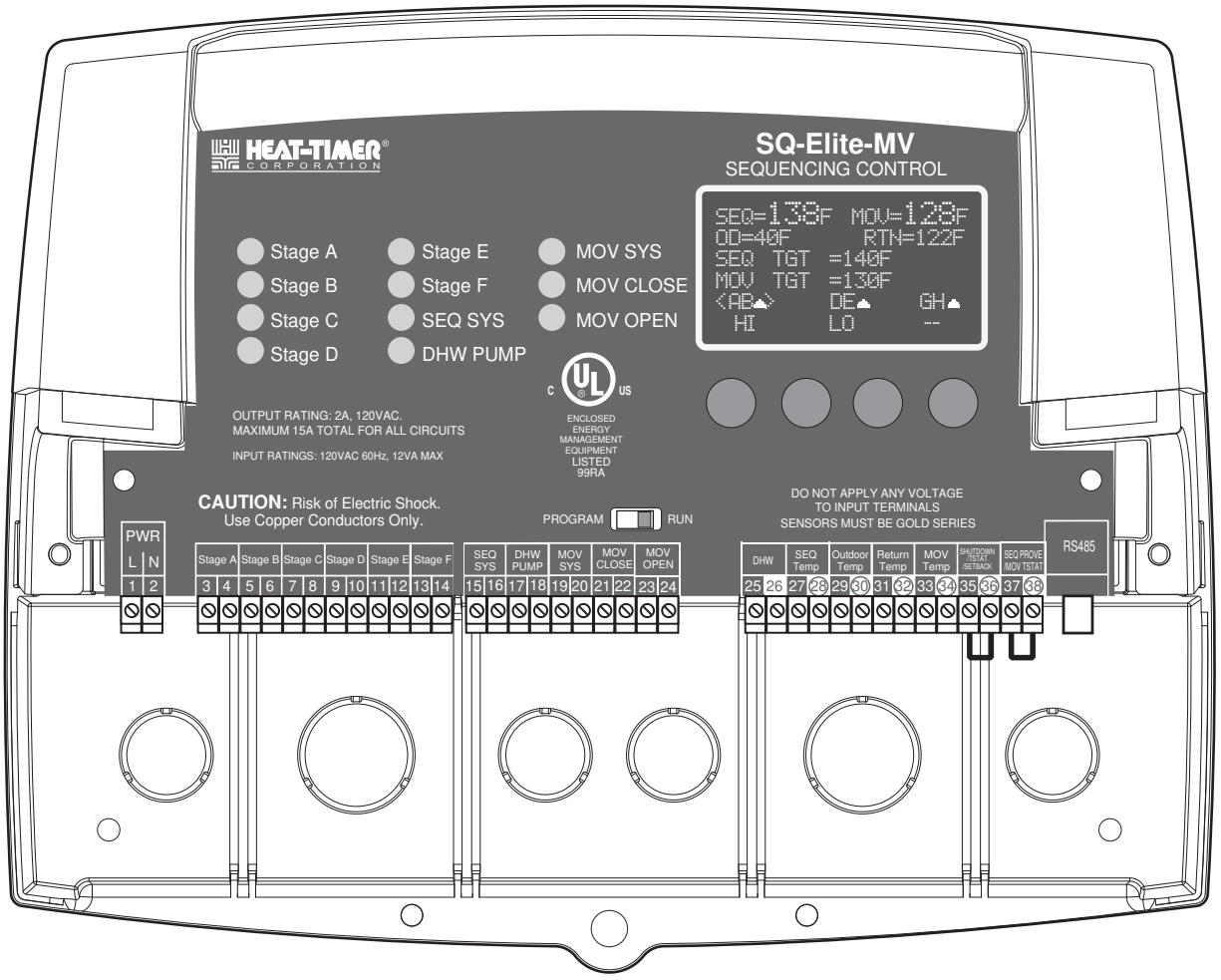
HEAT-TIMER®

• INSTALLATION AND OPERATION INSTRUCTIONS MANUAL
• USER OPERATIONS MANUAL

SQ-Elite-MV & SQ-Elite-EXT

HYDRONIC BOILER SEQUENCING WITH MOTORIZED VALVE CONTROL

FOR HYDRONIC HEATING SYSTEMS



⚠ WARNING

The SQ-Elite-MV is strictly an operating control. It CANNOT be used as a limit control. All boilers must have all safety and limit controls required by code. It is the responsibility of the installer to verify that all the safety and limits are working properly before the SQ-Elite-MV is installed.

This control must be installed by a licensed electrician.

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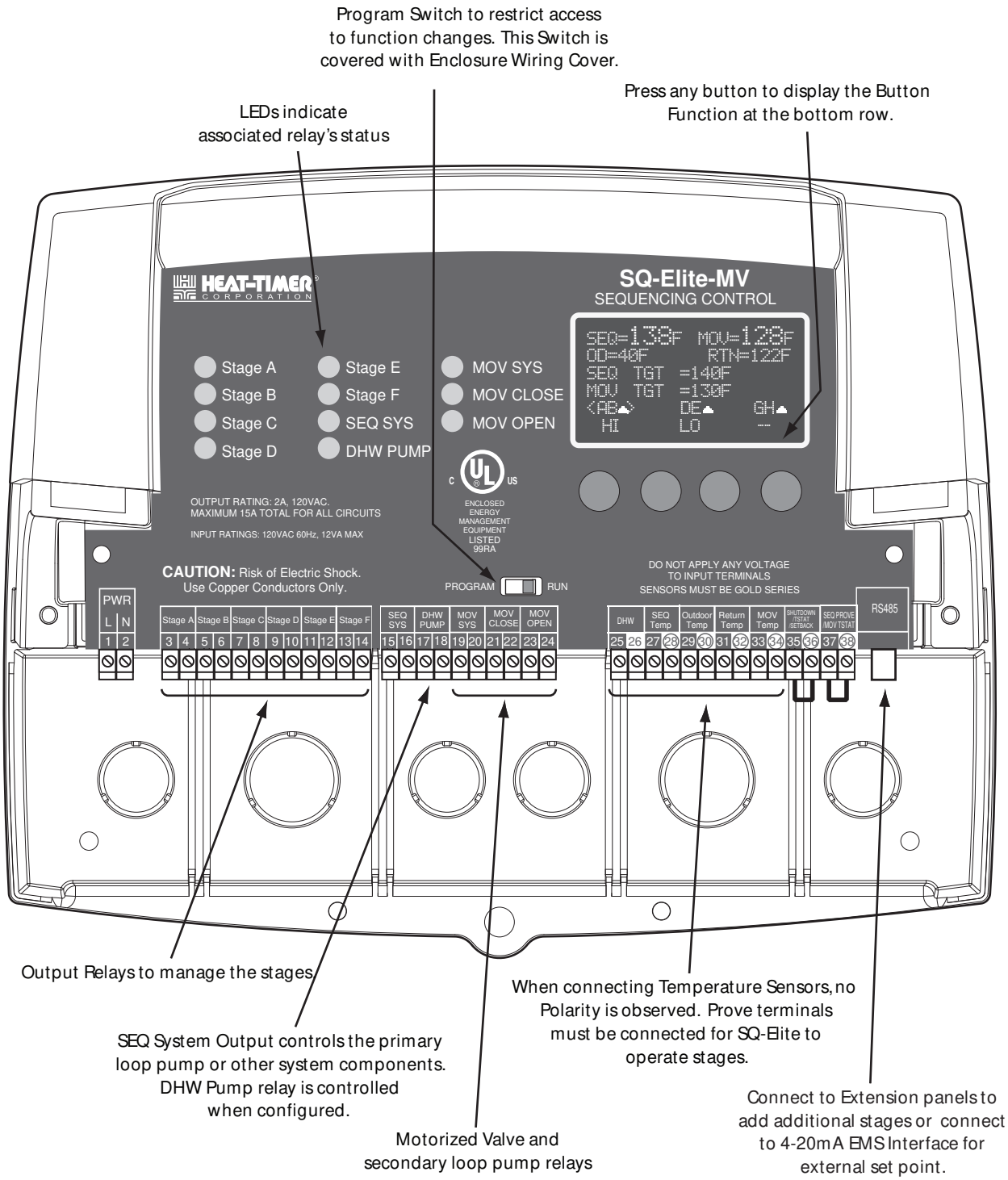
SQ-ELITE-MV LAYOUT



SQ-ELITE-MV OVERVIEW

TWO HEATING TEMPERATURES
The SQ-Elite-MV controls two loops, the boiler loop and the motorized valve loop. Each has their own temperature and set of parameters and reset settings . In addition, this configuration simplifies many aspects of the installation as the same control will utilize the same outdoor sensor and shutdown input, season settings, etc... This allows the user to control two separate heating temperatures using a single heating control.

SEQUENCES UP TO 22 STAGES WITH PUMPS OR VALVES.
The SQ-Elite-MV is the perfect control whenever multiple boiler stages in addition to a motorized are required for hydronic heating applications. As a stand-alone, the SQ-Elite-MV is designed to control six stages. However, it has the capability of expanding its control to two extension panels each with eight stages. Thus, the SQ-Elite-MV can control a total of up to 22 stages. It controls not just all the stages, but their pumps or valves, in addition to the secondary loop motorized valve and pump to maintain a precise system set point for each of the primary and secondary loops.

MODULATE A SECONDARY ZONE MOTORIZED VALVES.
The SQ-Elite-MV does the job of two individual heating controls. It replaces a multi-boiler/multi-stage sequencing control in addition to managing a secondary loop motorized valve and pump. It does that with ease and flexibility. Each of the primary loop and secondary loop has their own variables and reset ratios, however share the same outdoor sensor.

PID OR OVER-SIZED-SYSTEM (OSS) LOGIC
The SQ-Elite-MV's control algorithm allows it to look at the rate of change in the system. If the load is changing quickly, the SQ-Elite-MV can be set to OSS sequencing where it will react based on load changes. It will match the load by turning on or off stages quickly. If the system oscillations are minimal, the SQ-Elite-MV can be set to PID where it will make slow and gradual output adjustments. Therefore, the SQ-Elite-MV adapts to specific system requirements and minimizes oscillations around the set point.

INSTALLER AND USER SYSTEM SETTINGS
The SQ-Elite-MV's alphanumeric digital display names each system parameter in simple English and shows its precise value. The easy to follow menu system allows users to quickly make changes to any system setting without having to learn any specialized codes or keyboard commands. Two separate menus has been provided. One for the installer having all the functions. While the other is much simpler for the day-to-day user where their primary function is to adjust or maintain specified temperatures.

AUTOMATIC ROTATION AMONG STAGES
Rotating the first stage to be activated on a call for output promotes even wear on each boiler. The SQ-Elite-MV has three modes of rotation: Manual, FOFO, or Time. The Time rotates the lead stage every selected time period from every hour to every 41 days.

OUTDOOR RESET WITH CUSTOMIZABLE CURVE
Each of the loops controlled by the SQ-Elite-MV has an outdoor reset function, providing the capability to change the set point based on outdoor temperature. Furthermore, a customizable outdoor reset curve has been incorporated for unique applications. In addition, the following settings have been added to help fine tune all reset operation; Offset, Minimum, and Maximum Targets, and Scheduled Setback or Setback using an External Signal.

STANDBY BOILER OPTION
Any of the SQ-Elite-MV heating boilers can be configured as a Standby with an adjustable Standby delay. Assigning a specific boiler to work in standby mode will remove it from the rotation. In this mode, the boiler will be used for backup in large demand periods when the primary boilers will not suffice.

PROVE INPUT
The system outputs work with the control logic to operate a primary system pump (boiler loop pump). The System Prove input can be wired in to check the status of any component before any stage can be activated.

NORMAL OR PARALLEL (LO/LO/HI/HI) SEQUENCING
The SQ-Elite-MV can sequence heating boilers as needed. For heating systems where higher efficiency is achieved using lower firing stages, the SQ-Elite-MV offers the Parallel Sequencing option. It will sequence all the low firing stages first before bringing the rest of the stages on. For other types of heating boilers, using the Normal Sequencing option will bring the lower operating stage followed by the higher one of the lead boiler. Then, follow it by doing the same with the lag boiler.

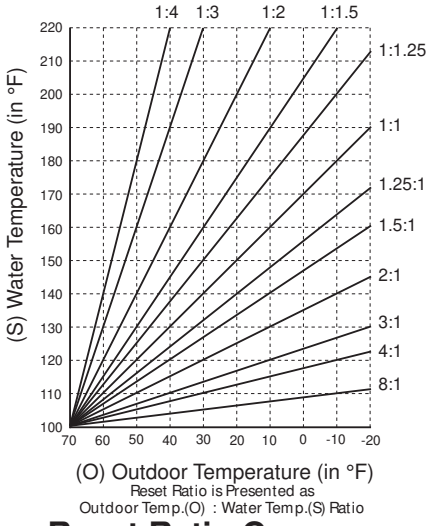
DHW PUMP CONTROL WITH MULTIPLE PRIORITY OPTIONS
Having a DHW input as a dry-contact to be used with an external aquastat allows the SQ-Elite-MV to control a DHW pump using its built-in output relay. The user will have different priority options that varies based on the DHW piping design.

UNDERSTANDING OPERATION CONCEPT

The SQ-Elite-MV has multiple operating modes that satisfy most hydronic systems. It can change any the of the loop temperatures' set point based on outdoor temperature. Or, it can sequence stages to achieve an adjustable fixed Set Point.

In Outdoor Reset, it controls a hot water heating system to provide a building with comfortable and even heat levels. The SQ-Elite-MV varies the temperature of the circulating heating water in response to changes in the outdoor temperature. The SEQ heating water temperature is controlled through the sequencing of the stages. The MOV heating water is controlled by modulating the motorized valve.

The SQ-Elite-MV also controls both boiler loop and motorized valve loop circulating pumps each with their own adjustable Outdoor Cutoff. When the outdoor temperature is above the Outdoor Cutoff, the system pump is turned off and no heating water is circulated through that loop. When the outdoor temperature drops below the Outdoor Cutoff, the system pump relay is activated and the heating water circulates through the system. The temperature of the heating water is controlled by the Reset Ratio, Water Offset, and changes to Outdoor temperature.



Reset Ratio Curves

RESET RATIO/OUTDOOR RESET

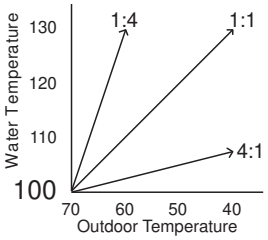
When a building is being heated, heat escapes through the walls, doors, and windows to the colder outside air. The colder the outside temperature, the more heat escapes. If you can input heat into the building at the same rate that it is lost out of the building, then the building temperatures will remain constant. The Reset Ratio is an adjustment that lets you achieve this equilibrium between heat input and heat loss.

The starting point for most systems is the 1.00 (OD):1.00 (SYS) (Outdoor Temperature : Heating Water Temperature) ratio. This means that for every degree the outdoor temperature drops, the temperature of the heating water will increase one degree. The starting point of the curves is adjustable, but comes factory selected at 70°F Outdoor Temp. and 100°F Water Temp. For example with a 1.00 (OD):1.00 (SYS) ratio, if the outdoor temperature is 50°F, this means the temperature has fallen 20° from the starting point of 70°F. Therefore, the heating water temperature will increase 20° to 120°F.

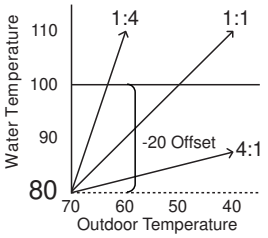
Each building has different heat loss characteristics. A very well insulated building will not lose much heat to the outside air, and may need a Reset Ratio of 2.00 (OD):1.00 (SYS) (Outdoor:Water). This means the outdoor temperature would have to drop 2 degrees to increase the water temperature 1 degree. On the other hand, a poorly insulated building with insufficient radiation may need a Reset Ratio of 1.00 (OD):2.00 (SYS). This means that for each degree the outdoor temperature dropped the water temperature will increase 2 degrees. The SQ-Elite-MV has a full range of Reset Ratios to match any buildings heat loss characteristics.

A heating curve that relies not only on Outdoor temperature but also on type of radiation will improve heat comfort. The following are suggested initial settings for different types of radiation based on average building insulation and heat loss. The contractor can fine tune these adjustments based on the specific building need.

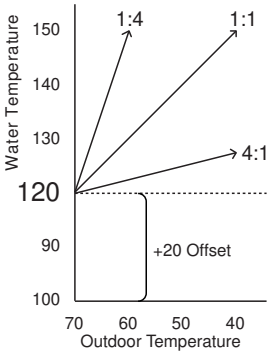
With a 0° Offset, the ratio curves begin at 100° Water Temperature.



With a -20° Offset, the ratio curves begin at 80° Water Temperature.



With a +20° Offset, the ratio curves begin at 120° Water Temperature.



Type of Radiation in Building	Reset Ratio	Offset
Radiators (Steel & Cast Iron)	1.00 (OD) : 1.00 (SYS)	0˚F
Baseboard (Finned copper tube& Cast Iron)	1.00 (OD) : 1.00 (SYS)	0˚F
Radiant (High Mass/Concrete)	4.00 (OD) : 1.00 (SYS)	-10˚F
Radiant (Low Mass/Joists)	2.00 (OD) : 1.00 (SYS)	-10˚F
Fan Coils & Air Handlers	1.00 (OD) : 1.00 (SYS)	20˚F

⚠ WARNING

When controlling a non condensing boiler, the SEQ minimum boiler water temperature must be set to boiler manufacturer specifications. In that case, SEQ system temperature must not go below such temperature.

MAKE SURE YOU HAVE THE RIGHT CONTROL

If you need the SQ-Elite-MV to do additional tasks that either are not listed or do not know how to configure them, contact Heat-Timer Corp. Sales Department either by Phone (973)575-4004, Fax (973) 575-4052, or by E-mail support@heat-timer.com.

INITIAL SETUP

Setting an Initial Program will ease the configuration of the SQ-Elite-MV and will give the opportunity to utilize many of the energy saving features and give more comfortable heat when needed.

The program should consist of the following:

- Selecting the features that your system can utilize.
- Installation: Install the Control, switches and sensors. See page 8.
- Setting the System Startup. See page 13.
- Setting the SEQ and MOV System Settings. See page 14.
- Setting the Stages. See page 25.
- Adjusting Reset Ratio and Water Offset (In Reset Mode Only). See page 22.

SELECTING THE SYSTEM FEATURES

The SQ-Elite-MV has been designed with Hydronic heating as the primary purpose. With this in mind, many of the SQ-Elite-MV features can be utilized to ease, enhance, and improve your system performance. Some of these features are listed in this section.

OUTDOOR RESET, SET POINT, OR EXTERNAL 4-20MA SET POINT

- The SQ-Elite-MV can control the boiler loop system temperature either by adjusting the calculated temperature according to the outdoor temperature (Outdoor Reset) or by maintaining an adjustable Set Point. The Outdoor Reset option uses an Outdoor Sensor (supplied with the control) and achieves better fuel savings in addition to better comfort.
- Using an optional 4-20mA EMS Interface (HTC# 926741-00), the SQ-Elite-MV can receive an external boiler system loop Set Point through EMS system.
- The motorized valve loop temperature can be set based on the outdoor temperature (Outdoor Reset) or by maintaining an adjustable Set Point.

PID OR OSS CONTROL LOGIC

- The SQ-Elite-MV PID can be used for applications where system reaction will require a long period to achieve or measure the results. However, OSS, can be used for applications where the load changes frequently and the sequencing must match the load and its immediate change.

NUMBER OF STAGES

- The SQ-Elite-MV can be configured to control up to six stages. It can control up to 22 stages using a maximum of two SQ-Elite-EXT Extension Panels each with eight stages.

STAGE PUMPS OR VALVES

- The SQ-Elite-MV can control multiple stages in addition to boiler pumps or valves.

CONTROL DHW PUMP

- The control of the DHW is based on using a dry-contact from an aquastat. The SQ-Elite-MV provides multiple DHW Priority options to choose from based on the DHW piping. The Prove input can be used to check the status on the System Pump Flow switch or any other devices before any stage is energized.

MONITOR BOILER RETURN

- The optional return line sensor, can be purchased separately, to monitor and help protect the boilers from thermal shock and condensation caused by cool returns.

MOTORIZED VALVE CONTROL

- What makes the SQ-Elite-MV unique is its ability to control the sequencing of the boiler stages in addition to modulating a floating motorized valve to achieve the desired building comfort. Thus, eliminating the need of having two controls each with its own set of wiring and settings. I.e., the same outdoor sensor, shutdown input, and season setting is used for the boiler system loop as well as the motorized valve secondary loop.

AUTOMATIC ROTATION AMONG BOILERS

- Rotating the lead boiler to be activated on a call for output promotes even wear on all boilers. The SQ-Elite-MV has three modes of rotation: Manual, First-On-First-Off, or Timed Rotation. This option automatically rotates boilers every selected time period from one hour to every 41 days (999 hours) .

SETBACK OR DAY/NIGHT SCHEDULING

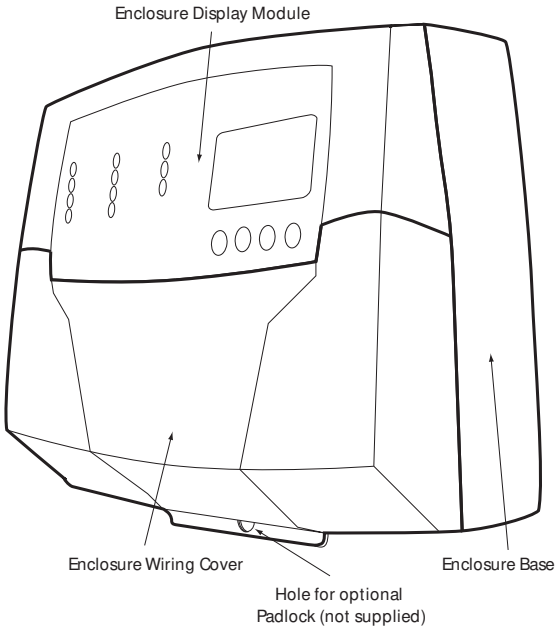
Two Setback modes are available for the SQ-Elite:

- The Day/Night Scheduling provides an adjustable time-based schedule for the Setback.
- The External Input 1`Setback mode uses an external signal to switch the operation of the SEQ in and out of setback mode.

