

CRISTAL

CCTHV-407

User Manual

Version 1.70.0 - 2026-10-21

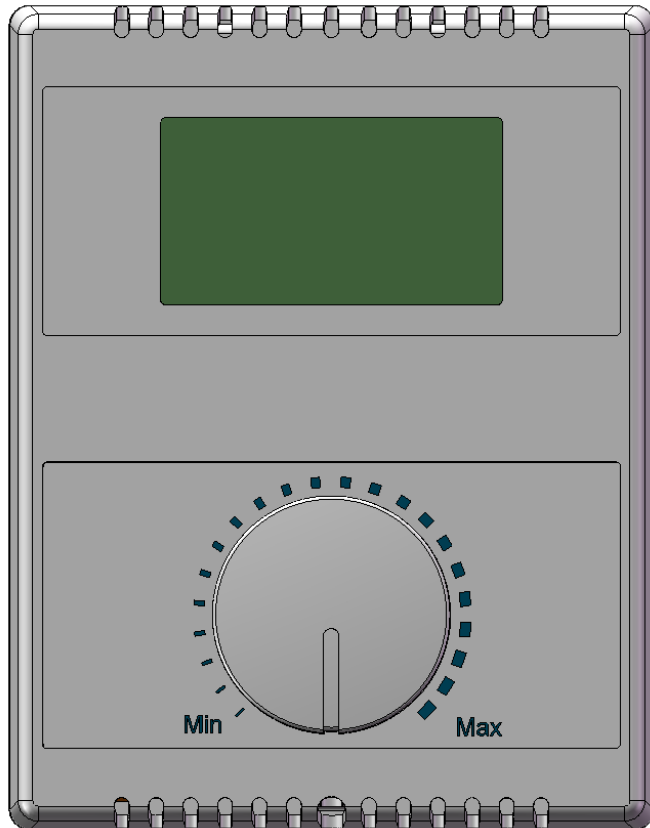


Table of Contents

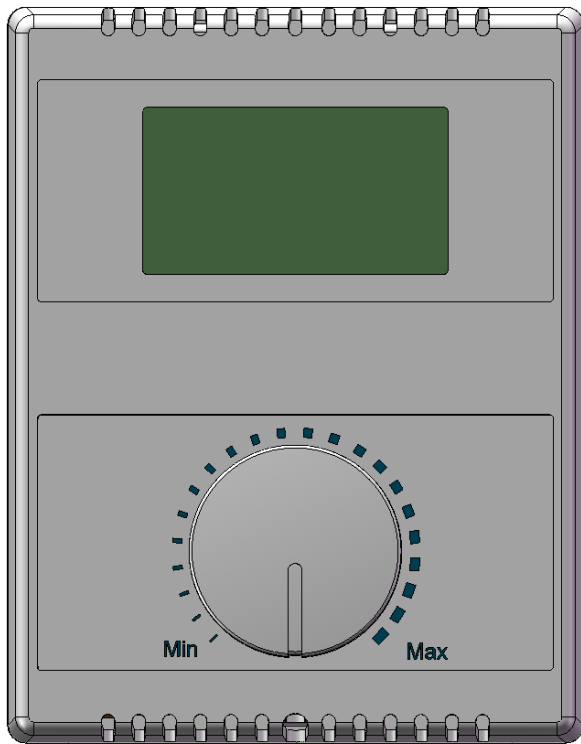
1	General Description	4
2	Installation.....	5
2.1	Opening the case.....	5
2.2	Installing the thermostat.....	5
3	Wiring.....	6
3.1	Terminal identification	6
3.2	1 Transformer connections	7
3.3	2 Transformers connections.....	8
3.4	3 Transformers connections.....	9
4	CCTHV Inputs.....	10
4.1	Digital.....	10
4.2	0-10Vdc	10
4.3	Remote temperature	10
5	CCTHV Outputs	11
5.1	2x Triac	11
5.2	4x Relay.....	11
5.3	0-10Vdc	11
6	General usage	12
7	Software Algorithm.....	14
7.1	Temperature	14
7.2	Thermostat configuration	14
8	Menu - User interface	15
8.1	Version.....	15
8.2	Room temperature	15
8.3	Room setpoint.....	16
9	Menu - Configuration	17
9.1	Version.....	17
9.2	Temperature Probe Type.....	17
9.3	MAC MSTP address	17
9.4	Maximum MSTP master	18
9.5	Serial Baud Rate.....	18
9.6	MSTP maximum info frames.....	19

9.7	Device Identifier	19
9.8	Temperature calibration	20
9.9	Minimum 0-10V Probe	20
9.10	Maximum 0-10V Probe	20
9.11	Read Property Multiple configuration	21
9.12	LCD test display	21
10	Communication	22
10.1	Objects.....	22
10.2	Proprietary Properties	25
11	Configuration	27
11.1	“Objects”	28
11.2	Temperature	29
11.3	HVAC Outputs	29
11.4	Digital Inputs	31
11.5	Relays.....	32
11.6	System Settings	33
11.7	Configuration Buttons	36
11.7.1	“Clone Config.” Button	36
11.8	System operation	38
12	Dimensions.....	40
13	Models.....	41
14	Hardware specifications	42
14.1	Outputs	42
14.2	Inputs	42
14.3	Jumpers	42
15	Legal Notice	43

1 General Description

The Cristal Controls CCTHV-407 is a thermostat which can be used stand-alone or with communication. It has 7 outputs: 2 triacs, 1 analog 0-10 Vdc and 4 dry contacts. Also, it has 2 dry contact inputs, one remote sensor input for a second (10K) temperature sensor and a 0-10Vdc input.

The CCTHV-407 software allows many adjustments of the heating and cooling algorithm. Its flexibility allows the control of many outputs types according to the software configuration.



CCTHV-407 thermostat

2 Installation

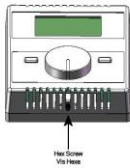


Figure 1 - Hexagonal screw

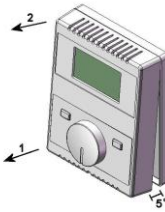


Figure 2 - Opening the enclosure

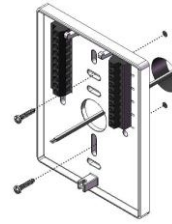


Figure 3 - Back plate

2.1 Opening the case

1. Turn OFF any power supply to the thermostat. Opening the thermostat enclosure while being powered on may damage the unit.
2. Use 1/16" hexagonal key to make the screw penetrate inside the enclosure and release the bottom-front part of the thermostat.
3. Gently pull bottom-front of the thermostat to release some pressure on the pins from the internal connectors.
4. Pull front enclosure from the top to free the connectors completely.

2.2 Installing the thermostat

Mount the thermostat at about 1.5 meters (5 feet) from the floor and avoid places where it can be disturbed by:

- Restrained vertical air circulation like behind a door or in a corner.
- Exposition to warm or chilled air from ventilation ducts.
- Direct sun radiation or heat from surrounding appliances.
- Hidden water pipes or chimneys.
- Do not install on an outside wall.
- Make sure there is no negative or positive back draft from the wall.

It is recommended to patch the hole in the wall with a non-flammable insulator to avoid air drafts and cause temperature fluctuations.

3 Wiring



WARNING: ELECTRICAL RISK Turn off the power supply before the beginning of the installation. Otherwise, it can cause electrical shocks and damage the equipment.

3.1 Terminal identification

Y1 Contact for first cooling stage.

Y2 Contact for second cooling stage.

Rc (Cooling hot supply) Connect to the hot on the secondary side of the transformer from your cooling unit.

0-10V out 0-10Vdc output for modulated heating stage.

W1 Triac output for first heating stage. This heating output is fed from the thermostat then its load reference must be the same as the one from the thermostat.

W2 Triac output for second heating stage.

Bus-A Positive terminal for RS-485 communication.

Bus-B Negative terminal for RS-485 communication.

0-10V In 0-10Vdc input.

Gnd Common terminal for analog 0-10Vdc signals.

AUX Relay contact for accessories or auxiliary heating.

G Fan Relay contact

COM Common hot signal for contacts AUX and G.

T Ext Two terminals for a remote temperature sensor with impedance of 10K at 25°C.

DI1-DI2 Digital inputs to detect a dry contact between this input and terminal COM2.

