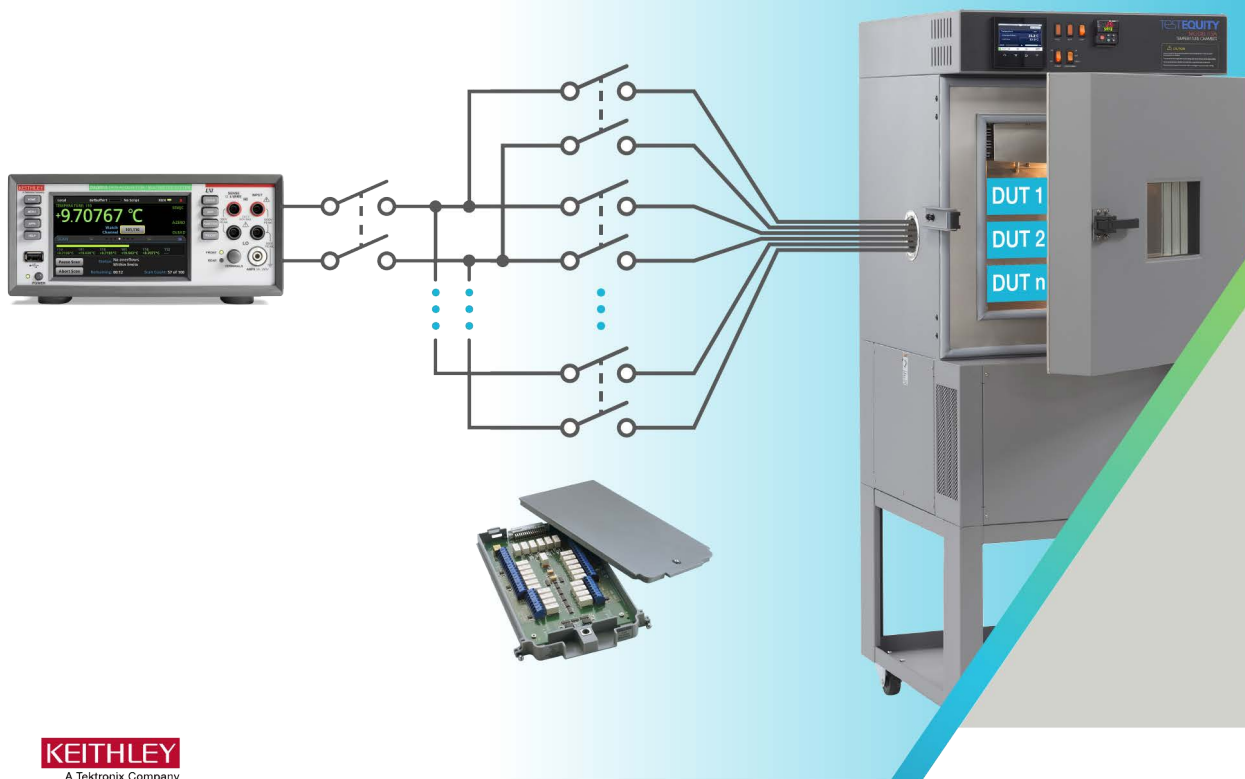


# Combined Temperature and Data Acquisition Control

Using the Watlow F4T Controller and Keithley DAQ6510 Data Acquisition and Logging Multimeter System

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## HOW-TO GUIDE

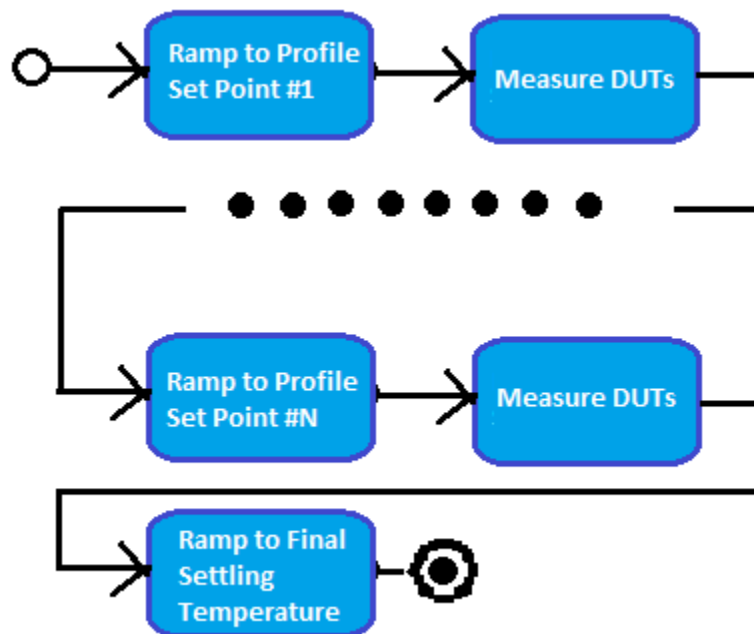


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## Introduction

New products must be tested to ensure that they continue to work properly, especially in extreme environments, or to verify the limits of proper working conditions. This may be prescribed per an industry standard or a manufacturer's in-house rule-of-thumb – in general, many of these standardized processes follow a common pattern. A device under test (DUT) is soaked in a controlled environment over an extended period, and data is taken to observe how the DUT's performance changes as a result.

The generalized overall process flow is shown as follows:



A temperature chamber such as the TestEquity Model 115A employs the Watlow F4T Touchscreen Controller to manage environmental conditions for the testing as outlined above, and can stress a DUT at temperatures from as low as  $-73^{\circ}\text{C}$  up to  $+175^{\circ}\text{C}$ . It can log its environmental conditions over the duration of a programmed profile execution and display this information in graph form on its own 4.3-inch screen. Additionally, this controller provides a series of SCPI commands to promote remote control of the chamber.

The Keithley DAQ6510 Data Acquisition and Multimeter System can monitor the environment until the desired test conditions are achieved before performing a scan and acquiring data. This way, the convenience of using the same unit to both monitor the test chamber and take readings is available to the user. Through the power of Keithley Test Script Processor® (TSP) scripting and instrument communication over a standard Ethernet connection, the DAQ6510 can control the F4T thermal chamber controller.

## Instrument Connection Overview

The DAQ6510 provides the user the ability to execute measurement sequences and apply environmental chamber settings all from a single interface. This is achieved by using programming API functions (local to the DAQ6510 embedded processing engine) to make a TCP/IP socket connection to

the F4T controller that manages the environmental chamber conditions. This Keithley instrument-level LAN connectivity is referred to as TSP-Net.

TSP-Net allows any Keithley Test Script Processor enabled instrument to directly control up to 32 different Ethernet-enabled devices without the immediate use of a controlling computer. Instead, the instruments are connected to the same network, router, or connected directly to one another via an Ethernet or crossover cable. The controlling instrument uses functions from the Keithley TSP-Net library to transfer control commands to and retrieve responses from a remote instrument, then transfers and formats the data into usable variables that the instrument's processing engine understands (via Lua programming language). This way, the user can send the appropriate commands (typically SCPI) to a subordinate instrument and the controlling/master instrument can receive responses, even if both devices use different command sets. Because the TSP commands used to establish TSP-Net communications format the ASCII data being sent and received, the subordinate device does not need to be TSP compatible. SCPI or any other command set can be used in conjunction with TSP for TSP-Net applications.

## Setup

Before running the script that will allow the DAQ6510 to facilitate F4T thermal chamber controller operation, a few steps must be taken or verified beforehand.

### 1. Scan Hardware Setup – Configuring the DAQ6510 Scan Card

Prior to starting your environmental test, you will need to determine the number of and types of measurements you want to make, whether they be temperature, voltage, or another stimulus. The Connection Log found in **Appendix A** can be used with the Model 7700 multiplexer (MUX) scan card to help plan and catalog the connections you make for a particular scenario.

It is important to note that the control script will provide you the option to specify the primary point of interest used to start the scan: either a point on the Primary Sensor itself (defined by a MUX channel wired to a transducer located on or near the DUT) or the Process Value reported by the F4T controller.

- **Primary Sensor:** This point on or near the DUT must be connected to Channel 101 (which is channel 1 of the card in slot 1 of the DAQ6510)
- **Process Value:** This is the ambient temperature value measured inside the chamber by the F4T controller.

The following steps are an overview of how you would configure your MUX card and install it within the DAQ6510.

#### a) If your test will rely on a temperature point on the Primary Sensor:

- Install the temperature transducer on channel 1 of the card, which will be placed in slot 1. Route this temperature sensor into to the chamber to monitor its internal temperature.
- Wire additional measurement points of interest to the card's other channels.
- Insert the switch card(s) into the slot(s) on the rear of the DAQ6510. The card populated with the temperature transducer used to monitor the chamber must be installed in slot 1.

b) If your test will rely on the Process Value of the environmental chamber:

- Wire all measurement points of interest to the card's channels.
- Insert the switch card(s) into the slot(s) on the rear of the DAQ6510.

