TESTEQUITY

F4T Touch Screen Controller
User's Guide
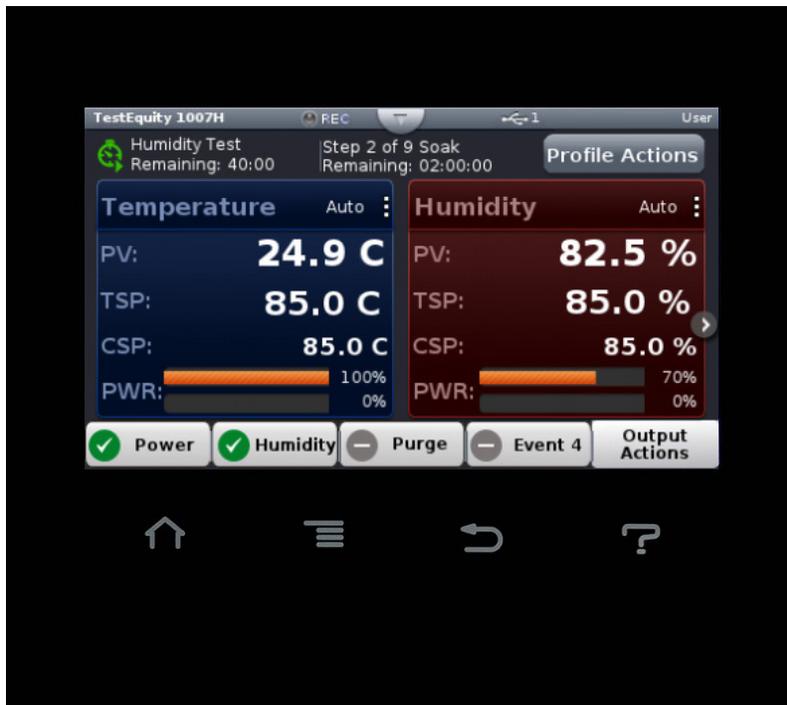
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Chapter 1 – Safety Instructions

Introduction

Follow all CAUTION notices to prevent damage to the chamber or your test sample. Failure to follow all CAUTION notices may void your warranty. CAUTION may also indicate a potentially hazardous situation which, if not avoided, may result in minor or moderate personal injury.

The safety alert symbol ⚠ precedes a general CAUTION statement.

Safety Notices

⚠ **CAUTION:**   The Watlow F4T Manuals are written by the manufacturer, Watlow, for a wide variety of applications and configurations. Not all features or functions are applicable. Only the capabilities of model F4T1J2EAA2A1017 (for Temperature Chambers) or F4T1J2EAA2B2018 (for Temperature/Humidity Chambers) are applicable. "Cascade Control" and "Retransmit" functions are available as options.

⚠ **CAUTION:**   The Series F4T "Alarm" functions are NOT used in the chamber's safety system. TestEquity does NOT recommend using the Series F4 alarm function as the main protection device. The independent EZ-Zone Limit Controller functions as the main protection device.

⚠ **CAUTION:**   The Series F4T Temperature Controller has been properly configured by TestEquity to match the chamber's system requirements and to perform optimally over a wide range of operating conditions. Improper modifications to these setup values can result in erratic performance and unreliable operation. Setup examples in the Watlow Series F4T Manuals are NOT applicable to this chamber. Do not attempt to modify the setup values, unless you thoroughly understand what you are doing. If there is any doubt, please call TestEquity before proceeding.

⚠ **CAUTION:**   Configuration files are unique to each particular model chamber and must NEVER be transferred to a different model chamber.

⚠ **CAUTION:**   NEVER select "Factory" in the "Restore Settings From" prompt in the Device Details menu in Composer Software. This will erase all controller configuration settings. The chamber will not work if you do this.

Chapter 2 – Using the F4T Front Panel

F4T Menus

This chapter is designed to give you a better understanding of the structure and navigation of the F4T menus as viewed from the front panel.

Understanding F4T Menus

The graphic below illustrates at a high level the structure of the F4T menus.
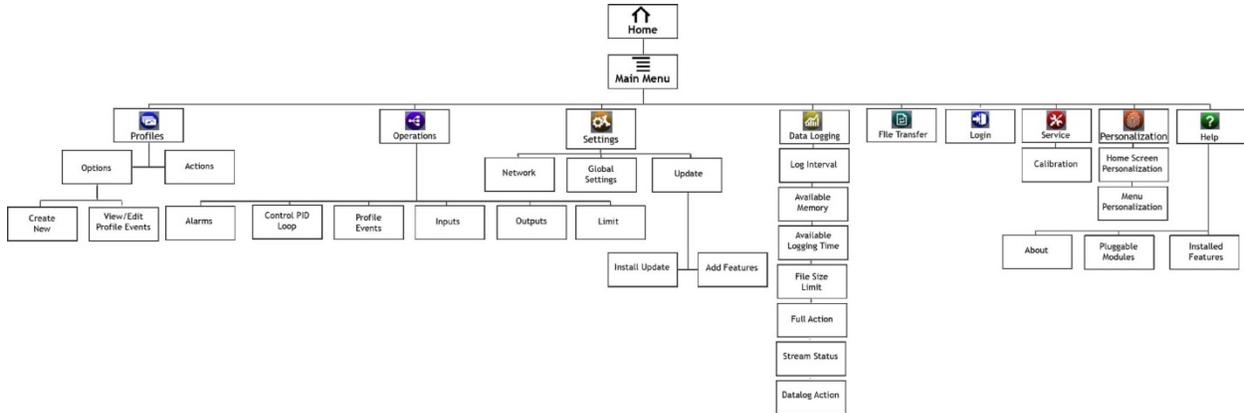
Event Driven Menus

During normal operation it is possible that an event can occur that will present the user with indications, pop-up windows and menu selections that are not shown above. As an example, if an alarm occurs then the status bar (top of screen shot as shown) will indicate its existence by blinking yellow. If the user presses the status bar button to view the alarm message, and then presses the alarm tab, menu options may appear (silence or clear) depending on the alarm settings. A representative alarm display is shown here.

As another example, if an input sensor opens, an error message will be displayed on the screen requiring user intervention. Once the error is acknowledged (Dismiss), the status bar will continue to blink red until the open sensor has been fixed. Once fixed, the status bar will return to its normal operational display.
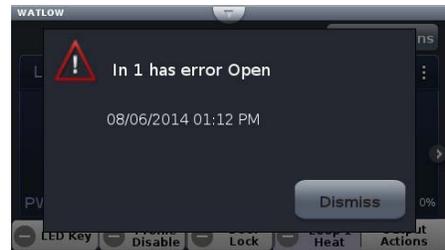
Navigating and Understanding the User Interface

Home Screen

After powering up the controller a white screen will appear first while initializing. Once the startup process is complete the Home Screen will be presented as shown below. The image below shows a configured Home screen for a TestEquity Temperature/Humidity Chamber while it is running a profile.
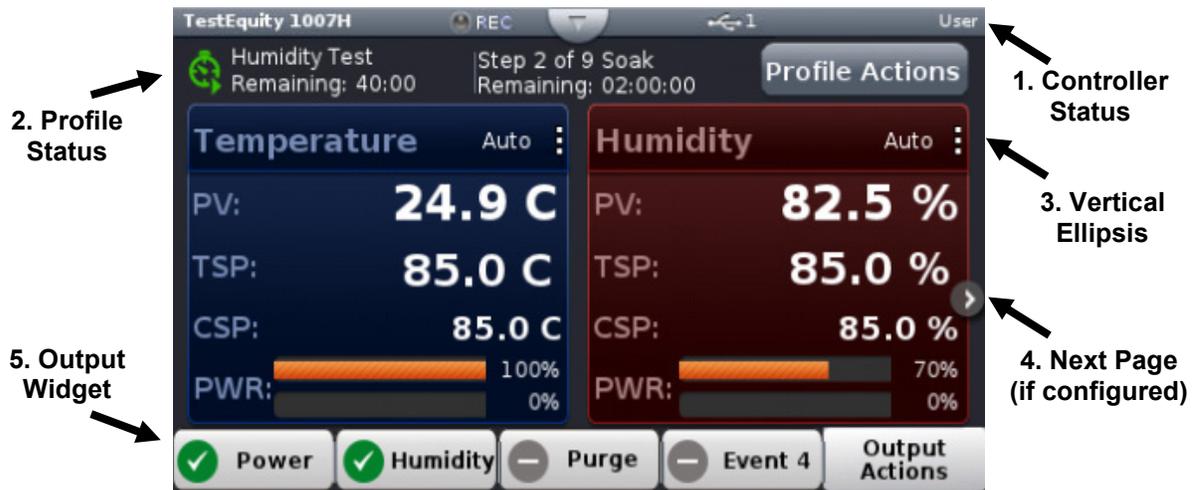
① **Controller Status:** Indicates alarms and errors if they occur while also showing the current security level if enabled (see "Security" section). Also indicates if Data Logging (optional) is enabled and if a USB thumb drive is plugged into the USB host port. The button shown in the center of the status bar allows you to view alarm and error messages when pressed.

② **Profile Status Bar:** Provides visibility and information pertaining to running profiles as well as access to available profile actions (see "Creating and Editing Profiles" section).

③ **Vertical Ellipsis:** Displays current control mode while also providing access to other operational parameters such as the Closed Loop Set Point, Autotune, PID Settings, and more (see "Changing Loop Operational Parameters" section).

④ **Next Page:** If the controller has more than one control loop (like temperature and humidity) and the Home screen has been setup to display multiple pages (loops), the left and right arrows on each side of the home screen provides navigation from one to the other (see "Personalizing the Home Screen" section).

⑤ **Output Widget Bar:** Function keys or output status (ON/OFF).

Home Screen Parameters

Parameters on the Home screen include:

- **Loop name:** "Temperature" and "Humidity" in the above example.
- **Control mode:** "Auto" shown in the above example.
- **Process Value or PV:** Actual Temperature or Humidity.
- **Target Set Point or TSP:** The desired set point in a step when running a profile)
- **Current Set Point or CSP:** The instantaneous set point during a ramp step when running a profile. May be the same value as the TSP)
- **Set Point:** The desired Temperature or Humidity to be maintained by the controller.
- **PWR:** % Output power levels (throttle) for heat and cool. The upper PWR bar (orange) is the heat throttle. The lower PWR bar (blue) is the cool throttle.
- **Output Actions:** Allows you to monitor the ON/OFF status of controller outputs.

