

# TESTEQUITY

## F4 Temperature Controller User's Manual



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## Chapter 1 – Safety Instructions


### ***Introduction***

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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.


WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.


The safety alert symbol  precedes a general CAUTION or WARNING statement.


The electrical hazard symbol  precedes an electric shock hazard CAUTION or WARNING statement.


### ***Operation Safety Notices***

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 **CAUTION:** The “Series F4 User’s Manual” is a general manual and is written by the manufacturer, Watlow, for a wide variety of applications and configurations. Not all features or functions are applicable. Only the capabilities of a model F4SH-CKA0-01, as described on page A.7 of the “Series F4 User’s Manual” are applicable. “Cascade Control” as described on page 3.6 of the “Series F4 User’s Manual” is not applicable in this configuration. The “Retransmit” function is available as an option.

 **CAUTION:** The Series F4 “Alarm” functions are NOT used in the chamber’s safety system and are NOT connected. 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 F4 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 “Series F4 User’s Manual” 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:** NEVER select “Full Defaults” in the Series F4 Controller’s Factory/Test Menu. This will erase all the correct values which are documented in the “Series F4 Temperature Controller Setup Parameters” section of this manual.



## Chapter 2 – Operation

### ***Introduction***

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The Series F4 Temperature Controller can function as either a single set point controller (static mode) or as a programmable profile controller. A four-line LCD display facilitates setup and programming, and presents informative messages about status, error, and alarm conditions. Digital outputs, profiles, and alarms can be named for easy reference. An Information Key gives you quick information about the pages, menus, parameters and values, as well as error and alarm conditions if they occur. The user-interface is organized into five “pages” of menus.

**⚠ CAUTION:** The Series F4 “Alarm” functions are NOT used in the chamber’s safety system and are NOT connected. 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 F4 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. Do not attempt to modify the setup values, unless you thoroughly understand what you are doing. Setup examples in the “Series F4 User’s Manual” are NOT applicable to this chamber. If there is any doubt, please call TestEquity before proceeding. The correct values are documented in the “Series F4 Temperature Controller Setup Parameters” section of this manual.

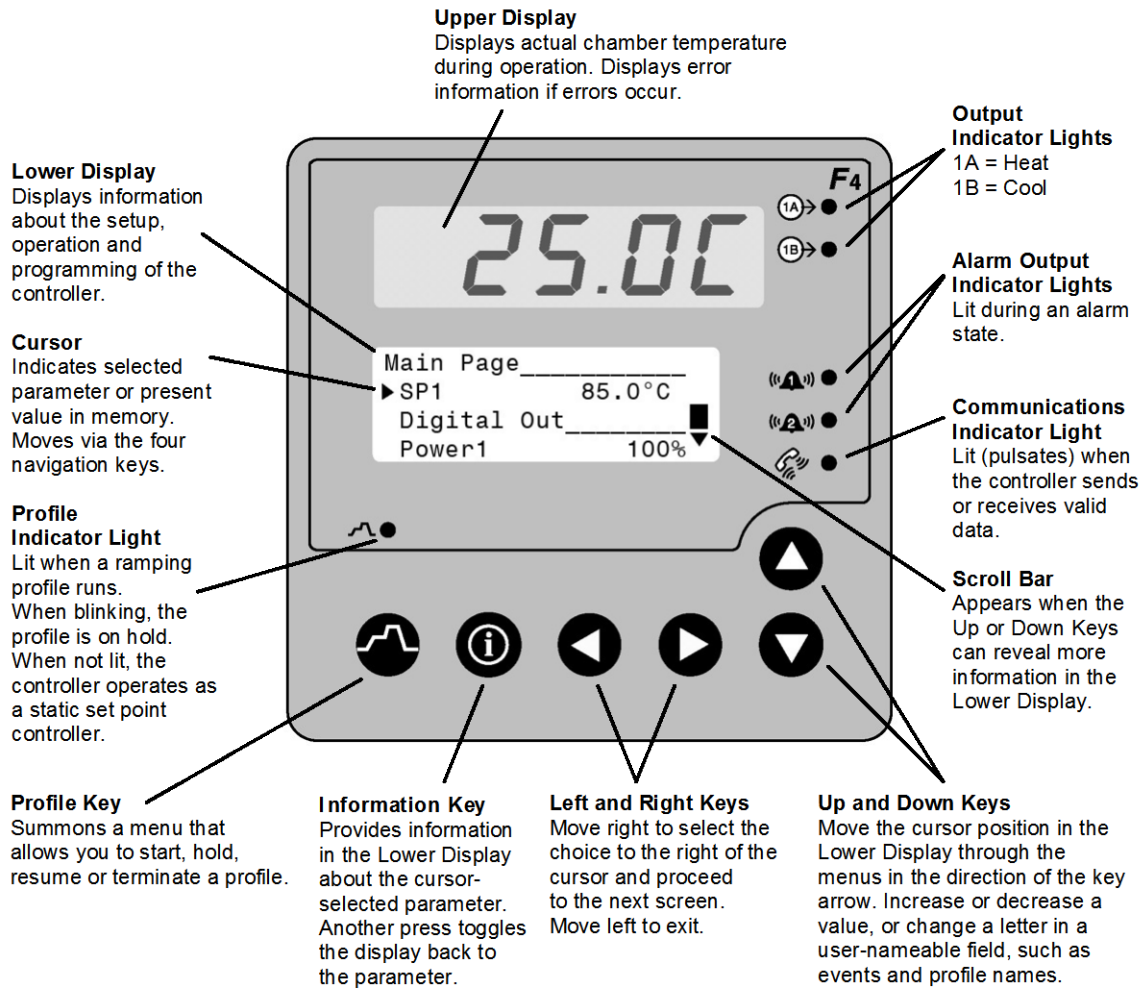
**⚠ CAUTION:** NEVER select “Full Defaults” in the Series F4 Factory/Test Menu. This will erase all the correct values which are documented in the “Series F4 Temperature Controller Setup Parameters” section of this manual.

### **Security Features**

The Series F4 Controller has several levels of security to prevent unauthorized users from changing critical configuration parameters. Only the Set Point and Profile menus have “Full Access”. TestEquity has configured all other menus to “Password”, and have protected them with a password.

TestEquity does not recommend that these security levels be changed for most applications. However, there will be times when entry into these menus is necessary. For example, you may need to gain access to Setup Page in order to change from °C to °F display, or to change the time or date. You must call TestEquity at 877-512-3457 or 805-480-0638 to obtain the password.

**Temperature Controller Keys and Displays**



**Figure 2.1 – Temperature Controller Keys and Displays**

To navigate through the menus:

1. Use the ▲ or ▼ key to move the cursor to line up with the item to be selected in a menu on the lower display.
2. Press the ► key to select the item.
3. Enter or change the value, or make a choice with the ▲ or ▼ key.
4. Press the ► key to enter the value or choice.
5. Repeat until you return to the original list.

The ► key again saves the value and proceeds to the next parameter in the series.

The ◀ key saves the value and backs out of the series, and returns to the Main Page.

To edit a parameter, proceed through the series using the ► key without changing values until you find the parameter you want to change. After making the change with the ▲ or ▼ key, you may back using the ◀ key out or proceed using the ► key to the end of the series.



**Main Page**

The Main Page displays manual operating parameters, running program parameters and error messages. It also provides access to the Operations, Profiles, Setup and Factory pages. The following is a list of Main Page parameters and the description of their functions.

Main Page _____	
Current File	Displayed if running a profile, the name of the profile.
Current Step	Displayed if running a profile, the current step of the profile.
▶ SP1	Static (manual) temperature set point entry. If running a profile, the current set point.
Step Type	Displayed if running a profile, the type of step.
Target SP1	Displayed if running a profile, the target temperature during a ramp step.
WaitFor Status	Displayed if running a profile, the status during a WaitFor step.
Jump Count	Displayed if running a profile, the number of jumps completed.
Time Remaining	Displayed if running a profile, the remaining time of the current step.
DigitalOut	Status of the event outputs 1 to 8. An “8” indicates when cooling system is ON.
Power1	The % of throttle of the heat (positive number) or cool (negative number) output.
Date	Real-time clock date.
Time	Real-time clock time.
TESTEQUITY XXXXX	Identifies the chamber model number (model appears in place of XXXX).
Go to Operations	Access to Operations Page
Go to Profiles	Access to Profiles Page
Go to Setup	Access to Setup Page. Not displayed if running a profile.
Go to Factory	Access to Factory Page. Not displayed if running a profile.