INSTALLATION

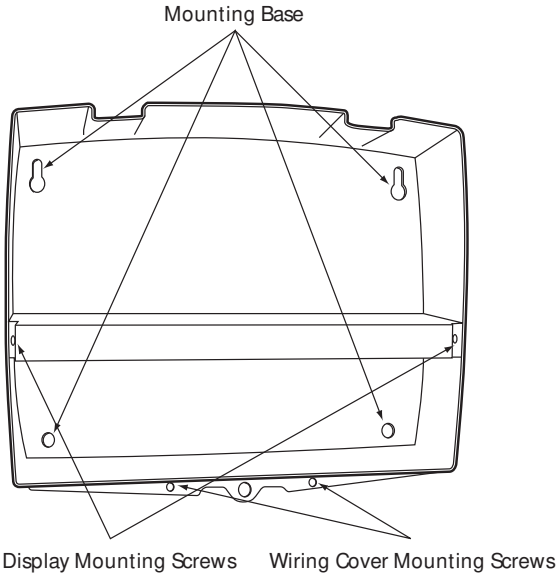
Each of the SQ-Elite-MV or SQ-Elite-EXT consists of three primary enclosure components.

- **The Enclosure Display Module:** contains the display, buttons, LEDs and electric wiring terminals. It has two screws to hold it to the base. A program configuration switch, used to adjust SQ-Elite-MV settings, is placed above the terminals. This switch is enclosed with the enclosure wiring cover for security. Wiring terminals are of the plug-in type to ease installation and removal.
- **The Enclosure Base:** contains the holes to mount and hold the control against the wall or any flat surface. All other enclosure components mount on the base. The bottom section of the Enclosure Base contains the wiring chamber with knockouts on the bottom to easy installation.
- **The Enclosure Wiring Cover:** seals the wires from the external environment. It has two screws to hold it the base and a hole to secure a lock on the wiring enclosure. A plastic web that separates the wiring chamber into high and low volt sections has been provided.



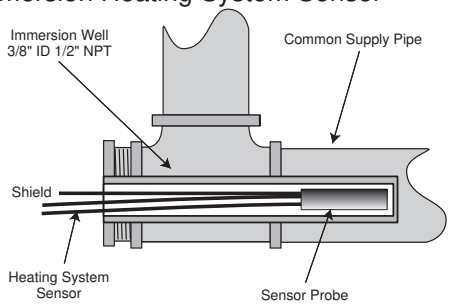
MOUNTING THE ENCLOSURE

- Select a location near the equipment to be controlled.
- The surface should be flat, and be sufficiently wide and strong to hold the SQ-Elite-MV or SQ-Elite-EXT.
- Keep the control away from extreme heat, cold, or humidity. Ambient operating temperature is from 20 to 120°F.
- Remove the Enclosure Wiring Cover from the control enclosure by removing the two bottom screws.
- Remove the Enclosure Display Module by removing the middle screws.
- Screw the Enclosure Base to the surface through the upper and lower mounting holes on the back of the enclosure.
- Replace the Enclosure Display Module and replace the middle screws.
- Do not replace the enclosure wiring cover until all wiring is done.
- When purchasing a padlock for the enclosure, the maximum shank diameter should not exceed ¼"



INSTALL THE SENSORS

Immersion Heating System Sensor



SYSTEM AND RETURN SENSORS INSTALLATION

- Only use the Standard Brass Tube sensors (HTC #904250-00) supplied as the SEQ System Sensor and MOV System Sensor. The Return Sensor is optional and can be purchased separately.
- The sensor wires can be extended up to 500' using a shielded 2-conductor cable (Belden #8760 or equivalent). Do not connect the shield at the sensor but at the panel using one of the terminals marked with an "O".
- Install a 3/8"ID immersion well (HT # 904011-00).
- Insert the sensor probe of the supplied sensor into the well.
- Do not run sensor wires in conduit with line voltage wiring.

LOCATING THE SEQ SYSTEM SENSOR

- Place the SEQ System sensor approximately 10' feet past the last heating boiler on the common supply header but before any major takeoffs.
- The SEQ System sensor must be located where it sees the output of all the stages. If a boiler is piped so that the SEQ System sensor does not see its output, the SQ-Elite-MV will not sequence the boilers correctly.

LOCATING THE MOV SYSTEM SENSOR

- Place the MOV System sensor approximately 10' feet past the motorized valve but before any major takeoffs.

LOCATING THE RETURN SENSOR

- Place the Return sensor approximately 10' feet before the boilers on the SEQ System loop return line.

⚠ ALERT

If any of the System Sensors cannot sense the correct system water temperature, the SQ-Elite-MV will not provide comfortable heat levels.

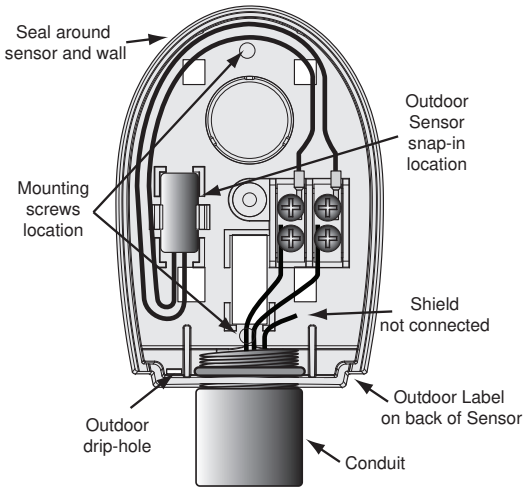
OUTDOOR SENSOR INSTALLATION

- Only use the Heat-Timer sensor included with the unit (HT# 904220-00).
- Locate the sensor in the shade on the north side of the building. The sensor should never be in direct sunlight.
- Be sure the location is away from doors, windows, exhaust fans, vents, or other possible heat sources.
- The sensor should be mounted approximately 10' feet above ground level.
- Adhere the Outdoor Label provided to the back of the sensor base.
- Use the Enclosure Base bottom knockout for the conduit. Use the locknut to hold the conduit and enclosure base together. Screw the cover to the base.
- If screws are used to affix the enclosure to the wall, make sure to seal around the sensor and wall except from the bottom.
- The sensor wires can be extended up to 500' using shielded 2-conductor cable (#18/2). Do not connect the shield at the sensor but at the control using the terminal marked with an "O".
- Do not run sensor wires in conduit with line voltage wiring.

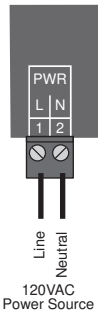
⚠ ALERT

Determining the proper location for the Outdoor Sensor is very important. The SQ-Elite-MV will base its operation on the outdoor temperature information it receives from this location. If the sensor is in the sun, or covered with ice, its reading will be different from the actual Outdoor temperature.

Outdoor Sensor



WIRING INPUTS



WIRING THE POWER
(TERMINALS 1, 2)

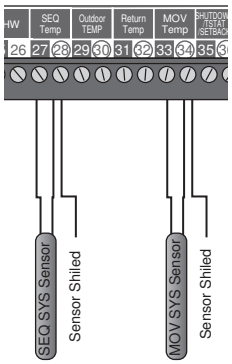
- Bring the 120VAC 60Hz power wires through the left bottom Knockout of the enclosure.
- Class 1 voltages must enter the enclosure through a different opening from any Class 2 voltage wiring.
- Connect the hot line to terminal marked L.
- Connect the neutral line to the terminal marked N.

⚠ WARNING

- **Class 1 voltages must enter the enclosure through a different opening from any Class 2 voltage wiring.**
- **Heat-Timer recommends installing a surge suppressor on the power source to the SQ-Elite.**

⚠ WARNING

Connect the shield at the control terminal end and cut the shield wire at the sensor end.

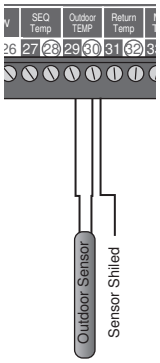


WIRING THE SENSORS

SEQ AND MOV SYSTEM TEMPERATURE SENSOR WIRING
SEQ SYSTEM (TERMINALS 27, 28)
MOV SYSTEM (TERMINALS 33, 34)

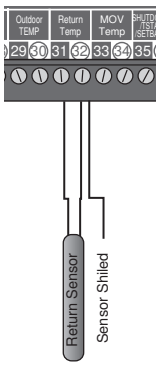
- The SQ-Elite-MV must be connected to a SEQ temperature sensor located in the boilers' common header.
- In addition, it must be connected to a MOV temperature sensor located after the 3-way motorized valve.
- Each of the System sensors must be inserted in 3/8ID wells (HT #904011-00).
- Temperature sensor wires can be extended up to 500' by splicing it to a shielded 2-conductor cable (Belden #8760 or equivalent).
- Temperature sensors have no polarity. Connect the sensor shield to the circled terminal with one of the sensor wires. The shield MUST NOT be connected at the sensor end.

OUTDOOR SENSOR WIRING
(TERMINALS 29, 30)



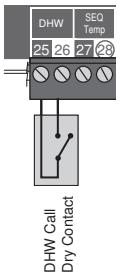
- When Outdoor Reset is selected, the SQ-Elite-MV will vary the system Set Point based on outdoor temperature.
- Whether in Set Point or Outdoor Reset modes, the outdoor sensor can be used as an Outdoor Cutoff. The SQ-Elite-MV will disable all Boilers and close the motorized valve when the outdoor temperature is above the adjustable Outdoor Cutoff temperature. This feature will automatically be activated when an outdoor sensor is connected.
- For an outdoor sensor, use a Heat-Timer outdoor sensor with the enclosure (HT #904220-00).
- The sensor wires can be extended up to 500' using shielded 2-conductor cable (Belden #8760 or equivalent).
- Temperature sensors have no polarity. Connect the wires from the outdoor sensor to the SQ-Elite-MV terminals marked *OUTDOOR TEMP - 29, 30*.
- Connect the shield to the circled terminal *30* with one of the sensor wires. The shield MUST NOT be connected at the sensor end.

RETURN SENSOR WIRING
(TERMINALS 31, 32) OPTIONAL



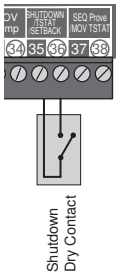
- If the Return Sensor is connected, must be purchased separately, the SQ-Elite-MV will recognize it and show its temperature on the display. If the Return is below the Minimum Return, the SQ-Elite-MV will sequence stages based on the Return Sensor, Minimum Return, SEQ Target, and the actual SEQ System Temperature.
- The Return on the SQ-Elite-MV is designed to be connected to a temperature sensor that can be purchased separately (HT #904220-00) for immersion in a 3/8ID well (HT #904011-00).
- The sensor wires can be extended up to 500' using shielded 2-conductor cable (Belden #8760 or equivalent).
- Temperature sensors have no polarity. Connect the wires from the outdoor sensor to the SQ-Elite-MV terminals marked *OUTDOOR TEMP - 31, 32*.
- Connect the shield to the circled terminal *32* with one of the sensor wires. The shield MUST NOT be connected at the sensor end.

WIRING THE DOMESTIC HOT WATER INPUT
(TERMINALS 25 26)



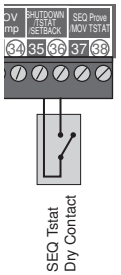
- DHW can be used to raise system Set Point to 200°F or Maximum Target, whichever is lower. DHW Piping concept must be selected from the Startup Menu. See DHW Piping in Startup on page 13 and DHW Priority Timer on page 29.
- *DHW* Call input terminals can accept only a dry-contact input.
- Wire an aquastat or other controls to provide dry-contact closure on the *DHW* terminals.
- If Shutdown was selected as the External Input 1, a DHW call will be ignored when the Shutdown is active.

WIRING THE SHUTDOWN
(TERMINALS 35, 36)



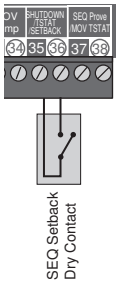
- This feature will only be available when Shutdown is selected as the External Input 1 option from the Startup menu. See External Input 1 on page 19.
- This feature can be used whenever it is desirable to turn off the SQ-Elite-MV stage as well as close the motorized valve from a remote location or another controller (i.e. EMS input).
- When the Shutdown feature is enabled by closing its dry-contact, all active stages will immediately turn off and the motorized valve close relay (MOV CLOSE) will energize for six minutes to guarantee valve closure. The System and boiler pumps' or valves' relays will remain energized for the Run-On delay period and then turn off.
- The Shutdown signal must be a dry-contact only. No voltage can be placed across the *Shutdown* terminals.
- Note that when the Shutdown is active, no DHW operation will take place.

WIRING THE SEQ TSTAT
(TERMINALS 35, 36)



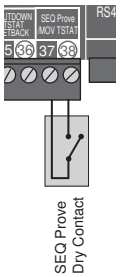
- This feature will only be available when Tstat is selected as the External Input 1 option from the Startup menu. See External Input 1 on page 19.
- This feature can be used whenever it is desirable to turn on the SQ-Elite-MV stages on from a remote location or another controller (i.e. EMS input).
- When the Tstat feature is enabled by closing a dry-contact, the SQ-Elite-MV will sequence the stages to achieve the desired SEQ Set Point. However, when the terminals are opened, all stages will de-energize.
- The Tstat signal must be a dry-contact only. No voltage can be placed across the *Tstat* terminals.

WIRING THE SEQ SETBACK
(TERMINALS 35, 36)



- This feature can be used whenever it is desirable to reduce the SQ-Elite-MV boiler loop temperature from a remote location (i.e. EMS input or external time clock). It will only be available when SEQ Setback is selected as the External Input 1 option from the Startup menu. In addition, no setback scheduling will be available. See External Input 1 on page 19.
- When the Setback is enabled by closing a dry-contact, the SEQ Target (boiler loop target temperature) will be reduced by the Setback value.
- The Setback signal must be a dry-contact only. No voltage can be placed across the *Setback* terminals.

WIRING THE SEQ PROVE
(TERMINALS 37, 38)

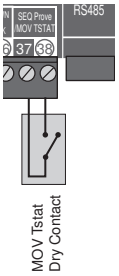


- For these terminals to function as a Prove signal, SEQ Prove must be selected from External Input 2 Startup menu. See External Input 2 on page 19.
- The *PROVE* input can be used to check on the SEQ System Output. A typical use of this feature is to check for system pump flow or a combustion air damper status before energizing any stage.
- If the PROVE input is open, the SQ-Elite-MV will leave the SEQ System Output energized. However, all stage outputs will be off.
- A factory-installed jumper provides the SEQ System Prove signal. Do not remove the jumper unless it will be replaced by a SEQ System Prove signal.
- No voltage can be placed across the *SEQ Prove* terminals

⚠ WARNING

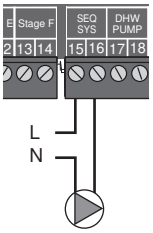
The PROVE input CANNOT be used as a safety limit. All equipment must have its own certified limit and safety controls as required by local codes. No boiler stage will start unless Prove terminals are shorted. DO NOT remove the PROVE jumper supplied unless replacing it with a Prove signal or changing input functionality.

WIRING THE MOV TSTAT
(TERMINALS 37, 38)



- For these terminals to function as a thermostat call for the motorized valve loop signal, MOV Tstat must be selected from External Input 2 start menu. See External Input 2 on page 19.
- This feature can be used whenever it is desirable to activate the motorized valve loop from a remote location or another controller (i.e. Thermostat).
- When the Tstat feature is enabled by closing a dry-contact, the SQ-Elite-MV will modulate the motorized valve to achieve the desired MOV Set Point.
- The Tstat signal must be a dry-contact only. No voltage can be placed across the *Tstat* terminals.

WIRING OUTPUTS
WIRING THE SYSTEM PUMPS

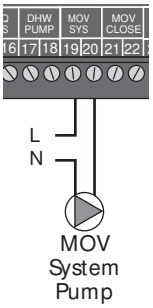


- Both system outputs will de-energize when the Season is set to Summer or the *Shutdown* input is activated.

WIRING THE SEQ SYSTEM OUTPUT (TERMINALS 15, 16)

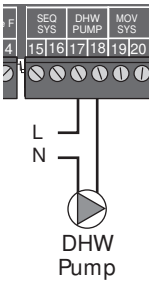
- Connect the SEQ pump (boiler loop pump) or pump starter to terminals 15, 16 so that the SEQ System relay will switch the hot power line to the pump.
- The SEQ System output has one Normally Open (N.O.) relay that acts as a switch. It does not source any power. However, the relay can switch a maximum power of 2 Amp pilot duty or 6 Amp resistive load at 120VAC.
- Class 1 voltages must enter the enclosure through a different opening from any Class 2 voltage wiring.
- The SEQ System output relays will energize whenever the outdoor temperature drops below its Outdoor Cutoff. It will de-energize when the outdoor temperature rises 2˚F above the respective Outdoor Cutoff and after a full SEQ Run-on has elapsed.
- If External Input 1 was set to SEQ Tstat, the SEQ System relay will de-energize after the Run-On delay when the *SEQ Tstat* input is opened.
- If Primary Secondary is selected as the DHW Piping, the SEQ System output will also energize on a call for DHW during Summer or when *SEQ Tstat* input is opened.

WIRING THE MOV SYSTEM OUTPUT (TERMINALS 19, 20)



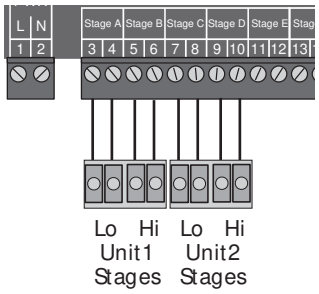
- Connect the MOV pump (Motorized valve loop pump) or pump starter to terminals 19, 20 so that the MOV System relay will switch the hot power line to the pump.
- The MOV System output has one Normally Open (N.O.) relay that acts as a switch. It does not source any power. However, the relay can switch a maximum power of 2 Amp pilot duty or 6 Amp resistive load at 120VAC.
- Class 1 voltages must enter the enclosure through a different opening from any Class 2 voltage wiring.
- The MOV System output relays will energize whenever the outdoor temperature drops below its Outdoor Cutoff. It will de-energize when the outdoor temperature rises 2˚F above the respective Outdoor Cutoff and after the Valve Close relay is energized for a full six minutes. The MOV System relay will remain energized for the MOV Run-On before de-energizing.
- If External Input 2 was set to MOV Tstat, the MOV System relay will de-energize after the Run-On delay when the *MOV Tstat* input is opened.

WIRING THE DHW PUMP
(TERMINALS 17, 18)



- The SQ-Elite-MV can control the DHW Pump when the DHW Pump Output option is activated in the Startup Menu. See DHW Pump Output on page 19.
- Connect the DHW pump or pump starter to terminals 17, 18 so that the DHW Pump relay will switch the hot power line to the pump.
- The DHW Pump output has one Normally Open (N.O.) relay that acts as a switch. It does not source any power. However, the relay can switch a maximum power of 2 Amp pilot duty or 6 Amp resistive load at 120VAC.
- Class 1 voltages must enter the enclosure through a different opening from any Class 2 voltage wiring.
- The SQ-Elite-MV will energize the DHW Pump whenever there is a call for DHW.
- If Shutdown was selected as the External Input 1 (See page 19), DHW calls will be ignored when Shutdown is active.

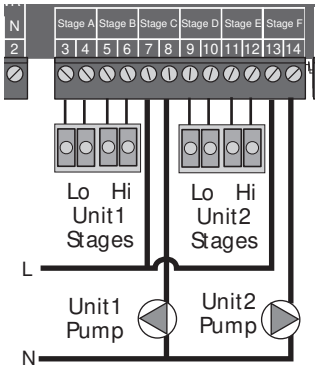
WIRING THE STAGES
(TERMINALS 3 TO 14)



The SQ-Elite-MV can be configured to operate the stages of a heating boiler or multiple boilers. Moreover, it can be configured to operate the boiler pumps or valves in addition to the stages.

- The N.O. contacts are dry-contacts only. They do not source any voltage.
- Wire the N.O. relay contacts in series with the boiler's limit circuit on On/Off boilers. However, on multi-stage boilers follow the burner manufacturer diagrams to wire the individual stages.
- No stage outputs will be activated until the *Prove* input is shorted. If a Prove is not required, the factory-installed jumper should remain connected or the *Prove* terminal functionality should change.
- Class 1 voltage wiring must enter the enclosure through a different opening from any Class 2 voltage wiring.

WIRING THE STAGE OUTPUTS

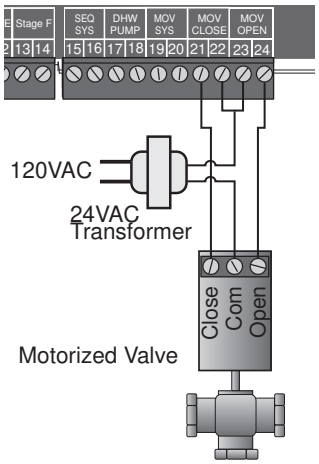


- Each Stage output (A through F) has one Normally Open (N.O.) relay contact.
- Wire the N.O. relay contacts in series with the boiler's limit circuit on On/Off boilers. However, on multi-stage boilers follow the burner manufacturer diagrams to wire the individual stages.
- When wiring several multi-stage boilers, start with the lower stage of the first boiler and wire it to Output A, followed by the higher stage of the same boiler and wire it to Stage B.

WIRING THE PUMP OR VALVE OUTPUTS

- If the SQ-Elite-MV is configured to operate Stage Pumps or Valves (See Boiler Output menu under the Startup on page 19), then, wire them using the stage after the highest firing stage on that boiler. That is, the low stage for the first boiler must be connected to A and the higher stage of the same boiler must be connected to Stage B. The boiler valve or pump must be connected to Stage C.

WIRING THE MOTORIZED VALVE
(TERMINALS 21 TO 24)



The SQ-Elite-MV has 2 S.P.S.T (single pole single throw) modulating output relays.

- The Motorized Valve *Open* and *Close* outputs are dry-contacts only. They do not source any power. A separate power source must be used to provide the actuator with power.
- To ease the wiring, the power to the motorized valve can be switched using the *MOV Open* and *Close relay* outputs. See diagram.

