

Hot Water Heating Controller HWHC2100

Operation Manual

1. Introduction

The Hot Water Heating Controller HWHC2100 (Fig 1) provides control of the Building's mixing valve, heat exchange valve or the burner operations to regulate the heating water temperature or the amount of thermal energy supplied to the Building. The HWHC2100 adjusts the temperature of the heating water, calculating the target temperature, in response to changes to the outdoor temperature. The HWHC2100 controls the motorized valve and the circulation pumps. Alternatively, the control could be provided directly to the burner operations.

In Auto mode the HWHC2100 distributes heat energy entering in the building in accordance with weather, outdoor temperature and installed parameters. Depending on the controller's configuration the main parameter of the regulation could be either the hot water in house input the supply temperature (system water temperature) or condensate return temperature (return water temperature).

HWHC2100 works as a standalone controller and can be connected to a Local Server, which provides additional parameters adjustments to HWHC2100 based on apartment's indoor real time temperature. This feature will improve the heating supply and distribution efficiency and can eliminate the apartments over or under heating. When the HWHC2100 is connected to the Local Server it can be monitored and controlled from the local Intranet and/or Internet with appropriate authentication.



Fig1. HWHC2100. Front view

The HWHC2100 features:

- Configurable to controls the zone valve or boilers to regulate the circulated water temperature.
- Adaptable to different type of actuators: floating point, 4-20mA, 0- 5V, 0-10V or 135ohm input.
- Automatic positioning of the zone valve or adjusting the boilers stages in accordance with operation settings and measured temperatures.
- Manual Control Mode.
- Displays the valve position circulation pumps and/or boilers status.
- Day and Night modes of operation with programmable time durations.
- Programmable heating season dates.
- Flexible selection of the feedback control temperature source (system (supply) or return).
- Extended Heat-Up period up to 100 minutes with step of 1 min.

- Morning Boost period up to 120 min or Vari-Boost (the length of the Boost time depends on the Outdoor temperature).
- Adjustable Indoor Temperature Cutoff (Day/Night) Set-Point. Based on the average apartment's temperature (Average Indoor Temperature) supplied from the host.
- Adjustable Return Temp or System (Supply) Temperature Cutoff Set-Points.
- Adjustable Zone of no action (D_Band) near the any Cutoff Set-Point.
- Adjustable Cut-Off depth from 0-100%.
- Displays outdoor and hot water heating system supply and return temperature.
- Detects for open and short of the temperature sensors input and displays on the status screen.
- Adaptable to different types of standard temperature sensors and valve motors.
- Provides compensator control for unusual weather conditions.
- Programmable maximum and minimum system (or return) water temperature.
- Internal real-time clock/calendar with backup battery.
- Automatic Daylight Saving Time clock adjustment.
- Automatic circulation pumps ON/OFF control with an adjustable outdoor cut-off.
- Automatic storage of setup values. No loss of setup values or mode of operation if power is OFF for extended time.
- Initial valve synchronization on power up.
- Automatic valve synchronization while in operation to eliminate possible deviation of the actual and calculated valve positions.
- Simple calibrations procedures.
- Locally controlled by the four-button keypad and convenient menu.
- Password protection for the critical parameters settings.
- Remotely controlled and/or monitored through the RS485 interface.

2. Control

The four-button keypad and 16 characters by 2 lines LCD backlit display are located on the front panel of the HWHC2100. These controls provide full local management of the system. Operator can read system setting and parameters (e.g. temperatures, valve position and alerts), set the operational modes, or change settings.

The control keypad consists of four pushbuttons: Escape (Esc), Down (▼), Up (▲), Enter (Enter). The keys are also marked with letters A, B, C, D used to simplify the passwords memorizing.

During normal operation the upper line of the display shows a current operation mode: OFF, AUTO, MANUAL OPEN (M_OPEN), MANUAL CLOSE (M_CLOSE), MANUAL SET (M_SET), target temperature (on AUTO or M_SET mode of operation), and system's status information (please see page). When calibration modes selected, the upper line displays the information regarding particular mode.

The line at the bottom of the display is dedicated to various status information and menu-driven setup dialogs. To browse to more options press the Enter key at the "Enter for more ..." status information line.

3. Operation

The HWHC2100 checks the Outdoor temperature (OD) by means of an Outdoor Sensor, at the same time it monitors the hot water system temperature (ST) or hot water return temperature (RtnT) of the building's heating system by means of the ST or RtnT Sensor. Controlled temperature (ST or RtnT) is main parameter of regulation. It could be selected from the menu by properly setting of the controller's configuration for a particular application. In the AUTO mode when Outdoor temperature falls below an adjustable Outdoor cutoff temperature, the controller activates the system pump and provides automatic positioning of the control valve in accordance with the configuration, measured temperatures, season, time of day, and selected parameters. If the ST(or RtnT) is different from the controller calculated Target Temperature, the HWHC2100 will correct the difference by moving the valve toward the close or open position. Also the controller can monitor return water temperature or system water temperature. This feature is activated from the controller's configuration and by setting water (System or Return) Temperature Cut Off Set Point (please refer to the controller's Menu on fig.2 or description on page 10). If ST(or RtnT) above the Cut Off Set Point the Valve shall be close. In the MANUAL SET mode the controller automatically keeps the System Hot Water Temperature or the Return Water

Temperature at the set-point entered by operator. In this case the HWHC2100 does not use the Outdoor temperature sensor. There are three additional operations implemented in the controller, they are useful when performing motor/valve maintenance, calibration or in emergency situation. Detailed description of the operation modes can be found on section 5. The controller has a possibility of management motorized valves with three different types of interface:

1. General Purpose Relays;
2. Current Loop (4ma -20ma);
3. Potentiometer.

In two last cases additional board is required on the controller.

