

TEC2103-1 Networked Multi-Stage Thermostat

Application

The TEC2103-1 is an N2 networked thermostat that provides control of multi-stage Heating, Ventilating, and Air Conditioning (HVAC) equipment. The TEC2103-1 provides exceptional accuracy through the use of a unique Proportional-Integral (PI) time proportioning algorithm. The algorithm virtually eliminates temperature offset associated with traditional, differential-based on/off thermostats. The TEC2103-1 also uses an adaptive control logic algorithm to control the space temperature during recovery to minimize overshoot while providing maximum comfort.

The TEC2103-1 has Metasys® N2 communication capability. This communication allows the user to view and adjust parameters from a remote workstation. Additionally, the menu driven backlit display, plain text menus, and five keys on the TEC2103-1 make operating the thermostat easy and intuitive.

Note: In this document, Building Automation System (BAS) is a generic term that refers to the Metasys Network (Network Control Module [NCM] or N30 Series), and Companion (CPN) supervisory systems. The specific system names are used when referring to system specific applications.

Installation

Location Considerations

Locate the TEC2103-1 thermostat as follows:

- on a partitioning interior wall, and approximately 5 ft. (1.5 m) above the floor in a location of average temperature
- away from direct sunlight, radiant heat, outside walls, behind doors, air discharge grills, stairwells, or outside doors
- away from steam or water pipes, warm air stacks, unheated/uncooled areas, or sources of electrical interference

To install the thermostat:

1. Remove the security screw on the bottom of the thermostat cover using a Phillips-head screwdriver. Open the thermostat by pulling on the bottom side of the thermostat cover (see Figure 1).
2. Unlock the Printed Circuit Board (PCB) by carefully pressing the locking tabs to the right (see Figure 2). Open the thermostat's PCB to the left.
3. Pull out approximately 6 in. (152 mm) of wires from the wall and insert the cable through the hole in the base.
4. Align the base on the wall, and using the base as a template, mark the location of the two mounting holes on the wall. Confirm the thermostat base is installed with the proper side up.
5. Use the supplied anchors and screws for mounting on drywall or plaster. Drill two 3/16 in. (4.7 mm) holes at the marked locations and tap nylon anchors flush to wall surface (see Figure 3).
6. Position base on the wall, insert screws through mounting base, and fasten into wall anchors. Do not overtighten screws.
7. Swing the thermostat PCB back to the right to close. Gently press on the PCB to secure each of the locking tabs.
8. Pull out the screw terminal blocks using the pull-tabs on each connector (see Figure 4).

Note: The number of terminals on the terminal blocks varies depending on the TEC model.

IMPORTANT: Use this TEC2103-1 networked thermostat only as an operating control. Where failure or malfunction of the TEC2103-1 could lead to personal injury or property damage to the controlled equipment or other property, additional precautions must be designed into the system. Incorporate and maintain other devices such as supervisory or alarm systems or safety or limit controls intended to warn of, or protect against, failure or malfunction of the TEC2103-1.

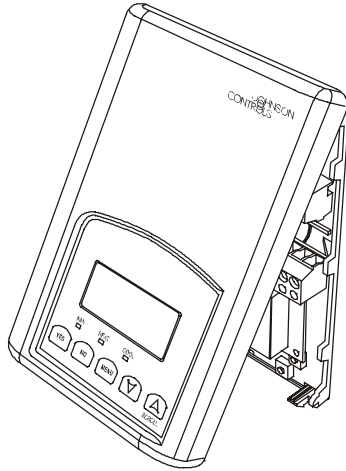


Figure 1: Removing the Thermostat Cover

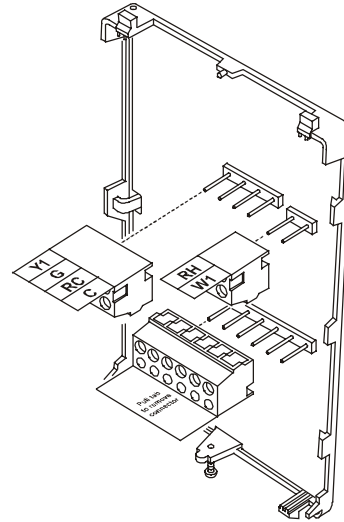


Figure 4: Removing the Terminal Blocks

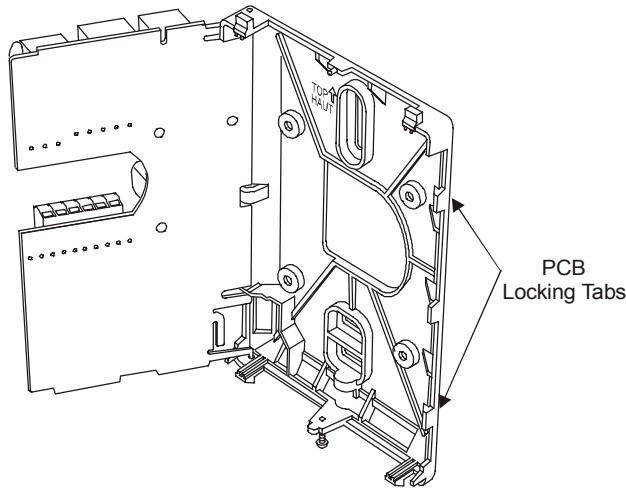


Figure 2: Opening the Thermostat PCB

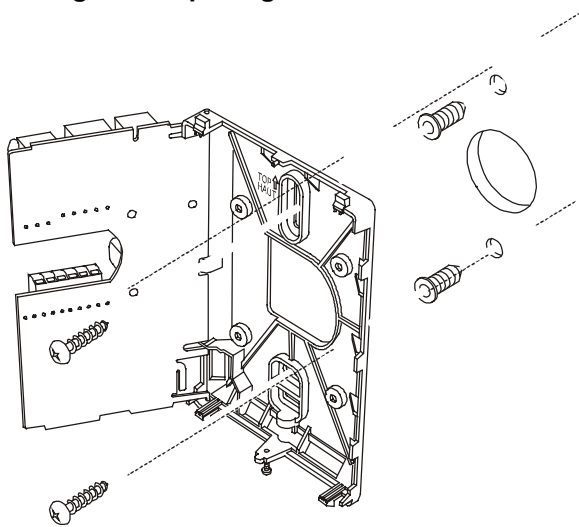


Figure 3: Mounting the Thermostat Base

Wiring



CAUTION: Risk of Electrical Shock.