Front Panel Navigational Buttons

Four buttons at the bottom of the F4T are displayed as icons shown below. The text in this graphic was placed there for clarity only and is not present on the front panel.

- **Home:** Regardless of the screen currently in view, when Home is pressed you will always return to the Home screen (shown on the previous page).
- **Menu:** Pressing the Menu button will provide access to other settings and functions within the controller.
- **Return:** Pressing this button will take you back to the previous screen until the top level of either the Home Screen or the Main Menu is reached.
- **Help:** Displays information about the controller such as part number and software revision.

Main Menu

The Main Menu provides access to settings and functions within the controller.

- **Profiles:** Profiles are added, accessed, and edited from this menu.
- **Operations:** Contains access to alarms, control setting, profile events, inputs, and outputs.
- **Settings:** Contains access to network settings, global settings (controller name, date, time, °C/°F display), firmware update utility, and feature update utility.
- **Data Logging:** (appears if this option was ordered) Contains access to settings for data logging.
- **File Transfer:** Contains access to USB file transfer utilities for Import/Export of Configuration and Profiles and Export of Data Log files.
- **Login (Logout):** For password entry, shown with a user already logged in.
- **Service:** Provides access to the calibration menu.
- **Personalize:** The home screen layout it modified in this menu, configured by TestEquity to only show if a user is logged in with a password.
- **Help:** (not shown, appears when display is scrolled down in this pictured configuration) Displays information about the controller such as part number and software revision.

Manual Chamber Operation

Static (Manual) Set Point

Set Point is the Temperature or Humidity setting that you want the chamber to maintain. The F4T Controller is in Static Set Point Mode when it is not controlling a Profile. The Static Set Point is entered in the **Closed-Loop Set Point** screen.

Navigating the Closed-Loop Set Point Screen

To enter the **Closed-Loop Set Point** screen, press the area in the **Set Point** box on the Home Screen. The **Closed-Loop Set Point** screen will appear. Values can be added with the numeric keypad or the ↑ or ↓ arrow keys.

Pressing the numeric keys will directly enter a value in the **Closed-Loop Set Point** box. There is no need to clear the existing value first.

Pressing the ↑ or ↓ arrow keys will increment or decrement the existing Closed-Loop Set Point value in 0.1 increments each time the key is pressed.

- **Clear** will clear all entries in the **Closed-Loop Set Point** box.
- **Bksp** (backspace) will clear the last digit in the **Closed Loop Set Point** box.
- **Enter** will enter the values in the **Closed-Loop Set Point** box and return you to the **Home Screen**.
- **Cancel** will return you to the **Home Screen** without changing the Set Point.

Chamber Functions (Output Widget)

Chamber functions can be turned ON/OFF using the buttons on the Output Widget. The buttons may be named differently depending on your model chamber. The buttons can be pressed to toggle the functions ON/OFF in manual mode or while a profile is running.

The image below shows an F4T with Power, Humidity Purge, and Event 4 in the output widget.

Below is a summary of some typical button functions.

Power: Turns the chamber ON/OFF. On some models, the front panel rocker switch (labeled CONDITIONING or TEMP depending on the model) must also be in the EVENT 1 position in order for this button to be active. If the CONDITIONING or TEMP switch is in the ON position, then the chamber will be on at all times, regardless of the F4T **Power** button status.

Humidity: For humidity chambers (Models 123H, 1007H, 1016H) only. This button turns the humidity system ON/OFF.

Purge: For chambers with GN2 or Dry Air Purge options. This button turns the purge system ON/OFF. **Note:** Your chamber may have a PURGE button even if the option is not installed.

LN2: For Model 3007C only. This button turns the LN2 system ON/OFF. **Note:** Your Model 3007C chamber may have an LN2 button even if the option is not installed.

Event 2 through 4: The remaining available outputs will vary depending on the model. Turns uncommitted event outputs ON/OFF for customer use. Events 5 through 7 are located in the **Operation Screen** > **Profile Events** submenu.

Ramp to Set Point

The F4T can ramp to a set point without having to write a profile. The Ramp settings are located in the Loop Operational Parameter screen. Pressing the vertical ellipsis or anywhere within the outlined box shown below will provide access to the Loop Operational Parameter screen.
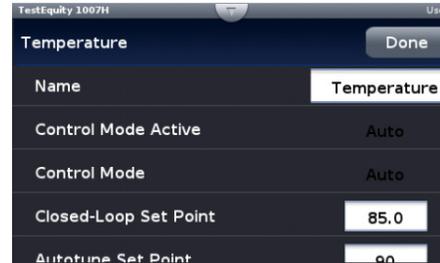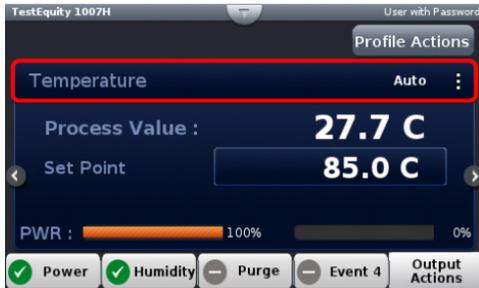
Ramp Action button is at the bottom of this screen

Once you are in the Loop screen, scroll to the bottom to find the Ramp Action button.

In a Temperature/Humidity chamber, there are separate settings for the Temperature loop and the Humidity loop. However, we do not recommend entering a humidity ramp. Humidity control is very "laggy" by nature and its ability to follow a ramp will likely be very unpredictable.

Ramp Action
Choose the conditions under which the loop ramps its set point. When the set point ramps, it starts at the Process Value and changes gradually to the Set Point setting rather than abruptly changing values. Options for Ramp Action are as follows:

- **Off**: the loop controls to the Set Point immediately
- **Startup**: each time the controller is powered up, the loop ramps the set point. At all other times abrupt changes to the Set Point are allowed
- **Set Point**: upon powering up the Set Point immediately resumes its last value, but the loop ramps the set point each time the Set Point is changed
- **Both**: the loop ramps the set point each time the controller is powered up or the Set Point is changed

Ramp Scale
Choose the time units for the Ramp Scale parameter. (Ramp Scale will not show if Ramp Action is set to Off)
- **Minutes** or **Hours**

Ramp Rate
Set how quickly the set point ramps. Set the time units for the rate with Ramp Rate. (Ramp Rate will not show if Ramp Action is set to Off)

- **0 to 55,555** (ºC) or **0 to 99,999** (ºF) per minute or hour

Profile Mode

Profile Actions

The profile status bar will appear on the home screen when the controller is powered up. When the Profile Actions button on the Home Screen is clicked, one of three pop-up windows will appear as described below.

Actions when profile is not running

Run Last	Starts the last executed profile.
Run Profile	Brings up a list of profiles by name for selection.
View/Edit Profile Events	View and edit profile events.
Create Profile	Create a new profile.
Go to Profile	Brings up a list of profiles by name for selection.
Clear Profile Status	Removes the profile icon and step status (profile status bar).
Cancel	Return to Home screen.

Actions when profile is running

Pause	Suspends running the profile, profile can resume running at the same point.
Terminate	Stop running a profile, profile cannot resume running, it must be started again.
View/Edit Profile Events	View and edit profile events.
Go to Profile	Displays a list of profiles
Cancel	Return to Home screen.

Actions when profile is paused

Resume	Continue step execution where previously paused and with the previous time remaining.
Terminate	Stop running a profile, profile cannot resume running, it must be started again.
View/Edit Profile Events	View and edit profile events.
Go to Profile	Brings up a list of profiles by name for selection.
Cancel	Return to Home screen.

Profile Parameters

The following settings apply to the entire profile. This screen will appear when **Create Profile** is pressed or when you edit a profile and **View/Edit Details** is pressed.

Name: User-entered identifier for the profile. The name follows the profile when it is saved in a file or moved to another controller.

Password: User-set code that must be entered prior to editing a protected profile. A password may consist of up to ten characters, may include letters, numbers or symbols and is case sensitive.

Log Data: Displayed only if optional Data Logging was ordered. Select **Yes** if you want to log data during the profile.

Guaranteed Soak Deviation/Guaranteed Soak Values: The amount by which the actual chamber temperature or humidity is allowed to differ from the set point for steps with Guaranteed Soak Enable set to **On**. In such steps when the actual chamber temperature or humidity differs from the set point by more than this value, the step timer stops running until the actual chamber temperature or humidity returns to within the band defined by the set point plus or minus this value. Each profile can have its own set of Guaranteed Soak values.

Step Parameters

After you create a profile with the procedure above, press the **Options** button in the upper left side. Then press **Create Steps** in the screen that pops up. You will see one step which is a **Soak** type. Pressing the **Soak** button will allow you to change the step type. If you are editing an existing profile, pressing the step type of any step will allow you to change its type. Pressing the **Actions** button will allow you to Edit Step Parameters, Delete Step, or Insert Step.
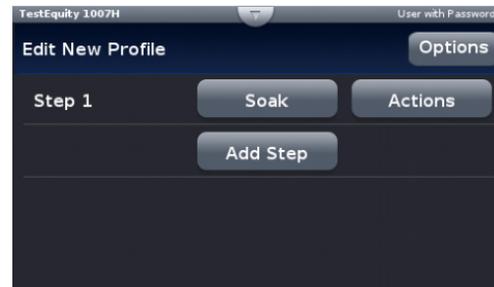
Each new step will automatically be a copy of the previous step. You can then edit the parameters of the new step to suit your profile.

