



WEB CONTROLLER SOFTWARE
Version 3
USER'S MANUAL

- Read this operation manual thoroughly before operating the equipment.
- Familiarize yourself with all safety precautions before using the equipment.
- Keep this operation manual handy for future reference.

ESPEC NORTH AMERICA, INC.

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Read this manual thoroughly and familiarize yourself with all safety precautions before using equipment.

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Part I

Introduction

CHAPTER 1

Introduction

This manual provides information for the use of ESPEC Web Controller, Version 3. ESPEC Web Controller is capable of communicating and controlling the following programmable logic controllers (PLCs): ESPEC P-300, SCP-220, Watlow F4 and F4T, Allen Bradley CompactLogix, ControlLogix and Micro8xx series. Communication can be established via an Ethernet TCP/IP protocol through an Ethernet port or via an RS-232/RS-485 through a serial or USB-to-Serial interface.

ESPEC Web Controller is an embedded computer powered by GNU/Linux operating system based on Debian distribution. The hardware platform is an embedded UP2Board x86 architecture by AAEON. Through stack programming, this embedded computer is customized and configured to utilize a standard Web browser to provide (i.e., host) its user interface (UI) to operate and control the chamber; hence, the name Web Controller. The system can be part of a network using its unique hostname and IP address. Thanks to the ability of a Web browser to operate from any computer on the network, operations of the chamber can be performed via the Web Controller UI remotely by authorized users. Access to ESPEC Web Controller is possible only for any device on the same network. No device outside the network can access ESPEC Web Controller, unless the network is configured to host port forwarding.

With ESPEC Web Controller, the tedious process of controlling or programming the chamber via the controller HMI is now replaced with the UI of the Web Controller which offers multi-tasking capabilities. Many practical features offered by ESPEC Web Controller include chamber alerts via an e-mail communication, remote operation through RESTful API, data-logging, access to other Web Controllers (and chambers) on the same network, and much more. These and other features will be described in detail in this manual.

To guard against security breach on ESPEC Web Controller, its root filesystem is configured to permit read-only access. By nature, the GNU/Linux operating system alone is already a secure system. However, the read-only access to the system's root filesystem puts in place another layer of defense mechanisms to deny an intruder the ability to install any software or modify the system's configurations. To provide robustness in terms of stability and self-correct operation, ESPEC Web Controller has a dual root partition structure. This configuration ensures that during a system update (or upgrade) at least one root partition is always in the stable operating state. This feature thereby provides seamless updates and overall system management. In short, ESPEC Web Controller is robust, secure, easy to manage and operate.

1.1 How to Use this Manual

This user manual is split into separate parts, each containing specific chapters to address detailed discussion of each chamber and PLC that ESPEC Web Controller supports.

1. **PART I:** Introduction

All users must read PART I to understand how ESPEC Web Controller operates. This part discusses the general features of ESPEC Web Controller that include the user interface (UI), user account types, network configuration, initial setup and end-users policies.

2. **PART II:** T-Series Chamber

For ESPEC T-series chamber, navigate to this part for its operation manual.

3. **PART III:** ESPEC Chamber with Watlow F4T

For ESPEC chamber with Watlow F4T, navigate to this part for its operation manual.

4. **PART IV:** ESPEC Chamber with Watlow F4

For ESPEC chamber with Watlow F4, navigate to this part for its operation manual.

5. **PART V:** ESPEC P300 Chamber

For ESPEC chamber with P300, navigate to this part for its operation manual.

6. **PART VI:** ESPEC SCP220 Chamber

For ESPEC chamber with SCP220, navigate to this part for its operation manual.

7. **PART VII:** Settings

The **Settings** menu is the administration page of ESPEC Web Controller where different settings and configurations can be applied to the Web Controller and the chamber.

1.2 Operating System, Software or Hardware Requirement

No software installation is required to use the Web Controller. Only a Web browser running on the local computer is needed to access the Web Controller via its IP address or hostname to control the chamber (see Chapter 2). A computer running MS Windows, Mac OS X or Linux can operate the Web Controller. A handheld device, such as a smartphone, on the same network can also access and operate the Web Controller.

1.3 Web browser Compatibility

ESPEC Web Controller supports the following Web browsers: Chromium, Google-Chrome, Mozilla Firefox, Microsoft Edge, Apple Safari and Opera. Microsoft Internet Explorer 11 can also be used to access and operate the Web Controller. However, due to its slow performance, the use of Microsoft Internet Explorer 11 is strongly discouraged.

1.4 ESPEC Web Controller Home Page

The following figure depicts the home page of ESPEC Web Controller, displayed using the Google Chrome Web browser. The Web Controller can be accessed via its IP address or its hostname. As depicted in the figure, it was accessed via its IP address (<http://10.30.100.108/>). Chapter 2 provides detail how to access the Web Controller via its IP address or its hostname from your local computer.

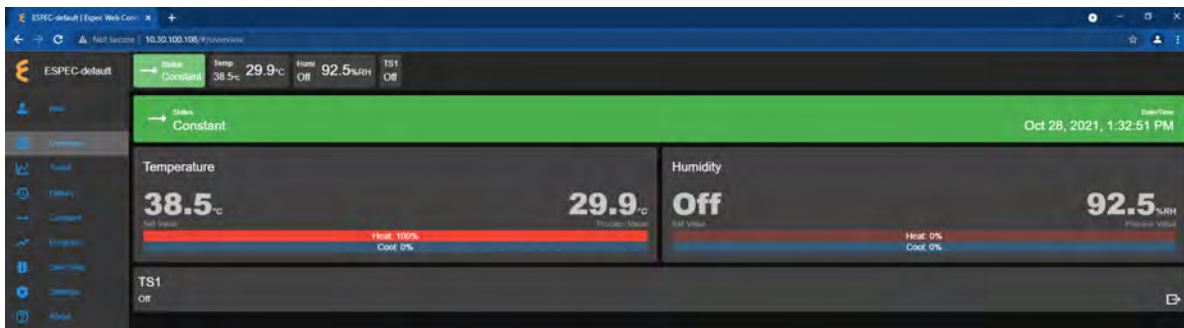


Figure 1.1: Web Controller home page

ESPEC Web Controller home page consists of the main operation menus grouped together in the menu bar which remains fixed on the left. Their descriptive names associated with their icons on the left identify their functionality.

The home page of ESPEC Web Controller is essentially the **Overview** menu. Every time the Web Controller starts, its home page is presented as an **Overview** page. Three display areas make up the Web Controller page, as depicted in the following figure. They are outlined and described as follows:

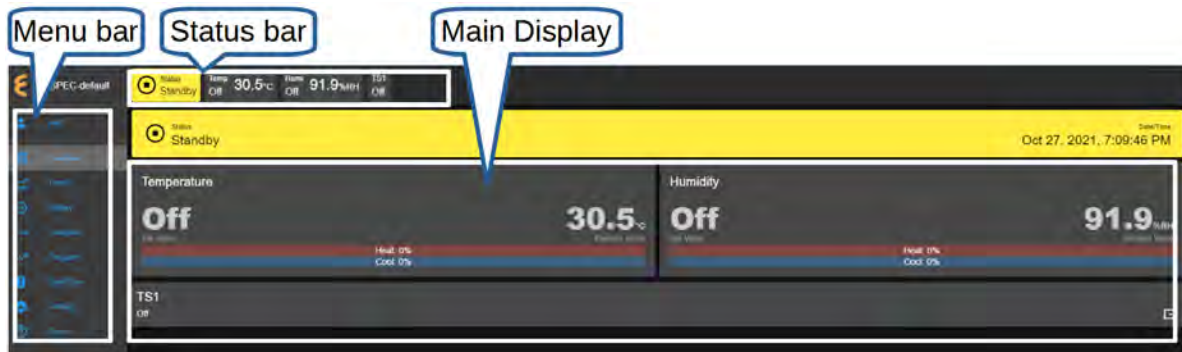


Figure 1.2: Overview page for users with full access privilege

1. **Menu bar:** The menu bar provides the main operation menu of ESPEC Web Controller which remains fixed on the left throughout the operation. The contents of each menu are displayed in the main display area (Item 3 below). **Settings** and **Program** menus contain submenus to offer further control of the Web Controller and operation of the chamber. Access permission to these menus is managed by the admin user. The **User Settings** sub-menu (under the **Settings** menu) allows the admin user to control access to the menu bar. Different types of access privilege are described in Section 1.5.
2. **Status bar:** The status bar displays the status of the chamber operation mode and its condition. The bar remains fixed on the top throughout the operation. The first tab (called status tab) displays the current status of the chamber operating modes, available in **Standby**, **Constant**, **Program** and **Alarm**. Depending on the type of chamber and controller, the next several tabs display the status of air temperature, product temperature, humidity, vibration, time signals, and refrigeration, including light fixtures in the chamber. The **Overview** menu discusses in detail the operation of these tabs.
3. **Main Display:** Contents associated with each specific menu in the menu bar are displayed in the main display area. The menu in the menu bar is highlighted to indicate its active status. As depicted in the above figure, the main display area displays the contents of the **Overview** menu, showing the current conditions of the chamber such as its temperature, humidity and time signal settings.

1.4.1 ESPEC Web Controller and HMI Touchscreen

During its startup (i.e., during booting), if ESPEC Web Controller detects a monitor connected directly to its HDMI or video display port, it will automatically start the graphical user interface on the detected monitor. This trigger applies to both a standard monitor or a touchscreen monitor. The dedicated touchscreen monitor is known as Web Controller HMI (attached onto

the front of the chamber). Standard operations on the Web Controller may be performed on this HMI.

The following figure depicts a typical home page of ESPEC Web Controller displaying the touch-screen menu bar designated and labeled as item 1. Components and functionality of the touch-screen menu bar are described as follows:

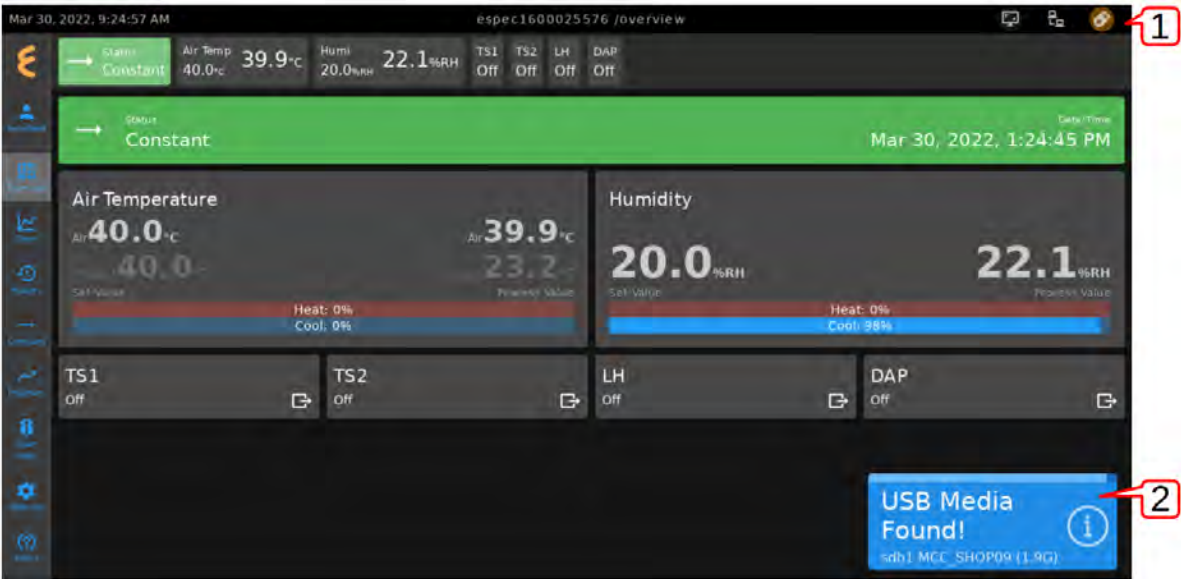


Figure 1.3: ESPEC Web Controller UI on its dedicated touchscreen monitor

1. **Touchscreen Menu Bar:** ESPEC Web Controller on its HMI has the touchscreen menu bar (at the top) to provide the touchscreen operation as shown above. It includes the URL that displays its current menu in the middle, three icons on the right (labeled as **Screen shot**, **Network Info** and **USB Device**) described as follows:

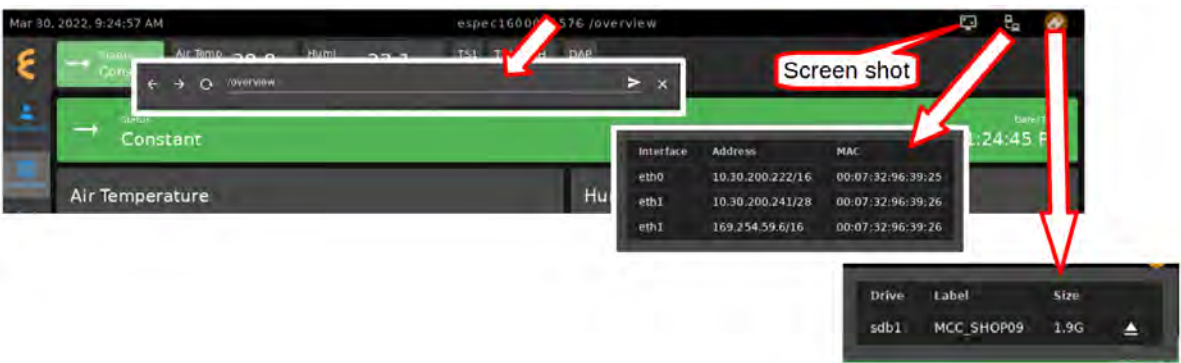


Figure 1.4: Touchscreen operational options

- **URL/Menu:** To access the URL menu bar, touch the middle area of the touchscreen menu bar indicated by the arrow. This URL displays the current menu of Web Controller. It provides an extended operation of Web Controller menu navigation, such as backward or forward menu, refresh the UI page, or access a new menu. It is probably easier to access a different menu via the menu bar (on the left via the touch op-

eration), but the URL field accepts input of a new menu by entering its name and pressing the right arrow.

- **Screen shot:** This button can only be used to take screen shots of the Web Controller UI if an external USB storage device is plugged into the USB port (on the HMI panel) and detected by the Web Controller. To use this button, first plug in the USB device.
 - **Network Info:** ESPEC Web Controller hardware has two Ethernet ports. They are labeled as **eth0** and **eth1**. Press this icon to list their IP address(es). As shown in the figure, **eth0** displays the IP address of the Web Controller with its MAC address, **eth1** displays the IP address. A user on the same network may access the Web Controller UI via the Web browser using the IP address on **eth0**. Detail of **eth0** and **eth1** is discussed in the **Settings** menu.
 - **USB Device:** This icon flashes in orange if a USB device is attached to the Web Controller. Do not unplug (that is, simply pull out) the USB thumb drive from the USB port. Doing so would corrupt the filesystem on the USB thumb drive. To disconnect the USB thumb drive from the Web Controller HMI, perform the following procedure:
 1. Touch the **USB Device** button.
 2. Touch the **Eject** button in the drop-down menu, as depicted above. The system will update the filesystem on the USB thumb drive and dismount it from the Web Controller. A pop-up window appears at the lower right to indicate the status of the ejection.
 3. Pull out your USB Thumb drive.
2. **USB Notification:** A notification is displayed when ESPEC Web Controller detects an external USB device. It displays the device name and storage space.

1.4.2 ESPEC Web Controller Display on Desktop

The **Overview** page automatically handles and renders the display based on the Web browser window or the monitor resolution. The menu bar will collapse to display only its icons if **Overview** cannot fit in the display window, as shown in the following figure. In order to maintain full display, the browser window has to be expanded (or maximized).

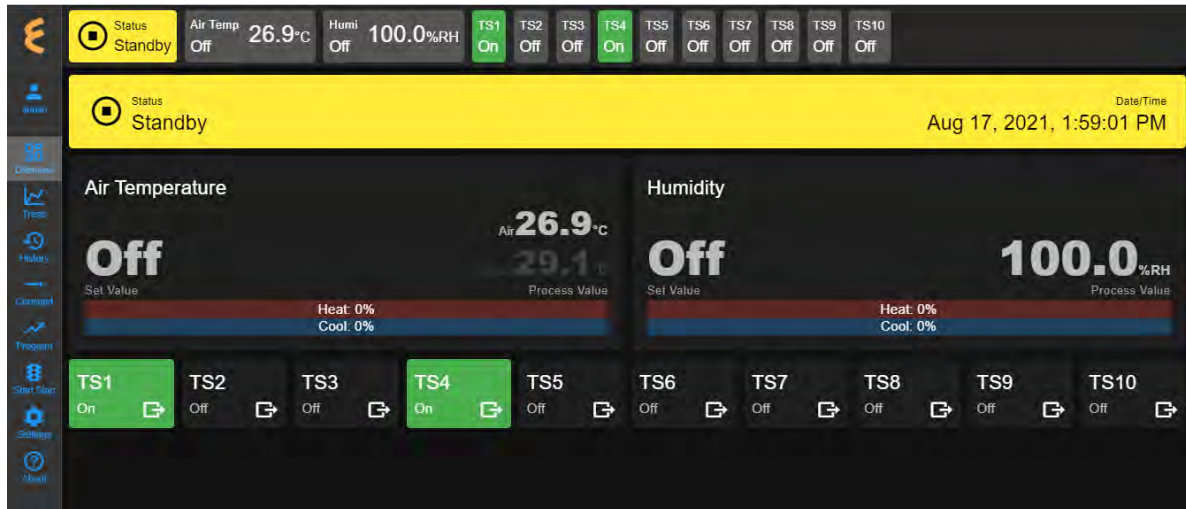


Figure 1.5: Overview page in a smaller display screen

1.4.3 ESPEC Web Controller Display on Handheld Device

ESPEC Web Controller can be accessed wirelessly via a handheld device, such as a tablet PC or a smartphone, provided the device is part of the main network that the Web Controller is connected to. Typical display of the Web Controller **Overview** page on a handheld device is depicted in the following figure.

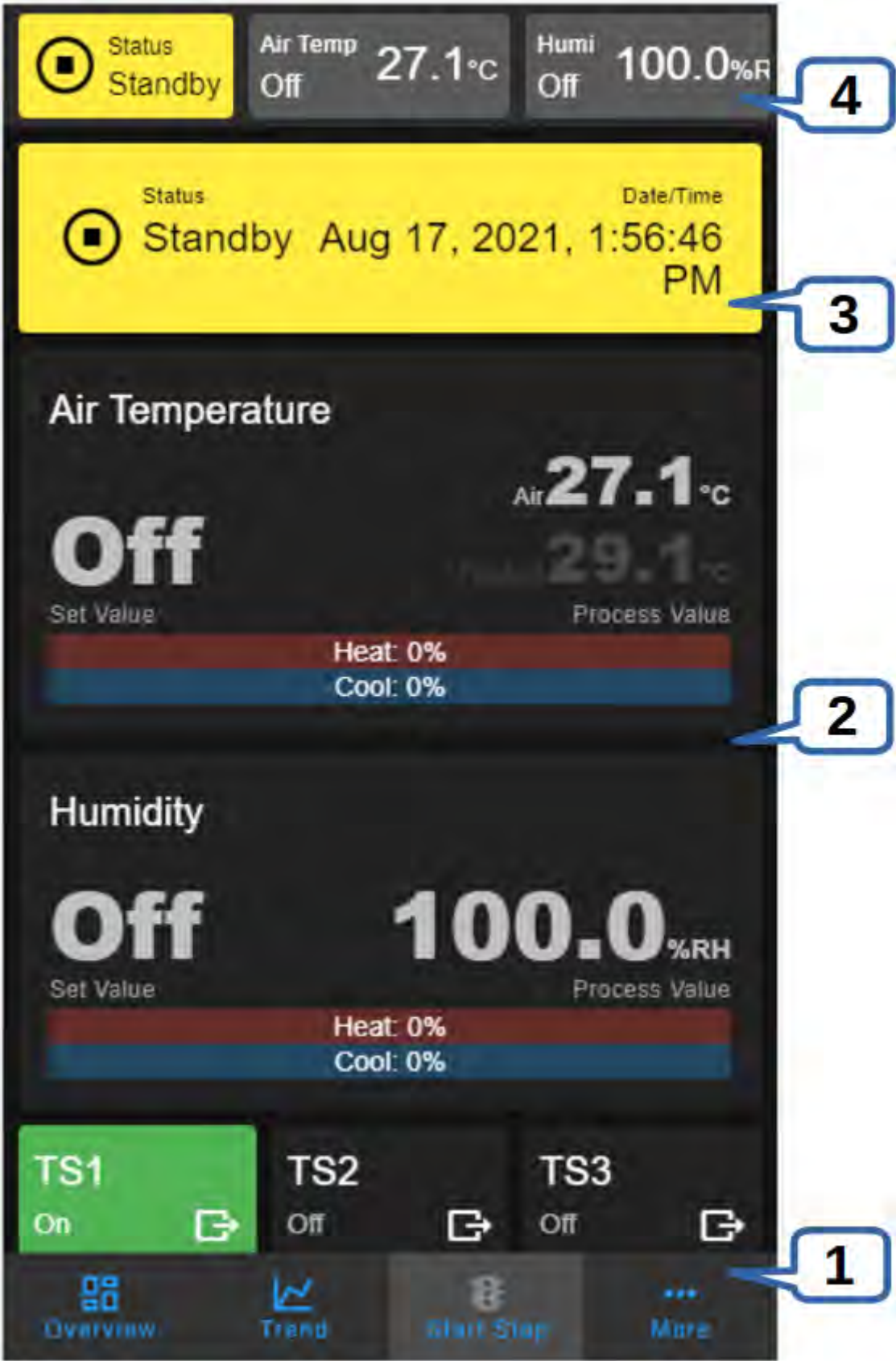


Figure 1.6: Overview page on a handheld device

1. **Tab bar:** The menu bar is relocated to the bottom of the page, called tab bar. As depicted in the above figure, three main menus are displayed. The rest of the menus can be accessed by tabbing on the **More** button. This action causes the menu to display in vertical bar. To close the vertical bar, tab on the down-arrow icon.
2. **Main Display:** The main display area provides a tab-up or tab-down action to access and control the chamber according to each selected (or active) menu.
3. **Status Tab Extension bar:** Still remains in the original position below the status tab, this extension bar of the status tab now opens as a drop-down menu to access and control all the operating modes.
4. **Status bar:** Still remains in the original position but displays only a few tabs, this status bar now becomes the slider bar.

The discussion in this manual will focus on the Web Controller operation using the Web browser on a desktop or laptop computer.

1.5 User Account Types

To help protect the chamber from getting damaged by unauthorized users or users with limited knowledge of the chamber operation, user accounts with different level of privileges can be created. ESPEC Web Controller is shipped with two user accounts with different level of privileges as outlined in the following table:

Account	Overview	Trend	History	Constant	Program	Start Stop	Settings
Guest	RO	RO	RO	NA	NA	NA	NA
Admin	RW	RW	RW	RW	RW	RW	RW

where **NA**, **RO** or **RW** under each menu has the following meaning:

- **NA** stands for No Access. Users with **NA** privilege cannot access the Web Controller menu in any form. Any menu associated with **NA** is grayed out; it is thus inaccessible to the user, as depicted in the following figure. Any attempt to access the grayed-out menu (by clicking on it), the user will be prompted to login.

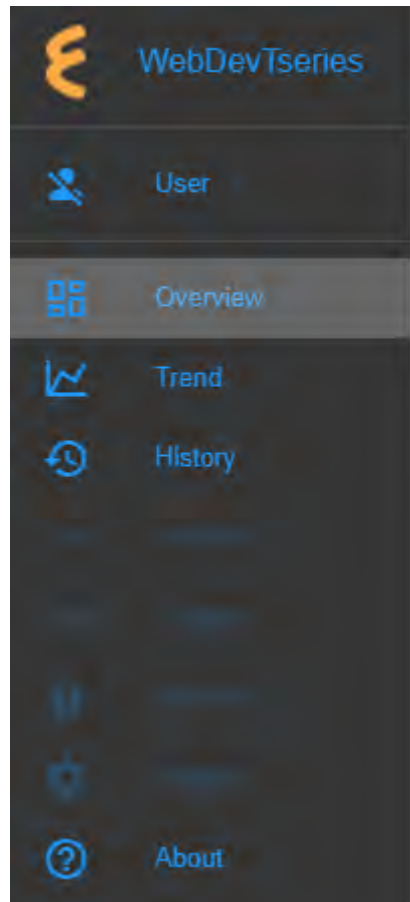


Figure 1.7: Overview page for users with limited access privilege

- **RO** stands for Read-Only access. Users with **RO** privilege may view the contents of any page (or menu). All clickable contents or links are disabled.
- **RW** stands for Read-Write access. Users with **RW** privilege can access, view and modify the contents of any page (or menu). All clickable contents or links may be accessed and/or modified by this user.

The Guest represents a user who does not have an account on the Web Controller. This user can access all the menus in browse or Read-Only mode (designated by **RO**). The administrator account called **admin** is one that has complete powers to operate the Web Controller, including managing user accounts.

These **NA**, **RO** and **RW** access types can be used by the administrator to assign access privilege to different user accounts on the Web Controller.

ESPEC Web Controller is shipped with the administrator account using the following credentials:

- **username:** admin
- **password:** admin

This password should be changed to something more secure. Additional accounts may be created to set different privileges for designated users as outlined in the **User Settings** submenu un the **Settings** menu (in the menu bar).

CHAPTER 2

Initial Setup and First-Time Use

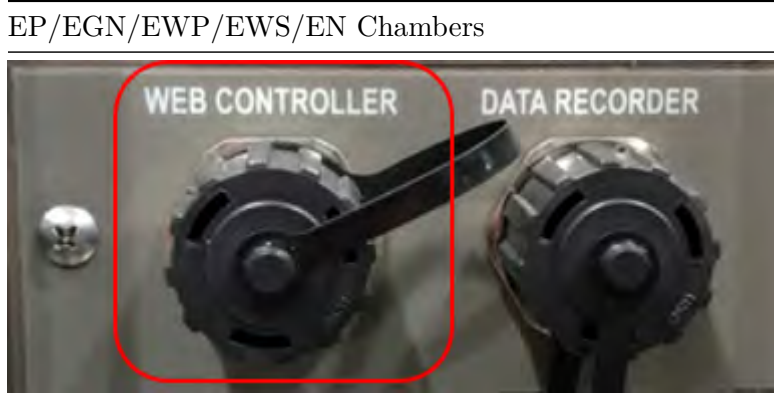
ESPEC Web Controller can be connected to a Dynamic Host Control Protocol (DHCP) network or a static network. The following sections describe how to set up the chamber and computer on these two types of network.

2.1 DHCP Network Setup

By default, ESPEC Web Controller applies DHCP to obtain an IP address assigned by the DHCP server to join the network. The configuration is done automatically on the Web Controller as soon as it detects a DHCP server on the network.

To connect the chamber (and Web Controller) to a DHCP main network, complete the following steps:

1. Plug an RJ-45 Ethernet cable into the Ethernet port on the chamber, as depicted in the following figure.



2. Plug the other end of the cable into an Ethernet port (or a router) that connects to the main network.
3. Your computer (PC or laptop) must also join the main network as shown in the following diagram.

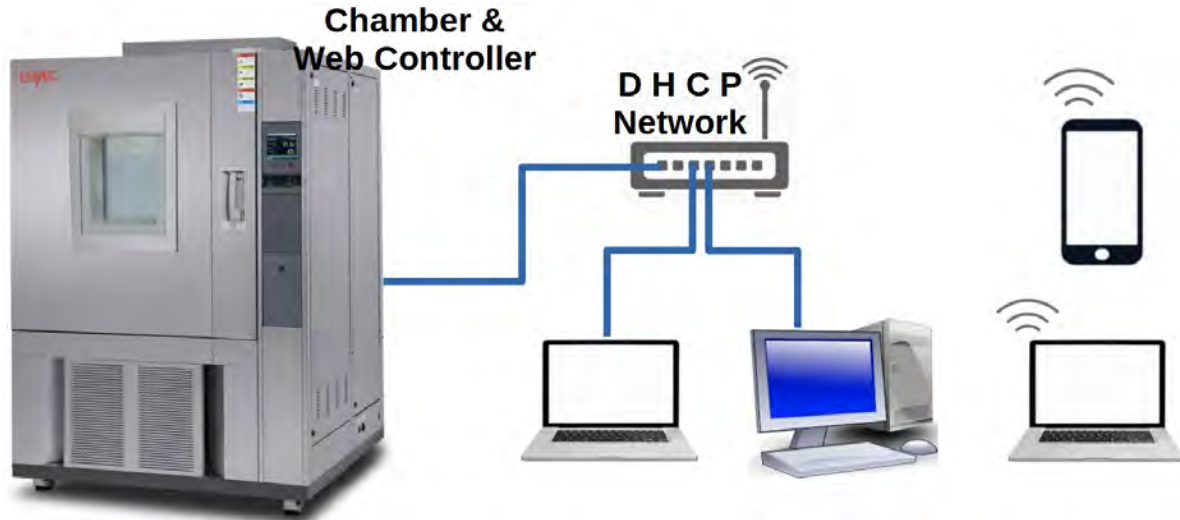


Figure 2.1: Network connection on a DHCP setup

To access and use the Web Controller wirelessly from a laptop (or a handheld device), that laptop (or handheld device) must also join the main network through a wireless connection.

2.2 Static Network Setup

2.2.1 Small Number of Network Hosts

By default, ESPEC Web Controller applies DHCP to obtain an IP address from the DHCP server to join the network. If DHCP service is not available, the Web Controller uses its pre-configured Class C static network settings called fallback static IP:

- **IP Address:** 192.168.0.83
- **Subnet Mask:** 255.255.255.0
- **Gateway:** 192.168.0.1

This static network protocol occurs when ESPEC Web Controller is connected directly to a computer via a crossover cable or a network hub without DHCP service. This preconfigured network protocol is suitable for a small number of hosts on the network where the first three groups of IP address (i.e., 192.168.0) identify the network and the last group defines the host.

To set up a Class C static network, complete the following steps:

1. Plug an RJ-45 Ethernet cable into the Ethernet port on the chamber.
2. Plug the other end of the cable into the Ethernet port of the computer or into an Ethernet port of a network hub. If a network hub is used, your computer must also connect to it via an Ethernet cable.
3. Your computer should be connected to the chamber directly or via a network hub as pictured below.

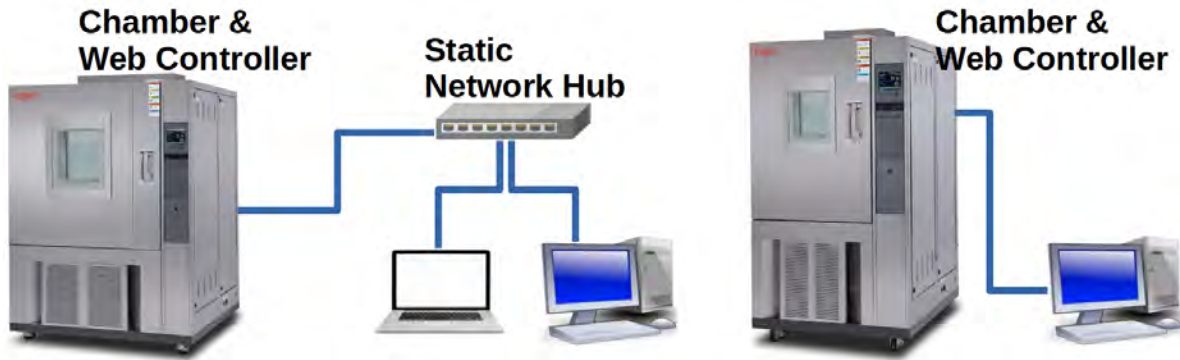


Figure 2.2: Network connection on a static setup

Your computer must also use a Class C network protocol. Complete the following steps to configure a static IP address with the following recommendation:

- **IP Address:** 192.168.0.84
- **Subnet Mask:** 255.255.255.0
- **Gateway:** 192.168.0.1
- **Preferred DNS server:** 8.8.8.8
- **Alternate DNS server:** 8.8.4.4

Administrative privilege may be required to perform the configuration on your computer. Your IT department may need to get involved in the preparation for the static network setup as this could become a complicated process. The following steps apply on MS Windows 7/8/10:

1. Hold down the **Windows** key and press **R** to launch the Run Command dialog box.
2. In the Run dialog box, enter **ncpa.cpl** into the Open box field and press **Enter**.
3. Point and Right-Click the “Local Area Connection” icon, then click Properties from the drop-down menu (as illustrated in the following figure). **NOTE:** The Local Area Connection icon is the one connected to a hub (or the Web Controller via a straight-through or crossover Ethernet cable). It is important to access the correct icon in case your computer has multiple Ethernet ports or devices.

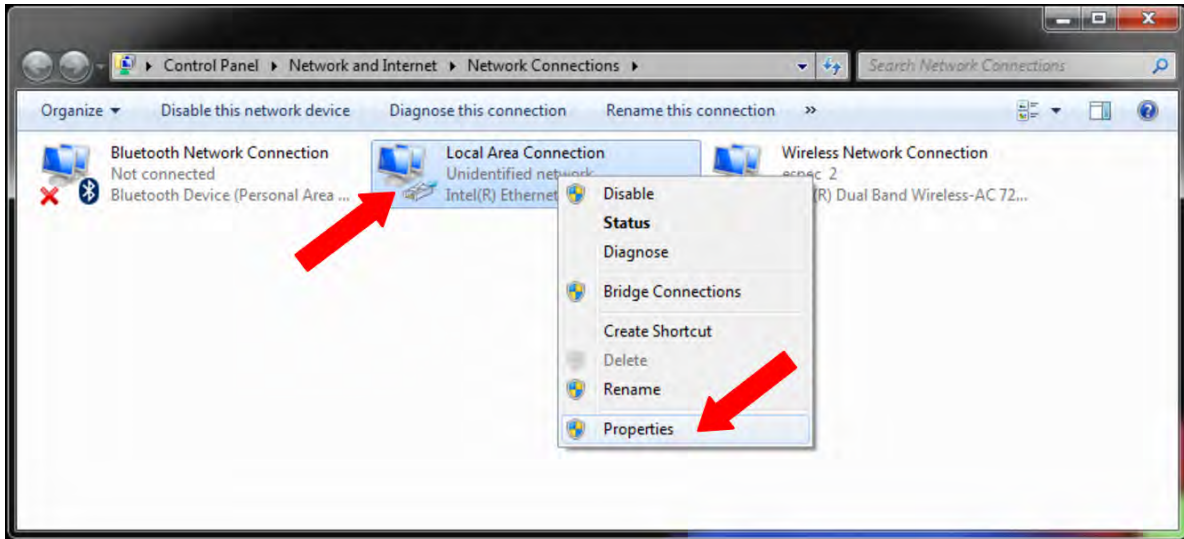


Figure 2.3: Selecting the right Local Area Connection

4. In the “Local Area Connection Properties” window, confirm that there is a check mark placed in front of “Internet Protocol Version 4 (TCP/IPv4)”, as illustrated in the following figure. If not, check it. Click to highlight “Internet Protocol Version 4 (TCP/IPv4)” and then click Properties in the lower-right corner.

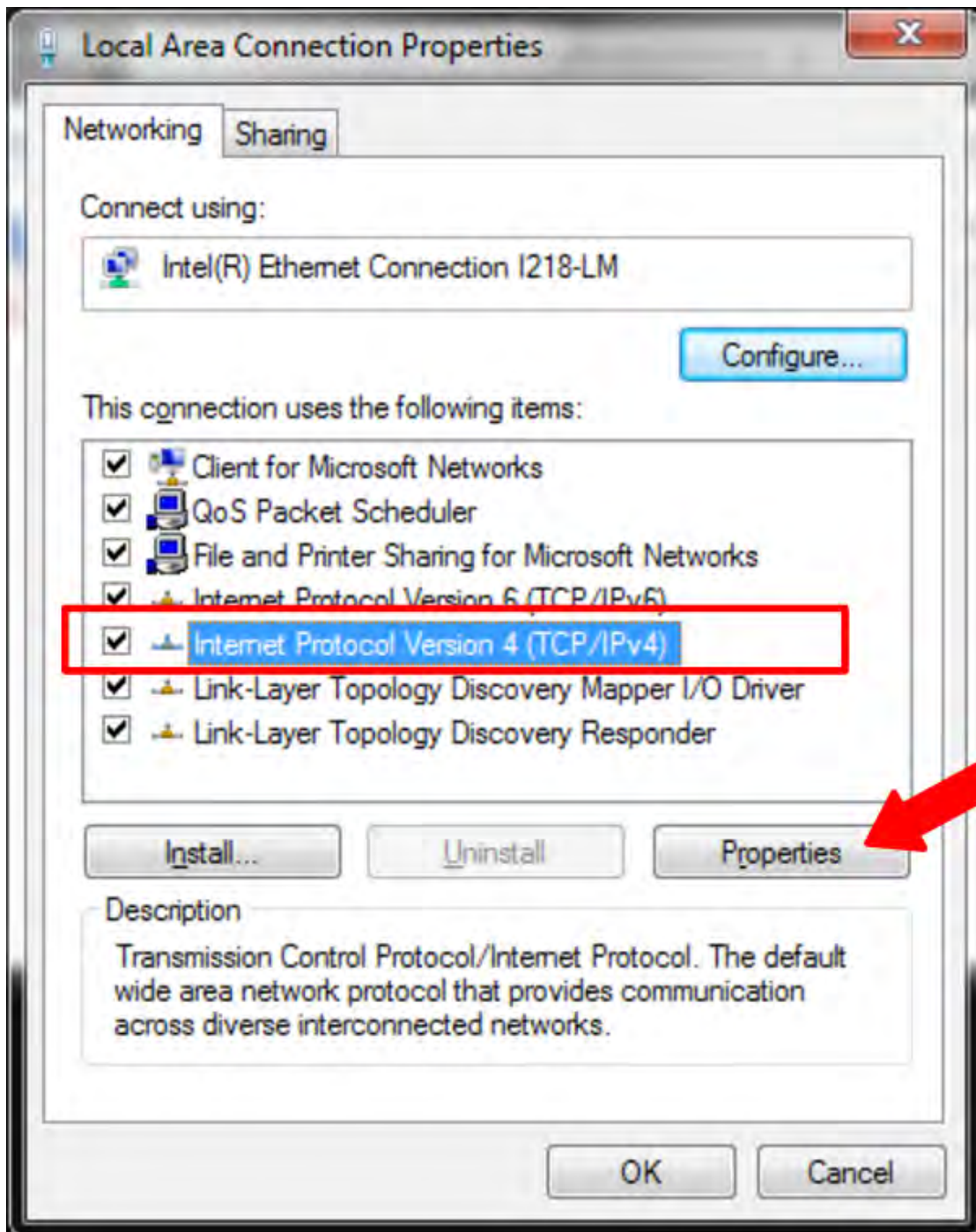


Figure 2.4: Setting TCP/IPv4 properties

5. In the “Internet Protocol Version (TCP/IPv4) Properties” window, turn on the radio button for “Use the following IP address:” and enter these settings (see the figure below):
 - **IP Address:** 192.168.0.84
 - **Subnet Mask:** 255.255.255.0
 - **Gateway:** 192.168.0.1
6. In the “Use the following DNS server addresses:” section, enter the following address (as shown in the following figure):
 - **Preferred DNS server:** 8.8.8.8
 - **Alternate DNS server:** 8.8.4.4
7. Turn on “Validate settings upon exit” with a check mark and click OK, as illustrated in the following figure.

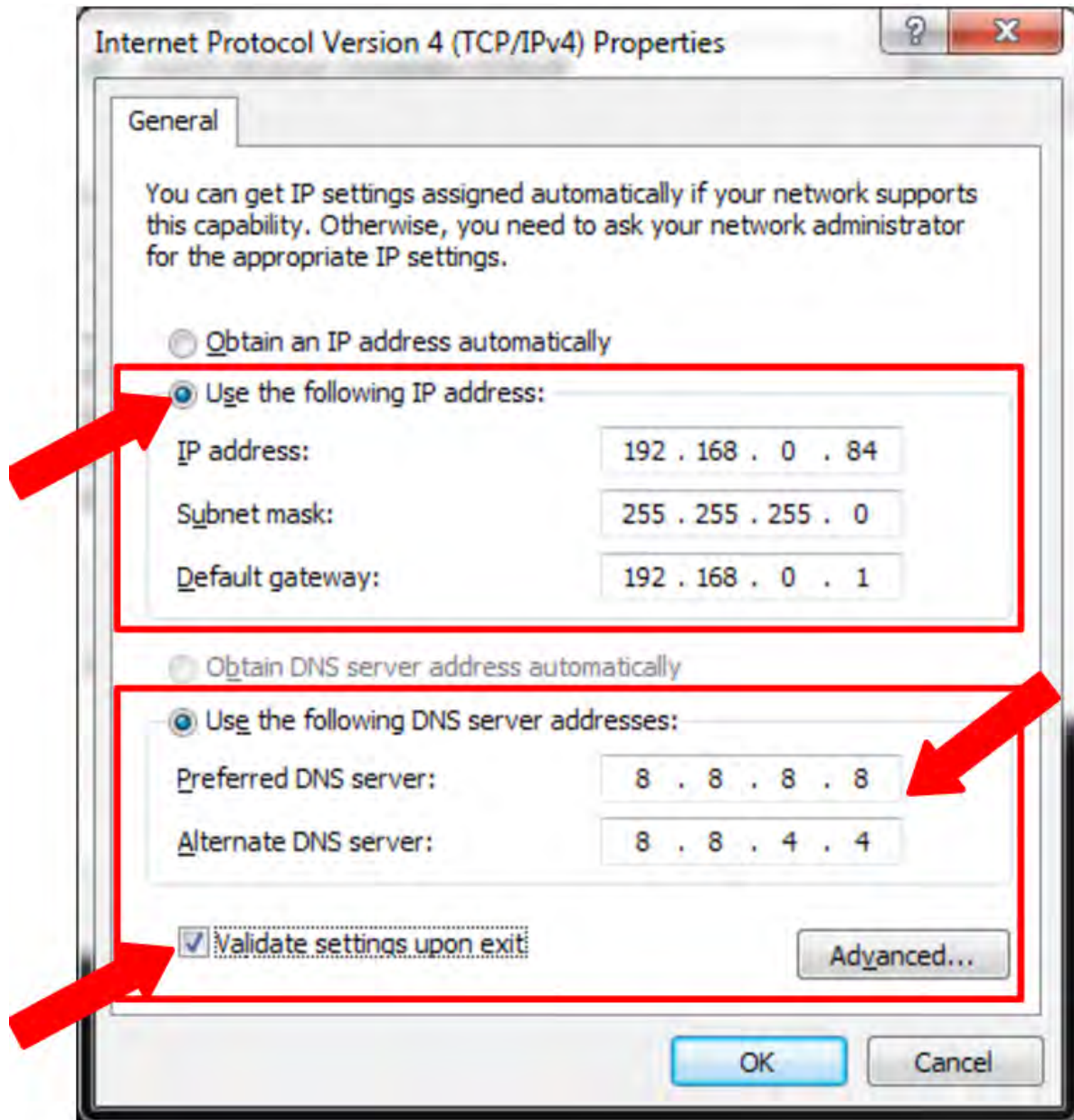


Figure 2.5: The complete static IP config on the TCP/IPv4 connection

8. Click OK to close “Local Area Connection Properties” window.
9. Close out the Network window.
10. To access the Web Controller, proceed to Section 2.3.2.

2.2.2 Large Number of Network Hosts

The Web Controller can use a static IP address on a network with large number of hosts, such as Class A or B. Your IT department will need to get involved in the configuration and provide a static IP address for the Web Controller to join your company network.

2.3 Accessing ESPEC Web Controller

ESPEC Web Controller can be accessed via its hostname or its IP address. If the Web Controller is shipped with the chamber as a single unit, its hostname is **ESPECserial#** where **serial#** is the serial number of the chamber which can be found on the label affixed on the chamber panel, as depicted in the following figure. If the Web Controller is purchased separately as a U-Web kit, its hostname is **ESPEC-default**. Follow the instructions that come with the U-Web kit to set up the Web Controller to join your DHCP or static network.

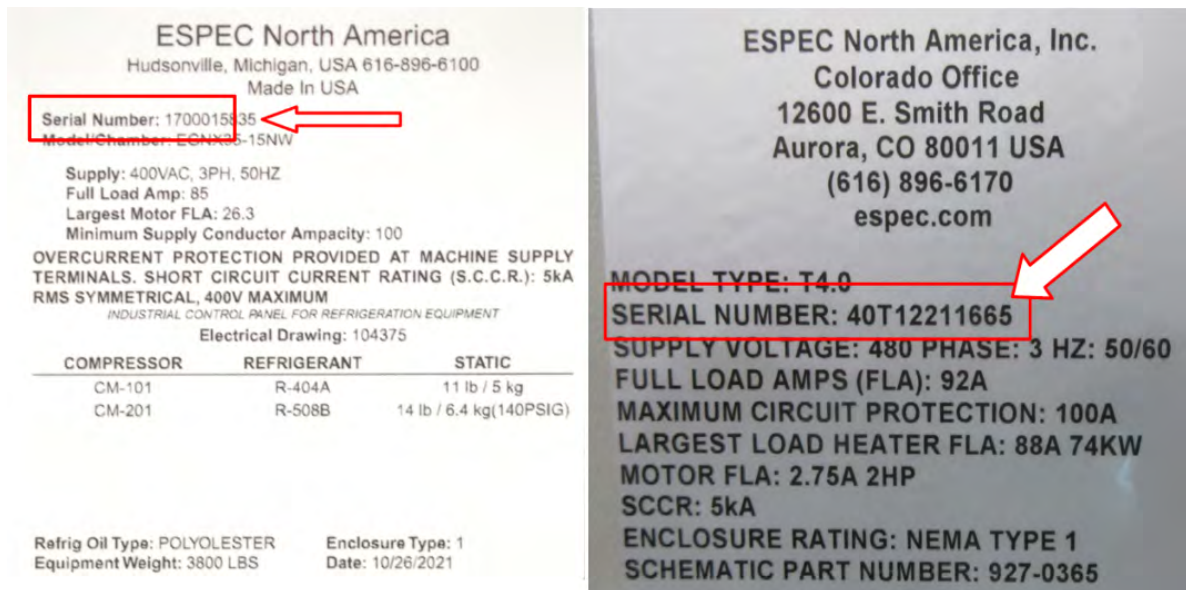


Figure 2.6: Serial number of the chamber

A new hostname can be assigned to the Web Controller via the **Settings** menu (described in Section 9.2). It is recommended that the default hostname be used during the initial setup. A new hostname may be assigned to the Web Controller after it has successfully joined the main network.

2.3.1 How to Locate ESPEC Web Controller Hostname or IP address

Looking up the hostname or IP address of ESPEC Web Controller on the network is possible via Locator utility. The software is MS Windows-based and executable on Windows 7/8/10.

Once executed, the utility scans for ESPEC Web Controllers (ver. 2.0 and higher) on the network. It displays hostname, IP address and firmware version, as depicted in the following figure. Hostname and IP address are listed as clickable links. The IP addresses are listed in the second column. To access the controller, click on its IP address. The hostname is accessible only if the computer can resolve it, in which case the hostname becomes a clickable link. The last entry in the figure also illustrates an example of a hostname which has not be resolved; and therefore, this Web Controller can only be accessed via its IP address.

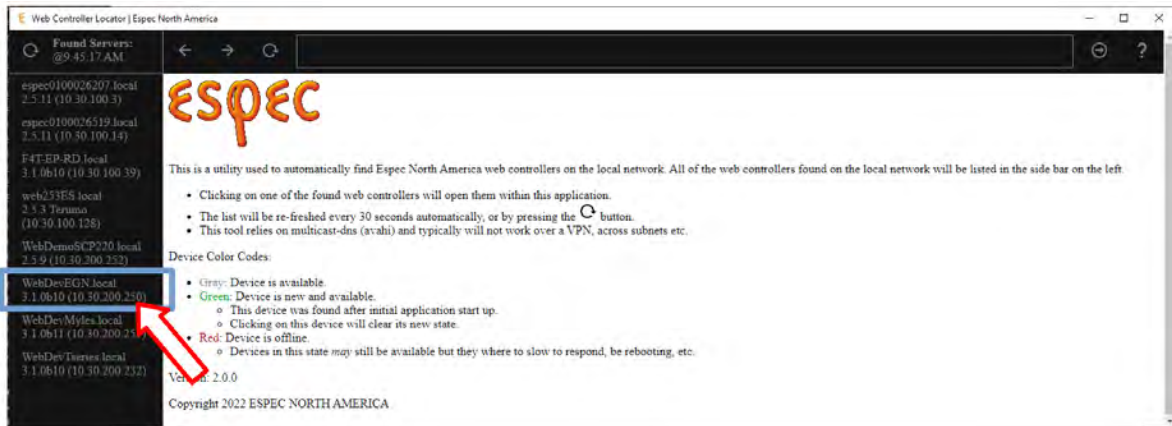


Figure 2.7: ESPEC Web Controller Locator Utility

With ESPEC P300 or Watlow F4T, another method exists via the PLC's HMI.

1. **P300 HMI:** When ESPEC Web Controller starts and is in communication with the chamber, it posts its hostname and IP address on the chamber's controller. On the P300, the IP address is displayed on the **Set LAN** screen. The following figure illustrates detailed steps to access and view the Web Controller's IP address on the P300 HMI.

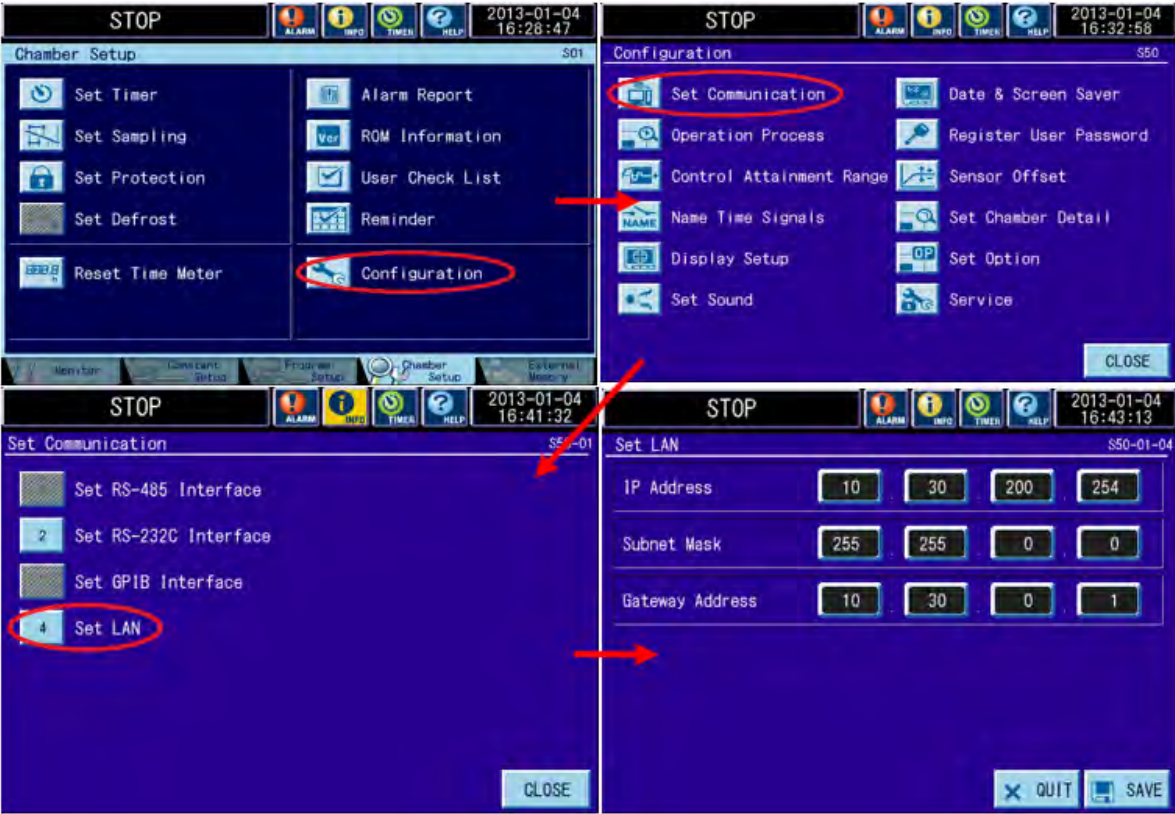


Figure 2.8: The “Set LAN” screen on the P300

2. **F4T HMI:** When ESPEC Web Controller starts and is in communication with the chamber, it posts its hostname and IP address on the chamber's controller. With Watlow F4T, this information is displayed on the **Message** tab via the **Controller Status** button, as depicted in the right image of the following figure.



Figure 2.9: The Watlow F4T message screen

2.3.2 Accessing ESPEC Web Controller on a DHCP Network

Complete the following steps to access the Web Controller on a DHCP network for the first time.

1. With both the chamber and computer joined the network as described in Section 2.1, apply power to both devices.
2. On your computer, open a Web browser of your choice based on the list provided in Section 1.3.
3. Enter `http://ESPECserial#.local/` in the URL address field of the Web browser, where `serial#` is the serial number of the chamber. For example, based on the serial number depicted in the previous figure, the hostname appears as: `http://ESPEC1700015835.local/`. If you cannot access your Web Controller via this method, use information in Section 2.3.1 to locate your Web Controller's IP address or hostname, and enter `http://hostname.local/` or `http://IP-address/` in the URL address field of the Web browser.
4. When ESPEC Web Controller is accessed for the first time, its **Setup Wizard** page will appear. Proceed to Section 2.4 to complete this **Setup Wizard** page.
5. If access failed, verify that both the chamber and computer are on the same network. Cycle power on the chamber to reboot the Web Controller and wait a few minutes before accessing the Web Controller again.
6. If the problem persists, contact Customer Support for assistance.

2.3.3 Accessing ESPEC Web Controller on a Static Network

Complete the following steps to access the Web Controller on a static network for the first time.

1. With both the chamber and computer joined a static network as described in Section 2.2, apply power to both devices.
2. On your computer, open a Web browser of your choice based on the list provided in Section 1.3.
3. Enter `http://192.168.0.83/` in the URL address field of the Web browser.
4. When the Web Controller is accessed for the first time, its **Setup Wizard** page will appear. Proceed to Section 2.4 to complete this **Setup Wizard** page.

5. If access failed, verify that both the chamber and computer are on the same network. Check to confirm that the computer uses a Class C network protocol as outlined in Section 2.2. The local computer must use an IP address 192.168.0.xxx, where xxx is any number other than 1 or 83. The recommended IP address is: 192.168.0.84. Cycle power on the chamber to reboot the Web Controller and wait a few minutes (three minutes) before accessing the Web Controller again.
6. If the problem persists, contact Customer Support for assistance.

2.4 ESPEC Web Controller and Setup Wizard

Before ESPEC Web Controller can be used for the first time, its basic settings must be confirmed and completed via the **Setup Wizard**. This process ensures that ESPEC Web Controller is configured correctly for the intended chamber, which includes the login configuration, chamber interface communication, e-mail alerts, network and administrator's password. The **Setup Wizard** page appears as follows:

1. **Login:** When prompted, log in with the administrator account credentials (Section 1.5) as follows:

2. **Terms of Service:** Scroll down the page to read and accept ESPEC terms of service in order to use the product.

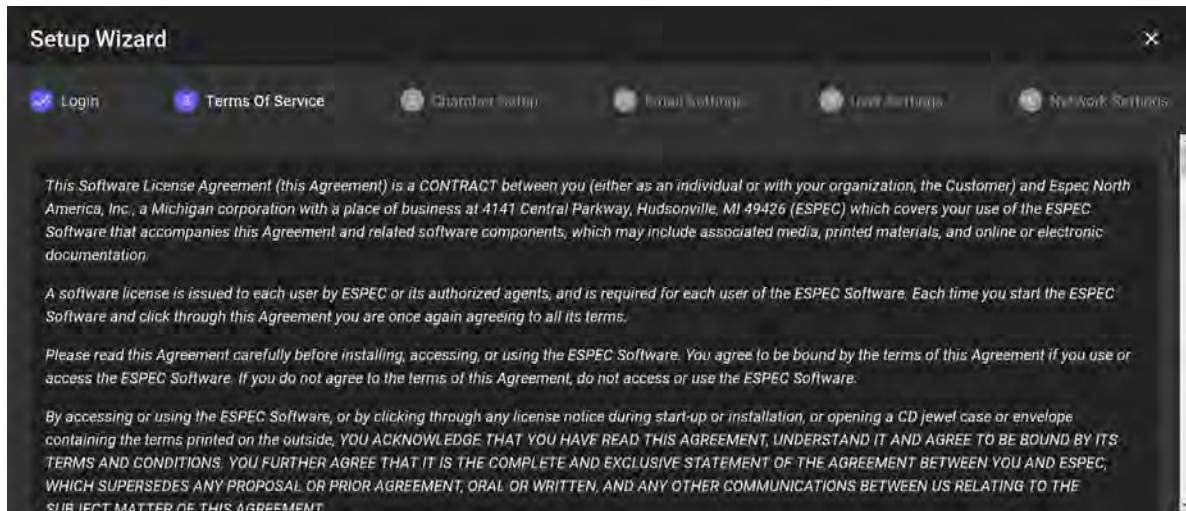


Figure 2.10: Terms of service and agreement

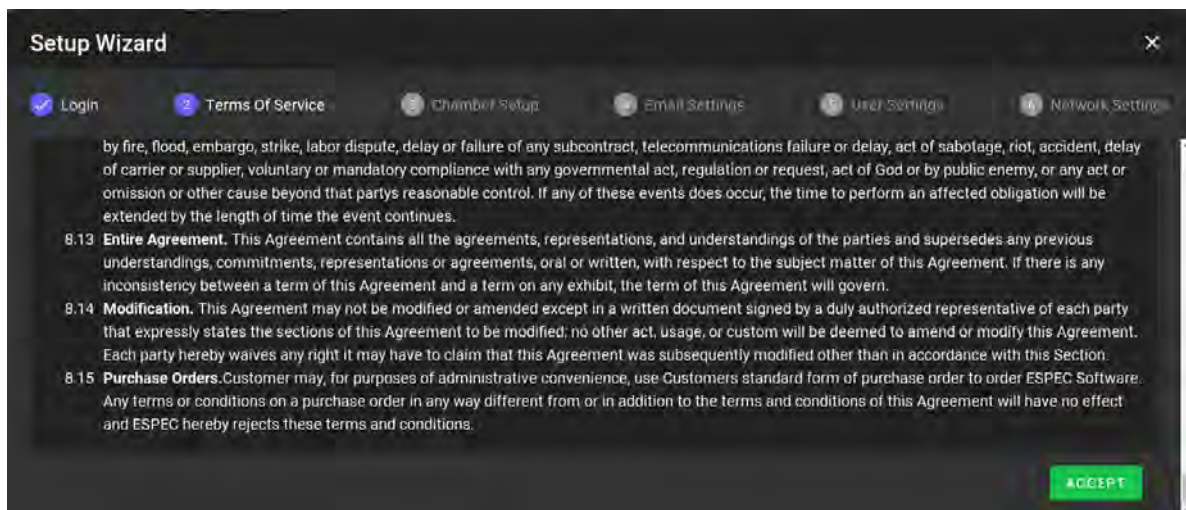


Figure 2.11: Accepting the Terms of service

If ESPEC Web Controller registration page appears as depicted in the following figure, enter the serial number of your chamber and click **REGISTER**; then, click **CLOSE** if necessary. Contact ESPEC customer service for detail about your registration.

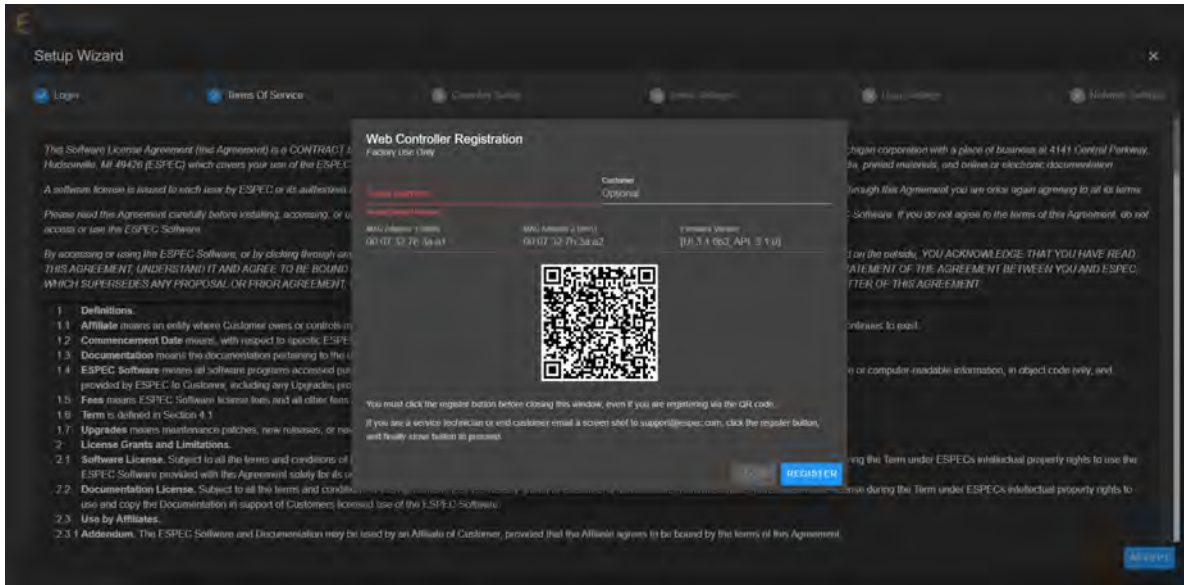


Figure 2.12: ESPEC Web Controller Registration

3. **Chamber Setup:** Verify that the correct target chamber/PLC has been selected and the right communication protocol is configured properly. A specific chamber type can be selected from the drop-down menu under the Chamber Category option.

1. **Watlow F4T:** The following figure illustrates how **BT: Benchtop** with F4T was selected as chamber category.

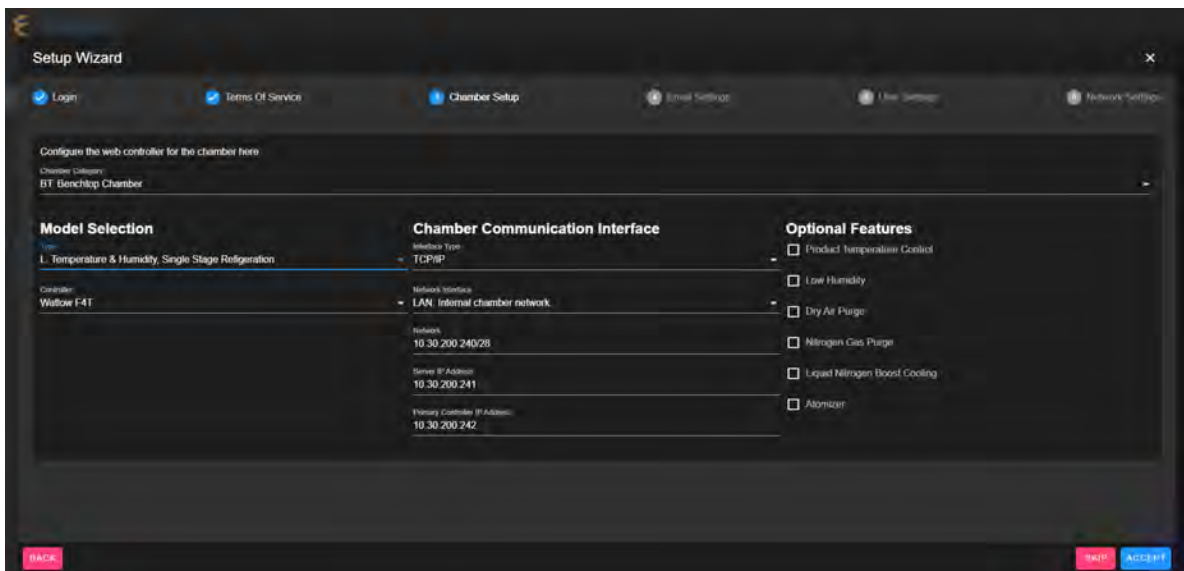


Figure 2.13: Chamber selection and configuration

Each selected chamber yields a list of model selection, communication interface and optional features. Refer to your chamber manual for the correct chamber category, model selection and operational features. With Watlow F4T, two types of communica-

tion interface are available: (1) TCP/IP and (2) Serial. Refer to your chamber manual for any optional feature which can be turned on by checking the box. Descriptions of these two communication types are outlined below. Click **ACCEPT** to apply the selection.

1. **TCP/IP:** The TCP/IP interface offers two options: (1) Internal LAN and (2) customer's network. Internal LAN is used as the default setting, where a network exists between ESPEC Web Controller and the F4T inside the chamber using a Class A network, with 10.30.200.241 assigned for ESPEC Web Controller IP address and 10.30.200.242 assigned for the F4T, as shown in the figure. The second option may be used if ESPEC Web Controller and chamber/F4T can (if allowed) connect to the customer's network for communication. This option requires rerouting the Ethernet cable from the F4T out to the customer's network.
2. **Serial:** The second communication interface is Serial via RS-232/RS-485. This option will require using F4T slot# 6 for the ModbusRTU serial communication module. This option will cut performance down tremendously in terms of communication speed between the the F4T and ESPEC Web Controller.
2. **T-Series Chamber:** The following figure illustrates how **T-Series Chamber** was selected as chamber category, with **Model Selection** T-series 2.5+ used for the configuration.

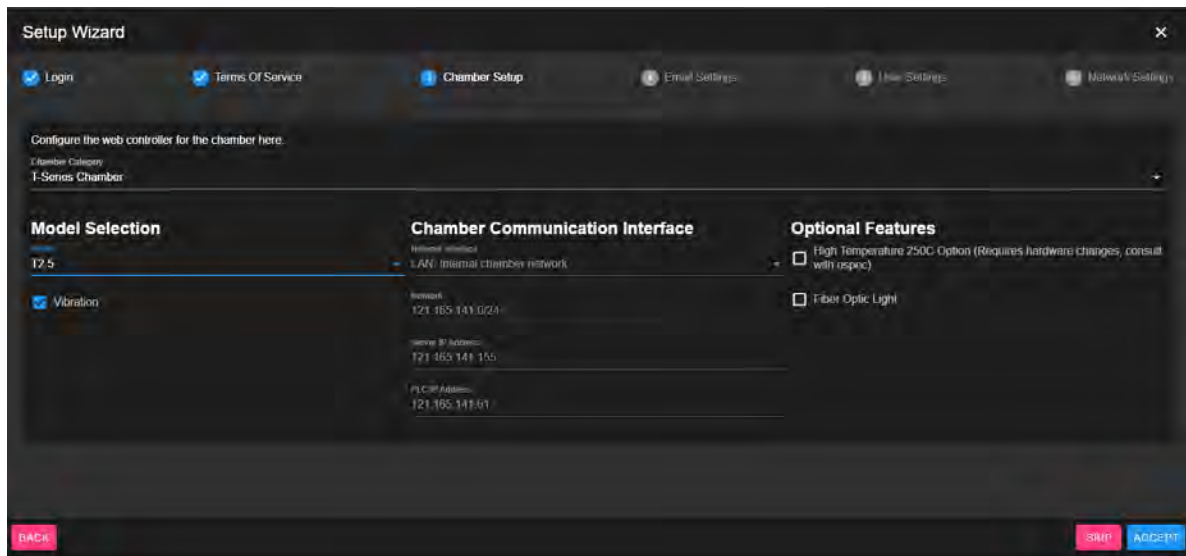


Figure 2.14: Chamber selection and configuration

Each selected chamber yields a list of model selection, communication interface and optional features. Refer to your chamber manual for the correct chamber category, model selection and operational features. TCP/IP is the default communication protocol for Allen Bradley PLC. Click **ACCEPT** to apply the selection.

3. **ESPEC P300:** The following figure illustrates how **EWP: Walk-in Chamber** with P300 was selected, with **Model Selection** type **Temperature Only, Cascade Refrigeration** for the configuration.

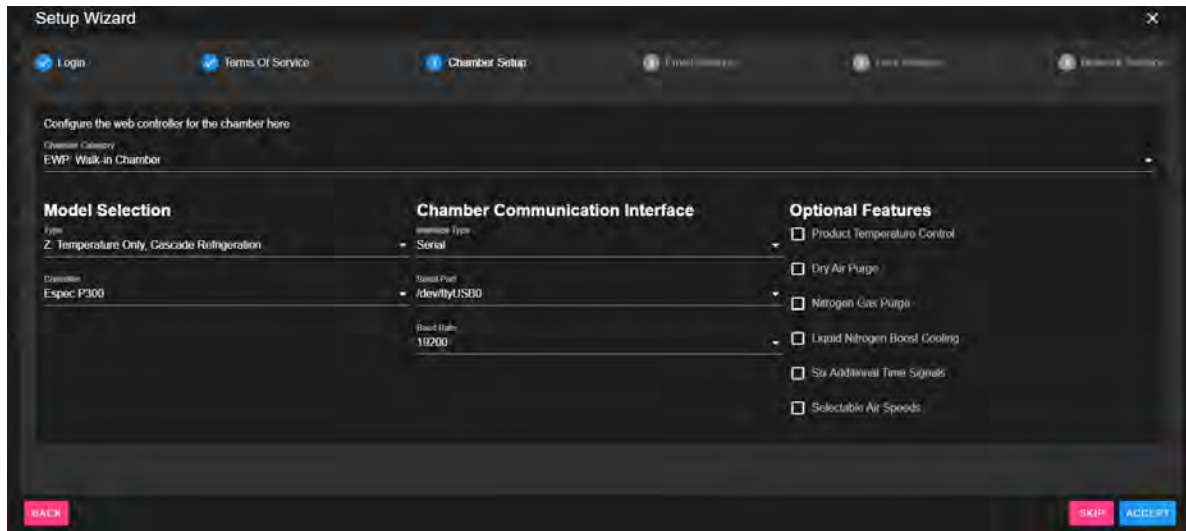


Figure 2.15: Chamber selection and configuration

For P300, communication interface type is **Serial** with baud rate of 19200. This baud rate must also be configured on the P300 (via its HMI). Its RS-232 communication must also be enabled. All of this should have been configured during testing at manufacturer's facility. Click **ACCEPT** to apply the selection.

4. **SCP220**: The following figure illustrates how **EWP: Walk-in Chamber** with SCP220 was selected for the configuration.

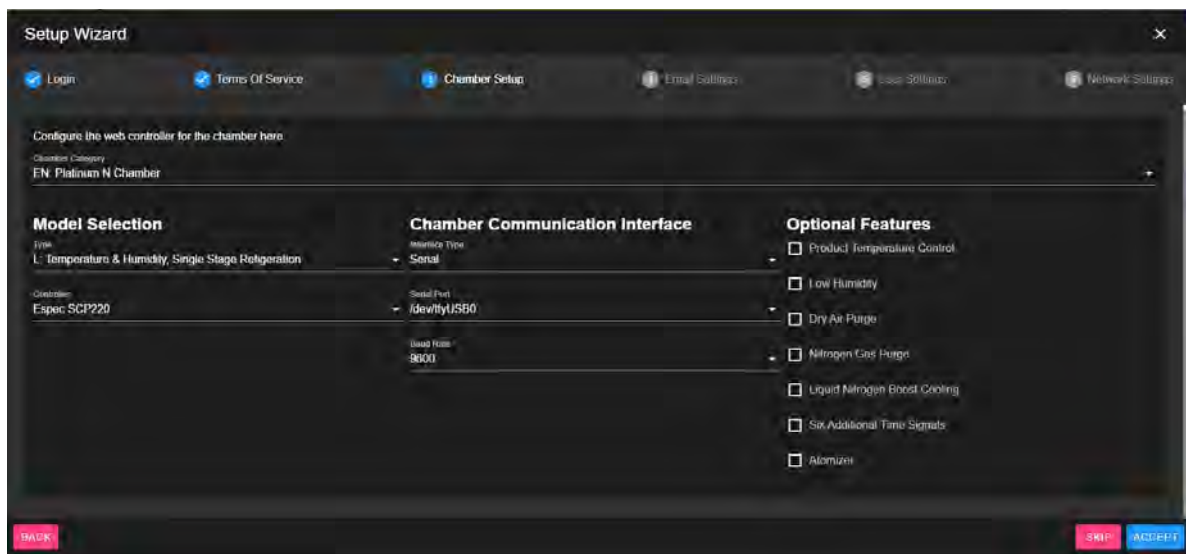


Figure 2.16: Chamber selection and configuration

For SCP220, communication interface type is **Serial** with baud rate of 9600. This baud rate must also be configured on the P300 (via its HMI). Its RS-232 communication must also be enabled. All of this should have been configured during testing at manufacturer's facility. Click **ACCEPT** to apply the selection.

5. **Watlow F4:** The following illustrates how **EWP: Walk-in Chamber** with F4 was selected, with **Model Selection** type **Temperature Only, Cascade Refrigeration** for the configuration.

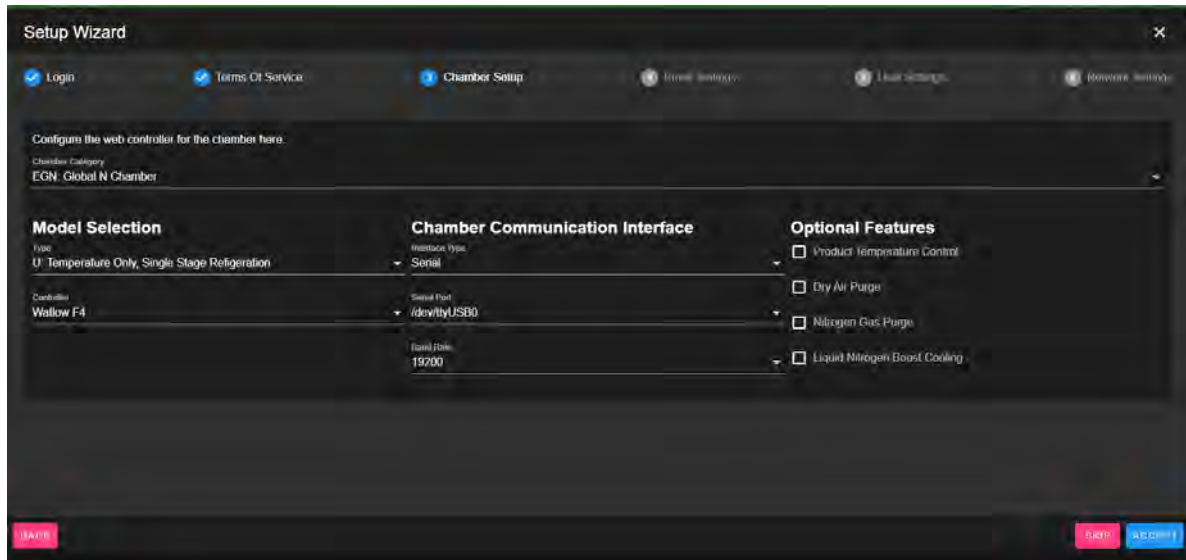


Figure 2.17: Chamber selection and configuration

The communication interface type is **Serial** with baud rate of 19200. This baud rate must also be configured on the PLC via its HMI. Its RS-232 communication must also be enabled. All of this should have been configured during testing at manufacturer's facility. Click **ACCEPT** to apply the selection.

4. **Email Settings:** An alert about the condition of the chamber can be notified via email. This setup page can be skipped at this point by clicking the **SKIP** button at the lower-right corner; it can be completed later via the **Settings** menu. However, if this **Setup Wizard** page was skipped (and other configurations are not completed), it will reappear following the next Web Controller reboot. To set up an email alert, scroll down the setup page and complete the following steps:
1. Enter the recipient's email address.
 2. If multiple emails are required, enter one email address per line in the recipient's box.
 3. To test an email notification, click on the **Test** button in the lower-right corner (as shown in the following figure). **Note:** By default, the Web Controller uses SMTP Office 365 for the email protocol; but this default protocol can trace to a local network with different SMTP server as needed. For email feature to work, the Web Controller must have access to the Internet. Click **ACCEPT** to save the changes.

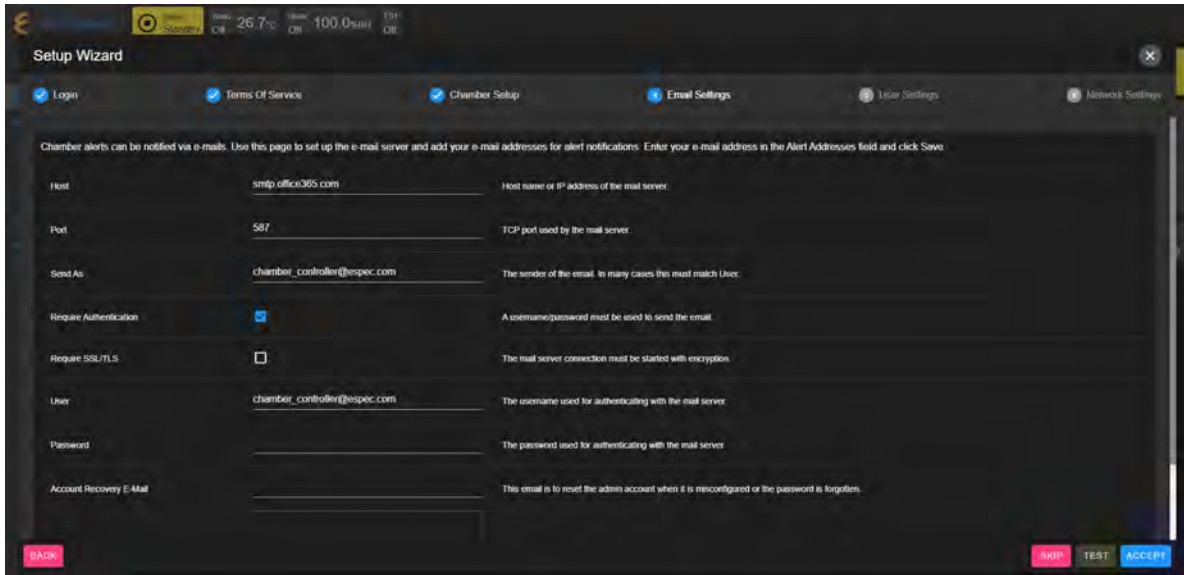


Figure 2.18: Setting e-mail alerts

5. **User Settings:** It is imperative that the administrator account password be changed to something more secure than the one given in the manual. Enter the current administrator's password, then enter the new secure password twice and click **ACCEPT** to apply the new password setting.

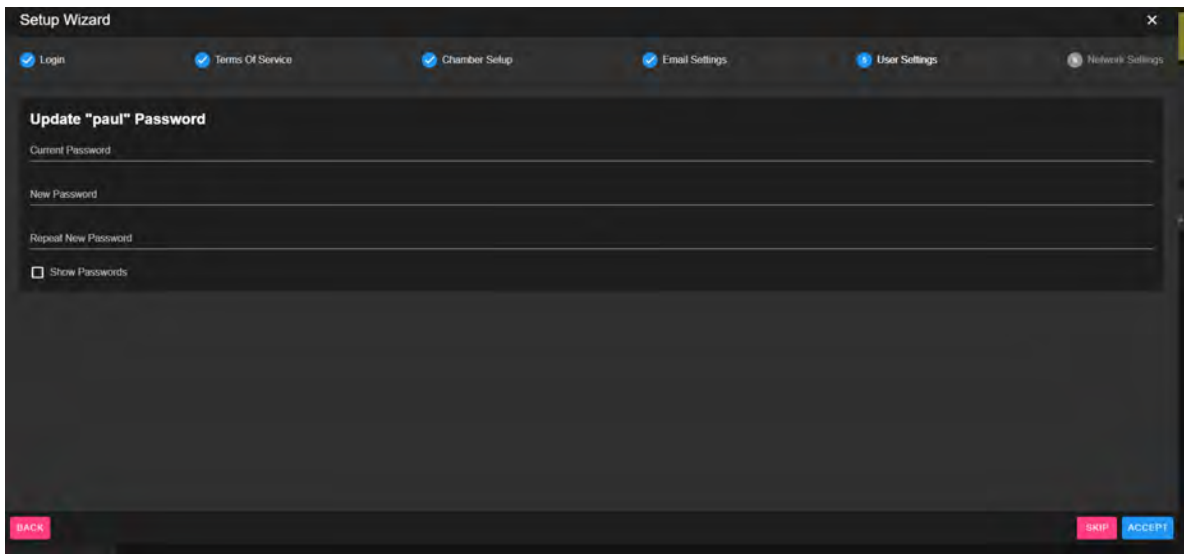


Figure 2.19: Changing the administrator's password

6. **Network Settings:** In this **Network** setup page, the Web Controller hostname may be changed at this time. Network configuration protocol (DHCP or Static) can be applied. If a static network configuration is required, uncheck the DHCP box and enter the correct and proper IP address, Subnet Mask (or Net Mask), Gateway and DNS1. Note: If the Web Controller was accessed via its IP address (or hostname) and the IP address (or hostname) has been changed, it will require accessing the Web Controller using the new IP address (or

hostname). It is recommended to use the default setting during the initial setup.

Setup Wizard

☒ Login
 ☒ Terms Of Service
 ☒ Chamber Setup
 ☒ Email Settings
 ☒ User Settings
 ☒ Network Settings

Hostname or IP address of the Web Controller can be configured for the target network. All changes will take effect immediately, however, it may require some time or even a reboot for a new hostname to resolve. If the Web Controller was accessed via its hostname (or IP address), and a new hostname (or IP address) has been applied, it will require opening a new browser with its new hostname (or IP address).

Network Interface Configuration (eth0)

Hostname	Web3Dev-Paul	Name of the server
DHCP	<input checked="" type="checkbox"/>	Get network settings automatically
IP Address	10.30.100.108	Static IPv4 Address
Net Mask	255.255.0.0	Static subnet mask
Gateway	10.30.0.1	Static gateway
DNS1	10.30.30.31	Static primary domain name server
DNS2	10.30.30.23	Static backup domain name server

Figure 2.20: Networking configuration—DHCP or Static

After the **Setup Wizard** is complete, the Web Controller displays its main home page in **Overview** mode. The Web Controller is ready for operation. Users may begin to log into the Web Controller to operate the chamber.

CHAPTER 3

User

This chapter explains how users log into ESPEC Web Controller to control and operate the chamber. The Web Controller protects the chamber by permitting only authorized users to login and operate the chamber. The following sections discuss how to login, logout and set a new password.

3.1 Login

To log into a specific account, click the **User** menu in the menu bar and enter account name and password, and click **SUBMIT** as depicted in the following figure.

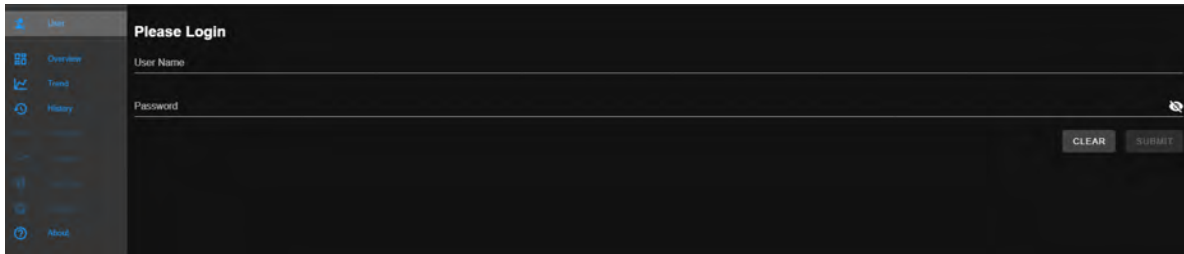


Figure 3.1: Log into the Web Controller

To log into a specific account on ESPEC Web Controller HMI (touchscreen monitor), use the touchscreen keyboard as shown below.



Figure 3.2: Log into the Web Controller via HMI

If the login fails, an **Invalid username or password** message pops up at the lower right corner. Click the **Close** button and re-enter username and password.

To set the Web browser to remember the login credentials, check the **Remember Me** box. This method is not advisable on a public computer using a public account. Only apply the **Remember Me** feature on your computer or your user account on a public computer. After authentica-

tion is verified, ESPEC Web Controller logs you in and the web page is displayed in **Overview** mode.

To log into a different account, click the **User** menu (which now displays the current login name), click **LOGOUT**, enter new username and password and click **SUBMIT** (or press **Enter**).

3.2 Logout

To end Web Controller session and logout your account, click the **User** menu in the menu bar, which now displays your username, and click **LOGOUT**, as depicted in the following figure.



Figure 3.3: Logout and login using a different username

ESPEC Web Controller reverts all its navigation links to Read-Only mode with only **User**, **Overview**, **Trend**, **History** and **About** visible and accessible as depicted in the figure in Section 3.1.

3.3 Set New Password

There are two ways to set or change a user's password:

1. **User-Own Setting:** A user can reset their password via the **User** menu, as depicted in the previous figure:
 - Once logged in, click **User** which now displays the account name.
 - Enter the current password in the **Current Password** field.
 - Enter the new password in the **New Password** and **Repeat New Password** fields.
 - Click **SUBMIT** to apply the setting, or click **CLEAR** to cancel the setting.

If authentication is checked and confirmed, a new password to the user account will be set and becomes effective immediately.

2. **Administrator Setting:** A user account password can be reset by the administrator via the **User Settings** submenu.

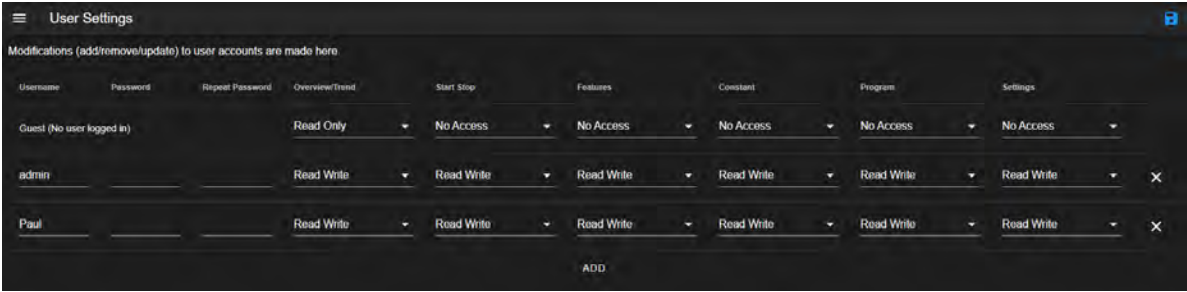


Figure 3.4: Resetting password via User Settings submenu

This method will be discussed in detail under a separate chapter on the **Settings** menu.

CHAPTER 4

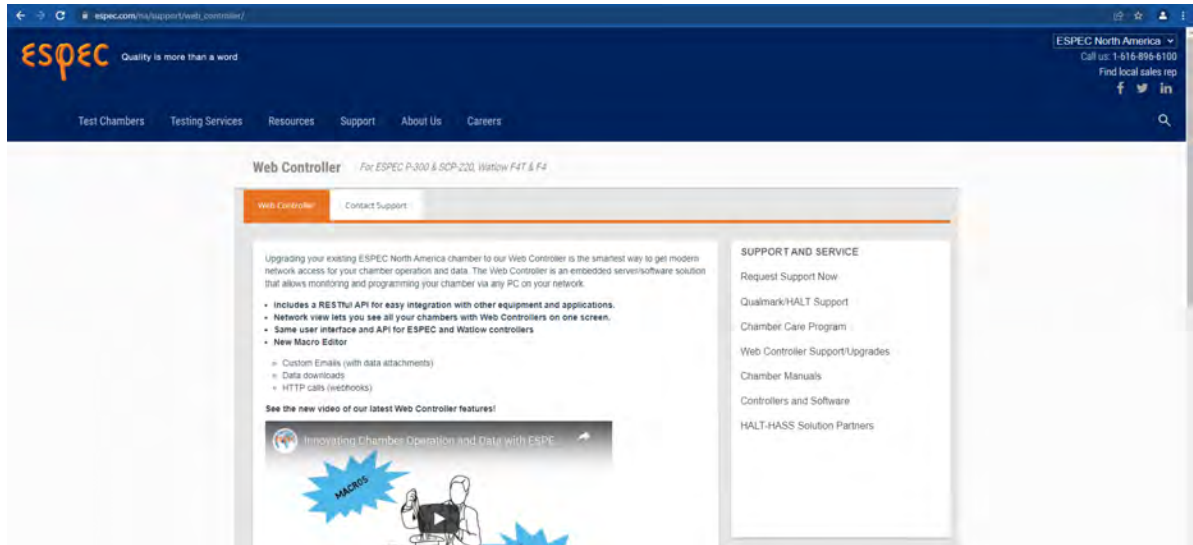
About

The last menu of ESPEC Web Controller in the menu bar is the **About** page. It provides information about ESPEC Web Controller software, its version number, terms of service to end-users, online manual, software support and download. By default, the menu opens and displays the **LEGAL** tab that provides an overview of the software license, its legal aspect, and its practical application and usage that all end-users must acknowledge and abide to in order to use the product. Important notes are outlined as follows:



Figure 4.1: Terms of service of ESPEC Web Controller

1. **Terms of Service:** The **LEGAL** tab consists of a one-page view containing complete information of ESPEC Web Controller software, its usage and license. The bottom portion of this page contains a list of different modules and functions used in ESPEC Web Controller software which are governed by various license terms. End-users are encouraged to view this page in its entirety, including the respective licenses applied to each of them. This page implies that, by using this software (i.e., ESPEC Web Controller), end-users have read, understood and accepted all the terms outlined herein.
2. **User's Manual:** ESPEC Web Controller User's Manual is available in two different formats: (1) online and (2) PDF. Item 4 (below) provides a link to the fully online manual on the Internet (hosted by bitbucket via the wiki public access). The PDF format is available under this tab. Users can browse through the table of contents to select and view a specific section or chapter regarding a particular topic.
3. **Web Controller Version:** This firmware version number can be used to check against the current release of ESPEC Web Controller by ESPEC to ensure your system is current and up to date. This firmware can also be used to check against the original version shipped with the chamber.
4. **Support and Download Page:** If your Web Controller has access to the Internet, this link points to ESPEC website that provides support of software download and other requests.



5. **Chamber Serial Number:** The serial number of your chamber can also be found here. Chamber serial number is important for requesting customer or software upgrade.
6. **Customer:** Customer's registered name.
7. **Shipped Firmware Version:** This is the version of the firmware that was shipped with the chamber. This version can be used to check against the current version posted under item 3 to determine update options.
8. **Registration Date:** The registration date shows the date when this chamber was registered in ESPEC service record.

Part II

T-Series Chamber

CHAPTER 5

Overview

The **Overview** page displays the current status of the chamber and its operating mode. A user is brought to this page after successfully logging into ESPEC Web Controller. The following figure depicts **Overview** showing the chamber in Standby mode, as indicated in the status tab and its extension bar. The extension bar of the status tab is only available in the **Overview** menu.

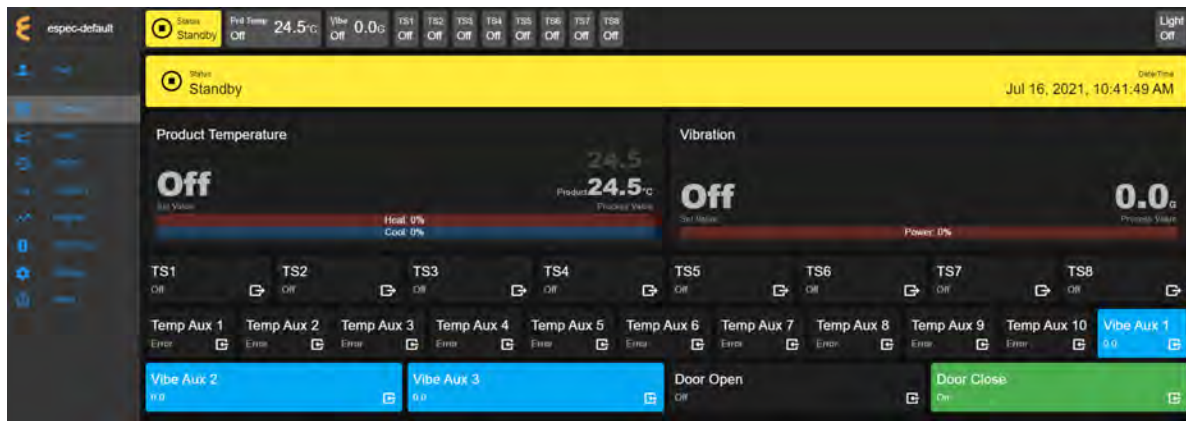


Figure 5.1: Overview page with chamber in Standby mode

The following figure depicts **Overview** showing the chamber in Constant mode.

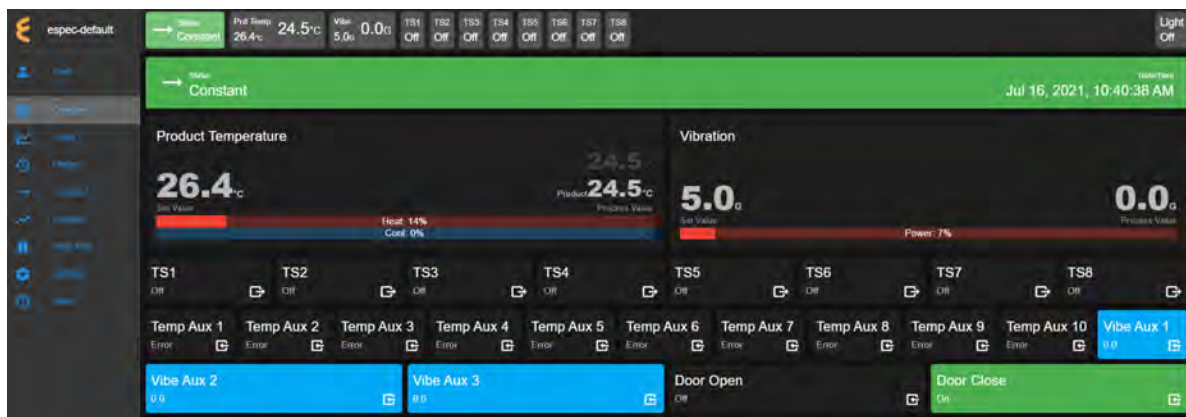


Figure 5.2: Overview page with chamber in Constant mode

The following figure depicts **Overview** showing the chamber in Program mode. Detailed information about the program, including what step is being executed, is listed in the extension bar (of the status tab). This feature provides the operator with useful information about the status of the chamber and the program.

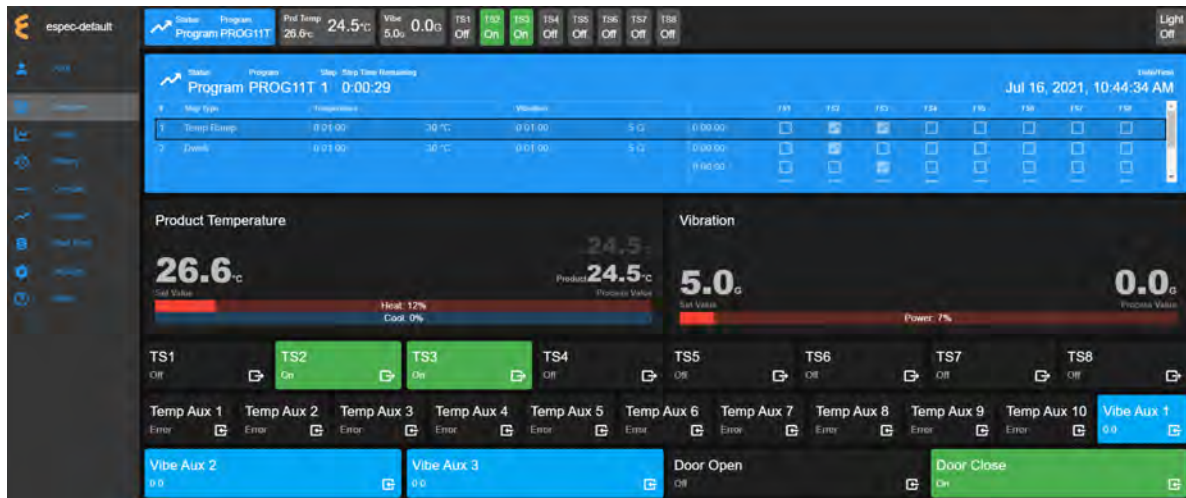


Figure 5.3: Overview page with chamber in Program mode

Only users with read-write privilege can control the chamber operation mode from within this page. Supported operation modes are **Standby**, **Constant** and **Program**. Each tab in the status bar may be accessed to apply new settings at any time. This feature enables the operator to control the chamber without having to access the **Start Stop** menu in the menu bar. The following sections detail a step-by-step procedure how to control the chamber's operating mode via the **Overview** menu for users with read-write privilege.

Management of **Alarm** mode can also be controlled (by an operator with read-write privilege) within this page to clear all alarm alerts triggered by the chamber. However, all alarms triggered by the chamber must be resolved before ESPEC Web Controller can clear all alert messages displayed in the alarm tab in the status bar.

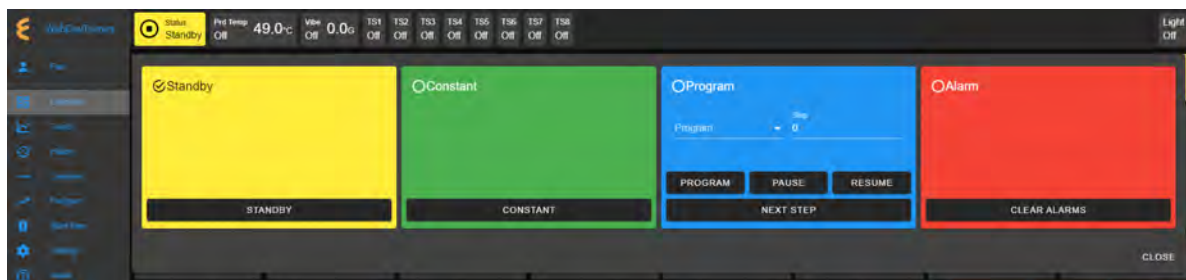


Figure 5.4: Status Bar in the Overview page

5.1 Standby Setting

For authorized users with read-write privilege, to set the chamber in **Standby** mode, proceed with the following steps. Initially, the chamber is operating in **Constant** mode. We wish to switch its operation mode to **Standby**.

1. Click the status tab in the status bar to access the drop-down tabs, as shown in the figure.



An alternative way to access these drop-down tabs is to click on the extended tab of the status tab itself, as depicted in the following figure. The drop-down tabs display over this extend tab as shown in the right figure. This extended tab is available only in the **Overview** page.

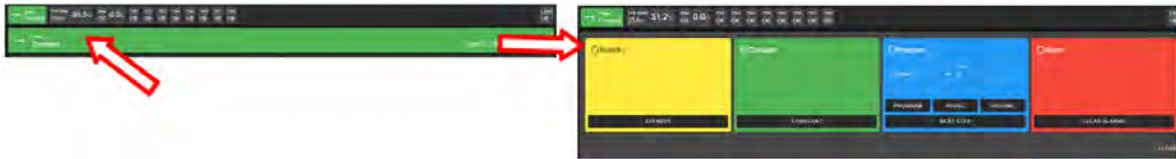


Figure 5.5: Status tab drop-down menu via the extended tab

2. Click the **STANDBY** button. ESPEC Web Controller immediately moves to apply the operating mode to the chamber. A pop-up window appears in the lower-right corner to indicate the update of the operating mode. A check mark in the **Standby** tab indicates and confirms its standby mode.
3. To close the drop-down tabs, perform one of the following action:
 - Click an empty area in the Main Display.
 - Click a different menu in the menu bar.
 - Click the status tab itself. or
 - Click the **CLOSE** button underneath the alarm tab.

5.2 Constant Setting

For authorized users with read-write privilege, to set the chamber in **Constant** mode, proceed with the following steps. Suppose, initially, the chamber is operating in **Standby** mode. We wish to switch its operation mode to **Constant**.

1. Click the status tab in the status bar. As depicted in the following figure, the chamber is in **Standby** mode.

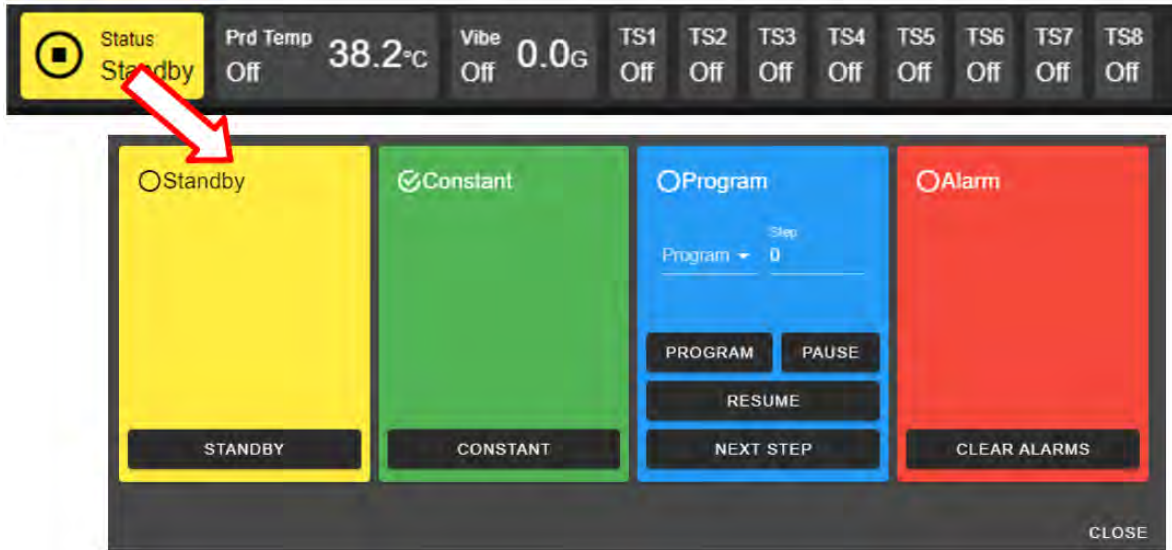


Figure 5.6: Constant mode setting

2. Click the **CONSTANT** button in the constant tab. ESPEC Web Controller immediately moves to apply the operating mode to the chamber.
3. To close the drop-down tabs, perform one of the following action:
 - Click an empty area in the Main Display.
 - Click a different menu in the menu bar.
 - Click the status tab itself. or
 - Click the **CLOSE** button underneath the alarm tab.

5.3 Program Setting

To set the chamber in **Program** mode means a program is loaded onto the Web Controller, it then executes the program and sends those instructions to the chamber controller to carry out the tasks. For authorized users with read-write privilege, to set the chamber in **Program** mode, proceed with the following steps:

1. Click the status tab in the status bar, or the extension bar of the status tab, to access the drop-down menu.
2. Click the radio button in the program tab to access the program drop-down list, as illustrated in the following figure.



Figure 5.7: Select program to start chamber in Program mode

If program has not been created, no program is available to be loaded, and a message depicted in the following figure will display. A program must be created first before it can be loaded for execution. Chapter 8 discusses how to create a program to control the chamber.

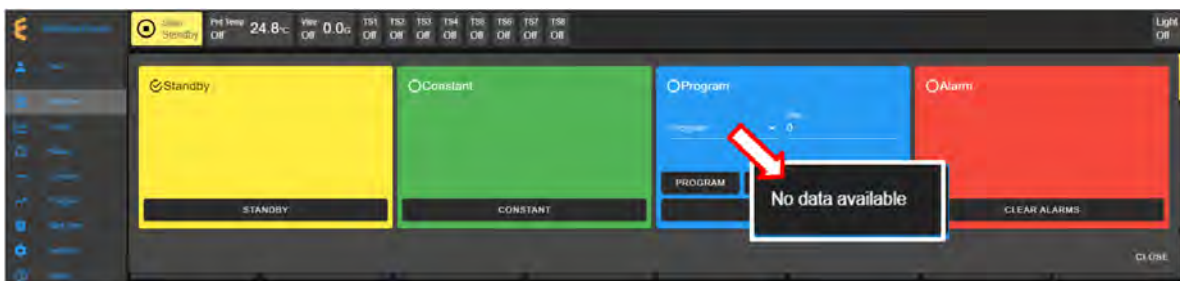


Figure 5.8: No program available for execution

3. Click to select a program from the list. Apply the scroll bar, if necessary, to select the desired program.
4. Enter a desired step number in the step field for program to start. Default step is 0 for program to begin at step 1.
5. Click the **PROGRAM** button to execute the program. ESPEC Web Controller immediately moves to apply the operating mode to chamber. A pop-up window appears in the lower-right corner to indicate the update. Note: This program tab offers a few practical methods during a program execution. The **Pause** button can be used to pause the program. Program can be resumed via the **RESUME** button. Program instruction lines can be stepped through via the **NEXT STEP** button.
6. Click the **CLOSE** button to view the status of program execution displayed in the status tab extension bar.
7. To end or interrupt the program execution, switch the chamber to **Standby** or **Constant** mode via the status tab.

5.4 Clear Alarms

When ESPEC Web Controller detects that the chamber is in an alarm state, it also sets itself in an alert state by displaying a list of active alarms and fault names in the **Overview** page to require an immediate action from the operator, as depicted in the following figure. To clear all alarm messages, for authorized users with read-write privilege, proceed with the following steps:

1. Click the status tab in the status bar, then click the **CLEAR ALARMS** button, as depicted in the following figure.

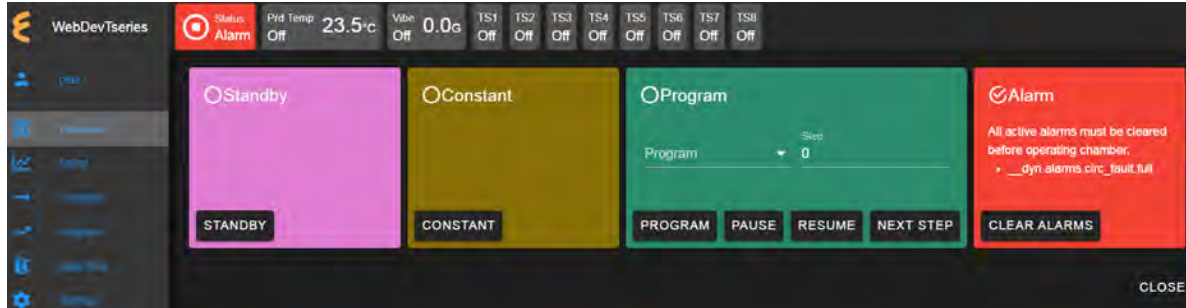


Figure 5.9: Overview page showing the Status bar with alarm message

Note: All alarm messages can be cleared only after alarms in the chamber are resolved.