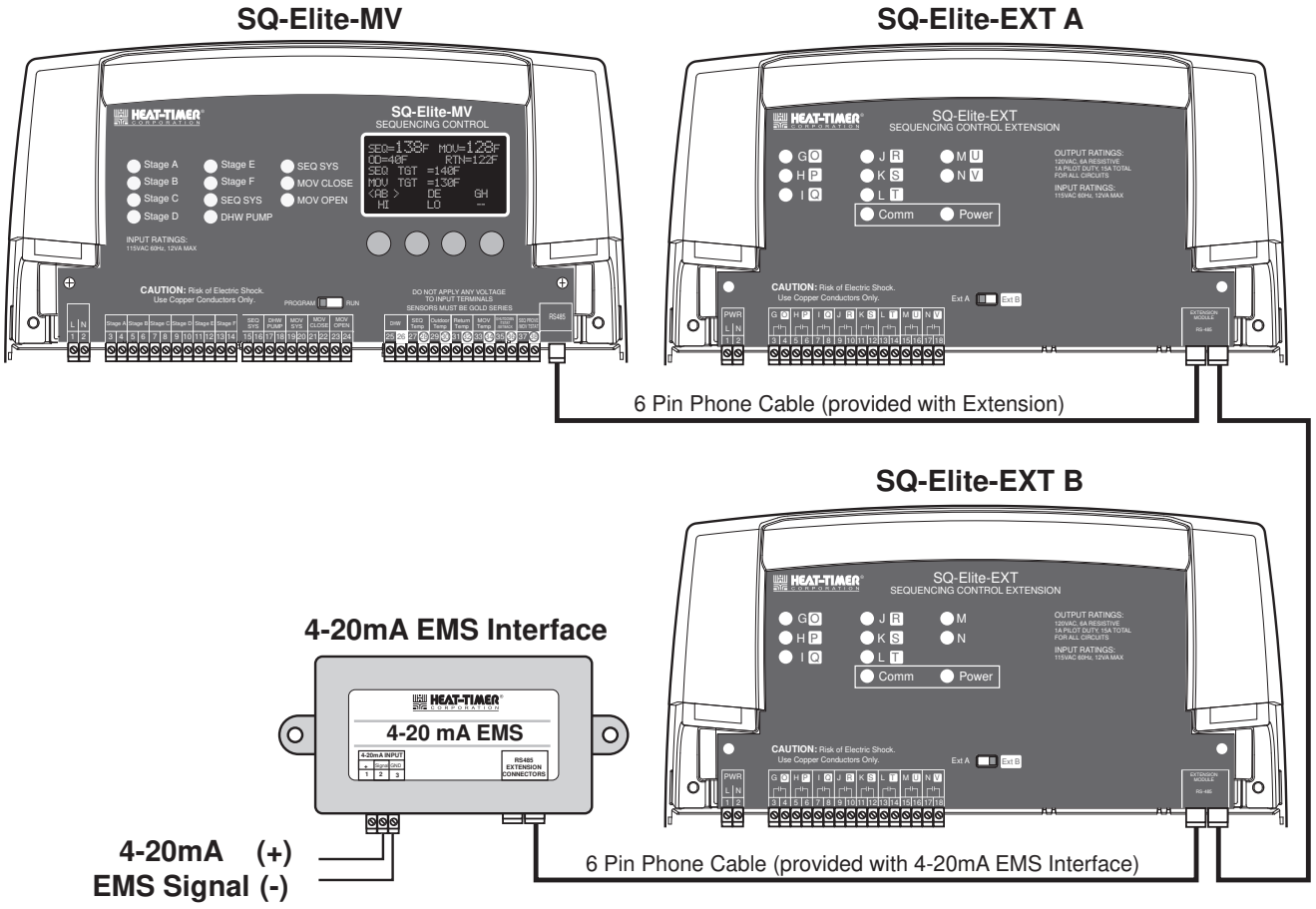
CONNECTING TO THE SQ-ELITE-EXT PANELS AND 4-20MA EMS INTERFACE

- The SQ-Elite-MV is equipped with a 6-pin phone socket to connect to SQ-Elite-EXT Extension panels or 4-20mA EMS Interface.
- Only the 6-wire phone cable provided must be used for proper operation.
- Each SQ-Elite-EXT Extension has two RS485 communication ports. Use one to connect to the SQ-Elite. Use the other port to connect to the second extension or 4-20mA EMS Interface.
- Additional compatible devices can utilize the second RS485 connection on the second SQ-Elite-EXT Extension. i.e. 4-20mA EMS Interface (HT# 926741-00) to provide a 4-20mA set point signal to the SQ-Elite-MV (SEQ Set Point only). See SEQ Control Mode on page 18.

SELECTING THE SQ-ELITE-EXT PANEL LETTER

- The SQ-Elite-MV is capable of communicating to two SQ-Elite-EXT Extensions. To avoid having communication problem, each extension must be identified as either A or B using the switch on each extension.
- Extension A (Switch is set to "A") will operate stages "G" through "N". While Extension B (Switch is set to "B") will operate stages "O" through "V".

Connecting SQ-Elite-MV to Two Extension Panels and 4-20mA EMS Interface using RS485



STARTUP SETTINGS

PROGRAM CHANGE SETTINGS

- To be able to change the SQ-Elite-MV settings the Program/Run Switch must be set to Program. The switch is located under the Enclosure Wiring Cover for security. The Enclosure Wiring Cover can be securely closed using a padlock.
- To display the button functionality, press any of the four buttons below the display.
- To enter the Installer Menu, hold down the MENU Button for at least three seconds. The Installer Menu have advanced settings in addition to the User Menu settings.
- To enter the User Menu, just press the MENU button. See User Menu Sequence on page 40.

⚠ ALERT

A good practice after performing any Startup menu modifications is to check all operating settings and adjustments to match the new settings.

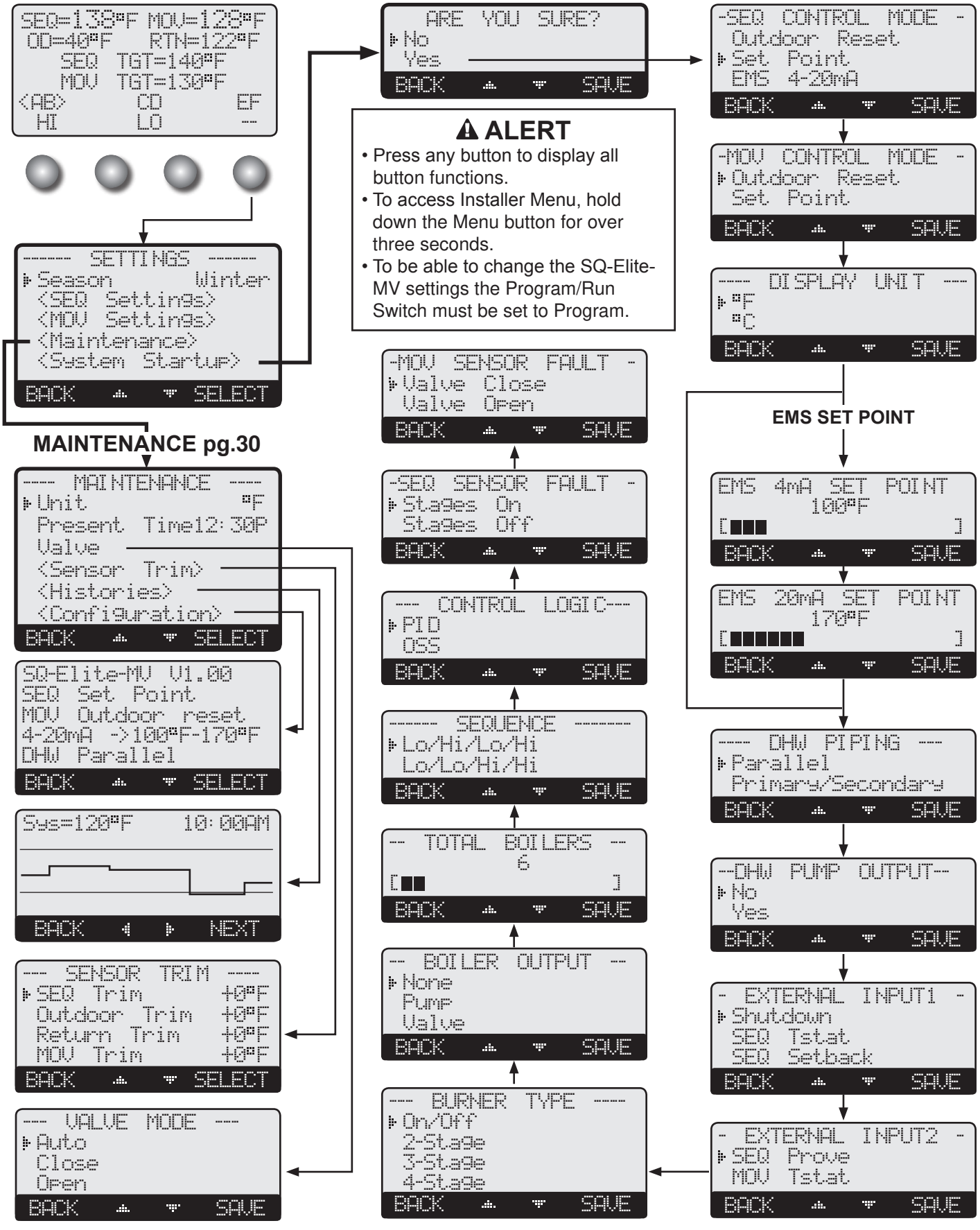
STARTUP SEQUENCE

Hold Button: *MENU/<System Startup>*

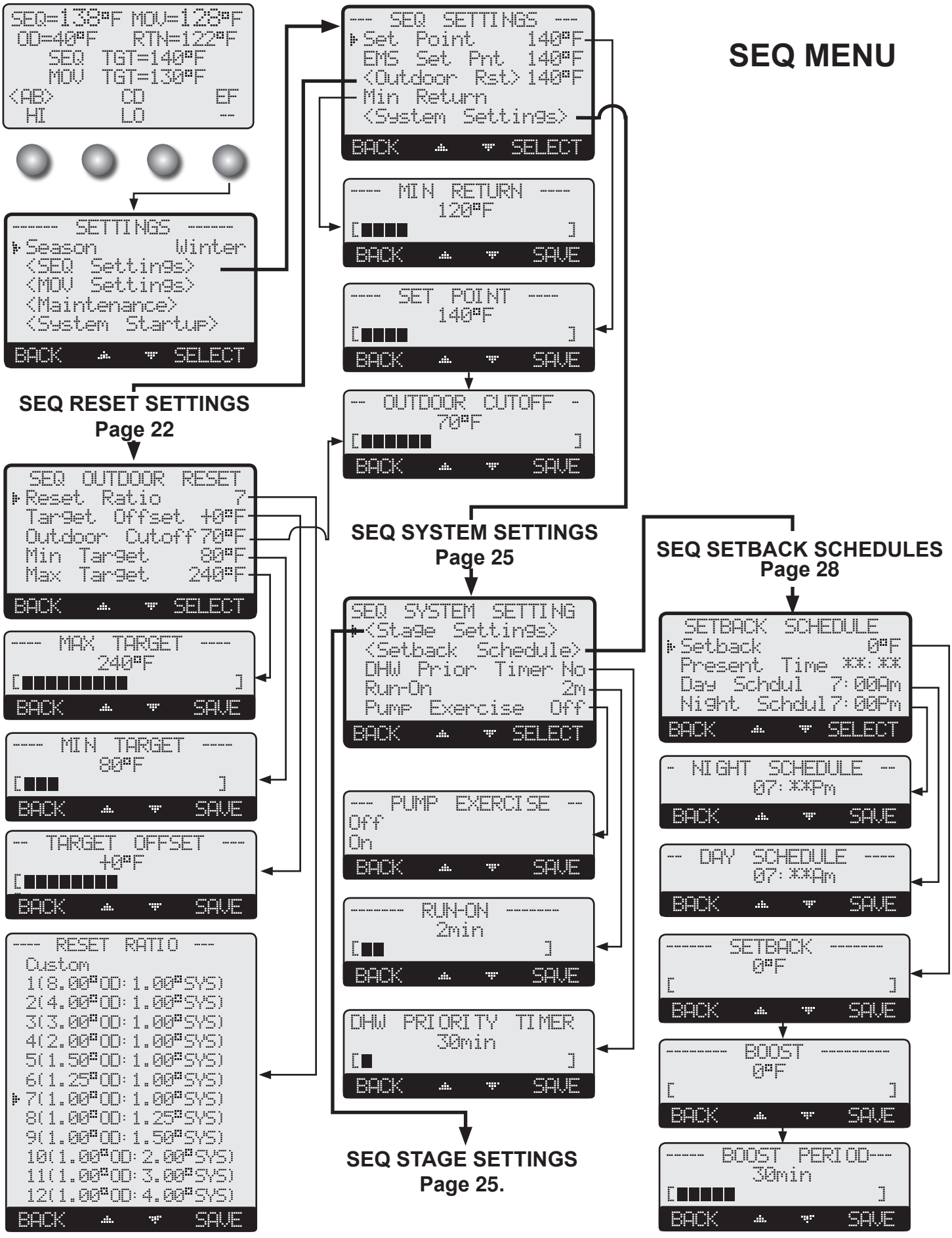
- When powered, the SQ-Elite-MV performs a self-test on its components. After the self-test diagnostics have been successfully completed, the SQ-Elite-MV will initialize the control.
- On the first power up, the System Startup screen will appear after the initialization is complete. If it doesn't, the SQ-Elite-MV has already been configured.
- The System Startup menu sets the main parameters like the type of logic used, the functionality of the outputs and inputs, and many other parameters described in this section.
- Before entering the Startup menu, several warnings will alert you to the consequences of making Startup changes.

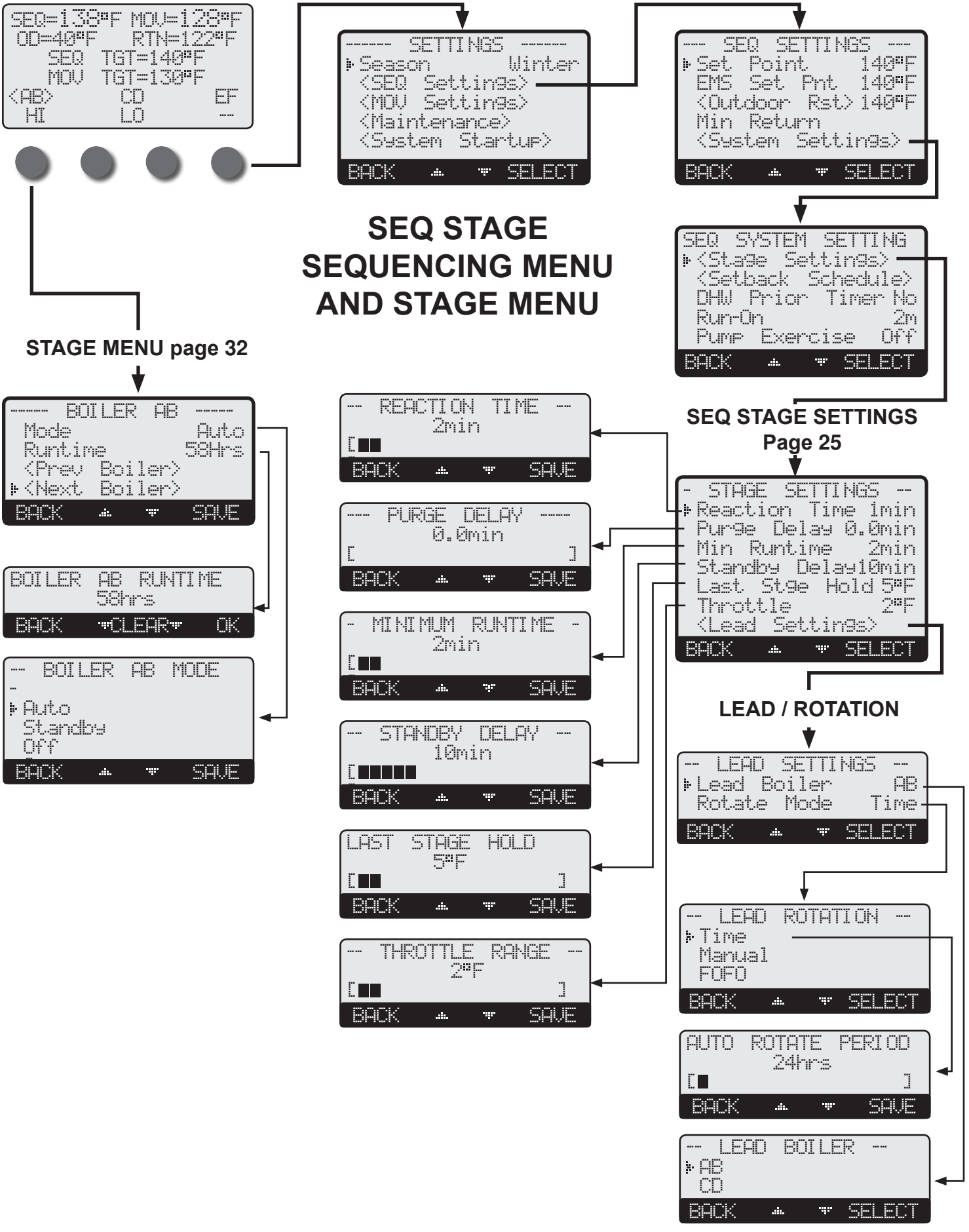
INSTALLER MENU SEQUENCE

STARTUP

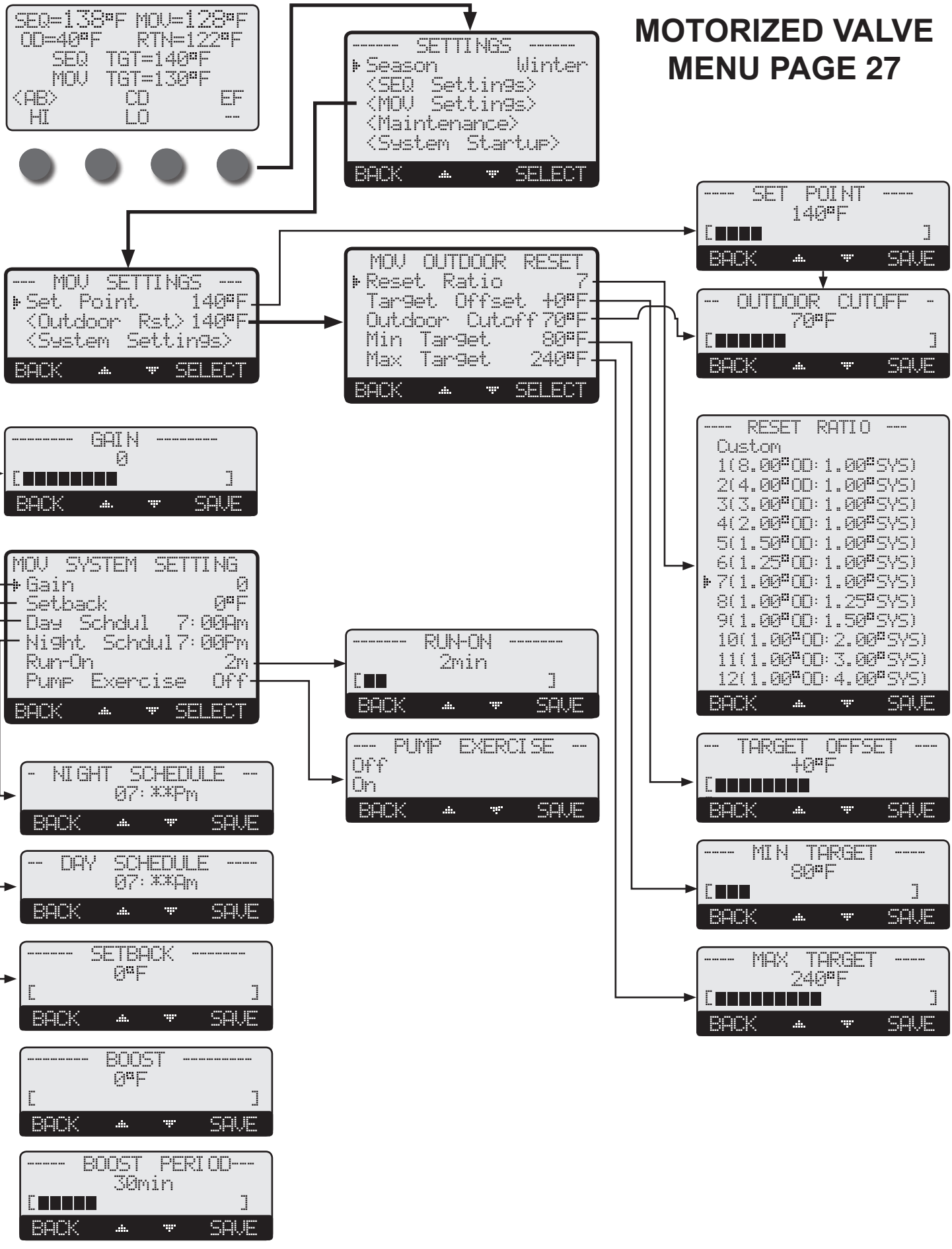


SEQ MENU

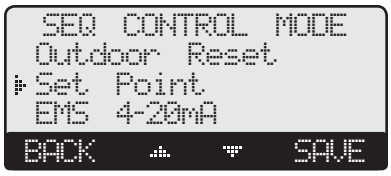

SEQ=138°F MOD=128°F
OD=40°F RTN=122°F
SEQ TGT=140°F
MOD TGT=130°F
<AB> CD EF
HI LO --
--- SEQ SETTINGS ---
Set Point 140°F
EMS Set Pnt 140°F
<Outdoor Rst> 140°F
Min Return
<System Settings>
BACK SELECT
---- MIN RETURN ----
120°F
BACK SAVE
---- SET POINT ----
140°F
BACK SAVE
-- OUTDOOR CUTOFF -
70°F
BACK SAVE
------ SETTINGS ------
Season Winter
<SEQ Settings>
<MOD Settings>
<Maintenance>
<System Startup>
BACK SELECT
SEQ RESET SETTINGS
Page 22
SEQ OUTDOOR RESET
Reset Ratio 7
Target Offset +0°F
Outdoor Cutoff 70°F
Min Target 80°F
Max Target 240°F
BACK SELECT
SEQ SYSTEM SETTINGS
Page 25
SEQ SETBACK SCHEDULES
Page 28
SEQ SYSTEM SETTING
<Stage Settings>
<Setback Schedule>
DHW Prior Timer No
Run-On 2m
Pump Exercise Off
BACK SELECT
SETBACK SCHEDULE
Setback 0°F
Present Time **:**
Day Schdul 7:00Am
Night Schdul 7:00Pm
BACK SELECT
---- MAX TARGET ----
240°F
BACK SAVE
----- MIN TARGET -----
80°F
BACK SAVE
-- TARGET OFFSET ---
+0°F
BACK SAVE
--- RESET RATIO ---
Custom
1(8.00"OD:1.00"SYS)
2(4.00"OD:1.00"SYS)
3(3.00"OD:1.00"SYS)
4(2.00"OD:1.00"SYS)
5(1.50"OD:1.00"SYS)
6(1.25"OD:1.00"SYS)
7(1.00"OD:1.00"SYS)
8(1.00"OD:1.25"SYS)
9(1.00"OD:1.50"SYS)
10(1.00"OD:2.00"SYS)
11(1.00"OD:3.00"SYS)
12(1.00"OD:4.00"SYS)
BACK SAVE
--- PUMP EXERCISE --
Off
On
BACK SAVE
------- RUN-ON -------
2min
BACK SAVE
DHW PRIORITY TIMER
30min
BACK SAVE
SEQ STAGE SETTINGS
Page 25.
- NIGHT SCHEDULE --
07:**Pm
BACK SAVE
-- DAY SCHEDULE ----
07:**Am
BACK SAVE
------ SETBACK -------
0°F
BACK SAVE
-------- BOOST ---------
0°F
BACK SAVE
------ BOOST PERIOD---
30min
BACK SAVE


