CAPITOL
ENERGY SYSTEMS

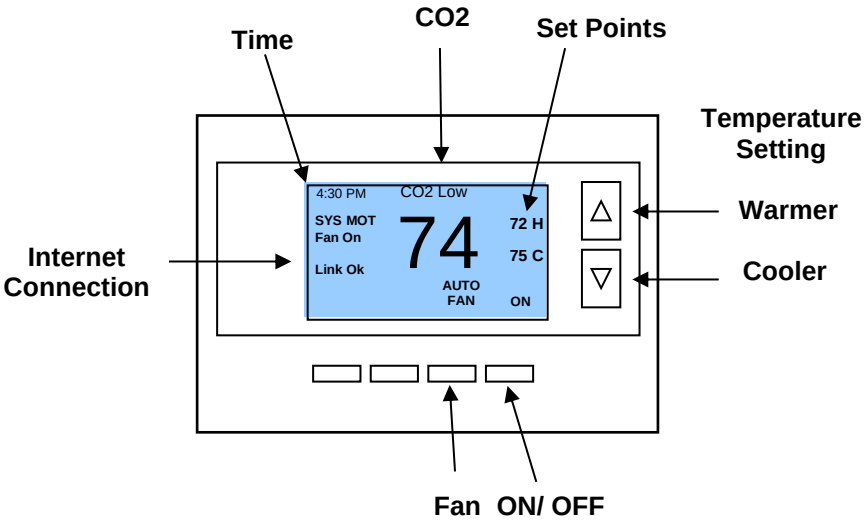
TWC-48 Wi-Fi Thermostat

USER'S MANUAL

CAPITOL ENERGY SYSTEMS
(916) 414-8747 • www.capitoltenergysystems.com • 2831 G Street #130 Sacramento, CA 95816

Operation Guide
Model TWC48 Wi-Fi Thermostat

In Session Display



Out of Session Display

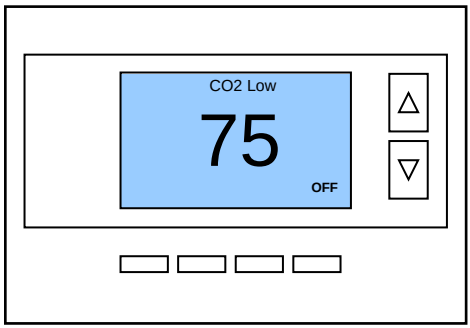


TABLE OF CONTENTS

Wiring 4
- Gas/ Electric 4
- Heatpump 5

TECS Overview 6

Accessing the Thermostat Menu 6

Initial Set-Up 7

Thermostat Operation 9
- Minimum Run Time 9
- Minimum Off Time 10
- Auto Mode 10
- 2nd Stage 10
- CO2 Sensor 10
- Economizer Fault Detection 11
- Loss of WiFi connection 11

End User Functionality 11

User Settings Menu 11

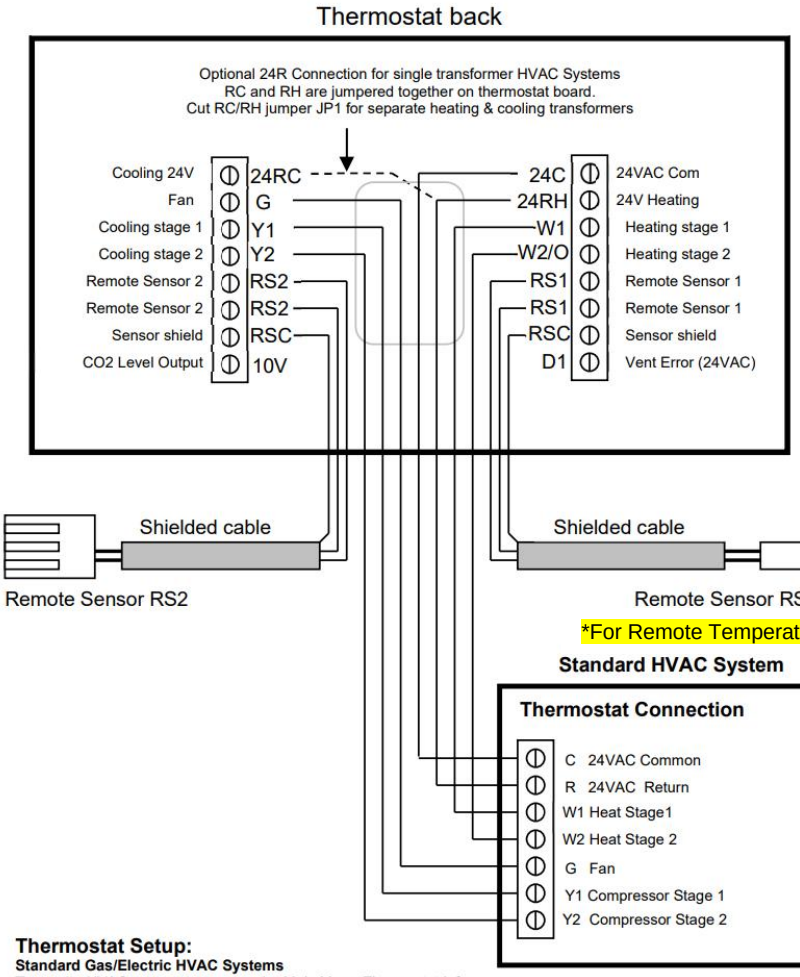
Menu Selection 14
- Thermostat Info 15
- Relay Status 16
- WiFi Network Status 16

