
Universal SuperHeat Controller/Sensor Software User Interface Manual

Revision 1.5

GUI Version: *USHX Modbus GUI v1.07*

Applicable Firmware Version(s): *43.71*



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1 Before You Begin

1.1 About the USHX Software

The USHX software is a graphical user interface (GUI) tool for DunAn Microstaq's Universal SuperHeat Controller (USHC) and Universal SuperHeat Sensor (USHS) products used typically in HVAC and refrigeration applications. The USHX product utilizes the Modbus RTU communication protocol for user interaction. The following table shows the features this software includes when used as either a USHC or USHS.

Feature	USHC	USHS
<i>Precise Superheat Control</i>	✓	
<i>Option to Input Desired Target Superheat Setpoint</i>	✓	
<i>Pressure Measuring Capability</i>	✓	✓
<i>Temperature Measuring Capability</i>	✓	✓
<i>Real-time Superheat Calculation</i>	✓	✓
<i>Data Collection Capability</i>	✓	✓
<i>Real-time Data Plotting</i>	✓	✓
<i>Alarm Detection with Notifications</i>	✓	✓
<i>Serial Communication Capability</i>	✓	✓
<i>Multiple-unit Communication Capability</i>	✓	✓
<i>Automatic Voltage Source Detection</i>	✓	✓

The software installation (.exe) package includes:

- USHX Software User Interface Program
- MSEV and USHX-G1.3 Hardware Installation Manual
- USHX Software User Interface Manual

1.2 Hardware and System Requirements

The following table provides the hardware and software requirements for installing and using the USHX software.

Hardware Requirements	System Requirements
<ul style="list-style-type: none">• <i>USHX device</i>• <i>USHX wiring harness</i>• <i>Isolated USB to RS485 converter</i>• <i>Laptop or desktop PC</i>• <i>Small flat tip screwdriver</i>• <i>Wire stripper</i>	<ul style="list-style-type: none">• <i>Operating System: Microsoft Windows XP, Windows Vista, Windows 7, or Windows 8/8.1</i>

1.3 About This Manual

This manual is intended to instruct the user how to install, configure, and operate DunAn Microstaq’s Universal SuperHeat Controller/Sensor software – **USHX Modbus GUI v1.07**.

The following table shows a summary of the sections in this document and their descriptions.

Section Title	Description
<i>Before You Begin</i>	This section provides preliminary information that the user should read before proceeding through the document.
<i>Software Installation and Communications Setup</i>	This section provides information about uninstalling, installing, and setting up the software.
<i>Software Functions</i>	This section provides detailed explanations of the functions of the software.
<i>Alarms</i>	This section provides details about alarms the user may potentially encounter and conditions under which they may appear.
<i>Additional Features</i>	This section provides details about additional features in the USHX Modbus GUI.

1.4 Document Conventions

The following table shows a list of symbols found in this document and their descriptions.

Symbol	Description
	WARNINGS indicate that the action you are taking could either cause injury to yourself or could harm your products and systems.
	IMPORTANT NOTES appear in the text to indicate additional information that should be noted.

1.5 Acronyms

The following table shows a list of acronyms used in this document.

Acronym	Description
GUI	Graphical User Interface
MSEV	Modular Silicon Expansion Valve
USHX	Universal SuperHeat Controller/Sensor
USHC	Universal SuperHeat Controller
USHS	Universal SuperHeat Sensor
F/W	Firmware
DMQ	DunAn Microstaq, Inc.

2 Software Installation and Communications Setup

This section provides instructions for installing, uninstalling, and setting up the USHX software.

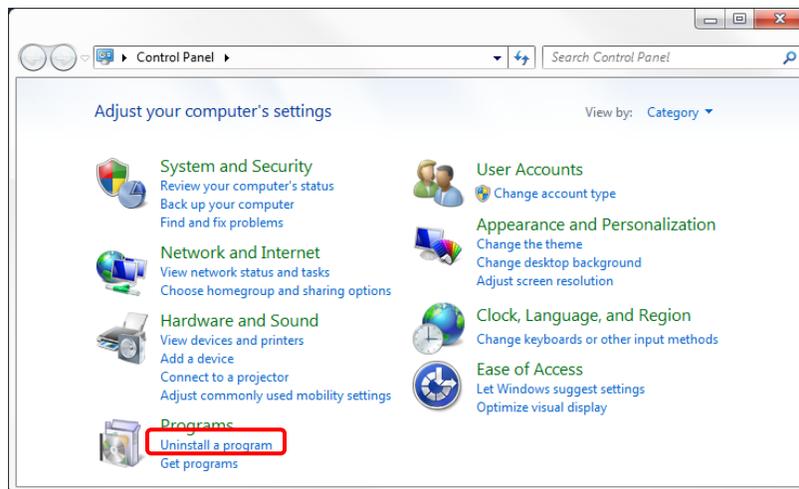


The user must have administrative rights for his or her computer account in order to install or uninstall the USHX software.

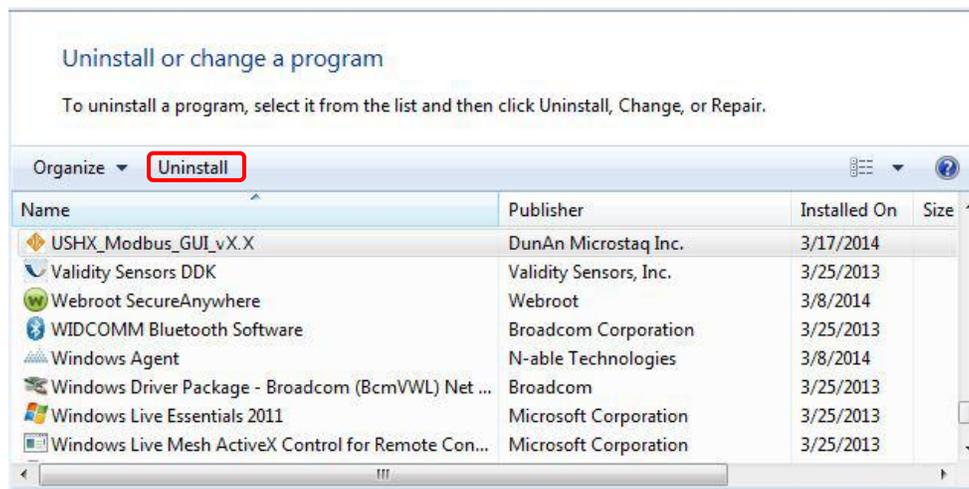
2.1 Uninstalling the USHX Software

Before installing the USHX software, any previous versions of the USHX software may be uninstalled first. To uninstall previous versions of the USHX software (if applicable), complete the following steps:

1. Navigate to the **Control Panel**.
2. Click **Uninstall a program** under **Programs**.



3. Select the **USHX_Modbus_GUI_vX.X** program and click **Uninstall**. Alternatively, **Right Click > Uninstall** will also uninstall the program on current and older versions of Microsoft Windows.



4. The USHX software Removal Utility will run and later prompt the user to confirm the removal of the USHX software and all of its components. Click **yes** to continue with the un-installation.
5. The USHX software un-installation is complete.

