electro-tech systems

EnviroPro PLC

M 5300, M 5300-24

Operating Manual

Table of Contents

Products described in this manual are designed and assembled in the U.S.A. by

Electro-Tech Systems, Inc.

700 West Park Avenue

Perkasie, PA 18944

I. Important Safety Information

WARNING

This symbol accompanied by the word “WARNING” calls attention to an act or a condition which can lead to serious personal injury or death of operators and bystanders.

CAUTION

This symbol accompanied by the word “CAUTION” indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

The symbol without any warning text indicates potential damage to device when misused.

This symbol indicates the presence of hazardous AC or DC voltages constituting the risk of electric shock.

This symbol indicates a risk of fire due to improper handling or failure of device. For continued protection against risk of fire, when replacing fuses use only fuses of the specified type and current ratings.

This symbol indicates the danger of an electro-static discharge to which equipment may be sensitive.

Observe all precautions for handling electrostatic sensitive devices.

These symbols indicate extreme temperature which can cause burns or frostbite. Avoid contact with surface. Failure to follow precautions may result in moderate to severe injury.

SAFETY INSTRUCTIONS

The equipment described in this manual is designed and manufactured to operate within defined design limits. Any misuse may result in electric shock or fire. To prevent the equipment from being damaged, the following rules should be observed for installation, use and maintenance. **Read the following safety instructions before operating the instrument.**

POWER

POWER CORD: Use only the power cord specified for this equipment and certified for the country of use. If the power (mains) plug is replaced, follow the wiring connections specified for the country of use. When installing or removing the power plug, **hold the plug, not the cord.** The AC supply must be single phase, with RMS Voltage in range 90 – 264 VAC, alternating at a frequency in range 47 – 63 Hz.

OPERATION

CAUTION

DO NOT OPERATE WITH COVERS OR PANELS REMOVED. **Voltages inside the equipment consist of line operating at 24 VDC.**

DO NOT OPERATE WITH SUSPECTED EQUIPMENT FAILURES. If any odor or smoke becomes apparent turn off the equipment and unplug it immediately. Failure to do so may result in electrical shock, fire, or permanent damage to the equipment. Contact the factory for further instructions.

DO NOT OPERATE IN AN EXPLOSIVE ATMOSPHERE. Operating the equipment in the presence of flammable gases or fumes **constitutes a definite safety hazard**. For equipment designed to operate in such environments the proper safety devices must be used such as dry air or inert gas purge, intrinsic safe barriers and/or explosion-proof enclosures.

DO NOT IMPEDE THE CHAMBER FROM VENTING EXCESS PRESSURE. Dehumidification system is an open loop system that pumps external air into the chamber. If the chamber is not allowed to vent, pressure can build up and cause serious damage to the chamber. A pressure monitoring system is highly recommended.

INLET AIR PRESSURE MUST BE LESS THAN 100 PSI (6.89 Bar) & INLET AIR TEMPERATURE MUST BE WITH RANGE OF 33° - 120° F (0.5° - 49° C) Serious injury could result.

APPROPRIATE FILTRATION OF COMPRESSED AIR IS RECOMMENDED. Build-up of contaminates can damage the desiccant towers & reduce their effectiveness in drying inlet air. **AIR PRESSURE MUST BE GREATER THAN 50 PSI (3.45 Bar)** For optimal system performance.

DO NOT USE IN ANY MANNER NOT SPECIFIED OR APPROVED BY THE MANUFACTURER. Unapproved use may result in damage to the equipment or present an electrical shock or fire hazard.

Informations Importantes d'inocuite

WARNING

Ce symbole accompagné du mot « AVERTISSEMENT »(WARNING) attire l'attention sur un acte ou une condition qui peut entraîner des blessures graves ou la mort des opérateurs et des passants.

CAUTION

Ce symbole accompagné du mot « ATTENTION » (CAUTION)indique une situation potentiellement dangereuse qui, si elle n'est pas évitée, pourra entraîner des blessures mineures ou modérées. Le symbole sans texte d'avertissement indique des dommages potentiels à l'appareil en cas d'utilisation abusive.

Ce symbole indique la présence d'une climatisation dangereuse ou d'un courant continu constituant le risque de choc électrique.

Ce symbole indique un risque d'incendie dû à une mauvaise manipulation ou à une défaillance de l'appareil. Pour une protection continue contre les risques d'incendie, lors du remplacement des fusibles, utilisez uniquement des fusibles du type et des valeurs nominales spécifiés.

Ce symbole indique le danger d'une décharge électrostatique à laquelle l'équipement peut être sensible. Observez toutes les précautions à prendre pour manipuler les appareils sensibles a l'electicite statique.

Ces symboles indiquent une température extrême qui peut causer des brûlures ou des engelures. Éviter le contact avec la surface. Le non-respect des précautions peut entraîner des blessures modérées à graves.

CONSIGNES DE SÉCURITÉ

Lisez et comprenez bien le manuel de l'utilisateur avant d'utiliser cette machine. Le non-respect des instructions d'utilisation peut entraîner la mort ou des blessures graves

L'équipement décrit dans ce manuel est conçu et fabriqué pour fonctionner dans les limites de conception définies. Toute mauvaise utilisation peut entraîner un choc électrique ou un incendie. Pour éviter que l'équipement ne soit endommagé, les règles suivantes doivent être respectées pour l'installation, l'utilisation et l'entretien. Lisez les consignes de sécurité suivantes avant d'utiliser l'instrument.

ALIMENTATION

CORDON D'ALIMENTATION : Utilisez uniquement le cordon d'alimentation spécifié pour cet équipement et certifié pour le pays d'utilisation. Si la fiche d'alimentation (secteur) est remplacée, suivez les connexions de câblage spécifiées pour le pays d'utilisation. Lors de l'installation ou du retrait de la fiche d'alimentation, **tenez la fiche, pas le fil.**

MISE À LA TERRE : Le cordon d'alimentation fourni est équipé d'une **fiche à 3 broches avec mise à la terre (une fiche avec une troisième broche de mise à la terre).** Il s'agit à la fois d'une fonction de sécurité pour éviter les chocs électriques et d'une exigence pour le bon fonctionnement de l'équipement. Si la prise à utiliser n'est pas compatible avec la fiche à 3 broches, changez la prise ou utilisez un adaptateur de mise à la terre.

FUSIBLES : Remplacez les fusibles uniquement par des fusibles ayant le courant nominal, la tension et le type spécifié tels que fusion normale, temporisation, etc. **N'UTILISEZ PAS** de fusibles de fortune ou ne court-circuitez pas le porte-fusible. Cela pourrait entraîner un risque d'électrocution ou d'incendie ou endommager gravement l'instrument.

OPÉRATION

PRUDENCE

NE PAS UTILISER AVEC LES COUVERCLES OU LES PANNEAUX RETIRÉS. **Les tensions à l'intérieur de l'équipement consistent en une ligne (secteur) pouvant aller de** 100 à 240 VAC.

NE PAS UTILISER AVEC DES PANNES D'ÉQUIPEMENT SUSPECTES. Si une odeur ou de la fumée se dégage, éteignez l'équipement et débranchez-le immédiatement. Le non-respect de cette consigne peut entraîner un choc électrique, un incendie ou des dommages permanents à l'équipement. Contactez l'usine pour plus d'instructions.

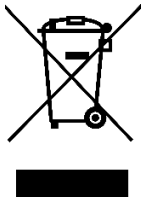
NE PAS UTILISER DANS UNE ATMOSPHÈRE EXPLOSIVE. L'utilisation de l'équipement en présence de gaz ou de fumées inflammables constitue un danger certain pour la sécurité. Pour les equipement concus pour fonctionnner dans de tels environnement, des dispositifs de sécurité appropriés doivent être utilisés, tels que la purge d'air sec ou de gaz inerte, les barrières de sécurité intrinsèque et/ou les enceintes antidéflagrantes..

NE PAS EMPÊCHER LA CHAMBRE D'ÉVACUER L'EXCÈS DE PRESSION. Les systèmes de déshumidification disponibles comprennent des systèmes en boucle ouverte qui pompent l'air extérieur dans la chambre. Si la chambre n'est pas autorisée à s'aérer, la pression peut s'accumuler et causer de graves dommages à la chambre.

UTILISEZ UNE SOURCE D'EAU DISTILLÉE OU DÉSIONISÉE POUR L'HUMIDIFICATION. L'accumulation de contaminants sur le transducteur causera des contraintes au transducteur et à l'électronique et entraînera une défaillance prématurée et invalidera la garantie.

NE PAS UTILISER D'UNE MANIÈRE NON SPÉCIFIÉE OU APPROUVÉE PAR LE FABRICANT. Une utilisation non approuvée peut endommager l'équipement ou présenter un risque d'électrocution ou d'incendie.

Recycle and Disposal Information (WEEE)



This symbol on the label of the EnviroPro PLC and accompanying documents means that, when disposing of the EnviroPro PLC, it should not be mixed with general waste. For proper treatment, recovery and recycling, please take the EnviroPro PLC to designated electronic waste collection points where it will be accepted.

Disposing of this product correctly will help save valuable resources and prevent any potential negative effects on human health and the environment, which could otherwise arise from inappropriate waste handling.

Please contact your local authority for further details of your nearest designated collection point.

Penalties may be applicable for incorrect disposal of the EnviroPro PLC in accordance with your national legislation.

If you are in the European Union and wish to discard the EnviroPro PLC, please contact Electro-Tech Systems for further information.

This symbol is only valid in the European Union. If you are not in the European Union and wish to discard this product, please contact your local authorities and ask for the correct method of disposal.

For inquiries for WEEE disposal, Electro-Tech Systems can be contacted at +1 215-887-2196 or online at www.electrotechsystems.com/contact-us/

II. Description of Contents

M 5300 shown

Item No.	Item	Qty.	Description
1	M 5300 or M 5300-24 EnviroPro PLC	1	A controller with a touchscreen HMI that can regulate the temperature and humidity when connected to the proper systems
2	7-Pin Power and Data Cable (Included with the M 5300-24)	1	A cable that connects the controller to an M 5477 Series Power Supply and Thermoelectric Heating/Cooling Systems.
3	Power Supply (Included with the M 5300)	1	A power supply that takes 120VAC and outputs 24 DC for the controller.
Optional Related Items			
4	Environmental Sensor and Cable	1	A sensor that measures temperature from -40 to 80 °C (-40 to 176 °F) and humidity from 0 to 100% RH. Includes a cable that connects the controller to the environmental sensor.
5	Pressure Sensor and 4-Pin Data Cable	1	A sensor that detects the pressure differential between the interior and exterior of the chamber. Required when using a M 5465 (Dry Gas) or M 5478 (Regenerative) dehumidification systems. Includes a cable that connects the controller to the pressure sensor.

III. Setup Guide

Part 1: Connect the Systems

Step 1 – Switched OFF

Before applying power to the system, verify that the switch on the back of the controller is off (O = OFF)

Step 2 – Connect All Systems and Sensors

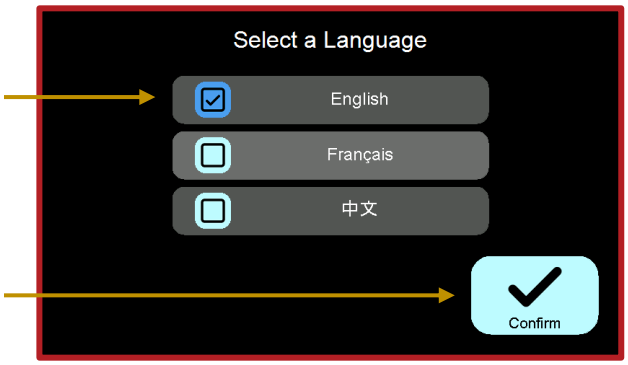
Note: depending on what systems you have, your setup might not look like the picture on the left. The picture has a setup with a humidifier and a pressure sensor.

Connect the Power Cable and environmental sensor to the back of the controller. If present, connect the humidifier, dehumidifier and/or the pressure sensor.

Step 3 – Switch power on

Flip the power switch on the back of the unit to the “ON” position. The controller should power on and display a boot-up screen.

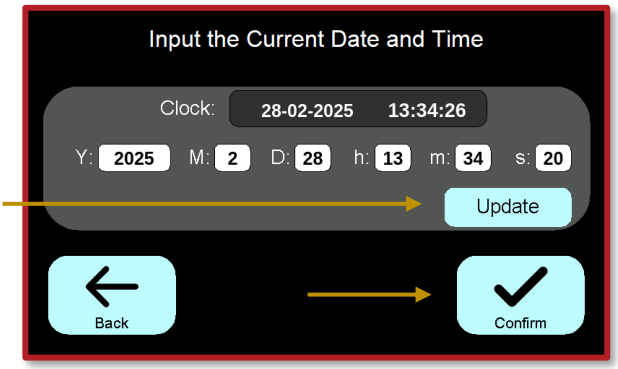
Part 2: Configure Settings



Step 4 – Select language

Once the system has finished booting, select a language for the controller. Hit the “Confirm” button to submit the selection.

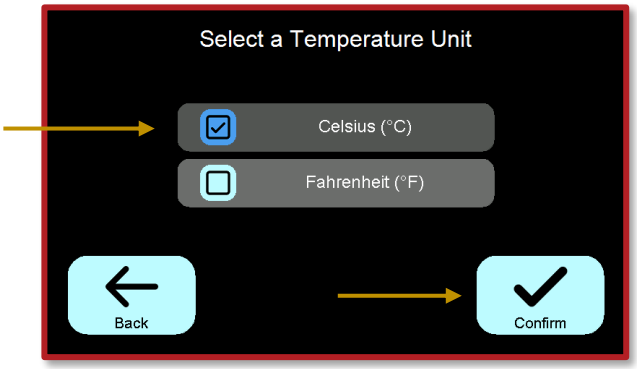
The language can always be changed under the “Profile” screen later (see page 17 for login credentials).



Step 5 – Set the Date and Time

Input the current date and time and press the “Update” button.