SEQ=138°F MOV=128°F
OD=40°F RTN=122°F
SEQ TGT=140°F
MOV TGT=130°F
<AB> CD EF
HI LO --
----- SETTINGS -----
Season Winter
<SEQ Settings>
<MOV Settings>
<Maintenance>
<System Startup>
BACK SELECT
--- SEQ SETTINGS ---
Set Point 140°F
EMS Set Pnt 140°F
<Outdoor Rst> 140°F
Min Return
<System Settings>
BACK SELECT
SEQ STAGE SEQUENCING MENU AND STAGE MENU
SEQ SYSTEM SETTING
<Stage Settings>
<Setback Schedule>
DHW Prior Timer No
Run-On 2m
Pump Exercise Off
BACK SELECT
STAGE MENU page 32
SEQ STAGE SETTINGS Page 25
----- BOILER AB -----
Mode Auto
Runtime 58Hrs
<Prev Boiler>
<Next Boiler>
BACK SAVE
-- REACTION TIME --
2min
BACK SAVE
--- PURGE DELAY ---
0.0min
BACK SAVE
- STAGE SETTINGS --
Reaction Time 1min
Purge Delay 0.0min
Min Runtime 2min
Standby Delay10min
Last Stge Hold 5°F
Throttle 2°F
<Lead Settings>
BACK SELECT
BOILER AB RUNTIME
58hrs
BACK CLEAR OK
- MINIMUM RUNTIME -
2min
BACK SAVE
-- BOILER AB MODE
Auto
Standby
Off
BACK SAVE
-- STANDBY DELAY --
10min
BACK SAVE
LEAD / ROTATION
-- LEAD SETTINGS --
Lead Boiler AB
Rotate Mode Time
BACK SELECT
LAST STAGE HOLD
5°F
BACK SAVE
-- LEAD ROTATION --
Time
Manual
FOFO
BACK SELECT
-- THROTTLE RANGE --
2°F
BACK SAVE
AUTO ROTATE PERIOD
24hrs
BACK SAVE
-- LEAD BOILER --
AB
CD
BACK SELECT

MOTORIZED VALVE MENU PAGE 27



SEQ CONTROL MODE



Outdoor Reset, Set Point, EMS 4-20mA **Default: Set Point**

Hold Button: *MENU/<System Startup>/..../SEQ Control Mode*

- Outdoor Reset provides a variable set point based on outdoor temperature.
- Outdoor Reset mode requires the use of an outdoor sensor. DO NOT select Reset without an outdoor sensor.
- SEQ Set Point mode does not require an outdoor sensor. If an outdoor sensor is connected in SEQ Set Point mode, it will be used only as an SEQ Outdoor Cutoff point. That is, to turn the stages, stage pumps or valves, and SEQ System relays off.
- The EMS 4-20mA allows the SQ-Elite-MV to receive an external SEQ Set Point from an EMS/BMS system. This option requires the use of the 4-20mA EMS Interface (HT# 926741-00). See Connecting 4-20mA Interface on page 12.
- The EMS 4-20mA option will allow the adjustment of the temperature in the following screens.

MOV CONTROL MODE

Outdoor Reset, Set Point **Default: Outdoor Reset**

Hold Button: *MENU/<System Startup>/..../MOV Control Mode*

- Outdoor Reset provides a variable set point based on outdoor temperature.
- Outdoor Reset mode requires the use of an outdoor sensor. DO NOT select Reset without an outdoor sensor.
- MOV Set Point mode does not require an outdoor sensor. If an outdoor sensor is connected in MOV Set Point mode, it will be used only as an MOV Outdoor Cutoff point. That is, to turn the MOV System relays off and close the motorized valve.

DISPLAY UNIT

ºF, ºC **Default: ºF**

Hold Button: *MENU/<System Startup>/..../Display Unit*

- The SQ-Elite-MV is designed to control multiple boilers and a motorized valve in hydronic environment where the temperature is the critical factor. This setting provides the user with the capability of displaying temperature information and settings in either ºF (Fahrenheit) or ºC (Celsius). Select the display unit that is best suited for your application.

SETTING THE 4MA AND 20MA SEQ SET POINTS

(AVAILABLE IN 4-20MA EMS FOR THE SEQ ONLY)

4mA from -10ºF/-23ºC to 240ºF/116ºC **Default:100ºF/38ºC**

20mA from -10ºF/-23ºC to 240ºF/116ºC **Default:170ºF/77ºC**

Hold Button: *MENU/<System Startup>/..../EMS 4mA Set Point/EMS 20mA Set Point*

- If EMS 4-20mA is selected from the SEQ Control Mode menu as the temperature set point source, the user must purchase a Heat-Timer 4-20mA EMS Interface (HT# 926741-00) to accept the 4-20mA signal and transmit it to the SQ-Elite-MV.
- In addition, the user will need to set the temperature range parameters. First, set the 4mA temperature, then the 20mA temperature.
- To shutdown the control using the EMS signal, send a signal that is above or below the 2-22mA range. The display will show the message "Shutdown by EMS" and all stages will de-energize. However, the system and boiler pumps or valves will remain energized for the Run-On delay period then de-energize.

DHW PIPING

Parallel, Primary/Secondary **Default: Parallel**

Hold Button: *MENU/<System Startup>/..../DHW Piping*

- When Parallel is selected, the SQ-Elite-MV will offer a DHW Priority Timer. The DHW Priority will only take place during heating periods by allowing the SEQ System relay to de-energize during DHW calls. See DHW Settings on page 29.
- If no DHW Priority Timer was selected, the SEQ System relay will remain energized during DHW calls. However, in Summer and SEQ Outdoor Cutoff situations, only the DHW Pump relay will energize.
- Selecting the Primary/Secondary option will energize the System relay with the DHW Pump relay whenever there is a call for DHW even during the Summer or when the outdoor temperature is above the SEQ Outdoor Cutoff. See DHW Settings on page 29.

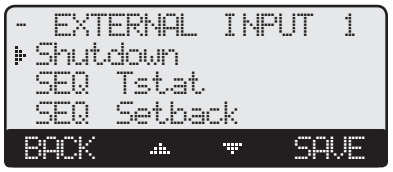
DHW PUMP OUTPUT

No, Yes **Default: Yes**

Hold Button: *MENU/<System Startup>/..../DHW Pump Output*

- The SQ-Elite-MV can operate the DHW Pump. This option allows the user to select if the SQ-Elite-MV should be controlling the DHW Pump or not.

EXTERNAL INPUT 1 MODE



Shutdown, SEQ Tstat, SEQ Setback **Default: Shutdown**

Hold Button: *MENU/<System Startup>/..../External Input1*

- The Shutdown function allows the SQ-Elite-MV to receive a remote dry-contact signal to terminals *35 and 36* to turn off all relays including boilers stages.
- When Shutdown is selected, any DHW call will be ignored when the control is in Shutdown.
- The SEQ Tstat option gives terminals *35 and 36* the capability of functioning as a heat-call. That is, when the terminals are shorted, the control will sequence the stages to maintain the set point. However, when terminals are opened, all stages will turn off. Unlike the Shutdown, when SEQ Tstat is selected, a DHW call will energize the stages even if the SEQ Tstat is not active.
- SEQ Setback is used to lower the SEQ Set Point when less load is required during nights and weekends. No Schedule options will be available for the SEQ when this option is selected. In this case, the Setback can only be activated using a remote input.
- For SEQ Setback operation, the SQ-Elite-MV can either utilize its built-in day schedule by selecting Shutdown or Tstat options, or an external dry-contact signal to input terminals *35 and 36* to switch to setback by selecting Setback from this menu.

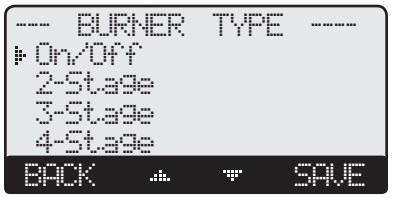
EXTERNAL INPUT 2 MODE

SEQ Prove, MOV Tstat **Default: SEQ Prove**

Hold Button: *MENU/<System Startup>/..../External Input2*

- The SEQ Prove option assigns terminals *37 and 38* the Prove function for the SEQ stages. Thus, not allowing any stage to operate when those terminals are opened. However, the SEQ System Pump can be energized.
- If SEQ Prove is selected, make sure to connect those terminals to either a flow switch that checks the SEQ System pump operation or a combustion air damper end switch. Otherwise, install a jumper on terminals *37 ad 38* to allow for stage operation.
- If MOV Tstat was the option selected, the SQ-Elite-MV will activate the motorized valve heating only when terminals *37 and 38* are shorted with a dry-contact input. When the terminals are opened, the motorized valve Close relay will energize for six minutes allowing it to fully close.

BURNER TYPE



On/Off, 2-Stage, 3-Stage, 4-Stage **Default: On/Off**

Hold Button: *MENU/<System Startup>/..../Burner Type*

- The SQ-Elite-MV can sequence from a single stage and up to four stages per boiler.

BOILER OUTPUT

None, Pump, Valve **Default: None**

Hold Button: *MENU/<System Startup>/..../Boiler Output*

- When None is selected, the SQ-Elite-MV will sequence multiple boilers without any additional boiler pumps or valves.
- The Pump option allows the SQ-Elite-MV to control the boiler stages in addition to their pumps. The stage pump relay will run for the Run-On delay after the lower stage of that boiler has de-energized.
- The Valve option functions similar to the pump option except that when all SQ-Elite-MV stages are off and after Run-On delay has elapsed, the Lead boiler's valve relay will remain energized to allow for flow across the system. The lead boiler's valve will remain energized until the Outdoor temperature rises above the SEQ Outdoor Cutoff or the Shutdown or Summer is activated.

TOTAL BOILERS

1 to 22 **Default: varies based on Burner Type and Boiler Output**

Hold Button: *MENU/<System Startup>/..../Boiler Output*

- This option in Combination with Burner Type and Boiler Output option will determine the total number of stages the SQ-Elite-MV will need to control.
- If more stages are selected than the SQ-Elite-MV and SQ-Elite-EXT Extension has, the additional boilers containing these stages will have CE displayed as their status.

SEQUENCE

Lo/Hi/Lo/Hi, Lo/Lo/Hi/Hi **Default: Lo/Hi/Lo/Hi**

Hold Button: *MENU/<System Startup>/..../Sequencing*

- Some boilers are designed to run more efficient when the lower firing stages are run than with the higher stages. These types of boilers should select Lo/Lo/Hi/Hi. Then, the SQ-Elite-MV will sequence the lower stages of all boilers with Modes configured as Auto before sequencing the higher stages.
- For the rest of the boiler types, the Lo/Hi/Lo/Hi should start the firing of the lower stage of the lead boiler followed by the higher stage of the same boiler. Then when more stages are needed, it will fire the lower stage of the lag boiler followed by the higher stage of the lag boiler.

CONTROL LOGIC

PID, OSS (Over-Sized-System) **Default: PID**

Hold Button: *MENU/<System Startup>/..../Control Logic*

- The PID option allows the SQ-Elite-MV to sequence stages based on Reaction Time and Boiler Min Run Time. The PID relies on the rate of change in the SEQ system temperature. The PID logarithmic calculations foresee changes and sequence stages based on those changes. It is the most efficient operation for most heating applications. See page 25.
- The Oversize option sequence stages based on how many Throttling ranges (differentials) is the SEQ system temperature away from the SEQ Target temperature. At one Throttling range below the SEQ Set Point, only one stage will be on. For each additional Throttling range below the SEQ Set Point, an additional stage will be activated. The last stage on will be allowed to exceed the SEQ Set Point by one Throttling range before turning off. This helps prevent the last stage from short cycling. See Throttle on page 26.

When PID is Selected, the following are the settings that directly affects this modes operation:

- Reaction Time ***Hold Button:*** *MENU/SEQ Settings/System Settings/Stage Settings/Reaction Time*
- Purge Delay ***Hold Button:*** *MENU/SEQ Settings/System Settings/Stage Settings/Purge Delay*
- Minimum Run Time ***Hold Button:*** *MENU/SEQ Settings/System Settings/Stage Settings/Min Runtime*
- Standby Delay ***Hold Button:*** *MENU/SEQ Settings/System Settings/Stage Settings/Standby Delay*
- Last Stage Hold ***Hold Button:*** *MENU/SEQ Settings/System Settings/Stage Settings/Last Stage Hold*

When Oversize (OSS) is Selected, the following are the settings that directly affects this modes operation:

- Throttle ***Hold Button:*** *MENU/SEQ Settings/System Settings/Stage Settings/Throttle*

SEQ SENSOR FAULT

Stages On, Stages Off **Default: Stages On**

Hold Button: *MENU/<System Startup>/..../SEQ Sensor Fault*

The SEQ Sensor Fault will determine the operating status of all output stages that are set to Auto when a sensor reads Short or Open.

RESET MODE

- When Stages-On is selected, the SQ-Elite-MV will turn all boiler stages On when the SEQ System reads Short or Open and the outdoor temperature is below SEQ Outdoor Cutoff. However, if the outdoor temperature is above the Outdoor Cutoff, the Outdoor Cutoff will take over turn off the stages. When the outdoor reads Short or Open, the SQ-Elite-MV will change the Target to the Maximum Target.
- When Stages-Off is selected, the SQ-Elite-MV will turn all stages Off when the SEQ System reads Short or Open. However, when the Outdoor reads Short or Open, the SQ-Elite-MV will change the Target to the Minimum Target.

SET POINT MODE

- When Stages-On is selected, the SQ-Elite-MV will turn all stages On when the SEQ System sensor reads Short or Open.
- When Stages-Off is selected, the SQ-Elite-MV will turn all stages Off when the SEQ System sensor reads Short or Open.
- The Outdoor Sensor Short or Open status will not affect the control operation in Set Point mode.

MOV SENSOR FAULT

Valve Close, Valve Open **Default: Valve Close**

Hold Button: *MENU/<System Startup>/.../MOV Sensor Fault*

The MOV Sensor Fault will determine the operating status of the motorized valve when a sensor reads Short or Open.

RESET MODE

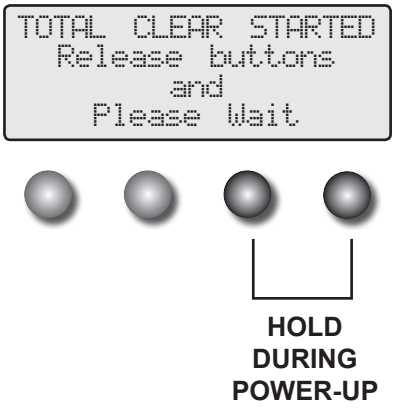
- When Valve Close is selected, the SQ-Elite-MV will energize the MOV Close relay when the MOV System reads Short or Open. However, when the Outdoor reads Short or Open, the SQ-Elite-MV will change the Target to the MOV Minimum Target.
- When Valve Open is selected, the SQ-Elite-MV will energize the MOV Open relay when the MOV System reads Short or Open and the outdoor temperature is below MOV Outdoor Cutoff. However, if the outdoor temperature is above the Outdoor Cutoff, the Outdoor Cutoff will take over turn off the stages. When the outdoor reads Short or Open, the SQ-Elite-MV will change the Target to the MOV Maximum Target.

SET POINT MODE

- If Valve Close is selected, the SQ-Elite-MV will energize the MOV Close relay when the SEQ System sensor reads Short or Open.
- If Valve Open is selected, the SQ-Elite-MV will energize the MOV Open relay when the MOV System sensor reads Short or Open.
- The Outdoor Sensor Short or Open status will not affect the control operation in Set Point mode.

SETTING THE CONTROL TO FACTORY DEFAULTS

To Reset the SQ-Elite-MV control to its original factory defaults, power down the control. Hold down the two right most buttons while powering the control back up until the Total Clear Started screen appears. The Display will direct you to the Startup menu after the defaults are loaded to program the control.



NOTE: When resetting the control to original factory defaults all control settings will be over written and will no longer exist.

⚠ ALERT

Do not turn off power to control until all Startup settings have been made. Otherwise, the next power-up will be set to many Startup factory settings that might not fit your application.

OPERATING SETTINGS

PROGRAM CHANGE SETTINGS

To be able to change the SQ-Elite-MV settings, the Program/Run Switch must be set to Program. The switch is located under the Enclosure Wiring Cover for security. The Enclosure Wiring Cover can be securely closed using a padlock.

SEASON

Winter, Summer **Default: Winter**

Hold Button: *MENU/Season*

- The SQ-Elite-MV will turn all boiler relays off when it is in Summer setting. In addition, the motorized valve MOV Close relay will energize for 6 minutes to guarantee valve closure. The Message Display Line will display Summer and Valve Close to show status. However, a DHW call will bring boilers back on if needed.
- When in Winter, the SQ-Elite-MV will activate the System relays whenever the outdoor temperature falls to or below the respective Outdoor Cutoff setting. In addition, it will begin heating whenever the system temperature falls below the Set Point Temperature.
- When the season is over, it is a good practice to switch the SQ-Elite-MV Season setting. This will allow DHW calls to operate the boilers when needed.

⚠ ALERT

DO NOT turn power off to the SQ-Elite-MV when in Summer. If you do so, the battery will run down and will have to be replaced. Instead switch to Summer.

SEQ AND MOV RESET RATIO SETTINGS

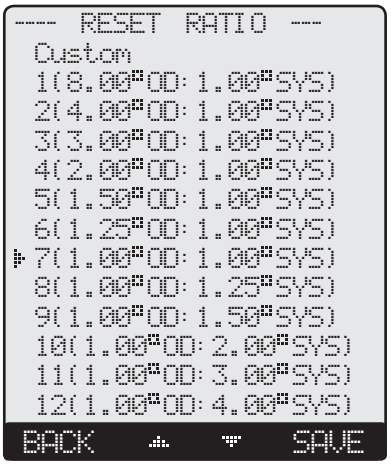
Each of the boiler loop (SEQ) and motorized valve loop (MOV) has their own reset ratio settings that can be configured independently from each other.

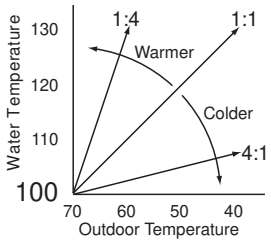
SEQ AND MOV RESET RATIO

Custom, 1(8.00ºOD : 1.00ºSys) to 12(4.00ºOD : 1.00ºSys) Default: 1(1.00ºOD : 1.00ºSys)

Hold Button: *MENU/<SEQ Setting>/<Outdoor Rst>/Reset Ratio* **SEQ**

Hold Button: *MENU/<MOV Setting>/<Outdoor Rst>/Reset Ratio* **MOV**





- The Reset Ratio determines how the System water temperature will vary with outside temperature changes. With any of the ratios, the colder it becomes outside, the hotter the temperature of the system water. (See Understanding Operation Concept on page 5)
- With a 1.00 (OD):4.00 (SYS) ratio, the System water temperature (SYS) will increase rapidly as the outside temperature falls, hitting the Maximum of 240°F at 35°F outside temperature. With a 4.00 (OD):1.00 (SYS) ratio, the System water temperature (SYS) will increase slowly as the outside temperature falls. Even at -30°F, the system water will only be 125°F, and at 22°F outside, the system water will be 112°F. Such a low Reset Ratio might be used in radiant floor heating applications.
- In most baseboard heating applications, a 1.00 (OD):1.00 (SYS) setting is a good place to start. With a 1.00 (OD):1.00 (SYS) ratio, for every degree the outside temperature falls, the system water temperature is increased one degree.
- If required: **Adjust the RESET RATIO in cold weather.** If the ambient building temperatures are too cold in cold weather, move the ratio to a higher selection. That is, if 1.00 (OD):1.00 (SYS) was initially selected, change the selection to 1.00 (OD):1.25 (SYS). If the building temperatures are too warm in cold weather, move the ratio to a lower selection. That is, if 1.00 (OD):1.00 (SYS) was initially selected, change the selection to 1.25 (OD):1.00 (SYS).
- After selecting the Reset Curve, pressing the SAVE button will switch to the Outdoor Cutoff setting option.