Disconnect power supply before making electrical connections to avoid electrical shock.

Note: When replacing an existing thermostat, remove and label wires to identify terminal designations. When replacing a TEC2103-1 thermostat, simply remove the terminal blocks and reinsert on to the new thermostat.

To wire the thermostat:

1. Strip each wire 1/4 in. (6.35 mm) and connect to the appropriate terminal according to the TEC2103-1 wiring diagram (see Figure 5).
2. Gently push excess wire back into the wall, plug the wall hole with fireproof material to prevent drafts from affecting ambient temperature readings, and install screw terminal blocks back onto the PCB.
3. Reattach the thermostat cover to the installed base (top side first) and install the security screw on the bottom.



CAUTION: Risk of Property Damage.

Do not apply power to the system before checking all wiring connections. Short circuited or improperly connected wires may result in permanent damage to the equipment.

Terminal	Function
Y1	Energizes on a call for first stage cooling
Y2	Energizes on a call for second stage cooling
G	Energizes fan in accordance with the selected fan mode
RC	24 VAC from equipment transformer
C	24 VAC (common) from equipment transformer
RH	24 VAC for heating stages
W1	Energizes on call for first stage heating
W2	Energizes on a call for second stage heating
D1	Configurable digital input
D2	Configurable digital input
RS	Remote room sensor
Scom	Sensor common
OS	Outdoor air sensor
N2+, N2-, REF	N2 Bus

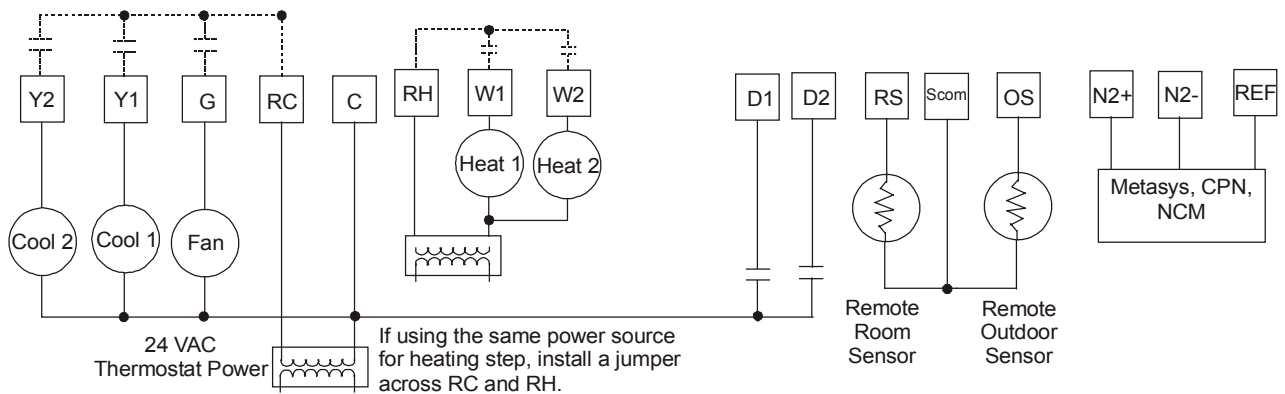
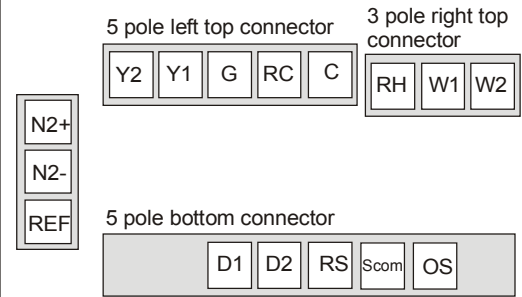


Figure 5: TEC2103-1 Wiring Schematic

Connecting the N2 Bus

To connect the N2 Bus:

1. Observe the polarity when connecting the N2 Bus wires to the TEC2103-1.

Note: An End-of-Line (EOL) is not needed on the N2 Bus at the TEC2103-1. However, one EOL is needed at the BAS (N30, Companion, Network Control Module).

2. Continue this process for each TEC2103-1 using the daisy chain wiring method.

N2 Device Mapping

When adding the TEC2103-1 to the Metasys system (Person-Machine Interface [PMI] and Companion system), you must define the TEC2103-1 as a Vendor Device (VND). For the NCM, do **not** direct map any points. Run control of these points through the Control System (CS) object only. Refer to *Setting the N2 Address (N2 addr)* to set the address for the thermostat.

Table 1: N2 Bus Objects

Point Name	TEC Point Type/ Address	N30 (CPN/FAC) Object Type	BAS Model Point Type	Override Range
Room Temp ^a	ADI-1	N2 AI (AI) ^d	CSAD ADI1	32 to 122°F (0 to 50°C)
Outdoor Temp ^a	ADI-2	N2 AI (AI) ^d	CSAD ADI2	-40 to 122°F (-40 to 50°C)
Heating SP ^{a, h} (Occupied Heating SP)	ADI-3	N2 AO (AO)	CSAD ADI3	40 to 90°F (4.5 to 32°C)
Cooling SP ^{a, h} (Occupied Cooling SP)	ADI-4	N2 AO (AO)	CSAD ADI5	54 to 100°F (12 to 37.5°C)