Step Type
Set the behavior of the step. Step Type options include:

Soak: Maintains the temperature or humidity set point constant for the step's Time.
- **Hours, Minutes, Seconds** (How long the step will hold at this condition)
- **Guaranteed Soak Enable 1** (Temperature)
- **Guaranteed Soak Enable 2** (Humidity)
- **Power, Humidity, Purge, Event 4 through 8** (On, Off, Unchanged from previous step)

Ramp Time: Adjusts the temperature or humidity set point gradually from the previous set point to the step's Set Point over the step's Time.
- **Target Set Point Loop 1** (Temperature)
- **Hours, Minutes, Seconds** (Time to ramp from the previous step condition)
- **Guaranteed Soak Enable 1** (Temperature)
- **Target Set Point Loop 2** (Humidity)
- **Guaranteed Soak Enable 2** (Humidity)
- **Power, Humidity, Purge, Event 4 through 8** (On, Off, Unchanged from previous step)

Rate: Adjusts the temperature or humidity set point at the user-set Rate of change until it reaches the step's Set Point.
- **Target Set Point Loop 1** (Temperature)
- **Rate** (Degrees per Minute)
- **Guaranteed Soak Enable 1** (Temperature)
- **Target Set Point Loop 2** (Humidity)
- **Rate** (% Humidity per Minute)
- **Guaranteed Soak Enable 2** (Humidity)
- **Power, Humidity, Purge, Event 4 through 8** (On, Off, Unchanged from previous step)

Wait For Process or Event: Holds the profile until the specified conditions on the event inputs are met. When multiple conditions are specified, the profile will not proceed until all the conditions are satisfied at the same time.
- **Step Wait for Process Enable 1** (Temperature) (None, Greater Than, Less Than)
- **Wait for Process 1 Value** (Temperature, if Greater Than or Less Than is selected)
- **Step Wait for Process Enable 2** (Humidity) (None, Greater Than, Less Than)
- **Wait for Process 2 Value** (Humidity, if Greater Than or Less Than is selected)
- **Power, Humidity, Purge, Event 4 through 8** (On, Off, Unchanged from previous step)

Instant Change: Sets the temperature or humidity set point without ramping from the previous set point and holds that set point for the step's Time. Use this when programming the chamber to go as fast as possible between steps.
- **Target Set Point Loop 1** (Temperature)
- **Hours, Minutes, Seconds** (How long the step will hold at this condition)
- **Guaranteed Soak Enable 1** (Temperature)
- **Target Set Point Loop 2** (Humidity)
- **Guaranteed Soak Enable 2** (Humidity)
- **Power, Humidity, Purge, Event 4 through 8** (On, Of, Unchanged from previous step)

Jump: Repeats previous steps in the profile starting at the step set with Jump to Step for the Number of Times set. This option is not available for step 1.
- **Jump Step**
- **Jump Count**
- **Power, Humidity, Purge, Event 4 through 8** (On/Of functions)

End: Sets the Temperature or Humidity condition after the profile is complete.
- **User** (program will end with the same Temperature and Humidity Static Set Point values and Event settings that were entered before the profile was run). If you want to select **User**, you should make sure that the Temperature and Humidity Static Set Point values and Event settings are indeed what you want the chamber to be at when the profile ends.
- **Off** (the Temperature and Humidity control mode is set to Off – **Not Recommended, see Note Below!**)
- **Hold** (the Temperature and Humidity Set Point is set to the last value used in the profile). This may be a preferable choice for most applications, since you can define the desired chamber conditions in the next-to-last step in the profile.

NOTE about selecting an End step of Off:

If you select an End step of **Off**, this sets the **Control Mode** in the **Loop Menu** to **Off**. This results in the inability to set a **Static (Manual) Set Point**. You would need to enter the **Loop Menu** and change **Control Mode** to **Auto**. See "Changing Loop Operational Parameters" for information on how to access this menu.

Sample Ramp and Soak Profile

Below is a typical ramp and soak profile. This should give you an idea of how to create your own custom profiles.

1. Start at 23°C. Stay at 23°C for 30 minutes.
2. Ramp to 85°C in 1 hour.
3. Soak at 85°C for 2 hours, 30 minutes.
4. Ramp to -40°C in 2 hours.
5. Soak at -40°C for 2 hours, 30 minutes.
6. Ramp to 85°C in 2 hours.
7. Jump back to step 3. Repeat cycle 9 times for a total of 10 cycles.
8. Go to 23°C as fast as possible. Wait until the temperatures reaches within 3° before advancing to the next step.
9. End with the chamber turned OFF.

Entering the above profile from the F4T front panel:

- From the **Main Page** press **Profile Actions**.
- Then press **Create Profile** on the screen that pops up. This will take you to the **New Profile Screen**.
- In the **New Profile** screen, enter your desired profile name in the **Name** field. You have the choice of entering a password in the **Password** field if desired. In the **Guaranteed Soak Deviation 1** field, enter **3** (this will be used in step 9 above).
- You will now see **Step 1**.
  - o Change step type to **Instant Change**.
  - o Enter **23** for **Target Set Point 1**.
  - o Enter **30** for **Minutes**.
  - o Scroll down to see **Power**. Press **Off** and the press **ON** at the popup. This will automatically be selected as **ON** for all subsequently added steps.
  - o Press **Done**.
- Press **Add Step**. You will now see **Step 2**.
  - o Change step type to **Ramp Time**.
  - o Enter **85** for **Target Set Point 1**.
  - o Enter **1** for **Hour** and **0** for **Minutes**.
  - o Press **Done**.
- Press **Add Step**. You will now see **Step 3**.
  - o Change step type to **Soak**.
  - o Enter **2** for **Hour** and **30** for **Minutes**.
  - o Press **Done**.
- Press **Add Step**. You will now see **Step 4**.
  - o Change step type to **Ramp Time**.
  - o Enter **-40** for **Target Set Point 1**.
  - o Enter **2** for **Hour** and **0** for **Minutes**.
  - o Press **Done**.

- Press **Add Step**. You will now see **Step 5**.
  - o Change step type to **Soak**.
  - o Enter **2** for **Hour** and **30** for **Minutes**.
  - o Press **Done**.
- Press **Add Step**. You will now see **Step 6**.
  - o Change step type to **Ramp Time**.
  - o Enter **85** for **Target Set Point 1**.
  - o Enter **2** for **Hour** and **0** for **Minutes**.
  - o Press **Done**.
- Press **Add Step**. You will now see **Step 7**.
  - o Change step type to **Jump**.
  - o Enter **3** for **Jump Step**. Enter **9** for **Jump Count**.
  - o Press **Done**.
- Press **Add Step**. You will now see **Step 8**.
  - o Change step type to **Instant Change**.
  - o Enter **23** for **Target Set Point 1**.
  - o Enter **0** for **Hour** and **0** for **Minutes**.
  - o Select **Guaranteed Soak Enable 1** to **On**.
  - o Press **Done**.
- Press **Add Step**. You will now see **Step 9**.
  - o Change step type to **End**.
  - o Press **Profile End Step Loop Action 1**, press **User** and change it to **Hold**.
  - o At **Power** press **On** and change it to **Off**.
  - o Press **Done**.
- Press **Options**.
  - o Press **Done** to save the profile.
    or…
  - o Press **Run Profile** to run the profile.

Data Logging

Overview
Data Logging can be enabled at any time and will log a fixed list of parameters based on installed hardware and configured control loops. All datalog files are stored in internal memory until transferred to a USB thumb drive. The file transfer process from internal memory to thumb drive will delete all log files from internal memory. Data <u>cannot</u> be written to a USB thumb drive in real time.

Below is an example of the number of hours that can be saved in memory in a typically-configured Temperature/Humidity controller.

Log Interval Available Logging Time
1 Second   198 hours (8.25 days)
5 Seconds   983 hours (41 days)
10 Seconds   1966 hours (82 days)

How to Enable Data Logging
There are three ways to initiate data logging:

To enable data logging using the front panel:
1. Press the **Menu** button.
2. Press the **Data Logging** button.
3. Select the desired log interval (0.1, 0.2, 0.5, 1, 2, 5, 10, 15, 30 seconds, 1, 2, 5, 10, 15, 30, 60 minutes)
4. Press the **Memory Full Action** button to define the desired action to take when memory is full [**Stop** or **Overwrite**].
5. Press the **Datalog Action** button to manually control data logging [**Start** or **Stop**].

Note: A new dedicated file is created when data logging starts and the filename format will be "Log""date stamp""time stamp".csv.

To enable data logging when running a profile:
1. Select the desired profile, press **Actions** and then **View/Edit Details**. Press **Yes** for **Log Data**.

Note: If data logging is already running when the profile starts with data logging enabled the data log filename will remain as stated in the note above with the profile log data concatenated to the currently running data log file. If data logging is not running, a new dedicated data log file is created when the profile starts and ends when the profile stops. The filename format will be "Profile name""date stamp""time stamp".csv.

To enable data logging using the Modbus communications protocol:
1. Load Modbus register 18888 (Profile Active File Number) with the desired profile number (1 to 40).
2. Load Modbus register 19038 "Log Data" with 106 (yes).
3. Write Modbus registers to the controller.

To enabling data logging (outside of a profile) using the Modbus communications protocol:
1. Think about and modify the following Modbus registers if need be:
    a. Memory Full Action, Modbus register 42350 [**Stop** or **Overwrite**]
    b. File Size Limit, Modbus register 42372 [**0** to **80** MB]
    c. Log Interval, Modbus register 42388 [0.1, 0.2, 0.5, 1, 2, 5, 10, 15 and 30 seconds, 1, 2, 5, 10, 15, 30 and 60 minutes]
2. Load Modbus register 42386 "Log Action" with 1782 [**start**].
3. Write Modbus registers to the controller.