Installer Settings 16
- Display Lock 16
- Maintenance Mode 17
- Remote Sensors 17
- Restore Defaults 17

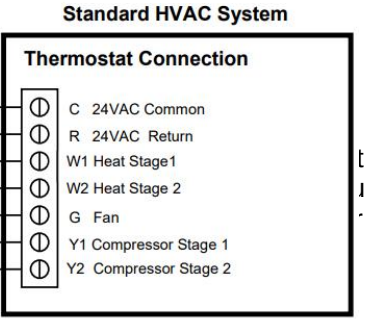
System Status Indicators 18

Troubleshooting 19

Capitol Energy Systems TWC48
Standard Gas/Electric HVAC System Wiring



*For Remote Temperature Sensor Only



Thermostat Setup:
Standard Gas/Electric HVAC Systems

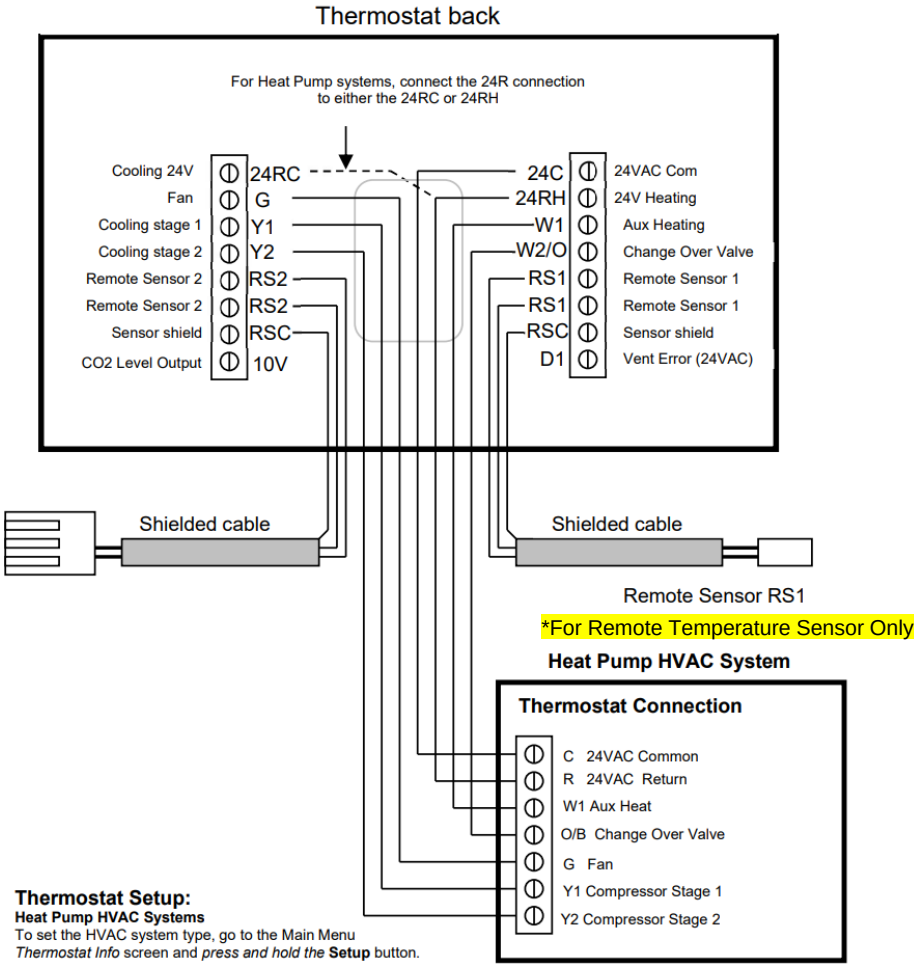
To set the HVAC system type, go to the Main Menu *Thermostat Info* screen and *press and hold* the **Setup** button.