**NOTE:** DO NOT hot swap switch cards. Insert and remove cards only while the DAQ6510 is powered off.

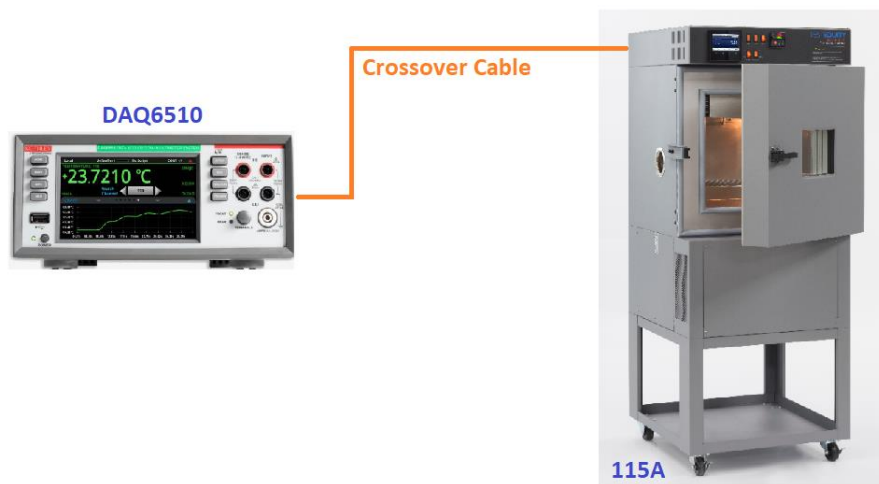
**NOTE:** For more information on how to make specific Model 77xx multiplexer card connections and install within the DAQ6510, refer to that card's Instruction Manual found at [tek.com](http://tek.com).

## 2. Networking Setup

While computer and instrument networking is not a trivial task, the following details are intended to allow even those users with limited networking experience to establish all necessary connections and modify all necessary instrument settings in order to get the whole system operational.

a) Determine the Network Connection Layout

- **Direct Ethernet Connection** – In this configuration, the DAQ6510 is directly connected to the F4T controller using an Ethernet crossover cable.



- **Connecting Through a Switch** – In this configuration, both the DAQ6510 and the F4T controller are connected to an Ethernet switch using crossover cables.



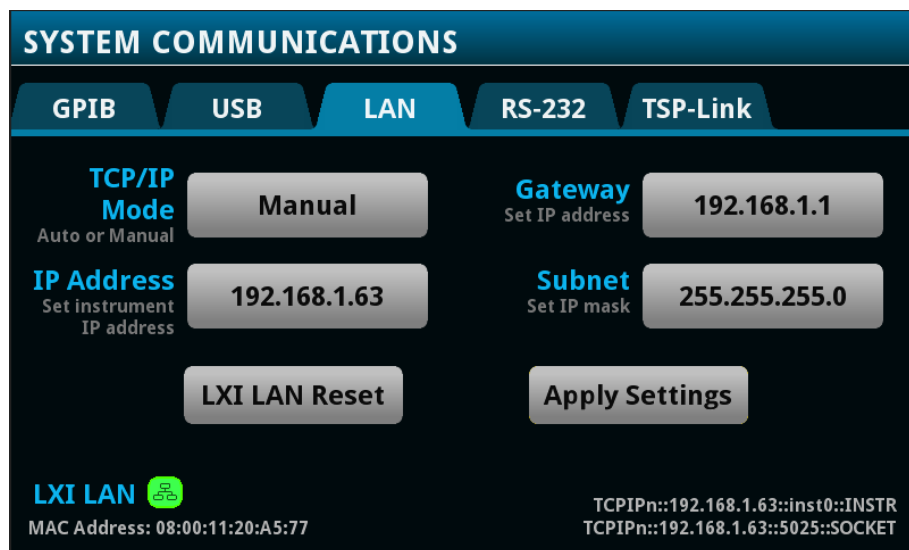
In either scenario, the network configuration setup for both the DAQ6510 and the F4T controller (in the Model 115A) remain the same as detailed below.

Select your desired configuration from the two options above and make the necessary connections.

***For simplicity, this section of the documentation will move forward using a direct connection of the instruments and apply Manual Network Configuration settings of both. If you have the option of connecting to your corporate network and would prefer to take advantage of the Automatic Network Configuration setup, refer to **Appendix B**.***

#### b) Configuring the DAQ6510 Local Area Network Communications Settings

- On the front panel, select the **MENU** button.
- Under the **System** column, select **Communication**.
- In System Communications UI, navigate to the **LAN** tab.
  - Set the **TCP/IP Mode** field to **Manual**.
  - Set the **IP Address** field to a specific static IP address.  
For example: **192.168.1.63**.
  - Set the Subnet field. For example: **255.255.255.0**.
  - Set the Gateway field. For example: **192.168.1.1**. *Note: while the Gateway field might not seem necessary for a direct connect setup, the DAQ6510 will not accept the 0.0.0.0 value.*
  - Select **Apply Settings**. It may take a few seconds for the DAQ6510 to change to a new network configuration.
  - Verify that the **LXI LAN** indicator is green. If not, make sure the connection is properly set up.



- The above DAQ6510 LAN example settings are merely suggestions and your own manual setup may use otherwise. Use the following table to note your configuration for comparison to the setup of the F4T controller.

IP Address	
Gateway	
Subnet	

#### c) Configuring the F4T Controller Local Area Network Communications Settings

- On the F4T front panel bezel, press the **Main Menu** icon.

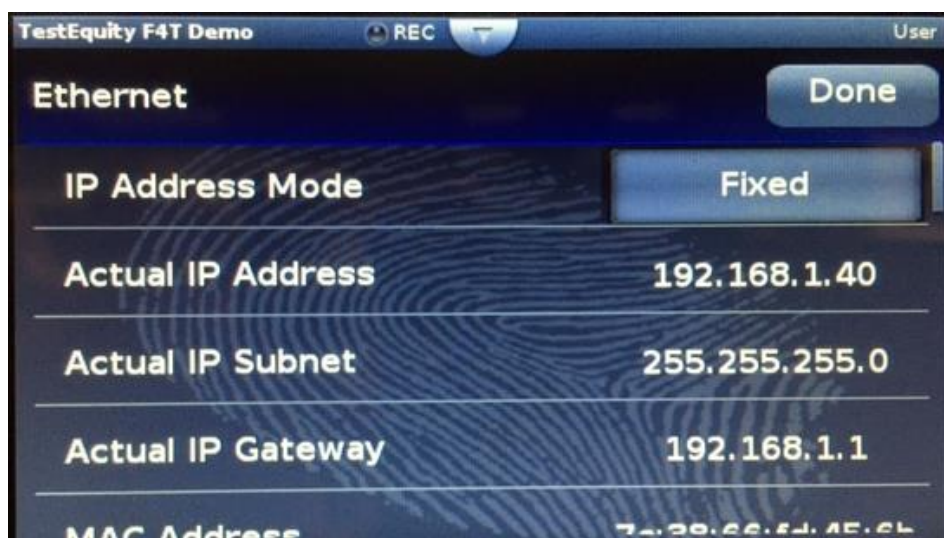


- In the Main Menu, select **Settings**, then scroll down and select **Network**, then select **Ethernet**.
- In the Ethernet menu, touch the button in the IP Address Mode and choose the **Fixed** option.
- Scroll to the **IP Fixed Address** entry fields and enter the following:
  - Part 1: **192**
  - Part 2: **168**
  - Part 3: **1**
  - Part 4: **40**
- Scroll to the **IP Fixed Subnet** entry fields and enter the following:
  - Part 1: **255**
  - Part 2: **255**

- Part 3: **255**
- Part 4: **0**
- Scroll to the **Fixed IP Gateway** entry fields and enter the following:
  - Part 1: **192**
  - Part 2: **168**
  - Part 3: **1**
  - Part 4: **1**
- When all settings have been entered, touch the **Done** icon (in the upper right corner of the screen) *three times* to return to the Home screen.
- **Cycle power** on the F4T Controller. It will take approximately 30 s for the unit to restart.

**NOTE:** When power is removed from the F4T Controller, the DAQ6510 will report “LAN cable disconnected”. Touch the OK button to accept – this will pass when the controller reboots.

- Press the **Main Menu** icon again and navigate to the **Network** settings UI (same as above)
- Verify that all network settings have been applied as expected:



- The above F4T Controller LAN settings are merely suggestions and your own manual setup may use otherwise. Use the following table to note your configuration for comparison to the setup of the DAQ6510.

IP Address	
Gateway (must match the DAQ6510)	
Subnet (must match the DAQ6510)	

- For more information on using the F4T (such as for modifying network settings), please see the documentation provided by the manufacturer.