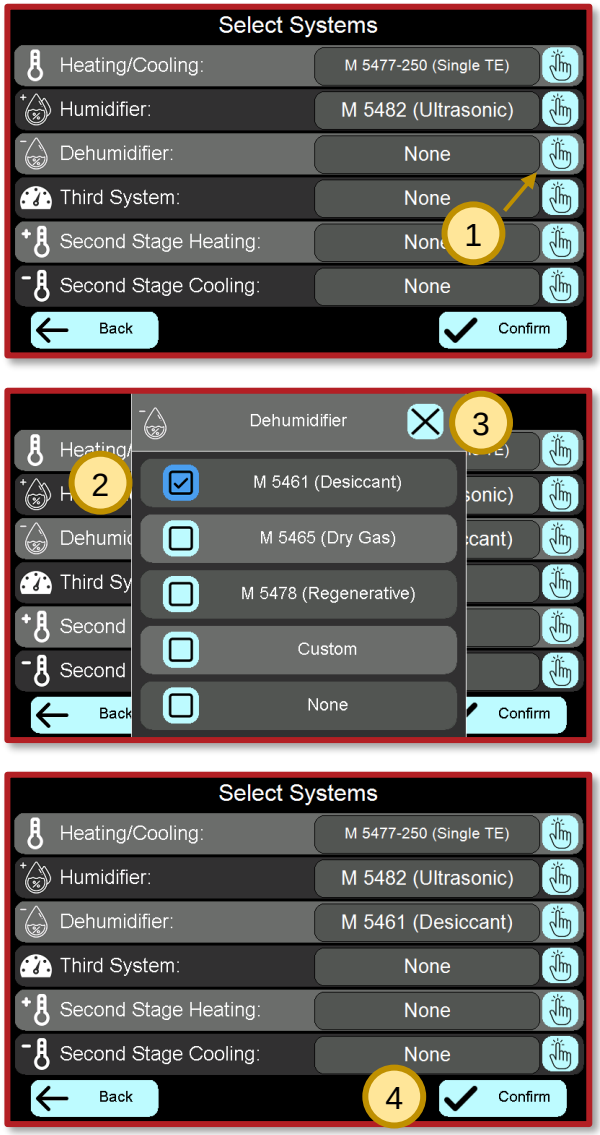
Press “Confirm” to continue.



Step 6 – Select Temperature Unit

Select a temperature unit for the controller to display temperatures in. Hit the “Confirm” button to submit the selection.

The temperature unit can always be changed under the “Profile” screen later (see page 17 for login credentials).

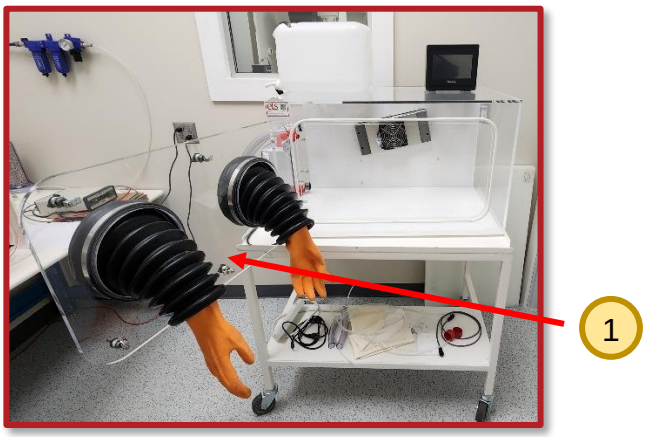


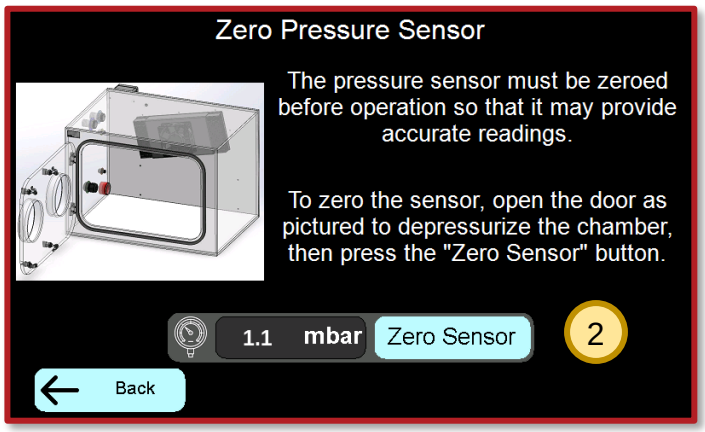
Step 7 – Select Installed Systems

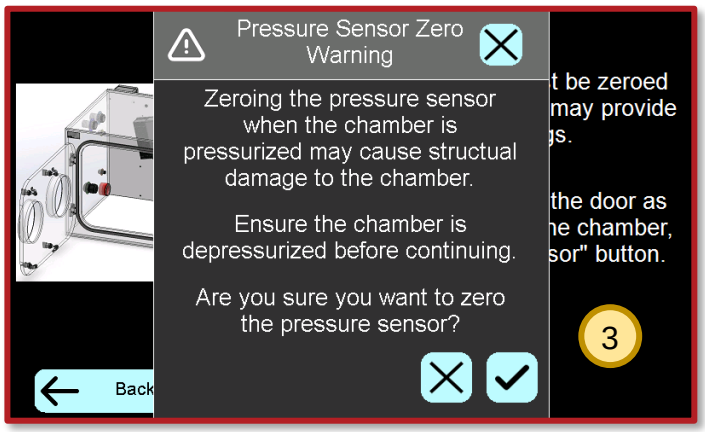
To ensure the controller is aware of what systems are installed, do the following:

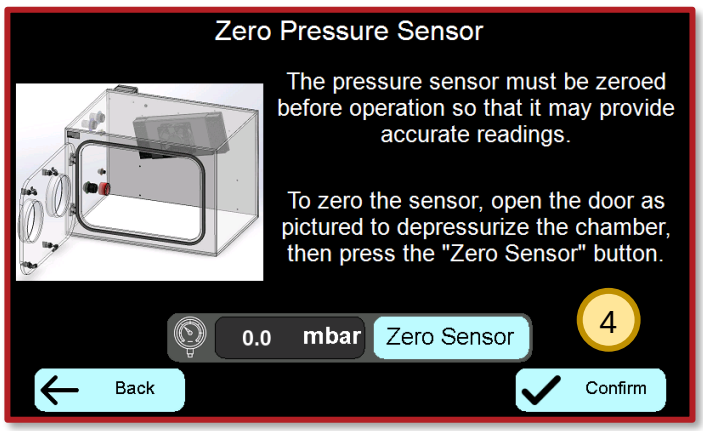
1. Tap the button next to a system to change it (the pictures to the left show the dehumidifier being changed).
2. Select the appropriate new system from the options that appear.
3. Tap the "X" to exit the menu.
4. Tap "Confirm" to accept the changes.

The selected systems can always be changed under the "Profile" screen later (see page 17 for login credentials).







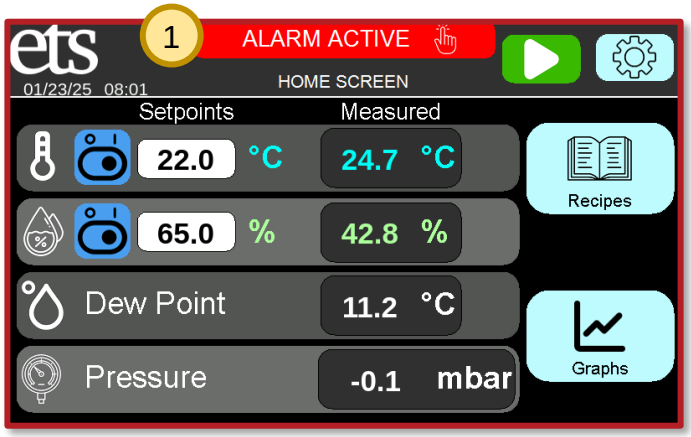


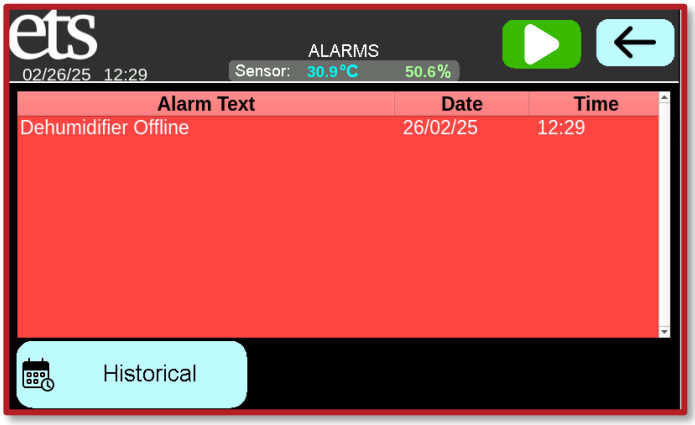
Step 8 – Zero the Pressure Sensor

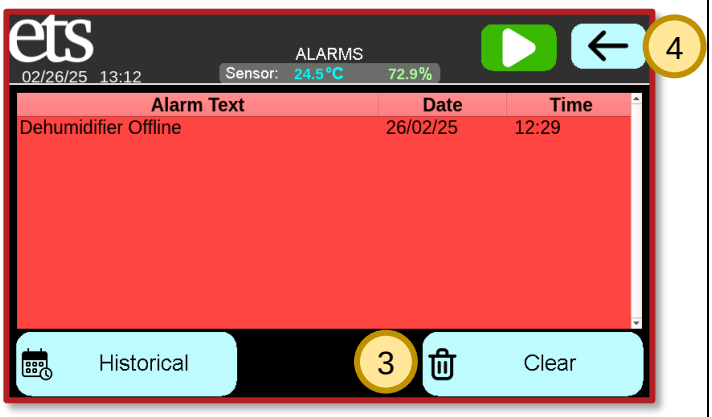
If the chamber has a pressure sensor, it must be zeroed before operation so that it may accurately detect pressure differentials. To zero the sensor, do the following:

1. Open the chamber door to depressurize the chamber.
2. Press the “Zero Sensor” button.
3. A warning will appear to make sure that the chamber is depressurized. Since the chamber door is already open, it is safe to hit the checkmark to proceed.
4. After 10 seconds, the pressure reading should reappear with a value close to 0.0 mbar. Press the “Confirm” button to complete setup

You may now shut the chamber door.







Step 9 – Clear any alarms

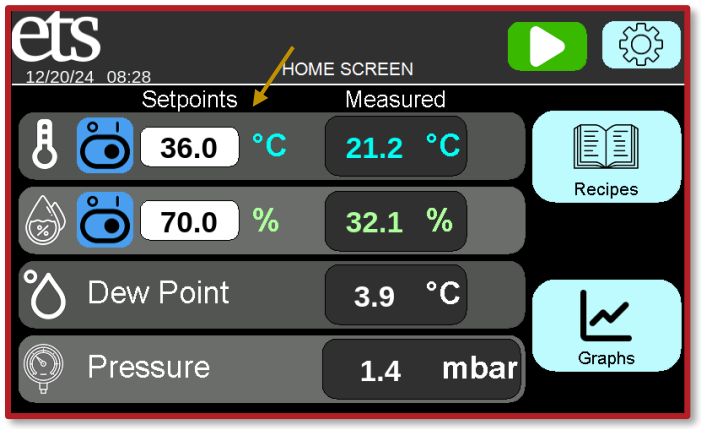
If a system is not connected when selected, the controller will raise an alarm. The controller will not operate if an alarm is active To dismiss the alarm, do the following:

1. Tap the “Alarm Active”/“Alarm Unacknowledged” banner to navigate to the Alarms Screen.
   - Active alarms appear in white text, Alarms that are no longer active appear in black text
2. Connect the missing system to the back of the controller in the proper location.
3. Tap the “Clear” button that appears when the alarm becomes inactive.
4. Tap the back button on the top right corner to return to the home screen.

Note: if other alarms or warnings are raised, see the Alarms and Warnings guide (page 41) to resolve them.

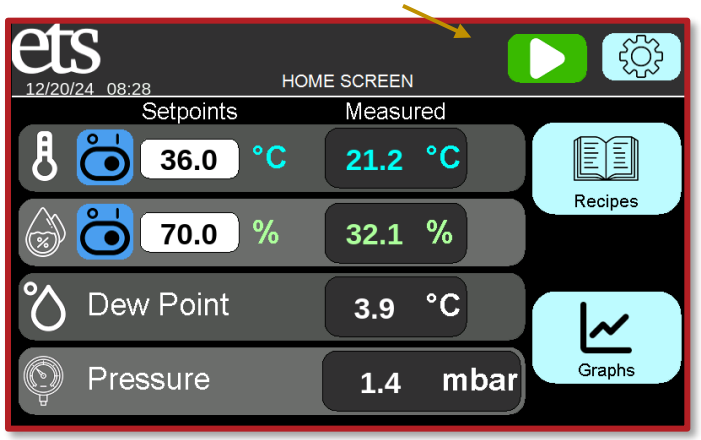
IV. Quick Start Guide

Quick Start Guide



Step 1 – Input the Setpoints

Tap the white entry fields to enter the desired setpoints for the systems you have installed.



Step 2 – Start the System

Tap the green “play” button on the upper right side to start the system. The button will turn into an orange “stop” button which can be used to stop the system. The various operating systems (e.g., heating, cooling, humidification, and/or dehumidification) should turn on within 10 seconds.

The controller will begin regulating the environment inside the chamber to achieve the desired setpoint.

V. Functionality

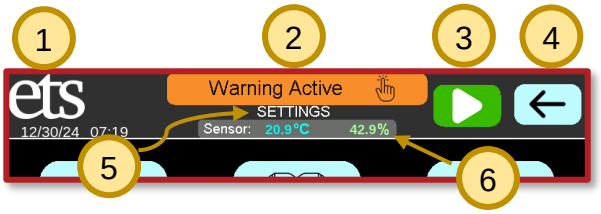
Depending on the systems installed, the EnviroPro PLC can regulate an environment to achieve and maintain the desired temperature and/or humidity.