Selection the type of the motorized valve can be made from SETUP menu (please refer to the controller's Menu on fig.2 or description on page 10).

On power-up the HWHC2100 restores all setup values. This eliminates the need for manual configuration re-entry. The last active operation before power down is also recovered.

Attention!!! Following description only for the motorized valve controlled by external relays!!!

Upon power-up the controller enters to Initial Synchronization state to synchronize the valve to the close position. During this time the LCD display indicates: the mode of operations and the current operational state - upper line, elapsed time (in seconds) to finish synchronization and system temperature - bottom line.

M_CLOSE: Sync_C
137sec ST = 145°

The elapsed time interval for the valve adjustment depends on the type of the motor used.

The valve will be fully opened or closed depending on the mode of the last operation as follows:

Operation Mode	Valve Direction	Status Information
AUTO	To Close Position	Sync_C
M_SET	To Close Position	Sync_C
M_CLOSE	To Close Position	Sync_C
M_OPEN	To Open Position	Sync_O
OFF	To Close Position	Sync_C

During the Initial Synchronization, the operator has full access to the controller. He can check temperature (OD ,ST, and RtnT), calibrate sensors, change setup parameters, change mode of operation, etc.

Please note the following:

1. All operation mode changes will be displayed on the LCD. But only last change will be executed when the Initial Synchronization completes.
2. If during the Initial Synchronization, the operator does not change the mode of the operation and restored operation was OFF, the controller will put the valve in the position prior to power down.
If during the Initial Synchronization, the operator change previous operation mode to OFF mode, then the valve will remain on the same position when the Initial Synchronization complete.

4. Menu

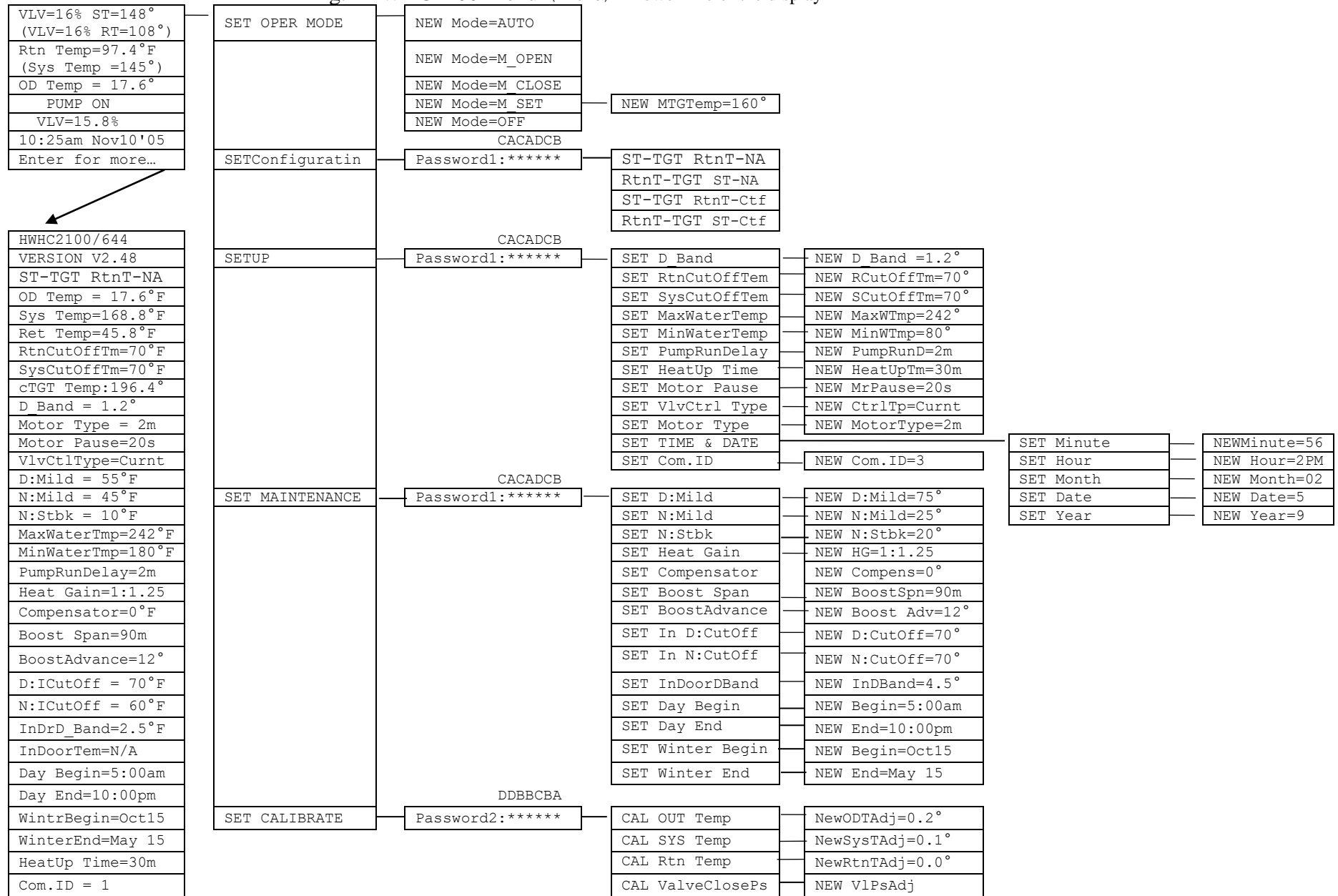
The process of interaction is menu driven. Menu chart is shown on Fig 2. The menu is organized in convenient and logical way, and follows a simple set of rules.