2. To close the extended status tab, click the status tab itself or the **CLOSE** button underneath the **Alarm** tab.

5.5 Temperature, Vibration or Time Signal Settings

On the **Overview** page, settings of Temperature, Vibration or Time Signals can be controlled via the tabs in the status bar or the dedicated tabs in the main display area, as shown in the following figure. Only authorized users with read-write privilege can make changes to these settings.



Figure 5.10: Control settings via the control panes

5.5.1 Settings via the Status Bar

To set product temperature with a new set value, complete the following steps:

1. Click the Temp tab in the status bar.

2. In the drop-down pane, click the boxes to **Enable** or turn on **Product** temperature, and enter new value in the Set Value field or click the up/down arrow to adjust the value, as illustrated in the following figure.

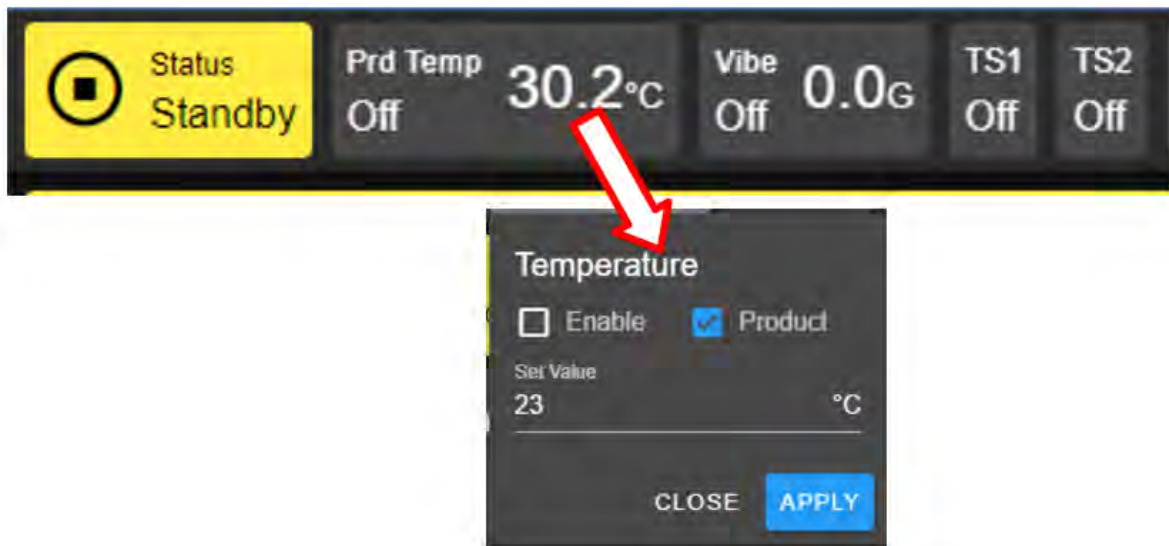


Figure 5.11: Setting new temperature value via the temp tab

3. Click **APPLY** to apply the new setting.
4. To cancel the setting, click the **CLOSE** button.

To turn on vibration and set its value, complete the following steps:

1. Click the Vibe tab in the status bar.
2. In the drop-down pane, click the box to **Enable** vibration, and enter new value in the Set Value field or click the up/down arrow to adjust the value, as illustrated in the following figure.

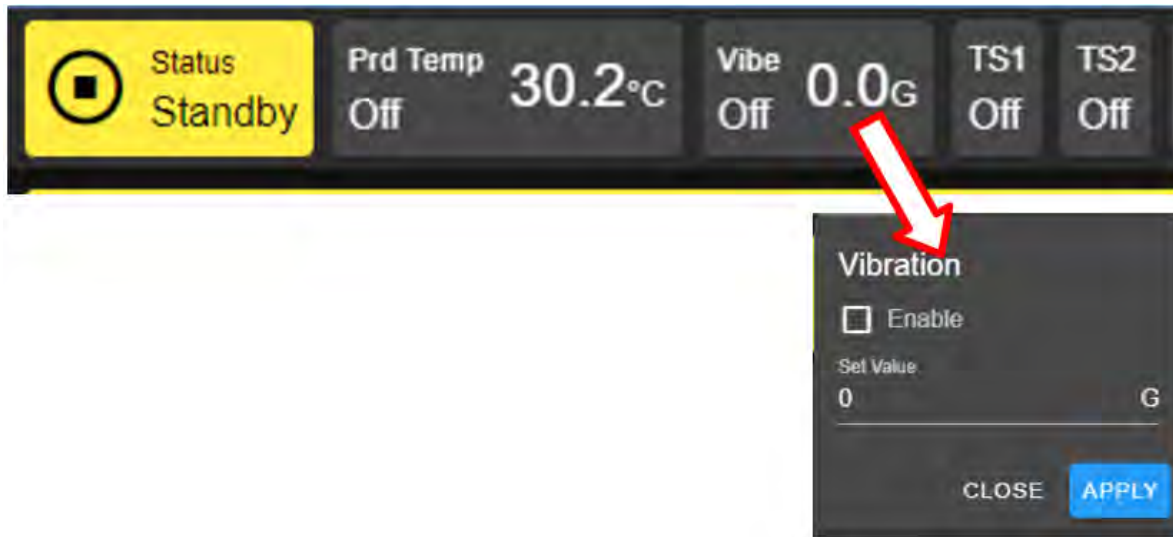


Figure 5.12: Setting new vibration value via the temp tab

3. Click **APPLY** button to apply the setting.
4. To cancel the setting, click the **CLOSE** button.

The time signals in the status bar can be switched on or off individually. The following steps illustrate how to turn on TS1. The rest of the time signals, if available, can be applied using the same method:

1. Click the TS1 tab in the status bar.
2. Check the box to enable TS1, as depicted in the following figure.

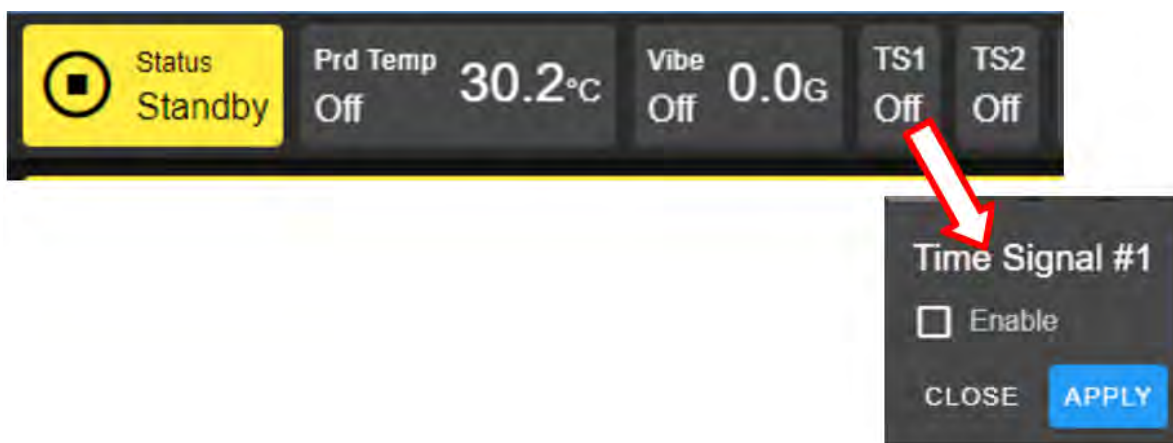


Figure 5.13: Enable or disable time signal setting

3. Click **APPLY**.
4. To cancel the setting, click **CLOSE** (instead of **APPLY**) or click the TS1 tab itself in the status bar.

To turn off TS1, apply the following steps:

1. Click the TS1 tab in the status bar.
2. Uncheck the box to disable TS1.
3. Click **APPLY**.
4. To cancel the setting, click **CLOSE** (instead of **APPLY**) or click the **TS1** tab itself in the status bar.

5.5.2 Settings via the Dedicated Panes

With ESPEC Web Controller, there are multiple ways to complete the same task. The dedicated panes for temperature, vibration or humidity, time signals, or refrigeration, in the main display area are actually clickable panes. These are CTA (call-to-action) panes through which new parameter settings (such as, temperature, vibration or humidity, time signal and refrigeration) can be applied.

To apply a new setting to temperature, proceed as follows:

1. Click the Temperature pane.
2. In the input pane, click and enter new value in the Set Value field or click the up/down arrow to adjust the value, as illustrated in the following figure.



Figure 5.14: Setting new temperature value via the temperature (CTA) pane

3. Click **APPLY**. To cancel the setting, click **CLOSE** (instead of **APPLY**).

The above procedure can be applied to vibration and time signal.

5.6 Web Controller on the Network

ESPEC Web Controller can communicate with other ESPEC Web Controllers on the same network. The hostname (with E logo) in the upper-left corner acts as a link that, when clicked, provides a list of any chamber with ESPEC Web Controller detected on the network by the local ESPEC Web Controller, as depicted in the following figure.

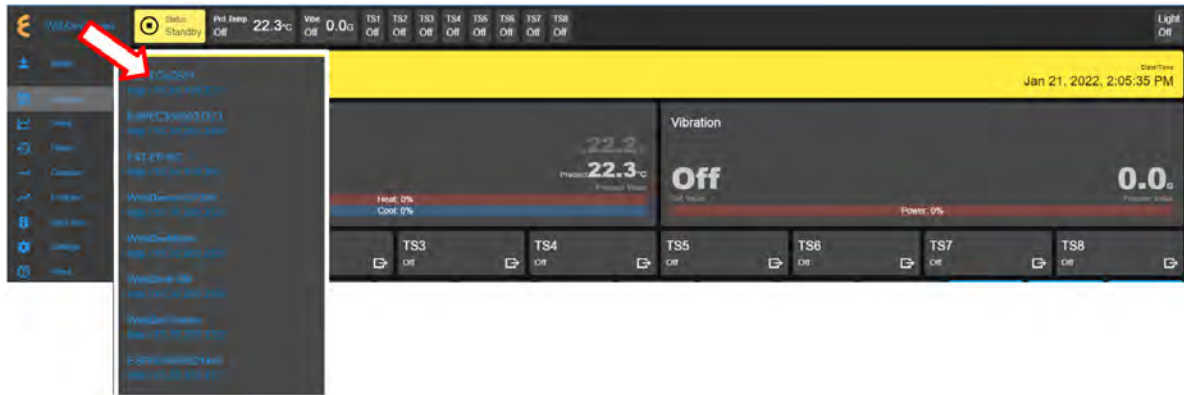


Figure 5.15: List of ESPEC Web Controller on the local network

This list can be opened from within any menus (not just in the **Overview** menu) by just clicking on the Web Controller hostname. Any chamber and ESPEC Web Controller on the list can be accessed directly by clicking on its hostname.

CHAPTER 6

Trend

Data points from the chamber's operation accumulated in the data log are displayed as a trend graph under the **Trend** menu, depicted in the following figure. By default, this graph provides an overview of the chamber's operation in the last one hour. Data can be downloaded in whole or in portion (refer to Item 4 below).

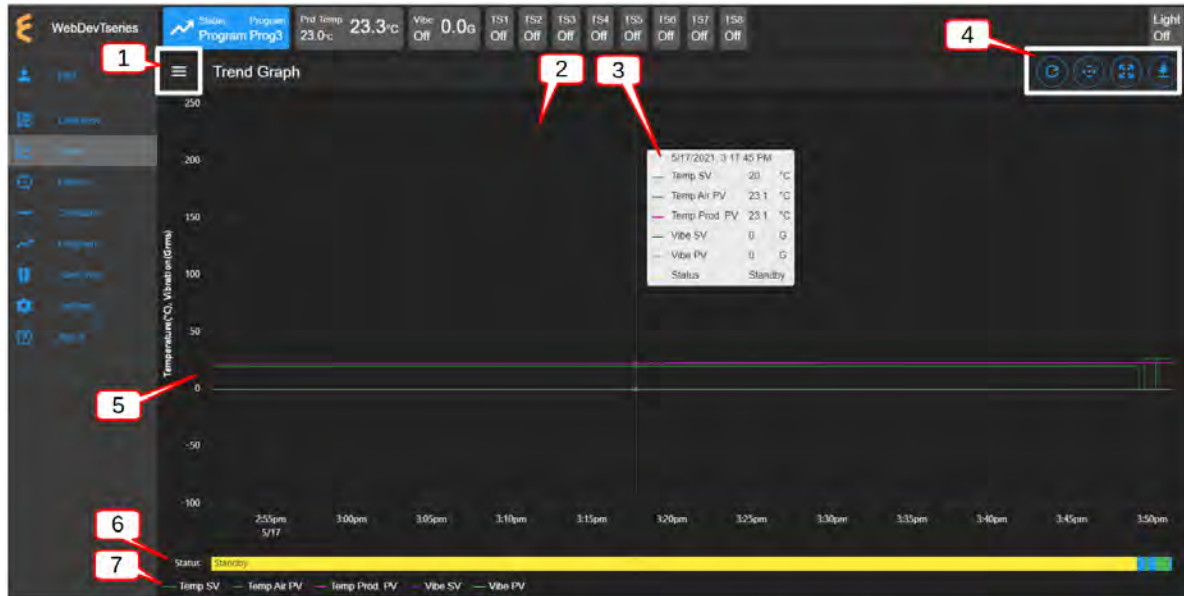


Figure 6.1: Trend graph showing plots of current data from the chamber

The main display area of the **Trend** menu is categorized into seven different groups with labels from 1 through 7. Detailed descriptions of these categories are outlined as follows:

1. **Time Frame:** This menu button shows or hides the time frame of the data points being plotted in the trend graph. As shown in the following figure, the trend graph is plotted for data points collected between 2:51 PM and 3:51 PM. That time frame is also displayed at the bottom of the trend graph, with grids at an interval of 5 minutes. To hide this time frame, click the menu button again.

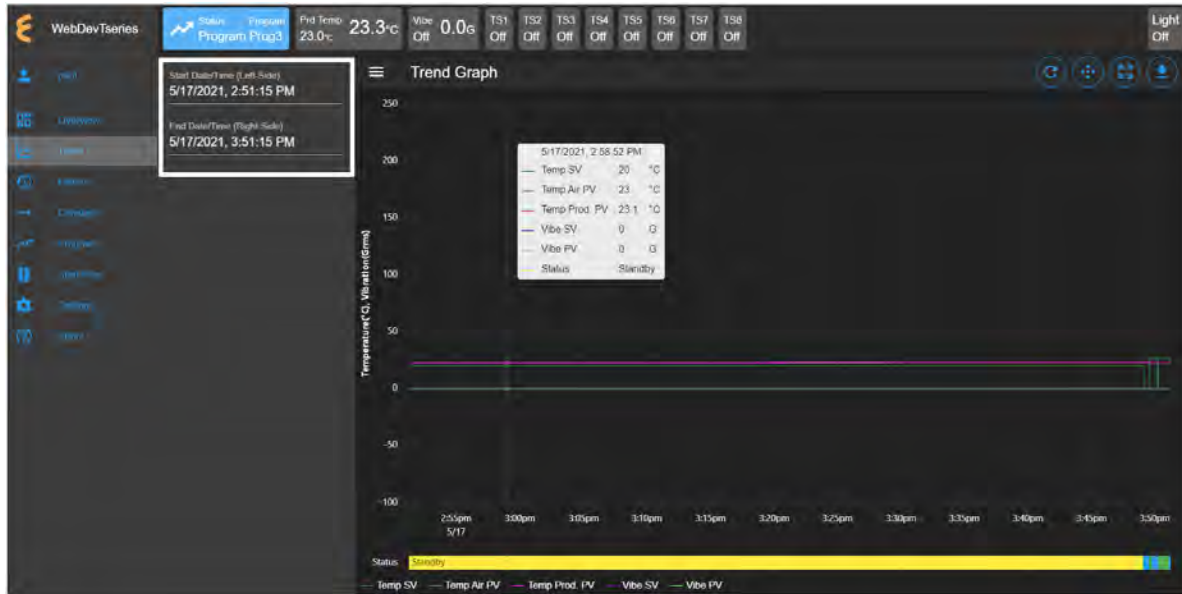


Figure 6.2: Detailed data of the Trend graph

2. **Trend Graph:** Data points collected from the chamber are rendered and displayed as a trend graph based on a scatter plot methodology. These data points represent product temperature, air temperature and/or vibration; they are plotted as a function of time. The vertical (Y) axis represents the scale of their values. Temperature is displayed in degree Celsius; vibration is displayed in root-mean-square of acceleration (Grms or G). The horizontal (X) axis represents the time scale with unit measured in a 1-second scale. Based on the default configuration, the T-series chamber logs data points in a 1-second interval. The scaling of the grid will change according to the Pan/Zoom Controls buttons application (see item 3 below). To reset the trend graph, click the **Zoom Extents** button (in the following figure), select **Last Hour** from the drop-down menu, then click the **Auto Refresh** button.
3. **Snapshot of Data:** By hovering a mouse pointer on the trend graph area, a snapshot of the data at a particular time is displayed. This feature allows a quick peak of the data at a certain point in time. Depending on the chamber's condition, the snapshot provides set values (SV) and process values (PV) of temperature, product or air temperature, or vibration, chamber's operation status and time signal status.
4. **Trend Graph Manipulation Buttons:** Four buttons are available to help manipulate and control the trend. This group of buttons is detailed in the following figure; their functions are described as follows:

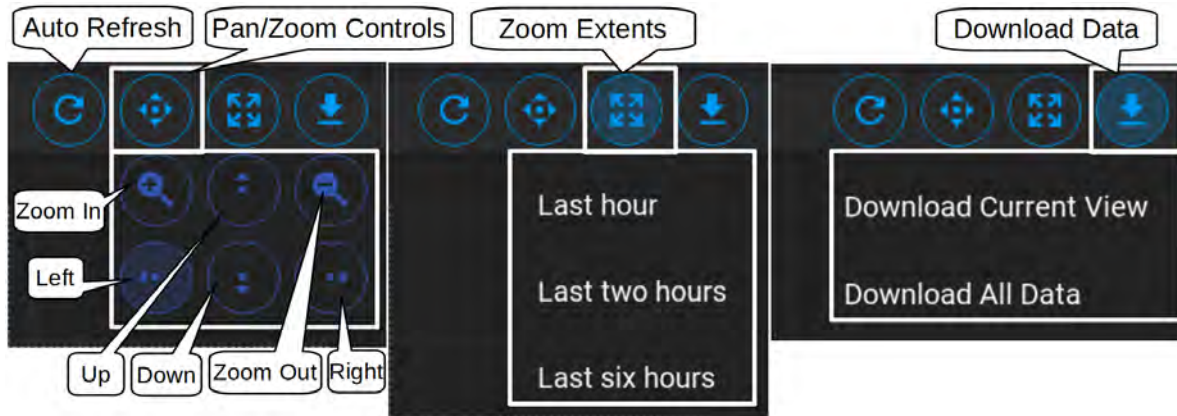


Figure 6.3: Manipulation buttons of the Trend graph

- **Auto Refresh:** This Auto Refresh button refreshes the trend graph; it thereby reconstructs the graph using the most recent data points which have been accumulated up to the current time.
- **Pan/Zoom Controls:** The Pan/Zoom Controls button allows the operator to control and adjust the viewable section in the trend graph. This button presents six operation buttons to manipulate and display the trend graph as follows:
 - **Zoom In:** The **Zoom In** button allows the operator to zoom into a small section of the trend graph. Depending on the degree of zooming, the display area will be confined to a small set of data points ranging between minutes to hours. To reset the trend graph, click the **Zoom Extents** button, select **Last Hour** from the drop-down menu, then click the **Auto Refresh** button.
 - **Zoom Out:** The **Zoom Out** button does the opposite by allowing the operator to zoom out on the trend graph, thereby giving the operator an expansive view of the trend graph. To reset the trend graph, click the **Zoom Extents** button, select **Last Hour** from the drop-down menu, then click the **Auto Refresh** button.
 - **Move Up:** This button allows the operator to move up the graph along the vertical axis to adjust the viewable area of the scatter plot. To reset the trend graph, click the **Zoom Extents** button, select **Last Hour** from the drop-down menu, then click the **Auto Refresh** button.
 - **Move Down:** This button allows the operator to move down the trend graph along the vertical axis with the purpose to adjust the viewable area of the scatter plot. To reset the trend graph, click the **Zoom Extents** button, select **Last Hour** from the drop-down menu, then click the **Auto Refresh** button.
 - **Move Left:** This button allows the operator to pan left on the trend graph, offering a quick preview of a plot of data points tracing back the time in hours or days. With this feature, the operator can quickly gain a preview of past data points which the operator may have missed.
 - **Move Right:** This button does the opposite to **Move Left** by allowing the operator to pan right on the trend graph to the current time. To reconstruct the trend graph to contain the most recent data points, the **Auto Refresh** button allows the quickest operation.

- **Zoom Extents:** With this button, trend graph may be provided using data points from within the last one hour, last two hours or the last six hours. To make adjustment of the trend graph based on these three selections, click on the **Zoom Extents** button, then click one of the selection from the drop-down menu.
- **Download Data:** To download data and store it on the local computer, click the **Download Data** button and select **Download Current View** to download a portion of data from the displayed trend graph. To download the entire collection of data, select **Download All Data**. Data file will be stored in the Downloads folder of the local computer with filename: hostname_data_date.CSV. **Note:** Only authorized users may download the data. The following error will occur if an unauthorized user attempted to download that data.

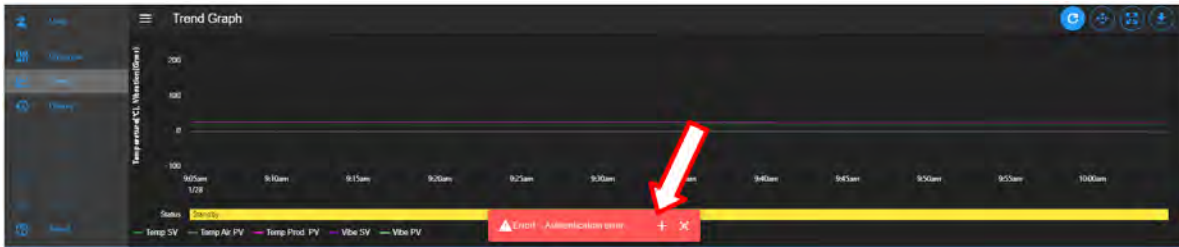


Figure 6.4: trend-graph-download-error-001a.PNG

5. **Line Graph:** Data points from Temperature (set values or process values) and vibration (set values and process values) are being plotted to produce the line graphs to visually display the operation condition of the chamber.
6. **Status:** Status of the operation mode of the chamber is displayed along the time line on the trend graph, indicating when and how long the chamber was in specific operating mode. This feature provides a quick preview of the chamber operating status. The **Left** button under the Pan/Zoom Controls may be used to extent further into the past to view the chamber's operating mode.
7. **Legend of Trend Graph:** The legends are used to identify each item on the trend graph with color code to designate the different line graph (described in Item 5 above).

CHAPTER 7

History

The **History** page displays operation history of the chamber, its operating modes and statistics. Any alarms or alerts that were triggered during the chamber's operation are logged and displayed here. By default, history log of the chamber's operating modes, alarms or statistics from the previous week will be displayed, as depicted in the following figure. There are five important components in the **History** main display area. They are labeled and described as follows:

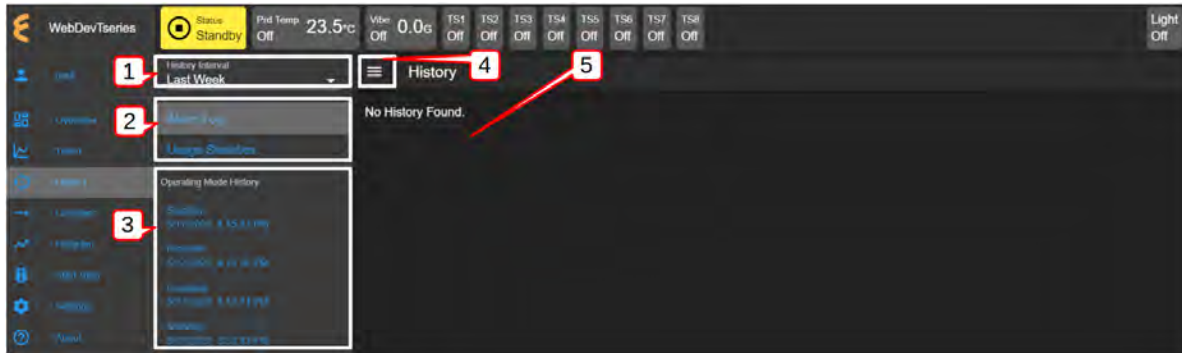


Figure 7.1: Operation history of the chamber

1. **History Interval:** Display options of the operating history are: one week, two weeks, one month, three months, six months, one year or the entire period of the chamber's operation. To access the history interval, click the radio button to select the period from the list.

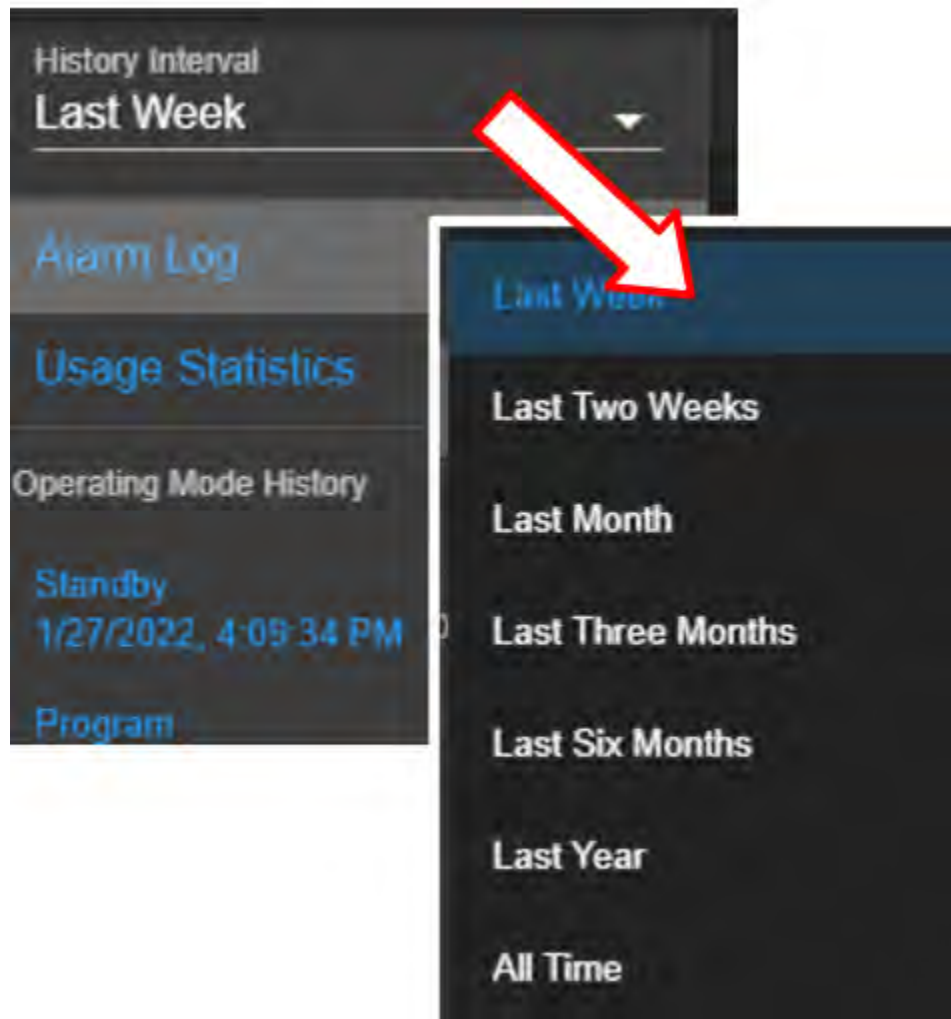


Figure 7.2: History interval and display selection

2. Alarm or Statistics Submenus:

- **Alarm Logs:** By default, alarm logs will be displayed in the main display area. The logs indicate which alarm had occurred and when they were resolved (cleared).

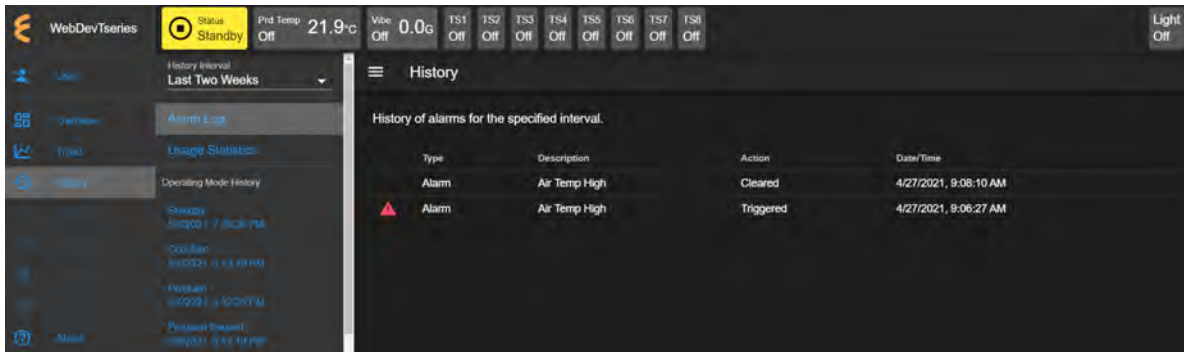


Figure 7.3: History of alarm

- **Usage Statistics:** To display the operation statistics, click on this submenu. Percentage of each operation mode based on the selection period in the **History Interval** is displayed as shown in the following figure:

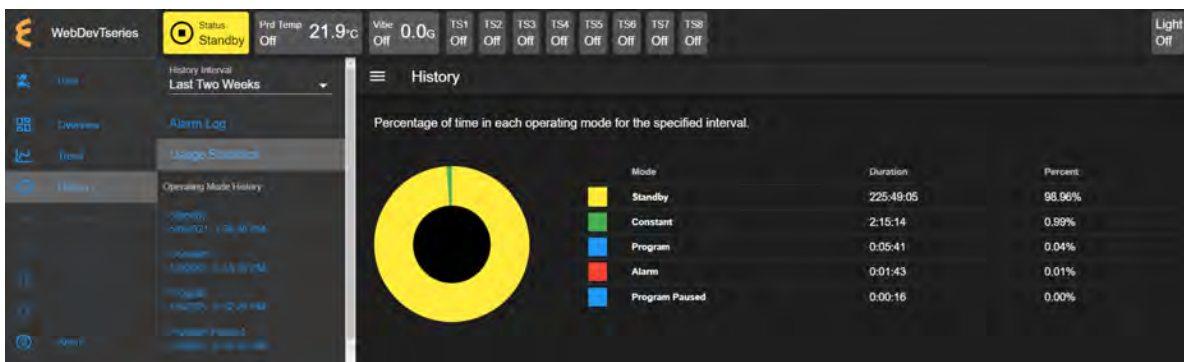


Figure 7.4: Operation statistics

Such information provides the operator a good idea of the overall performance of the chamber by identifying when and how much time it was in a certain operating mode.

3. **Operating Mode History:** A list of operating modes of the chamber is displayed here based on the option selected under the **History Interval**. Default listing is based on a one-week interval. A trend graph, identical to that produced in the **Trend** menu, based on the data points collected during the operating mode can be produced by clicking on the particular operating mode on this list, as illustrated in the following figure.



Figure 7.5: Trend graph of operating mode history

4. **Show/Hide Submenu:** To provide a larger real estate for the main display area, this Show/Hide button can be used to show or hide the **History** submenu. The following figure shows how the submenu is hidden and the main display area is expanded.

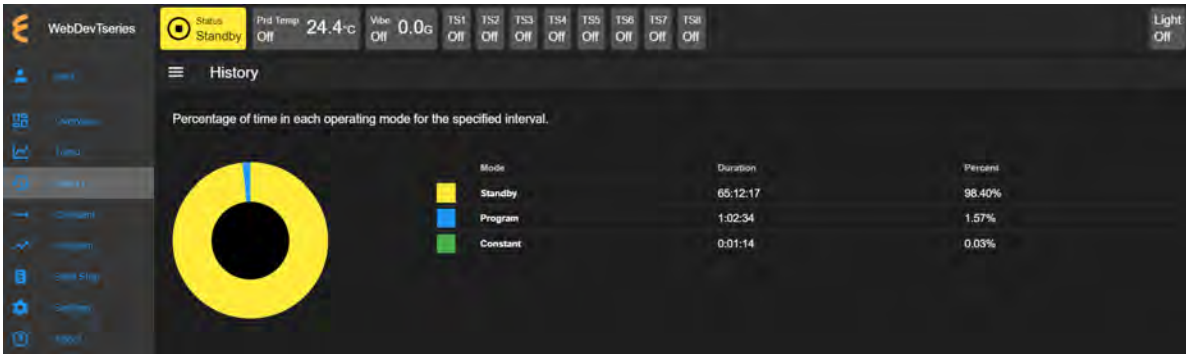


Figure 7.6: The show/hide button of the main display of the History page

5. **Main Display:** The content of the submenu page of **Alarm Log** and **Usage Statistics** is displayed here (refer to item 2, above).

CHAPTER 8

Constant

The existence of ESPEC Web Controller **Constant** page is such that all features and their parameters are collected and displayed in one place to control their constant mode settings. The main display of **Constant** consists of three separate CTA panes, displayed as **Temperature**, **Humidity** (or **Vibration**) and **Outputs**, as depicted in the following figure. These CTA panes provide input options to adjust the settings directly.

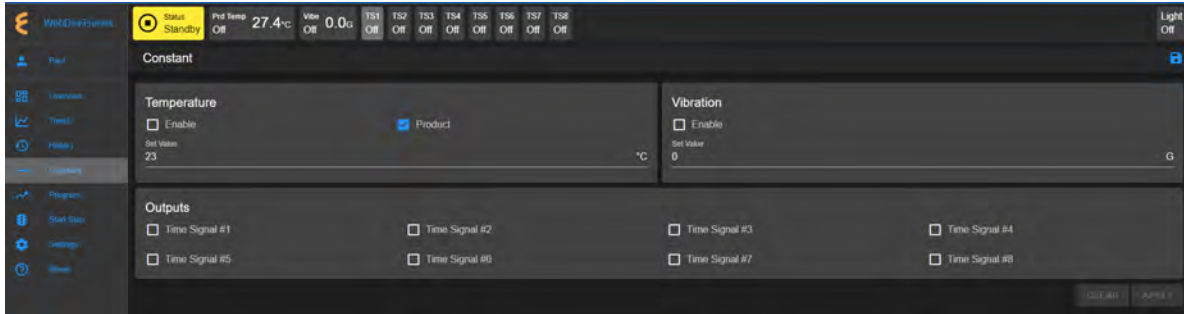


Figure 8.1: The Constant menu and its components

The following sections describe how to configure and control each of these parameters.

8.1 Product or Air Temperature Setting

Complete the following steps to turn on or modify temperature setting:

1. Enable air temperature or product temperature by checking the appropriate boxes.
2. Click the Set Value field and enter a new value, or apply the up/down arrow to adjust the value.

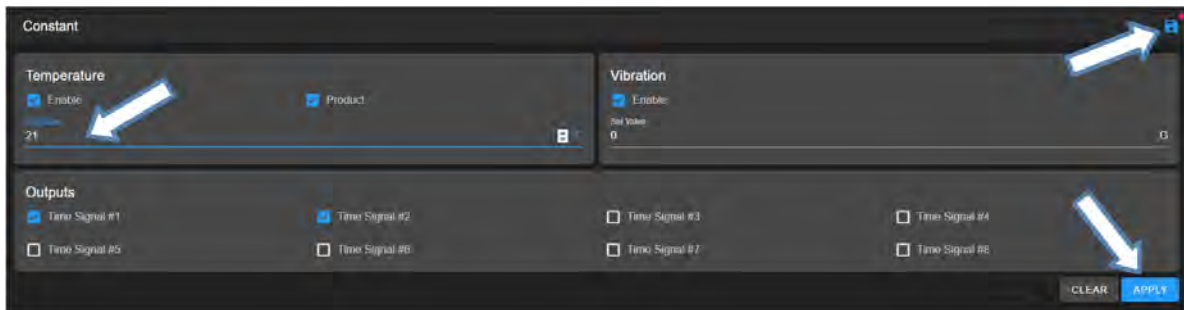


Figure 8.2: Apply new constant setting on temperature

3. Click the **APPLY** button or the **Save** icon (indicated by the arrows) to apply and save the new setting. The red dot next to the **Save** icon indicates that the new setting has not been saved. If you exit this pane by accessing a different menu in the menu bar, a warning message will appear (shown in figure).

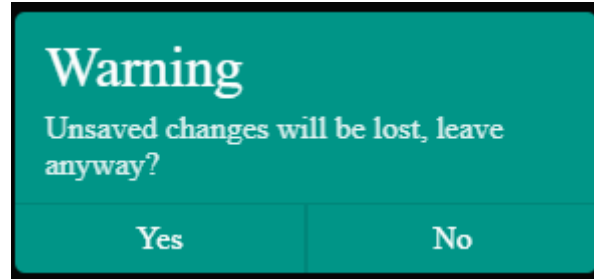


Figure 8.3: New setting must be save before exiting the pane

4. To cancel the setting, click **CLEAR**.

The new setting takes effect immediately with its new status displayed in the status bar. To reverse or cancel the setting, repeat the above steps to reset the set value and click **APPLY**.

8.2 Vibration Setting

Complete the following steps to turn on or modify vibration setting:

1. Place a check mark in the **Enable** box (refer to the above figure).
2. Click the Set Value field and enter a new value, or click the up/down arrow to adjust the value.
3. Click the **APPLY** button or the save icon as indicated by the arrows in the above figure to apply and save the setting.
4. To cancel the setting, click **CLEAR**. If you exit this pane by accessing a different menu in the menu bar, a warning will appear (see above figure) which requires you to save the setting before attempting to access any other menus.

The new setting takes effect immediately with its new status displayed in the status bar. To reverse or cancel the setting, repeat the above steps to uncheck the box, reset the set value and click **APPLY**.

8.3 Time Signals Setting

Complete the following procedure to turn on output for any time signal:

1. To turn on output for **Time Signal # 1**, place a check mark in its box.
2. Repeat the above step for any time signal available in the main display area.
3. Click the **APPLY** button or the save icon as indicated by the arrows in the above figure to apply and save the setting.
4. To cancel the setting, click **CLEAR**. If you exit this pane by accessing a different menu in the menu bar, a warning will appear which requires you to save the setting before attempting to access any other menus.

The new setting takes effect immediately with its new status displayed in the status bar. To reverse or cancel the setting, repeat the above steps to uncheck the box and click **APPLY**.

It is important to note that all the parameters (temperature, humidity, vibration, time signal) in the main display can be adjusted altogether simultaneously with a single **APPLY** or save button.

However, individual setting may provide security to avoid any adverse effect.

CHAPTER 9

Program

The **Program** menu allows the operator to create a program to control the chamber. All the programming features available on the supported PLC's listed in Chapter 1 (“**Introduction**”) can be composed into programs to control the chamber. The operator can: (1) open, view, edit a program; (2) preview the output of the program; (3) edit and/or overwrite an existing program ; (4) delete program from the list; (5) rename program on the list; (6) download a program and store it on the local computer in JSON file; (7) upload a program from the local computer to the Web Controller, and much more.

Here are some of the benefits of the **Program** menu:

- Easy to operate.
- Quick management of programs, programming or editing.
- Require less time to develop a new program or modify an existing program.
- Program Editor offers flexibility with multitasking capabilities.
- Control program operation and program end mode.
- Preview program operation before execution; operator can see exactly what the program does prior to its execution.
- Download program from the Web Controller to the local computer for backup.
- Upload program from the local computer to the Web Controller.

Only authorized users with read-write privilege can access and utilize the **Program** menu and its contents. The **Program** menu in the **Side Bar** is grayed out, as depicted in the following figure, which requires the user to log into their account with read-write privilege in order to access and utilize the **Program** menu.

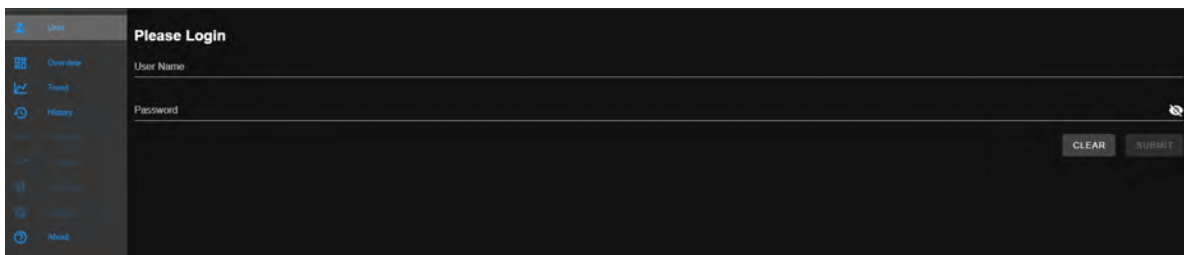


Figure 9.1: User with read-write privilege is required to operate the Program menu

9.1 List Programs

The following figure depicts a typical layout of the **Program** page with its submenu hidden. Its UI components are numbered and explained as follows:



Figure 9.2: Program listing page with submenu hidden

1. **Submenu Show/Hide:** To utilize the entire main display area for the program editor, this button can be used to hide the submenu (as shown in the above figure). Click it again to reveal the submenu.
2. **ID:** The system uses a program identification code (ID) to identify each program. This ID list is inaccessible to users; it is a list of all the available programs which have been created or stored in the system (that is, Web Controller).
3. **Program Name:** All available programs are listed under the **Name** column. Users can access each program under this list by clicking on the program name, which is a clickable link. The program editor then opens up to display the program instructions. Detailed operation of the program editor is discussed in the next section.
4. **Actions:** Three action buttons under the **Actions** column can be used to handle programs on the list under each row. These action buttons, once activated, affect the program on the same row. These buttons are: Upload Program, Download Program and Delete.
 - **Upload:** Program can be uploaded from the local computer directly to the Web Controller. Program will be saved and placed on the row where the **Upload** action button was clicked, thus overwriting the existing one on that row. If the program name is different than that under the **ID** column, the program name will be listed under the **Name** column; the name under the **ID** column will remain unchanged. To make both names consistent (under **ID** and **Name** columns), open the program in to the program editor, change the program name to match that under the **ID** column, save the program via the **Save** button. The following figure illustrates this effect when a new program was uploaded into last row.

Prog4	Prog4	↑ ↓	
Paul5	TempVibTest	↑ ↓	
Create new			

Figure 9.3: Program ID and Name unmatched

- **Download:** Program can be downloaded and saved on the local computer.
 - **Delete:** A program to the left of the trash bin (where this action is applied) will be deleted.
5. **Create New:** This button opens the program editor for creating a new program. The **Create New** button is conveniently placed in two locations: (1) under the **ID** list and (2)

in the **Program** submenu (shown in the following figure).

The following figure displays the **Program** page with its submenu unhidden. The submenu (item 2) has two operation buttons: (i) List Programs and (ii) Create New (program).



Figure 9.4: Program listing page with submenu unhidden

1. **Show/Hide:** The **Show/Hide** button can be used to hide or unhide the **Program** submenu (see item 2 below).
2. **Submenu:** This submenu has two operation buttons (indicated by the arrows): List Programs and Create New (program). All the available programs in the chamber stored in the Web Controller are listed below these operation buttons (as shown in the above figure). With the submenu hidden, the main display has a larger real estate to display the program elements.
 - **List Programs:** The **List Programs** button offers a quick exit out of the program editor (explained in the following section). To exit out of the program editor mode, simply click this **List Programs** button. This action will cancel and exit the program editor being used to create, edit or import a program.
 - **Create New:** Similar to the **Create New** button under the **List Programs** display page (see item 3 below), this button opens the program editor with an empty template for constructing a new program. Detailed discussion is provided in the following section. A program from the local computer can also be imported into this empty template.
3. **List Programs:** This is the main display of the program list depicted in the previous figure. Click the **Show/Hide** button (see item 1) to hide the submenu and to expand the **List Programs** display page.

9.2 Create New Program

To create a new program, simply click on the **Create New** button in the submenu or under the **List Programs** main display indicated by the arrows in the following figure.

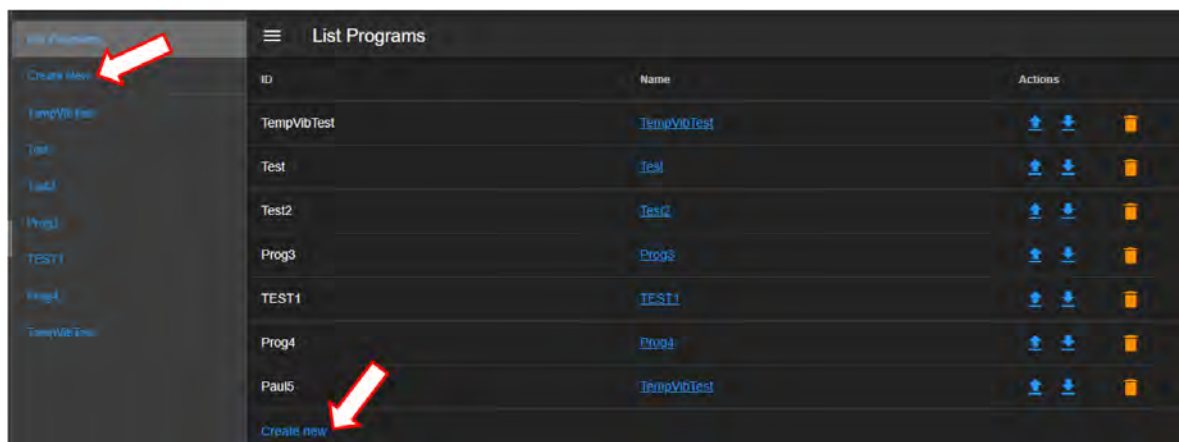


Figure 9.5: Creating a new program

The following figure depicts the general layout of the empty template for a new program.



Figure 9.6: The structure and UI of the Programming Editor

The UI and components of the program editor (pictured above) are numbered and described as follows:

- Editor:** By default, a program is open and placed in the program editor. The program editor is highlighted in blue to indicate its active status.
- Preview Plot:** The output of the current program can be previewed via this button. Both the Editor (item 1 above) and this button can be used to toggle between the editing and previewing mode of the current program. In order to apply the preview mode, the program must be loaded into the program editor first, then click the **PREVIEW PLOT** button.
- Submenu Show/Hide:** To utilize the entire main display area for the program editor, this button can be used to hide the submenu.
- Program Name:** A unique program name, using an alphanumeric naming convention (ASCII), is required for each program. The program name is case-sensitive. This means that program names **PROG01** and **Prog01** are two different programs. If your PC is based on Microsoft Windows, these two program names are identical; that is, Microsoft Windows sees them as one and the same program file. Therefore, a consistent naming convention must be established to guard against accidentally overwriting programs with identical names on your Windows-based PC when the **Export** button is used on the Web Controller.
- Start Temperature:** The initial temperature value (in Celsius) is required. The initial value can be set either by directly entering the specific value into the value field or by click-

ing the up/down arrow next to the C unit.

6. **Start Vibration:** The initial vibration value (in G) is required. The initial value can be set either by directly entering the specific value into the value field or by clicking the up/down arrow next to the G unit.
7. **End Mode:** Two types of operation mode are available for program End Mode:
 - **Turn Chamber Off:** The chamber will be turned off at the end of the program.
 - **Hold Last Step:** The chamber will operate based on the instructions in the last step of the program.
8. **Step Type:** There are five different step types available for each step in the program:
 - **Temp & Vibe Ramp:** Set ramp for both temperature and vibration.
 - **Temp Ramp:** Set ramp for temperature only.
 - **Vibe Ramp:** Set ramp for vibration only.
 - **Dwell:** Set constant value.
 - **Go To Step:** Jump to a specific step within the program. With this **Goto Step** feature, the program can have a loop or subroutine where instructions in a specific step (or steps) can be executed. With loops or subroutines, the program contains fewer lines of steps.

A selection can be made from these five types by accessing the program step option. To add the first step in a new program (as pictured in the above figure) requires clicking on the **APPEND STEP** button (item 8 below), at which point, the five step types can be accessed by clicking on the program step itself (to be explained below).

9. **Temperature:** In each step, temperature can be set via three parameters: Duration, Rate and Set Value. They are described as follows:
 - **Duration:** The format is HH:MM:SS. The time value must be less than 100:00:00. In other words, the entry for the maximum number of hours accepted by the system is 99:59:59. The operation time can be entered in HH:MM:SS format or in pure numerical value and the system will convert it to HH:MM:SS. For instance, if a numerical value 15 is entered, the system sets it to 15 seconds like this: 00:00:15. If 66 is entered, the system converts it to 00:01:06. Similarly, if 90:00 is entered, the system renders this value to 1:30:00.
 - **Rate (C/min):** Temperature rate (measured in Celsius per minute) is determined by the program editor based on the initial temperature (specified in item 3 above) and the target value (Set Value, as described below). The rate will be determined to operate within the specifications of the chamber. Consult the chamber operation manual for detail.
 - **Set Value:** This is the target temperature value. This value will be checked against the chamber's threshold value by the Web Controller to validate the proper operating value. Consult the chamber operation manual for detail on the threshold or the upper limit the chamber can reach.
10. **Vibration:** In each step, vibration can be set with three parameters:
 - **Duration:** The format is HH:MM:SS. The time value must be less than 100:00:00. The maximum number of hours accepted by the system is 99:59:59. Similar to the **Duration** described in item 5 (above), the operation time for vibration can be entered in HH:MM:SS format or in pure numerical value and the system will convert it to HH:MM:SS. Refer to item 5 for examples of acceptable values and format conversion. Note: If **Dwell** is selected for step type (see item 4), the vibration time will (automatically) default to use the temperature time.
 - **Rate (G/min):** Vibration rate (measured in G/min) is determined by the program

editor based on the initial vibration (specified in item 6 above) and the target value (Set Value, as described below). The rate will be determined to operate within the specifications of the chamber. Consult the chamber operation manual for detail.

- **Set Value:** This is the target vibration value. This value will be checked against the chamber's threshold value by the Web Controller to validate the proper operating value. Consult the chamber operation manual for detail on the threshold or the upper limit the chamber can reach.
11. **Time Signals:** Different time signals can be controlled individually.
 - **Time:** This is the delay time value when each TS # will be turned on (if checked) after the program step has been executed. To turn on any TS for the duration of the program execution, this time field can be left blank. Multiple lines for time duration (with line numbered 1, 2, 3, etc) can be used to control each or all TS's using various time delay.
 - **Time Signal:** Individual time signal(s) can be selected for output. For each step, multiple time signals with different time settings can be selected (to be illustrated below).
 12. **APPEND STEP:** As shown in the previous figure, the program editor has an empty template. No instructions or steps of program have been added. To create an instruction, a new step must be created (or added). This APPEND STEP button is used to add a new step. Once a program has a step, additional steps can be added using this button or the drop-down menu of the Step Number (to be explained below). The APPEND STEP button always adds a new step as the last step in the program. By contrast, the drop-down menu of the Step Number allows a new step to be inserted above or below the current step. It also has a delete button to remove any step from the program.
 13. **File Manipulation:** Three available buttons can be used to manipulate the program file.
 - **Open Program:** This button imports a program file from the local computer into the program editor. The filename will be used as the program name by program editor. The program is not yet saved in ESPEC Web Controller system until the **Save As** button is applied. The Web Controller only accepts a program in JSON format. To ensure compatibility, the program structure should be based on the one downloaded from the Web Controller itself (see **Download Program** below).
 - **Download Program:** This button downloads the current program and saves it on the local computer. The downloaded file is based on the program name, saved in JSON format.
 - **Save As:** The **Save As** button can be applied to save the current program with a new filename. **Note:** In edit mode, an additional button called **Save** will be available for saving (or updating) the modified program content.

A new program should begin with its unique name. The rest of the required components or parameters can be constructed based on the above listed items in the order that they appear.

9.2.1 Programming: Add Program Step

The following example outlines a simple procedure to create a new program and add a new step with step type **Temp & Vibe Ramp** and time duration of 10 minutes. The initial temperature used for this example is 23 C with a target value of 30. The rate of 0.7 C/min is determined and set by the program editor (according to the initial and set values, and chamber specifications). Vibration duration is also 10 minutes. Its initial value is 0 G/min with a set value of 10. Its

rate is thus 1 G/min based on the 10-min time duration. The program contains one time signal output (TS1) which will be turned on for the duration of the program. The chamber will be turned off at the end of the program execution.

1. **Program Name:** Enter **TempVib1** in the program name field.
2. **Start Temperature:** Enter 23 over the 0 value in the **Start Temperature** field, or hover the mouse pointer in front the C unit and click on the up arrow to set a value of 23.
3. **Start Vibration:** We will start vibration from 0; hence, the default setting in the **Start Vibration** field is left as is.
4. **End Mode:** Point and click the **End Mode** and select **Turn chamber off** from the list.
5. **Add New Step:** Click the **APPEND STEP** button at the bottom of the program template (indicated by the arrow). By default, the **Temp & Vibe Ramp** is selected for the list for this new step type. Refer to Item 4 in the previous section.
6. **Step 1:** By default, the **Temp & Vibe Ramp** is selected for this new step type; it is the desired step type for this program. If a different step type is required, click on the down arrow to select a different step type from the drop-down list.
 - **Temperature:** Enter the following values for the temperature parameters.
 - **Duration:** Enter 00:10:00 in the duration field.
 - **Rate:** This field can be left blank for the program editor to determine the value; or, enter the correct rate value based on the initial and target value computed using the duration time (i.e., 0.7 C/min).
 - **Set Value:** Apply the up-arrow button (next to the C unit) to set value to 30. The **Rate** value will be changed simultaneously.
 - **Vibration:** Enter the following values for the vibration parameters.
 - **Duration:** Enter 00:10:00 in the duration field.
 - **Rate:** Leave this field blank and let the program editor to determine the value; or, enter the correct rate value based on the initial and target value computed using the duration time (i.e., 10 min) and chamber specifications. If the incorrect rate value is enter manually, the program editor will flag an error message. The simplest approach is to allow the program editor to do its work.
 - **Set Value:** Apply the up arrow button (next to G) to set the value to 10. The **Rate** value (in the previous field) will be changed simultaneously.
 - **USR Outputs:**
 - **Time:** To allow TS1 to stay on for the entire program, leave this setting as is (i.e., 0:00:00).
 - **TS1:** Check the TS1 box.
7. **Step 2:** Two different methods are available for adding a second step in the program: (i) Click the **APPEND STEP** button or (ii) Click step number in the circle of Step 1 and choose **Insert Before**, **Insert After** or **Delete** (as shown in the following figure). The action of the **APPEND STEP** button is sequential; it always adds a new step as the last step in the program by copying the content of the immediate previous step. Method (ii) allows a programmer to add a new step any where within the program by inserting a new one above or below the selected step. This method also allows the programmer to delete any step within the program, thus, giving complete freedom to edit the program.

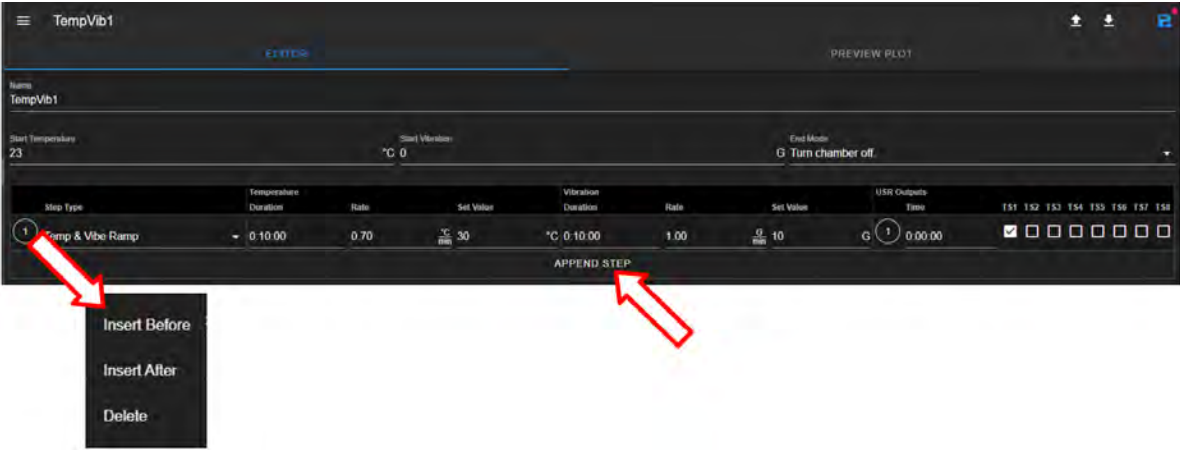


Figure 9.7: Adding or Inserting a program step

8. **Program Preview:** The Web Controller provides an instant preview of the program output. This feature allows the operator/programmer to study its output before execution. Click the **PREVIEW PLOT** button (as shown below) to preview the program output.



Figure 9.8: Preview of the program output

9. **Save Program:** To save program, click on the **Save As** button as shown below.



Figure 9.9: Saving a program profil

10. **List Programs:** Once saved, click the **Submenu Show/Hide** button to reveal the **Program** submenu. The new program should appear in the listing in this submenu.

This program (TempVib1) will be used as an example in the following sections.

9.3 View, Edit, Save Program

This section describes how to open an existing program for viewing and editing. Changes made in the program can be updated by overwriting the program contents back in the file (using **Save**) or saving them as a new program with a different name (using **Save As**).

9.3.1 Open Program

An existing program can be opened for viewing or editing by clicking on its name under the Name list, as shown in the following figure.

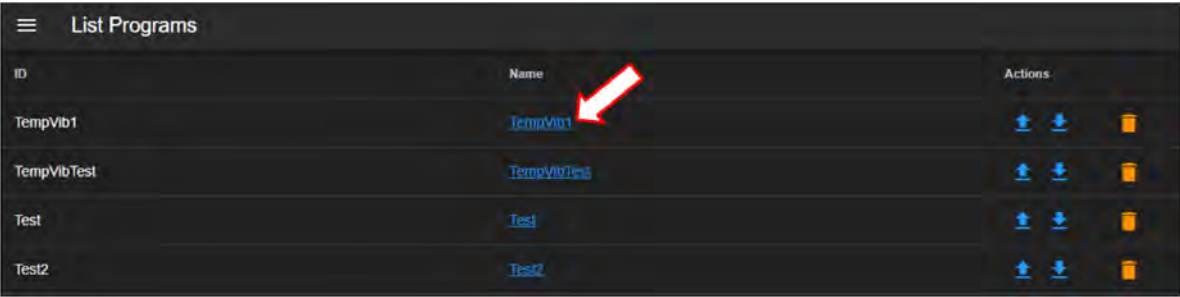


Figure 9.10: Opening a program profile

The program **TempVib1** (indicated by the arrow) that was created in the previous section will be used for illustration. It is open and displayed as follows:

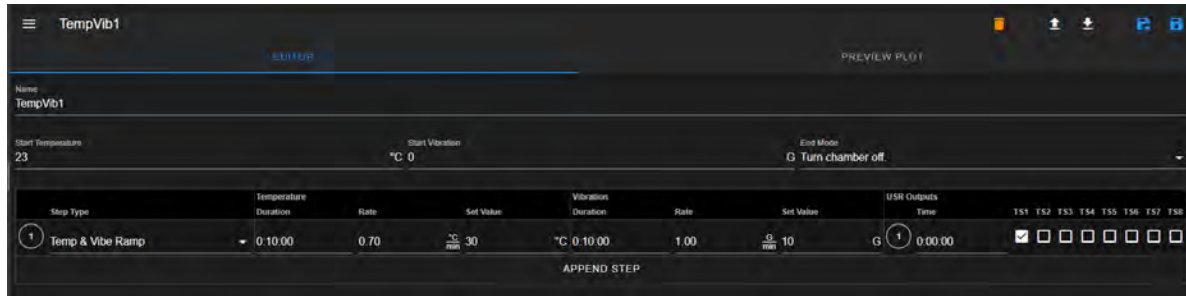


Figure 9.11: Editing program using Program Editor

As depicted in the upper-right in the above figure, five buttons are available for managing the program file in the program editor: **Delete**, **Open Program**, **Download Program**, **Save As** and **Save**. They will be explained in detail in the following sections.

9.3.2 Programming Example: Edit Program

In this section, we illustrate how to edit and modify **TempVib1** program with four additional steps, each using a different step type selected from the available list. We also illustrate how a subroutine can be applied to repeat a number of steps for a specific number of repetition. Application of a time interval and delay to turn on the time signals is also included.

With **TempVib1** program open in the program editor, as shown in the previous figure, complete the following steps to add four additional steps with their specific step type and parameters as follows:

1. **Add Step 2:** Click the **APPEND STEP** button to add the second step.
 - **Step Type:** Click the down arrow and select **Temp Ramp** from the drop-down list.
 - **Temperature:** Enter the following values for the temperature parameters.
 - **Duration:** Enter 00:10:00.
 - **Rate:** Leave it as 0 for program editor to determine the rate value. Or, enter 0.5 based on the calculation of initial and final temp values.
 - **Set Value:** Enter 35. The **Rate** value will change to 0.5 automatically.
 - **Vibration:** Since this step uses **Temp Ramp** without vibration, all the vibration parameters are not applicable.
 - **USR Outputs:** Enter the following values for the user signal relay outputs:
 - **Time:** (Leave it at 0:00:00).
 - **TS1:** Check the TS1 and TS2 boxes.
2. **Add Step 3:** Click the **APPEND STEP** button to add the third step.
 - **Step Type:** Click the down arrow and select **Vibe Ramp** from the drop-down list.
 - **Temperature:** Since this step uses **Vibe Ramp**, all the temperature parameters are not applicable.
 - **Vibration:** Enter the following values for the vibration parameters.
 - **Duration:** Enter 0:10:00.
 - **Rate:** Leave it as 0 for program editor to determine the rate value. Or, enter 0.5 based on the calculation of initial and final temp values.
 - **Set Value:** Enter 15. The **Rate** value will change automatically.

- **USR Outputs:** Enter the following values for the user signal relay outputs:
 - **Time:** (Leave it at 0:00:00).
 - **TS:** Check the TS3 and TS4 boxes.
3. **Step 4:** Click the **APPEND STEP** button to add the fourth step.
- **Step Type:** Click the down arrow and select **Dwell** from the drop-down list.
 - **Temperature:** Enter the following values for the temperature parameters.
 - **Duration:** Enter 0:10:00.
 - **Rate:** This field is grayed out.
 - **Set Value:** This field is grayed out.
 - **Vibration:** Enter the following values for the vibration parameters.
 - **Duration:** The vibration time duration will automatically default to use the temperature time duration; that is, 0:10:00 will be filled in immediately after clicking on the **Vibration Duration** field.
 - **Rate:** This field is grayed out.
 - **Set Value:** This field is grayed out.
 - **USR Outputs:** We will apply delay and time interval to control the time signal outputs for TS5 and TS6. We will be implementing this using the set time intervals.
 - **(1)Time:** (Leave it at 0:00:00).
 - **TS:** Check the TS5 box. Under this configuration, TS5 will turn on when Step 4 gets executed. It will remain on until the next time interval starts and TS6 turns on (refer to the program preview below).
 - **(2)Time:** To add the second time interval, click the 1 in the circle and select **Insert After** from the drop-down list, as depicted in the following figure. Enter 0:05:00 in the time field. This value will dictate when TS6 turns on.
 - **TS:** Check the TS6 box. Under this configuration, TS6 will turn on 5 minutes after this step has been executed. Thus, TS6 signal has a 5-minute time delay; it will stay on for 5 minutes (refer to the program preview below).

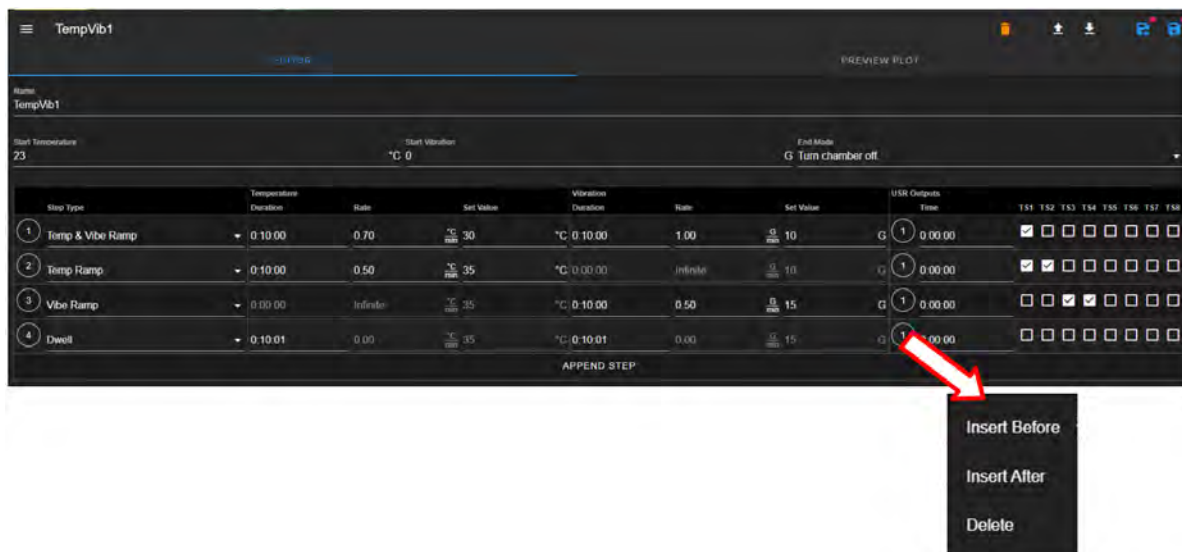


Figure 9.12: Adding the second time interval for TS

4. **Step 5:** Click the **APPEND STEP** button to add the fifth step.
 - **Step Type:** Click the down arrow and select **Go To Step** from the drop-down list.
 - **Temperature:** Under the **Go To Step** field (under the Temperature field), click the down arrow to select **Step 2**.
 - **Vibration:** Under the **Go To Step Count** (under the Vibration field), enter 10 or click the up arrow to select 10.
5. **Save Program:** The complete program is illustrated in the following figure. To save the program, click the Save icon in the upper-right corner. The following section describes how to apply other buttons in this upper-right corner. The complete program is illustrated in the following figure.

Step	Step Type	Temperature	Rate	Set Value	Vibration	Rate	Set Value	USB Outputs	Time
1	Temp & Vibe Ramp	0.10.00	0.70	30	0.10.00	1.00	10	G 1	0.00.00
2	Temp Ramp	0.10.00	0.50	35	0.00.00	Infinite	10	G 1	0.00.00
3	Vibe Ramp	0.00.00	Infinite	35	0.10.00	0.50	15	G 1	0.00.00
4	Dwell	0.10.01	0.00	35	0.10.01	0.00	15	G 1	0.00.00
5	Go To Step	Go To Step Step 2			Go To Step Count 10			G 2	0.05.00

Figure 9.13: A sample program in the Program Editor

6. **Preview Output:** Click the **PREVIEW PLOT** button to preview the program output, as depicted in the following figure.



Figure 9.14: An output preview of the Sample Program

9.3.3 Managing Program File via the Program Editor

This section describes how to apply the five file manipulation options available in the upper-right corner of the program editor, as depicted in the following figure. :

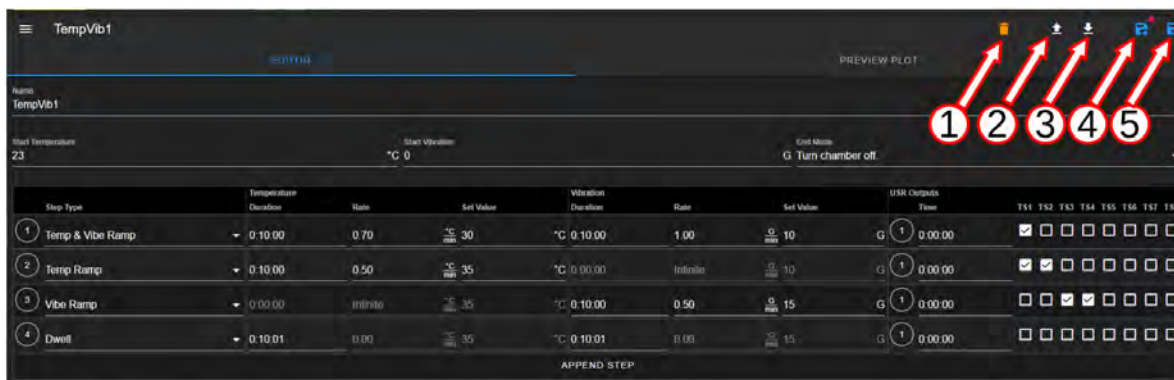


Figure 9.15: File manipulation options

They are described as follows:

1. **Delete:** Click the trash bin icon to delete the current program in the program editor. As a safety measure, the system will prompt to confirm the action with a pop-up warning with a Yes/No option to proceed with the action. Upon completion, the system returns to the Program menu to update and display the Name list.
2. **Open Program:** This button imports a program file from the local computer into the program editor. By default, the system opens the Downloads folder on the local computer to upload the program file. Navigate to the program's location, if necessary, and double-click on the desired program to import it into the program editor buffer. The program editor only accepts program structure and format in JSON.
3. **Download Program:** The current program in the program editor can be downloaded onto the local computer as a backup. By default, the program will be stored in the Downloads folder, with filename based on the program name (e.g., TempVib1.json).
4. **Save As:** This button can be used to produce a duplicate of the current program under a new name. In order to apply this feature, the program name in the Name field must be changed to a desired filename, as illustrated in the following figure.

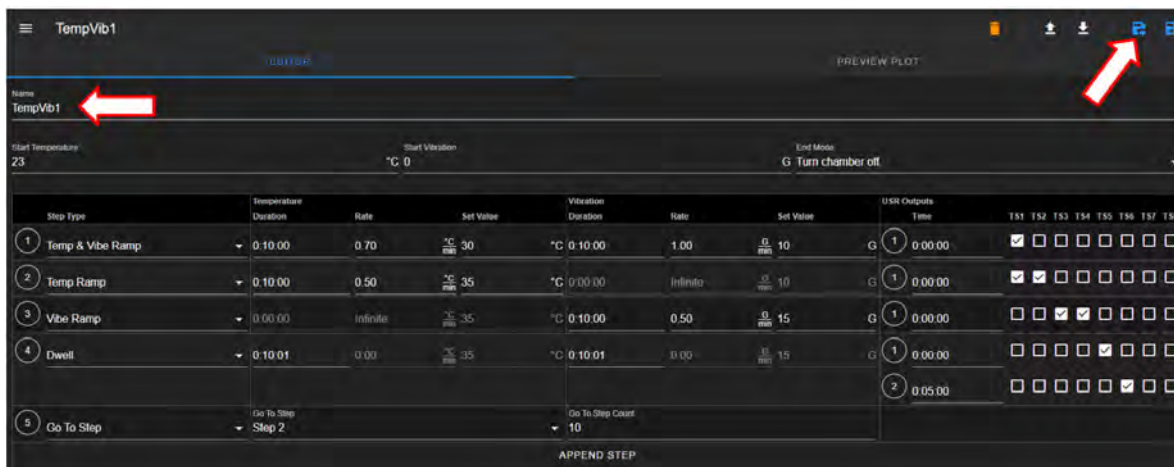


Figure 9.16: Renaming a program in the Program Editor

5. **Save:** Apply this button to update the program file. To help check the editing status of the program, the program editor utilizes a red dot placed above the **Save** or **Save As** button to indicate an update yet to be saved.

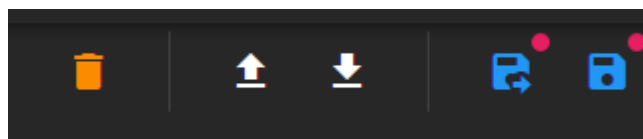


Figure 9.17: Update indicator

Navigating out of the editor without saving the update will trigger a warning prompt, as depicted in the following figure.

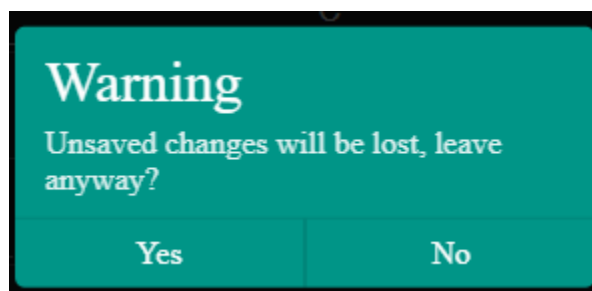


Figure 9.18: Confirm the save or discard update

The T-series chamber does not store any program in the controller. All programs displayed in the **List Programs** submenu are stored in the Web Controller. When an operator runs the program, the Web Controller loads that program into its memory, executes each line and sends instructions to the controller in the T-series to carry out the task. Even though these programs require the Web Controller for execution, they can be exported (item 3 above) to the local computer as backups.

9.3.4 Managing Program File via the Name List

This section describes how to apply the three file manipulation options on the Name list, as depicted in the following figure.

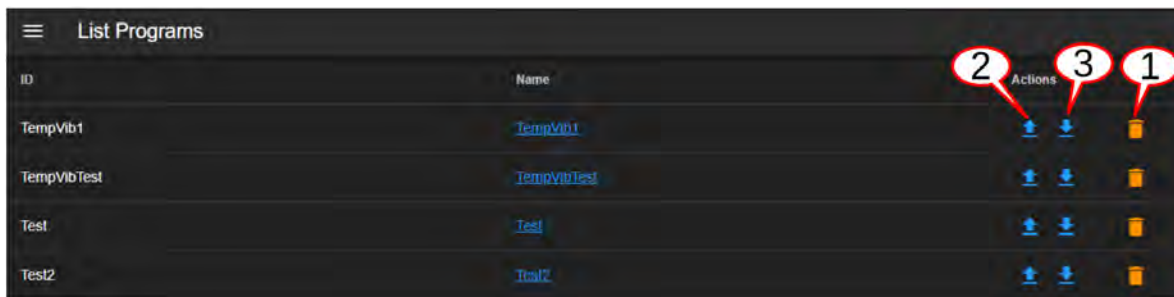


Figure 9.19: Manage programs on the Name list

These three options are listed and described as follows:

1. **Delete:** To delete **Test** from the Name list, click the trash bin icon as depicted in the following figure. As a safety measure, the system will prompt to confirm the action with a pop-up warning with a Yes/No option to proceed with the action. It may be necessary to apply the refresh button of the Web browser after deleting the program file from the Name list.

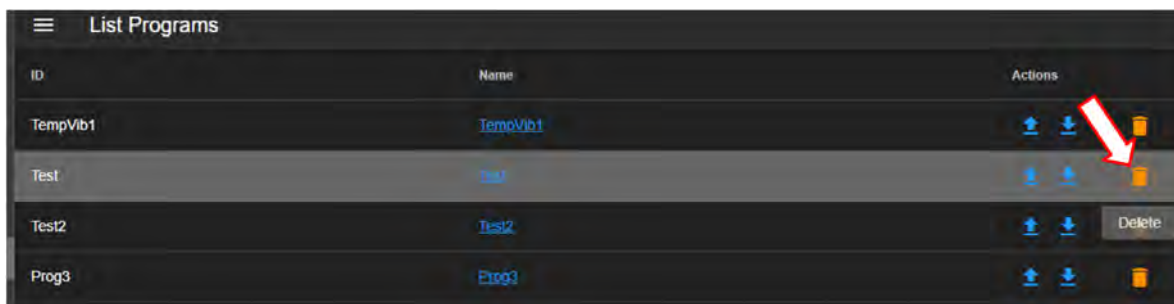


Figure 9.20: Deleting program from the Name list

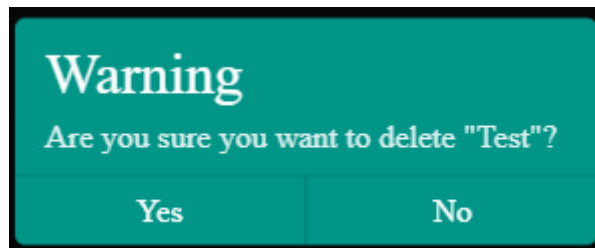


Figure 9.21: Confirm deletion

2. **Upload Program:** This button can be used to import a program from the local computer directly into the Web Controller (onto the Name list). To import a program into ID **Prog3**, click the **Upload** button, as indicated by the arrow in the following figure. Navigate to locate the desired file on the local computer and double-click it to complete the process.

Caution: This operation is extremely dangerous. The imported program will overwrite the contents of **Prog3** on the Name list under ID **Prog3**. A new name based on the name of the imported program will be placed on the Name list. Program **Prog3** is thus gone after this operation. The most effective way to add a new program (from the local computer) onto the Name list is via the Program Editor using the **Open Program** operation button or creating a new one in the program editor itself.

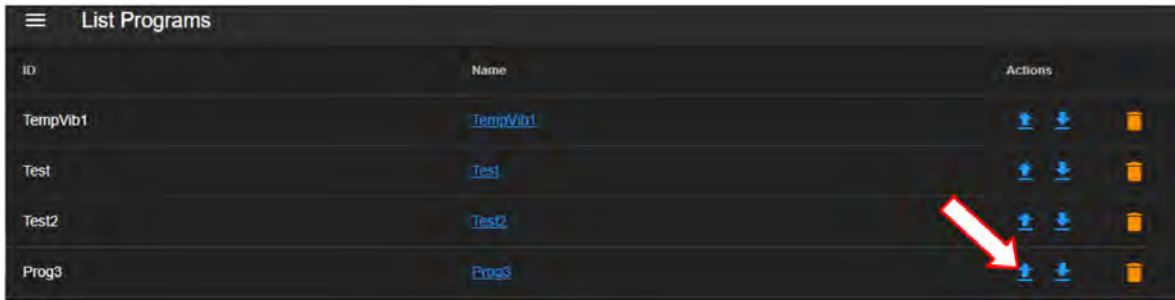


Figure 9.22: Importing a program

3. **Download Program:** To download (i.e., export) a program **Test2** under ID **Test2** on the Name list (see above figure), click on the **Download** button. By default, the program file will be stored in the **Downloads** folder on the local computer using filename: Test2.json.

CHAPTER 10

Start Stop

This menu allows the operator with read-write privilege to control or manage the chamber with the following operation modes: **Standby**, **Constant**, **Program**, **Alarm**. The following figure depicts these modes displayed in the main display area as individual tabs.

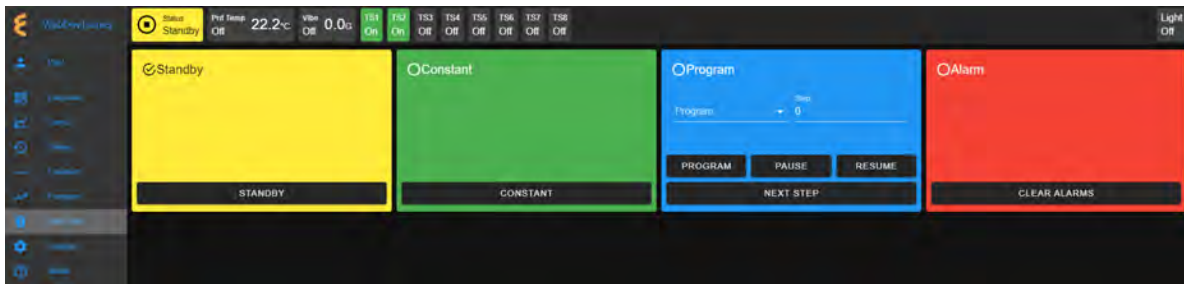


Figure 10.1: The Start/Stop menu with a Status Bar

It should be noted that the **Status** tab in the status bar also provides access to these modes for control and operation. Refer to the **Overview** menu for detail on how to control the chamber operating modes.

10.1 Standby Mode

In **Standby** mode, the chamber is off, and the status tab in the status bar displays as **Standby**. There is also a check mark placed in the circle next to **Standby** in the tab of the main display area, as illustrated in the above figure.

10.2 Constant Mode

In **Constant** mode, the chamber operates using the constant configuration, and the status tab displays as **Constant**. This status is also indicated by the check mark in the circle, as depicted in the following figure.

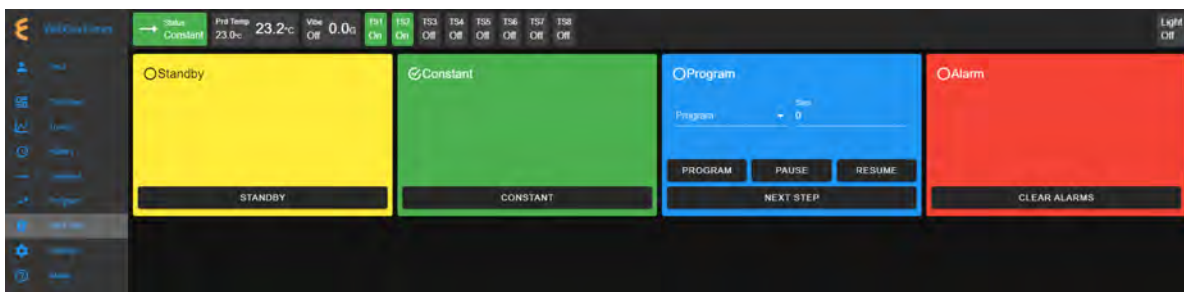


Figure 10.2: The Start/Stop menu with chamber in Constant mode

10.3 Program Mode

In **Program** mode, the chamber is carrying out instructions of the program being executed. The status tab in the status bar indicates the chamber is in **Program** mode, along with the name of the program being executed, as depicted in the following figure. This status is also indicated by the check mark in the circle in the program tab.

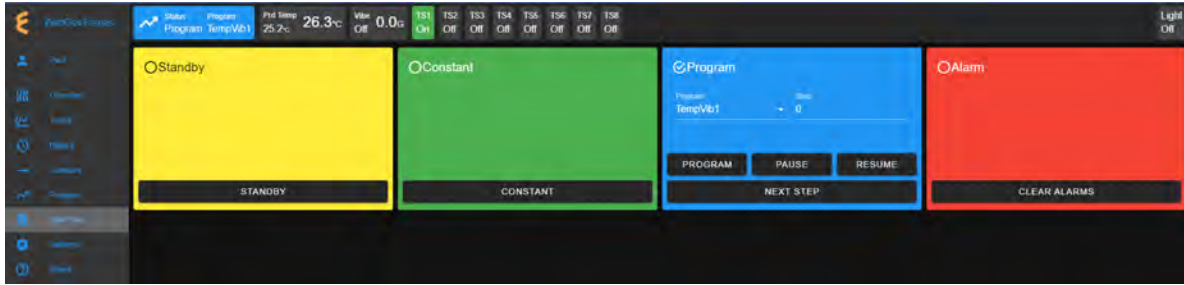


Figure 10.3: The Start/Stop menu with chamber in Program mode

10.4 Alarm Mode

In **Alarm** mode, the chamber is in alarm state. It will halt operation until issues are fixed and alarms triggered in the chamber are cleared.

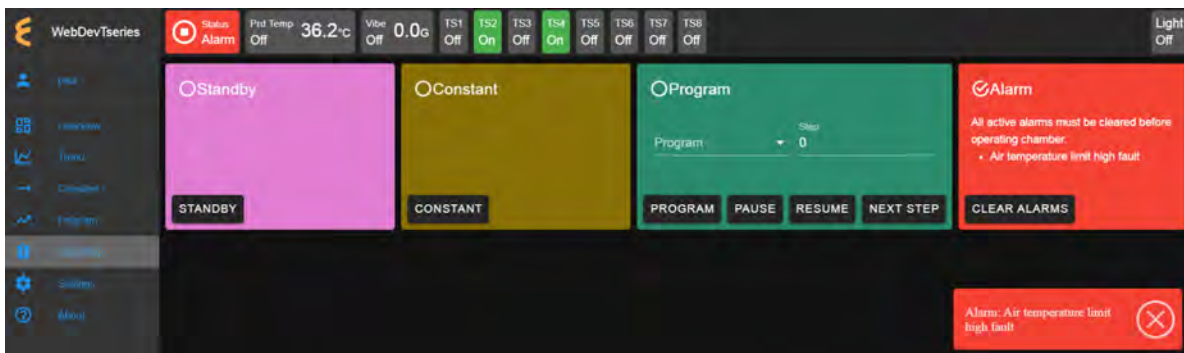


Figure 10.4: The Start/Stop menu with chamber in Alarm mode

As depicted in the above figure, we have one alarm occurred. Three different locations are used to flag the alert and the type of alarms. The status tab in the status bar indicates chamber is in **Alarm** state. A check mark next to the **Alarm** status in the tab of the main display area signifies the **Alarm** state; it also indicates the type of alarm as **Air temperature limit high fault**. An alert message of the nature of that alarm is displayed at the lower right of the main display area. This pop-up message can be suppressed by clicking the **X** button. But, the **Alarm** state still remains until all alarms triggered in the chamber are resolved.

If multiple alarms occurred, multiple alerts are displayed in this lower-right area (in the main display), as depicted in the following figure. A list of alarm types will be displayed in the **Alarm** tab in the main display area, as depicted in the following figure.



Figure 10.5: Managing chamber alarms in the Start/Stop menu

Each pop-up alert may be suppressed or cleared by clicking on their **X** buttons. But, again, the **Alarm** state still remains until all alarms triggered in the chamber are resolved.

10.5 Start/Stop Standby Mode

Authorized users with read-write privilege may set the chamber in **Standby** mode by clicking the **STANDBY** button in the **Standby** tab. In this mode, the chamber is in the **OFF** state. To terminate the **Standby** mode, activation of a new mode is necessary. For instance, to switch the chamber **ON** and to operate in **Constant** mode, click the **CONSTANT** button in the **Constant** tab in the main display area. ESPEC Web Controller immediately moves to apply the operating mode to the chamber.

10.6 Start/Stop Constant Mode

Authorized users with read-write privilege may set the chamber to operate in **Constant** mode by clicking the **CONSTANT** button in the main display area. In this mode, the chamber operates by executing the constant settings in the configuration. To terminate the **CONSTANT** mode, activation of a new mode is necessary. For instance, to switch the chamber from its **Constant** mode to **Standby** mode, click the **STANDBY** button in the **Standby** tab. ESPEC Web Controller immediately moves to apply the operating mode to the chamber.

10.7 Start/Stop Program Mode

Authorized users with read-write privilege may set the chamber to operate in **Program** mode by performing a series of operations in the **Program** tab. The following subsections describe the procedures how to run (execute) a program, pause, resume or step through the instructional steps in the program.

10.7.1 Run Program

To load and execute a program to control the chamber, complete the following steps:

1. Click the radio button in the **Program** tab to select a program from the list. Apply the scroll bar, if necessary, to search through the long list of programs, as depicted in the following figure.

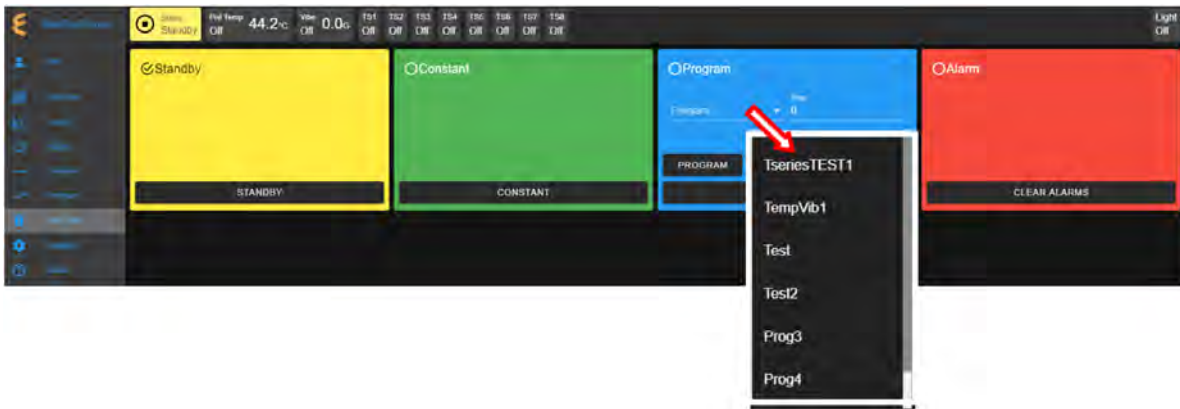


Figure 10.6: Executing a program from the Program List

2. Click to select the desired program name.
3. To start this program at a certain step, enter the step number in the **Step** field. Default setting is 0, which means to start program at step 1.
4. Click the **PROGRAM** button to execute the program. ESPEC Web Controller immediately moves to apply the operating mode to the chamber. The status tab and status bar now display the program being executed, as depicted in the following figure. The **Overview** page maybe accessed to display the detail of the program being executed.

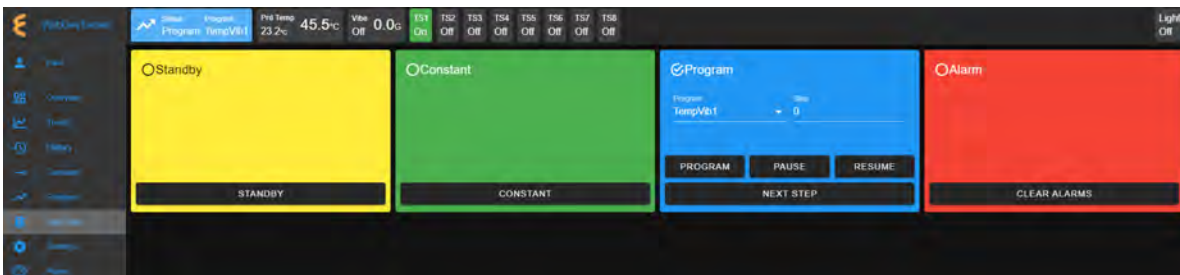


Figure 10.7: Program being executed

10.7.2 Pause/Resume Program

Authorized users with read-write privilege may control the chamber during program execution. **Program** mode may be interrupted and put in a “suspense mode” using the **PAUSE** button in the **Program** tab. To pause a program during execution, click the **PAUSE** button; all operations are suspended. An update notification appears in the lower-right corner. The **Paused** notification is posted in the status tab.

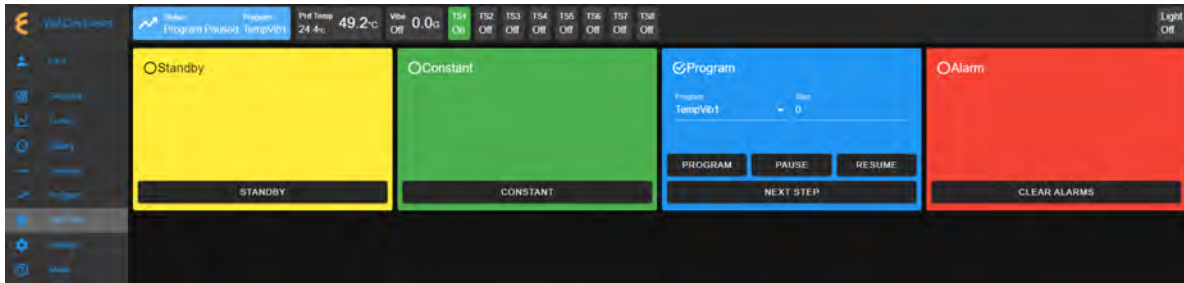


Figure 10.8: Program is paused, all operations suspended

To resume the operation and continue program execution, click the **RESUME** button. An update notification appears in the lower-right corner. The chamber will continue to operate based on instructions in the program. Program name is posted in the status tab to indicate chamber is in **Program** mode and that program (name) is being executed.

10.7.3 Stepping through Program

Without having to wait for each step in the program to complete its tasks for the entire time duration in the instruction, an operator may step through the program to study the effects of the instructions in a certain step. While the program is being executed, click the **NEXT STEP** button to execute the next step in the program. An update notification appears in the lower-right corner to confirm the action. This action may be repeated until the last step in the program is reached. The **Overview** page in combination with the extended tab maybe accessed to display the detail of the program being executed and its steps being stepped through. The following figure depicts program **TempVib1** being stepped through to executing step 4.

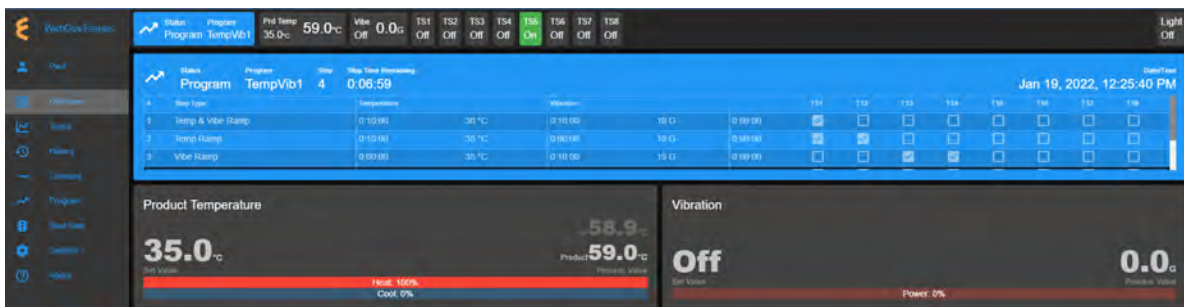


Figure 10.9: Stepping through a program

10.8 Clear Alarms

The chamber is set in the **Alarm** state as a result of an alarm or alarms triggered in and by the chamber. ESPEC Web Controller relays all alert messages to the operator for immediate action or intervention to prevent further damage to the chamber or any test products inside the chamber. The **Alarm** tab in the main display area can be used to clear all alarm messages once those alarms are resolved in the chamber. Click the **CLEAR ALARMS** button to clear all alarm messages in order to resume the chamber operation.

Part III

ESPEC Chamber with F4T

CHAPTER 11

Overview

The **Overview** page displays the current status of the chamber and its operating mode. A user is brought to this page after successfully logging into ESPEC Web Controller. The following figure depicts **Overview** showing the chamber in Standby mode, as indicated in the status tab and its extension bar. The extension bar of the status tab is only available in the **Overview** menu.

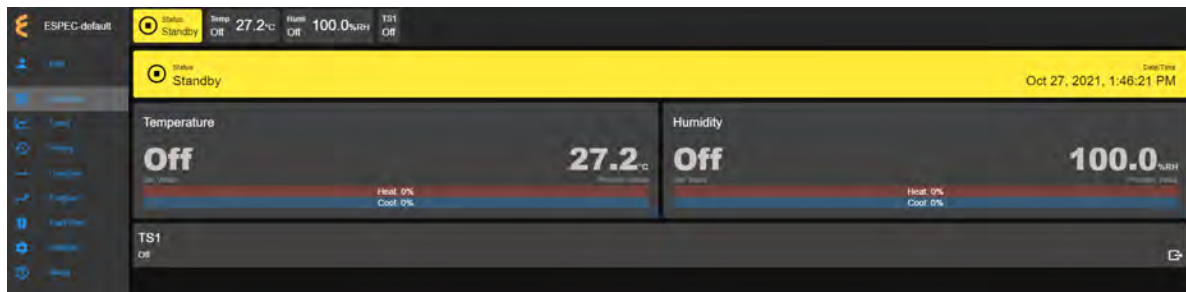


Figure 11.1: Overview page with chamber in Standby mode

The following figure depicts **Overview** showing the chamber in Constant mode.

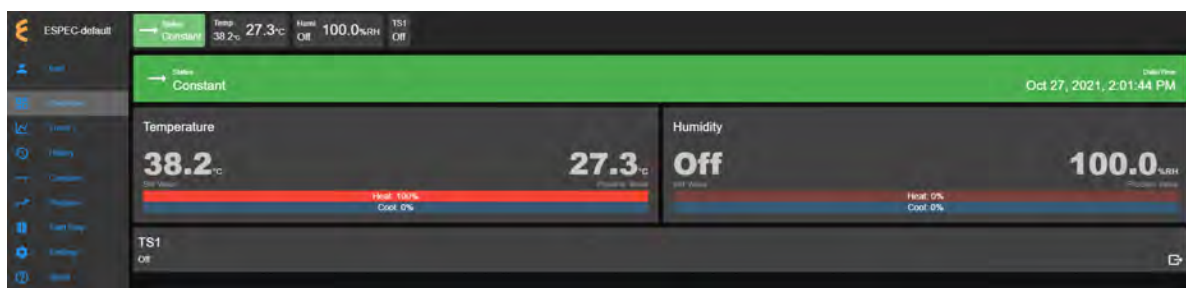


Figure 11.2: Overview page with chamber in Constant mode

The following figure depicts **Overview** showing the chamber in Program mode. Detailed information about the program, including what step is being executed, is listed in the extension bar (of the status tab). This feature provides the operator with useful information about the status of the chamber and the program.

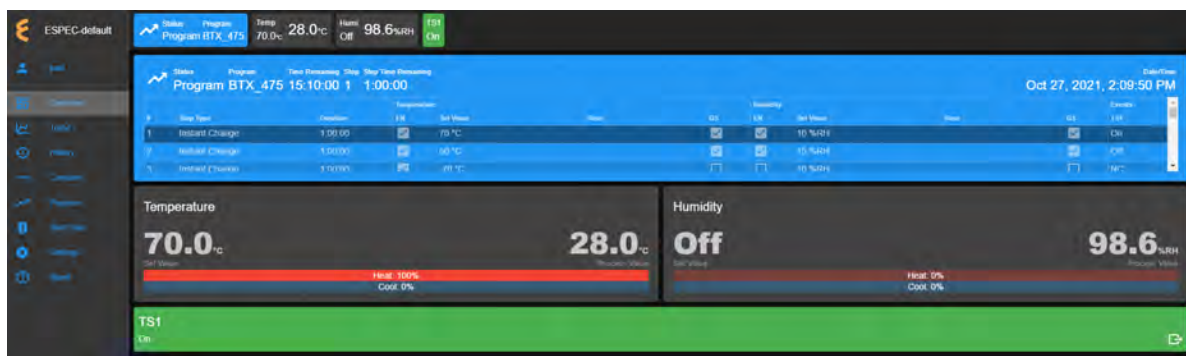


Figure 11.3: Overview page with chamber in Program mode

Only users with read-write privilege can control the chamber operation mode from within this page. Supported operation modes are **Standby**, **Constant** and **Program**. Each tab in the sta-

tus bar may be accessed to apply new settings at any time. This feature enables the operator to control the chamber without having to access the **Start Stop** menu in the menu bar. The following sections detail a step-by-step procedure how to control the chamber's operating mode via the **Overview** menu for users with read-write privilege.

11.1 Standby Setting

For authorized users with read-write privilege, to set the chamber in **Standby** mode, proceed with the following steps. Initially, the chamber is operating in **Constant** mode. We wish to switch its operation mode to **Standby**.

1. Click the status tab in the status bar to access the drop-down tabs, as shown in the figure.



An alternative way to access these drop-down tabs is to click on the extended tab of the status tab itself, as depicted in the following figure. This extended tab is available only in the **Overview** page.

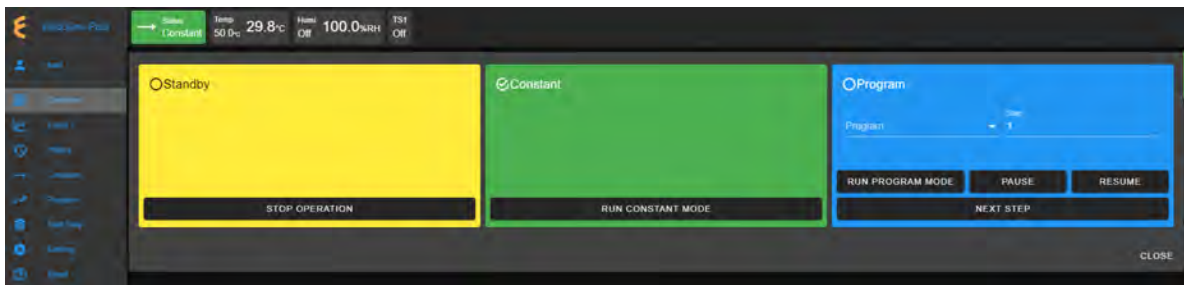


Figure 11.4: Status tab drop-down menu via the extended tab

2. Click the **Stop** button in the standby tab. ESPEC Web Controller immediately moves to apply the operating mode to the chamber. A check mark in the **Standby** tab indicates and confirms its standby mode.
3. To close the drop-down tabs, perform one of the following action:
 - Click an empty area in the Main Display.
 - Click a different menu in the menu bar.
 - Click the status tab itself. or
 - Click the **CLOSE** button underneath the alarm tab.

11.2 Constant Setting

Suppose the chamber is in **Standby** mode. For authorized users with read-write privilege, the chamber can be set in **Constant** mode with the following steps.

1. Click the status tab in the status bar. As depicted in the following figure, the chamber is in **Standby** mode.



Figure 11.5: Constant mode setting

2. Click the **CONSTANT** button in the constant tab. ESPEC Web Controller immediately moves to apply the operating mode to the chamber.
3. To close the drop-down tabs, click the **CLOSE** button in the lower-right corner (underneath the alarm tab); or the one of the alternative options mentioned above.

11.3 Program Setting

To set the chamber in **Program** mode means a profile (i.e., program) is loaded and executed.

1. Click the status tab in the status bar or the extension bar of the status tab.
2. Click the radio button in the program tab to access the program list (see the figure below).

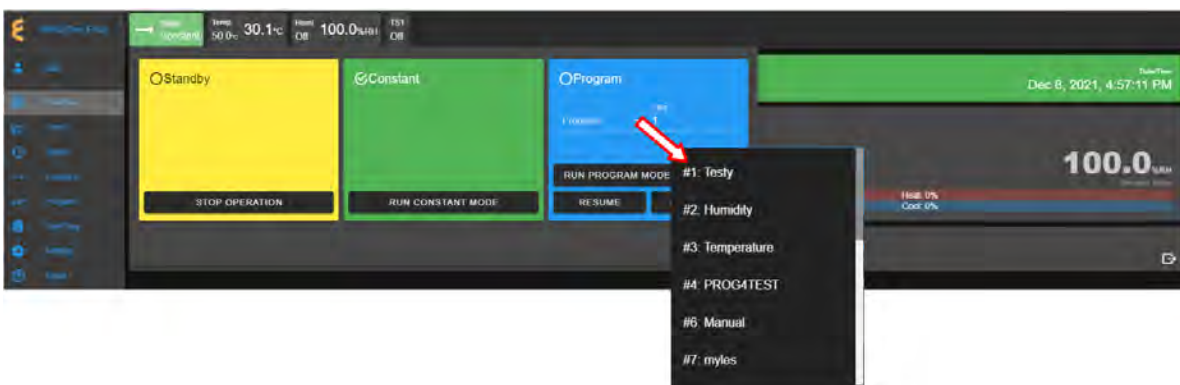


Figure 11.6: Select program to start chamber in Program mode

If no program is available for loading, the list contains slot numbers without programs, as depicted in the following figure. A program must be created first before it can be loaded for execution. Chapter 8 discusses how to create a program to control the chamber.

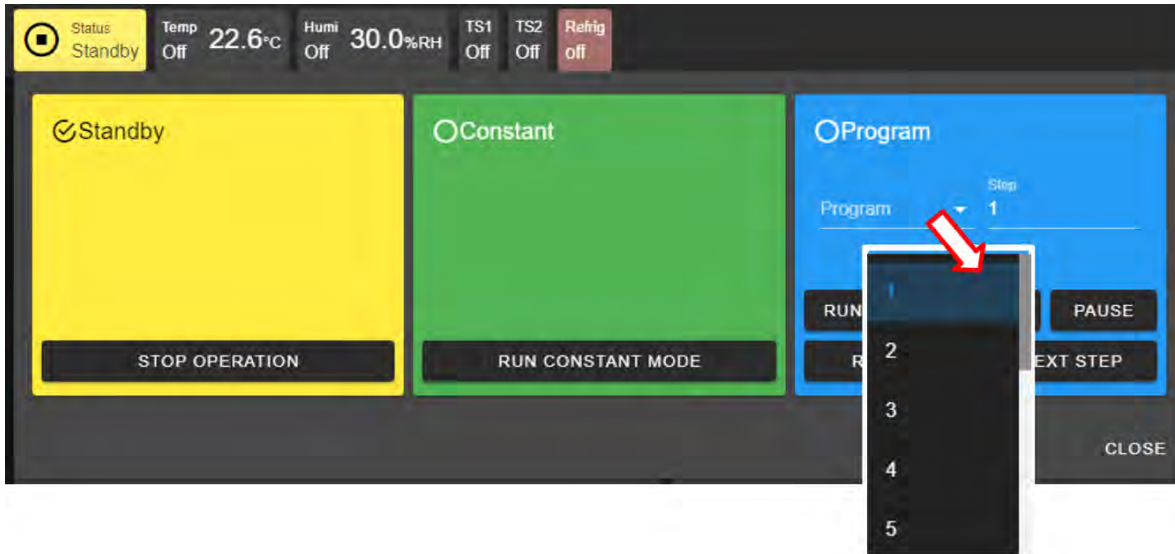
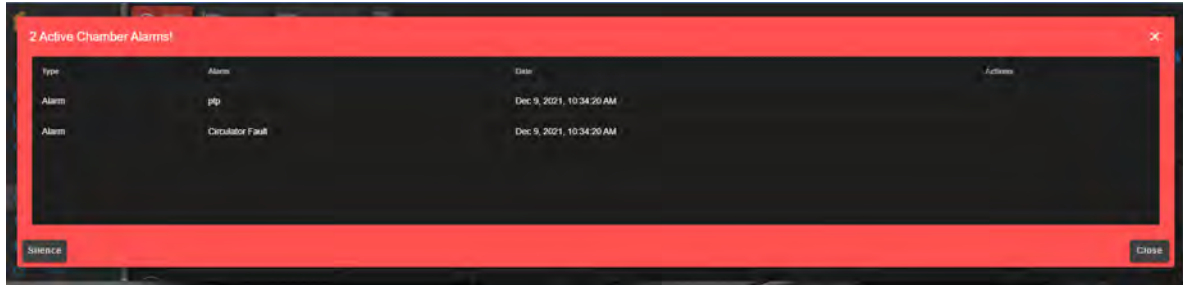


Figure 11.7: No program available for execution

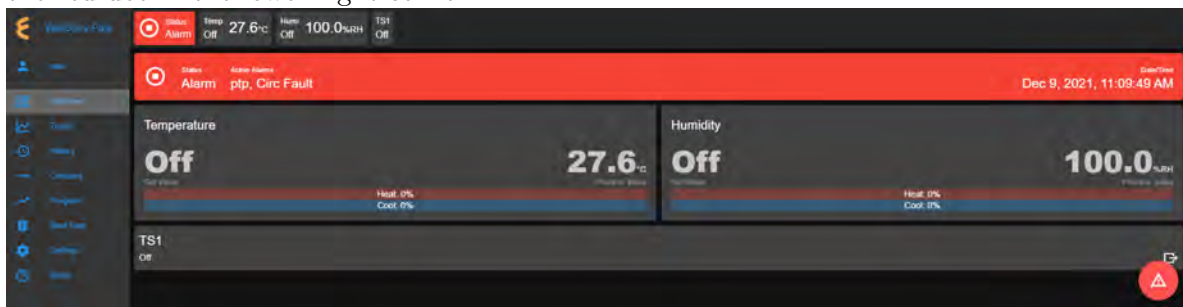
3. Click to select a program from the list. Apply the scroll bar, if necessary, to select the desired program.
4. Enter a desired step number in the step field for program to start. Default start step is 1.
5. Click to select a program from the list. Apply the scroll bar, if necessary, to select the desired program.
6. Enter a desired step number in the step field for program to start. Default start step number is 1.
7. Click the **RUN PROGRAM MODE** button to execute the program. ESPEC Web Controller immediately moves to apply the operating mode to the chamber. Note: This program tab offers a few practical methods during a program execution. The **Pause** button can be used to pause the program. Program can be resumed via the **RESUME** button. Program instruction lines can be stepped through via the **NEXT STEP** button.
8. Click the **CLOSE** button to view the status of program execution displayed in the extended tab.
9. To end or interrupt the program being executed, switch the chamber to **Standby** or **Constant** mode via the **Status** tab.