**Static Set Point Control (Manual Operation)**

The Temperature Controller is in Static Mode (Manual Operation) when it is not controlling a Profile. When in a Static Mode, the Profile Indicator Light is off (see Fig. 2.1). The Upper Display shows the actual chamber workspace temperature. The Static Set Point (SP1) prompt is accessed from the Main Page.

**To enter a Static Set Point:**

1. Press the ▲ or ▼ key to position the Cursor next to the SP1 prompt. You may already be at this prompt.
2. Press the ▶ key once. You will see **Static Set Point1** in the lower display with the current set point indicated below.
3. Press the ▲ or ▼ key to change the temperature set point value.
4. Press the ▶ key once to enter the new temperature set point. You are now back to the Main Page.

Main Page \_\_\_\_\_  
▶ SP1 85.0 °C  
DigitalOut \_\_\_\_\_  
Power1 50%

Static Set Point1: \_\_\_\_\_  
85.0 °C  
▲  
▼ Adjusts Value  
◀ Back ▶ Next

## System Enable Function

The chamber can be configured to enable or disable all chamber functions through Event 1 (Digital Output 1) in the F4 Controller. The CONDITIONING Switch needs to be in the Event 1 position. This configuration may be desirable if you want to turn off all chamber function at the end of a programmed profile, or through the communications interface.

All chamber functions will be disabled if Event 1 is Off. If Event 1 is On, all chamber functions will be enabled, as long as the Power Switch is also On.

NOTE: The Modbus register to program Digital Output 1 in static set point mode is 2000.

NOTE: In the Profile Create and Edit menus, Digital Output 1 is named **CONDITION**. Remember to set **CONDITION** to **On** in all programmed steps when the chamber is to be operational.

### To Enable or Disable all chamber functions in static set point mode:

1. The F4 Temperature Controller must first be on the Main Page. Press the ▲ or ▼ key to position the Cursor next to the DigitalOut prompt.

```
Main Page _____
  SP1          85.0°C ▲
▶ DigitalOut _____
  Power1       50% ▼
```

2. Press the ▶ key once. You will see **Choose Event Output** prompt in the lower display. Press the ▲ or ▼ key to position the Cursor next to **Event Output1**.

```
Choose Event Output_
▶ Event Output1
  Event Output2
  Event Output3 ▼
```

3. Press the ▶ key once to select **Event Output1**. Then, press the ▲ or ▼ key to select **On** or **Off**.

```
Event Output1 _____
  Off
▶ On
```

4. Press the ▶ key once to return to the **Choose Event Output** prompt.
5. Press the ◀ key once to return back to the Main Page. You will see a 1 in the DigitalOut line if Event1 is On.

```
Main Page _____
  SP1          85.0°C ▲
▶ DigitalOut1 _____
  Power1       50% ▼
```

### **Profile Programming**

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The Series F4 Temperature Controller can be programmed to store up to 256 steps into as many as 10 profiles. You do not need a computer to enter a profile – it can be easily done through the controller’s front panel keys. A Profile is a set of instructions programmed as a sequence of steps. The controller handles the profile steps automatically, in sequence. As many as 40 different profiles and a total of 256 steps can be stored in non-volatile memory. The 256 steps are grouped by profile. So, one profile could have 256 steps; or 39 profiles could have 6 steps and one could have 22; or 32 profiles could have eight steps each. The maximum number of steps is 256, and the maximum number of profiles is 40.

### **Step Types**

Use the six available step types – Autostart, Ramp Time, Ramp Rate, Soak, Jump and End – to create simple or complex profiles involving all inputs and outputs. The Series F4 prompts you to define each step’s properties.

#### **Autostart Step**

The use of an Autostart step in a profile is optional. Autostart pauses a profile until the specified date or day, and time (of a 24-hour-clock). Define the Autostart by choosing:

- Day (of the week) or Date,
- Time

To invoke an Autostart step in a profile, you must activate the profile via the Profile Key and select the Autostart step.

#### **Ramp Time Step**

Ramp Time changes the set point to a new value in a chosen period of time. Define the Ramp Time step by choosing:

- \*Wait for an event or process value
- Event outputs 1 through 7 to turn ON or OFF (For controlling the power to remote devices.)
- Time (in hours, minutes and seconds)
- Temperature Set Point
- PID set (One of five sets of PID tuning parameters. Normally, just leave at PID Set 1.)
- \*\*Guaranteed Soak

#### **Ramp Rate Step**

Ramp Rate changes the set point to a new value in a chosen rate of time. Define the Ramp Rate step by choosing:

- \*Wait for an event or process value
- Event outputs 1 through 7 to turn ON or OFF (For controlling the power to remote devices.)
- Rate (in degrees per minute)
- Temperature Set Point
- PID set (One of five sets of PID tuning parameters. Normally, just leave at PID Set 1.)
- \*\*Guaranteed Soak

### **Soak Step**

Soak maintains the set point from the previous step for a chosen time in hours, minutes and seconds. Define the Soak step by choosing:

- \*Wait for an event or process value
- Event outputs 1 through 7 to turn ON or OFF (For controlling the power to remote devices.)
- Time
- PID set (One of five sets of PID tuning parameters. Normally, just leave at PID Set 1.)
- \*\*Guaranteed Soak

### **Jump Step**

Jump initiates another step or profile. Define the Jump step by choosing:

- Profile to jump to;
- Step to jump to; and
- Number of Repeats

**NOTE:** If a power-out condition occurs during a profile and more than 20 jump steps are stored in the F4's Profile Program memory, the controller will terminate the profile and turn off all outputs if Continue, Hold or Terminate was selected as the Power Out action. If Profile Reset or Go to Idle Set Point was selected, the controller will take those actions. A pop-up message will warn of this when the 21st jump step is programmed

### **End Step**

End terminates the profile in a chosen state. All profiles must have an End step. It cannot be deleted or changed to another step type. Define the End by choosing Hold, Control Off, All Off or Idle end state.

**NOTE:** TestEquity recommends having the end step type to be Hold or Idle. TestEquity does NOT recommend using an end step type of Control Off or All Off. This does not turn off the chamber fan. The chamber temperature can reach +55°C just from heat generated by the fan and interior light, or even higher if your test sample is energized.

### **\*Wait For step option**

The use of Wait For in a profile is optional. Ramp Time, Ramp Rate and Soak steps can be programmed to wait for a particular chamber temperature or event input condition. The wait conditions must be satisfied before the time clock and the step activity proceeds. Digital inputs must first be configured in the System Menu as Wait For Events, with the condition to be met also specified. Then, to wait for this digital input, you must specify On, meaning the condition as configured in the Setup Page, or Off, meaning the opposite of that condition. The digital inputs have been configured to Off by TestEquity, so this option will not show unless reconfigured.

### **\*\*Guaranteed Soak step option**

The use of Guaranteed Soak in a profile is optional. The Guaranteed Soak step requires the chamber temperature to be at the set point temperature, within the Guaranteed Soak Band value, before the time clock and the step activity proceeds. The Guaranteed Soak Band is configured by TestEquity for 3.0°C, and this can be changed in the System Menu.

## How to Program a New Profile

<p>1. <b>Go to the Profiles Page.</b> Move the cursor down the Main Page to Go to Profiles, then press the ► key.</p>	<p>Main Page _____ ► Go to Profiles ▲ Go to Setup ■ Go to Factory ▼</p>
<p>2. <b>Create a new Profile.</b> The cursor will be on Create Profile. Press the ► key.</p>	<p>Main&gt;Profile _____ ► Create Profile ■ Edit Profile ▼ Delete Profile ▼</p>
<p>3. <b>Name the profile.</b> You can name your profiles for easy reference if desired. Names can have up to 10 characters. You can also use one of the default profile names (ex. Profile1), and skip this step. To name a profile:</p> <ul style="list-style-type: none"> <li>• Press ► to enter the name space and the first position.</li> <li>• Press the ▲ or ▼ to scroll through the alphabet and stop at the letter or number desired.</li> <li>• Press ► to move to the next position.</li> <li>• Continue until the name is complete, or until you move through the name space into the next screen.</li> <li>• Press ► to save the name of the profile.</li> </ul>	<p>Choose to Name: _____ No ► Yes</p> <p>Enter Profile Name: _ <u>PROFILE1</u> ▲ ▼ Adjusts Char ◀▶ Save Changes</p>
<p>4. <b>Choose the step type.</b> • There are five step types, each of which must be defined through different parameters. (See “Step Types,” earlier in this chapter.)</p>	<p>Choose Step1 Type: _____ Autostart ► Ramp Time ■ Soak ▼</p>
<p>5. <b>Define each step type.</b> • The Series F4 prompts you to define the parameters of each step type. (See “Step Types,” earlier in this chapter.)</p> <p>(Not all choices are shown in this example)</p>	<p>Choose to wait: _____ ► Step does not wait Step waits for...</p> <p>Choose DIGIT OUT1: _____ ► Off On</p> <p>Enter Ramp Time: _____ 00:00:01 (H:M:S) ▲ ▼ Adjusts Digit ◀▶ Save Changes</p> <p>Enter Ch1 SP: _____ 85.0 °C ▲ ▼ Adjusts Value ◀ Back ▶ Next</p>
<p>6. <b>Choose the end-state.</b> • All profiles end with an End step, which is preprogrammed into the new profile. (See “End Step,” earlier in this chapter.)</p>	<p>Choose End State: _____ Control Off ▲ All Off ■ ► Idle</p>
<p>7. <b>Save your settings.</b> • Press ◀ to exit the Profiles Page. • After exiting the Profiles Page, choose ▲ to save profile data.</p>	<p>Save profile data or restore values? ▼ Restore ▲ Save</p>