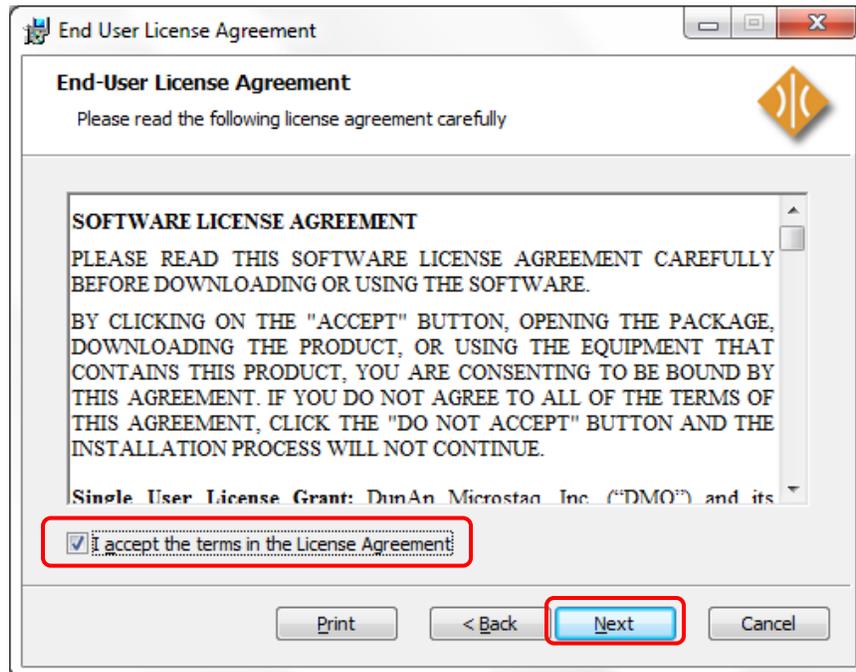
2.2 Installing the USHX Software

To install the USHX software, complete the following steps:

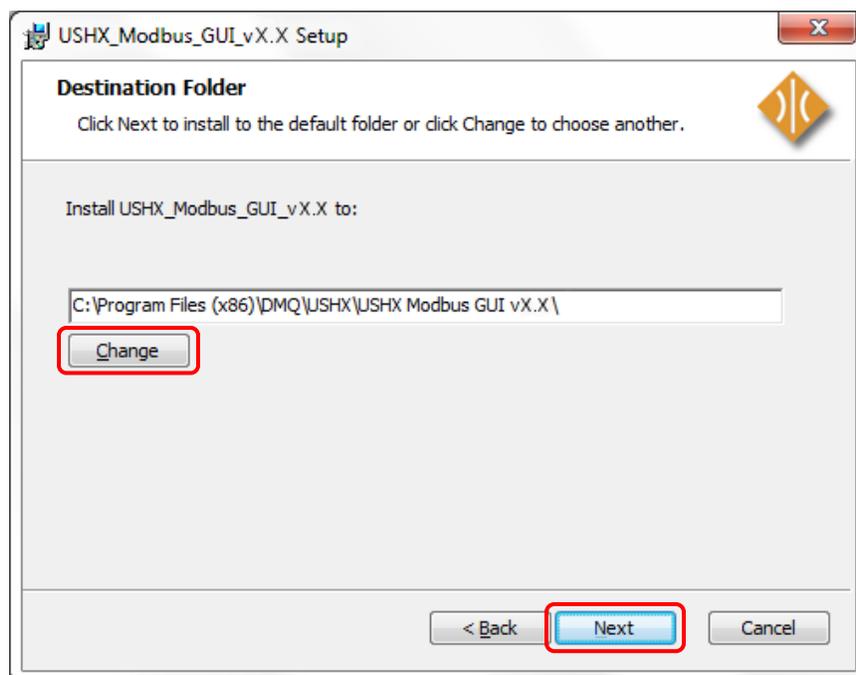
1. Double click **USHX_Modbus_GUI_vX.X_Installer.msi**.
2. The **USHX_Modbus_GUI_vX.X Setup** window appears. Click **Next**.



3. Read the end-user license agreement. Click **Next** to continue once the license agreement is accepted (the check box is ticked).



4. The default installation directory is the Program Files folder. Click **Change** to select a different installation location. Once the desired destination folder is listed, click **Next** to continue with the installation.



5. The **User Account Control** window may appear. Click **Yes** to allow the installation to continue.

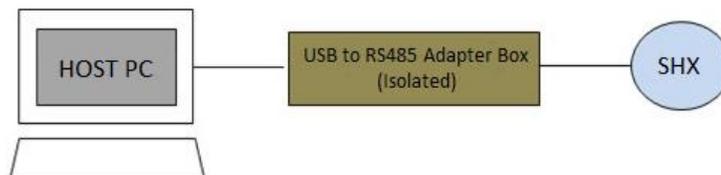
6. Click **Finish** to complete the installation process.



After the installation is complete, a shortcut to the application will be created on the desktop. The program may also be found through the Start Menu at **Start > All Programs > USHX Modbus vX.X**.

2.3 USHX Communications Setup

The HOST PC and the USHX should be connected through an isolated USB-to-RS485 converter box. See the **MSEV and USHX Hardware Installation Manual** for more hardware installation details. The following diagram shows the USHX hardware and software setup described above.

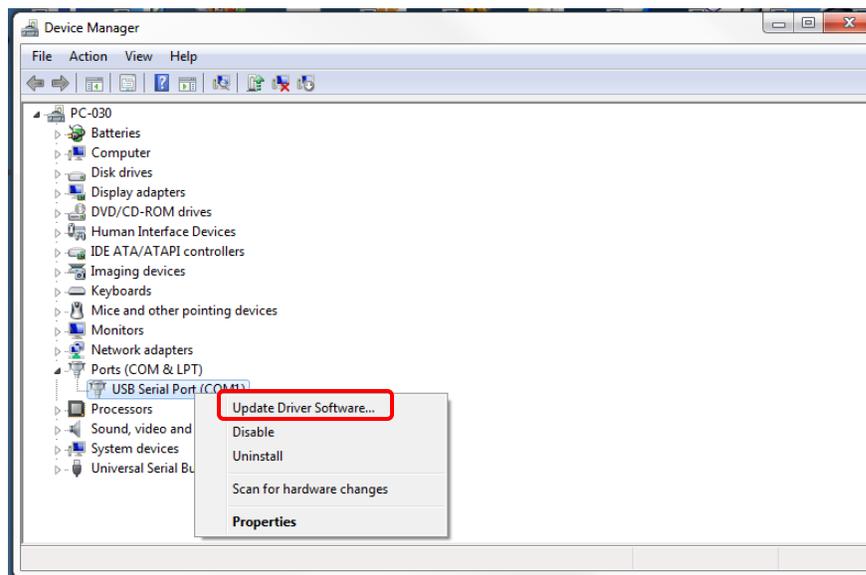


If the USB-to-RS485 converter is being used with the associated computer for the first time, the driver(s) for the device must be downloaded and installed. VirtualSCADA's VSU-485G is one example of a compatible isolated USB-to-RS485 converter. VirtualSCADA, like many manufacturers, hosts its latest drivers on its website. Follow the link below to obtain the driver for this particular device from VirtualSCADA's website.

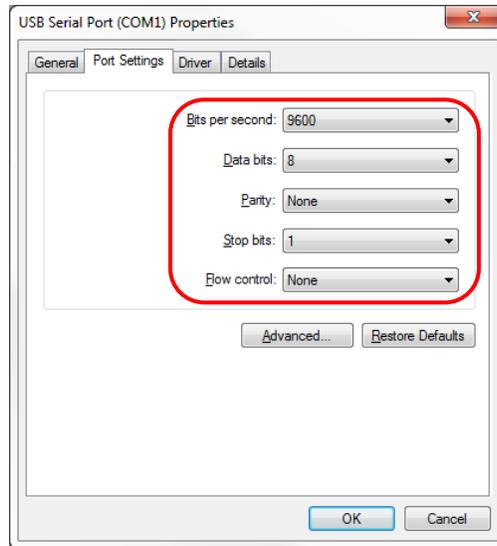
http://www.virtualscada.com/PRODUCTS/Serial_Converters_USB_RS485.htm

To set up communications between the computer and the USHX through the converter, complete the following steps:

1. Download the converter driver(s) from the Internet or, if applicable, obtain them from a CD/DVD. If the driver(s) is (are) in a compressed file, extract the file(s) to a desired location.
2. Connect the converter to the computer via a USB port.
3. When prompted for the device driver location, navigate to the location of the downloaded driver file(s). If no prompt appears, go to **My Computer > Right Click > Properties > Device Manager > Ports (COM & LPT)**, right click **USB Serial Port**, and select **Update Driver Software** and navigate to the driver file(s). The computer system will update the driver list and install the USB converter automatically. A new virtual COM port will now be available on the computer.