11.4 Clear Alarms

When ESPEC Web Controller detects that the chamber is in an alarm state, it also sets itself in an alert state by displaying a list of active alarms and fault names in the red window to require an immediate action from the operator, as depicted in the following figure.



A repeating beep on the local computer is also tripped to get the operator's attention. The **SILENCE** button can be used to turn off the beep. This alert window can be closed by clicking the **CLOSE** button or the X button. However, the alarm state still remains to be resolved as indicated by the **Status** tab in the following figure. To redisplay or expand the alarm list, click the red dot in the lower-right corner.



In an alarm state, operation is halted until all alarms triggered by chamber are resolved via the F4T (i.e., clear all alarms on the F4T) before the Web Controller (and the chamber) can resume the normal operation. Once all alarms are cleared, the Web Controller will automatically clear all alert messages and resume normal operation by switching the chamber to a **Standby** mode.

11.5 Temperature, Humidity or Time Signal Settings

On the **Overview** page, settings of temperature, humidity or time signals can be controlled via the tabs in the status bar or the dedicated panes in the main display area, as shown in the following figure.

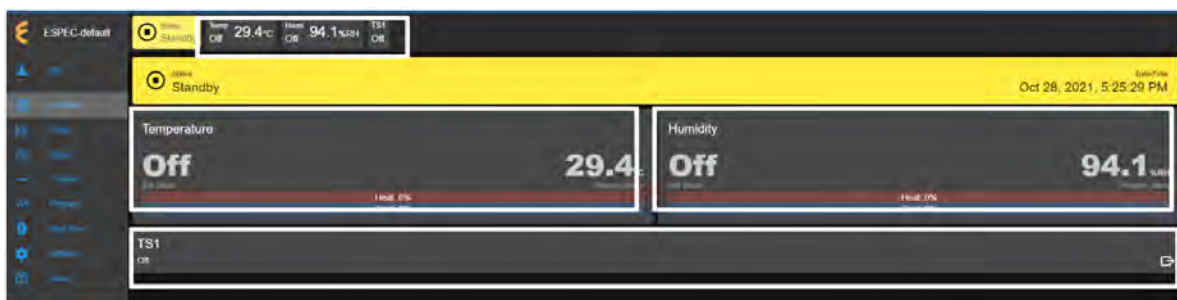


Figure 11.8: Perform settings via the main display area

11.5.1 Settings via the Status Bar

To set temperature with a new set value, complete the following steps:

1. Click the Temp tab in the status bar.
2. In the drop-down pane, click and enter new value in the Set Value field or click the up/down arrow to adjust the value, as illustrated in the following figure.

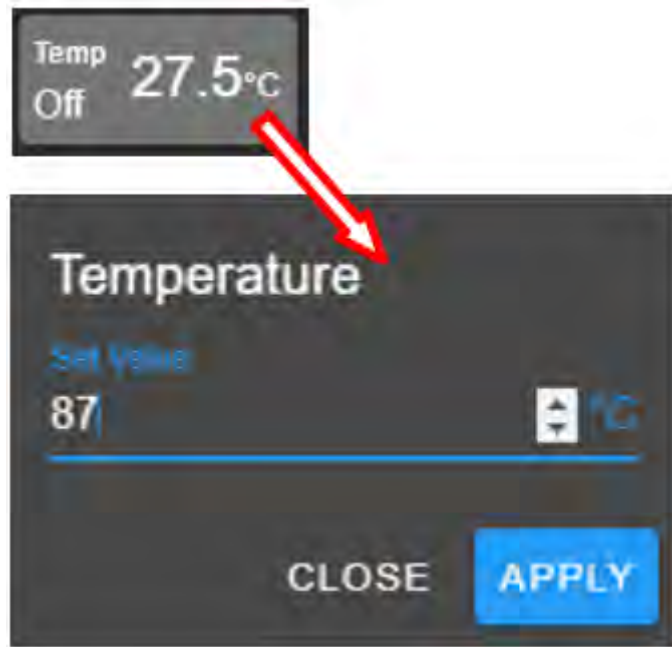


Figure 11.9: Setting new temperature value via the temp tab

3. Click **APPLY** to apply the new setting.
4. To cancel the setting, click the **CLOSE** button.

To turn on Humidity and set its value, complete the following steps:

1. Click the Humi tab in the status bar.
2. In the drop-down pane, check the box to enable humidity.
3. Click and enter new value in the Set Value field or click the up/down arrow to adjust the value, as illustrated in the following figure.

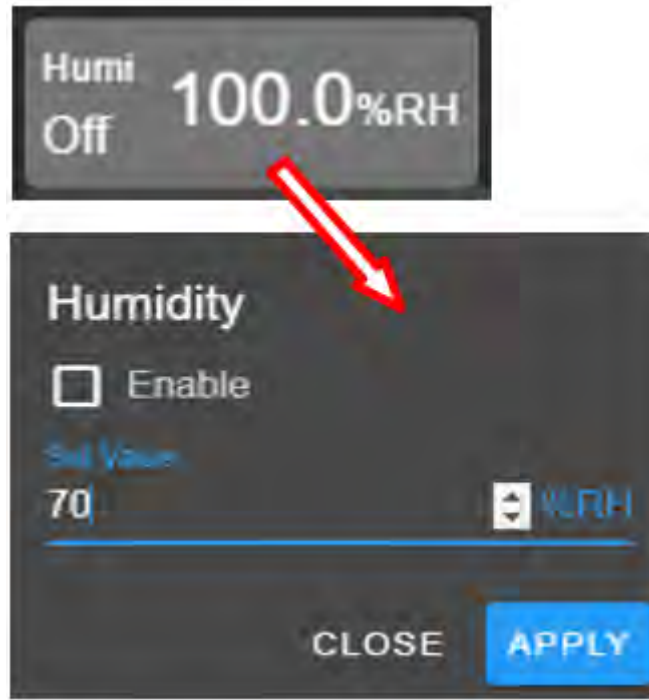


Figure 11.10: overview-humi-tab-setting-02.PNG

4. Click **APPLY** button to apply the setting.
5. To cancel the setting, click the **CLOSE** button.

The time signals in the status bar can be switched on or off individually. The following steps illustrate how to turn on TS1. The rest of the time signals, if available, can be applied using the same method:

1. Click the TS1 tab in the status bar.
2. Check the box to enable TS1.
3. Click **APPLY**.
4. To cancel the setting, click **CLOSE** (instead of **APPLY**) or click the TS1 tab itself in the status bar.

To turn off TS1, apply the following steps:

1. Click the TS1 tab in the status bar.
2. Uncheck the box to disable TS1.
3. Click **APPLY**.
4. To cancel the setting, click **CLOSE** (instead of **APPLY**) or click the **TS1** tab itself in the status bar.

11.5.2 Settings via the Dedicated Panes

With ESPEC Web Controller, there are multiple ways to complete the same task. The dedicated panes for temperature, vibration or humidity, time signals, or refrigeration, in the main display area are actually clickable panes. These are CTA (call-to-action) panes through which new pa-

parameter settings (such as, temperature, vibration or humidity, time signal and refrigeration) can be applied.

To apply a new setting to temperature, proceed as follows:

1. Click the Temperature pane.
2. In the input pane, click and enter new value in the Set Value field or click the up/down arrow to adjust the value, as illustrated in the following figure.

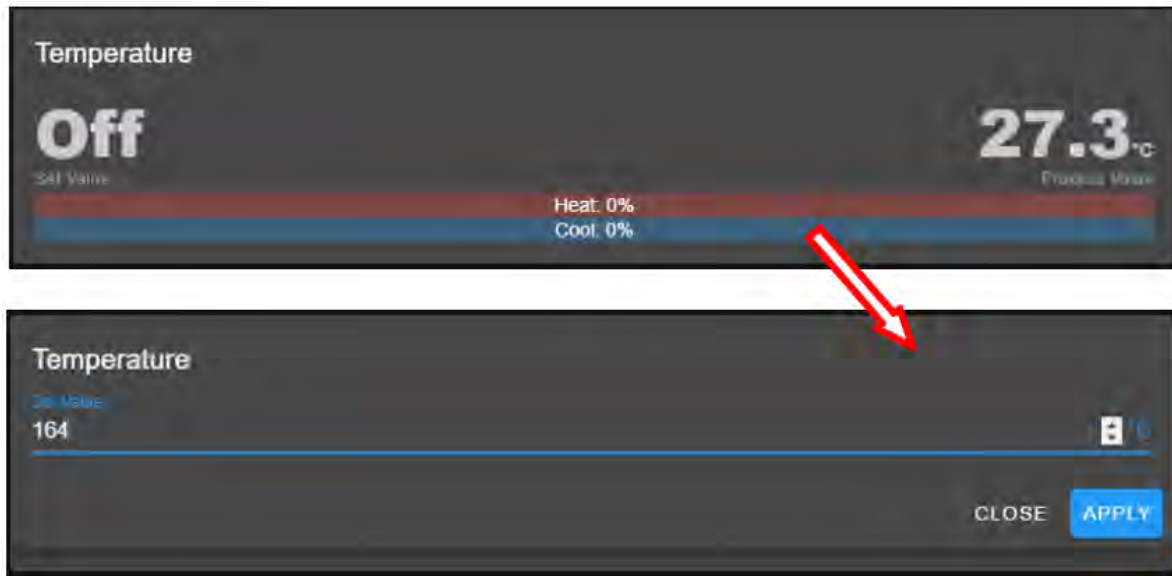


Figure 11.11: Setting new temperature value via the temperature (CTA) pane

3. Click **APPLY**. To cancel the setting, click **CLOSE** (instead of **APPLY**).

The above procedure can be applied to humidity and time signal.

11.6 Web Controller on the Network

ESPEC Web Controller can communicate with other ESPEC Web Controllers on the same network. The hostname (with E logo) in the upper-left corner acts as a link that, when clicked, provides a list of any chamber with ESPEC Web Controller detected on the network by the local ESPEC Web Controller, as depicted in the following figure.

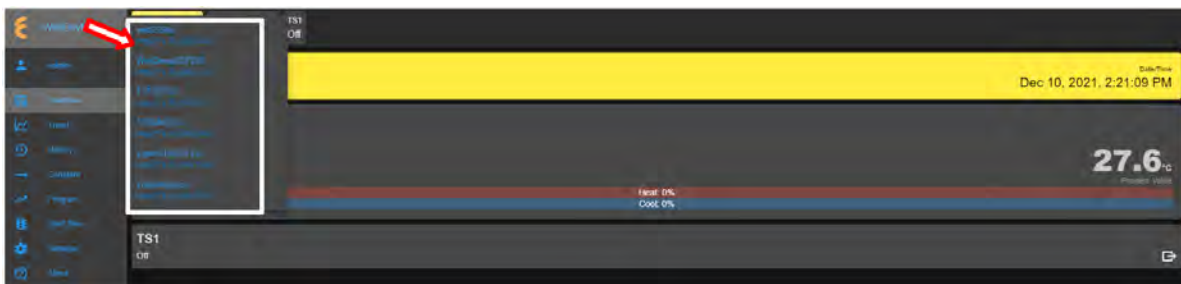


Figure 11.12: List of ESPEC Web Controller on the local network

This list can be opened from within any menus (not just in the **Overview** menu) by just clicking on the Web Controller hostname. Any chamber and ESPEC Web Controller on the list can be accessed directly by clicking on its hostname.

CHAPTER 12

Trend

Data points from the chamber's operation accumulated in the data log are displayed as a trend graph under the **Trend** menu, depicted in the following figure. By default, this graph provides an overview of the chamber's operation in the last one hour. Data can be downloaded in whole or in portion (refer to Item 4 below).

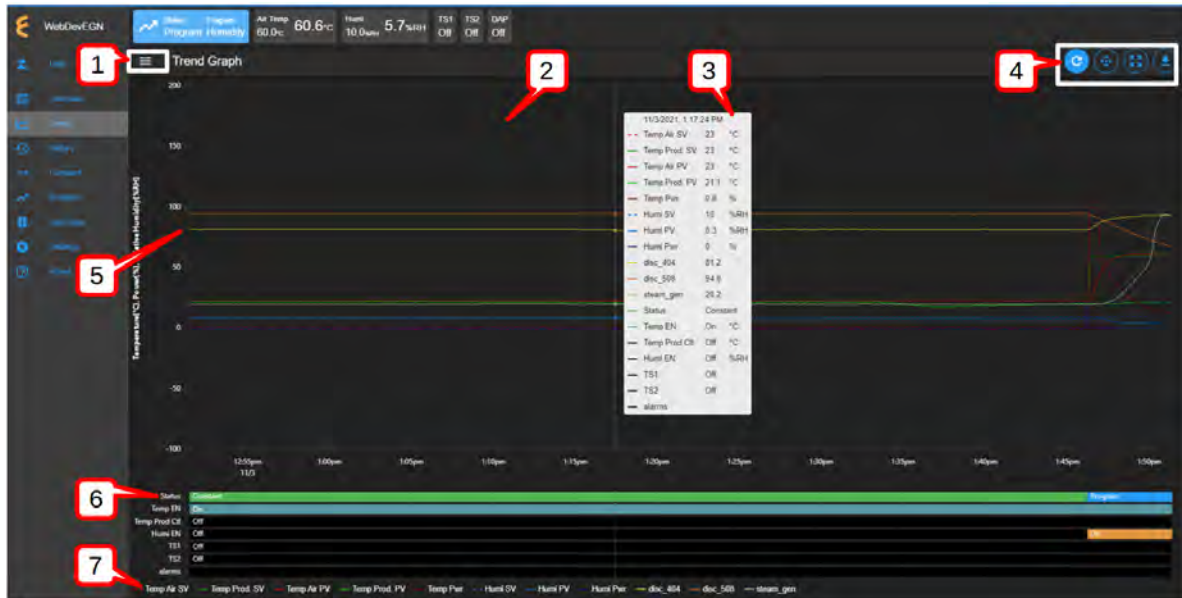


Figure 12.1: Trend graph showing plots of current data from the chamber

The main display area of the **Trend** menu is categorized into seven different groups with labels from 1 through 7. Detailed descriptions of these categories are outlined as follows:

1. **Time Frame:** This menu button shows or hides the time frame of the data points being plotted in the trend graph. As shown in the following figure, the trend graph is plotted for data points collected between 1:07 PM and 2:06 PM. That time frame is also displayed at the bottom of the trend graph, with grids at an interval of 5 minutes. This graph will continue to update and propagate through the progression of time in a 5-minute interval. To hide this time frame, click the menu button again.

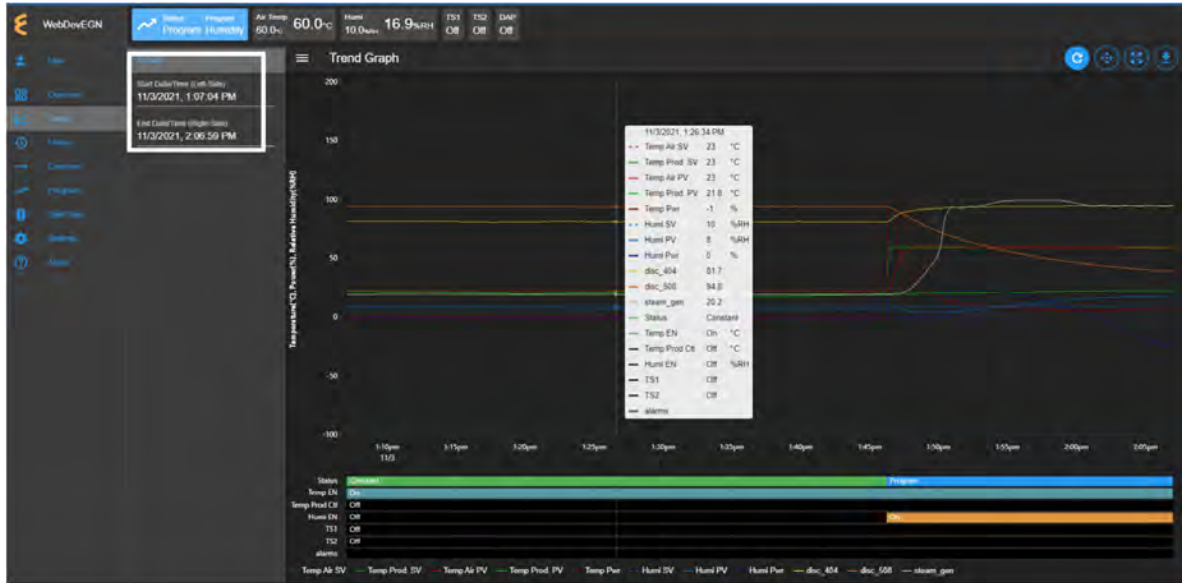


Figure 12.2: Detailed data of the Trend graph

2. **Trend Graph:** Data points collected from the chamber are rendered and displayed as a trend graph based on a scatter plot methodology. Depending on the chamber type and feature, these data points represent product temperature, air temperature, humidity and/or vibration; they are plotted as a function of time. The vertical (Y) axis represents the scale of their values. Temperature is displayed in degree Celsius; humidity in percentage as %RH, vibration in root-mean-square of acceleration (Grms or G). The horizontal (X) axis represents the time scale measured in a 1-second unit. The scaling of the grid will change according to the Pan/Zoom Controls buttons application (see item 3 below). To reset the trend graph, click the **Zoom Extents** button (in the following figure), select **Last Hour** from the drop-down menu, then click the **Auto Refresh** button.
3. **Snapshot of Data:** By hovering a mouse pointer on the trend graph area, a snapshot of the data at a particular time is displayed. This feature allows a quick peak of the data at a certain point in time. Depending on the chamber's condition, the snapshot provides set values (SV) and process values (PV) of temperature, product or air temperature, humidity or vibration, chamber's operation status and time signal status.
4. **Trend Graph Manipulation Buttons:** Four buttons are available to help manipulate and control the trend. This group of buttons is detailed in the following figure; their functions are described as follows:

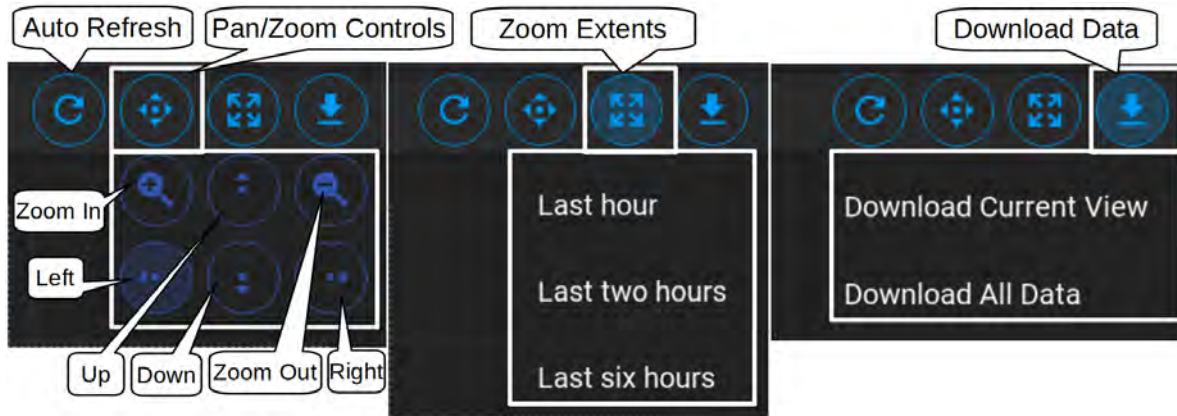


Figure 12.3: Manipulation buttons of the Trend graph

- **Auto Refresh:** This Auto Refresh button refreshes the trend graph; it thereby reconstructs the graph using the most recent data points which have been accumulated up to the current time.
- **Pan/Zoom Controls:** The Pan/Zoom Controls button allows the operator to control and adjust the viewable section in the trend graph. This button presents six operation buttons to manipulate and display the trend graph as follows:
 - **Zoom In:** The **Zoom In** button allows the operator to zoom into a small section of the trend graph. Depending on the degree of zooming, the display area will be confined to a small set of data points ranging between minutes to hours. To reset the trend graph, click the **Zoom Extents** button, select **Last Hour** from the drop-down menu, then click the **Auto Refresh** button.
 - **Zoom Out:** The **Zoom Out** button does the opposite by allowing the operator to zoom out on the trend graph, thereby giving the operator an expansive view of the trend graph. To reset the trend graph, click the **Zoom Extents** button, select **Last Hour** from the drop-down menu, then click the **Auto Refresh** button.
 - **Move Up:** This button allows the operator to move up the graph along the vertical axis to adjust the viewable area of the scatter plot. To reset the trend graph, click the **Zoom Extents** button, select **Last Hour** from the drop-down menu, then click the **Auto Refresh** button.
 - **Move Down:** This button allows the operator to move down the trend graph along the vertical axis with the purpose to adjust the viewable area of the scatter plot. To reset the trend graph, click the **Zoom Extents** button, select **Last Hour** from the drop-down menu, then click the **Auto Refresh** button.
 - **Move Left:** This button allows the operator to pan left on the trend graph, offering a quick preview of a plot of data points tracing back the time in hours or days. With this feature, the operator can quickly gain a preview of past data points which the operator may have missed.
 - **Move Right:** This button does the opposite to **Move Left** by allowing the operator to pan right on the trend graph to the current time. To reconstruct the trend graph to contain the most recent data points, the **Auto Refresh** button allows the quickest operation.
- **Zoom Extents:** With this button, trend graph may be provided using data points from within the last one hour, last two hours or the last six hours. To make adjust-

ment of the trend graph based on these three selections, click on the **Zoom Extents** button, then click one of the selection from the drop-down menu.

- **Download Data:** To download data and store it on the local computer, click the **Download Data** button and select **Download Current View** to download a portion of data from the displayed trend graph. To download the entire collection of data, select **Download All Data**. Data file will be stored in the Downloads folder of the local computer with filename: hostname_data_date.CSV.
5. **Line Graph:** Data points from Temperature (set values or process values) and vibration (set values and process values) are being plotted to produce the line graphs to visually display the operation condition of the chamber.
 6. **Status:** Status of the operation mode of the chamber is displayed along the time line on the trend graph, indicating when and how long the chamber was in specific operating mode. This feature provides a quick preview of the chamber operating status. The **Left** button under the Pan/Zoom Controls may be used to extent further into the past to view the chamber's operating mode.
 7. **Legend of Trend Graph:** The legends are used to identify each item on the trend graph with color code to designate the different line graph (described in Item 5 above).

CHAPTER 13

History

The **History** page displays operation history of the chamber, its operating modes and statistics. Any alarms or alerts that were triggered during the chamber's operation are logged and displayed here. By default, history log of the chamber's operating modes, alarms or statistics from the previous week will be displayed, as depicted in the following figure. There are five important components in the **History** main display area. They are labeled and described as follows:



Figure 13.1: Operation history of the chamber

The nomenclature of the **History** page is described as follows:

1. **History Interval:** Display options of the operating history are: one week, two weeks, one month, three months, six months, one year or the entire period of the chamber's operation. To access the history interval, click the radio button to select the period from the list.

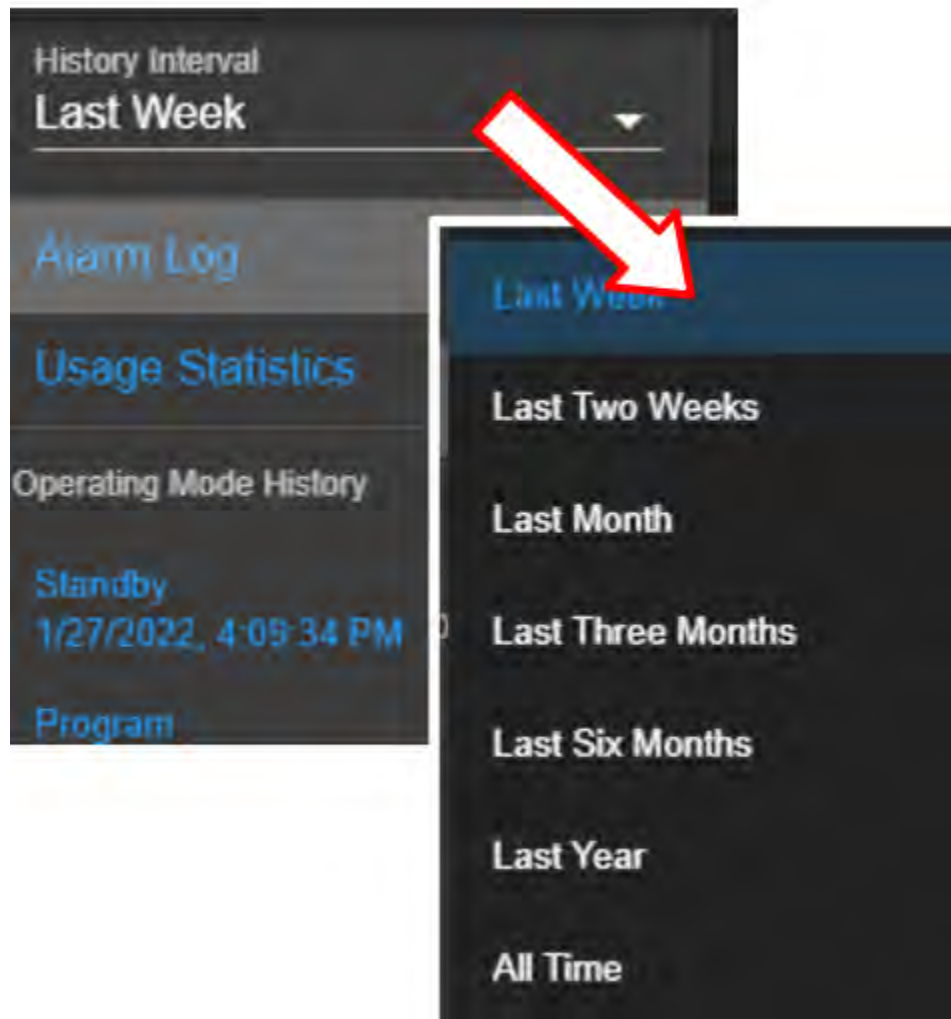


Figure 13.2: History interval and display selection

2. Alarm or Statistics Submenus:

- **Alarm Logs:** By default, alarm logs will be displayed in the main display area. The logs indicate which alarm had occurred and when they were resolved (cleared).



Figure 13.3: History of alarm

- **Usage Statistics:** To display the operation statistics, click on this submenu. Percentage of each operation mode based on the selection period in the **History Interval** is displayed as shown in the following figure:

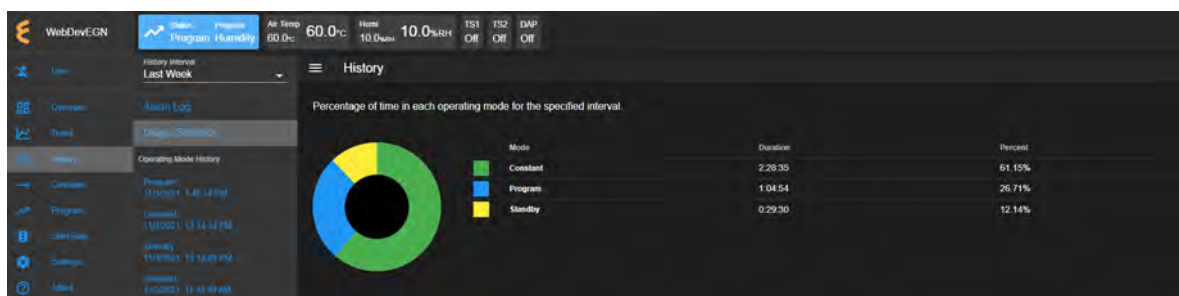


Figure 13.4: Operation statistics

Such information provides the operator a good idea of the overall performance of the chamber by identifying when and how much time it was in a certain operating mode.

3. **Operating Mode History:** A list of operating modes of the chamber is displayed here based on the option selected under the **History Interval**. Default listing is based on a one-week interval. A trend graph, identical to that produced in the **Trend** menu, based on the data points collected during the operating mode can be produced by clicking on the particular operating mode on this list, as illustrated in the following figure.

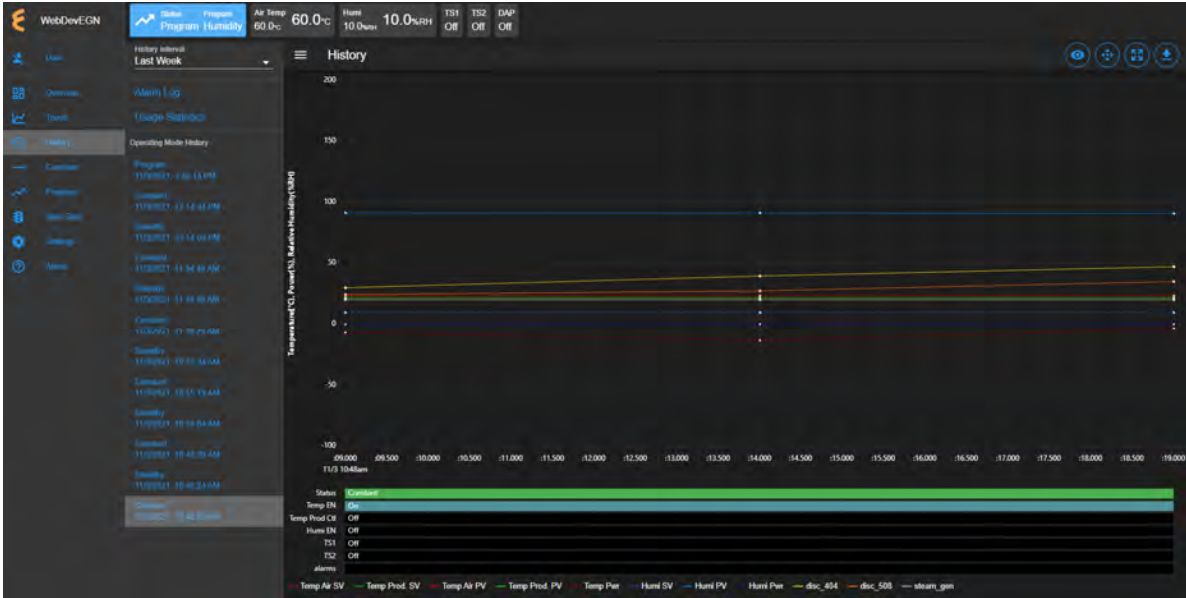


Figure 13.5: Trend graph of operating mode history

4. **Show/Hide Submenu:** To provide a larger real estate for the main display area, this Show/Hide button can be used to show or hide the **History** submenu. The following figure shows how the submenu is hidden and the main display area is expanded.

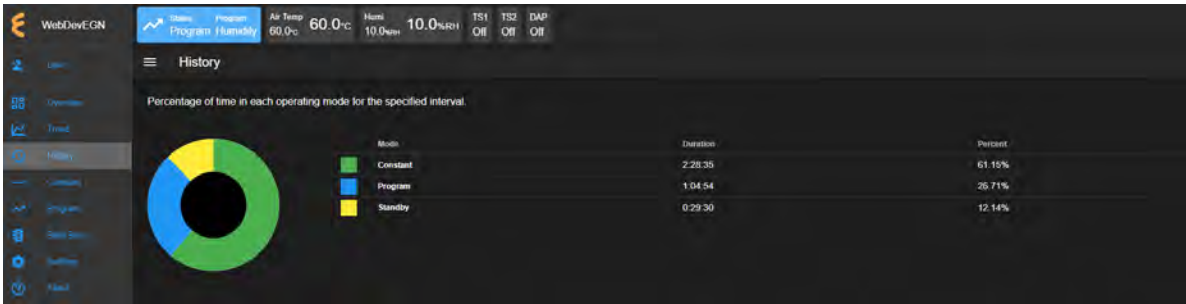


Figure 13.6: The show/hide button of the main display of the History page

5. **Main Display:** The content of the submenu page of **Alarm Log** and **Usage Statistics** is displayed here (refer to item 2, above).

CHAPTER 14

Constant

The existence of ESPEC Web Controller **Constant** page is such that all features and their parameters are collected and displayed in one place to control their constant mode settings. The main display of **Constant** consists of three separate CTA panes, displayed as **Temperature**, **Humidity** (or **Vibration**) and **Outputs**, as depicted in the following figure. These CTA panes provide input options to adjust the settings directly. The Humidity Range Chart is a two-dimensional graph of the current temperature-humidity relationship, displayed below these CTA panes.

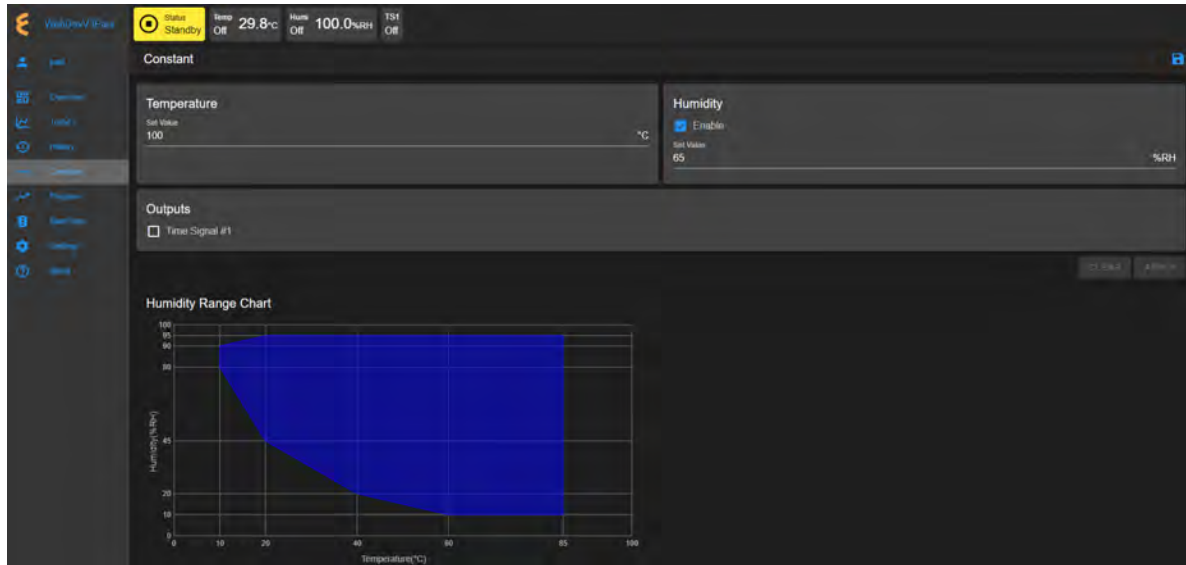


Figure 14.1: The Constant menu and its display page

The following sections describe how to configure and control each of these parameters.

14.1 Product or Air Temperature Setting

Complete the following steps to turn on or modify temperature setting:

1. Click the Set Value field and enter a new value, or click the up/down arrow to adjust the value.
2. Click the **APPLY** button or the save icon as indicated by the arrows in the following figure to apply and save the setting.



Figure 14.2: Apply new constant setting on temperature

3. To cancel the setting, click **CLEAR**. If you exit this pane by accessing a different menu in the menu bar, a warning will appear, as depicted in the following figure, which requires you to save the setting before attempting to access any other menus.

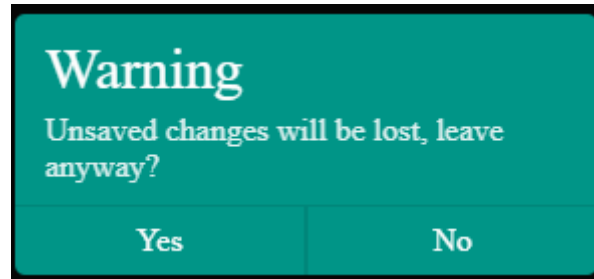


Figure 14.3: New setting must be save before exiting the pane

The new setting takes effect immediately with its new status displayed in the status bar. To reverse or cancel the setting, repeat the above steps to reset the set value and click **APPLY**.

14.2 Humidity Setting

Complete the following steps to turn on or modify humidity setting:

1. Place a check mark in the **Enable** box (refer to the above figure).
2. Click and enter new value in the Set Value field or click the up/down arrow to adjust the value.
3. Click the **APPLY** button or the save icon as indicated by the arrows in the above figure to apply and save the setting.
4. To cancel the setting, click **CLEAR**. If you exit this pane by accessing a different menu in the menu bar, a warning will appear (see above figure) which requires you to save the setting before attempting to access any other menus.

The new setting takes effect immediately with its new status displayed in the status bar. To reverse or cancel the setting, repeat the above steps to uncheck the box, reset the set value and click **APPLY**.

14.3 Time Signals Setting

Complete the following procedure to turn on output for any time signal:

1. To turn on output for **Time Signal # 1**, place a check mark in its box.
2. Repeat the above step for any time signal available in the main display area.
3. Click the **APPLY** button or the save icon as indicated by the arrows in the above figure to apply and save the setting.
4. To cancel the setting, click **CLEAR**. If you exit this pane by accessing a different menu in the menu bar, a warning will appear which requires you to save the setting before attempting to access any other menus.

The new setting takes effect immediately with its new status displayed in the status bar. To reverse or cancel the setting, repeat the above steps to uncheck the box and click **APPLY**.

It is important to note that all the parameters (temperature, humidity, vibration, time signal) in the main display can be adjusted altogether simultaneously with a single **APPLY** or save button. However, individual setting may provide security to avoid any adverse effect.

CHAPTER 15

Program

The **Program** menu allows the operator to create a program to control the chamber. All the programming features available on the supported PLC's listed in Chapter 1 (“**Introduction**”) can be composed into programs to control the chamber. The operator can: (1) open and view a program; (2) preview the output of the program; (3) edit and/or overwrite an existing program ; (4) delete program from the list; (5) rename program on the list; (6) download a program and store it on the local computer in JSON file; (7) upload a program from the local computer to the Web Controller, and much more.

Here are some of the benefits of the **Program** menu:

- Easy to operate.
- Quick management of programs, programming or editing.
- Require less time to develop a new program or modify an existing program.
- Program Editor offers flexibility with multitasking capabilities.
- Control program operation and program end mode.
- Preview program operation before execution; operator can see exactly what the program does prior to its execution.
- Download program from the Web Controller to the local computer for backup.
- Upload program from the local computer to the Web Controller.

Only authorized users with read-write privilege can access and utilize the **Program** menu. The menu is grayed out, as depicted in the following figure. Access to the menu requires read-write privilege and the user log into their account to use the menu.

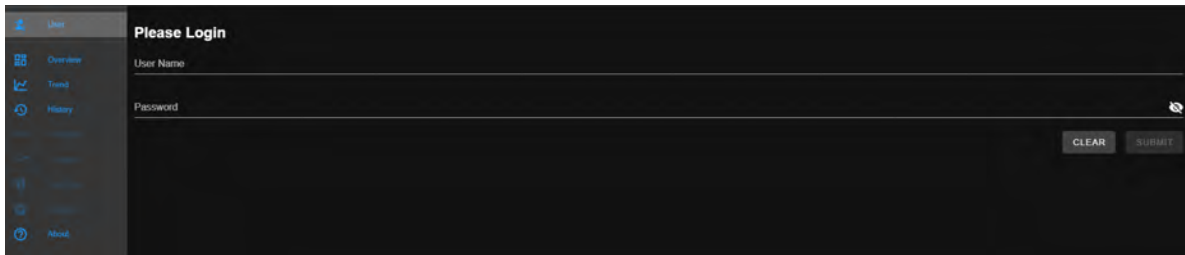


Figure 15.1: User with read-write privilege is required to operate the Program menu

15.1 List Programs

The following figure depicts a typical layout of the **Program** page with its submenu hidden. This is the default display of program list when the **Program** menu is accessed for the first time. Its UI components are numbered and explained as follows:

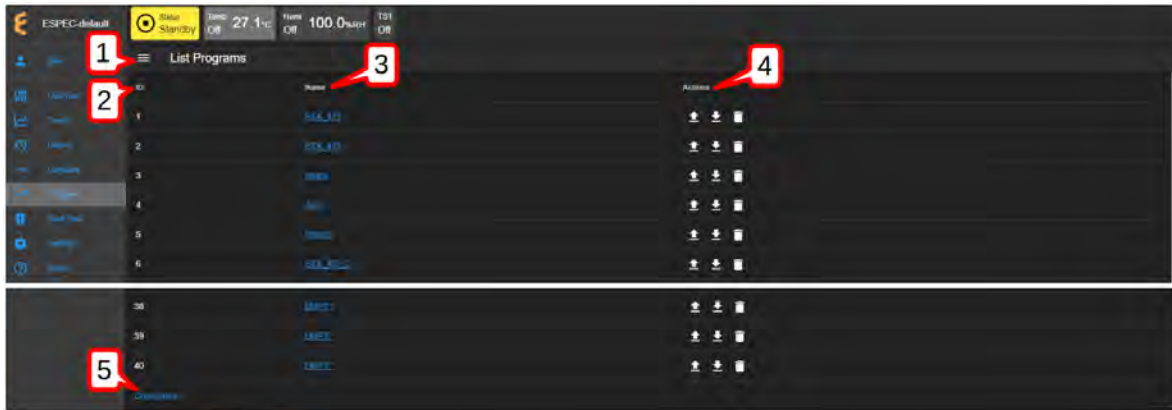


Figure 15.2: Program listing page with submenu hidden

1. **Submenu Show/Hide:** To utilize the entire main display area for the program editor, this button can be used to hide the submenu (as shown in the above figure). Click it again to reveal the submenu.
2. **ID:** ESPEC Web Controller identifies each program by its slot number stored in the PLC register. This list reflects the actual list of programs read from the F4T register. A total of 40 program slots are available, numbered from 1 to 40. The system uses a program identification code (ID) to identify each program.
3. **Program Name:** All available programs are listed under the **Name** column by program name. These programs are stored by their slot number. Any slot not yet occupied by the program is mark **EMPTY**. Users can access each program under this list by clicking on the program name, which is a clickable link. The program editor then opens up to display the program instructions. Detailed operation of the program editor is discussed in the next section. Displays the name of a program.
4. **Actions:** Three action buttons under the **Actions** column can be used to handle programs on the list under each row. These action buttons, once activated, affect the program on the same row. These buttons are: Upload Program, Download Program and Delete.
 - **Upload:** Program can be uploaded from the local computer to the Web Controller which will then be stored in the F4T register using the slot number where the action was applied.
 - **Download:** Program can be downloaded and saved on the local computer.
 - **Delete:** A program to the left of the trash bin (where this action is applied) will be deleted. The F4T register will no longer contain this program.
5. **Create New:** This button opens the program editor for creating a new program. The **Create New** button is conveniently placed in two locations: (1) under the **ID** list and (2) in the **Program** submenu (shown in the following figure).

The following figure displays the **Program** page with its submenu unhidden. The submenu (item 2) has two operation buttons: (i) List Programs and (ii) Create New (program).



Figure 15.3: Program listing page with submenu unhidden

1. **Show/Hide:** The **Show/Hide** button can be used to hide or unhide the **Program** submenu (see item 2 below).
2. **Submenu:** This submenu has two operation buttons (indicated by the arrows): **List Programs** and **Create New (program)**. All the available programs in the chamber stored in the Web Controller are listed below these operation buttons (as shown in the above figure). With the submenu hidden, the main display has a larger real estate to display the program elements.
 - **List Programs:** The **List Programs** button offers a quick exit out of the program editor (explained in the following section). To exit out of the program editor mode, simply click this **List Programs** button. This action will cancel and exit the program editor being used to create, edit or import a program.
 - **Create New:** Similar to the **Create New** button under the **List Programs** display page (see item 3 below), this button opens the program editor with an empty template for constructing a new program. Detailed discussion is provided in the following section. A program from the local computer can also be imported into this empty template.
3. **List Programs:** This is the main display of the program list depicted in the previous figure. Click the **Show/Hide** button (see item 1) to hide the submenu and to expand the **List Programs** display page.

15.2 Create New Program

A new program can be created via one of the buttons depicted in the following figure.

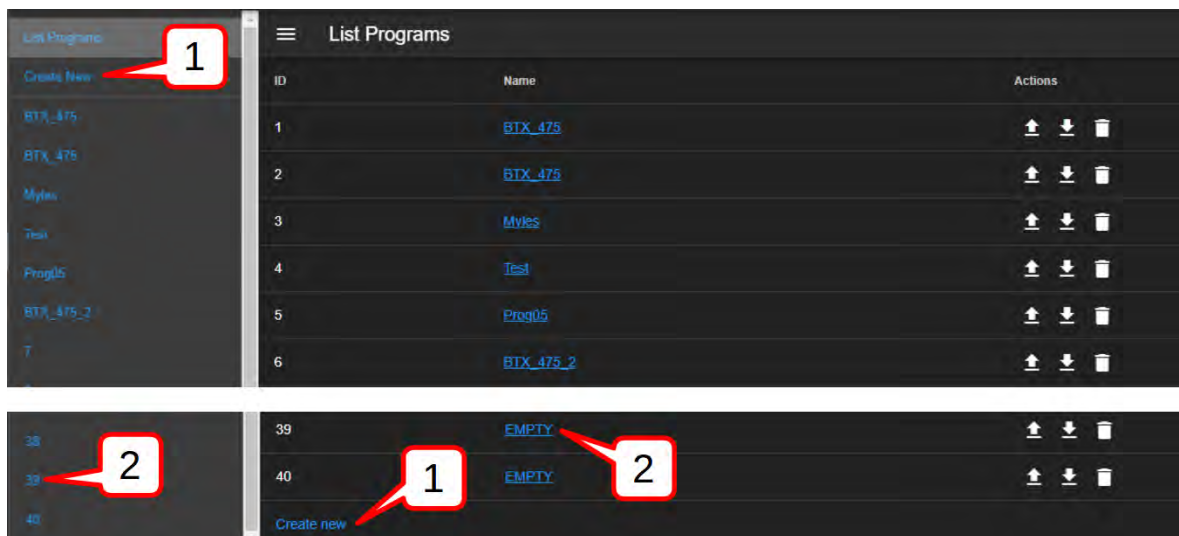


Figure 15.4: Different methods to creating a new program

Each of these buttons follows a different pattern to complete the task.

1. **Create New:** Click the **Create New** button in the submenu or under the **List Programs** in the main display to launch the program editor to create a new program. An empty template is opened for a new program, as depicted in the following figure. For the F4T chamber, this **Create New** button seems unnecessary or redundant. However, its important role is necessary for other types of chamber/controller (e.g., Typhoon HALT chambers).

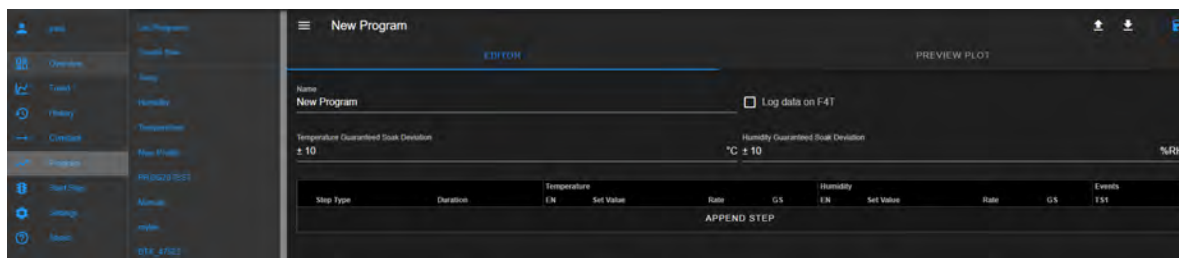


Figure 15.5: Empty template for a new program

The new program being constructed does not yet have a predefined location. For this reason, the program editor has only the **Save As** option to save the program in a specific or a desired slot number, as depicted in the following figure.

2. **EMPTY:** A new program can be created using a specific slot number. Click the slot number in the submenu or the **EMPTY** button on a desired slot number under the **List Programs** in the main display to launch the program editor to create a new program. An empty template is opened for a new program, as depicted in the previous figure.

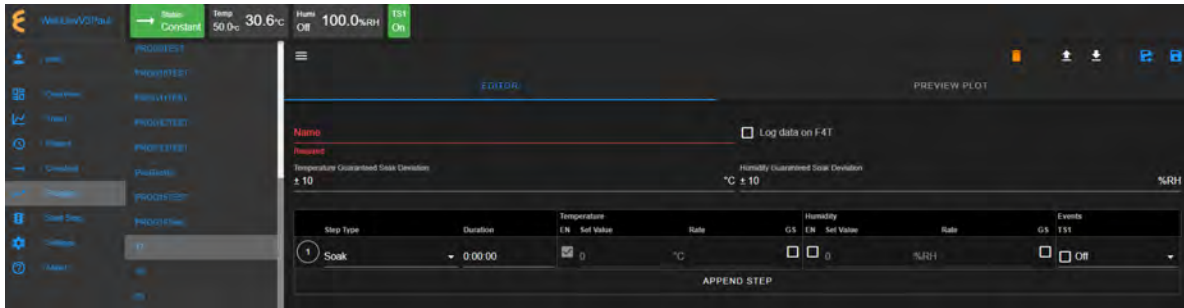


Figure 15.6: Empty template for a new program

Since the slot number has already been defined, the program editor offers two options to save the program: (1) Save As by selecting a new slot number or (2) Save (on the current slot number).

The following figure depicts the general layout of the empty template for a new program. As depicted in the following figure, slot 9 of the F4T register, as highlighted under the program list in the submenu, will be used to store the program once it is completed and saved.

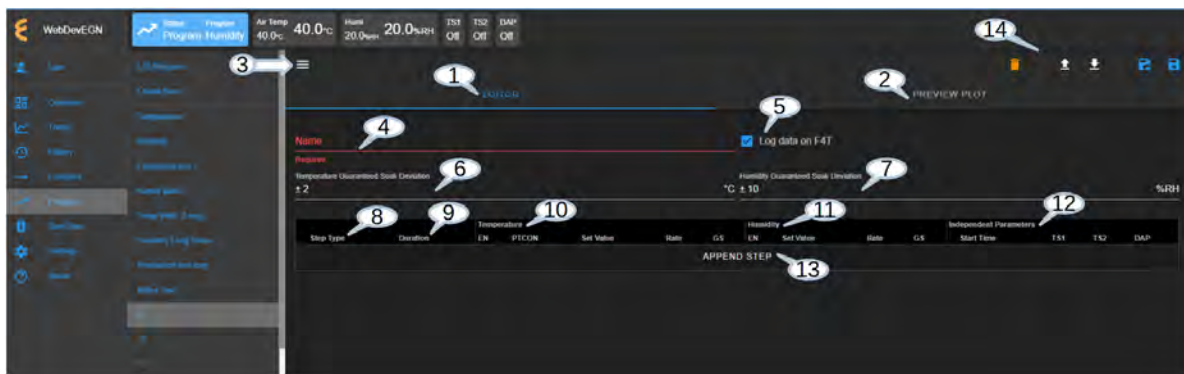


Figure 15.7: The structure and UI of the Programming Editor

The UI and components of the program editor (pictured above) are numbered and described as follows:

1. **Editor:** By default, a program is open and placed in the program editor. The program editor is highlighted in blue to indicate its active status.
2. **Preview Plot:** The output of the current program can be previewed via this button. Both the **Editor** (item 1 above) and this button can be used to toggle between the editing and previewing mode of the current program. In order to apply the preview mode, the program must be loaded into the program editor first, then click the **PREVIEW PLOT** button.
3. **Submenu Show/Hide:** This button toggles between the show and hide mode of the submenu. To utilize the entire main display area for the program editor, this button can be used to hide the submenu.
4. **Program Name:** An alphanumeric naming convention based on ASCII with lower- or upper-case letters applies to program name with up to 20 characters. The Web Controller

will chop and use only the first 20 characters if more than 20 characters were entered. Program name should be kept short and descriptive. Since each program is individually stored in a unique slot in the PLC, a unique name on the Web Controller is not necessary. However, these programs must have unique names when they are stored on the local computer. When a program name is entered into this field, this name also appears in the title bar next to the show/hide button (item 3).

5. **Log Data:** This checkbox is available for logging data on the F4T during program execution. This option applies only on an F4T with this feature, as shown in the following figure.



Figure 15.8: F4T with data logging feature

6. **Temp GS Dev:** This value determines how close the set point to the process value for the step duration timer to count down. If the temperature fluctuates outside this set point, the soak time will reset. This is to ensure (hence, guarantee) that soaking is taking place at that specific temperature for that specific amount of time. A desired value can be adjusted via the up/down arrow or via a direct input in the field. On the F4T touch screen, this is Guaranteed Soak Deviation 1.
7. **Humi GS Dev:** Similar to item 6, humidity guaranteed soak deviation can also be adjusted. On the F4T touch screen, this is Guaranteed Soak Deviation 2.
8. **Step Type:** Step type selection can be made after a step has been added to the program. The first step in a new program must be added using the **APPEND STEP** button (item 13 below). Additional steps can be added via the drop-down menu of the Step Number (explained below) or via the **APPEND STEP** button. There are seven (7) different step types available for each step in the program:
 - **Instant Change:** The set point will be set instantly. The Web Controller will deter-

mine the threshold value if this set point is possible based on the chamber specification. The time and guaranteed soak have no effect on this step type.

- **Ramp Time:** The set point will be ramped to the new set point over the given duration.
 - **Ramp Rate:** The set point will be ramped to the new set point based on the set rate.
 - **Soak:** Instead of changing the set point, the program maintains the previous set point for a specified duration for this step.
 - **Wait For:** With this step type, the F4T waits until the chamber has reached the set point value before it proceeds to the next step.
 - **Go To Step:** With this feature, the program can have a loop or subroutine where instructions in a specific step (or steps) can be executed and looped through for a specified number of time. With the go-to loop, the program contains fewer lines of steps.
 - **End:** All programs must have an end step. The end statement instructs the controller what to do when the program ends. The available options for end action are: Hold Last Step, Disable Control and Constant Set Value. They apply to both temperature and humidity (as well as vibration). The chamber can also be stopped completely when the program ends; it will be set in standby mode.
9. **Duration:** The time format for duration is HH:MM:SS. If a pure numerical value is entered, the Web Controller will convert it to HH:MM:SS. For instance, if a numerical value 15 is entered, the system treats it as 15 seconds, and the conversion in HH:MM:SS will be 00:00:15. If 66 is entered, the system converts it to 00:01:06. Similarly, if 90:00 is entered, the system renders the value to 1:30:00.
10. **Temperature:** In each step, temperature can be set via five parameters: (1) EN (2) PTCON, (3) Set Value, (4) Rate and (5) GS.
- **EN:** Enable temperature loop for this step.
 - **PTCON:** Enable Product Temperature Control (PTCON).
 - **Set Value:** This is the target temperature value. This value will be checked against the chamber's threshold value by the Web Controller to validate the proper operating value. Consult the chamber operation manual for detail on the threshold or the upper limit the chamber can reach.
 - **Rate (C/min):** Temperature rate (measured in Celsius per minute) is determined by the program editor based on the initial temperature (specified in item 3 above) and the target value (Set Value, as described below). The rate will be determined to operate within the specifications of the chamber. Consult the chamber operation manual for detail.
 - **GS:** Enable Guaranteed Soak with the checkbox. If enabled, it prevents the duration timer from counting down until the process value is within the deviation set in item 6 (above).
11. **Humidity:** In each step, humidity can be set with four parameters:
- **EN:** Enable humidity loop for this step.
 - **Set Value:** This is the target humidity value. This value will be checked against the chamber's threshold value by the Web Controller to validate the proper operating value. Consult the chamber operation manual for detail on the threshold or the upper

limit the chamber can reach.

- **Rate (%RH/min):** Humidity rate is determined by the program editor based on the initial temperature (specified in item 3 above) and the target value (Set Value, as described below). The rate will be determined to operate within the specifications of the chamber. Consult the chamber operation manual for detail.
 - **GS:** Enable Guaranteed Sock with the checkbox. If enabled, it prevents the duration timer from counting down until the process value is within the deviation set in item 7 (above).
12. **Independent Parameters:** These parameters describe the output signals of the chamber during operation. They can be controlled with a start time. Different chambers have different independent parameters. They may have different names, but they generally are labeled as TS1, TS2, etc.
- **Start Time:**
 - **TS1:** Output time signal number 1
 - **TS2:** Output time signal number 1
13. **APPEND STEP:** As shown in the previous figure, the program editor has an empty template. No instructions or steps of program have been added. To create an instruction, a new step must be created (or added). This APPEND STEP button is used to add a new step. Once a program has a step, additional steps can be added using this button or the drop-down menu of the Step Number (to be explained below). The APPEND STEP button always adds a new step as the last step in the program. By contrast, the drop-down menu of the Step Number allows a new step to be inserted above or below the current step. It also has a delete button to remove any step from the program.
14. **File Manipulation:** Five different buttons (icons) are available for file manipulation. Their action can be previewed by hovering the mouse pointer over them. They are described from left to right as follows.
- **Delete:** Click on the trash bin icon to delete the current program. This action will delete the program in the program editor and its location in the current slot number of the F4T register. A pop-up warning appears, as depicted in the following figure, to reaffirm the action.

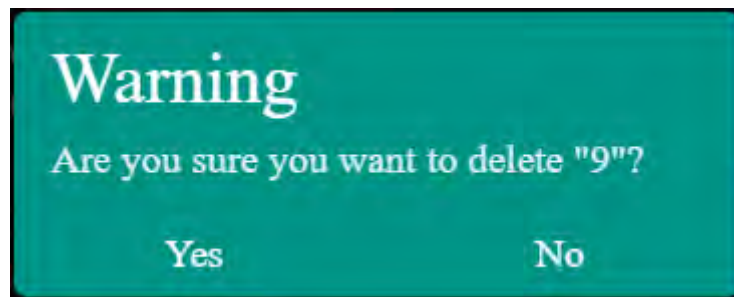


Figure 15.9: File deletion confirmation

- **Open Program:** This button imports a program file from the local computer into the program editor. The Web Controller only accepts a program in JSON format. To ensure compatibility, the program structure should be based on the one downloaded from the Web Controller itself (see **Download Program** below).

- **Download Program:** This button downloads the current program file and stores it on the local computer. The program is saved in JSON format using slot number as its filename (e.g., 9.json).
- **Save As:** Save the current program to a different slot number under the program list. This action brings up a program list, as depicted in the following figure, to select a new slot to hold the current program. To cancel this action, click the **CLOSE** button. **WARNING!:** A vacant slot should be selected to save the program. Otherwise, the current program will overwrite the existing one in the slot without prompting for reconfirmation, thus, destroying the program previously in that slot. The current program in a new slot still uses the same program name. To make it unique, edit item 4 (above) with a new name and apply the **Save** button (see below) to resave the program.

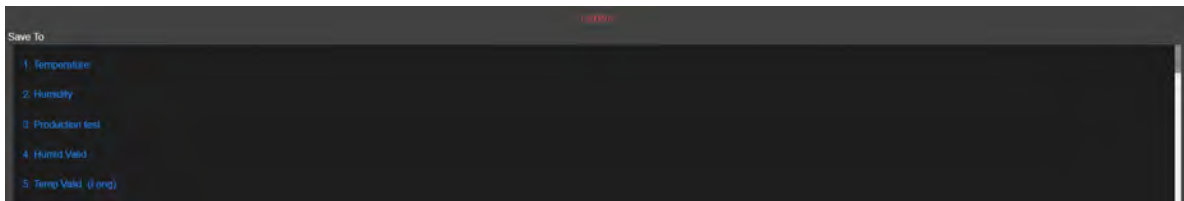


Figure 15.10: Save program to a new slot

- **Save:** This button saves the current program in the current slot on the F4T.

15.2.1 Programming: Add Program Step

The following example illustrates how to create a new program using three steps with step type **Ramp Time**, **Ramp Rate** and **End**. The duration for the ramp time is 5 minutes with the target temperature at 35 degrees C. The rate for **Ramp Rate** will be 10 degrees C/min with target value at 45 degrees C. Guaranteed soak deviation for both temperature and humidity will be set at +/-0.5 and +/- 10, respectively. A standby mode will be set when the program ends. While this sample program does not have any real practical implication, it does show how program steps and their parameters are created. New program will be selected to occupy slot 15. We begin from the main menu.

1. Click **Program** in the side bar.
2. Click **EMPTY** on slot 15 on the Program List (scroll down if necessary). To follow along with this example, slot 15 should be empty.
3. **Program Name:** Enter **PROG15TEST** in the program name field. The Web Controller will chop and use only the first 20 characters if more than 20 characters were entered.
4. **Log Data:** Enable data logging by checking the box.
5. **Temp GS Dev:** Apply the up/down arrow to adjust the deviation value to +/-0.5 or enter the value 0.5 directly into the field.
6. **Humi GS Dev:** Adjust deviation value for humidity guaranteed soak in the same way to +/-10.
7. **Add New Step:** Click the **APPEND STEP** button. By default, **Soak** is selected as the step type. Refer to Item 8 in the previous section.

8. **Step 1:** Click **Soak** under step type and select **Ramp Time** from the drop-down menu, as indicated by the arrow in the following figure. Complete the following fields for this step:

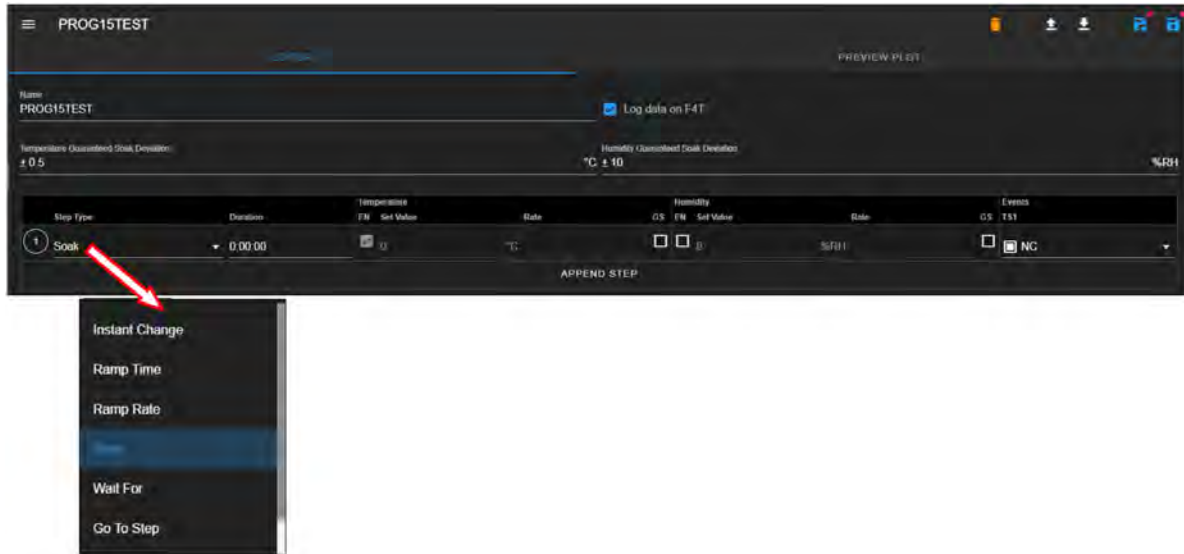


Figure 15.11: Adding step type

- **Duration:** Enter 0:05:00.
- **Temperature:**
 - **EN:** Enabled by default (from temperature ramp time selection).
 - **Set Value:** Enter 35 or apply the up/down arrow to adjust the value.
 - **Rate:** Greyed out. ESPEC Web Controller sets the rate based on the initial and final temperature according to the given duration.
 - **GS:** Disable; leave the box unchecked.
- **Humidity:**
 - **EN:** Check the box to enable humidity set value.
 - **Set Value:** Enter 15 or apply the up/down arrow to adjust the value.
 - **Rate:** Greyed out. ESPEC Web Controller sets the rate based on the set value and duration.
 - **GS:** Disable GS option with the box unchecked.
- **Events:**
 - **TS1:** Click the **NC** field (or the down-arrow) to select **On** from the drop-down menu, as depicted in the following figure.

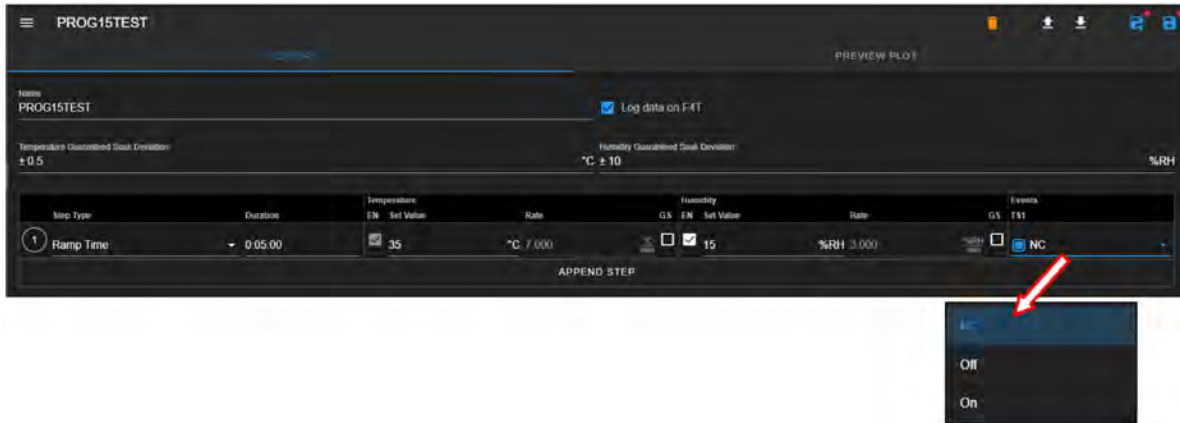
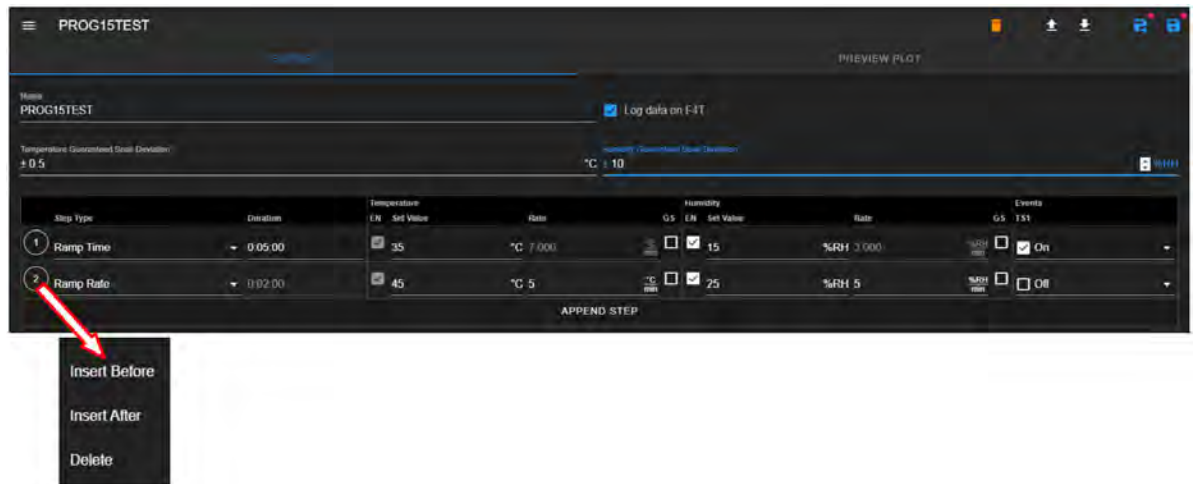
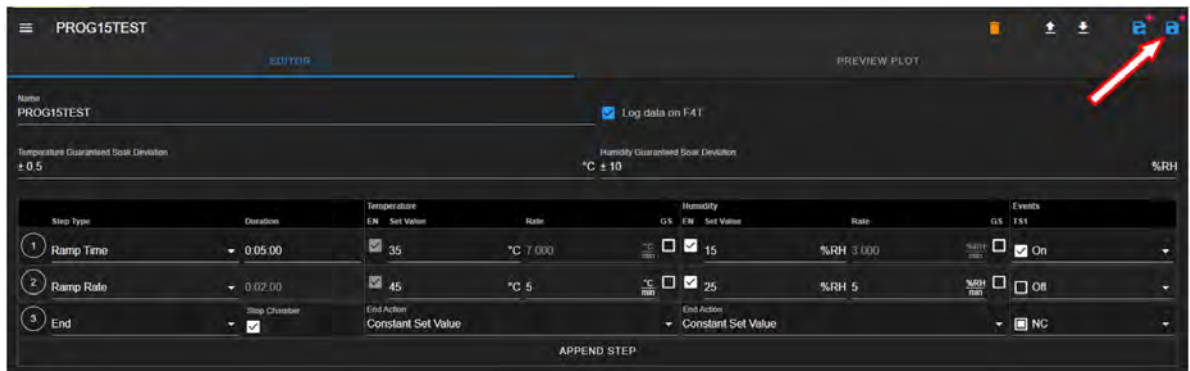


Figure 15.12: Enable time signal output.

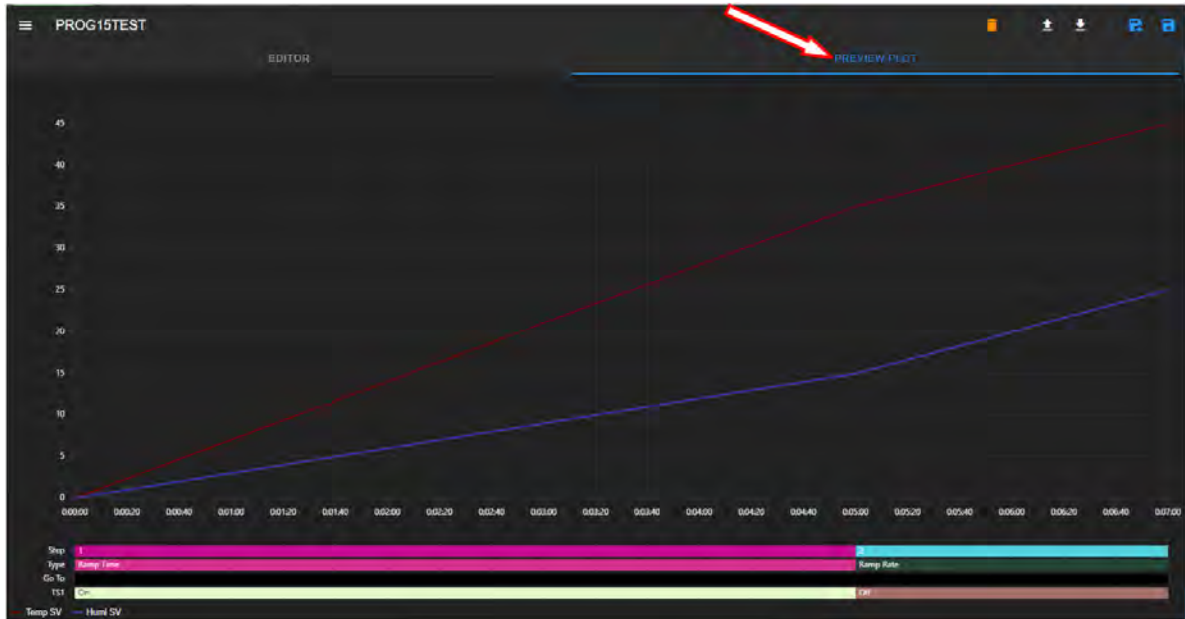
- **TS2:** If you have additional TS's, leave them as-is.
9. **Step 2:** Click **APPEND STEP**. Default step type is **Soak**. Click the **Soak** under step type and select **Ramp Rate** from the drop-down menu (refer to the previous figure, Step 8). Complete the following fields for this step:
- **Duration:** Grayed out. Value to be determined by system according to the set value and rate.
 - **Temperature:**
 - **EN:** Enabled by default.
 - **Set Value:** Enter 45.
 - **Rate:** Enter 10.
 - **GS:** Disable; leave the box unchecked.
 - **Humidity:**
 - **EN:** Check the box to enable humidity set value.
 - **Set Value:** Enter 25.
 - **Rate:** Enter 5.
 - **GS:** Disable GS option with the box unchecked.
 - **Events:**
 - **TS1:** Click the **NC** field (or the down-arrow) to select **Off** from the drop-down menu.
 - **TS2:** If you have additional TS's, leave them as-is.
10. **Step 3:** Click step number 2 in the circle that precedes **Ramp Rate** on the second step. Select **Insert After** from the drop-down menu as depicted in the following figure. Click the **Soak** under step type, scroll down to the bottom of the drop-down list and select **End**.
- **End:** Place a check mark in the box under **Stop Chamber**. This option will set the chamber in **Standby** mode when the program ends. The End Action for both temperature and humidity will be defaulted to **Constant Set Value**, but the **Stop Chamber** option will overwrite these settings. No setting is required for **NC** under **Events**.



11. **Save Program:** Click the **Save** icon in the upper-right corner, as shown in the following figure. This figure also illustrates the complete program in the program template.



12. **Preview:** The above program can be previewed before execution by clicking on the **Pre-view Plot** button as depicted in the following figure. To toggle back to the editor mode, click on **EDITOR**.



15.3 View, Edit, Save Program

This section describes how to open an existing program for viewing and editing. Changes made in the program can be updated by overwriting the program contents back in the file (using **Save**) occupying its existing slot or saving them as a new program using a new slot (with **Save As**).

15.3.1 Open Program

An existing program can be opened for viewing or editing by clicking on its name under the Name list, as shown in the following figure.



The program **PROG15TEST** (indicated by the arrow) that was created in the previous section will be used for illustration. It is open and displayed as follows:

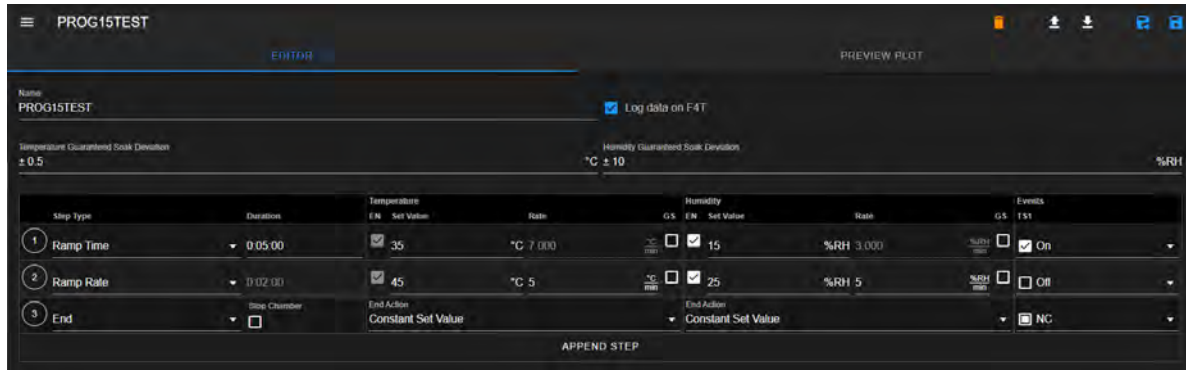


Figure 15.13: Program Editor displays an opened program in edit mode

As depicted in the upper-right in the above figure, five buttons are available for managing the program file in the program editor: **Delete**, **Open Program**, **Download Program**, **Save As** and **Save**. They will be explained in detail in the following sections.

15.3.2 Editing Program: Programming Example

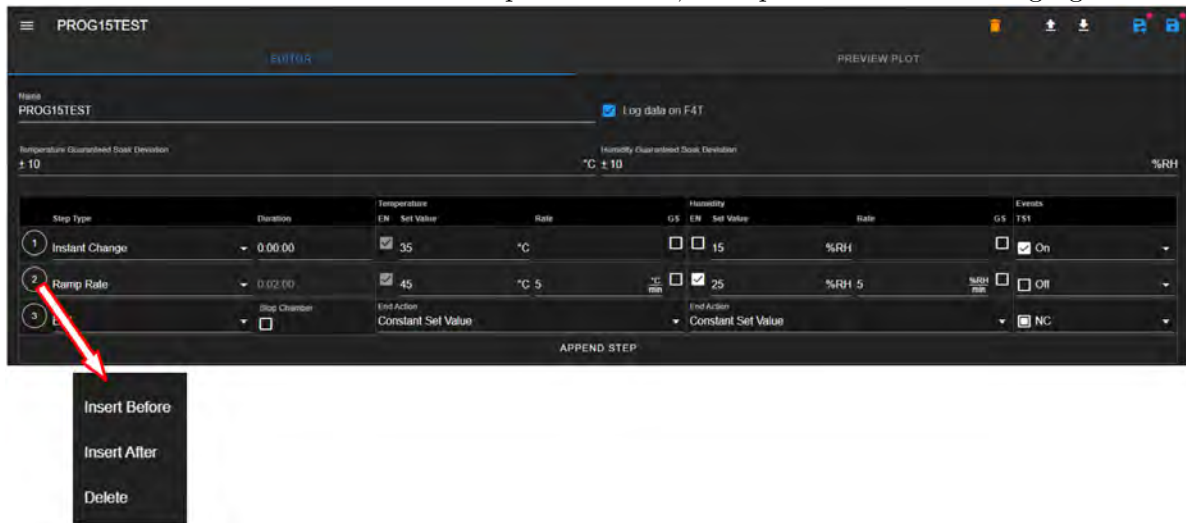
In this section, we illustrate how to edit and modify **PROG15TEST** program with additional steps, applying the available step types from the list. The structure of our new program consists of the following steps and types, with temperature and humidity guaranteed soak deviation both set at ± 10 .

1. **Instant Change** to 35 degrees C.
2. **Wait For** temp to drop below 35.1 degrees C.
3. **Soak** for 30 minutes.
4. **Ramp Rate** of 2 degrees C until -15 degrees C is reached.
5. **Wait For** temp to drop below -15 degrees C.
6. **Soak** for 30 minutes.
7. **Ramp Time** of 30 minutes to 45 degrees C and 50% RH.
8. **Wait For** temp to rise higher than 45.1 degrees C and humi below 50% RH.
9. **Soak** for 30 minutes.
10. **End** stop chamber.

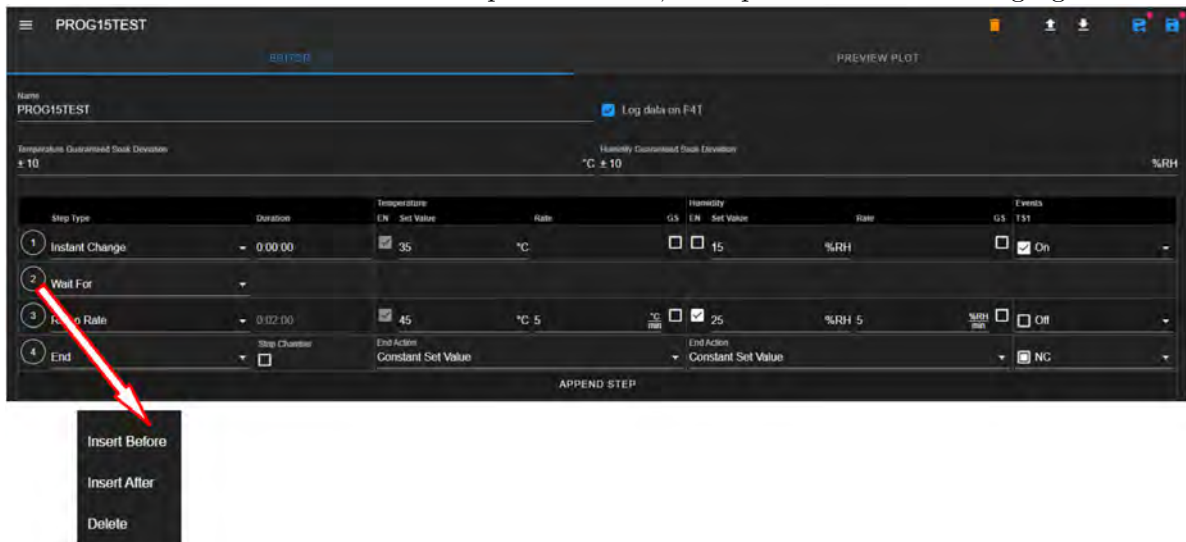
With **PROG15TEST** program open in the program editor, as shown in the previous figure, complete the following steps to modify and add additional steps with their specific step type and parameters as follows:

1. **Guaranteed Soak Deviation:** Set temperature and humidity guaranteed soak deviation to ± 10 degrees C and $\pm 10\%$ RH, respectively.
2. **Step 1:** Modify step type.
 - **Step Type:** Click the down arrow and select **Instant Change**.
 - **Duration:** Reset duration time to 0:00:00.
 - **Temperature:**
 - **EN:** Check the EN box.
 - **Set Value:** Enter 35 or click the up/down arrow to adjust the value to 35.
 - **Rate:** Leave blank (empty)
 - **GS:** Leave GS box unchecked.

- **Humidity:**
 - **EN:** Leave EN box unchecked.
 - **Set Value:** Leave set value as-is or at 0.
 - **Rate:** Empty
 - **Events:**
 - **TS1:** Set to **On**.
3. **Step 2:** Inserting a new step. Click step number 2 in the circle that precedes **Ramp Rate** and select **Insert Before** from the drop-down menu, as depicted in the following figure.



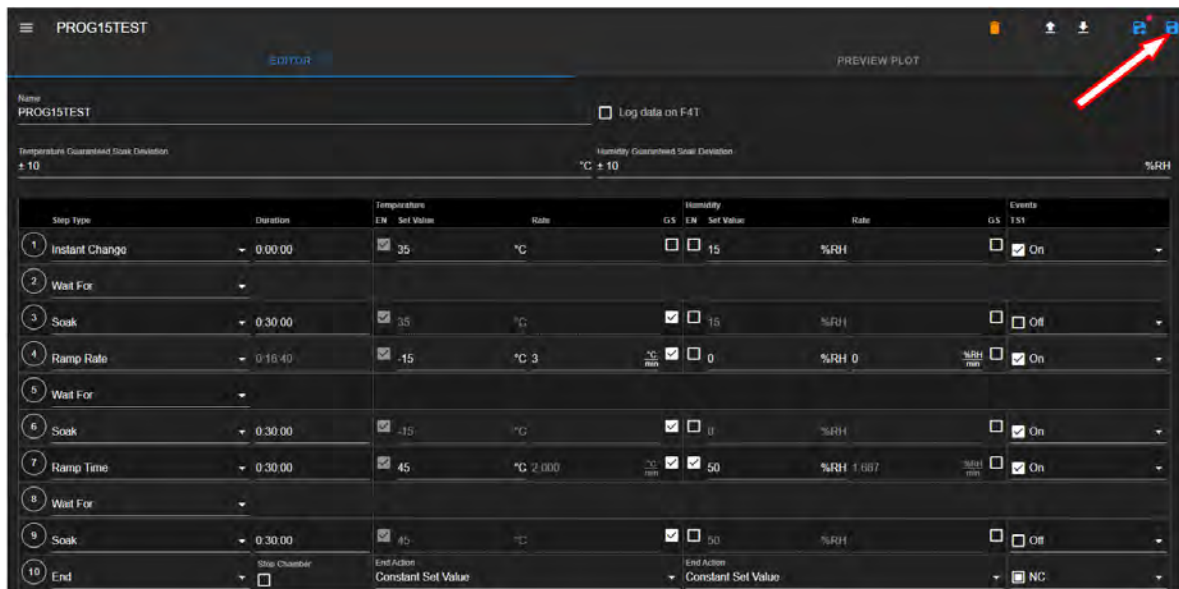
- **Step Type:** Click the down arrow and select **Wait For**. The rest of the parameters will be rendered blank.
4. **Step 3:** Inserting a new step. Click step number 2 in the circle that precedes **Wait For** and select **Insert After** from the drop-down menu, as depicted in the following figure.



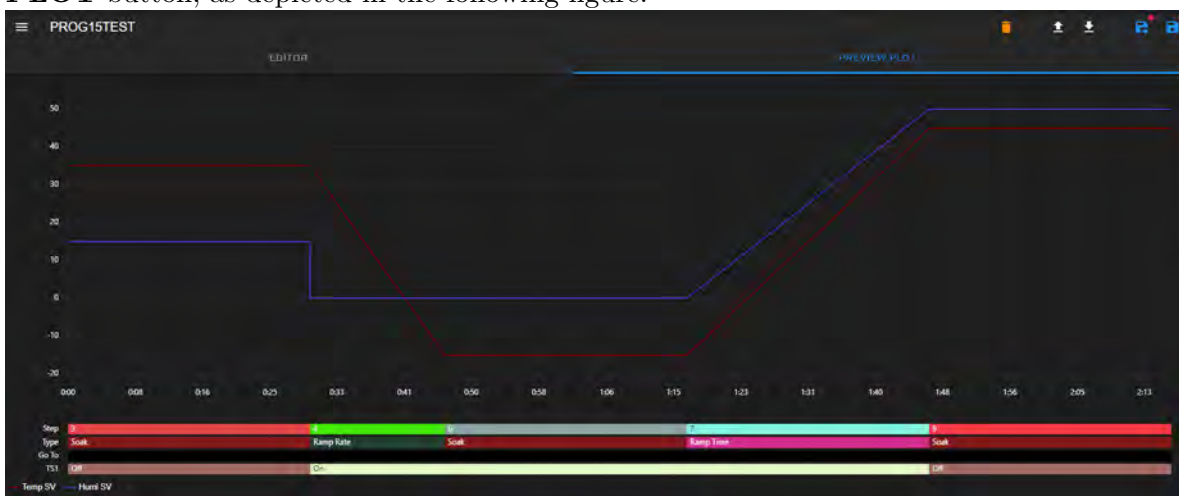
- **Step Type:** Default selection will be **Soak**.
- **Duration:** Set duration time to 0:30:00.
- **Temperature:**
 - **EN:** Enabled by default (grayed out).
 - **Set Value:** default (grayed out).

- **Rate:** default (empty)
 - **GS:** Place a check in the GS box.
 - **Humidity:**
 - **EN:** Leave EN box unchecked.
 - **Set Value:** Grayed out; default value from previous setting.
 - **Rate:** Empty (grayed out).
 - **Events:**
 - **TS1:** Set to **Off**.
5. **Step 4:** Modifying the current step.
- **Step Type:** Leave the step type as **Ramp Rate**.
 - **Duration:** Grayed out (to be determined by the Web Controller based on temperature set value and rate).
 - **Temperature:**
 - **EN:** Confirm that **EN** is enabled.
 - **Set Value:** Enter -15 or apply the up/down arrow to adjust the value to -15.
 - **Rate:** Enter 3 or apply the up/down arrow to adjust the value to 3.
 - **GS:** Place a check in the GS box.
 - **Humidity:**
 - **EN:** Leave EN box unchecked.
 - **Set Value:** Enter 0.
 - **Rate:** Enter 0.
 - **Events:**
 - **TS1:** Set to **On**.
6. **Step 5:** Inserting a new step. Click step number 4 in the circle that precedes **Ramp Rate** and select **Insert After** from the drop-down menu.
- **Step Type:** Click the down arrow and select **Wait For** from the drop-down list. The rest of the parameters are rendered blank.
7. **Step 6:** Inserting a new step. Click step number 5 in the circle that precedes **Wait For** and select **Insert After** from the drop-down menu.
- **Step Type:** Leave the step type as **Soak** (selected by default).
 - **Duration:** Set duration time to 0:30:00.
 - **Temperature:**
 - **EN:** Grayed out.
 - **Set Value:** Grayed out.
 - **Rate:** Grayed out.
 - **GS:** Place a check in the GS box.
 - **Humidity:**
 - **EN:** Leave EN box unchecked.
 - **Set Value:** Grayed out.
 - **Rate:** Grayed out.
 - **Events:**
 - **TS1:** Set to **On**.
8. **Step 7:** Inserting a new step. Click step number 6 in the circle that precedes **Soak** and select **Insert After** from the drop-down menu.
- **Step Type:** Click the down arrow and select **Ramp Time** from the drop-down list.
 - **Duration:** Set duration time to 0:30:00.
 - **Temperature:**
 - **EN:** Enable **EN** by checking the box.

- **Set Value:** Enter 45 or apply the up/down arrow to adjust the value to 45.
 - **Rate:** Grayed out.
 - **GS:** Place a check in the GS box.
 - **Humidity:**
 - **EN:** Enable **GS** with a check mark in the box.
 - **Set Value:** Enter 45 or apply the up/down arrow to adjust the value to 45.
 - **Rate:** Grayed out.
 - **Events:**
 - **TS1:** Set to **On**.
9. **Step 8:** Inserting a new step. Click step number 7 in the circle that precedes **Ramp Time** and select **Insert After** from the drop-down menu.
- **Step Type:** Click the down arrow and select **Wait For** from the drop-down list. The rest of the parameters are rendered blank.
10. **Step 9:** Inserting a new step. Click step number 8 in the circle that precedes **Wait For** and select **Insert After** from the drop-down menu.
- **Step Type:** Default selection will be **Soak**.
 - **Duration:** Set duration time to 0:30:00.
 - **Temperature:**
 - **EN:** Grayed out (default to previous setting).
 - **Set Value:** Grayed out (default to previous value).
 - **Rate:** Grayed out (blank).
 - **GS:** Place a check in the GS box.
 - **Humidity:**
 - **EN:** Uncheck the box.
 - **Set Value:** Grayed out (default to previous value).
 - **Rate:** Grayed out (blank).
 - **Events:**
 - **TS1:** Set to **Off**.
11. **Step 10:** This step has been pushed down while the above steps were being added.
- **Step Type:** Program is ended with **End**. Leave the Stop Chamber box unchecked. Select End Action under both temperature and humidity to **Constant Set Value** and set **TS1** to **NC**.
12. **Save Program:** To save the program, click the **Save** icon in the upper-right corner. The following section describes how to apply other buttons in this upper-right corner. The complete program is illustrated in the following figure.

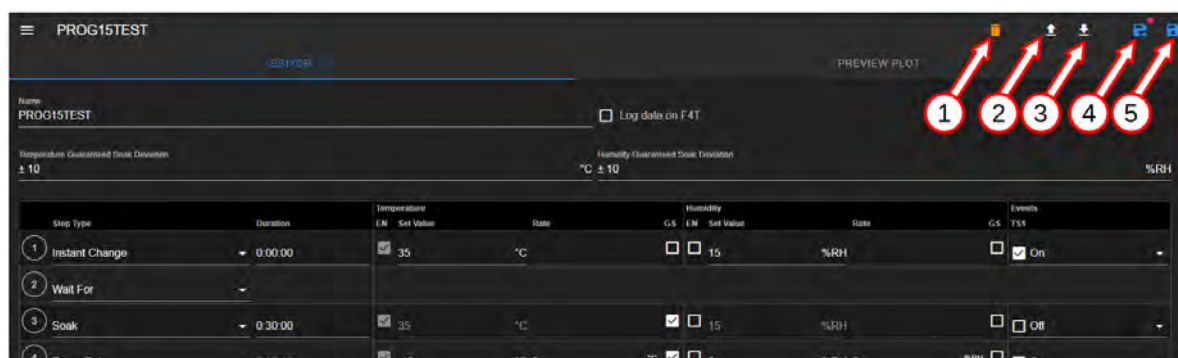


13. The above program can be previewed prior to execution by clicking on the **PREVIEW PLOT** button, as depicted in the following figure.



15.3.3 Managing Program File via the Program Editor

This section describes how to apply the five file manipulation options available in the upper-right corner of the program editor, as depicted in the following figure.



They are described as follows:

1. **Delete:** Click the trash bin icon to delete the current program in the program editor. The slot for this program on the Name list under the **List Programs** table will be rendered as **EMPTY**, since the program has been removed from the F4T register. As a safety measure, the system will prompt to confirm the action with a pop-up warning with a Yes/No option to proceed with the action. Upon completion, the system returns to the Program menu to display the programs on the Name list.
2. **Upload Program:** This button imports a program file from the local computer into the program editor. By default, the system opens the Downloads folder on the local computer to upload the program file. Navigate to the program's location, if necessary, and double-click on the desired program to import it into the program editor.
3. **Download Program:** The current program in the program editor can be downloaded onto the local computer as a backup. By default, the program will be stored in the Downloads folder, with filename based on the slot number (e.g., 15.json).
4. **Save As:** This button can be used to copy the current program to a different slot. To make the program name unique, the Name field may be edited with a new program name. This procedure thus requires a two-step process indicated by the arrows in the following figure. First, edit the program name; second, click the **Save** button and select a new slot from the drop-down list.

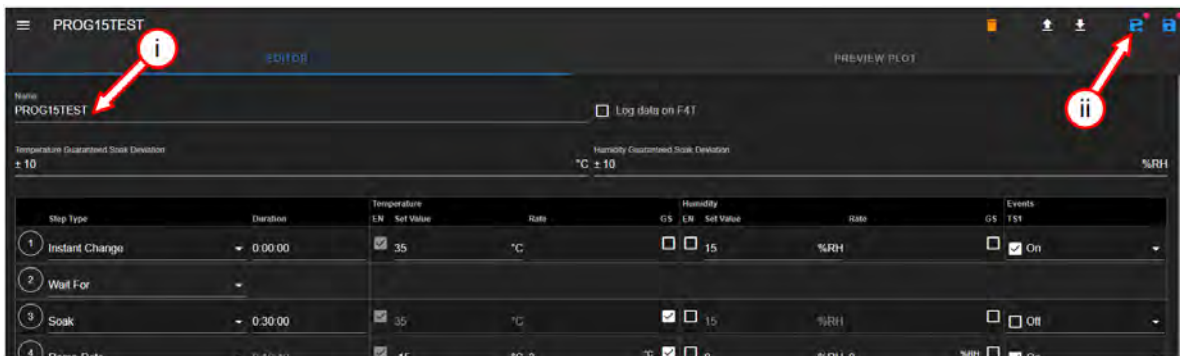


Figure 15.14: Save current program as a new file

5. **Save:** Apply this button to update the program file. To help check the editing status of the program, the program editor utilizes a red dot placed above the **Save** or **Save As** button to indicate an update yet to be saved.

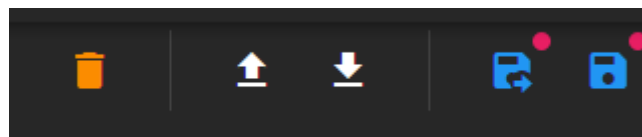


Figure 15.15: Update indicator

Navigating out of the editor without saving the update will trigger a warning prompt, as depicted in the following figure.

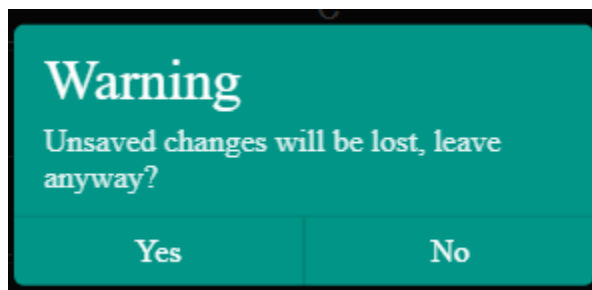


Figure 15.16: Confirm the save or discard update

15.3.4 Managing Program File via the Name List

This section describes how to apply the three file manipulation options on the Name list, as depicted in the following figure.



These three options are listed and described as follows:

1. **Delete:** To delete **PROG15TEST** from the Name list (and F4T register), click the trash bin icon as depicted in the following figure. As a safety measure, the system will prompt to confirm the action with a pop-up warning with a Yes/No option to proceed with the action. It may be necessary to apply the refresh button of the Web browser after deleting the program file from the Name list.



2. **Upload Program:** This button can be used to import a program from the local computer directly into a program slot on the Name list and F4T register. To upload (i.e., import) a program into slot 17, click on the **Upload** button, as indicated by the arrow in the following figure. Navigate to locate the desired file on the local computer and double-click it to complete the process.



3. **Download Program:** To download (i.e., export) a program **PROG16Test** on slot 16 (see above figure), click on the **Download** button. By default, the program file will be stored in the **Downloads** folder on the local computer using filename: 16.json.

CHAPTER 16

Start Stop

This menu allows the operator with read-write privilege to control or manage the chamber with the following operation modes: **Standby**, **Constant**, **Program**. The following figure depicts these modes displayed in the main display area as individual tabs.

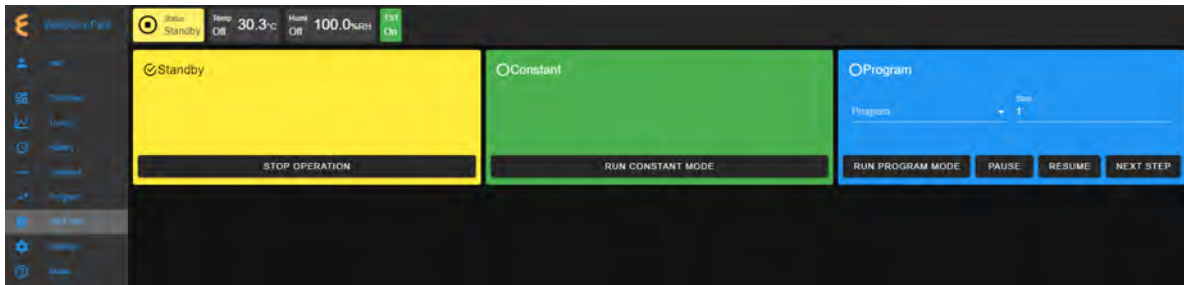


Figure 16.1: The Start/Stop menu with a Status Bar

It should be noted that the **Status** tab in the status bar also provides access to these modes for control and operation. Refer to the **Overview** menu for detail on how to control the chamber operating modes.

16.1 Standby Mode

In **Standby** mode, the chamber is off, and the status tab in the status bar displays as **Standby**. This status is also indicated by the check mark in the circle, as illustrated in the above figure.

16.2 Constant Mode

In **Constant** mode, the chamber operates using the constant configuration, and the status tab displays as **Constant**. This status is also indicated by the check mark in the circle, as depicted in the following figure.

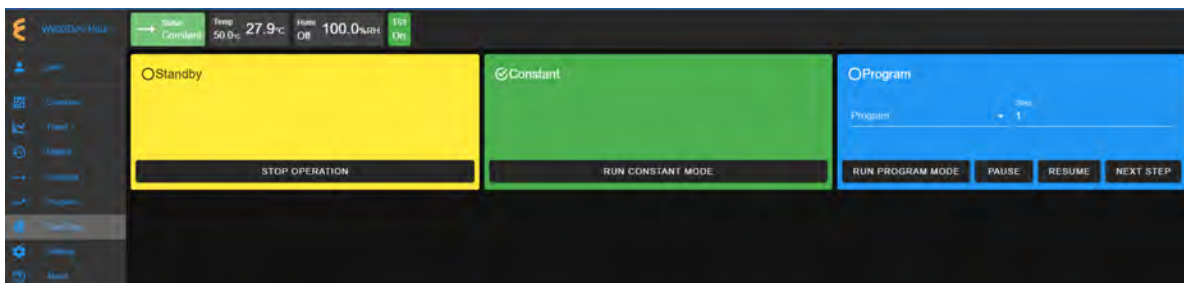


Figure 16.2: The Start/Stop menu with chamber in Constant mode

16.3 Program Mode

In **Program** mode, the chamber is carrying out instructions of the program being executed. The status tab in the status bar indicates the chamber is in **Program** mode, along with the name of the program being executed, as depicted in the following figure. This status is also indicated by the check mark in the circle in the program tab.

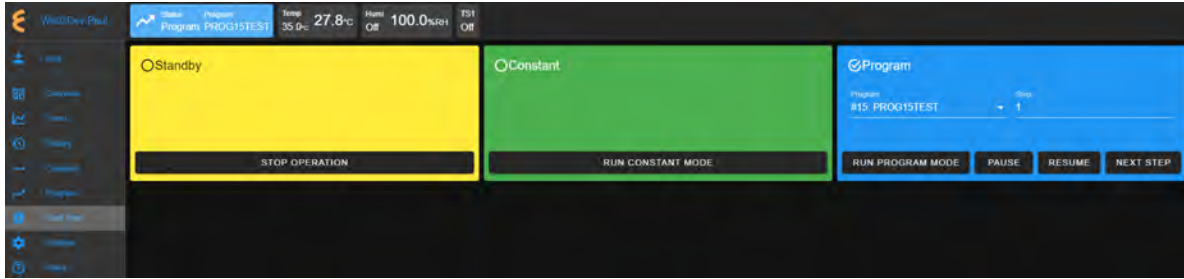


Figure 16.3: The Start/Stop menu with chamber in Program mode

16.4 Start/Stop Standby Mode

Authorized users with read-write privilege may set the chamber in **Standby** mode by clicking the **STANDBY** button in the **Standby** tab. In this mode, the chamber is in the **OFF** state. To terminate the **Standby** mode, activation of a new mode is necessary. For instance, to switch the chamber **ON** and to operate in **Constant** mode, click the **CONSTANT** button in the **Constant** tab in the main display area. ESPEC Web Controller immediately moves to apply the operating mode to the chamber.

16.5 Start/Stop Constant Mode

Authorized users with read-write privilege may set the chamber to operate in **Constant** mode by clicking the **CONSTANT** button in the main display area. In this mode, the chamber operates by executing the constant settings in the configuration. To terminate the **CONSTANT** mode, activation of a new mode is necessary. For instance, to switch the chamber from its **Constant** mode to **Standby** mode, click the **STANDBY** button in the **Standby** tab. ESPEC Web Controller immediately moves to apply the operating mode to the chamber.

16.6 Start/Stop Program Mode

Authorized users with read-write privilege may set the chamber to operate in **Program** mode by performing a series of operations in the **Program** tab. The following subsections describe the procedures how to run (execute) a program, pause, resume or step through the instructional steps in the program.

16.6.1 Run Program

To load and execute a program to control the chamber, complete the following steps:

1. Click the radio button in the **Program** tab to select a program from the list. Apply the scroll bar, if necessary, to search through the long list of programs, as depicted in the following figure.

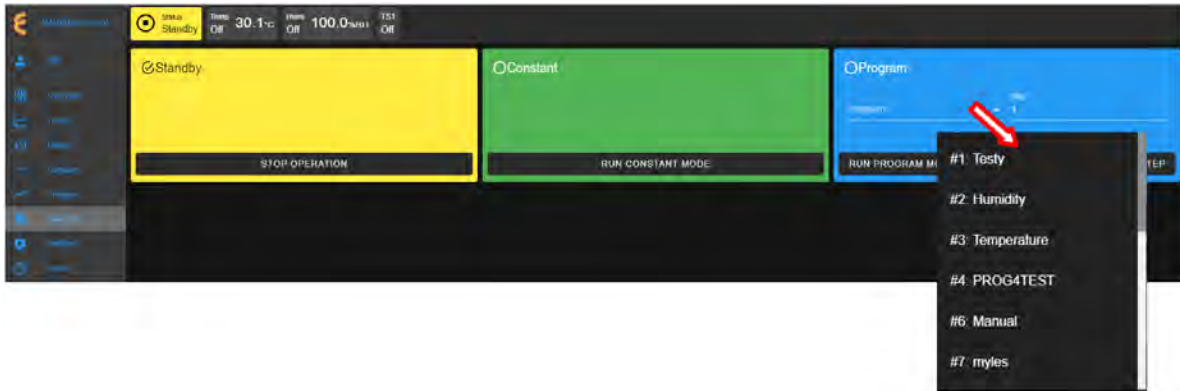
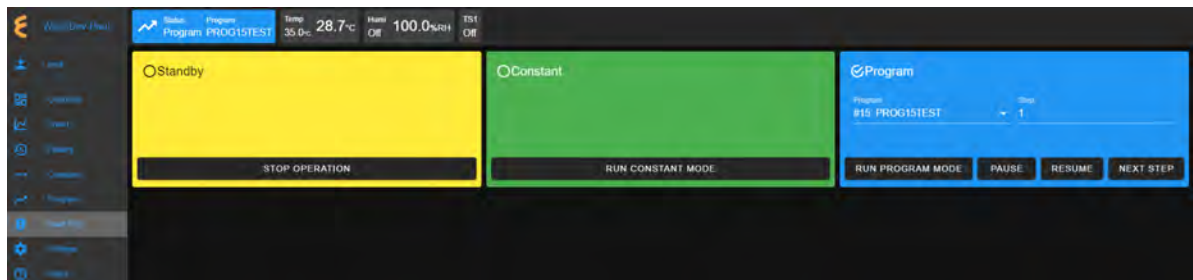


Figure 16.4: Executing a program from the Program List

2. Click to select the desired program name.
3. To start this program at a certain step, enter the step number in the **Step** field. Default setting is 1.
4. Click the **RUN PROGRAM MODE** button to execute the program. ESPEC Web Controller immediately moves to apply the operating mode to the chamber. The **Status** tab and **Status** bar now display the program being executed, as depicted in the following figure. The **Overview** page maybe accessed to display the detail of the program being executed.



16.6.2 Pause/Resume Program

Authorized users with read-write privilege may control the chamber during program execution. **Program** mode may be interrupted and put in a “suspense mode” using the **PAUSE** button in the **Program** tab. To pause a program during execution, click the **PAUSE** button; all operations are suspended. An update notification appears in the lower-right corner. The **Paused** notification is posted in the **Status** tab.

