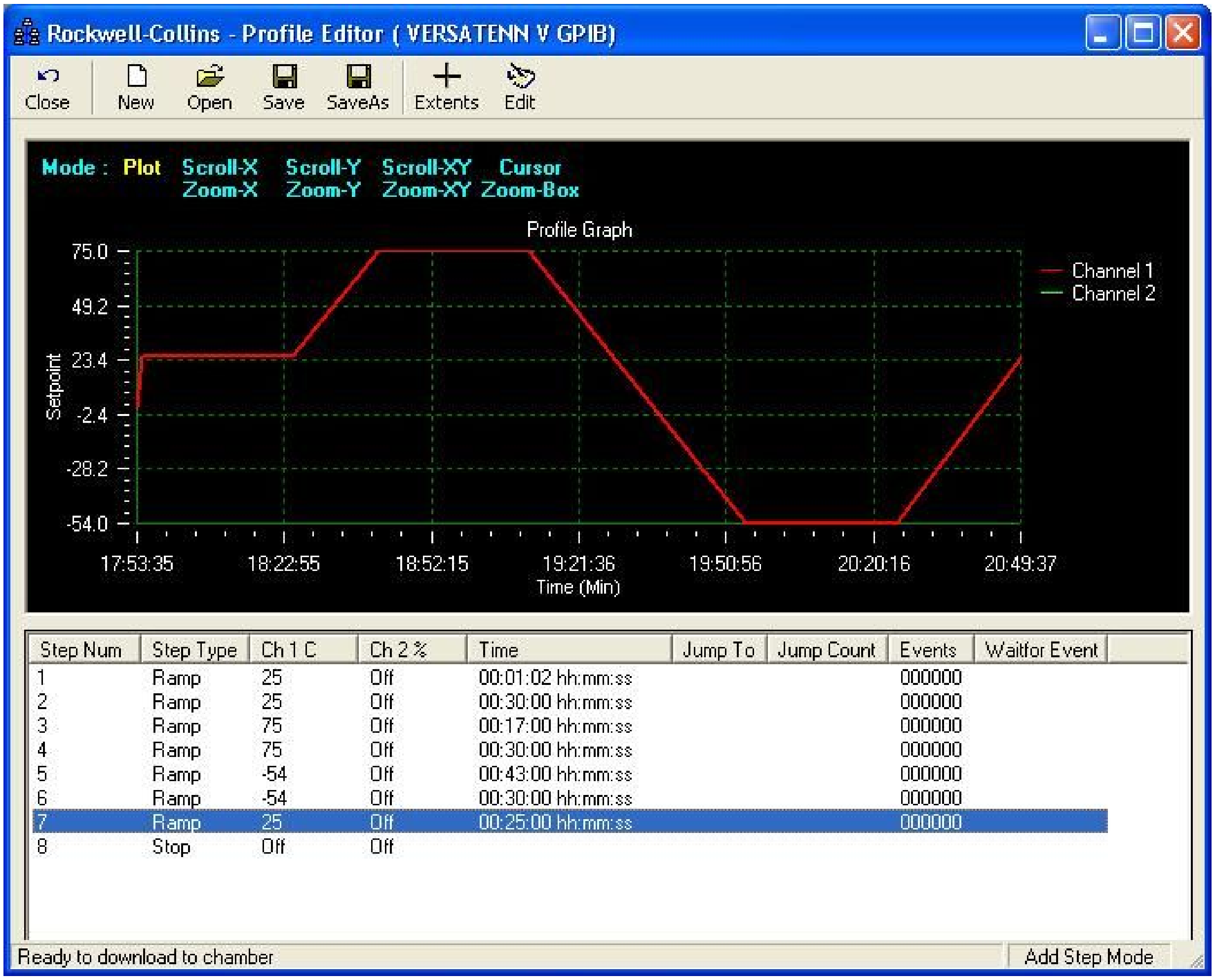
1. Type "*IDN?" in the **Command** field. Note that there are NO SPACES in this command.
2. Press the **Send** button and note the **Response** field.

Note: This query is universal for GPIB equipped instruments in accordance with the IEEE 488 standard. This command is also supported by the Synergy Nano for the TCP/IP and Serial (RS-232 and RS-485) communication.