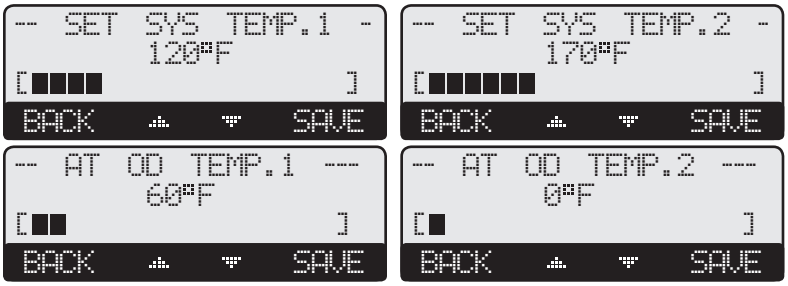
SEQ AND MOV CUSTOMIZED RESET RATIO

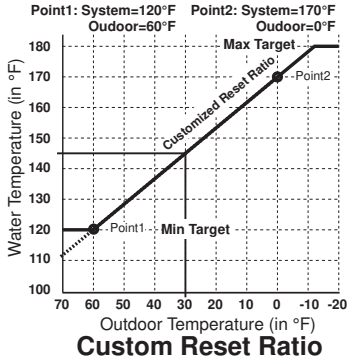
Hold Button: *MENU/<SEQ Setting>/<Outdoor Rst>/Custom* **SEQ**

Hold Button: *MENU/<MOV Setting>/<Outdoor Rst>/Custom* **MOV**

- For situations where the available reset ratios do not provide the perfect building heat-loss equilibrium, the customized option can be used. It provides the user with the capability of assigning two points on the reset ratio diagram and use the line that connects the two points as the customized reset ratio curve. Each of the two points will need a specific System and Outdoor Temperature to identify it on the diagram.

- To Set the first point, specify Sys Temp 1, and OD Temp 1. Then, specify Sys Temp 2, and OD Temp 2, to set the second point on the curve. The two points can be anywhere on the line, not necessarily at the ends.
- The chart shows an example of a customized curve 6(OD):5(SYS) that does not exist in the standard curve options. If the outdoor temperature reaches 30ºF, the system target will be 145ºF.
- Remember that the Offset, Min Target, and Max Target apply to all reset ratios including the customized reset ratio ones.



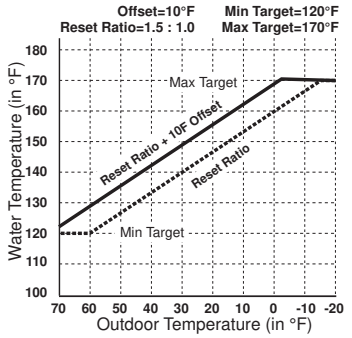


Custom Reset Ratio

SEQ AND MOV TARGET OFFSET

Adjustable from 40ºF/22ºC - (-40ºF/-22ºC) **Default: 0ºF/0ºC**
Button: *MENU/<SEQ Setting>/<Outdoor Reset>/Offset* **SEQ**
Button: *MENU/<MOV Setting>/<Outdoor Reset>/Offset* **MOV**

- The Offset setting lets you vertically shift the starting points of the Reset Ratio curves. This means that, regardless of the Outdoor temperature or the Reset Ratio, when the Offset setting is changed, that change is directly added to or subtracted from the calculated temperature. For example, if the Set Point temperature was 130°F and the Offset was changed from 0°F to 10°F (an increase of 10°F), then the Set Point temperature would increase to 140°F (130°F + 10°F).
- The Offset setting does not change the ratio selection. For instance, with 1.00 (OD):1.00 (SYS) Reset Ratio, the System water temperature will always increase one degree for each degree change in the Outdoor temperature. What the Offset does is add or subtract a constant temperature value. (See Understanding Operation Concept on page 5)
- The Minimum and Maximum Target will take precedence over the Offset. That is, if the Max Target was set to 180°F and the Offset was set to 20°F. If the set point was 170°F, the new calculated set point based with the Offset will not exceed 180°F.
- If required: **Adjust the Water Offset in mild weather**. If the ambient building temperatures are too warm in the mild weather, decrease the Target Offset. If the ambient building temperatures are too cold in the mild weather, increase the Target Offset. The rule of thumb for baseboard radiation is to change the Offset 4°F for every 1°F you wish to change the building temperatures. In radiant heat applications, change the Offset 1°F or 2°F for every 1°F you wish to change the building temperature.



Target Offset

SEQ AND MOV OUTDOOR CUTOFF

Adjustable 20ºF/-7ºC - 100ºF/38ºC, On **Default: 70ºF/21ºC**
Hold Button: *MENU/<SEQ Setting>/Set Point/Outdoor Cutoff* **in Set Point**
Hold Button: *MENU/<SEQ Setting>/<Outdoor Rst>/Outdoor Cutoff* **in Reset**

- In Outdoor Reset mode, Outdoor Cutoff will always exist. However, in Set Point mode, if the outdoor sensor is installed, the Outdoor Cutoff screen will automatically appear after the temperature Set Point has been selected.
- When the outdoor temperature falls to the adjustable Outdoor Cutoff temperature, the SQ-Elite-MV will control the outputs, whether those outputs are multiple boiler stages or a motorized valve, to hold the calculated temperature.
- When the outdoor temperature rises to the Outdoor Cutoff plus a 2°F differential, the SQ-Elite-MV will turn all boilers off and close the motorized valve. The System relay and any other stage pump or valve relays that were energized will remain energized for the Run-On delay.
- The Outdoor Cutoff can be set to ON where the System Relay will run regardless of the outdoor temperature.

SEQ AND MOV MINIMUM TARGET

Adjustable 70°F/21°C - 180°F/82°C **Default: 80°F/27°C**

Hold Button: *MENU/<SEQ Settings>/<Outdoor Reset>/Min. Target* **SEQ**

Hold Button: *MENU/<MOV Settings>/<Outdoor Reset>/Min. Target* **MOV**

- For the boiler system loop (SEQ), the Minimum Target must be set to the boiler manufacturer's specification. The SQ-Elite-MV will calculate the Set Point based on the Outdoor temperature, the Reset Ratio, and the Offset value. The SQ-Elite-MV will control all boilers and the motorized valve to hold the higher of either the Set Point temperature or the Minimum Target.
- In radiant and air handler applications, this setting should be adjusted to the minimum system design water temperature.
- The SQ-Elite-MV will not allow the calculated water temperature to drop below this setting.
- The Minimum Target must be at least 20°F lower than the Maximum Target. (See next setting).

SEQ AND MOV MAXIMUM TARGET

Adjustable 90°F/32°C - 240°F/116°C **Default: 240°F/116°C**

Hold Button: *MENU/<SEQ Settings>/<Outdoor Reset>/Max. Target* **SEQ**

Hold Button: *MENU/<MOV Settings>/<Outdoor Reset>/Max. Target* **MOV**

- This is the highest heating water temperature the SQ-Elite-MV will circulate.
- When using a radiation system, it should be set according to the tubing or floor manufacturer's specification.
- The SQ-Elite-MV will not allow the calculated water temperature to rise above this setting.
- The Maximum Target must be at least 20°F higher than the Minimum Target (See previous setting).

SEQ AND MOV SET POINT SETTINGS

(NOT ADJUSTABLE IN EMS MODE)

Adjustable -10°F/-23°C - 230°F/110°C **Default: 70°F/21°C**

Hold Button: *MENU/<SEQ Settings>/Set Point* **SEQ Set Point or EMS 4-20mA**

Hold Button: *MENU/<MOV Settings>/Set Point* **MOV**

- The Set point is the temperature value the SQ-Elite-MV will use to control the system.
- The system can be expected to fluctuate around the set point. The amount of fluctuation depends on the control Settings.
- The SQ-Elite-MV will add, subtract, or hold the stages to maintain the SEQ System temperature around the SEQ Set point.
- If the EMS Mode was Enabled, the Set Point will be set by the EMS/BMS system and will be available as a read only.
- The range of Set Point in the EMS is set in the Startup menu at 4mA and 20mA.
- Any reading below the 2mA or above 22mA will indicate a "Shutdown by EMS" message on the Message Line.
- The SQ-Elite-MV will modulate the motorized valve to maintain the MOV System temperature around the MOV Set point.
- If an Outdoor Sensor was connected, pressing the SAVE button will switch to the Outdoor Cutoff setting option.

BOILER MINIMUM RETURN

When a return sensor is connected to the SQ-Elite-MV, it will be used to monitor and control the boiler return. It does that by monitoring the Target temperature (SEQ TGT), System temperature (SEQ SYS), Minimum Return, and actual return. (RTN). When the SQ-Elite-MV predicts that a low return will occur, it will increase the SEQ Target automatically.

MINIMUM RETURN

Adjustable Off, 80°F/27°C - 140°F/60°C **Default: 120°F/49°C**

Hold Button: *MENU/<SEQ Settings>/Min. Return*

- It is the critical temperature at which the return sensor should be above. Normally, this setting is provided by the boiler manufacturer or the system engineer.
- The SQ-Elite-MV will use that value as a guide. It will start to add additional stages if it foresees that the RTN temperature will drop below the Min. Return. During that period, it will display "Hold Return at 120°F" in the Display Message Line to indicate that the SQ-Elite-MV is sequencing boilers to protect the return from dropping below the Minimum Return.
- Most condensing boilers will run more efficient with cooler return temperatures. In this case, select the Off option on the Minimum Return to allow the monitoring of the return on the display without affecting the stage sequencing.

RETURN LAG

Adjustable 0 - 30 minutes **Default: 2 minutes**

Hold Button: *MENU/<SEQ Settings>/Min. Return/Return Lag*

- It is the time it takes for the added stages to have an effect on the return temperature.
- To get this time, start with a warm stable system and add a stage manually. Calculate the amount of time it took to get the return warmer from the start of the stage. That should be your Return Lag.

SEQ SETTINGS

Hold Button: *MENU/<SEQ Settings>*

The SEQ Settings menu provide access to adjusting and fine-tuning the boiler loop and stage system for enhanced comfort and better fuel savings. The SQ-Elite-MV behaves differently based on the selected Control Modes (see Startup Settings on page 13).

SEQ STAGE SETTINGS

Hold Button: *MENU/<SEQ Settings>/<System Settings>/<Stage Settings>*

REACTION TIME

(Available in PID only)

Adjustable 1 - 10 minutes **Default: 2 minutes**

Hold Button: *MENU/<SEQ Settings>/<System Settings>/<Stage Settings>/Reaction time*

- It is the amount of time it takes a single stage to affect the system.
- After the SQ-Elite-MV turns on a stage trying to meet a set point, it will not turn on another stage until the reaction time has elapsed. Then, it will recalculate if a stage is need.
- To determine the optimum time, in a heating system start with a hot system. Then, turn on a single stage and calculate time it takes until the system begins to respond. That period should be set as the Reaction Time. (See PID Operation under Control Logic on page 20)

PURGE DELAY

(Available in PID only)

Adjustable 0.0 - 10.0 minutes **Default: 0.0 minutes**

Hold Button: *MENU/<SEQ Settings>/<System Settings>/<Stage Settings>/Purge Delay*

- Most large boilers must go through a purge cycle before they are brought online.
- When the SQ-Elite-MV activates a boiler (the lowest stage on a boiler), it does not start to calculate its output until the Purge Delay is over. This allows the boiler to fully come online and begin producing output. (See PID Operation under Control Logic on page 20)
- The Purge Delay helps prevent short cycling of a newly activated boilers. Once the lowest boiler stage is activated, it **MUST** run through the entire Purge Delay period.
- The minimum Purge Delay setting **MUST** be set to the time required by the boiler manufacturer's specification.

MINIMUM RUNTIME

(Available in PID only)

Adjustable 1 - 60 minutes **Default: 2 minutes**

Hold Button: *MENU/<SEQ Settings>/<System Settings>/<Stage Settings>/Min Runtime*

- This is the minimum amount of time any stage will run.
- For the lowest firing stage on a boiler, the Minimum Runtime starts after the purge cycle.
- This timer does not apply to the last stage online. The Last Stage Hold applies in that case.
- Initially, set the Min Runtime to half the Reaction Time. (See PID Operation under Control Logic on page 20)
- If the system tends to overshoot, reduce the Min Runtime. If boilers tends to short cycle, increase the Min Runtime.

STANDBY DELAY

(Available in PID only)

Adjustable 1 - 60 minutes **Default: 10 minutes**

Hold Button: *MENU/<SEQ Settings>/<System Settings>/<Stage Settings>/Standby Delay*

- The Standby Delay Time only applies to boilers in Standby Mode. See Mode on page 32.
- A Standby boiler can only be activated after all the boilers in Auto Mode have run for the full Standby Time.
- Standby boilers are used for backup or extreme load conditions only. A Standby Stage can never be a Lead Stage
- The full Standby Delay Time must always elapse regardless of what happens to system temperature. Therefore, shorter Standby Times will result in smoother set point operation in extreme conditions. Longer Standby Times may prevent a Standby boiler from starting if the other boilers can eventually meet the load or if the load decreases.
- When setting Standby Time, remember that it will be added to the Reaction Time for the first stage on the first Standby boiler. The following stages start time will rely on Pre-Purge and Reaction Time.

LAST STAGE HOLD

(Available in PID only)

Adjustable 0°F/0°C - 30°F/17°C **Default: 5°F/3°C**

Hold Button: *MENU/<SEQ Settings>/<System Settings>/<Stage Settings>/Last Stage Hold*

- The Last Stage Hold prevents short cycling of the Lead Stage during low load conditions where the system might have a load that is significantly less than the output of one stage.
- When the SQ-Elite-MV brings on the Lead Stage, the Set Point is quickly exceeded, and the Lead Stage is turned off. To prolong the run time during this type of condition, use the Last Stage Hold setting.
- The SQ-Elite-MV will allow the system temperature to exceed the Set Point by the number of degrees selected, before the Lead Stage is turned off. (See PID Operation under Control Logic on page 20)
- For example, with a Set Point of 160°F and a Last Stage Hold setting of 10°F, the Lead Stage boiler will remain on, until the Set Point reaches 170°F then turn off. During that period, the display will show "Hold Until 170F".

THROTTLE

(Available in OSS only)

Adjustable 2°F/1°C - 20°F/11°C **Default: 2°F/1°C**

Hold Button: *MENU/<SEQ Settings>/<System Settings>/<Stage Settings>/Throttle*

- The Throttling Range sets a temperature band around the Set Point that controls when stages will be turned on or off.
- For example, in the Oversize (OSS) heating mode, no stages will be activated until the temperature falls one full Throttling range below the Set Point. A second stage will be activated when the temperature falls to two full Throttling ranges below the Set Point, and so on, with one extra stage being turned on for every additional throttling below the Set Point the System temperature reaches.
- Stages will be turned off as the temperature rises toward the Set Point with one full throttling range as a differential.
- The last stage to be turned off will be allowed to exceed the Set Point by a full Throttle before it is turned off. This helps prevent the last stage from short cycling when the load is low or when the stage is oversized.

Throttling Example
Set Point = 180°F **Throttling = 5°F** **4 Boiler Stages, A, B, C, and D**

		Falling Temperature		Rising Temperature	
Temperature	Calculation	Stage Turned On	Stages On	Stage Turned Off	Stages On
185°F	180 + (1)THR	None	None	A	None
180°F	180 - (0)THR	None	None	None	A
175°F	180 - (1)THR	A	A	B	A
171 to 174°F	---	---	A	---	A,B
170°F	180 - (2)THR	B	A,B	C	A,B
166 to 169°F	---	---	A,B	---	A,B,C
165°F	180 - (3)THR	C	A,B,C	D	A,B,C
161 to 165°F	---	---	A,B,C	None	A,B,C,D
160°F	180 - (4)THR	D	A,B,C,D	None	A,B,C,D

Avoiding Conflicting Boiler Limits

⚠ WARNING
The temperature limits set on the boilers must be higher than the SQ-Elite-MV Set Point. Read the section at left for details that will prevent erratic system operation.

- The temperature limits set on the boilers MUST be set considerably higher than the SQ-Elite-MV's SEQ Set Point for the reasons detailed below.
- The SQ-Elite-MV SEQ System sensor is located in a header some distance from the boilers.
- As the temperature rises in the header and before reaching the sensor location, energy is dissipated. Therefore, the header temperature could be lower than that at the boilers.
- In addition to the normal drop experienced between the boiler temperature and that read by the SEQ System sensor, the Last Stage Hold setting must be accounted for. The boiler limit must be set above the SEQ Set Point PLUS the Last Stage Hold PLUS the normal drop experienced in the piping.
- Using the previous example of a 10°F Last Stage Hold with a 160°F SEQ Set Point, the boilers' limits must be set high enough over 170°F to prevent the boilers' internal limits from being reached. In this situation, the boiler high limit should be set at approximately 180°F to prevent the difference in boiler temperature vs. header temperature causing erratic operation.

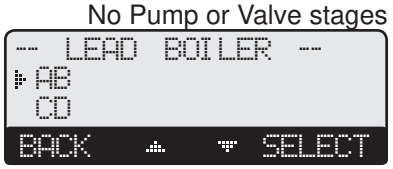
LEAD SETTINGS

Hold Button: *MENU/<SEQ Settings>/<System Settings>/<Stage Settings>/<Lead Settings>*
The lead menu is to set the Lead boiler and type of rotation appropriate for the system.

LEAD BOILER

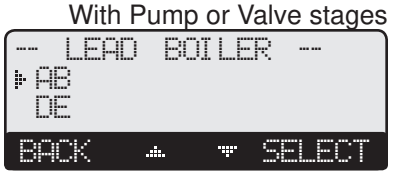
Depends on the number of stages **Default: The first set of stages**
Hold Button: *MENU/<SEQ Settings>/<System Settings>/<Stage Settings>/<Lead Settings>/ Lead boiler*

No Pump or Valve stages



- The Lead Boiler's lowest stage will always be the first stage brought on when there is a call for output. As more output is needed, additional stages are added.
- The Lead Boiler is always shown on the main display in brackets.
- In a 2-Stage system (see Burner Type in the Startup section on page 19), the display will show the two Lead Boiler stages bracketed <AB>. In a 3-Stage system, the display will show the three Lead Boiler stages bracketed <ABC>, and on a two stage with a pump will show <AB▲> where ▲ represents the pump.

With Pump or Valve stages



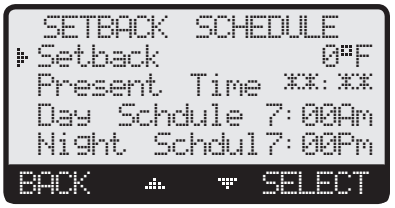
- If Pump or Valve is selected as the Boiler Output in the Startup menu (See Boiler Output on page 19), the Valve or Pump letter will be skipped from the stages. See example to the right. The missing stage C and F represent the Boiler Valve or Pump.
- The Lead Boiler can be rotated based on the Rotation Mode selected. (See next setting)

ROTATE MODE

Adjustable Time (1 hr to 999 hrs), Manual, FOFO **Default: Time (24Hours)**
Hold Button: *MENU/<SEQ Settings>/<System Settings>/<Stage Settings>/<Lead Settings>/ Rotate Mode*

If Time Rotation is selected

- The Lead Boiler is the first boiler brought on when output is required.
- The Lead Boiler can be rotated automatically, manually or based on First-On/First-Off (FOFO). The automatic rotation is recommended for most applications.
- The current Lead Boiler is shown in brackets on the main display.
- Only boilers which are set to Auto Mode can be Lead. Therefore, not all the boilers may be available when manually selecting a new Lead Boiler.
- If Time is selected, a second screen will allow the adjustment of the Auto Rotate Period If 24 Hours (default setting) was selected, the first rotation will take effect after 12 hours if the Time was not set. However, if the Time was set, the rotation will always take place at 2:00AM. The following rotations will take place every 24 hours thereafter.
- If First-On/First-Off (FOFO) is selected, the concept will follow this example; if *A* is the Lead, the starting sequence will be *A, B*, then *C*. When the de-energizing of the stages starts it will turn off *A, B*, Then *C*. Then stage *D* will be the new lead for the next load.



MOV SETTINGS

The MOV settings affects how the SQ-Elite-MV controls the motorized valve operation.

GAIN

Adjustable from -10 to 10 **Default: 0**
Hold Button: *MENU/<MOV Settings>/<System Settings>/Gain*

- The Gain adjusts the aggressiveness of the PID logic to control how much modulation is changed when the MOV System temperature deviates from the MOV Target.
- A Gain of 0 is a good starting point for all systems.
- If during normal load conditions, the MOV System value tends to oscillate, decrease the Gain by two numbers (for example, from 0 to -2). Wait for at least 15 minutes before evaluating how the change has affected the system.
- If, during normal load conditions the system value tends to remain significantly and consistently below or above the MOV Target, increase the Gain by two numbers. Wait for at least 15 minutes before re-evaluating the system.

SETBACK SCHEDULE

Hold Button: *MENU/<System Settings>/<Stage Settings>/<Setback Schedule>*
This menu provide the Day/Night Schedule as well as the Setback and Boost settings.

SEQ AND MOV SETBACK

Adjustable 0°F/0°C to 80°F/44°C **Default: 0°F/0°C**
Hold Button: *MENU/<SEQ Settings>/.../<Setback Schedule>/Setback* **Ext Output 1 = Shutdown or SEQ Tstat**
Hold Button: *MENU/<SEQ Settings>/<SEQ System Settings>/Setback* **External Output 1 = Setback**

- The Setback feature can be used to provide the SQ-Elite-MV with a lower temperature Set Point when less load is required.
- The new Set Point will appear on the main display indicating this condition "Setback to 160°F". For example, if the calculated temperature is 180°F and the Setback is 20°F, then when in Setback, the SQ-Elite-MV will hold a Set Point of 160°F.
- A typical use for Setback is to provide less system temperature to a building during the night or on the weekends when building is not occupied, but heat is still required.
- If External Output 1 was set to Shutdown or SEQ Tstat, the Setback will be activated using the Day/Night Schedule. Otherwise, if Setback was selected, the Setback can only be activated using a dry-contact input on terminals *35 and 36*. See page 19.
- After selecting a value in Setback, you'll be directed to the Boost menu.

SEQ AND MOV BOOST

Adjustable 0°F/0°C to 80°F/44°C **Default: 0°F/0°C**
Hold Button: *MENU/<SEQ Settings>/.../<Setback Schedule>/Setback/Boost* **SEQ**
Hold Button: *MENU/<MOV Settings>/.../<Setback Schedule>/Setback/Boost* **MOV**

- This features brings the building to warm-up quickly after a Setback period.
- The Boost temperature will be the number of degrees to be added to the Target.
- The new Set Point will appear on the main display indicating this condition "Boost to 190°F".
- Using the previous example, if the Target was 180°F and the Boost was 10°F for 30 minutes, after the scheduled setback period, the Boost will change the target to 190°F for a period of 30 minutes.
- If External Setback was used, the Boost will take place after the Setback is deactivated.
- If 0˚F Was selected, no boost will take place.