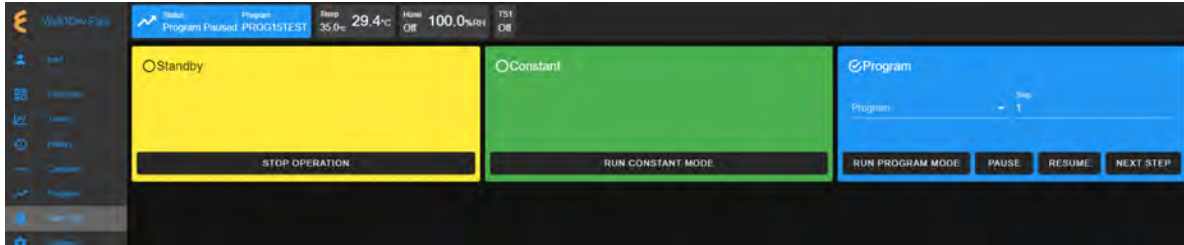


Figure 16.5: Program is being paused.

To resume the operation and continue program execution, click the **RESUME** button. The chamber will continue to operate based on instructions in the program. Program name is posted on the **Status** tab to indicate chamber is in **Program** mode and that program (name) is being executed.

16.6.3 Stepping through Program

Without having to wait for each step in the program to complete its tasks for the entire time duration in the instruction, an operator may step through the program to study the effects of the instructions in a certain step. While the program is being executed, click the **NEXT STEP** button to execute the next step in the program. An update notification appears in the lower-right corner to confirm the action. This action may be repeated until the last step in the program is reached. The **Overview** page in combination with the extended tab maybe accessed to display the detail of the program being executed and its steps being stepped through.

Part IV

ESPEC Chamber with F4

CHAPTER 17

Overview

The **Overview** page displays the current status of the chamber and its operating mode. A user is brought to this page after successfully logging into ESPEC Web Controller. The following figure depicts **Overview** showing the chamber in Constant mode, as indicated in the status tab and its extension bar. The extension bar of the status tab is only available in the **Overview** menu.

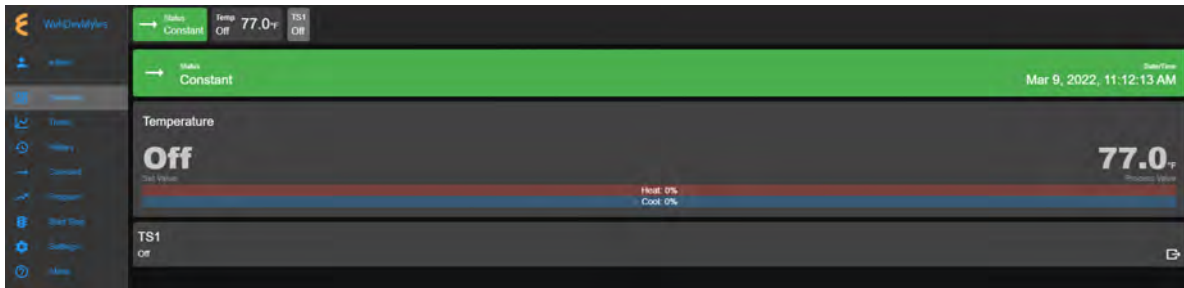


Figure 17.1: Overview page with chamber in Constant mode

The following figure depicts **Overview** showing the chamber in Program mode. Detailed information about the program, including what step is being executed, is listed in the extension bar (of the status tab). This feature provides the operator with useful information about the status of the chamber and the program.

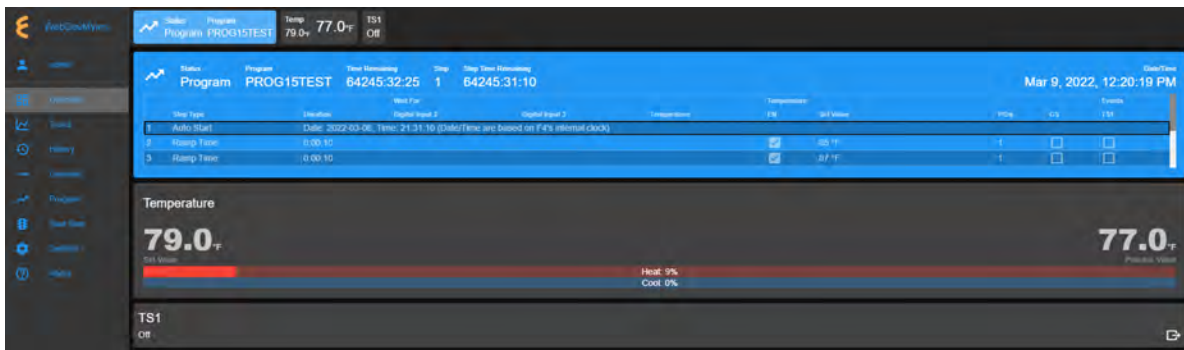


Figure 17.2: Overview page with chamber in Program mode

Only users with read-write privilege can control the chamber operation mode from within this page. Supported operation modes are **Constant** and **Program**. Each tab in the status bar may be accessed to apply new settings at any time. This feature enables the operator to control the chamber without having to access the **Start Stop** menu in the menu bar. The following sections detail a step-by-step procedure how to control the chamber's operating mode via the **Overview** menu for users with read-write privilege.

17.1 Constant Setting

Operating mode can be switched from **Program** to **Constant** or vice versa. For authorized users with read-write privilege, to set the chamber in **Constant** mode, proceed with the following steps.

1. Click the status tab in the status bar (as shown in the figure).

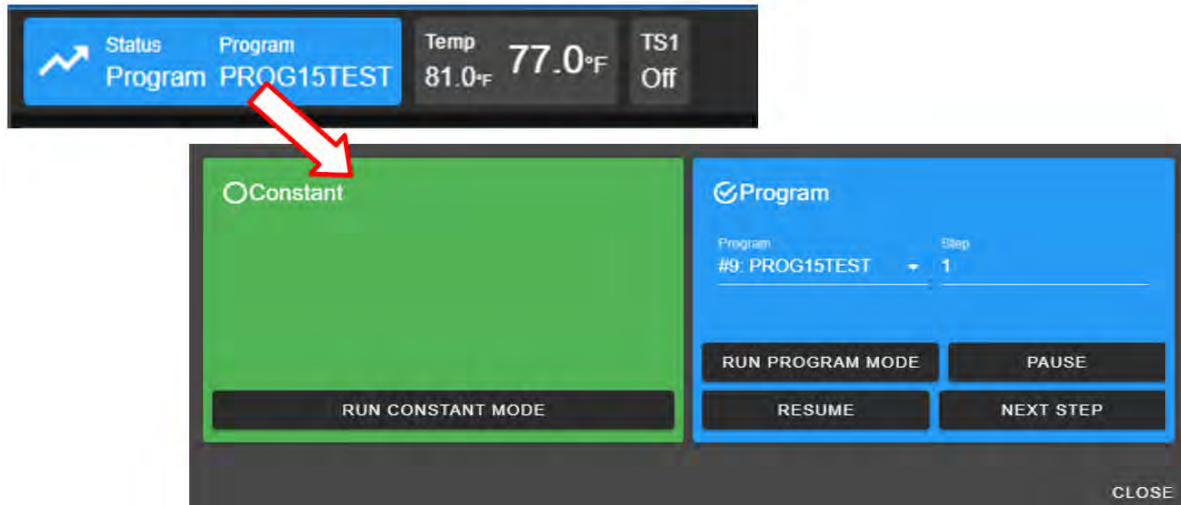


Figure 17.3: Constant mode setting

Or, click the extension bar, as shown in the figure.



Figure 17.4: Constant mode setting via extension bar

2. Click the **RUN CONSTANT MODE** button in the constant tab. ESPEC Web Controller immediately moves to apply the operating mode to the chamber.
3. To close the drop-down tabs, perform one of the following actions:
 - Click an empty area in the Main Display.
 - Click a different menu in the menu bar.
 - Click the status tab itself, or
 - Click the **CLOSE** button of the drop-down tabs or the extension bar.

17.2 Program Setting

To set the chamber in **Program** mode means a profile (i.e., program) is loaded and executed.

1. Click the status tab in the status bar or the extension bar of the status tab.
2. Click the radio button in the program tab to access the program list (see the figure below).

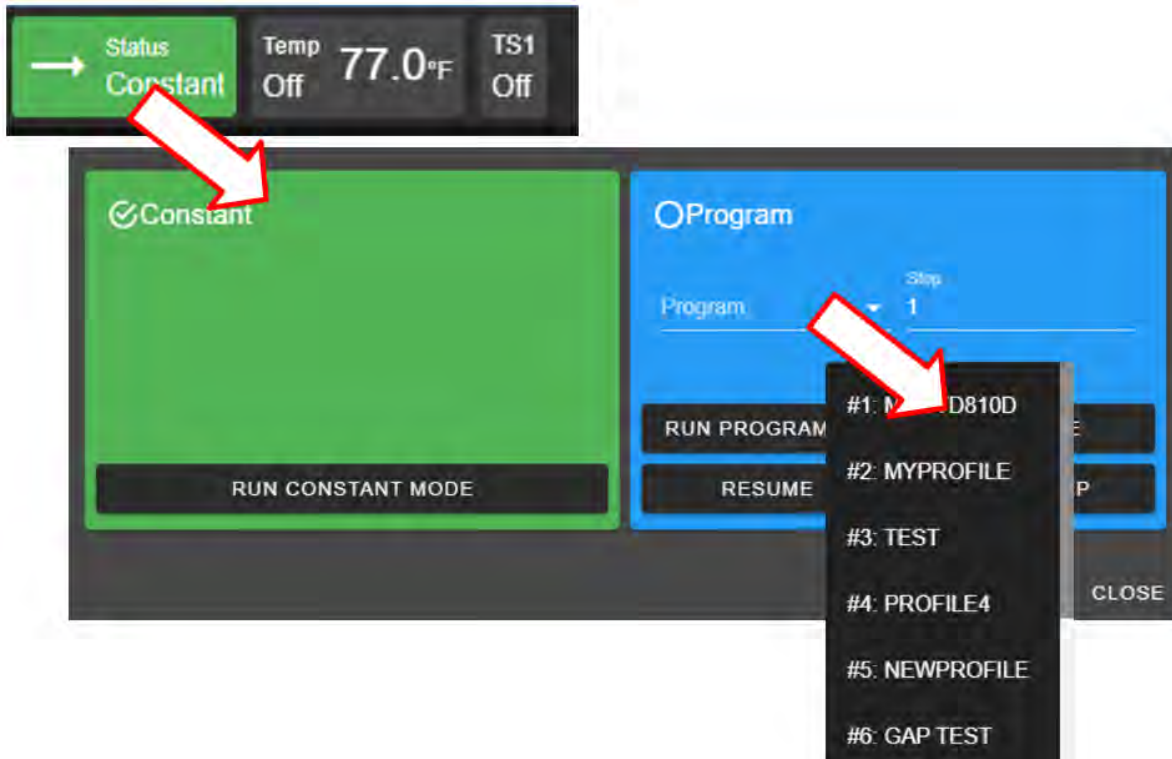


Figure 17.5: Select program to start chamber in Program mode

If no program is available for loading, the list contains slot numbers without programs, as depicted in the following figure. A program must be created first before it can be loaded for execution. Chapter 8 discusses how to create a program to control the chamber.

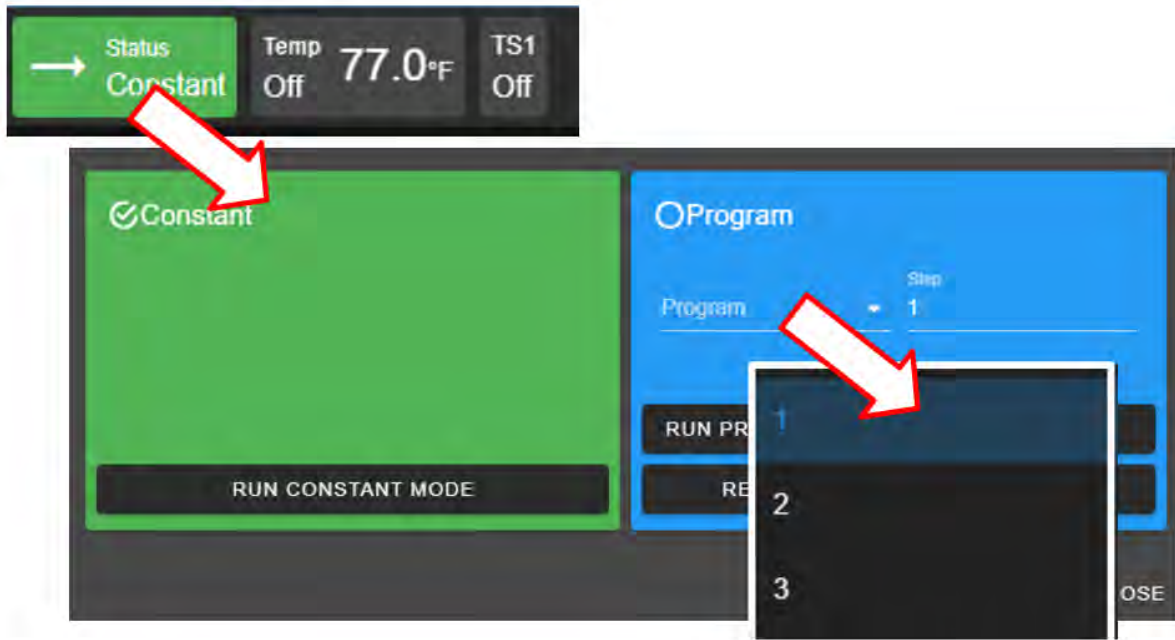


Figure 17.6: No program available for execution

3. Click to select a program from the list. Apply the scroll bar, if necessary, to select the desired program.
4. Enter a desired step number in the step field for program to start. Default start step is 1.
5. Click the **RUN PROGRAM MODE** button to execute the program. ESPEC Web Controller immediately moves to apply the operating mode to chamber. A pop-up window appears in the lower-right corner to indicate the update. Note: This program tab offers a few practical methods during a program execution. The **Pause** button can be used to pause the program. Program can be resumed via the **RESUME** button. Program instruction lines can be stepped through via the **NEXT STEP** button.
6. Click the **CLOSE** button to view the status of program execution displayed in the status tab extension bar.
7. To end or interrupt the program execution, switch the chamber to **Constant** mode via the status tab.

17.3 Clear Alarms

When ESPEC Web Controller detects an alarm in the chamber, it also sets itself in an alert state by displaying a list of active alarms and fault names in the red window to require an immediate action from the operator, as depicted in the following figure.

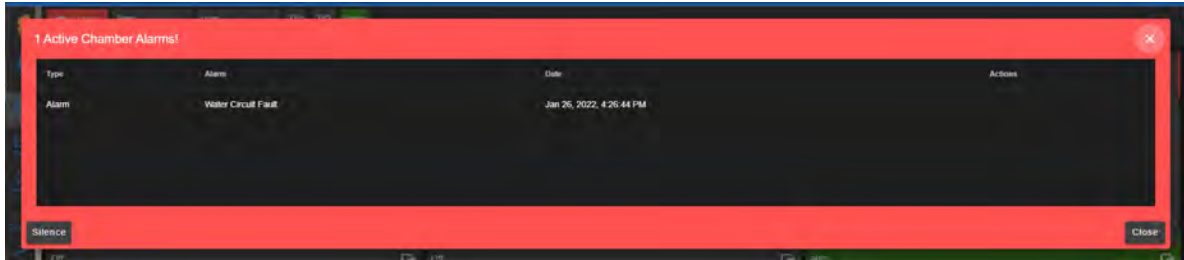


Figure 17.7: Chamber in alarm state

A repeating beep on the local computer is also tripped to get the operator's attention. The **SILENCE** button can be used to turn off the beep. This alert window can be closed by clicking the **CLOSE** button or the X button. However, the alarm state still remains to be resolved as indicated by the **Status** tab in the following figure. To redisplay or expand the alarm list, click the red dot in the lower-right corner.

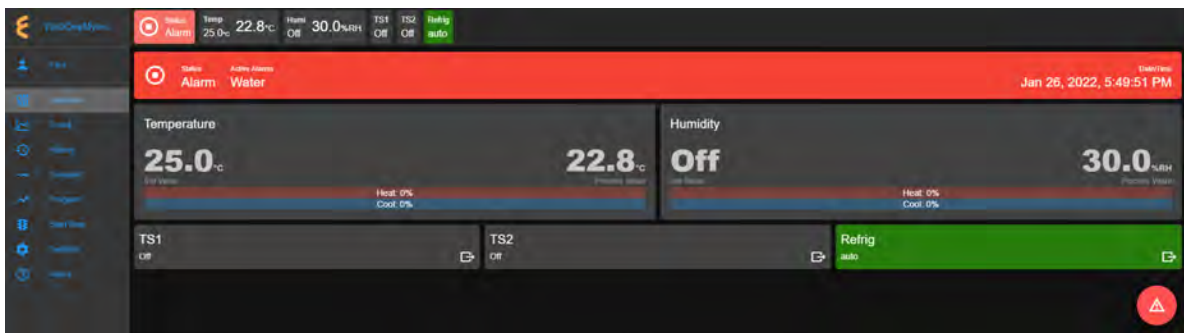


Figure 17.8: Alarm state in overview page

In an alarm state, operation is halted until all alarms triggered by chamber are resolved via the PLC before the Web Controller (and the chamber) can resume the normal operation. Once all alarms are cleared, the Web Controller will automatically clear all alert messages and resume normal operation by switching the chamber to a **Standby** mode.

17.4 Temperature, Humidity or Time Signal Settings

On the **Overview** page, settings of temperature, humidity, time signals or refrigeration can be controlled via the dedicated tabs in the status bar or the dedicated panes in the main display area, as depicted in the following figure.

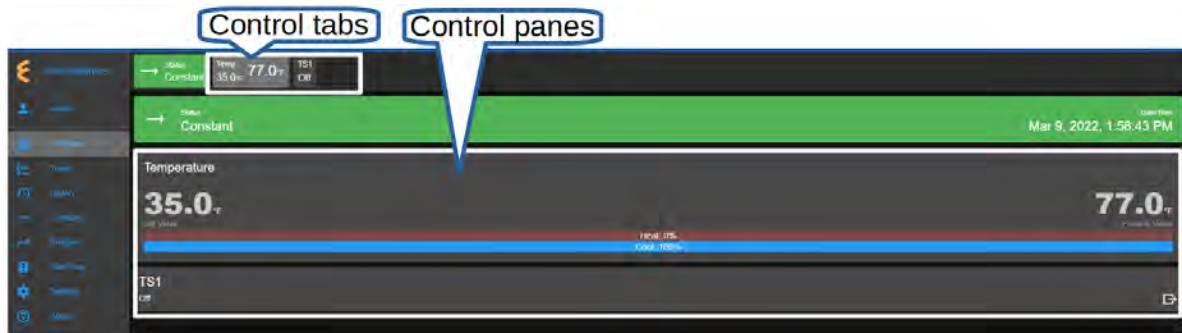


Figure 17.9: Parameter settings via control panes

17.4.1 Settings via the Status Bar

To set temperature with a new set value, complete the following steps:

1. Click the Temp tab in the status bar.
2. In the drop-down pane, click the box to **Enable** temperature, and enter new value in the Set Value field or apply the up/down arrow to adjust the value (shown in the figure).

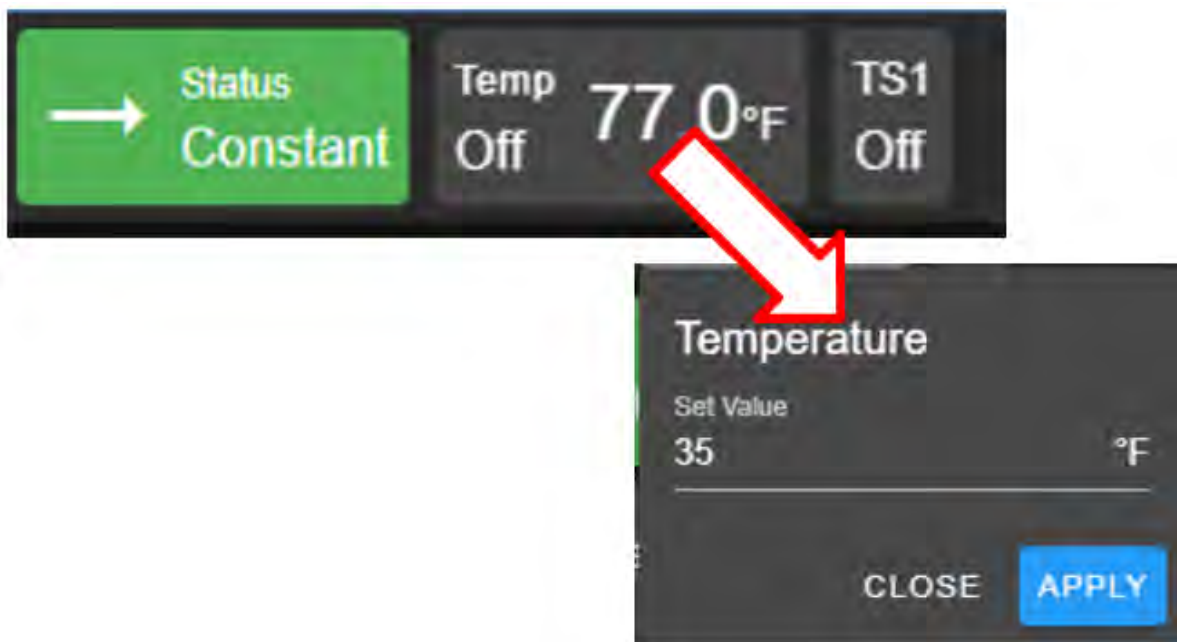


Figure 17.10: Setting new temperature value via the temp tab

3. Click **APPLY** to apply the new setting.
4. To cancel the setting, click the **CLOSE** button (or the Temp tab in the task bar).

To turn on time signal 1 (TS1), complete the following steps. Repeat the same procedure to turn on additional time signals.

1. Click the TS1 tab in the status bar.

2. Check the box to enable TS1 (shown in the figure).

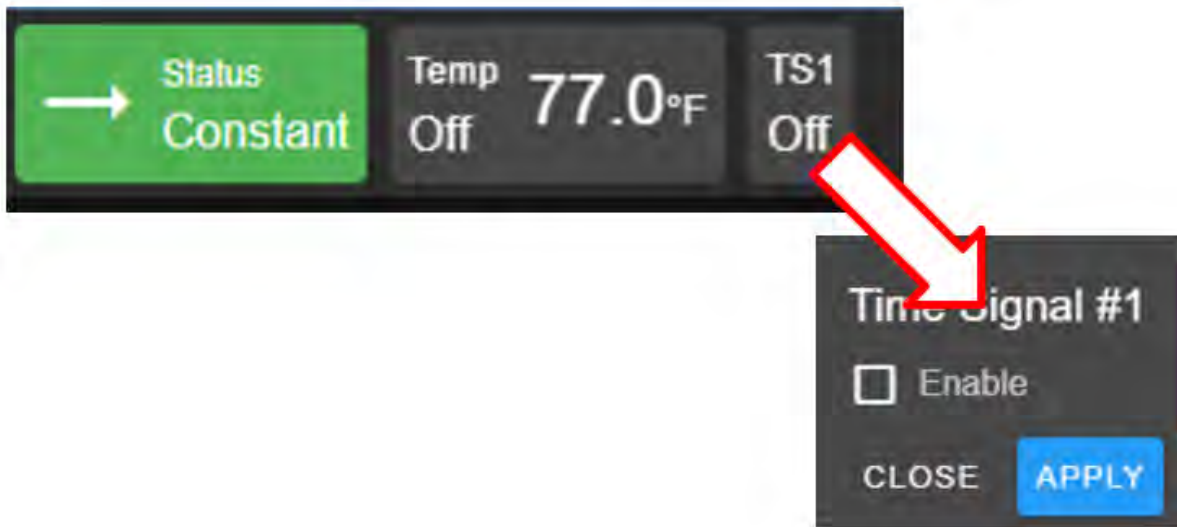


Figure 17.11: Enable or disable time signal setting

3. Click **APPLY**.
4. To cancel the setting, click **CLOSE** (instead of **APPLY**) or click the TS1 tab itself in the status bar.

To turn off TS1, apply the following steps:

1. Click the TS1 tab in the status bar.
2. Uncheck the box to disable TS1.
3. Click **APPLY**.
4. To cancel the setting, click **CLOSE** (instead of **APPLY**) or click the **TS1** tab itself in the status bar.

17.4.2 Settings via the Dedicated Panes

With ESPEC Web Controller, there are multiple ways to complete the same task. The dedicated panes for different control parameters (such as, temperature, vibration or humidity, time signals, or refrigeration) in the main display area are actually clickable panes. These are CTA (call-to-action) panes through which new parameter settings can be applied.

To apply a new setting to temperature, complete the following steps:

1. Click the Temperature pane to access the input pane (shown in figure below).



Figure 17.12: Setting new temperature value via the temperature (CTA) pane

2. In the input pane, click and enter new value in the Set Value field or apply the up/down arrow to adjust the value.
3. Click **APPLY**. To cancel the setting, click **CLOSE** (instead of **APPLY**).

The above procedure can also be applied to parameters.

17.5 Web Controller on the Network

ESPEC Web Controller can communicate with other ESPEC Web Controllers on the same network. The hostname (with E logo) in the upper-left corner acts as a link that, when clicked, provides a list of any chamber with ESPEC Web Controller detected on the network by the local ESPEC Web Controller, as depicted in the following figure.

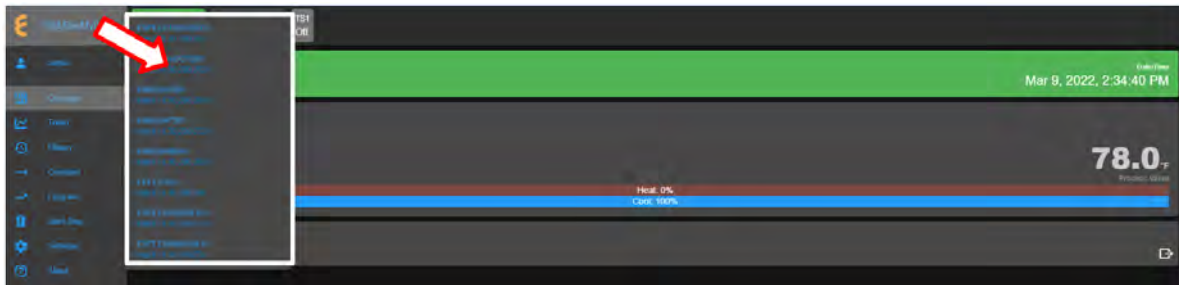


Figure 17.13: List of ESPEC Web Controller on the local network

This list can be opened from within any menus (not just in the **Overview** menu) by just clicking on the Web Controller hostname. Any chamber and ESPEC Web Controller on the list can be accessed directly by clicking on its hostname.

CHAPTER 18

Trend

Data points from the chamber's operation accumulated in the data log are displayed as a trend graph under the **Trend** menu, depicted in the following figure. By default, this graph provides an overview of the chamber's operation in the last one hour. Data can be downloaded in whole or in portion (refer to Item 4 below).



Figure 18.1: Trend graph showing plots of current data from the chamber

The main display area of the **Trend** menu is categorized into seven different groups with labels from 1 through 7. Detailed descriptions of these categories are outlined as follows:

1. **Time Frame:** This menu button shows or hides the time frame of the data points being plotted in the trend graph. As shown in the following figure, the trend graph is plotted for data points collected between 2:29 PM and 3:29 PM. That time frame is also displayed at the bottom of the trend graph, with grids at an interval of 5 minutes. This graph will continue to update and propagate through the progression of time in a 5-minute interval. To hide this time frame, click the menu button again.

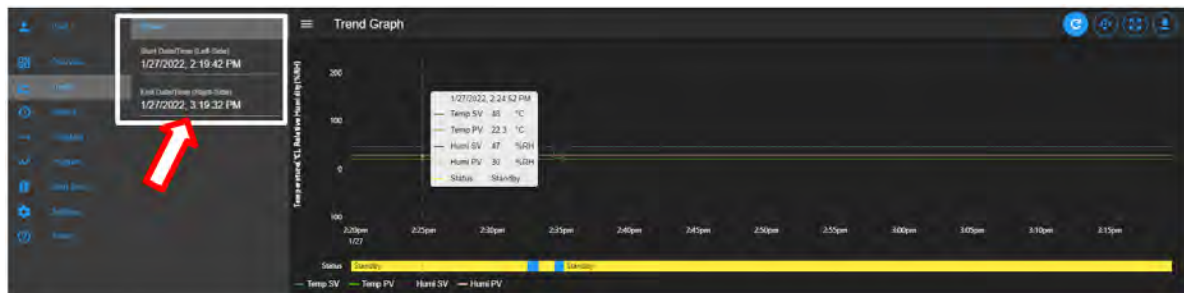


Figure 18.2: Detailed data of the Trend graph

2. **Trend Graph:** Data points collected from the chamber are rendered and displayed as a trend graph based on a scatter plot methodology. These data points represent product temperature, air temperature and/or vibration; they are plotted as a function of time. The vertical (Y) axis represents the scale of their values. Temperature is displayed in degree Celsius; vibration is displayed in root-mean-square of acceleration (Grms or G). The horizontal (X) axis represents the time scale with unit measured in a 1-second scale. Based on the default configuration, the Typhoon chamber logs data points in a 1-second interval. The scaling of the grid will change according to the Pan/Zoom Controls buttons application (see item 3 below). To reset the trend graph, click the **Zoom Extents** button (in the following figure), select **Last Hour** from the drop-down menu, then click the **Auto Refresh**

button.

3. **Snapshot of Data:** By hovering a mouse pointer on the trend graph area, a snapshot of the data at a particular time is displayed. This feature allows a quick peak of the data at a certain point in time. Depending on the chamber's condition, the snapshot provides set values (SV) and process values (PV) of temperature, product or air temperature, or vibration, chamber's operation status and time signal status.
4. **Trend Graph Manipulation Buttons:** Four buttons are available to help manipulate and control the trend. This group of buttons is detailed in the following figure; their functions are described as follows:

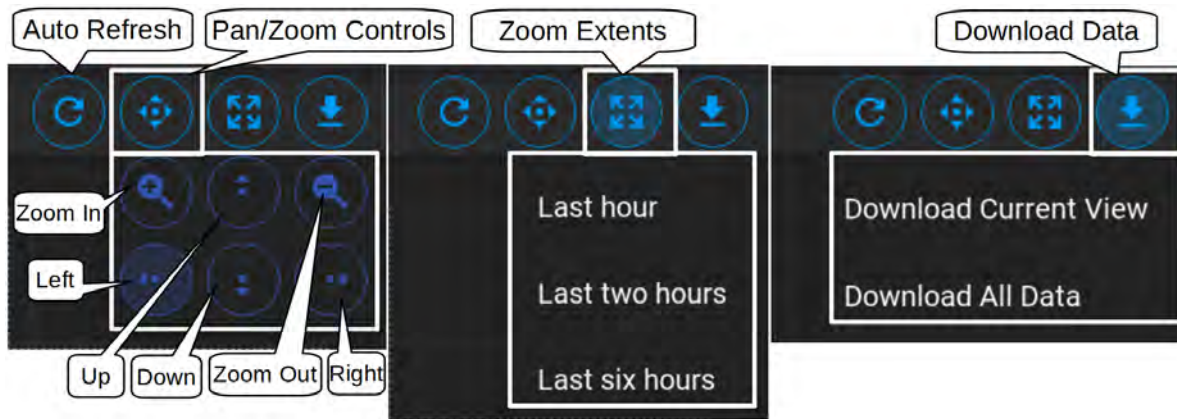


Figure 18.3: Manipulation buttons of the Trend graph

- **Auto Refresh:** This Auto Refresh button refreshes the trend graph; it thereby reconstructs the graph using the most recent data points which have been accumulated up to the current time.
- **Pan/Zoom Controls:** The Pan/Zoom Controls button allows the operator to control and adjust the viewable section in the trend graph. This button presents six operation buttons to manipulate and display the trend graph as follows:
 - **Zoom In:** The **Zoom In** button allows the operator to zoom into a small section of the trend graph. Depending on the degree of zooming, the display area will be confined to a small set of data points ranging between minutes to hours. To reset the trend graph, click the **Zoom Extents** button, select **Last Hour** from the drop-down menu, then click the **Auto Refresh** button.
 - **Zoom Out:** The **Zoom Out** button does the opposite by allowing the operator to zoom out on the trend graph, thereby giving the operator an expansive view of the trend graph. To reset the trend graph, click the **Zoom Extents** button, select **Last Hour** from the drop-down menu, then click the **Auto Refresh** button.
 - **Move Up:** This button allows the operator to move up the graph along the vertical axis to adjust the viewable area of the scatter plot. To reset the trend graph, click the **Zoom Extents** button, select **Last Hour** from the drop-down menu, then click the **Auto Refresh** button.
 - **Move Down:** This button allows the operator to move down the trend graph along the vertical axis with the purpose to adjust the viewable area of the scatter plot. To reset the trend graph, click the **Zoom Extents** button, select **Last Hour** from the drop-down menu, then click the **Auto Refresh** button.

- **Move Left:** This button allows the operator to pan left on the trend graph, offering a quick preview of a plot of data points tracing back the time in hours or days. With this feature, the operator can quickly gain a preview of past data points which the operator may have missed.
 - **Move Right:** This button does the opposite to **Move Left** by allowing the operator to pan right on the trend graph to the current time. To reconstruct the trend graph to contain the most recent data points, the **Auto Refresh** button allows the quickest operation.
 - **Zoom Extents:** With this button, trend graph may be provided using data points from within the last one hour, last two hours or the last six hours. To make adjustment of the trend graph based on these three selections, click on the **Zoom Extents** button, then click one of the selection from the drop-down menu.
 - **Download Data:** To download data and store it on the local computer, click the **Download Data** button and select **Download Current View** to download a portion of data from the displayed trend graph. To download the entire collection of data, select **Download All Data**. Data file will be stored in the Downloads folder of the local computer with filename: hostname_data_date.CSV.
5. **Line Graph:** Data points from Temperature (set values or process values) and vibration (set values and process values) are being plotted to produce the line graphs to visually display the operation condition of the chamber.
 6. **Status:** Status of the operation mode of the chamber is displayed along the time line on the trend graph, indicating when and how long the chamber was in specific operating mode. This feature provides a quick preview of the chamber operating status. The **Left** button under the Pan/Zoom Controls may be used to extent further into the past to view the chamber's operating mode.
 7. **Legend of Trend Graph:** The legends are used to identify each item on the trend graph with color code to designate the different line graph (described in Item 5 above).

CHAPTER 19

History

The **History** page displays operation history of the chamber, its operating modes and statistics. Any alarms or alerts that were triggered during the chamber's operation are logged and displayed here. By default, history log of the chamber's operating modes, alarms or statistics from the previous week will be displayed, as depicted in the following figure. There are five important components in the **History** main display area. They are labeled and described as follows:

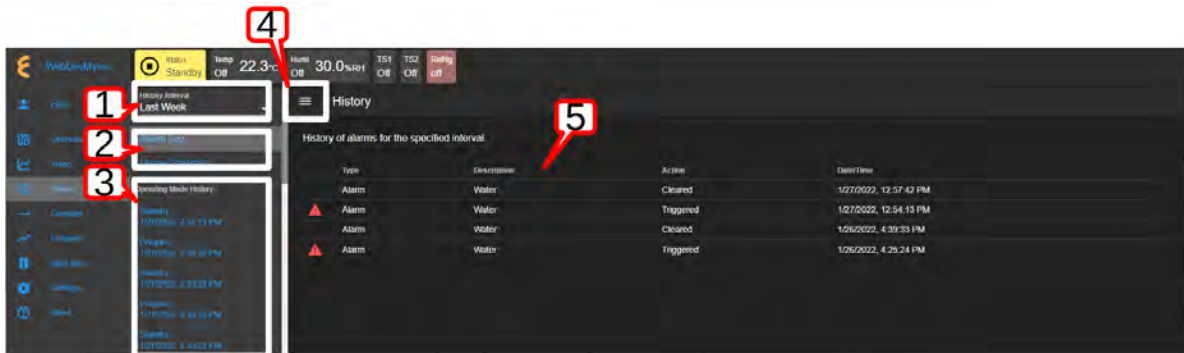


Figure 19.1: Operation history of the chamber

1. **History Interval:** Display options of the operating history are: one week, two weeks, one month, three months, six months, one year or the entire period of the chamber's operation. To access the history interval, click the radio button to select the period from the list.

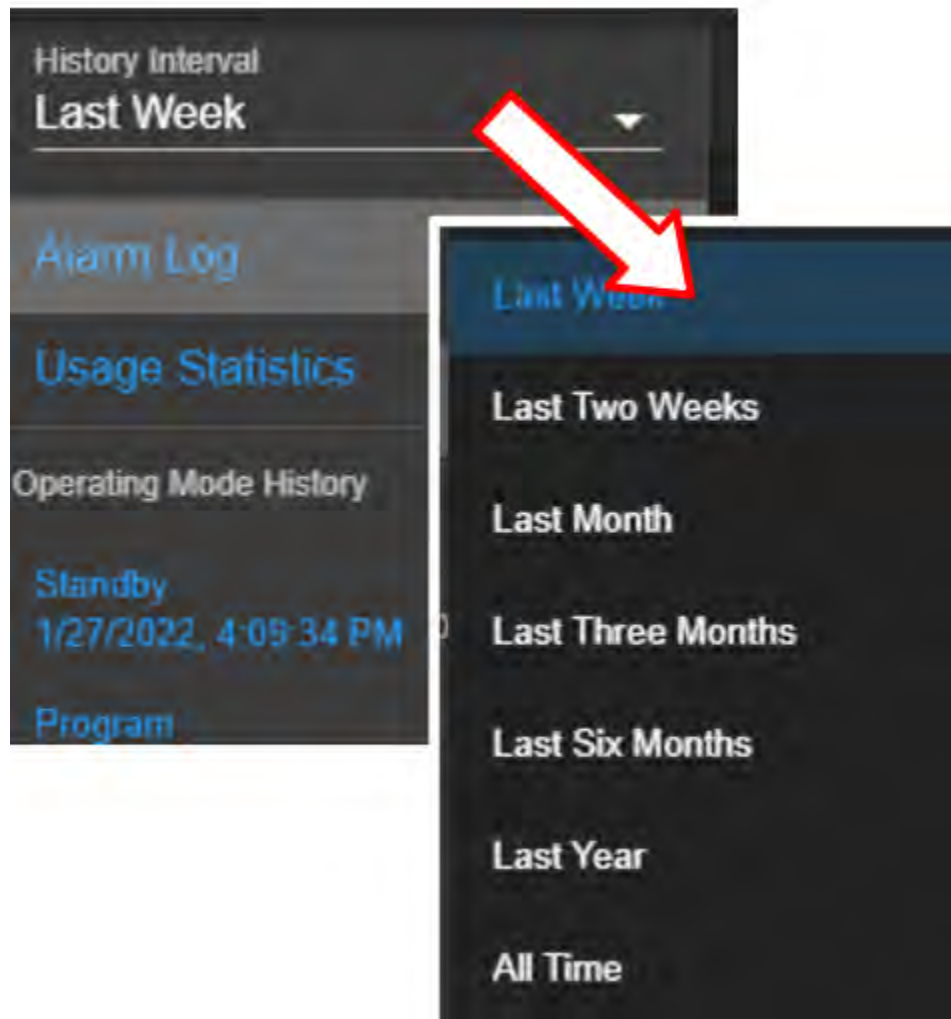


Figure 19.2: History interval and display selection

2. Alarm or Statistics Submenus:

- **Alarm Log:** By default, alarm logs will be displayed in the main display area. The logs indicate which alarm had occurred and when they were resolved (cleared).

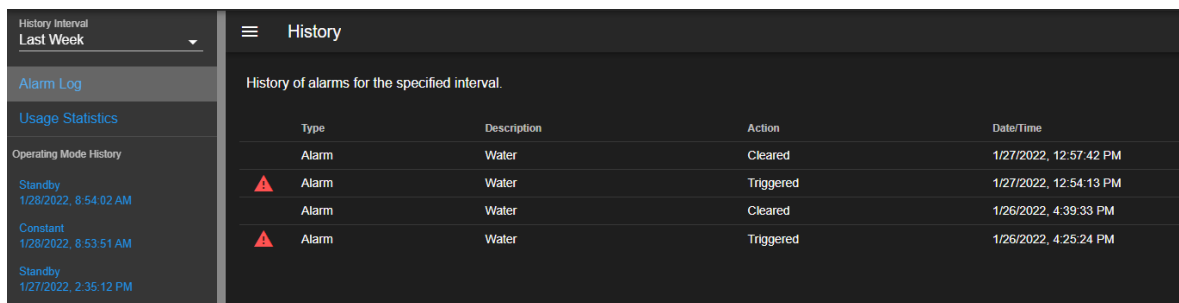


Figure 19.3: History of alarm

- **Usage Statistics:** To display the operation statistics, click on this submenu. Percentage of each operation mode based on the selection period in the **History Interval** is displayed as shown in the following figure:

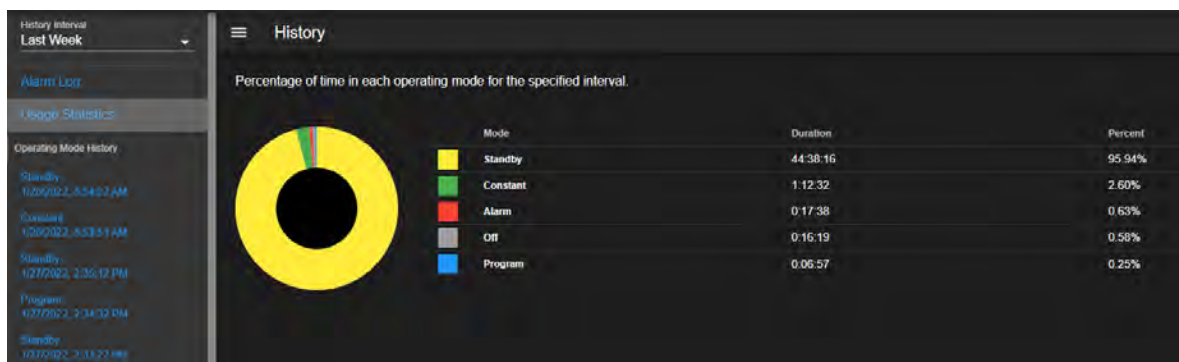


Figure 19.4: History of operation statistics

Such information provides the operator a good idea of the overall performance of the chamber by identifying when and how much time it was in a certain operating mode.

3. **Operating Mode History:** A list of operating modes of the chamber is displayed here based on the option selected under the **History Interval**. Default listing is based on a one-week interval. A trend graph, identical to that produced in the **Trend** menu, based on the data points collected during the operating mode can be produced by clicking on the particular operating mode on this list, as illustrated in the following figure.

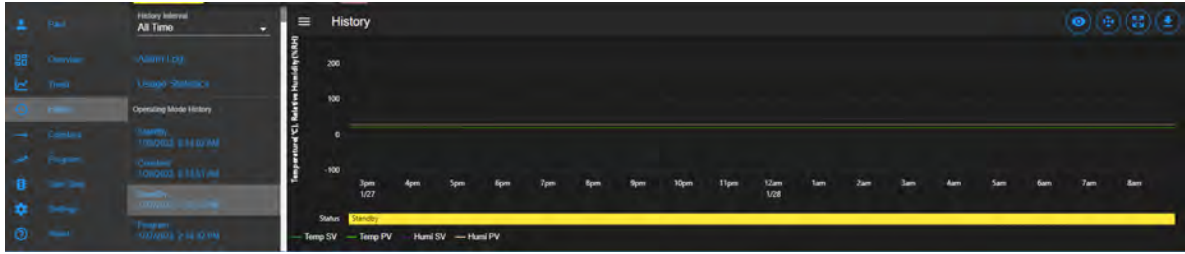


Figure 19.5: Trend graph of operating mode history

4. **Show/Hide Submenu:** To provide a larger real estate for the main display area, this Show/Hide button can be used to show or hide the **History** submenu. The following figure shows how the submenu is hidden and the main display area is expanded.

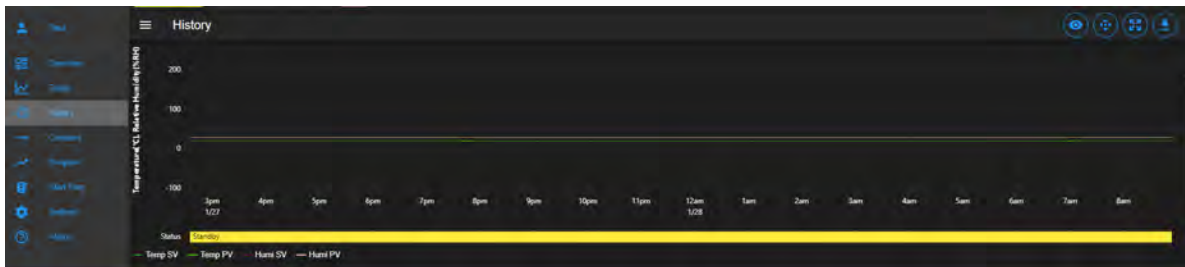


Figure 19.6: The show/hide button of the main display of the History page

5. **Main Display:** The content of the submenu page of **Alarm Log** and **Usage Statistics** is displayed here (refer to item 2, above).

CHAPTER 20

Constant

The existence of ESPEC Web Controller **Constant** page is such that all features and their parameters are collected and displayed in one place to control their constant mode settings. The main display of **Constant** consists of three separate panes, displayed as **Temperature**, **Humidity** (or **Vibration**) and **Outputs**, as depicted in the following figure. These CTA panes provide input options to adjust the settings directly. The Humidity Range Chart is a two-dimensional graph of the current temperature-humidity relationship, displayed below these CTA panes.



Figure 20.1: The Constant menu and its components

The following sections describe how to configure and control each of these parameters.

20.1 Product or Air Temperature Setting

Complete the following steps to turn on or modify temperature setting:

1. Enable air temperature or product temperature by checking the appropriate boxes.
2. Click the Set Value field and enter a new value, or apply the up/down arrow to adjust the value.
3. Adjust the plus/minus deviation in the appropriate fields.

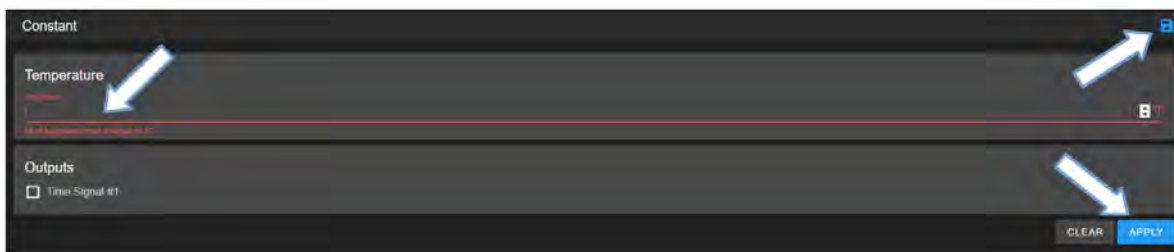


Figure 20.2: Apply new constant setting on temperature

4. Click the **APPLY** button or the **Save** icon (indicated by the arrows) to apply and save the setting. The red dot next to the **Save** icon indicates that the new setting has not been saved. If you exit this pane by accessing a different menu in the menu bar, a warning message will appear (shown in figure).

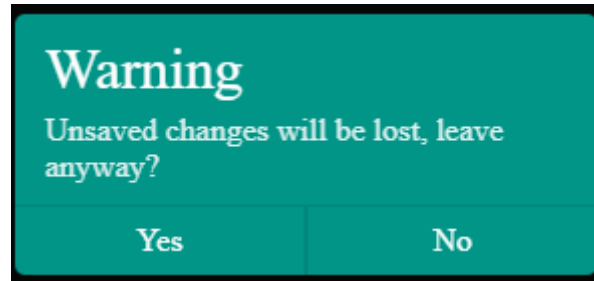


Figure 20.3: New setting must be save before exiting the pane

5. To cancel the setting, click **CLEAR**.

The new setting takes effect immediately with its new status displayed in the status bar. To reverse or cancel the setting, repeat the above steps to reset the set value and click **APPLY**.

20.2 Time Signals Setting

Complete the following procedure to turn on output for any time signal:

1. To turn on output for **Time Signal # 1**, place a check mark in its box.
2. Repeat the above step for any time signal available in the main display area.
3. Click the **APPLY** button or the save icon as indicated by the arrows in the above figure to apply and save the setting.
4. To cancel the setting, click **CLEAR**. If you exit this pane by accessing a different menu in the menu bar, a warning will appear which requires you to save the setting before attempting to access any other menus.

The new setting takes effect immediately with its new status displayed in the status bar. To reverse or cancel the setting, repeat the above steps to uncheck the box and click **APPLY**.

It is important to note that all the parameters (temperature, humidity, vibration, time signal) in the main display can be adjusted altogether simultaneously with a single **APPLY** or save button. However, individual setting may provide security to avoid any adverse effect.

CHAPTER 21

Program

The **Program** menu allows the operator to create a program to control the chamber. All the programming features available on the supported PLC's listed in Chapter 1 (“**Introduction**”) can be composed into programs to control the chamber. The operator can: (1) open and view a program; (2) preview the output of the program; (3) edit and/or overwrite an existing program ; (4) delete program from the list; (5) rename program on the list; (6) download a program and store it on the local computer in JSON file; (7) upload a program from the local computer to the Web Controller, and much more.

Here are some of the benefits of the **Program** menu:

- Easy to operate.
- Quick management of programs, programming or editing.
- Require less time to develop a new program or modify an existing program.
- Program Editor offers flexibility with multitasking capabilities.
- Control program operation and program end mode.
- Preview program operation before execution; operator can see exactly what the program does prior to its execution.
- Download program from the Web Controller to the local computer for backup.
- Upload program from the local computer to the Web Controller.

Only authorized users with read-write privilege can access and utilize the **Program** menu. The user must log into their account to access the **Program** menu based on their read-write privilege, as depicted in the following figure.

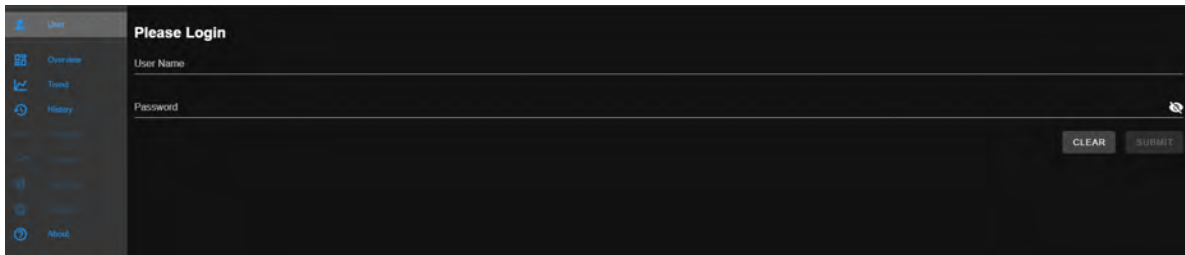


Figure 21.1: User with read-write privilege is required to operate the Program menu

21.1 List Programs

The following figure depicts a typical layout of the **Program** page with its submenu hidden. This is the default display of program list when the **Program** menu is accessed for the first time. Its UI components are numbered and explained as follows:

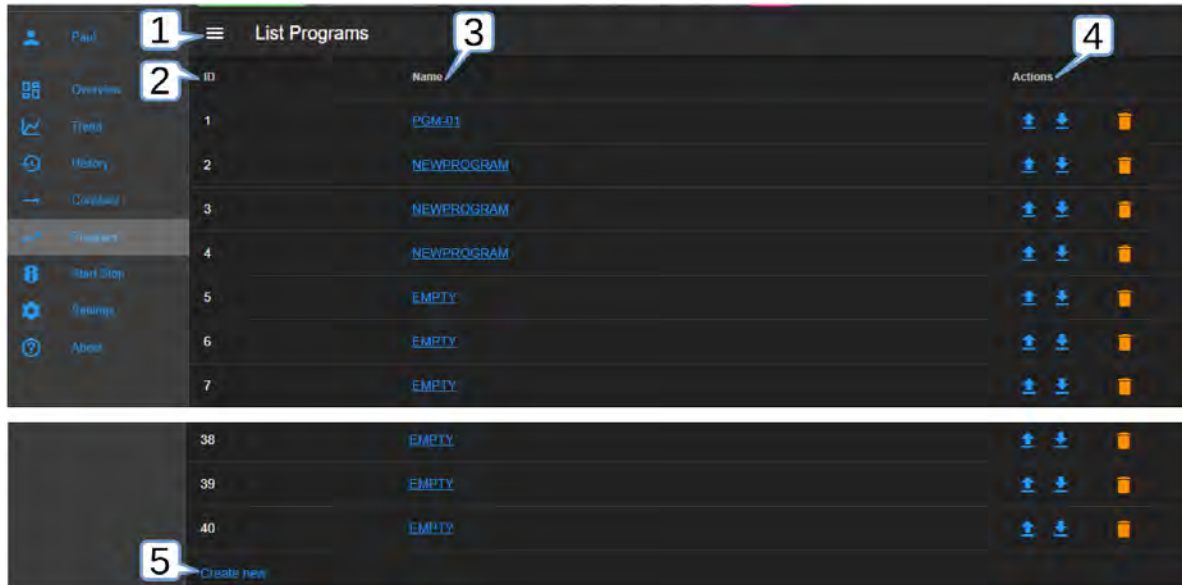


Figure 21.2: Program listing page with submenu hidden

1. **Submenu Show/Hide:** To utilize the entire main display area for the program editor, this button can be used to hide the submenu (as shown in the above figure). Click it again to reveal the submenu.
2. **ID:** ESPEC Web Controller identifies each program by its slot number stored in the PLC register. This list reflects the actual list of programs read from the PLC register. A total of 40 program slots are available, numbered from 1 to 40. Only slots 1 through 20 can be used to store profiles. The system uses a program identification code (ID) to identify each program.
3. **Program Name:** All available programs are listed under the **Name** column by program name. These programs are stored by their slot number. As such, identical program names may exist in different slots. Any slot not yet occupied by the program is marked **EMPTY**. Users can access each program under this list by clicking on the program name. The program editor then opens and displays the program instructions. Detailed operation of the program editor is discussed in the next section.
4. **Actions:** Three action buttons (Upload Program, Download Program, Delete) under the **Actions** column can be used to manage each program on the list under each row. These action buttons, once activated, affect the program on the row where the buttons were applied. They are described as follows:
 - **Upload:** Program can be uploaded from the local computer to the Web Controller which will then be stored in the PLC register using the slot number where the action was applied.
 - **Download:** Program can be downloaded and saved on the local computer.
 - **Delete:** A program to the left of the trash bin (where this action is applied) will be deleted. The PLC register will no longer contain this program.
5. **Create New:** This button opens the program editor for creating a new program. The **Create New** button is conveniently placed in two locations: (1) under the **ID** list and (2) in the **Program** submenu (shown in the following figure).

The following figure displays the **Program** page with its submenu unhidden. The submenu (item 2) has two operation buttons: (i) List Programs and (ii) Create New (program).

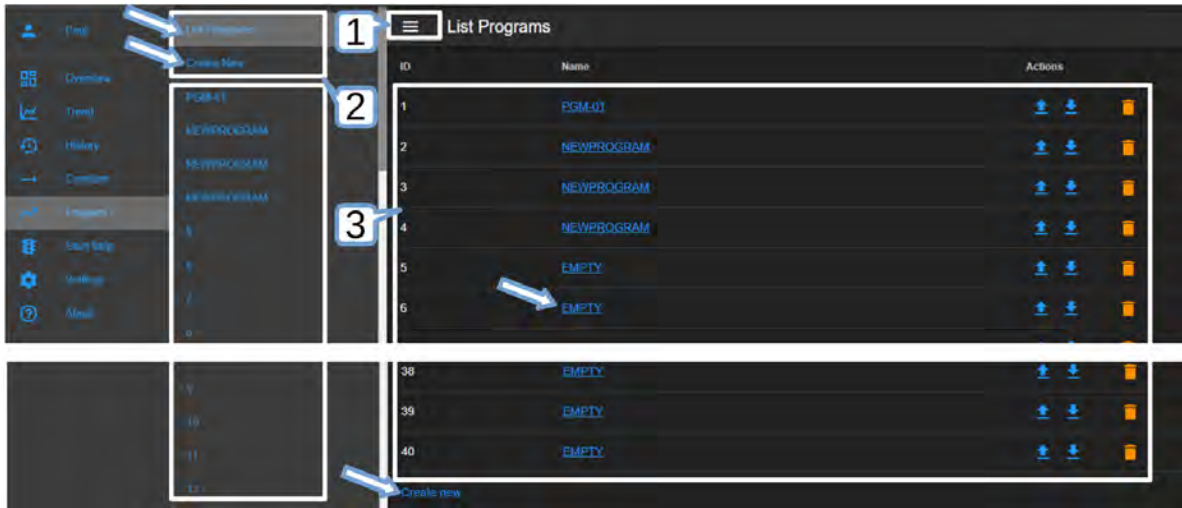


Figure 21.3: Program listing page with submenu unhidden

1. **Show/Hide:** The **Show/Hide** button can be used to hide or unhide the **Program** submenu (item 2 below).
2. **Submenu:** This submenu has two operation buttons (indicated by the arrows): List Programs and Create New (program). All the available programs in the chamber stored in the Web Controller are listed below these operation buttons (shown in above figure). With the submenu hidden, the main display has a larger real estate to display the program elements.
 - **List Programs:** The **List Programs** button offers a quick way to exit the program editor (explained in the following section). To exit the program editor mode, click this **List Programs** button. This action will cancel and exit the program editor being used to create, edit or import a program.
 - **Create New:** Similar to the **Create New** button under the **List Programs** display page (item 3 below), this button opens the program editor with an empty template for constructing a new program. Detailed discussion is provided in the following section. A program from the local computer can also be imported into this empty template.
3. **List Programs:** This is the main display of the program list depicted in the previous figure. Click the **Show/Hide** button (item 1) to hide the submenu and expand the **List Programs** display page.

21.2 Create New Program

A new program can be created via one of the following buttons as depicted in the following figure.

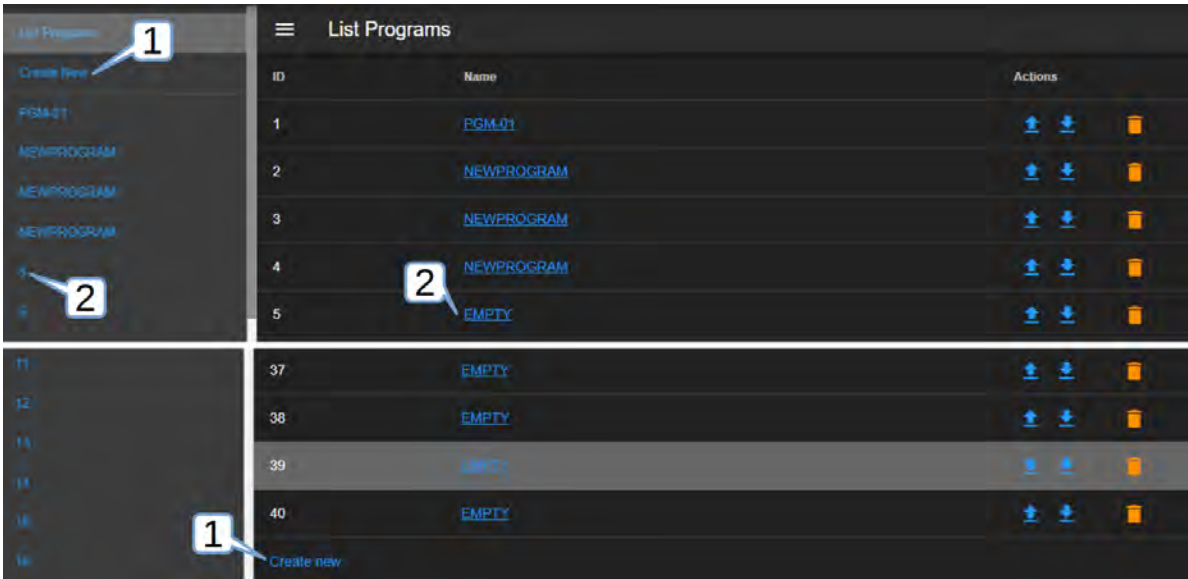


Figure 21.4: Different methods to creating a new program

Each of these buttons follows a different pattern to complete the task.

1. **Create New:** Click the **Create New** button in the submenu or under the **List Programs** in the main display to launch the program editor. An empty template is opened for a new program, as depicted in the following figure.

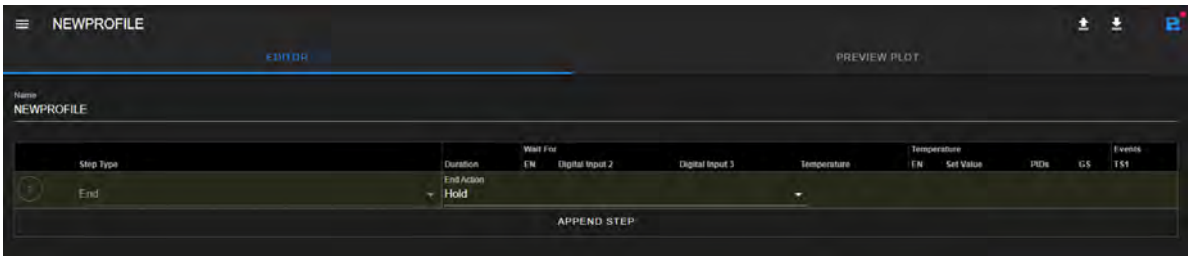


Figure 21.5: Empty template for a new program

The new program being constructed does not yet have a predefined location (i.e., slot number). The program editor therefore has only the **Save As** option to save the program in a specific or a desired slot number, as depicted in the following figure.

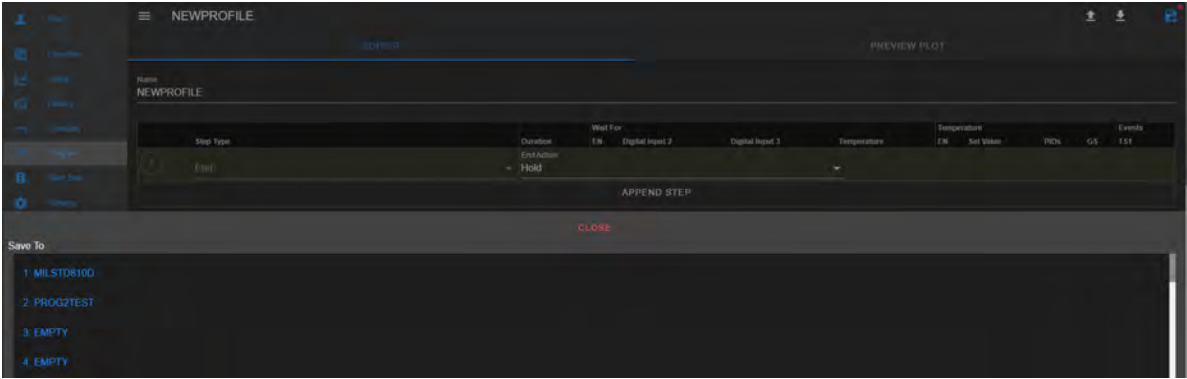


Figure 21.6: Selecting slot # to save new program

However, no matter what slot being chosen, Watlow F4 will dictate the location and it will store the program in the next vacant slot. Once saved, the new program will appear in the program list, occupying the next empty slot.

- 2. **EMPTY**: A new program can be created via the **EMPTY** button under the program list (in the submenu) or the name list in the main display. An empty template is opened for a new program, as depicted in the following figure.

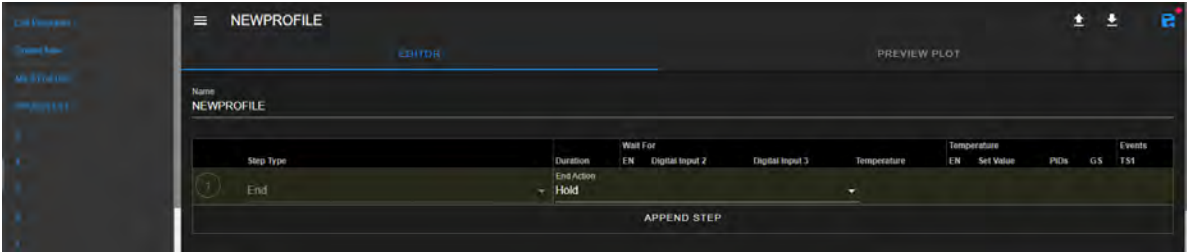


Figure 21.7: Empty template for a new program

The program editor has both **Save As** and **Save** buttons to manage the program file. However, again, Watlow F4 dictates the location of the program; no matter what slot number is chosen to store the program, F4 always stores the program in the next empty slot via the **Save As** or **Save** buttons.

The following figure depicts the general layout of the empty template for a new program. The first step has been added to illustrate its components.

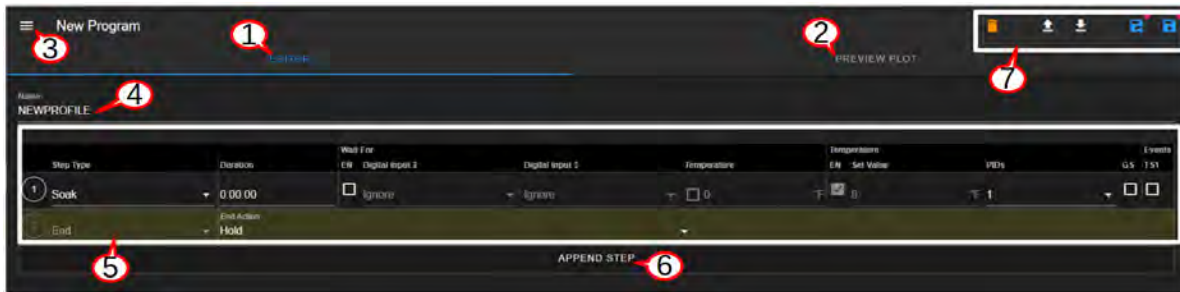


Figure 21.8: Program listing page with submenu unhidden

The UI and components of the program editor (pictured above) are numbered and described as follows:

1. **Editor:** By default, a program is open and placed in the program editor. It is highlighted in blue to indicate its active status.
2. **Preview Plot:** The output of the current program can be previewed via this button. Both the **Editor** (item 1 above) and this button can be used to toggle between the editing and previewing mode of the current program. In order to apply the preview mode, the program must be loaded into the program editor first, then click the **PREVIEW PLOT** button.
3. **Submenu Show/Hide:** This button toggles between the show and hide mode of the submenu. To utilize the entire main display area for the program editor, this button can be used to hide the submenu.
4. **Program Name:** An alphanumeric naming convention based on ASCII with lower- or upper-case letters applies to program name with up to 10 characters. The Web Controller will flag a warning if more than 10 characters were entered. Program name should be kept short and descriptive. Since each program is individually stored in a unique slot in the PLC, a unique name on the Web Controller is not necessary. However, these programs must have unique names when they are stored on the local computer. When a program name is entered into this field, this name also appears in the title bar next to the show/hide button (item 3).
5. **Program Step:** A program step contains instructions for the chamber to carry out the tasks. Depending on the type of chamber, a program step contains various components and parameters that make up an instruction within each step.
 - **Step Type:** Six available step types (Autostart, Ramp Time, Ramp Rate, Soak, Jump and End) can be used to construct an instruction. They are outlined as follows:
 - **Autostart Step:** A program featuring this step type can automatically start the execution based on day of the week or date and time.
 - **Ramp Time:** With Ramp Time, changes of the set point to a new value is down based on a chosen period of time.
 - **Ramp Rate:** With Ramp Rate, changes of the set point to a new value is down based on a chosen rate of time.
 - **Soak:** This feature maintains the set point from the previous step for a chosen time in hours, minutes and seconds.
 - **Go to Step:** This feature allows the program to jump (or **Go to**) to a certain

step within the program to repeat its execution. Watlow F4 refers to it as **Jump**.

- **End:** A program must have an end step to end and define its end action. Four different end actions are available for operation: (1) Hold, (2) Control Off, (3) All Off, and (4) Idle.
 - **Duration:** The duration specifies the length of time (measured in H:MM:SS) that the said step goes through to complete its task. The Web Controller accepts the input value in H:MM:SS or in pure numerical value. If a pure numerical value is entered, the Web Controller converts it to H:MM:SS. For instance, if 15 is entered, the system treats it as 15 seconds, and the H:MM:SS format therefore becomes 0:00:15. If 66 is entered, the system converts it to 0:01:06. Similarly, if 90 is entered, the system renders that value to 0:1:30.
 - **Wait For:** This is an optional feature in a program; but, when enabled, step types such as Ramp Time, Ramp Rate and Soak can be programmed to wait for a particular chamber temperature or event input condition to satisfy before this particular step begins its execution.
 - **Digital Inputs:** Options for Digital Inputs are: Ignore, On, Off.
 - **Temperature:** The desired temperature value set as a condition.
 - **Temperature:** The temperature control loop has three parameters:
 - **Set Value:** The value that the temperature must attain.
 - **PIDs:** There are five different PID numbers, though PID 1 is normally used.
 - **GS:** The Guaranteed Soak (GS) option can be enabled or disabled.
 - **Events:** Each time signal can be switched to **ON** or **OFF** for this step. Time signal (TS) operation is step dependent. Suppose TS1 is turned **ON** at step 1 and the rest of the steps do not have TS enabled. In this case, TS1 will remain “ON” for the entire program. Thus, TS may be controlled independently, step by step.
6. **Append Step:** When a program is first created via the **Create New** or **EMPTY** buttons, the program editor begins with an empty template, with no instructions or steps. To create an instruction, a new step must be created. This APPEND STEP button is used to add a new step. Once a program has a step, additional steps can be added using this button or the drop-down menu of the Step Number (to be explained below). The APPEND STEP button always adds a new step as the last step in the program. By contrast, the drop-down menu of the Step Number allows a new step to be inserted above or below the current step. It also has a delete button to remove any step from the program.
7. **File Manipulation:** Five different buttons (icons) are available for file manipulation. Their action can be previewed by hovering the mouse pointer over them. They are described from left to right as follows.
- **Delete:** Click on the trash bin icon to delete the current program. This action will delete the program in the program editor and the PLC. A pop-up warning (shown in the figure) appears to reaffirm the action.

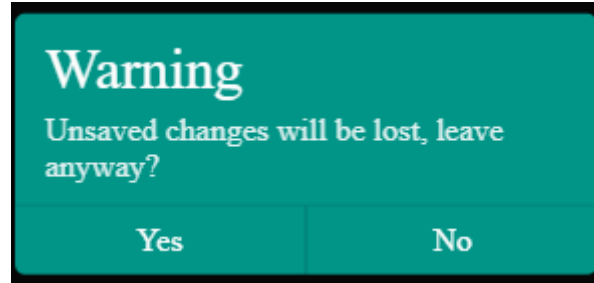


Figure 21.9: File deletion confirmation

- **Open Program:** This button imports a program file from the local computer into the program editor. The Web Controller only accepts a program in JSON format. To ensure compatibility, the program structure should be based on the one downloaded from the Web Controller itself (see **Download Program** below). The program is not yet saved until the **Save As** or **Save** button is applied.
- **Download Program:** This button downloads the current program file and stores it on the local computer. The program is saved in JSON format; filename is based on the hostname and slot number (e.g., hostnmae_program_9.json).
- **Save As:** This buttons stores the current program in the PLC. The action brings up a program list, as depicted in the following figure, to select a new slot to hold the current program. However, F4 will ignore the selected slot number save the program using the next empty slot available on its register regardless of what slot number has been chosen. To cancel this action, click the **CLOSE** button. **WARNING!:** A vacant slot should be selected to save the program. Otherwise, the current program will overwrite the existing one in the slot without prompting for reaffirmation, thus, destroying the program previously in that slot. The current program in a new slot still uses the same program name. To make it unique, edit item 4 (above) with a new name and apply the **Save** button (see below) to resave the program.

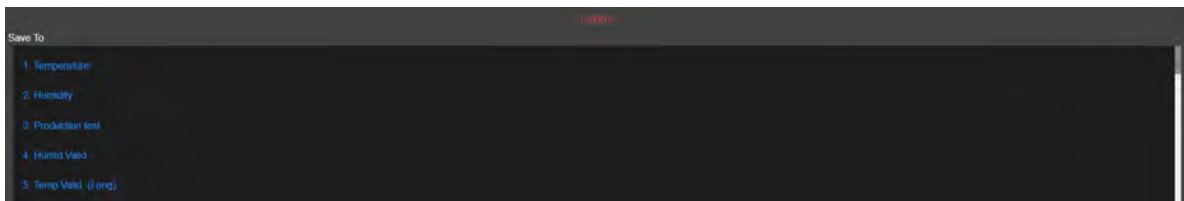


Figure 21.10: Save program to a new slot

- **Save:** This button saves the current program in the next available slot number on the F4.

21.2.1 Programming: Add Program Step

The following example illustrates how to create a new program using step types Ramp Time, Soak and Jump in the program. This example does not have any real practical implication, but it shows how the program editor provides an easy approach to constructing a program.

1. Click **Program** in the side bar.
2. Click **EMPTY** on slot 2 on the Program List. To follow along with this example, slot 2 should be empty.
3. **Program Name:** Enter **PROG2TEST** in the program name field.
4. **Add New Step:** Click the **APPEND STEP** button to add the first step.
5. **Step 1:** Complete the following fields:
 - **Step Type:** Click the down arrow and select Ramp Time from the list.
 - **Duration:** Enter 0:00:15.
 - **Wait For:** Leave this option disabled with EN box unchecked. Digital input and Temperature under this block should be grayed out.
 - **Temperature:** Confirm that EN is enabled.
 - **Set Value:** Enter 88 or apply the up/down arrow to adjust the value to 88.
 - **PIDs:** Select 1 for PIDs.
 - **GS:** Leave the box unchecked.
 - **Events:** Leave TS1 box unchecked.

The screenshot shows the 'PROG2TEST' program configuration window. It features a table with columns for Step Type, Duration, Wait For (EN, Digital Input 2, Digital Input 3), Temperature (EN, Set Value, PIDs), GS, and Events (TS1). Step 1 is configured as follows:

Step Type	Duration	Wait For	Digital Input 2	Digital Input 3	Temperature	Temperature	Temperature	PIDs	GS	Events
		EN				EN	Set Value			TS1
1 Ramp Time	0:00:15	<input type="checkbox"/>	Ignore	Ignore	<input type="checkbox"/>	<input checked="" type="checkbox"/>	88	"F 1"	<input type="checkbox"/>	<input type="checkbox"/>
End	Hold									

Below the table is an 'APPEND STEP' button.

Figure 21.11: Step 1 in program

6. **Step 2:** Click number 1 in the circle at the beginning of step 1 (shown in the figure below). Select **Insert After** from the drop-down menu and edit the fields with the following parameters:

The screenshot shows the 'PROG2TEST' program configuration window. A red arrow points to the number '1' in a circle at the beginning of Step 1. A context menu is open, showing three options: 'Insert Before', 'Insert After', and 'Delete'.

Figure 21.12: Inserting a program step

- **Step Type:** Click the down arrow to select Soak from the list. The rest of the parameters will be set as default.

Name: PROG2TEST

Step Type	Duration	Wait For IN Digital Input 2	Digital Input 3	Temperature IN Set Value	Temperature IN Set Value	PIDs	Events GS TS1
1 Ramp Time	0:00:15	<input type="checkbox"/> Ignore	Ignore	<input type="checkbox"/> 0	"F 88	"F 1	<input type="checkbox"/> <input type="checkbox"/>
2 Soak	0:00:00	<input type="checkbox"/> Ignore	Ignore	<input type="checkbox"/> 0	"F 88	"F 1	<input type="checkbox"/> <input type="checkbox"/>
3 End	End Action: Hold						

APPEND STEP

Figure 21.13: Step 1 in program

7. **Step 3:** Apply the **Insert After** button again to add Step 3 below Step 2, using Ramp Time as step type with duration of 1 minute (0:01:00), Wait For feature is disabled, with Temperature set at 93 and TS1 turned on.
8. **Step 4:** Apply the same procedure as step 3, but with Temperature set value at 95. Both steps 3 and 4 as illustrated below.

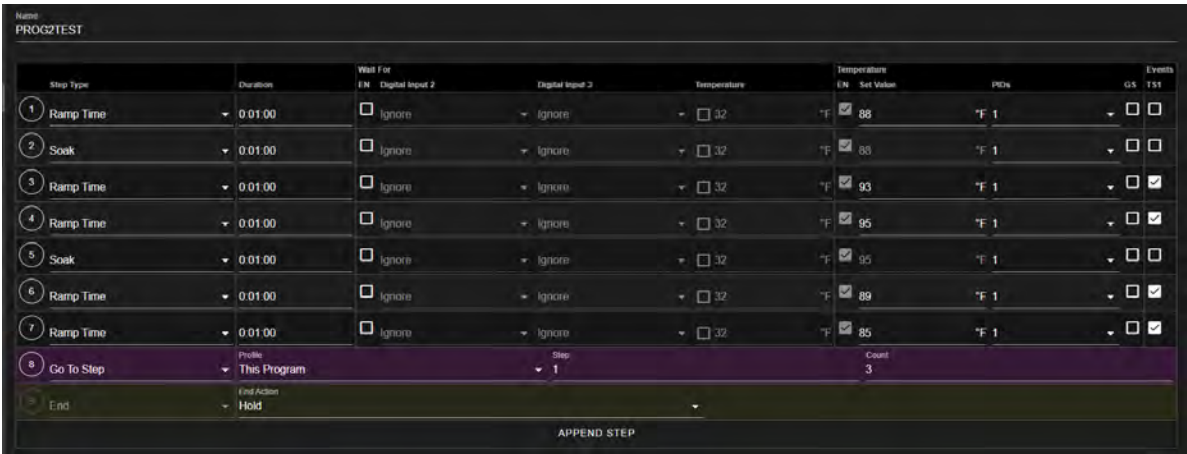
Name: PROG2TEST

Step Type	Duration	Wait For IN Digital Input 2	Digital Input 3	Temperature IN Set Value	Temperature IN Set Value	PIDs	Events GS TS1
1 Ramp Time	0:01:00	<input type="checkbox"/> Ignore	Ignore	<input type="checkbox"/> 0	"F 88	"F 1	<input type="checkbox"/> <input type="checkbox"/>
2 Soak	0:01:00	<input type="checkbox"/> Ignore	Ignore	<input type="checkbox"/> 0	"F 88	"F 1	<input type="checkbox"/> <input type="checkbox"/>
3 Ramp Time	0:01:00	<input type="checkbox"/> Ignore	Ignore	<input type="checkbox"/> 0	"F 93	"F 1	<input type="checkbox"/> <input checked="" type="checkbox"/>
4 Ramp Time	0:01:00	<input type="checkbox"/> Ignore	Ignore	<input type="checkbox"/> 0	"F 95	"F 1	<input type="checkbox"/> <input checked="" type="checkbox"/>
5 End	End Action: Hold						

APPEND STEP

Figure 21.14: Constructing Ramp Time steps 3 and 4

9. **step 5:** Apply the same procedure to add the next step using Soak as step type. Then add two additional steps using Ramp Time to decrease temperature set values to 89 and 85, respectively, with TS1 turned on for for both steps.
10. **Step 8:** We apply the **Go to Step** feature to jump to step 1 to repeat the process for three times. The End Action will be set to Hold. The complete program is illustrated as follows:



The screenshot shows a software interface for editing a program named "PROG2TEST". The program consists of 8 steps, each with a duration of 0.01.00. The steps are: 1. Ramp Time, 2. Soak, 3. Ramp Time, 4. Ramp Time, 5. Soak, 6. Ramp Time, 7. Ramp Time, and 8. Go To Step. Each step has a "Wait For" section with checkboxes for "EN", "Digital Input 2", and "Digital Input 3". The "Temperature" section has a "Set Value" and a "PID" value. The "Events" section has checkboxes for "GS" and "TS1". The "Go To Step" step is highlighted in purple and shows "Profile: This Program", "Step: 1", and "Count: 3". Below the steps is an "APPEND STEP" button.

Step Type	Duration	Wait For	Digital Input 2	Digital Input 3	Temperature	Temperature EN	Set Value	PIDs	Events
1 Ramp Time	0.01.00	<input type="checkbox"/> Ignore	<input type="checkbox"/> Ignore	<input type="checkbox"/> 32	<input type="checkbox"/> 88	<input checked="" type="checkbox"/> 88	<input type="checkbox"/> 1	<input type="checkbox"/> 1	<input type="checkbox"/> <input type="checkbox"/>
2 Soak	0.01.00	<input type="checkbox"/> Ignore	<input type="checkbox"/> Ignore	<input type="checkbox"/> 32	<input type="checkbox"/> 88	<input checked="" type="checkbox"/> 88	<input type="checkbox"/> 1	<input type="checkbox"/> 1	<input type="checkbox"/> <input type="checkbox"/>
3 Ramp Time	0.01.00	<input type="checkbox"/> Ignore	<input type="checkbox"/> Ignore	<input type="checkbox"/> 32	<input type="checkbox"/> 93	<input checked="" type="checkbox"/> 93	<input type="checkbox"/> 1	<input type="checkbox"/> 1	<input type="checkbox"/> <input checked="" type="checkbox"/>
4 Ramp Time	0.01.00	<input type="checkbox"/> Ignore	<input type="checkbox"/> Ignore	<input type="checkbox"/> 32	<input type="checkbox"/> 95	<input checked="" type="checkbox"/> 95	<input type="checkbox"/> 1	<input type="checkbox"/> 1	<input type="checkbox"/> <input checked="" type="checkbox"/>
5 Soak	0.01.00	<input type="checkbox"/> Ignore	<input type="checkbox"/> Ignore	<input type="checkbox"/> 32	<input type="checkbox"/> 95	<input checked="" type="checkbox"/> 95	<input type="checkbox"/> 1	<input type="checkbox"/> 1	<input type="checkbox"/> <input type="checkbox"/>
6 Ramp Time	0.01.00	<input type="checkbox"/> Ignore	<input type="checkbox"/> Ignore	<input type="checkbox"/> 32	<input type="checkbox"/> 89	<input checked="" type="checkbox"/> 89	<input type="checkbox"/> 1	<input type="checkbox"/> 1	<input type="checkbox"/> <input checked="" type="checkbox"/>
7 Ramp Time	0.01.00	<input type="checkbox"/> Ignore	<input type="checkbox"/> Ignore	<input type="checkbox"/> 32	<input type="checkbox"/> 85	<input checked="" type="checkbox"/> 85	<input type="checkbox"/> 1	<input type="checkbox"/> 1	<input type="checkbox"/> <input checked="" type="checkbox"/>
8 Go To Step	Profile: This Program	Step: 1	Count: 3						
End	Hold								

Figure 21.15: Complete program

11. **Save Program:** Click the **Save** icon indicated by the arrow (shown in the figure) to save the program in slot number 2. The PLC will dictate the location of the program; it will place the program in the next available slot, in this case, slot 2.

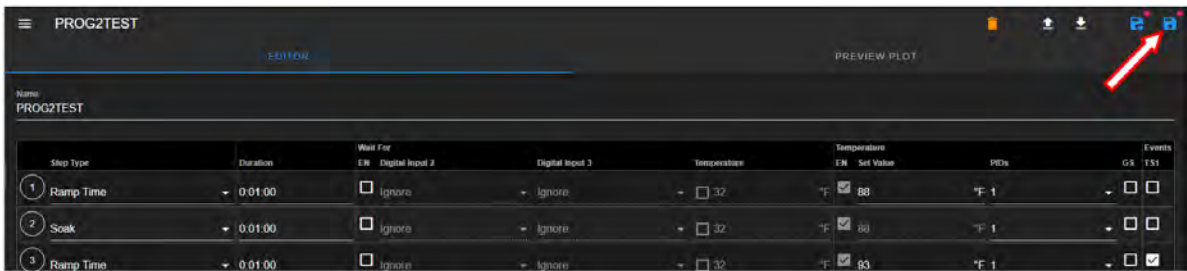


Figure 21.16: Save current program

Navigating out of the editor without saving the program will trigger the following warning prompt:

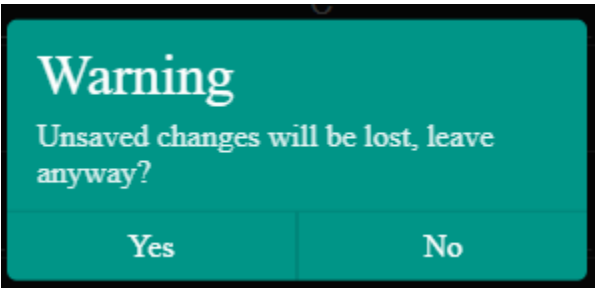


Figure 21.17: Confirm the save or discard update

12. **Preview:** The above program can be previewed before execution by clicking on the **Pre-view Plot** button as depicted in the following figure. To toggle back to the editor mode, click on **EDITOR**.

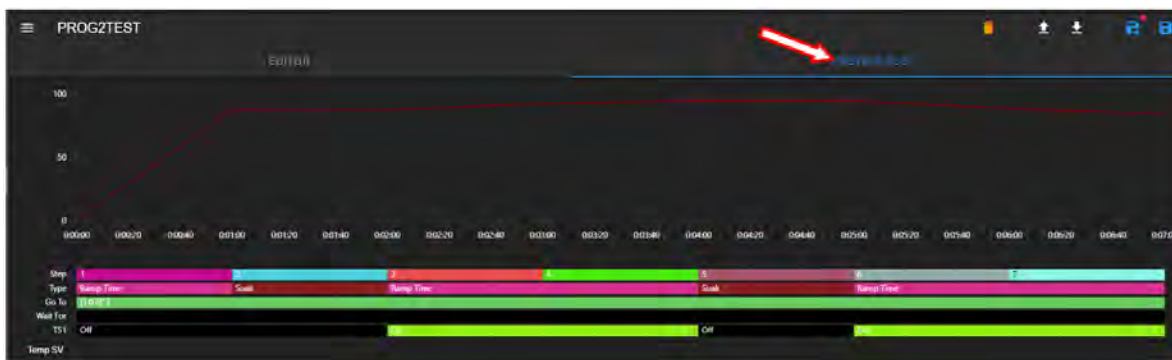


Figure 21.18: Program in preview mode

Note: Program cannot be saved while in the **Preview Plot** mode. In order to save the program, navigate back to the program editor and click **Save** or **Save As**.

21.3 View, Edit, Save Program

This section describes how to open an existing program for viewing and editing. Changes made in the program can be written back to the file with **Save**. A new slot can be used for this updated program using the **Save As** option.

21.3.1 Open Program

To open a program for viewing or editing, click on its name under the Name list, as depicted in the following figure. Program **PROG2TEST** (indicated by the arrow) will be used for illustration. The **Download** (or **Delete**) button is only available if any slot under the Name list has a program in it, such as slot 1 and 2.



Figure 21.19: Opening a program profile

Once open, the program is placed in the program editor for editing. The file manipulation buttons (**Delete**, **Open Program**, **Download Program**, **Save As** and **Save**) offer different options to handle the program file or manipulate the program editor. These buttons will be explained in detail in the following sections.

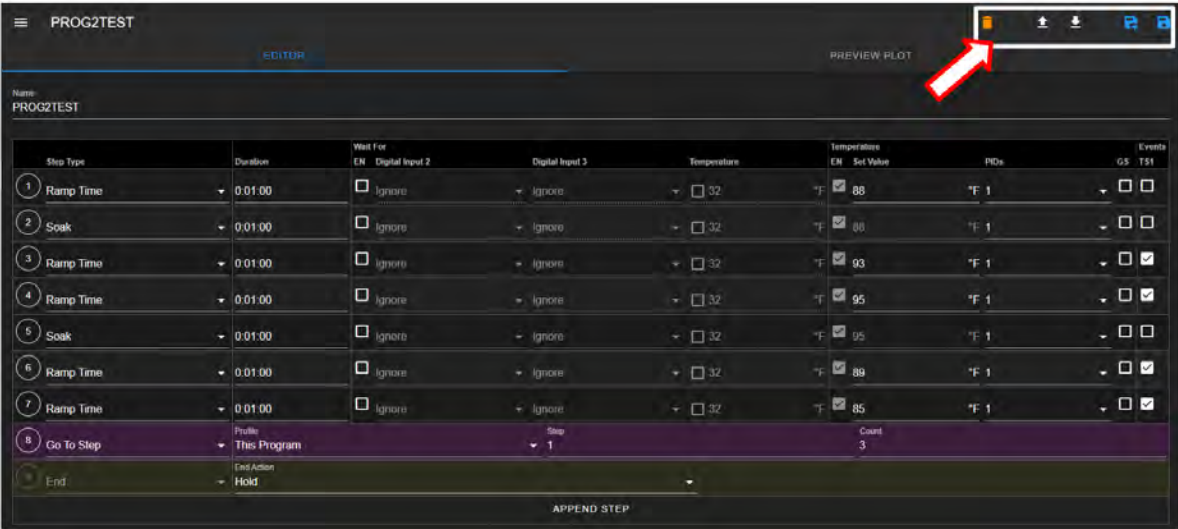


Figure 21.20: File manipulation buttons

21.3.2 Editing Program: Programming Example

This section illustrates the process of editing **PROG2TEST** program with additional steps, with the ability to autostart. To automatically execute the program, the autostart date must consist of future date.

The editing process is as follows:

1. **Step 1:** Click number 1 in the circle of Step 1 and select **Insert Before** to insert a new step above Step 1. Select **Auto Start** for Step Type; pick the future date and time to set the autostart feature as shown in the figure.

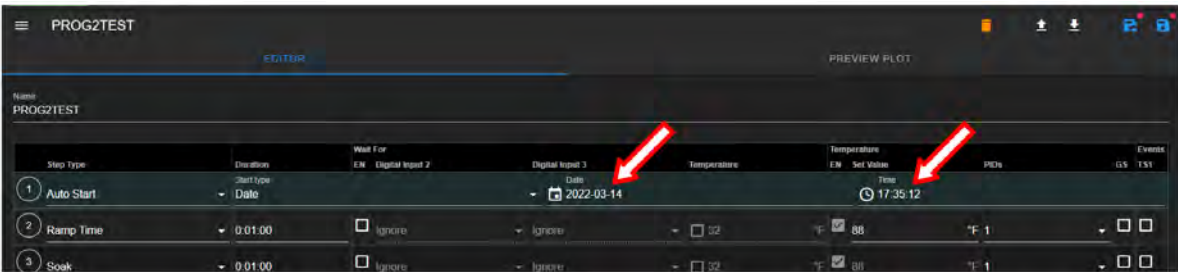


Figure 21.21: Configure autostart date and time

2. **Save Program:** This modified program can be saved back in its current slot with the **Save** button, or in the next available slot under a different name with the **Save As** button. Again, if the **Save As** button is selected, the slot list will be displayed for slot selection; however, the PLC dictates the location and it will save the new program in the next available slot. The following section describes how to utilize the file manipulation buttons in detail.

21.3.3 Managing Program File via the Program Editor

This section describes how to apply the five file manipulation options available in the program editor (upper-right corner), as depicted in the following figure.

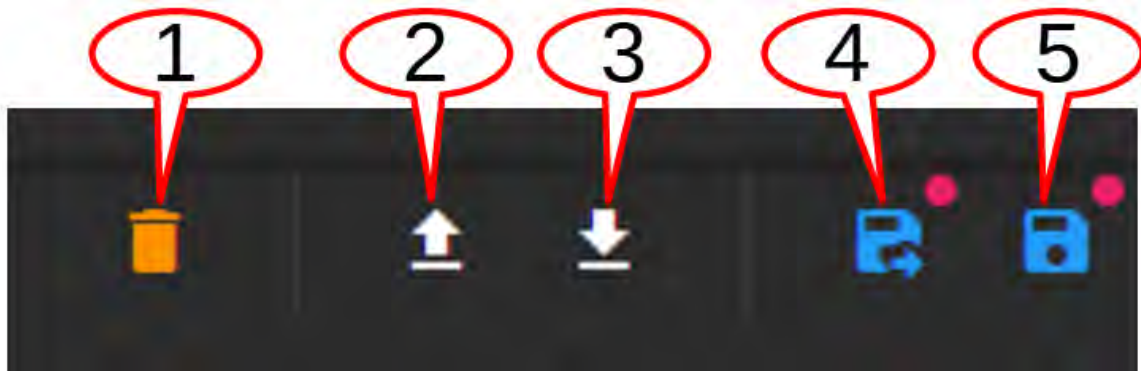


Figure 21.22: File manipulation options

They are described as follows:

1. **Delete:** The trash bin icon, when applied, deletes the current program in the program editor; that program is purged from the current slot in the PLC register, with the **EMPTY** listed under the ID list. For safety measure, the system prompts a pop-up warning with a Yes/No option. After deletion, the Program menu updates the Name list.
2. **Open Program:** This button imports a program file from the local computer into the program editor. By default, the system opens the Downloads folder on the local computer to upload the program file. The **Save** or **Save As** button must be applied to write the program onto the PLC's register (using the next available slot).
3. **Download Program:** The current program in the program editor can be downloaded onto the local computer as a backup. By default, the program will be stored in the Downloads folder. The hostname and program slot number are used as part of the downloaded filename (e.g., hostname_program_2.json).
4. **Save As:** Program in the program editor can be saved in a different slot, under a different name. To make the program name unique, the Name field may be edited with a new program name. This procedure thus requires a two-step process indicated by the arrows in the following figure. First, edit the program name; second, click the **Save** button and select a new slot from the drop-down list.

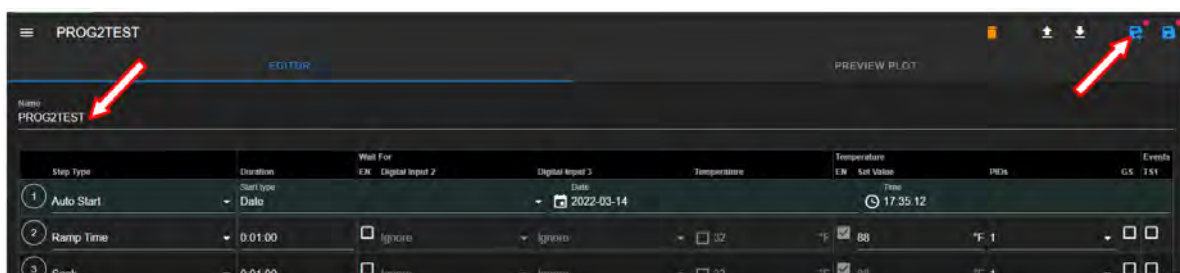


Figure 21.23: Save current program as a new file

5. **Save:** Apply this button to update the program file. To help check the editing status of the program, the program editor utilizes a red dot placed above the **Save** or **Save As** button to indicate an update yet to be saved.



Figure 21.24: Update indicator

Navigating out of the editor without saving the update will trigger a warning prompt, as depicted in the following figure.

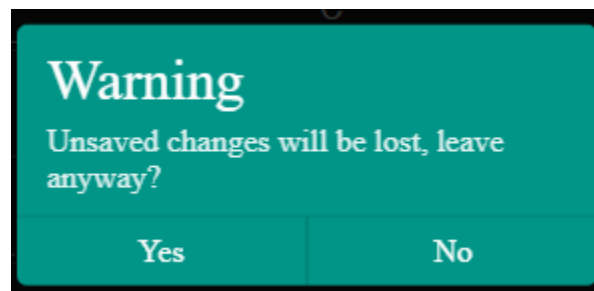


Figure 21.25: Confirm the save or discard update

21.3.4 Managing Program File via the Name List

This section describes how to apply the three file manipulation options on the Name list, as depicted in the following figure.

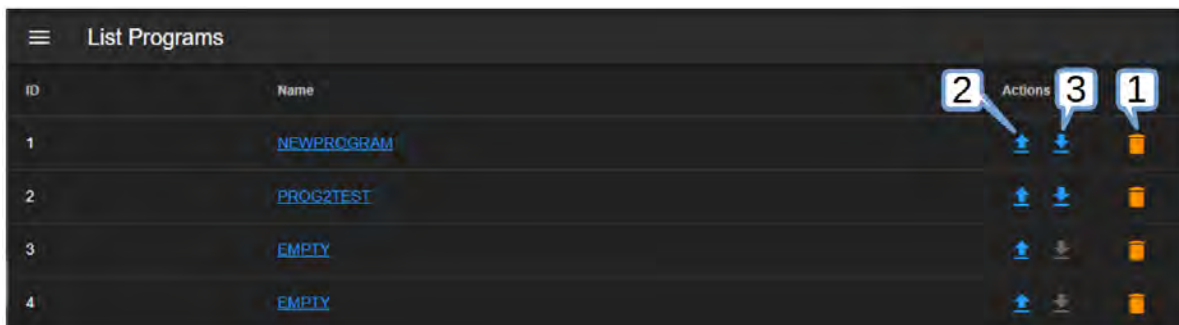


Figure 21.26: Manage programs on the Name list

These three options are listed and described as follows:

1. **Delete:** To delete **PROG2TEST** from the Name list (and the PLC register), click the trash bin icon indicated by the arrow (see figure below). As a safety measure, the system will prompt to confirm the action with a pop-up warning with a Yes/No option to proceed with the action. It may be necessary to apply the refresh button of the Web browser after deleting the program file from the Name list.

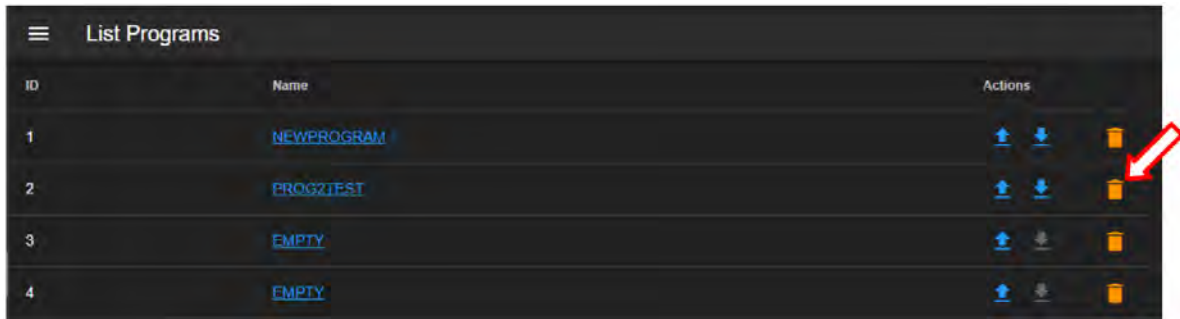


Figure 21.27: Deleting program from the Name list

2. **Upload Program:** This button can be used to import a program from the local computer directly into a program slot on the Name list and the PLC register. To upload a program into slot 3, click on the **Upload** button, as indicated by the arrow in the figure. Navigate to locate the desired file on the local computer and double-click it to complete the process.



Figure 21.28: Importing a program

3. **Download Program:** To download a program **PROG2TEST** on slot 2, click on the **Download** button (on the same row). By default, the program file will be stored in the **Downloads** folder on the local computer; filename naming convention is host-name_program2_.json.

CHAPTER 22

Start Stop

This menu allows the operator with read-write privilege to control or manage the chamber with the following operation modes: **Standby**, **Constant** and **Program**. The following figure depicts these modes displayed in the main display area as individual tabs.

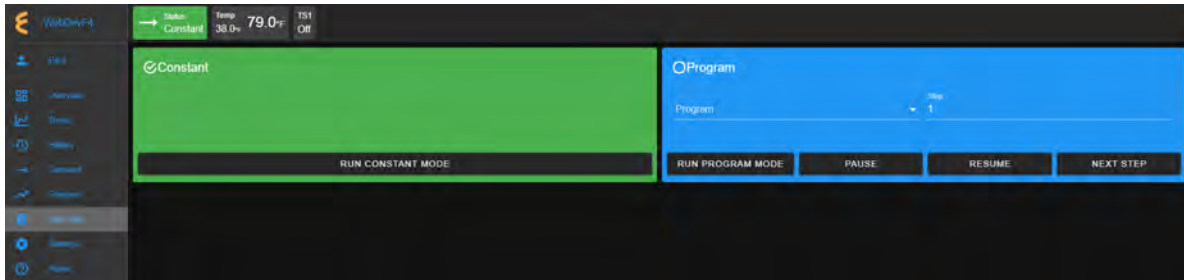


Figure 22.1: The Start/Stop menu with a Status Bar

The **Status** tab in the status bar also provides access to these modes for control and operation. Refer to the **Overview** menu for detail on how to control the chamber operating modes.

22.1 Constant Mode

In a constant mode, the chamber operates using the constant configuration. Authorized users with read-write privilege may set the chamber to operate in **Constant** mode. There are two operation modes: Constant and Program. A constant mode can thus be switched from a program mode and vice versa.

1. Click the **StartStop** menu.
2. Click the **RUN CONSTANT MODE** button in the **Constant** tab.

Its status tab displays **Constant**. This status is confirmed by the check mark in the **Constant** tab, as depicted in the following figure.

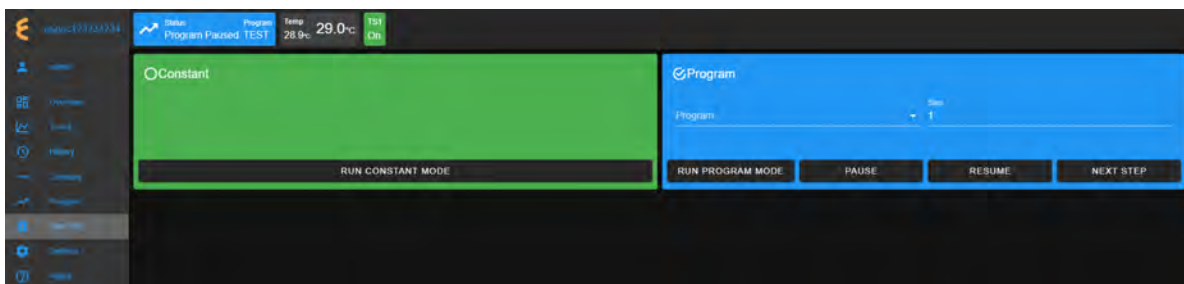


Figure 22.2: Setting a Constant mode

To terminate the **CONSTANT** mode, activation of a new mode is necessary. For instance, to switch the chamber from its **Constant** mode to **Standby** mode, click the **STOP OPERATION** button in the **Standby** tab. ESPEC Web Controller immediately moves to apply the operating mode to the chamber.

22.2 Program Mode

In a program mode, the chamber carries out instructions of the program being executed. The status tab in the status bar posts **Program**, along with the name of the program being executed. This status is confirmed by the check mark in the Program tab, as depicted in the following figure.

Authorized users with read-write privilege may set the chamber to operate in **Program** mode by performing a series of operations in the **Program** tab. The following subsections explain how to run (execute) a program, pause, resume or step through the instructional steps in the program.

22.2.1 Run Program

A program mode can be switched from standby or constant. To load and execute a program to control the chamber, complete the following steps:

1. Click the **StartStop** menu.
2. Click the radio button in the **Program** tab to select a program from the list (scroll down, if necessary), as depicted in the following figure.

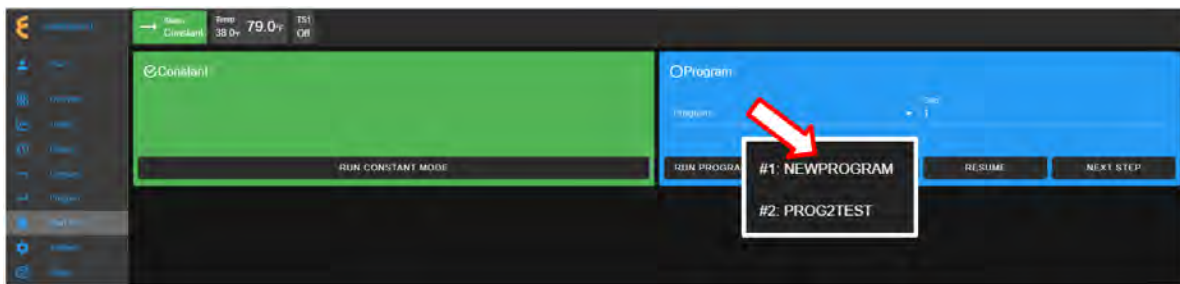


Figure 22.3: Executing a program from the Program List

3. Click to select the desired program name.
4. To start this program at a certain step, enter the step number in the **Step** field. Default setting is 1.
5. Click the **RUN PROGRAM** button to execute the program. ESPEC Web Controller immediately moves to apply the operating mode to the chamber. The status tab and status bar now display the program being executed, as depicted in the following figure.

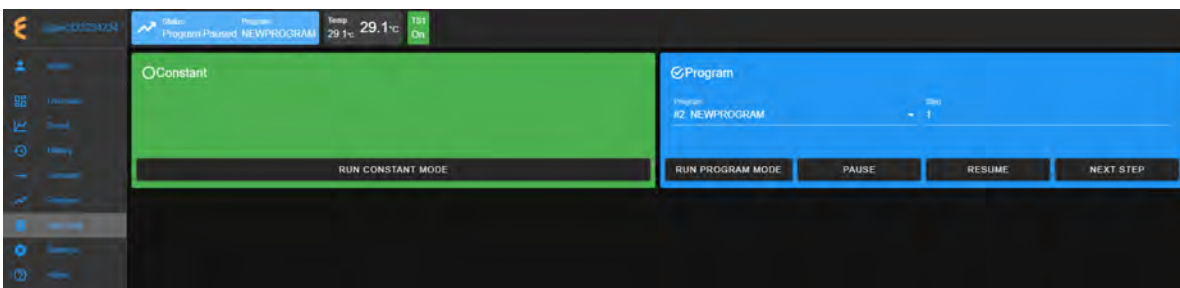


Figure 22.4: Setting a Constant mode

The **Overview** page may be accessed to display the detail of the program being executed.

22.2.2 Pause/Resume Program

Authorized users with read-write privilege may control the chamber during program execution. **Program** mode may be interrupted and put in a “suspense mode” using the **PAUSE** button in the **Program** tab. To pause a program during execution, click the **PAUSE** button; all operations are suspended. An update notification appears in the lower-right corner. The **Paused** notification is posted in the status tab.

To resume the operation and continue program execution, click the **RESUME** button. An update notification appears in the lower-right corner. The chamber will continue to operate based on instructions in the program. Program name is posted in the status tab to indicate chamber is in **Program** mode and that program is being executed.

22.2.3 Stepping through Program

Without having to wait for each step in the program to complete its tasks for the entire duration in the instruction, an operator may step through the program to study the effects of the instructions in a certain step. While the program is being executed, click the **NEXT STEP** button to execute the next step in the program. This action may be repeated until the last step in the program is reached. The **Overview** page in combination with the extended tab maybe accessed to display the detail of the program being executed and its steps being stepped through. The following figure depicts program **TempVib1** being stepped through to executing step 4.

