

COMMERCIAL ELECTRIC WATER HEATER



A DIVISION OF A. O. SMITH CORPORATION
RENTON, WASHINGTON
www.hotwater.com

MODELS DVE-150 THRU DVE-10000
DHE-200 THRU DVE-10000
UP TO 150KW







PLACE THESE INSTRUCTIONS ADJACENT TO HEATER AND NOTIFY OWNER TO KEEP FOR FUTURE REFERENCE.

SAFE INSTALLATION, USE AND SERVICE

Your safety and the safety of others is extremely important in the installation, use, and servicing of this water heater.

Many safety-related messages and instructions have been provided in this manual and on your own water heater to warn you and others of a potential injury hazard. Read and obey all safety messages and instructions throughout this manual. It is very important that the meaning of each safety message is understood by you and others who install, use, or service this water heater.

	<p>This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.</p>
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	<p>DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or injury.</p>
	<p>WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or injury.</p>
	<p>CAUTION indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury.</p>
<p>CAUTION</p>	<p>CAUTION used without the safety alert symbol indicates a potentially hazardous situation which, if not avoided, could result in property damage.</p>

All safety messages will generally tell you about the type of hazard, what can happen if you do not follow the safety message, and how to avoid the risk of injury.

The California Safe Drinking Water and Toxic Enforcement Act requires the Governor of California to publish a list of substances known to the State of California to cause cancer, birth defects, or other reproductive harm, and requires businesses to warn of potential exposure to such substances.

This product contains a chemical known to the State of California to cause cancer, birth defects, or other reproductive harm. This appliance can cause low level exposure to some of the substances listed.

IMPORTANT DEFINITIONS

- **Qualified Installer or Service Agency:**

Installation and service of this water heater requires ability equivalent to that of a Qualified Agency (as defined by ANSI below) in the field involved. Installation skills such as plumbing and electrical supply are required in addition to electrical testing skills when performing service.

- **ANSI Z223.1 2006 Sec. 3.3.83:**

“Qualified Agency” - “Any individual, firm, corporation or company that either in person or through a representative is engaged in and is responsible for (a) the installation, testing or replacement of gas piping or (b) the connection, installation, testing, repair or servicing of appliances and equipment; that is experienced in such work; that is familiar with all precautions required; and that has complied with all the requirements of the authority having jurisdiction.”

GENERAL SAFETY INFORMATION

PRECAUTIONS

DO NOT USE THIS APPLIANCE IF ANY PART HAS BEEN UNDER WATER. Immediately call a qualified service technician to inspect the appliance and to replace any part of the control system which has been under water.

If the unit is exposed to the following, do not operate heater until all corrective steps have been made by a qualified service agency.

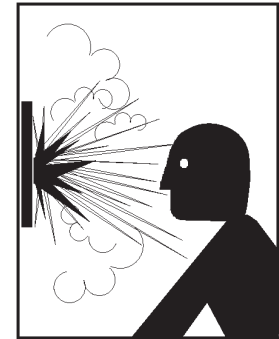
1. External fire.
2. Damage.
3. Firing without water.

GROUNDING INSTRUCTIONS

This water heater must be grounded in accordance with the National Electrical Code and/or local codes. These must be followed in all cases. Failure to ground this water heater properly may also cause erratic control system operation on ELECTRONIC CONTROL models.

This water heater must be connected to a grounded metal, permanent wiring system, or an equipment grounding conductor must be run with the circuit conductors and connected to the equipment grounding terminal or lead on the water heater.

HYDROGEN GAS (FLAMMABLE)




⚠ WARNING

Explosion Hazard

- Flammable hydrogen gases may be present.
- Keep all ignition sources away from faucet when turning on hot water.

Hydrogen gas can be produced in a hot water system served by this heater that has not been used for a long period of time (generally two weeks or more). Hydrogen gas is extremely flammable. To reduce the risk of injury under these conditions, it is recommended that the hot water faucet be opened for several minutes at the kitchen sink before using any electrical appliance connected to the hot water system. If hydrogen is present there will probably be an unusual sound such as air escaping through the pipe as the water begins to flow. THERE SHOULD BE NO SMOKING OR OPEN FLAME NEAR THE FAUCET AT THE TIME IT IS OPEN.

When servicing this unit, verify the power to the unit is turned off prior to opening the control cabinet door.

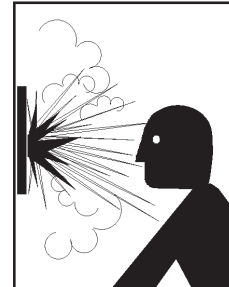


⚠ WARNING

Read and understand this instruction manual and the safety messages herein before installing, operating, or servicing this water heater.

Failure to follow these instructions and safety messages could result in death or serious injury.

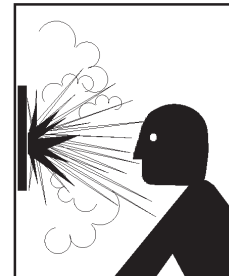
This manual must remain with the water heater.



⚠ WARNING

Explosion Hazard


- Flammable hydrogen gases may be present.
- Keep all ignition sources away from faucet when turning on hot water.



⚠ WARNING

Explosion Hazard

- Overheated water can cause watertank explosion.
- Properly sized temperature and pressure relief valve must be installed in opening provided.



⚠ WARNING

- Before removing any access panels or servicing the water heater, make sure the electrical supply to the water heater is turned "OFF."
- Failure to do this could result in death, serious bodily injury, or property damage.

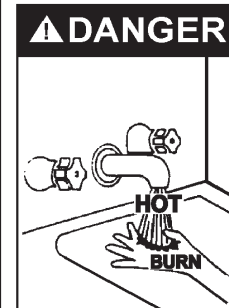
CAUTION

Improper Installation, use and service may result in property damage.

- Do not operate water heater if flood damaged.
- Inspect anode rods regularly, replace when significantly depleted.
- Install in location with drainage.
- Fill tank with water before operation.
- Properly sized thermal expansion tanks are required on all closed water systems.

Refer to this manual for installation and service.

⚠ DANGER



Water temperature over 125°F (52°C) can cause severe burns instantly resulting in severe injury or death.

Children, the elderly, and the physically or mentally disabled are at highest risk for scald injury.

Feel water before bathing or showering.

Temperature limiting valves are available.

Read instruction manual for safe temperature setting.

TABLE OF CONTENTS

This manual contains the operating instructions for the commercial electric Xi control. It is intended to be used in conjunction with the water heater instruction manual.

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INTRODUCTION

Thank You for purchasing this water heater. Properly installed and maintained, it should give you years of trouble free service.

Abbreviations Found In This Instruction Manual:

- ANSI - American National Standards Institute
- ASME - American Society of Mechanical Engineers
- NEC - National Electrical Code
- NFPA - National Fire Protection Association

PREPARING FOR THE INSTALLATION

1. Read the "General Safety" section of this manual first and then the entire manual carefully. If you don't follow the safety rules, the water heater may not operate safely. It could cause DEATH, SERIOUS BODILY INJURY AND/OR PROPERTY DAMAGE.

This manual contains instructions for the installation, operation, and maintenance of the water heater. It also contains warnings throughout the manual that you must read and be aware of. All warnings and all instructions are essential to the proper operation of the water heater and your safety. READ THE ENTIRE MANUAL BEFORE ATTEMPTING TO INSTALL OR OPERATE THE WATER HEATER.

General outline diagrams are in this manual. These diagrams will serve to provide the installer with a reference for basic installation of this product. IT IS NECESSARY THAT ALL WATER PIPING AND THE ELECTRICAL WIRING BE INSTALLED AND CONNECTED AS SHOWN IN THE DIAGRAMS.

Be sure to turn off power when working on or near the electrical system of the water heater. Never touch electrical components with wet hands or when standing in water. When replacing fuses always use the correct size for the circuit. Use same size and type of fuse when replacing.

The principal components of the heater are identified on page 6.

The model and rating plate on page 7 interprets certain markings into useful information. Both of these references should be used to identify the heater, its components and optional equipment.

2. The installation must conform with these instructions and the local code authority having jurisdiction and the requirements of the power company. In the absence of code requirements, follow NFPA-70 (current edition). The National Electrical Code may be ordered from: National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02269.
3. If after reading this manual you have any questions or do not understand any portion of the instructions, call the toll free number on the back cover for further assistance.

A sample rating plate and barcode tag are shown on page 7 of this manual. In order to expedite your request, please have the serial number and item ID from the barcode tag available for the technician.

4. Carefully plan your intended placement of the water heater. Examine the location to ensure the water heater complies with the "Locating the New Water Heater" section in this manual.

Clearance must be maintained so that the coil bundle may be removed for servicing after installation.

Installation and service of this water heater requires ability equivalent to that of a licensed tradesman or qualified agency (page 2) in the field involved. Plumbing and electrical work are required.