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Point Name (Cont.)	TEC Point Type/ Address	N30 (CPN/FAC) Object Type	BAS Model Point Type	Override Range
Setback Heating SP ^{a, h} (Unoccupied Heating SP)	ADI-5	N2 AO (AO)	CSAD ADI5	40 to 90°F (4.5 to 32°C)
Setback Cooling SP ^{a, h} (Unoccupied Cooling SP)	ADI-6	N2 AO (AO)	CSAD ADI6	54 to 100°F (12 to 37.5°C)
Minimum Heat SP	ADI-7	N2 AO (AO)	CSAD ADI7	40°F (4.5°C)
Maximum Heat SP ^a	ADI-8	N2 AO (AO)	CSAD ADI8	40 to 90°F (4.5 to 32°C)
Minimum Cool SP ^a	ADI-9	N2 AO (AO)	CSAD ADI9	54 to 100°F (12 to 37.5°C)
Maximum Cool SP	ADI-10	N2 AO (AO)	CSAD ADI10	100°F (37.5°C)
Fan ^a	BD-1	N2 BO (BO)	CSBD BD1	0 = Auto, 1 = On
Mode ^a	BD-2	N2 MSO ^{e, f} (AO)	CSMS BD2	0 = Off, 1 = Cool, 2 = Heat, 3 = Auto ^f
Occupancy ^a	BD-3	N2 BO (BO)	CSBD BD3	0 = Unoccupied, 1 = Occupied
W1 State	BD-4	N2 BI (BI)	CSBD BD4	0 = Off, 1 = On
W2 State	BD-5	N2 BI (BI)	CSBD BD5	0 = Off, 1 = On
Y1 State	BD-6	N2 BI (BI)	CSBD BD6	0 = Off, 1 = On
Y2 State	BD-7	N2 BI (BI)	CSBD BD7	0 = Off, 1 = On
G State – Fan	BD-8	N2 BI (BI)	CSBD BD8	0 = Off, 1 = On
Temp Units ^{a, c} (Local Display Only)	BD-9	N2 BO (BO)	CSBD BD9	0 = °C, 1 = °F
DI1 ^{b, g}	BI-1	N2 BI (BI)	CSBI BI1	0 = Off, 1 = On
Temp Alarm ^b	BI-2	N2 BI (BI)	CSBI BI2	0 = Normal, 1 = Alarm
DI2 ^{b, g}	BI-3	N2 BI (BI)	CSBI BI3	0 = Off, 1 = On

Notes:

- Commandable.
- Can be a Change of State (COS) alarm to the BAS or N2 Dialer Module (NDM) to initiate a dial-out.
- On the Metasys NCM system, map BD9 **Temp Units Mode** as a Binary Output (BO) object in a Control System (CS) object with Autorestore and Local Controls set.
- Analog Inputs (AIs) are commandable in the Companion system.
- The Multiple Command Output (MCO) object is used to schedule multiple Multi-State Objects (MSOs).
- When defining the N2 MSO object, select TEC Mode from the States Text Menu. Type 4 for the TEC2103-1.
- The state of DI1 and DI2 are communicated over the N2 network even if the digital inputs are configured as **None** through the local interface at the thermostat.
- The Heating and Cooling SP cannot be overridden simultaneously (this also applies to the Unocc Heating SP and Unocc Cooling SP). The overridden setpoint must be released prior to overriding the other setpoint. Additionally, if one setpoint is overridden, the other setpoint may be automatically adjusted by the TEC2103-1 to maintain the minimum deadband between the two setpoints.

The Controller Point Type is the fixed-point definition inside the controller. The Companion/Facilitator (CPN/FAC) point is the software point definition inside of the Companion software. The BAS Model Point type is the definition inside the model file. An NCM CS object must be used to retrieve the data.

Control of any N2 Bus Object listed in the table above is **the last command received is the one that controls the thermostat**. Unless the AD object is **overridden** by the Metasys system, in which case, all local changes attempted through the thermostat keypad for that AD object are ignored until the override is released. For example, if the Metasys system sends an Unoccupied **write** command, but the occupant selects Occupied mode, the TEC goes into Occupied mode. However, if the Metasys system sends an Unoccupied **override** command, but the occupant selects Occupied mode, the TEC stays in Unoccupied mode. Once the override is released, the AD object may once again be changed through the thermostat keypad; the thermostat does not **remember** any data that was attempted to be entered while it was being overridden.

All overrides are released automatically after ten minutes of no communications (for example, network cable is removed from the TEC causing loss of network communications).

Setup and Adjustments

Thermostat Operation Overview

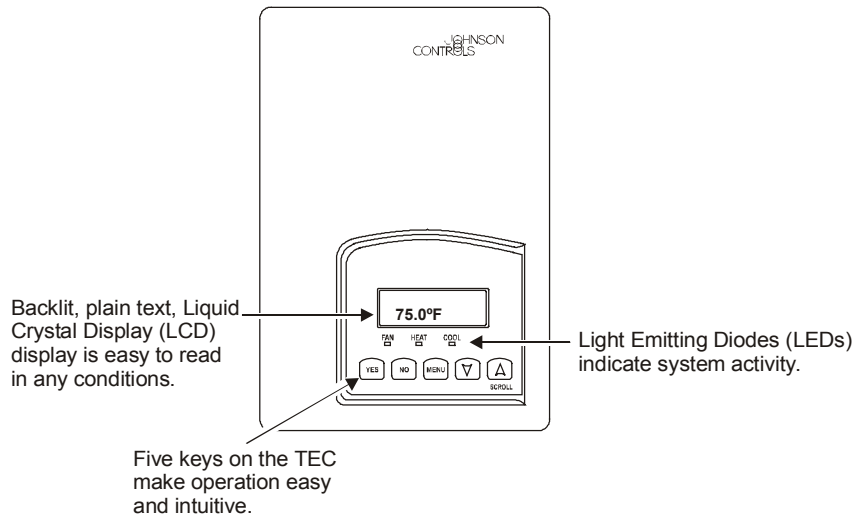


Figure 6: TEC2103-1 Front Cover

Thermostat Interface Keys

The TEC2103-1 interface consists of five keys on the front cover and one configuration key (see Figure 7) that is accessed by removing the front cover. The functions of the keys are as follows. Use the:

- YES key to confirm a selection and move onto the next menu item
- NO key when you do not desire a parameter change, and to advance to the next menu item
- MENU key to access the Main User Menu or exit the menu
- down arrow key to scroll through menu selections or adjust values
- up arrow/SCROLL key to:
 - a. scroll through menu selections or adjust values
 - b. stop the Status Display Menu from scrolling and to manually scroll to the next parameter on the menu. When left unattended for 45 seconds, the display resumes scrolling.