## Programming Hints

- The first step in a program should be an initialization step of 1-second, usually at a set point of +23°C.
- The next to last step establishes a condition to end on. For example, you may want to end the program by holding at +23°C, so this step would be to go to +23°C.
- The final step of every profile is End. You cannot delete an End step or change it to another type, but you can insert new steps before it.
- TestEquity recommends having the end step type to be Hold or Idle.
- TestEquity does NOT recommend using an end step type of All Off or Control Off. This does not turn off the chamber fan. The chamber temperature can reach +55°C just from heat generated by the fan, and even higher if your test sample is energized. See Protecting an Energized Test Sample in the chamber manual for important information regarding energized test samples.
- If you must turn off all chamber functions at the end of a profile, see System Enable Function on page 2-4. If this function is used, the you must remember to set Event 1 (CONDITION) to On in all programmed steps when the chamber is to be operational.

## Profile Key

The  Profile key:

- Initiates the profile mode;
- Initiates the Hold-profile state;
- Initiates the Resume-profile command;
- Initiates the Terminate-profile command.

The Profile Key functions only from the Main Page.

## How to Start a Profile

To initiate the profile mode, press the  Profile key and answer the questions that follow.

<p>1. <b>Press the Profile key to enter the Profile Control menu.</b></p> <ul style="list-style-type: none"> <li>• The Profile Indicator will begin blinking.</li> <li>• Press the ▲ key for Yes.</li> </ul>	<p>Start a Profile?</p> <p style="text-align: center;">▼ No    ▲ Yes</p>
<p>2. <b>Select the desired stored profile.</b></p> <ul style="list-style-type: none"> <li>• Press the ▲ or ▼ to scroll through the list of stored profiles.</li> <li>• Press ► to select the desired profile.</li> </ul>	<p>Start Profile: _____</p> <p>Profile1</p> <p>► Profile2    ▾</p> <p>Profile3</p>
<p>3. <b>Select the desired step to start on.</b></p> <ul style="list-style-type: none"> <li>• Press the ▲ or ▼ to scroll through the list of steps. Generally you would start on Step 1, but you can also start on any other step.</li> <li>• Press ► to select the desired start step and the profile will begin to run. The Profile Indicator will stay lit.</li> </ul>	<p>Start: _____</p> <p>► Step 1 Ramp Time</p> <p>Step 2 Soak    ▾</p> <p>Step 3 Ramp Time</p> <p>Main Page _____</p> <p>► Profile 2 Running</p> <p>Step 1    ▾</p> <p>SP1            85.0°C    ▾</p>

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## Chapter 2 – Operation

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While running a profile, the Main Page on the lower display will keep you informed about the progress of the profile. Use the ▲ or ▼ key to scroll through the list of running profile parameters. You cannot manually change any operating condition while the profile is running.

## How to Hold/Resume a Running Profile

<p>1. <b>To Hold a running profile, press the Profile key to enter the Profile Control menu.</b></p> <ul style="list-style-type: none"> <li>• Then press ▲ or ▼ to make your choice for Hold.</li> <li>• Press ► to select Hold.</li> <li>• The Main Page will appear with a profile status of Holding. The Profile Indicator will be off.</li> </ul>	<pre> Hold Profile: _____   Don't Hold   ► Hold   Terminate  Main Page _____   ► Profile 2   Holding   Step           2   SP1           23.0°C ▼                     </pre>
<p>2. <b>To Resume profile on hold, press the Profile key to enter the Resume Profile menu.</b></p> <ul style="list-style-type: none"> <li>• Then press ▲ or ▼ to make your choice for Resume.</li> <li>• Press ► to select Resume.</li> </ul>	<pre> Resume Profile: _____   Continue Holding   ► Resume   Terminate                     </pre>

While a profile is on Hold, the current set point can be adjusted at the SP1 prompt on the Main Page. When a profile is resumed during a Ramp step, the controller uses the Static Set Point from the Main Page to calculate the rate of change needed to get to the set point at the end of the step. When a profile is resumed in a soak step, the new set point value will be used as the soak value for the time remaining in the step.

## How to Terminate a Running/Holding Profile

<p>1. <b>Press the Profile key while the profile is running to enter the Resume Control menu.</b></p> <ul style="list-style-type: none"> <li>• Then press ▲ or ▼ to make your choice for Terminate.</li> <li>• Press ► to select Terminate.</li> </ul>	<pre> Hold Profile: _____   Don't Hold   Hold   ► Terminate                     </pre>
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If you manually terminate a running profile, the profile ends with a set point of Off. This does not turn off the chamber fan. The chamber temperature can reach +55°C just from heat generated by the fan, and even higher if your test sample is energized. See Protecting an Energized Test Sample in the chamber manual for important information regarding energized test samples.

## How to Delete or Re-Name a Profile

<p>1. <b>Go to the Profiles Page.</b> Move the cursor down the Main Page to Go to Profiles, then press the ► key.</p>	<pre> Main Page _____   ► Go to Profiles   Go to Setup   Go to Factory                     </pre>
<p>2. <b>Choose Delete or Re-Name.</b></p> <ul style="list-style-type: none"> <li>• Press ▲ or ▼ to scroll through your choice.</li> <li>• Press ► to select your choice.</li> <li>• The controller will prompt you to select the profile you want to delete or re-name.</li> </ul>	<pre> Main&gt;Profile _____   Edit Profile   ► Delete Profile   Re-Name Profile                     </pre>



## How to Edit a Profile

<p>1. <b>Go to the Profiles Page.</b> Move the cursor down the Main Page to Go to Profiles, then press the ► key.</p>	<p>Main Page _____ ► Go to Profiles Go to Setup Go to Factory</p>
<p>2. <b>Choose Edit Profile.</b> • Press the ▼ key to choose on Edit Profile. • Then press the ► key.</p>	<p>Main&gt;Profile _____ Create Profile ► Edit Profile Delete Profile</p>
<p>3. <b>Select the desired stored profile to edit.</b> • Press the ▲ or ▼ to scroll through the list of stored profiles. • Press ► to select the desired profile.</p>	<p>...Edit Profile: _____ Profile1 ► Profile2 Profile3</p>
<p>4. <b>Choose how to edit the step.</b> • Press the ▲ or ▼ to scroll through the list of step edit choices. • Press ► to select your choice.</p>	<p>Choose to: _____ Insert Step ► Edit Step Delete Step Done</p>
<p>5. <b>To edit a step.</b> • Press the ▲ or ▼ to scroll through the list of steps you want to edit. • Press ► to scroll through the step parameters and make any desired changes.</p>	<p>Edit Step: _____ ► Step 1 Ramp Time Step 2 Soak Step 3 Ramp Time</p>
<p>6. <b>To insert a step.</b> • Choose Edit Profile (see step 4 above) • Press the ▲ or ▼ to scroll through the number of the step that the new step will precede. • Press ► to enter the new step and follow the step parameter prompts.</p>	<p>Insert Before: _____ Step 1 Ramp Time ► Step 2 Soak Step 3 Ramp Time</p>
<p>7. <b>To delete a step.</b> • Choose Delete Step (see step 4 above) • Press the ▲ or ▼ to scroll through the number of the step you want to delete. • Press ► to delete the step.</p>	<p>Delete Step: _____ Step 1 Ramp Time ► Step 2 Soak Step 3 Ramp Time</p>
<p>8. <b>Save your settings.</b> • Press ◀ successively to exit the Profiles Page. • After exiting the Profiles Page, choose ▲ to save the new profile values, or ▼ to restore the old values.</p>	<p>Save profile data or restore values? ▼ Restore ▲ Save</p>

- Inserting or deleting a step will renumber all steps that follow.
- A Jump Step that jumps to an End Step cannot be deleted.
- An End Step cannot be deleted.
- Inserting a new ramp step usually requires inserting an associated soak step.
- Deleting a ramp step usually requires deleting the associated soak step.