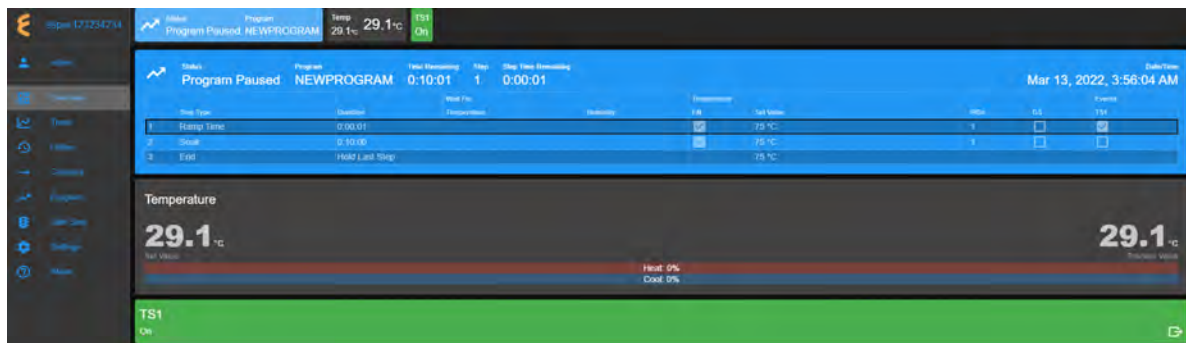


Figure 22.5: Stepping through a program

Part V

ESPEC P300 Chamber

CHAPTER 23

Overview

The **Overview** page displays the current status of the chamber and its operating mode. A user is brought to this page after successfully logging into ESPEC Web Controller. The following figure depicts **Overview** showing the chamber in Standby mode, as indicated in the status tab and its extension bar. The extension bar of the status tab is only available in the **Overview** menu.



Figure 23.1: Overview page with chamber in Standby mode

The following figure depicts **Overview** showing the chamber in Constant mode.



Figure 23.2: Overview page with chamber in Constant mode

The following figure depicts **Overview** showing the chamber in Program mode. Detailed information about the program, including what step is being executed, is listed in the extension bar (of the status tab). This feature provides the operator with useful information about the status of the chamber and the program.

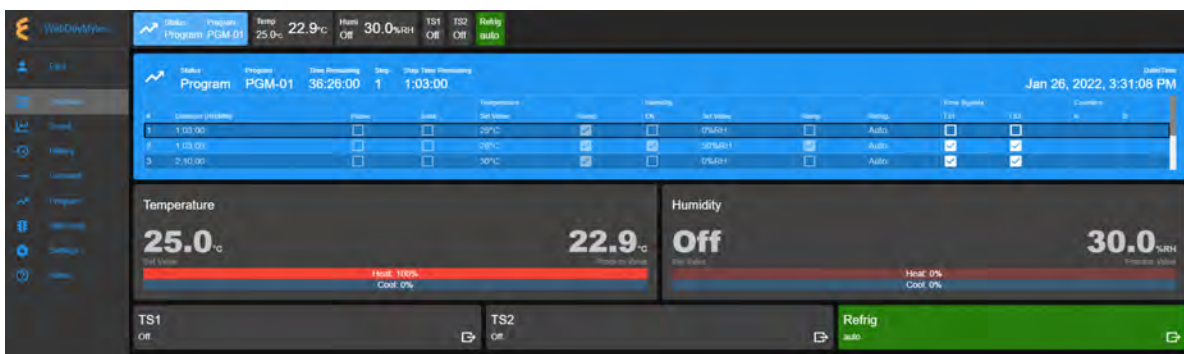


Figure 23.3: Overview page with chamber in Program mode

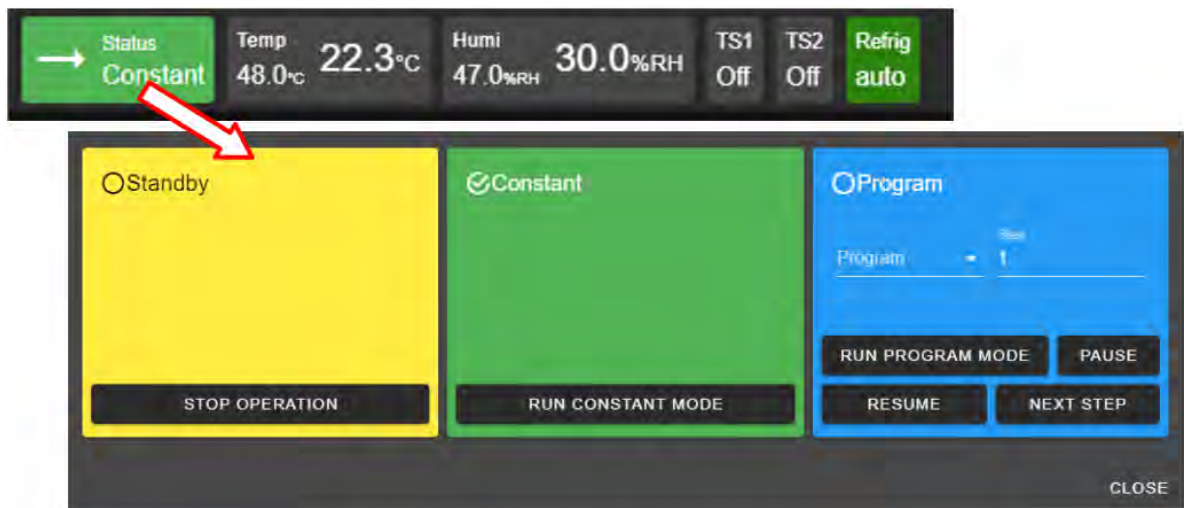
Only users with read-write privilege can control the chamber operation mode from within this page. Supported operation modes are **Standby**, **Constant** and **Program**. Each tab in the sta-

tus bar may be accessed to apply new settings at any time. This feature enables the operator to control the chamber without having to access the **Start Stop** menu in the menu bar. The following sections detail a step-by-step procedure how to control the chamber's operating mode via the **Overview** menu for users with read-write privilege.

23.1 Standby Setting

For authorized users with read-write privilege, to set the chamber in **Standby** mode, proceed with the following steps. Initially, the chamber is operating in **Constant** mode. We wish to switch its operation mode to **Standby**.

1. Click the status tab in the status bar to access the drop-down tabs, as shown in the figure.



An alternative way to access the drop-down tabs is to click on the extended tab of the status tab itself, as depicted in the following figure. The drop-down tabs display over the extended tab, as shown in the right figure. This extended tab is available only in the **Overview** page.



Figure 23.4: Status tab drop-down menu via the extended tab

2. Click the **STOP OPERATION** button. ESPEC Web Controller immediately moves to apply the operating mode to the chamber. A pop-up window appears in the lower-right corner to indicate the update of the operating mode. A check mark in the **Standby** tab indicates and confirms its standby mode.
3. To close the drop-down tabs, perform one of the following action:
 - Click an empty area in the Main Display.
 - Click a different menu in the menu bar.

- Click the status tab itself. or
- Click the **CLOSE** button underneath the alarm tab.

23.2 Constant Setting

For authorized users with read-write privilege, to set the chamber in **Constant** mode, proceed with the following steps. Suppose, initially, the chamber is operating in **Standby** mode. We wish to switch its operation mode to **Constant**.

1. Click the status tab in the status bar. As depicted in the following figure, the chamber is in **Standby** mode.

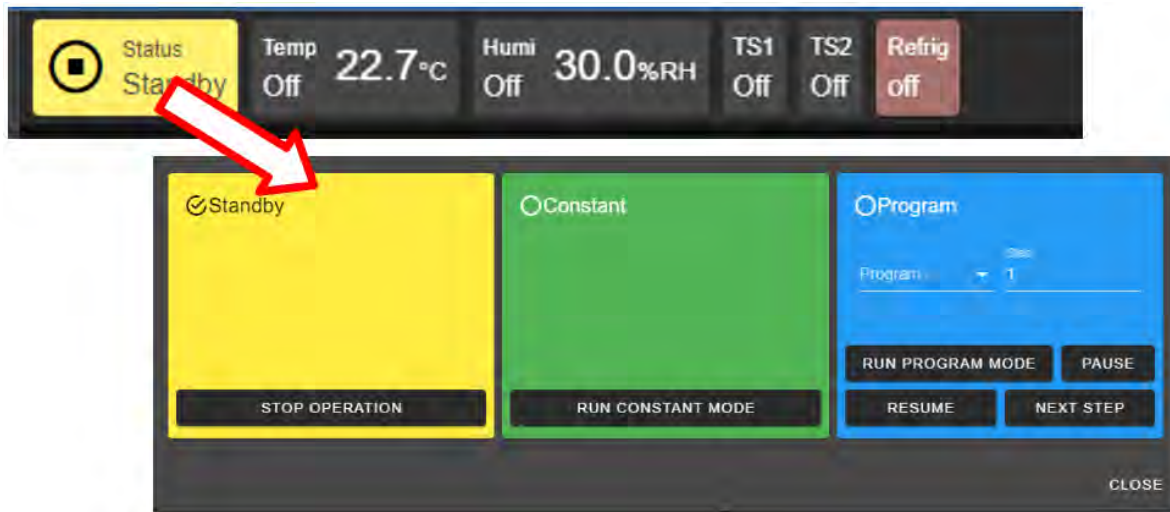


Figure 23.5: Constant mode setting

2. Click the **RUN CONSTANT MODE** button in the constant tab. ESPEC Web Controller immediately moves to apply the operating mode to the chamber.
3. To close the drop-down tabs, perform one of the following action:
 - Click an empty area in the Main Display.
 - Click a different menu in the menu bar.
 - Click the status tab itself. or
 - Click the **CLOSE** button underneath the alarm tab.

23.3 Program Setting

To set the chamber in **Program** mode means a profile (i.e., program) is loaded and executed.

1. Click the status tab in the status bar or the extension bar of the status tab.
2. Click the radio button in the program tab to access the program list (see the figure below).

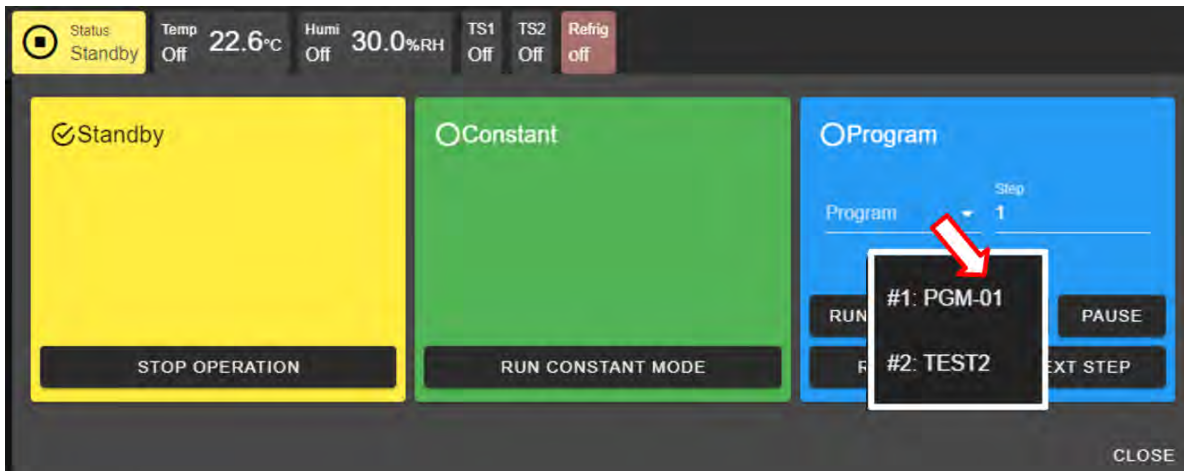


Figure 23.6: Select program to start chamber in Program mode

If no program is available for loading, the list contains slot numbers without programs, as depicted in the following figure. A program must be created first before it can be loaded for execution. Chapter 8 discusses how to create a program to control the chamber.

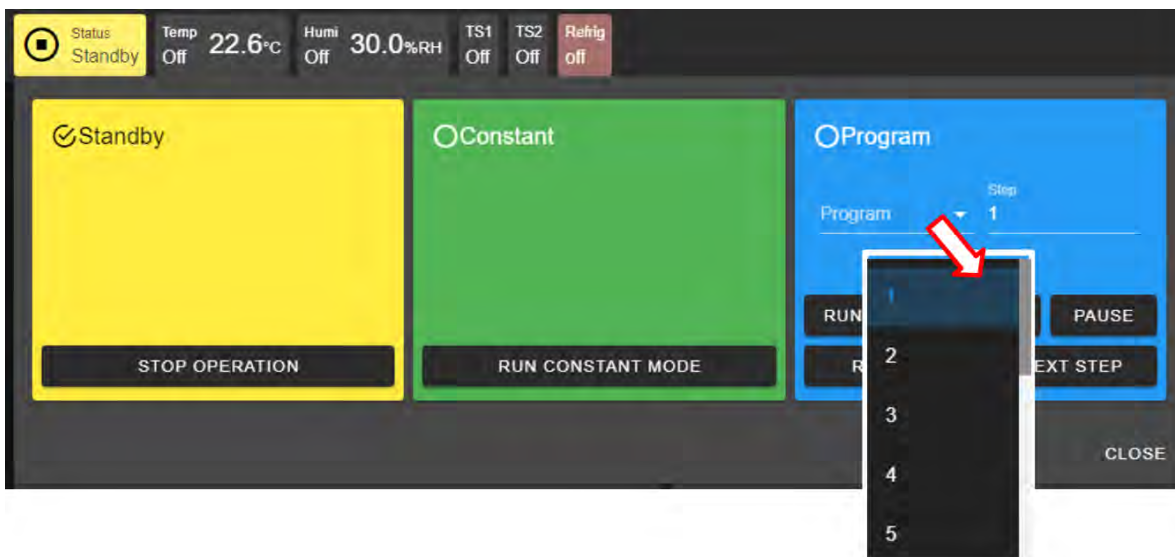


Figure 23.7: No program available for execution

3. Click to select a program from the list. Apply the scroll bar, if necessary, to select the desired program.
4. Enter a desired step number in the step field for program to start. Default start step is 1.
5. Click the **RUN PROGRAM MODE** button to execute the program. ESPEC Web Controller immediately moves to apply the operating mode to chamber. A pop-up window appears in the lower-right corner to indicate the update. Note: This program tab offers a few practical methods during a program execution. The **Pause** button can be used to pause the program. Program can be resumed via the **RESUME** button. Program instruction

lines can be stepped through via the **NEXT STEP** button.

6. Click the **CLOSE** button to view the status of program execution displayed in the status tab extension bar.
7. To end or interrupt the program execution, switch the chamber to **Standby** or **Constant** mode via the status tab.

23.4 Clear Alarms

When ESPEC Web Controller detects an alarm in the chamber, it also sets itself in an alert state by displaying a list of active alarms and fault names in the red window to require an immediate action from the operator, as depicted in the following figure.

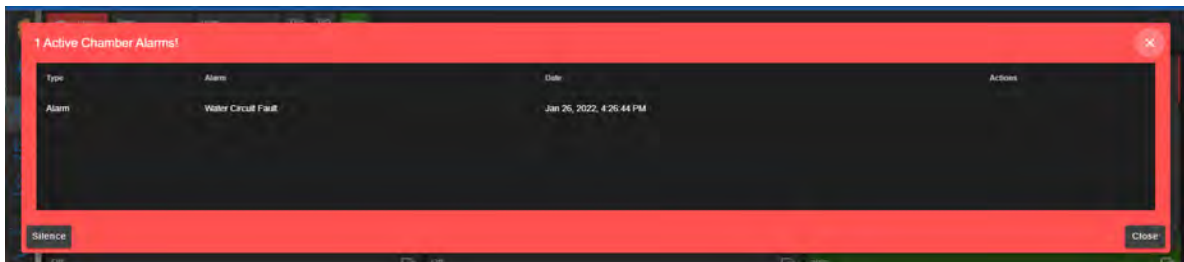


Figure 23.8: Chamber in alarm state

A repeating beep on the local computer is also tripped to get the operator's attention. The **SILENCE** button can be used to turn off the beep. This alert window can be closed by clicking the **CLOSE** button or the X button. However, the alarm state still remains to be resolved as indicated by the **Status** tab in the following figure. To redisplay or expand the alarm list, click the red dot in the lower-right corner.

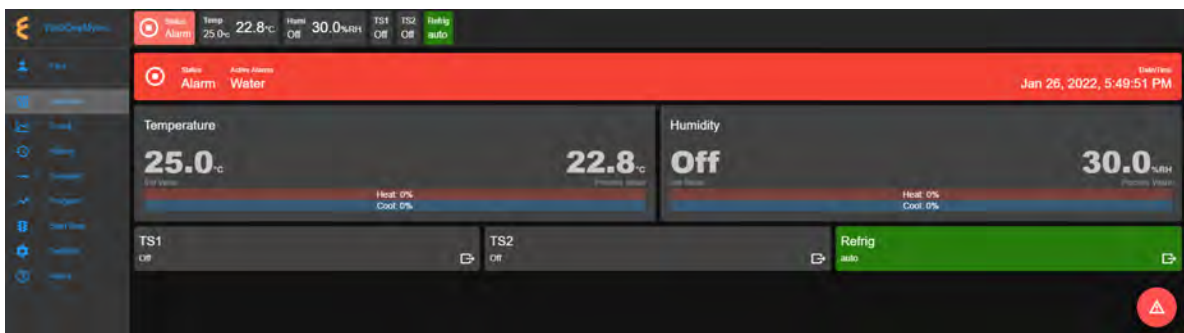


Figure 23.9: Alarm state in overview page

In an alarm state, operation is halted until all alarms triggered by chamber are resolved via the P300 (i.e., clear all alarms on the P300) before the Web Controller (and the chamber) can resume the normal operation. Once all alarms are cleared, the Web Controller will automatically clear all alert messages and resume normal operation by switching the chamber to a **Standby** mode.

23.5 Temperature, Humidity or Time Signal Settings

On the **Overview** page, settings of temperature, humidity, time signals or refrigeration can be controlled via the dedicated tabs in the status bar or the dedicated panes in the main display area, as depicted in the following figure.



Figure 23.10: Parameter settings via control panes

23.5.1 Settings via the Status Bar

To set temperature with a new set value, complete the following steps:

1. Click the Temp tab in the status bar.
2. In the drop-down pane, click the box to **Enable** temperature, and enter new value in the Set Value field or apply the up/down arrow to adjust the value (shown in the figure).

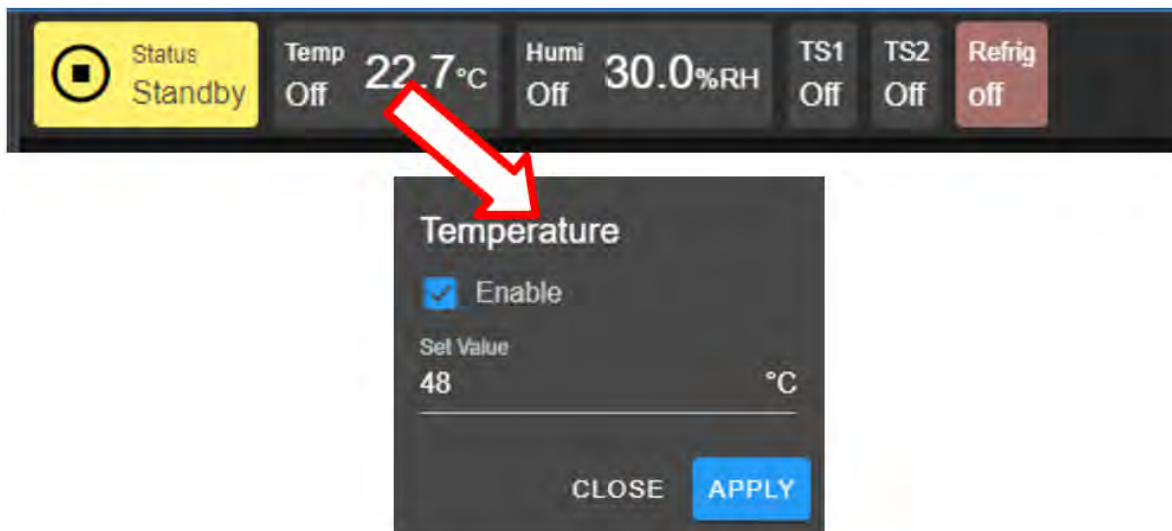


Figure 23.11: Setting new temperature value via the temp tab

3. Click **APPLY** to apply the new setting.
4. To cancel the setting, click the **CLOSE** button (or the Temp tab in the task bar).

To turn on humidity and set its value, complete the following steps:

1. Click the Humi tab in the status bar.
2. In the drop-down pane, click the box to **Enable** humidity, and enter new value in the Set Value field or apply the up/down arrow to adjust the value (shown in the figure).

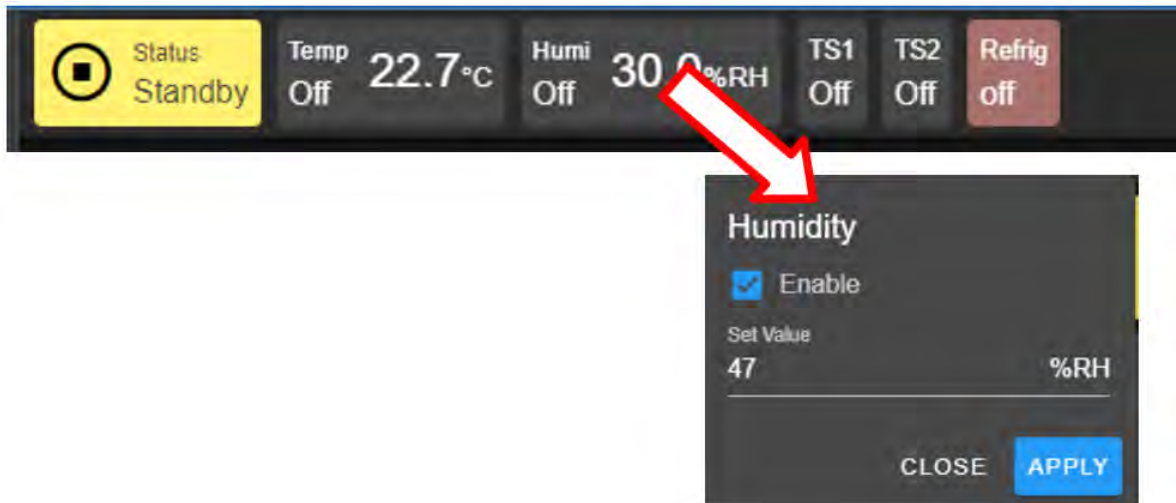


Figure 23.12: Setting new humidity value via the humi tab

3. Click **APPLY** button to apply the setting.
4. To cancel the setting, click the **CLOSE** button.

To turn on time signal 1 (TS1), complete the following steps. Repeat the same procedure to turn on additional time signals.

1. Click the TS1 tab in the status bar.
2. Check the box to enable TS1 (shown in the figure).



Figure 23.13: Enable or disable time signal setting

3. Click **APPLY**.
4. To cancel the setting, click **CLOSE** (instead of **APPLY**) or click the TS1 tab itself in the status bar.

To turn off TS1, apply the following steps:

1. Click the TS1 tab in the status bar.
2. Uncheck the box to disable TS1.
3. Click **APPLY**.
4. To cancel the setting, click **CLOSE** (instead of **APPLY**) or click the **TS1** tab itself in the status bar.

To turn on the refrigeration, complete the following steps:

1. Click the Refrig tab in the status bar.
2. Check the radio button to select set value from the drop-down list.

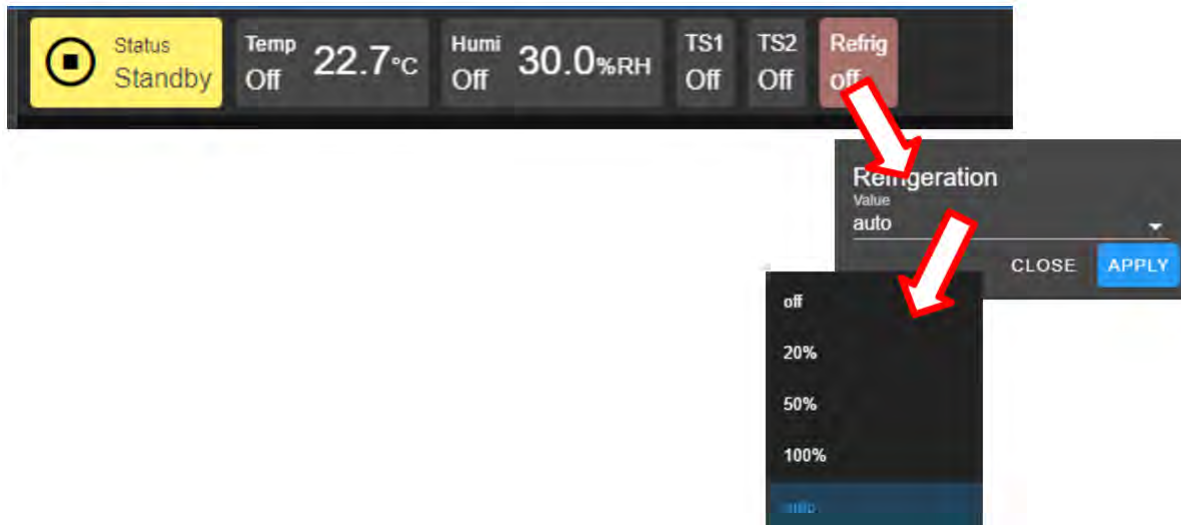


Figure 23.14: Setting refrig value

3. Click **Apply**.
4. To cancel the setting, click the **CLOSE** button.

23.5.2 Settings via the Dedicated Panes

With ESPEC Web Controller, there are multiple ways to complete the same task. The dedicated panes for temperature, vibration or humidity, time signals, or refrigeration, in the main display area are actually clickable panes. These are CTA (call-to-action) panes through which new parameter settings (such as, temperature, vibration or humidity, time signal and refrigeration) can be applied.

To apply a new setting to temperature, complete the following steps:

1. Click the Temperature pane to access the input pane (shown in figure below).



Figure 23.15: Setting new temperature value via the temperature (CTA) pane

2. In the input pane, click and enter new value in the Set Value field or apply the up/down arrow to adjust the value.
3. Click **APPLY**. To cancel the setting, click **CLOSE** (instead of **APPLY**).

The above procedure can be applied to humidity, vibration, time signal or refrigeration.

23.6 Web Controller on the Network

ESPEC Web Controller can communicate with other ESPEC Web Controllers on the same network. The hostname (with E logo) in the upper-left corner acts as a link that, when clicked, provides a list of any chamber with ESPEC Web Controller detected on the network by the local ESPEC Web Controller, as depicted in the following figure.

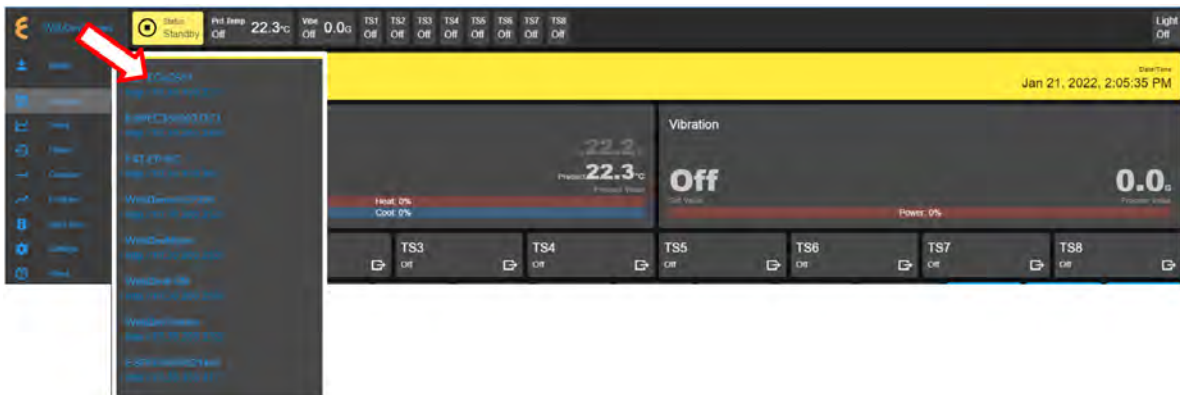


Figure 23.16: List of ESPEC Web Controller on the local network

This list can be opened from within any menus (not just in the **Overview** menu) by just clicking on the Web Controller hostname. Any chamber and ESPEC Web Controller on the list can be accessed directly by clicking on its hostname.

CHAPTER 24

Trend

Data points from the chamber's operation accumulated in the data log are displayed as a trend graph under the **Trend** menu, depicted in the following figure. By default, this graph provides an overview of the chamber's operation in the last one hour. Data can be downloaded in whole or in portion (refer to Item 4 below).

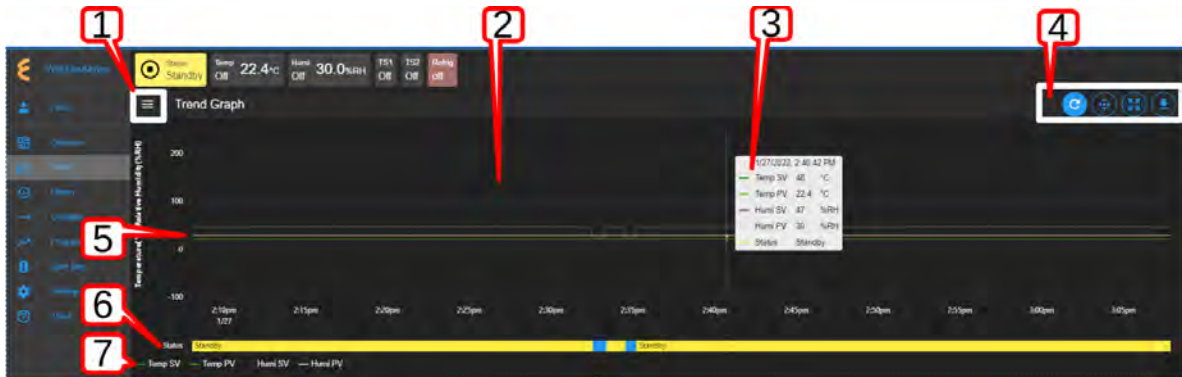


Figure 24.1: Trend graph showing plots of current data from the chamber

The main display area of the **Trend** menu is categorized into seven different groups with labels from 1 through 7. Detailed descriptions of these categories are outlined as follows:

1. **Time Frame:** This menu button shows or hides the time frame of the data points being plotted in the trend graph. As shown in the following figure, the trend graph is plotted for data points collected between 2:29 PM and 3:29 PM. That time frame is also displayed at the bottom of the trend graph, with grids at an interval of 5 minutes. This graph will continue to update and propagate through the progression of time in a 5-minute interval. To hide this time frame, click the menu button again.

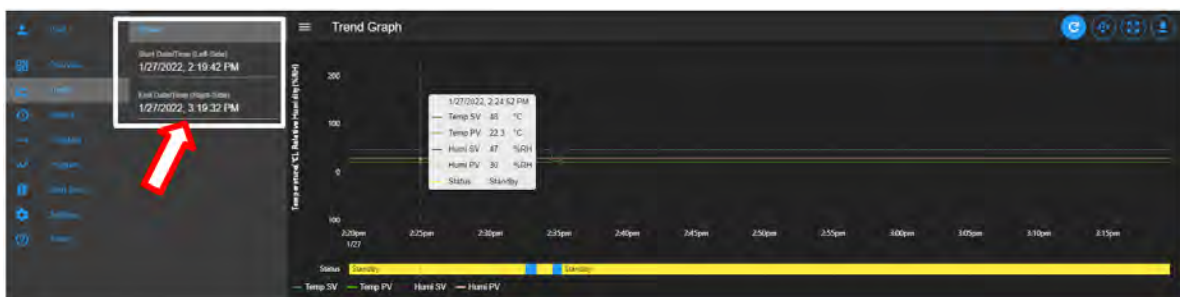


Figure 24.2: Detailed data of the Trend graph

2. **Trend Graph:** Data points collected from the chamber are rendered and displayed as a trend graph based on a scatter plot methodology. These data points represent product temperature, air temperature and/or vibration; they are plotted as a function of time. The vertical (Y) axis represents the scale of their values. Temperature is displayed in degree Celsius; vibration is displayed in root-mean-square of acceleration (Grms or G). The horizontal (X) axis represents the time scale with unit measured in a 1-second scale. Based on the default configuration, the Typhoon chamber logs data points in a 1-second interval. The scaling of the grid will change according to the Pan/Zoom Controls buttons application (see item 3 below). To reset the trend graph, click the **Zoom Extents** button (in the fol-

lowing figure), select **Last Hour** from the drop-down menu, then click the **Auto Refresh** button.

3. **Snapshot of Data:** By hovering a mouse pointer on the trend graph area, a snapshot of the data at a particular time is displayed. This feature allows a quick peak of the data at a certain point in time. Depending on the chamber's condition, the snapshot provides set values (SV) and process values (PV) of temperature, product or air temperature, or vibration, chamber's operation status and time signal status.
4. **Trend Graph Manipulation Buttons:** Four buttons are available to help manipulate and control the trend. This group of buttons is detailed in the following figure; their functions are described as follows:

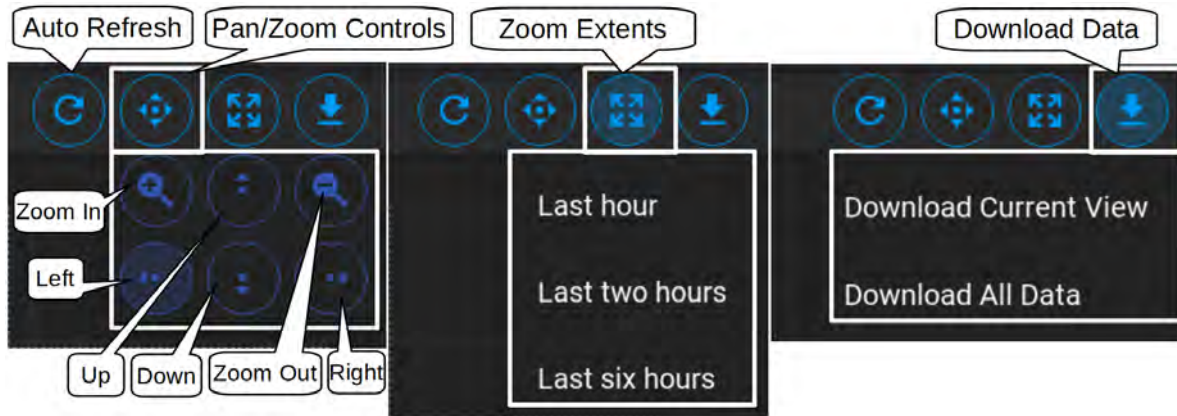


Figure 24.3: Manipulation buttons of the Trend graph

- **Auto Refresh:** This Auto Refresh button refreshes the trend graph; it thereby reconstructs the graph using the most recent data points which have been accumulated up to the current time.
- **Pan/Zoom Controls:** The Pan/Zoom Controls button allows the operator to control and adjust the viewable section in the trend graph. This button presents six operation buttons to manipulate and display the trend graph as follows:
 - **Zoom In:** The **Zoom In** button allows the operator to zoom into a small section of the trend graph. Depending on the degree of zooming, the display area will be confined to a small set of data points ranging between minutes to hours. To reset the trend graph, click the **Zoom Extents** button, select **Last Hour** from the drop-down menu, then click the **Auto Refresh** button.
 - **Zoom Out:** The **Zoom Out** button does the opposite by allowing the operator to zoom out on the trend graph, thereby giving the operator an expansive view of the trend graph. To reset the trend graph, click the **Zoom Extents** button, select **Last Hour** from the drop-down menu, then click the **Auto Refresh** button.
 - **Move Up:** This button allows the operator to move up the graph along the vertical axis to adjust the viewable area of the scatter plot. To reset the trend graph, click the **Zoom Extents** button, select **Last Hour** from the drop-down menu, then click the **Auto Refresh** button.
 - **Move Down:** This button allows the operator to move down the trend graph along the vertical axis with the purpose to adjust the viewable area of the scatter plot. To reset the trend graph, click the **Zoom Extents** button, select **Last**

Hour from the drop-down menu, then click the **Auto Refresh** button.

- **Move Left:** This button allows the operator to pan left on the trend graph, offering a quick preview of a plot of data points tracing back the time in hours or days. With this feature, the operator can quickly gain a preview of past data points which the operator may have missed.
 - **Move Right:** This button does the opposite to **Move Left** by allowing the operator to pan right on the trend graph to the current time. To reconstruct the trend graph to contain the most recent data points, the **Auto Refresh** button allows the quickest operation.
 - **Zoom Extents:** With this button, trend graph may be provided using data points from within the last one hour, last two hours or the last six hours. To make adjustment of the trend graph based on these three selections, click on the **Zoom Extents** button, then click one of the selection from the drop-down menu.
 - **Download Data:** To download data and store it on the local computer, click the **Download Data** button and select **Download Current View** to download a portion of data from the displayed trend graph. To download the entire collection of data, select **Download All Data**. Data file will be stored in the Downloads folder of the local computer with filename: hostname_data_date.CSV.
5. **Line Graph:** Data points from Temperature (set values or process values) and vibration (set values and process values) are being plotted to produce the line graphs to visually display the operation condition of the chamber.
 6. **Status:** Status of the operation mode of the chamber is displayed along the time line on the trend graph, indicating when and how long the chamber was in specific operating mode. This feature provides a quick preview of the chamber operating status. The **Left** button under the Pan/Zoom Controls may be used to extent further into the past to view the chamber's operating mode.
 7. **Legend of Trend Graph:** The legends are used to identify each item on the trend graph with color code to designate the different line graph (described in Item 5 above).

CHAPTER 25

History

The **History** page displays operation history of the chamber, its operating modes and statistics. Any alarms or alerts that were triggered during the chamber's operation are logged and displayed here. By default, history log of the chamber's operating modes, alarms or statistics from the previous week will be displayed, as depicted in the following figure. There are five important components in the **History** main display area. They are labeled and described as follows:



Figure 25.1: Operation history of the chamber

1. **History Interval:** Display options of the operating history are: one week, two weeks, one month, three months, six months, one year or the entire period of the chamber's operation. To access the history interval, click the radio button to select the period from the list.

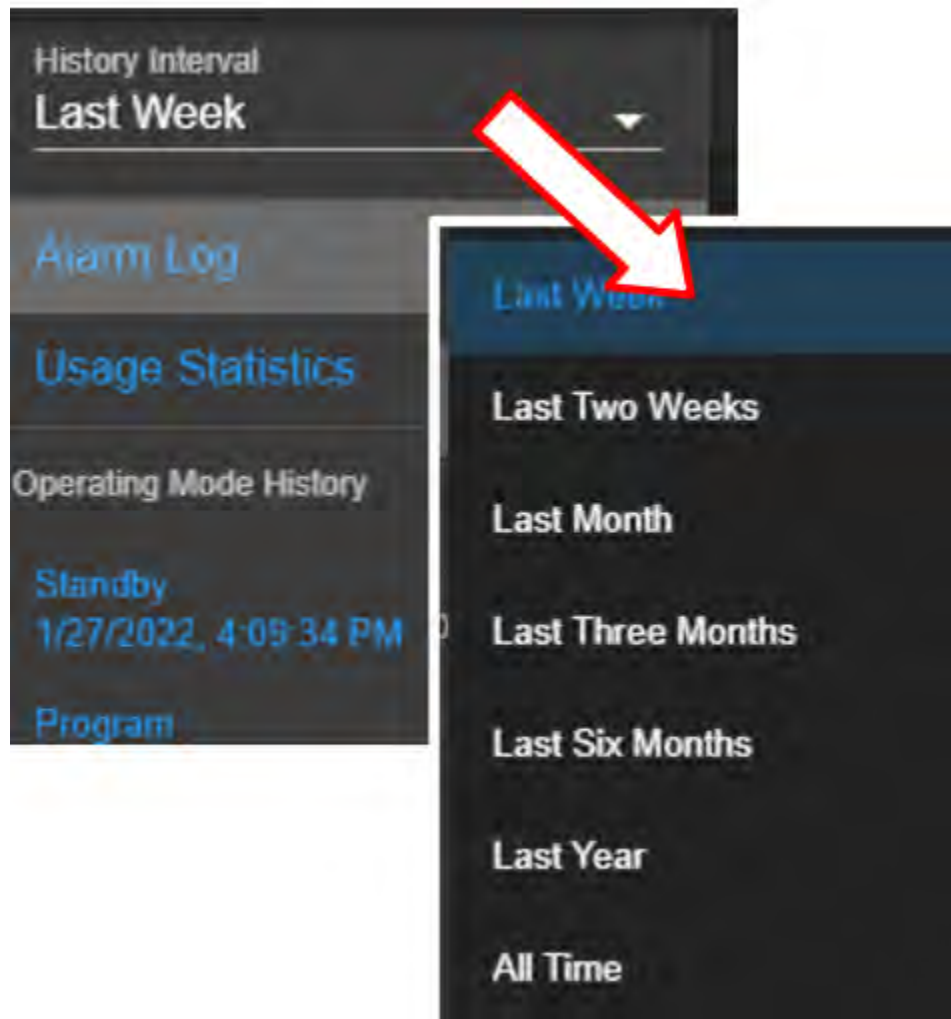


Figure 25.2: History interval and display selection

2. Alarm or Statistics Submenus:

- **Alarm Log:** By default, alarm logs will be displayed in the main display area. The logs indicate which alarm had occurred and when they were resolved (cleared).

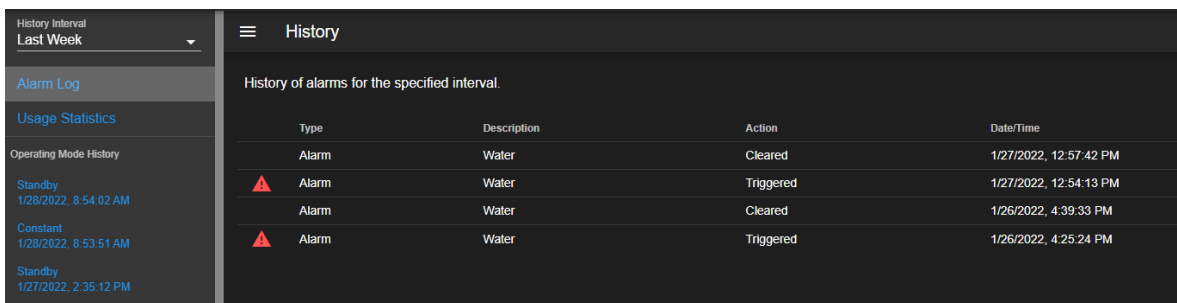


Figure 25.3: History of alarm

- **Usage Statistics:** To display the operation statistics, click on this submenu. Percentage of each operation mode based on the selection period in the **History Interval** is displayed as shown in the following figure:

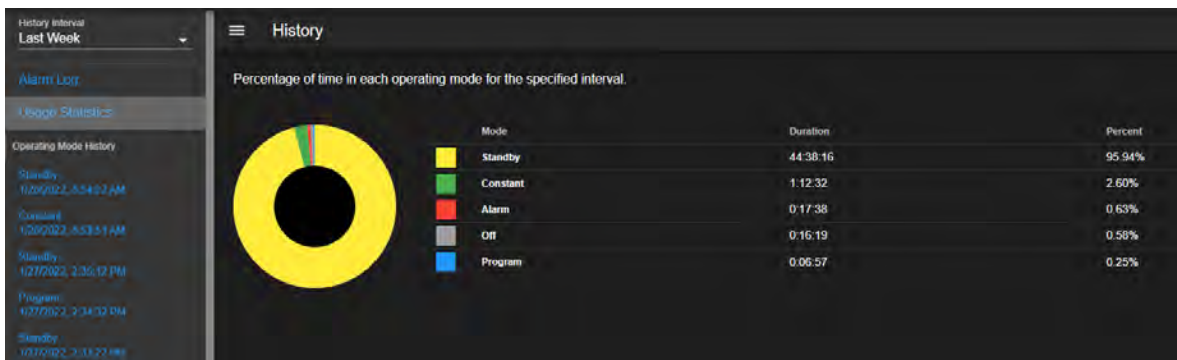


Figure 25.4: History of operation statistics

Such information provides the operator a good idea of the overall performance of the chamber by identifying when and how much time it was in a certain operating mode.

3. **Operating Mode History:** A list of operating modes of the chamber is displayed here based on the option selected under the **History Interval**. Default listing is based on a one-week interval. A trend graph, identical to that produced in the **Trend** menu, based on the data points collected during the operating mode can be produced by clicking on the particular operating mode on this list, as illustrated in the following figure.

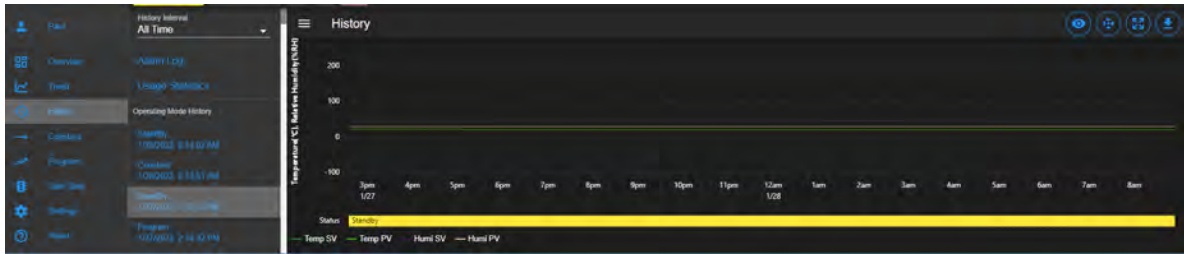


Figure 25.5: Trend graph of operating mode history

4. **Show/Hide Submenu:** To provide a larger real estate for the main display area, this Show/Hide button can be used to show or hide the **History** submenu. The following figure shows how the submenu is hidden and the main display area is expanded.

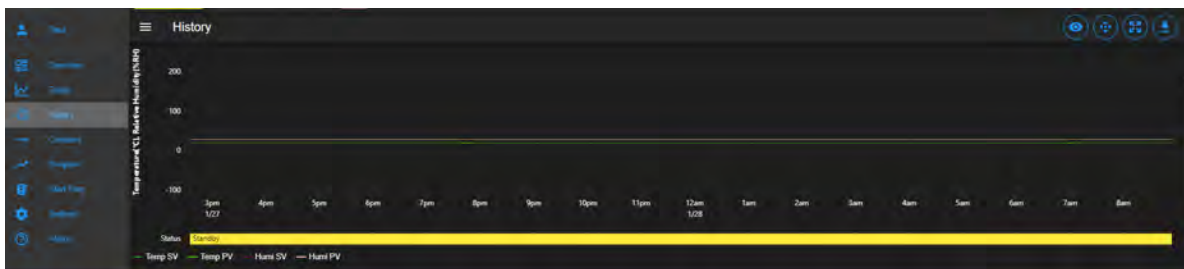


Figure 25.6: The show/hide button of the main display of the History page

5. **Main Display:** The content of the submenu page of **Alarm Log** and **Usage Statistics** is displayed here (refer to item 2, above).

CHAPTER 26

Constant

The existence of ESPEC Web Controller **Constant** page is such that all features and their parameters are collected and displayed in one place to control their constant mode settings. The main display of **Constant** consists of three separate panes, displayed as **Temperature**, **Humidity** (or **Vibration**) and **Outputs**, as depicted in the following figure. These CTA panes provide input options to adjust the settings directly. The Humidity Range Chart is a two-dimensional graph of the current temperature-humidity relationship, displayed below these CTA panes.

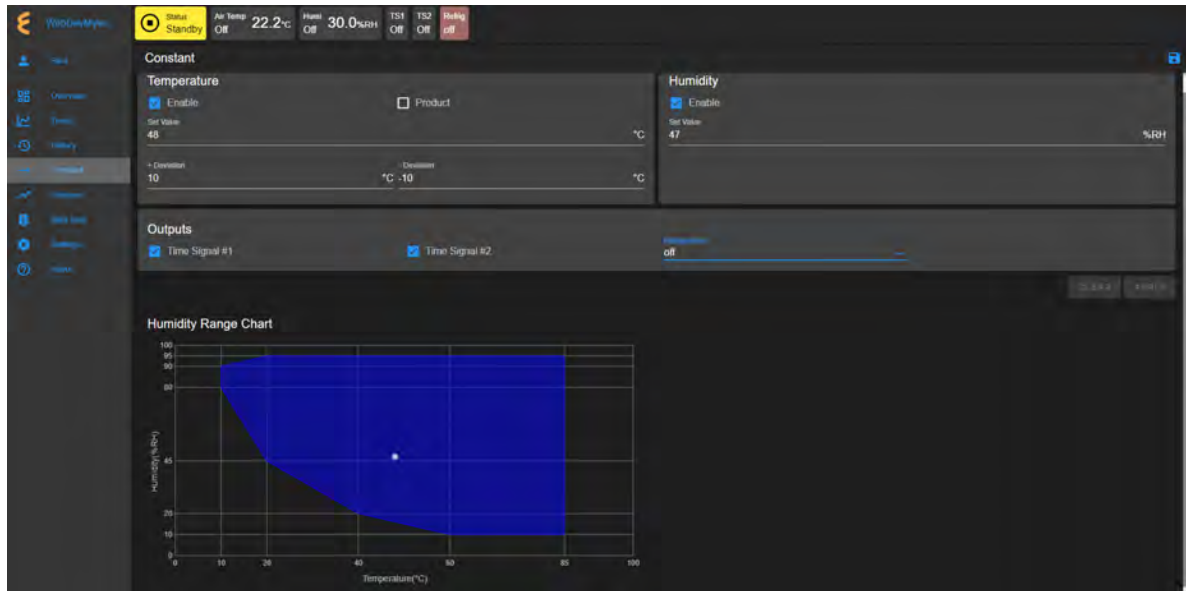


Figure 26.1: The Constant menu and its components

The following sections describe how to configure and control each of these parameters.

26.1 Product or Air Temperature Setting

Complete the following steps to turn on or modify temperature setting:

1. Enable air temperature or product temperature by checking the appropriate boxes.
2. Click the Set Value field and enter a new value, or apply the up/down arrow to adjust the value.
3. Adjust the plus/minus deviation in the appropriate fields.

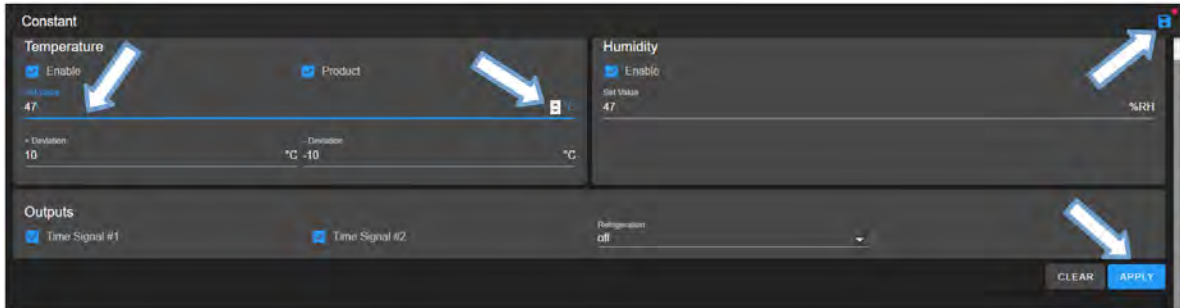


Figure 26.2: Apply new constant setting on temperature

4. Click the **APPLY** button or the **Save** icon (indicated by the arrows) to apply and save the setting. The red dot next to the **Save** icon indicates that the new setting has not been saved. If you exit this pane by accessing a different menu in the menu bar, a warning message will appear (shown in figure).

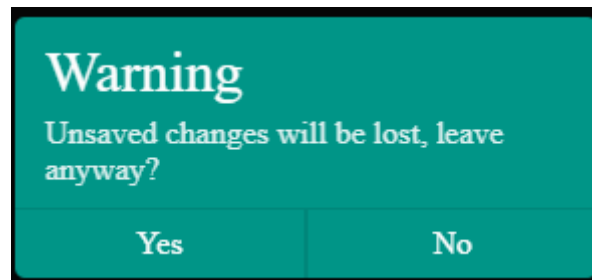


Figure 26.3: New setting must be save before exiting the pane

5. To cancel the setting, click **CLEAR**.

The new setting takes effect immediately with its new status displayed in the status bar. To reverse or cancel the setting, repeat the above steps to reset the set value and click **APPLY**.

26.2 Humidity Setting

Complete the following steps to turn on or modify humidity setting:

1. Enable or disable humidity with the appropriate check mark in the box.
2. Click the Set Value field and enter a new value, or apply the up/down arrow to adjust the value.
3. Click the **APPLY** button or the **Save** icon (indicated by the arrows) to apply and save the setting.
4. To cancel the setting, click **CLEAR**. If you exit this pane by accessing a different menu in the menu bar, a warning message will appear.

The new setting takes effect immediately with its new status displayed in the status bar. To reverse or cancel the setting, repeat the above steps to uncheck the box, reset the set value and click **APPLY**.

26.3 Time Signals Setting

Complete the following procedure to turn on output for any time signal:

1. To turn on output for **Time Signal # 1**, place a check mark in its box.
2. Repeat the above step for any time signal available in the main display area.
3. Click the **APPLY** button or the save icon as indicated by the arrows in the above figure to apply and save the setting.
4. To cancel the setting, click **CLEAR**. If you exit this pane by accessing a different menu in the menu bar, a warning will appear which requires you to save the setting before attempting to access any other menus.

The new setting takes effect immediately with its new status displayed in the status bar. To reverse or cancel the setting, repeat the above steps to uncheck the box and click **APPLY**.

It is important to note that all the parameters (temperature, humidity, vibration, time signal) in the main display can be adjusted altogether simultaneously with a single **APPLY** or save button. However, individual setting may provide security to avoid any adverse effect.

CHAPTER 27

Program

The **Program** menu allows the operator to create a program to control the chamber. All the programming features available on the supported PLC's listed in Chapter 1 (“**Introduction**”) can be composed into programs to control the chamber. The operator can: (1) open and view a program; (2) preview the output of the program; (3) edit and/or overwrite an existing program ; (4) delete program from the list; (5) rename program on the list; (6) download a program and store it on the local computer in JSON file; (7) upload a program from the local computer to the Web Controller, and much more.

Here are some of the benefits of the **Program** menu:

- Easy to operate.
- Quick management of programs, programming or editing.
- Require less time to develop a new program or modify an existing program.
- Program Editor offers flexibility with multitasking capabilities.
- Control program operation and program end mode.
- Preview program operation before execution; operator can see exactly what the program does prior to its execution.
- Download program from the Web Controller to the local computer for backup.
- Upload program from the local computer to the Web Controller.

Only authorized users with read-write privilege can access and utilize the **Program** menu. The user must log into their account to access the **Program** menu based on their read-write privilege, as depicted in the following figure.

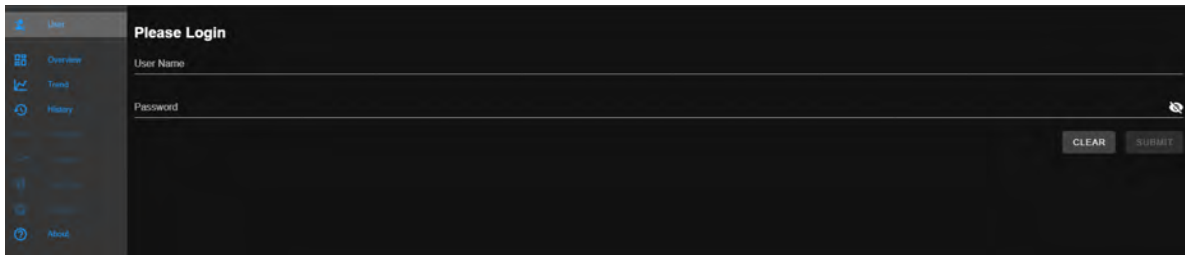


Figure 27.1: User with read-write privilege is required to operate the Program menu

27.1 List Programs

The following figure depicts a typical layout of the **Program** page with its submenu hidden. This is the default display of program list when the **Program** menu is accessed for the first time. Its UI components are numbered and explained as follows:

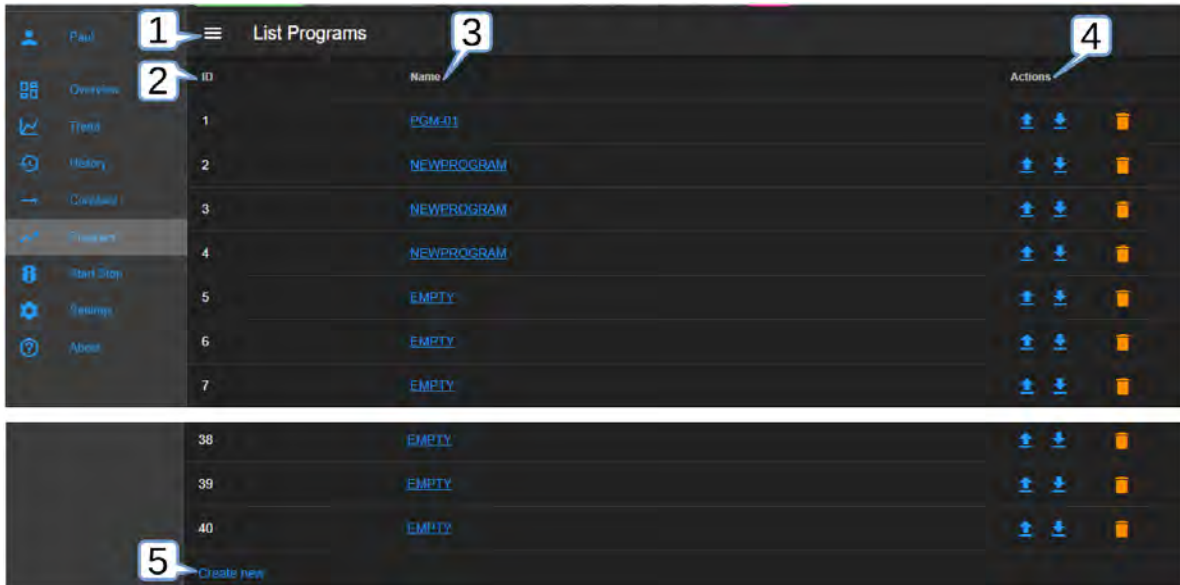


Figure 27.2: Program listing page with submenu hidden

1. **Submenu Show/Hide:** To utilize the entire main display area for the program editor, this button can be used to hide the submenu (as shown in the above figure). Click it again to reveal the submenu.
2. **ID:** ESPEC Web Controller identifies each program by its slot number stored in the PLC register. This list reflects the actual list of programs read from the PLC register. A total of 40 program slots are available, numbered from 1 to 40. The system uses a program identification code (ID) to identify each program.
3. **Program Name:** All available programs are listed under the **Name** column by program name. These programs are stored by their slot number. As such, identical program names may exist in different slots. Any slot not yet occupied by the program is marked **EMPTY**. Users can access each program under this list by clicking on the program name. The program editor then opens and displays the program instructions. Detailed operation of the program editor is discussed in the next section.
4. **Actions:** Three action buttons (Upload Program, Download Program, Delete) under the **Actions** column can be used to manage each program on the list under each row. These action buttons, once activated, affect the program on the row where the buttons were applied. They are described as follows:
 - **Upload:** Program can be uploaded from the local computer to the Web Controller which will then be stored in the PLC register using the slot number where the action was applied.
 - **Download:** Program can be downloaded and saved on the local computer.
 - **Delete:** A program to the left of the trash bin (where this action is applied) will be deleted. The PLC register will no longer contain this program.
5. **Create New:** This button opens the program editor for creating a new program. The **Create New** button is conveniently placed in two locations: (1) under the **ID** list and (2) in the **Program** submenu (shown in the following figure).

The following figure displays the **Program** page with its submenu unhidden. The submenu (item

2) has two operation buttons: (i) List Programs and (ii) Create New (program).

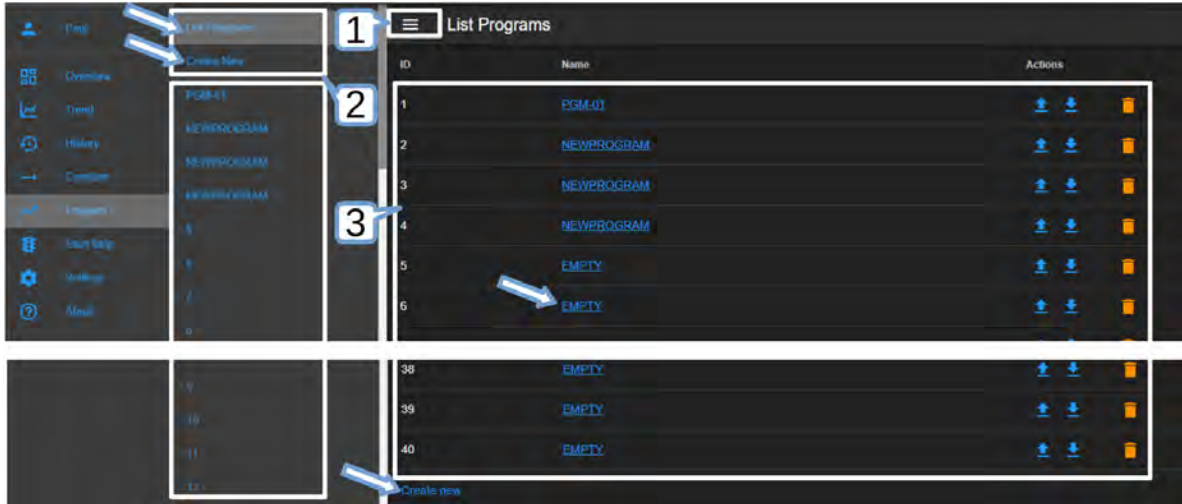


Figure 27.3: Program listing page with submenu unhidden

1. **Show/Hide:** The **Show/Hide** button can be used to hide or unhide the **Program** submenu (item 2 below).
2. **Submenu:** This submenu has two operation buttons (indicated by the arrows): List Programs and Create New (program). All the available programs in the chamber stored in the Web Controller are listed below these operation buttons (shown in above figure). With the submenu hidden, the main display has a larger real estate to display the program elements.
 - **List Programs:** The **List Programs** button offers a quick way to exit the program editor (explained in the following section). To exit the program editor mode, click this **List Programs** button. This action will cancel and exit the program editor being used to create, edit or import a program.
 - **Create New:** Similar to the **Create New** button under the **List Programs** display page (item 3 below), this button opens the program editor with an empty template for constructing a new program. Detailed discussion is provided in the following section. A program from the local computer can also be imported into this empty template.
3. **List Programs:** This is the main display of the program list depicted in the previous figure. Click the **Show/Hide** button (item 1) to hide the submenu and expand the **List Programs** display page.

27.2 Create New Program

A new program can be created via one of the buttons depicted in the following figure.

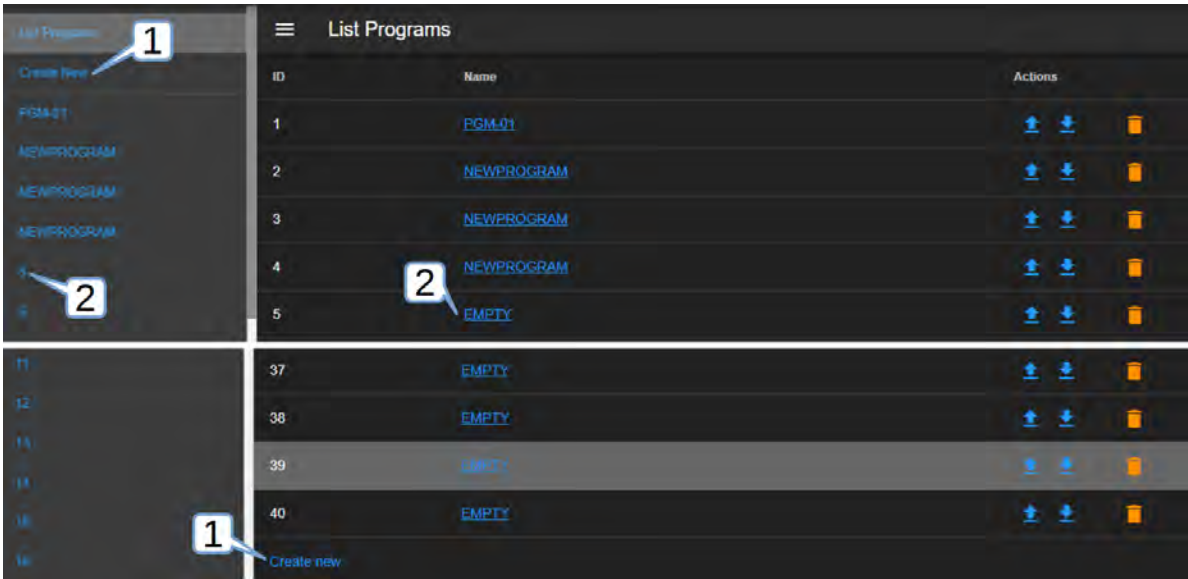


Figure 27.4: Different methods to creating a new program

Each of these buttons follows a different pattern to complete the task.

1. **Create New:** Click the **Create New** button in the submenu or under the **List Programs** in the main display to launch the program editor to create a new program. An empty template is opened for a new program, as depicted in the following figure.

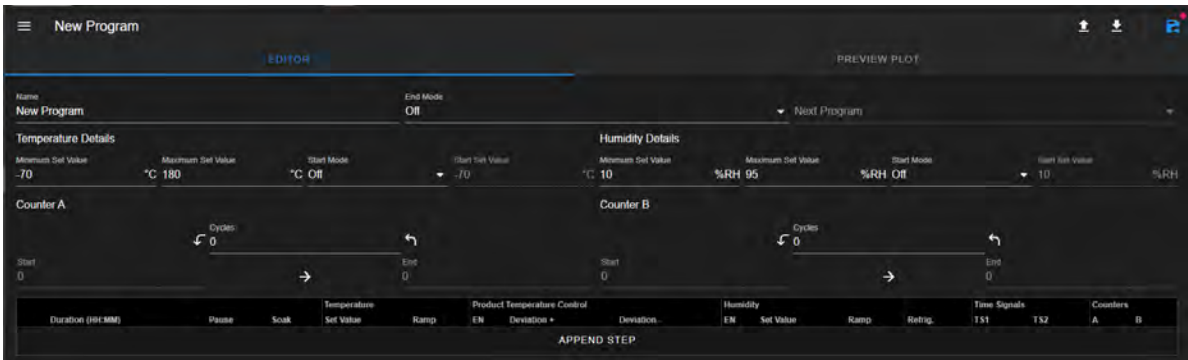


Figure 27.5: Empty template for a new program

The new program being constructed does not yet have a predefined location. For this reason, the program editor has only the **Save As** option to save the program in a specific or a desired slot number, as depicted in the following figure.

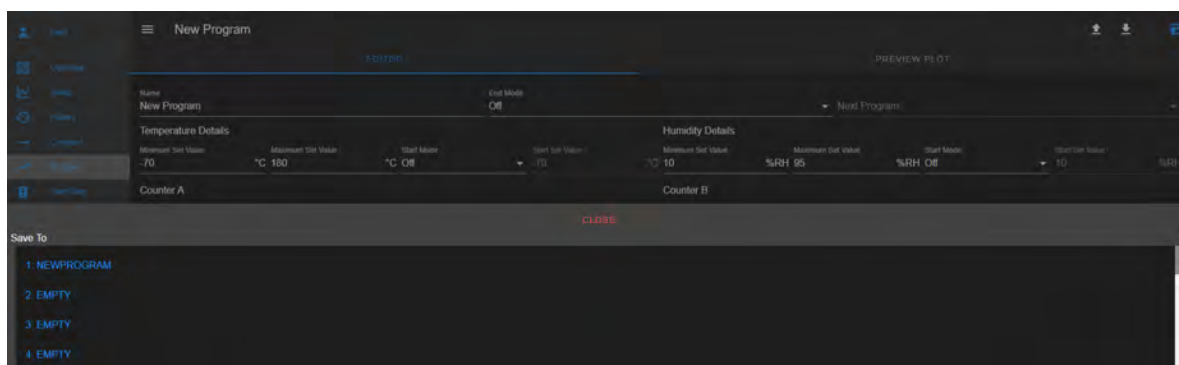


Figure 27.6: Selecting slot # to save new program

2. **EMPTY**: A new program can be created using a specific slot number. Click the slot number in the submenu or the **EMPTY** button on a desired slot number under the **List Programs** in the main display to launch the program editor to create a new program. An empty template is opened for a new program, as depicted in the previous figure.



Figure 27.7: Empty template for a new program

Since the slot number has already been defined, the program editor offers two options to save the program: (1) Save As by selecting a new slot number or (2) Save (on the current slot number).

The following figure depicts the general layout of the empty template for a new program. As depicted in the following figure, slot 2 as highlighted under the program list in the submenu will be used to store the program once it is completed and saved.



Figure 27.8: The structure and UI of the Programming Editor

The UI and components of the program editor (pictured above) are numbered and described as follows:

1. **Editor:** By default, a program is open and placed in the program editor. It is highlighted in blue to indicate its active status.
2. **Preview Plot:** The output of the current program can be previewed via this button. Both the **Editor** (item 1 above) and this button can be used to toggle between the editing and previewing mode of the current program. In order to apply the preview mode, the program must be loaded into the program editor first, then click the **PREVIEW PLOT** button.
3. **Submenu Show/Hide:** This button toggles between the show and hide mode of the submenu. To utilize the entire main display area for the program editor, this button can be used to hide the submenu.
4. **Program Name:** An alphanumeric naming convention based on ASCII with lower- or upper-case letters applies to program name with up to 15 characters. Program name should be kept short and descriptive. Since each program is individually stored in a unique slot in the PLC, a unique name on the Web Controller is not necessary. However, these programs must have unique names when they are stored on the local computer. When a program name is entered into this field, this name also appears in the title bar next to the show/hide button (item 3).
5. **End Mode:** An end mode available from four different options can be invoked after a program has completed its execution:
 - **Off:** The chamber will be turned off at the end of the program.
 - **Standby:** The chamber will be set to operate in a **Standby** mode at the end of the program.
 - **Constant:** The chamber will be set to operate in a **Constant** mode at the end of the program.
 - **Program:** The chamber will execute the next program listed in Next Program field. In theory, the PLC can continually execute different programs sequentially if each of those programs has its End Mode set to execute the next program on the list.
6. **Next Program:** A program to be executed following the completion of the current program.

7. **Temperature/Humidity/Vibration Details:** The minimum and maximum values of temperature, humidity or vibration are shown here for reference, including their start mode and set value. These are the specification values read off by the Web Controller from the PLC. The display of these values depends on the type of chamber. The display may consist of **Temperature Details**, **Temperature and Humidity Details** or **Temperature and Vibration Details**.
- **Minimum/Maximum Values::** These are the minimum and maximum values allowed by the chamber.
 - **Start Mode:** Three options are available with start mode: **Off**, **Process Value** and **Set Value**. A program must consist of one of these modes.
 - **Start Set Value:** If a **Set Value** was selected (in the previous item), enter a set value here by entering the value in the value field or apply the up/down arrow to adjust the value.
8. **Append Step:** As shown in the previous figure, the program editor has an empty template. No instructions or steps of program have been added. To create an instruction, a new step must be created (or added). This APPEND STEP button is used to add a new step. Once a program has a step, additional steps can be added using this button or the drop-down menu of the Step Number (to be explained below). The APPEND STEP button always adds a new step as the last step in the program. By contrast, the drop-down menu of the Step Number allows a new step to be inserted above or below the current step. It also has a delete button to remove any step from the program.
9. **Step:** A program step contains instructions (and parameters) for the chamber to carry out the tasks. Depending on the type of chamber, a program step may contain different components and parameters (associated with temperature, product temperature, humidity or vibration) outlined as follows:
- **Duration:** The duration specifies the length of time (measured in H:MM) that the said step goes through to complete its task. The Web Controller accepts the input value in H:MM or in pure numerical value. If a pure numerical value is entered, the Web Controller converts it to H:MM. For instance, if 15 is entered, the system treats it as 15 minutes, and the H:MM format, therefore, becomes 00:15. If 66 is entered, the system converts it to 01:06. Similarly, if 90 is entered, the system renders the value to 1:30.
 - **Pause:** If enabled, the program will pause execution when this step completes its task.
 - **Soak:** If enabled, the step will wait until the set point(s) are reached before the duration counter starts to count down.
 - **Temperature:** The temperature control loop has two parameters:
 - **Set Value:** The value that the temperature must attain.
 - **Ramp:** If enabled, the set point will gradually change from that of the previous step to the set value of this step over the duration of this step. If disabled, the set point of the previous step will jump immediately to the set value of this step.
 - **Product Temperature Control:** This option controls the product temperature (not the air temperature).
 - **EN:** This option enables or disables the production temperature control.
 - **Deviation +:** The allowable positive deviation between the product and air temperatures (must be positive).

- **Deviation -:** The allowable negative deviation between the product and air temperatures (must be negative).
 - **Humidity:** The humidity control loop setting.
 - **EN:** Enable or disable humidity control for this program step.
 - **Set Value:** The value that the humidity must attain.
 - **Ramp:** If enabled, the set point will gradually change from that of the previous step to the set value of this step over the duration of this step. If disabled, the set point of the previous step will jump immediately to the set value of this step.
 - **Refrig.:** This option offers configuration on the refrigeration system and its behavior during the execution of this step. It can be configured for automatic or manual cooling power percentage; it can be completely disabled.
 - **Time Signals:** Each time signal can be switched to **ON** or **OFF** for this step. Time signal (TS) operation is step dependent. Suppose TS1 is turned **ON** at step 1 and the rest of the steps do not have TS enabled. In this case, TS1 will remain “ON” for the entire program. Thus, TS may be controlled independently, step by step.
 - **Counters:** The counter can be used to repeat execute a specified number of steps within the program. This option allows Both counter A and counter B can be set by enabling the check box in their respective column then dragging the start and end arrows to the desired step. The number of times to repeat the steps can be adjusted in the text box in each column. When the text box is checked (or selected), the number of the repeating step begins with 1.
10. **Counter A, Counter B:** The counter (or loop) feature allows a certain step (or a range of steps) to be repeated multiple times within the program. With the counter feature, a program contains fewer instructional steps, and thereby requires less coding. Two separate counters are available: **Counter A** and **Counter B**. A program may contain a loop configured to run within a loop, such as Counter A executes inside Counter B. Two loops can be configured to run separately, repeating separate step numbers. For instance, Counter A can be configured to execute step 1 through step 3 for 5 times and Counter B can be configured to execute step 4 through step 6 for 3 times. ESPEC P300 PLC supports a maximum number of 999 cycles. Counter A or Counter B each requires three parameters to operate:
- **Start:** A value that specifies the step number to begin the loop.
 - **End:** A value that specifies the last step in the loop.
 - **Cycles:** A value that specifies the number of loops to complete the counter. The total number of loops is this number plus 1. Thus. if a program requires step 1 through step 3 to repeat three (3) times, the value for the Cycles will be 2.
11. **File Manipulation:** Five different buttons (icons) are available for file manipulation. Their action can be previewed by hovering the mouse pointer over them. They are described from left to right as follows.
- **Delete:** Click on the trash bin icon to delete the current program. This action will delete the program in the program editor and its location in the current slot number of the PLC. A pop-up warning appears, as depicted in the following figure, to reaffirm the action.

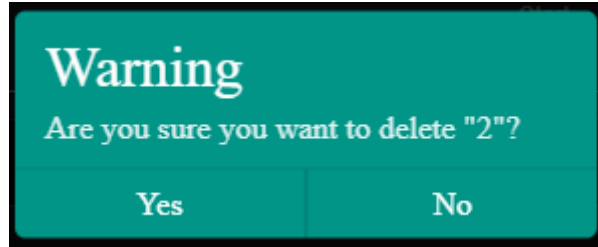


Figure 27.9: File deletion confirmation

- **Open Program:** This button imports a program file from the local computer into the program editor. The Web Controller only accepts a program in JSON format. To ensure compatibility, the program structure should be based on the one downloaded from the Web Controller itself (see **Download Program** below).
- **Download Program:** This button downloads the current program file and stores it on the local computer. The program is saved in JSON format using slot number as its filename (e.g., 9.json).
- **Save As:** Save the current program to a different slot number under the program list. This action brings up a program list, as depicted in the following figure, to select a new slot to hold the current program. To cancel this action, click the **CLOSE** button. **WARNING!:** A vacant slot should be selected to save the program. Otherwise, the current program will overwrite the existing one in the slot without prompting for reconfirmation, thus, destroying the program previously in that slot. The current program in a new slot still uses the same program name. To make it unique, edit item 4 (above) with a new name and apply the **Save** button (see below) to resave the program.

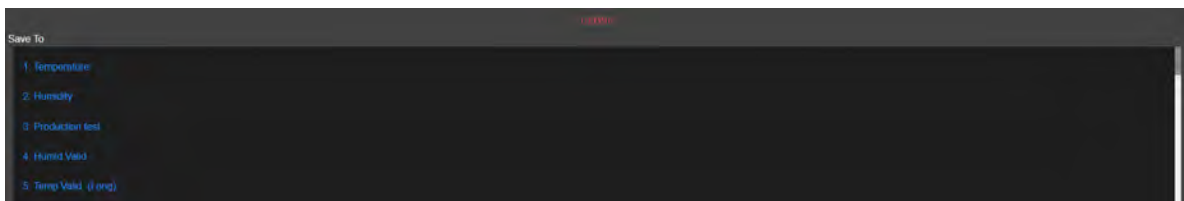


Figure 27.10: Save program to a new slot

- **Save:** This button saves the current program in the current slot on the F4T.

27.2.1 Programming: Add Program Step

The following example illustrates how to create a new program using four steps with both counters enabled to repeat these steps. Temperature and refrigeration are used to illustrate this example. The start mode for the temperature is set to Off. Each step will have its own set value as a target temperature value. The refrigeration will be set for a manual cooling power specified at 20% for the first three steps; the last step will have refrigeration power at 50%. The chamber will be turned off after the program completes its task. Counter A and Counter B will be used to demonstrate a loop running inside a loop; Counter A will between step 2 and step 3, while Counter B will loop between step 1 and step 4, thus making Counter A looping inside Counter

B. All steps must be constructed before enabling these loops. Alternating time signals will be controlled. Slot 2 will be used to create this program. We begin from the main menu.

1. Click **Program** in the side bar.
2. Click **EMPTY** on slot 2 on the Program List. To follow along with this example, slot 2 should be empty.
3. **Program Name:** Enter **PROG2TEST** in the program name field.
4. **End Mode:** Set end mode to Off.
5. **Start Mode:** Set temperature start mode to off.
6. **Add New Step:** Click the **APPEND STEP** button.
7. **Step 1:** Complete the following fields for this step from left to right:
 - **Duration:** Enter 0:20.
 - **Pause:** Leave the Pause box unchecked.
 - **Soak:** Leave the Soak box unchecked.
 - **Temperature:**
 - **Set Value:** Enter 23 or apply the up/down arrow to adjust the value to 23.
 - **Ramp:** Leave the Ramp box unchecked.
 - **Refrig.:** Click the Off field or arrow button and select 20% from the drop-down list (shown in figure below).



Figure 27.11: Set refrigeration with cooling power of 20%

- **Events:**
 - **TS2:** Check the TS2 box to enable time signal 2.
 - **Counters:** Loops for Counter A and Counter B can be configured once all the steps have been added.
8. **Step 2:** Click the **APPEND STEP** button to add a new step; then complete the following fields from left to right:

- **Duration:** Enter 0:10.
 - **Pause:** Leave the Pause box unchecked.
 - **Soak:** Leave the Soak box unchecked.
 - **Temperature:**
 - **Set Value:** Enter 24 or apply the up/down arrow to adjust the value to 24.
 - **Ramp:** Leave the Ramp box unchecked.
 - **Refrig.:** Click the arrow button and select 20% from the drop-down list (see above figure).
 - **Events:**
 - **TS1:** Check the TS1 box to enable time signal 1.
9. **Step 3:** Click number 2 in the circle at the beginning of step 2 (shown in the figure below). Select **Insert After** from the drop-down menu and edit the fields from left to right with the following parameters:



- **Duration:** Enter 0:10.
 - **Pause:** Leave the Pause box unchecked.
 - **Soak:** Leave the Soak box unchecked.
 - **Temperature:**
 - **Set Value:** Enter 32 or apply the up/down arrow to adjust the value to 32.
 - **Ramp:** Leave the Ramp box unchecked.
 - **Refrig.:** Click the arrow button and select 20% from the drop-down list (see above figure).
 - **Events:**
 - **TS2:** Check the TS2 box to enable time signal 2.
10. **step 4:** Click number 3 in the circle at the beginning of step 3 (see above figure). Select **Insert After** from the drop-down menu and edit the fields from left to right with the following parameters:
- **Duration:** Enter 0:10.
 - **Pause:** Leave the Pause box unchecked.
 - **Soak:** Leave the Soak box unchecked.
 - **Temperature:**
 - **Set Value:** Enter 34 or apply the up/down arrow to adjust the value to 34.
 - **Ramp:** Leave the Ramp box unchecked.
 - **Refrig.:** Click the arrow button and select 50% from the drop-down list (see above figure).
 - **Events:**

- **TS1:** Check the TS1 box to enable time signal 1.
11. **Counters:** Both counters will be used to create a loop inside a loop structure. Counter A will loop through step 2 and step 3 twice; Counter B will loop through step 1 and step 4 once, with Counter A looping inside it.
- **Counter A:** Activate the counter by entering the cycle (loop) number, with start step and end step as follows:
 - **Cycles:** Enter 2. Note: Before Counter A begins to loop, it already completed one loop; thus, 2 plus 1 equals 3, and 2 is the number used for the cycle number.
 - **Start:** Enter 2 for step 2.
 - **End:** Enter 3 for step 3.
 - **Counter B:** Activate the counter by entering the cycle (loop) number, with start step and end step as follows:
 - **Cycles:** Enter 1. Note: Before Counter A begins to loop, it already completed one loop; thus, 1 plus 1 equals 2, and 1 is the number used for the cycle number.
 - **Start:** Enter 1 for step 1.
 - **End:** Enter 4 for step 4.

The complete loop construction for Counter A and Counter B is depicted in the following figure.

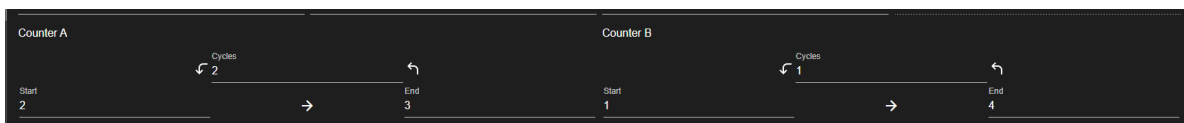


Figure 27.12: P300-counters-001.PNG

This construction also results in the activation of counters in the program structure (last column) as depicted in the following figure.

12. **Save Program:** Click the **Save** icon indicated by the arrow, as shown in the following figure, to save the program in slot number 2. This figure also illustrates the complete program in the program template.

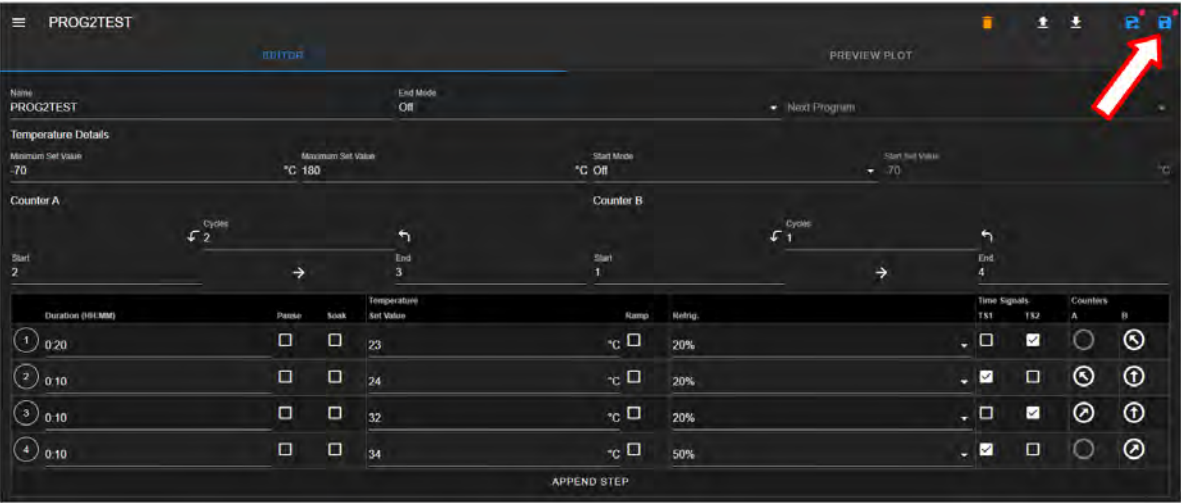


Figure 27.13: Save current program

Navigating out of the editor without saving the program will trigger the following warning prompt:

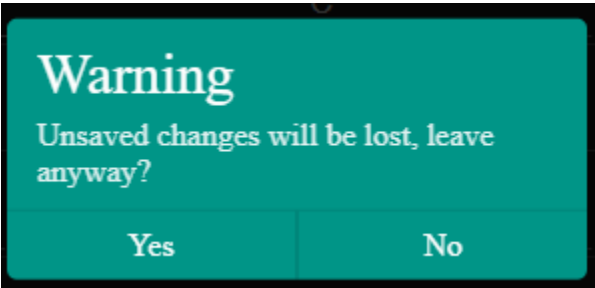


Figure 27.14: Confirm the save or discard update

13. **Preview:** The above program can be previewed before execution by clicking on the **Pre-view Plot** button as depicted in the following figure. To toggle back to the editor mode, click on **EDITOR**.



Figure 27.15: Program in preview mode

Note: Program cannot be saved while in the **Preview Plot** mode. In order to save the program, navigate back to the program editor and click **Save** or **Save As**.

27.3 View, Edit, Save Program

This section describes how to open an existing program for viewing and editing. Changes made in the program can be written back to the file with **Save**. A new slot can be used for this updated program using the **Save As** option.

27.3.1 Open Program

To open a program for viewing or editing, click on its name under the Name list, as depicted in the following figure. Program **PROG2TEST** (indicated by the arrow) will be used for illustration. The **Download** (or **Delete**) button is only available if any slot under the Name list has a program in it, such as slot 1 and 2.



Figure 27.16: Opening a program profile

Once open, the program is placed in the program editor for editing. The file manipulation buttons (**Delete**, **Open Program**, **Download Program**, **Save As** and **Save**) offer different options to handle the program file or manipulate the program editor. These buttons will be explained in detail in the following sections.

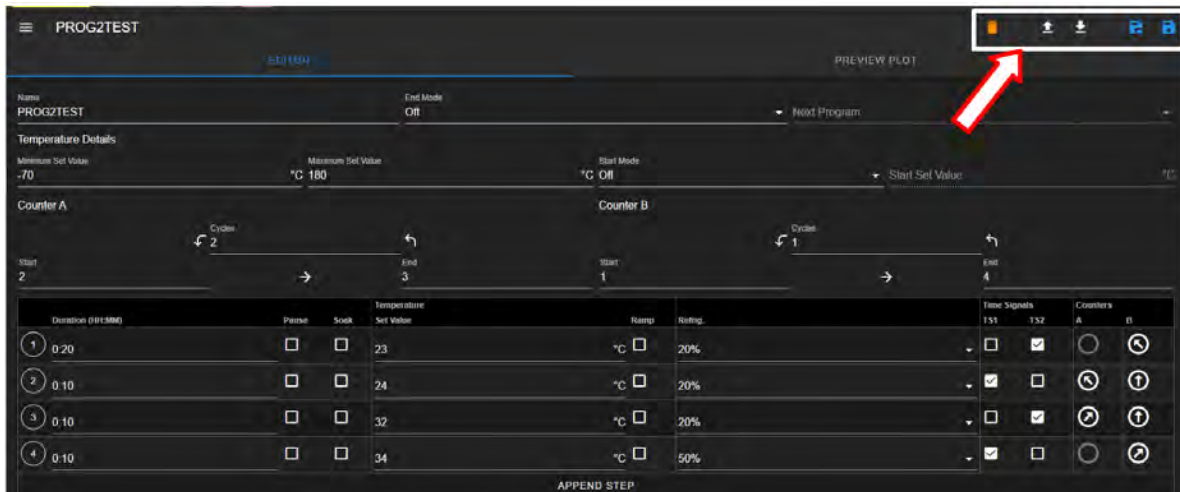


Figure 27.17: File manipulation buttons

27.3.2 Editing Program: Programming Example

This section illustrates the process of editing **PROG2TEST** program with additional steps and the ability to execute another program. The program to be executed after **PROG2TEST** completes its own execution is **NEWPROGRAM** in slot 1, as depicted in the previous figure. It contains only one step with temperature set value at 35 degrees C for the duration of 60 minutes, with refrigeration set to Auto and no time signal setting. **PROG2TEST** will consist of the following procedure:

1. **End Mode:** Set end mode to execute a new program.
2. **Temperature Start Mode:** Set temperature start mode with set value at 22 degrees C.
3. **Step 3:** Insert a new step between 2 and 3 with temperature set value of 28 with soak feature for a duration of 30 minutes. Set refrigeration to Auto with time signal 1 on 2 off. Counter A will be adjusted to include this step. Counter B will be adjusted to still include Counter A inside it.
4. **Step 6:** A new step to be added as the last step in the program with: temperature set value of 25, refrigeration of 50%, time signals 1 and 2 switched to On.

The editing process is as follows:

1. **End Mode/Next Program:** Click the End Mode field and select Program from the drop-down list (see figure below), then click the Next Program field and select the program from the drop-down list (**NEWPROGRAM** is used for example).

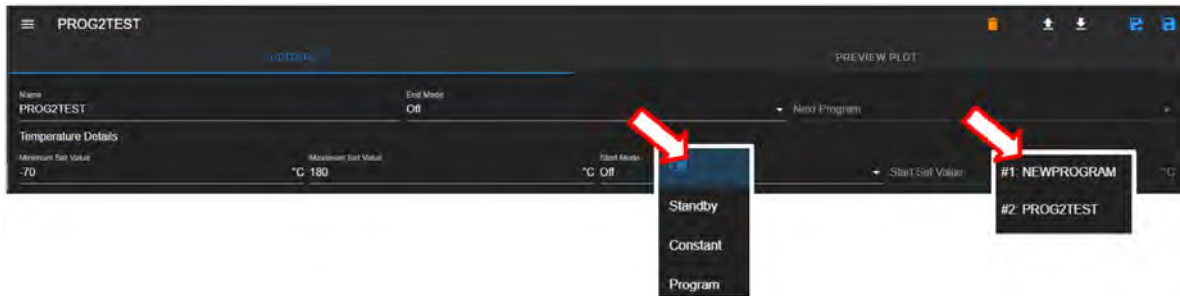


Figure 27.18: Select program to execute next

2. **Temperature Start Mode:** Click the Temperature Start Mode field and select Set Value. Apply the up/down arrow to adjust the set value to 22.

3. **Step 3:** Click number 2 in the circle at the beginning of step 2 and select **Insert After** from the drop-menu and set the parameter as follows:

- **Duration:** Enter 0:30.
- **Soak:** Enable the soak feature.
- **Temperature:**
 - **Set Value:** Enter 28.
- **Refrig.:** Select refrigeration to Auto.
- **Events:** Time signals 1 and 2 are off.

4. **Last Step:** Click the **APPEND STEP** button and set the parameters as follows:

- **Duration:** Enter 0:30.
- **Temperature:**
 - **Set Value:** Enter 28.
 - **Ramp:** Enable the ramp feature.
- **Refrig.:** Select refrigeration to 50%.
- **Events:** Time signals 1 and 2 are on.

5. **Loops:** Adjust Counter A with start step at 2 and end step at 4. Adjust Counter B with start step at 1 and end step at 5, keeping the cycle number the same.

6. The final program and its output (preview) are depicted in the following figures.



- Save Program:** The new program can be saved back in its current slot with the **Save** button. However, other options are available to manipulate the program file. It may be necessary to save it in a different slot so that the original program can be retained in the current slot. The following section describes how to utilize the file manipulation buttons in detail.

27.3.3 Managing Program File via the Program Editor

This section describes how to apply the five file manipulation options available in the program editor (upper-right corner), as depicted in the following figure.

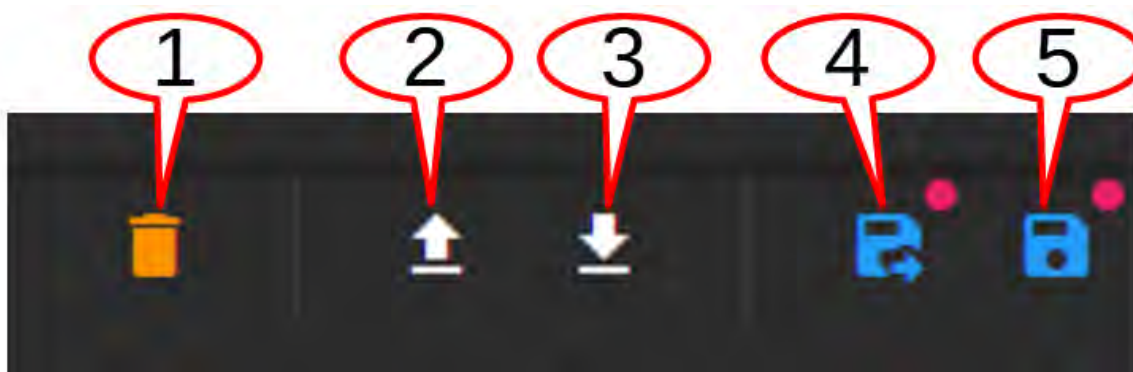


Figure 27.19: File manipulation options

They are described as follows:

1. **Delete:** The trash bin icon, when applied, deletes the current program in the program editor; that program is purged from the current slot in the PLC register, with the **EMPTY** listed under the ID list. For safety measure, the system prompts a pop-up warning with a Yes/No option. After deletion, the Program menu updates the Name list.
2. **Upload Program:** This button imports a program file from the local computer into the program editor. By default, the system opens the Downloads folder on the local computer to upload the program file.
3. **Download Program:** The current program in the program editor can be downloaded onto the local computer as a backup. By default, the program will be stored in the Downloads folder. The hostname and program slot number are used as part of the downloaded filename (e.g., hostname_program_2.json).
4. **Save As:** Program in the program editor can be saved in a different slot, under a different name. To make the program name unique, the Name field may be edited with a new program name. This procedure thus requires a two-step process indicated by the arrows in the following figure. First, edit the program name; second, click the **Save** button and select a new slot from the drop-down list.

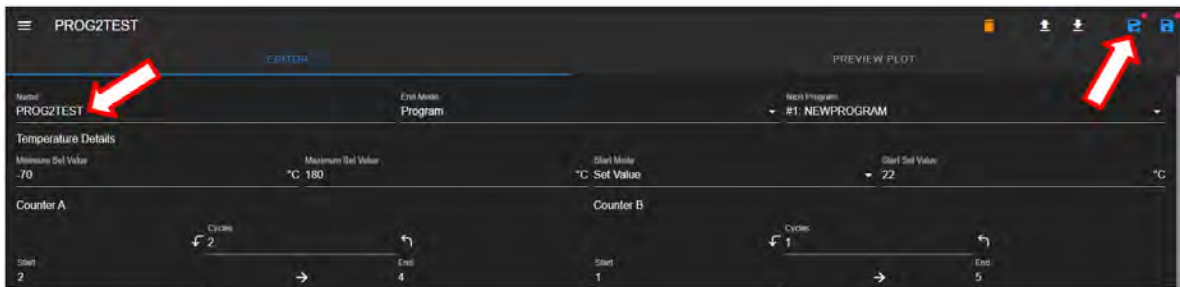


Figure 27.20: Save current program as a new file

5. **Save:** Apply this button to update the program file. To help check the editing status of the program, the program editor utilizes a red dot placed above the **Save** or **Save As** button to indicate an update yet to be saved.

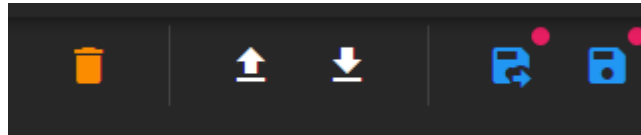


Figure 27.21: Update indicator

Navigating out of the editor without saving the update will trigger a warning prompt, as depicted in the following figure.

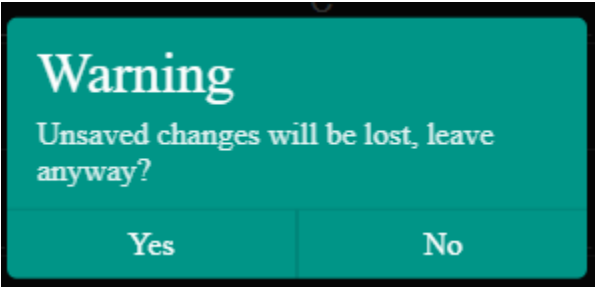


Figure 27.22: Confirm the save or discard update

27.3.4 Managing Program File via the Name List

This section describes how to apply the three file manipulation options on the Name list, as depicted in the following figure.



Figure 27.23: Manage programs on the Name list

These three options are listed and described as follows:

1. **Delete:** To delete **PROG2TEST** from the Name list (and the PLC register), click the trash bin icon indicated by the arrow (see figure below). As a safety measure, the system will prompt to confirm the action with a pop-up warning with a Yes/No option to proceed with the action. It may be necessary to apply the refresh button of the Web browser after deleting the program file from the Name list.



Figure 27.24: Deleting program from the Name list

2. **Upload Program:** This button can be used to import a program from the local computer directly into a program slot on the Name list and the PLC register. To upload a program

into slot 3, click on the **Upload** button, as indicated by the arrow in the figure. Navigate to locate the desired file on the local computer and double-click it to complete the process.



ID	Name	Actions
1	NEWPROGRAM	  
2	PROG2TEST	  
3	EMPTY	  
4	EMPTY	  

Figure 27.25: Importing a program

3. **Download Program:** To download a program **PROG2TEST** on slot 2, click on the **Download** button (on the same row). By default, the program file will be stored in the **Downloads** folder on the local computer; filename naming convention is host-name__program2__json.

CHAPTER 28

Start Stop

This menu allows the operator with read-write privilege to control or manage the chamber with the following operation modes: **Standby**, **Constant** and **Program**. The following figure depicts these modes displayed in the main display area as individual tabs.

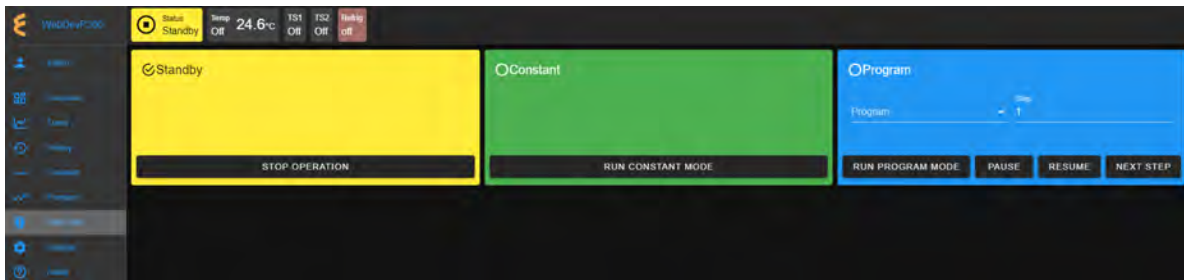


Figure 28.1: The Start/Stop menu with a Status Bar

The **Status** tab in the status bar also provides access to these modes for control and operation. Refer to the **Overview** menu for detail on how to control the chamber operating modes.

28.1 Standby Mode

In a standby mode, the chamber is off. Its status tab in the status bar displays **Standby**. This status is confirmed by the check mark in the Standby tab in the main display, as illustrated in the above figure. Authorized users with read-write privilege may set the chamber to operate in **Standby** mode.

28.1.1 Start/Stop Standby Mode

A standby mode can be switched from constant or program mode as follows:

1. Click the **StartStop** menu.
2. Click the **STOP OPERATION** button in the **Standby** tab.

ESPEC Web Controller immediately moves to apply the operating mode on the chamber, with a check mark in the Standby tab. Standby is also displayed in the Status tab of the status bar, as illustrated in the above figure. To terminate the **Standby** mode, activation of a new mode is necessary.

28.2 Constant Mode

In a constant mode, the chamber operates using the constant configuration. Authorized users with read-write privilege may set the chamber to operate in **Constant** mode.

28.2.1 Start/Stop Constant Mode

A constant mode can be switched from a standby or program mode as follows:

1. Click the **StartStop** menu.
2. Click the **RUN CONSTANT MODE** button in the **Standby** tab.

Its status tab displays **Constant**. This status is confirmed by the check mark in the **Constant** tab, as depicted in the following figure.

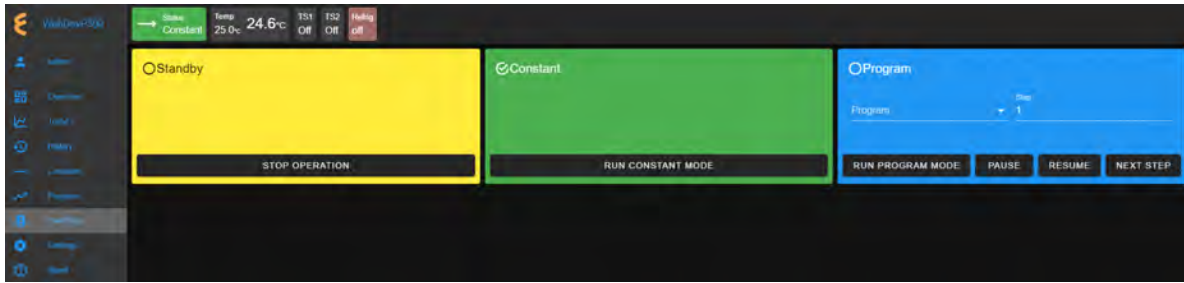


Figure 28.2: The Start/Stop menu with chamber in Constant mode

To terminate the **CONSTANT** mode, activation of a new mode is necessary. For instance, to switch the chamber from its **Constant** mode to **Standby** mode, click the **STOP OPERATION** button in the **Standby** tab. ESPEC Web Controller immediately moves to apply the operating mode to the chamber.

28.3 Program Mode

In a program mode, the chamber carries out instructions of the program being executed. The status tab in the status bar posts **Program**, along with the name of the program being executed. This status is confirmed by the check mark in the Program tab, as depicted in the following figure.

Authorized users with read-write privilege may set the chamber to operate in **Program** mode by performing a series of operations in the **Program** tab. The following subsections explain how to run (execute) a program, pause, resume or step through the instructional steps in the program.

28.3.1 Run Program

A program mode can be switched from standby or constant. To load and execute a program to control the chamber, complete the following steps:

1. Click the **StartStop** menu.
2. Click the radio button in the **Program** tab to select a program from the list (scroll down, if necessary), as depicted in the following figure.

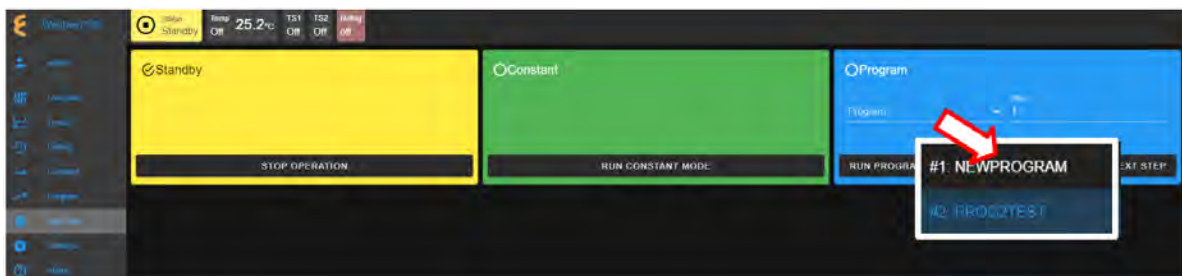


Figure 28.3: Executing a program from the Program List

3. Click to select the desired program name.

4. To start this program at a certain step, enter the step number in the **Step** field. Default setting is 0, which means to start program at step 1.
5. Click the **RUN PROGRAM** button to execute the program. ESPEC Web Controller immediately moves to apply the operating mode to the chamber. The status tab and status bar now display the program being executed, as depicted in the following figure.

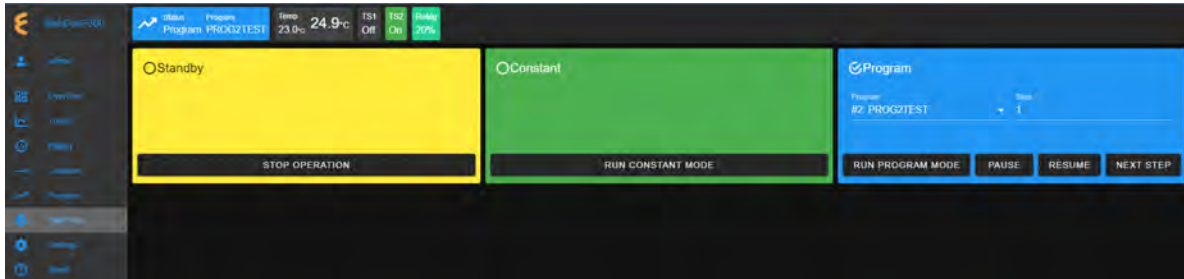


Figure 28.4: The Start/Stop menu with chamber in Program mode

The **Overview** page maybe accessed to display the detail of the program being executed.

28.3.2 Pause/Resume Program

Authorized users with read-write privilege may control the chamber during program execution. **Program** mode may be interrupted and put in a “suspense mode” using the **PAUSE** button in the **Program** tab. To pause a program during execution, click the **PAUSE** button; all operations are suspended. An update notification appears in the lower-right corner. The **Paused** notification is posted in the status tab.

To resume the operation and continue program execution, click the **RESUME** button. An update notification appears in the lower-right corner. The chamber will continue to operate based on instructions in the program. Program name is posted in the status tab to indicate chamber is in **Program** mode and that program is being executed.

28.3.3 Stepping through Program

Without having to wait for each step in the program to complete its tasks for the entire duration in the instruction, an operator may step through the program to study the effects of the instructions in a certain step. While the program is being executed, click the **NEXT STEP** button to execute the next step in the program. This action may be repeated until the last step in the program is reached. The **Overview** page in combination with the extended tab maybe accessed to display the detail of the program being executed and its steps being stepped through. The following figure depicts program **TempVib1** being stepped through to executing step 4.