- The menu chart is organized as a set of menu boxes. To navigate between the boxes one should press Enter key to move to the right on the chart, and Esc key to move backward.
- Each box contains one or more menu items. To switch between the items inside a box one should press Up or Down keys.
- Each item represents one menu entry - select a parameter to change, enter a new parameter value, change mode of operation etc.
If the item contains "NEW" word then the new value has to be entered, and Up and Down keys will change the value, pushing Enter accepts the new value, Esc - rejects the new value, and leaves the

parameter unchanged.

- If a password is required then one should enter a certain key sequence. For convenience the passwords are coded as the sequence of letters (e.g. DDBBCBA).
- Starting point of the menu is the topmost item of the leftmost box (current valve position VLV =xx%) on the chart. If lost in the menu just press Esc repeatedly, until the display shows VLV =xx%. You are now in the upper left corner of the menu chart.

Fig.2 HWHC2100 Menu (v2.48) - Lower line of the display



HINT: If lost in the menu or a password is unknown - push ESC repeatedly, until the display shows VLV =xx%. You are now in the upper left corner of the menu table

5. Configuration of the controller.

Depending on specific particularity of the consumption of the heat energy and accepted schemes of the heating, the controller can be set to four different configurations as follows:

Hot Water System Temperature and Return Water Temperature are used as:	Indication on the LCD:
SysTmp - Target, ReturnTmp - CutOff	ST-TGT RtnT-Ctf
SysTmp - Target, ReturnTmp - Not use	ST-TGT RtnT-NA
SysTmp - Ctf, ReturnTmp - Target	ST-Ctf RtnT-TGT
SysTmp - Not use, ReturnTmp- Target	ST-NA RtnT-TGT

To switch between the different configuration one should press Up or Down keys. Hitting Enter key accepts the new configuration, Esc - rejects and leaves the configuration unchanged.

6. Modes of operation

The upper line of the display shows the current mode of operation (**OFF, AUTO, M_SET, M_OPEN, M_CLOSE**), indicates System Target Temperature during AUTO or M_SET operation. The right corner of the upper line indicates operational state. (Please refer to the detailed description on section 7).

The HWHC2100 operates in one of the following modes:

Operation Mode	Description
OFF:	<p>The valve stops immediately in the position it has before operation was entered, pump relay de-energized.</p> <p>The controller is hot ready, continuing measurements and processing the sensors' data. This mode is useful when performing motor/valve maintenance and in emergency situation.</p>

<p>AUTO:</p>	<p>The controller provides automatic valve positioning in accordance with the measured temperatures, season, time of the day, and the selected parameters. This mode is designed to be the main mode of operation. If the system parameters are set properly, then there is no need in manual intervention in the system performance virtually at any weather condition. The HWHC2100 is capable to keep calculated target temperature in parameters set by 'D_Band' set point.</p> <p>In AUTO mode the controller distinguishes four day periods (Fig.6):</p> <ol style="list-style-type: none"> 1. The morning heat-up period starts at the 'DAY BEGIN' Set Point. During this period the controller changes the valve position from nighttime to daytime temperature values with a constant rate. The heat-up time span is variable form 0 to 100 minutes (with step of 1 minute). 2. The morning boost period begins immediately after the morning heat-up period ends. The 'BOOST SPAN' and 'BOOST ADVANCE' parameters define the boost duration and its amount. 3. Normal daytime operation begins from the Boost period end to 'DAY END' Set Point. 4. Nighttime period ('DAY END' to 'DAY BEGIN'). The amount of delivered heat can be reduced against the daytime period, as defined by the 'NIGHT MILD WEATHER' and 'NIGHT SETBACK' parameters. (Please see an example in section 6). <p>Notes:</p> <p>The valve will be unconditionally set to 0% when:</p> <ul style="list-style-type: none"> - Out Door Temperature achieves Day time Mild Weather Set Point (at Day Time) or Night Mild Weather Set Point (at Night time); - Apartments temperature (Indoor Temperature) average supplied from host computer highest then Indoor Temperature CutOff (Day/Night)set Point plus D_Band. - If Return Water Temperature(or System Water Temperature) above the Cut Off Set Point - If current date is between the Winter End and Winter Begin settings (Summer time).
<p>M_SET: (Manually Set Temperature)</p>	<p>In this mode the HWHC2100 automatically keeps the Supply (System) Hot Water Temperature (or Return Water Temperature) at the set point entered by operator within a dead band zone set by 'D_Band' parameter. (In case the outdoor sensor failed in AUTO mode, the HWHC2100 automatically switches to this mode of operation).</p>
<p>M_OPEN: (Manually Open) M_CLOSE: (Manually Close)</p>	<p>These modes can be used in emergency to open or close the valve fast and completely regardless of the valve position.</p> <p>The M_OPEN unconditional opening of the valve and turning pump on (if it was off).</p> <p>The M_CLOSE unconditional closing of the valve. After valve close the pump will stay on for a period of 2 seconds and will turn off.</p>

To change the mode, select **SET OPER MODE** item in the menu, press **Enter**, then, with **Up** or **Down** key select a new mode, and press **Enter**. When the M_SET mode is selected, the new temperature value ('MTGTemp') must be entered.