18.3 Profile Creation and Control Commands

The Synergy Nano 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 Nano, 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")
```

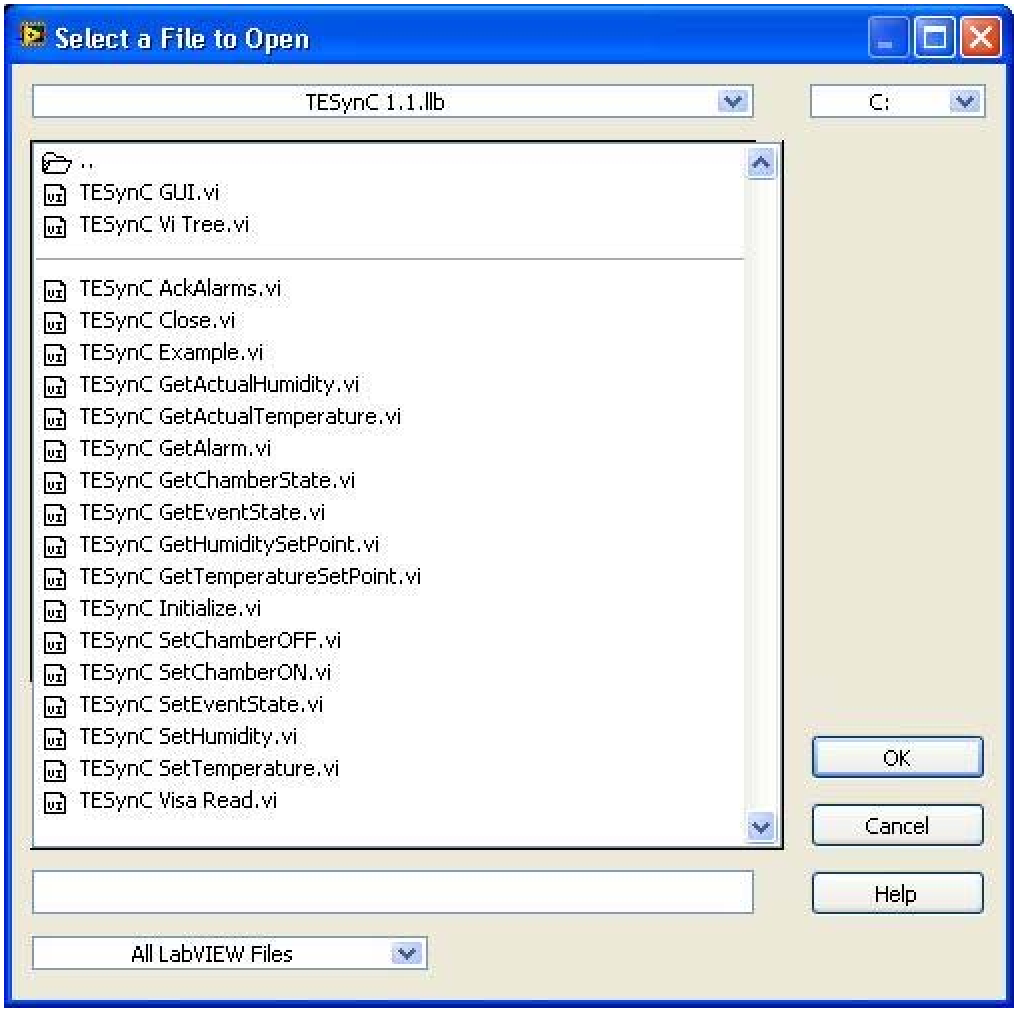
Synergy Nano Step Syntax.