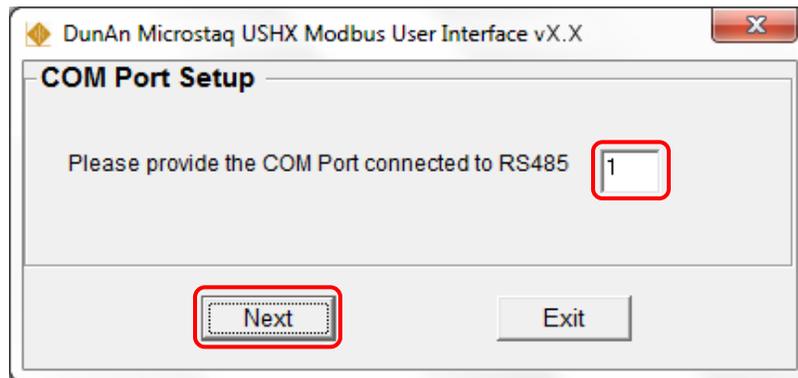
4. Once the converter driver(s) has (have) been successfully installed, connect the converter to the USHX device to complete the hardware installation process.



2. Enter the COM port number that is identified in [Step 1](#) and click **Next**. The figure below uses 1 as an example COM port number. The box is initially blank by default.



The COM port selection is limited to ports **1 through 16**. If the COM port number is not within this range, connect the converter to different ports on the computer until it is within the range.



If the COM port setup is successful, the user will be brought to the Slave ID Setup screen.

3.2 Slave ID Assignment

To assign Slave IDs to the connected USHX device(s), complete the following steps:



When assigning Slave IDs, ensure that power is being supplied to only one USHX device at a time. Only the USHX device being assigned a Slave ID should be powered via its wiring harness. Disconnect all other USHX devices from their wiring harnesses before proceeding. Failure to do so will result in errors.

1. Ensure that power is being supplied to the USHX by checking that the wiring harness is firmly attached to the device.



Review the **Multiple USHC-MSEVs or Multiple USHSs** section in the **MSEV and USHX Hardware Installation Manual** to learn about networking with more than one USHX device.

2. Enter an available Slave ID number and any Remarks for the connected USHX and then click **OK**.

SlaveID	ManufactureID	Remarks
---------	---------------	---------

3. If the Slave ID is assigned successfully, the connected USHX device information – Slave ID, Manufacture ID, and Remarks (if applicable) – will be shown in the Database section underneath the Add Slave ID section.
4. If there are additional USHXs to assign Slave IDs to, disconnect the currently connected USHX and connect the next USHX.
5. Repeat **Steps 2 through 4** to assign Slave IDs to USHXs until all USHXs have been assigned a Slave ID.



Do not assign the same Slave ID to two or more USHX devices (or possibly other devices). This will create a duplicate Slave ID which will cause networking conflicts and result in errors.

6. Once all USHXs have been assigned a Slave ID, ensure that all information about the device(s) is correct in the Database section. The figure at the top of the next page shows an example of information accumulated as a result of 10 different USHXs being assigned Slave IDs with example Remarks.

SlaveID	ManufactureID	Remarks
<input type="checkbox"/> 001	0100121710053522	First
<input type="checkbox"/> 002	0100121510055408	Second
<input type="checkbox"/> 003	0100121710054058	Third
<input type="checkbox"/> 004	0100121510051551	Fourth
<input type="checkbox"/> 005	0100121510044941	Fifth
<input type="checkbox"/> 006	0100121510060746	Sixth
<input type="checkbox"/> 007	0100121710054824	Seventh
<input type="checkbox"/> 008	0100121510054327	Eighth
<input type="checkbox"/> 009	0100121710055716	Nineth
<input type="checkbox"/> 010	0100121510044851	Tenth

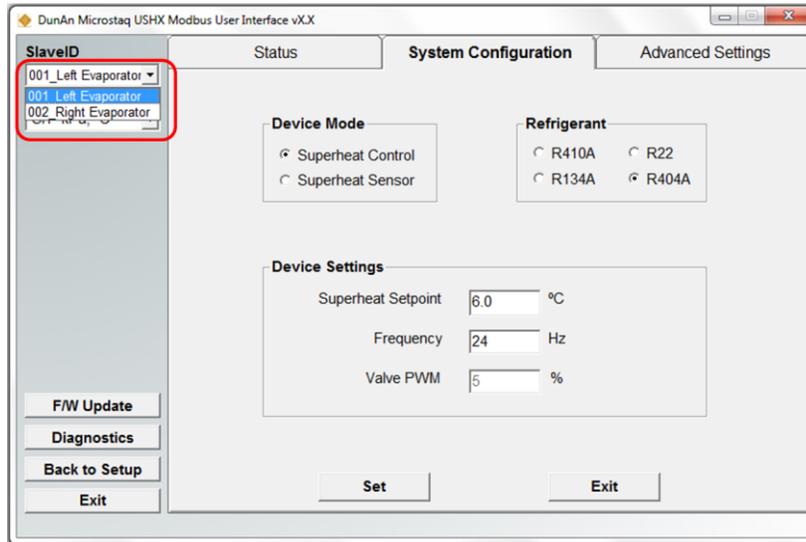
7. Connect and power on all USHXs (that were assigned Slave IDs) via their wiring harnesses.
8. Click **Next** to retrieve firmware information (and additional miscellaneous information) from all connected USHX devices. The figure below shows an example in which 2 USHXs are networked and had Slave IDs assigned to them.

SlaveID	ManufactureID_fromDB	ManufactureID_fromFW	FirmwareVersion	Refrigerant	DeviceMode	TargetedSH(C)	MeasuredPressure(kPa)	MeasuredTemp(C)	CalculatedSH(C)
001	0100020811155924	0100020811155924	43.50	R134A	Control	5	-0.03	23.79	49.72
002	0100020811125952	0100020811125952	43.50	R134A	Control	5	-0.03	26.06	52.00



If a 'mismatch' error message pops up or 'Unknown' appears as data under any of the categories in the above window, contact the manufacturer.

9. Click **Go to Main** on the Test Result window to proceed to the **System Configuration** tab of the main window of the program.



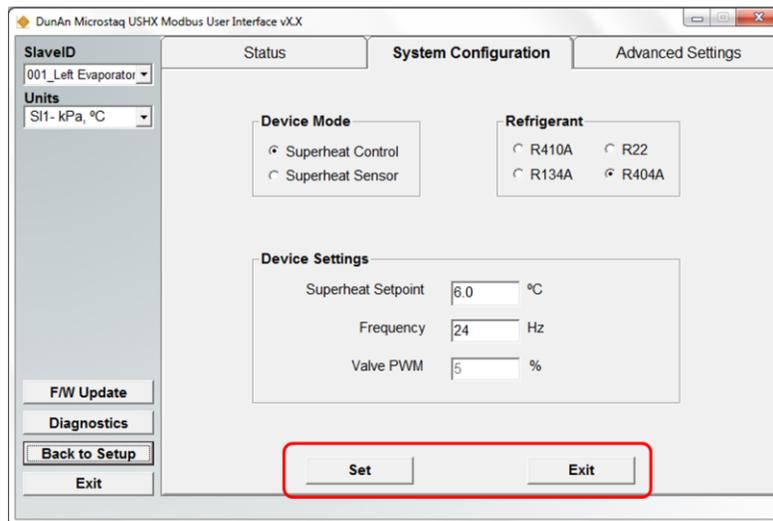
10. The USHX setup is now complete. Select the Slave ID of a USHX device from the drop-down menu to see its parameters. Select each USHX device individually to configure their settings.