Fixed List of Logged Parameters

As stated above, the parameters that are actually logged are dependent on installed hardware as well as the number of configured loops. You cannot disable any particular parameter in the log file. The log file for a typical TestEquity Temperature/Humidity Chamber includes:

Header	Description
Date (MDY)	Month/Day/Year
Time	00:00:00 am/pm
Closed Set Point 1 (Deg C or F)	Temperature Set Point in Degrees C or F depending on configuration
Closed Set Point 2 (RH)	Humidity Set Point
Heat Power 1 (%)*	% of Air Heater throttle for temperature control*
Heat Power 2 (%)*	% of Humidifier Heater throttle for humidity control (humidity chambers only)*
Cool Power 1 (%)*	% of Cool Solenoid throttle for temperature control*
Cool Power 2 (%)*	% of De-Humidify Solenoid for humidity control (humidity chambers only)*
Power 1 (%)*	+ or - % Power (signed version of Heat/Cool Power 1 above)*
Power 2 (%)*	+ or - % Power (signed version of Heat/Cool Power 2 above (humidity chamber only) *
Control Loop PV 1 (Deg C or F)	Chamber Temperature in Degrees C or F depending on configuration
Control Loop PV 2 (RH)	Chamber Humidity (humidity chamber only)
Temp_Sensor (Deg C or F)**	Chamber Temperature, same as Control Loop PV 1**
Humid_OverTemp_Sens. (Deg C or F)***	Temperature of the heater in the humidity vapor generator (humidity chamber only)***
Humidity_Sensor (%)**	Chamber Humidity, same as Control Loop PV 2 (humidity chamber only)**

*   Power % is provided for diagnostic purposes only and has no relevance to logged humidity or temperature values.
**   Temp_Sensor and Humidity_Sensor are the same as Control Loop PV 1 and 2 respectively because the sensor measurement is not scaled or modified before it is sent to the control loop. This might not be the case in some customized control schemes.
*** Humid_OverTemp_Sens. is the temperature of the heater in the humidity vapor generator. It is provided for reference and diagnostic purposes only and has no relevance to actual humidity or temperature values.

Transferring Data Log Files

All data log files are saved to the controller internal memory. Data Log files can only be transferred to a USB thumb drive if logging is stopped.

To transfer data log files to a USB thumb drive:
1. Insert a USB thumb drive into USB host port on the chamber.
2. Press the **Menu** button.
3. Press the **File Transfer** button.
4. Make sure the Import/Export button is selected for **Export**.
5. Press the **Export** button next to **Log File**.

Exporting/Importing Profiles and Configuration via USB

Transferring Profile Files

Profiles can be exported and imported as individual files via USB. This is useful for transferring profiles between different chambers and for archival purposes. The profile files contain all the profile steps that would ordinarily be entered via the front panel or Composer software. It does not contain any logged data.

To export a profile file to a USB thumb drive:
1. Insert a USB thumb drive into USB host port on the chamber.
2. Press the **Menu** button.
3. Press the **File Transfer** button.
4. Make sure the Import/Export button is selected for **Export**.
5. Press the **Export** button next to **Profile**.
6. A screen will pop up the names of each stored profile. Press the desired profile name to export it. A progress bar will appear and then indicate **Complete** when done.

To import a profile file to a USB thumb drive:
1. Insert a USB thumb drive into USB host port on the chamber.
2. Press the **Menu** button.
3. Press the **File Transfer** button.
4. Make sure the Import/Export button is selected for **Import**.
5. Press the **Export** button next to **Profile**.
6. A screen will pop up the names of each stored profile. Press the desired profile name to export it. A progress bar will appear and then indicate **Complete** when done.

Transferring Configuration Files

The F4T configuration file contains a "System Image" of all settings that determine how the controller inputs and outputs work and how the display appears. The configuration file also contains all profiles. It does not contain any logged data. The configuration can be exported for archiving purposes. It can also be imported to restore the configuration from a previous archive.

⚠ **CAUTION:**   Configuration files are unique to each particular model chamber and must NEVER be transferred to a different model chamber.

To export a Configuration file to a USB thumb drive:
1. Insert a USB thumb drive into USB host port on the chamber.
2. Press the **Menu** button.
3. Press the **File Transfer** button.
4. Make sure the Import/Export button is selected for **Export**.
5. Press the **Export** button next to **Configuration**.
6. A progress bar will appear and then indicate **Complete** when done.

Importing a configuration file is accomplished similar to the profile import except you select Configuration and then selecting the desired configuration file.

Personalizing the Home Screen

Placement of objects on the home screen can be modified by the user. You must have a password to enter the Personalization screen.

Note: Your controller might not have all the choices available depending on its configuration.

To personalize the Home screen, do the following:
1. From any screen, press the **Menu** button.
2. Press **Personalize**.
3. Press **Basic Personalization**.
4. Select the desired **Home Layout** by pressing **Main Top**, **Main Center**, or **Main Bottom**.
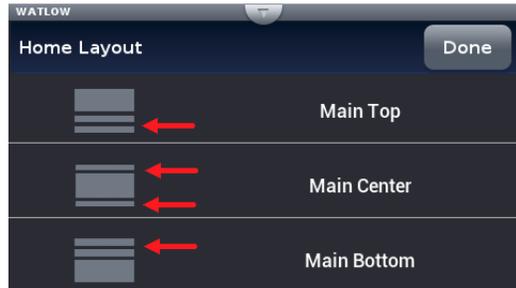
The red arrows were placed on this graphic for emphasis only and represent what the focus of this operation is; that being, defining the location of the profile status and the output widget bars. As shown above, the options include placing them on the bottom, split screen top and bottom or on the top.

1. Tap each page (through 4) in which loop information will be displayed. In the graphic shown, each page has been configured to display from 1 to 4 loops on each page.

2. Define the content blocks (number of loops) that will be displayed on each page.
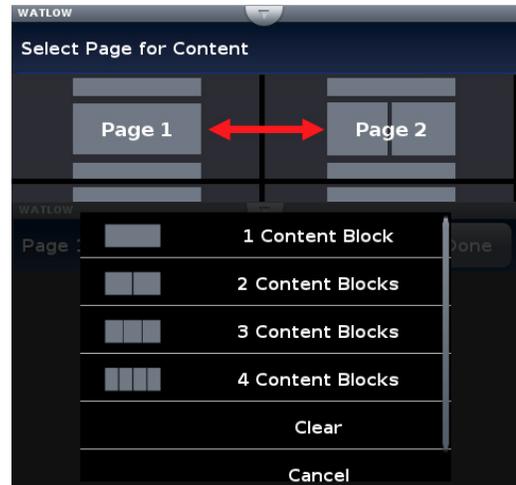
Defining page 1 to display two loops (content blocks):
- From any screen, press the **Menu** button.
- Press **Personalize**.
- Press **Basic Personalization**.
- Select the desired **Home Layout** by pressing **Main Top**, **Main Center**, or **Main Bottom**.
- Press Page 1.
- Select "**2 Content Blocks**".

3. Press on each content block above selecting **Temperature** for the left and **Humidity** for the right (Humidity is only applicable on Temperature/Humidity chambers). Pressing the **Temperature** or **Humidity** area in the **Loop Content Selection** screen will bring up the ability to select the color.
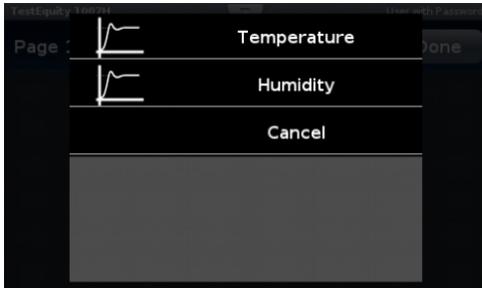
4. Press the **Home** screen button to see the result of this operation.

Changing Loop Operational Parameters

Pressing the vertical ellipsis or anywhere within the red outlined box shown below will provide access to the loop name, control mode, PID settings and many other parameters. In a Temperature/Humidity chamber, pressing the corresponding area for the humidity loop will provide access to that loop. You must have a password to change the loop PID tuning parameters.

⚠ **CAUTION:** The F4T PID tuning values have been properly configured by TestEquity to match the chamber's system requirements and to perform optimally over a wide range of operating conditions. Improper modifications to these values can result in erratic performance and unreliable operation. Do not attempt to modify the PID values, unless you thoroughly understand what you are doing.
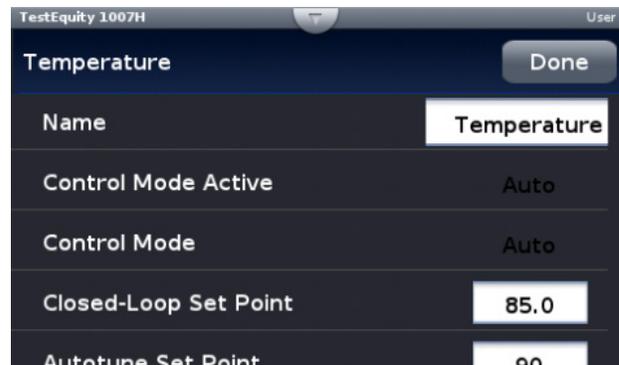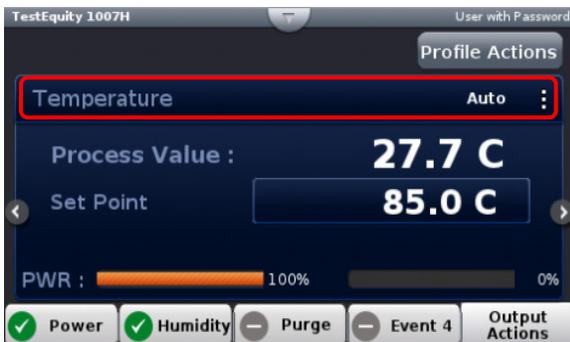
Chapter 3 – Composer Software

Installation

Overview
Watlow Composer Software can be used to create, edit, and archive profiles. It can also be used to configure the controller. Since the controller is already configured by TestEquity for use in your chamber, configuration instructions are not provided.

Downloading the Software and System Requirements
Software can also be downloaded directly from www.testequity.com/Composer

In order to install and run this software successfully there are some baseline requirements for PC hardware and operating systems that must be observed. These requirements are listed below:

- 30 Megabytes or more of available hard disk drive space
- 300 Megabytes of available RAM
- Supported operating systems include: Windows® 7 / 8 (32 or 64 bit)
- Requires Microsoft® .NET Framework 4.0 (this installs automatically if it is not already your computer)

Installing the Software
To install the software:
1. Double-click the Setup.exe.
2. Select the language of choice and click the OK to proceed.
3. Click the Next button to proceed.
4. After reading the Composer software license agreement click "I accept the terms" in the License Agreement radio button and then click on the Next button to proceed.
5. The next dialog box shows the default directory in which the software will be installed. The install location can be changed by clicking the Browse button and then point to the preferred location.
6. Click Next and then Install.
7. Clicking the Finish button will conclude the installation.