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

18.4 LabVIEW ™ Driver

The LabVIEW driver available for the Synergy Nano 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 Nano 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 Nano 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

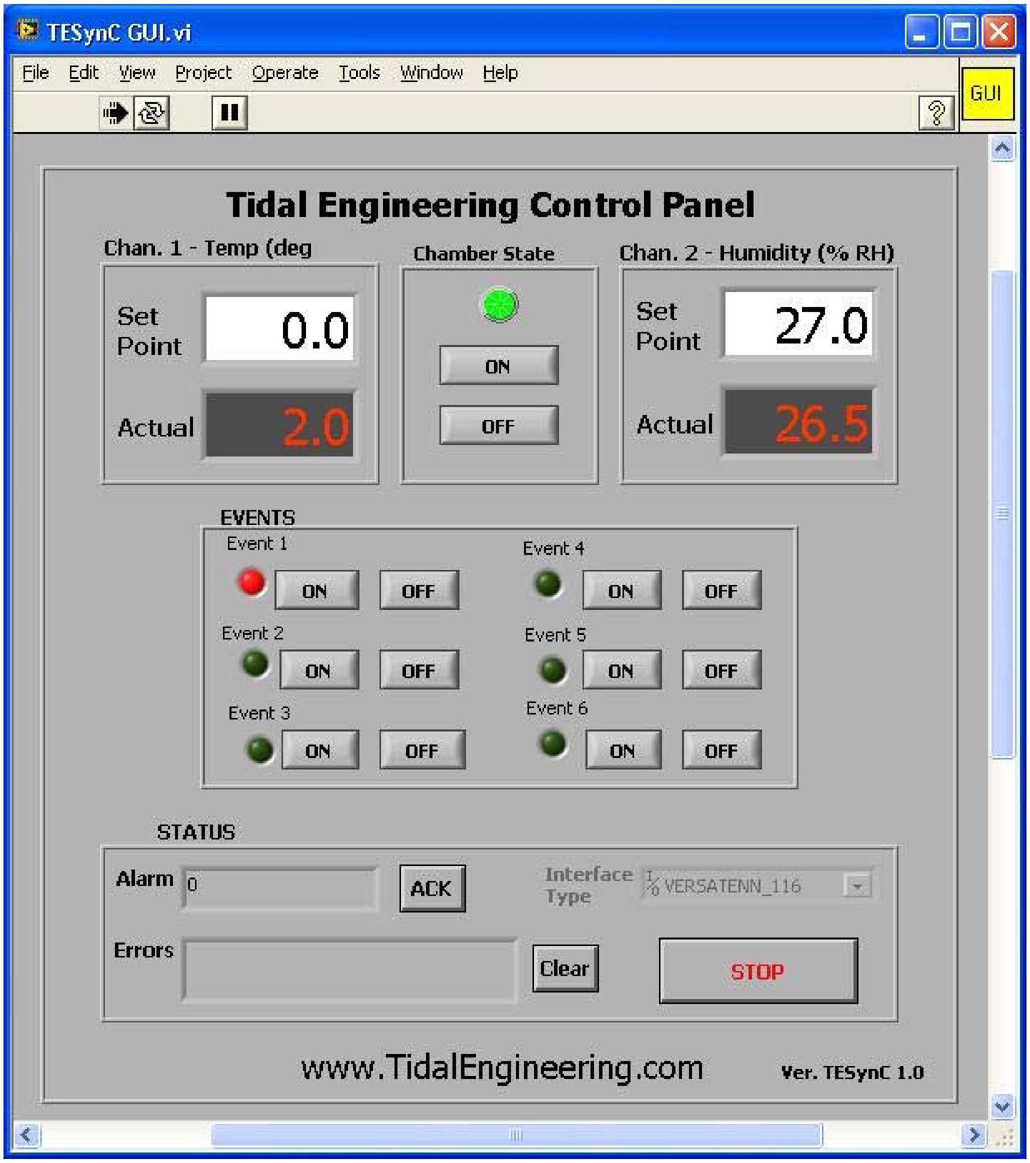
- *TESynC SetChamberOFF.vi*
- *TESynC SetChamberON.vi*
- *TESynC SetEventState.vi*
- *TESynC SetHumidity.vi*
- *TESynC SetTemperature.vi*

VI's to start and end GPIB communication

- *TESynC Initalize.vi*
- *TESynC Close.vi*
- *TESynC Visa Read.vi*