1. **Type.** Set the HVAC System Type: set to **Gas/Elec**
2. **Fan Type**. Set the HVAC Fan Type:
   Set to **Gas** for typical gas furnace (fan is controlled by the furnace)
   Set to **Elec** for electric heat (fan call with heat call)
3. **2nd Stage Heat**. Enable second stage heating outputs
   If you have a single stage heating system, leave this set to **N**
   If you have a 2 stage heating system, set to **Y** to enable.
4. **2nd Stage Cool**. Enable second stage cooling outputs
   If you have a single stage cooling system, leave this set to **N**.
   If you have a two stage cooling system, set to **Y** to enable.

Default Setup:
- HVAC Type: Gas/Elec
- Fan Type: Gas
- 2nd Stage Heat: No
- 2nd Stage Cool: No

No setup required for this configuration

Capitol Energy Systems TWC48
Heat Pump HVAC System Wiring



Thermostat Setup:
Heat Pump HVAC Systems
To set the HVAC system type, go to the Main Menu
Thermostat Info screen and *press and hold the* **Setup** button.

1. **Type.** Set the HVAC System Type: set to **Heat Pump**
2. **C/O type**. Change Over (reversing) Valve Type. Heat pumps change from heating to cooling by reversing operation.
You must configure the thermostat's changeover valve setting to work correctly with your HVAC system.
Check your system information to be sure and note the color of original thermostat wire and the terminal it was connected to.
No matter what the old stat connection was (O or B), connect the wire to the thermostats W2/O terminal.
The setting of the C/O Type will set the correct system operation.
For change over with cool systems (Orange wire, O terminal): set **C/O type** to w/cool (most common and default setting)
For change over with heat systems (Brown wire, B terminal): set **C/O type** to w/heat
3. **2nd Stage Heat**. Enable second stage heating outputs
If you have a single stage heating system, leave this set to **N**
If you have a 2 stage heating system, set to **Y** to enable.
4. **Aux Heat (HP).** If you have auxiliary heat strips, set this to **Y** to enable.
5. **2nd Stage Cool**. Enable second stage cooling outputs
If you have a single stage cooling system, leave this set to **N**.
If you have a two stage cooling system, set to **Y** to enable.

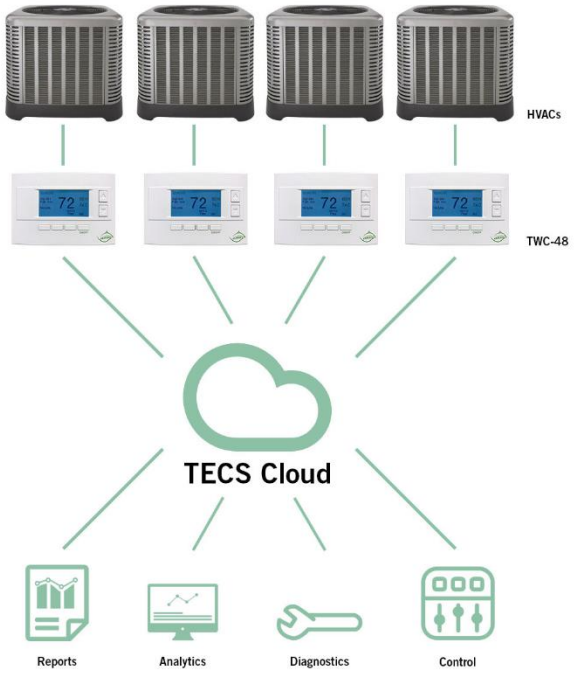
Note! If you get heating when you expected cooling, change the C/O type to the opposite setting.