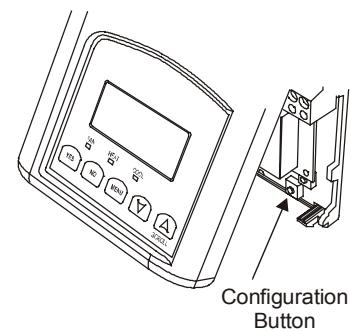


Figure 7: Configuration Key Location

Backlit Liquid Crystal Display (LCD)

The TEC2103-1 uses a two-line, eight-character backlit display. Low level backlighting is present during normal operation and it brightens when any user interface key is pressed. The backlight returns to the lower level when the thermostat is left unattended for 45 seconds.

Light-Emitting Diodes (LEDs)

Three LEDs are used to indicate the status of the fan, call for heat, or call for cooling. When:

- the fan is on, the FAN LED lights up
- heating is on, the HEAT LED lights up
- cooling is on, the COOL LED lights up

Programming Overview

There are three menus used to view, program, and configure the TEC2103-1 thermostat:

The **Status Display Menu** is displayed during normal thermostat operation. The menu continually scrolls through the following parameters.

- Room Temperature
- System Mode
- Schedule Status (Occupied/Unoccupied)
- Outdoor Temperature (requires outdoor air temperature sensor)
- Applicable Alarms (the backlight lights up as an alarm condition is displayed)

To temporarily stop the scrolling, press the up arrow/SCROLL key.

The **Main User Menu** is used to access and change the thermostat's basic operating parameters. Access the menu by pressing the MENU key during normal thermostat operation.

The **Installer Configuration Menu** is used to set up the thermostat for application specific operation. Access the menu by removing the front cover and pressing the configuration key, labeled CONFIG (see Figure 7).

Configuring the TEC2103-1

The TEC2103-1 ships from the factory with default settings for all configurable parameters. The default settings are shown in Table 2. To reconfigure the parameters, follow the steps in this section for the corresponding parameters. The parameters must be set up first by accessing the Installer Configuration Menu. Access the Installer Configuration Menu by removing the front cover and pressing the configuration key (see Figure 7).

Exit the Installer Configuration Menu any time by pressing the MENU key and, at the exit prompt, pressing the YES key. To pass over a parameter without changing it press the NO key.

When the thermostat is in the Installer Configuration Menu and left unattended for 45 seconds, it reverts to the Status Display Menu.

Table 2: Installer Configuration Menu

RoomTemp 75.0 °F	Remove the cover and press the CONFIG key from the Status Display Menu to enter the Installer Configuration Menu.
DI1 set? Y/N	Configures Digital Input 1 Default: No Function (None) See <i>Configuring the Digital Inputs</i> .
DI2 set? Y/N	Configures Digital Input 2 Default: No Function (None) See <i>Configuring the Digital Input</i> .
Lockout set? Y/N	Sets Keypad Lockout Level Default: No Lockout (0) See <i>Enabling Keypad Lockout</i> .
Pwr del set? Y/N	Sets Power-up Delay Default: Ten Seconds (10.0 sec) See <i>Setting the Power-up Delay</i> .
Frost pr set? Y/N	Enables/Disables Frost Protection Default: Disabled (Off) See <i>Enabling Frost Protection</i> .
Heat max set? Y/N	Sets the Maximum Heating Setpoint Default: 90.0°F (32.0°C) See <i>Setting the Maximum Heating Setpoint</i> .
Cool min set? Y/N	Sets the Minimum Cooling Setpoint Default: 54.0°F (12.0°C) See <i>Setting the Minimum Cooling Setpoint</i> .
Anticycl set? Y/N	Sets the Anti-Short Cycle Timer Default: Two Minutes (2.0 min) See <i>Setting the Anti-Short Cycle Timer</i> .
Heat cph set? Y/N	Sets the Heating Cycles per Hour Default: Four (4.0) See <i>Setting the Maximum Heating Cycles per Hour</i> .
Cool cph set? Y/N	Sets the Cooling Cycles per Hour Default: Four (4.0) See <i>Setting the Maximum Cooling Cycles per Hour</i> .
Continued on next page . . .	

Table 2: Installer Configuration Menu (Cont.)	
Deadband set? Y/N	Sets the Minimum Heating/Cooling Deadband Default: 2.0°F (1.1°C) See <i>Setting the Heating/Cooling Deadband</i> .
Fan cont set? Y/N	Determines how the Fan Activates in Response to a call for Heat Default: Thermostat Controls Fan (On) See <i>Setting the Fan Control</i> .
Fan del set? Y/N	Delays Fan Termination at Cycle's End for 60 Seconds Default: No Delay (Off) See <i>Setting the Fan Delay</i> .
N2 addr set? Y/N	Sets the N2 Address Default: 253 See <i>Setting the N2 Address</i> .
ToccTime set? Y/N	Sets the Duration for Temporary Occupancy Time Default: Three Hours (3.0 hrs) See <i>Setting the Temporary Occupancy Time</i> .
Cal RS set? Y/N	Room Air Sensor Calibration (Offset) Default: 0.0°F (0.0°C) See <i>Room Air Sensor Calibration</i> .
Cal OS set? Y/N	Outdoor Air Sensor Calibration (Offset) Default: 0.0°F (0.0°C) See <i>Outdoor Air Sensor Calibration</i> .
H Stage set? Y/N	Disable/Enable Second Heating Stage Default: Two Stages See <i>Disable/Enable Second Heating Stage</i> .
C Stage set? Y/N	Disable/Enable Second Cooling Stage Default: Two Stages See <i>Disable/Enable Second Cooling Stage</i> .
H lock set? Y/N	Disables Heating Operation based on Outdoor Air Temperature Default: 120°F (49°C) See <i>Setting the Heating Lockout</i> .
C lock set? Y/N	Disables Cooling Operation based on Outdoor Air Temperature Default: -40°F (-40°C) See <i>Setting the Cooling Lockout</i> .

Programming the Digital Inputs (DI1 and DI2)

Press the configuration menu access key. The first prompt is to program digital inputs DI1 and DI2.

The digital inputs display an alarm condition when the input is closed. An alarm message is included on the scrolling Status Display Menu and when the message is displayed, the backlight momentarily lights up.

Each digital input can be programmed in one of three conditions.

- **None** – No function is associated with the input.
- **Service** – A Service alarm is displayed.
- **Filter** – A Filter alarm is displayed.