SEQ AND MOV BOOST PERIOD

Adjustable 0 to 120 minutes **Default: 0 minutes**
Hold Button: *MENU/<SEQ Settings>/.../Setback/Boost/Boost Period* **SEQ**
Hold Button: *MENU/<MOV Settings>/.../Setback/Boost/Boost Period* **MOV**

- This will determine the length of Boost the System will receive.
- For convenience, the Boost will start a full Boost Period prior to the switch from Night Schedule to Day Schedule operation. It will then terminate at the start of the Day Schedule. If the Day was set to start at 7:00Am and the Boost Period was set to 30 minutes, the Boost will start at 6:30Am and terminate at 7:00Am.

SEQ AND MOV DAY/NIGHT SCHEDULES

(Available when External Input 1 = Shutdown or SEQ Tstat only)
Hold Button: *MENU/<SEQ Settings>/<SEQ System>/<Setback Schedule>/Day Schedule*
Hold Button: *MENU/<MOV Settings>/<SEQ System>/<Setback Schedule>/Day Schedule*

- Each of the SEQ and MOV Schedules provide two levels of heat. The Day level is used when a building is occupied and people are active. The Night/Setback level is used when a building is not occupied or when people are asleep.
- The Night setting reduces the calculated temperature by the Setback setting. If the Day calculated water temperature was 150˚F and the Setback was 20˚F, the Night Schedule will run at (150˚F - 20˚F) = 130˚F.
- If the Boost feature is being used, it uses the Day Schedule as a Boost ending point. That is, if the Day Schedule is set to start at 6:00AM,the Boost was set to 10ºF, and the Boost Period was 30 minutes, the Boost will start at 5:30AM. The SQ-Elite-MV will then raise the calculated water temperature by the Boost amount. Using the previous example, at 5:30AM the SQ-Elite-MV will raise the calculated water to 170˚F (150˚F + 20˚F) until 6:00AM.

SET PRESENT TIME

Hold Button: *MENU/<SEQ Settings>/<SEQ System>/<Setback Schedule>/Present Time*
Hold Button: *MENU/<Maintenance>/Present Time*

- The Time is used by Day/Night Schedule and History graph and is backed up by the battery.
- Adjust the time by selecting Time from the menu and then scrolling through the hours

followed by the minutes. If hours are to be set to PM, scroll through the AM hours to reach the PM hours.
- Remember that the battery is the backup for the Time. If no power is supplied to the SQ-Elite-MV, the battery will die in three months and time clock values will be lost and will need to be reset.

DHW SETTINGS

- A DHW call can be initiated by shorting the DHW input terminals, *25 and 2*6.
- In addition to raising the Target to lowest of 200ºF or the Maximum Target on a DHW call, the SQ-Elite-MV provides three levels of DHW Pump operation. The first is when Primary/Secondary is selected as the DHW Piping from the Startup Menu. (See DHW Piping on page 18.) This option will provide no DHW Priority. Furthermore, a DHW call during the Summer or when the outdoor temperature is above the SEQ Outdoor Cutoff will energize both the DHW Pump and the System Pump relays. Upon the termination of the DHW call, the DHW Pump relay will de-energize leaving the SEQ System relay energized for the Run-On delay.
- The other two DHW options are available when Parallel is selected as the DHW Piping from the Startup Menu. (See DHW Piping on page 18.) These two options will not allow the SEQ System relay to energize in Summer or outdoor cutoff situations.
- In Winter, if the DHW Priority Timer was set to NO, a DHW call will keep the SEQ System relay energized in addition to the DHW Pump relay. Upon termination of the DHW call, the DHW Pump relay will de-energize leaving the SEQ System relay on.
- In Winter, if the DHW Priority Timer was set to a time value, a DHW call will de-energize the SEQ System relay and energize the DHW Pump relay on a DHW call. This will remain for the period of the DHW Priority Timer setting or until the DHW call terminates, whichever is sooner. If the DHW call was still active after the DHW Priority Timer elapses, the SEQ System relay will energize for the remaining of the DHW call period.

DHW PRIORITY TIMER

(AVAILABLE WITH PARALLEL DHW PIPING)

Adjustable NO, 1 to 120 minutes **Default: NO**

Hold Button: *MENU/<SEQ Settings>/<SEQ System Settings>/DHW Prior. Timer*

- The DHW Priority Timer provides the user with the capability of selecting the DHW Priority period. If NO was selected, both DHW Pump and System relay will be energized on a DHW call whenever there is a DHW call during Winter.
- In Summer or SEQ Outdoor Cutoff, a DHW call will energize only the DHW Pump relay leaving the System relay de-energized.
- If the DHW Priority Timer was set to a value other than No, a DHW call in the Winter when the outdoor temperature is below the Outdoor Cutoff will cause the SEQ System relay to de-energize and the DHW Pump relay to energize for the period of the DHW Priority Timer or until the DHW call expertise, whichever happens sooner. If the DHW call did not expire within the priority period, then the SEQ System relay will energize.

PUMP AND VALVE OPERATION

- The SQ-Elite-MV controls multiple relays each controlling a different type of equipment. In addition to the control of the boilers, it can control, the SEQ System pump, MOV System pump, boiler pumps or valves, and the DHW Pump. The operation of those relays depends on the Startup and SEQ and MOV Settings.

SEQ AND MOV RUN-ON

Adjustable 0 to 60 minutes **Default: 2 minutes**

Hold Button: *MENU/<SEQ Settings>/<System Settings>/Run-On*

- The Run-On applies to all pumps and valves. It is the time a pump or valve will run after the output boiler relays has de-energized. After the pump or valve goes through the Run-On period, its relay de-energizes. For pumps and valves the Run-On is used to dissipate the excess energy from the heating system into the building.
- A boiler pump or valve will go through the Run-On when all the stages on that boiler has turned off. This will take place for all boiler pumps and valves except for the lead boiler valve.
- The Run-On will take place for the lead boiler valve and System relays whenever the season is changed to Summer, the outdoor temperature rises above the SEQ Outdoor Cutoff, or the Shutdown or SEQ Tstat is activated.
- The Run-On time should be set based on the size and type of the equipment. A boiler with high water content and high horsepower will need a longer Run-On than a boiler with the same horsepower but has less water content.

SEQ AND MOV PUMP EXERCISE

Adjustable Off, On **Default: Off**

Hold Button: *MENU/<SEQ Settings>/<System Settings>/Pump Exercise*

- The SQ-Elite-MV provides an option to exercise pumps for 10 seconds when not used for seven day to reduce pump impeller locking after off-season.

MAINTENANCE

Hold Button: *MENU/<Maintenance>*

The Maintenance menu gives access to sensor and output trimming. In addition, it provides access to view the Startup configuration settings as well as sensor histories.

VALVE

Adjustable Auto, Close, Open **Default: Auto**

Hold Button: *MENU/<Maintenance>/Valve*

- This setting provides a way to bypass the control logic and open/close the valve manually.
- The Valve mode is primarily used for equipment testing and troubleshooting.
- To revert to control PID operation, the Output Mode must be set to Auto.

SYSTEMS, OUTDOOR, OR RETURN SENSOR TRIM

Adjustable -20°F/-10°C to +20°F/+10°C **Default: 0°F**

Hold Button: *MENU/<Maintenance>/SEQ Trim*

Hold Button: *MENU/<Maintenance>/Outdoor Trim*

Hold Button: *MENU/<Maintenance>/Return Trim*

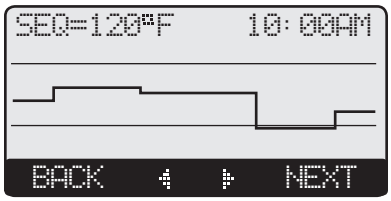
Hold Button: *MENU/<Maintenance>/MOV Trim*

- The Heat-Timer thermistor type sensors are very accurate, and normally require no calibration. However, sometimes it may be desirable to make small adjustments to the displayed value.
- Do not use the Trim setting to make the Outdoor temperature sensor match that reported on the radio or TV. Outdoor temperature can vary widely over a broadcast range.

HISTORY

Hold Button: *MENU/<Maintenance>/<Histories>*

The SQ-Elite-MV provides users with a graphical history of the SEQ System, MOV System, Outdoor, and Return temperatures for the previous 24 hours. The temperatures are sampled every 12 minutes.

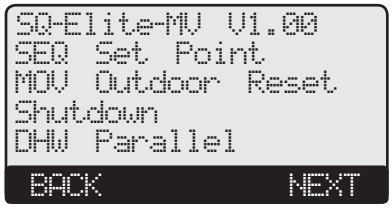


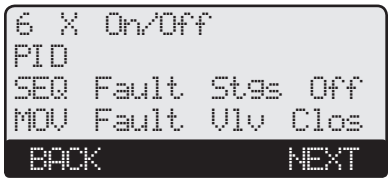
- To view the values of specific time period, use the two middle buttons to scroll to that time and read the upper left temperature.
- The first screen will be the SEQ System Temperature History. By clicking on the Next button, you'll be able to view the Outdoor Temperature History, then, the Return History followed by the MOV System History.

CONFIGURATION

Button: *MENU/<Maintenance>/<Configurations>*

- This menu option provides a consolidated view of the Startup settings.
- Press NEXT to view additional settings.

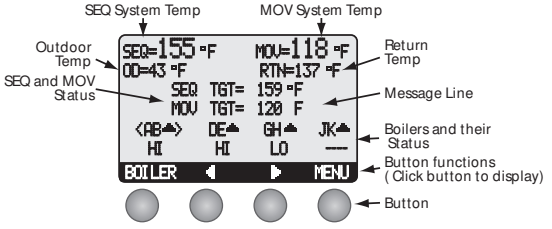




DISPLAY AND BUTTONS

The SQ-Elite-MV display layout provides a variety of information that gives an immediate picture of the operation status. The display shows a maximum of four heating boilers at a time. Each boiler is displayed as multiple letters indicating the stages on the boiler. The two middle buttons scrolls the screen to view additional boilers. Moreover, all the information is brightly displayed. It can be viewed in brightly or dimly lit rooms.

- When the display is in default view click any button to display each button functionality. The buttons' functionality changes based on the screen and menu level. The buttons' functionality is displayed on a dark background on the screen bottom line.
- When button functionality is displayed, the MOV status is hidden. It will be displayed again after 10 seconds.
- Horizontal arrows are to scroll through the available stages.
- Buttons assigned vertical arrows are to scroll through the menu functions when in menus or to change values of settings when in its specific screen.



DISPLAY BOILER STATUS

The display bottom line gives immediate access to each boiler status. The following list shows all possible boiler status:

- <AB> Two-Stage boiler and Boiler AB is the Lead in sequencing. (Brackets indicate Lead Stage).
- --- Boiler stages are de-energized. The boiler Mode is set to Auto.
- STB Boiler stages are de-energized. The boiler Mode is set to Standby. See Mode on page 32.
- HI Boiler highest stage is active. The boiler Mode is set to either Auto or Standby.
- MED Boiler Middle stage is active. Available in Three-stage boilers only. The boiler Mode is set to either Auto or Standby.
- MHI Boiler Middle High stage is active. Available in Four-stage boilers only. The boiler Mode is set to either Auto or Standby.
- MLO Boiler Middle Low stage is active. Available in Four-stage boilers only The boiler Mode is set to either Auto or Standby.
- LO Boiler Lowest stage is active. The boiler Mode is set to either Auto or Standby.
- ON All Boiler Stages are set to ON using the Mode. See Mode on page 32.
- OFF All Boiler Stages are set to OFF using the Mode. This must be the setting for nonexisting boilers. See Mode on page 32.
- C/E Boiler on Extension panel is not communicating back to the SQ-Elite-MV.
- Boiler Pumps are being controlled by the SQ-Elite. See Boiler Output on page 19.
- Boiler Valves are being controlled by the SQ-Elite. See Boiler Output on page 19.

DISPLAY MESSAGES

The SQ-Elite-MV normal display layout reserved the second and third lines for message indications. The following is a list of the most common Message Display Line information:

SEQ Messages

- Summer — The control is set to Summer. No heat is active. See Season on page 22.
- SEQ Outdoor Cutoff — The Outdoor temperature is above the SEQ Outdoor Cutoff. See Outdoor Cutoff on page 23.
- Shutdown Active — The Shutdown Terminals are Shorted. No heating boilers will be active the motorized valve will be closed. See Shutdown on page 10.
- SEQ Shutdown by EMS — The EMS is below 2mA or above 22mA. All boilers will be inactive. See Setting 4-20mA on page 18.
- DHW Call (200˚F) — There is a DHW (Domestic Hot Water) call. The SQ-Elite-MV will Raise the SEQ Set Point to the indicated temperature. DHW increases calculated temperature to the lower of 200˚F or Max Water.
- Holding Return at 110˚F — The Return sensor is reading less than the Minimum Return. SQ-Elite-MV is trying to raise return to 110˚F. See Boiler Minimum Return on page 25.
- Holding Until 150˚F — The Lead boiler is in Last Stage Hold. This example shows that the lead stage will turn off when system temperature reaches 150˚F. See Last Stage Hold on page 26.
- SEQ Prove Failure — After boilers have run for a while, Prove signal was opened. The boiler relays will de-energize. However, the System relay will remain energized. See External Input 2 on page 19.
- Waiting for SEQ Prove — Boilers have not been running, the Prove signal is opened. However, the System relay will remain energized. See External Input 2 on page 19.
- SEQ Tstat Open — No call for SEQ heat is activated on terminals *35 and 36*. See External Input 1 on page 19.
- All Stages On/Off — SEQ Sensor is reading fault. See SEQ Sensor Fault on page 20.
- OD Failure (240˚F) — Outdoor sensor is reading fault. SEQ Sensor Fault is set to Stages On. The control will maintain Maximum Water Temperature. See SEQ Sensor Fault on page 20.
- Boost to 170˚F — The SEQ Target has been increased to 170˚F to meet the Boost demand after the Setback period. See SEQ Boost on page 28.
- Setback to 150˚F — The SEQ Target has been decreased by the Setback to 150˚F. See Setback Schedule on page 28.

MOV Messages

- Valve Close — The control is set to Summer or Shutdown. No heat is active. See Season on page 22.
- Manual Valve Close/Open — The valve is set manually to Close or Open. See Valve on page 30.
- MOV Tstat Open — No call for MOV heat is activated on terminals *37 and 38*. See External Input 2 on page 19.
- MOV Outdoor Cutoff — The Outdoor temperature is above the MOV Outdoor Cutoff. See Outdoor Cutoff on page 23.
- Fail Valve Close/Open — MOV Sensor is reading fault. See MOV Sensor Fault on page 21.
- MOV OD Failure (240˚F) — Outdoor sensor is reading fault. MOV Sensor Fault is set to Valve Open. The control will maintain Maximum Water Temperature. See MOV Sensor Fault on page 21.
- MOV Boost to 170˚F — The MOV Target has been increased to 170˚F to meet the Boost demand after the Setback period. See MOV Boost on page 28.
- MOV Setback to 150˚F — The MOV Target has been decreased by the Setback to 150˚F. See Setback Schedule on page 28.

STAGE SETTINGS

Button: *BOILER/*

- In most installations, all active boiler adjustments are the same, but each can be configured differently if desired.
- When the Boiler button is depressed, the first Boiler settings menu will be shown.
- Make all the appropriate settings for the first boiler (See below).
- Then select the Next Boiler option from the menu and make all the settings. Continue until all boilers have been set.
- If a SQ-Elite-EXT is connected to the SQ-Elite-MV, scrolling through boilers using the Next and Prev Boiler menu options will scroll through the extension boilers as well.

> **⚠ ALERT**
> To be able to change the SQ-Elite-MV settings, the Program/Run Switch must be set to Program. The switch is located under the Enclosure Wiring Cover for security. The Enclosure Wiring Cover can be securely closed using a padlock.

MODE

Auto, Standby, Off, On **Default: Auto**

Button: *BOILER/Mode*

- The SQ-Elite-MV only controls any boiler set to Auto or (after a delay) Standby. The On and Off settings are not recommended for to active boilers.
- Any output without an active boiler must be set to Off.
- The following list describes the MODE options:

Auto - The SQ-Elite-MV will control the boiler operation to maintain the desired Set Point. Only boilers set to Auto can be Lead.

Standby Standby boilers can only be activated when all boilers in Auto have been at HI for an adjustable Standby delay period. A boiler can be set to Standby if needed to be available in extreme load conditions. Note that a Standby boiler Cannot be a Lead boiler. Standby Time is only available in PID mode.

Off Any boiler output not connected to a physical boiler should be set to Off. The Off Mode can also be used to disable boilers that are being serviced.

On The On Mode should only be used when testing a boiler. The On Mode overrides the *PROVE and SHUTDOWN* inputs. Once set to On the boiler will immediately start all of its stages as well as the SEQ System relay.

RUNTIME

Clear

Button: *BOILER/RunTime*

- The RunTime provides an accumulative hourly run for the selected boiler lowest stage.
- The RunTime for a specific boiler can be reset to zero by pressing the middle two buttons. When doing so, record the date and time at which the reset took place for future reference.

TROUBLESHOOTING

TEMPERATURE INPUTS

Display shows Sensor OPEN

Short the sensor input terminals. The display should read SHORT. If it does not, the SQ-Elite-MV is damaged. If it does, check the sensor is connected and the wires are continuous to the SQ-Elite-MV.

Display shows Sensor SHORT

The SQ-Elite-MV sees a short across the input terminals. Remove the wires from the sensor terminals. The display should change to read OPEN. If it doesn't, the SQ-Elite-MV may be damaged. If it does, replace the sensor.

Display shows an Incorrect Temperature Display

Remove the wires from sensor terminals. The display should change to read OPEN. If it doesn't, the SQ-Elite-MV may be damaged. Take an ohm reading across the detached sensor wires. The ohm reading should correspond to the side chart. If it doesn't, the sensor may be damaged or needs to be relocated.

Return Sensor does not Display Temperature

Check the sensor is connected and the wires are continuous to the SQ-Elite-MV. Finally follow the procedure for Display Shows Sensor Open.

Temperature Sensor Chart

TEMPERATURE (in Degrees °F)	Value (in Ohms)
-30	117720
-20	82823
-10	59076
0	42683
10	31215
20	23089
25	19939
30	17264
35	14985
40	13040
45	11374
50	9944
55	8714
60	7653
70	5941
80	4649
90	3667
100	2914
110	2332
120	1879
130	1524
140	1243
150	1021
160	842
170	699
180	583
190	489
200	412
210	349
220	297
230	253
240	217
250	187

CONTROL OPERATION

Too Much SEQ Heat

Check if the control has any of the following:

- **Domestic Hot Water Call** - The SQ-Elite-MV will raise the temperature of the SEQ Target to either 200˚F or SEQ Maximum Target on a DHW call. Check for DHW calls. See DHW Settings on page 29.
- **Reset Ratio and Offset** - If excessive heat occurs only in certain weather conditions, adjust the SEQ Reset Ratio and Offset (See Understanding Operating Concept on page 5). If excessive heat occurs year round, reduce the Offset. See SEQ Offset on page 23.
- **Setback and Day/Night Schedule** - If increased heat occurs only during morning hours, check the Boost and Boost Period values. Reduce the Boost amount or Boost Period setting. See Boost on page 28.
- **Boiler Mode Settings** - The SQ-Elite-MV will only sequence boilers their mode is set to Auto or Standby. Check to see if any boiler stage is set to On. See Mode on page 32.
- **Control Settings** - The Last Stage Hold will allow only the Lead boiler to exceed the set point. If the setting is too high, and only the Lead boiler is on, the system can over heat. Reduce the Last Stage Hold setting. See Last Stage Hold on page 26.
- **Reaction Time/Min Runtime** - View the SEQ Sensor history, if the temperature tends to increase rapidly and then drop slowly, increase the Reaction time or reduce the Minimum Runtime. See Reaction Time and Minimum Runtime on pages 25.
- **Sensor Fault** - If SEQ Sensor Fault is set to Stages On and the Outdoor or SEQ System sensor reads Short. or Open, the SQ-Elite-MV will change the SEQ Target to the Maximum Water temperature or turn all boiler stages on. Check the Outdoor and SEQ System Sensors. See SEQ Sensor Fault on page 20.c

Too Much MOV Heat

Check if the control has any of the following:

- **Reset Ratio and Offset** - If excessive heat occurs only in certain weather conditions, adjust the MOV Reset Ratio and Offset (See Understanding Operating Concept on page 5). If excessive heat occurs year round, reduce the MOV Offset. See MOV Offset on page 23.
- **Setback and Day/Night Schedule** - If increased heat occurs only during morning hours, check the Boost and Boost Period values. Reduce the Boost amount or Boost Period setting. See Boost on page 28.

- **Manual Valve** - The SQ-Elite-MV will only control the motorized valve if the valve was set to Auto. Check to see if the valve is set to On. See Valve on page 30.
- **Gain** - View the MOV Sensor history, if the temperature tends to oscillate, reduce the Gain. See Gain on page 27.
- **Sensor Fault** - If MOV Sensor Fault is set to Valve Open and the Outdoor or MOV System sensor reads Short. or Open, the SQ-Elite-MV will change the MOV Target to the Maximum Water temperature or open the valve. Check the Outdoor and MOV System Sensor readings. See MOV Sensor Fault on page 21.

Too Little SEQ Heat

Check if the control has any of the following:

- **Reset Ratio and Offset** - If reduced heat occurs only in certain weather conditions, adjust the SEQ Reset Ratio and Offset (See Understanding Operating Concept on page 5). If it occurs year round, increase the SEQ Offset. See SEQ Offset on page 23.
- **Setback and Day/Night Schedule** - If reduced heat occurs during Night hours, reduce the SEQ Setback setting. See SEQ Setback on page 28. If the building takes a long time to recover from the Night period, increase the SEQ Boost or Boost Period. See SEQ Boost on page 28.
- **Boiler Mode Settings** - If the decreased heat occurs under extreme cold weather conditions, check if any boiler Mode is set to Off, or Standby. The SQ-Elite-MV will only sequence boilers their mode is set to Auto or Standby. See Boiler Mode on page 32.
- **Sensor Fault** - If SEQ Sensor Fault is set to Stages Off and the Outdoor or SEQ System sensor reads Short. or Open, the SQ-Elite-MV will change the SEQ Target to the Minimum Water temperature or de-energize all boiler stages. Check the Outdoor and SEQ System Sensors. See SEQ Sensor Fault on page 20.