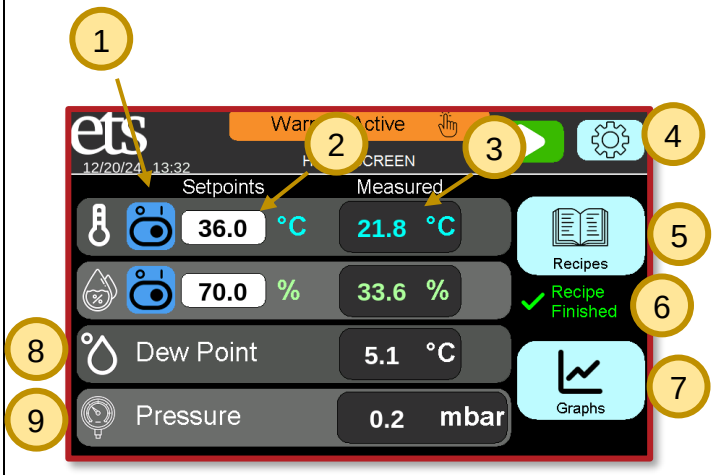
The controller can do the following:

- Graphically display environmental data
- Save and execute up to ten recipes that the user can create and edit
- Prevent equipment damage using built-in safety measures
- Display in English, French or Chinese
- Run a self-diagnostic test if the controller is not performing properly
- Log data which can later be exported to a USB drive
- Be remote controlled through a network via Virtual Network Computing (see page 30)
- Receive updated software through its USB connection (see page 35)
- Act as a Modbus TCP Server via its Ethernet port (see Appendix B on page 50)

Screen Overview

The EnviroPro PLC displays many different screens depending on user input and the state of the system. Below is a list of all the screens with explanations of their features:

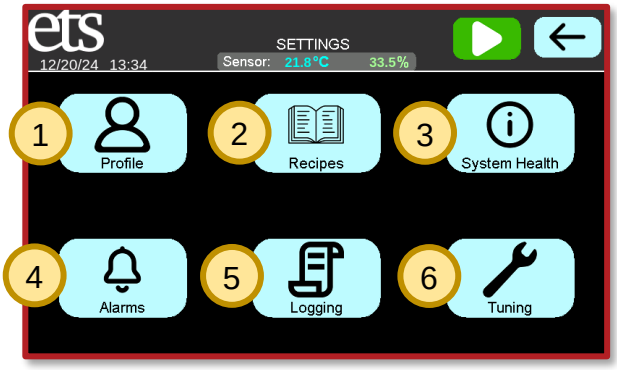
Picture of Screen	Screen Details
	**Top Bar – Visible on Most Screens** 1. ETS Logo: Navigates back to the Home screen when tapped. 2. Alarm/Warning Banner: Navigates to the Alarms/Warnings screen when tapped. • *The banner only appears when an alarm or a warning is raised.* 3. Start/Stop Button: Starts or stops controlling the chamber environment. 4. Back Button: Navigates to the previous screen. • *On the Home screen, this button instead takes you to the Settings screen.* 5. Screen Name: Displays the name of the current screen. 6. Sensor Readings: Displays the current readings from the environmental sensor



Home Screen

The screen allows the user to easily interact with the basic functionality of the controller. Depending on what systems the user has installed, the home screen may look slightly different.

1. System Enable Switches: Allows the user to temporarily enable/disable systems.
2. Setpoints: Tap these fields to change the setpoints.
3. Measurements: These are the current measurements as reported by the sensor(s).
4. Settings Button: This button will navigate to the Settings screen.
5. Recipes Button: This button will navigate to the Recipe Select screen.
6. Recipe Status Indicator: Displays the status of the current recipe.
7. Graphs Button: This button will navigate to the Graphs screen.
8. Dew Point: Displays the calculated dew point based on the current temperature and humidity.
9. Pressure Reading: If the pressure sensor is installed, its reading will be displayed here.

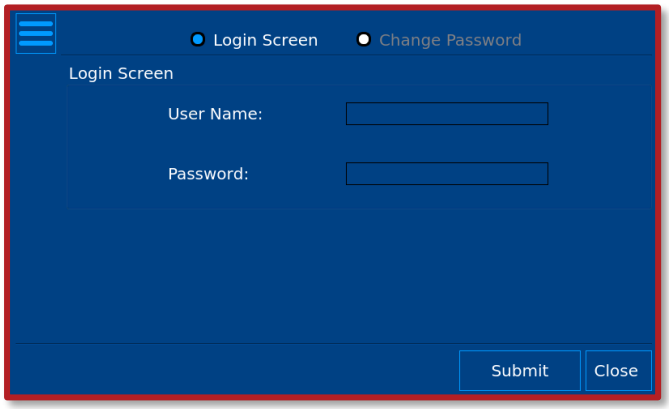


Settings Screen

This screen allows the user to navigate to the various submenus for adjusting the settings of the controller.

1. Profile: If the user is not logged in, this navigates to the login screen. If the user is logged in, this navigates to the Profile screen.
2. Recipes: Navigates to the Recipe Select screen.
3. System Health: Navigates to the System Health screen.
4. Alarms: Navigates to the Alarms screen.
5. Logging: Navigates to the Data Logging screen.
6. Tuning: Navigates to the Tuning Selection screen.
   - *The Tuning button only appears if the user is logged in.*

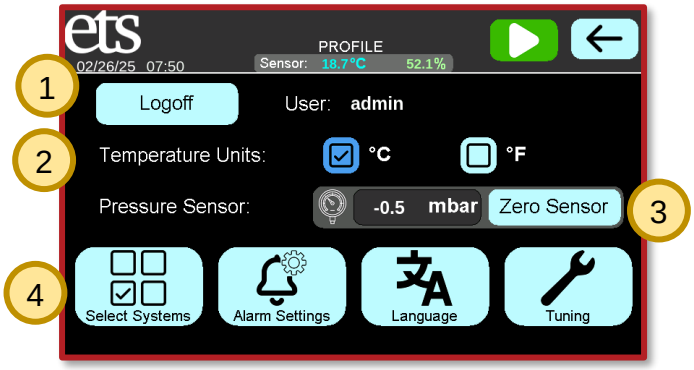
Profile Screens



Login Screen

Tap the “User Name” and “Password” boxes and fill in the following information to login to an admin profile and gain access to more features.

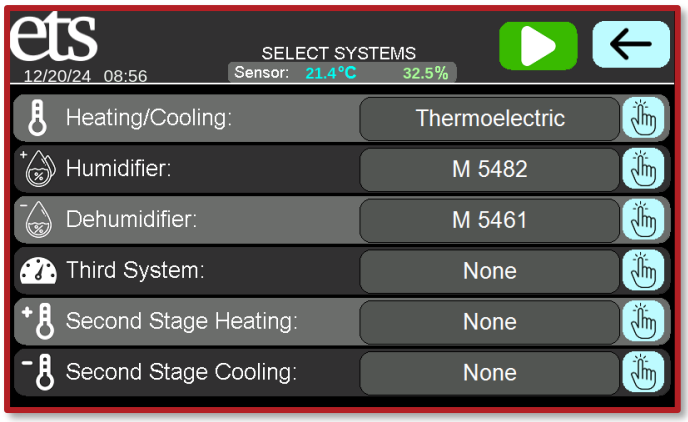
- *Username: admin*
- *Password: ets700*



Profile Screen

This screen is only accessible if the user is logged in.

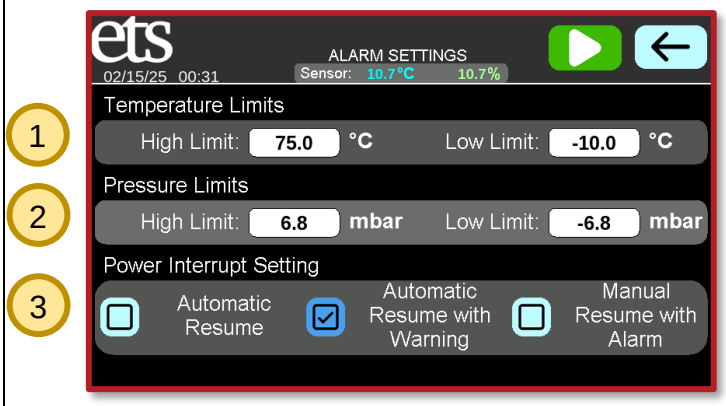
1. This button logs the user off the admin account
2. This setting changes the units that the temperature is displayed in
3. This button zeroes the pressure sensor
   - *Ensure the chamber is depressurized before zeroing the pressure sensor*.
4. From left to right, the three large buttons on the bottom do the following:
   a. Select Systems: Navigates to the Select Systems screen.
   b. Alarm Settings: Navigates to the Alarm Settings screen
   c. Language: Allows the user to change what language is displayed.
   d. Tuning: Navigates to the Tuning Menu screen.



Select Systems Screen

This screen allows the user to change what systems the user has installed.

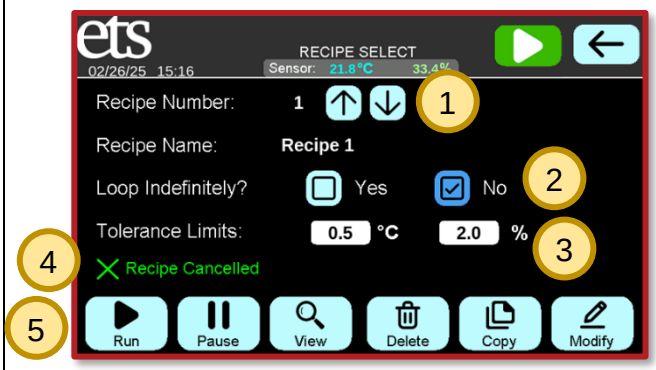
Attempting to enter this screen while the controller is regulating the chamber will cause a warning to appear. For safety reasons, if the user proceeds to this screen, the controller will cease regulating the chamber.



Alarms Settings Screen

This screen allows the user to configure when certain alarms are triggered.

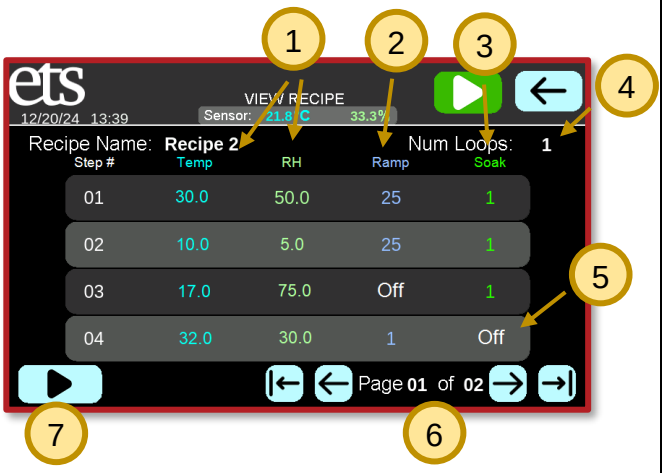
1. Temperature Limits: Allows the user to enter when the "Exceeded High Temp Limit" and the "Exceeded Low Temp Limit" alarms are triggered
   - *The "Approaching High Temp Limit" and "Approaching Low Temp Limit" warnings will appear when the temperature is within 5 °C of the limits*
2. Pressure Limits: Allows the user to enter the limits for which the "Pressure out of Range" alarm is triggered
   - *This setting only appears if the pressure sensor is connected*
3. Power Interrupt Setting: Allows the user to choose what happens should the controller lose power while it is running.
   a. Automatic Resume: When the controller regains power, it will continue running where it had left off.
   b. Automatic Resume with Warning: When the controller regains power, it will continue running where it had left off and raise a warning.
   c. Manual Resume with Alarm: When the controller regains power, the user must manually clear the "Power Interrupt" alarm before the controller can be run again.

	Recipe Screens
	**Recipe Select Screen** This screen allows the user to select one of ten recipes and execute them. 1. These buttons allow the user to cycle through the recipes saved on the device. 2. If “Yes” is checked, when the controller reaches the end of the recipe, it will repeat the recipe again from the beginning until the user manually stops the recipe. If “No” is checked, then the controller will only run the recipe for the specified number of loops. 3. These are the temperature and humidity bands within which the Recipe will begin the Soaking timer. • *These values are only editable if the user is logged in.* 4. This is the Recipe Status Indicator. It indicates if the recipe is running, paused, finished, or cancelled. 5. These buttons, from left to right, do the following: a. Run/Stop: Begins or stops the recipe. b. Pause/Resume: Holds the current value of the recipe until resumed. c. View: If a recipe is not running, this navigates to the Recipe View screen. Otherwise, this navigates to the View Running Recipe screen. d. Delete: Deletes the information in the current recipe. e. Copy: Brings up the Copy Recipe popup screen. f. Modify: Navigates to the Modify Recipe screen. *The Delete, Copy, and Modify buttons only appear when the recipe is not running and the user is logged in.*

Copy Recipe Popup

This popup allows the user to copy all the information from the currently selected recipe into a different recipe.

1. These arrow buttons increment/decrement the destination's recipe number
2. This field allows the user to enter a new name for the copied recipe, if desired
3. The checkmark button confirms the action whereas the "X" button cancels it.

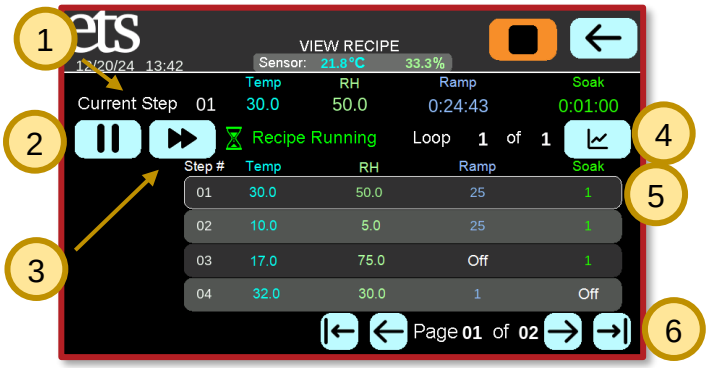


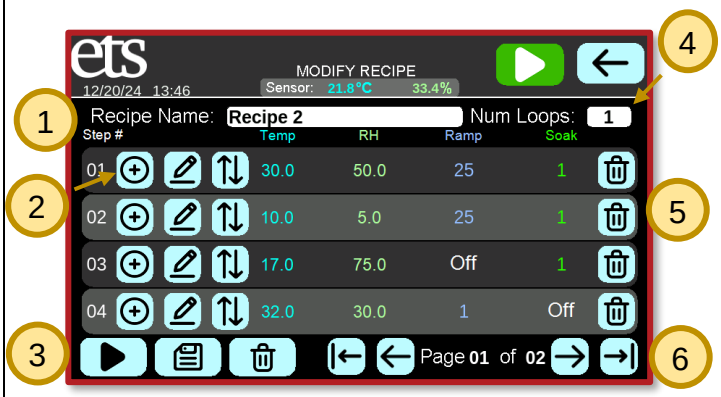
View Recipe Screen

This screen may look slightly different depending on what systems the user has selected.