TECS OVERVIEW

TECS is a cloud-based EMS with WIFI thermostat. Each HVAC unit or zone will need one TWC-48 thermostat installed. Before thermostats are shipped, all initial programming of TECS has been completed. This includes mapping all room locations, 7-day program, fan program, set-points, degrees of freedom, override time, and 365 day holiday calendar.

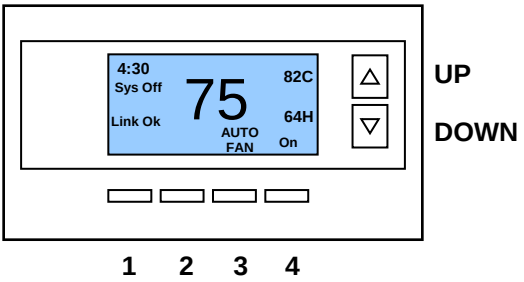
Your thermostats will arrive preprogrammed with your WIFI credentials, and the box will be labeled with the room location where it should be installed. It is necessary that each thermostat is installed in the marked room since each thermostat has a unique MAC address. This MAC address is used to label each room within TECS. Once thermostats are wired and connect to the WIFI network, they will receive their programing from TECS.

Thermostats will communicate with TECS every 5 minutes to report their operation and receive any programming changes made in TECS.



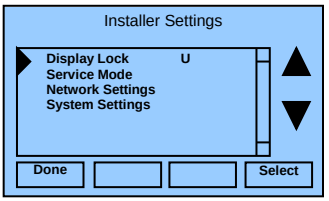
ACCESSING THE THERMOSTAT MENU

The programming menu's on the thermostat will normally be locked to prevent tampering since all of the programming should be done online through TECS. To access the thermostats programming menu you need to enter a code.



Hold down the number one button then enter the following sequence:
UP – UP – Down - Down – 2 - 4 – 2 - 4
Then release the number 1 button.

TECS sends a command to lock the programming screens to prevent tampering. If you are unable to use the up and down arrows in the Menu Selection Screen hold down the #2 and #3 buttons to launch the Installer Settings Menu



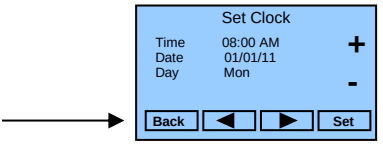
Display Lock: Use the + and – button until you display the U (Unlock) button to unlock the programming screens.

INITIAL SET-UP

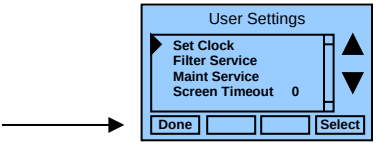
Each TWC-48 thermostat will need to be programmed with the correct mechanical settings. If remote sensors are being installed, those will also need to be set up. Below are the step-by-step instructions to program each thermostat.

Set Clock: The first screen you will see is to set the clock. You do not need to set the time since the time will automatically be set once the thermostat connects to TECS. Press the #1 back button to access the next menu.

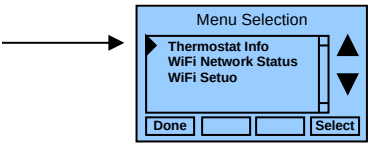
.



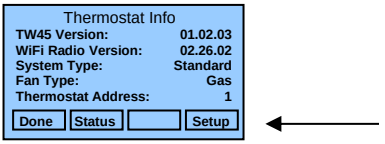
User Settings: The next menu which appears is the User Settings. Press the #1 Done button



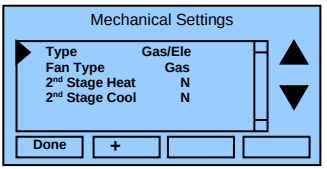
Menu Selection: The next menu which appears is Menu Selection. Use the down arrow to scroll down to Thermostat Info.



Thermostat Info: The Thermostat Info screen displays the current configuration of the thermostat. Press the #4 Setup button to open the Mechanical Settings Menu



Mechanical Settings



- **Type** Use the + and – buttons to choose Gas/ Elec or Heatpump
- **Fan Type** if HVAC type = Standard: Use the + and – buttons to choose Gas or Elect
  OR
- **Changeover** if HVAC type = Heat Pump: Use the + and – buttons to choose changeover with cool or changeover with heat
- **2nd Stage Heat** Use the + and – button for Y (yes) or N (no)
- **2nd Stage Cool** Use the + and – button for Y (yes) or N (no)

Press the #1 Done button once the mechanical settings are properly entered.