Too Little MOV Heat

Check if the control has any of the following:

- **Reset Ratio and Offset** - If reduced heat occurs only in certain weather conditions, adjust the MOV Reset Ratio and Offset (See Understanding Operating Concept on page 5). If reduced heat occurs year round, increase the MOV Offset. See MOV Offset on page 23.
- **Setback and Day/Night Schedule** - If reduced heat occurs during Night hours, reduce the MOV Setback setting. See MOV Setback on page 28. If the building takes a long time to recover from the Night period, increase the MOV Boost or Boost Period. See MOV Boost on page 28.
- **Gain** - View the MOV Sensor history, if the temperature tends to hover below the MOV Target, increase the Gain. See Gain on page 27.
- **Sensor Fault** - If MOV Sensor Fault is set to Valve Close and the Outdoor or MOV System sensor reads Short. or Open, the SQ-Elite-MV will change the MOV Target to the Minimum Water temperature. Check the Outdoor Sensor. See MOV Sensor Fault on page 21.

No Heat

Check if the control has any of the following:

- **Season** - If the Season is set to Summer, all boiler stages will be off and the motorized valve will be closed. See Season on page 22.
- **Sensor Fault** - If SEQ or MOV Sensor Fault is set to Valve Close or Stages Off and the respective system sensor reads Short. or Open, the boilers might all be off on the SEQ System Sensor fault. Or, the motorized valve will be closed on a MOV System Sensor fault. See SEQ Sensor Fault on page 20 and MOV Sensor Fault on page 21.
- **Shutdown** - If External Input 1 is configured as a Shutdown and the terminals were shorted/activated, all stages will be off and the motorized valve will close. See External Input 1 on page 19.
- **SEQ Tstat** - If External Input 1 is configured as a SEQ Tstat and the terminals were Open/deactivated, all stages will be off. See External Input 1 on page 19.
- **MOV Tstat** - If External Input 2 is configured as a MOV Tstat and the terminals were Open/deactivated, the motorized valve will closed. See External Input 2 on page 19.
- **Prove** - If External Input 2 was set as SEQ Prove and no wiring is attached to the Prove terminals all boilers will be off. See External Input 2 on page 19.
- **Manual Valve** - The SQ-Elite-MV will only control the motorized valve if the valve was set to Auto. Check to see if the valve is set to Off. See Valve on page 30.
- **Boiler Mode Settings** - Check if any boiler Mode is set to Off, or Standby. The SQ-Elite-MV will only sequence boilers their mode is set to Auto or Standby. See Boiler Mode on page 32.

SQ-Elite-MV Does Not Move the Floating Actuator

- **First check the valve wiring -** The SQ-Elite-MV does not source power to the actuator. Instead, a separate power source must be wired to the actuator as shown on page 12 for the floating output.
- **Check relay operation -** Remove any wires connected to terminals *21 through 24*. Set the Valve mode to Close and check for continuity across terminals *21 and 22* and across terminals *23 and 24*. The meter should register continuity across terminals *21 and 22* and should register no continuity across terminals *23 and 24.* Otherwise, the SQ-Elite-MV may be damaged. Then, set the Valve mode to Open and check for continuity across terminals *23 and 24* and across terminals *23 and 24*.. The meter should register no continuity across terminals *21 and 22* and should register continuity across terminals *23 and 24.* Otherwise, the SQ-Elite-MV may be damaged.

Boilers are Short-Cycling

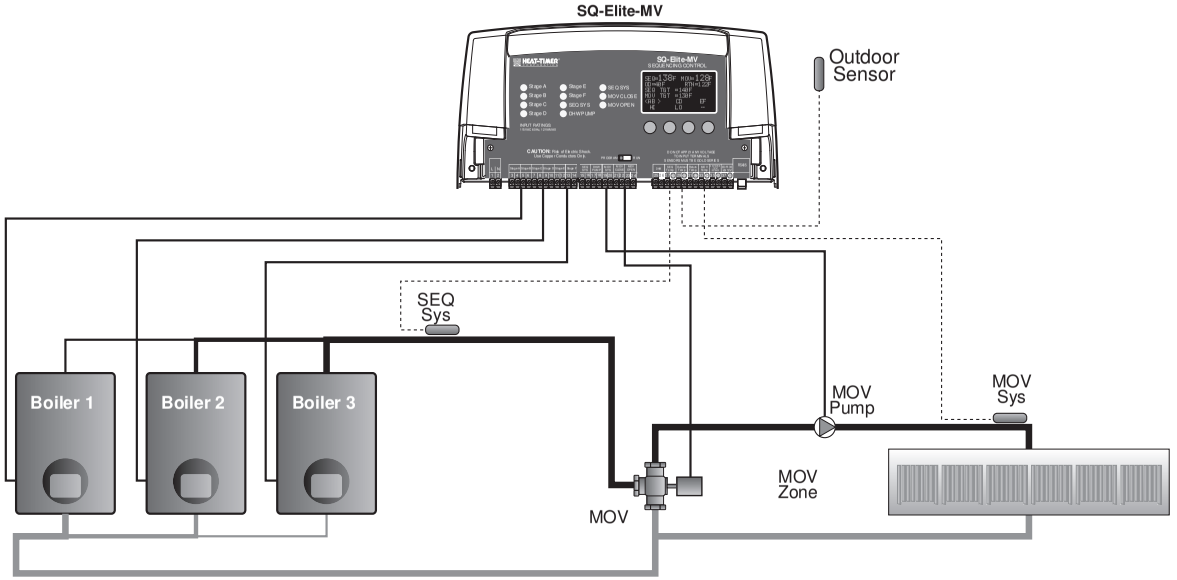
- **Minimum Runtime** - Increase the Minimum Runtime only if all boilers tend to short-cycle.
- **Last Stage Hold** - Increase the Last Stage Hold only if the lead boiler tends to short-cycle in mild weather conditions.

SEQ System is Overshooting or Undershooting

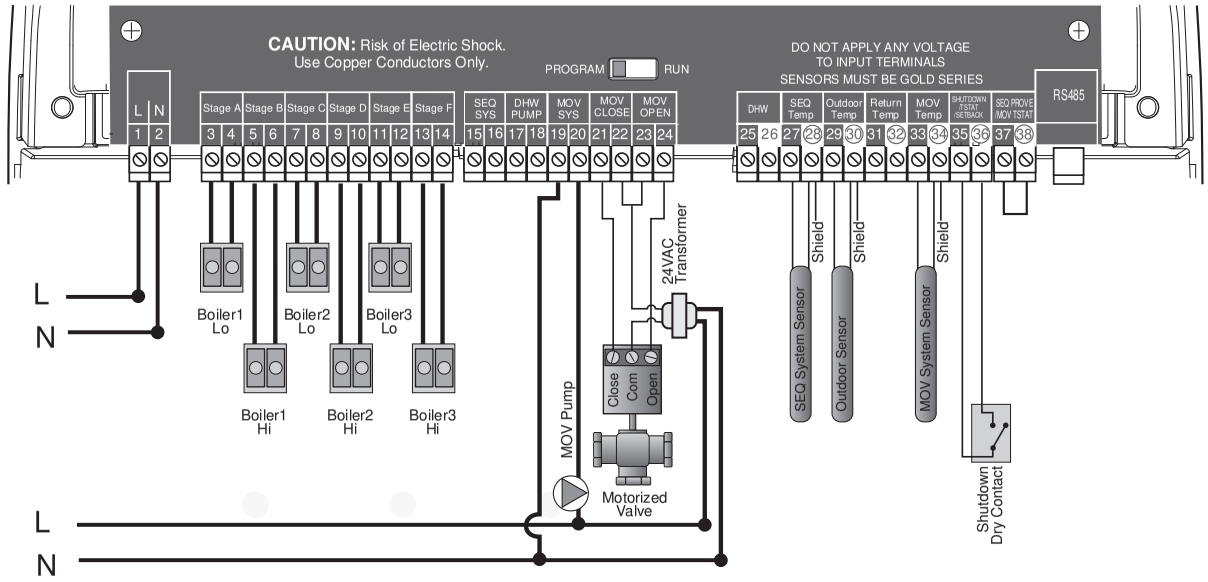
- **Reaction Time and Minimum Runtime** - If the SEQ System is overshooting or undershooting, adjust Minimum Runtime or the Reaction Time. That depends on if the stages are brought on fast and were not allowed to turn off until the Minimum Runtime elapsed. In that case adjust the Minimum Runtime. However, if the stages were brought on slowly, but were allowed to turn off quickly. Then, adjust the Reaction Time. See Reaction Time and Minimum Runtime on page 25.
- **PID vs OSS** - If the application the SEQ System is used on requires fast response that the normal PID mode cannot provide, try using the OSS mode and adjust the Throttle Range according to the system requirements. See Control Logic on page 20.

MULTIPLE 2-STAGE BOILERS WITH MOTORIZED VALVE CONTROLLING LOW TEMPERATURE ZONE

Mechanical



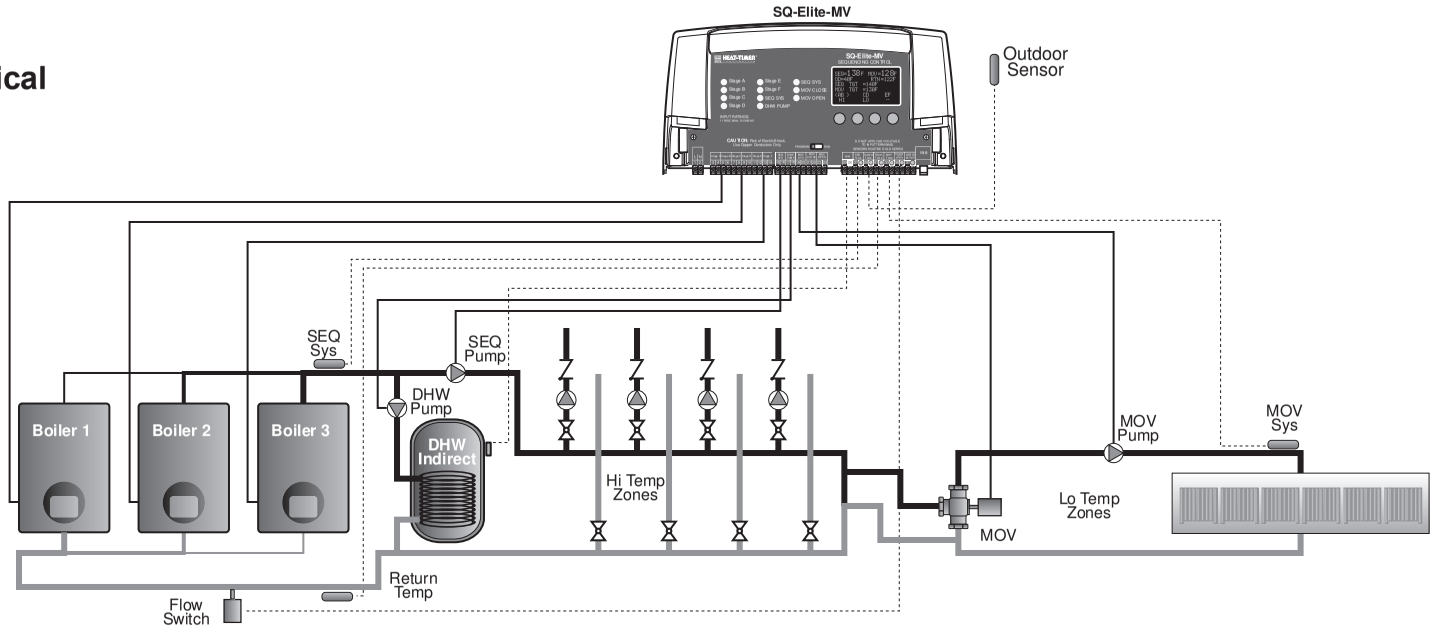
Electrical



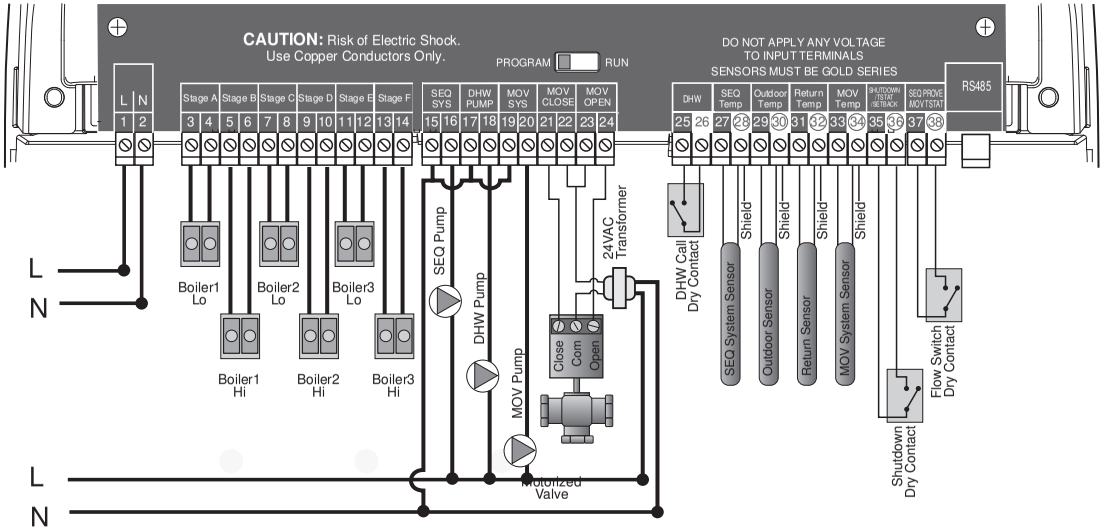
- The SQ-Elite-MV sequencing 3 2-stage boilers piped in Reverse Return. The low temperature zone is controlled by the 3-way motorized valve. The SQ-Elite-MV controls the boilers and the Motorized valve and the low temperature loop pump (MOV Pump).
- Heat-Timer Corp. is aware that each installation is unique. Thus, Heat-Timer Corp. is not responsible for any installation related to any electrical or mechanical diagram generated by Heat-Timer Corp.. The provided illustrations are to demonstrate Heat-Timer Corp.'s control operating concept only.

MULTIPLE 2-STAGE BOILERS WITH HIGH AND LOW TEMPERATURE ZONE AND DHW PRIORITY

Mechanical



Electrical

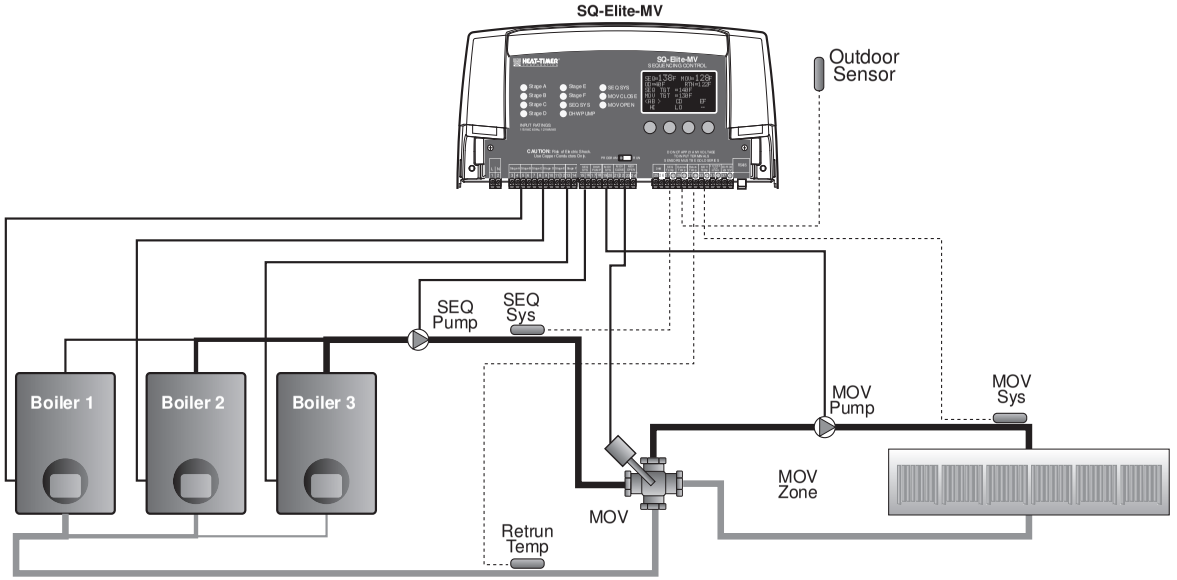


- The SQ-Elite-MV sequencing 3 2-stage boilers piped in Reverse Return. DHW is piped in parallel to boilers' loop. 4 high temperature zones are provided before connecting to the low temperature zone controlled by the 3-way motorized valve. The SQ-Elite-MV controls the boilers, the boiler loop pump (SEQ Pump), DHW Pump, the Motorized valve, and the low temperature loop pump (MOV Pump).

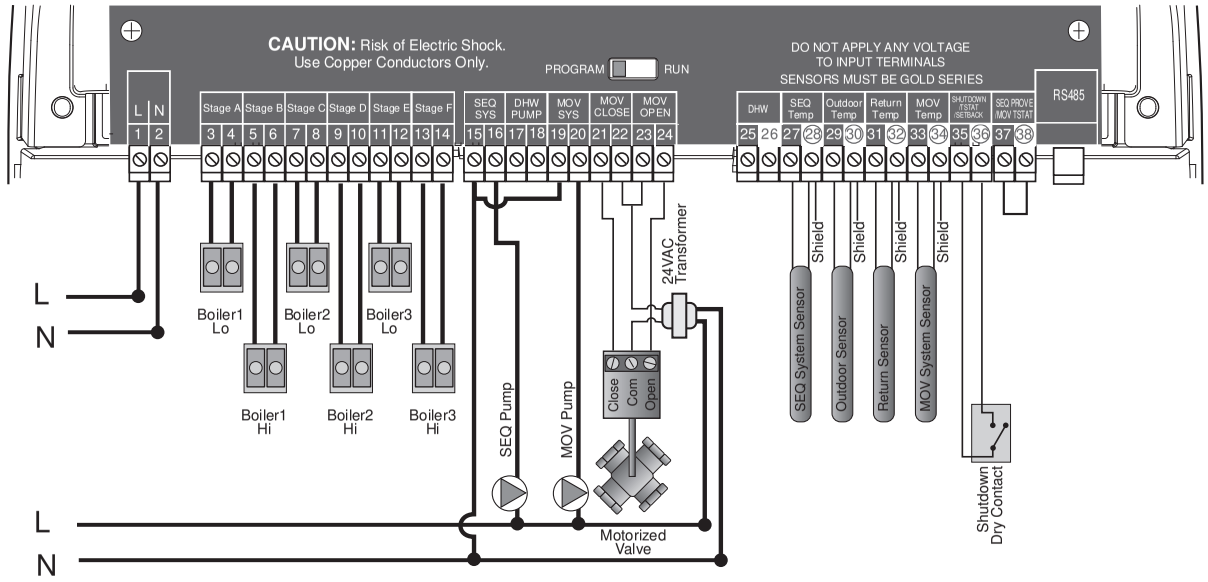
- Heat-Timer Corp. is aware that each installation is unique. Thus, Heat-Timer Corp. is not responsible for any installation related to any electrical or mechanical diagram generated by Heat-Timer Corp.. The provided illustrations are to demonstrate Heat-Timer Corp.'s control operating concept only.

MULTIPLE 2-STAGE BOILERS WITH MOTORIZED VALVE CONTROLLING LOW TEMPERATURE ZONE

Mechanical



Electrical

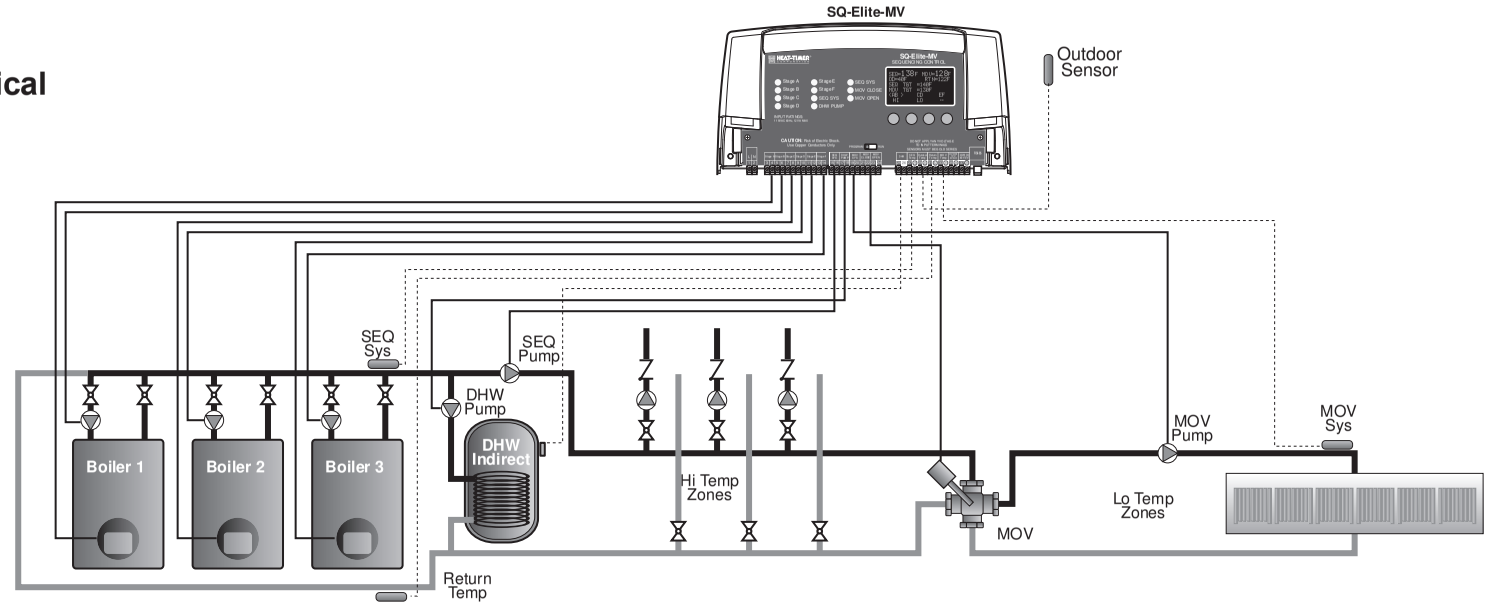


- The SQ-Elite-MV sequencing 3 2-stage boilers piped in Reverse Return. The low temperature zone controlled by the 4-way motorized valve. The SQ-Elite-MV controls the boilers, boiler loop pump (SEQ Pump), the Motorized valve, and the low temperature loop pump (MOV Pump).