COM2 Common reference terminal for digital inputs 1 and 2.

24Vac_L Positive (hot) power supply terminal.

24Vac_N Negative (neutral) power supply terminal.

CRISTAL



3.3 2 Transformers connections

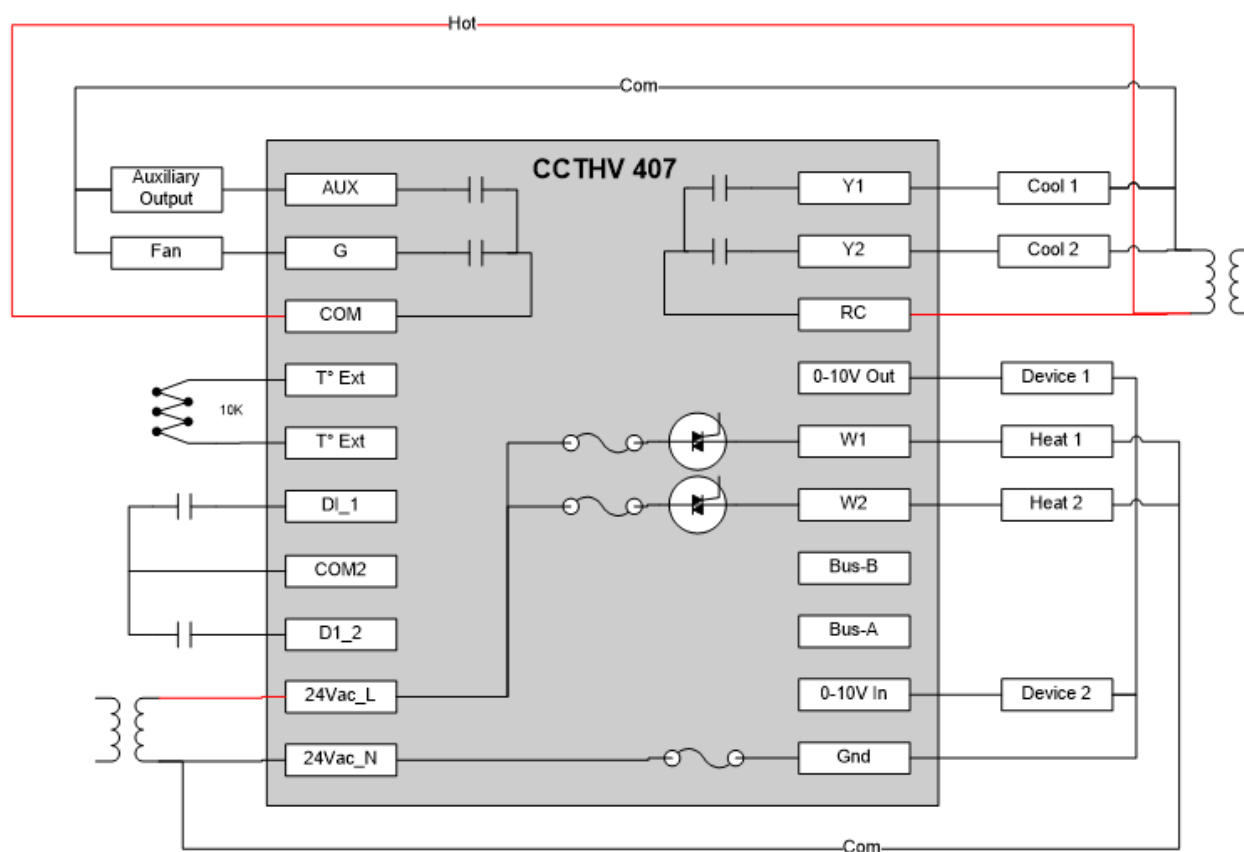


Figure 5 - 2 transformers wiring

3.4 3 Transformers connections

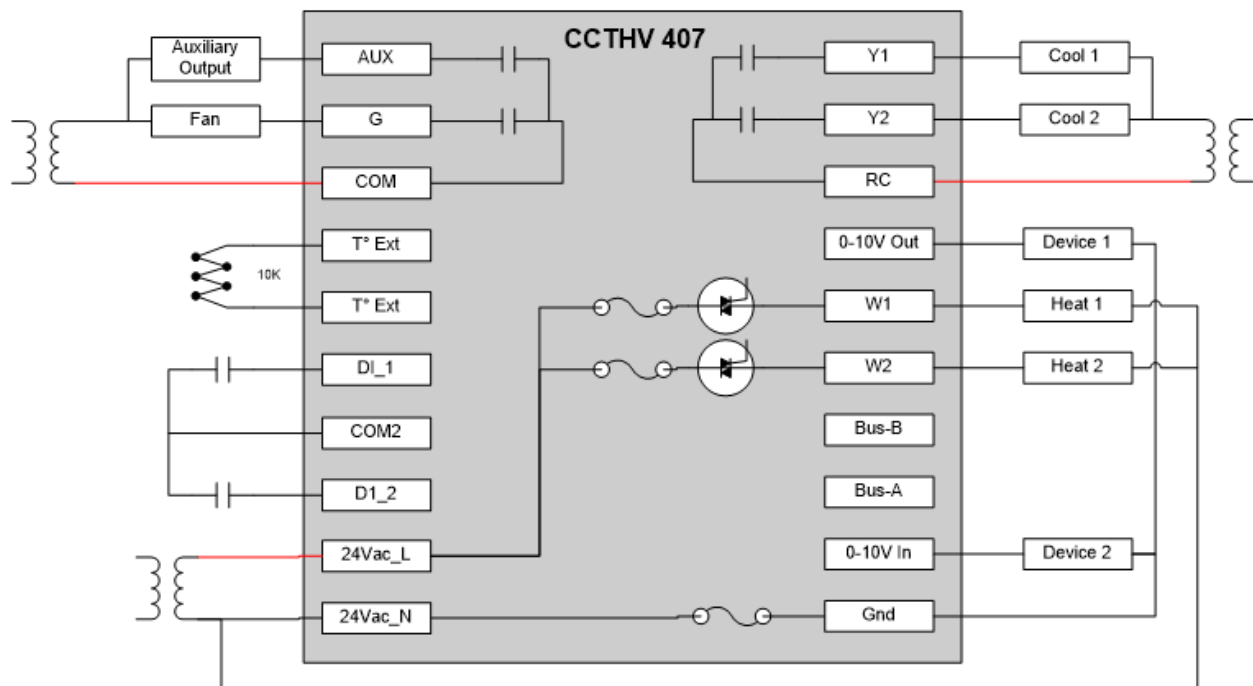


Figure 6 - 3 transformers wiring

4 CCTHV Inputs

4.1 Digital

The two digital inputs must be used with COM2. Terminal COM2 supplies 30Vdc and the digital inputs sense if this voltage is present or not. A contact must be closed between COM2 and one of the inputs to detect a signal. Those inputs are optically isolated.

4.2 0-10Vdc

This input could read as a 0 to 100% and °C value using the corresponding BACnet objects.

The thermostat algorithm can use a remote temperature sensor instead of the internal sensor. See the “Temperature” section.

The input impedance is 30KΩ.

4.3 Remote temperature

Terminals used for a remote temperature sensor of 10KΩ @ 25°C. Here are some compatible temperature curves:

- Dale curve #1
- ATP curve Z
- BAPI curve #2
- Mamac curve #12
- Greystone curve #2.

The thermostat algorithm can use the remote temperature sensor instead of the internal sensor. See the “Temperature” section.

5 CCTHV Outputs

5.1 2x Triac

The two triac outputs are protected with 550 mA fuses. Those fuses reset automatically when power supply is turned off from the thermostat for a few seconds.