5. For installation in California this water heater must be braced or anchored to avoid falling or moving during an earthquake. See instructions for correct installation procedures. Instructions may be obtained from California Office of the State Architect, 1102 Q Street, Suite 5100, Sacramento, CA 95811.
6. Massachusetts Code requires this water heater to be installed in accordance with Massachusetts 248-CMR 2.00: State Plumbing Code and 248-CMR 5.00.

ELECTRICAL DATA

GENERAL

Check the water heater model and rating plate information against the characteristics of the branch circuit electrical supply. Do not connect the heater to an improper source of electricity.

Voltage applied to the water heater should not vary more than +5% to -10% of the model and rating plate marking for satisfactory operation.

Do NOT energize the branch circuit for any reason before the water heater tank is filled with water. Doing so may cause the heating elements to fail.

The installation must conform to these instructions and the local code authority having jurisdiction. Grounding and electrical wiring connected to the water heater must also conform to the National Electrical Code, NFPA 70. This publication is available from The National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02269.

BRANCH CIRCUIT

The branch circuit wire size should be established through reference to the NEC (National Electrical Code) or other locally approved sources in conjunction with the water heater amperage rating. Wire rated at 75°C should be used. For convenience, portions of the wire size tables from the Code are reproduced in Table 1 on page 9. It is suggested the electrician size the branch circuit at 125 percent of the heater rating and further increase wire size as necessary to compensate for voltage drop in long runs. Voltage drop should not exceed 3% at the water heater.

HEATER CIRCUITS

The water heater's electrical components are pictured and identified in the Features and Components illustrations in Diagrams 1 and 2. The model and rating plate provides heater circuit ratings. There are two main electrical circuits:

Control Circuit: Power supply for the electromagnetic contactor coils. 120V power is supplied to the contactor coils by the CCB (Central Control Board) see wiring diagrams in this manual.

Power Circuit: High voltage, single or three phase, circuit that carries the heating element load.

The following section and pages describe the water heater circuits and includes wiring diagrams.

CONTROL CIRCUITS

The water heater is equipped with an electronic control system. The system includes a CCB (Central Control Board) circuit board, an immersion temperature probe with ECO for temperature sensing and limiting, a UIM (User Interface Module) for user interface & information display and element current sensors for monitoring the power circuits. Refer to the control circuit label on the water heater for details. The CCB is powered by a small 120V/24V transformer. The control circuit operates on 120V supplied by a larger 100VA transformer.

Sequence of Operation

1. When the control is powered, the UIM should display model information, water temperature, operating setpoint, heating status and operating mode.
2. If the control determines that the actual water temperature inside the tank is below the programmed operating setpoint minus the (1st) differential setpoint, a call for heat is activated.
3. After all safety checks are verified the CCB will energize the contactor coil(s). On models with more than one heating element the upper most heating elements are energized first. Successive heating elements are energized according to programmed differential setpoints for each heating element.
4. The control remains in the heating mode until the water temperature reaches the programmed operating setpoint. At this point the contactors will be de-energized.
5. The control system now enters the standby operating mode while continuing to monitor the water temperature and the state of other system devices. If the water temperature drops below the programmed Operating Setpoint minus the (1st) differential setpoint, the control will automatically return to step 2 and repeat the heating cycle.

POWER CIRCUIT

Power circuit wiring is type THHN (or equivalent) rated 600 volts, 105°C, sized as necessary.

The following wiring diagrams on page 6 are included in this manual to show typical arrangements of electrical components in the control and power circuits by voltage and phase characteristics. They are to be used as a reference by the installer or servicer in performing their work. An actual diagram of the water heater wiring is furnished with the water heater.

WIRING DIAGRAMS

DIAGRAM 1. LARGE COMMERCIAL WIRE DIAGRAM 208-240V / 3PH

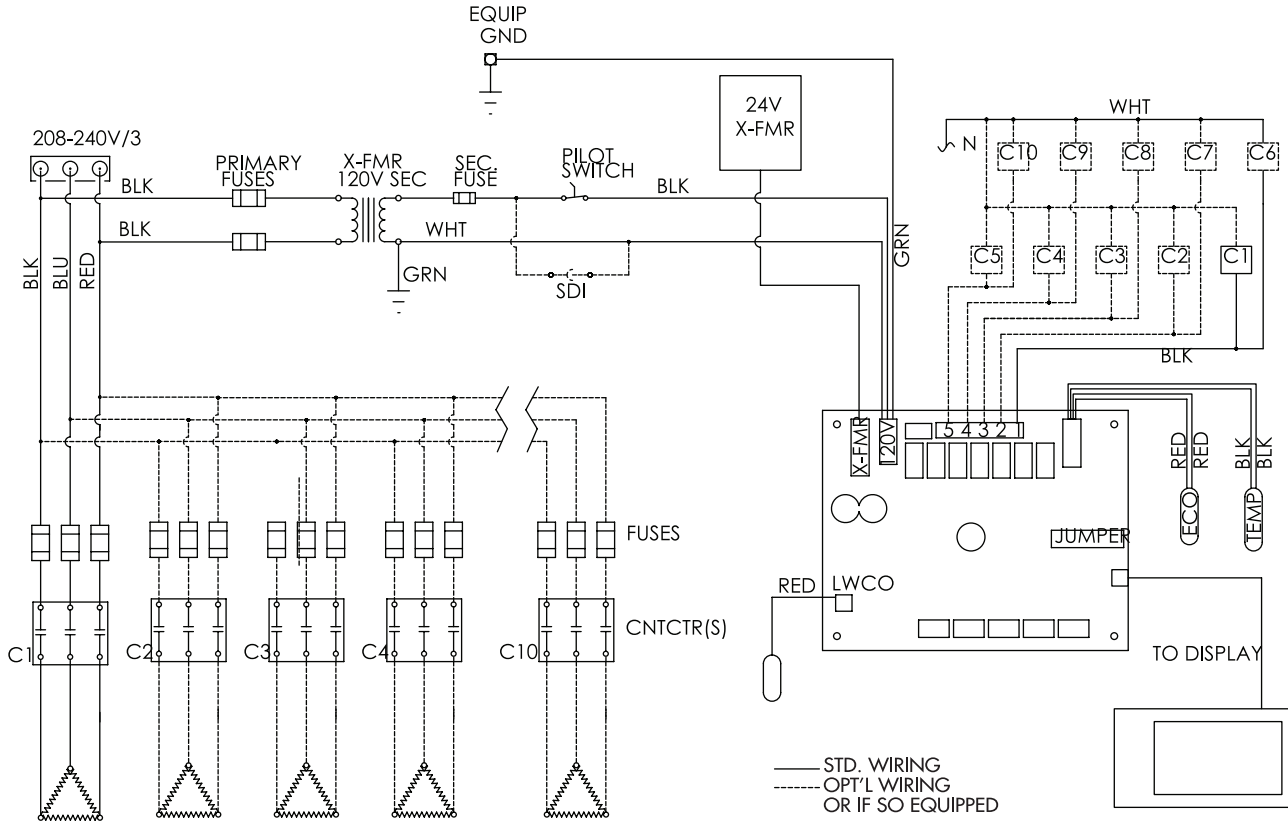
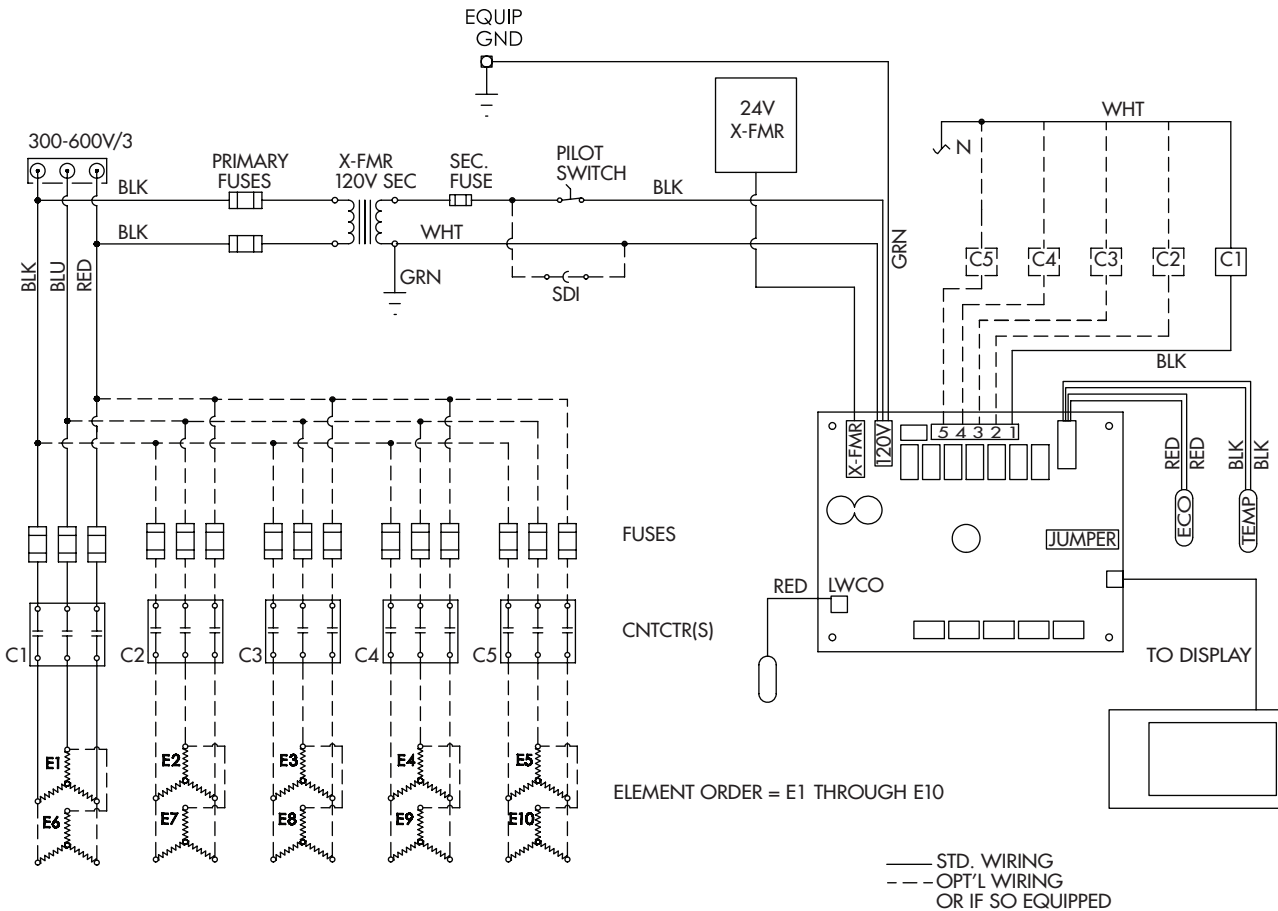