Remote Sensors

If you are installing a sensor (such as a LAT) with your TWC-48 please follow the below instructions. A shielded wire is required for all sensors to avoid interference. Sensors can be Type 2, Type 3, or A curve.

RS1 Enabled (Y/N)- This terminal is for a remote temperature sensor only and can override or average with the internal thermostat temperature sensor. Use the +/- keys to select Y if a sensor is installed in RS1

RS2 Enabled (Y/N)- This terminal is for any type of sensor, including LAT

Use the +/- keys to select Y if a sensor is installed in RS1

RS1 Type- Use the +/- keys to select A Curve, Type 2, or Type 3

RS2 Type- Use the +/- keys to select A Curve, Type 2, or Type 3

RS2 Location- Use the +/- keys to select IN, OUT or LAT

CO2 Sensor

CO2 Level Output

The thermostat is equipped with a Title 24 compliant CO2 sensor. Display will show CO2 Low if CO2 level is below 1100 PPM threshold and CO2 High if the PPM is above 1100. When CO2 level is high the backlight will flash continuously. No thermostat configuration required.

Economizer Fault Detection

Error Signal Monitor must be wired to the D1 Vent Error to be operational. 24V input that reads an error signal from the Jade economizer and reports the status to TECS. No thermostat configuration required.

THERMOSTAT OPERATION

Minimum Run Time (MRT)

The thermostat has a Minimum Run Time after the start of any heating or cooling call. This minimum run time assures even heating and cooling cycles. The MRT delay will keep the system on even if reaches setpoint or you change the setpoint to a temperature that would satisfy the call, until the MRT expires. Changing the Mode to OFF will cancel the MRT and the system will turn off immediately. The MRT can be adjusted in the Installer Settings menu of the thermostat.

Minimum Off Time (MOT)

The thermostat has a Minimum Off Time after any heating or cooling call is finished. This delay prevents rapid heating/cooling cycles and also provides "short cycle protection" for compressor calls. This delay may be noticeable when you change a setpoint and it does not respond immediately due to another call that has recently completed and the MOT delay timer is preventing the system from restarting. The MOT delay time can be adjusted in the Installer Settings menu of the thermostat. There is a minimum of 5 minutes delay to assure compressor protection.

Auto Mode

By default, thermostats will be in auto mode. There will be a desired temperature range programmed in TECS (example 68-74). This means that the thermostat will heat if the temperature is below the low setpoint and cool if the temperature is above the high set point. The

HVAC will not run if the room temperature is within the setpoint range. The HVAC will come on if the room temperature is 1 degree above or below the set point range. For optimal operation, we recommend at least 6 degrees between the heating and cooling targets.

If you are installing on a cool only or heat only HVAC unit, this can be programed in TECS

2nd Stage

Second stage will turn on if the temperature in the room is more than 1 degree away from setpoint after the minimum run time (MRT) of 3 minutes for 1st stage. The HVAC unit will stay in 2nd stage until set point is reached.

CO2 Sensor

CO2 Level Output

The thermostat is equipped with a Title 24 compliant CO2 sensor. The analogue output translates the CO2 level to a 2-10V output signal. Analog output is a proportional linear signal though the range 0 - 2000 ppm. Display will show CO2 Low if CO2 level is below 1100 PPM threshold and CO2 High if the PPM is above 1100. When CO2 level is high the backlight will flash continuously. No thermostat configuration required.

Economizer Fault Detection

Error Signal Monitor must be wired to the D1 Vent Error to be operational. 24V input that reads an error signal from the Jade economizer and reports the status to TECS. No thermostat configuration required.

Loss of WIFI Connectivity

In the event of a wireless network outage, thermostats will continue to operate HVAC units indefinitely with the latest programmed schedule and setpoints. The thermostat will display "No Link" on the display screen until WIFI connectivity is reestablished. While a thermostat is offline it will not receive any programing changes from TECS or report runtime minutes. When WIFI connectivity is reestablished, all data will be passed to TECS.

Loss of Power

Thermostats will not operate the HVAC unit if there is a loss of power. Thermostats that do not have power will show at "offline" in TECS. When power is restored, the thermostat will begin operating with the latest programmed schedule and setpoints.