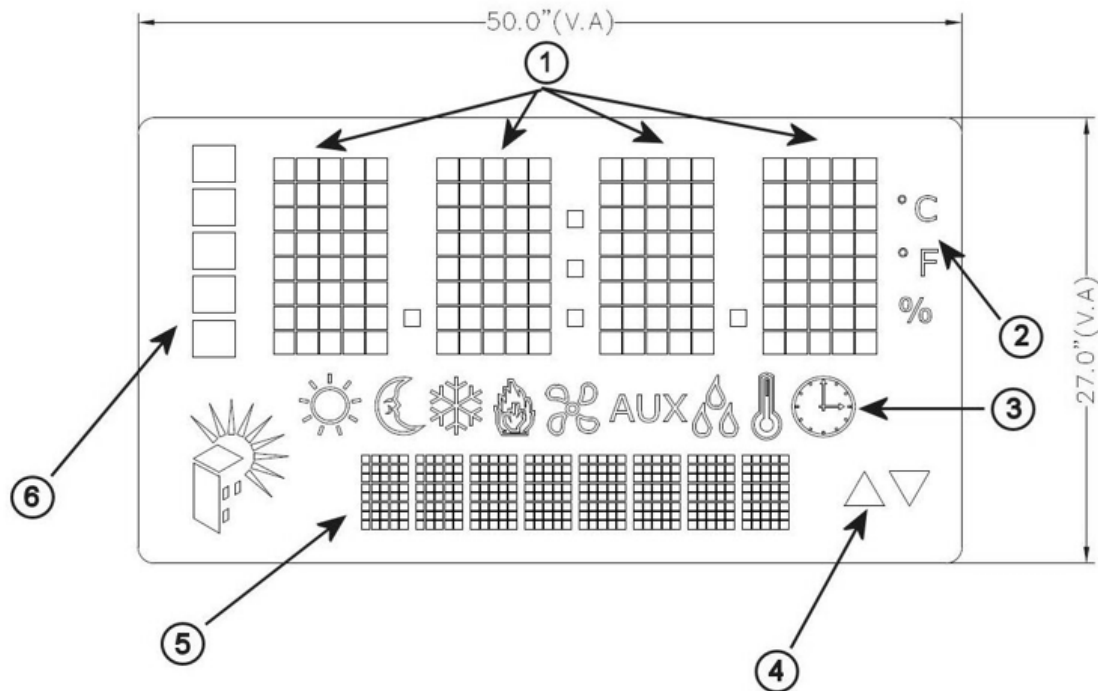
5.2 4x Relay

The 4 relay outputs are independent but are grouped from 2 common terminals. Terminal RC is tied to Y1 and Y2 and COM is tied to G and AUX.

5.3 0-10Vdc

0-10Vdc output is protected against short-circuits and inverted polarity from a 140 mA fuse. However, the use of a maximum 5 mA load or lower is recommended since it may generate heat and influence temperature readings of the device. The fuse resets automatically when power supply is turned off from the thermostat for a few seconds.

6 General usage



Liquid crystal display

Figure 7 - Liquid crystal display

1 - Main display characters. For example, show the temperature.

2 - Units for main display: degrees Celsius, degrees Fahrenheit or percent.

3 - Pictograms showing actual thermostat mode

☀	Day mode (occupied)	AUX	Auxiliary output activated
☾	Night Mode (unoccupied)	💧	Humidifier in use
❄	Cooling enabled	🌡	Temperature mode
🔥	Heating enabled	🕒	Time / Alarm
⚙	Fan enabled		

4 - Display a setpoint change is in progress. Can also tell if it is above or below the limit where applicable.

5 - Secondary text to identify main display characters.

CRISTAL

6 - Progress bar graph.

7 Software Algorithm

This software provides simple thermostat functions. The inputs and outputs of the thermostat can be configured as needed using the Cristal Controls “BACnet Browser” software application. Up to 2 cooling stages dry-contacts type can be configured and up to 5 heating stages (2 stages dry-contacts type, 2 modulating outputs and an emergency heating stage).

With the BACnet objects, it is possible to: apply occupied or unoccupied mode, do some shedding by adjusting maximum power for the thermostat and select heating or cooling mode only.

All outputs can be controlled directly, but depending on the thermostat configuration, they can also be controlled from the thermostat application.

7.1 Temperature

After being powered ON, it takes at least 15 minutes before temperature become stable and accurate. This delay must elapse before the electronic components warm the enclosure and stabilize readings.

Also, an internal filtering algorithm is applied on temperature readings to avoid fast glitches on readings. For large permanent changes, this has the effect of seeing 95% of the change in 3 minutes.

The thermostat algorithm continues even if the temperature is out of range. If the temperature is below 10° Celsius, the thermostat uses a temperature value of -99° Celsius for his internal calculation. If the temperature is over 60° Celsius, the thermostat uses a temperature value of 99° Celsius for his internal calculation.

7.2 Thermostat configuration

The thermostat configuration is done using the “Config.bin” file available in the BACnet network. The file is used to configure the 2 cooling stages, the 5 heating stages and to choose the used outputs for the activated stages. The temperature sensor can be configured to use the internal sensor or add an external sensor connected to the corresponding input. Unused relays and inputs can be configured to accomplish some specific tasks.

8 Menu - User interface

This section shows different screens on the display and their functionalities.

8.1 Version



After the thermostat is being powered up, it displays the name of the firmware and the current software version number for a period of 3 seconds. Then the display changes to the room temperature.

8.2 Room temperature



This is the default screen being displayed by the thermostat. To the left a bar graph shows heating demand in 5 x 20% steps.

If the round knob is being rotated, the display goes to the room temperature setpoint.

The display can be configured to display in °F or °C by installing a jumper (supplied) on JP4 on the back of the thermostat.

When the temperature falls below 10° Celsius, the screen displays “LOW”. When the temperature is over 60° Celsius, the screen displays “HIGH”. If the temperature falls under around -5° Celsius, the temperature sensor is considered as disconnected and the screen displays dashes “- - -”. If the temperature goes over around 70° Celsius, the temperature sensor is considered as shorted and the screen displays dashes. “- - -”.

8.3 Room setpoint



This screen is displayed while changing the room temperature setpoint. The 2 arrows indicate we are changing the setpoint. Also, the temperature setpoint is blinking once a second to let you know you are changing the setpoint and not seeing the temperature reading.

When the round knob is not moving for 5 seconds, the display goes back to the room temperature.

9 Menu - Configuration

Network configurations can be changed by installing the (supplied) jumper on JP3 **before powering** the thermostat. JP3 can be used to cycle through the menus if no buttons are installed on the thermostat. If no interaction occurs within 5 seconds, the next menu is displayed automatically.

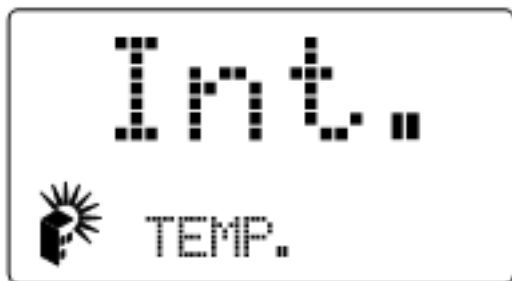
WARNING: A misuse of these parameters can cause network communication problems on this thermostat and other devices on the network. Consult your BACnet network administrator about accurate parameters to be configured.

The configurations are saved once the entire menu has been navigated, except for the “Temperature Probe Type” setting, which is saved as soon as the next menu is accessed.

9.1 Version

On a standard power up, display shows the name of the firmware and the current software version number for a 3 seconds period. After that, the display shows to the MAC MSTP address.

9.2 Temperature Probe Type



This setting allows to select the type of temperature probe used: “Internal,” “External,” or “0-10 V.” This configuration is saved as soon as the next menu is accessed.

9.3 MAC MSTP address



This parameter allows changing the address used on the RS-485 twisted pair network. We can see at the bottom of the display “MAC Addr”.

Rotating the round knob can change the MAC address. The values are displayed in hexadecimal. Possible values are from 0 to FE. This address must be unique for every device connected on the same RS-485 network segment.

When button “*” is pressed, the display changes for the maximum MSTP master.

9.4 *Maximum MSTP master*



This parameter allows adjustment of the maximum master searched by the MSTP protocol. We can see at the bottom of the display “Max Mstr”.

Rotating the round knob can change this value. The possible values are from 0 to 127 and the default value is 127. This can be decreased according to the device with the highest address to optimize search time from MSTP protocol.

When button “*” is pressed, the display changes for the serial baud rate.