-

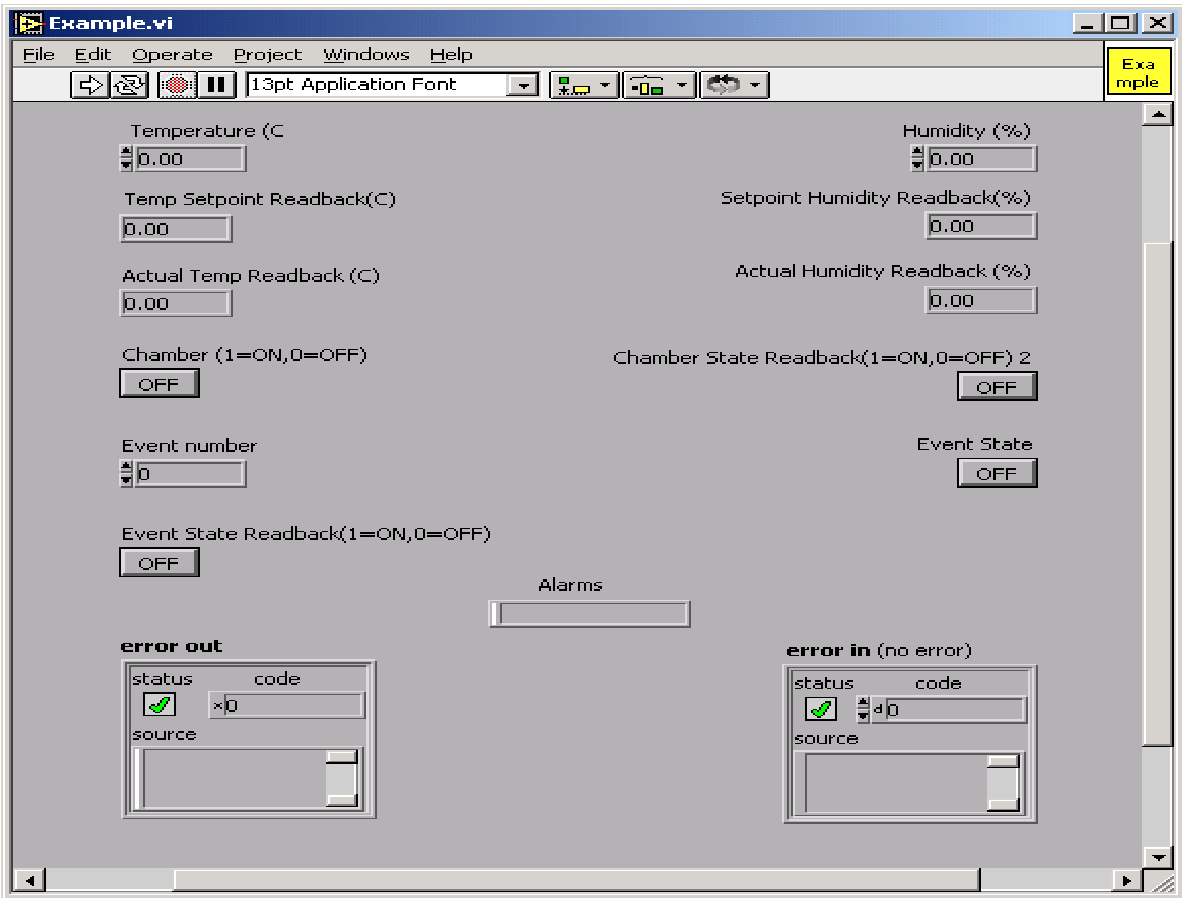
The User Interface.vi Example

The TESynC GUI.vi provides a simple control panel that can be used to quickly connect to the Synergy Nano 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

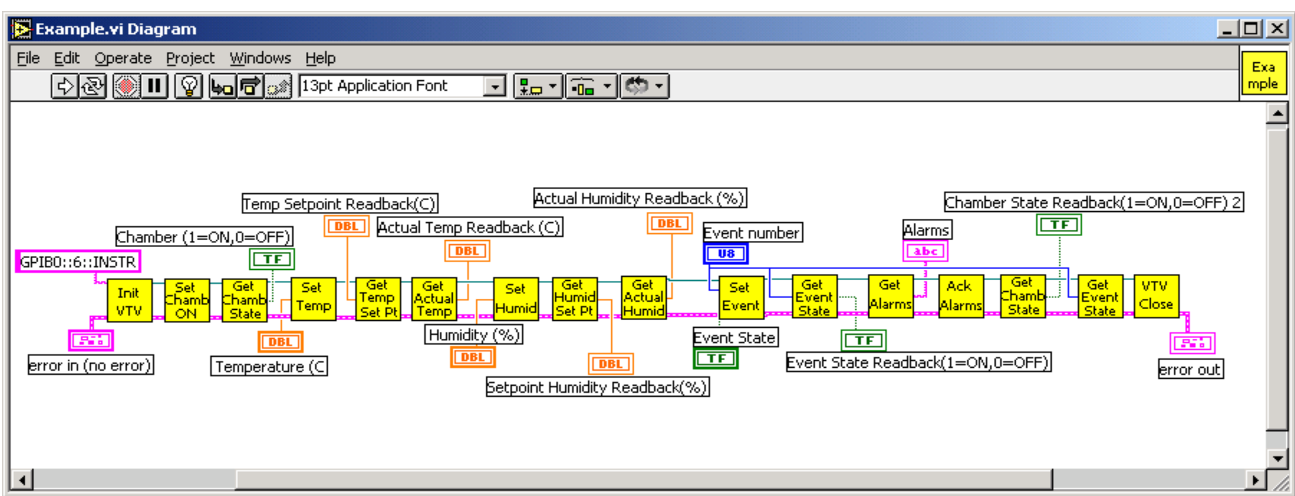