Network Configuration
See "Chapter 4 – Communications" in this manual for instruction on how to configure the Ethernet communications parameters in the F4T. You might need help from your IT department to configure this to match your computer settings.

Composer Welcome Screen Orientation
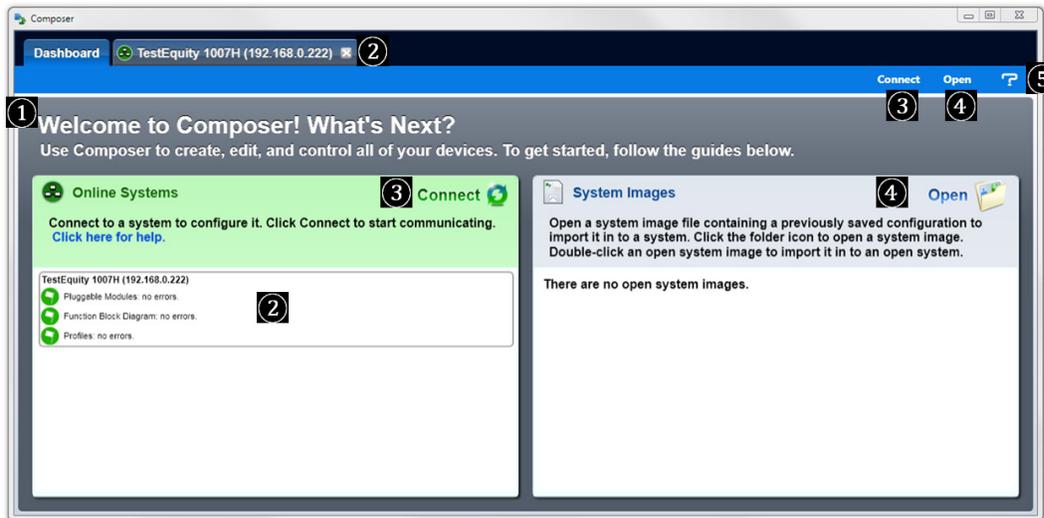
① **Welcome Screen:** Displays options for on-line connections between PC and a controller or opening a previously saved system image.

② **System Screen:** Two columns will be displayed showing connected systems and offline systems.

③ **Connect to a System:** Opens a window showing configured communications ports for selection.

④ **Open a System Image:** Opens a window allowing you to open a previously saved system image to download to a controller.

⑤ **Help:** Allows you to change automatic software update settings, as well as initiate an immediate check for updates (internet connection is required). Clicking on **About** will display technical support contact information and the current firmware versions of the installed software and installed modules.

Using Composer Software

Establishing an Online Connection to a System Using Ethernet
Connect the chamber to a PC through its Ethernet port.

Scanning for connected systems:
From the Welcome or Systems screen click on Connect to a System. A window will open allowing you to select a system. The software will then send a query through the Ethernet port looking for the presence of a controller. If there is a controller present, the software will respond showing the connection that exists. It might take a couple of minutes until the controller is found, especially of the F4T is configured for DHCP instead of a fixed IP address. Double clicking on the system will bring up the System Overview screen shown on the next page.

System Overview Screen

Dashboard ①

- Clicking on **Dashboard** at any time, will display all devices connected on the system.

System ②

When clicked, a drop down submenu will appear allowing navigation to Overview, Save Image, Save Image As, Import Image, Print, Global Settings, and Security screens.

Device Menus ③

- When clicked, a drop down submenu will appear allowing navigation to Device Details, Pluggable Modules, Function Block Diagram, Calibration, and Profile screens.

Security and Passwords ④

- The security feature is used to protect the system's configuration and settings from unwanted changes. The Admin user sets what access other users have to the systems features. When security is enabled, a user must enter a password to gain access to protected features through the controller's user interface or Composer software.

There are three configurable user groups and an admin user:

- **User** - no password required, admin sets feature access
- **User with Password** - requires a password, admin sets feature access, is permitted to change the password for this user group.
- **Maintenance User** - requires a password, admin sets feature access, is permitted to change the password for this user group.
- **Admin** - requires a password, has unlimited access to features, sets permissions and passwords for all user groups.

There are four entry levels when trying to acquire access to the controller. Those levels are:

- **User**, no password required with limited access based on settings.
- **User with Password**, password required with limited access based on settings.
- **Maintenance User Password**, password required with limited access based on settings.
- **Admin Password**, password required with full unlimited access.

The admin user can set each user groups' permission to allow full, read-only or no access to the following features:

- **Home**, controls access to controller's home screen.*
- **Control Mode**, controls access to setting the control mode, set points and PID parameters.*
- **Autotune**, controls access to running the autotune feature.*
- **PID Settings**, controls access to the PID settings.*
- **Profiles**, controls access to creating and editing ramp and soak profiles.

- **Global Settings**, controls access to the system's global settings, temperature units, AC line frequency and real time clock setting.
- **Communications**, controls access to Ethernet settings.
- **Operations**, controls access to operational parameter settings.*
- **Personalize**, controls access to customizing the controller's home screen.*
- **Diagnostics**, controls access to the device details.
- **Setup**, controls access to the pluggable module configuration and the function block diagram.

*This setting limits access to via controller's front panel user interface only, not via Composer.

The image below shows the security levels as configured by TestEquity. You must contact TestEquity to get the passwords for your chamber.

After making all of the desired security settings, ensure that the security enabled radio button (top left in the graphic above) is checked. Once security is applied to the controller, only the administrator (Admin) can reconfigure or remove the security.

When the system file is saved, any applied security will be saved with it.

Save System Image
Located in **System** ②

(a) **Save**
After importing a System Image or clicking on Save Image As, the Save button will become active (gray to white). This allows a user to make changes to the system image and simply save it to the same location using the same filename. Everything that will be saved is as listed below:
- Device Details
- Pluggable Modules
- Function Block Diagram in its entirety
- System Security
- Profiles (if control has profile capability)
- Profile passwords
- All parameters that can be read and written to

(b) **Save As**
- Save a system image to a storage device. Saves everything listed above.

Note: The real-time clock is not saved or imported.

Saving a System Image
To save a system image the first time:
1. On any Composer screen click System and then Save Image As.
2. Use the save as dialog to select the destination folder for the image.
3. Enter the desired filename.
4. Click Save.

Note: The system image filename will always have the extension **wsi** for Watlow System Image and cannot be changed.

Import System Image

Located in **System** ②

Restore a system image from a storage device to the controller. The list below shows what is restored:

- Device Details
- Pluggable Modules
- Function Block Diagram in its entirety
- System Security
- Profiles
- Profile passwords
- All parameters that can be read and written to

Importing a System Image

NOTE: We recommend changing the IP Address Mode to Fixed instead of DHCP when importing a system image. You might need help from your IT department to configure your computer to match this setting.

To import a system image:
1. On any Composer screen click System and then Import Image.
2. Use the open dialog to select the folder location for the previously saved system image.
3. Double-click the desired filename or single-click the filename and then click the Open button.
4. After a system image is imported, we suggest you cycle power to the F4T Controller and restart Composer software.

Device Details

The Device Details screen allows a user to make changes to the system settings described below. Descriptions are numbered correspondingly in the graphic below.

Device Name

Changes the name of the controller for easy identification.

Note: This name will also be displayed in the upper left corner of the user interface.

Restore Settings From

None - no action.

Factory - allows a user to bring the controller back to the factory default state. This is **NOT** the TestEquity default state and all configurations will be erased.

⚠ **CAUTION:** NEVER select "Factory" in the Restore Settings From prompt in the Device Details menu in Composer Software. This will erase all controller configuration settings. The chamber will not work if you do this.

To change any of the settings described above follow the steps below:
1. From the Device Menu, click Device Details.
2. Make desired changes (all changes are saved immediately).

Pluggable Flex Modules

This controller can have up to six Flex Modules (FM) installed in the chassis. The presence of each FM must be confirmed and accepted using Composer software. FMs can be fully configured as installed hardware or the user can type in a valid FM part number for later installation. The **Pluggable Module Screen** shows what modules are installed.

TestEquity has already installed and configured the correct modules for your chamber. Since this is not intended to be an ordinary user function, no further instructions will be covered in this manual.
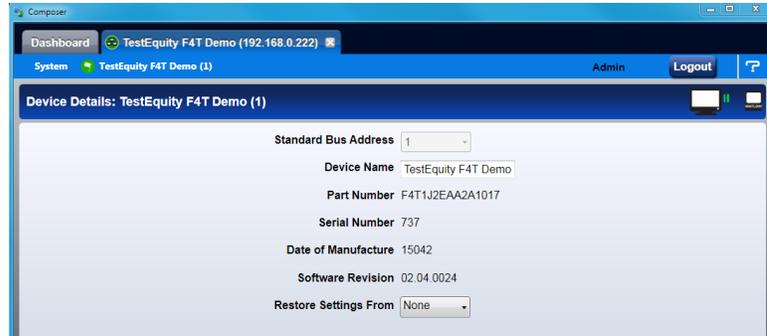
Creating and Editing Profiles in Composer Software

This section describes the features of the Profile View in Composer Software and includes instructions for using it. A profile is a set of instructions consisting of a sequence of steps. When a profile runs, the controller automatically executes its steps in sequence.

Profile View Orientation: Describes the layout of the profile screens.

Profile Parameters: Settings that apply to a profile.

Step Parameters: Settings that apply to a step.

Opening the Profile View: Displays the list of profiles in the device.

Creating Profiles: Up to 50 profiles can be created.

Saving a Profile: Store profiles on the computer to make it easy to load them in other controllers or to restore one that was inadvertently changed or deleted from the controller.

Loading a Profile: Loads a profile that was previously saved to the controller's memory.

Duplicating a Profile: An easy way to create a new profile similar to one that was created previously.

Deleting a Profile: Removes unneeded profiles from the controller memory freeing up space for new profiles.

Opening the Step Editor: Displays the details of the step.

Adding Steps: Up to 50 steps can be included within any given profile.

Inserting Steps: Create a new step at a specific point in a profile.

Deleting Steps: Remove a step from a profile.

Password Protect a Profile: Avoid unwanted and inadvertent changes to a profile with password protection.

Changing or Removing a Password from a Profile: When password protection is no longer needed it can be easily removed.