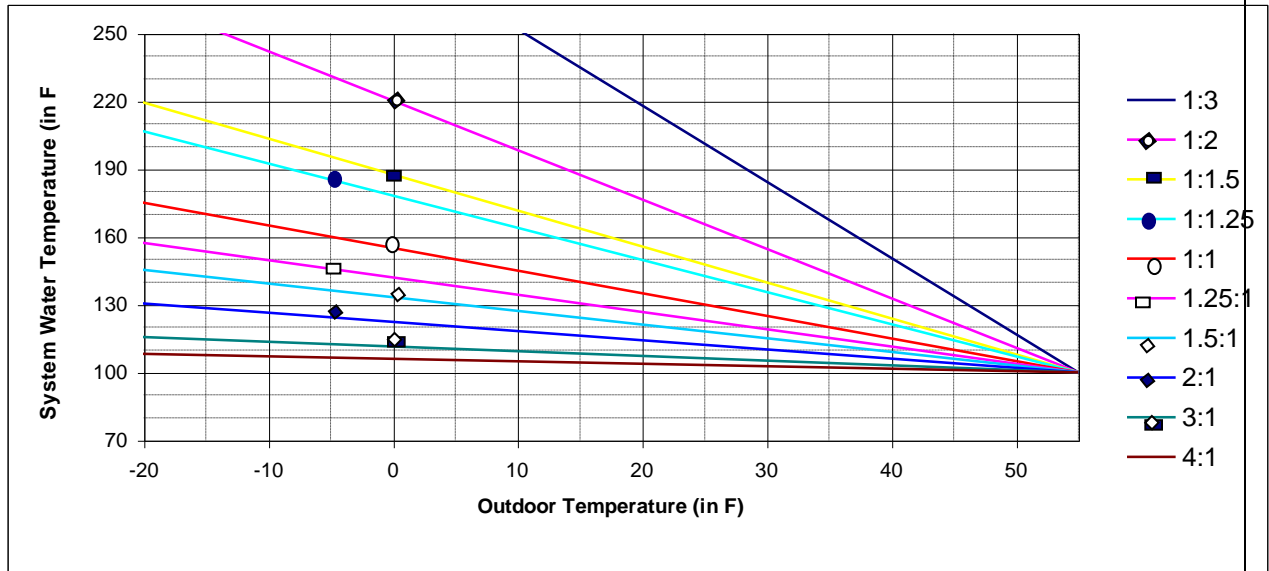
7. Operation Parameters

To provide correct and reliable operation of the HWHC2100 the operational parameters must be set properly. The parameter section of the menu is divided in two parts (MAINTENANCE and SETUP). Each part protected with a password. Use following tables as guidelines when selecting parameters' values:

MAINTENANCE (password:CACADCB)

Parameter	Description
Heat Gain	<p>Determines ratio between the System Hot Water Temperature and Outdoor Temperature.</p> <p>Fig. 3a,b represents the family of control curves with different Heat Gain as parameter when Mild Weather is 70°F (Fig.3a) and Mild Weather is 55°F (Fig.3b). With any of the ratios, the colder it becomes outside, the hotter the temperature of the system water. On the both examples Compensator=0 and NIGHT SETBACK=0.</p> <p>Positive Compensator values shift the curve up, negative - down.</p> <p>Positive Night Setback values shift the curve down.</p> <p>Positive Compensator values shift the curve up, negative - down.</p> <p>Positive Night Setback values shift the curve down.</p> <p>Implemented 10 different ratios: 1:3; 1:2; 1:1.5; 1:1.25; 1:1; 1.25:1; 1.5:1; 2:1; 3:1; 4:1.</p> <p>Ratio 4:1 (OD : ST) - the outdoor temperature would have to drop 4° to increase the system water temperature by 1 degree.</p> <p>Ratio 1:3 (OD : ST) - for each 1 degree drop in outdoor temperature the hot water temperature will increase by 3 degree.</p> <p>Default ratio is 1:1;</p>
Fig.3a Heat Gain Ratio (Mild Weather is 70°F) curves.	

Fig.3b Heat Gain Ratio (Mild Weather is 55°F) curves.



Compensator

The Compensator parameter provides day(or night) adjustment to the amount of heat being delivered to compensate for the influence of extreme weather condition. When calculating target temperature, the controller, adds or subtracts the Compensator value from the calculated temperature. Therefore, any change made to the Compensator will change the value of the calculated target temperature by the same amount and will change position of the valve. Positive values of the parameter increase heat delivery (more opens valve), while negative values reduce it (closes the valve). Fig.4 illustrates effects of the Compensator on the control curve.
Range: -40°F to +40°F with 1° step. Default value is 0°F.

D:Mild
(DAY MILD WEATHER)