DIAGRAM 2. LARGE COMMERCIAL WIRE DIAGRAM 300-600V/3PH

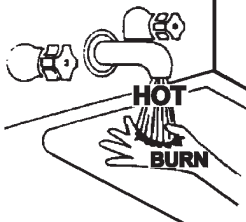


TEMPERATURE REGULATION

HIGH TEMPERATURE LIMIT CONTROLS (ECO)

This water heater is equipped with an ECO (energy cut off). This switch is adjustable, up to 190 degree F. An ECO is a normally closed switch that opens (activates) on a rise in temperature. If the ECO switch contacts open (activate) due to abnormally high water temperatures the control system will lock-out and disable further heating element operation. It is important that a qualified service agent be contacted to determine the reason for the ECO activation before resetting the ECO. Once the reason has been determined and corrected the ECO can be reset as follows:

When the ECO switch contacts open (activate) the electronic control system locks out and displays a Fault message. Voltage to the contactor coils and heating elements is terminated to prevent further heating operation. Should the ECO activate, the water temperature must drop below 120°F/49°C before the control system can be reset. Once the water temperature has cooled below this point the power supply to the water heater must be turned off and on again to reset the control system.



⚠ DANGER

Water temperature over 125°F (52°C) can cause severe burns instantly resulting in severe injury or death.

Children, the elderly, and the physically or mentally disabled are at highest risk for scald injury.

Feel water before bathing or showering.

Temperature limiting valves are available.

Read instruction manual for safe temperature setting.


THERMOSTAT CONTROLS

The water heaters covered in this instruction manual are equipped with adjustable thermostat controls to control water temperature. Hot water temperatures required for automatic dishwasher and laundry use can cause scald burns resulting in serious personal injury and/or death. The temperature at which injury occurs varies with the person's age and duration of exposure. The slower response time of children, the elderly or disabled persons increases the hazards to them. Never allow small children to use a hot water tap or draw their own bath water. Never leave a child or disabled person unattended in a bathtub or shower. The water heater should be located in an area where the general public does not have access to set temperatures.

Setting the water heater temperatures at 120°F will reduce the risk of scalds. Some States require settings at specific lower temperatures.

The following table shows the approximate time-to-burn relationship for normal adult skin.

TEMPERATURE ADJUSTMENT



⚠ DANGER

Full power is present whenever the cabinet door is opened even with the pilot switch turned off.

The water heaters covered in this instruction manual are equipped with an electronic control system. The control system senses temperature from a factory installed immersion temperature probe – see the Features and Components illustrations at the beginning of this manual for location. The “Operating Set Point” is adjusted to control water temperature. This is an adjustable user setting in the control system’s “Temperatures Menu.” This and all control system menus are accessed through the UIM (User Interface Module - see Figure 2) located on the front panel of the water heater.

The Operating Set Point is adjustable from 90°F/42°C to 190°F/88°C. The factory setting is 120°F/49°C. See the Control System Operation section of this manual for instructions on how to adjust the Operating Set Point and other user settings.



Set the Operating Set Point at the lowest setting which produces an acceptable hot water supply. This will always give the most energy efficient operation.

MODEL INFORMATION

Tank Temperature 114°F




Operating Set Point 120°F

Status: Heating

Friday
5:00 PM
Normal Mode

MENU
HELP

Water Temperature	Time to Produce 2nd & 3rd Degree Burns on Adult Skin
180°F (82°C)	Nearly Instantaneous
160°F (71°C)	About 1/2 second
150°F (66°C)	About 1-1/2 seconds
140°F (60°C)	Less than 5 seconds
130°F (54°C)	About 30 seconds
120°F (49°C)	More than 5 minutes
80°F (27°C)	-----

CONTROL SYSTEM OPERATION

HEATING ELEMENT OPERATION

Progressive Sequencing: Elements are energized and de-energized according to adjustable (1 to 20°F) Differential set points for each element. Element Rotation - first element on is rotated with each successive call for heat. First On/First Off - the first heating element energized at the beginning of a heating cycle is the first element de-energized at the end of the heating cycle. Successive heating cycles would progress as follows on a model equipped with 3 heating elements:

- First heating cycle: Elements come on [1, 2, 3] and cycle off [1, 2, 3].
- Second heating cycle: Elements come on [2, 3, 1] and cycle off [2, 3, 1].
- Third heating cycle: Elements come on: [3, 1, 2] and cycle off [3, 1, 2].
- Fourth heating cycle: pattern repeats - same as first.

CONTROL SYSTEM FEATURES

Advanced Diagnostics

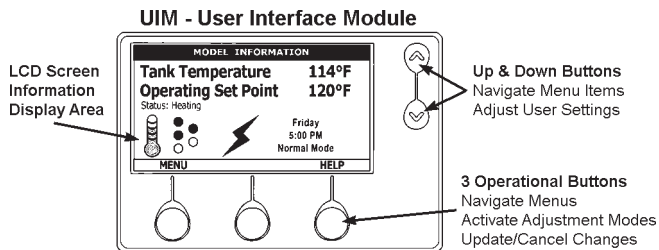
Plain English text and animated icons display detailed operational and diagnostic information. LCD screen on the front of the water heater displays the Sequence of Operation in real time. Fault or Alert messages are displayed when operational problems occur. Advanced Service menu displays a list of possible causes for current Fault and Alert conditions to aid in servicing.

Economy Mode Operation

Control system automatically lowers the Operating Set Point by a programmed value during user defined time periods. Helps reduce operating costs during unoccupied or peak demand periods.

CONTROL SYSTEM NAVIGATION

The UIM (User Interface Module) is located on the front cabinet of the water heater. All operational information and user settings are displayed and accessed using the UIM. The UIM includes five snap acting (momentary) user input buttons; an Up, Down and 3 Operational Buttons.



Up & Down Buttons

Used to navigate (up and down) and to select (highlight) menu items. Also used to adjust or change (increase/decrease, on/off, set time) various user settings.

Operational Buttons

The 3 Operational Buttons are multifunctional. Their current function is defined by the text that appears directly above each button on the LCD screen. The function will change depending on what menu is currently displayed or what menu item is selected. When no text

appears on the LCD screen above an Operational Button there is no function assigned.

THE DESKTOP SCREEN

The illustration below shows the control system “Desktop Screen.” This is the default screen. If there are no active Fault or Alert conditions and no user input for approximately 10 minutes the control system will return to this screen automatically.

Model Information: Model information and menu titles are shown in the black bar at the top of the Desktop Screen.

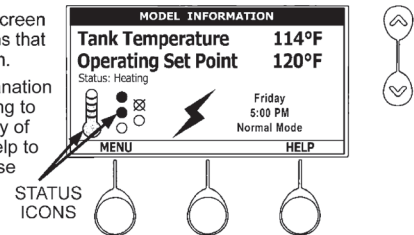
Tank Temperature: Current water temperature as sensed from the immersion Temperature Probe.