Profile View - Screen Orientation

The Profile View has the following features, numbered correspondingly in the graphic below.
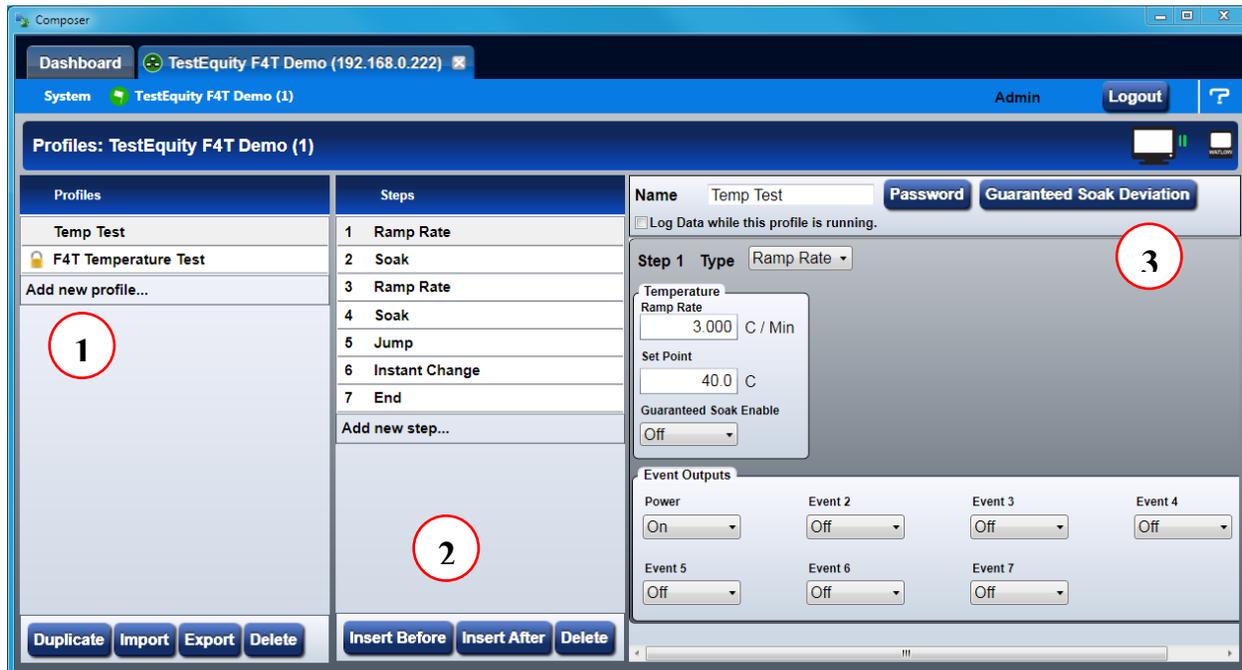
① **Profile List**
- In this column a user can view all currently existing profiles as well as whether or not the profile has password protection.
- You can use **Add new profile...** or the buttons at the bottom to delete, duplicate, import, or export profiles.

② **Step List**
- Shows all currently existing steps for the selected profile ("Temp Test" in the example above).
- You can use **Add new step...** or the buttons at the bottom to insert or delete a step.

③ **Step Detail**
- Shows all available selections for the selected step while also allowing each to be modified.
- You have the ability to give the profile a name as well as apply password protection.

Profile Parameters

The following settings apply to the entire profile.

Name

- User-entered identifier for the profile. The name follows the profile when it is saved in a file or moved to another controller.

Password

- User-set code that must be entered prior to editing a protected profile. A password may consist of up to ten characters, may include letters, numbers or symbols and is case sensitive.

Guaranteed Soak Deviation/Guaranteed Soak Values

- The amount by which the actual chamber temperature or humidity is allowed to differ from the set point for steps with Guaranteed Soak Enable set to **On**. In such steps when the actual chamber temperature or humidity differs from the set point by more than this value, the step timer stops running until the actual chamber temperature or humidity returns to within the band defined by the set point plus or minus this value. Each profile can have its own set of Guaranteed Soak values.

Data Logging

- Check "Log Data while the profile is running" to automatically initiated data logging during this particular profile. Only appears if the optional Data Logging feature was ordered.

Step Parameters

The following parameters set the behavior of a profile's steps. Only the parameters that apply to the selected step type appear in the step detail.

Step Type

Set the behavior of the step. Step Type options include:

- **Rate:** adjusts the temperature or humidity set point at the user-set Rate of change until it reaches the step's Set Point.
- **Soak:** maintains the temperature or humidity set point constant for the step's Time.
- **Jump:** repeats previous steps in the profile starting at the step set with Jump to Step for the Number of Times set. This option is not available for step 1.
- **Ramp Time:** adjusts the temperature or humidity set point gradually from the previous set point to the step's Set Point over the step's Time.
- **State:** sets the temperature or humidity set point to the step's Set Point without ramping from the previous set point and holds that set point for the step's Time.
- **Instant Change:** sets the temperature or humidity set point to the step's Set Point without ramping from the previous set point and holds that set point for the step's Time.
- **Wait For Process or Event:** holds the profile until the specified conditions on the event inputs are met. When multiple conditions are specified, the profile will not proceed until all the conditions are satisfied at the same time.
- **END:** Sets the temperature/humidity set points, and event output conditions when the profile ends. See page 16 for more information.

Time: Hrs Min Sec: Set the duration of the step.

Ramp Time: Set the speed at which the temperature or humidity set point is increased or decreased to the step's Set Point value.

Set Point: Set the value to which the loop's set point is changed by the step.

Guaranteed Soak Enable
- Set **On** to prevent step time from elapsing whenever the loop's process value differs from its Set Point by more than Guaranteed Soak Value for the loop.

Event Input 1 to Event Input 4
Only applicable if controller has Event Inputs configured. Set the condition on each input for a Wait For step. Event Input options include:
- **None:** do not wait for this input.
- **On:** wait until a digital input is on or true.
- **Off:** wait until a digital input is off or false.
- **Greater Than:** wait until the process value is greater than the setting of the corresponding Input Value parameter.
- **Less Than:** wait until the process value is less than the setting of the corresponding Input Value parameter.

Input 1 Value to Input 4 Value
- Set the process value (Input 1 is Temperature, Input 2 is Humidity when applicable) against which the corresponding condition is evaluated in a Wait For step.

Jump To Step
- Set the step number at which the profile should begin to repeat steps.

Number of Times
- Set the how many times the Jump Loop step repeats the previous profile steps.

Note: Number of Times is the number of times the steps are repeated not including the time they are executed prior to reaching the Jump Loop step. For example if step 5 of a six step profile is a Jump Loop with Jump To Step set to 2 and Number of Times set to 1, when the profile is run starting at step 1 it executes steps as follows: 1, 2, 3, 4, 5, 2, 3, 4, 5, 6.

Event Outputs: Event Output 1 to Event Output 4
Set the state to which the profile sets each event output at the start of the step. Event Output options include:
- **On:** the step sets the event output on or true.
- **Off:** the step sets the event output off or false.
- **Unchanged:** the step does not set the event output; it remains in whatever state was previously set.

End Action
Set what the Temperature or Humidity condition will be after the profile is complete. See page 16 for more information. Options include:
- **User:** program will end with the same Temperature and Humidity Static Set Point values that were entered before the profile was run. See page 16 for more information.
- **Off:** the Temperature and Humidity control mode is set to Off.
  NOTE: Selecting **Off** as the End Action is not recommended. See page 16 for more information.
- **Hold:** the Temperature and Humidity Set Point is set to the last value used in the profile. See page 16 for more information.

Opening the Profile View
To view the profile listing:
1. Click the device to view the device toolbox.
2. Click **Profiles** to bring up the profile listing.

Creating Profiles
To create a new profile in the controller:
1. Click the **Click to add...** button.
2. If desired, click in the Name field and change the profile's name.

Note: A profile name is limited to 20 characters.

Saving a Profile to a Storage Device
To save a profile:
1. Select the profile by clicking it in the profile list.
2. Click the **Save** button at the bottom of the profile list.
3. Use the Save As dialog to edit the name and select the desired location and click the **Save** button.

Hint: Save is an option on the profile pop-up menu.

Note: A profile that has a password applied will be saved with the password.

Loading a Profile
To load a profile previously saved on the computer in to controller memory:
1. Click the **Load** button.
2. Use the open dialog to locate and select the desired profile file.
3. Click Open.

Duplicating a Profile

To duplicate a profile:

- Right-click the profile and click **Duplicate** in the pop-up menu.

Or

- Click the profile, then click the **Dup** button at the bottom of the profile list.

Notes:

- The duplication process automatically appends the duplicated profile to the end of the profile list.
- If a profile is locked with a password and duplicated, the duplicated profile is not pass-word protected.
- The name of the duplicate profile is the original profile's name with the words "Copy of" added to the beginning. The result may be truncated so as not to exceed 20 characters.

Deleting Profiles

To delete a profile:

- Right-click the profile, click **Delete** in the pop-up menu and then click **OK** to confirm

Or

- Click the profile, click **Delete** button at the bottom of the profile list and then click **OK** to confirm.

Or

- Click the profile, press the **Delete** key on the computer keyboard and click **OK** to confirm.

Opening the Step Editor

To open the step editor:

- Click any step in the step list.

Adding Steps

To add a step to a profile:

- Right-click a step and choose **Add** in the pop-up menu

Or

- Click the **Click to Add...** button in the step list.

Hint: When clicking on **Add new step...**, if a step is selected, a duplicate of the selected step is added, if no step is selected, a duplicate of the last step is added.

Inserting Steps

To insert a new step ahead of an existing step:

- Right-click the step and choose **Insert Step Before** in the pop-up menu.

Or

- Click the step and then click the **Insert Before** button at the bottom of the step list.

Deleting Steps

To delete a step:

- Right-click the step and choose **Delete Step** in the pop-up menu.

Or

- Click the step and then click the **Delete** button at the bottom of the step list.

Or

- Click the step and press the **Delete** key on the computer keyboard.

Password Protect a Profile

To avoid inadvertent changes to a profile, apply password protection to it.