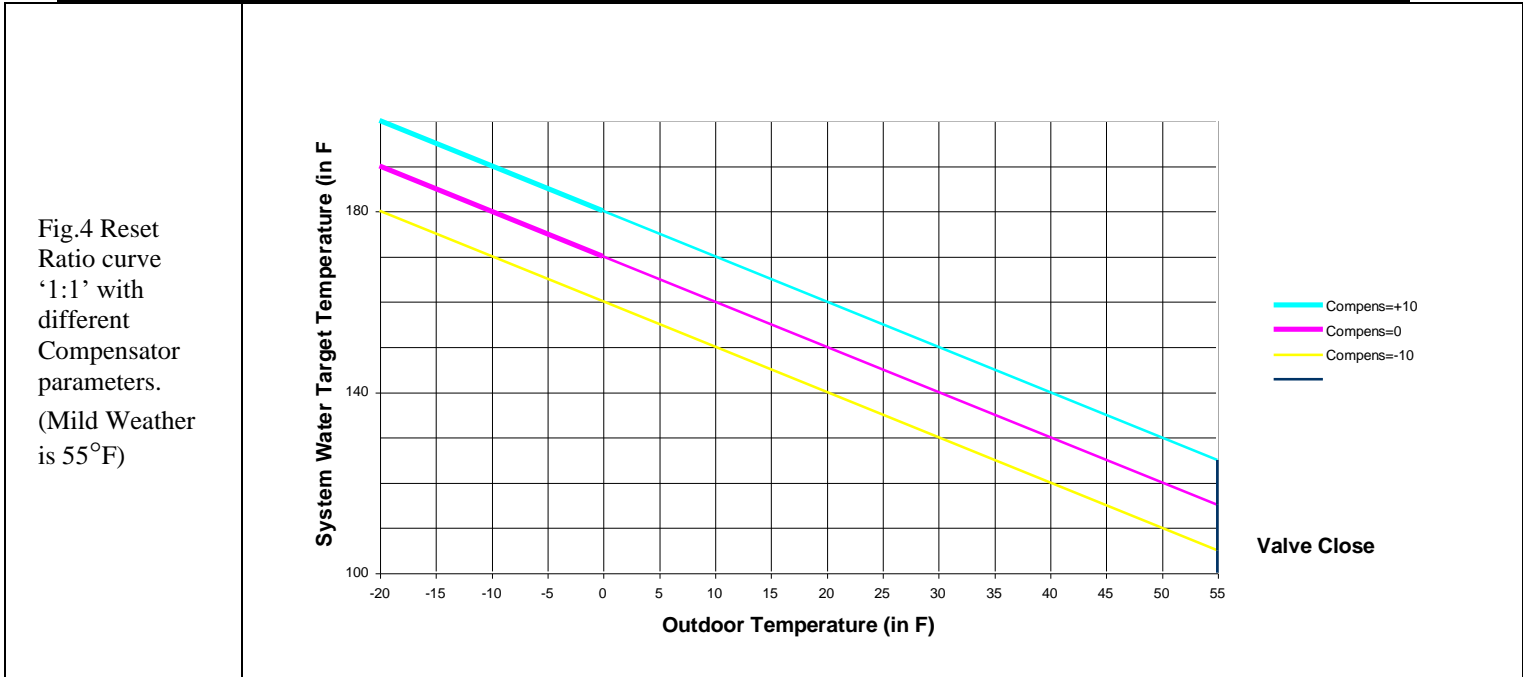
The controller closes the valve completely when the outdoor temperature is higher than this parameter and the time between 5AM and 10PM. The Pump will work on for a period of time set by the 'PumpRunDelay' setpoint and will turn off.
Range: 40° to 80 °F with 1° step. Default value is 55°F.

N:Mild
(NIGHT MILD WEATHER)

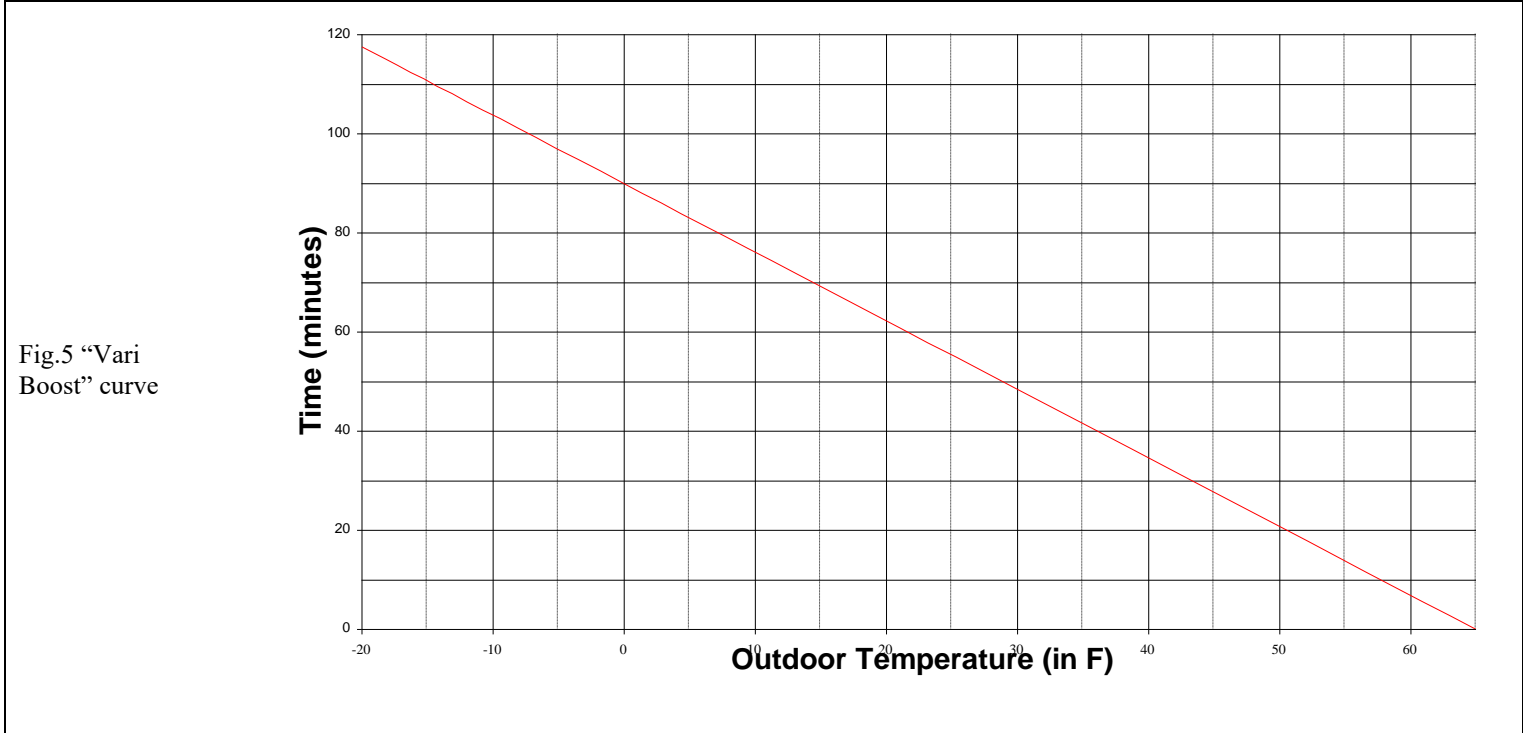
If the outdoor temperature is higher than this parameter and the time is between 10PM and 5AM, then the valve is closed completely. The Pump will work on for a period of time set by the 'PumpRunDelay' setpoint and will turn off.
If the outdoor temperature is lower than this parameter and the time is between 10PM and 5AM, then the valve position is corrected in accordance with the 'NIGHT SETBACK' parameter.
Range: 20° to 60 °F with 1° step. Default value is 40°F.