To configure the digital inputs while in the Installer Configuration Menu:

1. The first prompt is to configure the digital inputs. Press YES to configure Digital Input 1 or NO to advance to Digital Input 2.
2. Use the UP/DOWN arrow keys to locate the desired function for the Digital Input 1. Press YES to select the desired function.
3. Press YES to configure Digital Input 2 or NO to advance to the keypad lockout setup prompt.
4. Use the UP/DOWN arrow keys to locate the desired function for the Digital Input 2. Press YES to select the desired function.

The display now shows the keypad lockout setup prompt. See the *Enabling the Keypad Lockout (Lockout)* section for instructions.

Note: Regardless of the digital input configuration (**None**, **Service**, or **Filter**) established through the local interface at the TEC2103-1, the states of DI1 and DI2 are communicated over the N2 network. This enables the ability to communicate alarm conditions over the network without local annunciation on the TEC2103-1 display.

Enabling the Keypad Lockout (Lockout)

The TEC2103-1 has three levels of keypad lockout. The levels and degree of lockout are shown in Table 3.

To set the keypad lockout level while in the Installer Configuration Menu:

1. Answer NO to all prompts until the keypad lockout setup prompt appears in the display. Press YES to enter the keypad lockout menu.
2. Use the UP/DOWN arrow keys to locate the desired lockout level. Press YES to select the level.

The display now shows the power delay setup prompt. See the *Setting the Power-up Delay (Pwr del)* section for instructions.

Table 3: Keypad Lockout Levels

Level	Temperature Setpoints	System Mode Setting	Fan Mode Setting
0	Yes access	Yes access	Yes access
1	No access	Yes access	Yes access
2	No access	No access	No access

Setting the Power-up Delay (Pwr del)

On initial power up of the TEC2103-1 (or each time power is removed and reapplied), there is a delay before any operation is authorized (fan, cooling, and heating). The delay time is adjustable between 10 and 120 seconds. This parameter can also be used to sequence the start-up of multiple units in one location.

Note: When adjusting the time with the UP/DOWN arrow keys, holding the keys down changes the time by 10-second intervals.

To set the delay time while in the Installer Configuration Menu:

1. Answer NO to all prompts until the power delay setup prompt appears in the display. Press YES to enter the power delay setup menu.
2. Use the UP/DOWN arrow keys to adjust the power-up delay setting. Press YES to store the setting.

The display now shows the frost protection setup prompt. See the *Enabling Frost Protection (Frost pr)* section for setup instructions.

Enabling Frost Protection (Frost pr)

Frost protection establishes a minimum heating setpoint of 42°F (5.5°C) to prevent freezing in the zone controlled by the thermostat. If enabled, frost protection is activated even if the thermostat is set to the Off System Mode. If frost protection is active, it is displayed as an alarm (**Frost on** with the backlight lit) on the Status Display Menu.

To enable frost protection while in the Installer Configuration Menu:

1. Answer NO to all prompts until the frost protection setup prompt appears in the display. Press YES to enter the frost protection menu.
2. Use the UP/DOWN arrow keys to select **off** or **on**. Press YES to store the selection.

The display now shows the maximum heating setpoint prompt. See the *Setting the Maximum Heating Setpoint (Heat max)* section for instructions.

Setting the Maximum Heating Setpoint (Heat max)

The maximum heating setpoint establishes the maximum temperature in the heating setpoint range that can be adjusted from the Main User Menu. The parameter is adjustable from 40 to 90°F (4.5 to 32°C).

Note: When adjusting the temperature, holding the keys down changes the temperature by 5 F/C° increments.

To set the maximum heating setpoint while in the Installer Configuration Menu:

1. Answer NO to all prompts until the maximum heating setpoint prompt appears in the display. Press YES to enter the maximum heating setpoint menu.
2. Use the UP/DOWN arrow keys to adjust the maximum heating setpoint temperature. Press YES to store the value.

The display now shows the minimum cooling setpoint prompt. See the *Setting the Minimum Cooling Setpoint (Cool min)* section for instructions.

Setting the Minimum Cooling Setpoint (Cool min)

The minimum cooling setpoint establishes the minimum temperature in the cooling setpoint range that can be adjusted from the Main User Menu. The parameter is adjustable from 54 to 100°F (12 to 37.5°C).

Note: When adjusting the temperature, holding the keys down changes the temperature by 5 F/C° increments.

To set the minimum cooling setpoint while in the Installer Configuration Menu:

1. Answer NO to all prompts until the minimum cooling setpoint prompt appears in the display. Press YES to enter the minimum cooling setpoint menu.
2. Use the UP/DOWN arrow keys to adjust the minimum cooling setpoint temperature. Press YES to store the value.

The display now shows the anti-short cycle timer prompt. See the *Setting the Anti-Short Cycle Timer (Anticycl)* section for instructions.

Setting the Anti-Short Cycle Timer (Anticycl)

The anti-short cycle timer establishes the minimum on/off times for the cooling and heating stages. The timer is adjustable from 0 to 5 minutes in 1-minute increments. Set the anti-short cycling to 0 minutes for equipment that possesses its own anti-short cycling timer.



CAUTION: Risk of Property Damage to Equipment. Do not set the TEC2103-1 anti-short cycling timer to 0 minutes if the controlled equipment is not protected by its own internal anti-short cycling timer. Doing so may result in damage to the controlled equipment.

To set the anti-short cycle time while in the Installer Configuration Menu:

1. Answer NO to all prompts until the anti-short cycle timer prompt appears in the display. Press YES to enter the anti-short cycle timer menu.
2. Use the UP/DOWN arrow keys to adjust the minimum on/off times for the heating and cooling stages. Press YES to store the value.

The display now shows the heating cycles per hour setup prompt. See the *Setting the Maximum Heating Stage Cycles per Hour (Heat cph)* section for instructions.

Setting the Maximum Heating Stage Cycles per Hour (Heat cph)

The heating cycles per hour establishes the maximum number of times the equipment or stages are turned on and off in one hour. The selection ranges from three to eight cycles per hour.

Note: A higher number of heating cycles per hour results in more accurate temperature control, but could accelerate the wear of mechanical components in the equipment.

To set the maximum number of heating cycles per hour while in the Installer Configuration Menu:

1. Answer NO to all prompts until the heating cycles per hour prompt appears in the display. Press YES to enter the heating cycles per hour menu.
2. Use the UP/DOWN arrow keys to adjust the maximum number of heating cycles per hour. Press YES to store the value.