Operating Set Point: Temperature at which the control system will maintain tank (water) temperature in the Normal Mode. This line of text will read Economy Set Point whenever the control system is operating in the Economy Mode.

Status: The Operating State of the control system is displayed beneath the Operating Set Point.

Service Note: The Desktop Screen displays text and animated icons that convey operational information.

Review the Status Icons explanation in Table 3 on page 10. Learning to use this real time visual display of the operating sequence will help to quickly and accurately diagnose operational problems.



Menu: The left Operational Button is pressed to enter the Main Menu where all control system menus are accessed. See Table 3 on page 10 for a list of control system menus.

Help: The right Operational Button is pressed to access instructions and explanations for user settings, Operating States, Status Icons, manufacturer’s web address, technical support phone number and service agent contact information.

Day/Time/Operating Mode: The current time and day are also displayed on the Desktop Screen. “Clock Not Set” will be displayed until the time clock has been initially set. Day and Time are adjusted in the Economy Mode Setup menu. The current Operating Mode, either Normal Mode or Economy Mode, is displayed beneath the day and time.

Discreet Menu Contact Information: From the Desktop Screen press and hold down the middle (unmarked) Operational Button for 30 seconds and then release it. This will launch a discreet menu where personalized contact information can be entered. Installing contractors and/or service agents can enter their company name and telephone number. This contact information will be displayed with all Fault and Alert messages.

TABLE 1 - STATUS ICONS







ICON	DESCRIPTION
	Water temperature in the tank has fallen. Shaded area of the animated thermometer icon will rise and fall in response to water temperature in the storage tank as sensed from the immersion Temperature Probe.
	Water temperature in the tank has reached the Operating Set Point. Shaded area of the animated thermometer icon will rise and fall in response to water temperature in the storage tank as sensed from the immersion Temperature Probe.
	The control is unable to initiate a heating cycle. This will happen whenever a Fault condition is detected by the control system or when either of the two Enable/Disable circuits are open circuits.
	The control system is in Heating Mode and has energized the electromagnetic contactor coils for at least one heating element. This animated icon DOES NOT indicate current has been sensed from the heating elements, only that there is a call for heat present and the control system has initiated heating element operation.
	The control has detected/declared a Fault Condition. Fault message details can be viewed in the Current Fault menu. Heating operation is discontinued (locked out) until the condition that caused the fault is corrected. Power to the water heater must be cycled off and on to reset the control system. Note; cycling power will not reset the control system if the condition that caused the fault has not been corrected.
	The control has detected/declared an Alert Condition. The water heater will continue to operate during an Alert Condition but there is an operational condition that requires the attention of a Qualified Service Agent. Alert message details can be viewed in the Current Alert menu.

TABLE 2 - OPERATING STATES

STATE	DESCRIPTION
Standby	The water heater is not in an active heating cycle. This usually indicates the temperature in the tank has reached the Operating Set Point and the control system has terminated the heating cycle.
Heating	The control system is in the Heating Mode. At least one heating element has been energized.
Alert	The control system has detected/declared an Alert Condition. The controls system will continue heating operation. However, a Qualified Service Agent should be contacted to check/service the water heater.
Fault	The control system has detected/declared a Fault Condition. The control system will discontinue heating operation and "lock out." Power to the water heater must be cycled off and on to reset the control system. Note; cycling power will not reset the control system until the condition that caused the fault has been corrected.

TABLE 3 - CONTROL SYSTEM MENUS

MENUS	DESCRIPTION
Temperatures	Most commonly accessed menu. Operating Set Point, Differential settings, Tank Temperature and Tank Probe Offset are located in this menu.
Heater Status	Current Operating State/Mode (heating/standby etc) and status (open/closed - on/off - yes/no) of monitored water heater functions and components are displayed in this menu.
Economy Mode Setup	Seven day 24 hour time clock with temperature set back capability to reduce operating costs during unoccupied or reduced demand periods.
Alarm Output Setup	The control system's CCB (Central Control Board - see wiring diagrams) features on board SPDT (single pole double throw) relay contacts for building EMS (Energy Management System) notification of operational conditions such as Fault Conditions and heating mode status. This menu features a list of user definable conditions for relay activation.
Display Settings	Temperature units (°F or °C), appearance (brightness contrast) and backlight delay user adjustable settings are located in this menu.
Heater Information	Elapsed time of operation, total heating cycle time, heating cycle count, heating element(s) cycle count and on time along with UIM and CCB software revisions can be viewed in this menu.
Current Fault/Alert	Displays any current Alert or Fault messages.
Fault History	Retains 9 event history of Fault/Alert messages with time stamp. The Fault History is useful when dealing with intermittent operational problems or when the customer has reset the control system prior to a service agent's arrival.
Fault Occurrence	Total accumulated number each individual Fault condition has occurred is displayed in this menu. This running total of Fault Occurrences can be useful in determining which (if any) operational problems have been persistent.
Restore Factory Defaults	This control system feature allows the user to restore control system user settings to their factory default settings. Alarm Output Setup and Display Settings menu items ARE NOT changed when factory defaults are restored.
Help Menu	Accessible by pressing the corresponding Operational Button from most menus and screen displays. This menu provides access to instructions and explanations for user settings, Operating States, Status Icons, manufacturer's web address, technical support phone number and service agent contact information.

TEMPERATURES MENU

Operating Set Point

User adjustable setting 90°F to 190°F range; factory default is 120°F. When the water temperature sensed by the control system from the immersion Temperature Probe reaches the Operating Set Point the control system will end the heating cycle. A call for heat will be activated again when the water temperature drops below the Operating Set Point minus the 1st Differential Setting.

Example: Operating Set Point is 120°F, the 1st Differential Setting is 2°F (factory default). A call for heat will be activated when the sensed water temperature drops to 118°F.

Temperatures	
Operating Set Point	120°F
1st Differential	2°F
2nd Differential	2°F
3rd Differential	2°F
Tank Temperature	105°F
Tank Probe Offset	0°F
CHANGE	BACK HELP

Differential Settings

Adjustable user setting(s) 1°F to 20° range; factory default is 2°F. The water heaters covered in this manual will have between 1 and 5 heating elements. There is at least one Differential Setting on all models. There will be additional Differential Settings for each additional heating element installed.

Operating Sequence

On a water heater equipped with 3 heating elements, with an Operating Set Point of 120°F and all Differential settings at 2°F the On/Off sequencing of heating elements would be as follows:

ELEMENT NUMBER	DIFFERENTIAL SETTING	TURN ON TEMP	TURN OFF TEMP
Element 1	2°F	118°F	120°F
Element 2	2°F	116°F	118°F
Element 3	2°F	114°F	116°F

Tank Temperature

Non adjustable information display. Current water temperature as sensed by the control system from the immersion Temperature Probe.

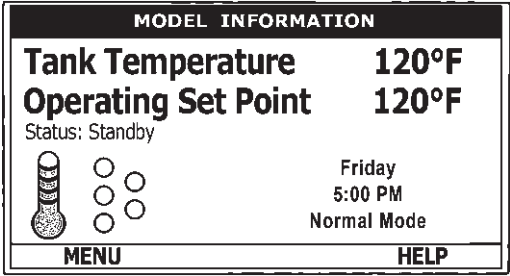
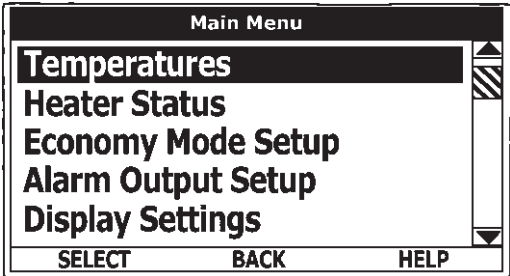
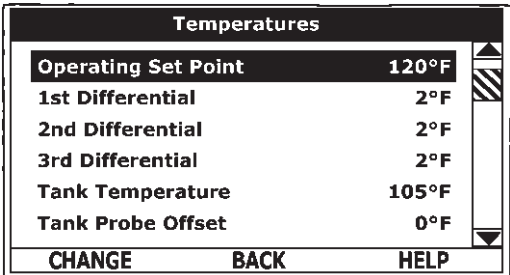
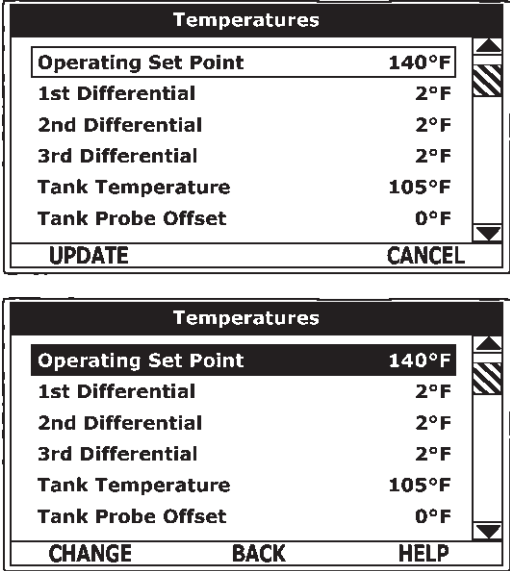
Tank Probe Offset

User adjustable setting -5°F to +5°F range; factory default is 0°F. If the current Tank Temperature is sensed (from the immersion Temperature Probe) at 120°F and the offset is adjusted to -5°F the control system would calibrate or "offset" the Tank Temperature to 115°F. Heating cycles would then start/stop based on the calibrated Tank Temperature.