This screen displays the information contained within the selected recipe. Recipes are saved as a series of steps, with each step having a group of setpoints, a ramp time, and a soak time.

1. Setpoints: These are the setpoints for each step.
2. Ramp Time: The duration in minutes while the controller will gradually transition from the previous setpoints to the setpoints of this step.
3. Soak Time: The duration in minutes that the controller will maintain the setpoint before transitioning to the next step
   - The controller will only start the soak timer if the temperature and/or humidity are within the Tolerance Limits indicated on the Recipe Select Screen (see page 19)
4. Num Loops: This displays the number of complete run-throughs of the recipe the controller will execute before stopping
5. A setting of "Off" indicates that part of the step will be disabled
6. These buttons allow the user to navigate recipes that have more than four steps
7. This button begins executing the recipe and navigates to the View Running Recipe screen

	Recipe Screens
	**View Running Recipe Screen** *This screen may look slightly different depending on what systems the user has selected.* This screen displays the information contained within the currently running recipe. 1. Current Step: Displays information about the currently running step. 2. Pause/Resume: Holds the current conditions inside the chamber until Resume is pressed. 3. Advance: Advances to the next part of the step (e.g., if the controller is ramping, the Advance button skips the ramp and begins soaking. If the controller is soaking, the Advance button skips the soak and begins the next step). 4. Graph: Hides the recipe information and displays a real-time graph to monitor the environment inside the chamber. 5. The current step is outlined in white. 6. These buttons allow the user to navigate recipes that have more than four steps.

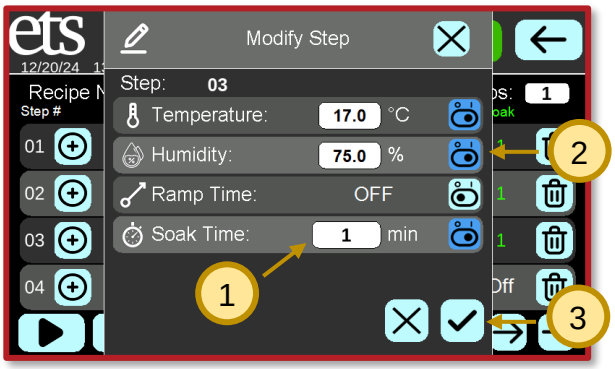


Modify Recipe Screen

This screen may look slightly different depending on what systems the user has selected.

This screen allows the user to create and edit recipes.

1. Recipe Name: Allows the user to rename the recipe.
2. From left to right, these three buttons perform the following operations on the associated step:
   a. Insert: Adds a new step at this location, shifting this and subsequent steps downward.
   b. Edit: Opens the Edit Step Popup
   c. Move: Allows the user to move the associated step to a new position.
3. From left to right, these buttons perform the following operations on the recipe:
   a. Play: Begins executing the recipe and navigates to the View Running Recipe screen.
   b. Save: Saves the recipe to retentive memory, allowing it to be recalled later.
   c. Delete: Deletes all the data stored in the recipe.
4. Num Loops: This setting changes the number of complete run-throughs of the recipe the controller will execute before stopping.
5. Delete Step: This button will remove the associated step from the recipe.
6. These buttons allow the user to navigate recipes that have more than four steps.

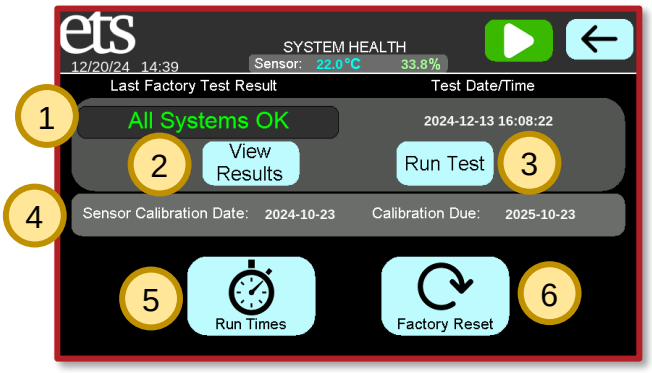


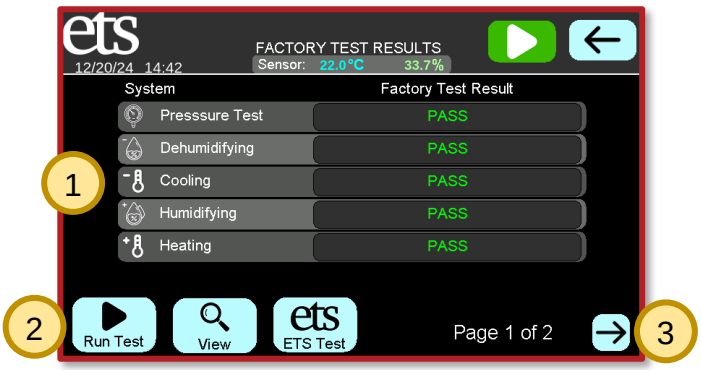
Modify Step Popup

This screen may look slightly different depending on what systems the user has selected.

This popup allows the user to edit a step in the recipe.

1. Setpoints: Tap these numbers to modify the target values for the step.
2. On/Off Buttons: Tap these buttons to enable/disable the associated step element.
3. Use the checkmark button to confirm your changes, use the “X” button to discard them.

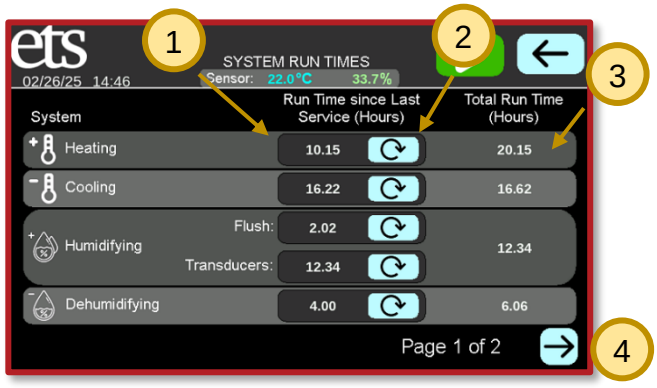
	System Health Screens
	**System Health Screen** This screen shows information about the system. 1. Last Factory Test Result: This shows the overall result of the factory test that was run most recently 2. View Results: This navigates to the View Factory Test Results screen, which shows the results of the factory test in more detail 3. Run Test: This navigates to the Run Factory Test screen and begins the factory test • *The Run Test button only appears if the user is logged in.* 4. Sensor Calibration Information: Shows the date the sensor was calibrated and when the next calibration is due. • *This information is not available if the controller is using an E+E environmental sensor.* 5. Run Times: This navigates to the Run Times screen 6. Factory Reset: This button resets all the tuning values to their original settings. • *The Factory Reset button only appears if the user is logged in.*



View Factory Test Results Screen

This screen shows the results of the most recent factory test in detail.

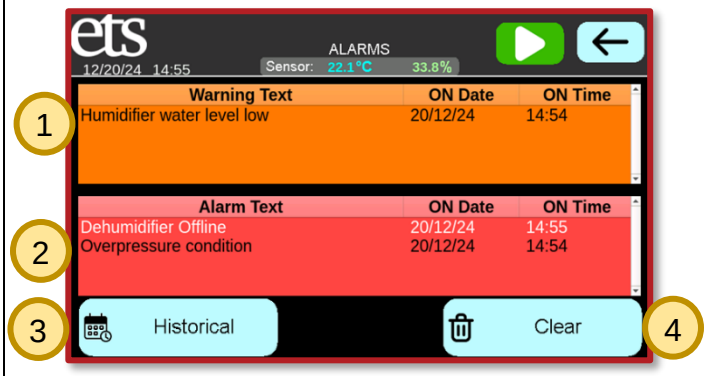
1. Individual Test Results: These record the performance of the individual systems attached to the controller. The results can be “PASS” (indicating acceptable performance), “FAIL” (indicating unacceptable performance), or “N/A” (indicating the test was skipped or was otherwise not applicable)
2. These three buttons perform the following tasks, in order from left to right:
   a. Run/Stop Test: Begins running a new factory test *(You must be logged in to see this button)*
   b. View: Navigates to the View Factory Test screen *(This button only appears if a factory test is currently running)*
   c. ETS Test: Shows the results of the Factory Test that was performed at ETS before the controller was shipped
3. These buttons navigate to previous or next pages of tests

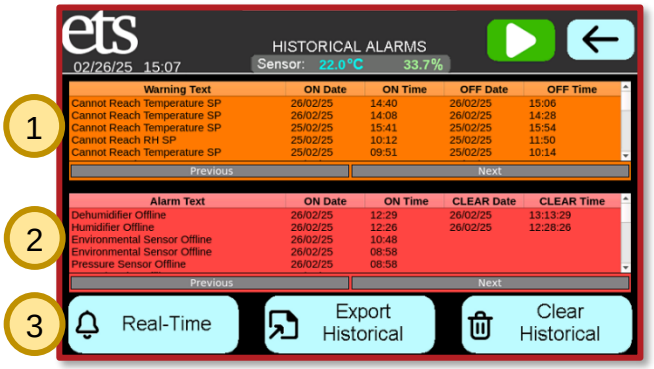


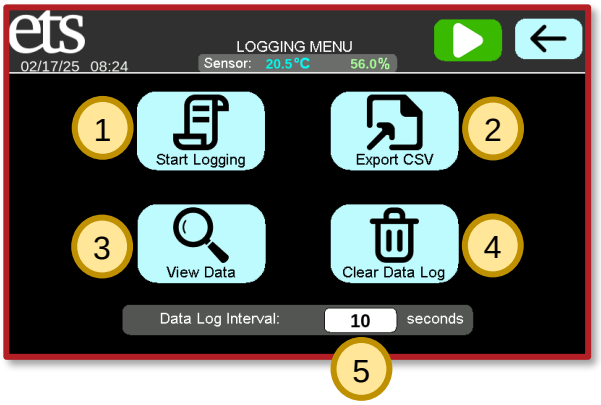
System Run Times Screen

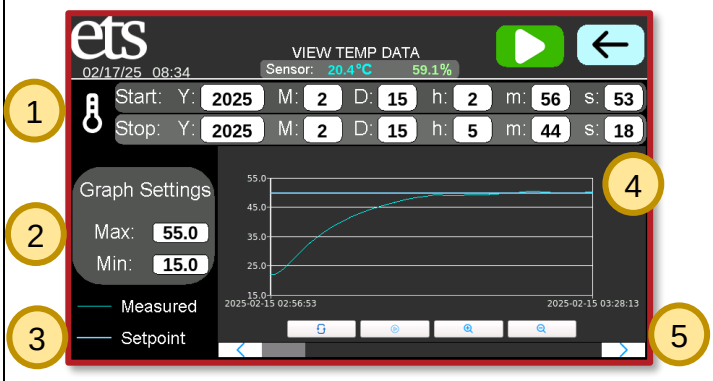
This screen shows the amount of time each system has been run.

1. Run Time Since Last Service: This records the number of hours that the system has run since the last time the Reset button has been pressed
   - *Note: the controller has no way to automatically detect when a system has been serviced. When a system is serviced, this value must manually be reset by pressing the Reset button*
2. Reset Button: This button sets the Run Time Since Last Service value back to 0 hours
   - *This button only appears when the user is logged in*
3. Total Run Time: This records the number of hours that the associated system has run on this controller since the controller first powered on. This number is not resettable
4. These buttons navigate to previous or next pages of systems

	Alarms
	**Real-Time Alarms and Warnings Screen** This screen shows the alarms and warnings that are affecting the system. Warnings are notifications of potential issues that do not require immediate action. Alarms are errors that must be addressed for the system to operate. Most warnings automatically clear themselves when they are no longer active. Alarms do not clear themselves when they become inactive and must be manually cleared by pressing the Clear button. 1. Warning Box: This box displays the warnings affecting the system. If there are no warnings, this box does not appear. 2. Alarm Box: This box displays active and uncleared inactive alarms. The active alarms are in white text and the uncleared inactive alarms are in black text. If there are no active or uncleared inactive alarms, this box does not appear. 3. Historical Alarms Button: This button navigates to the Historical Alarms screen. 4. Clear Button: This button removes any inactive alarms and warnings from the alarm and warning boxes. Any active alarms and warnings are retained. If there are no alarms or warnings that can be cleared, this button does not appear. For more information, please see the Alarms and Warnings Guide on page 41.

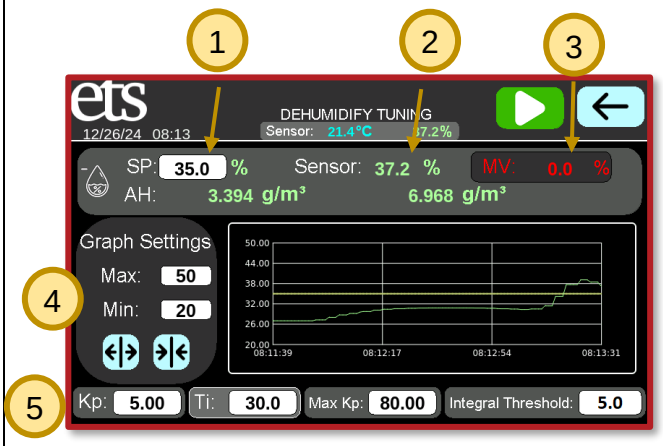
	Alarms
	**Historical Alarms and Warnings Screen** This screen displays a log of the alarms and warnings that were previously active. 1. Warning Box: This box displays the warnings that previously affected the system. The ON Date/Time is the date/time when the warning was raised. The OFF Date/Time is the date/time when the warning became inactive. The Previous/Next buttons allow the user to scroll through the entries one at a time. 2. Alarm Box: This box displays the alarms that previously affected the system. The ON Date/Time is the date/time when the alarm was raised. The CLEAR Date/Time is the date/time when the "Clear Alarms" button was pressed. The Previous/Next buttons allow the user to scroll through the entries one at a time. 3. These buttons perform the following tasks, in order from left to right: a. Real-Time: Navigates to the Real-Time Alarms and Warnings screen. b. Export Historical: Exports the historical alarms and warnings as a CSV file. c. Clear Historical: Clears the historical alarms and warnings log. • This button only appears if the user is logged in.