The display now shows the cooling cycles per hour setup prompt. See the *Setting the Maximum Cooling Stage Cycles per Hour (Cool cph)* section for instructions.

Setting the Maximum Cooling Stage Cycles per Hour (Cool cph)

The cooling cycles per hour establishes the maximum number of times the equipment or stages are turned on and off in one hour. The selection ranges from three to four cycles per hour.

Note: A higher number of cooling cycles per hour results in more accurate temperature control, but could accelerate the wear of mechanical components in the equipment.

To set the maximum number of cooling cycles per hour while in the Installer Configuration Menu:

1. Answer NO to all prompts until the cooling cycles per hour prompt appears in the display. Press YES to enter the cooling cycles per hour menu.
2. Use the UP/DOWN arrow keys to adjust the maximum number of cooling cycles per hour. Press YES to store the value.

The display now shows the minimum heating/cooling deadband prompt. See the *Setting the Heating/Cooling Deadband (Deadband)* section for instructions.

Setting the Heating/Cooling Deadband (Deadband)

The heating/cooling deadband setting establishes the minimum difference between the heating and cooling setpoints. The range is adjustable from 2 to 4 F° (1 to 2 C°).

To change the minimum deadband between the heating and cooling setpoints while in the Installer Configuration Menu:

1. Answer NO to all prompts until the deadband setpoint prompt appears in the display. Press YES to enter the deadband setpoint menu.
2. Use the UP/DOWN arrow keys to adjust the minimum deadband between the heating and cooling setpoints. Press YES to store the value.

The display now shows the fan control prompt. See the *Setting the Fan Control (Fan cont)* section for instructions.

Setting the Fan Control (Fan cont)

This parameter controls how the fan activates in response to a call for heating.

When the fan is in Auto Mode (as selected on the Main User Menu):

- Selecting **on** enables the thermostat to control the fan on a call for heating or cooling.
- When selecting **off**, the fan is energized by the thermostat on a call for cooling only. On a call for heating, the fan is controlled by the equipment fan limit control.

To set the fan control while in the Installer Configuration Menu:

1. Answer NO to all prompts until the fan control prompt appears in the display. Press YES to enter the fan control menu.
2. Using the UP/DOWN arrow keys, select **on** or **off**. Press YES to store the selection.

The display now shows the fan delay prompt. See the *Setting the Fan Delay (Fan del)* section for instructions.

Setting the Fan Delay (Fan del)

The fan delay extends the fan operation by 60 seconds after the call for heating or cooling has ended. This feature is only active when the fan is in the **Auto** mode.

To enable the fan delay while in the Installer Configuration Menu:

1. Answer NO to all prompts until the fan delay prompt appears in the display. Press YES to enter the fan delay menu.
2. Using the UP/DOWN arrow keys, select **on** or **off**. Press YES to store the selection.

The display now shows the N2 address prompt. See the *Setting the N2 Address (N2 addr)* section for instructions.

Setting the N2 Address (N2 addr)

To adjust the N2 address (adjustable from 1 to 253) while in the Installer Configuration Menu:

1. Answer NO to all prompts until the setting the N2 address prompt appears in the display. Press YES to set the address.
2. Use the UP/DOWN arrow keys to display the desired address. Press YES to store the address.

The display now shows the temporary occupancy time prompt. See the *Establishing the Temporary Occupancy Time (ToccTime)* section for instructions.

Note: Pressing the YES and NO keys simultaneously for 5 seconds on the user interface of the TEC2103-1 temporarily displays the N2 address of the thermostat.

Establishing the Temporary Occupancy Time (ToccTime)

The temporary occupancy time is the length of time the occupied mode setpoints are used when the override function is enabled (the override function can be enabled from the Main User Menu) or a temporary setpoint is entered. The range is adjustable from 0 to 12 hours.

To change the temporary occupancy time while in the Installer Configuration Menu:

1. Answer NO to all prompts until the temporary occupancy time prompt appears in the display. Press YES to enter the temporary occupancy time menu.
2. Use the UP/DOWN arrow keys to adjust the length of time the temporary occupancy setpoint should be in effect. Press YES to store the time.

The display now shows the room sensor calibration prompt. See the *Room Air Sensor Calibration (Cal RS)* section for instructions.

Room Air Sensor Calibration (Cal RS)

An offset can be added or subtracted to the actual displayed room temperature as needed. The range is $\pm 5.0\text{ F}^\circ$ ($\pm 2.5\text{ C}^\circ$), adjustable in increments of 1 F° (0.5 C°).

To change the room sensor calibration/offset while in the Installer Configuration Menu:

1. Answer NO to all prompts until the room sensor calibration prompt appears in the display. Press YES to enter the room sensor calibration menu.
2. Use the UP/DOWN arrow keys to adjust the correction that should be applied to the sensor reading. Press YES to store the offset.

The display now shows the outdoor air sensor calibration prompt. See the *Outdoor Air Sensor Calibration (Cal OS)* section for instructions.

Outdoor Air Sensor Calibration (Cal OS)

An offset can be added or subtracted to the actual displayed outdoor air temperature as needed. The range is $\pm 5.0\text{ F}^\circ$ ($\pm 2.5\text{ C}^\circ$), adjustable in increments of 1 F° (0.5 C°).

To change the outdoor air sensor calibration/offset while in the Installer Configuration Menu:

1. Answer NO to all prompts until the outside sensor calibration prompt appears in the display. Press YES to enter the outside sensor calibration menu.
2. Use the UP/DOWN arrow keys to adjust the correction that should be applied to the sensor reading. Press YES to store the offset.

The display now shows the heating stage setting prompt. See the *Disable/Enable Second Heating Stage (H Stage)* section for instructions.

Disable/Enable Second Heating Stage (H Stage)

This parameter reverts the operation of two stage thermostats to a single stage when the second heating stage is not needed.

To enable or disable the second heating stage while in the Installer Configuration Menu:

1. Answer NO to all prompts until the setting heating stages prompt appears in the display. Press YES to enter the setting heating stages menu.
2. Using the UP/DOWN arrow keys; select **1.0** or **2.0** stages. Press YES to store the selection.