## Profile Examples

The following are examples of two typical profiles Note that Digit Out 1 is named CONDITION.

Profile Summary: -40°C to 85°C, no ramps, 30 minute soak time, 4 cycles. End with program hold at +23°C.

Step Number	Step Type	Date Day, Time	Wait for	Choose Digit Out	Time H:M:S	Rate	Ch1 SP	PID Set	Guar. Soak	Jump to Profile	Step	Repeats	End Type
1	Ramp Time	—	>	1	00:00:01	—	23.0	1	—	—	—	—	—
2	Ramp Time	—	>	2	00:00:01	—	-30.0	1	—	—	—	—	—
3	Soak	—	>	3	00:30:00	—	—	1	Yes	—	—	—	—
4	Ramp Time	—	>	4	00:00:01	—	85.0	1	—	—	—	—	—
5	Soak	—	>	5	00:30:00	—	—	1	Yes	Name	2	3	—
6	Jump	—	>	6	—	—	—	—	—	—	—	—	—
7	Ramp Time	—	>	7	00:00:01	—	23.0	1	—	—	—	—	—
8	End	—	—	—	—	—	—	—	—	—	—	—	Hold

### Step Description

- Establishes a recommended initialization step. Goes to +23°C as quickly as possible.
- Goes to -30°C as quickly as possible.
- Will hold for 30 minutes. Time will not start until chamber reaches -37°C (within the 3° Guaranteed Soak Band\*).
- Goes to +85°C as quickly as possible.
- Will hold for 30 minutes. Time will not start until chamber reaches +82°C (within the 3° Guaranteed Soak Band\*).
- Jumps back to step 2. Repeats this 3-times, for a total of 4-cycles.
- After all cycles are completed, establishes the condition to end on. Goes to +23°C as quickly as possible.
- Holds at +23°C indefinitely, until program is manually stopped.

Profile Summary: +50°C to 0°C, 1°C/minute ramp, 1 hour soak time, 100 cycles. Test sample turned ON/OFF depending on step. End with return to +23°C manual set point.

Step Number	Step Type	Date Day, Time	Wait for	Choose Digit Out	Time H:M:S	Rate	Ch1 SP	PID Set	Guar. Soak	Jump to Profile	Step	Repeats	End Type
1	Ramp Time	—	>	1	00:00:01	—	23.0	1	—	—	—	—	—
2	Ramp Rate	—	>	2	—	1.0	50.0	1	—	—	—	—	—
3	Soak	—	>	3	01:00:00	—	—	1	No	—	—	—	—
4	Ramp Rate	—	>	4	—	1.0	0.0	1	—	—	—	—	—
5	Soak	—	>	5	01:00:00	—	—	1	No	—	—	—	—
6	Jump	—	>	6	—	—	—	—	—	Name	2	99	—
7	Ramp Rate	—	>	7	—	1.0	23.0	1	—	—	—	—	—
8	End	—	—	—	—	—	—	—	—	—	—	—	Idle 23.0

### Step Description

- Establishes a recommended initialization step. Goes to +23°C as quickly as possible. Test sample is turned ON via Event 1.
- Goes to +50°C at a controlled rate of 1°C per minute. Test sample is turned ON via Event 1.
- Will hold for 1 hour. Test sample remains ON via Event 1.
- Goes to 0°C at a controlled rate of 1°C per minute. Test sample is turned OFF via Event 1.
- Will hold for 1 hour. Test sample remains OFF via Event 1.
- Jumps back to step 2. Repeats this 99-times, for a total of 100-cycles.
- After all cycles are completed, establishes the condition to end on. Goes to +23°C at a controlled rate of 1°C per minute. Test sample is turned OFF via Event 1.
- End of program. Controller returns to a +23°C manual set point. Test sample is remains OFF via Event 1.

### Notes

- \* Guaranteed Soak Band is set at the factory for 3.0°C. Can be changed in the System Menu.
- > Means no entry or selection is required. Just scroll through this prompt to the next prompt.
- Means prompt does not show for this step type.

## Digital Event Outputs

The Temperature Controller has digital outputs which can be configured as Event Outputs to turn remote devices on and off. There are six Event Outputs which are available for customer use (five if the Purge option is installed). Output number eight is configured to control the refrigeration compressors and is not available for customer use. The Event Outputs are accessed from the Main Page.

To control the Event Outputs:

9. Press the ▲ or ▼ key to position the Cursor next to the DigitalOut prompt.
10. Press the ► key once. You will see Choose Event Output prompt in the lower display.
11. Press the ▲ or ▼ key to position the Cursor next to the EventOutput prompt which you want to change. You will be able to select from EventOutput1 through EventOutput7.
12. Press the ► key once to select the desired EventOutput. Then, press the ▲ or ▼ key to select On or Off.
13. Press the ► key once to return to the Choose Event Output prompt.
14. Press the ◀ key once to return back to the Main Page.

## Digital Output Connections

The Digital Output connections are on the back of the F4 Controller.

Rating:

OFF: 42 VDC @ 10  $\mu$ A max.

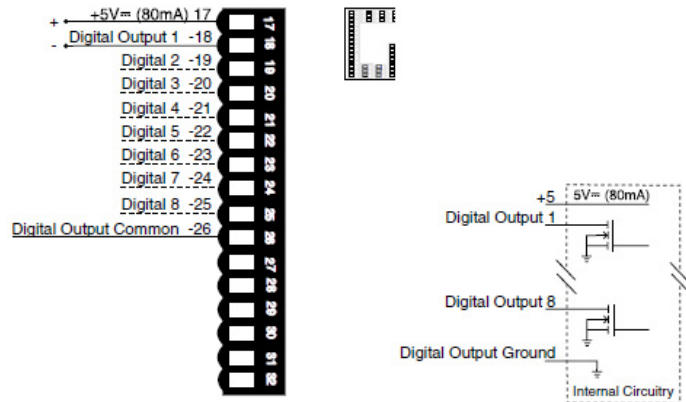
ON: 0.2 VDC @ 50 mA sink max.

Internal supply: 5 VDC @ 80 mA

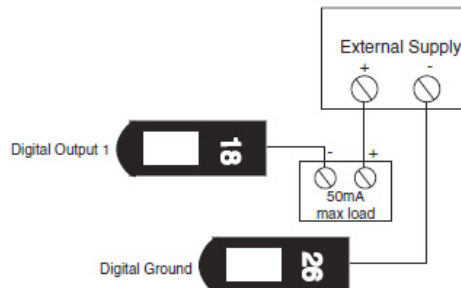
Digital Output 1 (pin 18) is committed for use as a System Enable function and is not available for customer use.

Digital Output 2 (pin 19) is committed for the Purge System when applicable and is not available for customer use when the Purge System is installed.

Digital Output 8 (pin 25) is committed for the Compressor Enable function and is not available for customer use.



### Open Collector Example



### Switched DC Example



### **Computer Interface**

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**⚠ CAUTION:** Every setting in the F4 Controller can be accessed via the computer interface. Improper modifications to configuration settings can result in erratic performance and unreliable operation. Setup examples in the “Series F4 User’s Manual” are NOT applicable to this chamber. The correct values are documented in the “Series F4 Temperature Controller Setup Parameters” section of this manual.

### **RS-232C**

The F4 Temperature Controller has an RS-232C interface. A DB-9 connector is located on the rear panel. It is wired to accommodate a null-modem cable. The controller is configured from our factory for 9600 baud and a Modbus address of 1.

To communicate with the controller from a PC, you need to run software that uses the Modbus RTU protocol. Each controller function has a “register” number which can be read or written to (when applicable). These registers are listed Chapter Seven of the “Series F4 User’s Manual”.

RS-232C Modbus programming resources can be downloaded from <http://www.testequity.com/RS232>.

For more information about the Modbus RTU protocol, visit the Modbus industry consortium website at <http://www.modbus.org>.

### **Common Modbus Registers**

- The actual chamber temperature reading is Modbus register 100 (Input 1 Value).
- The static temperature set point is Modbus register 300 (Set Point 1).
- The temperature set point during a profile is Modbus register 4122 (Set Point 1, Current Profile Status).
- The decimal points are implied. For example, 1005 is actually 100.5 and -230 is -23.0.

### **GPIB (optional)**

GPIB communications is achieved through as GPIB-to-Modbus Interface Converter which has been specifically designed to work with the Watlow F4 controller used on TestEquity chambers. The converter lets you send simple read-write messages over GPIB to control and query the chamber’s controller. The converter lets you send simple read-write messages over the network to control and query the chamber’s controller. The converter does all of the Modbus RTU packet formatting and handles the response packets.