To set a password for a profile:

1. Click the **Password** button.
2. In the dialog box enter a password (10 characters maximum).
3. Re-enter the same password to verify it.
4. Click **OK**.

Note: A password protected profile requires the password be entered to edit but not to copy it or to delete it. If the profile is duplicated, the duplicate is not password protected.

Changing or Removing a Password from a Protected Profile

To change or remove a profile's password, the password must be known.

To change a profile's password:

1. Select the profile by clicking it in the profile list.
2. Enter the password and click **OK**.
3. Click the **Password** button.
4. Enter a new password (10 characters maximum).
5. Re-enter the same password to verify it.
6. Click **OK**.

To remove a profile's password:

1. Select the profile by clicking it in the profile list.
2. Enter the password and click **OK**.
3. Click the **Password** button.
4. Click the **Remove** button.

Chapter 4 – Communications

Ethernet Parameters

This section describes how to configure the Ethernet Communications settings in the F4T controller.

Changing Ethernet Parameters

1. Press the **Menu**, **Settings** and **Network** buttons, in that order.
2. Under **Communications Channels** press **Ethernet**.
3. Change the desired settings.
4. Recycle the power to put the new settings into effect.

Ethernet Parameters and Settings

The bracketed bold settings below represent the defaults as delivered from the factory:

- **IP Address Mode**: [DHCP], Fixed
    - DHCP, Dynamic Host Configuration Protocol, allows for dynamic distribution of network settings by a DHCP server.
    - Fixed, also referred to as a static IP address, is configured manually for a specified network.
- **Actual IP Address**: [192.168.0.222]
- **Actual IP Subnet**: [255.255.255.0]
    - Subnet, a method used to logically divide and isolate networks.
- **Actual IP Gateway**: [0.0.0.0]
    - Gateway, is a device used on the network to route messages with IP addresses that do not exist on the local network.
- **MAC Address**: xx:xx:xx:xx:xx:xx (Will be different and unique for each controller)
    - MAC address, is a manufacturer supplied address for the network interface card.
- **Display Units**: °F, °C [configured by TestEquity for °C]
- **Modbus® TCP Enable**: [Yes], No
    - Modbus is an industrially hardened field bus protocol used for communications from the controller to other devices on the network.
- **Modbus Word Order**: [High], Low
    - Modbus allows a user to select the word order of two 16-bit words in floating point values.
- **Data Map**: [1], 2
    - Data Map, the user can switch Modbus registers from the comprehensive listing of F4T registers.
    - Map 1 = F4T registers (default)
    - Map 2 = Limited set of F4 compatible registers (for compatibility with software written for the F4)

RS-232 Parameters

This section describes how to configure the RS-232 Modbus Communications settings in the F4T controller.

Changing RS-232 Parameters

1. Press the **Menu**, **Settings** and **Network** buttons, in that order.
2. Under **Communications Channels** press **Modbus**.
3. Change desired settings.
4. Recycle the power to put the new settings into effect.

RS-232 Parameters and Settings

The bracketed bold settings below represent the defaults as delivered from the factory:

- **Modbus Address**: [1]
    - Each device is given a unique address. Up to 247 devices can be on the same data link.
- **Baud Rate**: [9600]
    - Must match the baud rate of your computer's serial port and software.
- **Parity**: [None]
    - Must match the parity of your computer's serial port and software.
- **Display Units**: °F, °C [configured by TestEquity for °C]
- **Modbus Word Order**: [High], Low
    - Modbus allows a user to select the word order of two 16-bit words in floating point values.
- **Data Map**: [1], 2
    - Data Map, the user can switch Modbus registers from the comprehensive listing of F4T registers.
    - Map 1 = F4T registers (default)
    - Map 2 = Limited set of F4 compatible registers (for compatibility with software written for the F4)

Modbus

The F4T controller is equipped with Modbus® TCP as an embedded protocol.

Introduction to the Modbus Protocol

Gould Modicon, now called AEG Schneider, first created the protocol referred to as Modbus RTU used in process control systems. Modbus provides the advantage of being extremely reliable in exchanging information, a highly desirable feature for industrial data communications. This protocol works on the principle of packet exchanges. The packet contains the address of the controller to receive the information, a command field that says what is to be done with the information, and several fields of data. Each F4T parameter has a unique Modbus register and they can be found in the table below.

All Modbus registers are 16-bits and are listed in the following table as relative addresses (actual). Some F4T parameters are contained within 32 bits (IEEE Float, signed 32 bit). Notice that only one (low order) of the two registers is listed on the next page. By default, the low order word contains the two low bytes of the 32-bit parameter. As an example, in the table below see Actual Chamber Temperature. Note that it lists register 27586. Because this parameter is a float, it is actually represented by registers 27586 (low order bytes) and 27587 (high order bytes). The Modbus specification does not dictate which register should be high or low order therefore, the controller provides the user the ability to swap this order.

F4T and F4 Modbus Mapping

For the purpose of making an easy transition from the F4 to the F4T controller using Modbus, a special set of the most commonly used F4 registers were created. Notice that there are two tables of Modbus registers, they are unique sets of registers (not interchangeable) and the user must select one set or the other when implementing using Modbus.

- Map 1 = F4T registers (default)
- Map 2 = Limited set of F4 compatible registers (for compatibility with software written for the F4)

To change the Modbus mapping using the F4T front panel:
1. From any screen, press the **Menu** button
2. Press the **Settings** button and then the **Network** button
3. Select the **Ethernet** (for LAN) or **Modbus** (for RS-232) communications channel
4. Scroll the screen down to find **Data Map** and select **1** (for F4T) or **2** (for legacy F4 Compatibility Mode).
5. Recycle the power to put the new settings into effect.

Common Modbus Registers

F4T Mode

The following registers are applicable in the F4T Mode (Data Map 1). These are the most common registers that would need to be used in an automation environment.

Some F4T parameters are contained within 32 bits (IEEE Float). Notice that only one (low order) of the two registers is listed. By default, the low order word contains the two low bytes of the 32-bit parameter. As an example, in the table below see Actual Chamber Temperature. Note that it lists register 27586. Because this parameter is a float, it is actually represented by registers 27586 (low order bytes) and 27587 (high order bytes).

Parameter Name	Register	Data Type and Access (Read or Write)
Temperature Set Point	2782	IEEE Float RW
Closed Loop Set Point*	2810	IEEE Float R
Actual Chamber Temperature	27586	IEEE Float R
Humidity Set Point	2942	IEEE Float RW
Closed Loop Set Point*	2970	IEEE Float R
Actual Chamber Humidity	28906	IEEE Float R
Event 1	16594	16-bit RW
Event 2	16596	16-bit RW
Event 3	16598	16-bit RW
Event 4	16600	16-bit RW
Event 5	16822	16-bit RW
Event 6	16824	16-bit RW
Event 7	16826	16-bit RW
Events 1-7	Off = 62, On = 63	

* Instantaneous Set Point during a ramp or profile

Manual Ramp Parameters (Ramp to Set Point without a profile)

Ramp Action (Temperature)	2794 Off = 62 Startup = 88 Set Point = 85 Both = 13
Ramp Scale (Temperature)	2796 °/Minutes = 57 °/Hours = 39
Ramp Rate (Temperature)	2798

F4 Compatibility Mode

The following common registers are available in the F4 Compatibility Mode (Data Map 2). This will allow you to use software that was written for the original F4 Controller. Only a limited set of parameters are available in this compatibility mode, but it should be sufficient for most applications.

Parameter Name	Register	Data Type and Access (Read or Write)
Temperature Set Point	300	16-bit Signed RW
Actual Chamber Temperature	100	16-bit Signed R
Humidity Set Point	319	16-bit Signed RW
Actual Chamber Humidity	104	16-bit Signed R
Event 1	2000	16-bit RW
Event 2	2010	16-bit RW
Event 3	2020	16-bit RW
Event 4	2030	16-bit RW
Event 5	2040	16-bit RW
Event 6	2050	16-bit RW
Event 7	2060	16-bit RW
Events 1-7	Off = 0	
	On = 1	
Profile Action:		
Resume Profile	1209	16-bit R
Hold Profile	1210	16-bit W
Terminate Profile	1217	16-bit W
Profile Start:		
Profile Start File #	4000	16-bit W
Profile Start Step #	4001	16-bit W
Profile Action Start:	4002	16-bit W
	Create (1)	
	Insert Step (2)	
	Delete Current profile (3)	
	Delete Step (4)	
	Start Profile (5)	
	Delete all Profiles (256)	

SCPI Programming Mode

SCPI commands are ASCII text strings with a wide array of defined SCPI commands, all of which are not included in this implementation. The SCPI protocol is only available over Ethernet port 5025. The only available SCPI commands for the F4T are shown below:

:SOURCE:CLOOP#:PVALUE? - reads the process value for a control loop
Example :SOURCE:CLOOP1:PVALUE? (read the value for chamber temperature)
Example :SOURCE:CLOOP2:PVALUE? (read the value for chamber humidity)

:SOURCE:CLOOP#:SPOINT <value> - set the set point for a control loop
Example :SOURCE:CLOOP1:SPOINT -40.0 (set the temperature set point to -40.0)
Example :SOURCE:CLOOP2:SPOINT 85.0 (set the humidity set point to 85.0% RH)

:SOURCE:CLOOP#:SPOINT? - reads the set point for a control loop
Example :SOURCE:CLOOP1:SPOINT? (read the set point for chamber temperature)
Example :SOURCE:CLOOP2:SPOINT? (read the set point for chamber humidity)

GPIB and Ethernet Modbus Interface Converters (optional)

Serial Modbus-to-GPIB Converter

Your chamber may have been ordered with a GPIB Interface option. GPIB communications is achieved through an ICS Electronics 4899A (external, TestEquity Option 1052) or 4809A (internal, TestEquity Option 003) GPIB-to-Modbus Interface Converter. The ICS 4899A converts GPIB commands to serial Modbus commands that are transmitted over RS-232. The GPIB Converter also takes care of calculating block checksums that are required for communications to and from the F4T Controller. For more details, see the documentation that came with the GPIB interface option.