3.3 System Configuration

In the **System Configuration** tab, the user may switch the **Device Mode**, change the **Refrigerant** type, and alter additional **Device Settings**. Furthermore, an **F/W Update** may be performed from this tab, but this feature is password protected and only accessible for DMQ maintenance purposes.

Two buttons are located at the bottom of the tab and boxed in the figure below:

- **Set** – This button will set all the selections and changes made by the user.
- **Exit** – This button will bring the user to the **Status** tab.



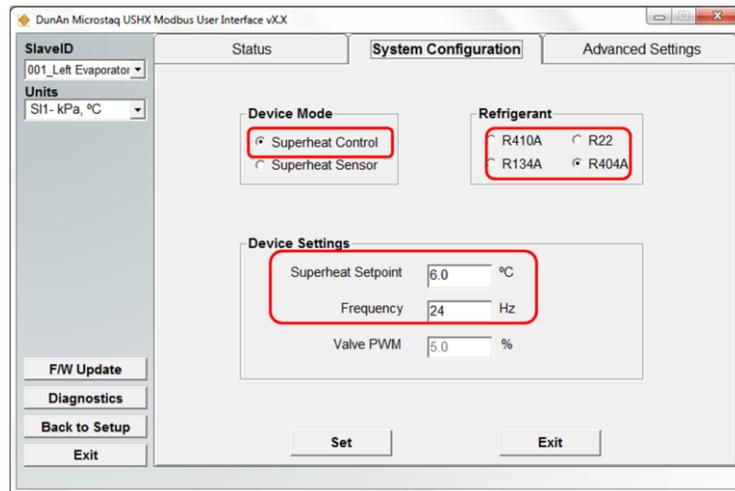
3.3.1 Universal SuperHeat Controller

To set the system configuration for a USHC, complete the following steps:

1. Select the respective **Slave ID** of the USHX that the user wants to configure.
2. For the **Device Mode**, select Superheat Control.



This mode is used with a MSEV to control the superheat temperature of the HVAC/R system. In this mode, the control loop of the software is constantly running, and the valve PWM will adjust automatically so that the system will maintain its target superheat.



3. For the **Refrigerant**, select the appropriate refrigerant for the current system.
4. For the **Device Settings**, input the desired Superheat Setpoint (target) value and appropriate Frequency.



The Frequency setting adjusts the PWM signal frequency. It is typically 24 Hz.

5. Click the **Set** button to save any changes and set the new parameters. Click **OK** when the confirmation window appears.



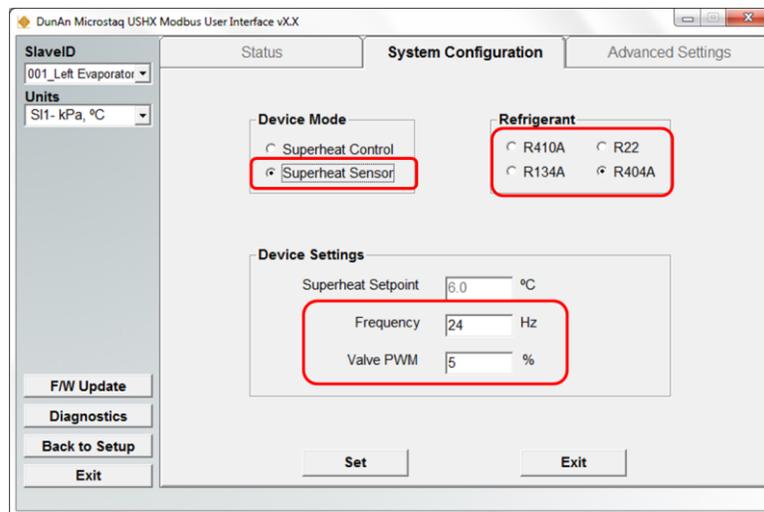
In Superheat Control mode, the Valve PWM setting is disabled; its adjustments will be automated so that the system can maintain the target superheat set by the user.

6. For Advanced Settings setup go to [Section 3.4](#).
7. Repeat [Steps 2 through 5](#) for all SlaveIDs. When this step is finished, the system configuration for the USHC(s) will be complete.

3.3.2 Universal SuperHeat Sensor

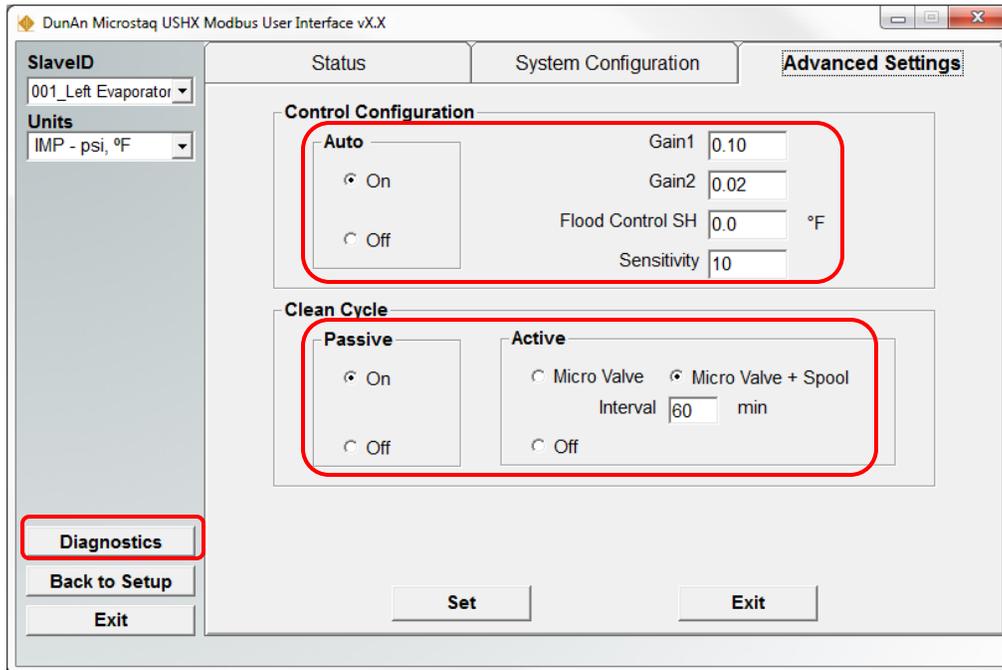
To set the system configuration for a USHS, complete the following steps:

1. Select the respective **Slave ID** of the USHX that the user wants to configure.
2. For the **Device Mode**, select Superheat Sensor.
3. For the **Refrigerant**, select the appropriate refrigerant for the current system.
4. For the **Device Settings**, input the appropriate Frequency and desired Valve PWM. In Superheat Sensor mode, the Superheat Setpoint setting is disabled and a constant PWM output can be set to the device through the PWM output wires (18 AWG, white).
5. Click the **Set** button to save any changes and set the new parameters. Click **OK** when the confirmation window appears.
6. Advanced Settings will be grayed out for Superheat Sensor.
7. Repeat **Steps 2 through 5** for all SlaveIDs. When this step is finished, the system configuration for the USHS(s) will be complete.



3.4 Advanced Settings (Only Applicable for USHCs)

In the **Advanced Settings** tab, the user may alter the **Control Configuration** of the system, turn the **Passive and Active Clean Cycles** on or off, and access the **Diagnostics** window. This tab is only applicable to a USHX that is in Superheat Control mode. The **Diagnostics** window is password protected and only accessible for DMQ maintenance purposes.



3.4.1 Control Configuration

The purpose of the **Control Configuration** section is to allow the user to set the control loop parameters. The settings may vary depending on the application.