9.5 *Serial Baud Rate*

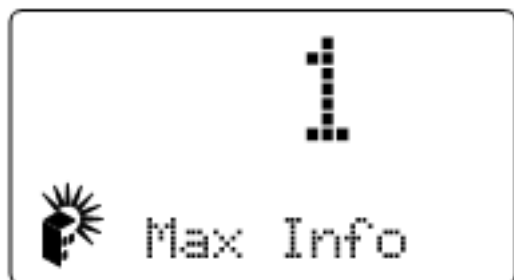


This parameter allows adjusting RS-485 serial communication speed. We can see at the bottom of the display “BaudRate”.

Rotating the round knob can change this value. The possible values are 9K, 19K, 38K, 57K, 76K, 115K, and 230K. They represent the serial speed in kilo bits per second. The exact values for “Baud Rate” are: 9600, 19200, 38400, 57600, 76800, 115200, and 230400. The default value is 38K for 38400 baud.

When button “*” is pressed, the display changes for MSTP maximum info frames.

9.6 MSTP maximum info frames



This parameter allows adjusting the maximum number of messages sent by the device before passing the token to another MSTP device.

Rotating the round knob can change this value. Possible values are between 1 and 32. Usually this value is 1. Increasing this value will allow this device to communicate more often than the others.

When button “*” is pressed, the display changes for the device identifier.

9.7 Device Identifier



This parameter allows adjusting the BACnet device ID. This number must be unique on the whole BACnet network and must be between 0 and 4194302 (0x3FFFFE).

Rotating the round knob can change this value. The device ID is displayed as a hexadecimal number. Each number is changed individually when displayed between the two arrows “>” and “<”. Each time the button “*” is pressed, the arrows and the number being modified is moving to the right.

After the “*” button has been pressed 6 times, the display changes for the temperature calibration.

9.8 Temperature calibration



This parameter allows calibrating the temperature as read by the thermostat. We can see at the bottom of the display “Offset”.

Rotating the round knob can change this value. This will be added to the thermostat reading.

When button “*” is pressed, the display changes for the Read Property Multiple configuration.

9.9 Minimum 0-10V Probe



This menu is available only when the selected probe type is “0-10 V.” It allows to configure the minimum temperature (in °C) that can be measured by this probe.

9.10 Maximum 0-10V Probe



This menu is available only when the selected probe type is “0-10 V.” It allows to configure the maximum temperature (in °C) that can be measured by this probe.

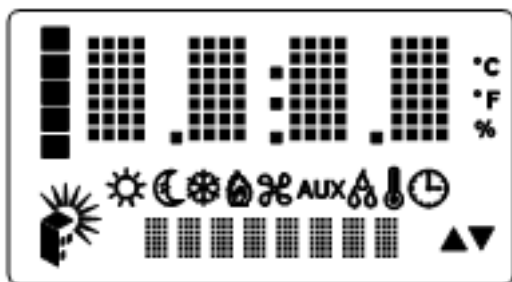
9.11 Read Property Multiple configuration



This parameter allows the activation of “Read property multiple” BACnet message type. When a controller does not manage this type of message correctly, it is suggested keeping this parameter disabled.

When button “*” is pressed, the display changes for the LCD test display.

9.12 LCD test display



The last screen is the LCD test. It allows checking that every segment is displaying properly.

When button “*” is pressed, the display exit from the configuration menu and the displays go to the main screen with local room temperature.

10 Communication

The communication to the CCTHV-407 is done using BACnet MSTP protocol on a RS-485 physical link. The BACnet network allows the reading of the thermostat states and the writing of new setpoints and configurations.

Network Characteristics

When the CCTHV-407 thermostat is at one end of a RS-485 network, we may enable the terminating resistor by installing JP1 (supplied) to end the network or use an external resistor. **(Call Cristal Controls for model number and order)**

For more information, refer to the Cristal Controls manual “Setting up a RS-485 Network”.

10.1 Objects

Next is the BACnet objects list. This list is simple and many objects allow direct control on inputs and outputs of the thermostat.

Object	Instance	Name	Min Value	Max Value	Default	Description	Notes
Device		CCTHV-407-BAC	0	4194302			
BI	0	DIGITAL IN 1	0 = OFF	1 = ON		Digital input DI 1	
BI	1	DIGITAL IN 2	0 = OFF	1 = ON		Digital input DI 2	
BO	0	RELAY AU	0 = OFF	1 = ON	0 = OFF	Auxiliary Relay “AU”	3
BO	1	RELAY G	0 = OFF	1 = ON	0 = OFF	Fan Relay “G”	3
BO	2	RELAY Y1	0 = OFF	1 = ON	0 = OFF	Cooling Relay “Y1”	3
BO	3	RELAY Y2	0 = OFF	1 = ON	0 = OFF	Cooling Relay “Y2”	3
BV	0	OCCUPIED MODE	0 = UNOCCUPIED	1 = OCCUPIED	1 = OCC	Occupied mode. Will allow thermostat to change the setpoint.	
BV	1	FAN STATUS	0 = OFF	1 = ON	0 = OFF	Fan Relay state feedback	

Object	Instance	Name	Min Value	Max Value	Default	Description	Notes
AI	0	TEMPERATURE INT	- 327.6° C	327.6° C		On-board internal 10K temperature sensor.	
AI	1	TEMPERATURE REM	- 327.6° C	327.6° C		Optional remote 10K temperature sensor.	
AI	2	INPUT 0-10V	0.0%	100.0%		From 0-10 Volts DC analog input "0-10_In".	
AI	3	TEMPERATURE 0-10V	- 3276.7° C	819.0° C		Optional 0-10V temperature sensor.	
AO	0	TRIAC W1	0.0%	100.0%	0.0%	Heating Triac "W1". Value will pulse at 1 Hz.	3
AO	1	TRIAC W2	0.0%	100.0%	0.0%	Heating Triac "W2". Value will pulse at 1 Hz.	3
AO	2	OUTPUT 0-10V	0.0%	100.0%	0.0%	0-10 Volts DC analog output "0-10_Out".	3
AV	0	OFFSET INT	-10.0°C	10.0°C	0.0°C	Internal temperature calibration.	4
AV	1	OFFSET REM	-10.0°C	10.0°C	2.4°C	External temperature calibration.	4
AV	9	SETPOINT HEAT	- 327.0° C	327.0° C	20.0°C	Temperature setpoint for heating.	2, 6, 7
AV	10	SETPOINT COOL	- 327.0° C	327.0° C	22.0°C	Temperature setpoint for cooling.	2, 6, 7
AV	2	SETPOINT HEAT UNOCC	- 327.0° C	327.0° C	18.0°C	Unoccupied temperature setpoint for heating.	1, 4, 6, 7
AV	3	SETPOINT COOL UNOCC	- 327.0° C	327.0° C	25.0°C	Unoccupied temperature setpoint for cooling.	1, 4, 6, 7
AV	4	SETPOINT MIN	10.0°C	70.0°C	15.0°C	Minimum temperature setpoint adjustable on the thermostat.	4

Object	Instance	Name	Min Value	Max Value	Default	Description	Notes
AV	5	SETPOINT MAX	10.0°C	70.0°C	25.0°C	Maximum temperature setpoint adjustable on the thermostat.	4
AV	6	HEATING STATUS	0.0%	100.0%	0.0%	Heating status of the thermostat, output independent.	4, 6
AV	7	COOLING STATUS	0.0%	100.0%	0.0%	Cooling status of the thermostat, output independent.	4, 6
AV	8	POWER LIMIT	0.0%	100.0%	100.0%	Allowed maximum value for the outputs. 0% = Full Shedding.	4
AV	11	SETPOINT HEAT LIMIT	-99.0°C	99.0°C	99.0°C	Disable shedding if temperature fall below this limit.	1, 4, 8
AV	12	SETPOINT COOL LIMIT	-99.0°C	99.0°C	-99.0°C	Disable shedding if temperature increase over this limit.	1, 4, 8
AV	13	TEMPERATURE 0-10V MIN	-3276.0°C	3276.0°C	-50.0°C	Minimal value in °C for the 0-10V input. Value in °C corresponding to 0V.	
AV	14	TEMPERATURE 0-10V MAX	-3276.0°C	3276.0°C	50.0°C	Maximal value in °C for the 0-10V input. Value in °C corresponding to 10V.	
MSV	0	HVAC MODE	1	6	1	System operating mode selection.	9
MSV	1	FAN MODE	1	5	2	Fan mode behavior adjustment.	5
FILE	0	Config.bin	-	-	-	Thermostat configuration file	

Notes:

1. Negative values will be relative to the occupied setpoint.
2. User setpoint adjustment from thermostat write at a configurable priority in the “Settings” tab of the software “BACnet Browser” (see the “Settings” tab).