**NOTE:** For more detail on specific networking configurations, refer to Appendix B



### 3. Measurement Scan Setup

Your measurement scan setup will be configured using the DAQ6510 and must be configured prior to running the F4T thermal chamber control script.

- a) Set the terminal switch to **REAR**.
- b) Press the **MENU** key.
- c) Under the **Channel** column, select **Scan**.
- d) Press **Add Group of Channels** to add and apply measurement functions to the channels the user wants to scan.
  - The configuration selected should match the planned MUX card wiring as applied in the section above entitled “*Scan Hardware Setup – Configuring the DAQ6510 Scan Card*”.
  - Be certain that if you plan to use a temperature measurement sensor mounted on or near the DUT, it is configured at the MUX card in slot 1 and on channel 1.
- e) Accessing the **Settings**, **Scan**, and **Trigger** tabs will allow you to further customize your scan configuration.

For a more comprehensive example on how to build a measurement scan, refer to **Appendix C**.

**NOTE:** For more information on how to build scans, refer to the *DAQ6510 User Manual* found at [tek.com](http://tek.com).

### 4. [OPTIONAL] Establishing Temperature Units on the F4T Controller

The F4T Touchscreen Controller is configured by TestEquity for both communication units and display units on the front panel to be in Celsius (°C). Other OEMs may integrate the F4T differently. Additionally, the controller may also be configured by the user to display units in degrees Fahrenheit (°F) via the front panel. Communication units and display units can be set independently.

The F4T controller includes in its SCPI command set a directive that allows an operator to programmatically define the units shared between itself and its remote operator – reported via ethernet – independent of the front panel state. This helps the remote interface ensure proper readback of values as they are expected to be consumed by the controlling program.

For simplicity, the standalone test script program presently only supports °C values issued over the ethernet connection. This script program uses the SCPI command (alluded to above) to specifically configure the F4T controller to report all values over ethernet in °C.

This section first describes how to ensure proper units reported programmatically, and describes how to configure the F4T controller to display Set Point and Process Value readings on its front panel in either °C or °F.

#### a) Configure the F4T Units Reported Over Ethernet

- Ensure proper LAN configuration as defined in the section above entitled, “*Configuring the F4T Controller Local Area Network Communications Settings*”.
- Using a remote communications tool, issue one of the following commands to the F4T controller to establish units in °C over the ethernet communication channel:



**:UNIT:TEMPERATURE C\n**

- To verify the setting has been applied, issue the following query to the F4T controller:

**:UNIT:TEMPERATURE?\n**

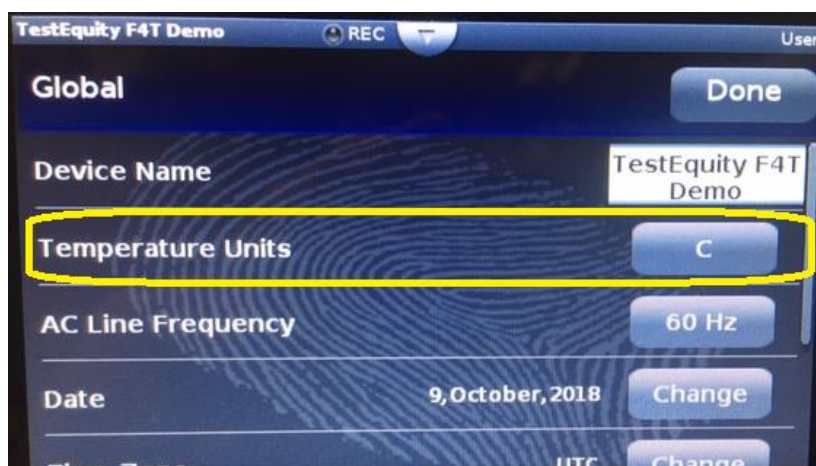
The controller will report 'C\n'.

b) [Configure the F4T Units Shown on the Controller Front Panel](#)

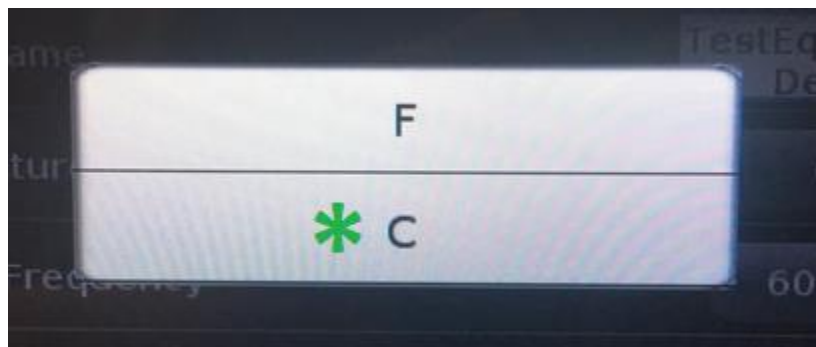
- On the F4T front panel bezel, press the **Main Menu** icon.



- In the Main Menu, select **Settings**, then scroll down and select **Global**.
- Touch the button on the right-hand side of the row reading Temperature Units.



- From the options provided, select the "C" to set to display values on the front panel in °C.



- On the F4T front panel bezel, press the **Home** icon.



- After returning to the Home screen, the F4T controller will take approximately 5 seconds to apply all necessary changes.

## Loading and Running the Test Script Program

The DAQ6510 has an embedded test script processing engine which allows it execute test sequences (with function calls, decision-making, and communication with other LAN-based instrumentation) local to the instrument in the absence of a controlling PC. This functionality promotes simplified hardware configurations and pairs it with the ease and intuitiveness of the DAQ6510 touchscreen interface.

The script used in this example – entitled *F4T\_EnvController\_DAQ6510* – can do the following:

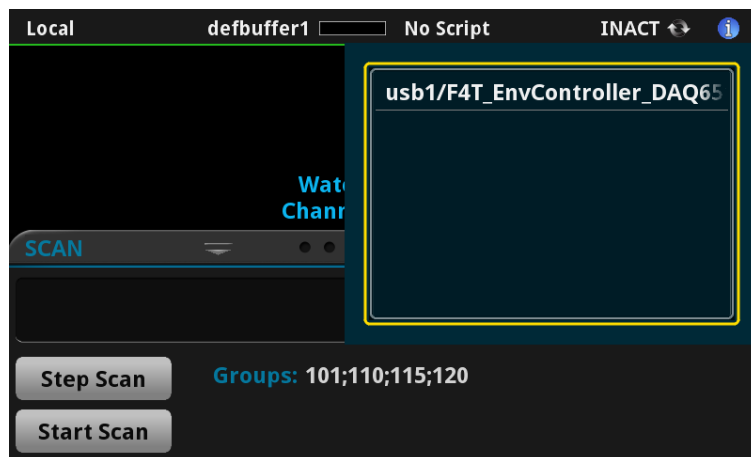
- a) Open a remote sockets-based connection to the F4T controller (from the DAQ6510).
- b) Define a series of temperature set points (up to 10) for the controller to reach prior to executing the programmed measurement scanning.
  - The rate at which a set point is reached can be defined by the user as either immediate (as fast as the chamber can reach setpoint) or as a programmed ramp rate.
  - Allow for the applying of a specific soak time for each defined set point. Select a tolerance of how close the measured temperature must be before a soak time is initiated.
- c) Provide the option for the temperature chamber to return to a user-defined ambient or safe temperature.
- d) Saving of test data to a USB drive at each of the temperature set points.

**NOTE:** For simplicity, the standalone test script program presently only supports F4T controllers without Cascade Control (Part Temperature Control).

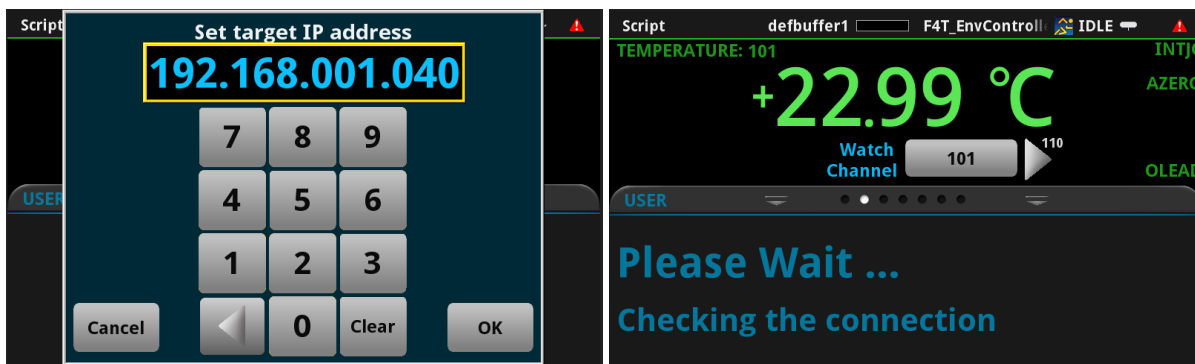
The *F4T\_EnvController\_DAQ6510* test script can be obtained from a Keithley Instruments Call Center representative or a TestEquity Sales Associate.