The optional GPIB interface, model TE-1052, consists of an external converter box that connects to the chamber’s RS-232C interface. Model TE-003 GPIB interface is an internal converter board that fits inside our larger chambers and is functionally identically to TE-1052.

GPIB programming resources and LabVIEW drivers can be downloaded from <http://www.testequity.com/GPIB>.

### **Ethernet (optional)**

TE-1055 and TE-1056 Ethernet Interface Converter is a specialized Ethernet-to-Serial Modbus Interface that provides Modbus RTU packet communication to adapt the F4 Controller used on TestEquity chambers to a network. The converter lets you send simple read-write messages over the network to control and query the chamber's controller. The converter does all of the Modbus RTU packet formatting and handles the response packets. The converter is fully VXI-11.3 compliant. An internal webserver provides a web page to read and control the chamber's setpoints and event outputs. This external converter box connects to the chamber's RS-232C interface.

Ethernet programming resources can be downloaded from <http://www.testequity.com/ETHERNET>.



### Chapter 3 – Calibration and Service

#### ***Introduction***

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This section describes how to verify the calibration and perform a calibration on the F4 controller. It also documents the settings which configure the F4 controller to work with the control architecture of the chamber.

**⚠ WARNING:** Maintenance must be performed by properly trained personnel only.

#### ***How to Verify the Calibration***

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TestEquity recommends verifying the calibration before attempting to actually perform a calibration. The state-of-the-art instrumentation used in TestEquity chambers is of the highest quality and seldom goes out of calibration. If you try to calibrate the instrumentation before determining that calibration is necessary, you may make it worse if done incorrectly.

Variations in temperature throughout the chamber interior is NOT a measurement of accuracy. These variations, called “gradients”, are a function of the physical design of the chamber and its airflow, the characteristics of the test sample, and how it is oriented in the chamber. You cannot “calibrate” to improve gradients. The correct way to adjust what the temperature controller “displays” compared to what is measured at some point other than the controller’s sensor, is with the “Calibration Offset” parameter which is located in the Setup\Analog Input 1 menu. Calibration verification should be performed with the Calibration Offset set to 0.0 (zero).

The F4 Temperature Controller accuracy is specified  $\pm 1.55^{\circ}\text{C}$  (above  $-50^{\circ}\text{C}$ ) and  $\pm 1.66^{\circ}\text{C}$  (below  $-50^{\circ}\text{C}$ ). Total system accuracy in the chamber includes the controller plus the thermocouple wire accuracy of  $\pm 1.0^{\circ}\text{C}$ . Total system accuracy over the chamber’s operating range is can be as much as  $\pm 2.66^{\circ}\text{C}$ , although it is typically better than  $\pm 1.0^{\circ}\text{C}$ .

The easiest way to verify the instrumentation accuracy is with an independent calibrated temperature sensor and display. Place the sensor near the chamber’s sensors, which are located towards the right side of the conditioner fan grille. If the readings agree within the specified limits above, then no calibration adjustments are necessary.

If adjustment of the temperature controller is necessary, refer to the information on the next page.

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**Calibrating the F4 Controller**

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**⚠ CAUTION:** Calibrating the F4 Controller requires the electrical compartment to be exposed. Live and potentially lethal voltages will be present. Use extreme caution to prevent injury and death.

You will need a password to enter the Calibration menu (Main Page\Go to Factory\Calibration). You must call TestEquity at 877-512-3457 or 805-480-0638 to obtain the password.

**Equipment Required**

- Precision millivolt source, 0 to 50mV minimum range, 0.002mV resolution.
- Thermocouple calibrator capable of simulating Type J and Type T thermocouples.
- Type J thermocouple extension wire.
- Type T thermocouple extension wire.

**Input Setup and Calibration**

1. Disconnect the chamber from the power source and remove the top cover (or open the lower door for the 1000 and 3000 Series chambers). Remove the chamber's thermocouple wires from F4 terminals 62 and 61.
2. Connect the millivolt source to Input 1 terminals 62 (–) and 61 (+).
3. Reconnect the chamber to the power source.
4. Enter the Calibration menu (Main Page\Go to Factory\Calibration\Calibrate Input 1). You will need to contact TestEquity for the password to enter this menu.
5. Enter 50.000mV from the millivolt source. Allow at least 10 seconds to stabilize. Press the Right Key **▶** once at the Calibrate Input 1 prompt in the Factory Page. At the 50.00mV prompt press **▶** once. To store 50.00mV press the Up Key **▲** once.
6. Enter 0.000mV from the millivolt source. Allow at least 10 seconds to stabilize. At the 0.00mV prompt press **▶** once. To store 0.00mV press **▲** once.
7. Disconnect the millivolt source and connect the thermocouple calibrator using Type J extension wire to Input 1 terminals 62 (–) and 61 (+). Set the calibrator for Type J to simulate 32°F (0°C). Allow 10 seconds for the controller to stabilize. Press **▶** once at the Calibrate Input 1 prompt at the Factory Page. At the 32°F Type J prompt press **▶** once. To store type J thermocouple calibration press **▲** once.
8. Exit the calibration menu. Disconnect the Type J extension wire between the calibrator and the F4 controller.
9. To validate that the calibration is correct for the sensor type and range used in the chamber, Connect Type T extension wire to Input 1 terminals 62 (–) and 61 (+). Set the calibrator for Type T to simulate temperatures within your desired range of interest (for example +125°C and –55°C or +85°C and –40°C). The upper display on the F4 should be within ±1.55°C (above –50°C) or ±1.66°C (below –50°C) of the Type T simulator temperature setting.
10. Reattach the chamber's thermocouple wires to F4 terminals 62 (red wire) and 61 (blue wire). Observe that the upper display on the F4 controller is reading correctly.



### ***Operations Page***

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The Operations Page provides access to menus for control tuning (PID) and controller alarms. TestEquity has configured the security to require a password for access to all parameters in the Operations Page. You must call TestEquity at 877-512-3457 or 805-480-0638 to obtain the password.

**⚠ CAUTION:** The Series F4 Temperature Controller “Alarm” functions are NOT used in the chamber’s safety system and are NOT connected. 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 F4 Temperature Controller PID 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. Setup examples in the “Series F4 User’s Manual” are NOT applicable to this chamber. If there is any doubt, please call TestEquity before proceeding. The correct values are documented in the “Series F4 Temperature Controller Setup Parameters” section of this manual.

**⚠ CAUTION:** The Autotune PID function is not appropriate for use in this chamber. Using this function will result in tuning values that will not work correctly.

### ***Setup Page***

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The Setup Page provides access to menus for configuring the controller hardware. TestEquity has configured the security to require a password for access to the Setup Page. However, there will be times when entry into these menus is necessary. For example, you may need to gain access to Setup Page in order to change from °C to °F display, or to change the time or date. You must call TestEquity at 877-512-3457 or 805-480-0638 to obtain the password.

**⚠ CAUTION:** The Series F4 Temperature Controller setup 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 setup values, unless you thoroughly understand what you are doing. Setup examples in the “Series F4 User’s Manual” are NOT applicable to this chamber. If there is any doubt, please call TestEquity before proceeding. The correct values are documented in the “Series F4 Temperature Controller Setup Parameters” section of this manual.

### ***Factory Page***

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The Factory Page provides access to menus for controller diagnostics and calibration. TestEquity has configured the security to require a password for access to the Setup Page. However, there will be times when entry into these menus is necessary. For example, you may need to gain access to Factory Page in order to perform a calibration, or to change the security password. You must call TestEquity at 877-512-3457 or 805-480-0638 to obtain the password.

**⚠ CAUTION:** NEVER select “Full Defaults” in the Factory/Test Menu. This will erase all the correct values which are documented in the “Series F4 Temperature Controller Setup Parameters” section of this manual.

## ***F4 Temperature Controller Setup Parameters***

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- △ **CAUTION:** The “Series F4 User’s Manual” is a general manual and is written by the manufacturer, Watlow, for a wide variety of applications and configurations. Not all features or functions are applicable. Only the capabilities of a model F4SH-CKA0-01, as described on page A.7 of the “Series F4 User’s Manual” are applicable. “Cascade Control” as described on page 3.6 of the “Series F4 User’s Manual” is not applicable in this configuration. The “Retransmit” function is available as an option.
- △ **CAUTION:** The Series F4 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 “Series F4 User’s Manual” 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:** The alarm outputs of the Temperature Controller are NOT connected to the chamber’s safety system. TestEquity does NOT recommend using the Temperature Controller’s alarm function as the main protection device.
- △ **CAUTION:** NEVER select “Full Defaults” in the Factory/Test Menu. “Full Defaults” are NOT the TestEquity configuration parameters for this chamber. If you select “Full Defaults”, you must reconfigure all System and Operation Parameters as documented in the TestEquity manual, NOT the “Series F4 User’s Manual”.