Parameter	Description	Recommendation
<i>Auto</i>	This provides user to select automatic control (On) or manually control (Off).	On
<i>Gain 1</i>	This determines how quickly the control loop responds to fluctuations in superheat.	0.1
<i>Gain 2</i>	This determines how quickly the control loop brings the superheat to the superheat setpoint.	0.02
<i>Flood Control SH</i>	This is the superheat value below which the valve PWM goes to 5% (valve closed) to prevent liquid refrigerant to flood back. This value must be lower than the Superheat Setpoint.	0°C or 0°F
<i>Sensitivity</i>	This control parameter is associated with type of application under automatic control.	10 for Refrigeration Systems; 30 for HVAC Systems

3.4.2 Clean Cycle

The function of the **Clean Cycle** feature is to clean the MSEV so that debris that collects within the valve can be removed.

Parameter		Recommendation
<i>Passive Clean Cycle</i>		On
<i>Active Clean Cycle</i>	Micro Valve	Off
	Micro Valve + Spool	On
	Interval	60 Minutes

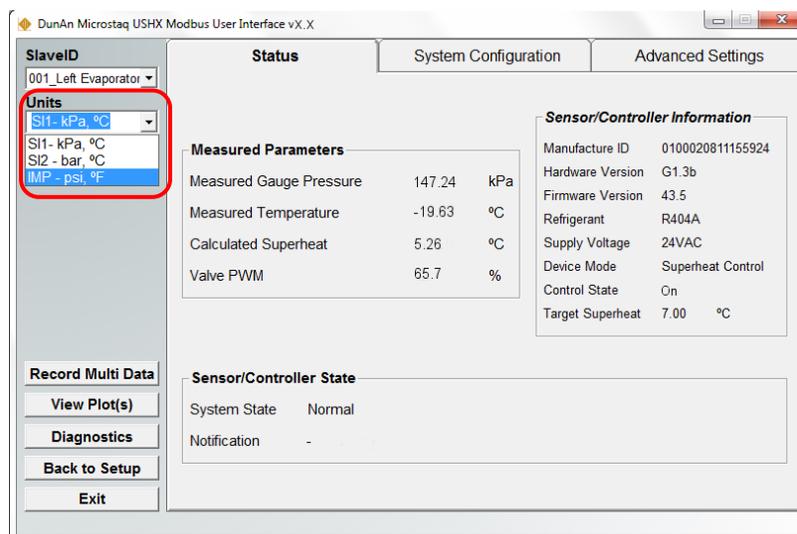
To configure the advanced settings described in [Sections 3.4.1 \(Control Configuration\)](#) and [3.4.2 \(Clean Cycle\)](#), complete the following steps:

1. Input parameter values or select settings as desired. DMQ suggests that the recommended settings are used, although the settings may vary depending on the application.
2. Click the **Set** button to save any changes and set the new parameters. Click **OK** when the confirmation window appears.
3. Repeat **Steps 1 and 2** for all SlaveIDs. When this step is finished, the advanced settings configuration will be complete.

3.5 Status

The **Status** tab displays the current status of the selected USHX Slave ID and relays information about the system to the user.

Select the preferred units of measurement (for pressure and temperature) from the **Units** drop-down menu in the left column of the tab. Values in the tab will automatically be converted and update to reflect changes in units. The default are IMP – psi, °F. This menu is also present in the other tabs.



The table below tabulates the parameters that are displayed in the **Status** tab.

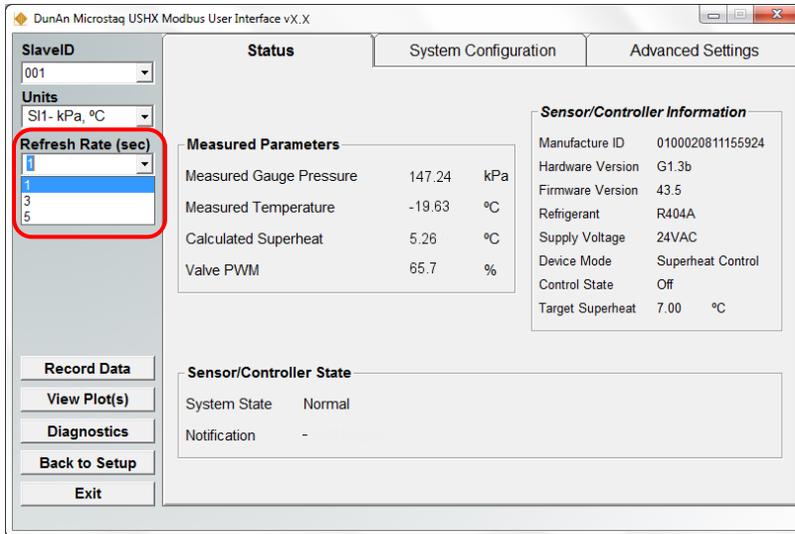
Parameter	Description
<i>Measured Gauge Pressure</i>	This is the measured gauge pressure at the evaporator outlet where the USHX is installed.
<i>Measured Temperature</i>	This is the fluid temperature (measured by the temperature of the external wall of the copper tubing) at the evaporator outlet where the thermistor is installed.
<i>Calculated Superheat</i>	This is the calculated superheat determined in real-time based on pressure and temperature measurements.
<i>Valve PWM</i>	This is the PWM applied to the valve by the USHX.
<i>Sensor/Controller Information</i>	This section displays the Manufacture ID, Hardware Version, Firmware Version, Refrigerant, Supply Voltage, Device Mode, Control State, and Target Superheat (Superheat Setpoint) of the system.
<i>System State</i>	This is the current system state determined by the USHX in operation. States that may be displayed include: <ul style="list-style-type: none"> • Normal – The USHX is operating normally. • Passive Valve Clean – The MSEV is in Passive Clean mode. • Active Valve Clean – The MSEV is in Active Clean mode. • Safety Mode – A system or USHX fault has been detected. In this case, the Valve PWM will be fixed at 40%. Contact Manufacturer
<i>Notification</i>	Notifications that are displayed indicate a fault in the system. Conditions under which notifications appear are defined in Section 4.1 (Notifications) .

3.6 Recording Data

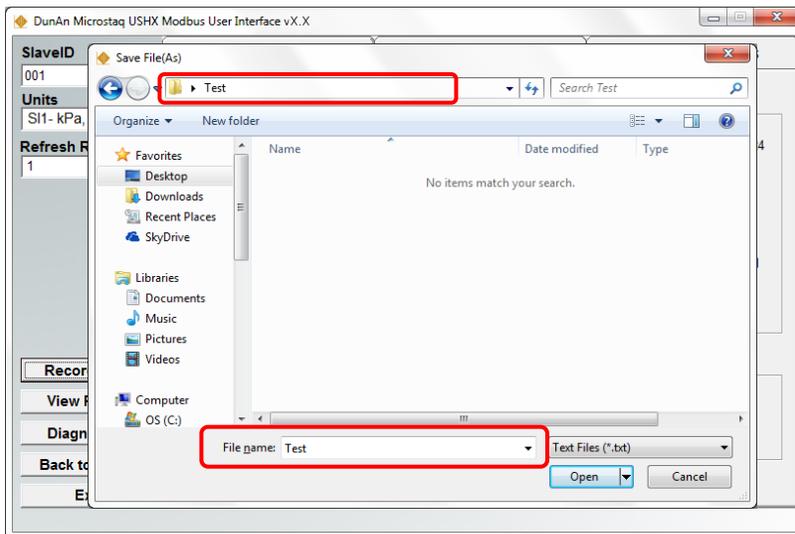
To record data with the USHX, complete the steps below. If more than one USHX is installed, refer directly to [Section 3.6.2 \(Multiple USHXs\)](#) below.

3.6.1 Single USHX

1. Select an appropriate refresh rate for the data collection using the **Refresh Rate (sec)** drop-down menu in the left column of the **Status** tab. The refresh rate selection will impact:
 - a. The status screen refresh rate.
 - b. The rate at which data is recorded.
 - c. The rate at which the run-time plot is updated to show new values.