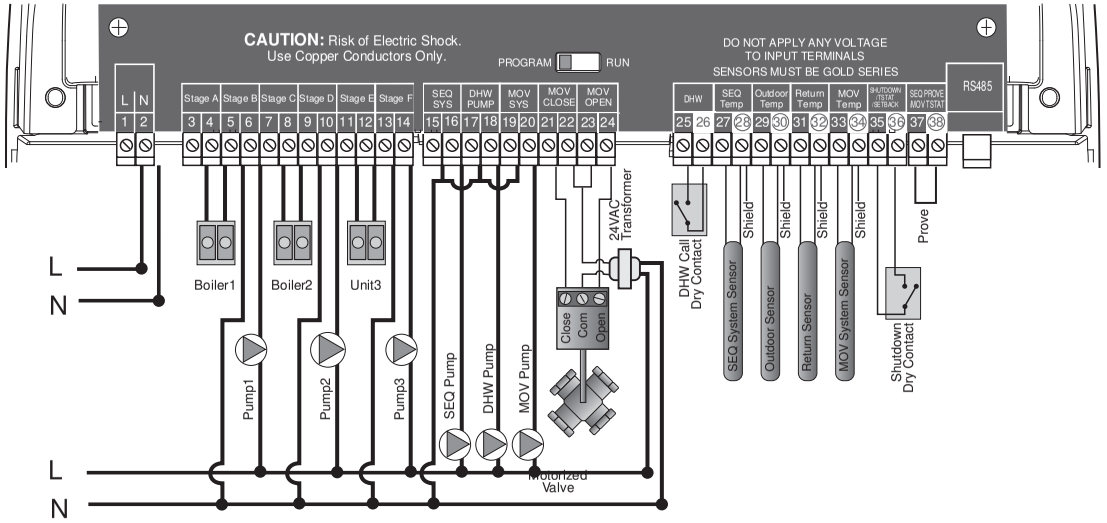
- Heat-Timer Corp. is aware that each installation is unique. Thus, Heat-Timer Corp. is not responsible for any installation related to any electrical or mechanical diagram generated by Heat-Timer Corp.. The provided illustrations are to demonstrate Heat-Timer Corp.'s control operating concept only.

MULTIPLE ON/OFF BOILERS WITH PUMPS. ZONES ARE HIGH AND LOW TEMPERATURE IN ADDITION TO DHW WITH PRIORITY

Mechanical



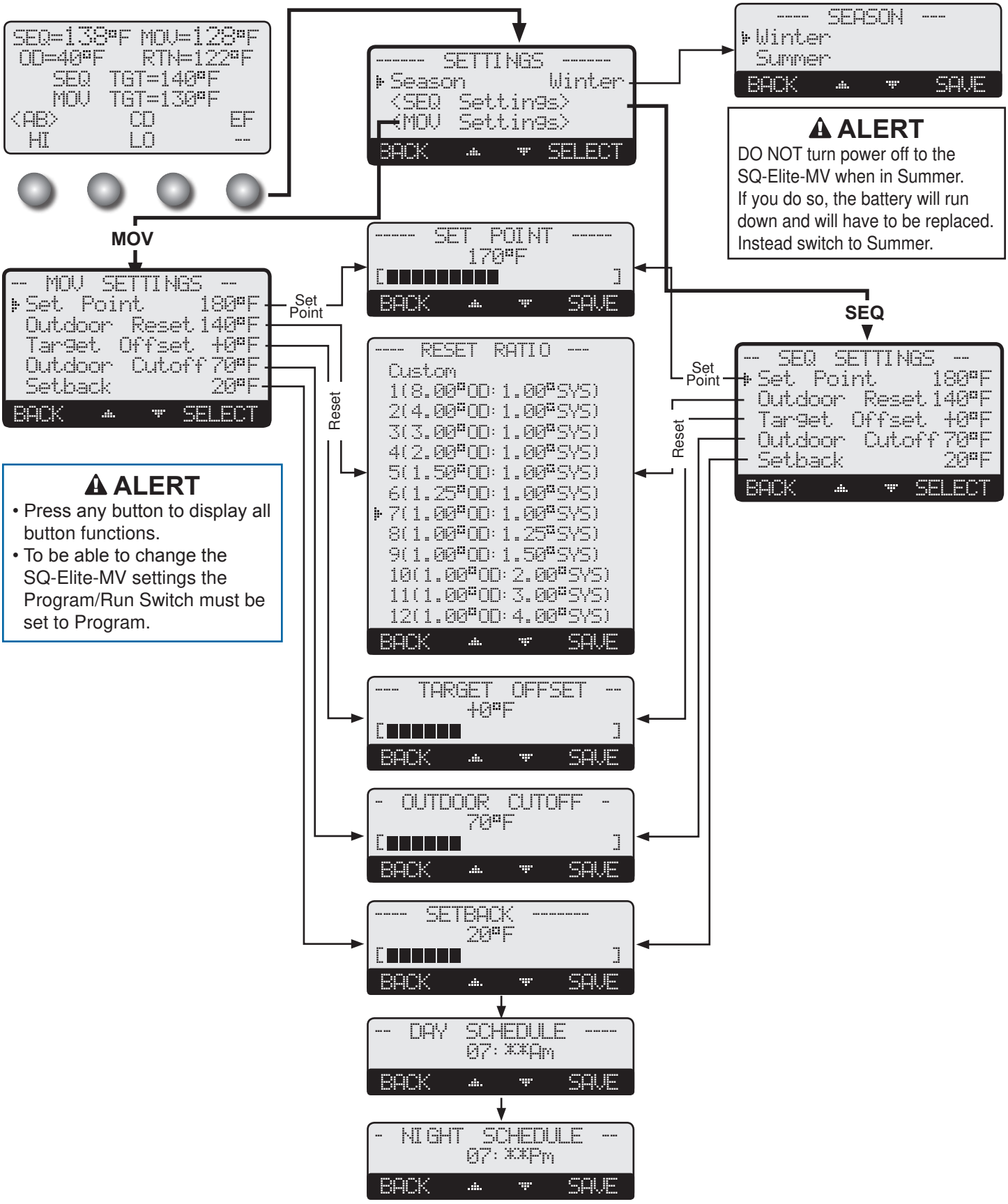
Electrical



- The SQ-Elite-MV sequencing 3 On/Off boilers with pumps piped in Primary/Secondary configuration. DHW is piped in parallel to boilers' loop. 3 high temperature zones are provided before connecting to the low temperature zone controlled by a 4-way motorized valve. The SQ-Elite-MV controls the boilers, their pumps, Boiler loop pump (SEQ Pump), DHW Pump, the Motorized valve, and the low temperature loop pump (MOV Pump).

- Heat-Timer Corp. is aware that each installation is unique. Thus, Heat-Timer Corp. is not responsible for any installation related to any electrical or mechanical diagram generated by Heat-Timer Corp.. The provided illustrations are to demonstrate Heat-Timer Corp.'s control operating concept only.

USER MENU SEQUENCE



⚠ ALERT

DO NOT turn power off to the SQ-Elite-MV when in Summer. If you do so, the battery will run down and will have to be replaced. Instead switch to Summer.

⚠ ALERT

- Press any button to display all button functions.
- To be able to change the SQ-Elite-MV settings the Program/Run Switch must be set to Program.

USER SETTINGS

Operating users have a simplified menu that can be accessed by clicking the Menu button. Installer menu will have the same settings in addition to Startup and more advanced operation settings. The installer menu can be access by holding down the Menu button for three seconds or more.

PROGRAM CHANGE SETTINGS

- To be able to change the SQ-Elite-MV settings the Program/Run Switch must be set to Program. The switch is located under the Enclosure Wiring Cover for security. The Enclosure Wiring Cover can be securely closed using a padlock.
- To display the button functionality, press any of the four buttons below the display.
- To enter the Installer Menu, hold down the MENU Button for at least three seconds. The Installer Menu have advanced settings in addition to the User Menu settings.
- To enter the User Menu, just press the MENU button.

⚠ ALERT

DO NOT turn power off to the SQ-Elite-MV when in off-season or season is over. If you do so, the battery will run down and will have to be replaced. Instead switch to Summer or Winter.

SEASON

Winter, Summer **Default: Winter**

Button: *MENU/Season*

- The SQ-Elite-MV will turn all boiler relays off when it is in Summer setting. In addition, the motorized valve MOV Close relay will energize for six minutes to guarantee closure. However, a DHW call will bring boilers back on if needed. The Message Display Line will display Summer and Valve Close to show status.
- When in Winter, the SQ-Elite-MV will activate the System relays whenever the outdoor temperature falls to or below the respective Outdoor Cutoff setting. In addition, it will begin heating whenever the system temperature falls below the Set Point Temperature. No season information will be displayed.
- When the Winter is over, it is a good practice to switch the SQ-Elite-MV Season setting to Summer. This will allow DHW calls to operate the boilers when needed as well as preserve the battery life.

SEQ AND MOV RESET RATIO SETTINGS

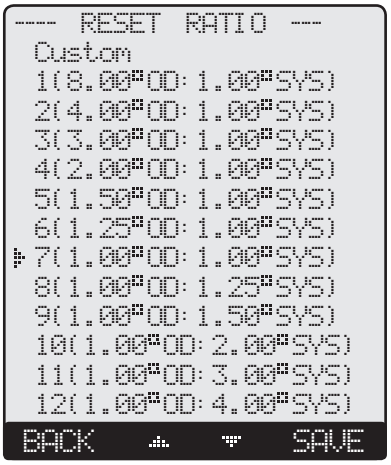
Each of the boiler loop (SEQ) and motorized valve loop (MOV) has their own reset ratio settings that can be configured independently from each other.

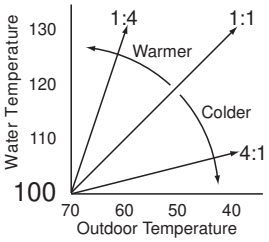
SEQ AND MOV RESET RATIO

Custom, 1(8.00ºOD : 1.00ºSys) to 12(4.00ºOD : 1.00ºSys) Default: 1(1.00ºOD : 1.00ºSys)

Button: *MENU/<SEQ Setting>/Outdoor Reset* **SEQ**

Button: *MENU/<MOV Setting>/Outdoor Reset* **MOV**



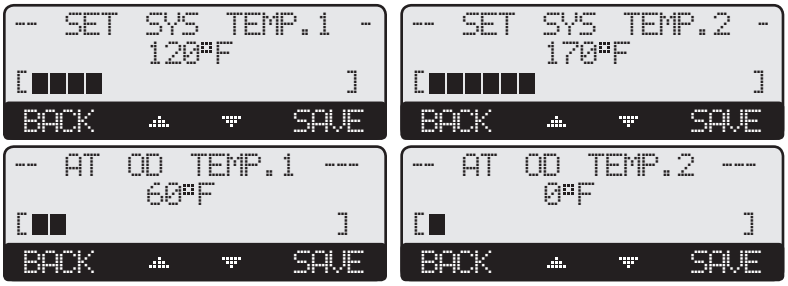


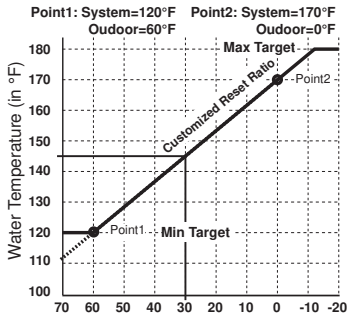
- The Reset Ratio determines how the System water temperature will vary with outside temperature changes. With any of the ratios, the colder it becomes outside, the hotter the temperature of the system water. (See Understanding Operation Concept on page 5)
- With a 1.00 (OD):4.00 (SYS) ratio, the System water temperature (SYS) will increase rapidly as the outside temperature falls, hitting the Maximum of 240°F at 35°F outside temperature. With a 4.00 (OD):1.00 (SYS) ratio, the System water temperature (SYS) will increase slowly as the outside temperature falls. Even at -30°F, the system water will only be 125°F, and at 22°F outside, the system water will be 112°F. Such a low Reset Ratio might be used with radiant floor heating applications.
- With most baseboard heating applications, a 1.00 (OD):1.00 (SYS) setting is a good place to start. With a 1.00 (OD):1.00 (SYS) ratio, for every degree the outside temperature falls, the system water temperature is increased one degree.
- If required: **Adjust the RESET RATIO in cold weather.** If the ambient building temperatures are too cold in cold weather, move the ratio to a higher selection. That is, if 1.00 (OD):1.00 (SYS) was initially selected, change the selection to 1.00 (OD):1.25 (SYS). If the building temperatures are too warm in cold weather, move the ratio to a lower selection. That is, if 1.00 (OD):1.00 (SYS) was initially selected, change the selection to 1.25 (OD):1.00 (SYS).

SEQ AND MOV CUSTOMIZED RESET RATIO

Button: *MENU/<SEQ Setting>/Outdoor Reset/Custom* **SEQ**
Button: *MENU/<MOV Setting>/Outdoor Reset/Custom* **MOV**

- For situations where the available reset ratios do not provide the perfect building heat-loss equilibrium, the customized option can be used. It provides the user with the capability of assigning two points on the reset ratio diagram and use the line that connects those two points as the customized reset ratio curve. Each of the two points will need a specific System and Outdoor Temperature to identify it on the diagram.
- To Set the first point, specify Sys Temp 1, and OD Temp 1. Then, specify Sys Temp 2, and OD Temp 2, to set the second point on the curve. The two points can be anywhere on the line, not necessarily at the ends.
- The chart shows an example of a customized curve 6(OD):5(SYS) that does not exist in the standard curve options. If the outdoor temperature reaches 30ºF, the system target will be 145ºF.
- Remember that the Min Target, Max Target, and Offset apply to all reset ratios including the customized reset ratio ones.



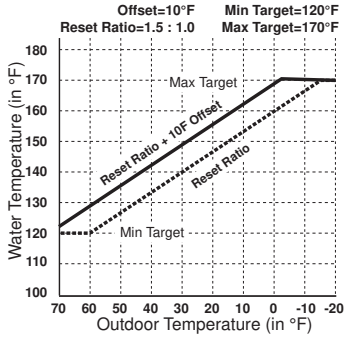


Custom Reset Ratio

SEQ AND MOV TARGET OFFSET

Adjustable from 40ºF/22ºC - (-40ºF/-22ºC) **Default: 0ºF/0ºC**
Button: *MENU/<SEQ Setting>/Offset* **SEQ**
Button: *MENU/<MOV Setting>/Offset* **MOV**

- The Offset setting lets you adjust the starting points of the Reset Ratio curves. This means that, regardless of the Outdoor temperature, or the Reset Ratio that has been selected, when the Offset setting is changed, that change is directly added to or subtracted from the calculated temperature. For example, if the Set Point temperature was 130°F and the Offset was changed from 0° to 10° (an increase of 10°), then the Set Point temperature would increase to 140°F.
- The Offset setting does not change the ratio selection. For instance, with 1.00 (OD):1.00 (SYS) Reset Ratio, the System water temperature will always increase one degree for each degree change in the Outdoor temperature. What the Offset does is add or subtract a constant temperature value. (See Understanding Operation Concept on page 5)
- The Minimum and Maximum Target (available in Installer Menus only) will take precedence over the Offset. That is, if the Max Target was set to 180°F and the Offset was set to 20°F. If the set point was 170°F, the new calculated set point based with the Offset will not exceed 180°F.
- If required: **Adjust the Water Offset in mild weather**. If the ambient building temperatures are too warm in the mild weather, decrease the Target Offset. If the ambient building temperatures are too cold in the mild weather, increase the Target Offset. The rule of thumb for baseboard radiation is to change the Offset 4°F for every 1°F you wish to change the building temperatures. In radiant heat applications, change the Offset 1°F or 2°F for every 1°F you wish to change the building temperature.



Target Offset

SEQ AND MOV OUTDOOR CUTOFF

Adjustable 20ºF/-7ºC - 100ºF/38ºC, On **Default: 70ºF/21ºC**
Button: *MENU/<SEQ Setting>/Outdoor Cutoff* **SEQ**
Button: *MENU/<MOV Setting>/Outdoor Cutoff* **MOV**

- In Outdoor Reset mode, Outdoor Cutoff will always exist. However, in Set Point mode, if the outdoor sensor is installed, the Outdoor Cutoff menu option will automatically appear.
- When the outdoor temperature falls to the adjustable Outdoor Cutoff temperature, the SQ-Elite-MV will control the outputs, whether those outputs are multiple boiler stages or a motorized valve, to hold the calculated temperature.

- When the outdoor temperature rises to the Outdoor Cutoff plus a 2°F differential, the SQ-Elite-MV will turn all boilers off and close the motorized valve. The System relay and any other stage pump or valve relays that were energized will remain energized for the Run-On delay (adjustable in Installer Menu only).
- The Outdoor Cutoff can be set to On where the System Relay will run regardless of the outdoor temperature.

SETBACK SCHEDULE

This menu provide the Day/Night Schedule as well as the Setback setting.

SEQ AND MOV SETBACK

Adjustable 0°F/0°C to 80°F/44°C **Default: 0°F/0°C**
Button: *MENU/<SEQ Settings>/Setback* **SEQ**
Button: *MENU/<MOV Settings>/Setback* **MOV**

- The Setback feature can be used to provide the SQ-Elite-MV with a lower temperature Set Point when less load is required.
- The new Set Point will appear on the main display indicating this condition "Setback to 160°F". For example, if the calculated temperature is 180°F and the Setback is 20°F, then when in Setback, the SQ-Elite-MV will hold a Set Point of 160°F.
- A typical use for Setback is to provide less system temperature to a building during the night or on the weekends when building is not occupied, but heat is still required.

SEQ AND MOV DAY/NIGHT SCHEDULES

(Available when External Input 1 = Shutdown or SEQ Tstat only)
Button: *MENU/<SEQ/MOV Settings>/Setback/Day Schedule*
Button: *MENU/<SEQ/MOV Settings>/Setback/Day Schedule/Night Schedule*

- Each of the SEQ and MOV Schedules provide two levels of heat. The Day level is used when a building is occupied and people are active.
- The Night/Setback level is used when a building is not occupied, or when people are asleep. This setting reduces the calculated temperature by the Setback setting. If the Day calculated water temperature was 150˚F and the Setback was 20˚F, the Night Schedule will run at (150˚F - 20˚F) = 130˚F.

SPECIFICATIONS:

Voltage Input: . . . . . 120 VAC 60 Hz
Power Consumption: . . . . . .12 VA Max
Operating Temperature: . . . . . 20°F/-7°C to 120°F/49°C
Operating Humidity: . . . . . 20% to 80%
Dimensions: . . . . . 11"W x 9" H x 3 ¾
Weight: . . . . . 2.5 pounds

SQ-Elite-MV Specifications:

Lead Stage Rotation: . . . . . Time (1 to 999 Hours (41 days)), Manual, First-On/First-Off
SQ-Elite-MV Outputs and LEDs: . . . . . 11 N.O. S.P.S.T (6 Stages, 2 System, 1 DHW Pump, 2 Motorized Valve)
SQ-Elite-MV Inputs: . . . . . 2 Sys (Temp), 1 Outdoor, Return Temp, DHW, Shutdown/Tstat/Setback, SEQ Prove/SEQ Tstat
Stage Modes: . . . . . Auto, Standby, Off, On
Standby Time (PID only): . . . . . 1 to 60 minutes
Output Relay Ratings: . . . . . 2 Amp inductive (Maximum of 1/4 HP) at 120 VAC 60 Hz
Add-On SQ-Elite-EXT Panels: . . . . . up two SQ-Elite-EXT Panels using RS485
Temperature Display: . . . . . Fahrenheit or Celsius.
Display: . . . . . Graphical Alphanumeric (7 rows x 21 char. each)
Temperature Sensor Ranges: . . . . . -35°F to 250°F
Outdoor Cutoff Range: . . . . . .20°F/-17°C to 100°F/38°C, ON and OFF
Set Point: . . . . . -10°F/-23°C to 230°F/110°C
External Set Point: . . . . . -10°F/-23°C to 240°F/116°C using 4-20mA EMS Interface (optional)
Reset Ratio Range (Outdoor Reset Only): . . . . . (1:4) to (8:1) (Outdoor : System Water), and Custom Reset Ratio
Offset Adjustment (Outdoor Reset Only): . . . . . .minus -40°F/-22°C to plus 40°F/22°C
Minimum Target (Outdoor Reset Only): . . . . . 70°F/21°C to 170°F/77°C
Maximum Target (Outdoor Reset Only): . . . . . 90°F/38°C to 240°F/116°C
Reaction Time (PID only): . . . . . 1 to 10 minutes
Minimum Run-Time (PID only): . . . . . 0 to 60 minutes
Purge Delay (PID only): . . . . . 0.0 to 10.0 minutes
Last Stage Hold (PID only): . . . . . 0°F/0°C to 30°F/17°C
Throttle Range (OSS only): . . . . . 2°F/1°C to 20°F/11°C
Domestic Hot Water Priority Options: . . . . . .Parallel Piping with Priority or without Priority and Primary Secondary
Pump Run-On: . . . . . 0 to 60 minutes
Pump Exercise: . . . . . Yes or No
Schedules: . . . . . .1 Day and 1 Night (Setback) settings per day
Night Setback: . . . . . 0°F/0°C to 80°F/44°C
Power Backup: . . . . . .Lithium coin battery, 100 days minimum 5 year replacement (Maintains Clock in power outages).
External Inputs: . . . . . .Shutdown Input, and Prove Input. (Dry-contacts Only)
Season: . . . . . .Winter and Summer.

SQ-Elite-EXT Specifications:

Extension Numbering: . . . . . Toggle Switch A or B
LED: . . . 1 Power (Dual Color Green (A)/Red (B)), 1 Communication, 8 Stage Output relays (Dual Color Green (A)/Red (B))
Stage Outputs: . . . . . 8 N.O. S.P.S.T.
Output Relay Ratings: . . . . . 2 Amp inductive (Maximum of 1/4 HP) at 120 VAC 60 Hz
Connection to SQ-Elite-MV and another SQ-Elite-EXT: . . . . . Two RS485

HEAT-TIMER® CORPORATION
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