TestEquity has configured the Temperature Controller with the parameters as documented on the following pages. Make sure you are referring to the correct configuration which matches the model number of your chamber.

You will need a password to enter the System and Operations menus. You must call TestEquity at 877-512-3457 or 805-480-0638 to obtain the password.

## F4 System Parameters (Models 106 & 107 only)

<p><b>System Menu</b> Main Page\Go to Setup\System</p> <p>Choose GSB1 Source     Input1 Guaranteed Soak Band 1     3.0 °C (5.4 if °F) PID Units     US F or C     C Show F or C     Yes Ch1 Autotune SP     90% Input 1 Fail     0% Open Loop Ch1     Off Power Out Time     10 Sec Power-Out Action     Continue</p> <p><b>Analog Input Menu</b> Main Page\Go to Setup\ Analog Input 1</p> <p>Choose Sensor     Thermocouple Type     T Choose Decimal     0.0 SP Low Limit     -44.0 °C (-47.2 if °F) SP High Limit     130.0 °C (266.0 if °F) Calibration Offset     0 Filter Time     1.0 sec Error Latch     Self-Clear</p> <p><b>Digital Input Menu</b> Main Page\Go to Setup\ Digital Input (1-4)</p> <p>Name     DIGIT IN (1-4) Function     Off</p>	<p><b>Control Output Menu</b> Main Page\Go to Setup\ Control Output (1A-1B)</p> <p><b>\Control Output 1A</b> Function     Heat Process Type     Fixed Time Cycle Time     3.0 sec Hi Power Limit     100 % Low Power Limit     0 %</p> <p><b>\Control Output 1B</b> Function     Cool Process Type     Fixed Time Cycle Time     10.0 sec Hi Power Limit     100 % Low Power Limit     0 %</p> <p><b>Alarm Output Menu</b> Main Page\Go to Setup\ Alarm Output (1, 2)</p> <p><b>\Alarm Output 1</b> Choose to Name     Yes Name     TEMP ALARM Type     Process Source     Input 1 Latching     Alarm Latches Silencing     Yes Alarm Hysteresis     1.7 °C (3.0 if °F) Sides     Both Logic     Open on Alarm Show Message     Yes on Main Page</p> <p><b>\Alarm Output 2</b> Choose to Name     Yes Name     FACTORYSET Alarm Type     Process Alarm Source     Input 1 Latching     Alarm Self-Clears Silencing     No Alarm Hysteresis     1.7 °C (3.0 if °F) Alarm Sides     Low Alarm Logic     Close on Alarm Show Message     No</p>	<p><b>Digital Output Menu</b> Main Page\Go to Setup\ Digital Output (1-8)</p> <p><b>\Digital Output 1</b> Name     Yes Name Digital Output     TEMP Function     Event Output</p> <p><b>\Digital Output 2 through 7</b> Name     No Function     Event Output</p> <p><b>\Digital Output 8</b> Name     No Function     Compressor Comp. On % Power     -2% Comp. Off % Power     25% Comp. Off Delay     30 sec Comp. On Delay     10 sec</p> <p><b>Communications Menu</b> Main Page\Go to Setup\ Communications</p> <p>Baud Rate     9600 Address     1</p> <p><b>Custom Main Page Menu</b> Main Page\Go to Setup\System\ Custom Main Page</p> <p>P1     Current File P2     Current Step P3     Set Point 1 P4     Step Type P5     Target SP1 P6     Wait For Status P7     Jump Count P8     Time Remaining P9     Digital Outs P10     % Power 1 P11     Time P12     Date P13     Static Message 1 P14     None P15     None P16     None</p> <p><b>Static Message Menu</b> Main Page\Go to Setup\ Static Message</p> <p>Message 1     TESTEQUITY XXX (XXX is 106 or 107 depending on model)</p>
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## F4 System Parameters (All models except 106, 107, 3007C)

<p><b>System Menu</b>  <b>Main Page\Go to Setup\System</b>                  GSB 1 Source           Input 1                  Guar. Soak Band 1     3.0 °C (5.4 if °F)                  Current Time           (local time)                  Current Date           (local date)                  PID Units               US, Reset/Rate                  °F or °C                 °C                  Show °F or °C         Yes, Upper Display                  Ch1 Autotune SP       90%                  Input 1 Fail             0%                  Open Loop Ch1         Off                  Power-Out Time         10 Sec                  Power-Out Action       Continue</p> <p><b>Analog Input Menu</b>  <b>Main Page\Go to Setup\Analog Input1</b>                  Sensor                  Thermocouple                  Type                     T                  Decimal                 0.0                  SP Low Limit            See Note 1                  SP High Limit          175.0 °C (347.0 if °F)                  Calibration Offset     0.0                  Filter Time             1.0 sec                  Error Latch             Self-Clear</p> <p><b>Digital Input Menus</b>  <b>Main Page\Go to Setup\Digital Input (1-4)</b>                  Name                    No                  Function                 Off</p> <p><b>Control Output Menus</b>  <b>Main Page\Go to Setup\Control Output 1A</b>                  Function                Heat                  Choose Cycle Time     Fixed Time                  Enter Cycle Time      3.0 sec                  Hi Power Limit         100 %                  Low Power Limit        0 %</p> <p><b>Main Page\Go to Setup\Control Output 1B</b>                  Function                Cool                  Choose Cycle Time     Fixed Time                  Enter Cycle Time      6.0 sec                  Hi Power Limit         100 %                  Low Power Limit        0 %</p>	<p><b>Alarm Output Menus</b>  <b>Main Page\Go to Setup\Alarm Output (1-2)</b>                  Name                    No                  Alarm Type             Process                  Source                 Input 1                  Latching               Alarm Self-Clears                  Silencing               Yes                  Hysteresis             1.7 °C (3.0 if °F)                  Alarm Sides            Both                  Alarm Logic            Open on Alarm                  Show Message         Yes on Main Page</p> <p><b>NOTE:</b> The alarm outputs of the Temperature Controller are NOT connected to the chamber's safety system. TestEquity does NOT recommend using the Temperature Controller's alarm function as the main protection device.</p> <p><b>Retransmit Output Menu</b>                  (if retransmit option is ordered)  <b>Main Page\Go to Setup\Retransmit Output 1</b>                  Retransmit Source     Set point 1                  Analog Range          0-5V                  Low Scale              See Note 1                  High Scale             175.0 °C (347.0 if °F)                  Scale Offset           0.0</p> <p><b>Main Page\Go to Setup\Retransmit Output 2</b>                  Retransmit Source     Input 1                  Analog Range          0-5V                  Low Scale              See Note 1                  High Scale             175.0 °C (347.0 if °F)                  Scale Offset           0.0</p>	<p><b>Digital Output Menu</b>  <b>Main Page\Go to Setup\Digital Output (1)</b>                  Name                    Yes                  Name Digital Output   CONDITION                  Function                Event Output</p> <p><b>Main Page\Go to Setup\Digital Output (2-7)</b>                  Name                    No                  Function                Event Output</p> <p><b>Main Page\Go to Setup\Digital Output 8</b>                  Function                Compressor                  Comp. On % Power      -2%                  Comp. Off % Power     2%                  Compressor Off Delay  60 sec                  Compressor On Delay  10 sec</p> <p><b>Communications Menu</b>  <b>Main Page\Go to Setup\Communications</b>                  Baud Rate              9600                  Address                 1</p> <p><b>Custom Main Page Menu</b>  <b>Main Page\Go to Setup\Custom Main Page</b>                  P1                      Current File                  P2                      Current Step                  P3                      Set Point 1                  P4                      Step Type                  P5                      Target SP1                  P6                      WaitFor Status                  P7                      Time Remaining                  P8                      Digital Outputs                  P9                      % Power 1                  P10                     Digital Inputs                  P11                     Date                  P12                     Time                  P13                     Custom Message 1                  P14                     None                  P15                     None                  P16                     None</p> <p><b>Static Message Menu</b>  <b>Main Page\Go to Setup\Static Message</b>                  Message 1              TESTEQUITY XXXX                  (XXXX is the actual Model Number)</p>
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**Note 1:**  
**Model 115A:** -74.0 °C (-101.0 if °F)  
**Model 123C, 140, 1007C, 1016C, 1027C:** -75.0 °C (-103.0 if °F)  
**Model 1007S, 1016S, 1027S:** -35.0 °C (-31.0 if °F)