The following steps provide an example of how the *F4T\_EnvController\_DAQ6510* test script is used with the DAQ6510 and F4T temperature controller configured as detailed in the previous sections.

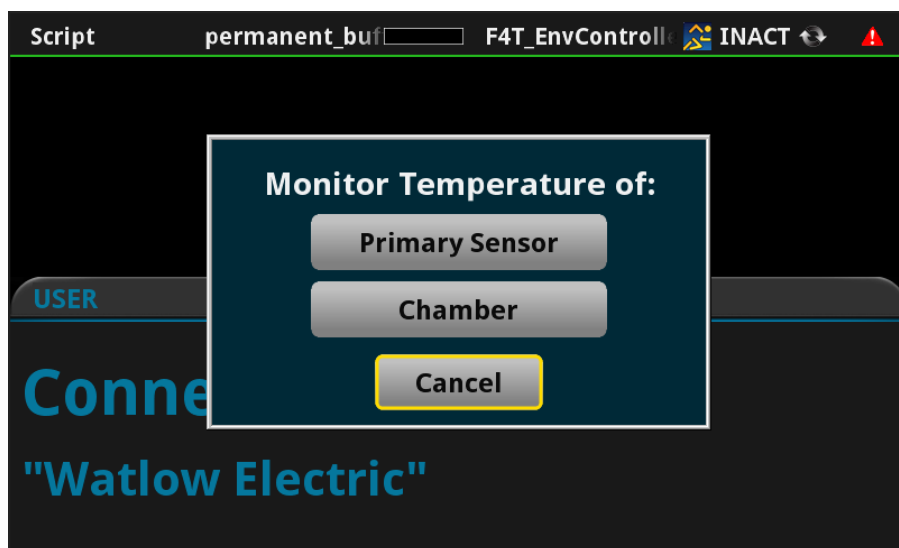
1. Load the *F4T\_EnvController\_DAQ6510* test script on to a USB flash drive.
2. Insert the USB flash drive into the front panel of the DAQ6510. Towards the top of the HOME screen, touch the “No Script” annunciator and select the script *F4T\_EnvController\_DAQ6510* in the resulting menu.



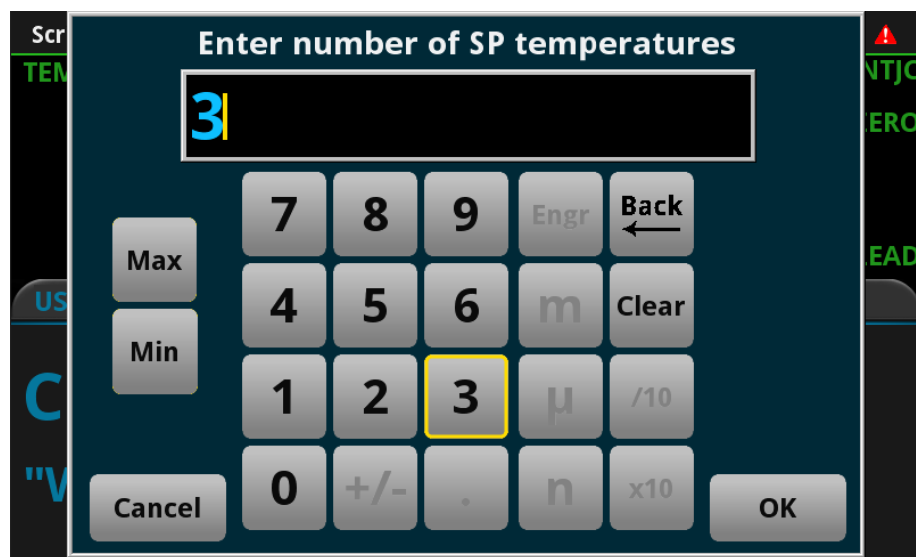
3. The DAQ6510 will open a socket connection to the F4T controller in one of two ways:
  - a. If this is the *first time* the script is run from the USB drive, you will be prompted to enter the IP address of the F4T controller. Enter the address and press **OK**. Upon successful connection to the F4T controller, this IP Address is saved to a file on the USB drive for future recall.
  - b. Subsequent runs of the script using the same USB drive and the F4T controller with a matching IP address will automatically extract the IP address from the saved file and use it to make the connection.



4. The script will prompt the user to select the the temperature measurement device used for checking against the programmed set point(s) and MUX scanning.
  - a. **Primary Sensor** - This is the transducer on or near the DUT connected to Channel 101 (which is channel 1 of the card in slot 1 of the DAQ6510)
  - b. **Chamber** – This is the ambient temperature measured inside the chamber by the F4T controller and reported as the *Process Value* by the controller.



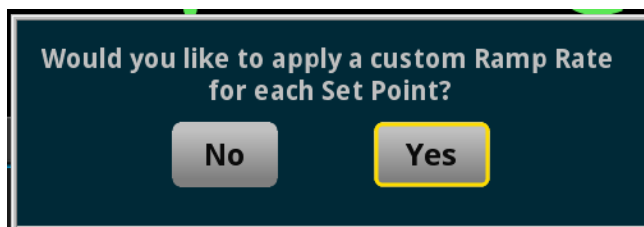
5. You will then define how many temperature set points the chamber will need to achieve over the duration of the test. The maximum is 10; minimum is 1.



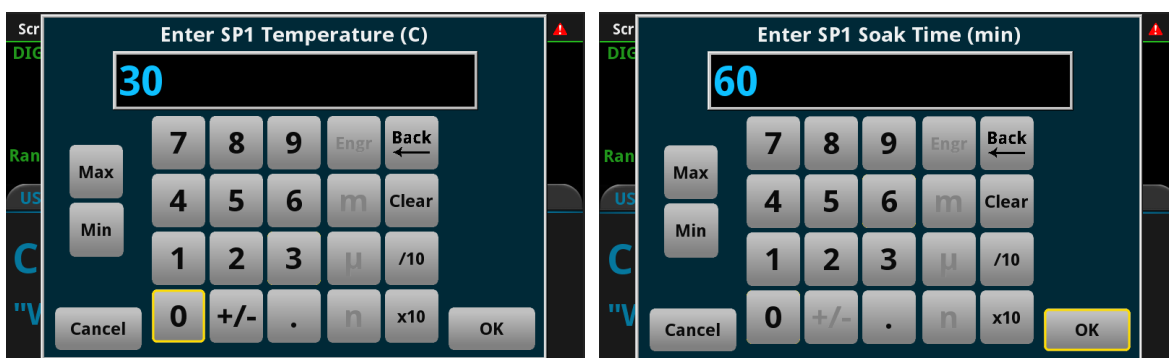
6. You are then presented with the option to apply a custom Ramp Rate to your scan.

**NOTE:** All chambers have a physical limitation to how fast they can ramp. For example, TestEquity Model 115A is capable of cooling from +85°C to -40°C in 45 minutes, or an AVERAGE of 2.8°C/minute. This is specified with an instantaneous set point change. If you program the chamber for 30°C/minute it will still cool at its maximum achievable rate of 2.8°C/minute. Conversely, if you enter a ramp rate of 2.8°C/minute the chamber will not likely achieve 2.8°C/minute towards the end of the ramp. The maximum published ramp rate is AVERAGE, not linear. It will cool faster in the beginning and slower towards the end. However, if you enter a ramp rate of 1°C/minute, it WILL follow that ramp because that rate is significantly slower than the "full throttle" achievable ramp rate.

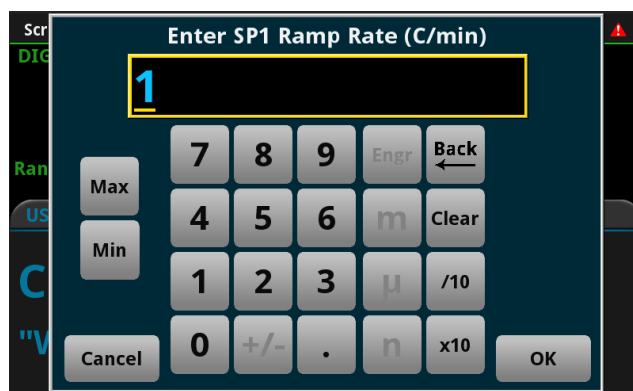
- a. Selecting **No** indicates that the chamber will go to each set point temperature immediately, as fast as it possibly can.
- b. Selecting **Yes** will enable an additional dialog for the remaining set point step attributes entry. You will be able to define the specific Ramp Rate per set point in degrees per minute ( $^{\circ}\text{C}/\text{min}$ ). The maximum is **30 $^{\circ}\text{C}/\text{min}$** ; minimum is **1 $^{\circ}\text{C}/\text{min}$** .