N:Stbk
(NIGHT SETBACK)

The controller subtracts from the previously calculated target temperature the 'NIGHT SETBACK' value to reduce heat delivery during the nighttime.
Range: 0° to 80 °F with 1° step. Default value is 10°F.

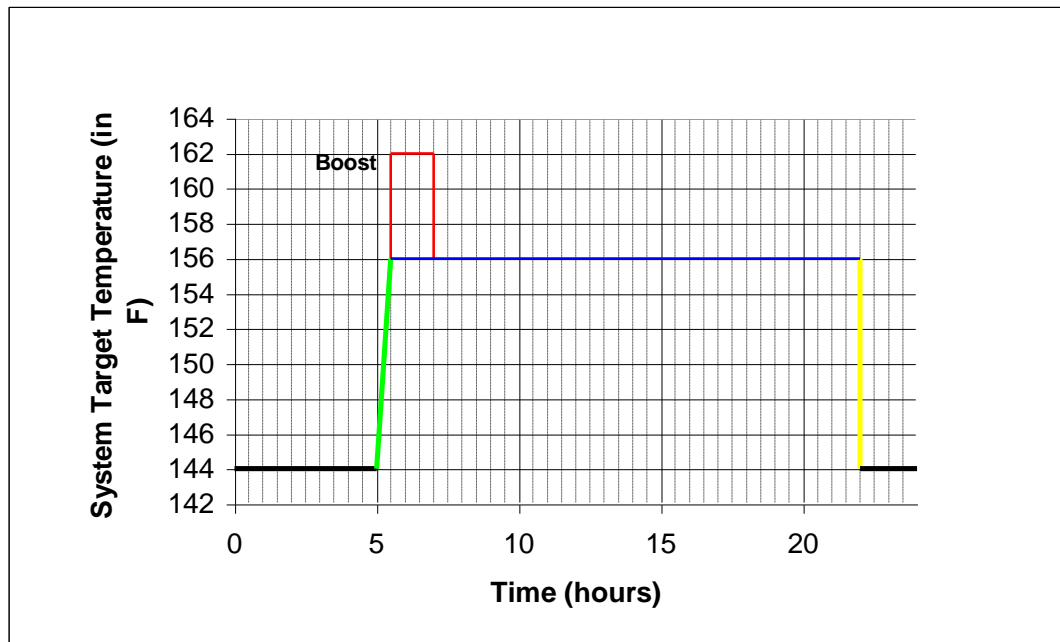


Boost Span Morning boost time span. The controller boosts heat only with **AUTO** mode in effect.
Range: 0, 30, 60, 90, 120 minutes (0 means no boost) or "Vari-Boost" (the length of the Boost time depends on the outdoor temperature - Fig.4).



BoostAdvance The controller adds the 'BOOST ADVANCE' value to the previously calculated system target temperature thus increase heat delivery during the morning boost period.
Range: 0° to 30° F with 1° step (0 means no boost). Default value is 0.

Fig.6 24 hours round the clock Heating Cycle with Morning Boost (Step of the green lines is 30 minutes).



Black line – Night Time Period (10:00PM – 5:00AM); Green line – Morning Heat-Up (5:00AM – 5:30AM); Blue line – Day Time Period (5:30AM – 10:00 PM); Red curve – possible Morning Boost (5:30AM – 7:00AM).

In D:CutOff (In Door Day Temperature Cutoff)	The controller closes the valve completely when the In Door temperature average (supplied from host computer) is higher than this set point during the Day - time between Day Begin and Day End. (D : ICOFF state). Range: 40 to 90 °F
In N:CutOff (In Door Night Temperature Cutoff)	If the In Door temperature average (supplied from host computer) is higher than this set point and the time is between Day End and Day Begin, then the valve will be closed completely. (N : ICOFF state). Range: 40 to 80 °F
InDrD_Band	Used along with 'In Door Temperature' parameter and 'In Door Day(Night) Temperature Cutoff' Set Point. This parameter defines the allowable delta between the actual In Door Temperature and Cutoff Set Point. Range: 0.1°F to 19.9°F with 0.1°F steps.
DAY BEGIN	Hours and minutes (with 10 minutes step) when Day Begins
DAY END	Hours and minutes (with 10 minutes step) when Day Ends
WINTER BEGIN	Month and Day when Winter Begin (dependent of the region)
WINTER END	Month and Day when Winter End (dependent of the region)

SETUP (password:CACADCB)

Parameter	
D_Band	Used in AUTO or M_SET modes. This parameter defines the allowable delta between the actual System Water Temperature or Return Water Temperature (dependent of the Configuration) and the Target Temperature. Range: 0.5°F to 25.5°F with 0.1°F steps.
RtnCutOffTem	Return Water Temperature Cut Off Set Point. If Return Water Temperature above the Cut Off Set