Used to calibrate for slight differences in control system temperature sensing. This can improve the precision of temperature control in the storage tank and at points of use. This feature can also be used to compensate for building recirculation loops (hot water returning to the storage tank) that may cause the heating cycle to terminate prematurely.

Temperature Settings

The Operating Set Point and the Differential Settings are adjusted in the Temperatures Menu. The following instructions explain how to adjust these user settings and navigate the control system menus.

ACTION	DISPLAY
<p>From the Desktop Screen, press the Operational Button underneath "MENU" to enter the Main Menu.</p> <p>Notice how the text above the Operational Buttons on the display changes as you navigate through the various menus and screens.</p>	
<p>With Temperatures selected (highlight in black) in the Main Menu, press the Operational Button underneath "SELECT" to enter the Temperature Menu.</p> <p>If Temperatures is not selected use the Up and Down buttons to select this menu item.</p>	
<p>With the Operating Set Point selected (highlighted in black) in the Temperatures Menu, press the Operational Button underneath "CHANGE" to activate the adjustment mode for this menu item.</p>	
<p>Press the Up and Down buttons to adjust the Operating Set Point to the desired setting.</p> <p>Press the Operational Button underneath "UPDATE" to confirm the new setting. Press the Operational Button underneath "CANCEL" to discard the new setting and retain the previous setting.</p> <p>The new Operating Set Point value should now be displayed as the current value.</p> <p>NOTE: Use this same procedure to adjust the Differential settings and the Tank Probe Offset in the Temperatures Menu.</p> <p>This same procedure is used to change user settings in other control system menus.</p>	

WATER HEATER STATUS MENU

This menu displays non adjustable operational information. Use the Up & Down Buttons to navigate to the bottom of this menu.

Top of Menu

Heater Status	
Status	Heating
Elements On	1
ECO Contact	Closed
Enable / Disable 1	Closed
Enable / Disable 2	Closed
Element 1 On	Yes
Element 2 On	No
BACK HELP	

Bottom of Menu

Heater Status	
Enable / Disable 2	Closed
Element 1 On	Yes
Element 2 On	No
Element 3 On	No
Tank Full	Yes
Alarm Condition	No
Alarm Relay Output	Open
BACK HELP	

Status

Displays the current Operating State of the control system. IE: Heating, Standby, Fault.

Elements On

Displays the number of heating elements the control system has energized.

ECO Contact

Displays the current state of the ECO high temperature limit switch contacts.

Enable / Disable 1 & 2

Displays the current state, open or closed, of the two Enable/Disable circuits (J7 socket on the CCB - see wiring diagrams on page 6) provided for external supervisory controls such as building EMS (Energy Management System). Both of these Enable/Disable circuits must be closed to "enable" heating operation. If either Enable/Disable circuit is open for any reason heating operation will be "disabled." There is a plug with two jumper wires installed from the factory in the CCB J7 socket to enable heating operation when external controls are not in use.

Service Note: If a supervisory control(s) is used to enable/disable heating operation, install field wiring between the J7 socket on the CCB and a set of "dry contacts" on the external control per all applicable building codes. This is a switching circuit only: DO NOT apply any external voltage or connect any load (IE: relay coil) to either circuit.

Element # On

Displays the on/off status of each heating element. Yes = On, No = Off.

Tank Full

Displays the status of the optional LWCO (Low Water Cut Off) device. Yes = water level is acceptable, No = water level is low.

Alarm Condition

Displays the status of the user definable Alarm Output function - see Alarm Output Setup Menu. Yes = alarm condition has been met, No = alarm condition has not been met.


Alarm Relay Output

Displays the state of the normally open contacts of the Alarm Output relay. This relay (J3 contacts on the CCB - see wiring diagrams) is used for building EMS (Energy Management System) notification of operational conditions such as Fault conditions.

ECONOMY MODE SETUP MENU

This menu contains settings used to establish an "Economy Set Point" and "Economy Mode" operating periods. This control system feature can help reduce operating costs during unoccupied, low load, or peak demand periods.

Desktop Screen During Economy Mode

MODEL INFORMATION	
Tank Temperature	120°F
Economy Set Point	100°F
Status: Standby	
	Friday 5:00 PM Economy Mode
MENU HELP	

Economy Mode Setup Menu

Economy Mode Setup	
Setpoint Adjustment	20
Current Time	Mon 5:00 PM
Heater In Economy Mode	No
Sun	Economy Mode All Day
Mon	Normal 7:30 AM to 8:00 PM
Tue	Normal All Day
Wed	Normal All Day
CHANGE BACK HELP	

Setpoint Adjustment

Adjustable user setting (2°F to 50°F - factory default is 20°F) the control system uses to calculate the "Economy Set Point." The Economy Set Point = normal Operating Set Point minus the programmed Setpoint Adjustment value.

The Economy Set Point is the water temperature the control system maintains during programmed Economy Mode time periods. "Economy Set Point" is displayed instead of "Operating Set Point" and "Economy Mode" appears beneath the current time on the Desktop Screen during Economy Mode time periods.

Current Time

Seven Day 24 hr clock. Use this menu item to set the current time and day of the week. Current day and time are not set from the factory. "Clock Not Set" will be displayed on the Desktop until the time/day has been initially set. Note: the time will not self adjust for Daylight Savings time.

Heater In Economy Mode

Displays whether the control system is currently operating in Economy Mode or not.

Daily Operating Mode (Sun - Mon - Tue - Wed - Thu - Fri - Sat)

Seven daily sub menus are listed at the bottom of the Economy Mode Setup menu. There are 3 Operating Modes in each sub menu; "Normal Operation All Day" - "Economy Mode All Day" and "Normal Operation Between." Only one Operating Mode can be active, the factory default is Normal Operation All Day.

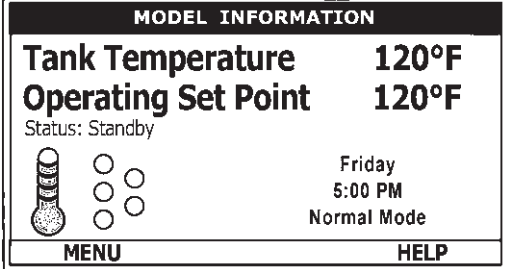
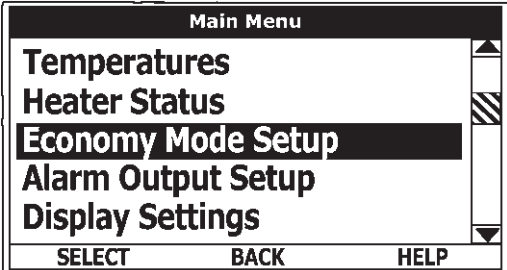
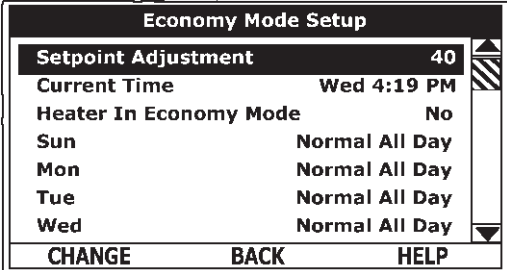
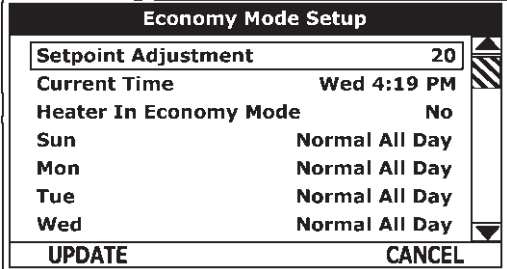
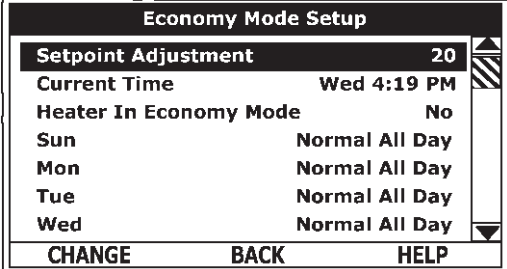
Normal Operation All Day: When this operating mode is active the normal Operating Set Point is used for the entire day.