	Logging Screen
	**Logging Menu** This screen allows the user to extract the logged data or change how frequently the data is sampled. 1. Start/Stop Logging Button: This button will toggle the data logging state • *Note: Whenever the controller is regulating the environment, the data logging will automatically activate. If the controller has not been regulating the environment for two hours, the data logging will automatically stop.* 2. Export CSV: Copies the data log from the controller onto a .CSV file in the USB drive • *Note: The CSV file can take up to 20 minutes to copy.* 3. View Data: This button navigates to the View Historical Data Selection Screen 4. Clear Data Log: This button empties both the data log and the historical alarm log, since they are linked together. Periodically clearing the data log will speed up exporting CSV files. • *This button only appears if the user is logged in* 5. Data Logging Interval: This number determines how frequently the controller will sample data. Smaller numbers mean more data is captured, and larger numbers mean less data is captured

	Logging Screen
	**Historical Data View** *For context, the Temperature Data is pictured to the left* This screen allows you to view the historical information in the data log. 1. Start/Stop Date and Time: These fields specify what section of the data log is loaded on the graph. If no information is in the data log for the specified duration, no lines are drawn 2. Graph Settings: These fields specify the maximum and minimum limits of the y axis 3. Legend: Shows what each of the lines on the graph represents 4. Graph: Displays the specified data • *Note: by default, the graph will only display the latest 13 minutes of the specified duration. To view more data, the user must use the Graph Tools* 5. Graph Tools: These buttons allow the user to perform various actions on the graph. From left to right, the buttons are: • Redraw: Refreshes the graph • Play/Stop: If viewing live data as it comes in, this button will allow you to stop updating the graph • Zoom In: Zoom in 40 seconds along the x axis • Zoom Out: Zoom out 40 seconds along the x axis • Scroll Bar: Allows the user to select what portion of the duration is being viewed

Tuning Screen

The tuning screen is only accessible when the user is logged in (see page 17)



Tuning Screen (for reference, the Dehumidify Tuning Screen is pictured to the left)

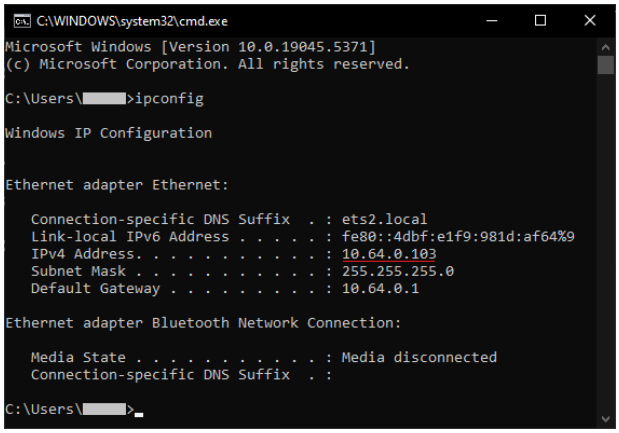
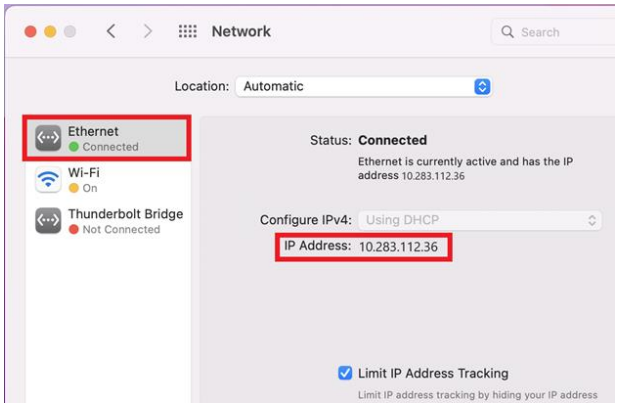
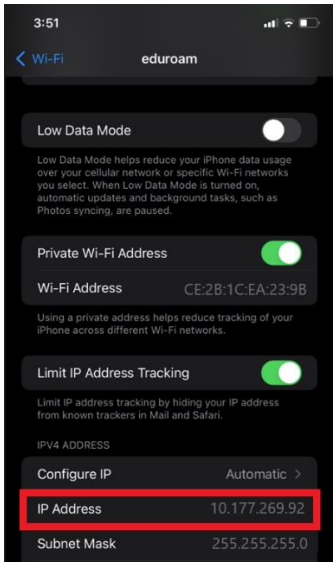
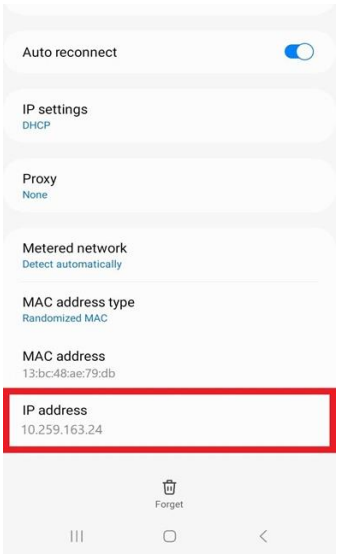
This screen allows the user to adjust any of the parameters used to fine-tune the system control logic.

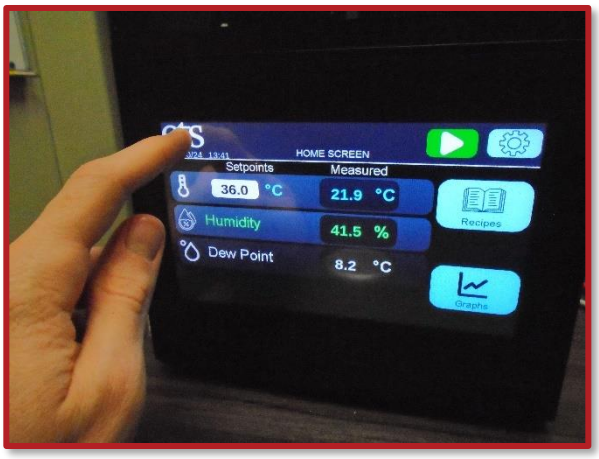
1. Setpoint: This is the target value that the controller will attempt to achieve
2. Sensor: This is the current reading of the environmental sensor
   - *For the humidity control systems, the associated absolute humidity is displayed beneath the target and measured relative humidity*
3. Manipulated Value (MV): This value, which ranges from 0% to 100%, is the percentage of the duty cycle that the system will run
4. Graph Settings: The Max and Min options change the y-axis limits. The Expand and Contract buttons change the x-axis limits
5. Tuning Parameters: These four values help determine how aggressively the controller will attempt to achieve the target values. See Appendix A on page 46 for more information on adjusting these parameters. These are the parameters from left to right:
   a. Kp: This value is the Base Proportional Gain
      - *If the controller is ramping to the setpoint, the Kp parameter will have a white outline*
   b. Ti: This value is the Integral Time Constant, which adjusts how quickly the controller will try to correct steady-state error
      - *If the controller is eliminating steady-state error, the Ti parameter will have a white outline*
   c. Max Kp: This value is the Maximum Proportional Gain
   d. Integral Threshold: This value determines how small the error must be before the integral control may be engaged

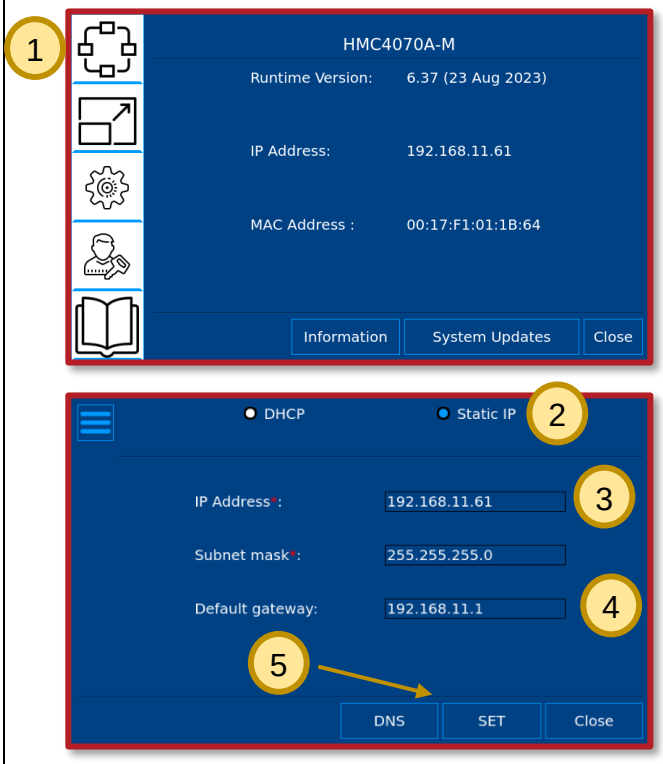
Remote Control via VNC

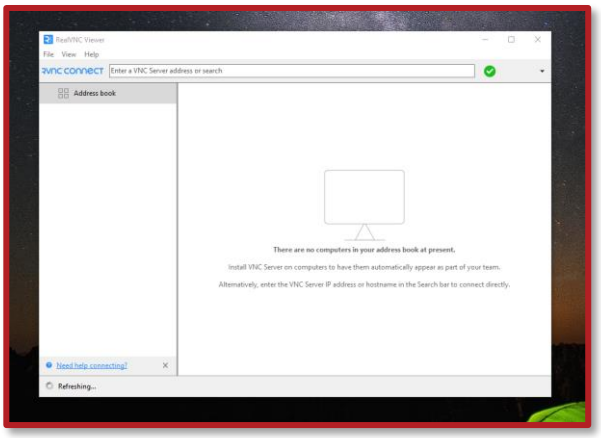
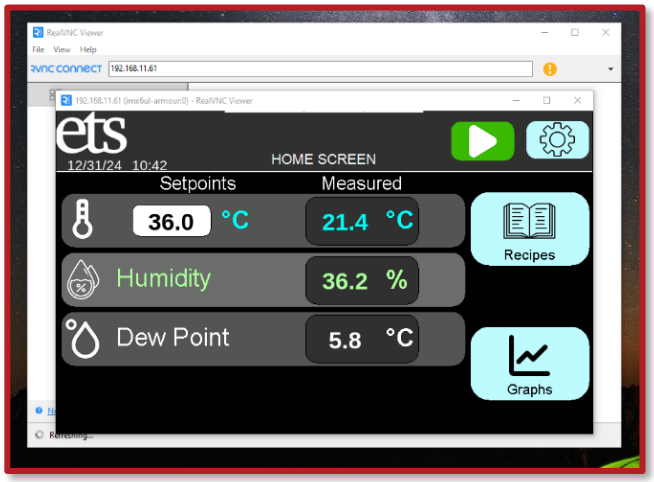
The EnviroPro PLC can be accessed remotely using VNC (Virtual Network Computing). This allows the user to change settings or monitor performance without needing to be physically near the device. A VNC connection requires both the remote client (a smartphone can be a remote client) and the EnviroPro PLC to be on the same local network. Typically, this means that the first three numbers separated by dots of both IP addresses must match. For example, 192.168.10.43 and 192.168.10.205 are likely on the same local network because they both start with "192.168.10". However, 192.160.10.107 is probably on a different network because it starts with "192.160.10". Some networks are set up differently and can have the same local network even if the first three numbers of the IP address do not match, but such exceptions are uncommon. Below are general instructions on how to use this functionality (*Note – the instructions use the program RealVNC to establish the VNC connection, but any other VNC software could be used instead)*:

Picture	Details
	**Step 1 – Connect the Controller and Remote Client to a Network** Connect the EnviroPro PLC to a network using the ethernet port on the back of the controller. Connect your remote client to the same network.

Picture	Details
Windows:  **macOS:**  **IOS:**  **Andriod:** 	**Step 2 – Identify the Local Network Subnet** We need to determine the IP address of your remote client so that we can assign a proper IP address to the controller. **Ensure your remote client (e.g., a desktop or a smartphone) is connected to the same network as the controller before continuing.** To determine your IPv4 Address, follow the instructions specific to your device: **On Windows:** 1. Open the Run window by hitting the **Windows** and **R** keys simultaneously 2. Type “cmd” and then hit the **Enter** key to open the command prompt 3. Type “ipconfig” and hit the **Enter** key 4. The **IPv4 Address** will be listed. **On macOS:** 1. Open **System Preferences** 2. In System Preferences, click on the **Network** option. 3. Click the **Ethernet** tab if using ethernet, otherwise, click on the **Wi-Fi** tab 4. The **IP Address** will be listed on this page. **On IOS Devices:** 1. Open **Settings** 2. Tap **Wi-Fi** 3. Tap the **Information Icon** (the blue “i” in a circle) next to the network name 4. Scroll down to the **IPV4 Address** section and the **IP Address** will be listed as the second entry. **On Android Devices:** 1. Open **Settings** 2. Tap **Connections** 3. Tap **Wi-Fi** 4. Tap the **Gear Icon** next to the network name 5. Tap **View More** and scroll to find the **IP Address**. Remember this address, as you will need it for step 4.

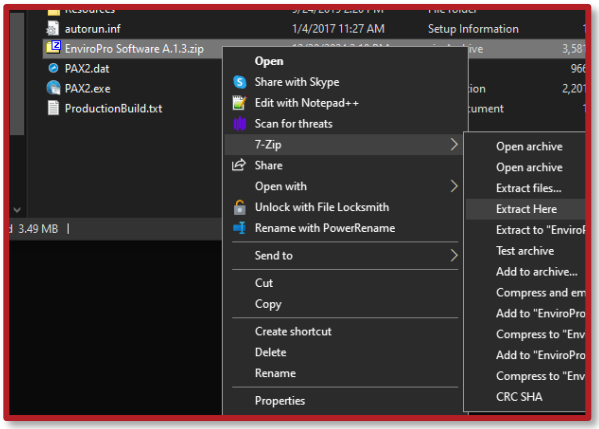
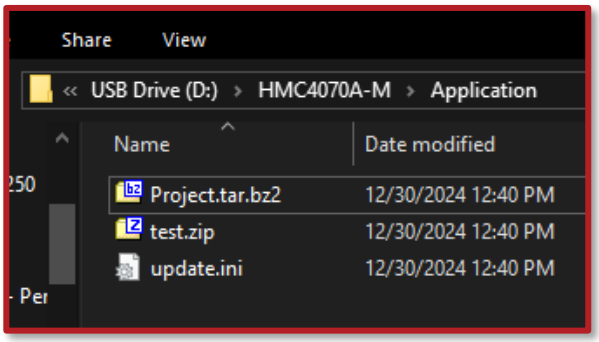
Picture	Details
	**Step 3 – Open the HMI Settings Menu** Press and hold the upper left corner of the screen for about six seconds until the HMI Settings Menu opens.