	Point the Valve shell be close. Range: 40°F to 220°F with 1°F steps. Default value is 70°F.
SysCutOffTem	System Water Temperature Cut Off Set Point. If System Water Temperature above the Cut Off Set Point the Valve shell be close. Range: 40°F to 220°F with 1°F steps. Default value is 90°F.
MaxWaterTemp	Maximum allowed water temperature. If calculated Target temperature exceeds MaxWaterTemp the controller in AUTO mode will maintain the water temperature at MaxWaterTemp . Range: 170°F to 250°F with 1° step. Default value is 250°F.
MinWaterTemp	Defines minimum water temperature in the system. Used only in the AUTO mode of operation. The controller calculates the Target water temperature based on the outdoor temperature, heat gain, and the compensator value and controls burner or valve to hold either the calculated temperature, or the MinWater Temperature, whichever is higher. Range: 70°F to 170°F with 1° step. Default value is 140°F.
PumpRunDelay	Sets the time to run the System Pump for a longer period of time after the boiler has been turned off or the valve has been closed. This feature allows for dissipating the excess heat from the boiler combustion chamber and prevent the boiler from overheating. Range: 0 to 99 minutes with 1-minute step. Default value is 2m.
HeatUp Time	The heat-up time is designated to return the building temperature to its Day heat level after Night heat level. Range: 0 to 99 minutes with 1-minute step. Default value is 30minutes.
Motor Pause	In AUTO and SET mode of operation specify the appropriate time (in seconds) between the Valve (Motor) motion. Normally, this parameter is set at the system installation time. Range: 0 to 127 seconds with 1 second step. Default value 30sec.
VlvCtrl Type	Defines Type of Control Interface to the motorized Valve. There are three possible Type of Control Interface to the motorized Valve implemented on the controller: <ul style="list-style-type: none"> - Relays; - Current Loop (4ma-20ma); - Potentiometer. o Default Interface = Relay.
Motor Type	There are 8 types of motors (dependent on the time duration of valve close position to the open position) from 2minutes to 9 minutes with increment of one minute. Type 2m – for time duration of 2 minutes; Type 3m – for time duration of 3 minutes, and so on. Default value is 3m.
TIME & DATE	Current Year, Month, Day, and Time can be entered and adjusted. The "am/pm" displayed with capital letters when Daylight Saving Time is in effect.
Com.ID	Each HWHC2100 connected to the local server via the RS485 bus. To establish proper connection the controller should have a unique communication address (ID). Range: 1 to 99.

8. System Status Information

All operational parameters and useful information can be seen on the low line of the LCD display by using Up/Down and Enter keys (see Fig.2 left corner). The following information can be selected for displaying on the lower line of the LCD:

Information	Example	Description
Valve Position and System Temperature (or Return Temperature)	VLV =16% ST = 152° or VLV =24% RT = 175°	Current valve position as percent of the Open status and Hot water heating system temperature at the RTD sensor (= "fail" if temperature sensor malfunction).
Return Temperature (or System Temperature)	Ret Temp = 60.4° or Sys Temp = 123.5°	Condensate return temperature at the RTD sensor. If sensor not installed or not use: ("RtnTempSr-NotUse"), If the sensor malfunction: (= "fail")

Outdoor Temperature	OD Temp = -12.3°	Outdoor temperature at the OD sensor (= "fail" if temperature sensor malfunction).
Configuration	ST-TGT RtnT-Ctf	SysTmp - Target, ReturnTmp - CutOff
Pump Status	PUMP ON *	The asterisk (*) is indicating the Winter season.
Exact Valve Position	VLV=15.8%	Useful to make sure that the system works properly
Time and Date	10:25am Mar10'09	Time, Month, and Year.
More information	Enter for more...	Pressing the 'Enter' key will show additional information

The following are examples of various controller operations as indicated on the LCD. The first line shows the mode of operation, target system temperature and operational status. The second line shows additional information (see above table). The short explanation of the LCD's lines follows. The current status of the device dependent on many parameters (modes of the operation, temperature, season, settings etc) and is located on the right corner of the upper line of the LCD display.

Mode of Operation: AUTO

AUTO:176° D:Norm
VLV=37% ST=144°
Normal Day of Operation. Calculated Target Temperature is 176°F.

AUTO:172° N:Norm
VLV=37% ST=144°
Normal Night of Operation. Valve position is 37%(open). System temperature is 144°F.

AUTO:188° HeatUp
VLV=37% ST=144°
Morning Heat Up. Calculated Target Temperature is 188°F.

AUTO:189° BOOST
VLV=37% ST=155°
Morning Boost. Calculated Target Temperature is 189°F.

AUTO:140° D:Mild
VLV=12% ST=144°
Day Mild Weather – Valve is going to be close. The automotive adjustment valve position would execute.

AUTO:140° N:Mild
VLV_0% ST=144°
Night Mild Weather – Valve is close. The automotive adjustment valve position is executing.

AUTO:176° FailSf
VLV=17% ST=fail
System Temperature Sensor fails. The valve would transition into the close position. After it, motor will run certain amount of time to make sure that the valve at the close position (this procedure calls - automotive adjustment valve position). The motor would stop, and after a short period of time the valve would transition into open position at 60%. The motor would stop and the valve would remain on this position until the issue is resolved.

AUTO:140° FailSf
VLV=43% ST=132°
Outdoor Temperature Sensor fails. The controller would use external Outdoor Temp. info from host or server, if they are attached. If they are not attached the controller would use 35°F as Outdoor Temperature night setpoint or 45°F as Outdoor Temperature day setpoint.

AUTO:146° Sync_C°
168sec ST=80°
Initial Synchronization. Valve is going to be close. Calculated Target Temperature is 146°F. 168 seconds remain to finish synchronization. System Temperature is 80°F.

AUTO:140° RtnCtf
VLV=6% ST=60°
Return Water Temperature above the Cut Off Set Point the Valve is going to be close

* For the motorized valve controlled by relays only

AUTO_140° Summer
VLV=0% ST=60°
Summer season. Valve is closed. System Temperature is 60°F.