Figure 28.5: Stepping through a program

28.4 Alarm Mode

An alarm mode is not an operation mode controllable by the **StartStop** menu as the previous three modes. An alarm mode occurs when the chamber is in an alarm state. When ESPEC Web Controller detects the chamber in an alarm state, it sets itself in an alert state by displaying a list of active alarms and fault names in the red window to require an immediate action from the operator, as depicted in the following figure.

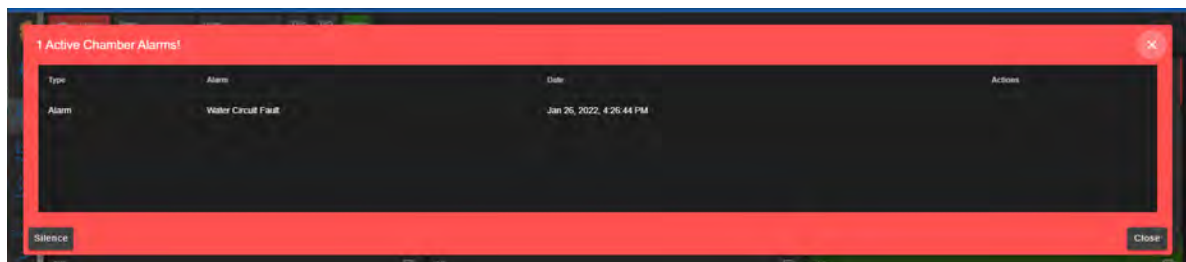


Figure 28.6: Chamber in alarm state

A repeating beep on the local computer is tripped to get the operator's attention. The **SILENCE** button can be used to turn off the beep. The **CLOSE** or X buttons can be used to close this window. However, the alarm state still remains to be resolved as indicated by the red **Status** tab in the status bar (shown in the following figure). To redisplay or expand the alarm list, click the red dot in the lower-right corner.

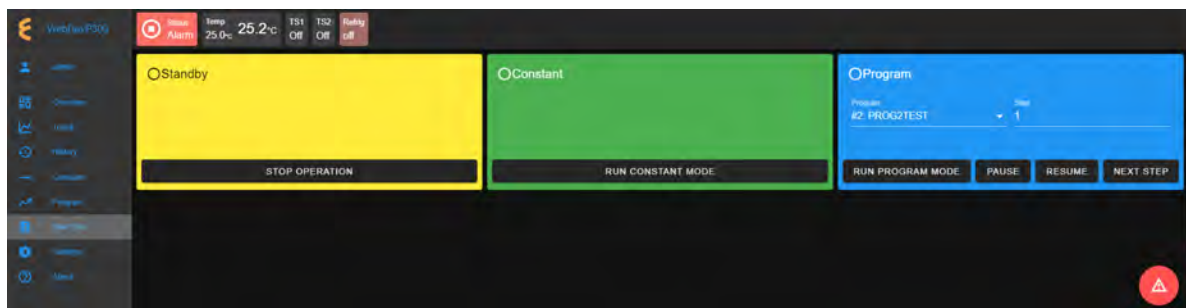


Figure 28.7: Alarm state during constant or program mode

28.4.1 Clear Alarms

The chamber is set in the **Alarm** state as a result of an alarm or alarms triggered in and by the chamber. ESPEC Web Controller relays all alert messages to the operator for immediate action or intervention to prevent further damage to the chamber or any test products inside the chamber.

In an alarm state, all operations are halted until all alarms triggered by chamber are resolved by clearing all alarms via the PLC's HMI (see the chamber and PLC operation manual for detail). When all alarms are cleared, the Web Controller will automatically clear all alert messages and resume normal operation by switching the chamber to a **Standby** mode.

Part VI

ESPEC SCP220 Chamber

CHAPTER 29

Overview

The **Overview** page displays the current status of the chamber and its operating mode. A user is brought to this page after successfully logging into ESPEC Web Controller. The following figure depicts **Overview** showing the chamber in Standby mode, as indicated in the status tab and its extension bar. The extension bar of the status tab is only available in the **Overview** menu.



Figure 29.1: Overview page with chamber in Standby mode

The following figure depicts **Overview** showing the chamber in Constant mode.



Figure 29.2: Overview page with chamber in Constant mode

The following figure depicts **Overview** showing the chamber in Program mode. Detailed information about the program, including what step is being executed, is listed in the extension bar (of the status tab). This feature provides the operator with useful information about the status of the chamber and the program.

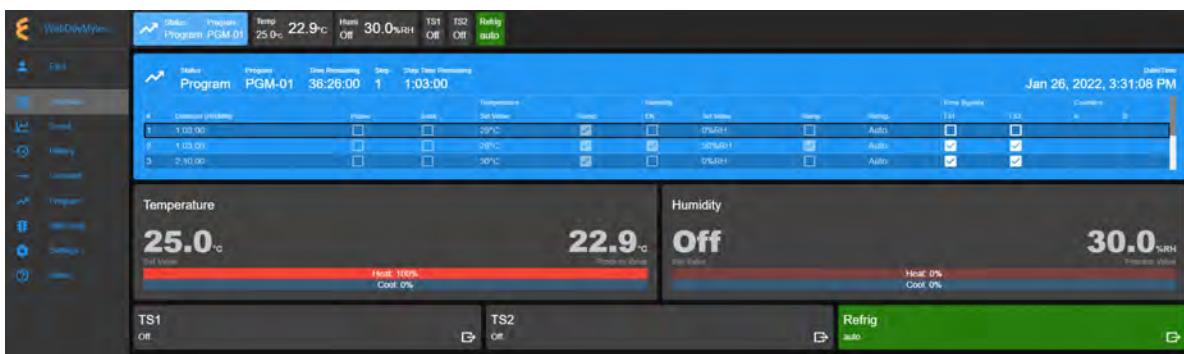


Figure 29.3: Overview page with chamber in Program mode

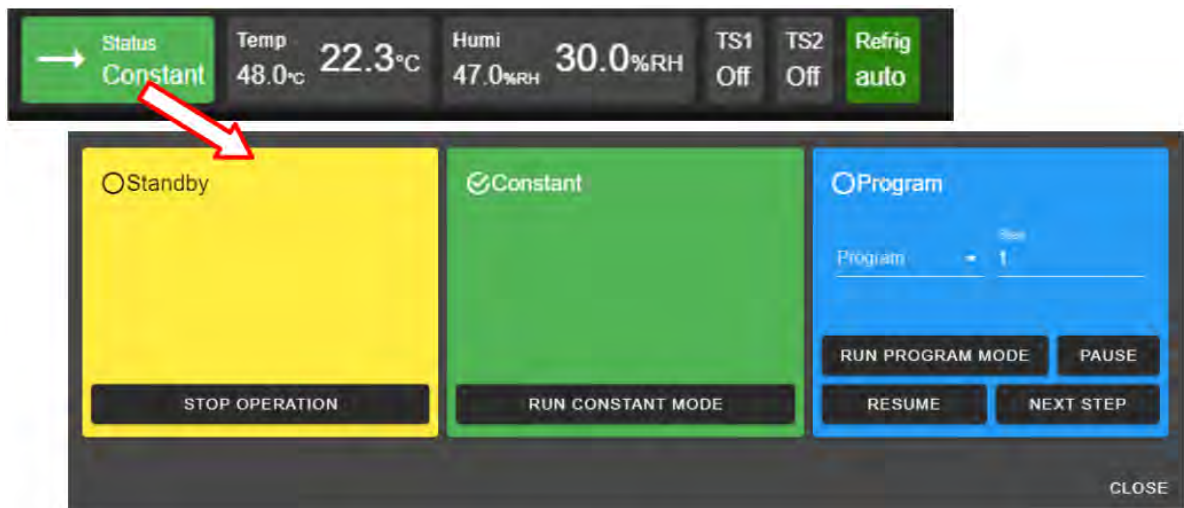
Only users with read-write privilege can control the chamber operation mode from within this page. Supported operation modes are **Standby**, **Constant** and **Program**. Each tab in the sta-

tus bar may be accessed to apply new settings at any time. This feature enables the operator to control the chamber without having to access the **Start Stop** menu in the menu bar. The following sections detail a step-by-step procedure how to control the chamber's operating mode via the **Overview** menu for users with read-write privilege.

29.1 Standby Setting

For authorized users with read-write privilege, to set the chamber in **Standby** mode, proceed with the following steps. Initially, the chamber is operating in **Constant** mode. We wish to switch its operation mode to **Standby**.

1. Click the status tab in the status bar to access the drop-down tabs, as shown in the figure.



An alternative way to access the drop-down tabs is to click on the extended tab of the status tab itself, as depicted in the following figure. The drop-down tabs display over the extended tab, as shown in the right figure. This extended tab is available only in the **Overview** page.



Figure 29.4: Status tab drop-down menu via the extended tab

2. Click the **STOP OPERATION** button. ESPEC Web Controller immediately moves to apply the operating mode to the chamber. A pop-up window appears in the lower-right corner to indicate the update of the operating mode. A check mark in the **Standby** tab indicates and confirms its standby mode.
3. To close the drop-down tabs, perform one of the following action:
 - Click an empty area in the Main Display.
 - Click a different menu in the menu bar.

- Click the status tab itself. or
- Click the **CLOSE** button underneath the alarm tab.

29.2 Constant Setting

For authorized users with read-write privilege, to set the chamber in **Constant** mode, proceed with the following steps. Suppose, initially, the chamber is operating in **Standby** mode. We wish to switch its operation mode to **Constant**.

1. Click the status tab in the status bar. As depicted in the following figure, the chamber is in **Standby** mode.

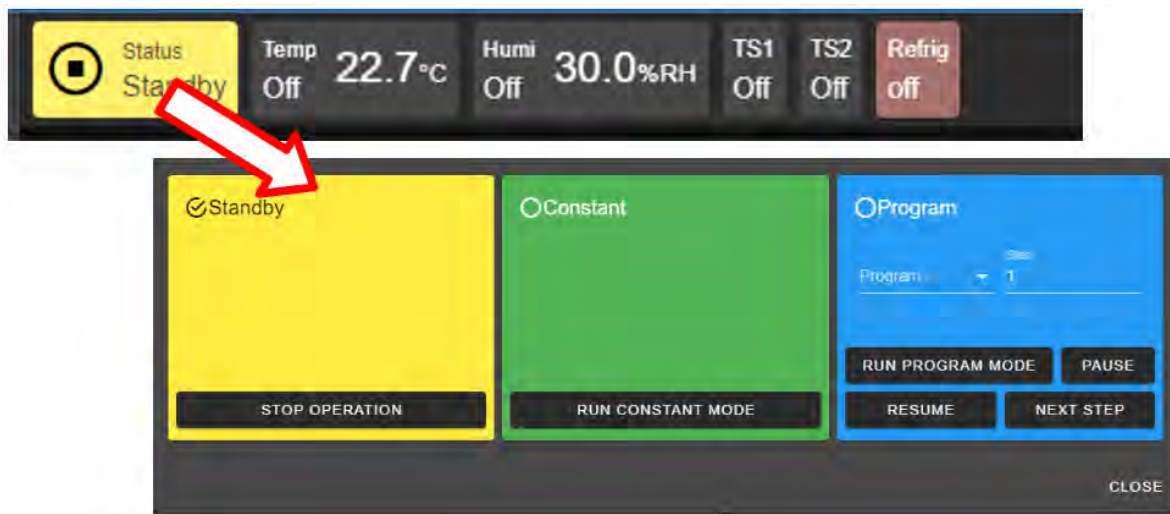


Figure 29.5: Constant mode setting

2. Click the **RUN CONSTANT MODE** button in the constant tab. ESPEC Web Controller immediately moves to apply the operating mode to the chamber.
3. To close the drop-down tabs, perform one of the following action:
 - Click an empty area in the Main Display.
 - Click a different menu in the menu bar.
 - Click the status tab itself. or
 - Click the **CLOSE** button underneath the alarm tab.

29.3 Program Setting

To set the chamber in **Program** mode means a profile (i.e., program) is loaded and executed.

1. Click the status tab in the status bar or the extension bar of the status tab.
2. Click the radio button in the program tab to access the program list (see the figure below).

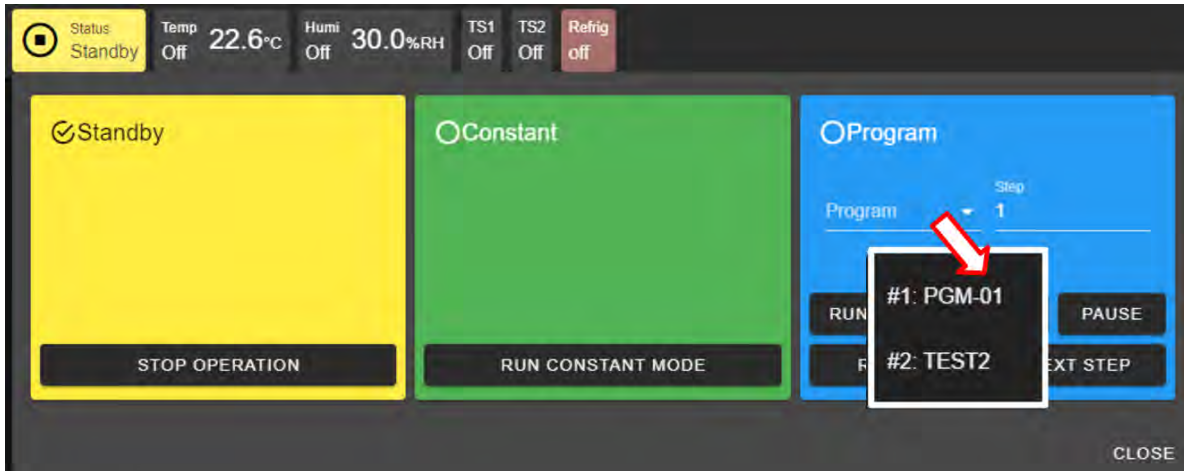


Figure 29.6: Select program to start chamber in Program mode

If no program is available for loading, the list contains slot numbers without programs, as depicted in the following figure. A program must be created first before it can be loaded for execution. Chapter 8 discusses how to create a program to control the chamber.

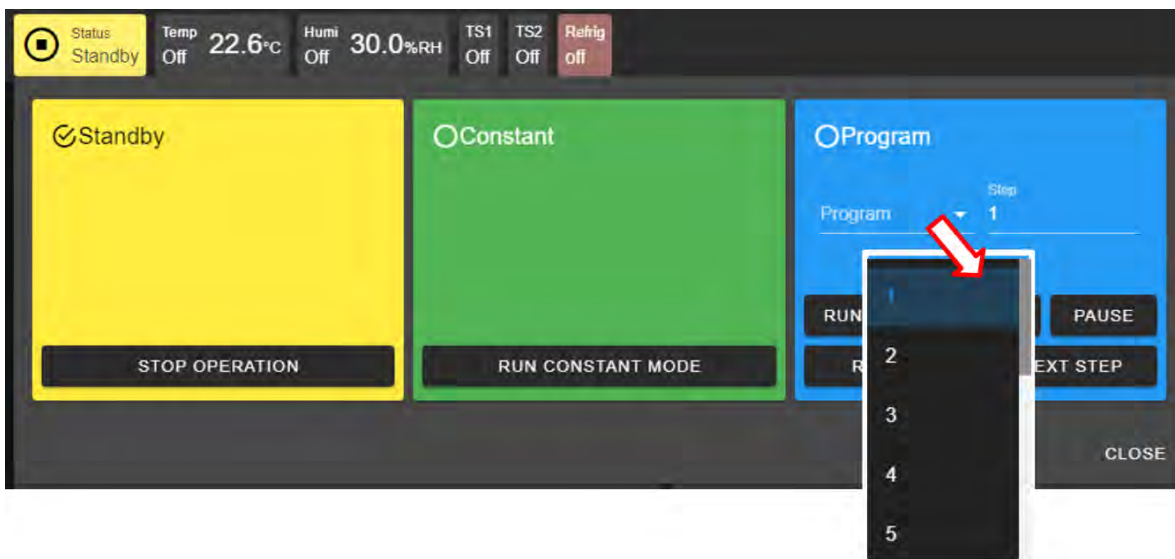


Figure 29.7: No program available for execution

3. Click to select a program from the list. Apply the scroll bar, if necessary, to select the desired program.
4. Enter a desired step number in the step field for program to start. Default start step is 1.
5. Click the **RUN PROGRAM MODE** button to execute the program. ESPEC Web Controller immediately moves to apply the operating mode to chamber. A pop-up window appears in the lower-right corner to indicate the update. Note: This program tab offers a few practical methods during a program execution. The **Pause** button can be used to pause the program. Program can be resumed via the **RESUME** button. Program instruction

lines can be stepped through via the **NEXT STEP** button.

6. Click the **CLOSE** button to view the status of program execution displayed in the status tab extension bar.
7. To end or interrupt the program execution, switch the chamber to **Standby** or **Constant** mode via the status tab.

29.4 Clear Alarms

When ESPEC Web Controller detects an alarm in the chamber, it also sets itself in an alert state by displaying a list of active alarms and fault names in the red window to require an immediate action from the operator, as depicted in the following figure.

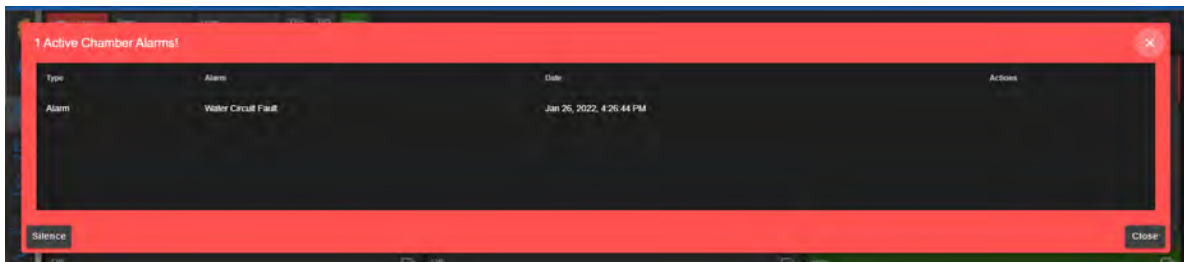


Figure 29.8: Chamber in alarm state

A repeating beep on the local computer is also tripped to get the operator's attention. The **SILENCE** button can be used to turn off the beep. This alert window can be closed by clicking the **CLOSE** button or the X button. However, the alarm state still remains to be resolved as indicated by the **Status** tab in the following figure. To redisplay or expand the alarm list, click the red dot in the lower-right corner.

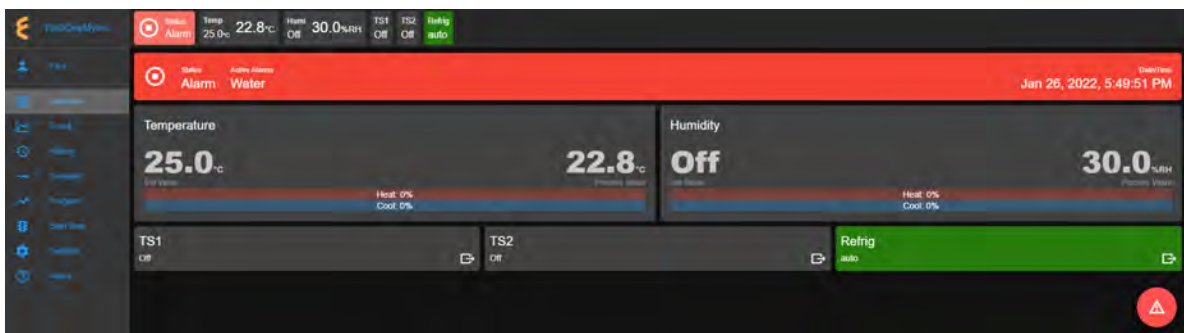


Figure 29.9: Alarm state in overview page

In an alarm state, operation is halted until all alarms triggered by chamber are resolved via the P300 (i.e., clear all alarms on the P300) before the Web Controller (and the chamber) can resume the normal operation. Once all alarms are cleared, the Web Controller will automatically clear all alert messages and resume normal operation by switching the chamber to a **Standby** mode.

29.5 Temperature, Humidity or Time Signal Settings

On the **Overview** page, settings of temperature, humidity, time signals or refrigeration can be controlled via the dedicated tabs in the status bar or the dedicated panes in the main display area, as depicted in the following figure.



Figure 29.10: Parameter settings via control panes

29.5.1 Settings via the Status Bar

To set temperature with a new set value, complete the following steps:

1. Click the Temp tab in the status bar.
2. In the drop-down pane, click the box to **Enable** temperature, and enter new value in the Set Value field or apply the up/down arrow to adjust the value (shown in the figure).

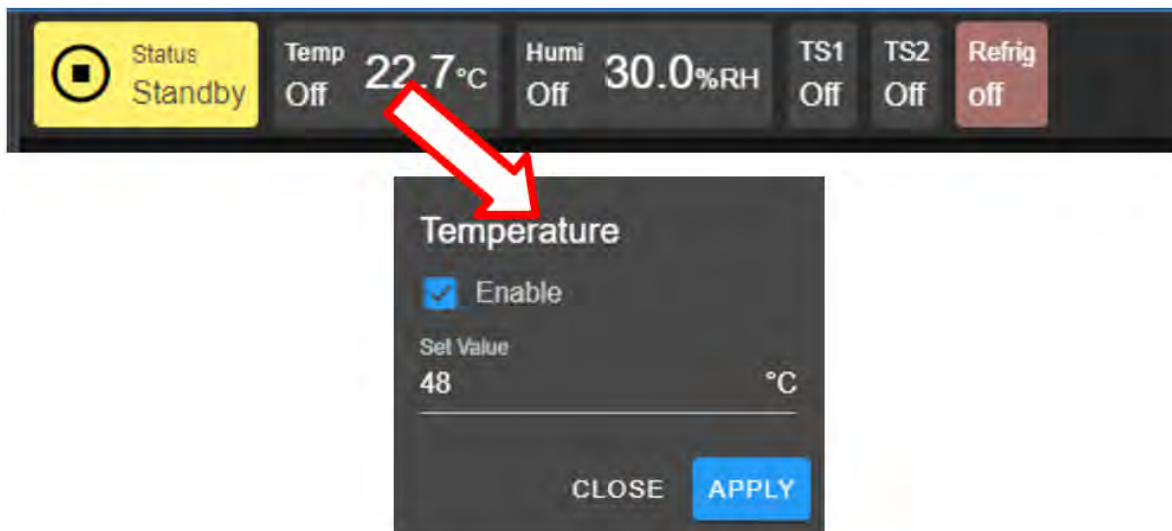


Figure 29.11: Setting new temperature value via the temp tab

3. Click **APPLY** to apply the new setting.
4. To cancel the setting, click the **CLOSE** button (or the Temp tab in the task bar).

To turn on humidity and set its value, complete the following steps:

1. Click the Humi tab in the status bar.
2. In the drop-down pane, click the box to **Enable** humidity, and enter new value in the Set Value field or apply the up/down arrow to adjust the value (shown in the figure).

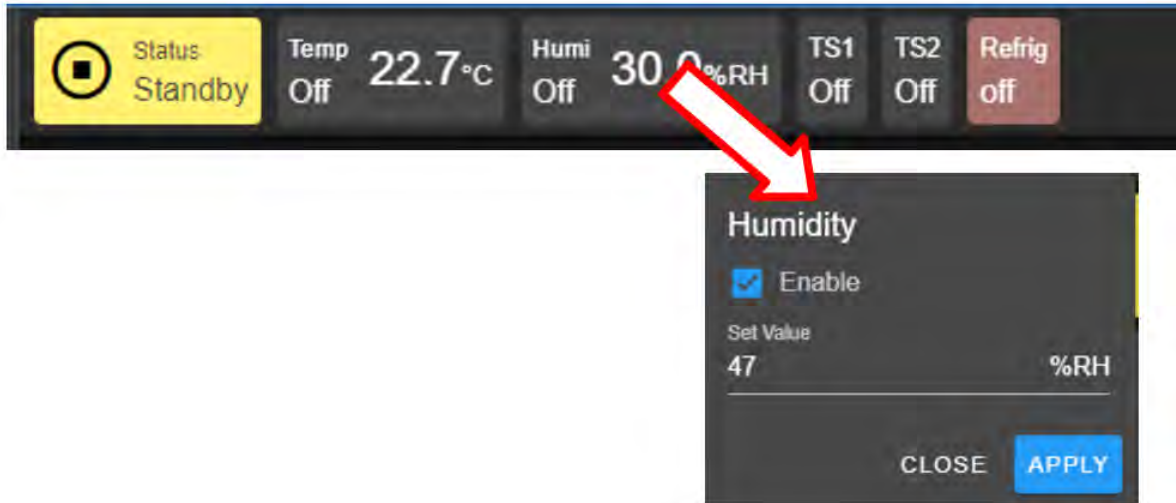


Figure 29.12: Setting new humidity value via the humi tab

3. Click **APPLY** button to apply the setting.
4. To cancel the setting, click the **CLOSE** button.

To turn on time signal 1 (TS1), complete the following steps. Repeat the same procedure to turn on additional time signals.

1. Click the TS1 tab in the status bar.
2. Check the box to enable TS1 (shown in the figure).



Figure 29.13: Enable or disable time signal setting

3. Click **APPLY**.
4. To cancel the setting, click **CLOSE** (instead of **APPLY**) or click the TS1 tab itself in the status bar.

To turn off TS1, apply the following steps:

1. Click the TS1 tab in the status bar.
2. Uncheck the box to disable TS1.
3. Click **APPLY**.
4. To cancel the setting, click **CLOSE** (instead of **APPLY**) or click the **TS1** tab itself in the status bar.

To turn on the refrigeration, complete the following steps:

1. Click the Refrig tab in the status bar.
2. Check the radio button to select set value from the drop-down list.

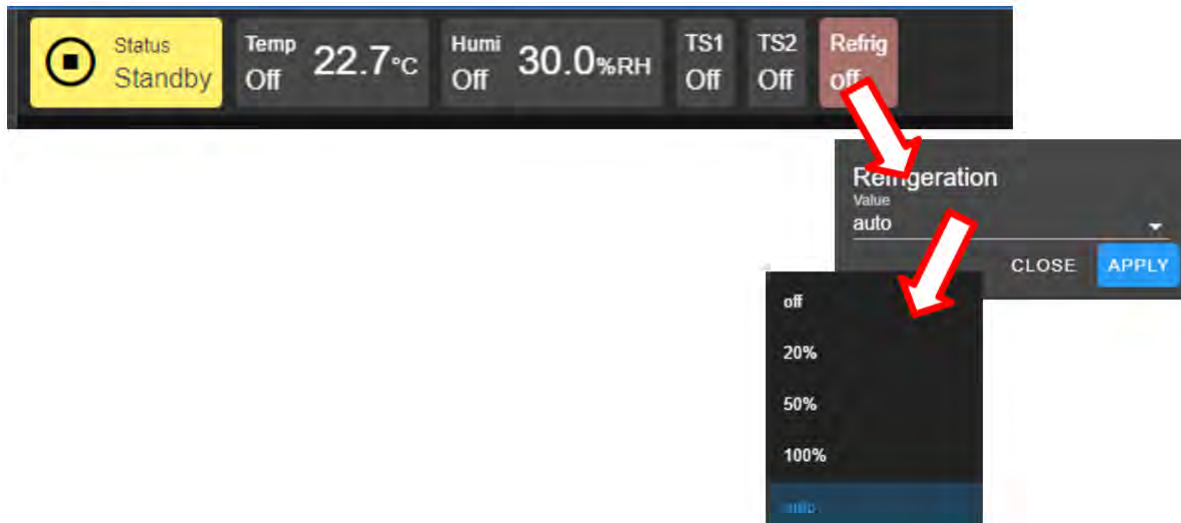


Figure 29.14: Setting refrig value

3. Click **Apply**.
4. To cancel the setting, click the **CLOSE** button.

29.5.2 Settings via the Dedicated Panes

With ESPEC Web Controller, there are multiple ways to complete the same task. The dedicated panes for temperature, vibration or humidity, time signals, or refrigeration, in the main display area are actually clickable panes. These are CTA (call-to-action) panes through which new parameter settings (such as, temperature, vibration or humidity, time signal and refrigeration) can be applied.

To apply a new setting to temperature, complete the following steps:

1. Click the Temperature pane to access the input pane (shown in figure below).



Figure 29.15: Setting new temperature value via the temperature (CTA) pane

2. In the input pane, click and enter new value in the Set Value field or apply the up/down arrow to adjust the value.
3. Click **APPLY**. To cancel the setting, click **CLOSE** (instead of **APPLY**).

The above procedure can be applied to humidity, vibration, time signal or refrigeration.

29.6 Web Controller on the Network

ESPEC Web Controller can communicate with other ESPEC Web Controllers on the same network. The hostname (with E logo) in the upper-left corner acts as a link that, when clicked, provides a list of any chamber with ESPEC Web Controller detected on the network by the local ESPEC Web Controller, as depicted in the following figure.

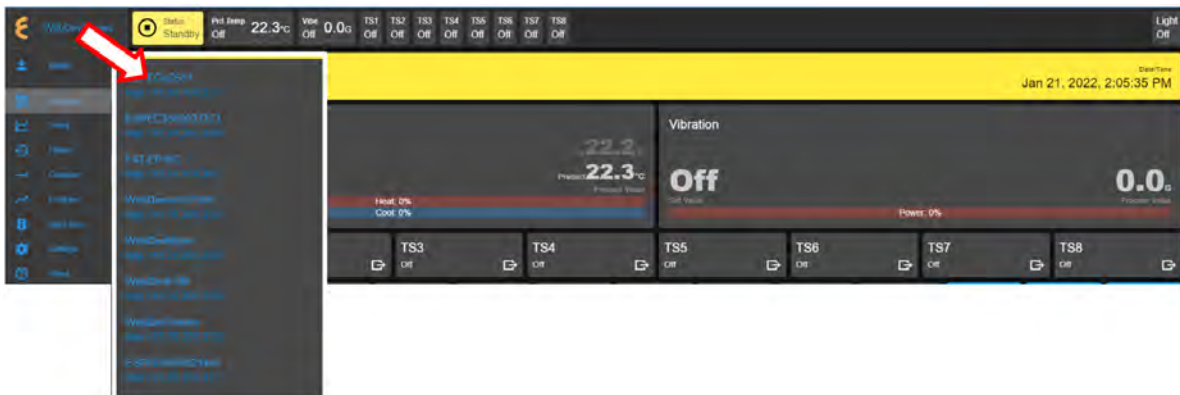


Figure 29.16: List of ESPEC Web Controller on the local network

This list can be opened from within any menus (not just in the **Overview** menu) by just clicking on the Web Controller hostname. Any chamber and ESPEC Web Controller on the list can be accessed directly by clicking on its hostname.

CHAPTER 30

Trend

Data points from the chamber's operation accumulated in the data log are displayed as a trend graph under the **Trend** menu, depicted in the following figure. By default, this graph provides an overview of the chamber's operation in the last one hour. Data can be downloaded in whole or in portion (refer to Item 4 below).

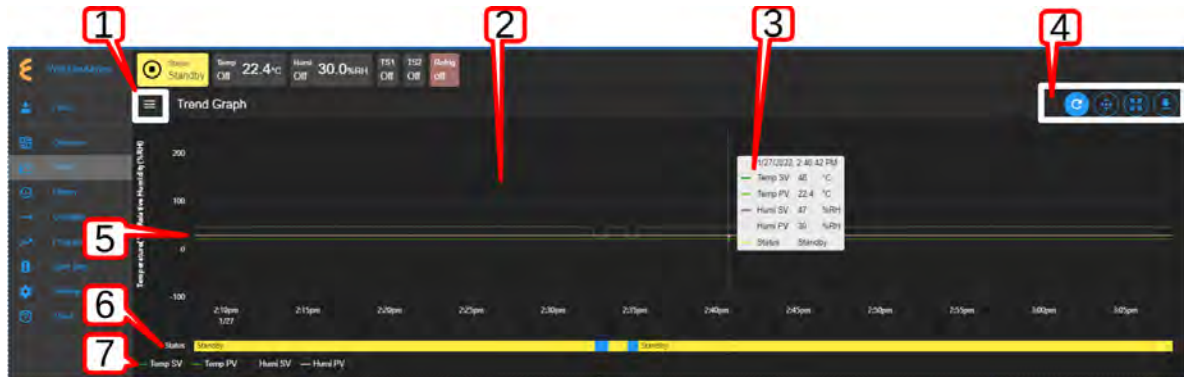


Figure 30.1: Trend graph showing plots of current data from the chamber

The main display area of the **Trend** menu is categorized into seven different groups with labels from 1 through 7. Detailed descriptions of these categories are outlined as follows:

1. **Time Frame:** This menu button shows or hides the time frame of the data points being plotted in the trend graph. As shown in the following figure, the trend graph is plotted for data points collected between 2:29 PM and 3:29 PM. That time frame is also displayed at the bottom of the trend graph, with grids at an interval of 5 minutes. This graph will continue to update and propagate through the progression of time in a 5-minute interval. To hide this time frame, click the menu button again.

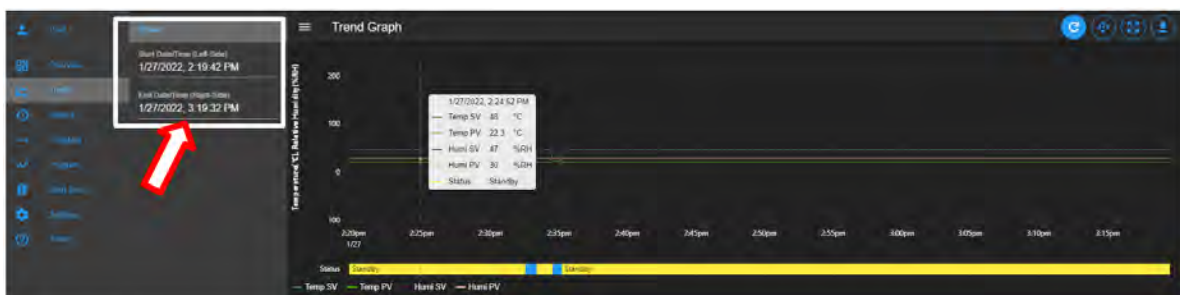


Figure 30.2: Detailed data of the Trend graph

2. **Trend Graph:** Data points collected from the chamber are rendered and displayed as a trend graph based on a scatter plot methodology. These data points represent product temperature, air temperature and/or vibration; they are plotted as a function of time. The vertical (Y) axis represents the scale of their values. Temperature is displayed in degree Celsius; vibration is displayed in root-mean-square of acceleration (Grms or G). The horizontal (X) axis represents the time scale with unit measured in a 1-second scale. Based on the default configuration, the Typhoon chamber logs data points in a 1-second interval. The scaling of the grid will change according to the Pan/Zoom Controls buttons application (see item 3 below). To reset the trend graph, click the **Zoom Extents** button (in the fol-

lowing figure), select **Last Hour** from the drop-down menu, then click the **Auto Refresh** button.

3. **Snapshot of Data:** By hovering a mouse pointer on the trend graph area, a snapshot of the data at a particular time is displayed. This feature allows a quick peak of the data at a certain point in time. Depending on the chamber's condition, the snapshot provides set values (SV) and process values (PV) of temperature, product or air temperature, or vibration, chamber's operation status and time signal status.
4. **Trend Graph Manipulation Buttons:** Four buttons are available to help manipulate and control the trend. This group of buttons is detailed in the following figure; their functions are described as follows:

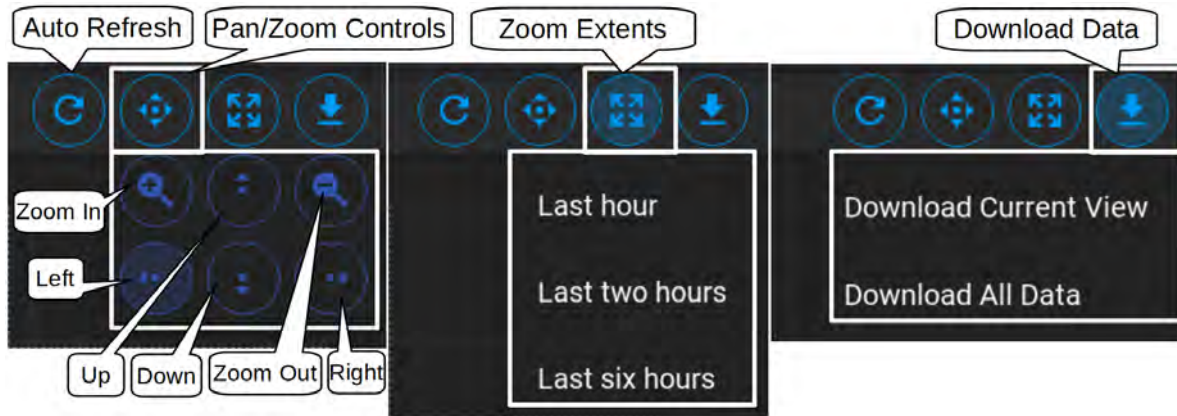


Figure 30.3: Manipulation buttons of the Trend graph

- **Auto Refresh:** This Auto Refresh button refreshes the trend graph; it thereby reconstructs the graph using the most recent data points which have been accumulated up to the current time.
- **Pan/Zoom Controls:** The Pan/Zoom Controls button allows the operator to control and adjust the viewable section in the trend graph. This button presents six operation buttons to manipulate and display the trend graph as follows:
 - **Zoom In:** The **Zoom In** button allows the operator to zoom into a small section of the trend graph. Depending on the degree of zooming, the display area will be confined to a small set of data points ranging between minutes to hours. To reset the trend graph, click the **Zoom Extents** button, select **Last Hour** from the drop-down menu, then click the **Auto Refresh** button.
 - **Zoom Out:** The **Zoom Out** button does the opposite by allowing the operator to zoom out on the trend graph, thereby giving the operator an expansive view of the trend graph. To reset the trend graph, click the **Zoom Extents** button, select **Last Hour** from the drop-down menu, then click the **Auto Refresh** button.
 - **Move Up:** This button allows the operator to move up the graph along the vertical axis to adjust the viewable area of the scatter plot. To reset the trend graph, click the **Zoom Extents** button, select **Last Hour** from the drop-down menu, then click the **Auto Refresh** button.
 - **Move Down:** This button allows the operator to move down the trend graph along the vertical axis with the purpose to adjust the viewable area of the scatter plot. To reset the trend graph, click the **Zoom Extents** button, select **Last**

Hour from the drop-down menu, then click the **Auto Refresh** button.

- **Move Left:** This button allows the operator to pan left on the trend graph, offering a quick preview of a plot of data points tracing back the time in hours or days. With this feature, the operator can quickly gain a preview of past data points which the operator may have missed.
 - **Move Right:** This button does the opposite to **Move Left** by allowing the operator to pan right on the trend graph to the current time. To reconstruct the trend graph to contain the most recent data points, the **Auto Refresh** button allows the quickest operation.
 - **Zoom Extents:** With this button, trend graph may be provided using data points from within the last one hour, last two hours or the last six hours. To make adjustment of the trend graph based on these three selections, click on the **Zoom Extents** button, then click one of the selection from the drop-down menu.
 - **Download Data:** To download data and store it on the local computer, click the **Download Data** button and select **Download Current View** to download a portion of data from the displayed trend graph. To download the entire collection of data, select **Download All Data**. Data file will be stored in the Downloads folder of the local computer with filename: hostname_data_date.CSV.
5. **Line Graph:** Data points from Temperature (set values or process values) and vibration (set values and process values) are being plotted to produce the line graphs to visually display the operation condition of the chamber.
 6. **Status:** Status of the operation mode of the chamber is displayed along the time line on the trend graph, indicating when and how long the chamber was in specific operating mode. This feature provides a quick preview of the chamber operating status. The **Left** button under the Pan/Zoom Controls may be used to extent further into the past to view the chamber's operating mode.
 7. **Legend of Trend Graph:** The legends are used to identify each item on the trend graph with color code to designate the different line graph (described in Item 5 above).

CHAPTER 31

History

The **History** page displays operation history of the chamber, its operating modes and statistics. Any alarms or alerts that were triggered during the chamber's operation are logged and displayed here. By default, history log of the chamber's operating modes, alarms or statistics from the previous week will be displayed, as depicted in the following figure. There are five important components in the **History** main display area. They are labeled and described as follows:

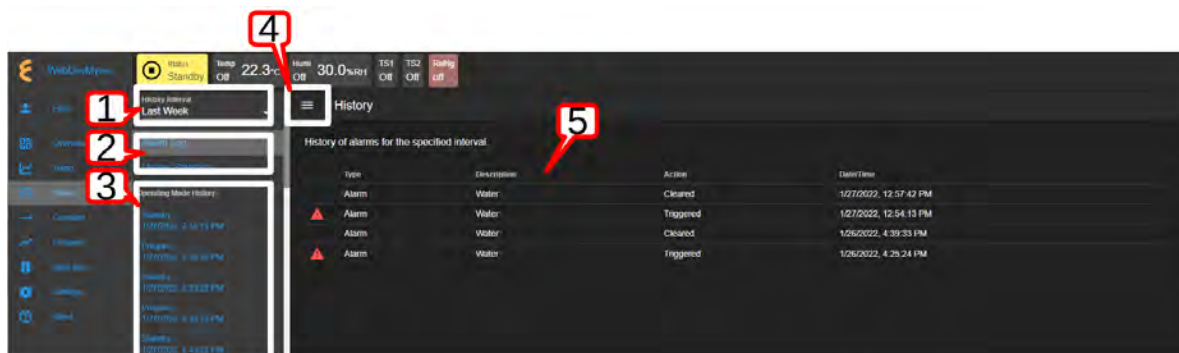


Figure 31.1: Operation history of the chamber

1. **History Interval:** Display options of the operating history are: one week, two weeks, one month, three months, six months, one year or the entire period of the chamber's operation. To access the history interval, click the radio button to select the period from the list.

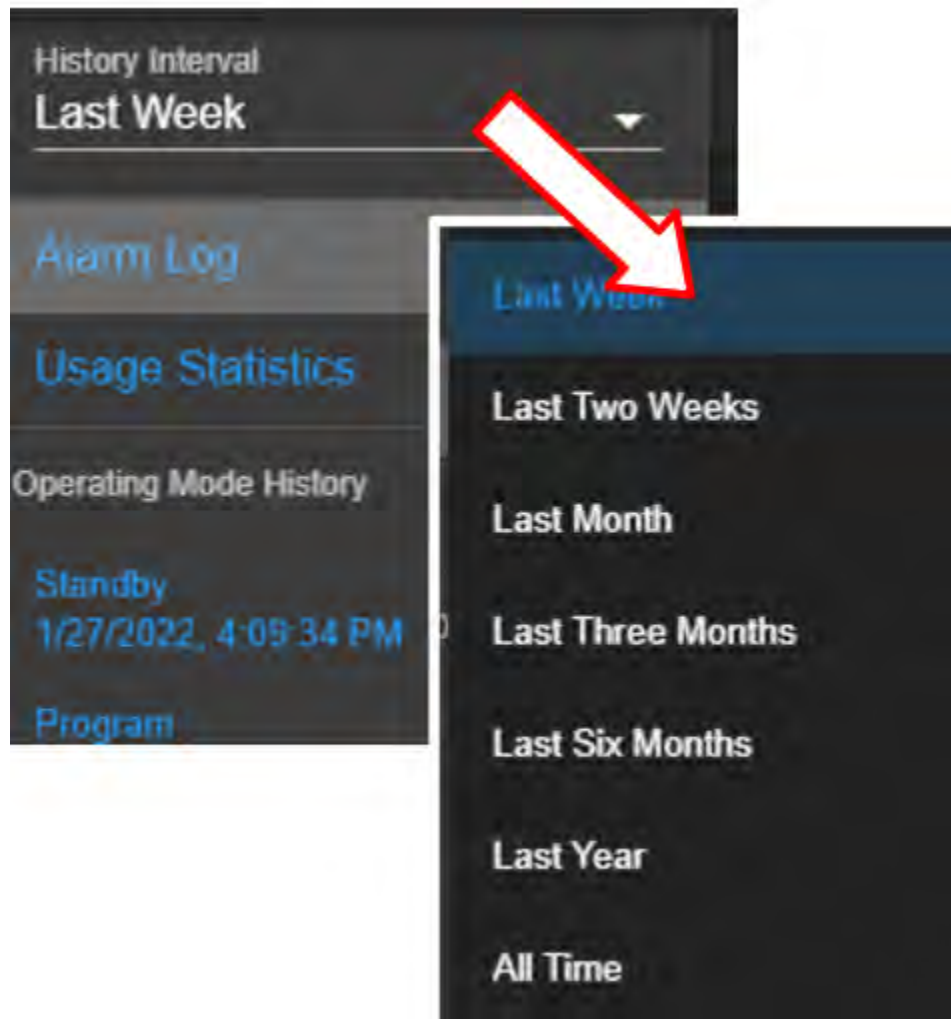


Figure 31.2: History interval and display selection

2. Alarm or Statistics Submenus:

- **Alarm Log:** By default, alarm logs will be displayed in the main display area. The logs indicate which alarm had occurred and when they were resolved (cleared).

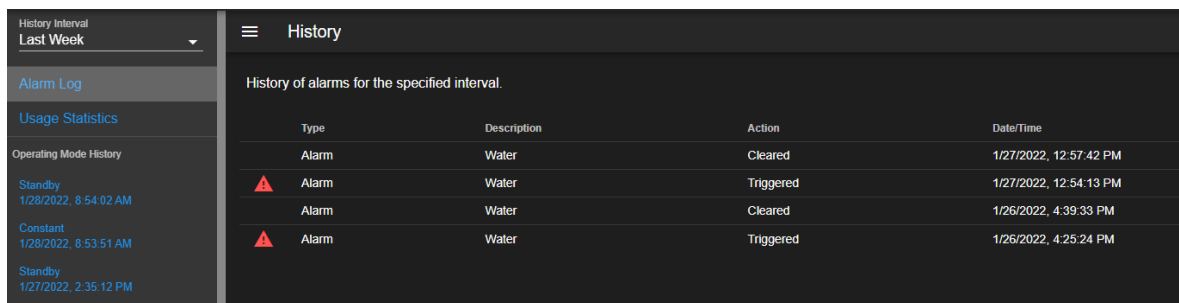


Figure 31.3: History of alarm

- **Usage Statistics:** To display the operation statistics, click on this submenu. Percentage of each operation mode based on the selection period in the **History Interval** is displayed as shown in the following figure:

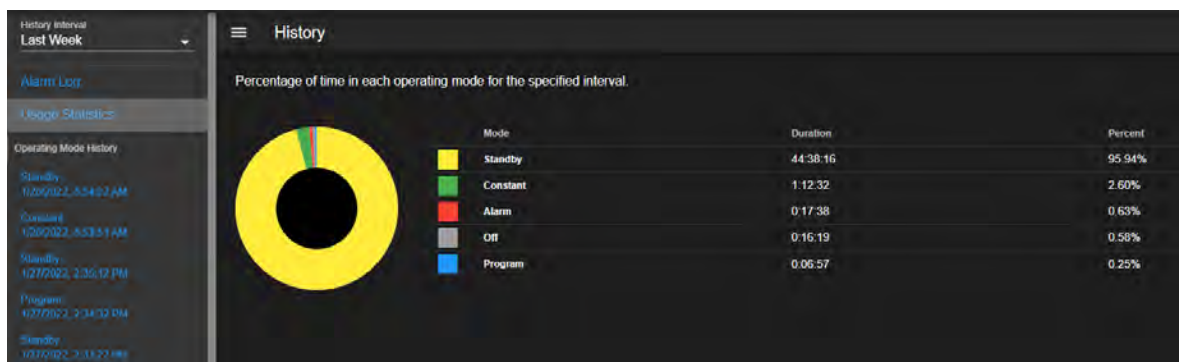


Figure 31.4: History of operation statistics

Such information provides the operator a good idea of the overall performance of the chamber by identifying when and how much time it was in a certain operating mode.

3. **Operating Mode History:** A list of operating modes of the chamber is displayed here based on the option selected under the **History Interval**. Default listing is based on a one-week interval. A trend graph, identical to that produced in the **Trend** menu, based on the data points collected during the operating mode can be produced by clicking on the particular operating mode on this list, as illustrated in the following figure.

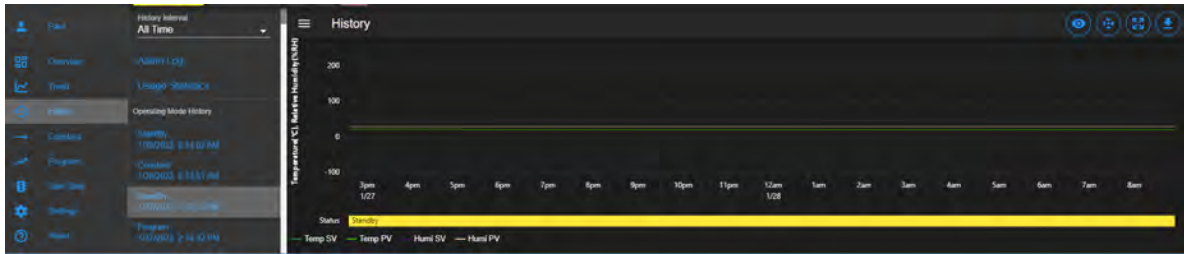


Figure 31.5: Trend graph of operating mode history

4. **Show/Hide Submenu:** To provide a larger real estate for the main display area, this Show/Hide button can be used to show or hide the **History** submenu. The following figure shows how the submenu is hidden and the main display area is expanded.

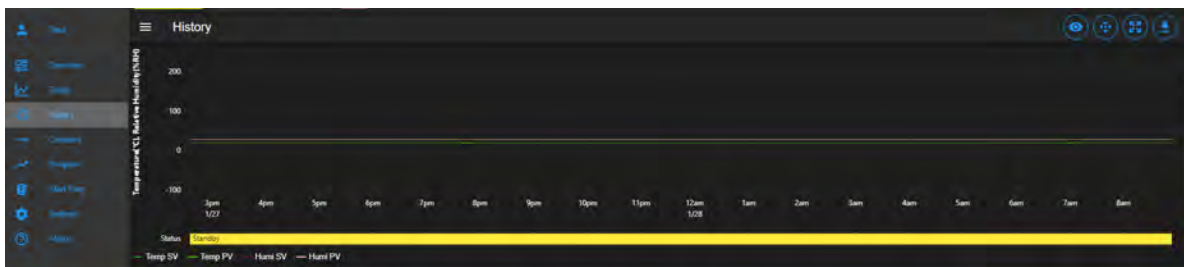


Figure 31.6: The show/hide button of the main display of the History page

5. **Main Display:** The content of the submenu page of **Alarm Log** and **Usage Statistics** is displayed here (refer to item 2, above).

CHAPTER 32

Constant

The existence of ESPEC Web Controller **Constant** page is such that all features and their parameters are collected and displayed in one place to control their constant mode settings. The main display of **Constant** consists of three separate panes, displayed as **Temperature**, **Humidity** (or **Vibration**) and **Outputs**, as depicted in the following figure. These CTA panes provide input options to adjust the settings directly. The Humidity Range Chart is a two-dimensional graph of the current temperature-humidity relationship, displayed below these CTA panes.

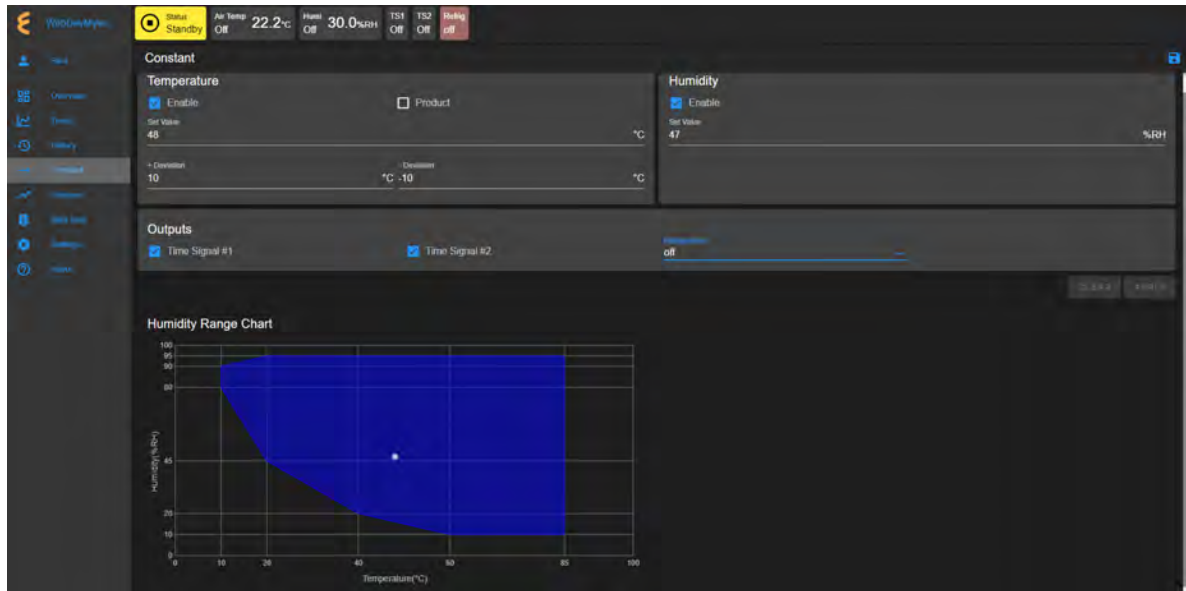


Figure 32.1: The Constant menu and its components

The following sections describe how to configure and control each of these parameters.

32.1 Product or Air Temperature Setting

Complete the following steps to turn on or modify temperature setting:

1. Enable air temperature or product temperature by checking the appropriate boxes.
2. Click the Set Value field and enter a new value, or apply the up/down arrow to adjust the value.
3. Adjust the plus/minus deviation in the appropriate fields.

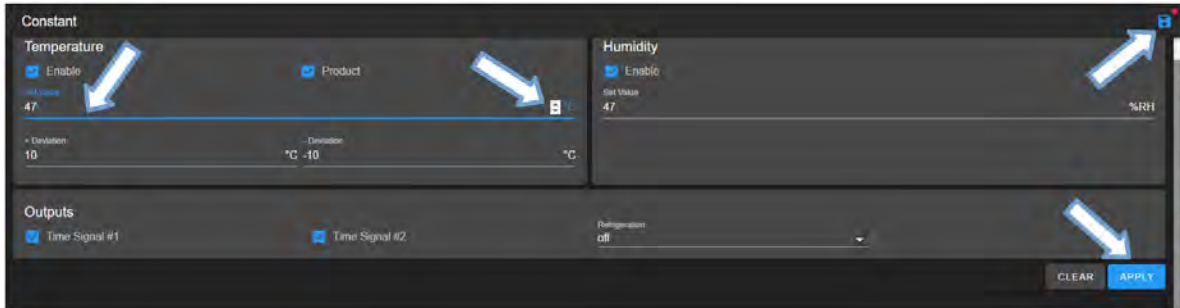


Figure 32.2: Apply new constant setting on temperature

4. Click the **APPLY** button or the **Save** icon (indicated by the arrows) to apply and save the setting. The red dot next to the **Save** icon indicates that the new setting has not been saved. If you exit this pane by accessing a different menu in the menu bar, a warning message will appear (shown in figure).

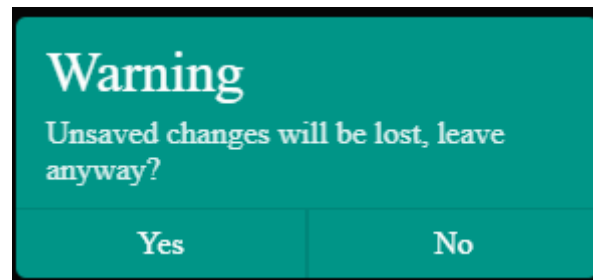


Figure 32.3: New setting must be save before exiting the pane

5. To cancel the setting, click **CLEAR**.

The new setting takes effect immediately with its new status displayed in the status bar. To reverse or cancel the setting, repeat the above steps to reset the set value and click **APPLY**.

32.2 Humidity Setting

Complete the following steps to turn on or modify humidity setting:

1. Enable or disable humidity with the appropriate check mark in the box.
2. Click the Set Value field and enter a new value, or apply the up/down arrow to adjust the value.
3. Click the **APPLY** button or the **Save** icon (indicated by the arrows) to apply and save the setting.
4. To cancel the setting, click **CLEAR**. If you exit this pane by accessing a different menu in the menu bar, a warning message will appear.

The new setting takes effect immediately with its new status displayed in the status bar. To reverse or cancel the setting, repeat the above steps to uncheck the box, reset the set value and click **APPLY**.

32.3 Time Signals Setting

Complete the following procedure to turn on output for any time signal:

1. To turn on output for **Time Signal # 1**, place a check mark in its box.
2. Repeat the above step for any time signal available in the main display area.
3. Click the **APPLY** button or the save icon as indicated by the arrows in the above figure to apply and save the setting.
4. To cancel the setting, click **CLEAR**. If you exit this pane by accessing a different menu in the menu bar, a warning will appear which requires you to save the setting before attempting to access any other menus.

The new setting takes effect immediately with its new status displayed in the status bar. To reverse or cancel the setting, repeat the above steps to uncheck the box and click **APPLY**.

It is important to note that all the parameters (temperature, humidity, vibration, time signal) in the main display can be adjusted altogether simultaneously with a single **APPLY** or save button. However, individual setting may provide security to avoid any adverse effect.

CHAPTER 33

Program

The **Program** menu allows the operator to create a program to control the chamber. All the programming features available on the supported PLC's listed in Chapter 1 (“**Introduction**”) can be composed into programs to control the chamber. The operator can: (1) open and view a program; (2) preview the output of the program; (3) edit and/or overwrite an existing program ; (4) delete program from the list; (5) rename program on the list; (6) download a program and store it on the local computer in JSON file; (7) upload a program from the local computer to the Web Controller, and much more.

Here are some of the benefits of the **Program** menu:

- Easy to operate.
- Quick management of programs, programming or editing.
- Require less time to develop a new program or modify an existing program.
- Program Editor offers flexibility with multitasking capabilities.
- Control program operation and program end mode.
- Preview program operation before execution; operator can see exactly what the program does prior to its execution.
- Download program from the Web Controller to the local computer for backup.
- Upload program from the local computer to the Web Controller.

Only authorized users with read-write privilege can access and utilize the **Program** menu. The user must log into their account to access the **Program** menu based on their read-write privilege, as depicted in the following figure.

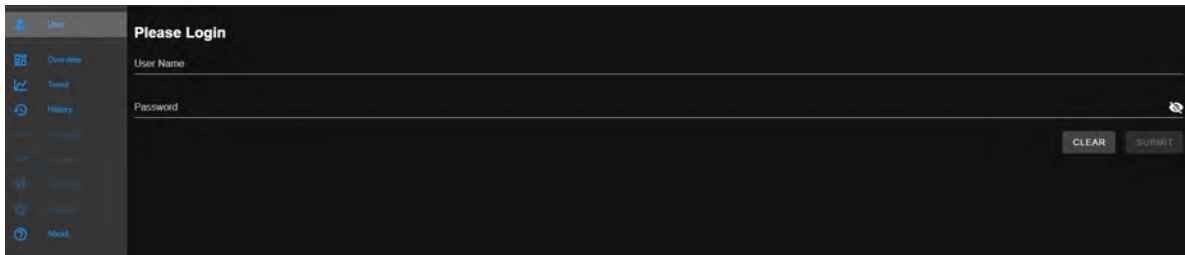


Figure 33.1: User with read-write privilege is required to operate the Program menu

33.1 List Programs

The following figure depicts a typical layout of the **Program** page with its submenu hidden. This is the default display of program list when the **Program** menu is accessed for the first time. Its UI components are numbered and explained as follows:

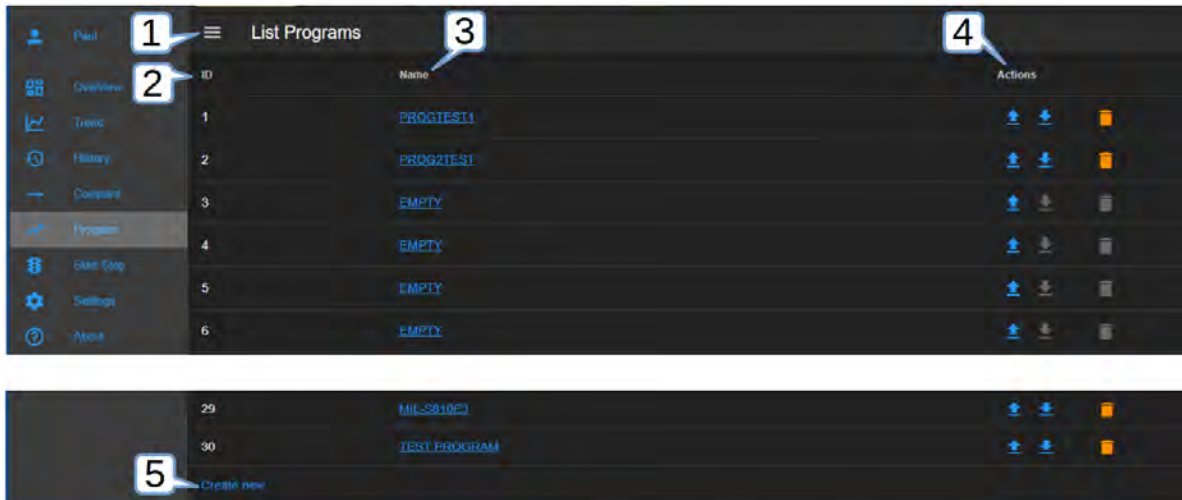


Figure 33.2: Program listing page with submenu hidden

1. **Submenu Show/Hide:** To utilize the entire main display area for the program editor, this button can be used to hide the submenu (as shown in the above figure). Click it again to reveal the submenu.
2. **ID:** ESPEC Web Controller identifies each program by its slot number stored in the PLC register. This list reflects the actual list of programs read from the PLC register. Only the first 20 (numbered from 1 to 20) are available for profile storage. The system uses a program identification code (ID) to identify each program.
3. **Program Name:** All available programs are listed under the **Name** column by program name. These programs are stored by their slot number. As such, identical program names may exist in different slots. Any slot not yet occupied by the program is marked **EMPTY**. Users can access each program under this list by clicking on the program name. The program editor then opens and displays the program instructions. Detailed operation of the program editor is discussed in the next section.
4. **Actions:** Three action buttons (Upload Program, Download Program, Delete) under the **Actions** column can be used to manage each program on the list under each row. These action buttons, once activated, affect the program on the row where the buttons were applied. They are described as follows:
 - **Upload:** Program can be uploaded from the local computer to the Web Controller which will then be stored in the PLC register using the slot number where the action was applied.
 - **Download:** Program can be downloaded and saved on the local computer.
 - **Delete:** A program to the left of the trash bin (where this action is applied) will be deleted. The PLC register will no longer contain this program.
5. **Create New:** This button opens the program editor for creating a new program. The **Create New** button is conveniently placed in two locations: (1) under the **ID** list and (2) in the **Program** submenu (shown in the following figure).

The following figure displays the **Program** page with its submenu unhidden. The submenu (item 2) has two operation buttons: (i) List Programs and (ii) Create New (program).

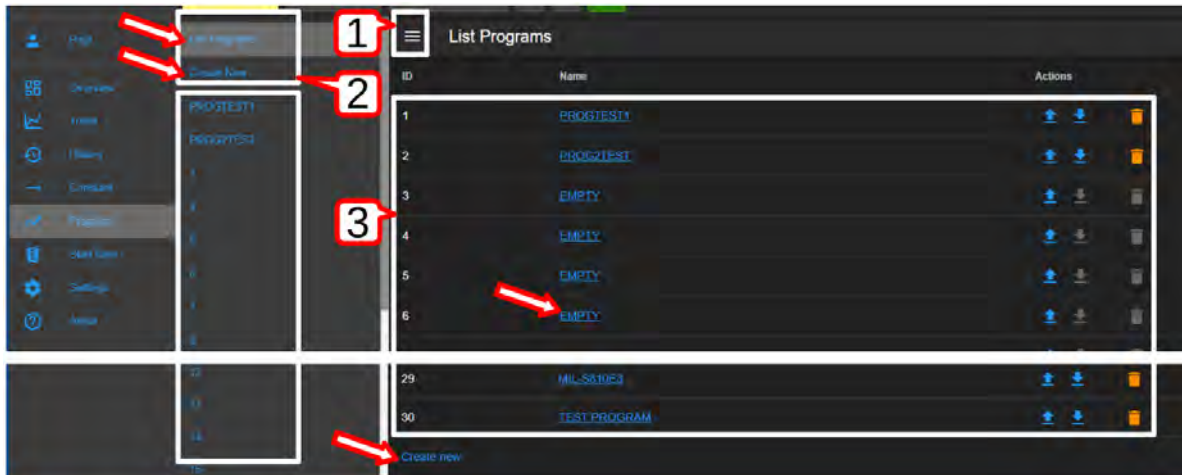


Figure 33.3: Program listing page with submenu unhidden

1. **Show/Hide:** The **Show/Hide** button can be used to hide or unhide the **Program** submenu (item 2 below).
2. **Submenu:** This submenu has two operation buttons (indicated by the arrows): List Programs and Create New (program). All the available programs in the chamber stored in the Web Controller are listed below these operation buttons (shown in above figure). With the submenu hidden, the main display has a larger real estate to display the program elements.
 - **List Programs:** The **List Programs** button offers a quick way to exit the program editor (explained in the following section). To exit the program editor mode, click this **List Programs** button. This action will cancel and exit the program editor being used to create, edit or import a program.
 - **Create New:** Similar to the **Create New** button under the **List Programs** display page (item 3 below), this button opens the program editor with an empty template for constructing a new program. Detailed discussion is provided in the following section. A program from the local computer can also be imported into this empty template.
3. **List Programs:** This is the main display of the program list depicted in the previous figure. Click the **Show/Hide** button (item 1) to hide the submenu and expand the **List Programs** display page.

33.2 Create New Program

A new program can be created via one of the buttons depicted in the following figure.

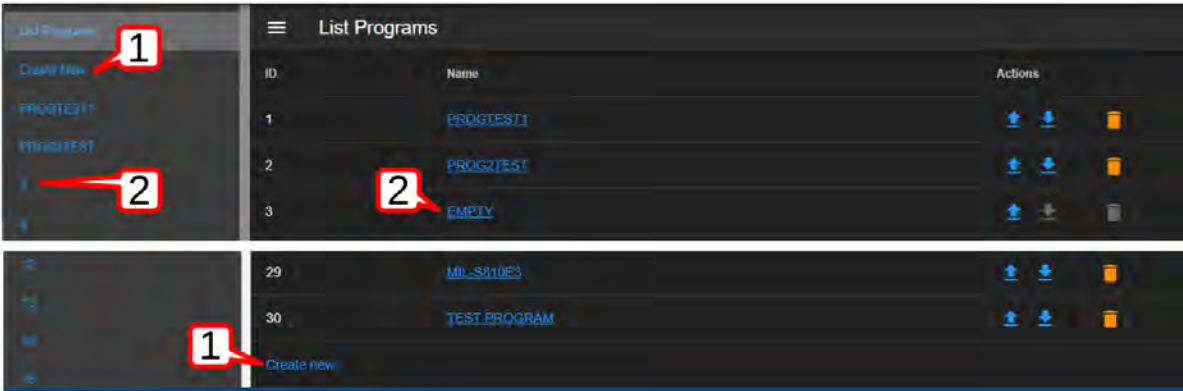


Figure 33.4: Different methods to creating a new program

Each of these buttons follows a different pattern to complete the task.

1. **Create New:** Click the **Create New** button in the submenu or under the **List Programs** in the main display to launch the program editor. An empty template is opened for a new program, as depicted in the following figure.

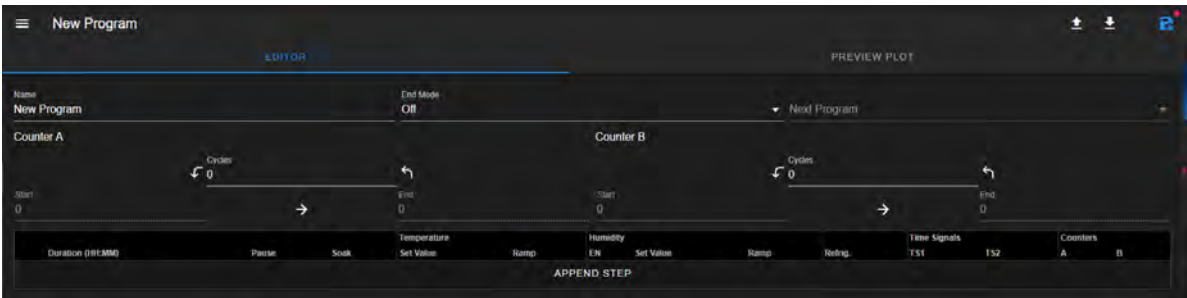


Figure 33.5: Empty template for a new program

The new program being constructed does not yet have a predefined location. For this reason, the program editor has only the **Save As** option to save the program in a specific or a desired slot number, as depicted in the following figure.

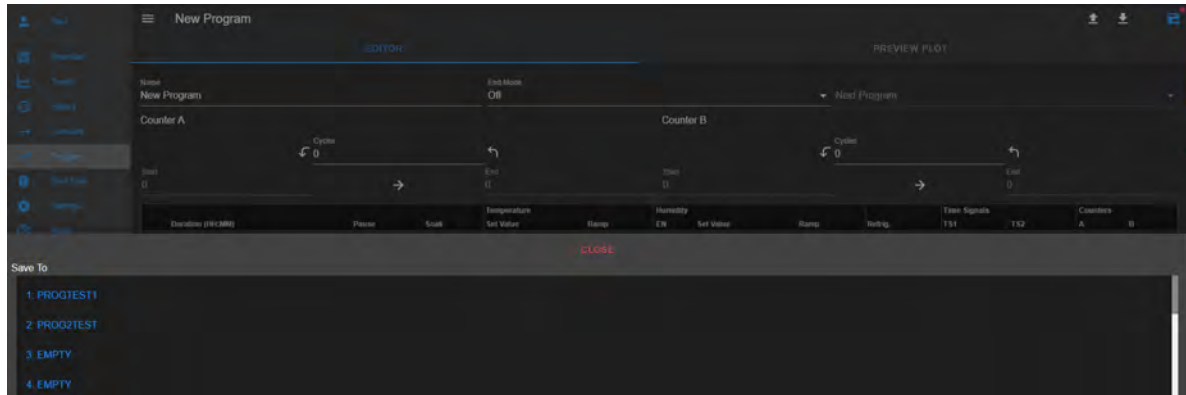


Figure 33.6: Selecting slot # to save new program

2. **EMPTY**: A new program can be created using a specific slot number. Click the slot number in the submenu or the **EMPTY** button on a desired slot number under the **List Programs** in the main display to launch the program editor to create a new program. An empty template is opened for a new program, as depicted in the previous figure.

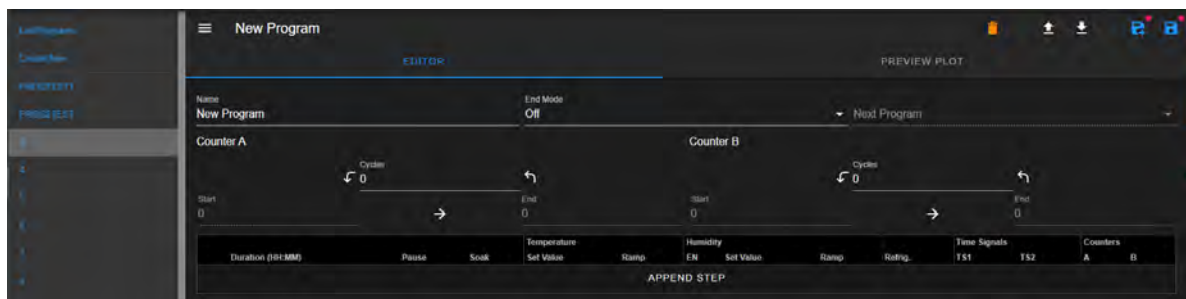


Figure 33.7: Empty template for a new program

Since the slot number has already been defined, the program editor offers two options to save the program: (1) Save As by selecting a new slot number or (2) Save (on the current slot number).

The following figure depicts the general layout of the empty template for a new program. As depicted in the following figure, slot 3 as highlighted under the program list in the submenu will be used to store the program once it is completed and saved.



Figure 33.8: The structure and UI of the Programming Editor

The UI and components of the program editor (pictured above) are numbered and described as follows:

1. **Editor:** By default, a program is open and placed in the program editor. It is highlighted in blue to indicate its active status.
2. **Preview Plot:** The output of the current program can be previewed via this button. Both the **Editor** (item 1 above) and this button can be used to toggle between the editing and previewing mode of the current program. In order to apply the preview mode, the program must be loaded into the program editor first, then click the **PREVIEW PLOT** button.
3. **Submenu Show/Hide:** This button toggles between the show and hide mode of the submenu. To utilize the entire main display area for the program editor, this button can be used to hide the submenu.
4. **Program Name:** An alphanumeric naming convention based on ASCII characters (lower- or upper-case letters) applies to program name containing up to 14 characters. Program name should be kept short and descriptive. When a program name is entered into this field, this name also appears in the title bar next to the show/hide button (item 3).
5. **End Mode:** An end mode available from four different options can be invoked after a program has completed its execution:
 - **Off:** The chamber will be turned off at the end of the program.
 - **Standby:** The chamber will be set to operate in a **Standby** mode at the end of the program.
 - **Constant:** The chamber will be set to operate in a **Constant** mode at the end of the program.
 - **Program:** The chamber will execute the next program listed in Next Program field. In theory, the PLC can continually execute different programs sequentially if each of those programs has its End Mode set to execute the next program on the list.
6. **Next Program:** A program to be executed following the completion of the current program.
7. **Append Step:** As shown in the previous figure, the program editor has an empty template. No instructions or steps of program have been added. To create an instruction, a new step must be created (or added). This APPEND STEP button is used to add a new step. Once a program has a step, additional steps can be added using this button or the

drop-down menu of the Step Number (to be explained below). The APPEND STEP button always adds a new step as the last step in the program. By contrast, the drop-down menu of the Step Number allows a new step to be inserted above or below the current step. It also has a delete button to remove any step from the program.

8. **Step:** A program step contains instructions (and parameters) for the chamber to carry out the tasks. Depending on the type of chamber, a program step may contain different components and parameters (associated with temperature, product temperature, humidity or vibration) outlined as follows:
 - **Duration:** The duration specifies the length of time (measured in H:MM) that the said step goes through to complete its task. The Web Controller accepts the input value in H:MM or in pure numerical value. If a pure numerical value is entered, the Web Controller converts it to H:MM. For instance, if 15 is entered, the system treats it as 15 minutes, and the H:MM format, therefore, becomes 00:15. If 66 is entered, the system converts it to 01:06. Similarly, if 90 is entered, the system renders the value to 1:30.
 - **Pause:** If enabled, the program will pause execution when this step completes its task.
 - **Soak:** If enabled, the step will wait until the set point(s) are reached before the duration counter starts to count down.
 - **Temperature:** The temperature control loop has two parameters:
 - **Set Value:** The value that the temperature must attain.
 - **Ramp:** If enabled, the set point will gradually change from that of the previous step to the set value of this step over the duration of this step. If disabled, the set point of the previous step will jump immediately to the set value of this step.
 - **Product Temperature Control:** This option controls the product temperature (not the air temperature) if the PLC is equipped with it.
 - **EN:** This option enables or disable the production temperature control.
 - **Deviation +:** The allowable positive deviation between the product and air temperatures (must be positive).
 - **Deviation -:** The allowable negative deviation between the product and air temperatures (must be negative).
 - **Humidity:** The humidity control loop setting.
 - **EN:** Enable or disable humidity control for this program step.
 - **Set Value:** The value that the humidity must attain.
 - **Ramp:** If enabled, the set point will gradually change from that of the previous step to the set value of this step over the duration of this step. If disabled, the set point of the previous step will jump immediately to the set value of this step.
 - **Refrig.:** This option offers configuration on the refrigeration system and its behavior during the execution of this step. It can be configured for automatic or manual cooling power percentage; it can be completely disabled.
 - **Time Signals:** Each time signal can be switched to **ON** or **OFF** for this step. Time signal (TS) operation is step dependent. Suppose TS1 is turned **ON** at step 1 and the rest of the steps do not have TS enabled. In this case, TS1 will remain “ON” for the entire program. Thus, TS may be controlled independently, step by step.
 - **Counters:** The counter can be used to repeat execute a specified number of steps within the program. This option allows Both counter A and counter B can be set by enabling the check box in their respective column then dragging the start and end

arrows to the desired step. The number of times to repeat the steps can be adjusted in the text box in each column. When the text box is checked (or selected), the number of the repeating step begins with 1.

9. **Counter A, Counter B:** The counter (or loop) feature allows a certain step (or a range of steps) to be repeated multiple times within the program. With the counter feature, a program contains fewer instructional steps, and thereby requires less coding. Two separate counters are available: **Counter A** and **Counter B**. A program may contain a loop configured to run within a loop, such as Counter A executes inside Counter B. Two loops can be configured to run separately, repeating separate step numbers. For instance, Counter A can be configured to execute step 1 through step 3 for 5 times and Counter B can be configured to execute step 4 through step 6 for 3 times. ESPEC SCP220 PLC supports a maximum number of 99 cycles. Counter A or Counter B each requires three parameters to operate:

- **Start:** A value that specifies the step number to begin the loop.
- **End:** A value that specifies the last step in the loop.
- **Cycles:** A value that specifies the number of loops to complete the counter. The total number of loops is this number plus 1. Thus, if a program requires step 1 through step 3 to repeat three (3) times, the value for the Cycles will be 2.

10. **File Manipulation:** Five different buttons (icons) are available for file manipulation. Their action can be previewed by hovering the mouse pointer over them. They are described from left to right as follows.

- **Delete:** Click on the trash bin icon to delete the current program. This action will delete the program in the program editor and its location in the current slot number of the PLC. A pop-up warning appears, as depicted in the following figure, to reaffirm the action.

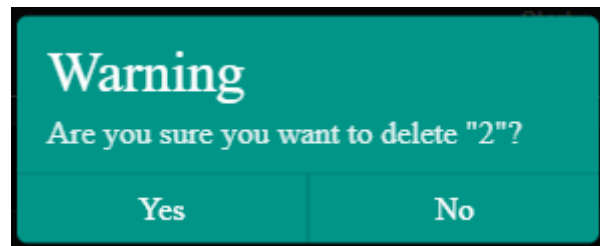


Figure 33.9: File deletion confirmation

- **Open Program:** This button imports a program file from the local computer into the program editor. The Web Controller only accepts a program in JSON format. To ensure compatibility, the program structure should be based on the one downloaded from the Web Controller itself (see **Download Program** below).
- **Download Program:** This button downloads the current program file and stores it on the local computer. The program is saved in JSON format using slot number as its filename (e.g., 9.json).
- **Save As:** Save the current program to a different slot number under the program list. This action brings up a program list, as depicted in the following figure, to select a new slot to hold the current program. To cancel this action, click the **CLOSE** button.

WARNING!: A vacant slot should be selected to save the program. Otherwise, the current program will overwrite the existing one in the slot without prompting for reconfirmation, thus, destroying the program previously in that slot. The current program in a new slot still uses the same program name. To make it unique, edit item 4 (above) with a new name and apply the **Save** button (see below) to resave the program.

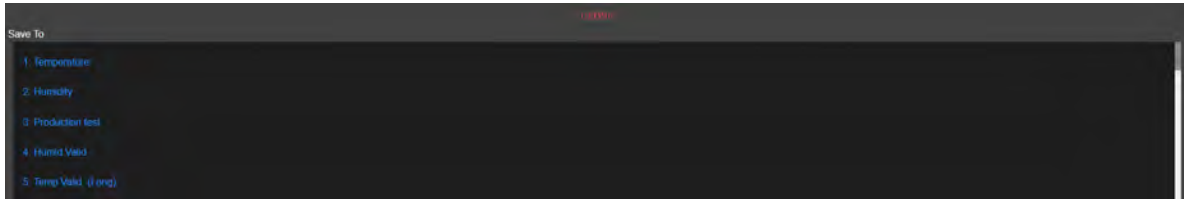


Figure 33.10: Save program to a new slot

- **Save:** This button saves the current program in the current slot on the F4T.

33.2.1 Programming: Add Program Step

The following example illustrates how to create a new program using four steps without the application of Counter A or Counter B. Temperature and humidity are illustrated this example. Time duration for each step is 30 minutes. Refrigeration will be set to auto. Humidity will be enabled for each step and set as 15, 50, 50 and 25, respectively. End mode will be set to Constant. We begin from the main menu.

1. Click **Program** in the side bar.
2. Click **EMPTY** on slot 3 on the Program List. To follow along with this example, slot 3 should be empty.
3. **Program Name:** Enter **PROG3TEST** in the program name field.
4. **End Mode:** Click End Mode field and select Constant from the drop-down list.
5. **Add New Step:** Click the **APPEND STEP** button.
6. **Step 1:** Complete the following fields:
 - **Duration:** Enter 0:30.
 - **Pause:** Leave the Pause box unchecked.
 - **Soak:** Leave the Soak box unchecked.
 - **Temperature:**
 - **Set Value:** Enter -65 or apply the up/down arrow to adjust the value to -65.
 - **Ramp:** Leave the Ramp box unchecked.
 - **Humidity:** Complete the following fields.
 - **EN:** Turn on humidity by checking this box.
 - **Set Value:** Enter 15 or apply the up/down arrow to adjust the value.
 - **Ramp:** Leave the Ramp box unchecked.
 - **Refrig.:** Leave the setting at Auto, by default.
 - **Events:**
 - **TS1:** Check the TS1 box to enable time signal 1.
 - **Counters:** Leave Counters A and B unchecked (skip it).

7. **Step 2:** Click the **APPEND STEP** button to add a new step and complete the following fields:

- **Duration:** Enter 0:30.
- **Pause:** Leave the Pause box unchecked.
- **Soak:** Leave the Soak box unchecked.
- **Temperature:**
 - **Set Value:** Enter 180 or apply the up/down arrow to adjust the value.
 - **Ramp:** Leave the Ramp box unchecked.
- **Humidity:** Complete the following fields.
 - **EN:** Turn on humidity by checking this box.
 - **Set Value:** Enter 50 or apply the up/down arrow to adjust the value.
 - **Ramp:** Leave the Ramp box unchecked.
- **Refrig.:** Leave the setting at Auto, by default.
- **Events:**
 - **TS2:** Check the TS2 box to enable time signal 2.
- **Counters:** Leave Counters A and B unchecked (skip it).

8. **Step 3:** Click number 2 in the circle at the beginning of step 2 (shown in the figure below) and select **Insert After** from the drop-down menu, and edit the fields as follows:

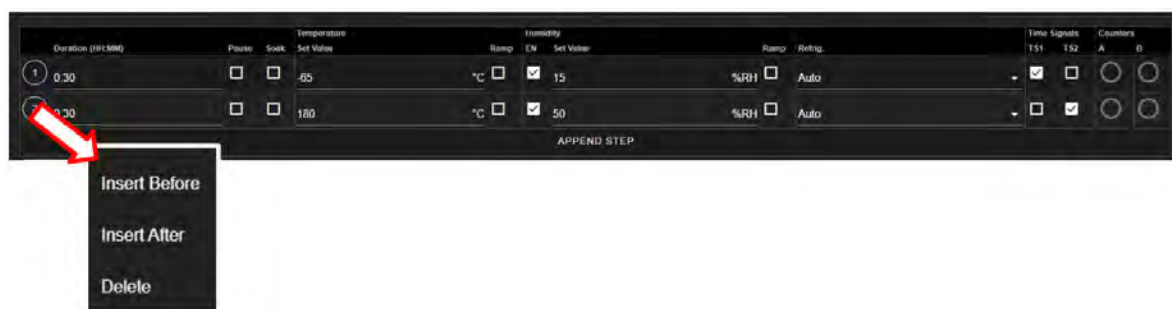


Figure 33.11: Adding a new step via the drop-down menu

- **Duration:** Enter 0:30.
- **Pause:** Leave the Pause box unchecked.
- **Soak:** Leave the Soak box unchecked.
- **Temperature:**
 - **Set Value:** Set the value to -40.
 - **Ramp:** Leave the Ramp box unchecked.
- **Humidity:** Complete the following fields.
 - **EN:** Turn on humidity by checking this box.
 - **Set Value:** Enter 50 or apply the up/down arrow to adjust the value.
 - **Ramp:** Leave the Ramp box unchecked.
- **Refrig.:** Leave the setting at Auto, by default.
- **Events:** Set both **TS1** and **TS2** to on.
- **Counters:** Leave Counters A and B unchecked (skip it).

9. **step 4:** Repeat the previous step to add the final step. The complete program is depicted as follows:



	Duration (H:M:MM)	Pause	Soak	Temperature Set Value	Ramp °C	Humidity EN Set Value	Ramp %RH	Reheat Auto	Time Signals TS1 TS2	Counters A B
1	0:30	<input type="checkbox"/>	<input type="checkbox"/>	-65	<input type="checkbox"/>	<input checked="" type="checkbox"/> 15	<input type="checkbox"/>	Auto	<input checked="" type="checkbox"/> <input type="checkbox"/>	<input type="radio"/> <input type="radio"/>
2	0:30	<input type="checkbox"/>	<input type="checkbox"/>	180	<input type="checkbox"/>	<input checked="" type="checkbox"/> 50	<input type="checkbox"/>	Auto	<input type="checkbox"/> <input checked="" type="checkbox"/>	<input type="radio"/> <input type="radio"/>
3	0:30	<input type="checkbox"/>	<input type="checkbox"/>	-40	<input type="checkbox"/>	<input checked="" type="checkbox"/> 50	<input type="checkbox"/>	Auto	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/>	<input type="radio"/> <input type="radio"/>
4	0:30	<input type="checkbox"/>	<input type="checkbox"/>	150	<input type="checkbox"/>	<input checked="" type="checkbox"/> 25	<input type="checkbox"/>	Auto	<input type="checkbox"/> <input type="checkbox"/>	<input type="radio"/> <input type="radio"/>
APPEND STEP										

Figure 33.12: example-add-step-002.PNG

10. **Save Program:** Click the **Save** icon indicated by the arrow, as shown in the following figure, to save the program. This figure also illustrates the complete program in the program template.

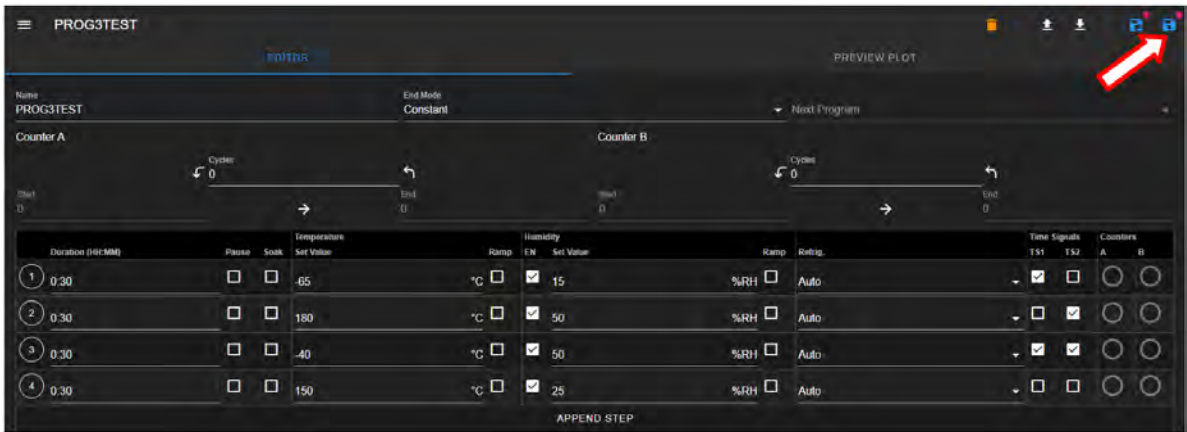


Figure 33.13: Save current program

Navigating out of the editor without saving the program will trigger the following warning prompt:

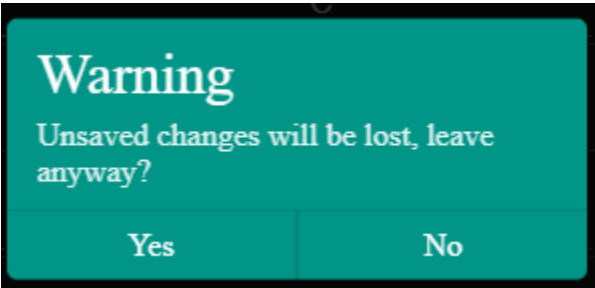


Figure 33.14: Confirm the save or discard update

11. **Preview:** The above program can be previewed before execution by clicking on the **Preview Plot** button as depicted in the following figure. To toggle back to the editor mode, click on **EDITOR**.



Figure 33.15: Program in preview mode

Note: Program cannot be saved while in the **Preview Plot** mode. In order to save the program, navigate back to the program editor and click **Save** or **Save As**.

33.3 View, Edit, Save Program

This section describes how to open an existing program for viewing and editing. Changes made in the program can be written back to the file with **Save**. A new slot can be used for this updated program using the **Save As** option.

33.3.1 Open Program

To open a program for viewing or editing, click on its name under the Name list, as depicted in the following figure. Program **PROG3TEST** (indicated by the arrow) will be used for illustration. The **Download** and **Delete** buttons are grayed out (unavailable) for an empty slot under the Name list.



Figure 33.16: Opening a program profile

Once open, the program is placed in the program editor for editing. The file manipulation buttons (**Delete**, **Open Program**, **Download Program**, **Save As** and **Save**) offer different options to handle the program file or manipulate the program editor. These buttons will be explained in detail in the following sections.

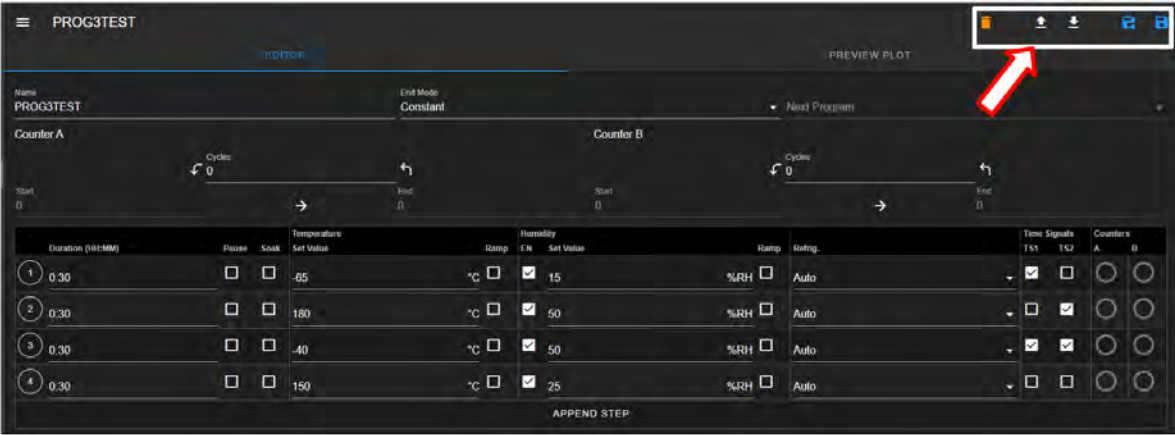


Figure 33.17: File manipulation buttons

33.3.2 Editing Program: Programming Example

This section illustrates the process of editing **PROG3TEST** program to include an application of loops with Counter A and Counter B and the ability to execute another program. The program to be executed after **PROG3TEST** has completed its own execution is **PROGTEST1** in slot 1, as depicted in the previous figure. This program has two steps but makes use of Counter A. **PROG3TEST** will consist of the following procedure:

1. **End Mode:** Set end mode to execute a new program.
2. **Next Program:** Set next program to be executed selected from slot 1.
3. **Loops:** Invoke Counter A to repeat step 2 through step 3 and cycle through twice. Invoke Counter B to repeat step 1 through step 4 and cycle through twice. Counter A loop will be executed inside Counter B.

The editing process is as follows:

1. **End Mode/Next Program:** Click the End Mode field and select Program from the drop-down list (see figure below), then click the Next Program field and select the program from the drop-down list (**PROGTEST1** in slot 1 is used for example).

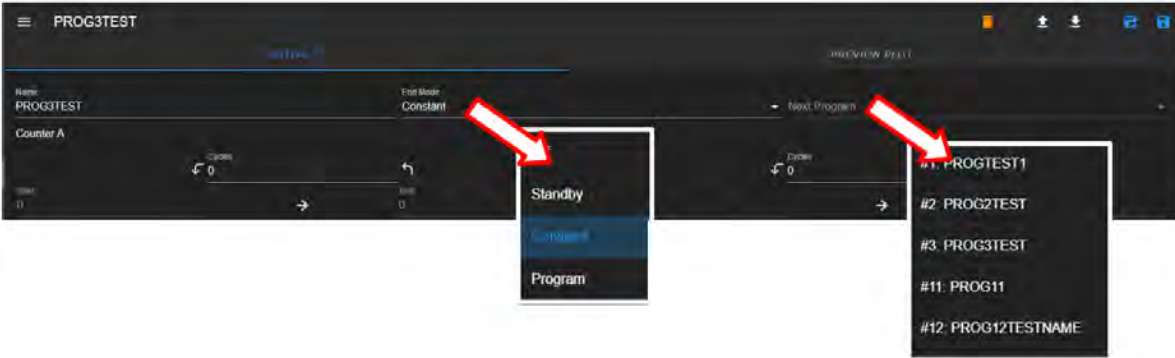


Figure 33.18: Select program to execute next

2. **Counter A:** Set Counter A loop as follows:

- **Cycles:** Enter 2 in the Cycles field or apply the up/down arrow to set the value.
- **End:** Click the up arrow to adjust the value to 3.
- **Start:** Click the up arrow to set the value to 2. Note: If a value is entered into the Start field before entering a value in the End, an error message may flag until the end step is entered.

3. **Counter B:** Set Counter B loop as follows:

- **Cycles:** Enter 1 in the Cycles field or apply the up/down arrow to set the value.
- **End:** Click the up arrow to adjust the value to 4.
- **Start:** Click the up arrow to set the value to 1. Note: If a value is entered into the Start field before entering a value in the End, an error message may flag until the end step is entered.

The complete program is illustrated as follows:

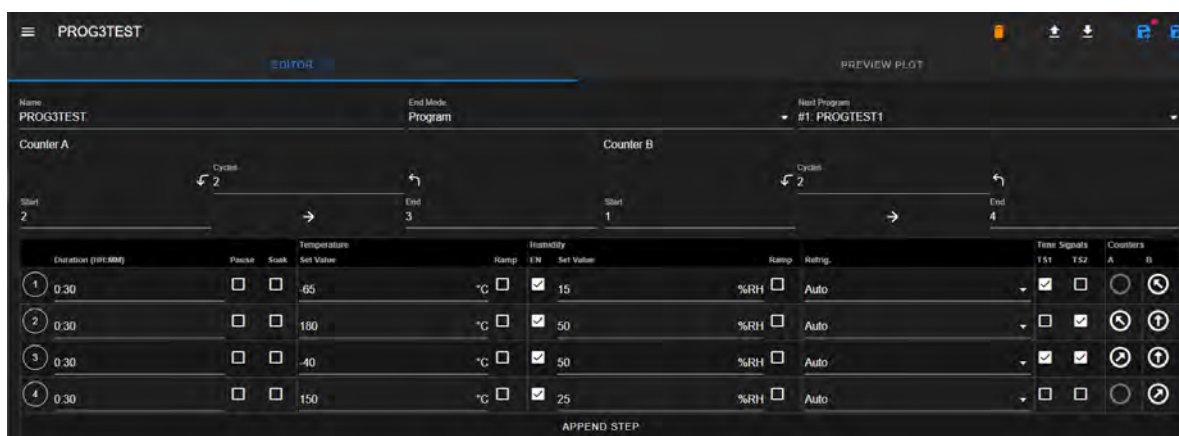


Figure 33.19: Modified program

4. **Save Program:** The new program can be saved back in its current slot with the **Save** button. However, other options are available to manipulate the program file. It may be necessary to save it in a different slot so that the original program can be retained in the current slot. The following section describes how to utilize the file manipulation buttons in detail.

33.3.3 Managing Program File via the Program Editor

This section describes how to apply the five file manipulation options available in the program editor (upper-right corner), as depicted in the following figure.

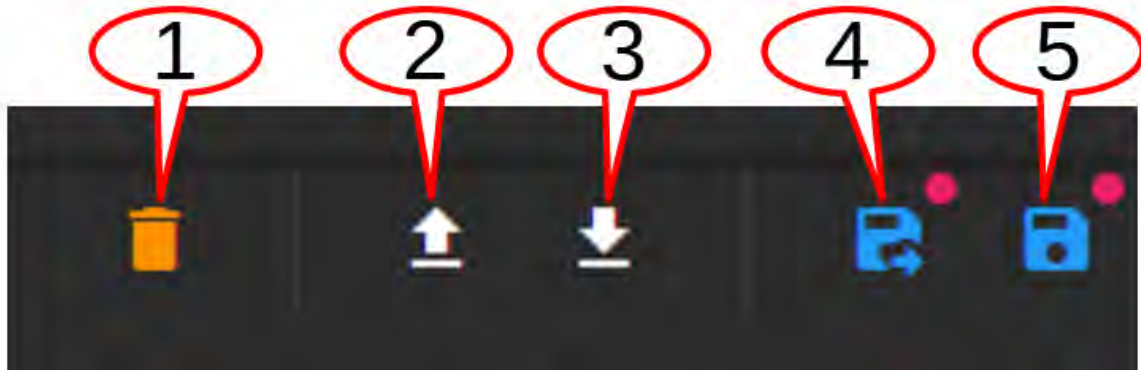


Figure 33.20: File manipulation options

They are described as follows:

1. **Delete:** The trash bin icon, when applied, deletes the current program in the program editor; that program is purged from the current slot in the PLC register, with the **EMPTY** listed under the ID list. For safety measure, the system prompts a pop-up warning with a Yes/No option. After deletion, the Program menu updates the Name list.
2. **Upload Program:** This button imports a program file from the local computer into the program editor. By default, the system opens the Downloads folder on the local computer to upload the program file.
3. **Download Program:** The current program in the program editor can be downloaded onto the local computer as a backup. By default, the program will be stored in the Downloads folder. The hostname and program slot number are used as part of the downloaded filename (e.g., hostname_program_2.json).
4. **Save As:** Program in the program editor can be saved in a different slot, under a different name. To make the program name unique, the Name field may be edited with a new program name. This procedure thus requires a two-step process indicated by the arrows in the following figure. First, edit the program name; second, click the **Save** button and select a new slot from the drop-down list.

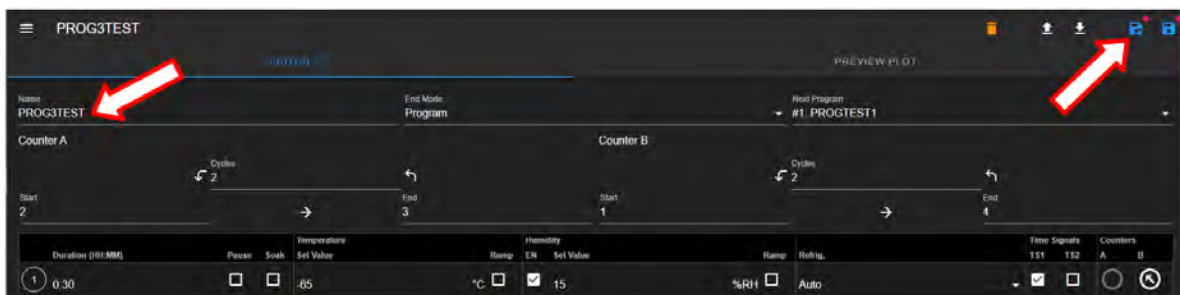


Figure 33.21: Save current program as a new file

5. **Save:** Apply this button to update the program file. To help check the editing status of the program, the program editor utilizes a red dot placed above the **Save** or **Save As** button to indicate an update yet to be saved.

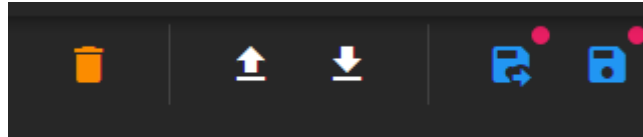


Figure 33.22: Update indicator

Navigating out of the editor without saving the update will trigger a warning prompt, as depicted in the following figure.

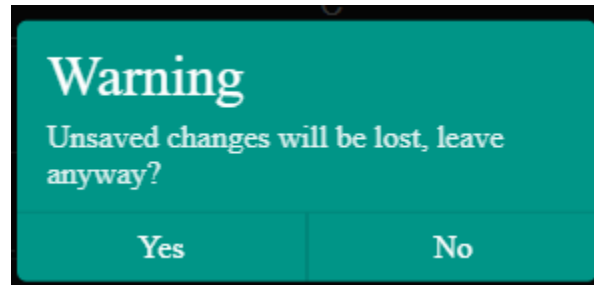


Figure 33.23: Confirm the save or discard update

33.3.4 Managing Program File via the Name List

This section describes how to apply the three file manipulation options on the Name list, as depicted in the following figure.

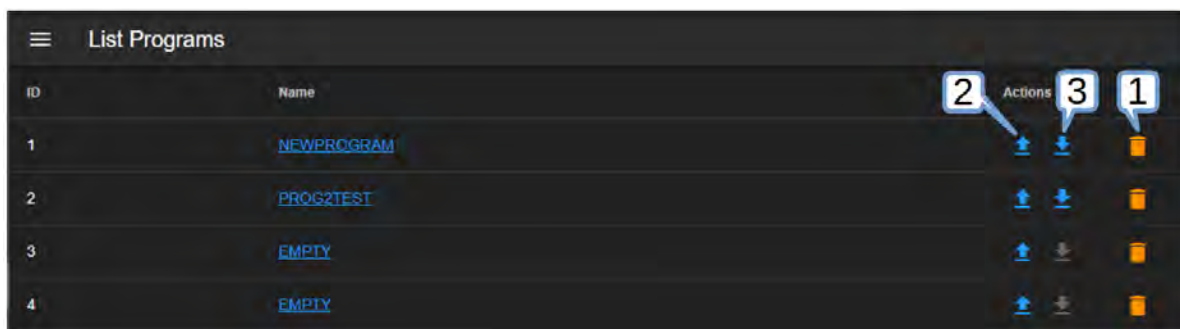


Figure 33.24: Manage programs on the Name list

These three options are listed and described as follows:

1. **Delete:** To delete **PROG2TEST** from the Name list (and the PLC register), click the trash bin icon indicated by the arrow (see figure below). As a safety measure, the system will prompt to confirm the action with a pop-up warning with a Yes/No option to proceed with the action. It may be necessary to apply the refresh button of the Web browser after deleting the program file from the Name list.

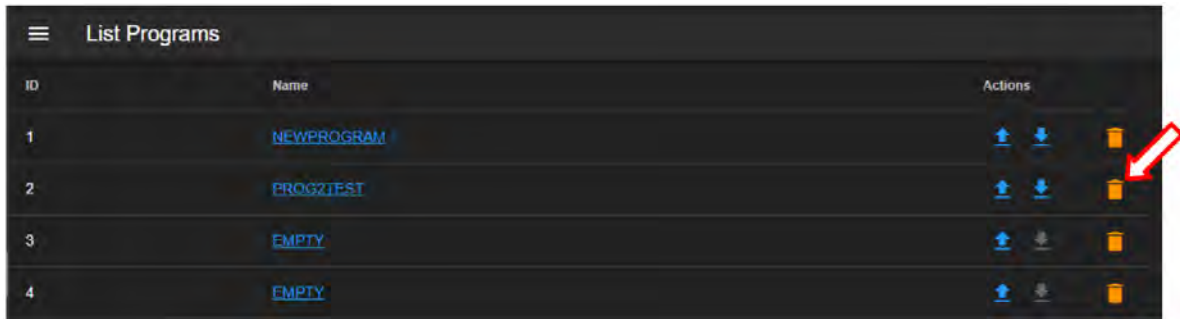


Figure 33.25: Deleting program from the Name list

2. **Upload Program:** This button can be used to import a program from the local computer directly into a program slot on the Name list and the PLC register. To upload a program into slot 3, click on the **Upload** button, as indicated by the arrow in the figure. Navigate to locate the desired file on the local computer and double-click it to complete the process.



Figure 33.26: Importing a program

3. **Download Program:** To download a program **PROG2TEST** on slot 2, click on the **Download** button (on the same row). By default, the program file will be stored in the **Downloads** folder on the local computer; filename naming convention is host-name_program2_.json.

CHAPTER 34

Start Stop

This menu allows the operator with read-write privilege to control or manage the chamber with the following operation modes: **Standby**, **Constant** and **Program**. The following figure depicts these modes displayed in the main display area as individual tabs.

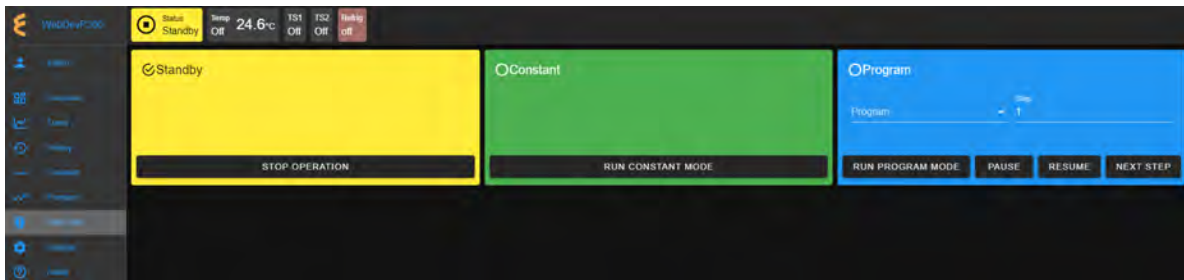


Figure 34.1: The Start/Stop menu with a Status Bar

The **Status** tab in the status bar also provides access to these modes for control and operation. Refer to Sections 4.1 through 4.5 for detail on how to control the chamber operating modes.

34.1 Standby Mode

In a standby mode, the chamber is off. Its status tab in the status bar displays **Standby**. This status is confirmed by the check mark in the Standby tab in the main display, as illustrated in the above figure. Authorized users with read-write privilege may set the chamber to operate in **Standby** mode.