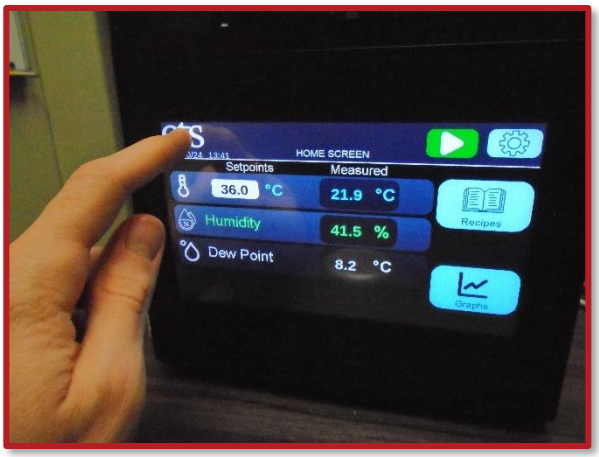
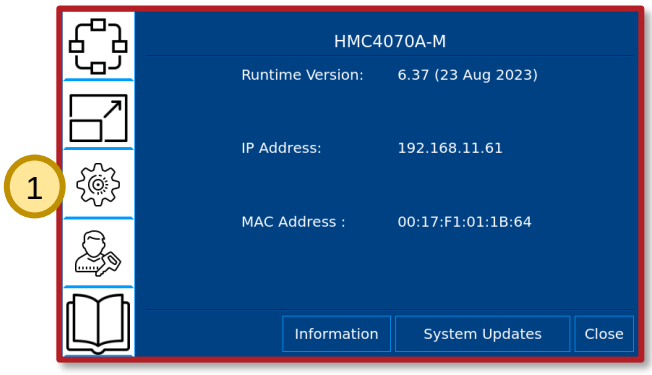
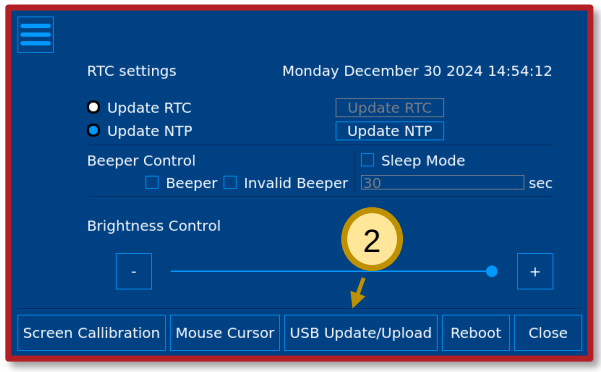
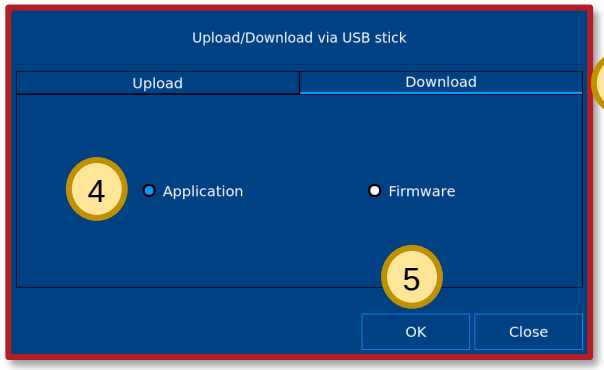
Picture	Details
	**Step 4 –Change the Controller's IP Address** This screen displays the controller's IP address. Compare the controller's IP address to your remote client's IP address (determined in Step 2). The controller and the client need to have the same local area network but different host IDs. See the graphic below for clarification: XXX.XXX.XXX.XXX These three groups should match exactly (this is the local area subnet) This last group should not match (this is the host ID) So if your remote client IP address was 192.168.72.14, an acceptable controller IP address would be 192.168.72.104 If you need to change the controller's IP address, perform the following: 1. Tap the Network Settings button to go to the Network Settings screen 2. Tap Static IP 3. Enter a new acceptable IP address with the same local network subnet but a different host ID of your remote client (determined in step 2). See the graphic above if you do not know what the local area subnet or the host ID is. 4. Input the Default Gateway of your network. Typically, the Default Gateway has the same local area subnet and a host ID of 1. • For example, if your remote client's IP address is 192.168.72.14, the Default Gateway is 192.168.72.1 • If this is not your Default Gateway, determine the Default Gateway using your remote client (often, this information will be shown close to where you found the IP address of your client) 5. Hit the "SET" button to set the controller's IP address. Once the "Please wait…" text disappears, the IP address is set.

Picture	Details
	**Step 5 – Open RealVNC** On a device on the same local network as the EnviroPro PLC, open the RealVNC Viewer software, which is available for free at their website www.realvnc.com A mobile-friendly version of RealVNC Viewer is available for iOS and Android devices and is downloadable from the associated operating system's app store.
	**Step 5 – Connect to the Controller** Configure a VNC connection to the IP address shown on the controller (for the desktop version, this is done by entering the IP address into the search bar). The controller can now be used remotely.

Updating Software via USB

If Electro-Tech Systems releases updated software, the user can apply these updates via a USB thumb drive. Below are detailed instructions for doing this process:

Picture	Details
 	**Step 1 – Prepare the USB Drive** Extract the compressed .zip file that contains the software onto the USB Drive. Doing so creates the HMC4070A-M folder. The HMC4070A-M folder contains the Application folder, and the application folder contains three files: “Project.tar.bz2”, “test.zip”, and “update.ini”. Ensure all three of these files are present in the HMC4070A-M/Application folder before proceeding.
	**Step 2 – Insert the USB Drive into the Controller** Insert the USB drive into the back of the controller as pictured.

Picture	Details
	**Step 3 – Open the HMI Systems Menu** Press and hold the upper left corner of the screen for about six seconds until the HMI Systems Menu opens.
  	**Step 4 – Download the Software** To download the software, perform the following: 1. Press the Gear button to open the System Settings Menu 2. Press the “USB Update/Upload” button 3. Ensure the “Download” tab is selected, not the “Upload” tab 4. Press the “Application” radio button () 5. Press the “OK” button. At this point, the software should start downloading to the unit. It takes anywhere from 30-50 seconds for the download to complete and for the EnviroPro PLC to reboot.

VI. Specifications

MECHANICAL

- Dimensions: 8” W x 7” H x 7” L (20cm x 17.7cm x 17.7cm)
- Material: Black Anodized Aluminum
- Weight: 4.0 lbs. (1.81 kg)

PORTS:

- RJ45 Ethernet Port
- USB 2.0 Port
- Quick Lock Circular Waterproof Aviation Plug Connectors

ELECTRICAL

- Voltage and Current: 24VDC, 4.0A
- 4-Amp Thermal Circuit Breaker Rocker Switch

COMPATIBILITY

- ETS M 5477 Series Thermoelectric Heating/Cooling Systems
- ETS M 5482-24 Ultrasonic Humidifier
- ETS M 5461-24 Desiccant Dehumidifier
- ETS M 5465-24 Dry Gas Dehumidifier
- ETS M 5478-24 Regenerative Dehumidifier

VII. Repair and Maintenance

Repair

- To get your unit repaired or serviced by ETS, you first need to obtain an RMA (Return Merchandise Authorization) number.
- You can obtain an RMA by any of the following methods:
    - Calling: 215-887-2196
    - Emailing: service@ets2.com
    - Completing the contact form on the website: www.electrotechsystems.com

Maintenance and Calibration

- The environmental sensor has a recommended calibration cycle of one year. To ensure that the sensor continues to accurately report the temperature and humidity, please contact ETS to have it recalibrated.
    - If using a Vaisala sensor, the controller will alert the user when the environmental sensor's calibration due date is approaching.
    - If using an E+E sensor, it is the user's responsibility to check the sticker on the sensor to determine when the sensor needs recalibration.
- In addition, the various operating systems, such as the humidifier and desiccant dehumidification system, require preventive maintenance. Reference the manuals for those products for their respective preventive maintenance instructions.

VIII. Troubleshooting

Troubleshooting Guide

Problem	Possible Cause	Corrective Action
Controller does not power up	Unit is not receiving power	Ensure power switch on the back of the unit is switched ON (I = ON)
		For the M 5300-24, ensure 7-Pin Power Cable is connected to the controller
		For the M 5300-24, ensure the power supply for the 7-Pin Power Cable is on
		For the M 5300, ensure the power supply is connected and plugged into an electrical outlet.
No reading from environmental sensor or pressure sensor	Sensor is not plugged in	Ensure the sensor is connected to the controller.
Controller does not use a connected system	System disabled on Home Screen	Ensure that the switch icon on the Home Screen is set on (I = ON)
	System not running due to intentional software design	To increase efficiency, when both temperature and RH control are enabled, the humidifier will not engage until the measured temperature is within 5 °C of the setpoint. No corrective action is needed in this case
		To avoid condensation in the chamber, when both temperature and RH control are enabled, the cooling system will not engage until the dehumidifier has lowered the dew point to be below the setpoint. No corrective action is needed in this case
	System is not selected in “Profile” settings	Log on to an admin profile (see page 17) and use the “Select Systems” screen to ensure the correct systems are selected
	System has improper tuning values	Log on to an admin profile (see page 17) and use the “Tuning” screen to check the tuning values of the system. Ensure that KP and Max KP are both greater than zero. If necessary, perform a Factory Reset.
	Issue with the connected system	Reference the troubleshooting section of the associated operating manual for the connected system
Incorrect Operating System Activates (e.g., the humidification system activates when the dehumidification system should do so)	Operating system plugged into the incorrect port	Ensure that the operating systems are connected to the correct ports on the back of the controller

Troubleshooting Guide

Problem	Possible Cause	Corrective Action
Frequent “Pressure out of Range” Alarms	Pressure sensor not properly zeroed	Log on to an admin profile to re-zero the sensor. See page 17 for the login credentials.
	Pressure Limits too stringent	Log on to an admin profile (see page 17) and change the pressure limits from the “Alarms Settings” screen.
	Insufficient pressure relief in chamber	Remove the red cable pass-through cap from the back left of the chamber. If this is not acceptable for your use-case scenario, please contact ETS for guidance.

If none of the above corrective actions resolve the issue, please contact ETS for service support.

Alarms and Warnings Guide

Below are descriptions and corrective actions for the various alarms and warnings the EnviroPro PLC can raise.

Alarms Guide

Alarm	Description	Corrective Action
Environmental Sensor Offline	The controller does not detect the environmental sensor	• Ensure the environmental sensor cable is connected to the back of the controller and to the sensor.
Pressure Sensor Offline	The controller does not detect the pressure sensor when the M 5465 (Dry Gas) or the M 5478 (Regenerative) dehumidification systems are selected	• Ensure the pressure sensor is connected to the back of the controller. • Log into the admin profile (see page 17) and deselect the M 5465 (Dry Gas) and M 5478 (Regenerative) dehumidification systems on the “Select Systems” screen.
[System] Offline	The controller does not detect the system in question	• Ensure the system is connected to the correct port on the back of the controller. • Log into an admin profile (see page 17) and deselect the system on the “Select Systems” screen.
Power Interrupted	The controller lost power while regulating the environment	• Ensure the system is not regulating the environment before switching off. • Ensure the controller has a reliable source of power.
Temp Control is Swapped	The controller detects that the temperature increases when the cooling system is engaged or the temperature decreases when the heating system is engaged	• If using an M 5477-250 (Single Thermoelectric) or M 5477-500 (Dual Thermoelectric) temperature control system, this alarm should not appear. • If using a custom temperature control system, ensure that there are no wiring issues causing the wrong system to be powered
RH Control is Swapped	The controller detects that the humidity increases when the dehumidification system is engaged or the humidity decreases when the humidification system is engaged	• Ensure that the humidification and dehumidification systems are connected to the correct ports on the back of the controller. • If using the M 5461 (Desiccant) dehumidification system, ensure that the desiccant is not expired (visually inspect the indicating desiccant). • If using the M 5465 (Dry Gas) or M 5478 (Regenerative) dehumidification systems, ensure the input air is sufficiently dry.

Alarms Guide

Alarm	Description	Corrective Action
Pressure Out of Range	The pressure sensor detects a differential less than the low pressure limit or greater than the high pressure limit. By default, these limits are set to -6.8 mbar (-0.1 psi) and 6.8 mbar (0.1 psi)	• Ensure the pressure sensor is properly zeroed by logging into an admin profile (see page 17) to re-zero the sensor • Ensure the pressure limits are not too stringent by logging into an admin profile (see page 17) and checking the Alarm Settings. • Ensure there is sufficient pressure relief by removing the red cable pass-through cap from the back left of the chamber. If this is not acceptable for your use-case scenario, please contact ETS for guidance
Exceeded High Temp Limit	The environmental sensor detected a temperature above the high temperature limit. By default, this is 75 °C (167 °F)	• Ensure there is nothing in or around the chamber causing the temperature to go higher than expected • Ensure the high temperature limit is not too low by logging into an admin profile (see page 17) and checking the Alarm Settings
Exceeded Low Temp Limit	The environmental sensor detected a temperature below the low temperature limit. By default, this is -10 °C (14 °F)	• Ensure there is nothing in or around the chamber causing the temperature to go lower than expected • Ensure the low temperature limit is not too high by logging into an admin profile (see page 17) and checking the Alarm Settings

Warnings Guide

Warning	Description	Corrective Action
No Operating Systems Selected	Indicates that no operating systems are selected on the “Select Systems” screen	• Log into an admin profile (see page 17) and select the proper operating systems
Cannot Reach Temperature SP	Indicates that the temperature control system is not strong enough to achieve the temperature setpoint	• Ensure the temperature setpoint is reasonable to achieve with the temperature control system and ambient conditions
Cannot Reach RH SP	Indicates that the humidity control system is not strong enough to achieve the humidity setpoint	• Ensure the humidity setpoint is reasonable to achieve with the humidity control system and ambient conditions