END USER THERMOSTAT FUNCTIONALITY

All end user thermostat functionality is programmed within TECS. The end user will not be able to adjust the temperature setpoints outside of the programed max and min values.

- The thermostat temperature setpoints and degrees of freedom are programmed in TECS. The end user will be able to adjust the temperature within the temperature ranges allowed.

- To adjust the temperature set point click an arrow key. The top of the screen will display COOLING SETPOINT or HEATING SETPOINT. To select a different mode than displayed click the bottom right button. Use the arrow keys on the right to increase the heat set point or decrease the cool setpoint for the day.

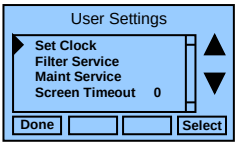
- The thermostat is programed to be in either occupied mode or unoccupied mode. The thermostat is never in off mode. If you are in a room outside of the programed occupied hours, press the bottom right button to turn the thermostat from OFF to ON. The heater/ac will come on for the programed override time.

- The fan is programmed in TECS to either be in ON mode or AUTO mode. If your fan is in AUTO mode and you would like to turn it on, press the third button on the bottom and use the arrows to select ON. If the fan is programed to be ON the end user will not be able to turn the fan to AUTO mode.

- This thermostat monitors CO2 levels in the room. If the CO2 level in the room exceeds the threshold, the backlight will flash. Please open doors/windows to bring fresh air into the room.

USER SETTINGS MENU

Menu Items:



- Set Clock > go to the clock setting screen
- Filter Service > go to the filter timer setup screen
- Maint Service > go to the maintenance timer setup screen
- Screen Timeout > sets the time in seconds to switch to the minimized screen
- F/C Settings > go to the F/C mode selection screen
- Sensor Calibration > go to the sensor calibration screen
- Backlight/Display > go to the backlight and display setup screen

Filter Service: Go to the Filter Service Screen to set/reset the filter timer/alert. This screen shows the filter runtime in hours and the service interval alert in hours (typically 300 hrs). You can change the service interval with the +/- buttons. You should reset the service alert after you have changed the filter.

Maintenance Service: Go to the Maintenance Service Screen. On this screen you can sets/reset the maintenance timer/alert.

The Maintenance Service screen will show the accumulated Heat and Cool runtime hours as well as the Service Interval that will be used to trigger a Maintenance alert.

Service interval is 3000 hours. Use the +/- buttons to adjust service interval.
Press reset to clear the service alert and reset the runtimes to zero.

When the combined HEAT and COOL Runtime hours equals the Service Interval hours, a "Maint" message will be displayed as a reminder that the HVAC system may require periodic maintenance. Pressing the Menu button will take you to the Filter Service screen. The Reset button can be pressed and the HEAT and COOL Runtime values will be reset to zero.

Screen Timeout: Minimized Screen. Set the display timeout time in seconds. Options are 0 or 15 to 120 (default set to 0 seconds). This is the

time before the main thermostat screen reverts to the minimized temperature only display screen, after the last button press. The Minimized Screen feature is disabled by setting this time to "0".
Any button press will restore the main thermostat screen display.

F/C Settings: Go to the F/C Settings Screen. Select which temperature display mode you desire, Fahrenheit (F) or Celsius (C).

Sensor Calibration: Go to the Sensor Calibration Screen. This screen allows you to adjust the calibration of the internal sensor. You can change the temperature calibration by +/- 7 degrees using the + and – buttons

When the Sensor Calibration screen is selected it will show the current temperature calibration and the current number of degrees of offset being applied (typically 0). If the sensor's actual temp is (74) with 0 degrees of offset and you want it to show 75, then press "+" to add 1 degree and it will show (75).
You can refresh the info on this screen by pressing the right hand (blank) button.

When you close this screen, it may take a few seconds for the temperature displayed on the main thermostat screen to update to the new temperature selected.

Backlite/Display: Go to the Backlite/Display settings screen. This menu allows you to set the backlight timeout period and adjust the display contrast.

Backlite Timeout: Sets the time from last button press that the backlite will timeout and turn off. The timeout value is adjustable from 0 or 20 to 120 seconds. If set to "0", the Backlite will always be ON. If set in the range of 20 to 120 seconds, the Backlite will turn OFF after the selected time expires.