3. The thermostat writes the object at a configurable priority in the “Settings” tab of the software “BACnet Browser” (see the “Settings” tab).
4. No priority
5. Mode definition: “On” : always enable, “Auto”: enable when heating or cooling, “Fan Cool”: stay enable when last active stage was a cooling stage, “Fan Heat”: stay enable when last active stage was a heating stage, “As schedule”: enable when occupancy mode is occupied, “Auto” otherwise.
6. When no heating stages are configured, the “Reliability” properties of the objects linked to heating take the “No Output” value. Same thing happens to objects linked to cooling when no cooling stages are configured.
7. Using the 0-10V temperature input, the minimum and maximum values depend on the objects “TEMPERATURE 0-10V MIN” and “TEMPERATURE 0-10V MAX”.
8. Temperature setpoints less comfortable than the occupied setpoint are ignored.
9. State definition: 1 = “Auto”: enable heating and cooling, 2 = “Heat”: heating only, 3 = “Cool”: cooling only, 4 = “Emergency Heat”: emergency heat stage, 5 = “Fan”: fan only, no heating or cooling, 6 = “Off”: all stages disabled.

10.2 Proprietary Properties

In addition to the standard BACnet properties, the Device object exposes vendor proprietary properties.

Property ID	Name	Type	Access	Default	Description
512	MAC ADDRESS	Unsigned	Read / Write		MSTP MAC address of the thermostat on the RS-485 network. Writable range 0 to 254.
513	BAUDRATE	Unsigned	Read / Write	2 = 38400	RS-485 baud rate index: 0 = 9600, 1 = 19200, 2 =

Property ID	Name	Type	Access	Default	Description
					38400, 3 = 57600, 4 = 76800, 5 = 115200, 6 = 230400.
901	SYSTEM INFO TEMPERAT URE	Real	Read only		Temperatur e in degree celcius measured by the on- board microcontrol ler sensor.
903	SYSTEM INFO UPTIME	Unsigned	Read only		Elapsed time in seconds since the last device restart.

11 Configuration

The thermostat can be configured using the Cristal Controls “BACnet Browser” software. This software allows you to read (“Read Config” button) and write (“Send Config” button) the CCTHV-407 configuration. The configuration can also be saved (“Save Config” button) and read (“Load Config” button) the configuration in a file. The button “Clone Config” allows sending a similar configuration to multiple thermostats. Here are the different CCTHV-407 configurations and their uses.

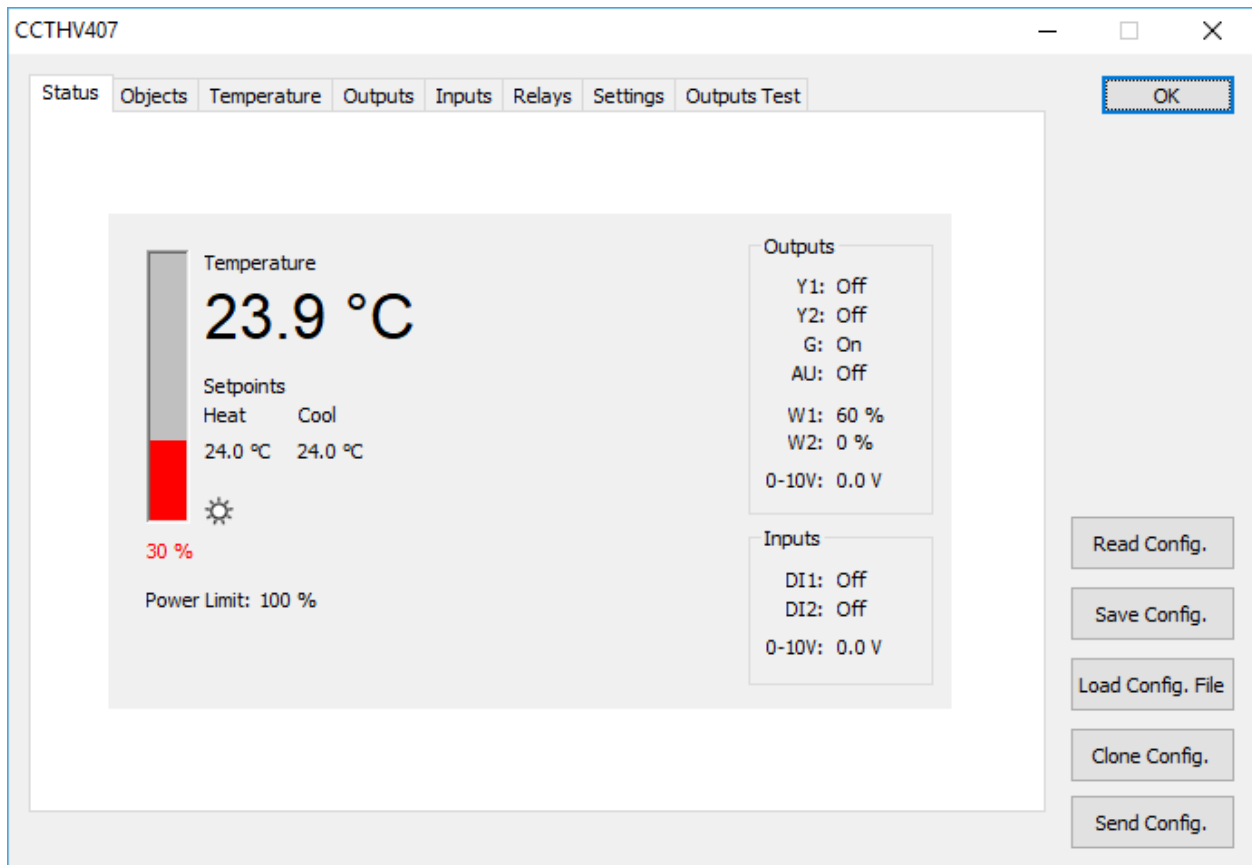


Figure 8 - Status

11.1 “Objects”

The screenshot shows the 'CCTHV407 - CCTHV-407-BAC' window with the 'Objects' tab selected. The window has a standard Windows-style title bar and a tabbed interface. The 'Objects' tab is active, showing configuration fields for a BACnet device. The left pane contains fields for device identification and temperature sensor data. The right pane contains setpoint configuration fields, including occupied and unoccupied heating and cooling setpoints, and operating modes. A vertical column of buttons on the right allows for saving, loading, and cloning configurations. At the bottom, 'Read All' and 'Write All' buttons are present.

Figure 9 - Objects tab

The “Objects” tab provides access to the configuration of BACnet objects. You can configure the “Device Id”, the “Device Name” as well as adjustments to the two temperature sensors. Different setpoints can be changed, and the maximum and minimum allowable when the user changes the setpoints. Temperature read by the 2 probes is also shown (Note: temperatures are read only once and are not updated). You can change the operating modes of the thermostat (“HVAC Mode” and “Fan Mode”).

The “SET-POINT HEAT UNOCC” and “SET-POINT COOL UNOCC” values indicate the setpoint in heating and cooling use when the thermostat is in unoccupied mode. A positive value indicates the setpoint to be used directly. A negative value (between 0 ° C and -5 ° C) indicates that the unoccupied setpoint is relative to the value of the occupied setpoint. Unoccupied heating setpoint is equal to the occupied heating setpoint plus the setpoint unoccupied. The cooling setpoint is equal to the unoccupied cooling setpoint occupied subtracted from the unoccupied setpoint.

11.2 Temperature

This tab is to select the temperature sensor to be used, either the thermostat internal sensor, an external sensor to be connected to the corresponding input or a temperature reading connected to a 0-10V input. See the “Remote Temperature” section for the specifications required to use an external probe. See the “0-10Vdc” section for the specifications required to use the 0-10Vdc input. The value of “Temp. filter time” indicates the time constant of the filter imposed on the temperature. This value limits the rate of change on the temperature reading, thus eliminating temporary disturbances. It is recommended keeping the default setting at (60). When this value decreases, the temperature varies more rapidly, and it varies more slowly when increasing the value.