34.1.1 Start/Stop Standby Mode

A standby mode can be switched from constant or program mode as follows:

1. Click the **StartStop** menu.
2. Click the **STOP OPERATION** button in the **Standby** tab.

ESPEC Web Controller immediately moves to apply the operating mode on the chamber, with a check mark in the Standby tab. Standby is also displayed in the Status tab of the status bar, as illustrated in the above figure. To terminate the **Standby** mode, activation of a new mode is necessary.

34.2 Constant Mode

In a constant mode, the chamber operates using the constant configuration. Authorized users with read-write privilege may set the chamber to operate in **Constant** mode.

34.2.1 Start/Stop Constant Mode

A constant mode can be switched from a standby or program mode as follows:

1. Click the **StartStop** menu.
2. Click the **RUN CONSTANT MODE** button in the **Standby** tab.

Its status tab displays **Constant**. This status is confirmed by the check mark in the **Constant** tab, as depicted in the following figure.

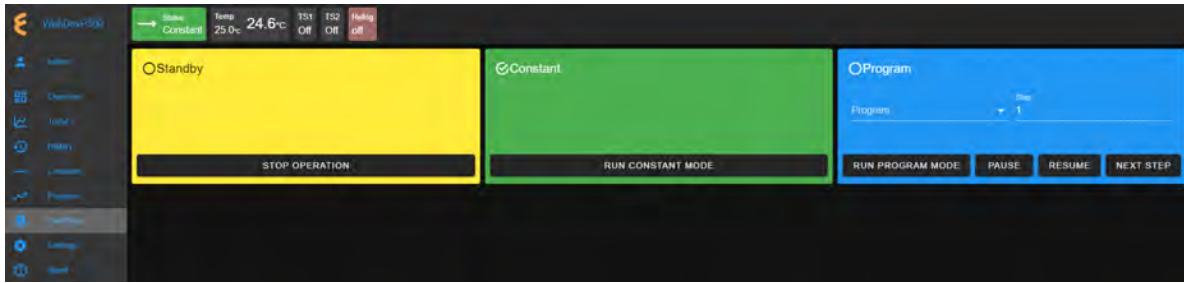


Figure 34.2: The Start/Stop menu with chamber in Constant mode

To terminate the **CONSTANT** mode, activation of a new mode is necessary. For instance, to switch the chamber from its **Constant** mode to **Standby** mode, click the **STOP OPERATION** button in the **Standby** tab. ESPEC Web Controller immediately moves to apply the operating mode to the chamber.

34.3 Program Mode

In a program mode, the chamber carries out instructions of the program being executed. The status tab in the status bar posts **Program**, along with the name of the program being executed. This status is confirmed by the check mark in the Program tab, as depicted in the following figure.

Authorized users with read-write privilege may set the chamber to operate in **Program** mode by performing a series of operations in the **Program** tab. The following subsections explain how to run (execute) a program, pause, resume or step through the instructional steps in the program.

34.3.1 Run Program

A program mode can be switched from standby or constant. To load and execute a program to control the chamber, complete the following steps:

1. Click the **StartStop** menu.
2. Click the radio button in the **Program** tab to select a program from the list (scroll down, if necessary), as depicted in the following figure.

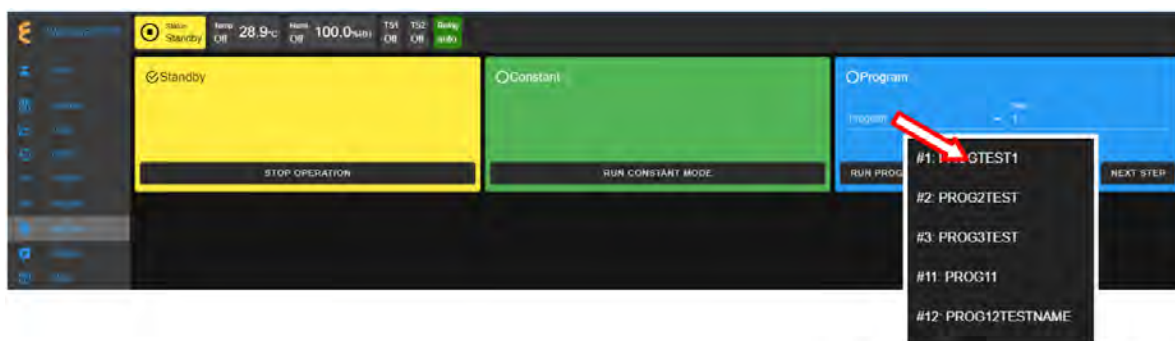


Figure 34.3: Executing a program from the Program List

3. Click to select the desired program name.
4. To start this program at a certain step, enter the step number in the **Step** field. Default setting is 0, which means to start program at step 1.
5. Click the **RUN PROGRAM** button to execute the program. ESPEC Web Controller immediately moves to apply the operating mode to the chamber. The status tab and status bar now display the program being executed, as depicted in the following figure.

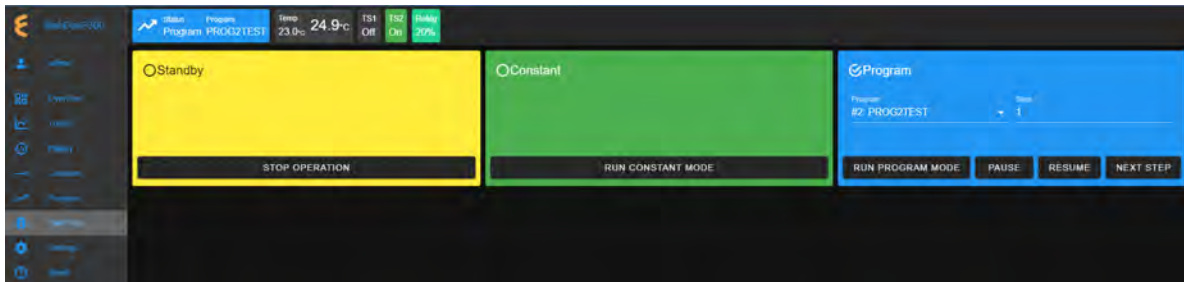


Figure 34.4: The Start/Stop menu with chamber in Program mode

The **Overview** page maybe accessed to display the detail of the program being executed.

34.3.2 Pause/Resume Program

Authorized users with read-write privilege may control the chamber during program execution. **Program** mode may be interrupted and put in a “suspense mode” using the **PAUSE** button in the **Program** tab. To pause a program during execution, click the **PAUSE** button; all operations are suspended. An update notification appears in the lower-right corner. The **Paused** notification is posted in the status tab.

To resume the operation and continue program execution, click the **RESUME** button. An update notification appears in the lower-right corner. The chamber will continue to operate based on instructions in the program. Program name is posted in the status tab to indicate chamber is in **Program** mode and that program is being executed.

34.3.3 Stepping through Program

Without having to wait for each step in the program to complete its tasks for the entire duration in the instruction, an operator may step through the program to study the effects of the instructions in a certain step. While the program is being executed, click the **NEXT STEP** button to execute the next step in the program. This action may be repeated until the last step in the program is reached. The **Overview** page in combination with the extended tab maybe accessed to display the detail of the program being executed and its steps being stepped through. The following figure depicts program **TempVib1** being stepped through to executing step 4.

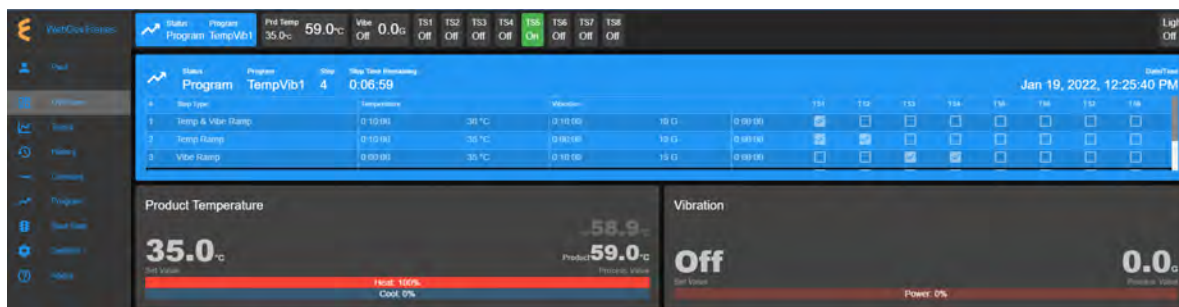


Figure 34.5: Stepping through a program

34.4 Alarm Mode

An alarm mode is not an operation mode controllable by the **StartStop** menu as the previous three modes. An alarm mode occurs when the chamber is in an alarm state. As indicated in Section 4.4, when ESPEC Web Controller detects the chamber in an alarm state, it sets itself in an alert state by displaying a list of active alarms and fault names in the red window to require an immediate action from the operator, as depicted in the following figure.



Figure 34.6: Chamber in alarm state

A repeating beep on the local computer is tripped to get the operator's attention. The **SILENCE** button can be used to turn off the beep. The **CLOSE** or X buttons can be used to close this window. However, the alarm state still remains to be resolved as indicated by the red **Status** tab in the status bar (shown in the following figure). To redisplay or expand the alarm list, click the red dot in the lower-right corner.

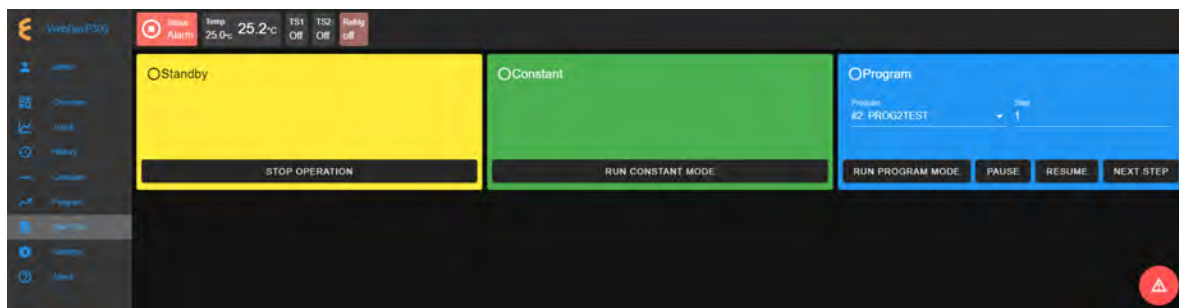


Figure 34.7: Alarm state during constant or program mode

34.4.1 Clear Alarms

The chamber is set in the **Alarm** state as a result of an alarm or alarms triggered in and by the chamber. ESPEC Web Controller relays all alert messages to the operator for immediate action or intervention to prevent further damage to the chamber or any test products inside the chamber.

In an alarm state, all operations are halted until all alarms triggered by chamber are resolved by clearing all alarms via the PLC's HMI (see the chamber and PLC operation manual for detail). When all alarms are cleared, the Web Controller will automatically clear all alert messages and resume normal operation by switching the chamber to a **Standby** mode.

Part VII

Settings Menu

CHAPTER 35

Settings

The **Settings** menu in the menu bar is the administration page of ESPEC Web Controller where different settings and configurations can be applied to the Web Controller and the chamber. The administrator who manages this Web Controller should take the necessary precautions to limit or allow users with certain privileges to access and control this menu and its submenus. Refer to **User Settings** submenu in the following for detail on how to enforce user policy and access privileges to different users on this Web Controller.

The **Settings** menu has thirteen (13) different submenus listed in the submenu bar, each with its own link to its page. To access each submenu, click **Settings** in the menu bar to bring up the submenu bar. When the **Settings** menu is accessed for the first time, it displays its submenu bar underneath the **Show/Hide** button, as depicted in the following figure.

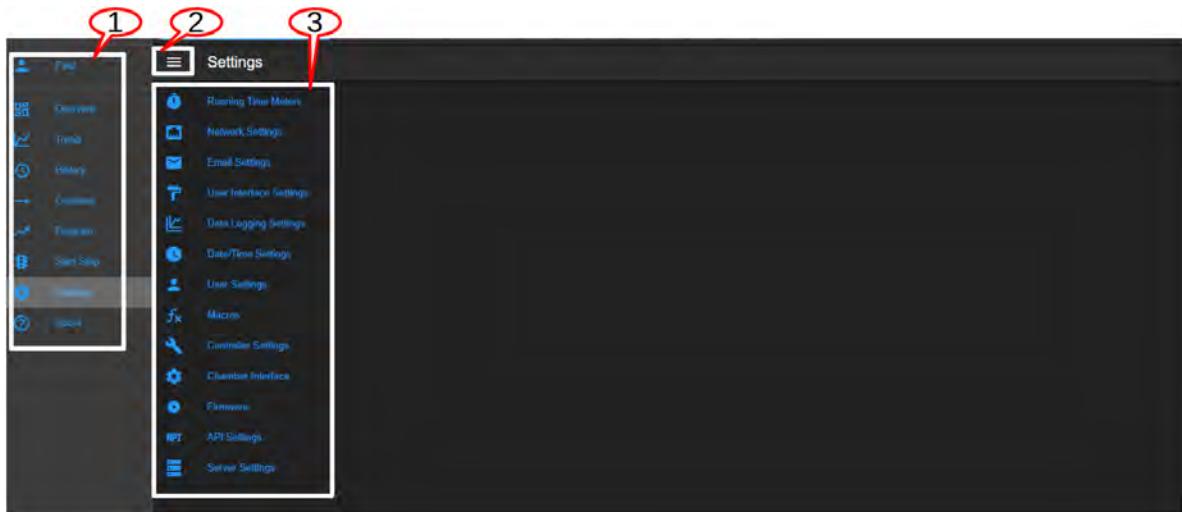


Figure 35.1: The Settings menu and its submenus

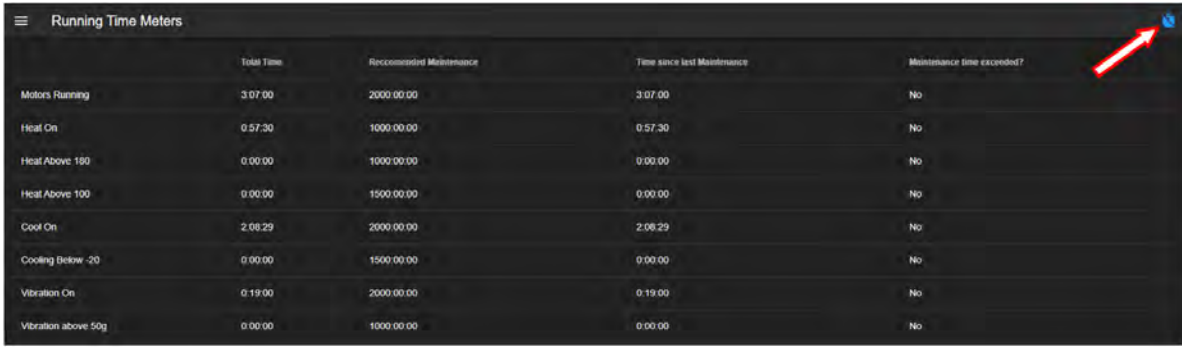
The items associated with the UI of the **Settings** menu are described as follows:

1. **Settings:** This **Settings** menu in the menu bar should be accessible to only the system administrator or a qualified operator with administrator's privileges.
2. **Show/Hide:** This is the **Show/Hide** button for the submenu bar. This feature allows the submenu page to be displayed in a larger real estate when the submenu bar is hidden. As depicted in the above figure, other submenus can be accessed only when the submenu bar is unhidden. Thus, this button can be used to toggle between full display and submenus accessibility.
3. **Submenu Bar:** Click the submenu name or its icon to access and display its page.

The following subsections will be devoted to discuss each of these submenus.

35.1 Running Time Meters

Available only for the T-series chambers, the **Running Time Meters** page provides a list of the operating condition of the hardware components or devices installed inside the chamber. The following figure depicts the **Running Time Meters** submenu with the submenu bar hidden by applying the **Show/Hide** button (item 2 in the previous figure).



	Total Time	Recommended Maintenance	Time since last Maintenance	Maintenance time exceeded?
Motors Running	3:07:00	2000:00:00	3:07:00	No
Heat On	0:57:30	1000:00:00	0:57:30	No
Heat Above 190	0:00:00	1000:00:00	0:00:00	No
Heat Above 100	0:00:00	1500:00:00	0:00:00	No
Cool On	2:08:29	2000:00:00	2:08:29	No
Cooling Below -20	0:00:00	1500:00:00	0:00:00	No
Vibration On	0:19:00	2000:00:00	0:19:00	No
Vibration above 50g	0:00:00	1000:00:00	0:00:00	No

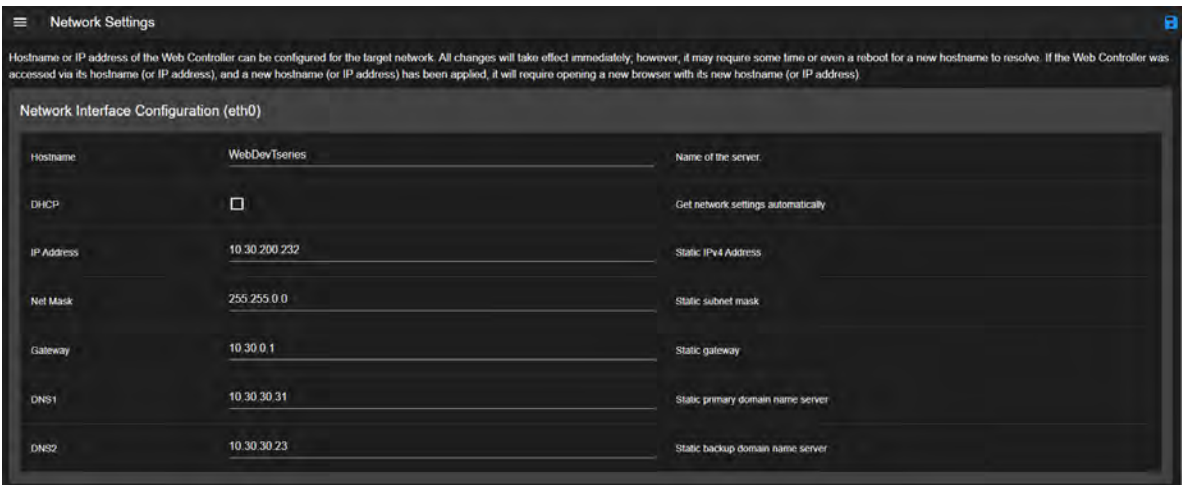
Figure 35.2: The running time meters of hardware devices in the chamber

By analogy, the list shows the odometer of all the devices. It shows how long each device has been in operation (i.e., running) listed under the **Total Time** column. It shows the recommended maintenance when each device has reached its recommended total runtime. It also shows the history of maintenance or service on each device, as well as its past due maintenance interval. Such information serves to provide the life expectancy of each device.

To reset the total runtime for each device after service or maintenance, click the **Reset** button in the upper-right corner indicated by the arrow.

35.2 Network Settings

The **Network Settings** page allows the operator (i.e., administrator) to manage the network settings. As depicted in the following figure, the **Network Settings** page shows the network settings of the Web Controller, its hostname and the type of network configuration it uses. By default, the Web Controller applies DHCP for its network configuration, with a dynamic IP address assigned by the DHCP server. As depicted in the following figure, it has been configured to use a static network protocol, which can be verified by the unchecked box of DHCP.



Hostname or IP address of the Web Controller can be configured for the target network. All changes will take effect immediately, however, it may require some time or even a reboot for a new hostname to resolve. If the Web Controller was accessed via its hostname (or IP address), and a new hostname (or IP address) has been applied, it will require opening a new browser with its new hostname (or IP address).

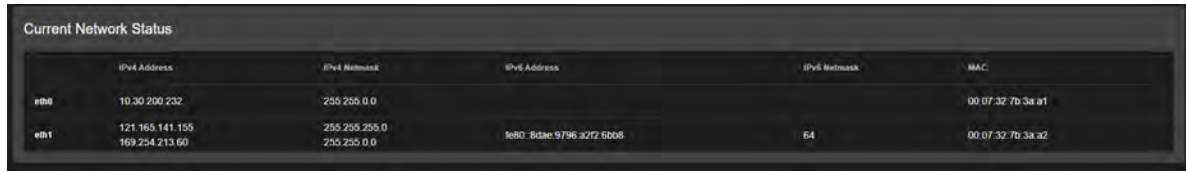
Network Interface Configuration (eth0)

Hostname	WebDevSeries	Name of the server.
DHCP	<input type="checkbox"/>	Get network settings automatically
IP Address	10.30.200.232	Static IPv4 Address
Net Mask	255.255.0.0	Static subnet mask
Gateway	10.30.0.1	Static gateway
DNS1	10.30.30.31	Static primary domain name server
DNS2	10.30.30.23	Static backup domain name server

Figure 35.3: The network configuration page

The Web Controller hardware has two Ethernet ports designated as **eth0** and **eth1**. Each of

them has its unique function. **eth0** is used to join the main network, while **eth1** is reserved for internal networking, such as communication with the Allen Bradley or Watlow F4T PLC.



	IPv4 Address	IPv4 Netmask	IPv6 Address	IPv6 Netmask	MAC
eth0	10.30.200.232	255.255.0.0			00:07:32:7b:3a:a1
eth1	121.165.141.155 169.254.213.60	255.255.255.0 255.255.0.0	fe80::83ae:9796:a2f2:6b08	64	00:07:32:7b:3a:a2

Figure 35.4: Network setting on the Web Controller hardware

The following subsections outline the procedure to set a new hostname or IP address.

35.2.1 Set Hostname

A unique and descriptive hostname for the Web Controller may be configured by editing the **Hostname** field. Complete the following steps to set a new hostname:

1. Click **Hostname** field.
2. Delete the existing hostname.
3. Enter a desired hostname (using alphanumeric).
4. Click the **Save** button as shown in the following figure.

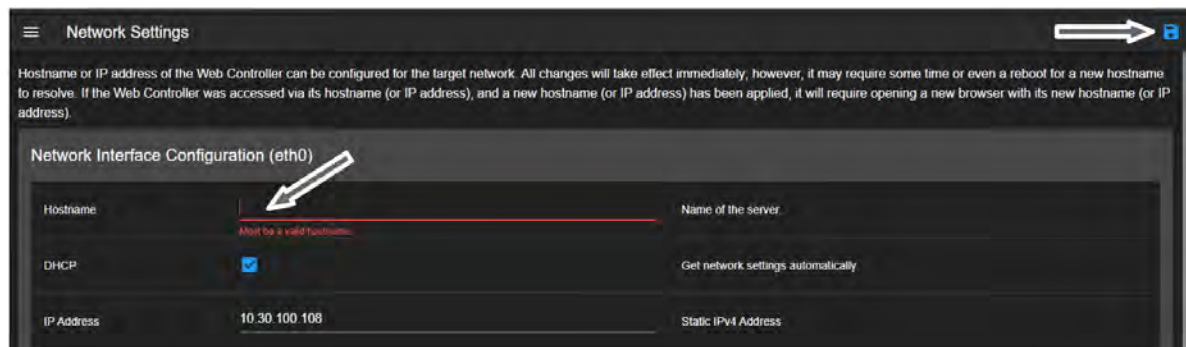


Figure 35.5: Changing a hostname on the Web Controller

The setting will take effect immediately after the **Save** button is applied. It will then try to resolve and refresh the Web page. However, if ESPEC Web Controller was accessed via its now old hostname, it may not be able to resolve and refresh the Web page, if the **Server is Offline** message took more than several minutes, as depicted in the following figure. A new Web browser (or tab) needs to be open to access ESPEC Web Controller via its new hostname.

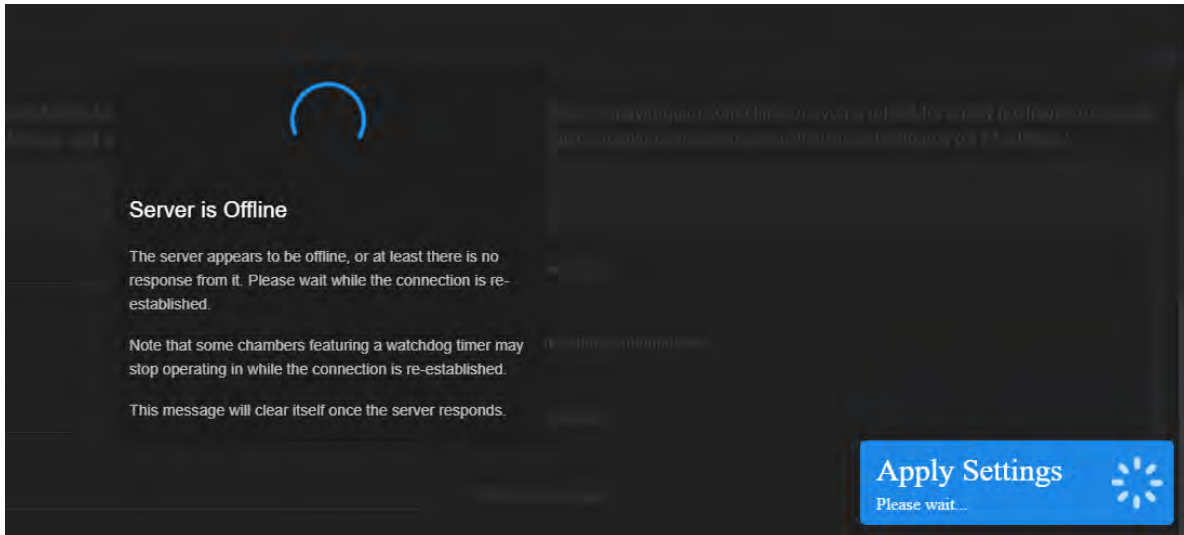


Figure 35.6: Apply static network setting

35.2.2 Set Static Network

A static network configuration can be accomplished by unchecking the DHCP box and entering a desired IP address and its static protocol settings, which includes the appropriate Subnet Mask (or Net Mask), Gateway and DNS values specific to the Network Class (such as, Class A, B or C).

1. Uncheck the DHCP box.
2. Enter a desired IP address.
3. Enter the appropriate Net Mask.
4. Enter the appropriate Gateway.
5. Enter the appropriate DNS1 and DNS2.
6. Click **Save** to apply the setting.

ESPEC Web Controller will validate the new network configuration for the correct format and class type before it applies the settings to take effect. If successful, ESPEC Web Controller applies the settings immediately, as depicted in the above figure. It will then try to resolve and refresh the Web page.

If ESPEC Web Controller was accessed via its now old IP address, it may not be able to resolve and refresh the Web page, if the **Server is Offline** message took more than several minutes. A new Web browser (or tab) needs to be open to access ESPEC Web Controller via its new IP address.

35.2.3 Set DHCP Network

If the Web Controller has been configured to use a static IP address, to revert it back to DHCP, enable the DHCP box with a check mark and click the **Save** button. The system moves immediately to apply the setting. The **Server is Offline** message appears while the Web Controller tries to resolve and refresh its Web page. If the **Server is Offline** message took more than several minutes, a new Web browser (or tab) needs to be open to access ESPEC Web Controller via its hostname.

35.3 Email Settings

The **Email Settings** submenu provides a few practical features. It includes setting email encryption, password authentication, administrator's account recovery and alert via email about the operating condition(s) of the chamber. By default, the mail server is configured without a password authentication or encryption.

The screenshot shows the 'Email Settings' page with the following fields and options:

- Host:** smtp.office365.com (Host name or IP address of the mail server)
- Port:** 587 (TCP port used by the mail server)
- Send As:** chamber_controller@espec.com (The sender of the email. In many cases this must match User)
- Require Authentication:** ☒ (A username/password must be used to send the email)
- Require SSL/TLS:** ☐ (The mail server connection must be started with encryption)
- User:** chamber_controller@espec.com (The username used for authenticating with the mail server)
- Password:** (The password used for authenticating with the mail server)
- Account Recovery E-Mail:** (This email is to reset the admin account when it is misconfigured or the password is forgotten)
- Recipients:** (The users the email will be sent too. One address per line)

Figure 35.7: Options of e-mail settings page

35.3.1 Mail Server Encryption and Password Authentication

To set up the mail server connection with encryption, place a check mark in the **Require SSL/TLS** box and apply the **Save** button (in the upper-right corner). To set up a password authentication for the mail server, enter the password in the **Password** field and apply the **Save** button (in the upper-right corner).

This screenshot highlights the configuration steps for encryption and password authentication. Arrows point to the **Require SSL/TLS** checkbox, the **Password** field, and the **Save** button in the top right corner.

Figure 35.8: Configure encryption and password authentication

35.3.2 Account Recovery Email

To set up the administrator's account recovery, enter the e-mail address in the **Account Recovery E-Mail** field and apply the **Save** button (in the upper-right corner). A one-time password will be sent to this e-mail address to recover the administrator's account.

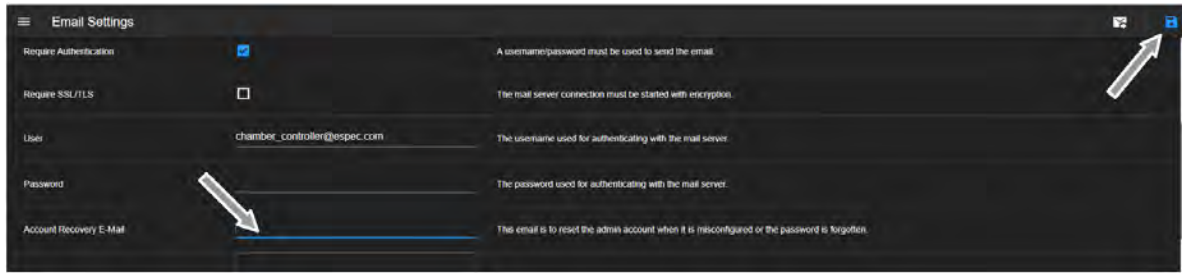


Figure 35.9: Configure administrator's account recovery

35.3.3 Setting Email Alert

To set up e-mail alert to receive notification of the operating conditions of the chamber, complete the following steps:

1. Enter the recipient's e-mail address in the **Recipients** box (indicated by the arrow). If multiple e-mails are required, enter one e-mail address per line in the recipient's box.
2. To test an e-mail notification, click the **Test Email** button in the upper-right corner (as shown in the following figure). **Note:** The Web Controller uses SMTP Office 365 for the e-mail protocol. Therefore, the Web Controller must have access the Internet in order for the e-mail notification to operate.

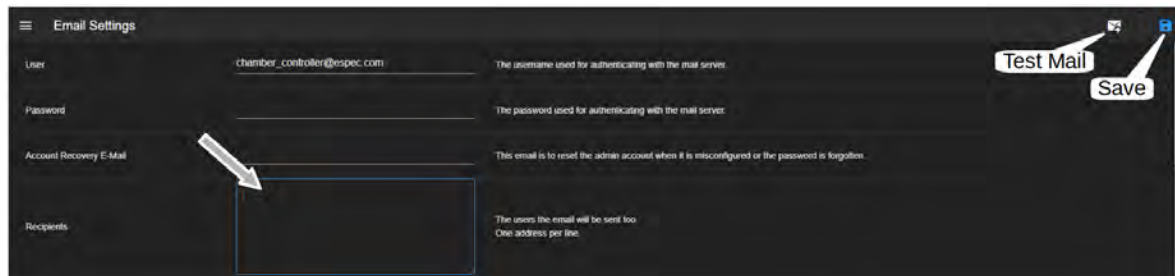


Figure 35.10: Setting up email alert for single or multiple recipients

3. To save the settings, click the **Save** button in the upper-right corner (as shown in the above figure).

35.4 User Interface Settings

ESPEC Web Controller, version 3.0, is very customizable. Its UI can be configured or personalized to suite the operator's preferences with features and color decorations. The following figure depicts the UI and its current setting that displays a list of the operating mode, its name and color in the top pane, input/output display setting in the bottom pane. As shown in the figure, the current operating mode is **Program** as depicted in the **Status** tab with the color based on the one defined on the Operating Status Display Settings list. The input/output **TS1** signal displayed in the **Status** bar is also based on the color defined on the list in the bottom pane.

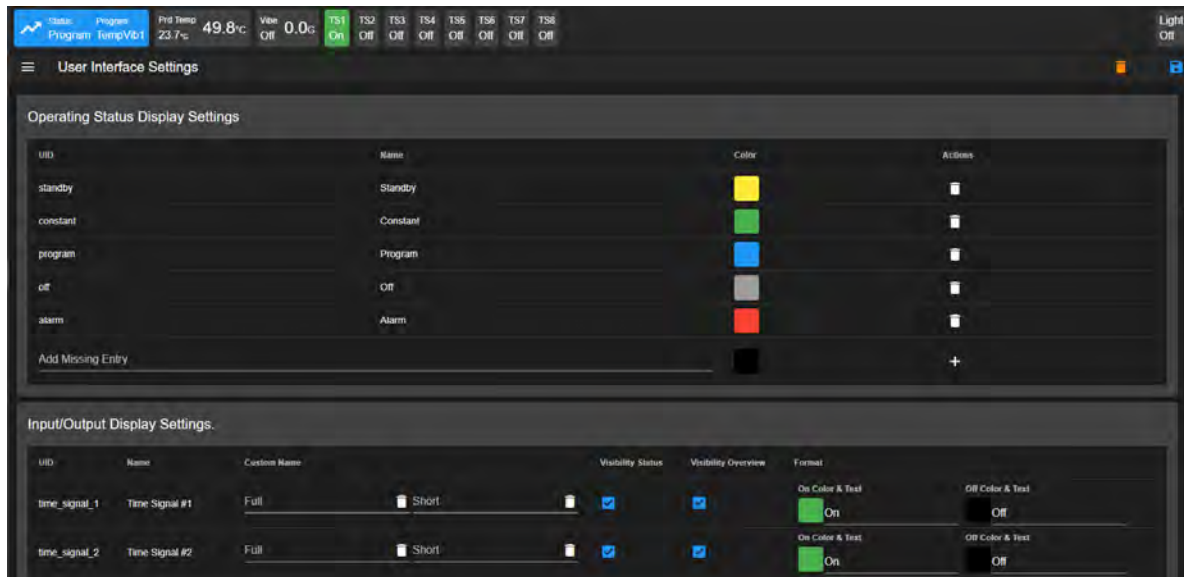


Figure 35.11: Customizable UI

The **User Interface Settings** submenu allows the operator to manage the operating status color as well as input/output text description. As depicted in the following figure, the operator can adjust a different display color for the operating status, or remove it completely using the trash bin icon under the **Actions** list (last column). Any operating status color not defined on the list, the system will apply a default color setting (forest green).

35.4.1 Managing Operating Status

To add and define a color for a specific operating status, complete the following steps:

1. Click the **Add Missing Entry** field and enter ID name under the UID list (first column).
2. Click the color icon (under the Color list) to pick and select a desired color.
3. Click the + button under the **Actions** list.
4. To cancel the current setting, click the trash bin (**Restore Defaults**) indicated by the arrow in the upper-right corner. This action will revert the operating status colors to their default settings.
5. To apply the current setting, click the **Save** button in the upper-right corner.
6. Repeat the process for a different UI and apply the **Save** button again.

To define a new color for a specific operating status, complete the following steps:

1. Click the color icon for a desired operating status name and select a desired color.
2. To cancel the current setting, click the trash bin (**Restore Defaults**) indicated by the arrow in the upper-right corner. This action will revert the operating status colors to their default settings.
3. To apply the current setting, click the **Save** button in the upper-right corner.
4. Repeat the process for a different UI and apply the **Save** button again.



Figure 35.12: Personalize the Operating Status for the user interface

Note: There are only five predefined operating status modes: **Standby**, **Constant**, **Program**, **Alarm** and **Off**. The ID code for them are standby, constant, program, alarm and off, respectively.

35.4.2 Managing Input/Output Status

The available input/output status names (particularly, the time signals) are based on the chamber configuration. As depicted in the following figure, there is only one time signal (**TS1**); its color displayed in the status bar corresponds to that defined under the format column in the following figure.

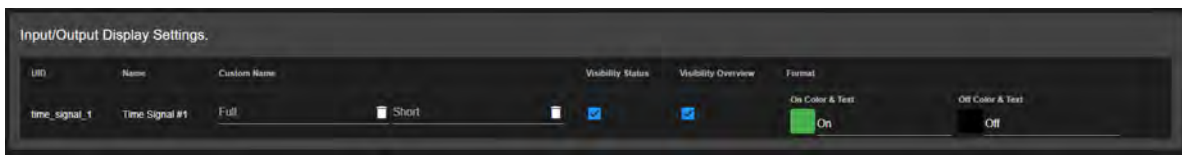


Figure 35.13: Personalize the input/output of the user interface

The default on/off colors for the time signal are green/black, respectively. These on/off colors can be customized by selecting a desired color from the color panel. The name of the time signal can also be customized to something more descriptive by editing the Custom Name field both for Full or Short. The short name is used and displayed in the status bar. Again, new settings can be saved by applying the **Save** button in the upper-right corner. The **Restore Defaults** button (trash bin icon) can be used to revert the configuration to default setting.

35.5 Data Logging Settings

ESPEC Web Controller makes it possible to collect data from the chamber at a desired interval. This submenu allows the operator to specify the data logging interval, set the trend graph to include a desired set of data types (temperature, humidity, etc.) and in what color they should be plotted in, when to collect data points (all the time or only when the chamber is on).

The default data logging interval (or frequency) is 10 seconds; data collected at all times as indicated by the **Always** key word under the **Log data when** selector, as depicted in the following

figure. Another option beside **Always** is **When Chamber is on**, accessible from the drop-down menu. The data types to be included in the trend graph are selected with a check mark in their respective box, as shown in the figure.

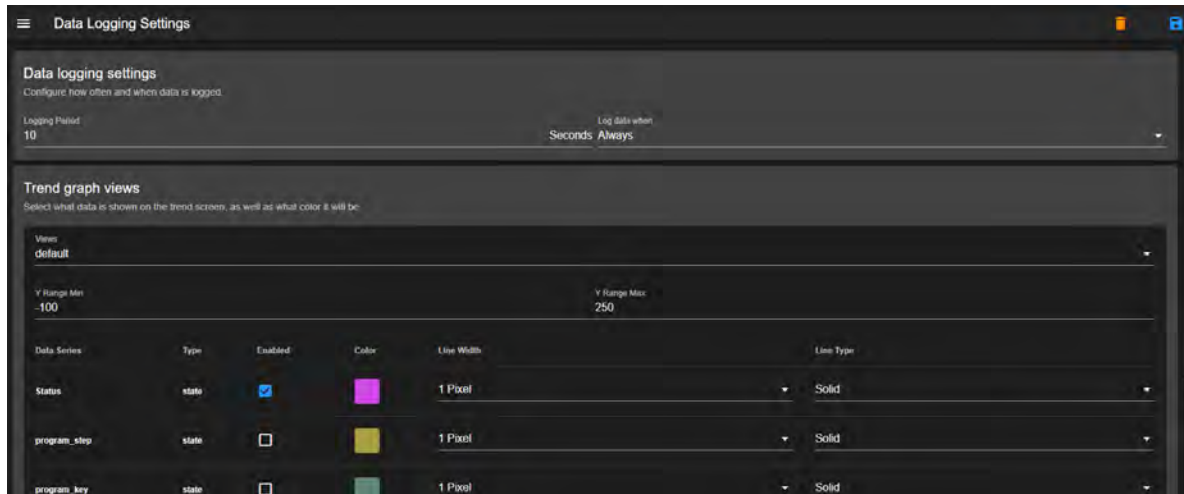


Figure 35.14: Options of data log setting

Two buttons (delete data log and save settings) are available for managing the data log file and its settings on this submenu. They are described in the following section.

35.5.1 Set Data Logging Interval and Data Types

To configure a new data logging interval and select different data types for the trend graph, complete the following steps.

1. Enter the frequency number in the field of **Logging Period** or apply the up/down arrow next to the **Seconds** mark, as depicted in the following figure, to adjust the frequency number.
2. Click and select **Always** or **When Chamber is on** option from the drop-down menu under the **Log data when**. Default setting is **Always**.

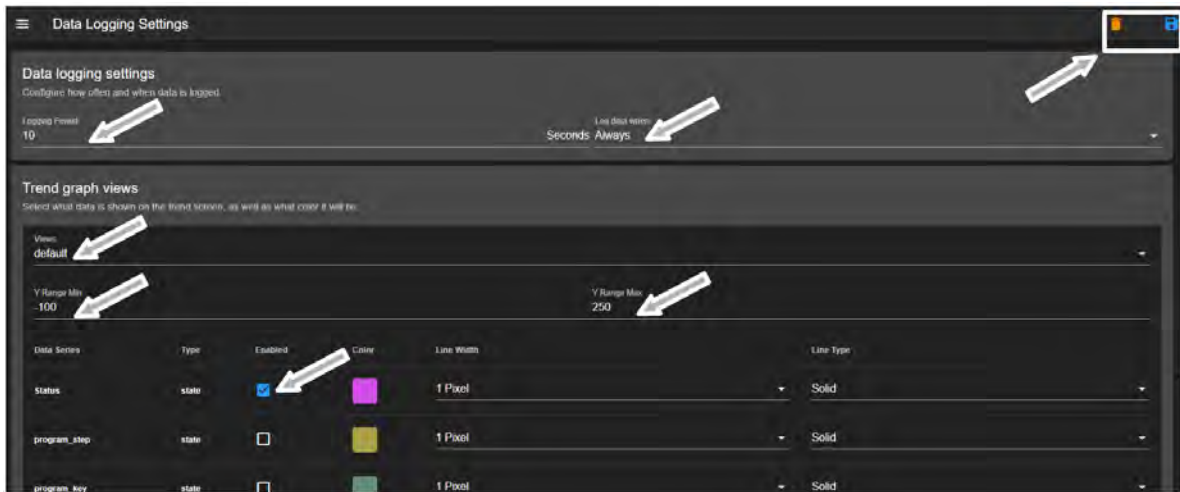


Figure 35.15: Configure data log setting

3. Enable any data series and type under the **Enabled** box list.
4. Click the color picker to select a desired color for each data type.
5. Select the **Line Width** for a desired number of pixels.
6. Select the **Line Type** in solid or dash.
7. Click the **Save** button at the upper-right corner.

35.5.2 Clear Data Log

It maybe necessary to start a new data log. To clear the current log, click the **Trash bin** in the upper-right corner. A warning dialog box appears to reconfirm the action with a Yes/No option to proceed.

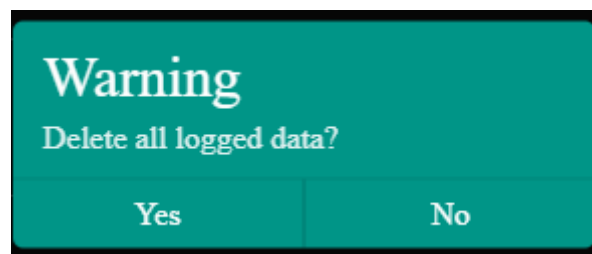


Figure 35.16: Confirm to delete current data log

The data log will be deleted immediately after confirmation. ESPEC Web Controller creates a new data log file, which in turn produces a warning sign, as depicted in the following figure.

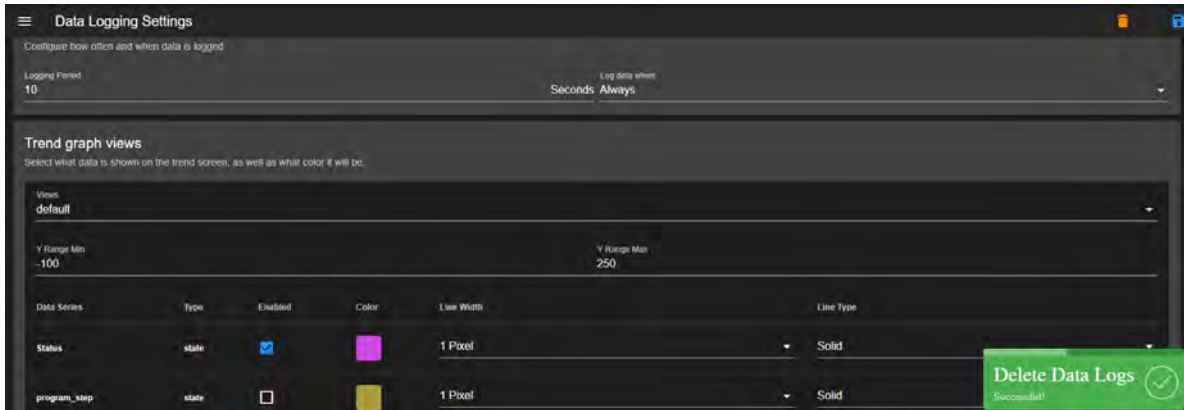


Figure 35.17: deleting-data-log-file-001.PNG

Once data begins to accumulate, a trend graph can be produced. Refer to the **Trend** menu in the menu bar for detail on the trend graph.

35.6 Date/Time Settings

To keep an accurate data log, it is important to have the correct date and time on the Web Controller and the chamber, since this is where data is being collected and logged. By default, the Web Controller date/time is configured to synchronize using the Network Time Protocol (NTP) server provided by the Debian network time pool, as depicted in the following figure.

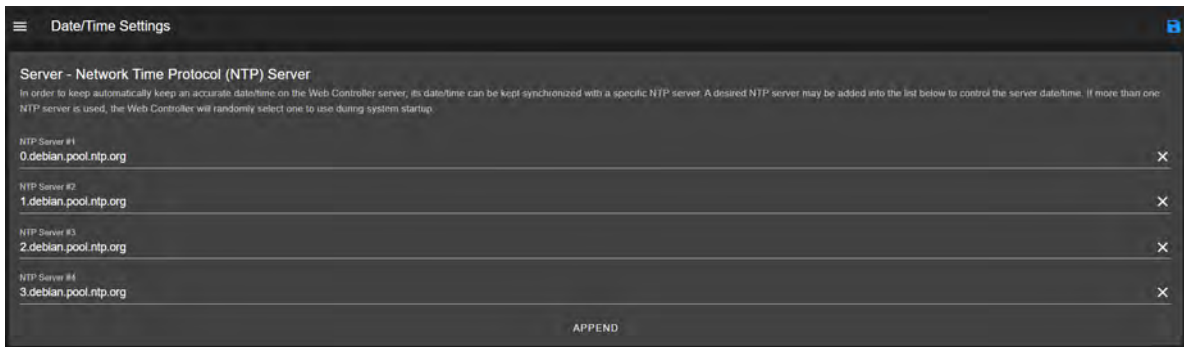


Figure 35.18: Using a different Network Time Protocol (NTP)

If the Web Controller does not have access to the Internet, the NTP server of the Debian network time pool does not work; and its date/time will be out of sync. If your network (isolated from the Internet) has its own NTP, you may point the Web Controller to use that NTP server. If your network does not have an NTP server, you may synchronize the Web Controller with the date/time of the local device (your PC or laptop), as depicted in the following figure.

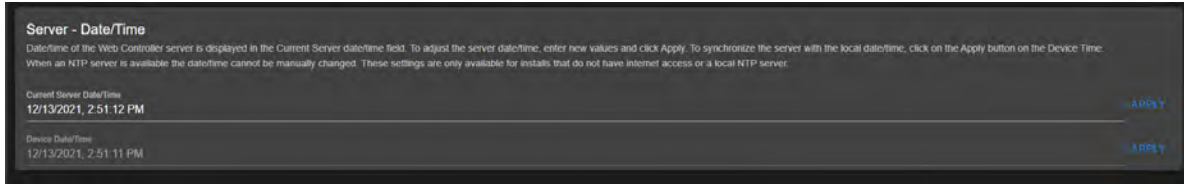


Figure 35.19: Date/time setting on the Web Controller

This **Date/Time Settings** page offers two ways to synchronize the date/time of the Web Controller and the chamber. If your network allows access to the Internet, then the Web Controller should be using the right date/time matched to your local time.

To set up the Web Controller to use a local NTP server or NTP server other than the default Debian pool, complete the following steps.

1. Edit and enter the hostname or IP address of the local NTP server to occupy the top line.
Note: The Web Controller synchronizes its date/time using the first NTP server on the list—the top line. Therefore, a desired NTP server must be entered in the top line. If the **APPEND** button is used, the new NTP Server will be added at the bottom, and the Web Controller may not get to use it if the top ones are operational. However, the **APPEND** button may be used if all the existing NTP Server lines were deleted (with the X button). Refer to the following figure for the configuration procedure.
2. Confirm that the first (top) line begins with 0.IP-address or 0.hostname. Refer to the existing format in the figure. If the desired NTP server is listed at the top, it may not be necessary to delete the rest of the lines. They can be used as a reference.
3. Click the **Save** button in the upper-right corner to save the current settings.



Figure 35.20: Editing the NTP for custom setting

If the NTP server is not available, the date/time of the Web Controller can be configured to synchronize with the local date/time of the PC/laptop. This synchronization will take place automatically by the Web browser that was used to access the Web Controller from the PC/laptop.

The date/time of the Web Controller can also be configured manually. Complete the following steps to edit or configure the date/time:

1. Click the date/time field under **Current Server Date/Time**, indicated by the arrow depicted in the following figure, to bring up the calendar and time.

2. Make the necessary adjustments
3. Close the date/time calendar.
4. Click the **APPLY** button on the right.
5. Click the **Save** button in the upper-right corner.

To synchronize the date/time of the Web Controller with that of the local device (i.e., PC/laptop), click on the **APPLY** button on the right of the **Device Date/Time** field.

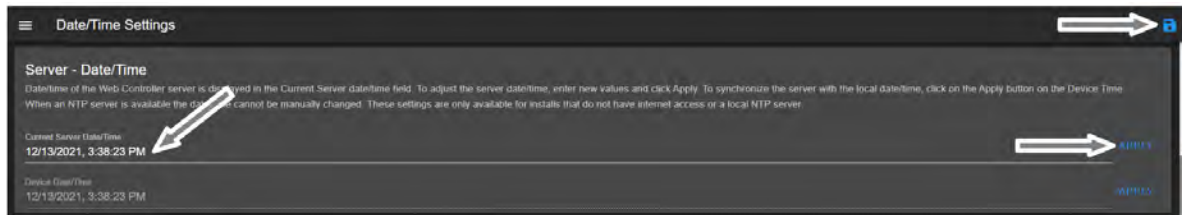


Figure 35.21: Apply date/time setting on the Web Controller

35.7 User Settings

The **User Settings** submenu allows the system administrator to manage user accounts and access privileges on the Web Controller. The layout of the **User Settings** is depicted in the following figure.



Figure 35.22: The nomenclature of the User Settings submenu

The UI and nomenclature of the **User Settings** are described as follows:

1. **Show/Hide**: The Show/Hide button can be used to show or hide the **Settings** submenu. As illustrated in the above figure, the **Settings** submenu is hidden. Click this button to show the submenu in order to access other submenus from the list, as depicted in the following figure.

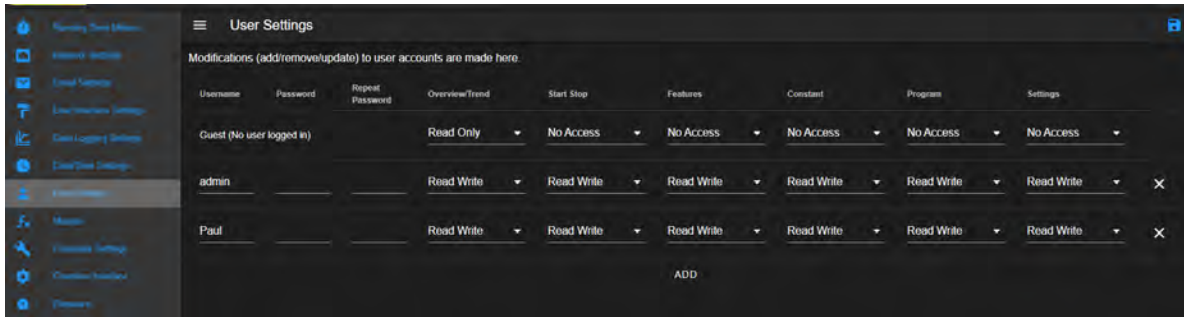


Figure 35.23: The UI of the User Settings submenu with Show/Hide button activated

2. **Username:** All accounts with username on the Web Controller are listed here.
3. **Password:** The password field(s) can be used to reset a password or create a password for a new account (to be explained below).
4. **Access Privileges:** Different privileges can be assigned to each account on the Web Controller. These policies are applied to the accessibility on the menus in the menu bar. A user can be granted access to these menus as **No Access**, **Read Only** and **Read Write**.
5. **ADD:** The ADD button can be used (by the administrator) to add/create a new account.
6. **Delete:** To delete a user account, click the trash bin to the right of that user account (on the same row).
7. **Save:** Use this button to save the current settings as well as new accounts just created.

35.7.1 Add User Account

Complete the following steps to create/add a new user account. Refer to the following pictorial diagram for detail.



Figure 35.24: Creating or Adding a new user account

1. **ADD:** Click the **ADD** button (shown in the above figure).
2. **Username:** Enter username under the **Username** column.
3. **Password:** Enter the password for this user in the **Password** fields (twice).

4. **Access Privileges:** Click and select access privilege (No Access, Read Only, Read Write) for each menu. Repeat the process for the rest of the menus.
5. **Save:** Click the **Save** button at the upper-right corner to save the settings.

This new account will be available for use immediately after the **Save** button is applied.

35.8 Macros

Frequently used tasks can be automated by creating and running macros. Macros are a series of scripted commands and instructions grouped together to accomplish a certain task. These scripted commands can be triggered automatically by the state of the chamber or by an authorized operator through a manual manipulation. Automated tasks through macro-scripted actions can range from sending e-mail notification about test completion to synchronization of operation between multiple chambers.

The following figure depicts the **Macros** setup page with a default scripted action called **Alarm Emails**. The lock symbol indicates that the contents of the **Alarm Emails** script cannot be modified, since it was generated by the Web Controller.

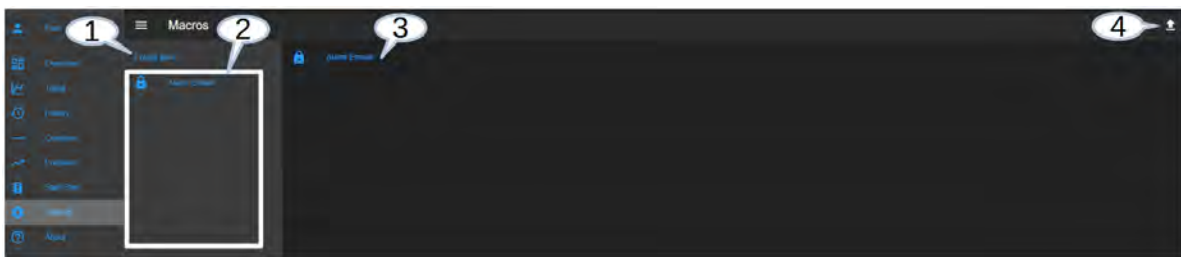


Figure 35.25: Macros main display page

The submenu of **Macros** consists of four main operation buttons for managing and manipulating the macro scripted profiles:

1. **Create New:** A new macro script can be created via this **Create New** button.
2. **List of Macro Actions:** A list of all macro scripted profiles on the system. Click on its name to display its contents in the macro editor page (item 3).
3. **Macro Scripts:** The first macro script on the list (item 2) is listed in the main display by default. Its contents can be viewed using the macro editor (main display).
4. **Import from local file:** A macro scripted profile can be imported from the local computer. Apply this button to import a macro profile from the local computer. The macro editor will be launched to display the contents of the profile. The **Save As** button needs to be applied to save the imported profile; its name will appear under the list of macro actions (item 2).

NOTE: Many operations associated with the macros require that the Web Controller has access to the Internet.

35.8.1 Macro Editor and Trigger Options

A macro script can be created to contain various trigger options. The **Create New** button, when clicked, launches the macro editor, within which the operator can compose the macro

scripts to set different alert and trigger options. The components of the macro editor are listed as follows:

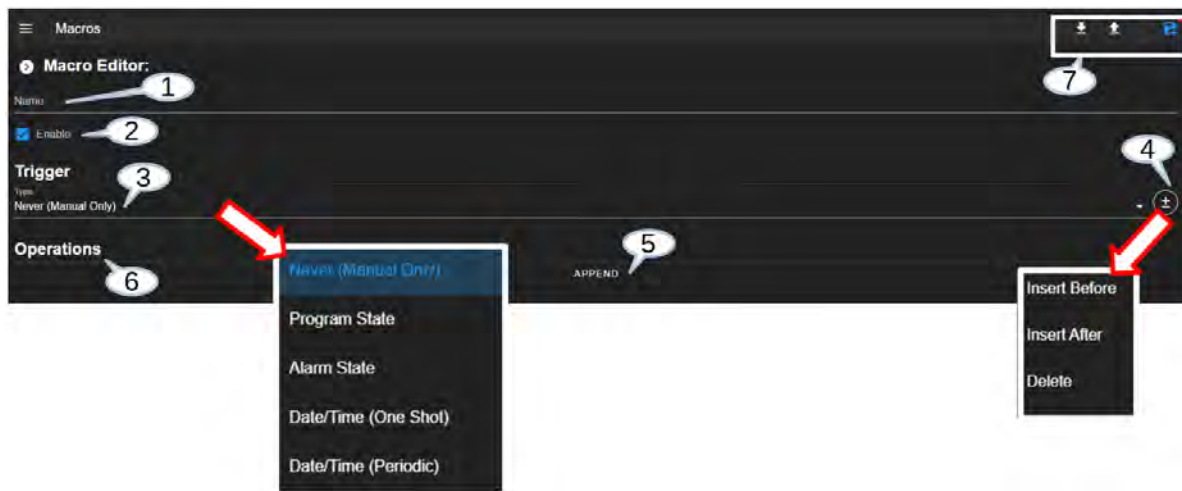


Figure 35.26: Macro trigger modes/options

1. **Name:** A macro has a unique name to identify its action or task.
2. **Enable:** The macro action can be enabled or disabled. When enabled, trigger will take effect based on the chamber condition specified in the macro script.
3. **Trigger:** A macro may be triggered by any of the following types:
 - **Always:** The macro will run every time. This type of trigger is not recommended.

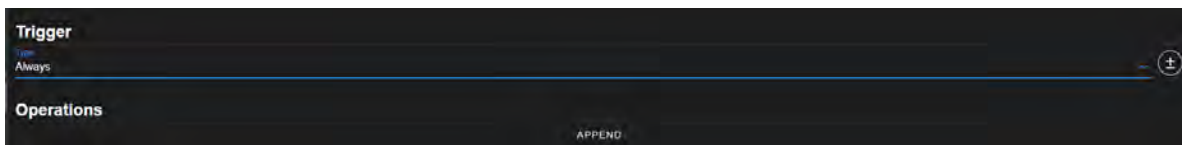


Figure 35.27: Trigger mode with always option

- **Never (Manual Only):** The macro must be manually triggered by an authorized operator or an API request.

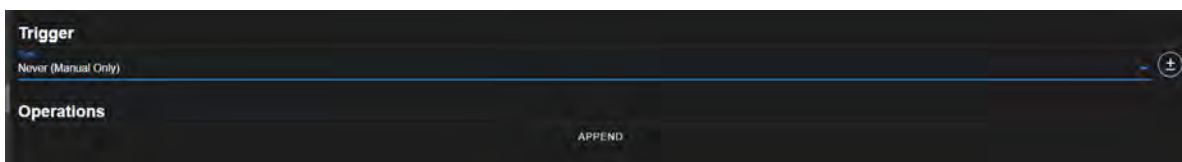


Figure 35.28: Trigger mode with manual

- **Program State:** The macro script will run when an execution state in the selected program has changed based on the parameters listed in the following figure.

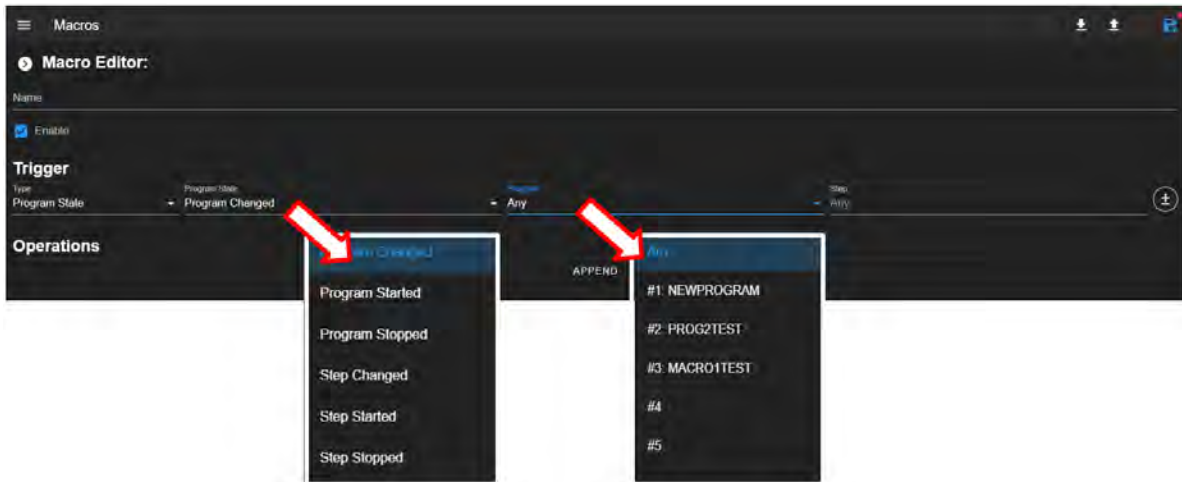


Figure 35.29: P300-macro-prog-state-001a.PNG

- **Program State:** Under the Program State options (drop-down menu in the above figure), a trigger alert can happen when there is a change in the program execution (designated as Program Changed), when a program has started or stopped (Program Started, Program Stopped); or a step within the executed program has changed (Step Changed), or a step has started or stopped (Step Started, Step Stopped). All of these options can be incorporated into the Program State trigger type.
- **Program:** A specific program may be selected to trigger the effect if the condition is met. If **Any** (default setting) is selected, any program will cause the trigger effect if the trigger condition during execution is met.
- **Step Number:** A specific step in the selected program can be used to trip the trigger effect if the condition is met, such as when step 5 in the selected program has completed its execution.
- **Alarm State:** The macro will run when the state of an alarm has changed. The parameters that specify the alarm state are listed in the drop-down menu shown in the following figure. The alarm list is chamber and PLC dependent.

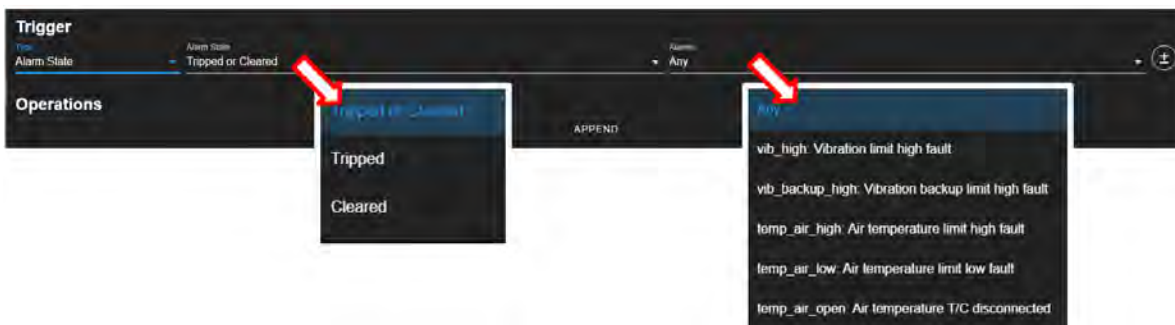


Figure 35.30: Trigger alarm options

- **Date/Time Trigger:** The macro will run at a specified time or date and time with periodic operation. When the date/time matches the configured “Month”, “Day of the

Month”, “Year”, “Day of the Week”, “Hour”, “Minute”, and “Second” the macro will fire. This operation can be configured for a one-time trigger or a periodic trigger, as depicted in the following figures.

The top screenshot shows a 'Trigger' configuration window. Under 'Type', 'Date/Time (One Shot)' is selected. The 'Date/Time' field is set to '3/2/2022, 11:30:49 AM'. Below this is an 'Operations' section with an 'APPEND' button.

The bottom screenshot shows a 'Trigger' configuration window. Under 'Type', 'Date/Time (Periodic)' is selected. Below this are several dropdown menus: 'Month' (Any), 'Day of the Month' (Any), 'Day of the Week' (Any), 'Hour' (Any), 'Minute' (Any), and 'Second' (Any). Below these is an 'Operations' section with an 'APPEND' button.

- Additional trigger types can be selected from the trigger list that include time signals, loop temperature, custom expression and logical operations. All of which have the same programming or scripting paradigm based on specific parameters and trigger conditions. A single macro script can be created to monitor a list of programs, their status or conditions, using a set of complex logical operations selected from the list of trigger types (such as, **and**, **or**, **not**).
4. **Multiple Trigger Types:** Additional trigger types can be added via the (+/-) button, with options to insert additional trigger type using **Insert Before** or **Insert After** buttons. Trigger type can be removed from the list via the **Delete** button.

The screenshot shows a 'Trigger' configuration window with a list of three triggers. Each trigger has a 'Type' dropdown, a configuration field, and a +/- button for adding or removing it.

- Alarm State:** Type: Alarm State, Configuration: Tripped or Cleared, Alarm: Any.
- Program State:** Type: Program State, Configuration: Program Changed, Program: Any, Step: Any.
- Date/Time (One Shot):** Type: Date/Time (One Shot), Configuration: 2/16/2022, 4:01:49 PM.

Figure 35.31: Three trigger types in macro script

5. **APPEND:** The action or actions of the trigger (item 3, above) can be implemented in the body of the **Operations** template. The **APPEND** button can be applied to add and compose the trigger operations. The components of the trigger operations are outlined as follows:

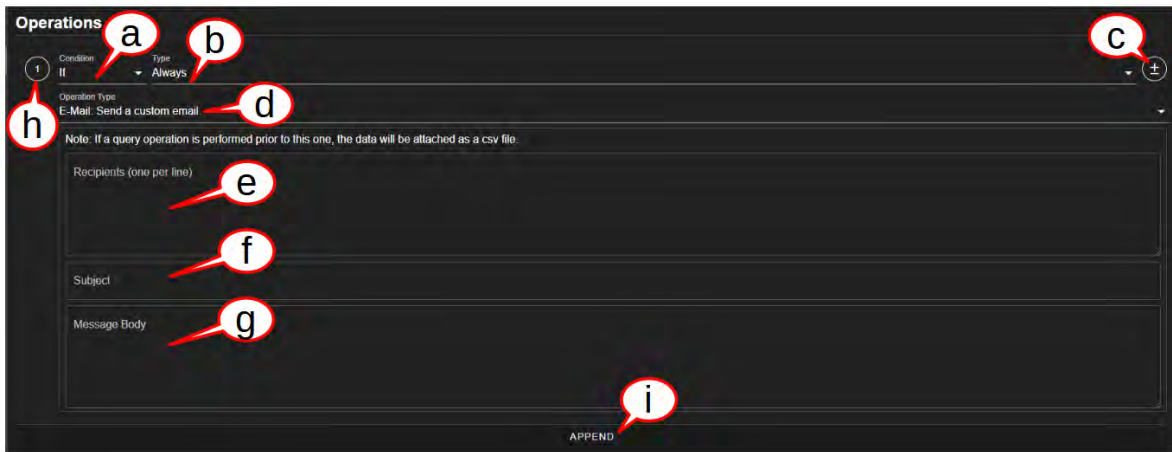


Figure 35.32: Components of trigger operations

- a. **Conditional Statement:** The conditional statements of trigger operations consist of **If**, **Else If**, **Else** and **Wait For**. These conditional statements can be used to check the type(s) of trigger operation.
 - b. **Type of Condition:** The type of trigger used in the conditional statement.
 - c. **Additional Conditions:** additional conditions can be added via (+/-) button. The available options are: Insert Before (current type), Insert After (current type), Delete.
 - d. **Alert Method:** Available alert methods for the trigger operation. Default option is: Mail: Send a custom e-mail.
 - e. **E-mail Address:** The operator's e-mail address in this block will be used to send an alert e-mail. Multiple e-mail addresses can be used, one e-mail address per line.
 - f. **Subject title:** A descriptive subject title is important in an alert e-mail.
 - g. **Message:** The message in the e-mail should be brief and descriptive.
 - h. **Manage Trigger Operations Steps:** With this button, management of trigger operations steps is possible with the **Insert After**, **Insert Before** or **Delete** options.
 - i. **Add Trigger Operations Step:** The **APPEND** button appends an additional step at the bottom of the step list.
6. **Operations:** Components of the trigger **Operations** are outlined in the previous and the following figure. The default operation type is **E-Mail: Send a custom email**. Different operation types can be selected from the list. Each selected type is used in the conditional statement to trip the operation. Multiple types can be implemented by applying the (+/-) button. The operation type thus consists of three fields: (1) who to send the alert, (2) subject of the alert, (3) message of the alert. Multiple operations can be added using the **APPEND** button to create additional or multiple operations.

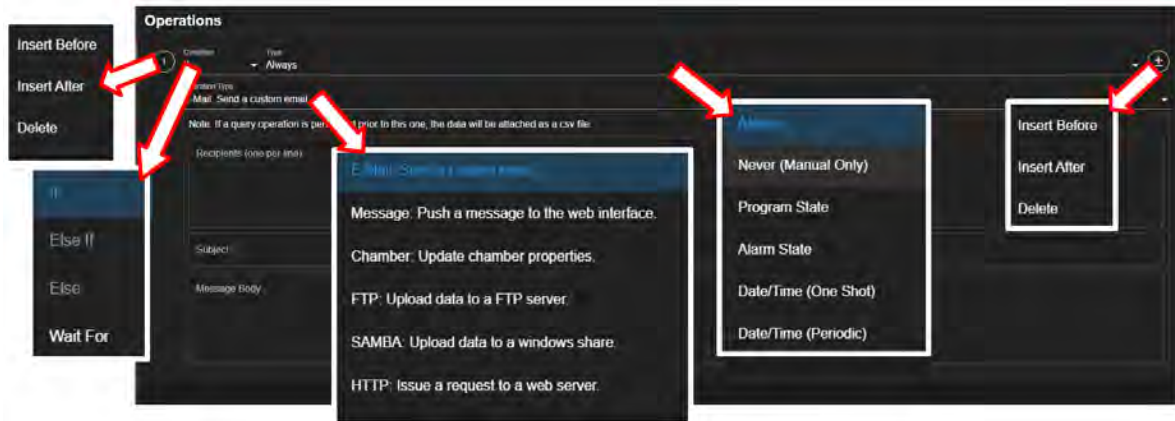


Figure 35.33: Options of trigger components

7. **File Manipulation:** Three file manipulation options are available in the main macro editor when the **Create New** option is applied. These are **Export to local file**, **Import from local file** and **Save**.

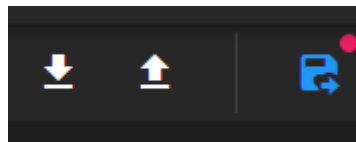


Figure 35.34: File manipulation buttons

After the macro script has been composed and saved, additional options are available as follows:

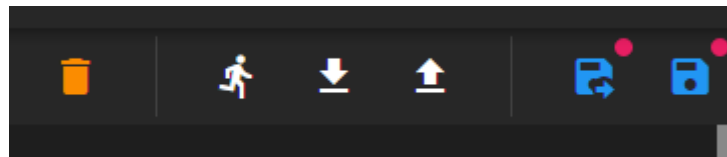


Figure 35.35: File manipulation options for macro editing

The current macro script can be deleted from the macro editor with the **Delete** button (trash bin). A warning appears to reconfirm the action.

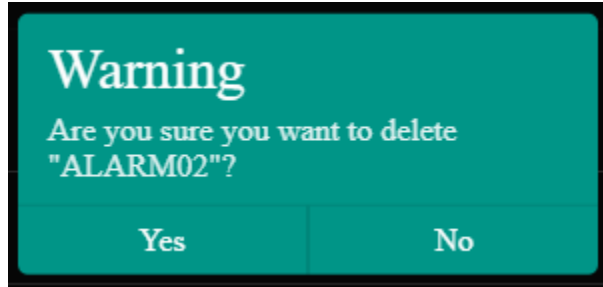


Figure 35.36: Reconfirm the deletion of macro script

This script can be invoked to test its operation by applying the **person** icon. If the macro operation involves sending out an alert e-mail, the recipient on the e-mail list will immediately receive the e-mail alert. ESPEC Web Controller can send out e-mail alerts only if it has access to the Internet because, by default, it uses SMTP Office 365 for the email protocol.

35.8.2 Example: A Macro Script with Alarm Alert

The following example illustrates a simple macro script to send out an e-mail alert when the chamber trips an alarm (any alarm). In order for the macro setup to work, the Web Controller must have access to the Internet. The procedure for this example is outlined as follows:

1. Click **Macros** in the **Settings** submenu.
2. Click **Create New**.
3. Click the Name field in the macro editor, enter **ALARM01** for the macro name. Confirm that the trigger is enabled (with its box checked).
4. Click the type field under the **Trigger** type and select **Alarm State** from the list (as shown).

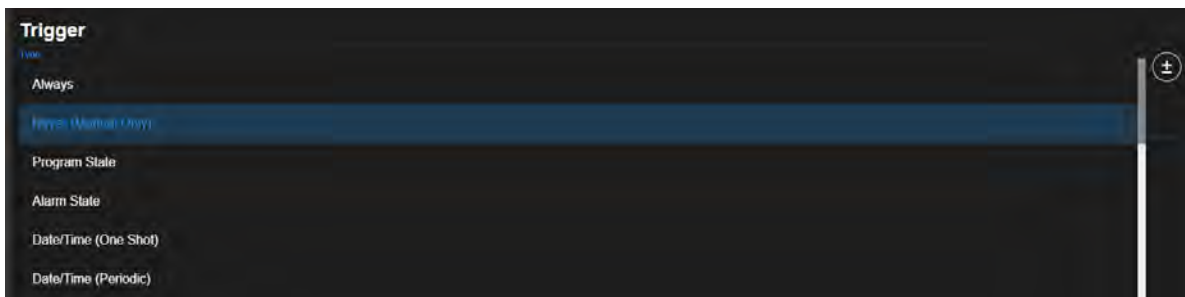


Figure 35.37: Select Alarm State type from the list

5. Click the **Alarm State** field and select **Tripped** from the drop-down list as its parameter (as shown).

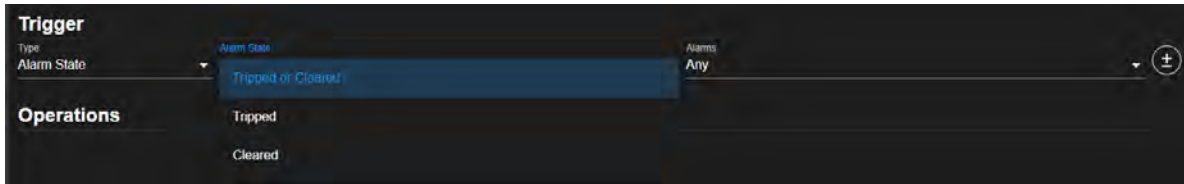


Figure 35.38: Set trip parameter for the Alarm State

6. Confirm that **Any** is selected under the Alarms option. The complete selection type, state and alarms options is depicted below.

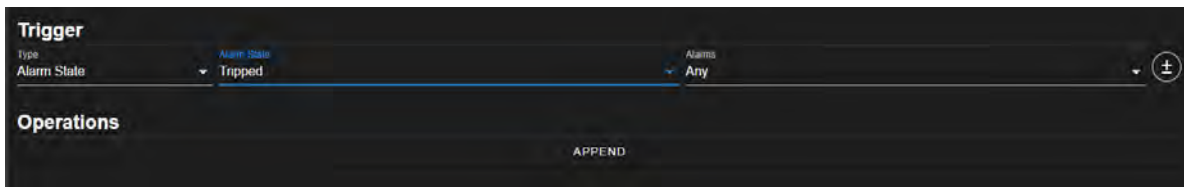


Figure 35.39: Parameters of alarm trigger type

7. Click **APPEND** to add the operations instructions.
8. Confirm that the logic **If** is selected by default to check the condition, and the condition type **Always** is select. This is to ensure that an alert will be sent out whenever an alarm is tripped.
9. Confirm, under the Operation Type, that “E-Mail: Send a custom email” has been selected.
10. In the **Recipients** block, enter the operator’s e-mail address. Multiple e-mail addresses can be used, with one e-mail address per line.
11. Enter the subject title of the e-mail in the **Subject**.
12. Enter the message to be included in the e-mail in the **Message body** box.
13. Click the **Save** button. The macro list now has the macro script listed by its file name. If you attempt to exit the macro editor (by clicking on other submenus or menus), a warning message will appear (as shown below).

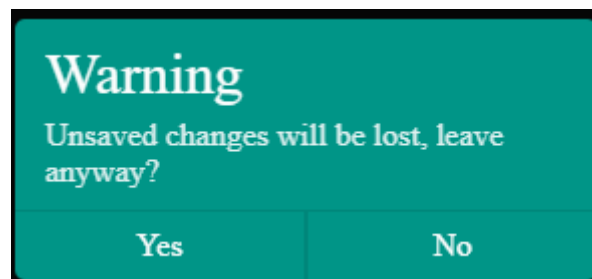


Figure 35.40: Macro script must be save before exiting the pane

14. To test the macro script, click the **person** icon. The operator should receive an e-mail alert from the Web Controller.

The complete macro script is depicted in the following figure.

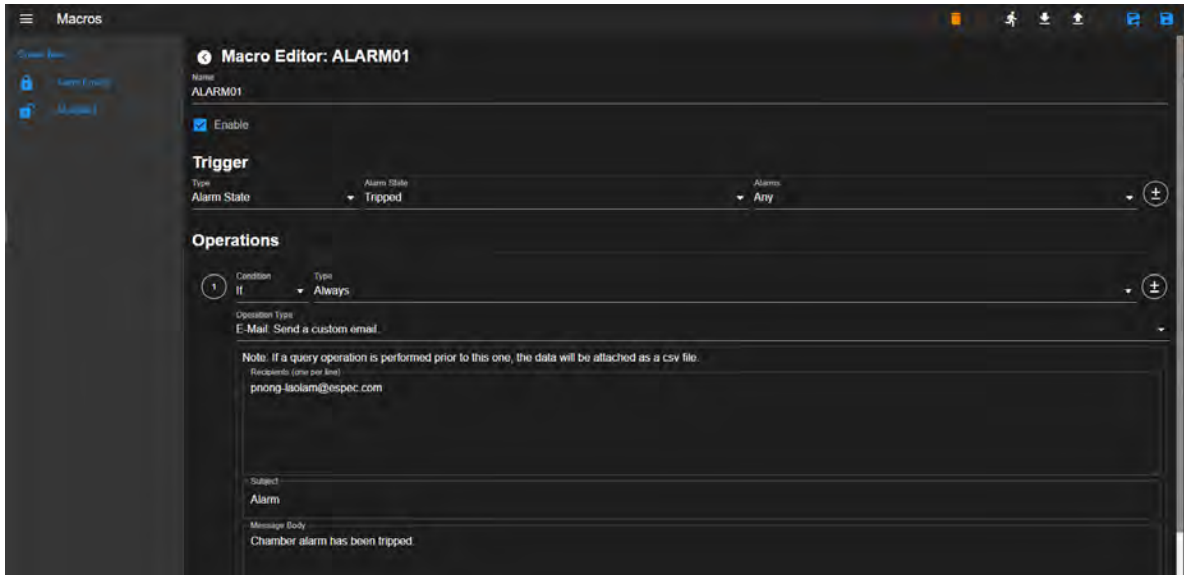


Figure 35.41: Macro profile with Alarm alert

35.8.3 Example: Macro Script with Program State and Alarm Alert

Here is an example of the use of two logical **Or** conditions of the trigger type to monitor two specific programs (**PROGTEST001** and **PROG3TEST**) and trigger the e-mail operation. Two logical **If** conditions monitor the program state and alarms; an alert is sent out accordingly. The first **If** condition is set up to monitor the program activity; the second **If** condition monitors any alarm occurrences. Note: This sample macro script is presented to illustrate the flexibility of the macro editor. There are numerous ways to achieve the same the task noted here.

To construct the macro script, proceed as follows:

1. Click **Create New** on the **Macro** submenu.
2. Click the Name field and enter **ALARM02**.
3. Confirm that the trigger is enabled (with its box checked).
4. Under **Trigger**:
 - Click the Type field and select **Program State** from the drop-down list.
 - Click the Program State field and select **Program Started** from the drop-down list.
 - Click the Program field and select **PROG2TEST** on slot 2. NOTE: **PROG2TEST** must be made available on the program list.
 - The last option on step number is set as default for the trigger to apply at any step.
 - Click the (+/-) and select **Insert After** to add a new trigger type, as shown in the figure.



Figure 35.42: Inserting additional trigger type

- Click the Type field and select **Or** from the drop-down list.
- Click the Type field and select **Program State** from the drop-down list.
- Click the Program State field and select **Program Started** from the drop-down list.
- Click the Program field and select **PROG3TEST** on slot 3. NOTE: **PROG3TEST** must be created and is available on the program list.
- The last option on step number is set as default for the trigger to apply at any step.
- Apply the (+/-) button to add two more trigger type steps to contain the logical **Or** and **Alarm State** as depicted in the following figure which depicts the complete configuration of the conditional statements in the trigger logic:



Figure 35.43: Trigger setup logic

5. Click **APPEND** under the **Operations** block to create the first step of the trigger operation.
 - Confirm that **If** condition is selected (by default).
 - Click the Type field and select **Always** from the list. This is to ensure that an e-mail alert will be sent out if the state of a specified program occurs.
 - Confirm that **E-Mail: Send a custom email** is selected (by default) for Operation Type.
 - Enter the recipient's e-mail address in the Recipients block, one e-mail address per line.
 - Enter subject title in the Subject block.

- Enter a brief message in the Message Body block. The complete configuration is illustrated as follows:



Figure 35.44: Conditions for trigger actions

6. Click the operation step number (number 1 in the circle, as shown below) and select **Insert After** to add a new step to the trigger operation.



Figure 35.45: Inserting additional step of trigger operation

- Confirm that **If** condition is selected (by default).
- Click the Type field and select **Alarm State** from the list.
- Click the Program State field and select **Tripped** from the list.
- Confirm that **Any** is selected by default under the Alarms field; it is to ensure any alarm will trigger this action.
- Confirm that **E-Mail: Send a custom email** is selected (by default) for Operation Type.
- Enter the recipient's e-mail address in the Recipients block, one e-mail address per line.
- Enter subject title in the Subject block.
- Enter a brief message in the Message Body block to indicate alarm has been tripped. The complete configuration is illustrated as follows:

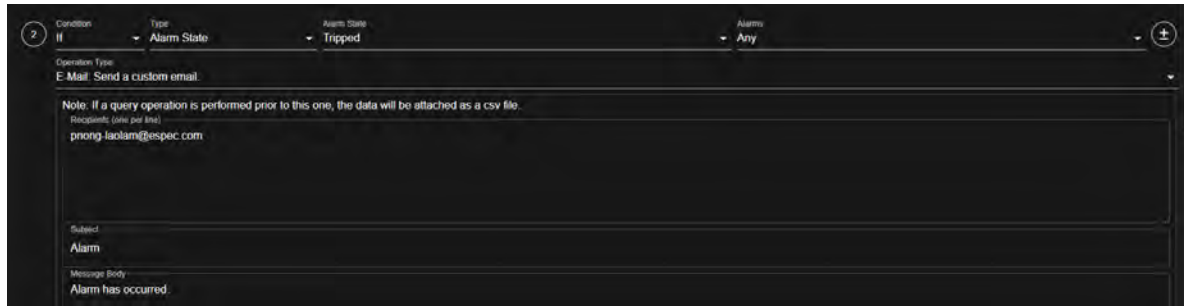


Figure 35.46: Conditions for step trigger operation

7. Click **Save** to save this macro scripted profile.
8. **Testing the Macro Script:** Click the **person** icon to test and run the macro script.
 - If the run is successful (that is, no errors are found in the script), a **Successful** message appears and an e-mail alert is sent to the recipient(s) listed in the Recipients block.

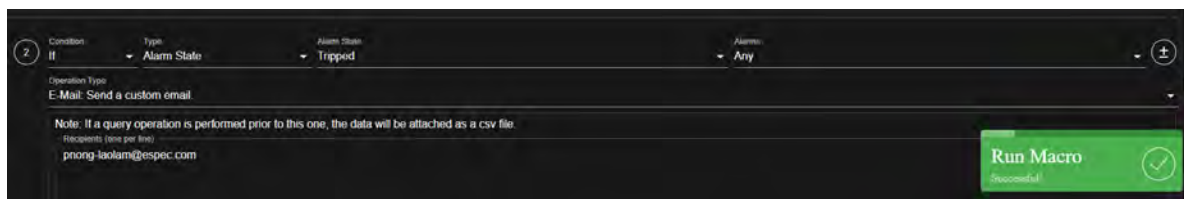


Figure 35.47: A macro script ran successfully

- If the run failed, an error message appears as shown below. The macro script does not work.

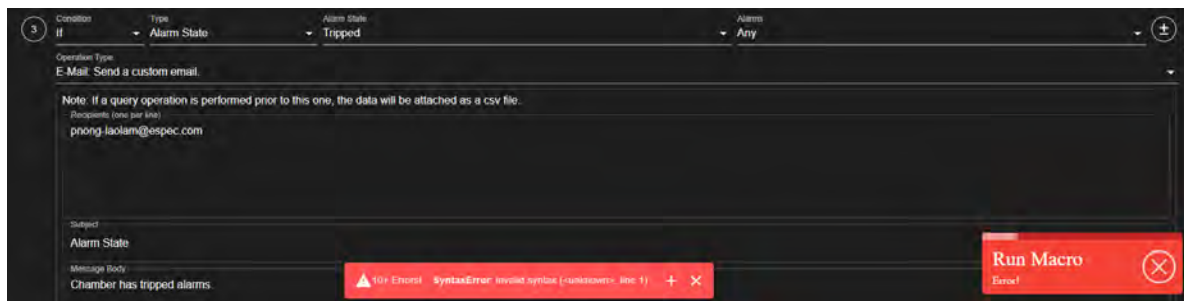


Figure 35.48: A macro script failed, errors found in the script

35.9 Controller Settings

The **Controller Settings** submenu is only available for chambers equipped with Allen Bradley CompactLogix, ControlLogix and Micro8xx PLC series. Such chambers are referred to as T-series chambers. This submenu will be grayed out for any chamber other than the T-series chamber.

The **Controller Settings** submenu allows the operator to set different parameters of the chamber's control features. This submenu divides into four separate tabs: **General**, **Calibrate Thermocouples**, **Calibrate Accelerometers**, and **Diagnostics**, as depicted in the following figure. The **General** tab is displayed by default, when this submenu is accessed.

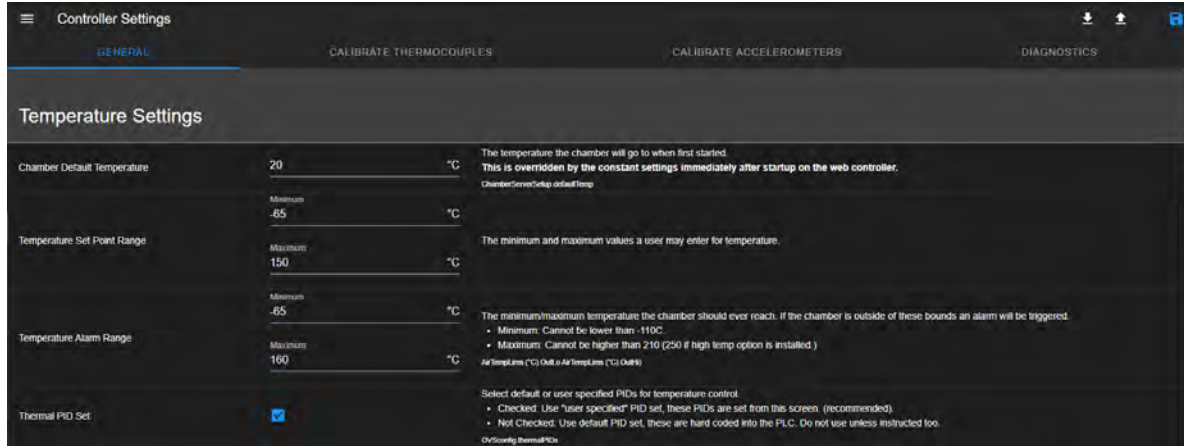


Figure 35.49: Controller settings for T-Series chambers

Under the **General** tab, different settings are available for **Temperature Settings**, **Vibration Settings** and **Misc Settings**; all of which can be browsed and configured by scrolling through Web page.

The current configuration of the chamber can be downloaded as a backup via the **Export to local file** button in the upper-right corner. The export file will be stored in the **Downloads** folder on the local computer, in JSON format (with filename as TyphoonV1.json). New settings can be performed and applied using the **Save** button in the upper-right corner. This configuration file can be uploaded back into the Web Controller any time.

35.9.1 General

The **General** tab lists the general specifications of the chamber, such as **Temperature**, **Vibration** and other miscellaneous items. Each item is listed with description of its operation and features. With this tab, an operator can directly control and reconfigure the specifications of the chamber. As depicted in the following figure, if a user sets a temperature value higher than the specified parameter, the Web Controller will flag the user to apply the setting below the threshold value.

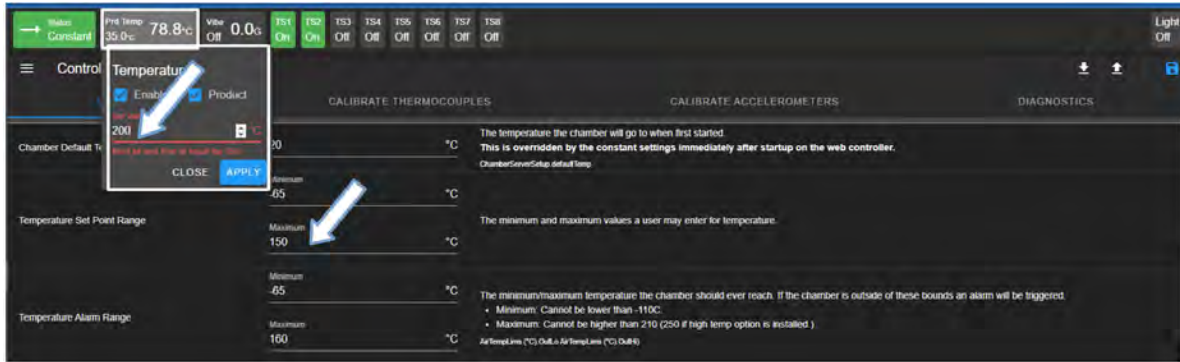


Figure 35.50: A list of the general specifications of the chamber

To apply a new configuration, perform the following steps.

1. Click the **Export to local file** button (item 1, indicated by the arrow) to download the current configuration as a backup. The configuration file will be stored in the **Downloads** folder on the local computer under the name TyphoonV1.json. This practice is a precaution measure to safeguard the original configuration in case the chamber's general configuration needs to be restored.

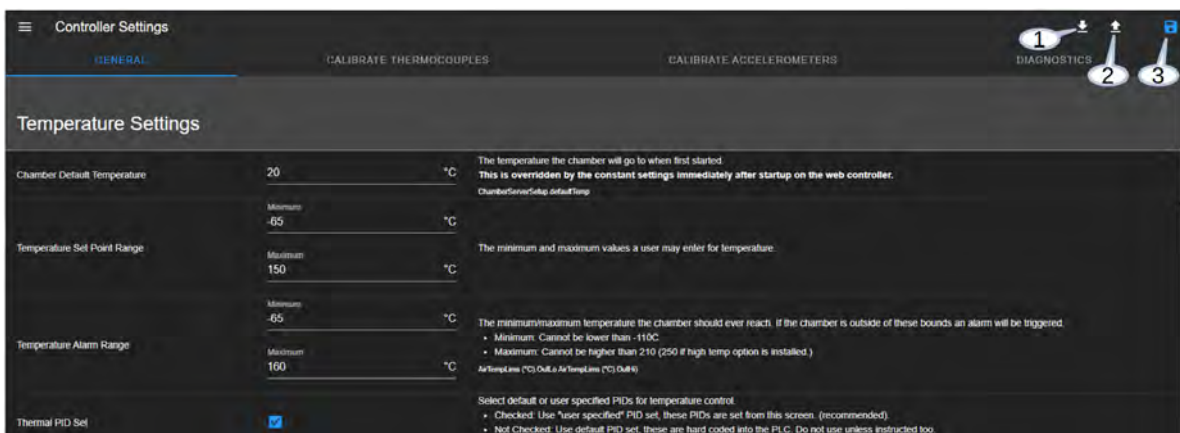


Figure 35.51: Setting options of the chamber general specification

2. Enter a new set value or click the up/down button on each line next to the parameter unit (in the middle column) to adjust the value, as shown in the above figure.
3. Scroll down the tab to apply settings to the rest of the parameters.
4. Click the **Save** button (item 3, indicated by the arrow) to save the current settings.

To load a configuration from a backup file, click the **Import** button (item 2, indicated by the arrow), then select the configuration file (in JSON) on the local computer.

35.9.2 Thermocouple Calibration

To calibrate different thermocouples settings, click the up/down button of the **Offset** and/or **Scale** columns to adjust the value.

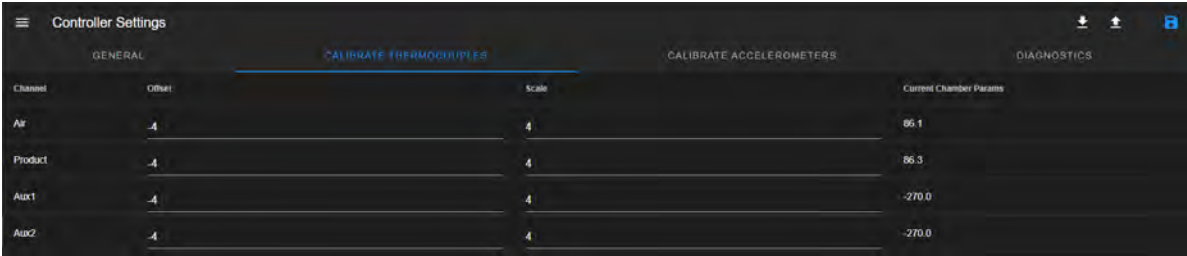


Figure 35.52: The thermocouple calibration submenu

35.9.3 Accelerometer Calibration

To calibrate different accelerometer settings, click the up/down button of the **Offset** and/or **Scale** columns, **Sensitivity** and **User Sensitivity** columns to adjust the value.

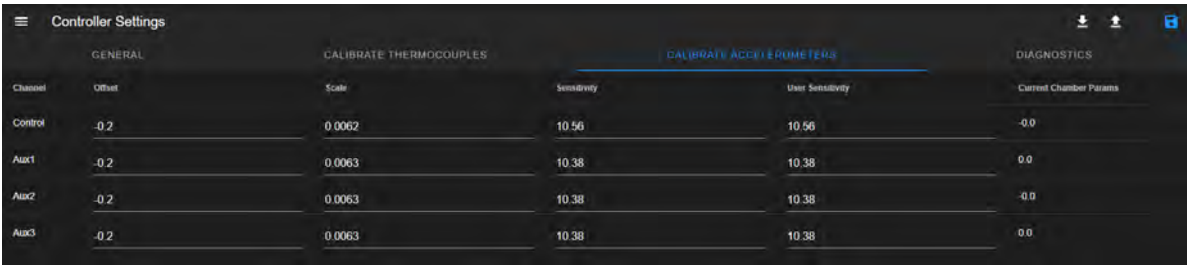


Figure 35.53: The accelerometer calibration submenu

35.9.4 Diagnostic

It may be necessary to perform a diagnostic test on the chamber after a maintenance. This tab allows an operator to perform a certain diagnostic tests on the chamber.

- 1. Turn on the Diagnostic Mode (indicated by the arrow). This action will enable the **START** button.

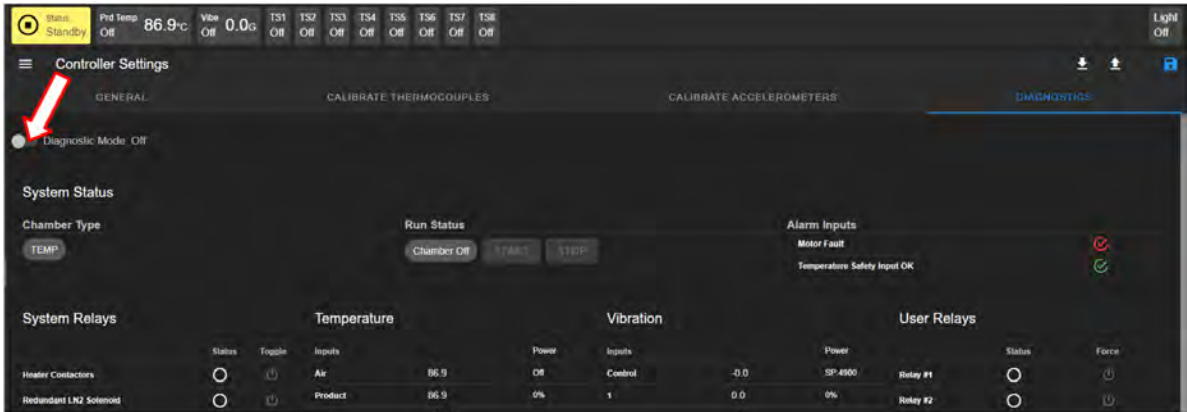


Figure 35.54: The diagnostic submenu

- 2. Click the **START** button (indicated by the arrow) to update the diagnostic mode. A message box pops up (in the lower corner) to indicate diagnostic update process.

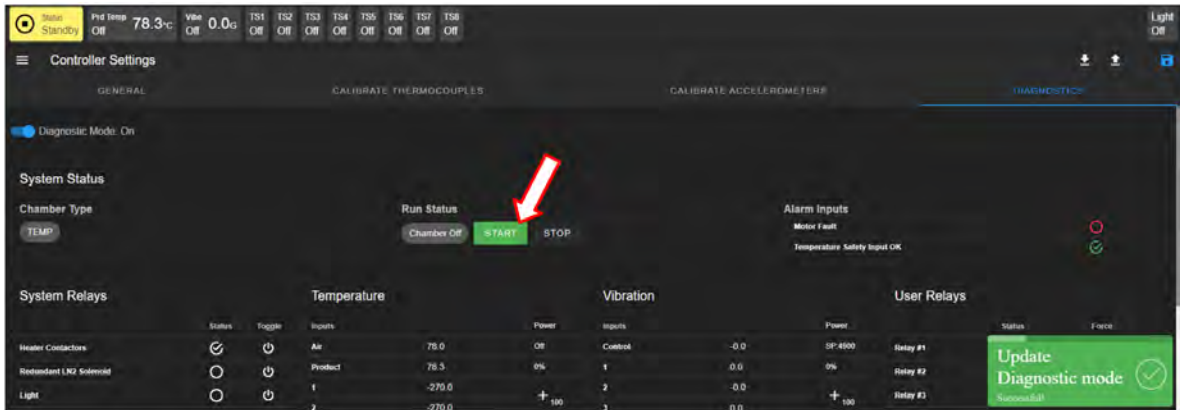


Figure 35.55: Configure a diagnostic test

- Click the **START** button (Again) to initiate the diagnostic test. The **Chamber On** button (under the Run Status tab) should turn from gray to green. Diagnostic is being performed; changes on values of different parameters will be displayed under **Temperature**, **Vibration** and **User Relays**.

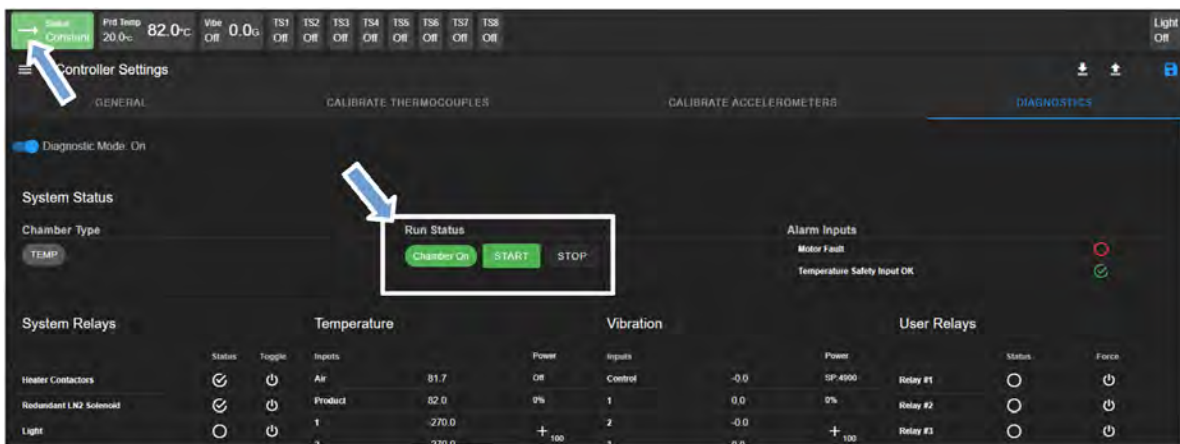


Figure 35.56: Start/stop a diagnostic test

- To terminate the diagnostic test, click the **Stop** button. The chamber will be turned off and switched back to the **Standby** mode.
- Turn off the Diagnostic Mode (see Step 1).

35.10 Chamber Interface

The **Chamber Interface** submenu plays a crucial role in the configuration of ESPEC Web Controller and chamber for control and operation. Configuration involves selecting the right chamber category, model type and controller, as well as any optional features available for the said chamber. Next, a proper communication protocol between the chamber and ESPEC Web Controller must be established. The type of controller dictates the type of communication protocol.

- TCP/IP Interface:** TCP/IP protocol is the default communication interface for a T-

series chamber or a chamber equipped with Watlow F4T. The following figures depict a typical configuration of the T-Series and F4T chambers.

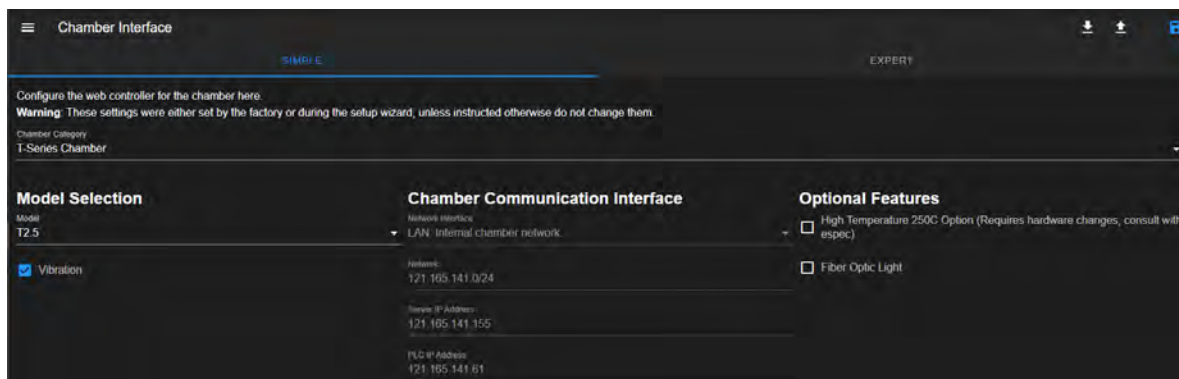


Figure 35.57: Chamber configuration and communication protocol

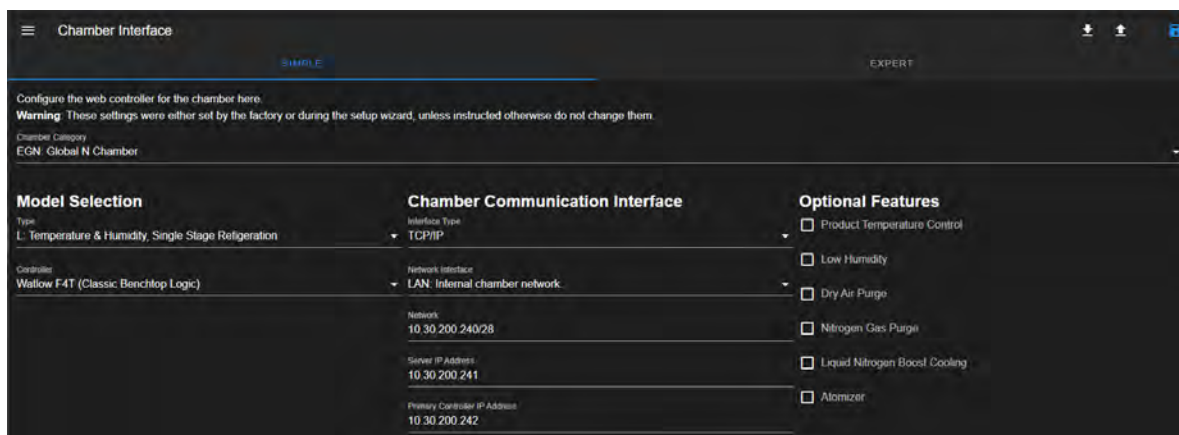


Figure 35.58: Chamber configuration and communication protocol

2. **Serial Interface:** For a chamber equipped with ESPEC P300, SCP220 or Watlow F4, default communication interface is the serial RS-232 or RS-485. The following figures depict a typical configuration for a chamber equipped with ESPEC P300, SCP220 or Watlow F4 via the serial RS-232 interface.