ON Level: Sets the backlight brightness when it is on. Adjustable from 0 to 100% in 5% steps. Screen will change brightness as you adjust setting.

OFF Level: Sets the backlight brightness when it is off. Adjustable from 0 to 100% in 5% steps. Can be 0% = off or a low level for night viewing.

Contrast: Sets the contrast level of the LCD display, adjustable from 0 to 20. Use this control to adjust the sharpness of the display. To light and the display looks faded, too dark and dark lines will appear in the display. Typically, 10-15 is a good setting. Adjust as needed.

MENU SELECTION

Schedules and set points are configured in TECS. Anything programmed at the thermostat level will be overridden from TECS

- Schedules > Schedules should be setup in TECS
- Occupied Settings > setpoints are configured in TECS
- User Settings > set various user preferences
- Usage Graph > show heating and cooling run times
- Away Setpoints > setpoints are configured in TECS
- Thermostat Info > displays thermostat setup info
- WiFi Network Status > displays IP Network Info
- WiFi Setup > Set IP Network parameters

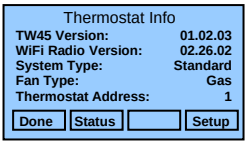
Thermostat Info

The Thermostat Info screen displays the current configuration of the thermostat. This information is useful for quick check of firmware versions and HVAC system setup.

Thermostat information displayed is:

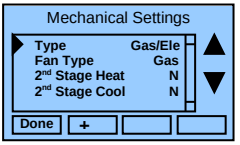
- **Thermostat Version -** Model and firmware version number
- **WiFi Radio Version –** Firmware version of the WiFi radio
- **System Type -** Standard or Heat Pump HVAC system
- **Fan Type –** if HVAC type = Standard: Gas or Elect
  OR
- **Changeover –** if HVAC type = Heat Pump: Changeover with cool or changeover with heat
- **Network Address –** This is an internal address, not the IP address

Thermostat Info Screen



Mechanical Settings

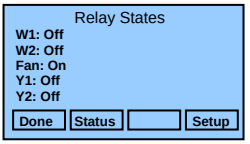
Press the #4 Setup button to open the Mechanical Settings Menu



- **Type** Use the + and – buttons to choose Gas/ Elec or Heatpump
- **Fan Type** if HVAC type = Standard: Use the + and – buttons to choose Gas or Elect
  OR
- **Changeover** if HVAC type = Heat Pump: Use the + and – buttons to choose changeover with cool or changeover with heat
- **2nd Stage Heat** Use the + and – button for Y (yes) or N (no)
- **2nd Stage Cool** Use the + and – button for Y (yes) or N (no)

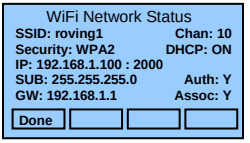
Relay Info

Pres the #2 Status button on the Thermostat info screen to assess the Relay States Screen. Here you will find the commands that the thermostat is passing to the HVAC Unit.



WiFi Network Status

This screen displays all known network status parameters as shown below:



Ad Hoc Mode

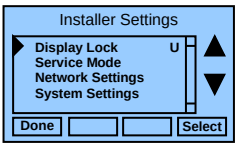
The Wi-Fi radio can also be placed into Ad Hoc mode which enables Peer-to-Peer communication without a network router. This is the only way to program the WIFI credentials for the TW48 thermostat.

- Enable Ad Hoc mode by pressing the "+" key at the appropriate screen
- This sets the Thermostat IP Address to: 192.168.0.1 and the Subnet to: 255.255.255.0
- Use your PC to connect to the thermostat and set the wifi settings.
- Contact technical support to be sent the WIFI provisioning tool and instruction.

Capitol Energy Solutions Technical Support can be reached at 916-414-8747 or by e-mail at support@capitolenergysystems.com

INSTALLER SETTINGS

When you are in the Menu Selection Screen hold down the #2 and #3 buttons to launch the Installer Settings Menu



Display Lock: Use the + and – button until you display the U button to unlock the programming screens. The EMS sends commands to lock these menu's when not in use to prevent changing thermostat settings.

Maintenance Mode: When doing repair work on the HVAC unit, you can set the thermostat into maintenance mode through TECS. This will override the temperature settings for 2 hours so you can test the unit as needed.