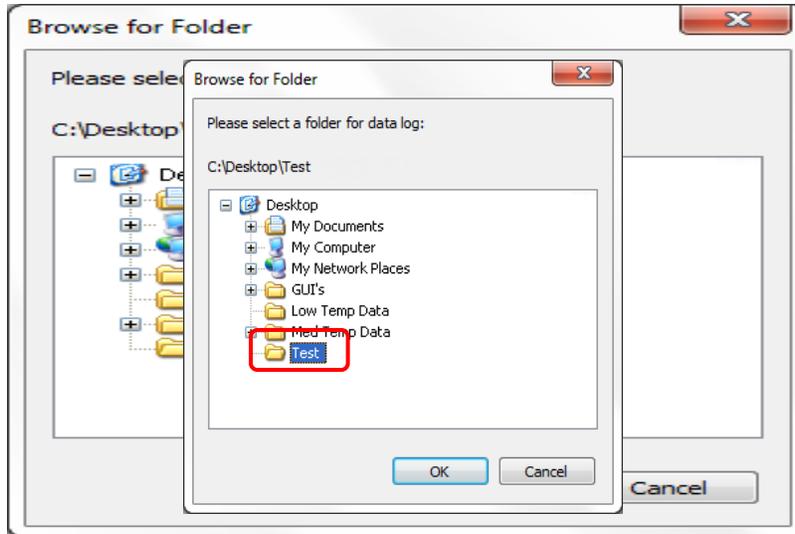
2. Click the **Record Data** button.
3. In the Save File(As) window that appears, select a suitable location to save the file to, enter an appropriate **File Name**, and then click **Open** to begin recording data. The **Record Data** button will be green and state **Recording Data** while data is being recorded.



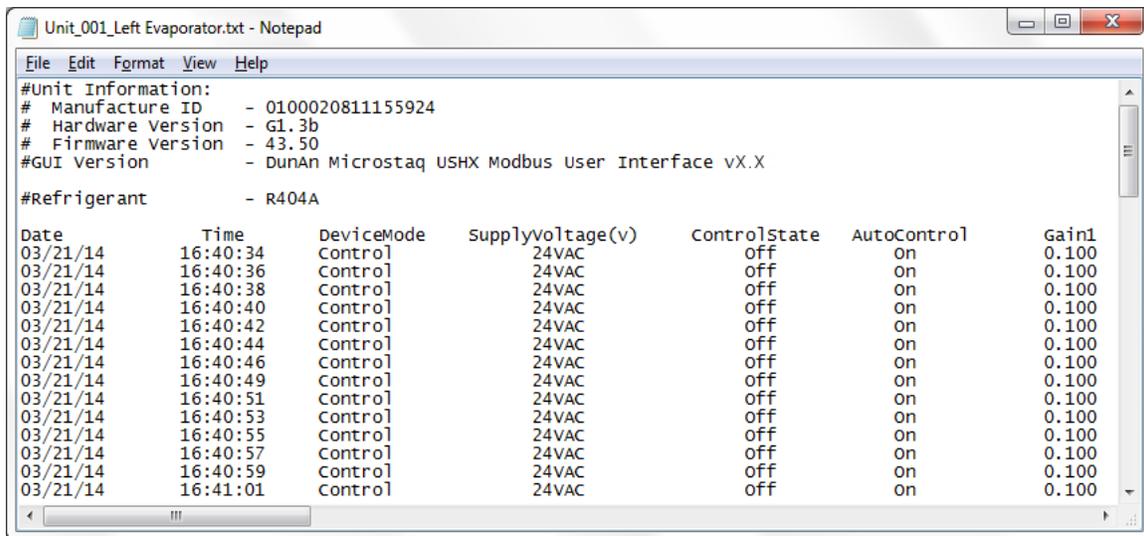
If data will be recorded for more than 4 hours, DMQ recommends that the user use a 5-second refresh rate.

3.6.2 Multiple USHXs

1. Click the **Record Multi Data** button.
2. In the Save File(As) window that appears, select a folder to save the files to and then click **Open** to begin recording data. The **Record Multi Data** button will be green and state **Recording Multi Data** while data is being recorded.



Text files containing the data will be generated and named automatically once the user stops the data collection process. Each text file will correspond to a different Slave ID and contain only that Slave ID's data.



The units of measurement for pressure and temperature in all data files are psi and °F, respectively, regardless of the units that the user has selected. This is the case with systems containing either a single USHX or multiple USHXs.

3.7 Plotting Data

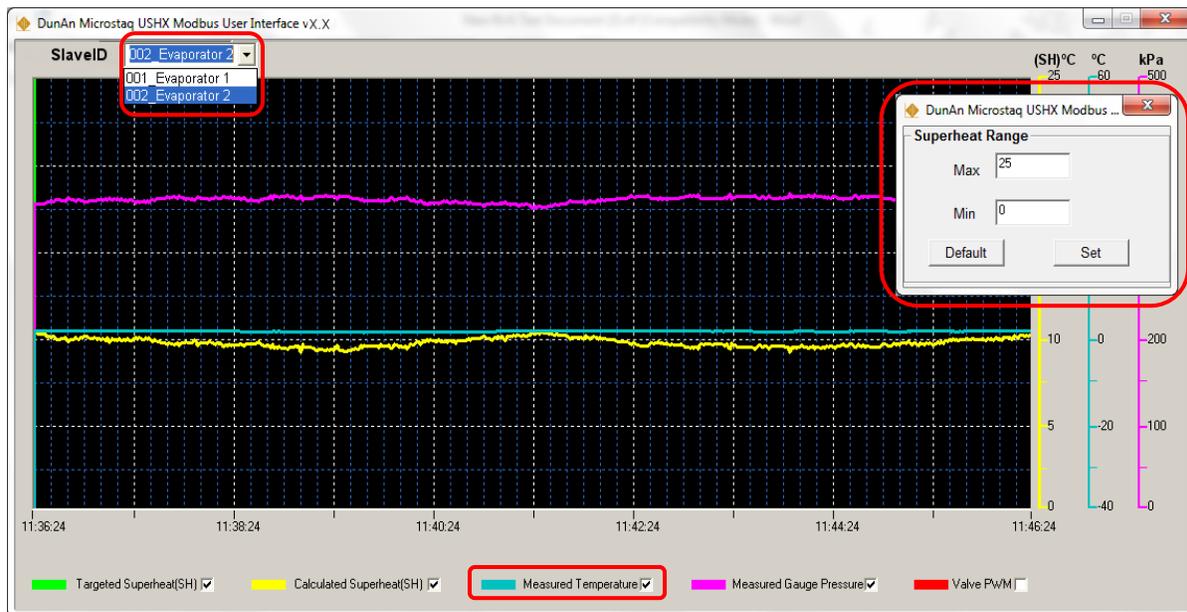
The USHX software is capable of generating a run-time plot of the Targeted Superheat, Calculated Superheat (SH), Measured Temperature, Measured Gauge Pressure, and Valve PWM. To plot data that is being recorded, complete the following steps:

1. Click the **View Plot(s)** button in the **Status** tab. A plot should appear in a new window with superheat and pressure run-time curves already displayed.
2. The units of the values graphed in the plot can be changed through the **Units** drop-down menu in the **Status** tab.
3. The range(s) of the axis (axes) of the parameter(s) displayed can be changed by double clicking the corresponding axis (axes). A new window in which the user can input a desired range for the parameter should pop up.
4. The **Refresh Rate (sec)** setting – which is only available when there is only one USHX – proportionally affects the time range of data that is displayed in the plot.



A 1-second refresh rate allows for 10 minutes of data to be displayed at once;
A 3-second refresh rate, 30 minutes of data;
A 5-second refresh rate, 50 minutes of data.

5. The user may choose for all, some, or none of the parameters to be graphed in the plot by checking or un-checking the check boxes beside the parameter labels below the horizontal axis of the plot.
6. When there are multiple USHXs, the plot only displays data pertaining to the Slave ID currently selected in the **Slave ID** drop-down menu at the top-left corner of the window.