The display now shows the cooling stage setting prompt. See the *Disable/Enable Second Cooling Stage (C Stage)* section for instructions.

Disable/Enable Second Cooling Stage (C Stage)

This parameter reverts the operation of two-stage thermostats to a single stage when the second cooling stage is not needed.

To enable or disable the second cooling stage while in the Installer Configuration Menu:

1. Answer NO to all prompts until the setting cooling stages prompt appears in the display. Press YES to enter the setting cooling stages menu.
2. Using the UP/DOWN arrow keys; select **1.0** or **2.0** stages. Press YES to store the selection.

The display now shows the heating lockout prompt. See the *Setting the Heating Lockout (H lock)* section for instructions.

Setting the Heating Lockout (H lock)

This feature disables heating operation based on outdoor air temperature (requires outdoor air temperature sensor to be connected for the function to be enabled). If the outdoor air temperature is above the heating lockout temperature, heating operation is disabled.

The heating lockout temperature parameter is adjustable from -15 to 120°F (-26 to 49°C) in increments of 5 F/C°.

To change the outdoor air temperature heating lockout while in the Installer Configuration Menu:

1. Answer NO to all prompts until the heating lockout prompt appears in the display. Press YES to enter the heating lockout menu.
2. Use the UP/DOWN arrow keys to adjust the lockout temperature. Press YES to store the value.

The display now shows the cooling lockout prompt. See the *Setting the Cooling Lockout (C lock)* section for instructions.

Setting the Cooling Lockout (C lock)

This feature disables cooling operation based on outdoor air temperature (requires outdoor air temperature sensor to be connected for the function to be enabled). If the outdoor air temperature is below the cooling lockout temperature, cooling operation is disabled.

The cooling lockout temperature parameter is adjustable from -40 to 95°F (-40 to 35°C) in increments of 5 F/C°.

To change the outdoor air temperature cooling lockout while in the Installer Configuration Menu:

1. Answer NO to all prompts until the cooling lockout prompt appears in the display. Press YES to enter the cooling lockout menu.
2. Use the UP/DOWN arrow keys to adjust the lockout temperature. Press YES to store the value.
3. The exit menu is displayed. Press YES to exit the Installer Configuration Menu or press NO to return to the beginning of the menu (digital input configuration).

Operation

Entering Setpoints, System Mode, and Fan Mode from the TEC2103-1 Interface

Once the TEC2103-1 is configured through the Installer Configuration Menu, select operating parameters can be entered through the Main User Menu (access the Main User Menu by pressing the MENU button during normal thermostat operation). To enter the setpoints, system mode, and fan mode from the TEC2103-1 interface, follow the procedure described in this section.

The Main User Menu uses Auto Help. Auto Help is displayed automatically in the Main User Menu when there is a pause in programming activity. To exit Auto Help, continue with the programming selections.

When the thermostat is in the Main User Menu and is left unattended for 45 seconds, it reverts to the Status Display Menu.

Entering Temperature Setpoints

The first prompt appearing in the Main User Menu of the TEC2103-1 is to set the temperature setpoints. This is where all heating and cooling setpoints for the occupied and unoccupied states are entered. It is also where any temporary setpoints are entered.

To enter the heating and cooling setpoints for the occupied and unoccupied modes (permanent or temporary), follow the steps in Table 4. When changing the temperatures, pressing the keys once changes the temperature 0.5 F/C° and holding down the keys changes the temperature by 5 F/C° increments.

Setpoint Type

Permanent Setpoints are permanently stored in the programmed schedule. This is the default setpoint type.

Temporary Setpoints are changed, but is in effect only for the time specified in the *Temporary Occupancy Time* parameter (see *Configuring the TEC2103-1* section).

Note: There is no indication that a temporary setpoint is enabled or active.

After the specified temporary occupancy time elapses, the temporary setpoint reverts to the permanent setpoint.

The temporary setpoint can be cancelled at any time by using the Permanent Setpoint option in this menu. When permanent modifications of the setpoints are required, this parameter needs to be set to permanent.

Note:

1. If a setpoint is overridden over the N2 network, it appears the setpoint value can be changed through the TEC2103-1, but the setpoint is actually still held at overridden value.
2. If the heating and cooling setpoints are overridden over the N2 network such that the deadband is violated, the TEC2103-1 automatically changes one of the setpoints to maintain the deadband.

Table 4: Entering Temperature Setpoints

RoomTemp 75.0°F	Press MENU from the Status Display Menu to enter the Main User Menu.
Temperat set? Y/N	Answer NO to all prompts until the temperature set prompt appears in the display (it may be the first prompt). Press YES to enter temperature setting menu.
Cooling set? Y/N	Press YES to change occupied cooling setpoint. Press NO to advance to occupied heating setpoint menu.
Cooling 75.0°F	Use the UP/DOWN arrow keys to set temperature. Press YES to store value and advance to next menu.
Heating set? Y/N	Press YES to change the occupied heating setpoint. Press NO to advance to unoccupied cooling setpoint menu.
Heating 68.0°F	Use the UP/DOWN arrow keys to set temperature. Press YES to store value and advance to next menu.
Unocc CL set? Y/N	Press YES to change the unoccupied cooling setpoint. Press NO to advance to the unoccupied heating setpoint.
Unocc CL 80.0°F	Use the UP/DOWN arrow keys to set temperature. Press YES to store value and advance to next menu.
Unocc HT set? Y/N	Press YES to change the unoccupied heating setpoint. Press NO to advance to temperature display units.
Unocc HT 62.0°F	Use the UP/DOWN arrow keys to set temperature. Press YES to store value and advance to next menu.
Continued on the next page . . .	

Table 4: Entering Temperature Setpoints (Cont.)	
°F/°C set? Y/N	Press YES to set the display units to °F or °C. Press NO to advance to temperature setpoint type menu. This only changes the local display.
Setpoint type Y/N	Press YES to select the setpoint type (permanent or temporary).
Setpoint permnent	Using the UP/DOWN arrow keys select the setpoint type (see <i>Setpoint Type</i> section for a description of choices). Press YES to enter the choice.
Exit? Y/N	Press YES to return to the Status Display Menu or NO to re-enter the temperature setting menu.

Selecting the System Mode

The TEC2103-1 has four system modes.