System Settings: All system setting will be programmed in TECS and will override the temperatures set at the thermostat if the thermostat is online

Max Heat SP: Use the + and – buttons to adjust the maximum heat set point. This will be set and overridden by TECS.

Min Cool SP: Use the + and – buttons to adjust the minimum cool set point. This will be set and overridden by TECS.

Min Run Time: Use the + and – buttons to adjust the minimum run time. The default is 3 minutes.

Min Off Time: Use the + and – buttons to adjust the minimum off time. The default is 5 minutes.

Fan Cycler: Use the + and – buttons to adjust the minimum run time. The default is 0 minutes for the fan ON time and 10 minutes for the fan OFF time.

Remote Sensors A shielded wire is required for all sensors to avoid interference. Sensors can be Type 2, Type 3, or A curve.

RS1 Enabled (Y/N)- This terminal is for a remote temperature sensor only and can override or average with the internal thermostat temperature sensor. Use the +/- keys to select Y if a sensor is installed in RS1
RS2 Enabled (Y/N)- This terminal is for any type of sensor, including LAT
Use the +/- keys to select Y if a sensor is installed in RS1
RS1 Type- Use the +/- keys to select A Curve, Type 2, or Type 3
RS2 Type- Use the +/- keys to select A Curve, Type 2, or Type 3
RS2 Location- Use the +/- keys to select IN, OUT or LAT
R1 Node ID-
R2 Node ID-

Restore Defaults: Use the arrows to select the Yes option to restore all default settings

Factory Defaults: Use the arrows to select the Yes option to restore all factory defaults.

System Status Indicators

When the main thermostat screen is displayed, the on-screen labels indicate the following.

SYSTEM OPERATION MODE INDICATOR

"SYS OFF" displayed > System is OFF
"SYS MOT"[1] displayed > System is OFF and Minimum Off Time (MOT) delay On is active
"HEAT ON" displayed > System is ON and heating
"COOL ON" displayed > System is ON and cooling
"HEAT MRT"[2] displayed > System is ON and heating. Minimum Run Time (MRT) delay off is active.
"COOL MRT" displayed > System is ON and cooling. Minimum Run Time (MRT) delay off is active.

Staging display

"2nd Stg" displayed > Stage 2 heating or cooling is ON
"Aux Heat" displayed > Stage 3 heating is ON
For Heat Pump systems only: "EHEAT" > emergency heat mode active

System Alerts

Alert Text displayed > Specific alert text (Filter or Maintenance Timer)

TROUBLE SHOOTING

The thermostat LCD reads "COOL ON", but hot air is supplied

Or

The thermostat LCD reads "HEAT ON", but cool air is supplied

Go to the thermostat info menu (pg 7) and double check that the thermostat is configured correctly for the HVAC unit. Double check if it is set for Gas/ Electric or Heat pump and if the changeover is set correctly.

If changing the settings does not fix the problem double check the wiring to confirm it is wired correctly for gas/ electric or heat pump. Refer to the wiring diagrams on pages 3 & 4.

The thermostat is displaying "No Link"

Here are a few steps to walk through to reestablish connectivity

1. Double check that there is a Wifi signal where the thermostat is being installed. You can do this by confirming the wifi signal is accessible from a smart phone or laptop.
2. Double check that the wifi credentials were entered correctly.
3. Press the restore default button

Working on the HVAC unit

When doing repair work on the HVAC unit, you can set the thermostat into maintenance mode through TECS. This will override the temperature settings for 2 hours so you can test the unit as needed.

Replacing a thermostat

Many customers have a few spare thermostats on hand for replacements. These spare thermostats will be preloaded with your WIFI credentials. If the backplate is not damaged, it can be reused with the new thermostat faceplate. After the replacement thermostat is installed, follow the initial set-up instructions (pg 7).

TECS will need to be updated with the MAC address for the replacement thermostat.

Capitol Energy Solutions Technical Support can be reached at 916-414-8747 or by e-mail at support@capitolenergysystems.com

INFORMATION TO USER

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for Class B Digital Device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures.

- Reorient or relocate the receiving antenna
- Increase the separation between the equipment and receiver
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected
- Consult the dealer or an experienced radio/TV technician for help

Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

CAPITOL
ENERGY SYSTEMS

(916) 414-8747 • www.capitoltenergysystems.com • 2831 G Street #130 Sacramento, CA 95816