To view the plot window, it is mandatory that the **Status** tab is active. Otherwise, the data collection process will pause and the plot will not be updated.

4 Alarms

The USHX software is equipped to notify the user when some notifications/alarms are found.



Multiple notifications will be displayed if multiple errors are encountered by the USHX at once.

4.1 Notifications

In the **Status** tab, the software will display notifications when errors are encountered. The table below lists the notifications that the user may see and describes the conditions that trigger their appearance.

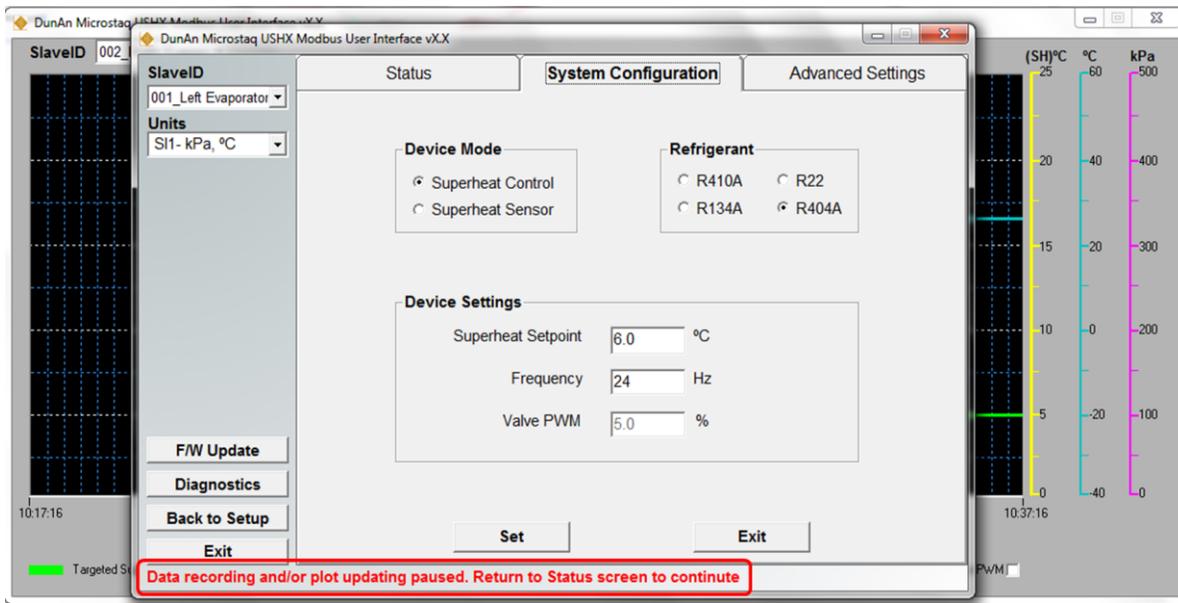
Notification	Description
PWM Toggle	It gets triggered when the valve PWM is at 95% and no change in superheat. During the PWM toggle, the valve PWM continuously cycles between 5 and 80%. This safety feature keeps the valve body temperature to be cool.
High Input Voltage*	The input voltage has exceeded the range of operation.
Low Input Voltage*	The input voltage has fallen below the range of operation.
External Temp. Not within Sensor Range*	The temperature measured by the external sensor has exceeded or fallen below the normal operating temperature limits.
Internal Temp. Not within Sensor Range*	The temperature measured by the internal temperature sensor has exceeded or fallen below the normal operating temperature limits.
Pressure Not within Sensor Range*	The input pressure has exceeded the pressure range of the pressure sensor.
EEPROM Error	Contact manufacturer if this notification is seen.
RAM Failed	Contact manufacturer if this notification is seen.
Temperature Difference Error	Contact manufacturer if this notification is seen.

* These notifications pertain to errors involving the operating range of the USHX. When any of these notifications are displayed, ensure that the USHX is being operated properly within its design limits as specified in the product datasheet.

4.2 Additional Messages

Additional messages are shown in red text at the bottom-left corner of the **Status** tab. The table below lists additional messages that the user may see and describes the conditions that trigger their appearance.

Message	Description
Message not received completely	There is either a partial loss of data or a compatibility issue between the firmware and the USHX software interface.
Wrong checksum	Data traveling across the communication wire is corrupted.
Data recording and plot updating is paused. Return to status screen to continue	The user is active in a tab other than the Status tab while data is being recorded and/or plotted. The user should return to the Status tab to continue the data collection process.

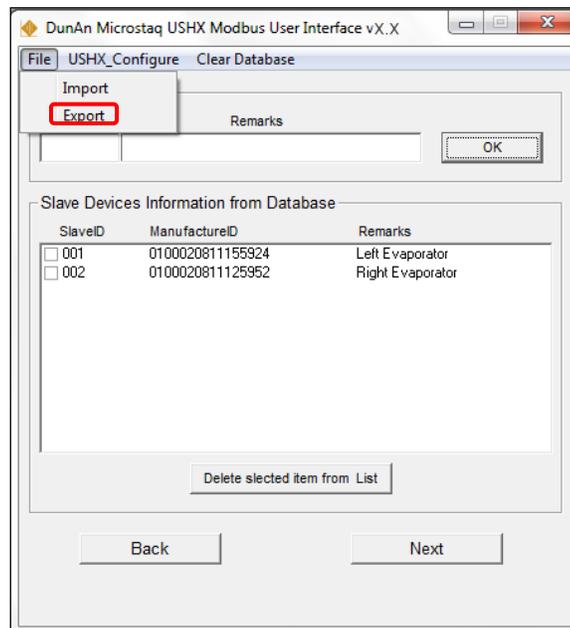


5 Additional Features

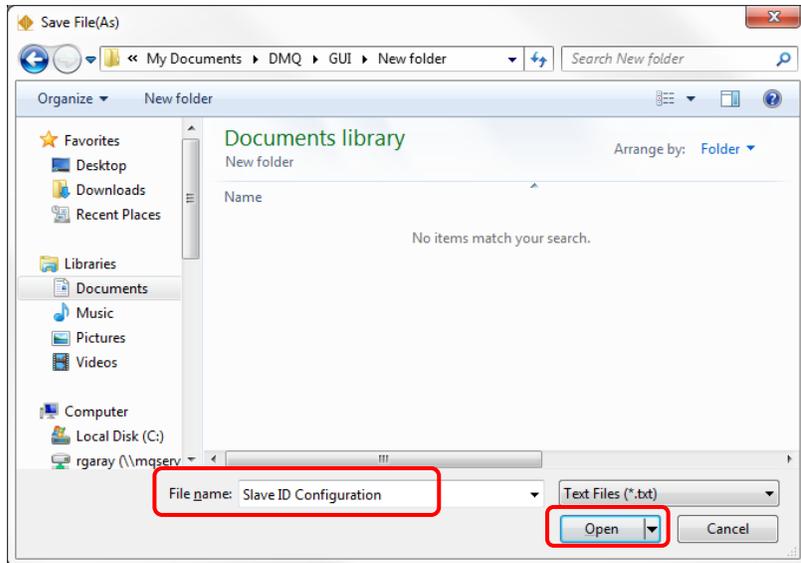
5.1 File Export/Import

The **File Export/Import** feature allows the user to save the database of Slave IDs (export the database to a text file) and use it later (import the text file to load the database) if the database is needed again. This feature helps protect the user from the loss of the database, which could occur if the user clears the database by clicking **Clear Database** or if the computer used is changed. It eliminates the need to manually recreate a database, which can potentially be time consuming if there are multiple USHXs networked together. The steps below show how to use the **File Export/Import** feature.