In the AUTO mode, sign ‘:’ shows that the calculated Target Temperature is between the defined maximum and minimum system hot water temperature limits. If calculated Target Temperature exceeds the maximum allowed limit, the controller would set Target Temperature as MaxWaterTemp setpoint and change sign ‘:’ to sign ‘^’. If calculated Target Temperature lower than allowed minimum limit –the controller would set the Target Temperature as MinWaterTemp setpoint and change the sign ‘:’ to sign ‘_’.

•The controller performs automotive adjustment valve position when it reaches the borders (0% or 100%) during the operation. On this procedure the controller ‘pushes’ the valve (certain amount of time) toward the open or the close position. This situation is indicated on bottom line after ‘VLV ‘ by sign ‘_’ (when valve ‘pushes’ toward close position) or ‘^’ (when valve ‘pushes’ toward open position). When the procedure has completed the sign will change to ‘=’;

Mode of Operation: OFF

OFF :
VLV=42% ST=144°
Motorized valve stops on position 42% open. The pump state remains unchanged. System Temperature is 144F°

OFF :
VLV=42% ST = fail
System Temperature Sensor fail. Motorized valve stops on position 42% open. The pump state remains unchanged.

OFF: Sync_C*
101sec ST=fail
Initial Synchronization. Valve is going to be close. 101seconds remain to finish synchronization. ST sensor fail.

Mode of Operation: M_SET

SET: 180°
VLV = 67% ST = 123°
Target Temperature is 180F° Normal operation, system temperature is 123F°

SET:166° Sync_C*
168sec ST=80°
Initial Synchronization. Valve is going to be close. Target Temperature is 166°F. 168 seconds remain to finish synchronization. System Temperature is 80°F.

SET: 168° FailSf
VLV = 67% ST = fail
System Temperature Sensor fails. The valve would transition into the close position. The automotive adjustment valve position would perform. The motor would stop, and after a short period of time the valve would transition into open position at 60%. The motor would stop and the valve would remain on this position until the issue is resolved.

• For the motorized valve controlled by relays only

Mode of Operation: M_CLOSE

M_CLOSE:	M_CLOSE:	M_CLOSE: Sync_C*
VLV_0% ST=176 °	VLV=42% ST=fail	168sec ST=80°
Valve is Close The automotive adjustment valve position is executing at the close position. Pump would be turn off after period of time set by the Pump Run On set point.	Valve is going to be Close. The automotive adjustment valve position would perform at the close position. Pump would be turn off after period of time set by the Pump Run On set point System Temperature Sensor fails.	Initial Synchronization. Valve is going to be close. 168 seconds remain to finish synchronization. System Temperature is 80°F.

Mode of Operation: M_OPEN

M_OPEN:	M_OPEN:	M_OPEN: Sync_O*
VLV=27 ST=176°	VLV^100% ST=fail	168sec ST=80°
Valve is going to be Open, The automotive adjustment valve position would perform at the open position.	Valve is Open. The automotive adjustment valve position is executing at the open position. System Temperature Sensor fails	Initial Synchronization. Valve is going to be open. 168 seconds remain to finish synchronization. System Temperature is 80°F.

* For the motorized valve controlled by relays only

9. Calibration Procedures

The temperature sensors must be calibrated after the initial system installation or after the parts replacement. The HWHC2100 facilitates the calibration procedure. To enter the calibration section of the menu, select **SET CALIBRATE** and then enter the password (DDBBCBA). Following table provides explanations for the calibration procedure.

<p>Outdoor Temperature Sensor Calibration</p>	<ol style="list-style-type: none"> 1. Select CAL OUT Temp. and press Enter 2. The upper line of the display indicates mode of operation (“CALBR”) and shows actual reading of the temperature sensor: " ODT=xx.y° ". 3. The lower line of the display shows possible adjustment for example “NewODTAdj=0.1°” 4. Press Up or Down key to make the ODT equal to the real outdoor temperature, measured by the reference thermometer. 5. Press Enter.
<p>System Hot Water Temperature Sensor Calibration</p>	<ol style="list-style-type: none"> 1. Select CAL SYS Temp. and press Enter 2. The upper line of the display indicates mode of operation (“CALBR”) and shows actual reading of the temperature sensor: " ST=zz.x° ". 3. The lower line of the display shows possible adjustment for example “NewSysTAdj=-0.2°” 4. Press Up or Down key to make the reading equal to the real system temperature, measured by the reference thermometer. 5. Press Enter
<p>Return Water Temperature Sensor Calibration</p>	<ol style="list-style-type: none"> 1. Select CAL Rtn Temp. and press Enter 2. The upper line of the display indicates mode of operation (“CALBR”) and shows actual reading of the temperature sensor: " RtnT=zz.x° ". 3. The lower line of the display shows possible adjustment for example “NewRtnTAdj=-0.2°” 4. Press Up or Down key to make the reading equal to the real system temperature, measured by the reference thermometer. 6. Press Enter
<p>Valve Position Calibration</p>	
<p>Motor current loop (4ma-20ma) interface Calibration</p>	<p>From ‘MANUAL CLOSE’ Operation when Valve is closed (VALVE POS=0%):</p> <ol style="list-style-type: none"> 1. Connect ampere meter between the HWHC’s terminal pin#2 (CLOSE) and motor connector (use 100ohm resistor when motor is not connected). 2. Select CAL Out Current. and press Enter 3. The upper line of the display indicates mode of operation (“CALBR”) and OutCr=4ma. 4. The lower line of the display shows possible adjustment for example “New CAdj = 1” 5. Press Up or Down key to make the reading 4ma at the ampere meter. 6. Press Enter.

HOT WATER HEATING CONTROLLER

INSTALLATION WIRING DIAGRAM