Economy Mode All Day: When this operating mode is active the Economy Set Point is used for the entire day.

Normal Operation Between: When this operating mode is active there will also be start and stop times to program. The normal Operating Set Point is used between the programmed start and stop times and the Economy Set Point will be in effect during the rest of the day. There is one start time and one stop time event per day.

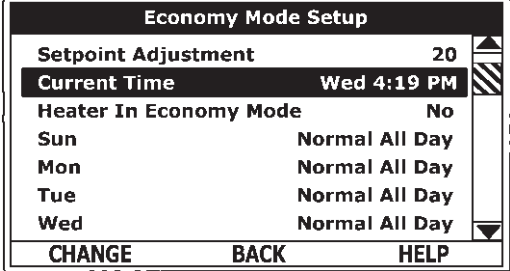
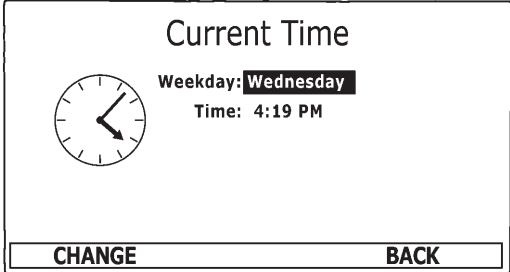
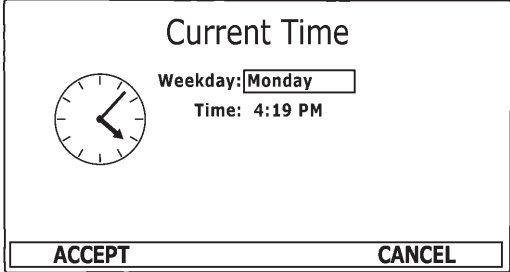
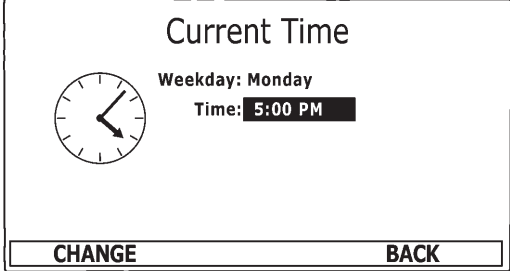
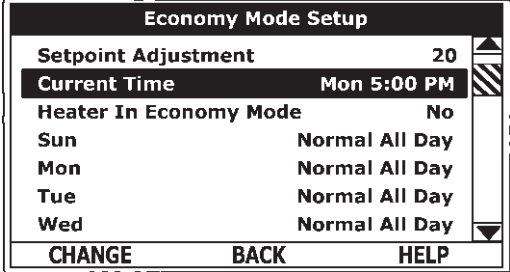
ECONOMY MODE SETTINGS

Setpoint Adjustment Value

ACTION	DISPLAY
<p>From the Desktop screen, press the Operational Button underneath "MENU" to enter the Main Menu.</p> <p>Notice how the text above the Operational Buttons on the display changes as you navigate through the various menus and screens.</p>	
<p>Use the Up/Down buttons to select (highlight in black) the Economy Mode Setup menu from the Main Menu. Press the Operational Button underneath "SELECT" to enter the Economy Mode Setup menu.</p>	
<p>Use the Up/Down buttons to select (highlight in black) Setpoint Adjustment. Press the Operational Button underneath "CHANGE" to activate the adjustment mode for the Setpoint Adjustment value.</p>	
<p>Use the Up/Down buttons to change the Setpoint Adjustment to the desired value. The Setpoint Adjustment value is adjustable from 2°F to 50°F. The factory default is 20°F.</p> <p>Notice how the text above the Operational Buttons on the display changes to "UPDATE" & "CANCEL" when the adjustment mode is activated and how the current value is outlined rather than highlighted in black.</p> <p>Press the Operational Button underneath "UPDATE" to enter and confirm the new value. Pressing the Operational Button underneath "CANCEL" would discard the new value and retain the previous value.</p>	
<p>The new Setpoint Adjustment value should now be displayed as the current value.</p>	

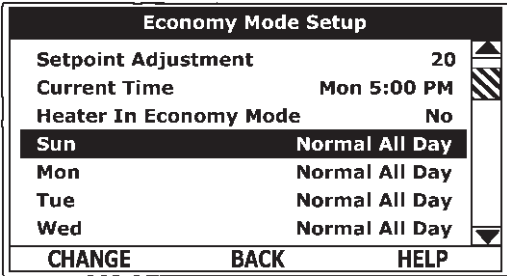
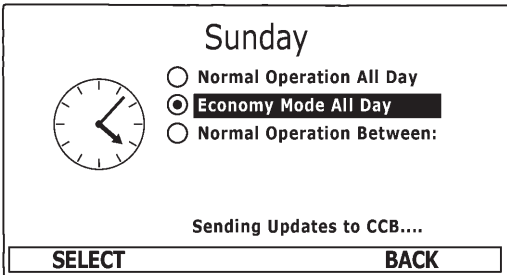
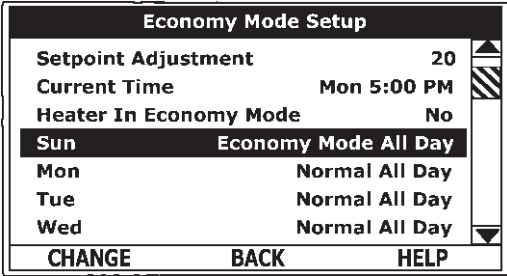
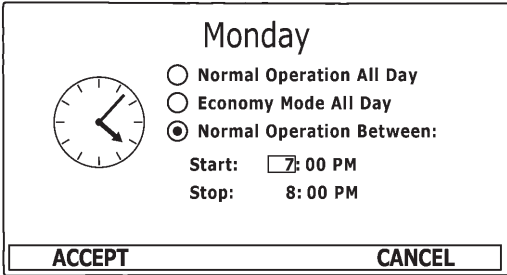
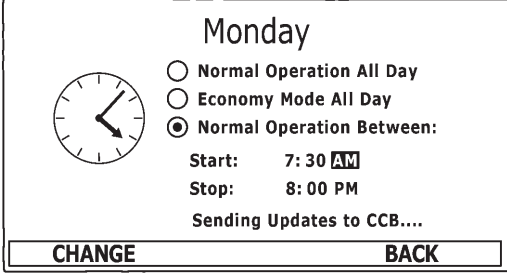
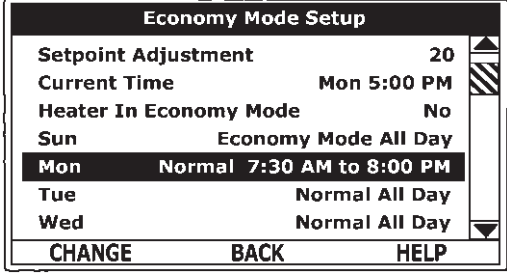
ECONOMY MODE SETTINGS

Time Clock Settings

ACTION	DISPLAY
<p>From the Desktop Screen navigate to the Economy Mode Setup menu.</p> <p>Use the Up/Down buttons to select (highlight in black) Current Time sub menu. Press the Operational Button underneath "CHANGE" to enter the Current Time sub menu.</p>	
<p>Use the Up/Down buttons to select the "Weekday" setting.</p> <p>Press the Operational Button underneath "CHANGE" to activate the adjustment mode for this setting.</p>	
<p>Press the Up/Down buttons to adjust the Weekday setting to the current day.</p> <p>Notice how the text above the Operational Buttons on the display changes to "ACCEPT" & "CANCEL" when the adjustment mode is activated and how the current setting is outlined rather than highlighted in black.</p> <p>Press the Operational Button underneath "ACCEPT" to enter and confirm the new setting. Pressing the Operational Button underneath "CANCEL" would discard the new setting and retain the previous setting.</p>	
<p>Use the Up/Down and the CHANGE/ACCEPT Operational Buttons to individually select and change the remaining time settings (Hour, Minutes, AM/PM) to the current time in the same way as outlined above.</p> <p>When finished making changes press the Operational Button underneath "BACK" to confirm all new settings and update the control system. The display will automatically return to the Economy Mode Setup menu.</p>	
<p>The new settings should be displayed as the Current Time.</p>	