Serial Modbus-to-Ethernet Converter

Your chamber may have been ordered with a Serial Modbus-to-Ethernet Interface option. GPIB communications is achieved through an ICS Electronics 8099 (TestEquity Option 1055). The programming syntax is the same as the GPIB Interface Converter mentioned above. For more details, see the documentation that came with the Ethernet interface option.

NOTE: The native F4T Ethernet Interface uses the Modbus protocol. Composer software will only work with the native F4T Ethernet interface, not the Serial Modbus-to-Ethernet Converter.

Programming Syntax for the F4T Controller, Data Map 2

The following applies if the F4T serial interface is configured for Data Map 2, F4 Compatibility Mode. See register numbers on the previous page. This only applies for programming through the GPIB or Ethernet Modbus converters.

Modbus Register Read / Write Commands

R? reg, n   Read register command
                    Reg = Modbus register
                    n = number of registers to send

W reg, data   Write register command
                    Reg = Modbus register
                    Data = ASCII data written as 16-bit decimal value

Examples:

Write Temperature Set Point	W 300, value
Write Humidity Set Point	W 319, value
Read Chamber Temperature	R? 100, 1
Read Chamber Humidity	R? 104, 1
Event 1 ON	W, 2000, 1
Event 1 OFF	W, 2000, 0

Programming Syntax for the F4T Controller, Data Map 1

The following applies if the F4T serial interface is configured for Data Map 1. This only applies for programming through the GPIB or Ethernet Modbus converters.

The F4T Controller uses two consecutive register to control a value or to read back a process variable. The two registers hold an IEEE-754 32-bit floating point word. The registers are read and written to in the low word-upper word order. The RF? query reads a 32-bit floating point value from two sequential register in low word-upper word order. The RF? does not require the number of registers to read since it is fixed at two registers.

Some registers in the F4T Controller are 16-bit words. These registers are programmed with the same syntax as shown for Data Map 2 below.

Modbus Register Read / Write Commands

RF? reg   Read register command

The WF command writes the num value in floating point format to two consecutive registers starting with the low word register.

WF reg, data   Write register command
                      Reg = Modbus register plus next consecutive register
                      Data = ASCII data written as a direct numerical value

Examples:

Write Temperature Set Point   WF 2782, value
Write Humidity Set Point   WF 2942, value

Read Chamber Temperature   RF? 27586
Read Closed Loop Set Point   RF? 2810 (instantaneous temperature set point during a ramp
                                 or profile)

Read Chamber Humidity   RF? 28906
Read Closed Loop Set Point   RF? 2970 (instantaneous humidity set point during a ramp
                                 or profile)

Turn (Event 1) ON   W 16594, 63   Event 1 is "Power"
Turn (Event 1) OFF   W 16594, 62

Turn (Event 2) ON   W 16596, 63   Event 2 is "Humidity" in Humidity models
Turn (Event 2) OFF   W 16596, 62   Event 2 is "Purge" in Temperature models
                                                  Event 2 is "LN2" in Model 3007C

Manual Ramp Parameters (Ramp to Set Point without a profile)

Ramp Action (Temperature)	W 2794, ## (where ## is one of the four choices below)
	Off = 62
	Startup = 88
	Set Point = 85
	Both = 13

Ramp Scale (Temp. °/Minutes)	W 2796, 57
Ramp Scale (Temp. °/Hours)	W 2796, 39
Ramp Rate (Temperature)	WF 2798, value (0 to 99,999)

## Chapter 5 – Event Board Option TE-0033

Introduction

The F4T Controller has several uncommitted outputs which can be used to turn remote devices on and off. Option TE-0033 provides four Solid State Relays that are controlled by Event Outputs in the F4T Controller.

Connections

The Event Board has four Solid State Relays which have TRIAC outputs that are rated for 24 VAC to 240 VAC at 5 Amps each. These Solid State Relays are just switches; they do not provide a voltage output by themselves. You must provide power from an external source.

The image below shows an Event Board in a 1000 Series Chamber. Connections are made directly to the Solid State Relay's AC Load terminals.
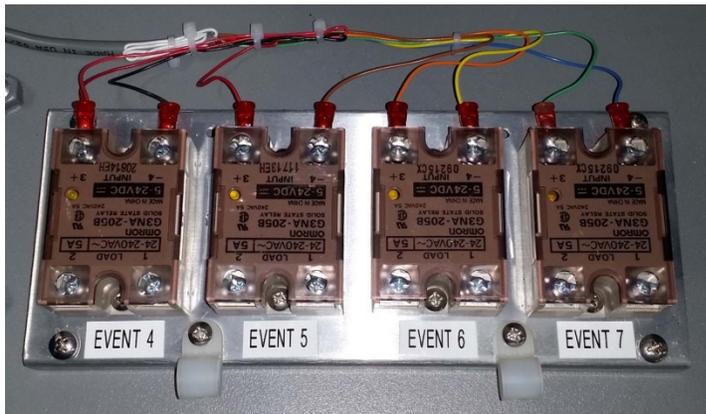
Connecting to the Event Board (for 1000 Series Chambers)
1. Turn the Main Disconnect Switch (big knob on the front panel) to the OFF position.
2. Remove the lower door retaining screw located on the right side. Open the lower door.
3. **1007 Series:** The Event Board is located on the bottom of the chamber frame, towards the left side.
    1016, 1027 Series: The Event Board is located to the left of the electrical subpanel.
4. A 1/2-inch conduit hole is provided on the left side of the lower door to route your wires through. Use the appropriate wire/cable management fittings.
5. The Main Disconnect Switch AND selector knob must both be in the off position before closing the door. Failure to do this will damage both switch and the selector knob.

Connecting to the Event Board (for Models 140 and 115A)
1. Unplug the chamber from the wall socket.
2. Remove the top cover (two top covers on the Model 140).
3. A 1/2-inch conduit hole is provided on the rear panel to route your wires through. Use the appropriate wire/cable management fittings.
4. Replace the top cover(s) before plugging the chamber back into the wall socket.

Controlling the Events

The Event Relay Option uses Event 4, 5, 6, and 7.

Events can be turned ON/OFF manually using the buttons on the F4T Output Widget. The buttons may be named differently depending on your model chamber. The buttons can be pressed to toggle the functions ON/OFF in manual mode or while a profile is running.

The image below shows an F4T with Power, Humidity Purge, and Event 4 in the output widget. Depending on your chamber configuration, you might see Event 4, 5, and 6 on the output widget. The remaining Events are located in the **Operation Screen** > **Profile Events** submenu.

Events can also be turned ON/OFF automatically in a profile step.
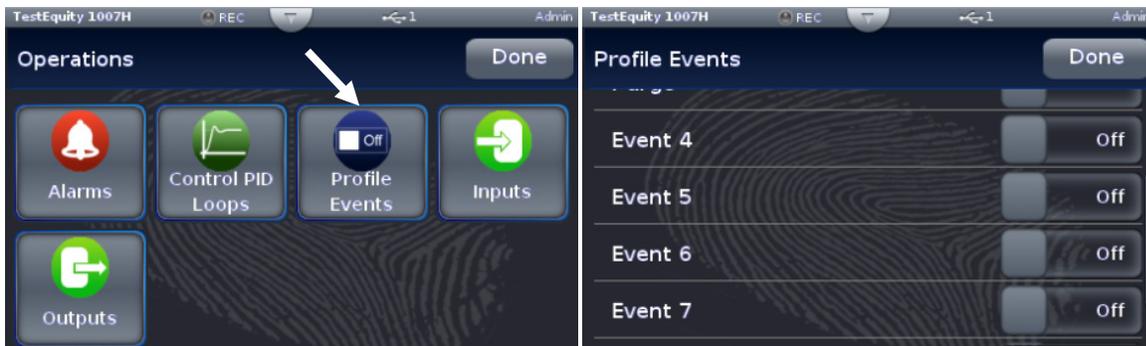
## Chapter 6 – Retransmit Option TE-F4T-RETRANSMIT

Introduction

The Retransmit option provides three analog outputs which can be used to drive an analog recorder. When used in a humidity chamber, this option deletes Events 6 and 7.

Connections

Connections to the Retransmit terminals are on the back of the F4T controller. You will have to open the chamber's electrical system to access these terminals.

These settings shown below only be accessed using Composer Software via Ethernet; they cannot be changed via the front panel interface. You will have to contact TestEquity for the password in order to have access to these settings in Composer Software.

Chamber Temperature Retransmit
Terminals F1 - H1
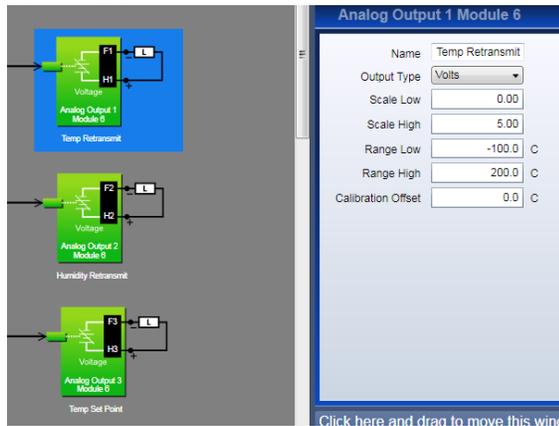
Chamber Humidity Retransmit
Terminals F2 - H2
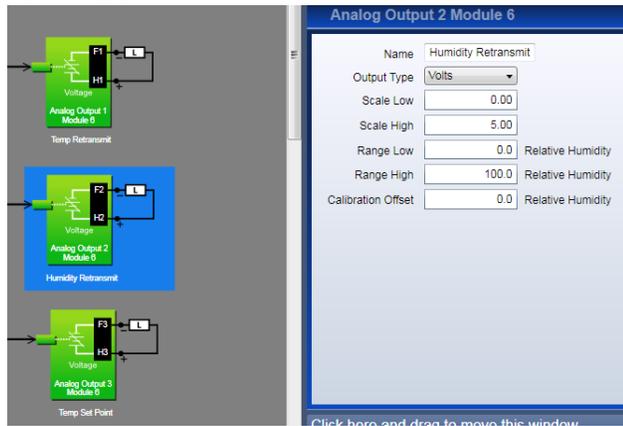
(Applicable to humidity models only)

Temperature Set Point Retransmit
Terminals F3 - H3