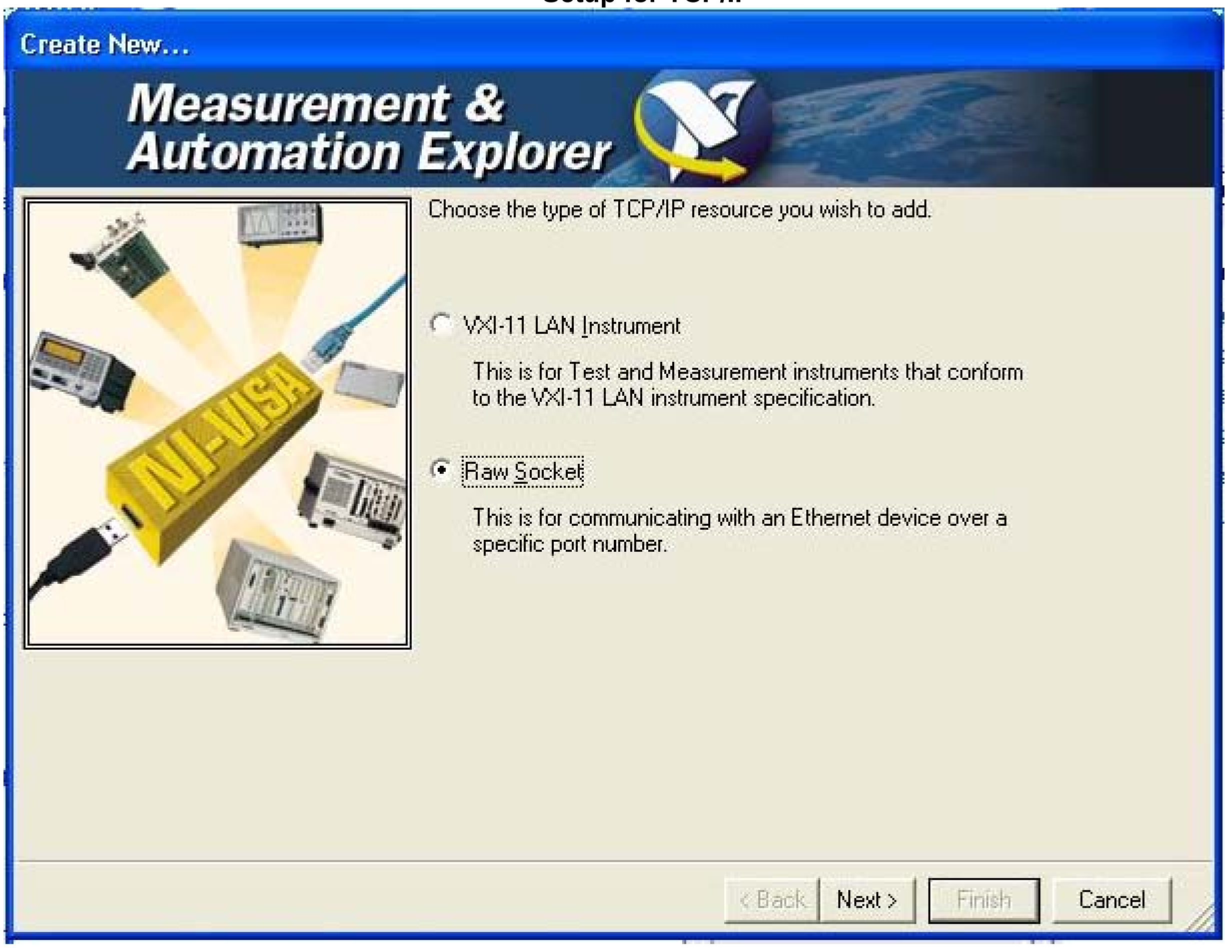
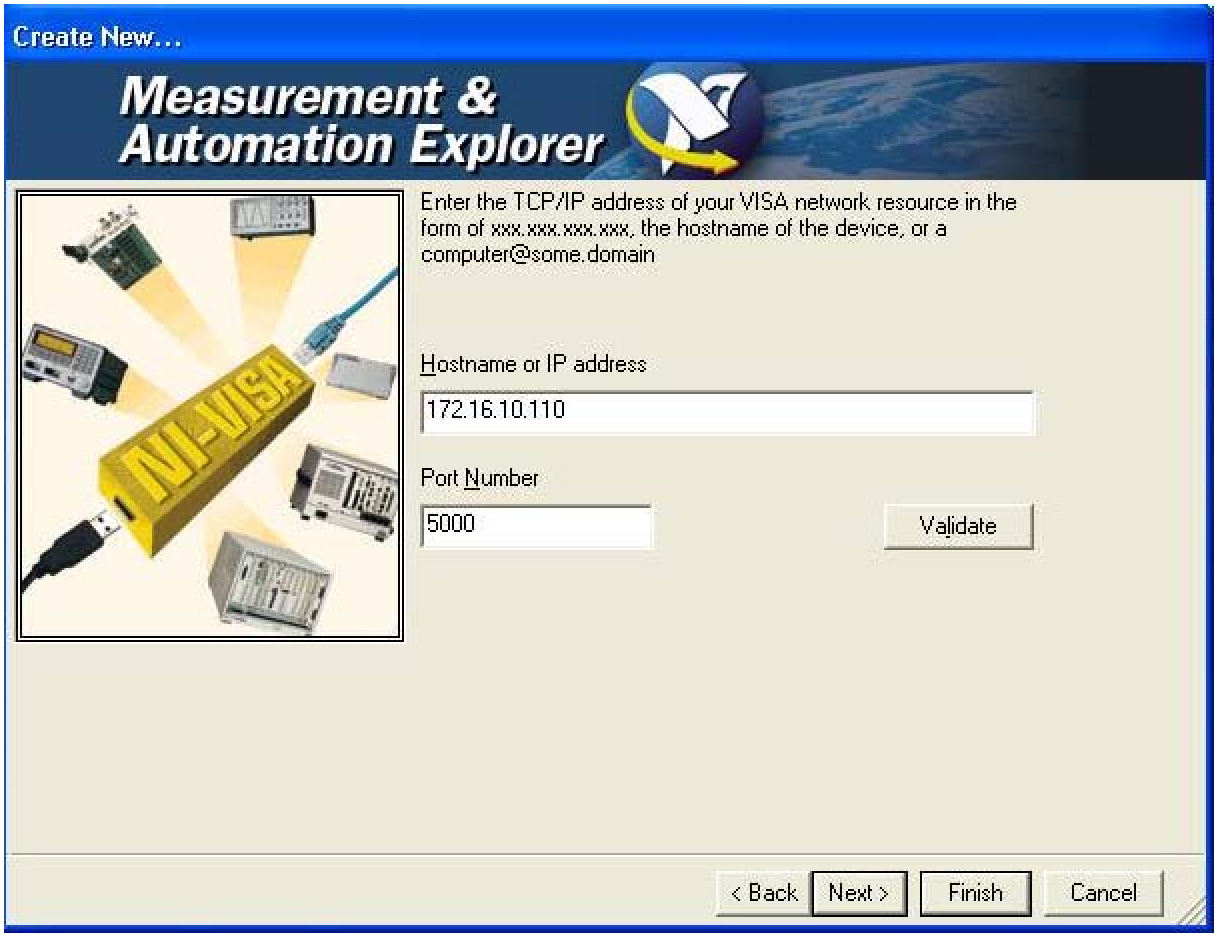


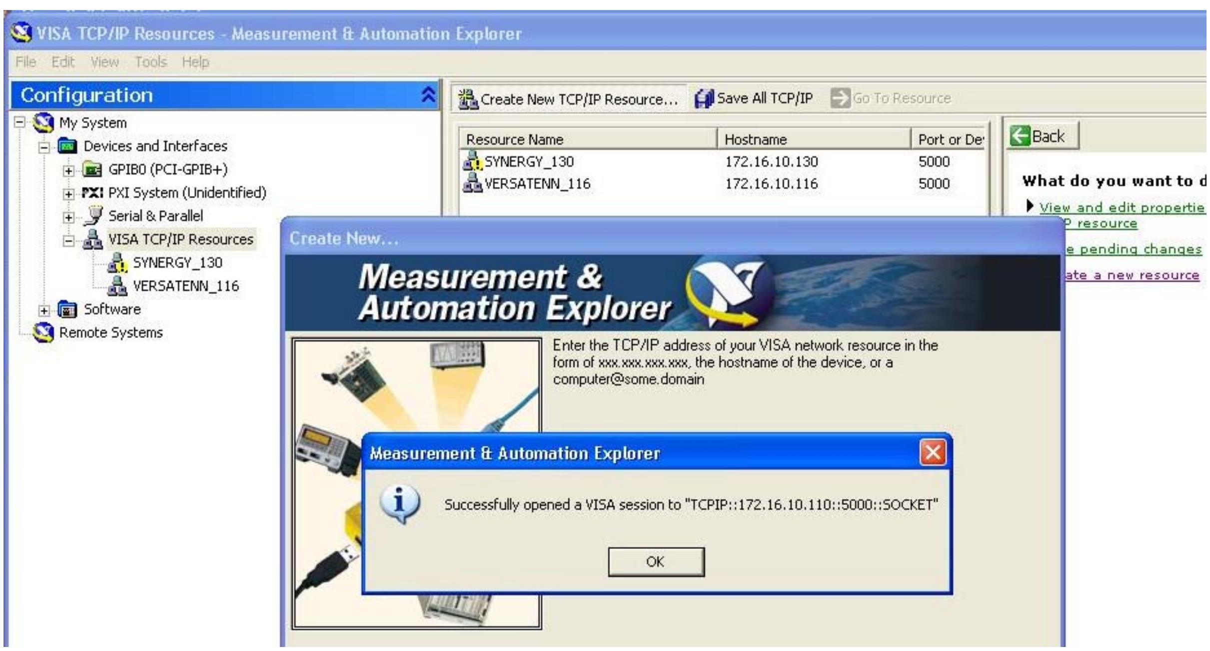
Diagram View

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.

19.0 APPENDIX A RESOURCES

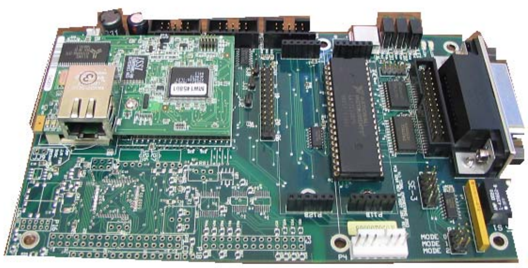
Web Site Resources

The following documents are available at Tidal Engineering's web site www.tidaleng.com/synergy.htm

- Synergy Nano Frequently Asked Questions.
- Synergy Nano Version Changes
- Synergy Nano Application Notes
- Detailed chamber specific retrofit installation instructions are available for some chambers.