11.3 HVAC Outputs

The screenshot shows the 'Panel CCTH - CCTH-407' window with the 'Outputs' tab selected. The configuration is organized into several sections:

- Fan:** Radio buttons for Y1, Y2, AU, G (selected), None, and a checkbox for NC.
- Cool1:** Radio buttons for Y1, Y2, AU, G, None (selected), and a checkbox for NC. A checkbox 'Off on Cool2' is also present.
- Cool2:** Radio buttons for Y1, Y2, AU, G, None (selected), and a checkbox for NC.
- Heat2:** Radio buttons for Y1, Y2, AU, G, W1, W2, 0-10V, None (selected), and checkboxes for 'NC / Inverted' and 'Off on Heat3'.
- Heat3:** Radio buttons for Y1, Y2, AU, G, W1, W2, 0-10V, None (selected), and checkboxes for 'NC / Inverted'.
- Reversing valve:** Radio buttons for Y1, Y2, AU, G, None (selected), and a checkbox for NC.
- Emg. Heat:** Radio buttons for W1, W2, 0-10V, Y1, Y2, AU, G, None (selected), and a checkbox for 'Inverted / NC'.
- Heat1:** Radio buttons for W1 (selected), W2, 0-10V, None, and a checkbox for 'Inverted'.
- Heat4:** Radio buttons for W1, W2, 0-10V, None (selected), and a checkbox for 'Inverted'.

On the right side of the window, there are buttons for 'OK', 'Annuler', 'Read Config.', 'Save Config.', 'Load Config. File', 'Clone Config.', and 'Send Config.'.

Figure 10 - HVAC Outputs tab

This tab allows the “outputs” configuration use for heating and cooling. You can configure the “Fan”, “Cool1”, “Cool2”, “Heat2” and “Heat3” stages on the desired output. Those stages are ON/OFF stage. The “Heat1” and “Heat4” stages are used as modulating outputs. Select “None” to indicate that a stage is not used in the thermostat configuration.

On the output configuration the option “NC / Inverted” or “Inverted” is used to indicate that the output is normally closed (i.e. the relay makes contact) or the analog output is at 100% when the corresponding stage is not enabled. When modulating the output, the signal will also be reversed and then use its maximum output when demand is 0%. The output is at its minimum when demand is higher.

The “Off on Cool2” and “Off on Heat3” options of “Cool1” and “Heat2” stages indicate that when moving to a higher stage (“Cool2” in the case of “Cool1” and “Heat3” in the case of “Heat2”), the lower stage is disabled. When you return to the stage below, it is reactivated.

A reversing valve can be configured. The relay then makes contact when the thermostat is in cooling mode. It can also reverse this configuration by using the “NC” and thus make contact when the thermostat is on heating mode.

“Cool1”, “Cool2”, “Heat2” and “Heat3” stages are considered using a compressor. Starts and stops of these 4 stages are limited by the properties “Min. ON Time” and “Min. Time OFF” in the “Settings” tab.

The “Emg. Heat” stage is used to configure a modulated or relay output to be used when the system is on the “Emergency Heat” mode. The options “NC / Inverted” reverse the operating mode of the output according to its type used.

11.4 Digital Inputs

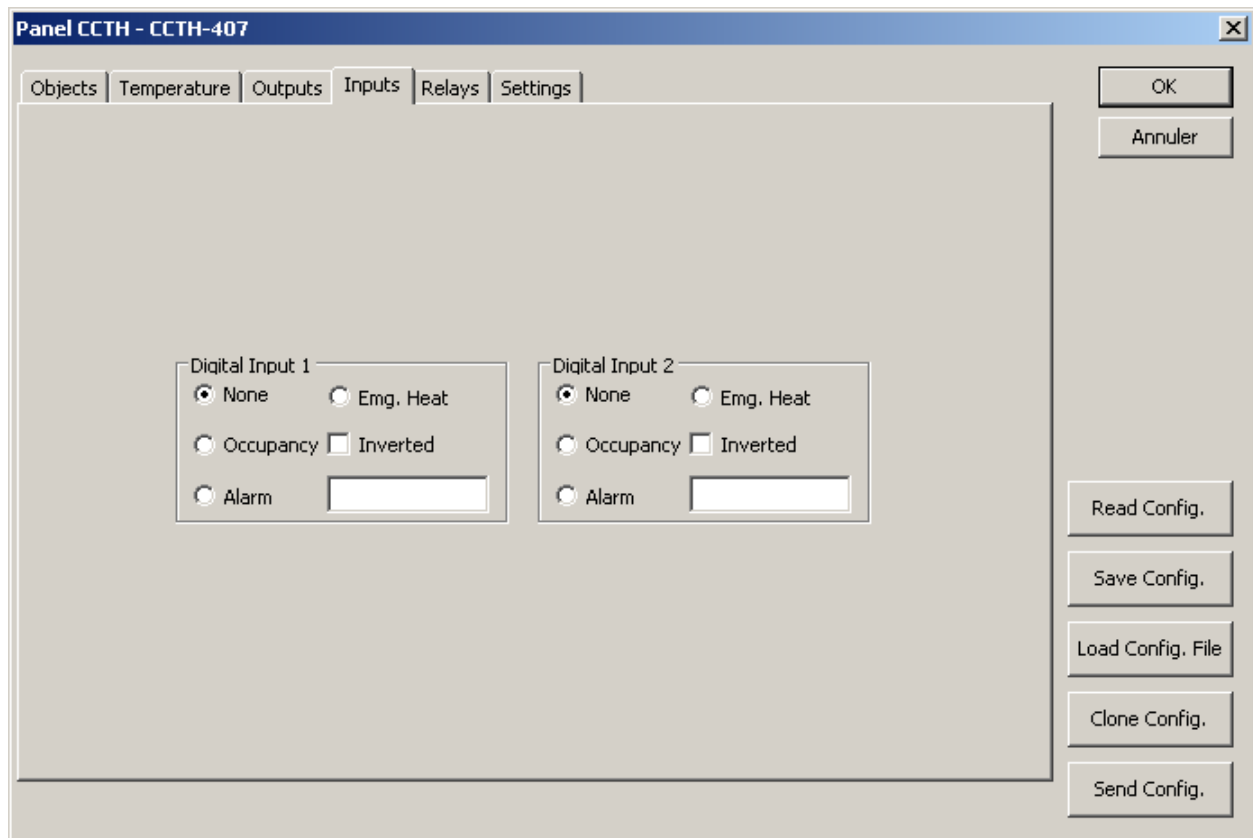


Figure 11 - Inputs tab

This tab allows the configuration of the digital inputs so they perform different tasks. The option “Occupancy” allows the input to change the occupancy mode of the thermostat. The option “Alarm” allows the input to control the display of an alarm that will be displayed on the screen.

The alarm message is limited to 8 characters and must be entered in the text box option. The option “Emg. Heat” allows the activation of the “Emergency Heat” stage by the digital input. The various options are normally activated when the digital input makes contact, and can reverse this operation with the “Inverted” checkbox.