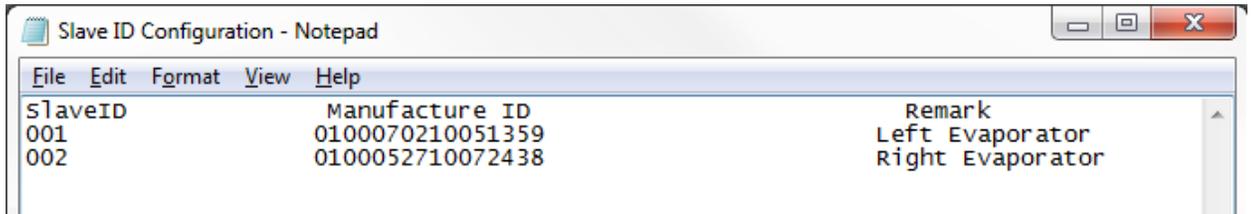
1. Click **File > Export** at the top of the Slave ID Setup window seen in [Section 3.2 \(Slave ID Assignment\)](#).



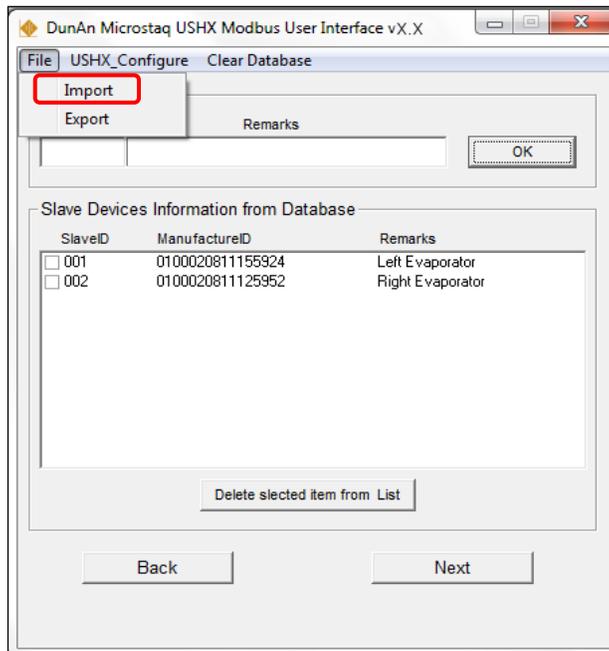
2. In the Save File (As) window that appears, select a suitable location to save the file to, enter an appropriate **File Name**, and then click **Open** to export and save the current database as a text file.



3. The database will be stored in the text file in the manner shown in the figure below.



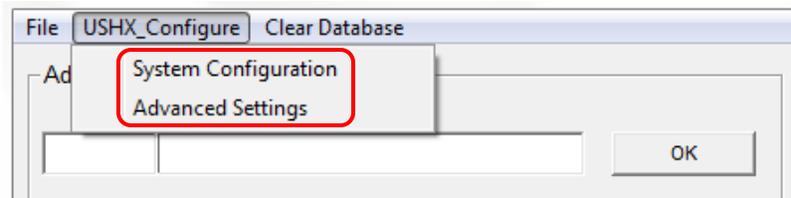
4. The user can import exported databases by clicking **File > Import** and selecting the appropriate text file.



The **Clear Database** button at the top of the window allows the user to clear all the Slave ID information in the database. It is typically used when a new database needs to be created and provides a quick way to delete previous database information all at once. The **Delete selected item from List** button below the Database allows the user to delete the Slave ID information of only selected Slave IDs within the Database. To select a Slave ID, check the box next to it in the Database.

5.2 Pre-Configuration

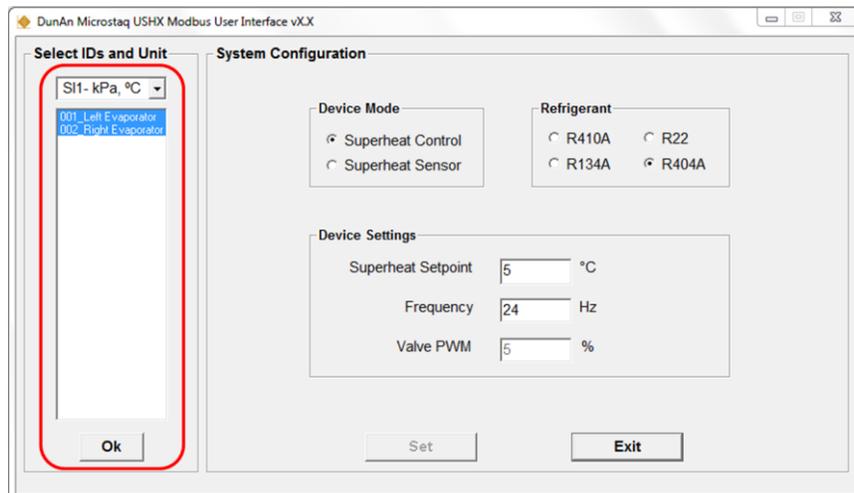
The **USHX_Configure** feature allows the user to alter the **System Configuration** and configure the **Advanced Settings** of multiple USHXs at once as opposed to one USHX at a time. The end result of pre-configuration is identical to that seen after the user completes [Sections 3.3 \(System Configuration\) and 3.4 \(Advanced Settings\)](#). However, this feature offers the user a quicker way to configure the system when there is more than one USHX.



5.2.1 System Configuration

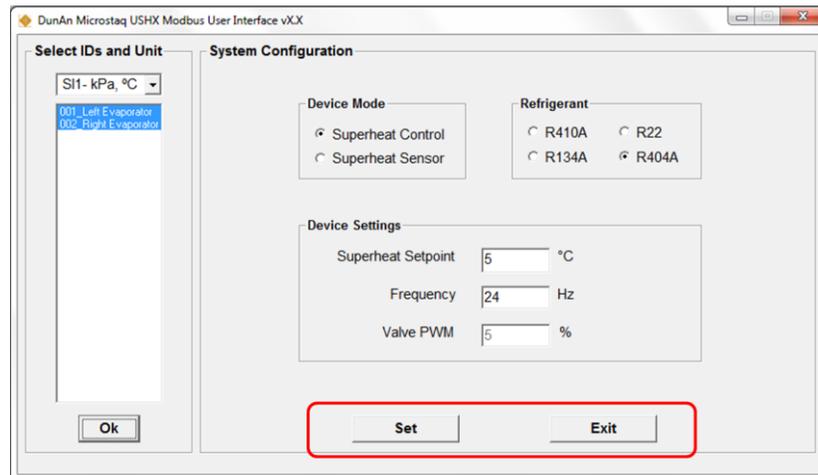
To adjust the **System Configuration**, complete the following steps:

1. Click **USHX_Configure > System Configuration** at the top of the Slave ID Setup window.
2. Select all Slave IDs in the **Select IDs and Unit** list in the left column of the window that are to be configured and click **OK**.



When pre-configuring multiple USHXs, all selected USHXs will be set with the same settings and parameters. Therefore, care must be taken by the user to select and group together only the USHXs that are supposed to follow the same parameters or be set with the same settings.

3. Adjust the **Device Mode**, **Refrigerant** type, and **Device Settings** as desired. Click the **Set** button to save any changes and set the new parameters.



4. Repeat **Steps 2 through 3** until all USHXs have been configured. Click **Exit** to close the **System Configuration** window.

5.2.2 Advanced Settings

To configure the advanced settings, complete the following steps:

1. Click **USHX_Configure > Advanced Settings** at the top of the Slave ID Setup window.
2. Select all Slave IDs in the **Select IDs and Unit** list in the left column of the window that are to be configured and click **OK**.



When pre-configuring multiple USHXs, all selected USHXs will be set with the same settings and parameters. Therefore, care must be taken by the user to select and group together only the USHXs that are supposed to follow the same parameters or be set with the same settings.

3. Adjust the **Control Configuration** and **Clean Cycle** settings as desired. Click the **Set** button to save any changes and set the new parameters.
4. Repeat **Steps 2 through 3** until all USHXs have been configured. Click **Exit** to close the **Advanced Settings** window.



The **Diagnostics** window is password protected and only accessible for DMQ maintenance purposes.