ECONOMY MODE SETTINGS

Daily Operating Mode Settings

ACTION	DISPLAY
<p><u>Economy Mode All Day:</u></p> <p>From the Economy Mode Setup menu use the Up/Down buttons to select (highlight in black) the Daily sub menu for “Sun.” Press the Operational Button underneath “CHANGE” to enter this menu.</p>	 <p>Economy Mode Setup</p> <p>Setpoint Adjustment 20</p> <p>Current Time Mon 5:00 PM</p> <p>Heater In Economy Mode No</p> <p>Sun Normal All Day</p> <p>Mon Normal All Day</p> <p>Tue Normal All Day</p> <p>Wed Normal All Day</p> <p>CHANGE BACK HELP</p>
<p>Use the Up/Down buttons to select (highlight in black) the “Economy Mode All Day” setting.</p> <p>Press the Operational Button underneath “SELECT” to change from the factory default Normal Operation All Day setting to the Economy Mode All Day setting.</p> <p>Press the Operational Button underneath “BACK” to confirm the new setting and update the control system. You will be returned to the Economy Mode Setup menu. The new setting should now be displayed for Sun.</p>	 <p>Sunday</p> <p><input type="radio"/> Normal Operation All Day</p> <p><input checked="" type="radio"/> Economy Mode All Day</p> <p><input type="radio"/> Normal Operation Between:</p> <p>Sending Updates to CCB....</p> <p>SELECT BACK</p>  <p>Economy Mode Setup</p> <p>Setpoint Adjustment 20</p> <p>Current Time Mon 5:00 PM</p> <p>Heater In Economy Mode No</p> <p>Sun Economy Mode All Day</p> <p>Mon Normal All Day</p> <p>Tue Normal All Day</p> <p>Wed Normal All Day</p> <p>CHANGE BACK HELP</p>
<p><u>Normal Operation Between:</u></p> <p>From the Economy Mode Setup menu Use the Up/Down and CHANGE buttons to enter the Mon sub menu as described above.</p> <p>Use the Up/Down buttons to select (highlight in black) the “Normal Operation Between” setting. Press the Operational Button underneath “SELECT” to change the operating mode for Monday to Normal Operation Between. Note that when this setting is selected Start and Stop time user settings appear on the display.</p> <p>Use the Up/Down buttons to navigate between the Start and Stop time Hour, Minutes and AM/PM settings.</p> <p>With each item selected press the Operational Button underneath “CHANGE” to activate the adjustment mode for each setting. Use the Up/Down buttons to change the value to the desired setting.</p> <p>Press the Operational Button underneath “ACCEPT” to enter the new setting or “CANCEL” to discard the new setting and retain the previous setting.</p> <p>Press the Operational Button underneath “BACK” when finished to confirm the new settings and update the control system. The display will return to the Economy Mode Setup menu with the new settings shown for Mon.</p>	 <p>Monday</p> <p><input type="radio"/> Normal Operation All Day</p> <p><input type="radio"/> Economy Mode All Day</p> <p><input checked="" type="radio"/> Normal Operation Between:</p> <p>Start: 7:00 PM</p> <p>Stop: 8:00 PM</p> <p>ACCEPT CANCEL</p>  <p>Monday</p> <p><input type="radio"/> Normal Operation All Day</p> <p><input type="radio"/> Economy Mode All Day</p> <p><input checked="" type="radio"/> Normal Operation Between:</p> <p>Start: 7:30 AM</p> <p>Stop: 8:00 PM</p> <p>Sending Updates to CCB....</p> <p>CHANGE BACK</p>  <p>Economy Mode Setup</p> <p>Setpoint Adjustment 20</p> <p>Current Time Mon 5:00 PM</p> <p>Heater In Economy Mode No</p> <p>Sun Economy Mode All Day</p> <p>Mon Normal 7:30 AM to 8:00 PM</p> <p>Tue Normal All Day</p> <p>Wed Normal All Day</p> <p>CHANGE BACK HELP</p>

ALARM OUTPUT SETUP MENU

Permits user to set the condition (from a list of options) for when the CCB's integral alarm output relay will be energized. Alarm relay connections (common, normally open, normally closed) are located on the J3 terminal strip on the CCB - see wiring diagrams. Alarm output relay contacts are capable of switching **1 amp maximum at 120 VAC**.

Alarm Output Setup	
Output Function	Fault
Alarm SP	120°F
CHANGE	BACK HELP

Alarm Output Setup	
Output Function	Temp < Alarm SP
Alarm SP	120°F
CHANGE	BACK HELP

The alarm relay operates in the background according to the settings in this menu and is not capable of disabling water heater operation. The alarm relay is used for external notification/verification of various operational conditions such as fault conditions and heating mode status. This relay can be used with building EMS (Energy Management System) and other external supervisory controls.

Output Function

Adjustable user setting. Available options for the Alarm Output Function setting are:

Heating Mode: Used for heating mode on/off status notification.

Enable / Disable Closed: Used for notification and/or verification of the enable/disable circuits open/closed status. There are two enable/disable circuits available for external supervisory control(s) at the J7 socket on the CCB - see wiring diagrams on page 6. Enable/disable circuit(s) status can be viewed in the Heater Status Menu.

Temp < Heater SP: Used for external notification when current tank temperature drops below Operating Set Point.

Temp < Alarm SP: Used for external notification when current tank temperature drops below programmable Alarm SP.

Fault or Alert: Used for external notification whenever a Fault or Alert condition is active.

Fault: Used for notification whenever a Fault condition is active.

Disabled: Disables the Alarm Relay Output Function.

Alarm SP

Adjustable user setting (90°F to 190°F) the control system uses for the "Temp < Alarm SP" function described above. This setting has no effect with any other Alarm Output functions.

Alarm Output Settings

Changing the user settings in this menu is done using the same methods for changing the Operating Set Point.

Service Note: Adjustable user settings in the Alarm Output Setup menu are unaffected by Restore Factory Defaults.

DISPLAY SETTINGS MENU

Permits user to set display options for viewing information on the UIM's LCD screen.

Display Settings	
Temperature Units	°F
Backlight Delay	30s
Contrast	20%
CHANGE	BACK HELP

Temperature Units

Adjustable user setting that changes temperature units display to Celsius °C or Fahrenheit °F.

Backlight Delay

Adjustable user setting that determines how long the UIM's LCD backlight remains illuminated after a key has been pressed. Available settings are; Always Off, 10, 30 or 60 seconds and Always On.

Contrast

Adjustable user setting to adjust the UIM's LCD screen contrast between text and background.

Display Settings

Changing the user settings in this menu is done using the same methods for changing the Operating Set Point.

Service Note: Adjustable user settings in the Display Settings menu are unaffected by Restore Factory Defaults.

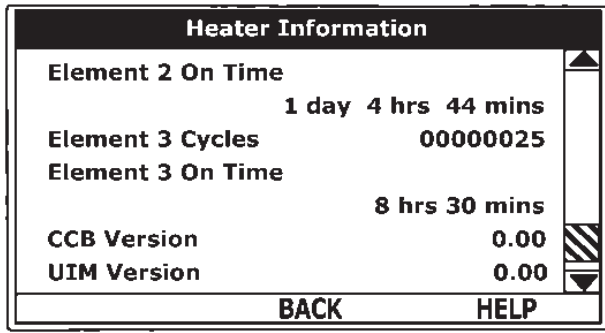
HEATER INFORMATION MENU

This menu displays non adjustable operational information.

Top of Menu

Heater Information	
Elapsed Time	7 days 18 hrs 35 mins
Total Heating Time	2 days 46 mins
Cycle Count	0000042
Element 1 Cycles	0000035
Element 1 On Time	
BACK	HELP

Bottom of Menu



Elapsed Time

Total accumulated time the control system (water heater) has been energized.

Total Heating Time

Total accumulated time the control system has been in the heating mode. IE: any heating elements have been energized.

Element # Cycles

Total accumulated count of heating cycles for each heating element.

Element # On Time

Total accumulated heating on time for each heating element.

CCB Version

Software version for Central Control Board.

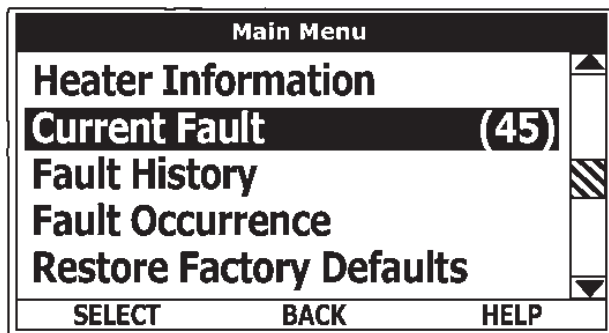
UIM Version

Software version for User Interface Module

CURRENT FAULT / ALERT MENU

This menu displays non adjustable operational information. With the Fault History sub menu selected in Main Menu; press the Operational Button underneath "SELECT" to display the current Fault or Alert message. If there is not a Fault or Alert condition currently active "(none)" is displayed to the right of this menu.