11.5 Relays

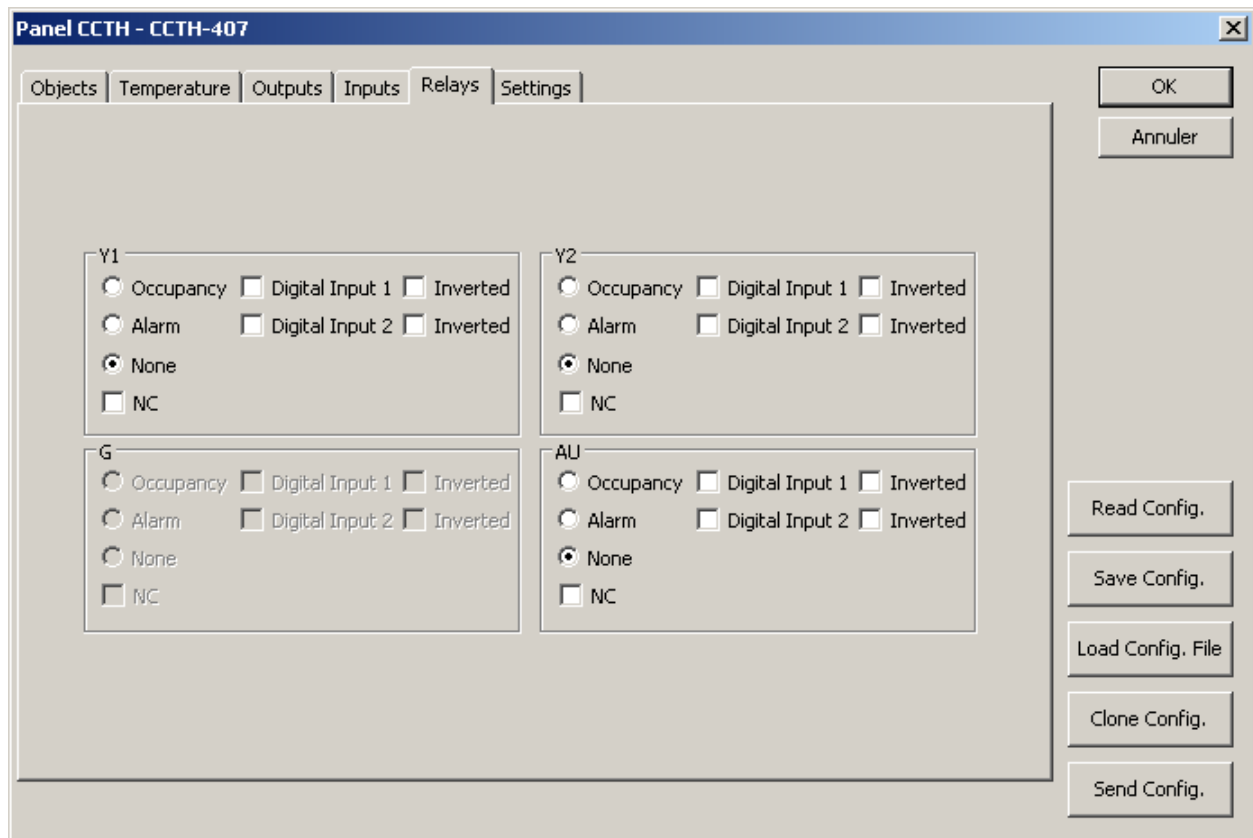


Figure 12 - Relays tab

This tab allows the configuration of the relays so that they perform other tasks than output for the different stages of heating and cooling. When a relay is already used in the “Output” tab, it is not configurable in the “Relays” tab. The “Occupancy” option has the relay to change its state when the occupancy of the thermostat changes. The relay then makes contact when the thermostat is in occupancy but using the “NC” option can reverse it. The option “Alarm” has the relay to make contact when a selected digital input is connected. Both digital inputs can be activated for a relay so the relay will make contact when one of the digital inputs is connected. The “Inverted” options enable the corresponding relay contact when the input is open and the “NC” option allows the relay to be normally closed.

11.6 System Settings

Figure 13 - Settings tab

This tab allows the configuration of different numerical values managing the system behavior. Here are the configurable numerical values and their descriptions.

Values	Description	Units	Default	Note
"Dead band"	Difference between the heating and cooling setpoints.	Degrees Celsius	1.0	
"Hysteresis"	Difference between the activation and deactivation of the "Heat2", "Heat3",	Degrees Celsius	1.0	

Values	Description	Units	Default	Note
	“Cool1” and “Cool2” stages.			
“Stage diff.”	Difference between Cooling or Heating stages (ex. : between “Cool1” and “Cool2”)	Degrees Celsius	1.0	
“Prop. Band”	Gap on which the modulated heat stages increase the output from 0% to 100%	Degrees Celsius	1.0	
“Override time”	Length of the bypass of the unoccupied setpoint.	Seconds	3600	
“TimeOut Comm.”	Maximum delay between each writing from the master controller. Zero = disable.	Seconds	0 (Inactive)	1
“Delay Fan”	Delay between the Cooling / Heating deactivation and the deactivation of the fan.	Seconds	60	
“Temp. Filter time”	Filter time constant of the temperature.	Seconds	60	2

Values	Description	Units	Default	Note
"Output Priority"	Priority the CCTHV-407 use to write in the BACnet objects.	No Units	8	
"Min. time ON"	Minimum operation time of the compressor once it is running. (Cool1 and Heat2)	Seconds	0	
"Min. time OFF"	Minimum operation time of the compressor once it is not running. (Cool1 and Heat2)	Seconds	0	
W1 Time	Triac W1 period	Seconds	1	
W2 Time	Triac W2 period	Seconds	1	

Note:

1. After the delay has expired, the thermostat sees that a problem has occurred. It changes the value of the BACnet object "Power Limit" to 100%, it changes the occupancy to "occupy" and change the value of the BACnet "HVAC Mode" to "Auto".
2. On a temperature changes, this value indicates the time taken by the system to allow the change to be considered at 63%. 2 times after that period, the change is considered to 86% and 95% after 3 times this period. This value helps the reading not to vary too quickly during an abrupt temporary temperature variation.

11.7 Configuration Buttons

The “Read Config”, “Save Config”, “Load Config”, “Clone Config” and “Send Config” buttons are used to manage the configuration of the “Temperature”, “Outputs”, “Input”, “Relays” and “Settings” tabs. The “Objects” tab performs reads and writes in the BACnet objects available directly in the tab. Here are the different buttons functions:

- “Read Config”: Re-read the CCTHV-407 configuration.
- “Save Config”: Write the CCTHV-407 configuration in a file.
- “Load Config”: Read a configuration from a file.
- “Send Config”: Send the configuration to the CCTHV-407.
- “Clone Config”: see next section.

11.7.1 “Clone Config.” Button

When using the button “Clone Config.” The following interface appears:

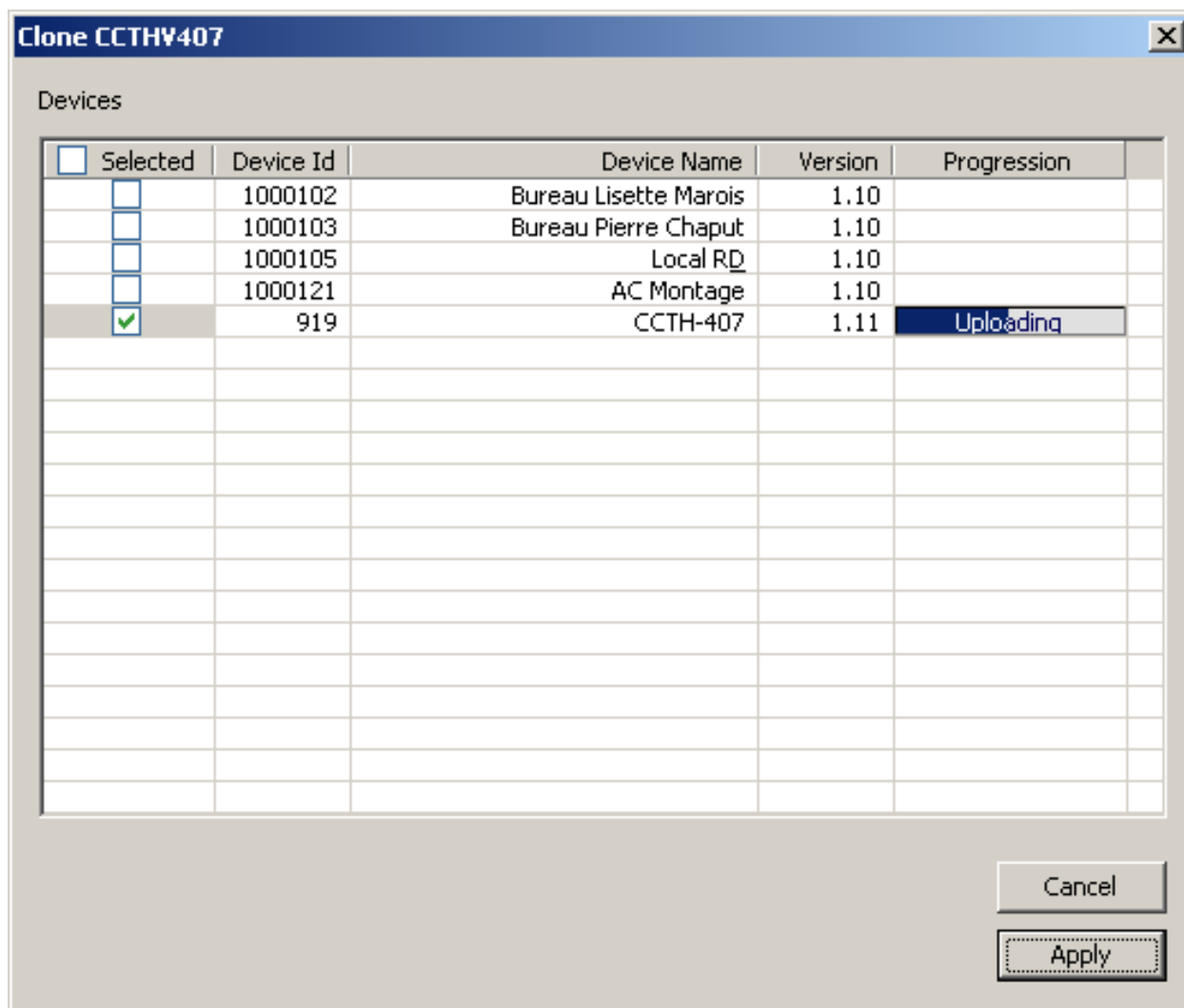


Figure 14 - “Clone config.” interface

The configuration defined in the tabs “Temperature”, “Outputs”, “Input”, “Relays” and “Settings” can be sent to selected thermostats in the column “Selected”. Pressing the column headers will sort the values below. The configuration is sent to the selected thermostats by pressing the button “Apply” and you can follow the progress of sending in the column “Progress”.

11.8 System operation

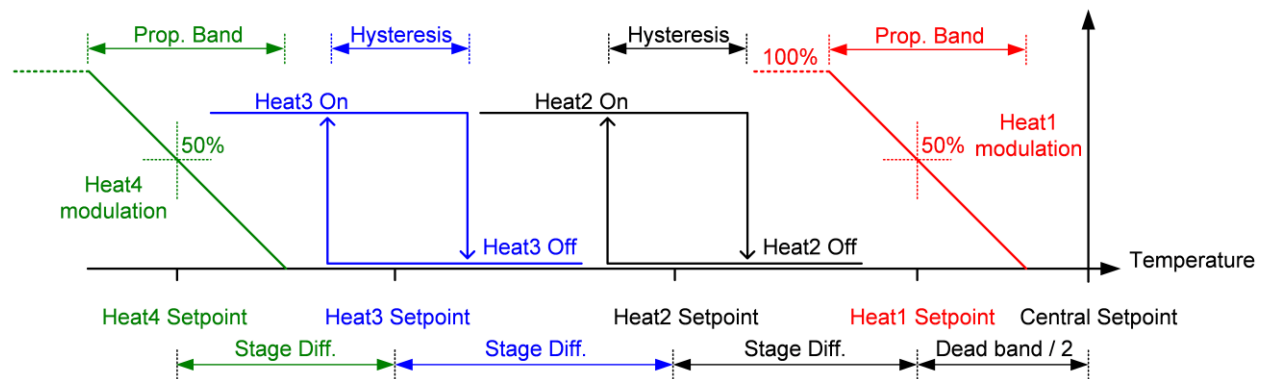


Figure 15 - Heating schematic

Above is a diagram showing the heating operation. This scheme allows you to view changes made by each configuration on the system dynamics.

Diagram showing the operation of the cooling:

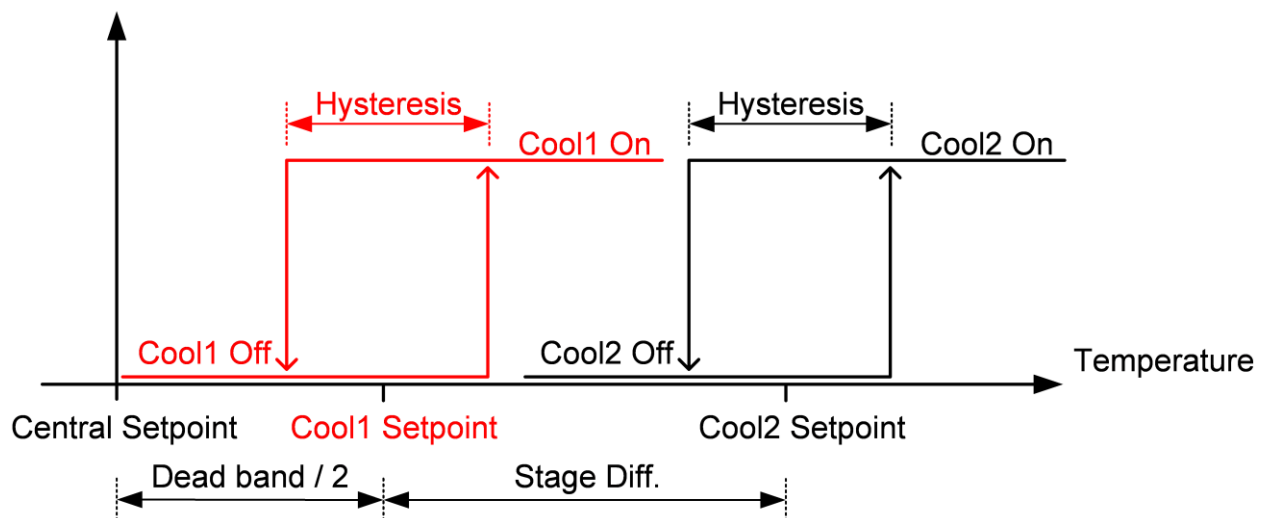


Figure 16 - Cooling schematic

The “Central Setpoint” value is the setpoint displayed on the thermostat LCD and is changed by the user. The value “Stage Diff” applies a difference between each configured stage. If a stage is not configured, the upper stages will take the place of the missing stage. Thus, if the “Heat1” stage is absent, the “Heat2” stage will take place at the “Heat Setpoint” value, and the “Heat3” stage will move to the “Heat Setpoint - Stage Diff” value and so on. The same thing happens with cooling, but the use of a “Cool2” stage when no “Cool1” stage is configured may seem absurd.

When configuring and using a “Emg. Heat” stage, it is placed at the value “Setpoint Heat” as the “Heat1” stage.

12 Dimensions

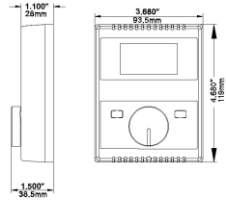


Figure 17 - CCTHV-407 dimensions

13 Models



Figure 18 - Blind Thermostat



Figure 19 - Thermostat with a round knob

CRISTAL

14 Hardware specifications

- Microcontroller : Freescale MCF51QE128
- Communication: RS-485 / BACnet MSTP.
- Supply Voltage : 18 - 28 Vac Half Wave
- Supply Current : 40 mA typical, 50 mA max
- Operating temperature : 10°C to 45°C (50°F to 113°F)
- Storage temperature : -30°C to 80°C (-22°F to 176°F)

14.1 Outputs

- 4x Dry contact: 1A @ 24Vac / 30Vdc
- 2x Triac : fused @ 550mA
- 1x Analog 0-10Vdc fused @ 5mA

14.2 Inputs

- 2x Dry contact (with 1 common for both)
- 1x Analog 0-10Vdc (in 30K Ω impedance)
- 1x 10K Ω thermistor input

14.3 Jumpers

- JP1 : 120 Ω RS-485 termination.
- JP2 : Display at 0.1°C if installed, otherwise at 0.5°C.
- JP3 : Enable configuration menu if installed.
- JP4 : Degrees Fahrenheit if installed, otherwise degrees Celsius.

15 Legal Notice

No representation or reproduction, in whole or in part, may be made without the consent of Cristal Controls Ltd. The information contained in this document is subject to change without notice and does not represent a commitment on the part of Cristal Controls Ltd. Cristal Controls Ltd assumes no responsibility for any errors that may appear in this document.

© Cristal Controls Ltd. All rights reserved 1996 - 2026.