7. Next, you will define the **Temperature** and **Soak Time** for each Set Point.

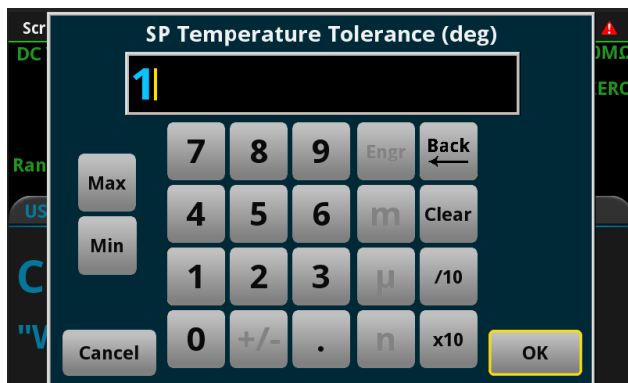


If you chose to also apply a **Ramp Rate**, a dialog will be provided for you to enter this as well.



8. You will be presented with the option to apply a tolerance around your target set points. This helps to account for temperatures which may near a particular set point but not be an exact match. Example: Attempting to go to 30 $^{\circ}\text{C}$  and the temperature reads 29.8 $^{\circ}\text{C}$ . This may be okay for the chamber, but the test program may continue indefinitely because it is looking for a precise level.

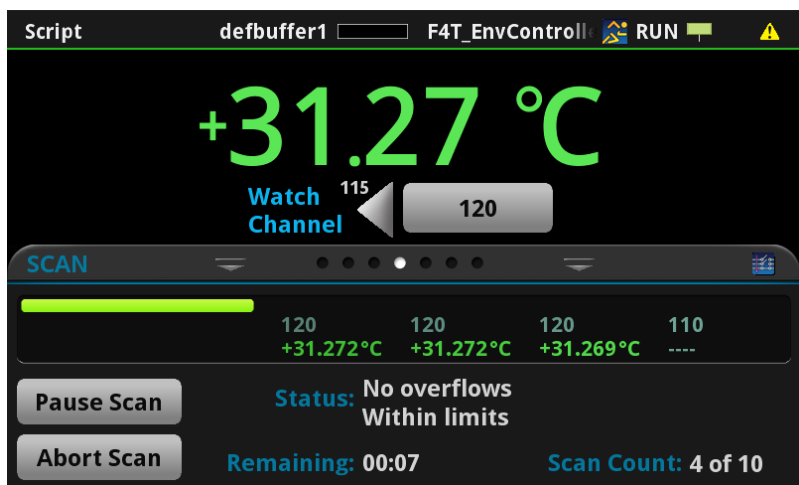
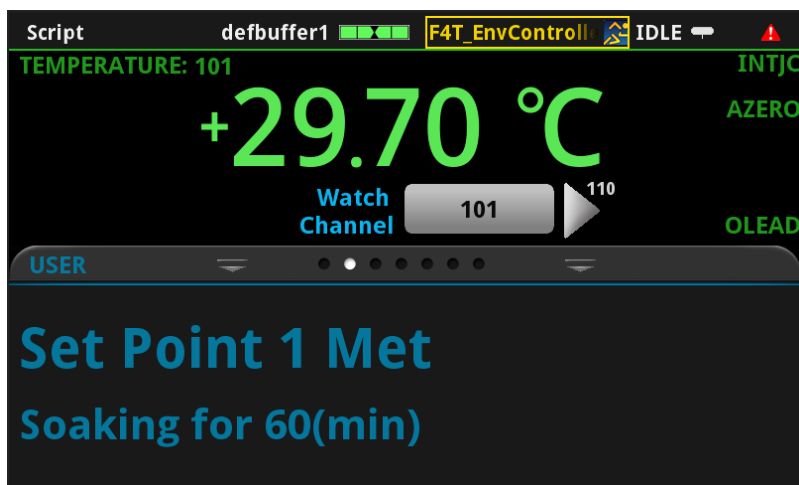
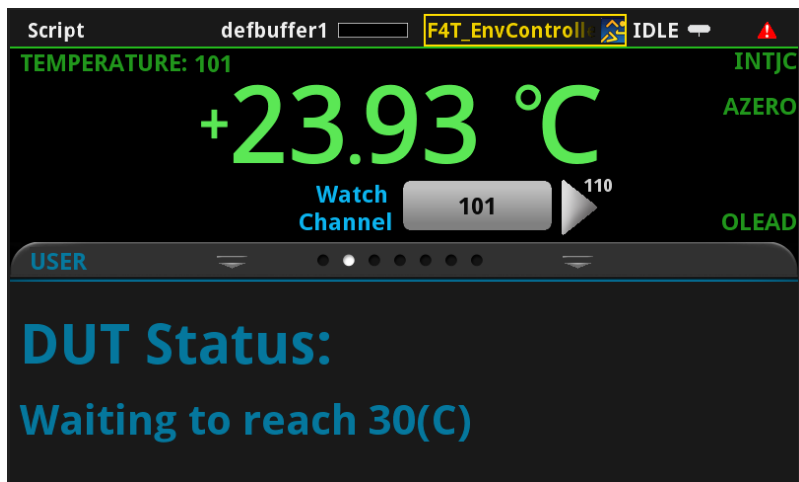
Adding the tolerance provides the extra leeway needed and helps progress the testing. The maximum is **5°C**; the minimum is **0°C**.



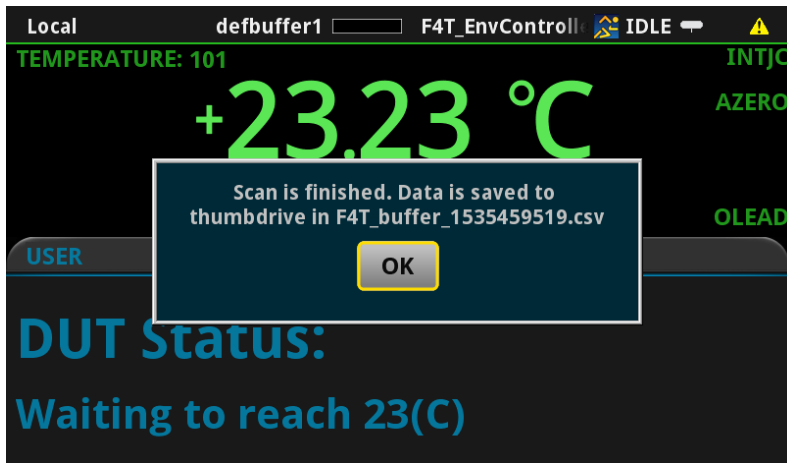
- You will then be provided the option of applying a final settling temperature. This is especially important for scenarios when the last temperature of your test is at an extreme level (for example, 100°C), and you want to ensure that the operator does not interact with either the DUT or the internals of the environmental chamber.



- The testing will start and provide notifications to the user with respect to test status. You will be provided indications of the temperature change process; the soak time in process; and the scanning process as each becomes active for each of the defined Set Points. Finally, you will receive notice of the test chamber changing to the final settling temperature (if one was applied). A dialog will be presented to you indicating the end of the test and the name of the \*.csv file holding the test data saved to the USB thumb drive.







## FAQs

***Q: Is there a way to save my scan measurement configuration? I do not like to perform the same scan measurement setup every time I need to use the F4T\_EnvController\_DAQ6510 test script program. Many of my tests are the same and do not require much modification.***

A: Yes. After you have saved your scan configuration...

- a) On the DAQ6410 front panel, navigate to **MENU->Scripts->Save Setup**.
- b) Touch the **Create** button.
- c) Enter a name for the setup using the on-screen keypad then touch **OK**.


To recall the setup, you can access it (by the name you entered) in the same manner as you would launch the *F4T\_EnvController\_DAQ6510* test script, or....

- d) Navigate to **MENU->Scripts->Run**.
- e) Locate and select the name of your scan configuration setup then touch **Run Selected**.

Running the *F4T\_EnvController\_DAQ6510* test script immediately after applying your setup will not affect the setup.

***Q: Is there a way to copy the F4T\_EnvController\_DAQ6510 test script program to the DAQ6510 instead of keeping it on the USB flash drive?***

A: Yes, the controller test script program can be loaded local to the instrument.

- a) Insert the USB flash drive which holds the test script program into the port on the front panel of the DAQ6510.
- b) On the instrument front panel, navigate to **MENU->Scripts->Manage**.
- c) Locate and select the *F4T\_EnvController\_DAQ6510* option in the USB Scripts list box on the right side of the screen.
- d) Touch the  icon to move the script file to the Internal Scripts.

You can now remove the script from the USB flash drive and run directly from the internal memory of the DAQ6510. Keep in mind however that...

- e) The USB flash drive will still be needed to save the test data after the scans.
- f) There may be a \*.ini file on the USB flash drive which hold the IP address of your environmental chamber. If there is a mismatch, you will be prompted to enter the IP address of the connected F4T controller.