Main Menu - Current Fault Selected



FAULT HISTORY MENU

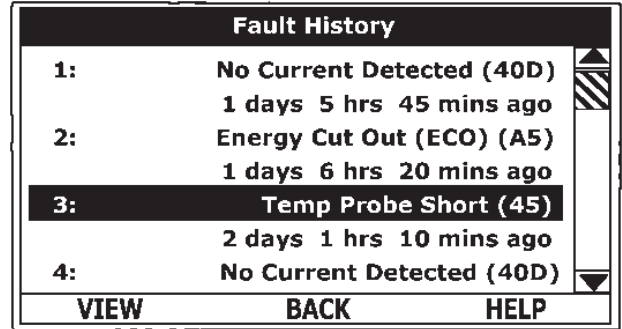
This menu displays non adjustable operational information. The control system records and stores the last 9 Fault and Alert

messages in chronological order in this menu. The most recent will be at the top of the list. A time stamp is displayed below each listed Fault and Alert message showing when the Fault or Alert condition occurred.

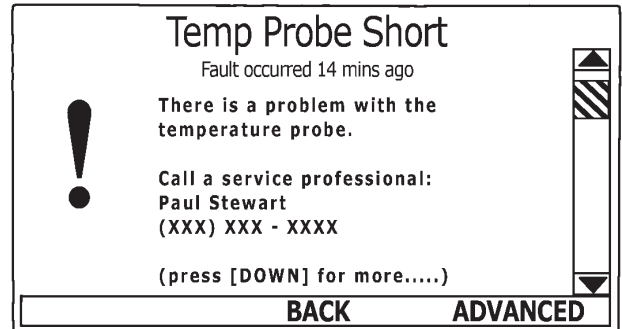
The Fault History is useful when dealing with intermittent operational problems or when the customer has reset the control system prior to a service agent's arrival.

With a Fault or Alert item selected press the Operational Button underneath "VIEW" to display the details for the Fault or Alert message. The Fault/Alert message screen displays a brief description of the condition, contact information and access to the Advanced service information sub menu.

Fault History Menu



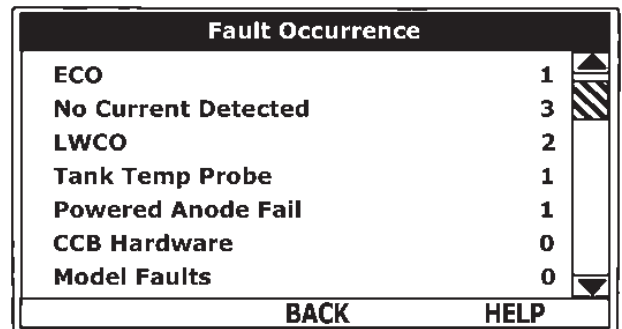
Current/History Fault Message



FAULT OCCURRENCE MENU

Total accumulated number each individual Fault condition has occurred is displayed in this menu. This running total of Fault Occurrences can be useful in determining which (if any) operational problems have been persistent.

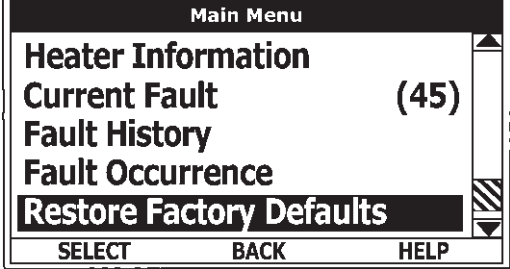
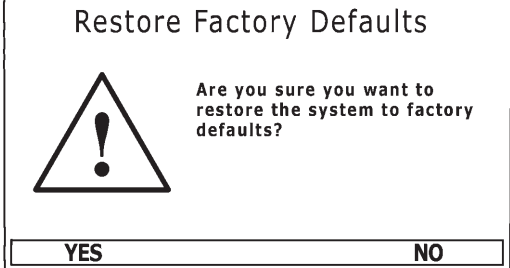
Fault Occurrence Menu



RESTORE FACTORY DEFAULTS MENU

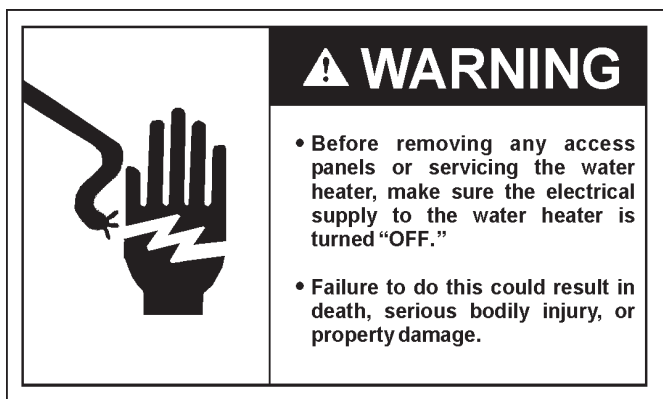
This control system menu allows the user to restore most of the control system's user settings to their factory default settings. **User settings in the Alarm Output Setup and Display Settings menus are unaffected by executing Restore Factory Defaults.**

Restore Factory Defaults

ACTION	DISPLAY
<p>From the Main Menu use the Up/Down buttons to select (highlight in black) the "Restore Factory Defaults" menu.</p> <p>Press the Operational Button underneath "SELECT." The Restore Factory Defaults menu will be displayed.</p>	
<p>From the Restore Factory Defaults menu press the Operational Button underneath "YES." The display will show text confirming the factory default settings have been restored.</p> <p>Press the Operational Button underneath "BACK" to exit the Restore Factory Defaults menu.</p>	

TROUBLESHOOTING CHECKLIST

Before calling for service, check the following points to see if the cause of trouble can be identified and corrected. Reviewing this checklist may eliminate the need of a service call and quickly restore hot water service.



BE SURE TO TURN OFF THE ELECTRICITY (ELECTRICAL DISCONNECT SWITCH) WHEN CHECKING EQUIPMENT.

NOT ENOUGH OR NO HOT WATER

1. Be certain the electrical disconnect switch serving the water heater is in the ON position. The pilot toggle switch on the cabinet should be ON.

In some areas water heater electrical service may be limited by the power company. If the heater operates on a controlled circuit, heater recovery may be affected.

The optional manual override switches on the cabinet front may be turned off, de-energizing the elements.

2. Check the fuses.

The electrical disconnect switch usually contains fuses.

The water heater has fuses located behind the cabinet front door, see the Features and Components section of this manual for their location.

3. If the water was excessively hot, and is now cold, the ECO high limit switch may have activated.

- See the Temperature Regulation section of this manual for more information on how to reset the ECO high limit controls.

Repeated activation of the ECO high limit switch should be investigated by a Qualified Service Agent.

4. The storage capacity and/or recovery rate of the water heater may have been exceeded by a large demand for hot water.

Large demands require a recovery period to restore water temperature.

5. Cold incoming water temperature will lengthen the time required to heat water to the desired temperature.

If the heater was installed when incoming water temperature was warm, colder water creates the effect of less hot water.

7. Sediment or lime scale may be affecting water heater operation.

WATER IS TOO HOT

Refer to the TEMPERATURE REGULATION section of this manual.

WATER HEATER MAKES STRANGE SOUNDS

1. Sediment or lime scale accumulations on the elements causes sizzling and hissing noises when the heater is operating.

The sounds are normal, however, the tank bottom and elements should be cleaned. Refer to MAINTENANCE section of this manual for details.

2. Some of the electrical components of the water heater make sounds which are normal ie. contactors will "Click" or snap as the heater starts and stops.

LEAKAGE CHECKPOINTS

1. Check to see if the drain valve is tightly closed.
2. The apparent leakage may be condensation which forms on cool surfaces of the heater and piping.
3. If the outlet of the relief valve is leaking it may represent:

- Excessive water pressure.
- Excessive water temperature.
- Faulty temperature and pressure relief valve.

Excessive water pressure is the most common cause of relief valve leakage. Water supply systems may, because of code requirements or such conditions as high line pressure, among others, have installed devices such as pressure reducing valves, check valves, and back flow preventers. Devices such as these cause the water system to be a closed system.

As water is heated, it expands (thermal expansion). In a closed system the volume of water will grow when it is heated. As the volume of water grows there will be a corresponding increase in water pressure due to thermal expansion. Thermal expansion can cause intermittent temperature-pressure relief valve operation: water discharged from the valve due to excessive pressure build up. This condition is not covered under the limited warranty. The temperature-pressure relief valve is not intended for the constant relief of thermal expansion.

A properly sized thermal expansion tank should be installed on all closed systems to control the harmful effects of thermal expansion. Contact a local qualified service agency to have a thermal expansion tank installed.

4. Examine the flange area of the elements for gasket leakage.

Tighten the bolts or, if necessary, follow the WATER AND LIME SCALE REMOVAL procedure in the MAINTENANCE section of this manual to replace the gaskets.

IF YOU CANNOT IDENTIFY OR CORRECT THE SOURCE OF MALFUNCTION:

1. Place the water heater electrical disconnect switch in the OFF position.
2. Close the cold water inlet valve to the heater.
3. Call the toll free number on the back cover of this manual for further assistance.



A DIVISION OF A. O. SMITH CORPORATION
RENTON, WASHINGTON
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