- **Automatic Mode (auto)**
Automatic changeover between heating and cooling. This is the default setting.
- **Cooling Mode (cool)**
Cooling operation only.
- **Heating Mode (heat)**
Heating operation only.
- **Off Mode (off)**
The TEC2103-1 is off. However, if frost protection is enabled and frost conditions are detected, the thermostat still calls for heat even if the system mode is set to Off.

To set the system mode while in the Main User Menu:

1. Answer NO to all prompts until the system mode prompt appears in the display. Press YES to set the system mode.
2. Use the UP/DOWN arrow keys to locate the desired system mode. Press YES to select the desired system mode.
3. Press YES to return to the Status Display Menu or NO to return to the system mode selection menu.

Fan Mode Setting

The TEC2103-1 has three fan mode settings:

- **On Fan Mode (on)**
Energizes the fan all the time for both occupied and unoccupied periods (even if the system mode is set to off).
- **Automatic Fan Mode (auto)**
Operates the fan only on a call for heating or cooling for both occupied and unoccupied periods. This is the default setting.
- **Smart Fan Mode (smart)**
Energizes the fan all the time for occupied periods and only on a call for heating and cooling in unoccupied periods.

To set the fan mode while in the Main User Menu:

1. Answer NO to all prompts until the fan mode prompt appears in the display. Press YES to set the fan mode.
2. Use the UP/DOWN arrow keys to locate the desired fan mode. Press YES to select the desired fan mode.
3. Press YES to return to the Status Display Menu or NO to return to the fan mode selection menu.

Accessories

Using the information in Table 5, contact the nearest Johnson Controls branch office or wholesale distributor to order these accessories.

**Table 5: Optional Accessories
(Includes Mounting Hardware)**

Item	Product Code Number
Remote Indoor Temperature Sensor	SEN-600-1
Outdoor Air Temperature Sensor	SEN-600-2
Duct Mount Temperature Sensor	SEN-600-3

Troubleshooting

Table 6: N2 Bus Configuration Troubleshooting

Error/Trouble Condition	Possible Causes	Solution
TEC2103-1 cycles online and offline.	Two or more controllers have the same address.	Change each duplicate address to a unique number.
	There are Y or T taps or the repeater lost power or is wired incorrectly.	Refer to the <i>N2 Communication Bus Technical Bulletin (LIT-636018)</i> .
TEC2103-1 does not come online.	Two or more controllers have the same address.	Change each duplicate address to a unique number.
	N2 Bus contains too many devices.	The maximum of N2 devices allowed on the N2 Bus is as follows: 100 devices per NCM, 32 devices per N30, 32 devices per N31, 150 devices per the Companion/Facilitator system.
	TEC2103-1 does not have power.	Apply power to the TEC2103-1.
	N2 cable runs are broken.	Locate and correct the wiring.
	Device type is incorrect.	TEC2103-1 address must be VND device type.
Entire N2 Bus is offline.	EOL jumpers on MM-CVT101 or NCM are not installed.	Install EOL jumpers properly.
	MM-CVT101 is not plugged into the Personal Computer (PC) or 120 VAC source.	Plug MM-CVT101 into PC or plug it into a 120 VAC source.
	Wiring near the Bus is broken.	Repair the wiring.
	No point mapping entered.	Define the BAS dataset.

Table 7: Alarm Messages

Display	Function
Frost ON	Indicates heating is energized by the low limit frost protection (42°F [5.5°C]).
Service	Indicates there is a service alarm in accordance with one of the programmable digital inputs (DI1 or DI2).
Filter	Indicates the filter (or filters) are dirty in accordance with one of the programmable inputs (DI1 or DI2).

Note: There is a temperature alarm message that is displayed at the head end control should the setpoint not be reached within 45 minutes (there is no indication locally at the TEC2103-1).

Technical Specifications

Product	TEC2103-1 Thermostat with N2 Bus, Multi-stage
Power Requirements	20-30 VAC, 50/60 Hz, 24 VAC nominal, Class 2
Relay Contact Rating Maximum Inductive	1 ampere with in-rush surges up to 3 amperes, 30 VAC maximum, Class 2
Digital Inputs	Relay dry contact only across the C terminal to DI1 or DI2
Recommended Wire Size	18 gauge maximum, 22 gauge recommended
Thermostat Measurement Range	-40 to 122°F (-40 to 50°C)
Sensor Type:	Local 10 K ohm NTC thermistor
Resolution:	± 0.2 F° (± 0.1 C°)
Control Accuracy	± 0.9 F° (± 0.5 C°) @ 70°F (21°C) typical calibrated
Outdoor Air Temperature Indication Range	-40 to 122°F (-40 to 50°C)
Control Range	Cooling: 54 to 100°F (12 to 37.5°C) in 1/2 degree increments Heating: 40 to 90°F (4.5 to 32°C) in 1/2 degree increments
Minimum Deadband	(Between heating and cooling) 2 F° or 1 C°
Ambient Operating Conditions	32 to 122°F (0 to 50°C); 0 to 95% RH noncondensing
Ambient Storage Conditions	-22 to 122°F (-30 to 50°C); 0% to 95% RH noncondensing
Dimensions (H x W x D)	4.94 x 3.38 x 1.13 in. (125 x 86 x 29 mm)
Shipping Weight	0.75 lb (0.34 kg)
UL and cUL Listing	File E27734 with CCN's XAPX (US, UL 873) and XAPX7 (Canada, CSA C22.2 No. 24)
CE Compliance	CE Directives EN50081-1: 1992 EMC Emission; EN50082-2 EMC Immunity (Pending)
FCC Compliance	This equipment has been tested and found to comply with the limits for a Class A digital device and verified to Class B pursuant to Part 15 of FCC Rules. These limits are designed to provide reasonable protection against harmful interference when this equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.

The performance specifications are nominal and conform to acceptable industry standards. For application at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products.

This device complies with Class A Part 15 of the FCC rules. It was also verified to Class B. Operation is subject to the following two conditions:

- (1) This device may not cause harmful interference.
 - (2) This device must accept any interference received, including interference that may cause undesired operation.
- This Class A digital apparatus meets all of the requirements of the Canadian Interference-Causing Equipment Regulations. Cet appareil numérique de la Classe A respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

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