Warnings Guide

Warning	Description	Corrective Action
Temp SP below Dew Point	Indicates that the controller is trying to achieve a temperature setpoint that is below the dew point, which means that dew may condense in the chamber	• Connect a dehumidification system to dry the air in the chamber, or else ensure the temperature and humidity setpoints are reasonable with the ambient conditions
Humidifier Water Level Low	Indicates that the M 5482 Ultrasonic Humidifier has attempted to draw water for the past 15 seconds, meaning the water supply for the humidifier is empty	• Refill the water supply • Ensure the valve for the water supply is open • Ensure there is no kink or obstruction in the tubing to the humidifier
Approaching High Temp Limit	The environmental sensor detected a temperature within 5 °C (9 °F) of the high temperature limit. By default, this is 70 °C (158 °F)	• Ensure there is nothing in or around the chamber causing the temperature to go higher than expected • Ensure the high temperature limit is not too low by logging into an admin profile (see page 17) and checking the Alarm Settings
Approaching Low Temp Limit	The environmental sensor detected a temperature within 5 °C (9 °F) of the low temperature limit. By default, this is -5 °C (23 °F)	• Ensure there is nothing in or around the chamber causing the temperature to go lower than expected • Ensure the low temperature limit is not too high by logging into an admin profile (see page 17) and checking the Alarm Settings
Desiccant Performance Poor	The EnviroPro has detected decreased dehumidification performance when the M 5461-24 (Desiccant) Dehumidification System is installed	• Ensure the ports on the M 5461-24 dehumidification are unplugged • If the desiccant is expired (the blue indicator beads have faded), replace or regenerate the desiccant
Factory Test Not Done	Indicates that no factory test has been done on the unit to ensure proper functioning. ETS performs a factory test before shipping the unit, so this warning should never appear	• Log into an admin profile (see page 17) to perform a factory test on the “System Health” screen (see page 23)
Factory Test Failure	Indicates one or more of the tests in the previous factory test has failed	• Determine which tests have failed on the “Factory Test Results” screen (see page 24) and address the poorly performing systems
Sensor Calibration Due Soon	Indicates that the environmental sensor’s calibration expires within two months	• Contact ETS for environmental sensor calibration

Warnings Guide

Warning	Description	Corrective Action
Sensor Calibration Due	Indicates that the environmental sensor's calibration expired (this warning only appears if using a Vaisala sensor)	• Contact ETS for environmental sensor calibration
Humidifier Flush Reminder	The M 5482-24 Humidifier has been run 500 hours without servicing	• Perform the "Humidifier Flush" preventive maintenance as detailed in the M 5482-24 Humidifier Operating Manual
Humidifier Replace Transducer Reminder	The M 5482-24 Humidifier has been run 5000 hours without transducer servicing	• Contact ETS for transducer replacement

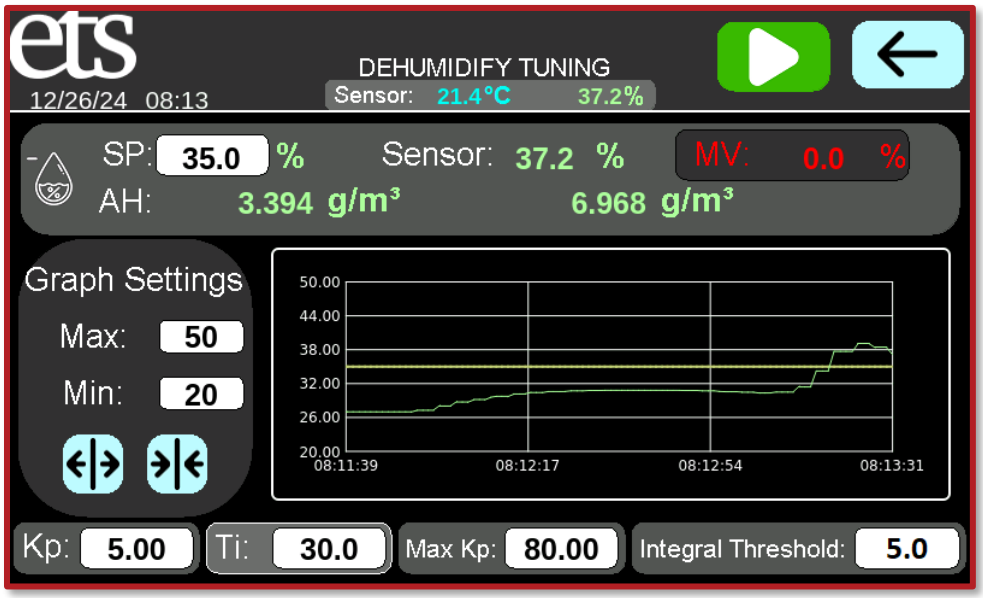
IX. Warranty

Limited Warranties. Seller warrants that all goods manufactured and delivered hereunder shall (a) conform to any samples, drawings, specifications, or other written documents provided to Seller by Buyer or approved by Buyer to Seller and (b) be free from all defects in workmanship and material. Buyer's sole remedy against Seller for breach of either of the specifically mentioned warranty shall be the repair or replacement, at Seller's sole option, of the defective workmanship or material. Seller expressly disclaims all other warranties, express and/or implied, including but not limited to those of merchantability and fitness for a particular purpose. In no event shall Seller be liable, under either warranty or otherwise, to Buyer in excess of the purchase price of the products paid to Seller by Buyer. In no event shall Seller be liable for any loss or damage arising directly or indirectly from the use of the product or for consequential or incidental damages. Seller's specified warranties will expire and lapse (i) for renewable items (such as gloves, iris ports and desiccants), sixty (60) days from date of shipment and (ii) for all standard equipment and otherwise nonrenewable items, one year from date of shipment.

Appendix A: Tuning Guide

The EnviroPro PLC comes pre-programmed with general tuning values that achieve the setpoint with an acceptable rise time, overshoot, and steady-state stability. However, if you adjust the tuning parameters for your specific use-case scenario, you may be able to obtain better results.

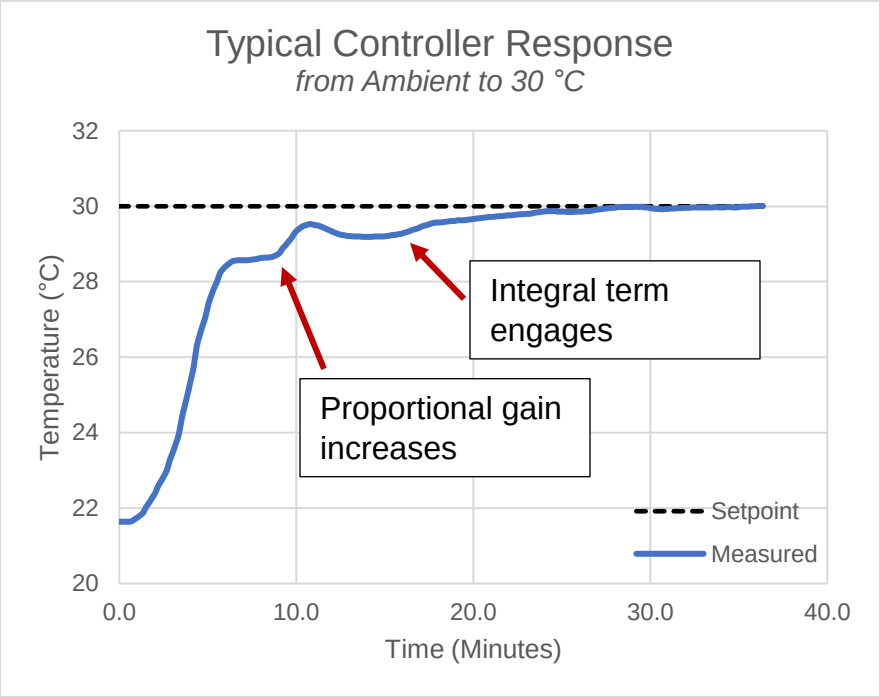
To adjust the tuning parameters, you must be logged into an admin account (see the login screen on page 17). Then, navigate to the Tuning Screen of the specific operating system you wish to refine the response for. The tuning screen for the dehumidification system is shown below.



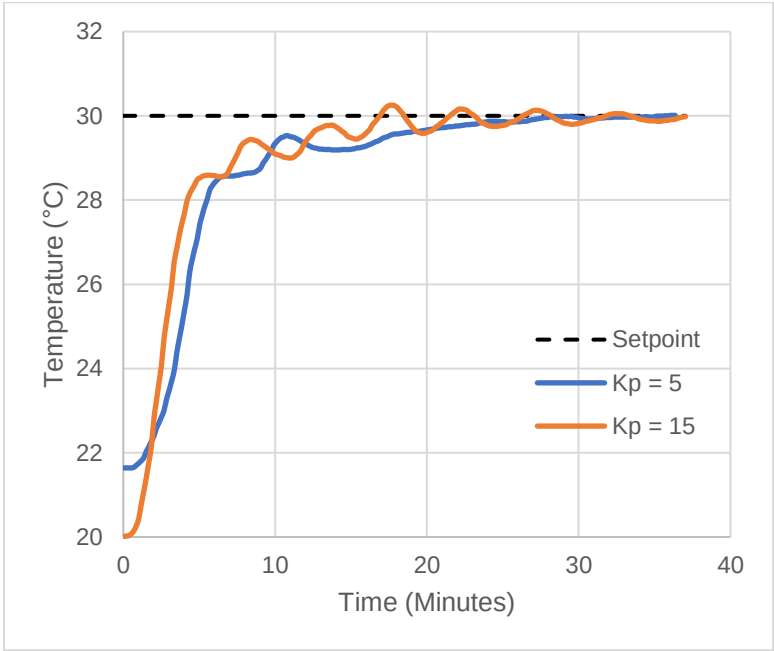
To avoid the effects of integral windup, the controller initially attempts to correct the error using proportional control with no integral control when the controller begins regulating the environment. It starts using “Kp” as the base proportional gain, but, if the base proportional gain is insufficient for achieving the setpoint in a reasonable amount of time, the controller will increase the proportional gain. However, if the controller would increase the proportional gain beyond the “Max Kp” value, then it caps the proportional gain at the “Max Kp” value.

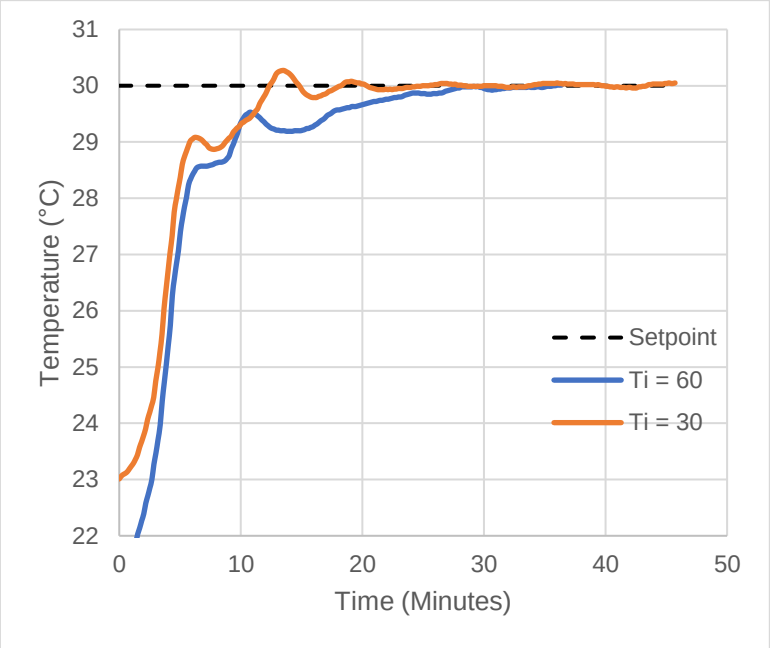
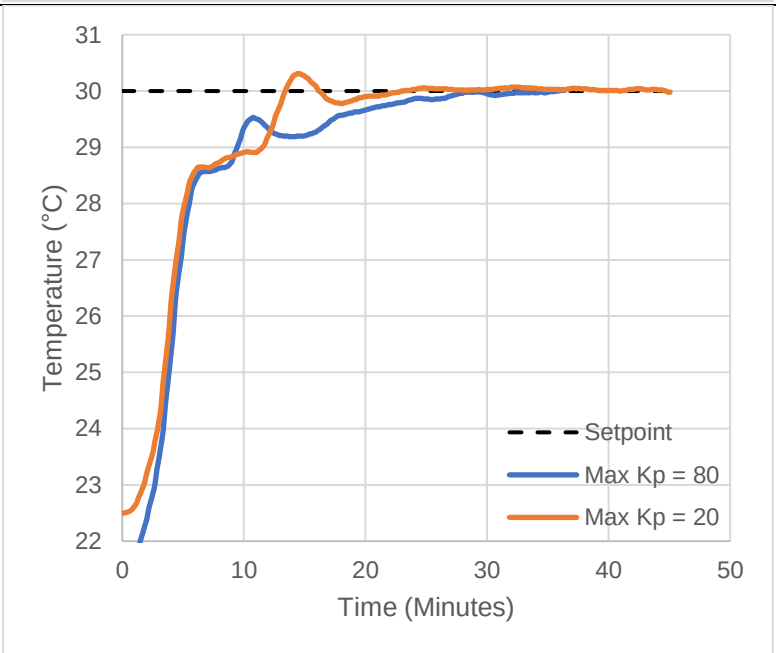
If the controller reduces the error to less than the “Integral Threshold” value, or if the proportional gain gets capped at the “Max Kp” value, then the integral term of the controller engages to eliminate the steady state error. The Integral Time Constant, “Ti”, changes the aggressiveness of the integral control. A larger “Ti” value makes the controller less aggressive at correcting steady state error, and a smaller “Ti” value makes the controller more aggressive.

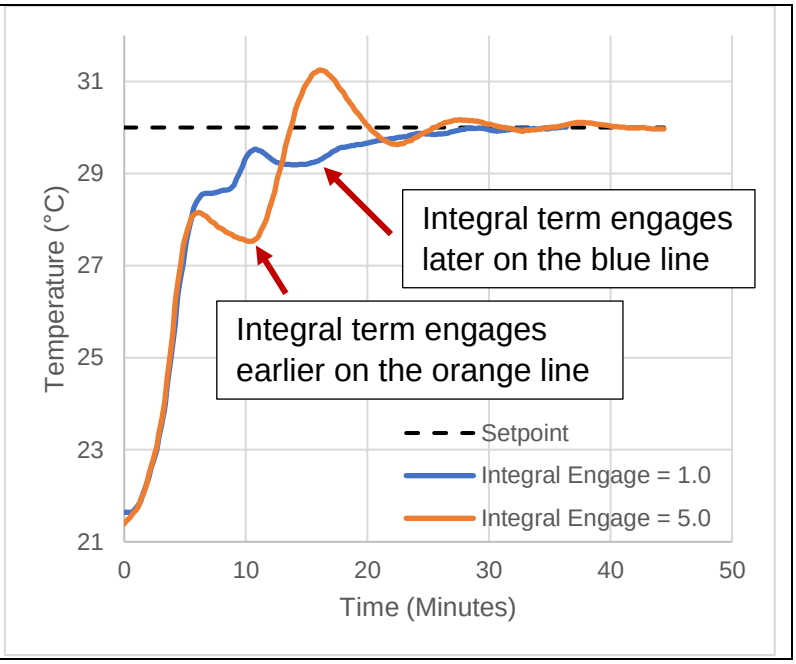
A typical response looks like this:



Below is an overview of the effects of changing the four tuning parameters:

	Increase	Decrease	
Kp	Response time improves, but oscillations and overshoot worsen.	Response time worsens, but oscillations and overshoot improve.	