***Q: I would like to review and possibly modify the F4T\_EnvController\_DAQ6510 test script program. What tools do I need to accomplish this?***

A: The DAQ6510 has a Lua language interpreting engine, and the \*.tsp files that it reads can be viewed/modified with any text editor. However, Keithley recommends using the Test Script Builder

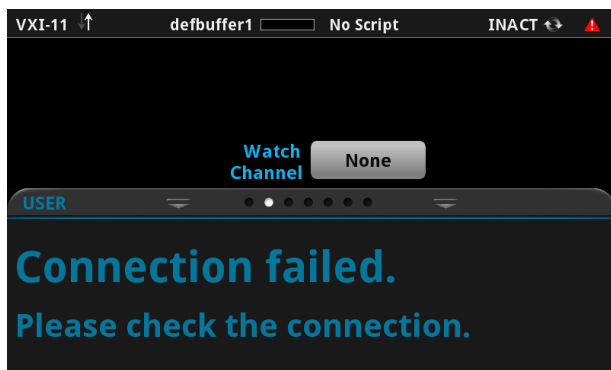
software (freely available at [tek.com](http://tek.com)) so that you can benefit from features of a rich programming IDE (similar to Eclipse or Visual Studio) and take advantage of the debugging tools it includes.

***Q: Is there a way to change the units reported over Ethernet manually? I want to bypass the programming option found in the section entitled “Configure the F4T Units Reported Over Ethernet”.***

A: Yes. While the test script program for this application ensures °C is utilized in the instrument communications, we can appreciate that the user may want to set or verify this on their own. To do so, from the **Main Menu** of the F4T Controller, navigate to **Settings->Network->Ethernet**. Locate the row reading Modbus Display Units and set for your desired units.

## Troubleshooting Information

In the event of errors in the setup, the *F4T\_EnvController\_DAQ6510* test script program contains some diagnostic provisions, which presents messages to the operator on the front panel of the DAQ6510. The messages are listed as follows with short descriptions of meanings and corrective measures.

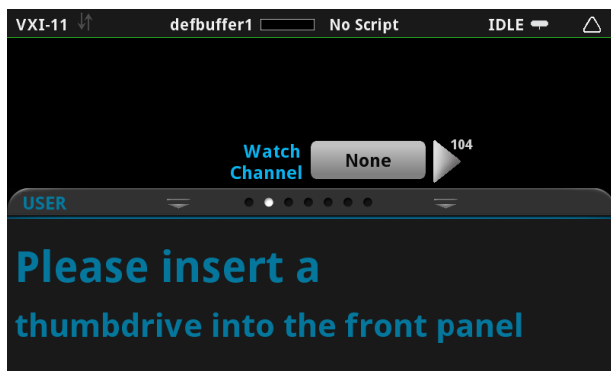


*This message indicates a failure of the DAQ6510 to make a LAN connection to the F4T controller. Check the following:*

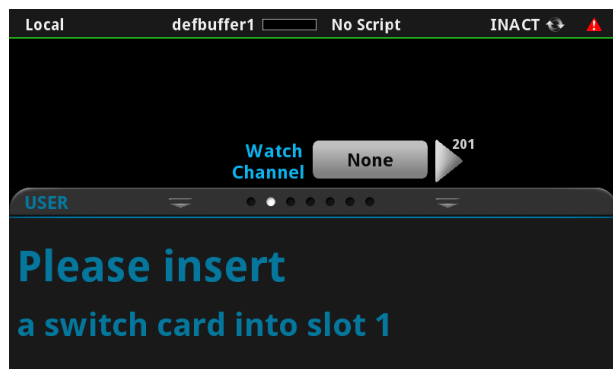
- Ethernet cable connections at the DAQ6510, F4T, or the Ethernet switch (if one is used).
- The IP address entered by the operator or saved on the USB flash drive does not match the controller.



*This message indicates that no measurement scan has been configured or established. Refer to the section above – Measurement Scan Setup – to correct.*



*This message indicates that no USB flash drive has been inserted into the front port on the DAQ6510.*



*This message indicates that there is a significant hardware setup issue. A multiplexing scan card (such as the Model 7700) is either missing or not properly seated in Slot 1 of the DAQ6510.*

*The measurement scan card must be properly configured – see Measurement Scan Setup – and be installed in the DAQ6510. Refer to the scan card operator's guide for a more detailed information on proper installation and removal procedure.*

## Conclusion

The Keithley DAQ6510 Data Acquisition and Multimeter System can monitor the environment within a test chamber (such as the TestEquity 115A), take readings, and with TSP scripting and instrument communication via TSP-Net, control the test chamber. This functionality applies the ease and intuitiveness of the DAQ6510 touch interface to a F4T thermal chamber controller, including the ability to control the chamber through easy-to-navigate GUIs. The method detailed in this document for thermal chamber control and data acquisition allows for simple and straightforward operation. Because the same unit is being used for both chamber control and data acquisition, those unfamiliar with these devices only need to learn how to operate a single instrument as opposed to an entire environmental testing setup.

## APPENDIX A: Model 7700 Connection Log Example

You can use the next table to record your connection information.

Channel		Color	Description
AMPS COM	H		
	L		
INPUT	H		
	L		
SENSE	H		
	L		
CH1	H		
	L		
CH2	H		
	L		
CH3	H		
	L		
CH4	H		
	L		
CH5	H		
	L		
CH6	H		
	L		
CH7	H		
	L		
CH8	H		
	L		
CH9	H		
	L		
CH10	H		
	L		
CH11	H		
	L		
CH12	H		
	L		
CH13	H		
	L		
CH14	H		
	L		
CH15	H		
	L		
CH16	H		
	L		
CH17	H		
	L		
CH18	H		
	L		

CH19	H		
	L		
CH20	H		
	L		
AMPS CH21	H		
	L		
AMPS CH22	H		
	L		

*NOTE: If using a multiplexer module other than the Model 7700, refer to that module's instruction manual for its specific connection log. Instruction manuals can be found at [tek.com](http://tek.com).*



## APPENDIX B: Automatic and Manual Networking Supplement

The Keithley DAQ6510 Data Acquisition and Multimeter System can monitor the environment within a test chamber, take readings, and, with TSP scripting and instrument communication via TSP-Net, control the test chamber. To accomplish the last of these items requires proper networking configuration, and a general understanding of the two setups available at the instrument level: automatic and manual. The automatic option typically relies on a public network where a dynamic host configuration protocol (DHCP) server is available to promote a population of the equipment IP address, gateway, and subnet mask without user intervention.

The advantage of the manual networking setup is that it provides the user more direct control of their setup. This method is typically utilized when the operator wishes to keep their test communications isolated from public/corporate networks possibly for reliability, throughput, or security reasons.

The sections below are provided as guidance for configuring the DAQ6510 for either automatic or manual network configurations. Similar functionality and/or actions are provided for the F4T controller as well but are not detailed in this work.

### Automatic Networking

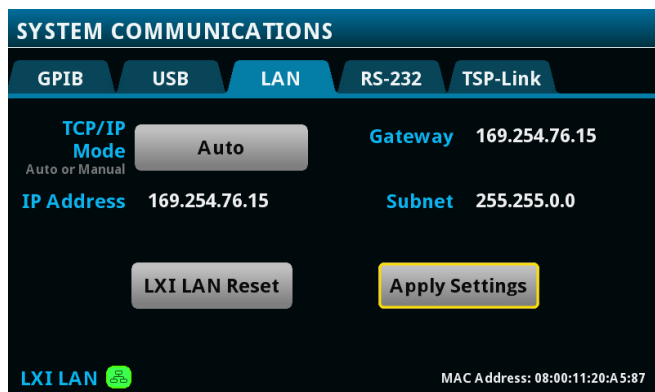
The automatic TCP/IP mode automatically acquires an IP address (along with the gateway and subnet mask) for the instrument to utilize for Ethernet/LAN communications. When set to automatic, the instrument will identify and match its Subnet and Gateway addresses to those of the connected network or adapter (per the local DHCP server) and obtain a valid IP address.

Ensure that an Ethernet cable is plugged into the LAN port on the back of the instrument, connecting it to your public network.

**NOTE:** LAN communications cannot be utilized if the DAQ6510 is currently using a USB connection. To swap communication methods from USB to LAN, simply unplug the USB cable from the port on the back of the instrument, leaving the LAN connection in place.

To set up an automatically generated IP address:

1. Press the **Menu** Key.
2. Under System, select **Communication**.
3. Go to the **LAN** tab.
4. Hit the button next to TCP/IP Mode.
5. Select **Auto**. (Note: It may take several minutes for an IP address to be generated when using **Auto** mode.)
6. Press **Apply Settings**.



## Manual Networking

The manual TCP/IP mode allows the user to specify a usable IP address, gateway, and subnet mask of their own choosing for the instrument to utilize for Ethernet/LAN communications.