## F4 System Parameters (Model 3007C only)

<p><b>System Menu</b>  <b>Main Page\Go to Setup\System</b>                  GSB 1 Source           Input 1                  Guar. Soak Band 1    3.0 °C (5.4 if °F)                  Current Time           (local time)                  Current Date           (local date)                  PID Units              US, Reset/Rate                  °F or °C                °C                  Show °F or °C         Yes, Upper Display                  Ch1 Autotune SP       90%                  Input 1 Fail            0%                  Open Loop Ch1         Off                  Power-Out Time        10 Sec                  Power-Out Action      Continue</p> <p><b>Analog Input Menu</b>  <b>Main Page\Go to Setup\Analog Input1</b>                  Sensor                 Thermocouple                  Type                    T                  Decimal                0.0                  SP Low Limit           -75.0 °C (-103.0 if °F)                  SP High Limit          175.0 °C (347.0 if °F)                  Calibration Offset     0.0                  Filter Time            1.0 sec                  Error Latch            Self-Clear</p> <p><b>Digital Input Menus</b>  <b>Main Page\Go to Setup\Digital Input (1-4)</b>                  Name                   No                  Function                Off</p> <p><b>Control Output Menus</b>  <b>Main Page\Go to Setup\Control Output 1A</b>                  Function               Heat                  Choose Cycle Time     Fixed Time                  Enter Cycle Time      3.0 sec                  Hi Power Limit         100 %                  Low Power Limit       0 %</p> <p><b>Main Page\Go to Setup\Control Output 1B</b>                  Function               Cool                  Choose Cycle Time     Fixed Time                  Enter Cycle Time      6.0 sec                  Hi Power Limit         100 %                  Low Power Limit       0 %</p>	<p><b>Alarm Output Menus</b>  <b>Main Page\Go to Setup\Alarm Output (1-2)</b>                  Name                   No                  Alarm Type            Process                  Source                 Input 1                  Latching               Alarm Self-Clears                  Silencing              Yes                  Hysteresis            1.7 °C (3.0 if °F)                  Alarm Sides           Both                  Alarm Logic           Open on Alarm                  Show Message         Yes on Main Page</p> <p><b>NOTE:</b> The alarm outputs of the Temperature Controller are NOT connected to the chamber's safety system. TestEquity does NOT recommend using the Temperature Controller's alarm function as the main protection device.</p> <p><b>Retransmit Output Menu</b>                  (if retransmit option is ordered)  <b>Main Page\Go to Setup\Retransmit Output 1</b>                  Retransmit Source    Set point 1                  Analog Range         0-5V                  Low Scale             -75.0°C (-103.0 if °F)                  High Scale            175.0°C (347.0 if °F)                  Scale Offset          0.0</p> <p><b>Main Page\Go to Setup\Retransmit Output 2</b>                  Retransmit Source    Input 1                  Analog Range         0-5V                  Low Scale             -75.0°C (-103.0 if °F)                  High Scale            175.0°C (347.0 if °F)                  Scale Offset          0.0</p>	<p><b>Digital Output Menu</b>  <b>Main Page\Go to Setup\</b></p> <p><b>Digital Output 1</b>                  Name                   Yes                  Name Digital Out.     CONDITION                  Function               Event Output</p> <p><b>Digital Output 2</b>                  Name                   Yes                  Name Digital Out.     LN2                  Function               Event Output</p> <p><b>Digital Output 3, 4, 5</b>                  Name                   No                  Function               Event Output</p> <p><b>Digital Output 6</b>                  Name                   No                  Function               Boost Heat                  Boost % Power         50%                  Boost Heat Delay Time 1 sec</p> <p><b>Digital Output 7</b>                  Name                   No                  Function               Boost Cool                  Boost % Power         50%                  Boost Cool Delay Time 1 sec</p> <p><b>Digital Output 8</b>                  Function               Compressor                  Comp. On % Power     -2%                  Comp. Off % Power    0%                  Compressor Off Delay 60 sec                  Compressor On Delay 10 sec</p> <p><b>Communications Menu</b>  <b>Main Page\Go to Setup\Communications</b>                  Baud Rate             9600                  Address                1</p> <p><b>Custom Main Page Menu</b>  <b>Main Page\Go to Setup\Custom Main Page</b>                  P1                     Current File                  P2                     Current Step                  P3                     Set Point 1                  P4                     Step Type                  P5                     Target SP1                  P6                     WaitFor Status                  P7                     Time Remaining                  P8                     Digital Outputs                  P9                     % Power 1                  P10                    Digital Inputs                  P11                    Date                  P12                    Time                  P13                    Custom Message 1                  P14-16                None</p> <p><b>Static Page Menu</b>  <b>Main Page\Go to Setup\Static Message</b>                  Message 1             TESTEQUITY 3007C</p>
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## F4 Operations Parameters (Models 106 & 107 only)

<p><b>PID Set Channel 1 Menu</b> Main Page\Go to Operations&gt;Edit PID\PID Set Channel 1\ PID Set (1-5)</p> <p><b>PID Set 1-5</b></p> <table style="width: 100%; border-collapse: collapse;"> <tr><td>Prop. Band A</td><td>3.0 °C (7.2 if °F)</td></tr> <tr><td>Reset A</td><td>0.10 min</td></tr> <tr><td>Rate A</td><td>0.00 min</td></tr> <tr><td>Dead Band A</td><td>0 °C</td></tr> <tr><td>Prop. Band B</td><td>3.0 °C (7.2 if °F)</td></tr> <tr><td>Reset B</td><td>0.10 min</td></tr> <tr><td>Rate B</td><td>0.00 min</td></tr> <tr><td>Dead Band B</td><td>0 °C</td></tr> </table>	Prop. Band A	3.0 °C (7.2 if °F)	Reset A	0.10 min	Rate A	0.00 min	Dead Band A	0 °C	Prop. Band B	3.0 °C (7.2 if °F)	Reset B	0.10 min	Rate B	0.00 min	Dead Band B	0 °C	<p><b>Alarm Setpoints Menu</b> Main Page\Go to Operations\Alarm Setpoints</p> <p><b>TEMP ALARM</b> (See Note 1)</p> <table style="width: 100%; border-collapse: collapse;"> <tr><td>Alarm1 Low SP</td><td>-44.0 °C (-47.2 ° if °F)</td></tr> <tr><td>Alarm1 High SP</td><td>130.0 °C (266.0 if °F)</td></tr> </table> <p><b>FACTORYSET</b> (See Note 2)</p> <table style="width: 100%; border-collapse: collapse;"> <tr><td>Alarm2 Low SP</td><td>-35.0 °C (-31.0 ° if °F)</td></tr> </table> <p><b>Note 1:</b> The Alarm1 output of the Temperature Controller is NOT connected to the chamber's safety system. TestEquity does NOT recommend using the Temperature Controller's alarm function as the main protection device.</p> <p><b>Note 2:</b> The Alarm2 output of the Temperature Controller is used for an internal process and is not available for customer use.</p>	Alarm1 Low SP	-44.0 °C (-47.2 ° if °F)	Alarm1 High SP	130.0 °C (266.0 if °F)	Alarm2 Low SP	-35.0 °C (-31.0 ° if °F)
Prop. Band A	3.0 °C (7.2 if °F)																						
Reset A	0.10 min																						
Rate A	0.00 min																						
Dead Band A	0 °C																						
Prop. Band B	3.0 °C (7.2 if °F)																						
Reset B	0.10 min																						
Rate B	0.00 min																						
Dead Band B	0 °C																						
Alarm1 Low SP	-44.0 °C (-47.2 ° if °F)																						
Alarm1 High SP	130.0 °C (266.0 if °F)																						
Alarm2 Low SP	-35.0 °C (-31.0 ° if °F)																						