<table>
<tr><td rowspan="2">Ti</td><td>Increase</td><td>Decrease</td><td rowspan="2"> 
</td></tr>
<tr><td>Settling time worsens, but stability and overshoot improve.</td><td>Settling time improves, but stability and overshoot worsen due to integral windup (Wikipedia)</td></tr>
<tr><td rowspan="2">Max Kp</td><td>Increase</td><td>Decrease</td><td rowspan="2"> 
</td></tr>
<tr><td>Allows the proportional gain to increase further, which decreases steady-state stability. However, this allows the system to engage the integral control later, which prevents integral windup.</td><td>Prevents the proportional gain term from increasing as much, which increases steady-state stability. However, if Max Kp is set too low, this may require the system to engage the integral control early, which worsens overshoot because of integral windup.</td></tr>
</table>

	Increase	Decrease	
Integral Engage	Allows the integral term to engage earlier, improving response and settling time, but worsening overshoot and oscillation due to integral windup.	Waits longer for the integral term to engage, worsening response time, but improving overshoot and oscillation by preventing integral windup.	

Appendix B: Modbus Register Guide

The EnviroPro PLC can function as a TCP Modbus server via the ethernet port on the back of the enclosure. This allows for live monitoring of several of the variables stored in the controller. The server exists on port number 502. Below is the list of the Modbus-accessible registers:

Register Number	Address	Register Description	Data Format
40001	0x9C40 0x9C41	Temperature Measurement (°C)	32-bit float
40003	0x9C42 0x9C43	Temperature Measurement (°C or °F, depending on what the user has selected)	32-bit float
40005	0x9C44 0x9C45	Relative Humidity Measurement (%RH)	32-bit float
40007	0x9C46 0x9C47	Absolute Humidity Measurement (g/m^3)	32-bit float
40009	0x9C48 0x9C49	Chamber Pressure Measurement (mbar)	32-bit float
40011	0x9C4A 0x9C4B	Temperature Setpoint (°C)	32-bit float
40013	0x9C4C 0x9C4D	Temperature Setpoint (°C or °F, depending on what the user has selected)	32-bit float
40015	0x9C4E 0x9C4F	Relative Humidity Setpoint (%RH)	32-bit float
40017	0x9C50 0x9C51	Absolute Humidity Setpoint (g/m^3)	32-bit float
40019	0x9C52 0x9C53	Heating Output MV (% of duty cycle that the heating system is running)	32-bit float
40021	0x9C54 0x9C55	Cooling Output MV (% of duty cycle that the cooling system is running)	32-bit float

<table>
<tr><th>Register Number</th><th>Address</th><th>Register Description</th><th>Data Format</th></tr>
<tr><td>40023</td><td>0x9C56
0x9C57</td><td>Humidify Output MV (% of duty cycle that the humidification system is running)</td><td>32-bit float</td></tr>
<tr><td>40025</td><td>0x9C58
0x9C59</td><td>Dehumidify Output MV (% of duty cycle that the dehumidification system is running)</td><td>32-bit float</td></tr>
<tr><td>40027</td><td>0x9C5A</td><td>Current Year</td><td>16-bit integer</td></tr>
<tr><td>40028</td><td>0x9C5B</td><td>Current Month</td><td>16-bit integer</td></tr>
<tr><td>40029</td><td>0x9C5C</td><td>Current Day of Month</td><td>16-bit integer</td></tr>
<tr><td>40030</td><td>0x9C5D</td><td>Current Hour (in 24-hour format)</td><td>16-bit integer</td></tr>
<tr><td>40031</td><td>0x9C5E</td><td>Current Minute</td><td>16-bit integer</td></tr>
<tr><td>40032</td><td>0x9C5F</td><td>Current Second</td><td>16-bit integer</td></tr>
<tr><td>40033</td><td>0x9C60</td><td>Alarm Flags<table><tr><th>Bit</th><th>Flag</th></tr><tr><td>0</td><td>High if an alarm is currently active, low otherwise</td></tr><tr><td>1</td><td>High if an alarm was previously active and the user has not yet cleared it</td></tr><tr><td>2</td><td>High if the "Humidifier Absent" alarm is active</td></tr><tr><td>3</td><td>High if the "Dehumidifier Absent" alarm is active</td></tr><tr><td>4</td><td>High if the "Heater/Cooler Absent" alarm is active</td></tr><tr><td>5</td><td>High if the "Pressure Sensor Absent" alarm is active</td></tr><tr><td>6</td><td>High if the "Environmental Sensor Absent" alarm is active</td></tr><tr><td>7</td><td>High if the "Power Interrupt" alarm is active</td></tr></table></td><td>8-bit packed flag list</td></tr>
</table>

<table>
<tr><th>Register Number</th><th>Address</th><th>Register Description</th><th>Data Format</th></tr>
<tr><td>40034</td><td>0x9C61</td><td>Alarm Flags (Continued)<table><tr><th>Bit</th><th>Flag</th></tr><tr><td>0</td><td>High if the "Pressure out of Range" alarm is active.</td></tr><tr><td>1</td><td>High if the "Exceeded High Temperature Limit" alarm is active</td></tr><tr><td>2</td><td>High if the "Exceeded Low Temperature Limit" alarm is active</td></tr><tr><td>3</td><td>High if the "Temperature Control Swapped" alarm is active</td></tr><tr><td>4</td><td>High if the "RH Control Swapped" alarm is active</td></tr><tr><td>5-7</td><td>Unused</td></tr></table></td><td>8-bit packed flag list</td></tr>
<tr><td>40035</td><td>0x9C62</td><td>Warning Flags<table><tr><th>Bit</th><th>Flag</th></tr><tr><td>0</td><td>High if a warning is currently active, low otherwise</td></tr><tr><td>1</td><td>High if the "Sensor Calibration Due" warning is active</td></tr><tr><td>2</td><td>High if the "Sensor Calibration Due Soon" warning is active</td></tr><tr><td>3</td><td>High if the "Humidifier Water Low" warning is active</td></tr><tr><td>4</td><td>High if the "Approaching High Temperature Limit" warning is active</td></tr><tr><td>5</td><td>High if the "Approaching Low Temperature Limit" warning is active</td></tr><tr><td>6</td><td>High if the "Cannot Reach Temperature Setpoint" warning is active</td></tr><tr><td>7</td><td>High if the "Cannot Reach RH Setpoint" warning is active</td></tr></table></td><td>8-bit packed flag list</td></tr>
</table>

<table>
<tr><th>Register Number</th><th>Address</th><th>Register Description</th><th>Data Format</th></tr>
<tr><td>40036</td><td>0x9C63</td><td>Warning Flags (continued)<table><tr><th>Bit</th><th>Flag</th></tr><tr><td>0</td><td>High if the "Temperature Setpoint below Dew Point" warning is active</td></tr><tr><td>1</td><td>High if the "Factory Test not Done" warning is active</td></tr><tr><td>2</td><td>High if the "Factory Test Failure" warning is active</td></tr><tr><td>3</td><td>High if the "Factory Test Poor Performance" warning is active (unused)</td></tr><tr><td>4</td><td>High if the "No Systems Selected" warning is active</td></tr><tr><td>5-7</td><td>Unused</td></tr></table></td><td>8-bit packed flag list</td></tr>
<tr><td>40037</td><td>0x9C64</td><td>System Active Flags<table><tr><th>Bit</th><th>Flag</th></tr><tr><td>0</td><td>High if the Heating System is currently active</td></tr><tr><td>1</td><td>High if the Cooling System is currently active</td></tr><tr><td>2</td><td>High if the Humidification System is currently active</td></tr><tr><td>3</td><td>High if the Dehumidification System is currently active</td></tr><tr><td>4</td><td>High if the Third Variable Increase System is currently active (unused)</td></tr><tr><td>5</td><td>High if the Third Variable Decrease System is currently active (unused)</td></tr><tr><td>6</td><td>High if the Second Stage Heating System is currently active (unused)</td></tr><tr><td>7</td><td>High if the Second Stage Cooling System is currently active (unused)</td></tr></table></td><td>8-bit packed flag list</td></tr>
<tr><td>40038</td><td>0x9C65
0x9C66</td><td>Heating System Base Proportional Gain (KP)</td><td>32-bit float</td></tr>
</table>

Register Number	Address	Register Description	Data Format
40040	0x9C67 0x9C68	Heating System Timing Constant (TI)	32-bit float
40042	0x9C69 0x9C6A	Heating System Maximum Proportional Gain (KP Max)	32-bit float
40044	0x9C6B 0x9C6C	Heating System Integral Activation Threshold	32-bit float
40046	0x9C6D 0x9C6E	Heating System Current Proportional Gain (KP Current)	32-bit float
40048	0x9C6F 0x9C70	Contribution to the Heating MV from the Proportional Term (Heating MV = Proportional Term + Integral Term)	32-bit float
40050	0x9C71 0x9C72	Contribution to the Heating MV from the Integral Term (Heating MV = Proportional Term + Integral Term)	32-bit float
40052	0x9C73 0x9C74	Cooling System Base Proportional Gain (KP)	32-bit float
40054	0x9C75 0x9C76	Cooling System Timing Constant (TI)	32-bit float
40056	0x9C77 0x9C78	Cooling System Maximum Proportional Gain (KP Max)	32-bit float
40058	0x9C79 0x9C7A	Cooling System Integral Activation Threshold	32-bit float
40060	0x9C7B 0x9C7C	Cooling System Current Proportional Gain (KP Current)	32-bit float
40062	0x9C7D 0x9C7E	Contribution to the Cooling MV from the Proportional Term (Cooling MV = Proportional Term + Integral Term)	32-bit float

Register Number	Address	Register Description	Data Format
40064	0x9C7F 0x9C80	Contribution to the Cooling MV from the Integral Term (Cooling MV = Proportional Term + Integral Term)	32-bit float
40066	0x9C81 0x9C82	Humidification System Base Proportional Gain (KP)	32-bit float
40068	0x9C83 0x9C84	Humidification System Timing Constant (TI)	32-bit float
40070	0x9C85 0x9C86	Humidification System Maximum Proportional Gain (KP Max)	32-bit float
40072	0x9C87 0x9C88	Humidification System Integral Activation Threshold	32-bit float
40074	0x9C89 0x9C8A	Humidification System Current Proportional Gain (KP Current)	32-bit float
40076	0x9C8B 0x9C8C	Contribution to the Humidify MV from the Proportional Term (Humidify MV = Proportional Term + Integral Term)	32-bit float
40078	0x9C8D 0x9C8E	Contribution to the Humidify MV from the Integral Term (Humidify MV = Proportional Term + Integral Term)	32-bit float
40080	0x9C8F 0x9C90	Dehumidification System Base Proportional Gain (KP)	32-bit float
40082	0x9C91 0x9C92	Dehumidification System Timing Constant (TI)	32-bit float
40084	0x9C93 0x9C94	Dehumidification System Maximum Proportional Gain (KP Max)	32-bit float
40086	0x9C95 0x9C96	Dehumidification System Integral Activation Threshold	32-bit float

Register Number	Address	Register Description	Data Format
40088	0x9C97 0x9C98	Dehumidification System Current Proportional Gain (KP Current)	32-bit float
40090	0x9C99 0x9C9A	Contribution to the Dehumidify MV from the Proportional Term (Dehumidify MV = Proportional Term + Integral Term)	32-bit float
40092	0x9C9B 0x9C9C	Contribution to the Dehumidify MV from the Integral Term (Dehumidify MV = Proportional Term + Integral Term)	32-bit float
40094	0x9C9D 0x9C9E	Total Heating System Runtime in Milliseconds	32-bit integer
40096	0x9C9F 0x9CA0	Total Cooling System Runtime in Milliseconds	32-bit integer
40098	0x9CA1 0x9CA2	Total Humidification System Runtime in Milliseconds	32-bit integer
40100	0x9CA3 0x9CA4	Total Dehumidification System Runtime in Milliseconds	32-bit integer
40102	0x9CA5 0x9CA6	Total "Third Variable Increase" System Runtime in Milliseconds (Unused)	32-bit integer
40104	0x9CA7 0x9CA8	Total "Third Variable Decrease" System Runtime in Milliseconds (Unused)	32-bit integer
40106	0x9CA9 0x9CAA	Total Second Stage Heating System Runtime in Milliseconds (Unused)	32-bit integer
40108	0x9CAB 0x9CAC	Total Second Stage Cooling System Runtime in Milliseconds (Unused)	32-bit integer
40110	0x9CAD 0x9CAE	The Runtime of the Heating System since its Last Service in Milliseconds	32-bit integer

Register Number	Address	Register Description	Data Format
40112	0x9CAF 0x9CB0	The Runtime of the Cooling System since its Last Service in Milliseconds	32-bit integer
40114	0x9CB1 0x9CB2	The Runtime of the Humidification System since its Last Service in Milliseconds	32-bit integer
40116	0x9CB3 0x9CB4	The Runtime of the Dehumidification System since its Last Service in Milliseconds	32-bit integer
40118	0x9CB5 0x9CB6	The Runtime of the "Third Variable Increase" System since its Last Service in Milliseconds (Unused)	32-bit integer
40120	0x9CB7 0x9CB8	The Runtime of the "Third Variable Decrease" System since its Last Service in Milliseconds (Unused)	32-bit integer
40122	0x9CB9 0x9CBA	The Runtime of the Second Stage Heating System since its Last Service in Milliseconds (Unused)	32-bit integer
40124	0x9CBB 0x9CBC	The Runtime of the Second Stage Cooling System since its Last Service in Milliseconds (Unused)	32-bit integer