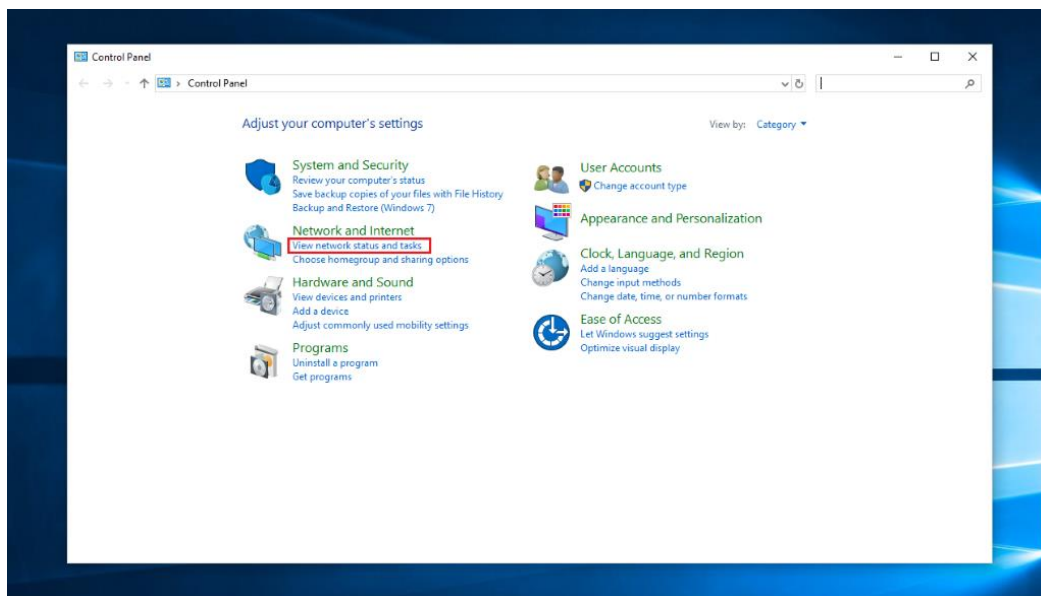
Ensure that an Ethernet cable is plugged into the LAN port on the back of the instrument, connecting it to your public network.

**NOTE:** LAN communications cannot be utilized if the DAQ6510 is currently using a USB connection. To swap communication methods from USB to LAN, simply unplug the USB cable from the port on the back of the instrument, leaving the LAN connection in place.

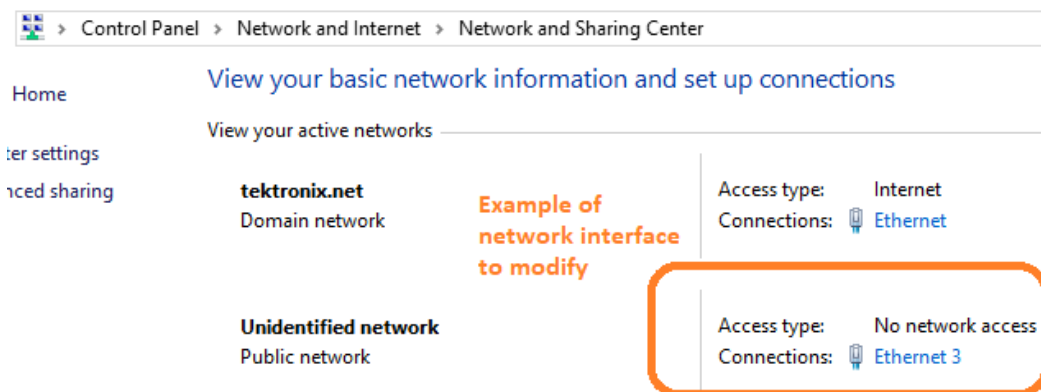
The user may configure their computer's network interface card IPV4 settings and match the DAQ6510 settings to those of the computer, though keeping the IP address unique.

To configure or determine the IP, Subnet, and Gateway addresses used by the computer or Ethernet adapter running with a Windows operating system:

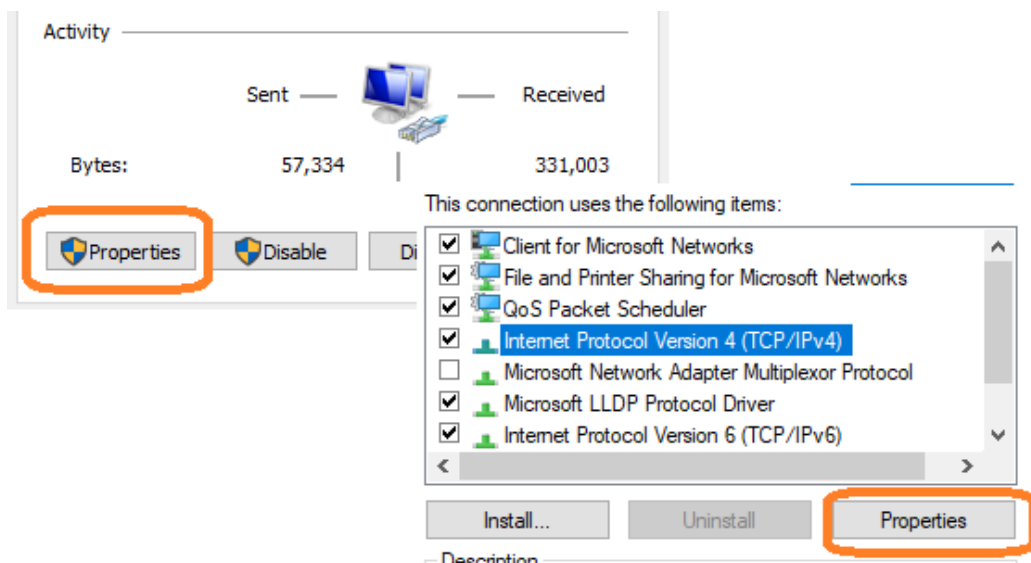
1. Open the **Control Panel**.
  - a. For Windows 7 users, the Control Panel can be found from the start menu.
  - b. For Windows 10 users, the Control Panel can be found by using the Cortana search bar next to the start menu.
2. From the Control Panel, under Network and Internet, select **View Network Status and Tasks**. This will open the **Network and Sharing Center**.



3. From the Network and Sharing Center, the user can select the network interface to be used for instrument communication by clicking on the (blue) connection of choice.



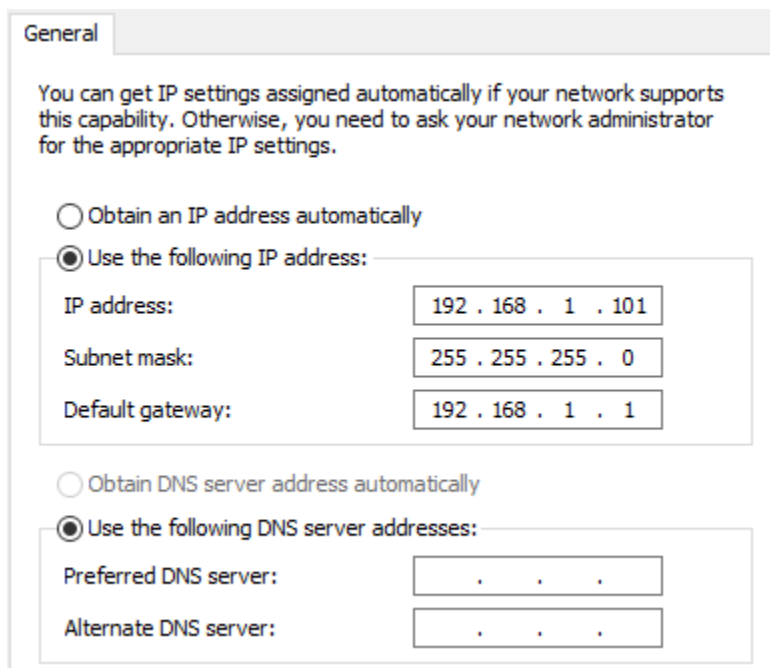
4. Click on the **Properties** button for the network interface, then locate and highlight the “Internet Protocol Version 4 (TCP/IPv4)” item. Click on the **Properties** button.



5. The interface presented allows for viewing and/or modifying the IP settings.

**NOTE:** Only modify the IP settings if you understand the overall network setup and the settings (to be) applied at the connected instruments. Improper configuration can result in loss or lack of communication between instruments or other computers connected to the same network.

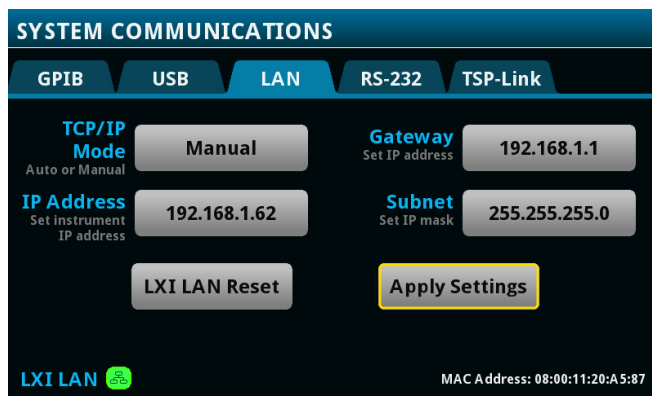
**NOTE:** Do not enter/modify the DNS server address settings if you do not have access to this information.