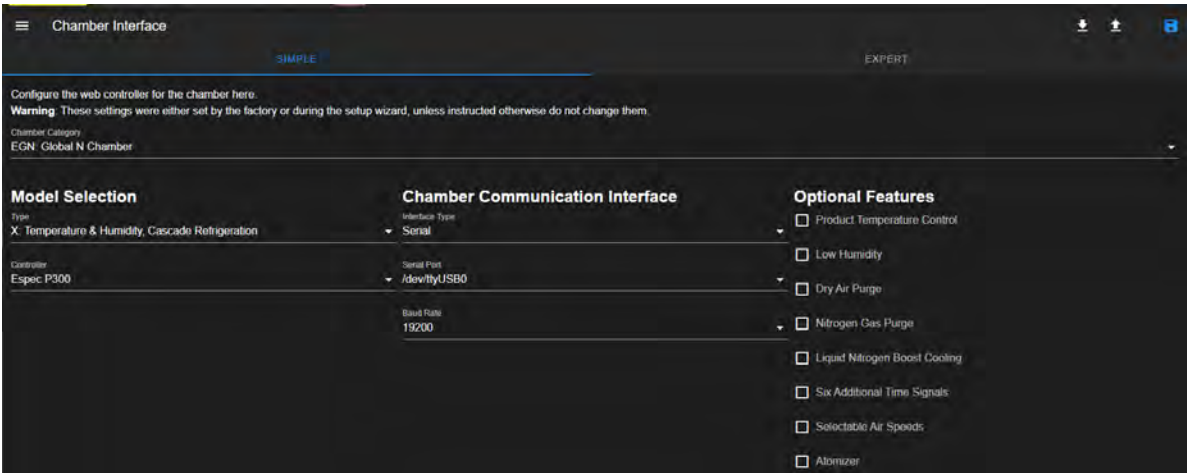


Figure 35.59: Chamber configuration and communication protocol

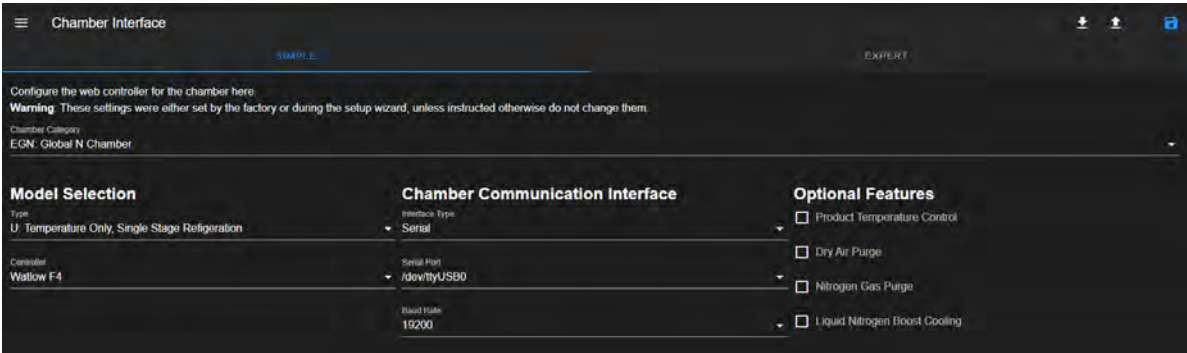


Figure 35.60: Chamber configuration and communication protocol

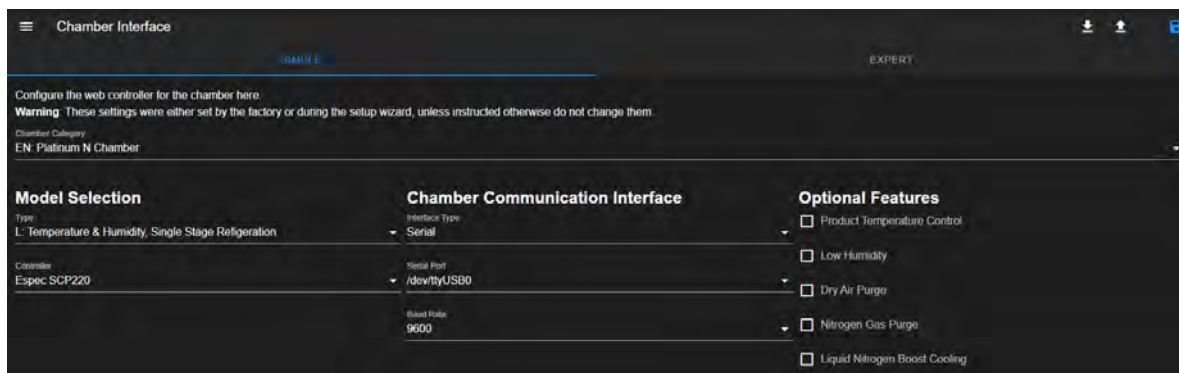


Figure 35.61: Chamber configuration and communication protocol

The following figure depicts a configuration for an F4T chamber via a serial interface.

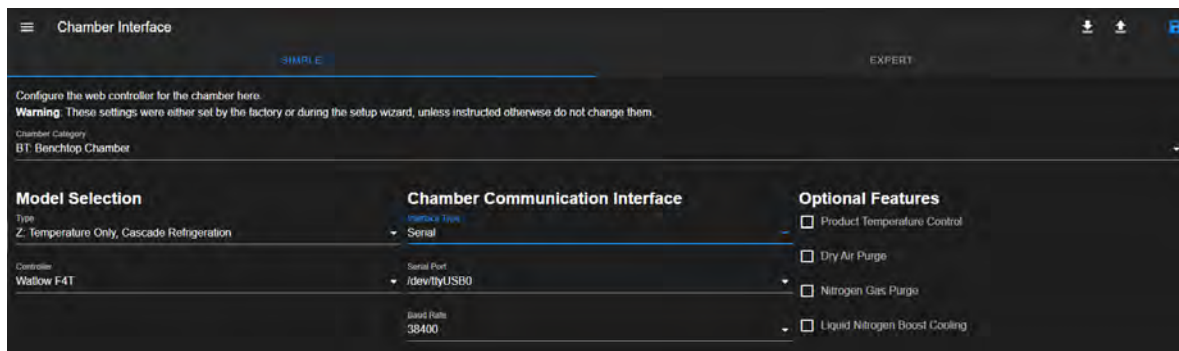


Figure 35.62: Configuration via serial interface

Two options are available for interface configuration: **Simple** and **Expert**. The settings depicted in the above figure are based on the **Simple** option; they were completed at the facility during testing. This configuration can be confirmed during the **Setup Wizard** procedure (as outlined in Section 2.4) when the Web Controller operates for the first time with the chamber. For this reason, there is generally no need to configure the settings, unless a new setting is required.

The following subsections outline the different configuration procedure for all PLCs supported by ESPEC Web Controller. Select the appropriate subsection that applies to your chamber and PLC.

35.10.1 Simple: T-Series Chamber Interface

Under the **Simple** option, communication between the chamber and ESPEC Web Controller is configured through three predetermined parameters: (1) Chamber Category, (2) Chamber Model and Controller, (3) Communication Interface. They are depicted in the following figure.

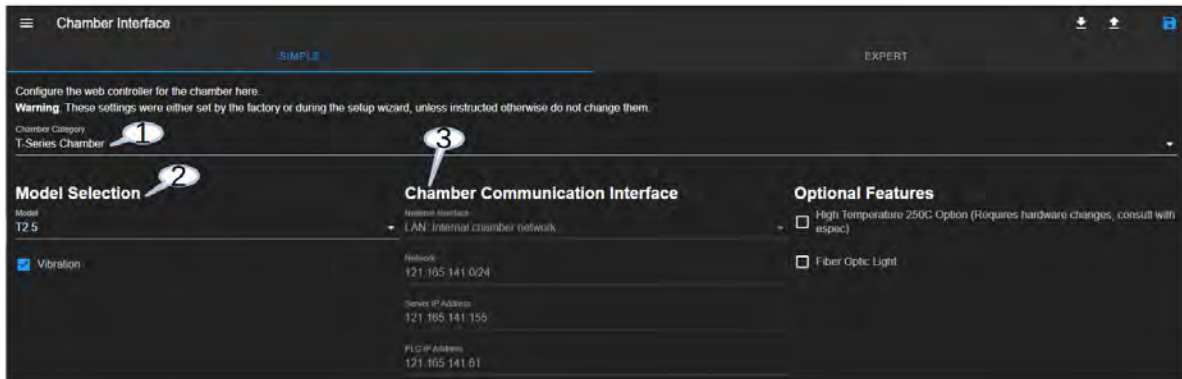


Figure 35.63: Configuration parameters

Refer to your documentations that were shipped with the chamber to obtain information for these parameters. They are required to successfully configure ESPEC Web Controller to control your chamber.

1. **Chamber Category:** Click the text field under **Chamber Category** to access a drop-down list, as depicted in the following figure. Select your chamber category from the list that matches the one described in your chamber manual.

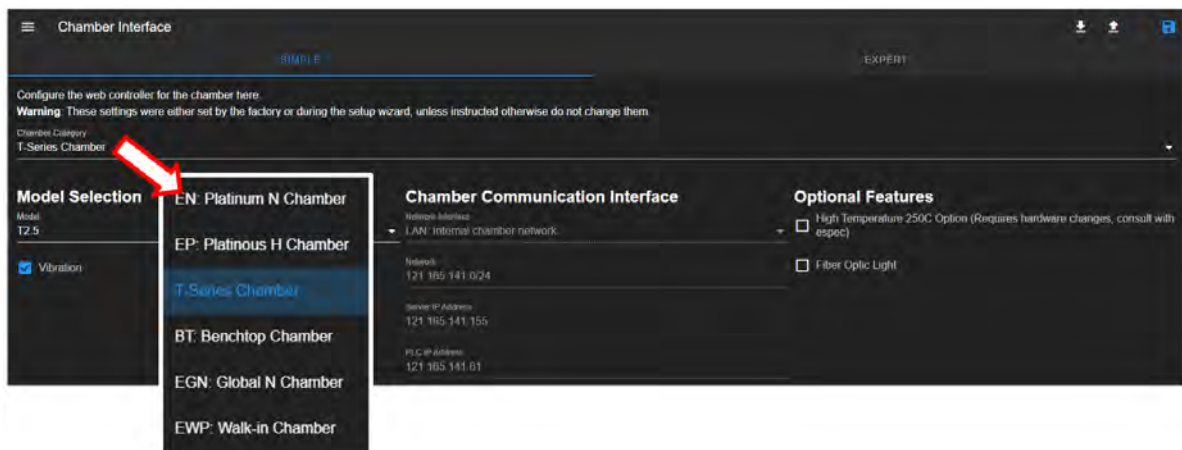


Figure 35.64: Chamber category selection

2. **Model Selection:** Click the text field under **Model** to access a drop-down list, as depicted in the following figure. Select your chamber model from the list that matches the one described in your chamber manual.

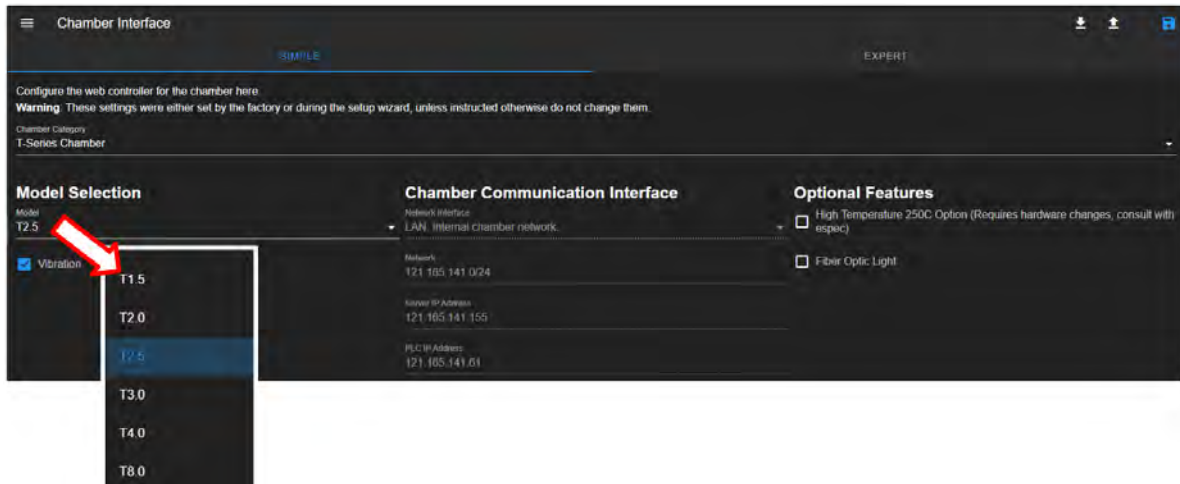


Figure 35.65: Model type and controller configuration

3. **Communication Interface:** By default, ESPEC Web Controller applies TCP/IP to communicate with the T-Series chamber using a set of predefined network parameters, as shown in the following figure. An internal network (based on 121.165.141.0/24) was set up for this communication with an IP address of 121.165.141.156 assigned to ESPEC Web Controller and 121.165.141.61 to the Allen Bradley PLC.

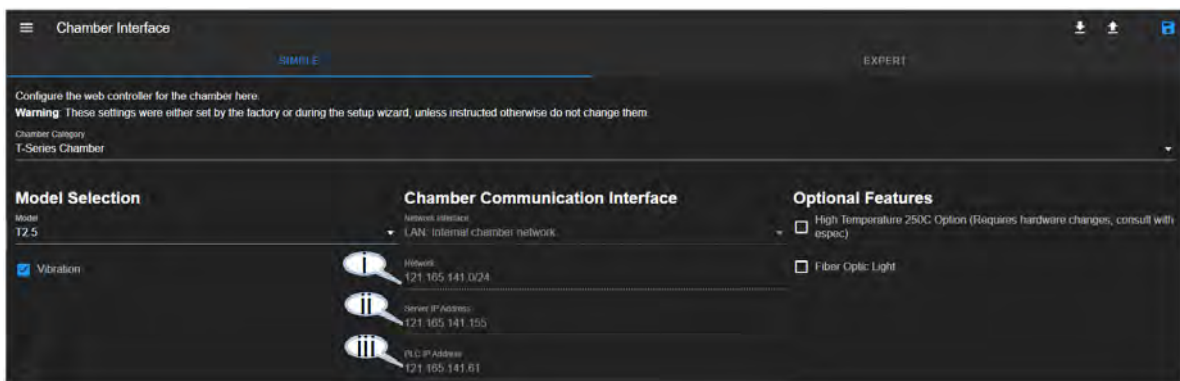


Figure 35.66: Predefined network parameters

The predefined parameters of the chamber communication interface, based on the above figure, are described as follows:

- i. **Internal Network:** This is the internal network that exists between the Web Controller and the chamber. It is statically configured using Class A network protocol.
- ii. **Server IP Address:** This is the Web Controller IP address. It is statically configured as 121.161.141.155. The Ethernet port designated for this network is labeled as **eth1**. Refer to the following diagram on the Web Controller hardware.
- iii. **PLC IP Address:** This is the IP address of the Allen Bradley PLC, statically configured as 121.165.1141.61.

ESPEC Web Controller hardware has two Ethernet ports; each is predefined and configured for a specific network connection, as depicted in the following figure. **eth1** is preconfigured for internal network between Web Controller and PLC; **eth0** is preconfigured to connect the Web Controller to the main network. Thus, during network troubleshooting, these two ports must have the correct cables plugged into them. To help identify **eth0** (when the Web Controller hardware is enclosed in a box), use the HDMI port as a reference; **eth0** is adjacent to it.

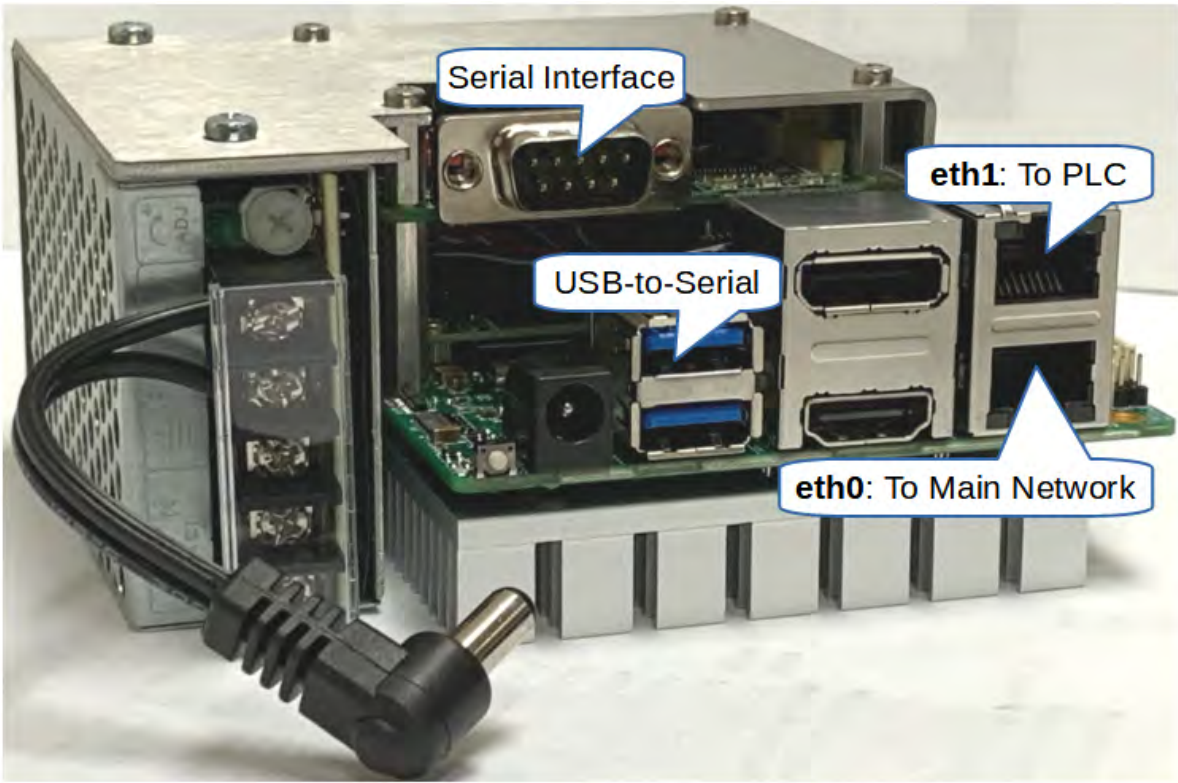


Figure 35.67: Ethernet ports on Web Controller hardware

The following figure depicts the two IP addresses used by ESPEC Web Controller for the two Ethernet ports designated in the above figure.

Current Network Status				
	IPv4 Address	IPv4 Netmask	IPv6 Address	MAC
eth0	10.30.200.232	255.255.0.0		00:07:32:7b:3a:a1
eth1	121.165.141.155 169.254.213.60	255.255.255.0 255.255.0.0	fe80::8d4e:9796:a2f2:62b6	64 00:07:32:7b:3a:a2

Figure 35.68: Ethernet ports of ESPEC Web Controller

4. **Save Settings:** There are three options to manage the chamber interface configuration (shown in the figure).

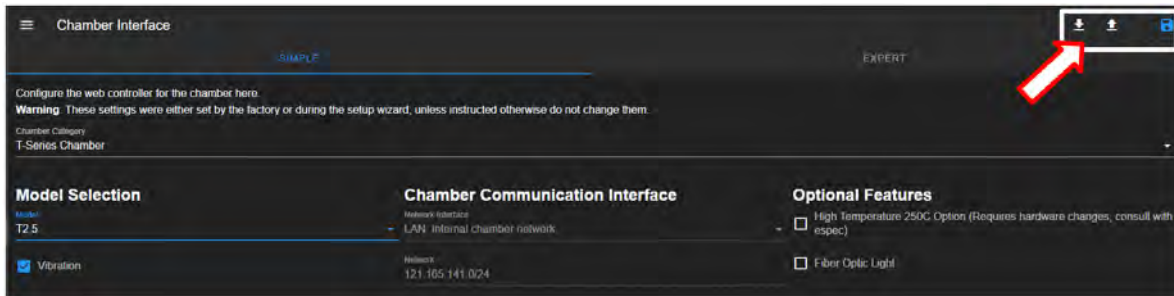


Figure 35.69: Manipulating interface settings

- **Export to Local File:** Click the down-arrow button to download the current settings for backup. The configuration file (in yaml) will be stored on the local computer with filename: chamber_interface_1.yaml.
- **Import from Local File:** Click the up-arrow button to import a configuration file from the local computer. To apply the new settings from this file, click the **Save** button.
- **Save Settings:** After modifying the parameters in the expert option, click the **Save** button to apply the current settings.

35.10.2 Simple: SCP220 Chamber Interface

Under the **Simple** option, communication between the chamber and ESPEC Web Controller is configured through three predetermined parameters: (1) Chamber Category, (2) Chamber Model and Controller, (3) Communication Interface. They are depicted in the following figure.

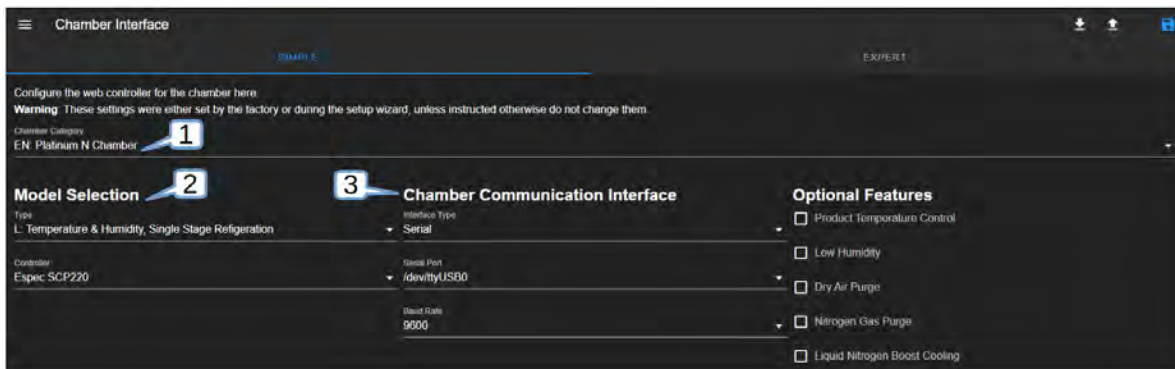


Figure 35.70: Configuration parameters

Refer to your documentations that were shipped with the chamber to obtain information for these parameters. They are required to successfully configure ESPEC Web Controller to control your chamber.

1. **Chamber Category:** Click the text field under **Chamber Category** to access a drop-down list, as depicted in the following figure. Select your chamber category from the list that matches the one described in your chamber manual.

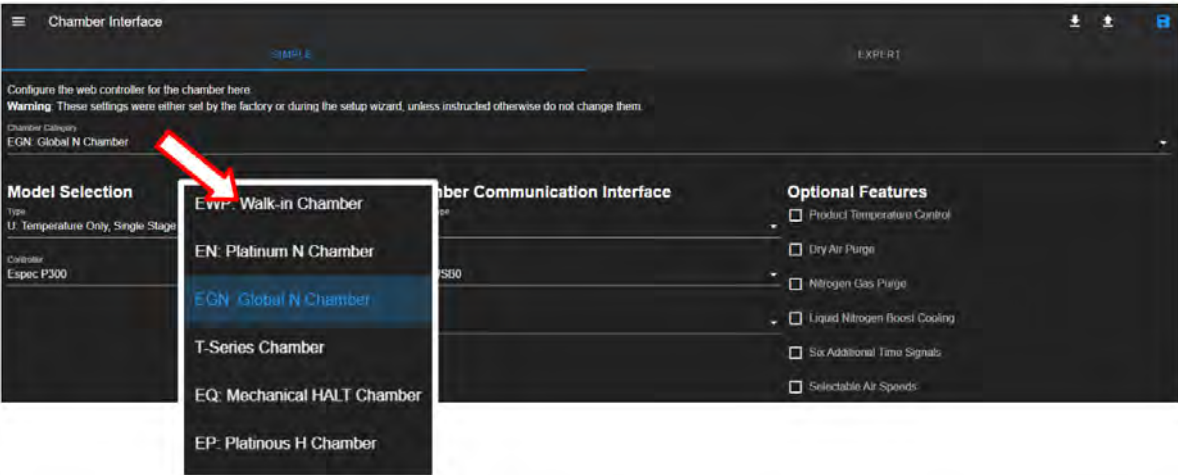


Figure 35.71: Chamber category selection

2. **Model Selection:** Click the text field under **Model** to access a drop-down list, as depicted in the following figure. Select your chamber model from the list that matches the one described in your chamber manual.

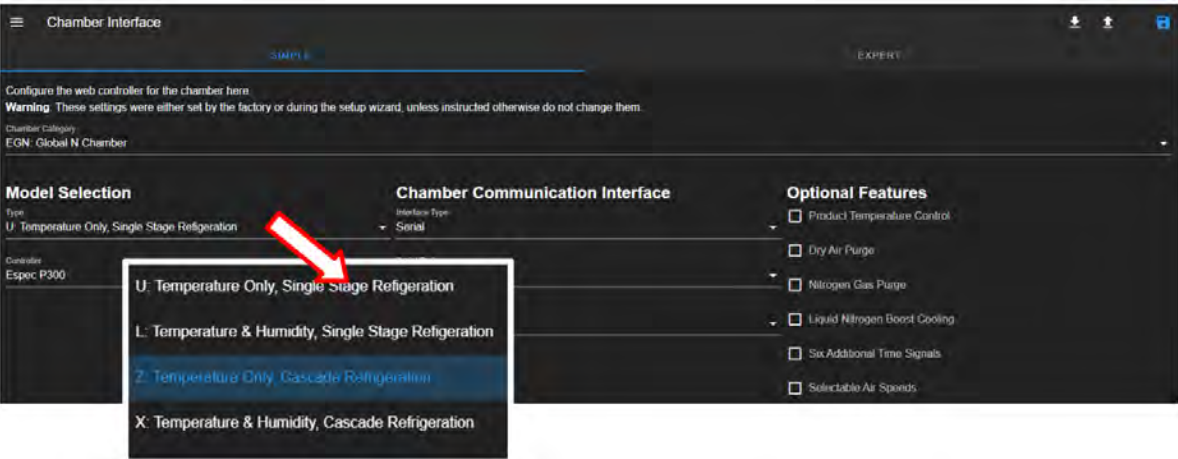


Figure 35.72: Model type and controller configuration

3. **Communication Interface:** Serial interface is the default communication protocol between ESPEC Web Controller and SCP220 PLC. The only predefined parameter for this protocol is the baud rate, setting at 9600.

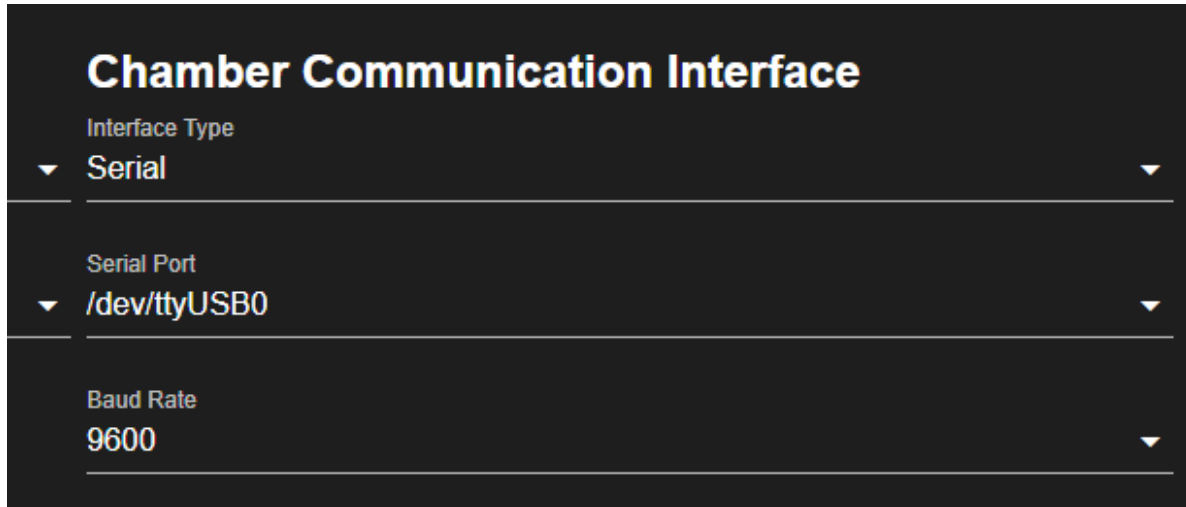


Figure 35.73: Predefined serial comm. parameters

ESPEC Web Controller will automatically select and configure a serial port designated as `/dev/ttyUSB0` (or `/dev/ttyUSB1`) for its interface.

4. **Save Settings:** Three options are available for managing the chamber interface configuration. These are **Export to local file**, **Import from local file** and **Save**, as depicted in the figure.

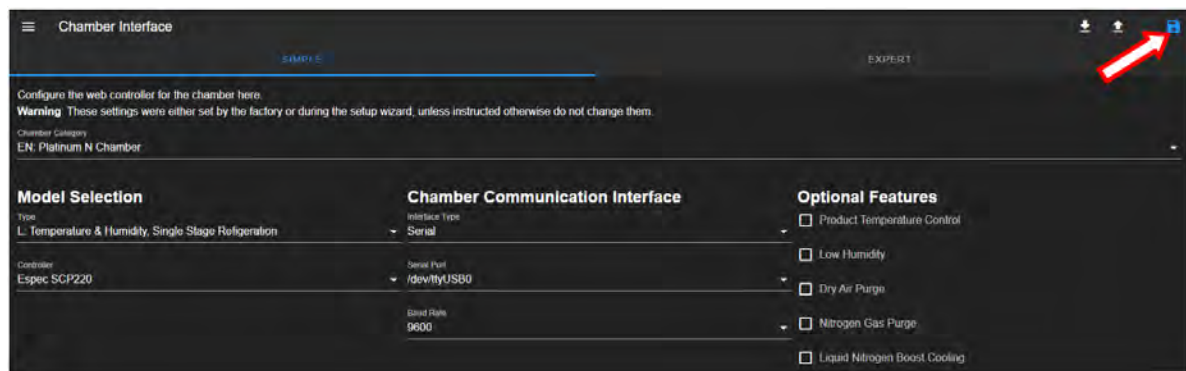


Figure 35.74: Manipulating interface settings

- **Export to Local File:** Click the down-arrow button to download the current settings for backup. The configuration file (in yaml) will be stored on the local computer with filename: `chamber_interface_1.yaml`.
- **Import from Local File:** Click the up-arrow button to import a configuration file from the local computer. To apply the new settings from this file, click the **Save** button.
- **Save Settings:** After modifying the parameters in the expert option, click the **Save** button to apply the current settings.

35.10.3 Simple: ESPEC 300 Chamber Interface

Under the **Simple** option, communication between the chamber and ESPEC Web Controller is configured through three predetermined parameters: (1) Chamber Category, (2) Chamber Model and Controller, (3) Communication Interface. They are depicted in the following figure.

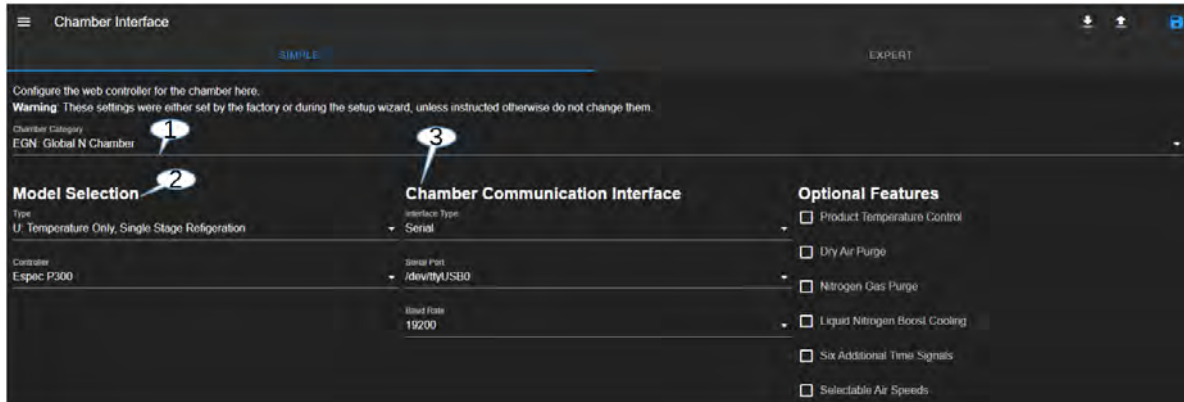


Figure 35.75: Configuration parameters

Refer to your documentations that were shipped with the chamber to obtain information for these parameters. They are required to successfully configure ESPEC Web Controller to control your chamber.

1. **Chamber Category:** Click the text field under **Chamber Category** to access a drop-down list, as depicted in the following figure. Select your chamber category from the list that matches the one described in your chamber manual.

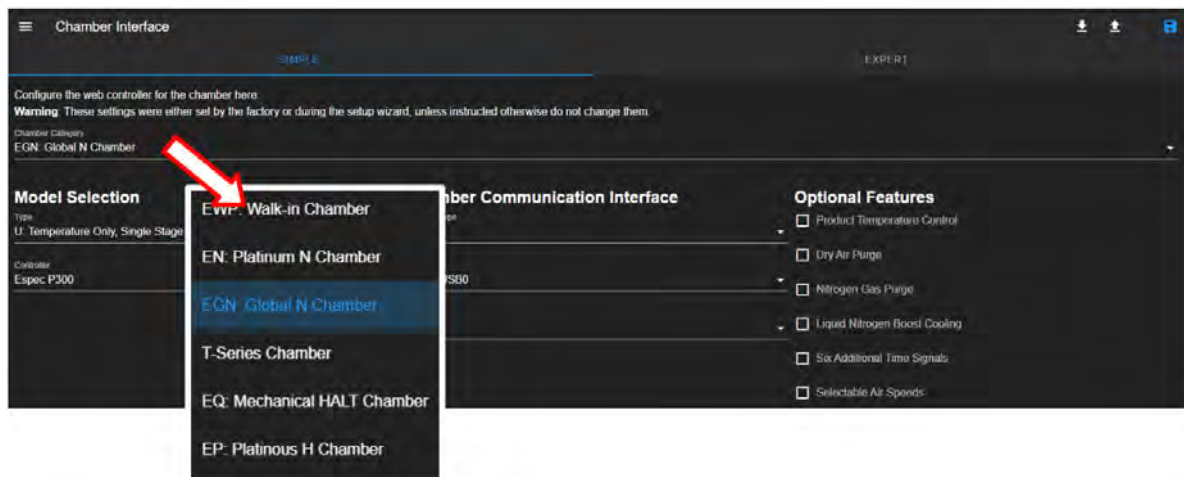


Figure 35.76: Chamber category selection

2. **Model Selection:** Click the text field under **Model** to access a drop-down list, as depicted in the following figure. Select your chamber model from the list that matches the one described in your chamber manual.

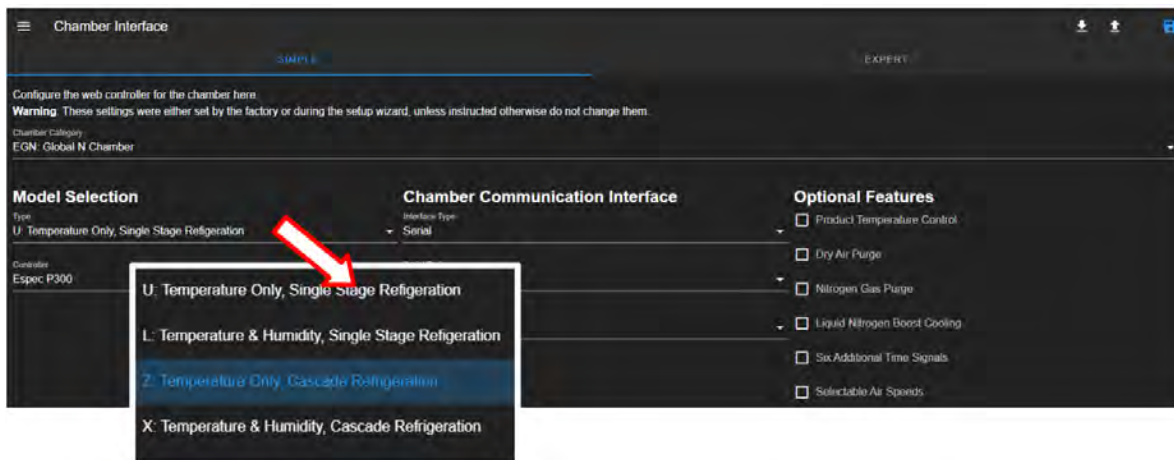


Figure 35.77: Model type and controller configuration

3. **Communication Interface:** Serial interface is the default communication protocol between ESPEC Web Controller and P300 PLC. The only predefined parameter for this protocol is the baud rate, setting at 19200.

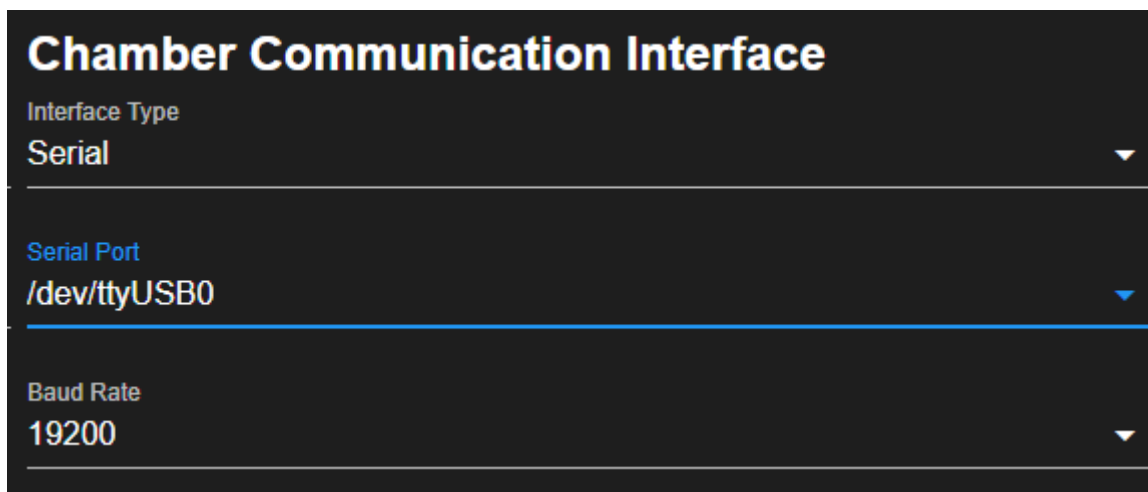


Figure 35.78: Predefined serial comm. parameters

ESPEC Web Controller will automatically select and configure a serial port designated as `/dev/ttyUSB0` (or `/dev/ttyUSB1`) for its interface.

4. **Save Settings:** Three options are available for managing the chamber interface configuration. These are **Export to local file**, **Import from local file** and **Save**, as depicted in the figure.

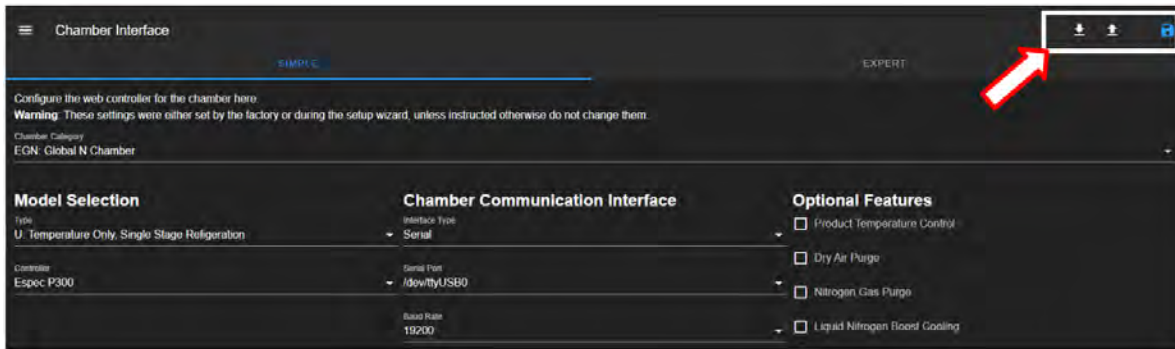


Figure 35.79: Manipulating interface settings

- **Export to Local File:** Click the down-arrow button to download the current settings for backup. The configuration file (in yaml) will be stored on the local computer with filename: chamber_interface_1.yaml.
- **Import from Local File:** Click the up-arrow button to import a configuration file from the local computer. To apply the new settings from this file, click the **Save** button.
- **Save Settings:** After modifying the parameters in the expert option, click the **Save** button to apply the current settings.

35.10.4 Simple: Watlow F4T Chamber Interface

Under the **Simple** option, communication between the chamber and ESPEC Web Controller is configured through three predetermined parameters: (1) Chamber Category, (2) Chamber Model and Controller, (3) Communication Interface. They are depicted in the following figure.

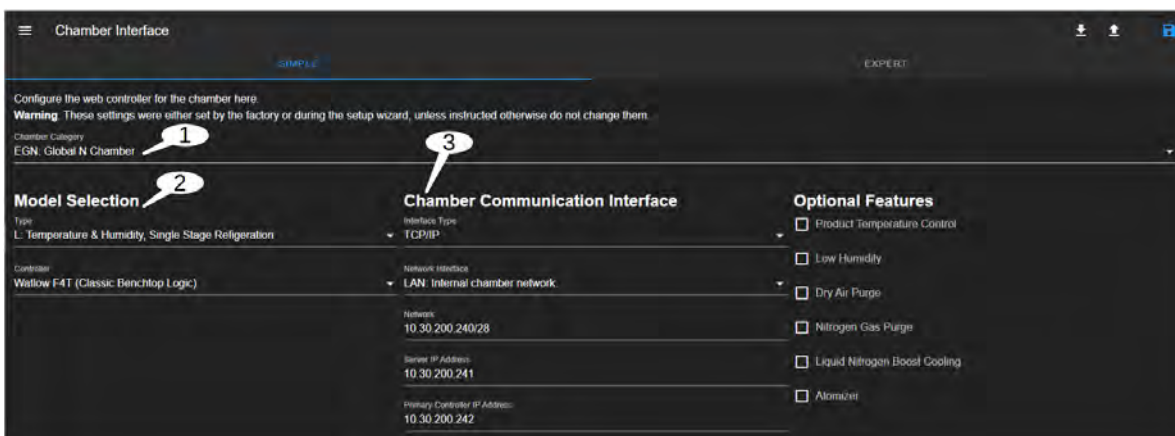


Figure 35.80: Configuration parameters

Refer to your documentations that were shipped with the chamber to obtain information for these parameters. They are required to successfully configure ESPEC Web Controller to control your chamber.

1. **Chamber Category:** Click the text field under **Chamber Category** to access a drop-down list, as depicted in the following figure. Select your chamber category from the list

that matches the one described in your chamber manual.

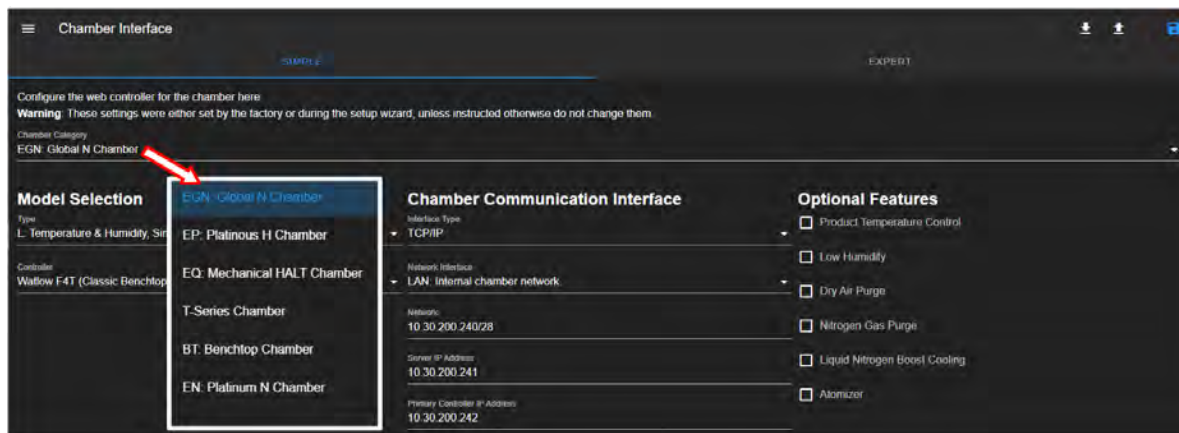


Figure 35.81: Chamber category selection

2. Model Selection:

- **Type:** Click the text field under **Type** to access a drop-down list, as depicted in the following figure. Select your chamber type from the list that matches the one described in your chamber manual.
- **Controller:** Click the text field under **Controller** to access a drop-down list, as depicted in the following figure. Select your controller type from the list that matches the one described in your chamber manual.

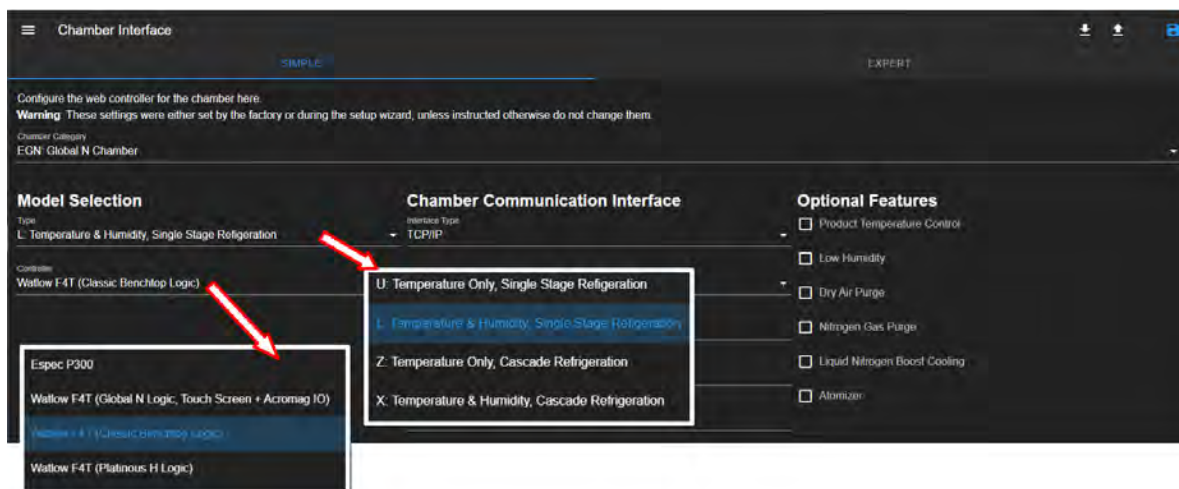


Figure 35.82: Model type and controller configuration

3. **Communication Interface:** By default, ESPEC Web Controller applies TCP/IP to communicate with Watlow F4T using a set of predefined network parameters, as shown in the following figure. An internal network was set up for this communication with an IP address of 10.30.200.241 assigned to ESPEC Web Controller and 10.30.200.242 to the F4T.

Model Selection	Chamber Communication Interface	Optional Features
Type L: Temperature & Humidity, Single Stage Refrigeration	Interface Type TCP/IP	<input type="checkbox"/> Product Temperature Control
Controller Watlow F4T (Classic Benchtop Logic)	Network Interface LAN: Internal chamber network	<input type="checkbox"/> Low Humidity
	Network 10.30.200.240/28	<input type="checkbox"/> Dry Air Purge
	Server IP Address 10.30.200.241	<input type="checkbox"/> Nitrogen Gas Purge
	Primary Controller IP Address 10.30.200.242	<input type="checkbox"/> Liquid Nitrogen Boost Cooling
		<input type="checkbox"/> Atomizer

Figure 35.83: Predefined network parameters

ESPEC Web Controller hardware has two Ethernet ports; each is predefined and configured for a specific network connection, as depicted in the following figure. **eth1** is preconfigured for internal network between Web Controller and PLC; **eth0** is preconfigured to connect the Web Controller to the main network. Thus, during network troubleshooting, these two ports must have the correct cables plugged into them. To help identify **eth0** (when the Web Controller hardware is enclosed in a box), use the HDMI port as a reference; **eth0** is adjacent to it.

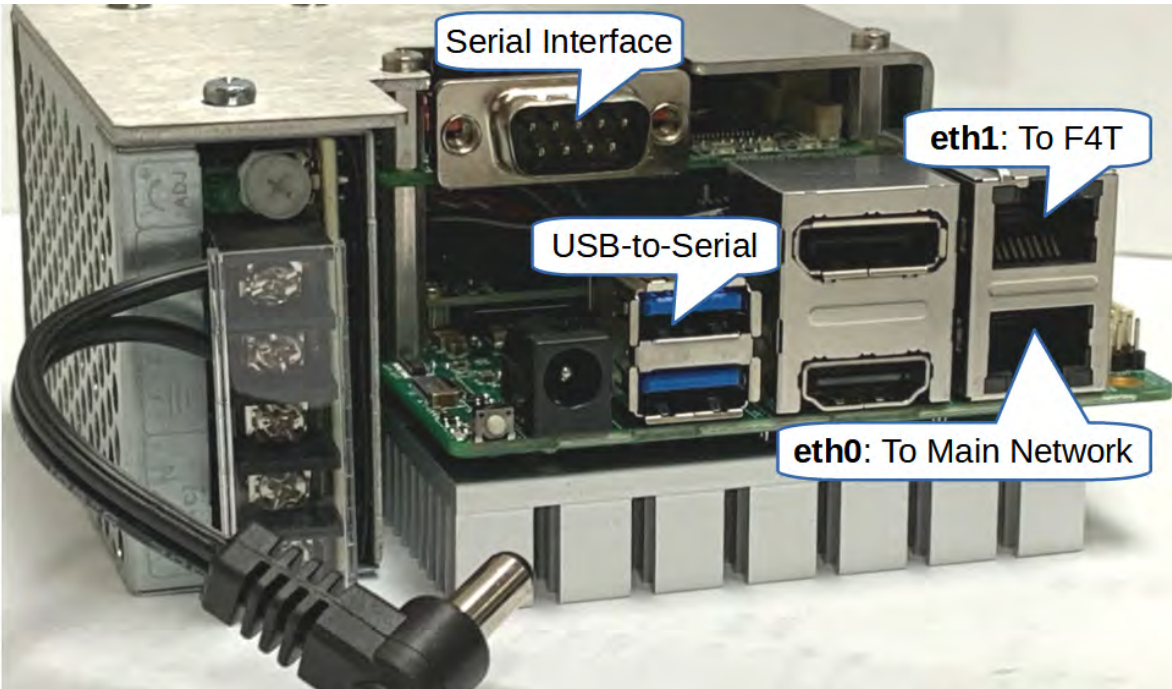


Figure 35.84: Ethernet ports on Web Controller hardware

The following figure depicts the two IP addresses used by ESPEC Web Controller for the two Ethernet ports designated in the above figure.

Current Network Status					
	IPv4 Address	IPv4 Netmask	IPv6 Address	IPv6 Netmask	MAC
eth0	10.30.100.108	255.255.0.0			00:07:32:7b:3a:a1
eth1	10.30.200.241	255.255.255.240			00:07:32:7b:3a:a2

Figure 35.85: Ethernet ports of ESPEC Web Controller

- **Interface Type:** It is to be emphasized that TCP/IP is the default communication protocol. There is no need to make any selection for the interface type, except to confirm that TCP/IP has been selected. If your chamber uses a serial interface for communication with ESPEC Web Controller, and the chamber manual specifies such information, then make sure to select **Serial** from the drop-down list. Confirm also that the F4T has the right settings for ModbusRTU protocol (via Settings, Network and Modbus).

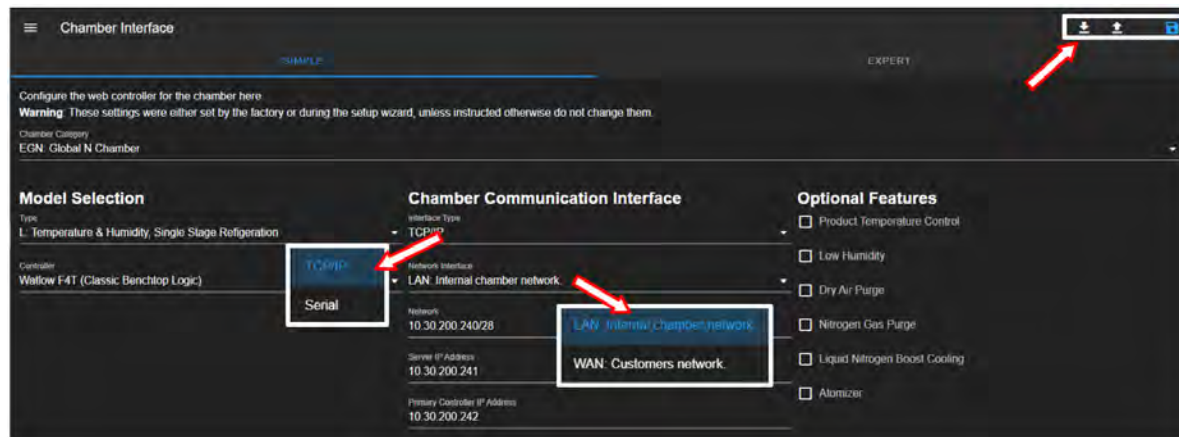


Figure 35.86: Communication interface configuration

- **Network Interface:** If ESPEC Web Controller uses TCP/IP as the default communication, then LAN is the default selection. The WAN option is a configuration where the internal network does not exist between ESPEC Web Controller and the F4T. This option requires a reconfiguration of the network setup with both ESPEC Web Controller and F4T part of the (customer's) main network. This setup may require assistance from ESPEC customer support.
4. **Save Settings:** There are three options to manage the chamber interface configuration, as depicted in the upper-right corner.
 - **Export to Local File:** Click the down-arrow button to download the current settings for backup. The configuration file (in JSON) will be stored on the local computer.
 - **Import from Local File:** Click the up-arrow button to import a configuration file from the local computer.
 - **Save Settings:** To update the current setting, click the **Save** button.

35.10.5 Watlow F4 Chamber Interface

Under the **Simple** option, communication between the chamber and ESPEC Web Controller is configured through three predetermined parameters: (1) Chamber Category, (2) Chamber Model and Controller, (3) Communication Interface. They are depicted in the following figure.

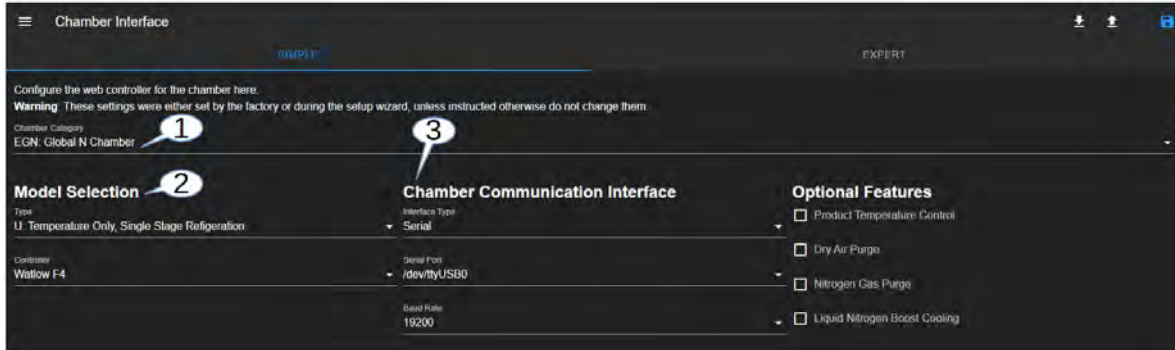


Figure 35.87: Configuration parameters

Refer to your documentations that were shipped with the chamber to obtain information for these parameters. They are required to successfully configure ESPEC Web Controller to control your chamber.

1. **Chamber Category:** Click the text field under **Chamber Category** to access a drop-down list, as depicted in the following figure. Select your chamber category from the list that matches the one described in your chamber manual.

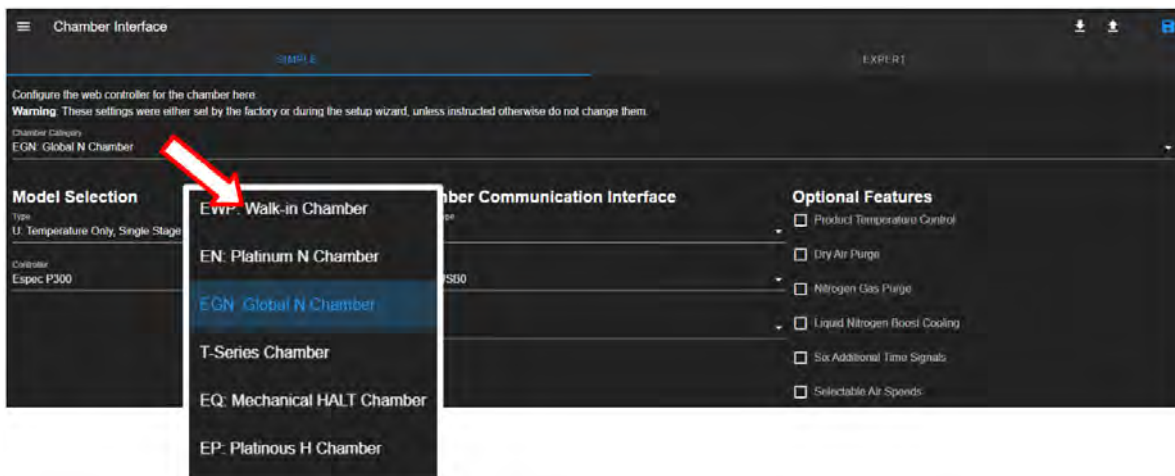


Figure 35.88: Chamber category selection

2. **Model Selection:** Click the text field under **Model** to access a drop-down list, as depicted in the following figure. Select your chamber model from the list that matches the one described in your chamber manual. Under **Controller**, select Watlow F4.

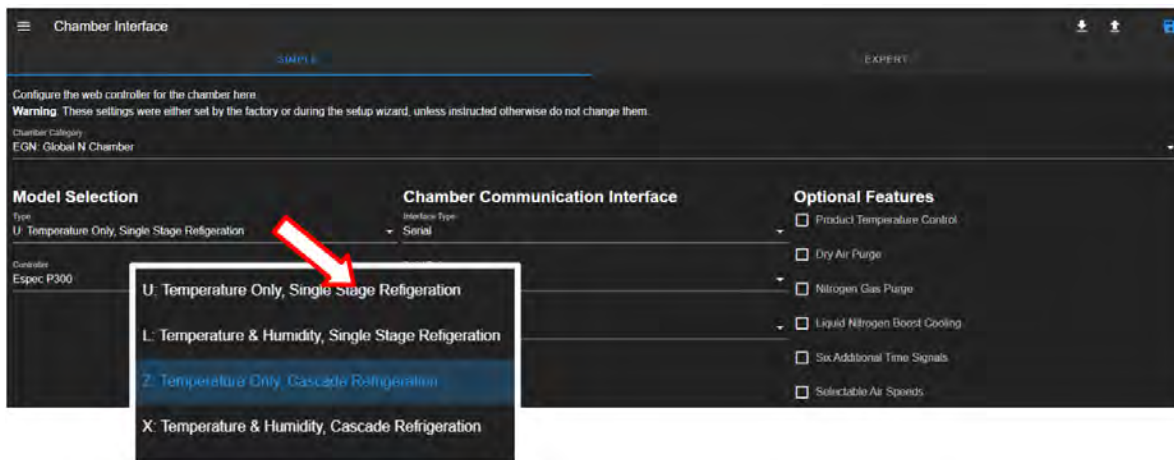


Figure 35.89: Model type and controller configuration

3. **Communication Interface:** Serial interface is the default communication protocol between ESPEC Web Controller and F4 PLC. The only predefined parameter for this protocol is the baud rate, setting at 19200.

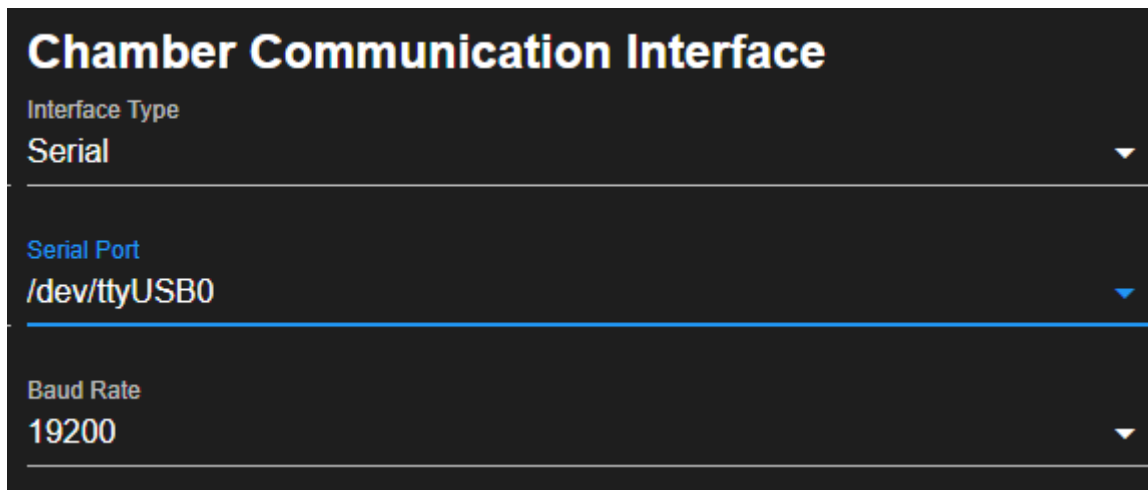


Figure 35.90: Predefined serial comm. parameters

ESPEC Web Controller will automatically select and configure a serial port designated as `/dev/ttyUSB0` (or `/dev/ttyUSB1`) for its interface.

4. **Save Settings:** Three options are available for managing the chamber interface configuration. These are **Export to local file**, **Import from local file** and **Save**, as depicted in the figure.

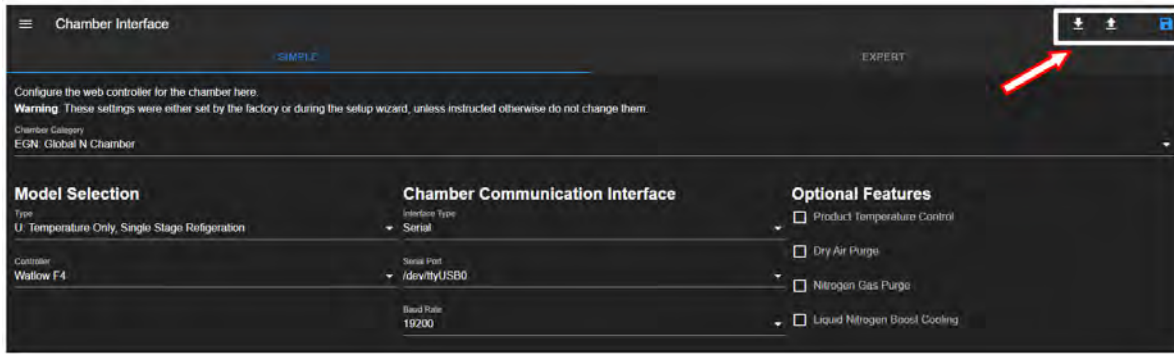


Figure 35.91: Manipulating interface settings

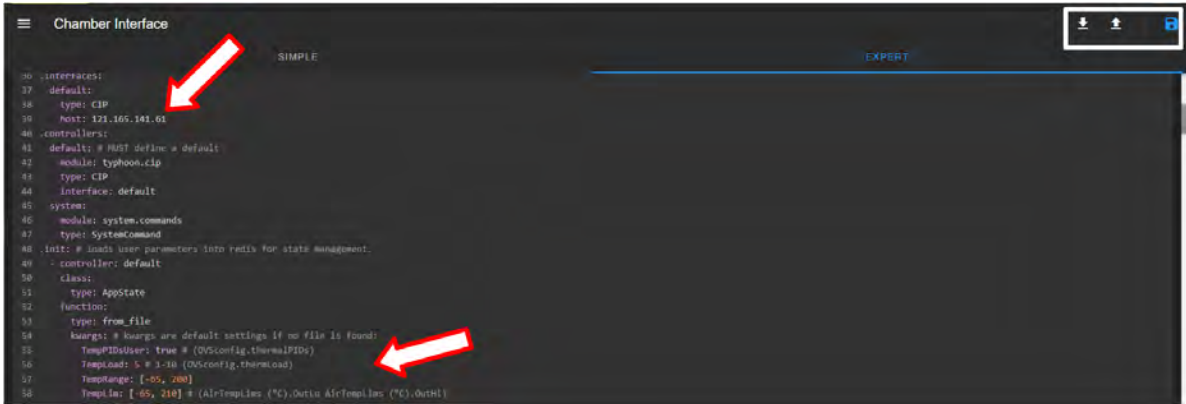
- **Export to Local File:** Click the down-arrow button to download the current settings for backup. The configuration file (in yaml) will be stored on the local computer with filename: chamber_interface_1.yaml.
- **Import from Local File:** Click the up-arrow button to import a configuration file from the local computer. To apply the new settings from this file, click the **Save** button.
- **Save Settings:** After modifying the parameters in the expert option, click the **Save** button to apply the current settings.

35.10.6 Chamber Interface: Expert

The expert menu offers flexibility for customizing the interface configuration for the intended chamber. Only an operator with knowledge of the PLC configuration and the **yaml** syntax should modify the settings. Knowledge of the PLC features and its I/O modules is required to successfully configure ESPEC Web Controller to connect to and use the chamber. The expert option consists of a list or set of parameters structured in **yaml** syntax, as depicted in the following figure. ESPEC Web Controller scans this file and parses the parameters to apply the settings for chamber operation.

Refer to the specific item that applies to your chamber and PLC.

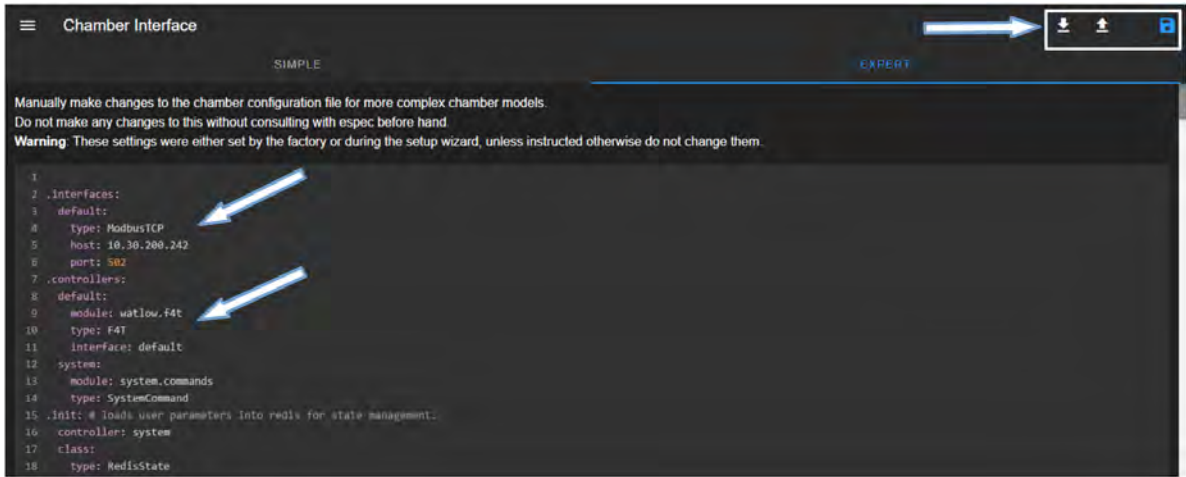
1. **T-Series:** The following figure illustrates the **Expert** configuration of a T-series chamber.



```
30 .interfaces:
31   default:
32     type: CIP
33     host: 121.165.141.61
34
35 .controllers:
36   default: # MUST define a default
37     module: typhoon.cip
38     type: CIP
39     interface: default
40     system:
41       module: system.commands
42       type: SystemCommand
43
44 .init: # loads user parameters into redis for state management.
45
46 .controller: default
47
48 class:
49   type: AppState
50
51 function:
52   type: from_file
53
54 #args: # args are default settings if no file is found:
55 Temp2Doubles: true # (OSconfig.therm2Doubles)
56 TempLoad: 5 * 1.10 (OSconfig.thermLoad)
57 TempRange: [-65, 200]
58 TempIn: [-65, 210] + (AirTempIn (°C), OutIn AirTempIn (°C), OutIn)
```

Figure 35.92: Configuration file of Expert setting option

2. **Watlow F4T**: The following figure illustrates the **Expert** configuration of an F4T chamber.



```
1
2 .interfaces:
3   default:
4     type: ModbusTCP
5     host: 10.30.200.242
6     port: 502
7
8 .controllers:
9   default:
10    module: watlow.F4t
11    type: F4T
12    interface: default
13    system:
14      module: system.commands
15      type: SystemCommand
16
17 .init: # loads user parameters into redis for state management.
18
19 .controller: system
20
21 class:
22   type: RedisState
```

Figure 35.93: Configuration file of Expert setting option

3. **Watlow F4**: The following figure illustrates the **Expert** configuration of an F4 chamber.

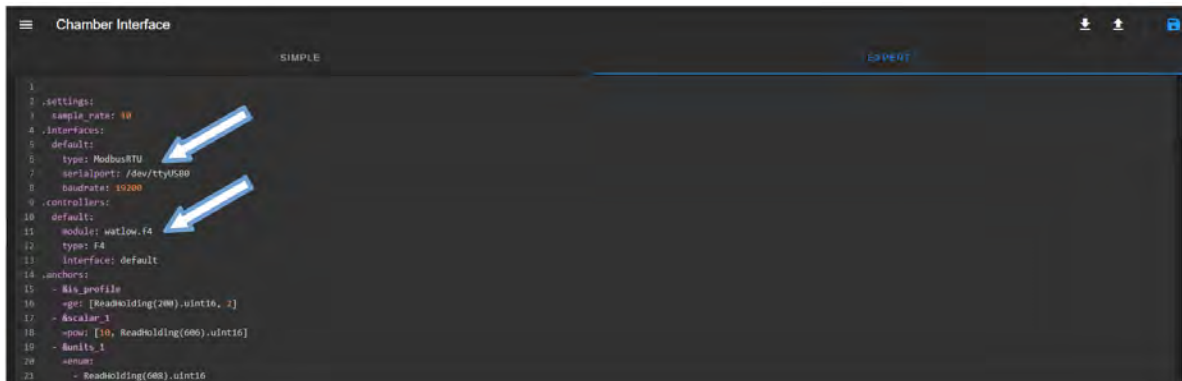


Figure 35.94: Configuration file of Expert setting option

4. **ESPEC P300**: The following figure illustrates the **Expert** configuration of a P300 chamber.

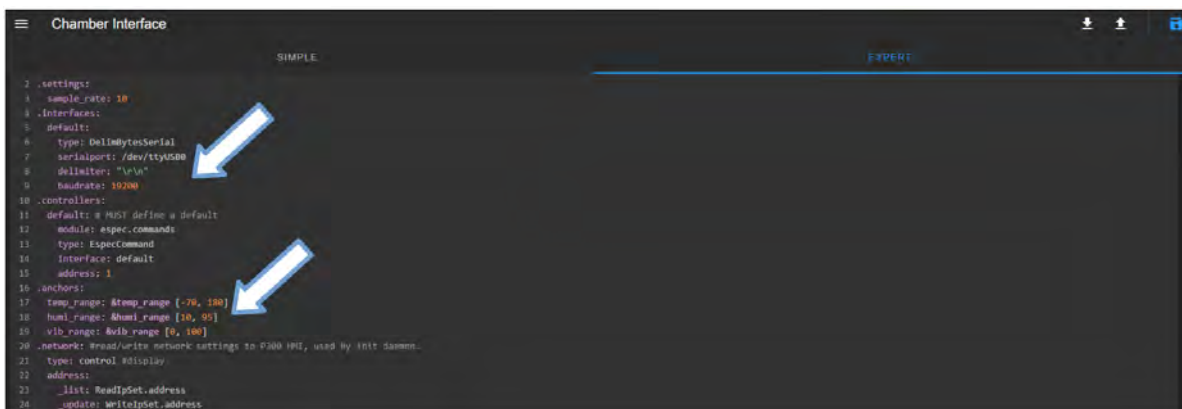


Figure 35.95: Configuration file of Expert setting option

5. **ESPEC SCP220**: The following figure illustrates the **Expert** configuration of an SCP220 chamber.

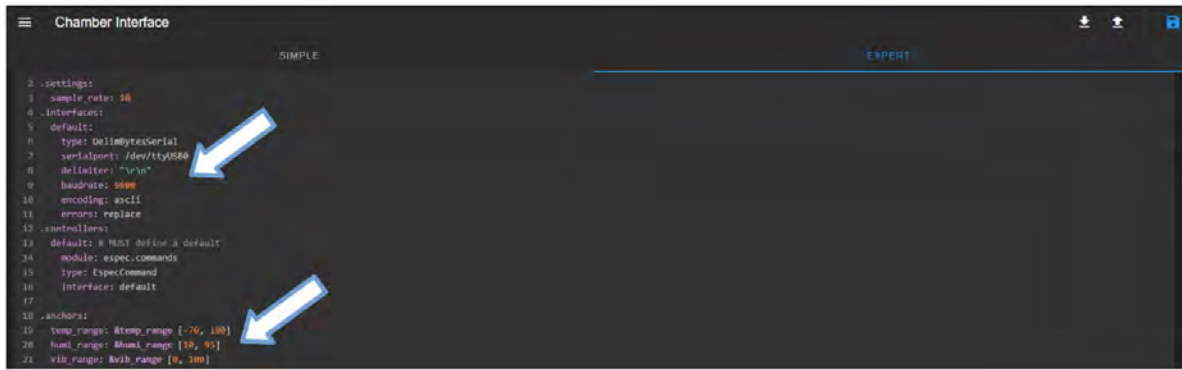


Figure 35.96: Configuration file of Expert setting option

The contents in this yaml file begins with the sample rate configuration and the type of interface used for communication, indicated by the arrow. The list continues with all the available features and specifications of the chamber that include temperature, humidity and vibration range.

Custom configuration can follow any one of these two methods:

1. **Content Modification:** Modify the contents of the yaml file, with an appropriate yaml syntax and data structure. For the new settings to take effect, click the **Save** button.
2. **Uploading Yaml File:** Click the **Import** button to upload the yaml configuration file from the local computer. The contents of this file must follow the syntax and data structure of **yaml**.

It is important to have a backup of the original yaml file listed on this page. Click the **Export** button (down-arrow) in the upper-right corner to download the yaml file to store on the local computer. This file can be used to quickly restore the chamber interface settings.

35.11 Firmware

ESPEC Web Controller is designed with the ability to continually receive improvements in the form of a Firmware Update to provide bug fixes and software upgrade with new features. Firmware update follows one of two approaches (as depicted in the following figure): (1) Automatic Firmware Updates, (2) Offline (Manual) Firmware Updates.

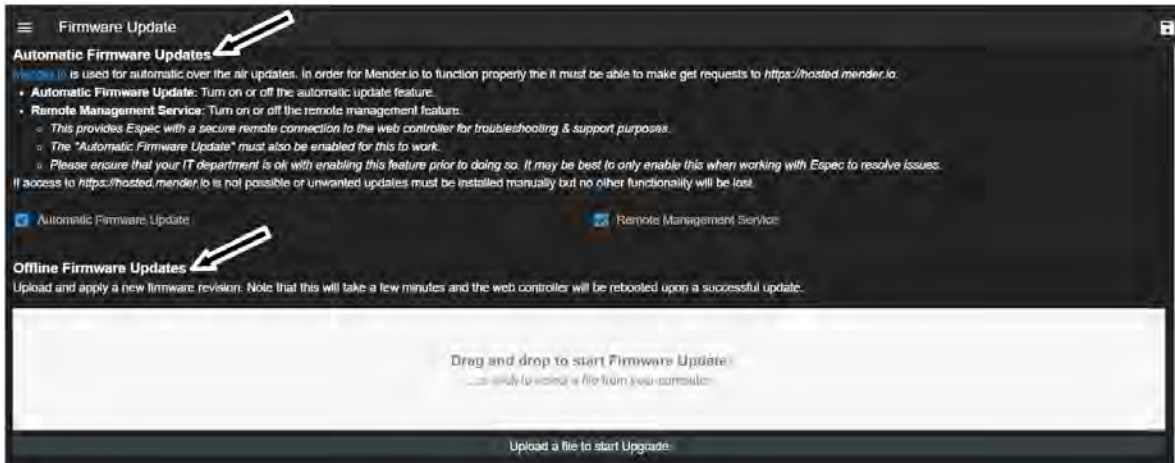


Figure 35.97: Firmware update options

ESPEC Web Controller has been carefully designed to be robust and stable. It incorporates a mechanism that prevents interruption to the work flow during a software update. Technically, the system keeps two versions of the software:

1. Current version of the operating firmware.
2. Previously installed version.

If, for some reasons, firmware update failed, the system reverts to using its previous version known to be in the stable state, until the update issue is resolved. ESPEC Web Controller will switch its operation to run on the new firmware immediately after a successful update. All data logging files and configurations will be brought over to operate on the new firmware. The operator may not even notice the changes in the internal system.

35.11.1 Online Automatic Update

Automatic firmware update allows ESPEC to link to the Web Controller remotely to perform a software update. Mender.io service is employed to handle the firmware update. The customers and their IT department have complete control and freedom to dictate the use of this service. Should they decide to use this service, they will need to complete the following steps:

1. Check the **Automatic Firmware Update** box.
2. Check the **Remote Management Service** box.
3. Click **Save** in the upper-right corner to apply and save the setting, as illustrated in the following figure. **Note:** In order for the automatic update service to work, the Web Controller must have access to the Internet.



Figure 35.98: Automatic update configuration

35.11.2 Offline Manual Update

The Offline Manual Update can be used if the Automatic Update is undesirable. Complete the following steps to apply the manual firmware update:

1. Obtain Firmware Update Package from ESPEC and store it on the local computer.
2. Drag-and-drop the package in the white box as shown in the following figure. Or, click the **Upload a file to start Upgrade** and select the Firmware Update package on the local computer.

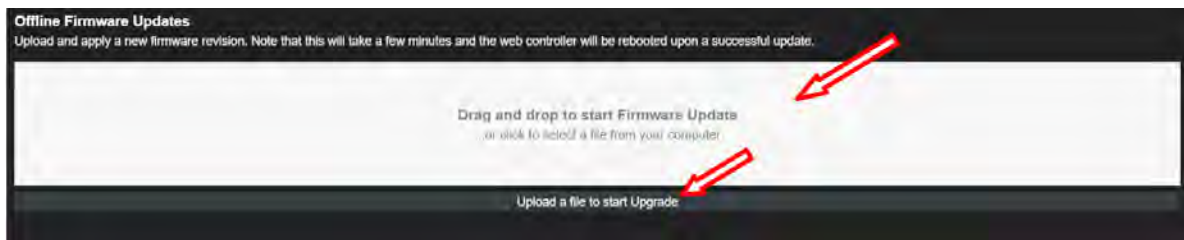


Figure 35.99: Manual update configuration

3. Once an update package has been loaded, the system begins to install the new firmware, as shown in the following figure.



Figure 35.100: System moves to perform firmware update

4. Click **REBOOT** indicated in the figure to restart the system.

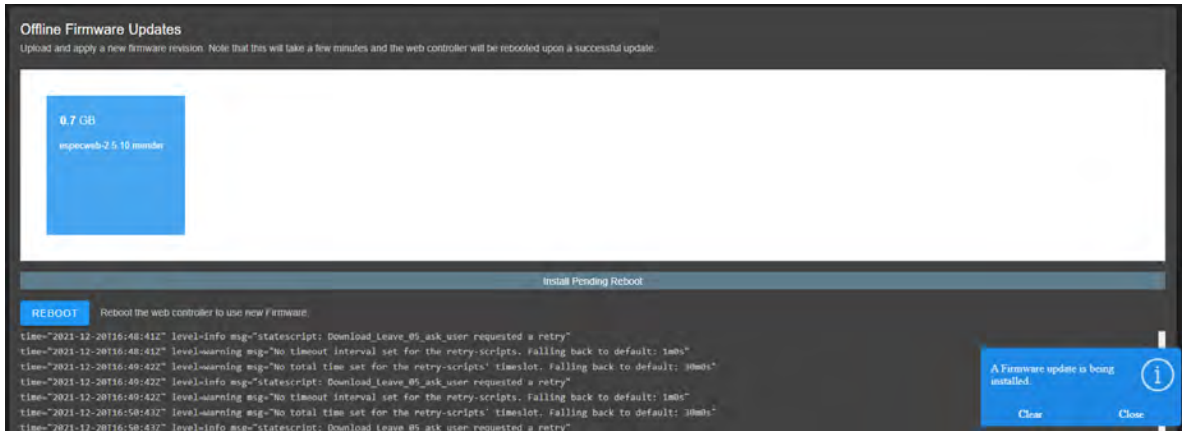


Figure 35.101: Firmware update is complete

35.11.3 Rollback Firmware

The Web Controller can rollback its firmware to the previous stable state by clicking on the **ROLLBACK** button as depicted in the following figure.

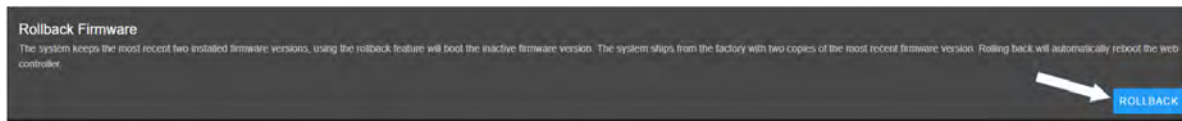


Figure 35.102: Rollback a firmware update

35.12 Programming Interface via API Settings

ESPEC Web Controller offers several interfaces for other application software to read or write the parameters from or to the target chamber. One such method is the API (Application Programming Interface) front-end application with two separate methods: General and Delimited ASCII.

With the **GENERAL** setting, RESTful API can be quickly configured via the authentication mode and a direct controller access, using the **No Authentication** and **Enable** settings, respectively. Default communication priority level is 6.

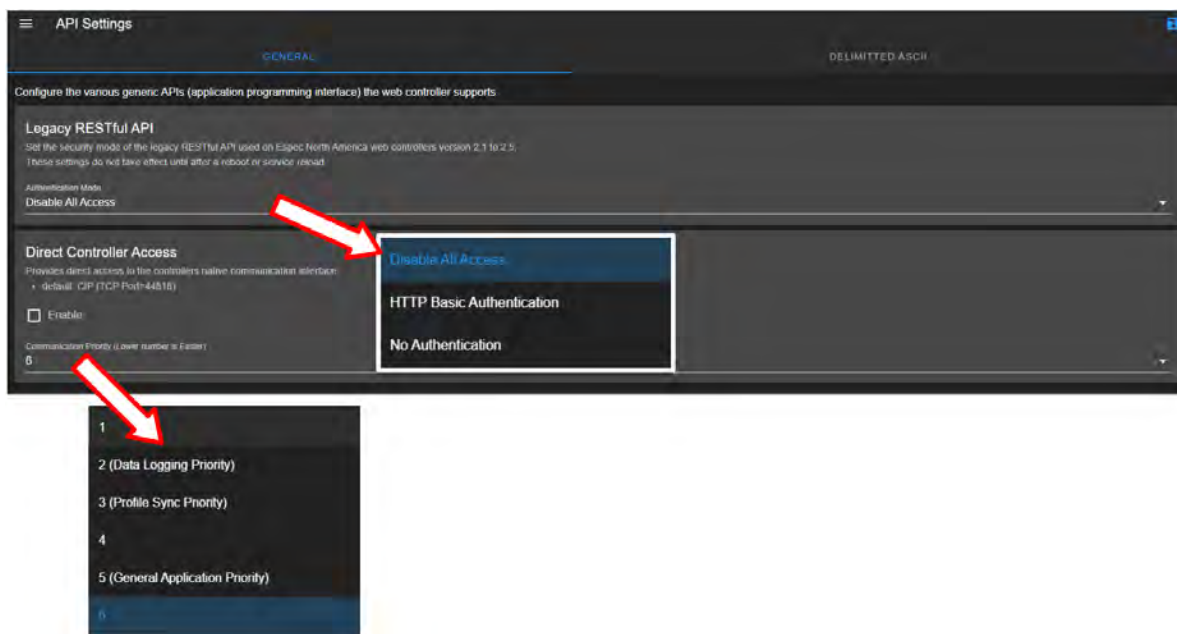


Figure 35.103: api-general-settings-001a.PNG

The **DELIMITED ASCII** configuration supports the text command application based on ASCII commands. Different rules and syntax settings apply to provide the correct ASCII commands, as depicted in the following figure.

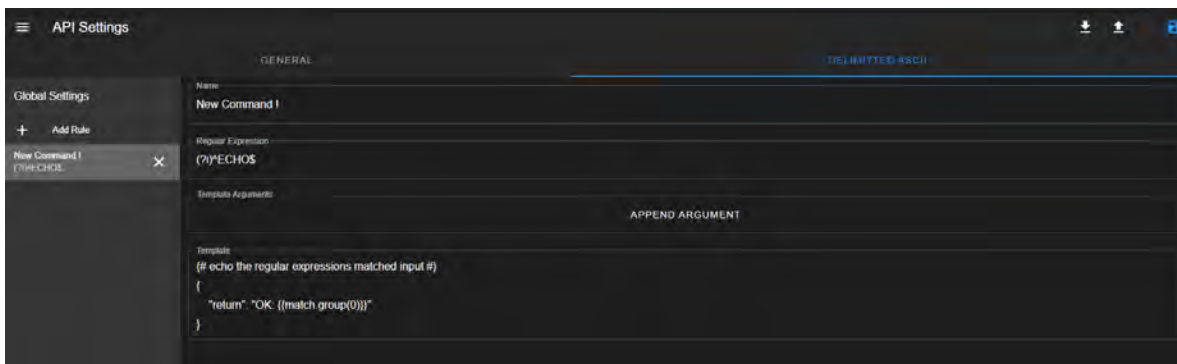


Figure 35.104: api-delimitier-001.PNG

35.12.1 Communication Protocol for ESPEC P300/SCP-220

Direct communication with the P300/SCP-220 via raw data through the Web Controller can be achieved using the raw TCP protocol. The TCP forwarder listens for a raw TCP stream on port 10001. To establish communication, with PuTTY terminal emulator installed on your MS Windows system and launched, enter the hostname or IP address of the Web Controller in the Host Name field and set 10001 for port communication, as depicted in the following figure.

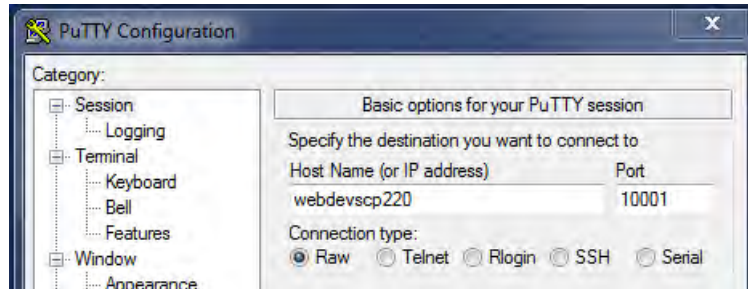


Figure 35.105: PuTTY setup for raw TCP communication

Two types of data transmission exist in this protocol: Command data and Response data.

1. **Command Data:** The command data consists of two types: Monitor commands and Setting commands. The monitor commands are used to monitor the conditions of the chamber, while the setting commands are used to change or configure the settings of the chamber, such as temperature and humidity.
2. **Response Data:** The response data are basically data returned (responded) by the controller in response to the command data.

The command data sent from the computer to the controller has a specific syntax based on a two-component format: command data and delimiter. The response data sent from the controller also contains a two-component format: response data and delimiter. The delimiter is the carriage return (CR) character followed by a line feed (LF), abbreviated as CRLF.

A brief overview of these two data types is outlined below. Refer to the “P300 or SCP-220 Controller Communications Option Manual” for complete details on them.

1. The command data format will be as follows: [command data][delimiter]
 - [command data] is any command found in the “P300 or SCP-220 Controller Communications Option Manual”.
 - [delimiter] is CRLF. The effect of pressing the Enter key on the keyboard produces the CRLF on the terminal.
2. Each command will return a Response in the following format: [response data][delimiter]
 - [response data] can be any of the following:
 1. If the command data is issued to query for a data, response data will return the data in the format described in the “P300 or SCP-220 Controller Communications Option Manual”.
 2. If the command data is issued to set a parameter in the controller, response data will return “OK: [command data]” where [command data] is the command that prompted the response.
 3. If there was an error executing the command, the controller will return “NA: [error message]”. Error messages and their meanings are listed in the “P300 or SCP-220 Controller Communications Option Manual”. In addition to the error messages listed in the manual, this interface also adds the error message “NA: SERIAL TIMEOUT” when the chamber Controller takes too long to respond to the command data.
 - [delimiter] is CRLF.
3. The interface will timeout after one hour of no activity.

The following figure illustrates the use of a command data to display the ROM information of the controller and its temperature setting. As shown in the figure, to monitor the ROM of the controller, type “ROM?” (or “rom?”) and press Enter. To monitor the temperature setting, type “TEMP?” (or “temp?”) and press Enter.



Figure 35.106: Example of PuTTY command data and response data

35.12.2 Communication Protocol for the Watlow F4T, F4

The communication protocol provided for the Watlow F4T is Modbus TCP port 502. Due to its slow performance, the Modbus TCP interface is not recommended to use for communicating with the Web Controller. The Watlow F4T’s own Modbus TCP interface should be used instead.

35.13 Server Settings

The **Server Settings** page is the “flight control center” for ESPEC Web Controller, where the entire set of operations and system processes can be monitored, managed and controlled. This page contains a long list of different groups of services to support ESPEC Web Controller maintain a smooth operation. Different services are categorized and grouped as tabs in the service bar, as shown in the following figure.

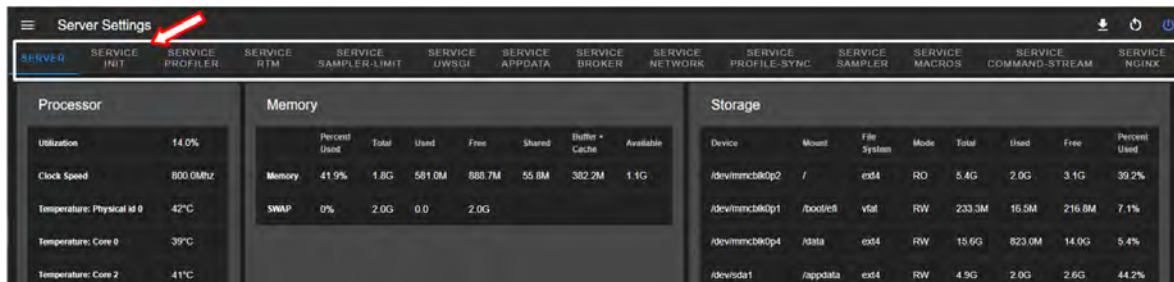


Figure 35.107: Server settings control center

By default, the **Server Settings** page displays the server’s (that is, ESPEC Web Controller’s) hardware resources that include CPU, primary storage (RAM) and secondary storage (disk) utilization, as depicted in the following figure. A list of different services (i.e., processes) is displayed under the **Processes** window. These processes can be browsed through via the scroll bar.



displayed in the service bar. The **Service Broker**, whose job is to monitor the communication status between ESPEC Web Controller and the chamber, has reported a communication error, as depicted in the following figure.



Figure 35.112: Communication error between Web Controller and chamber

This error causes a chain reaction (ripple effect) on other daemons, such as **Service Profiler**, **Service Init**, **Service Sampler**, **Service Macros**. It prevents ESPEC Web Controller from “controlling” the chamber. The **Service Network** tab shows that network connection has become **inactive** (or dead), as depicted in the following figure.

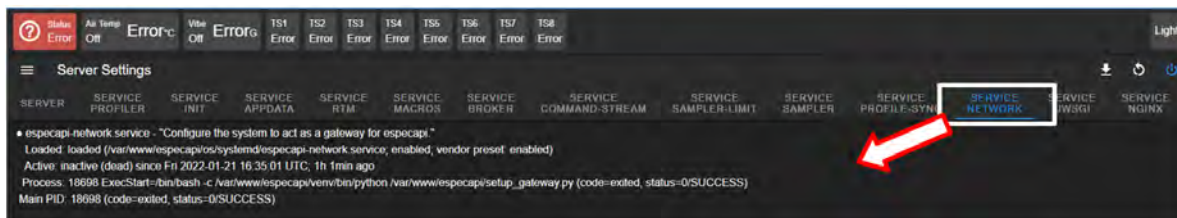


Figure 35.113: Network communication was disconnected

The issue illustrated here is caused by a loss of network connection. To re-establish network connection between the Web Controller and the chamber, complete the following steps:

1. Check for loose Ethernet connection between ESPEC Web Controller and the chamber.
2. ESPEC Web Controller will reestablish connection with the chamber automatically, as depicted in the following figure.

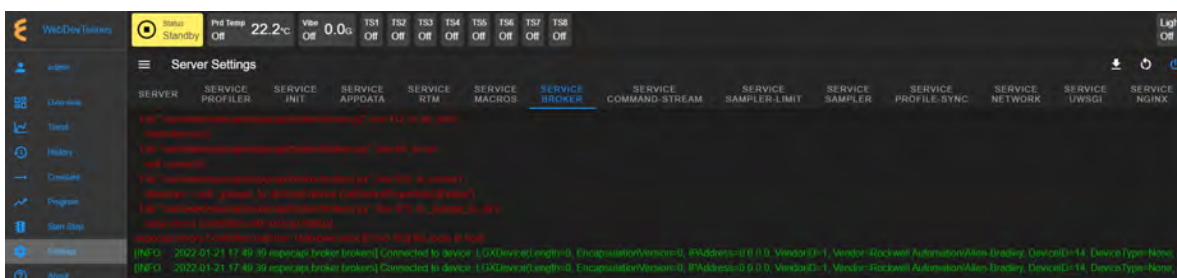


Figure 35.114: Network connection reestablished

ESPEC Web Controller now resumes its operation, as indicated by the status bar as **Standby**.

If the above procedure did not work, the services effected by the lost of communication need to be restarted. Complete the following steps:

1. Click the **SERVICE INIT** tab in the service bar.
2. Click the **Restart Services** button indicated by the arrow.

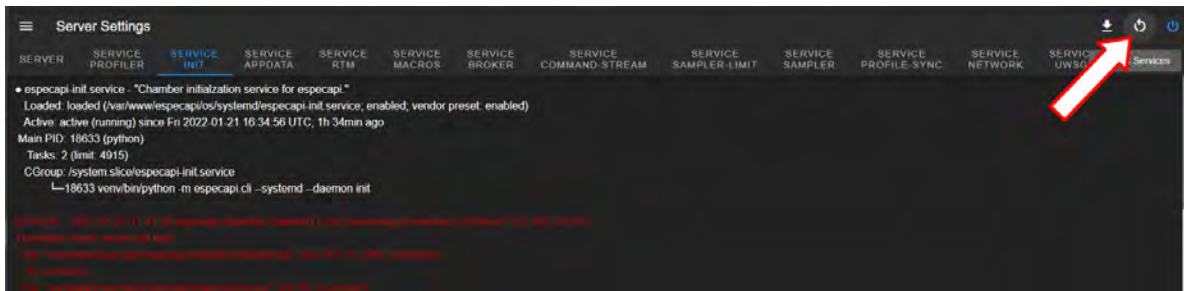


Figure 35.115: Restarting network service

3. The **SERVICE INIT** is the **especapi-init.service** (i.e., initialization service) responsible for setting up a service available for bridging the chamber with the Application Programming Interface (especAPI) and chamber initialization. It also reinitializes other daemons, such as **Service Profiler**, **Service Sampler**, **Service Macros**. The new message appeared under each tab indicates that the daemon has been started and chamber initialization process is complete. Communication between the Web Controller and chamber has been established, as depicted in the following figures.

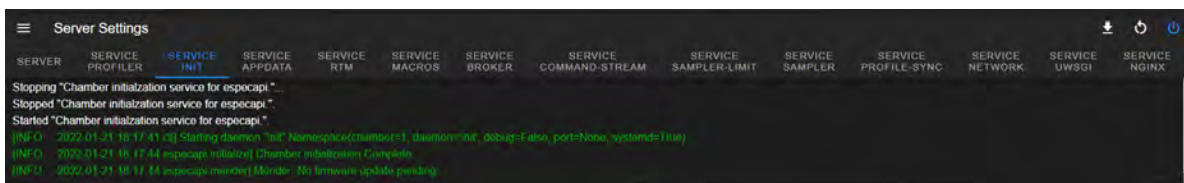


Figure 35.116: Initialization service completed

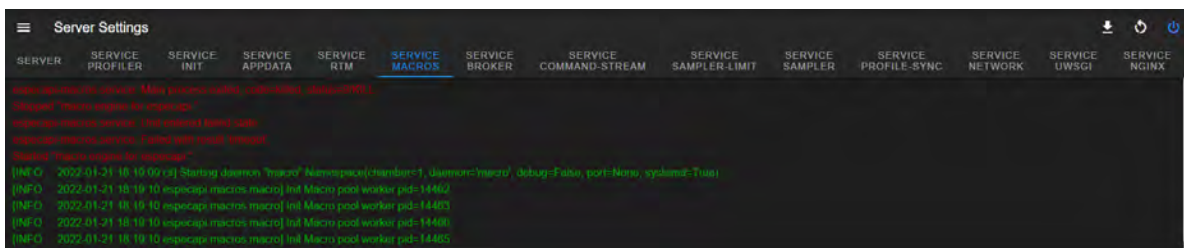


Figure 35.117: Macros service also restarted

4. Network communication has been established. The Web controller can now resume its operation.

In most cases, restarting a network connection is all that is needed to get the Web Controller and chamber working again. It is rare that other services become corrupted and stop working for no reason. However, if the situation arises, these services can be restarted with the **RESTART SERVICES** button (as outlined above).

35.13.2 Reboot Server

Sometimes, certain services may stop working and refuse to respond to the restart request. In this case, rebooting ESPEC Web Controller is the only option to bring the entire system back to normal operation.

complete the following steps:

1. Click the **Reboot Server** button.

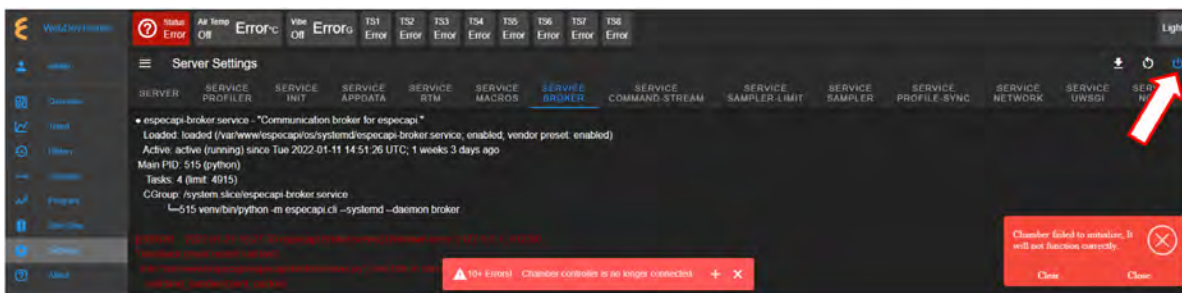


Figure 35.118: Rebooting ESPEC Web Controller

2. Reboot action will commence as depicted in the following figure.

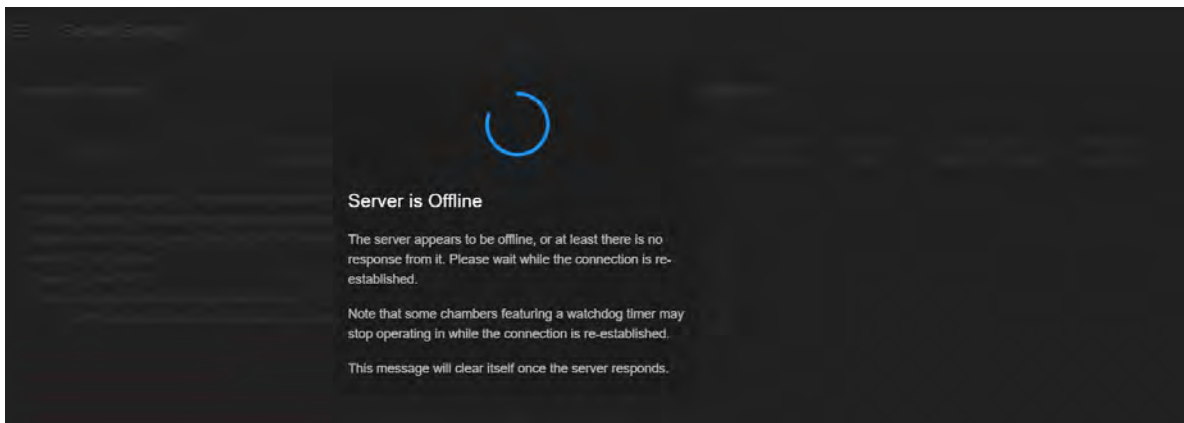


Figure 35.119: Reboot the Web Controller

3. If ESPEC Web Controller is not back online, after 3-5 minutes, refresh the Web page or open a new Web browser to access ESPEC Web Controller on the new page. Upon refreshing the Web page, ESPEC Web Controller is back online.



Figure 35.120: Service broker in normal operation

35.14 HMI Settings

The **HMI Settings** submenu is available only when ESPEC Web Controller detects a monitor (touchscreen or non-touchscreen) directly connected to its HDMI or video display port during its startup (i.e., during booting). The following figure depicts the **HMI Settings** submenu displayed on the detected touchscreen monitor. This submenu is not visible on the **Settings** submenu when accessed via a Web browser on the local computer.

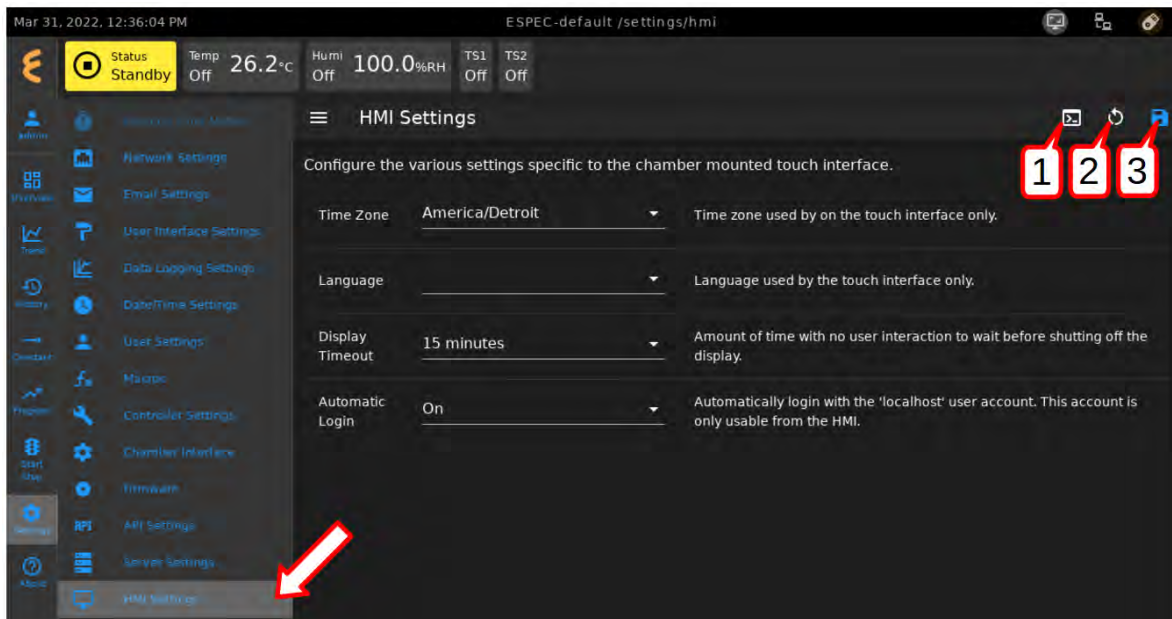


Figure 35.121: HMI setting options

The **HMI Settings** submenu has three manipulation buttons or options; they are described as follows:

1. **Terminal:** This option is for Manufacturer's use only.
2. **Restart Application:** Click the cycle icon to cancel and clear any changes on the HMI setting and restart the UI application.
3. **Save:** Click the **Save** button to save changes on the current settings.

Four different HMI settings are available for configuration: Time Zone, Language, Display Time-

out and Automatic Login. These four settings have specific descriptions to support their functionality as depicted in the following figure. Each setting can be configured using the available options from the drop-down menu and via the on-screen keyboard, as shown below.

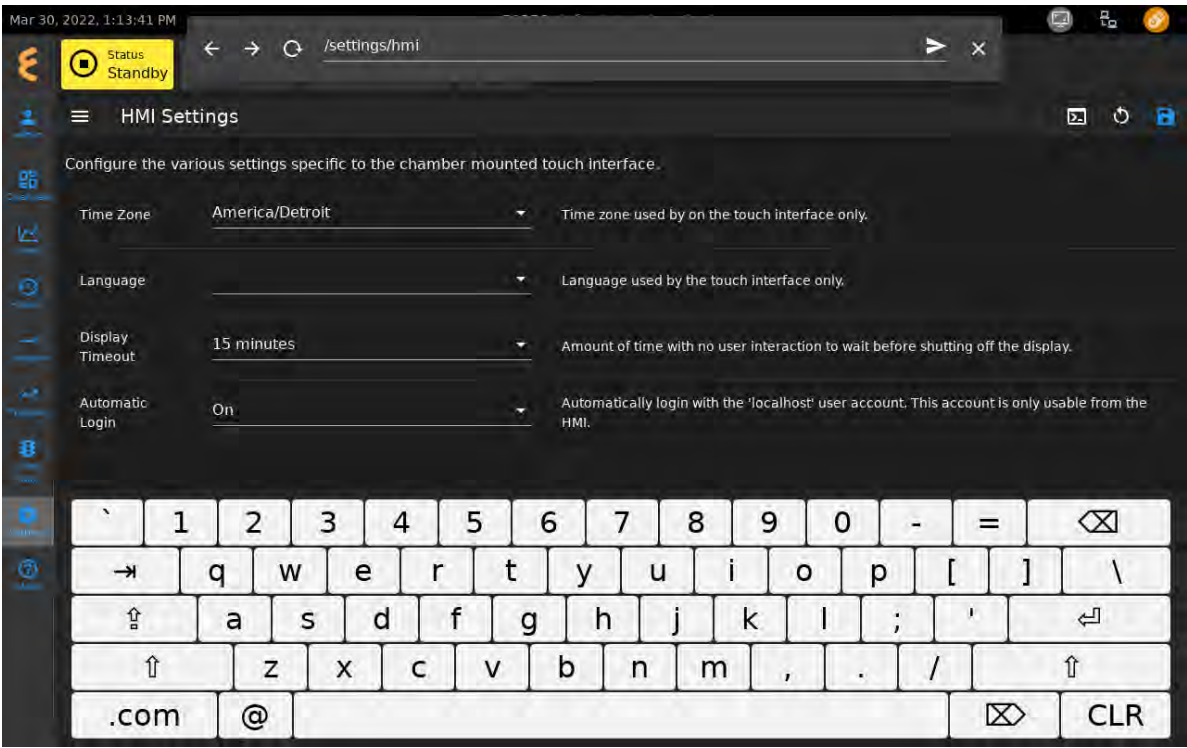


Figure 35.122: Using on-screen keyboard

ESPEC Web Controller Software, Version 3
USER'S MANUAL

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