## F4 Operations Parameters (All models except 106, 107)

<p><b>PID Set Channel 1 Menu</b> Main Page\Go to Operations&gt;Edit PID\PID Set Channel 1\ PID Set (1-5)</p> <table style="width: 100%; border-collapse: collapse;"> <tr><td>Proportional BandA</td><td>5.0 °C (9.0 if °F)</td></tr> <tr><td>Reset A</td><td>0.05 min (0.10 for Model 123C)</td></tr> <tr><td>Rate A</td><td>0.00 min</td></tr> <tr><td>Dead Band A</td><td>0.0 °C</td></tr> <tr><td>Proportional BandB</td><td>5.0 °C (9.0 if °F)</td></tr> <tr><td>Reset B</td><td>0.05 min (0.10 for Model 123C)</td></tr> <tr><td>Rate B</td><td>0.00 min</td></tr> <tr><td>Dead Band B</td><td>0.0</td></tr> <tr><td>Hysteresis</td><td>0.0</td></tr> </table>	Proportional BandA	5.0 °C (9.0 if °F)	Reset A	0.05 min (0.10 for Model 123C)	Rate A	0.00 min	Dead Band A	0.0 °C	Proportional BandB	5.0 °C (9.0 if °F)	Reset B	0.05 min (0.10 for Model 123C)	Rate B	0.00 min	Dead Band B	0.0	Hysteresis	0.0	<p><b>Alarm Setpoints Menu</b> Main Page\Go to Operations\Alarm Setpoints\Alarm1</p> <table style="width: 100%; border-collapse: collapse;"> <tr><td>Alarm1 Low SP</td><td>See Note 1</td></tr> <tr><td>Alarm1 High SP</td><td>175.0 °C (347.0 if °F)</td></tr> </table> <p><b>Main Page\Go to Operations\Alarm Setpoints\Alarm2</b></p> <table style="width: 100%; border-collapse: collapse;"> <tr><td>Alarm2 Low SP</td><td>See Note 1</td></tr> <tr><td>Alarm2 High SP</td><td>175.0 °C (347.0 if °F)</td></tr> </table> <p><b>NOTE:</b> The alarm outputs of the Temperature Controller are NOT connected to the chamber's safety system. TestEquity does NOT recommend using the Temperature Controller's alarm function as the main protection device.</p>	Alarm1 Low SP	See Note 1	Alarm1 High SP	175.0 °C (347.0 if °F)	Alarm2 Low SP	See Note 1	Alarm2 High SP	175.0 °C (347.0 if °F)
Proportional BandA	5.0 °C (9.0 if °F)																										
Reset A	0.05 min (0.10 for Model 123C)																										
Rate A	0.00 min																										
Dead Band A	0.0 °C																										
Proportional BandB	5.0 °C (9.0 if °F)																										
Reset B	0.05 min (0.10 for Model 123C)																										
Rate B	0.00 min																										
Dead Band B	0.0																										
Hysteresis	0.0																										
Alarm1 Low SP	See Note 1																										
Alarm1 High SP	175.0 °C (347.0 if °F)																										
Alarm2 Low SP	See Note 1																										
Alarm2 High SP	175.0 °C (347.0 if °F)																										

Note 1: Model 115A: -74.0 °C (-101.0 if °F)  
 Model 123C, 140, 1007C, 1016C, 1027C, 3007C: -75.0 °C (-103.0 if °F)  
 Model 1007S, 1016S, 1027S: -35.0 °C (-31.0 if °F)

### F4 Set Lockout Parameters (All Models)

The Series F4 Controller has several levels of security to prevent unauthorized users from changing critical configuration parameters. Only the Set Point and Profile menus have “Full Access”. TestEquity has configured all other menus to “Password”, and have protected them with a password.

TestEquity does not recommend that these security levels be changed for most applications. However, there will be times when “Full Access” is necessary. For example, you may need to gain access to Setup Page in order to change from °C to °F display, or to change the time or date. You must call TestEquity at 877-512-3457 or 805-480-0638 to obtain the password.

#### Set Lockout Menu

Main Page\Go to Factory\Set Lockout

Set Point	Full Access
Oper. Autotune PID	Password
Oper. Edit PID	Password
Oper. Alarm SP	Password
Profile	Full Access
Setup	Password
Factory	Password

### F4 Controller Service and Repair

There are no user-serviceable parts within the F4 controller. If there are any internal failures the entire controller must be replaced. To purchase a replacement F4 controller, contact TestEquity with the model and serial number of your chamber so we can provide a properly configured controller.

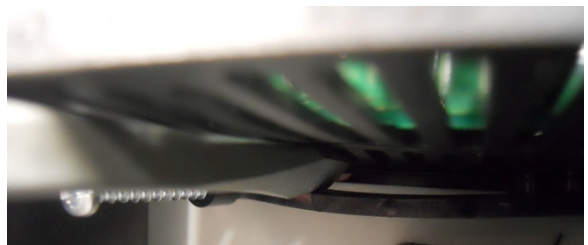
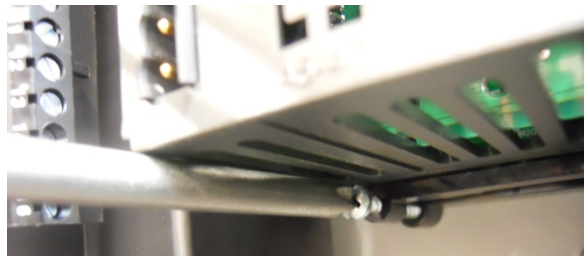


### Removing and replacing the F4 Controller

**Tools required:** One #2 phillips screwdriver, one 5/16" hex key (for 1000 and 3000 Series chambers), one flathead screwdriver and some means of supporting the controller as it slides out the front of the panel.

Before starting make sure the power cord is not plugged in. To access the electrical panel remove the top cover. Or, on the 1000 and 3000 Series chambers you will need to open the lower door. See the chamber manual for instructions on how to open the lower door. Pull the connectors off the back of the controller but leave the wires attached. You can simply remove the connectors from the replacement controller and attach the existing connectors instead. The controller can be removed by disengaging the mounting bracket hooks and pushing the controller forward through the panel. Be ready to support it as it slides forward through the panel.

1. Remove all the wiring connectors from the back of the F4 controller. Using the Phillips screwdriver, unscrew the four screws on the mounting bracket (start with the bottom two, there are two on top and two on bottom) until the tips are completely retracted into the shafts.
2. Slide the tip of a flat screwdriver between the case and the center bottom side of the mounting bracket. Rotate the screwdriver 90 degrees, stretching the bracket away from the case so the hooks on the bracket disengage from the slots on the case. Hold the bracket at the bottom so it does not re-engage. Slide the tip of a flat screwdriver between the case and the center top side of the mounting bracket. Rotate the screwdriver 90 degrees, stretching the bracket away from the case so the hooks on the bracket disengage from the slots on the case. Press the controller forward slightly to prevent the disengaged hooks from snapping back into the slots.
3. Press with one or two fingers on the lower half of the back of the unit so that the controller slides forward through the panel. Hold the bracket steady; do not pull back. Be ready to support the controller as it comes through the front panel. Remove the mounting brackets and retention collar from the back side of the panel.



## ***F4 Temperature Controller Specifications***

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Specifications as configured for the TestEquity Temperature Chambers

<b>Accuracy &amp; Sensor Conformity*</b>	$\pm 1.55^{\circ}\text{C}$ (above $-50^{\circ}\text{C}$ ) $\pm 1.66^{\circ}\text{C}$ (below $-50^{\circ}\text{C}$ )
<b>Stability</b>	$\pm 0.1^{\circ}\text{C}/^{\circ}\text{C}$ rise in ambient
<b>Digital Inputs</b>	(Four) Contact closure or dc voltage, 10 k $\Omega$ impedance
<b>Retransmit Outputs (Optional)</b>	(Two) User-selectable ranges: 0 to 10 VDC, 0 to 5 VDC, 1 to 5 VDC 0 to 20 mA, 4 to 20 mA
<b>Alarm Outputs</b>	(Two) Electromechanical relay; Form C, 2 A @ 20 VDC or 240 VAC max.
<b>Digital Outputs</b>	(7 available for customer use) Open collector output OFF: 42 VDC @ 10 $\mu\text{A}$ max. ON: 0.2 VDC @ 50 mA sink max. Internal supply: 5 VDC @ 80 mA
<b>Communications</b>	EIA-232 and EIA-485 serial communications with Modbus™ RTU protocol
<b>Safety &amp; Agency Approvals</b>	UL/c-UL 916-listed, File #E185611 CE to EN61010 NEMA 4X and IP65 CE EMC to EN50082-2 CE EMC to EN55011
<b>Displays</b>	<b>Process:</b> 5, seven-segment red LED. <b>Interface Display:</b> 4-line high-definition green LCD; selectable $^{\circ}\text{C}$ or $^{\circ}\text{F}$
<b>Data Retention</b>	Retention upon power failure via nonvolatile memory (seven years for battery-backed RAM)

**\*Note:** Total system accuracy in the chamber includes thermocouple wire accuracy. Thermocouple wire accuracy is  $\pm 1^{\circ}\text{C}$  or 0.75% of reading, whichever is greater. Therefore, total system accuracy over the chamber's operating range can be as much as  $\pm 2.66^{\circ}\text{C}$ , although the typical accuracy is often better than  $\pm 1.0^{\circ}\text{C}$ .