6. Click the **OK** button in the active and subsequent dialogs to accept and apply all modified settings

To manually set up an IP address on the DAQ6510:

1. Press the **Menu** Key.
2. Under System, select **Communication**.
3. Go to the **LAN** tab.
4. Hit the button next to TCP/IP Mode.
5. Select **Manual**.
6. Type in the preferred IP Address, Gateway Address, and Subnet Address in the appropriate fields using the displayed number pad.
  - a. Be sure to match the Subnet and Gateway addresses to those of the preferred network, but DO NOT match the IP addresses. Be sure to use a unique IP address for the instrument.
7. Press **Apply Settings**.



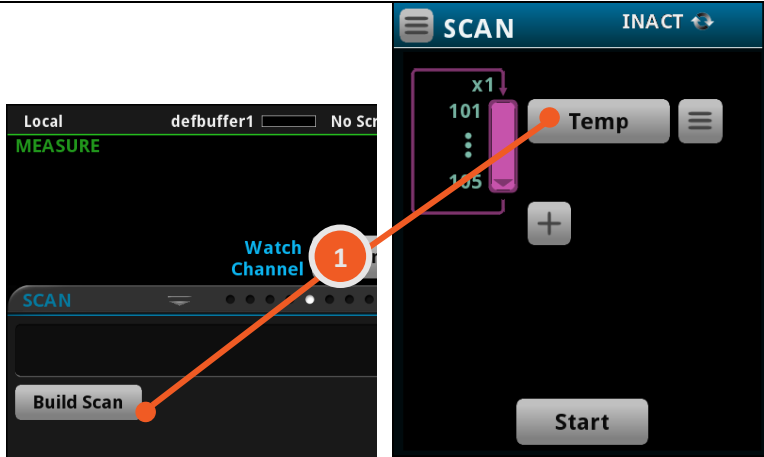
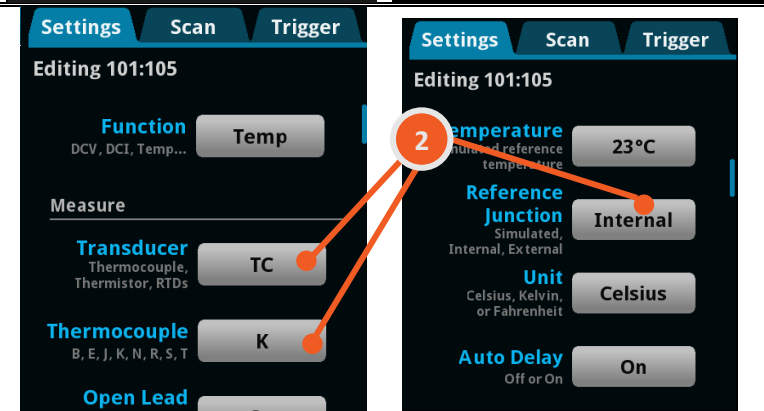
Keithley instruments has a convenient indicator that displays the LAN connection status (see the green “LXI LAN” icon in the above image).

## APPENDIX C: Example of a Specific DAQ6510 Measurement Scan Setup

To help the user gain a better understanding of how to set up a measurement scan with the Keithley DAQ6510 Data Acquisition and Multimeter System and Model 7700 Multiplexer Module, the following example will show them how to...

- Create a 5-channel temperature measurement scan that acquires thermocouple measurements once per minute over a 24-hour period.
- Configure the DAQ6510 to export (and preserve) data to a USB flash drive for each scan that occurs per minute.

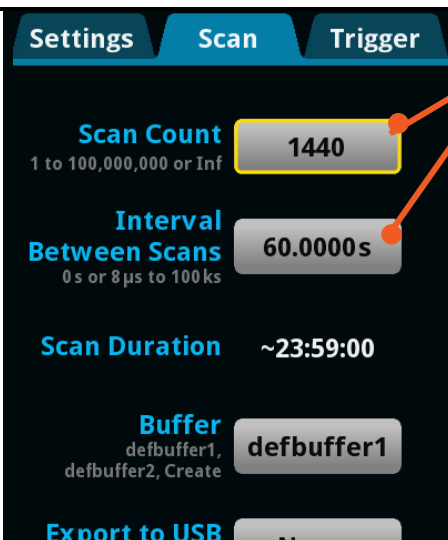
### Build a Simple 24-hour Temperature Scan

<p><b>1.</b> Power cycle the instrument and ensure the <b>TERMINAL</b> switch is set to <b>REAR</b>.</p> <p>Build a scan and <b>Add Groups of Channels</b>, inclusive of 101 to 105 for <b>Temperature</b>.</p>	
<p><b>2.</b> Scroll down in the <b>Settings</b> tab and ensure that the <b>Transducer</b> is set to <b>Thermocouple</b> and the <b>Type</b> is set to <b>K</b>.</p> <p>Also ensure that the <b>Reference Junction</b> is set to <b>Internal</b>.</p>	

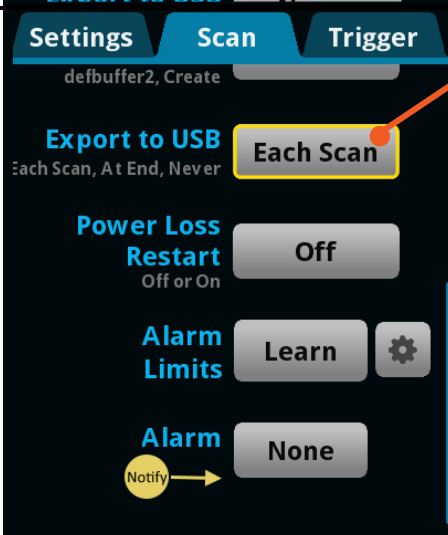
3. Touch the '**Scan**' tab and set the **Scan Count** to **1440**, and set the **Interval Between Scans** to **60 s**.

*NOTE: Why a count of 1440?*

$$24 \text{ hrs} * 60 \text{ sec} = 1440$$



4. Scroll down in the '**Scan**' tab to locate the **Export to USB** option. Touch the adjacent button, set to **After Each Scan**, and accept all the default settings presented in the resulting dialog by touching **OK**.

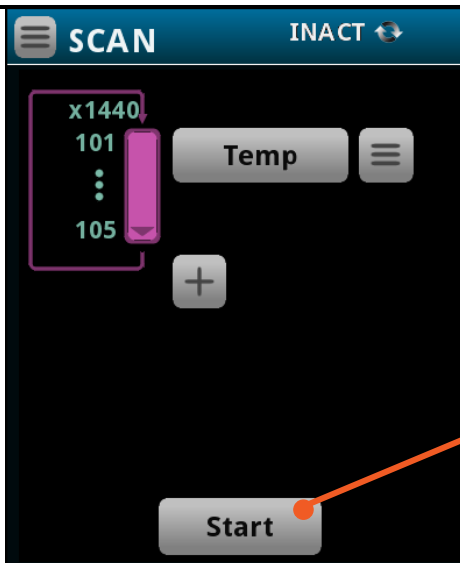


5. Insert a USB flash drive into the port on the front of the instrument.





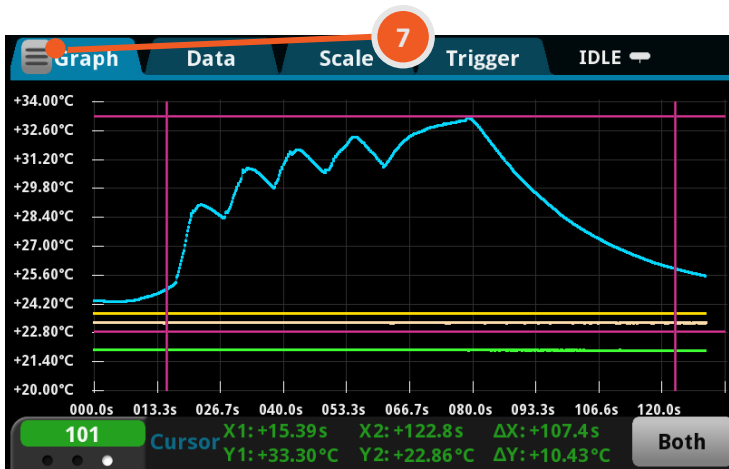
6. Touch the **Start** button to begin the scanning process.



7. Either during or upon completion of the scan, the operator may desire to view the acquired data graphically. To do so, navigate to

**MENU->Views->Graph**

Use the menu control to change the channels being viewed.



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