20.0 APPENDIX B REPLACEMENT PARTS

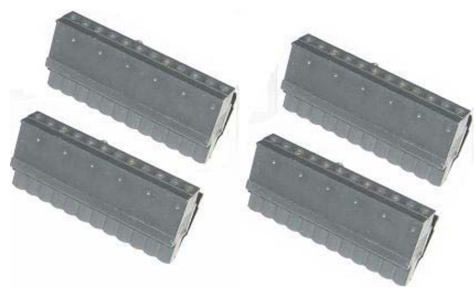
TE1588-1, Synergy Nano GPIB/Serial



TE1378 Synergy Nano RS-232 Cable

TE1155, Olympic Board

TE1378 Connector Kit



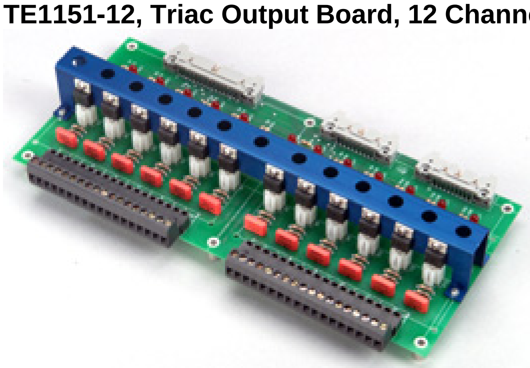
TE1299-16, UUT Module, 16-Channel T-Type Thermocouple Monitor

TE1803, 4-20 mA Transmitter

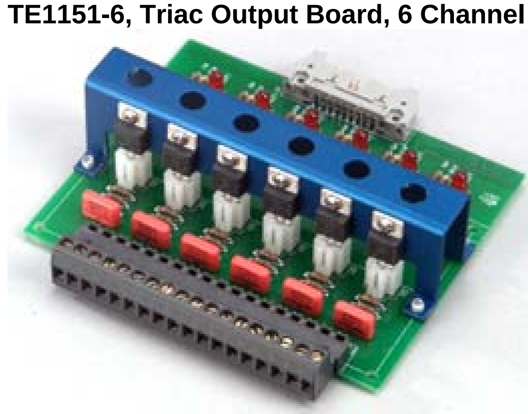
TE1908 Single Channel Thermocouple Signal Conditioner

TE1988 Single Channel RTD Signal Conditioner

TE1151-12, Triac Output Board, 12 Channel

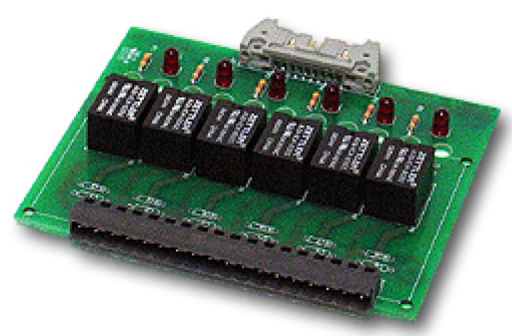


TE1151-6, Triac Output Board, 6 Channel



TE1151-5, Triac Output Board, 5 Channel

TE1708-6, Relay Output Board, 6 Channel



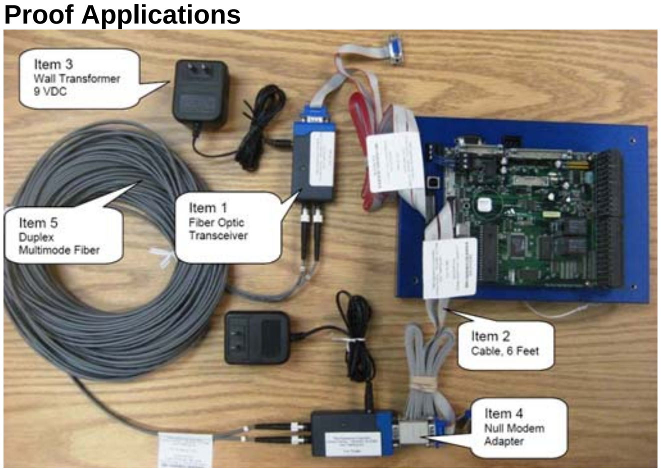
TE1596, GPIB/IEEE 488 Communications Cable

TE1608, RS-232 /RS-485 Communications Cable

TE1722-34-6ft, 12-Channel Triac Board Cable

TE1722-20-6ft, 6-Channel Triac Board Cable

TE1972 Fiber Optic Extension kit for Explosion-Proof Applications



Notes: