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E340 BOILER ROOM CONTROL

Technical Description and Set-up Manual

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DESCRIPTION

The E340 Boiler Room Control is a microprocessor-based Boiler Management System designed to interface with and expand on the capabilities of the existing FIREYE® FLAME-MONITOR™ and "D" Series Flame safeguard control systems, as well as competitive flame safeguard systems. Following are some of the monitor and control capabilities provided by the E340:

- **Operating Control Function** for automatic sequencing of the boiler system to start and stop the boiler to meet system demand.

- **Full Modulation Control** of fuel and combustion air through the firing rate motor to meet system demand.

- **Solid State Sensors** to monitor steam pressure, water temperature, oil pressure, gas pressure, oil temperature, stack temperature, boiler water temperature, or outdoor air temperature.

- **High and Low Pressure and Temperature Alarm Limits** (user selectable) based on inputs from solid state sensors. Exceeded limits will open interlock circuit to the flame safeguard control for shutdown of the burner and boiler.

- **Cold Start Thermal Shock Protection** to slowly increase the burner firing rate on a cold start to limit mechanical stress due to thermal differences.

- **Interface with an Existing Flame Safeguard Control** (Fireye FLAME-MONITOR, D-Series, or competitive flame safeguard control to provide ease of installation in a retrofit application.

- **Lead/Lag** operation of two boilers.

- **Remote Communication Capability** to access system information via IBM compatible PC and E340 Communications Software.

- **Keypad/Display Module** with 8 character LCD Display and 12 key keypad for on-site program and review of system setpoints and operating parameters.

- **Software Password Protection** (two levels of security) to restrict unauthorized entry and modification of system setpoints and operating parameters.

- **Time of Day** scheduling to program set-back of water temperature or steam pressure setpoints.

- **Timed Override of Setback Schedule** via momentary push button. Override period keypad selectable.

- **Marginal High and Low Pressure and Temperature Alarm Limits** (user selectable) based on input from solid state sensors to indicate system approaching high or low alarm limits.

- **Auxiliary Analog Output (4-20 mA)** to provide an output signal (to a chart recorder) that is directly proportional to one of the five pressure or temperature sensors.

- **Programmable Maximum High Fire Position** of modulating firing rate damper motor.

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SYSTEM SPECIFICATIONS

SUPPLY VOLTAGE: 24 VAC (+10%, -15%)

OPERATING TEMPERATURE LIMITS:
-40°F (-40°C) to 140°F (60°C) (control unit without keypad/display module)
15°F (-9°C) to 131°F (55°C) (with keypad/display module)

OPERATING HUMIDITY LIMITS: 5% to 85% Non-condensing @ 0°C to 60°C

RELAY OUTPUTS:
2 Line voltage normally open (NO) isolated outputs rated at 5 amps @ 120 VAC, 1/3 HP.
Maximum connected load for each relay is 600 VA.
2 Low voltage, normally open (NO) outputs rated at: 5 amps @ 24 VAC or VDC,
internally connected to Terminal 41.

DIGITAL INPUTS:
4 Line voltage digital inputs (120 VAC).
3 Low voltage dry contact inputs
1 Low voltage resistive input (0-135Ω).

ANALOG OUTPUTS:
2 Analog outputs, 4-20 mA signal, current source, 8 bit resolution.
Maximum connected load = 750 ohms.

ANALOG INPUTS:
3 Pressure Inputs, 1-5 VDC input control signal, 12 bit resolution
2 Temperature Inputs, 1,000Ω @ 0°C, 12 bit resolution

COMMUNICATIONS:
Protocol is Fireye half-duplex DF1 or MODBUS
EIA standard RS485 serial link using 22 gauge twisted shielded pair wire.
Maximum number of addressable controllers per communication link = 255.
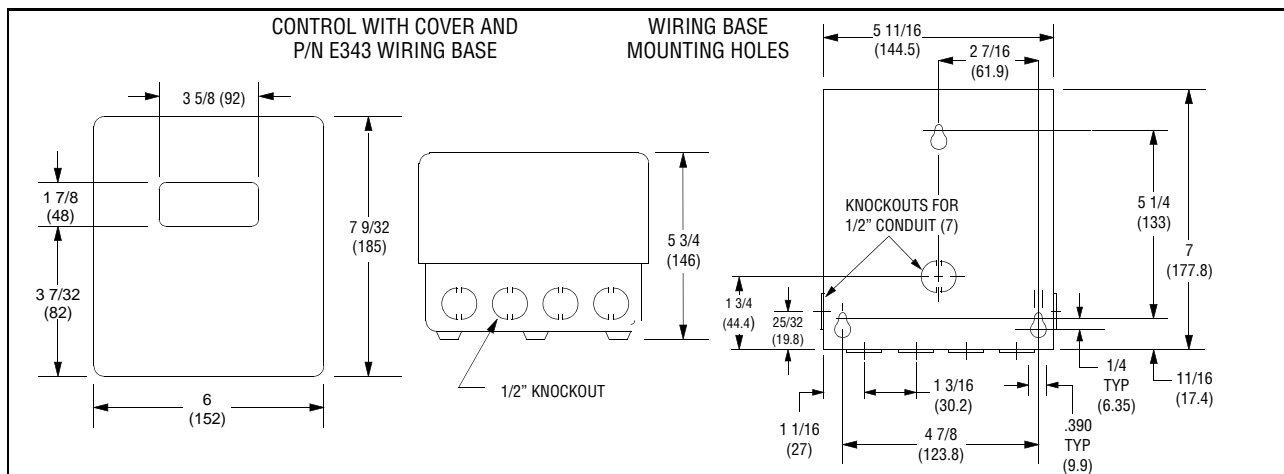
BATTERY BACKUP:
Lithium battery with expected life of 5 years @ 77°F (25°C).
Maintain RAM memory for 1 year @ 77°F (25°C) without power.

POWER REQUIREMENTS: 20 Watts (All relays energized)

STORAGE TEMPERATURE LIMITS: -40°F (-40°C) to 158°F (70°C)

FIGURE 1.   COMPONENT DIMENSIONS

SYSTEM INPUTS AND OUTPUTS

RELAY OUTPUTS:

The E340 provides 4 digital outputs to perform the following functions:

- **Operating Control** output wired in series with existing external operating limits to operating control circuit of the flame safeguard control. (Terminals L1 & 13 of FLAME-MONITOR and D-Series Control).
  Rated at 5 amps @ 120 VAC.
  Normally Open (NO) isolated output.

- **Safety Circuit** wired in series with existing external running safety interlocks to running interlock circuit of the flame safeguard control. (Terminals 3 & P of FLAME-MONITOR and D-Series Control).
  Rated at 5 amps @ 120 VAC.
  Normally open (NO) isolated output.

- **Marginal Alarm** output relay: Rated at 5 amps @ 24 VAC.

- **Auxiliary Relay** output: Rated at 5 amps @ 24 VAC.

DIGITAL INPUTS:

The E340 provides 8 digital inputs to monitor the following inputs:

- **Fuel selector switch** for gas operation.   Rated at 120 VAC
- **Fuel selector switch** for oil operation.   Rated at 120 VAC.
- **Fuel selector switch** for heavy oil operation.   Rated at 120 VAC.
- Status of **Main Fuel Valve**   Rated at 120 VAC.
- Input to determine **Lead/Lag** operation.   Dry Contact Only.
- Input to **Initiate Setback Mode**.   Dry Contact Only.
- Input to **Override Setback Mode**.   Time determined by user. Momentary Dry Contact Only.

ANALOG INPUTS:

The E340 provides 5 analog inputs to monitor the following:

INPUT	DESCRIPTOR	PRESSURE SENSOR OPTIONS	MARGINAL ALARMS & ALARM LIMITS
1	PRI FUEL	Gas Pressure	High and Low
		Oil Pressure	High and Low
2	SEC FUEL	Gas Pressure	High and Low
		Oil Pressure	High and Low
3	STM PRES	Steam Pressure	High and Low*

INPUT	DESCRIPTOR	TEMPERATURE SENSOR OPTIONS	MARGINAL ALARMS & ALARM LIMITS
4	PRIMARY	Primary Water Temp.	High and Low*
		Standby Water Temp.	None
		Stack Temp	High Only
		Outdoor Temp.	None
5	AUXILIARY	Oil Temp.	High and Low
		Stack Temp.	High Only
		Outdoor Temp.	None

* Low marginal alarm only. No low alarm limit.

ANALOG OUTPUTS:

The E340 provides 2 analog outputs (4-20 mA, current source) to provide the following:

• Proportional control of the **Firing Rate Damper Motor**.

• **Selectable Output Signal** based on the value of one of the 5 analog inputs.

ORDERING INFORMATION

PART NUMBER	DESCRIPTION
	CONTROL COMPONENTS
E340	Boiler Room Control. (Includes Chassis, Keypad/Display Module, and Dust Cover).
EP340	Programmer Module for E340 Boiler Room Control.
EB342	Chassis for E340 Boiler Room Control.
E343	Wiring Base for E340 Boiler Room Control (surface mounted - UL Listed).
E344	Wiring Base for E340 Boiler Room Control (cabinet mounted - UL Recognized).
E345	Keypad/Display Module for E340 Boiler Room Control.
60-2223	Dust Cover.
	SOLID STATE SENSORS
PS348-1	Gas Pressure Sensor. Range: 0-16″ Water Column.
PS348-2	Gas Pressure Sensor. Range: 0-32″ Water Column.
PS348-3	Gas Pressure Sensor. Range: 0-160″ Water Column.
PS348-4	Steam Pressure Sensor. Range: 1-17 psig.
PS348-5	Steam Pressure Sensor. Range: 1-33 psig.
PS348-6	Steam/Oil Pressure Sensor. Range: 10-170 psig.
PS348-7	Steam/Oil Pressure Sensor. Range: 10-330 psig.
PS348-8	Steam Pressure Sensor. Range: 50-850 psig.
TS348-2	Temperature Sensor. Range: 32°-750°F / 0°-400°C. 2″ Probe Length.
TS348-4	Temperature Sensor. Range: 32°-750°F / 0°-400°C. 4″ Probe Length.
TS348-8	Temperature Sensor. Range: 32°-750°F / 0°-400°C. 8″ Probe Length.

SEQUENCE OF OPERATION

The E340 Boiler Control is designed to operate in conjunction with an accompanying flame safe-guard control system to provide the following capabilities:

E340 Boiler Control Provides:

• Operating control function for automatic sequencing of the boiler to start and stop the boiler to meet system demand, based on input from solid state sensors.

• Full modulating control of fuel and combustion air through the firing rate control to meet system demand, based on input from solid state sensors.

• Utilize inputs from solid state sensors to provide programmable high and low temperature and pressure alarm limits.

⚠ **WARNING: Electro-mechanical high steam pressure or high water temperature limits must remain in the running interlock circuit of the flame safeguard control.**

• Utilize inputs from solid state sensors to provide programmable marginal temperature and pressure alarm limits.

• Monitoring the damper motor via a positional feedback circuit (optional) to assure damper motor is in the required position.

• Cold Start Thermal Shock Protection to slowly increase the burner firing rate on a cold start to limit mechanical stress due to thermal indifferences.

Flame Safeguard Control Provides:

- Automatic sequencing of the boiler system through prepurge, pilot trial for ignition (PTFI), main trial for ignition (MTFI), run, and post purge.
- Flame proving and lockout on flame failure during PTFI, MTFI, and run.
- Monitor purge interlock[1], running interlock, and low fire start interlock circuits.
- Position damper motor to low fire during PTFI and MTFI.
- Alpha-numeric LED display readout of main fuel operational hours and complete cycles.[2]
- Alpha-numeric LED display readout of flame signal strength.[2]
- Alpha-numeric LED display indicating cause of "Lockout" condition as well as the position in the operating sequence when it occurred.[2]
- Remote communication capability to provide both current and historical information concerning burner operation.[2,3]

[1] Determined by Programmer Module
[2] Fireye FLAME-MONITOR Flame Safeguard Control
[3] Fireye E500 Communication Interface

KEYPAD/DISPLAY MODULE

The Keypad/Display Module consists of an eight character liquid crystal diode (LCD) display and a 12-key, positive action keypad. It reviews and/or program the various System Setpoints and Operating Parameters of the system. Before proceeding, you should familiarize yourself with the operation of each key, as well as the descriptors and indicators displayed on the LCD display. The table below is a description of each key's function:

KEY	FUNCTION
Sensor Values	Displays the values of each pressure and temperature sensor, as well as the status of the digital inputs for review. Also displays burner hours and system hours.
Output Values	Displays the value of each output relay and proportional analog output for review.
Set Points	Displays the value of each setpoint for review or programming.
Time Schedule	Displays the values for Time and Day for review or programming.
Back	Displays the previous sensor value, output value, or setpoint. Holding down this key will scroll backwards through the previous values.
Next	Displays the next sensor value, output value, or setpoint. Holding down this key will scroll forward through the next values.
Modify	Modifies (programs) setpoints, time, and day.
Up	Increases the value of the time, day, or setpoints when modifying (programming).
Down	Decreases the value of the time, day, or setpoints when modifying (programming).
Enter	Enters the value of time, day, or setpoint into the memory of the E340. If the ENTER key is not pressed, the new value will not be stored. The previous value will remain in memory.
Help	Displays the complete descriptor associated with each sensor value, output value, or setpoint.
System Test	Allows the user to review certain historical information concerning the operation of the E340 (e.g.: last 10 lockout conditions), manually position firing rate motor, troubleshooting support, and system reset.

FIGURE 2.   **KEYPAD DISPLAY MODULE**

MNEMONICS, DESCRIPTORS, ALLOWABLE VALUES, AND DEFAULT VALUES

To assist the user in programming or reviewing setpoints and operating parameters, every sensor value, output value, and setpoint has a mnemonic code, up to 8 characters in length, which serves as an abbreviated descriptor for that value. Every mnemonic code also has a full length descriptor associated with it which fully describes the setpoint, sensor value, or output value. This full length descriptor is displayed by pushing the HELP key. When modifying setpoints, only certain allowable value (or ranges) can be programmed. When an operating parameter is selected, its mnemonic code is periodically displayed, followed by its value. In this bulletin, the mnemonic codes are highlighted in bold when describing the various setpoints and operating parameters.

Certain setpoints (and mnemonic codes) are repeated several times when programming the E340. For example, the mnemonic code **CUT IN** (for Cut In value) is used with Steam Pressure Setpoint (**STM SP**), Water Temperature Setpoint (**WTR SP**), Lag Boiler Setpoint (**LAG SP**), Setback Steam Pressure Setpoint (**STBK STM**), and Setback Water Temperature Setpoint (**STBK WTR**). In these cases, the mnemonic code is displayed immediately after the setpoint it is associated with.

INDICATORS ON LCD DISPLAY

In addition to the eight characters on the LCD screen, the E340 will also indicate certain functions by displaying the following indicators and symbols on the LED screen:

Indicator	Description	Location
OCC	Operating Control (Terminals 52 and 53) are closed.	Top row of LCD Display
UNOCC	Safety Interlock Circuit (Terminals 50 and 51) are open.	Top row of LCD Display
PROG	The Modify key has been pressed.	Top row of LCD Display
RUN	Normal operation of the E340. When blinking, the operating control is forced open due to "Program On" schedule.	Top row of LCD Display
*	Controlling according to the Lag Boiler Setpoints	1st LCD Display Character
⊐	Controlling according to the Setback Schedule Setpoints	1st LCD Display Character

Programming/Set-up Guide

Included with this bulletin is a Programming/Set-up Guide to aid the user in programming the control. The set-up sheet lists all of the setpoints associated with the E340 control. The set-up sheet is a valuable tool by providing an overview of what setpoints need to be programmed for the various functions, as well as providing a written copy of the setpoints to refer to when actually programming the setpoints. It also serves as a permanent hard copy record.

The E340 requires the user to program a number of operating parameters for proper system operation. While the E340 Boiler Room Control offers a number of features and functions, a user can program five basic steps to get the boiler up and operational, while becoming familiar with the operation and programming of the control. These five steps are:

1. Enter the password.
2. Select and program the appropriate sensor ranges and functions.
3. Program high and low limits.
4. Program the operating control function.
5. Program the modulating control function.

> **The password must be entered to modify any of the setpoints.**

STEP 1 - Enter the Password

The first step in programming the E340 is to enter the password. See also pages 33-35.

IMPORTANT: THE E340 IS SHIPPED WITH THE SOFTWARE PASSWORD SET BY THE FACTORY. THE USER CANNOT PROGRAM ANY SETPOINTS UNTIL THE PASSWORD IS ENTERED. THE PASSWORDS SHIPPED WITH THE E340 ARE:

LEVEL 1 PASSWORD = 02
LEVEL 2 PASSWORD = 05

To enter the password of 02 for Level 1 and 05 for Level 2:

Press the **Set Points** key `Set Points` and the screen will display: **PRI FUEL** followed by its

Press the **Back** key twice `Back` and the screen will display: **LV1 PASS** followed by **0**.

Press the **Modify** key. `Modify` The **Prog** indicator lights up.

Press the **Up** or **Down** key `Up` `Down` until the screen displays: **02**.

Press the **Enter** key `Enter` and the screen will display: **LV1 PASS** followed by **02**.

Press the **Next** key `Next` and the screen will display: **LV2 PASS** followed by **0**.

Press the **Modify** key. `Modify` The **Prog** indicator lights up.

Press the **Up** or **Down** key `Up` `Down` until the screen displays: **05**.

Press the **Enter** key `Enter` and the screen will display: **SET LV2** followed by **05**.

Once the proper passwords have been entered, the user will be able to modify any system setpoints and operating parameters. The values for the password itself can be modified or disabled. For more detail, see ENTERING LEVEL 1 AND LEVEL 2 PASSWORDS and CHANGING LEVEL 1 AND LEVEL 2 PASSWORDS.

STEP 2 - Program Pressure Sensor Functions/Ranges and Temperature Sensor Functions

The next step in programming the E340 is identifying the appropriate pressure and temperature sensors that are installed on the boiler. The E340 control is shipped with all of the sensors programmed UNUSED. See SYSTEM SETPOINTS - DEFAULT VALUES section. **You must program the range and function of the pressure or temperature sensor to match the range and function of the installed sensor.**

⚠ **WARNING: Programming a sensor range or function that is different from the actual range or function of the installed sensor could result in improper operation of the burner or boiler.**

Note: A general rule to follow when selecting the appropriate range for the sensor is the expected value of the monitored pressure or temperature should fall between 40-70% of upper range of the sensor. For example, a steam boiler maintains 20 pounds pressure, select the PS348-5 Pressure Sensor with a 1-33 PSIG range.

See Bulletin ES-3481 for the proper location and wiring of the pressure sensors.

Fuel Pressure Sensors - Primary and Secondary Fuels:

Both the function (Gas or Oil) and the pressure range (0-16 inches, 1-17 PSI, etc.) of the pressure sensors used to monitor the primary fuel (PRI FUEL) and the secondary fuel (SEC FUEL) are programmed using the **Set Points** menu.

*Note: PRI FUEL and SEC FUEL are displayed **twice** under the **Set Points** menu. Once to select the function (GAS or OIL) of the sensor, and the other to select its range.*

This allows the user to connect two (2) gas pressure sensors (i.e., natural gas and propane), two (2) oil pressure sensors, or one sensor each of oil and gas to the E340 control. Primary fuel (PRI FUEL) refers to the pressure sensor connected to terminals 60 (+24 VDC), 61 (sensor return), and 62 (signal). Secondary fuel (SEC FUEL) refers to the pressure sensor connected to terminals 63 (+24 VDC), 64 (sensor return), and 65 (signal).

Fuel Pressure Sensors - Sensor Ranges:

The user can program the pressure range for both the primary fuel and secondary fuel sensors from 0-16 inches water column (0-16I) up to 10-330 PSI (10-330P). The available ranges for each setpoint is displayed as follows:

PRIMARY FUEL Unused (Default)	SECONDARY FUEL Unused (Default)
0-16I	10-170P
0-32I	10-330P
0-160I	0-16I
1-17P	0-32I
1-170P	0-160I
1-330P	1-17P

⚠ **CAUTION: Only the pressure sensors PS348-1 (0-16I), PS348-2 (0-32I), and PS348-3 (0-160I) are listed by approval agencies (UL - US & Canada and FM) for use as a gas pressure sensor. The higher range pressure sensors (1-17P, 1-170P, and 1-330P) are NOT LISTED by approval agencies for use as a gas pressure sensor. The higher range pressure sensors DO NOT provide a method to vent any potential gas leaks to atmosphere.**

To program the Primary Fuel pressure sensor as a gas pressure sensor with a range of 0-32I:

Press the **Set Points** key and the screen will display **PRI FUEL** followed by **UNUSED** or its programmed value.

Press the **Modify** key. The **Prog** indicator lights up.

Press the **Up** or **Down** key until the screen displays 0-32I

Press the **Enter** key and the screen displays **PRI FUEL** followed by **0-32I**.

Fuel Pressure Sensors - Sensor Functions:

The function (Gas or Oil) of the pressure sensors used to monitor the primary fuel (PRI FUEL) and the secondary fuel (SEC FUEL) are programmed using the **Set Points** menu. The default values for the primary and secondary fuels are as follows:

> **SetpointDefault**
>
> PRI FUELGAS
>
> SEC FUELOIL

Note: The setpoints to program the function of the primary and secondary fuels are near the end of the setpoint menu. See example below for programming sensor functions.

The E340 will only recognize and respond to the alarm limits of the PRI FUEL or SEC FUEL only if their programmed function (GAS or OIL) matches the selection of the Fuel Selector switch. For example, if the fuel selector switch is set on OIL (terminal 57 powered with 120 VAC) or HEAVY OIL (terminals 56 and 57 powered with 120 VAC), the E340 will ignore the "PRI FUEL" if it is programmed for GAS.

To program the function of the primary fuel pressure sensor as an oil pressure sensor:

Press the **Set Points** key **and the screen will display PRI FUEL followed by UNUSED or its programmed value.**

Note: This setpoint programs the pressure sensor's range.

Press the **Back** key four times. The screen displays **PRI FUEL** followed by **GAS**.

Press the **Modify** key. The **Prog** indicator lights up.

Press the **Up** or **Down** key until the screen displays: **OIL**.

Press the **Enter** key and the screen displays **PRI FUEL** followed by **OIL**.

Sensor Values

The appropriate fuel selected for "PRI FUEL" and "SEC FUEL" will be displayed under "SENSOR VALUES." For example, if both Primary and Secondary Fuel are programmed for GAS, pressing the "SENSOR VALUES" key will first display "GAS PRESSURE (for Primary Fuel). Pressing the "NEXT" key will then display "GAS PRESSURE" (for Secondary Fuel).

Temperature Sensors

The input signal from the temperature sensors can be programmed to have several functions. In other words, the actual temperature sensor can be used to monitor a number of different variables (e.g.: hot water supply temp., outdoor air temp., etc.). The temperature range for the temperature sensors, regardless of their function is 32-750° F (0-400°C).

The function for the temperature sensors is programmed by using the **Set Points** key and then pressing the **Next** key to display the appropriate temperature sensor setpoint. The two setpoints associated with the temperature inputs are Primary Temperature **(PRI TEMP)** and Auxiliary Temperature **(AUX TEMP)**. The default value for each temperature sensor is **UNUSED**.

PRI TEMP

The temperature sensor for the primary temperature setpoint (**PRI TEMP**) is wired to Terminals 69 and 70, and can be programmed any one of for the following functions:

VALUE	FUNCTION
WATER	Monitor and control the hot water supply temperature of a hot water boiler (see SEQUENCE OF OPERATION - OPERATING CONTROL section).
STACK	Monitor stack temperature (see MONITORING STACK TEMPERATURE and SEQUENCE OF OPERATION - HIGH AND LOW ALARM LIMITS sections).
STANDBY	Monitor and control temperature of the boiler water within a steam boiler (see SEQUENCE OF OPERATION - LEAD/LAG CONTROL - STANDBY OPERATION section).
OUTDOOR	Monitor the outdoor air temperature. See OUT SENS.
UNUSED	No temperature sensor is wired to Terminals 69 and 70.

AUX TEMP

The temperature sensor for the auxiliary temperature setpoint **(AUX TEMP)** is wired to Terminals 71 and 72, and can be wired for any one of the following functions:

VALUE	FUNCTION
UNUSED	No temperature sensor is wired to Terminals 71 and 72.
OIL TEMP	Monitor oil temperature (see SEQUENCE OF OPERATION - HIGH AND LOW ALARM LIMITS section).
STACK	Monitor stack temperature (see MONITORING STACK TEMPERATURE and SEQUENCE OF OPERATION - HIGH AND LOW ALARM LIMITS sections).
OUTDOOR	Monitor outdoor air temperature. See OUT SENS.

To program the primary temperature sensor (wired to Terminals 69 and 70) to monitor and control the hot water supply temperature of a hot water boiler:

Press the **Set Points** key **Set Points** and the screen will display: **PRI FUEL** followed by

Press the **Next** key **Next** until the screen displays: **PRI TEMP** followed by

Press the **Modify** key. **Modify** The **Prog** indicator lights up.

Press the **Up** or **Down** key **Up** **Down** until the screen displays: **WATER**.

Press the **Enter** key. **Enter** and the screen will display: **PRI TEMP** followed by **WATER**.

Program the appropriate usage for the remaining temperature sensors.

OUT SENS

The outdoor air temperature sensor can be wired to either the primary temperature sensor (terminals 69 and 70) or the auxiliary temperature sensor (terminals 71 and 72). The setpoint **OUT SENS** is used to select where the outdoor sensor is connected (Primary or Auxiliary). (See MONITORING OUTDOOR AIR TEMPERATURE).

⚠ **CAUTION:** The **OUT SENS** setpoint will take priority over the setpoints **PRI TEMP** and **AUX TEMP**. If the function of the Primary (**PRI TEMP**) or Auxiliary sensor (**AUX TEMP**) is programmed **before** programming the **OUT SENS** setpoint, then the value of the **PRI TEMP** or **AUX TEMP** will revert to **UNUSED** when the setpoint **OUT SENS** is programmed for that value. If the **OUT SENS** is programmed first, then the **PRI TEMP** or **AUX TEMP** cannot be programmed to any value and will remain on **UNUSED.**

STEP 3 - Program the High and Low Alarm Limits

Once the appropriate pressure and temperature functions and ranges have been entered, the user then programs the high and low alarm limits. For a detailed description, see SEQUENCE OF OPERATION - HIGH AND LOW ALARM LIMITS section.

Note: The actual high and low limits you program should indicate an unsafe burner operation if any of the limits are exceeded. When the programmed limits are exceeded, the E340 will open its safety circuit and the flame safeguard control will lockout the boiler.

For example, the steam boiler maintains 20 pounds pressure, the High Limit Steam Pressure Setpoint **(HSP ALRM)** might be 25 PSIG. There is no Low Limit Steam Pressure setpoint. If the primary fuel setpoint (PRI FUEL) is set for GAS, and the gas pressure operates at 8" water column, the high gas pressure limit, programmed as the High Primary Fuel Alarm Limit setpoint (HPF ALRM), might be set at 12" water column, and the low gas pressure limit, programmed as the Low Primary Fuel Alarm Limit setpoint (LPF ALRM), might be set at 4."

⚠ **WARNING: A separate electro-mechanical steam pressure high limit switch must remain in the running interlock circuit of the flame safeguard control and should be set higher than the programmed High Limit Steam Pressure Setpoint (e.g. electro-mechanical steam pressure high limit switch set at 27 PSIG, High Limit Steam Pressure programmed at 25 PSIG).**

Note: The High Limit Steam Pressure Setpoint (HSP ALRM) should be programmed higher than the Steam Pressure Setpoint (STM SP) plus the Cut Out Setpoint (CUT OUT). See SEQUENCE OF OPERATION - OPERATING CONTROL section. This also applies to the High Limit Water Temperature Setpoint (HWT ALRM).

FIGURE 3.
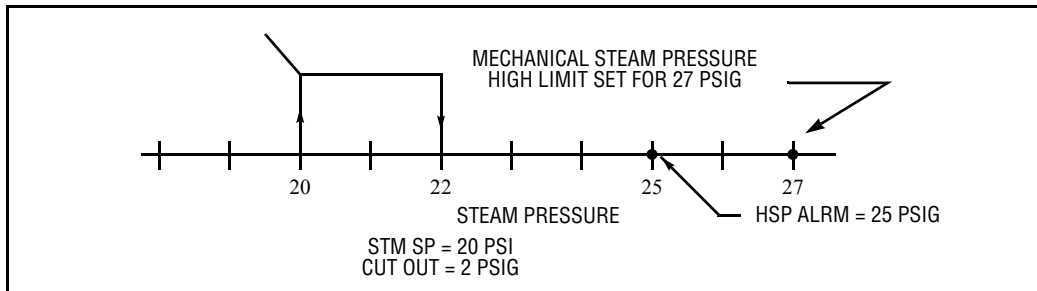
To program a High Limit Steam Pressure setpoint of 25 PSIG:

Press the **Set Points** key [Set Points] and the screen will display: **PRI FUEL** followed by

Press the **Next** key [Next] until the screen displays: **HSP ALRM** followed by

Press the **Modify** key. [Modify] The **Prog** indicator lights up.

Press the **Up** or **Down** key [Up] [Down] until the screen displays: **25.0 P**.

Press the **Enter** key. [Enter] and the screen will display: **HSP ALRM** followed by **25.0 P**.

Program the appropriate high and low alarm limits for the remaining pressure and temperature sensors.

STEP 4 - Program the Operating Control Function

Once the ranges and limits are programmed, the user then programs the setpoints associated with the operating control function of the E340. These setpoints are Steam Pressure Setpoint **(STM SP)** or Water Temperature Setpoint **(WTR SP)**, Cut In **(CUT IN)**, and Cut Out **(CUT OUT)**.

In Figure 3 , the Steam Pressure Setpoint **(STM SP)** is 15 PSIG, the Cut In setpoint **(CUT IN)** is 0 PSIG, and the Cut Out setpoint **(CUT OUT)** is 2 PSIG. The Cut In Setpoint is a differential value that is **subtracted** from the Steam Pressure Setpoint to determine the cut in point, and the Cut Out setpoint is a differential value that is **added** to the Steam Pressure Setpoint to determine the cut out point so the operating control would close at 15 PSIG (15 PSIG - 0 PSIG), and open at 17 PSIG (15 PSIG + 2 PSIG). For a complete description of these setpoints and the operating control function, see SEQUENCE OF OPERATION - OPERATING CONTROL section.

To program a Steam Pressure Setpoint (**STM SP**) OF 15 PSIG:

Press the **Set Points** key [Set Points] and the screen will display: **PRI FUEL** followed by

Press the **Next** key [Next] until the screen displays: **STM SP** followed by

Press the **Modify** key. [Modify] The **Prog** indicator lights up.

Press the **Up** or **Down** key [Up] [Down] until the screen displays: **15 P**.

Press the **Enter** key. [Enter] and the screen will display: **STM SP** followed by **15 P**.

Program the appropriate values for **CUT IN** and **CUT OUT**.

STEP 5 - Programming Modulating Control Function

Once the Operating Control setpoints are programmed, the user then programs the Modulating Range Setpoint **(MOD RNGE)** and Maximum Modulating Firing Rate Position Setpoint **(MOD MAX)**. The Modulating Range Setpoint determines the pressure (or temperature) range the E340 commands the firing rate damper motor to go from low to high fire. The MOD MAX Setpoint restricts the control signal to the firing rate motor. For a complete description of these setpoints and the operating control function, see SEQUENCE OF OPERATION - MODULATING CONTROL section.

In Figure 2, the Modulating Range **(MOD RNGE)** is 3 PSIG. The Modulating Range Setpoint is a differential value that is **subtracted** from the Steam Pressure Setpoint, so the firing rate motor would be at low fire at 15 PSIG, which is the Steam Pressure Setpoint (**STM SP**) and at high fire at 12 PSIG (15 PSIG - 3 PSIG). The Maximum Modulating Firing Rate Position Setpoint (**MOD MAX**) is set at 80%.

To program a Modulating Range Setpoint of 3 PSIG:

Press the **Set Points** key [Set Points] and the screen will display: **PRI FUEL** followed by

Press the **Next** key [Next] until the screen displays: **MOD RNGE** followed by

Press the **Modify** key. [Modify] The **Prog** indicator lights up.

Press the **Up** or **Down** key [Up] [Down] until the screen displays: **3.0 P**.

Press the **Enter** key. [Enter] and the screen will display: **MOD RNGE** followed by **3.0 P**.

Program the appropriate value for the Modulating Maximum Setpoint (**MOD MAX**). The default value for MOD MAX is 100%.

SEQUENCE OF OPERATION - OPERATING CONTROL

Note: Refer to Figure 4 .

The E340 performs the operating control function to cycle the boiler on and off to maintain the programmed pressure or temperature setpoint. Terminals 52 and 53 (wired in the operating control circuit of the flame safeguard control in series with other operating limits) will operate according to the following setpoints:

STM SP [1](Steam Pressure Setpoint) - This determines the steam pressure the E340 will maintain the boiler.

   or

WTR SP [1] (Water Temperature Setpoint) - This determines the water temperature the E340 will maintain the boiler.

CUT IN (Cut In Value) - Determines the point in which the steam pressure (or water temperature) must reach to close the operating control. This is a differential value that is subtracted from the steam pressure setpoint **(STM SP)** or water temperature setpoint **(WTR SP)**.

CUT OUT (Cut Out Value) - Determines the point in which the steam pressure (or water temperature) must reach to open the operating control. This is a differential value that is added to the steam pressure setpoint **(STM SP)** or water temperature setpoint **(WTR SP)**.

When the steam pressure (or water temperature) is above the cut out point (Point "E"), system demand is satisfied and the operating control output (Terminals 52 and 53) of the E340 is open.

As system demand increases and the steam pressure (or water temperature) falls below the cut in point (Point "D" - see note below), the operating control output (Terminals 52 and 53) of the E340 will close. (The indicator **OCC** is lit when the operating control output is closed).

*Note: The cut in setpoint (**CUT IN**) is a differential value. Point "D" (steam pressure or water temperature in which the operating control closes) is determined by **subtracting** the cut in setpoint (**CUT IN**) from the steam pressure setpoint (**STM SP**) or water temperature setpoint (**WTR SP**).*

In Figure 4 , the Cut In setpoint (**CUT IN**) is programmed to zero, so the cut in point for the operating control (Point "D") is the Steam Pressure Setpoint (**STM SP**). This should be typical for most applications.

When all other circuits within the Operating Control circuit of the accompanying Flame Safeguard Control are also closed, the Flame Safeguard Control will initiate a burner start-up sequence. This includes Pre-Purge, Pilot Trail For Ignition, and Main Trial For Ignition (MTFI). Upon completion of the MTFI, the Flame Safeguard Control sets its firing rate motor in the auto position and under control of the E340 (see SEQUENCE OF OPERATION - MODULATING CONTROL section).

Whenever the steam pressure (or water temperature) rises above the cut out point (Point "E" - see note below), the operating control output (Terminals 52 and 53) of the E340 will open and the accompanying Flame Safeguard (FSG) control will initiate a normal shutdown (e.g.: de-energize main fuel valve, firing rate motor driven to low fire, post purge, etc.).

*Note: The cut out setpoint (**CUT OUT**) is a differential value. Point "E" (steam pressure or water temperature in which the operating control opens) is determined by **adding** the cut out setpoint (**CUT OUT**) to the steam pressure setpoint (**STM SP**) or water temperature setpoint (**WTR SP**).*

[1.]   **Note:** Only one of these setpoints will be displayed as the controlled variable, depending on which sensor is selected for that function: Steam Pressure (**STM PRES**) selected with the appropriate range, or Primary Temperature (**PRI TEMP**) selected as **WATER**.

FIGURE 4.
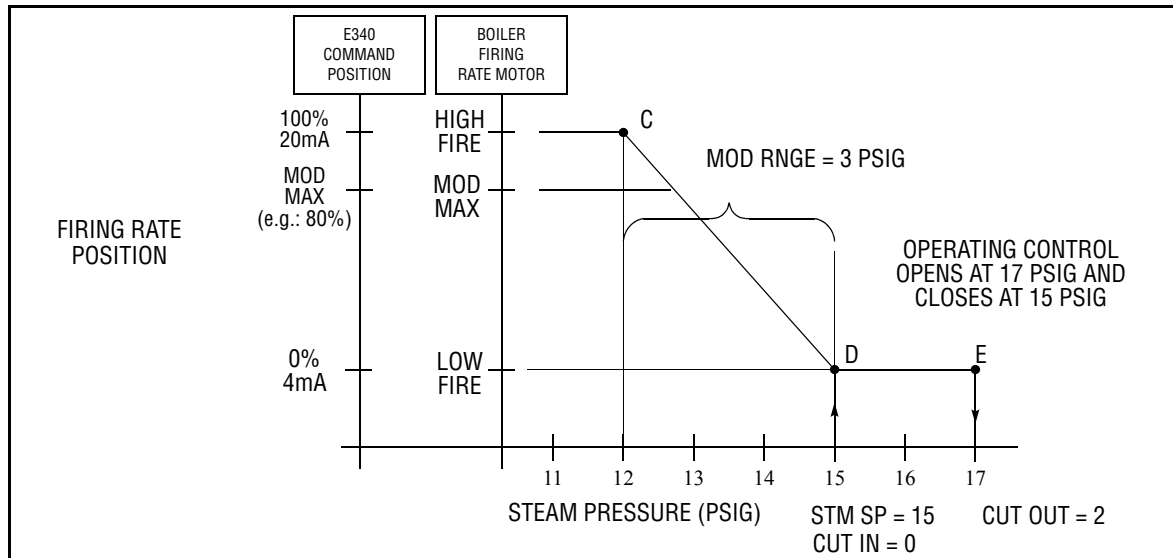
SEQUENCE OF OPERATION - MODULATING CONTROL

Note: Refer to Figure 4 .

The E340 also performs the modulating control function of the firing rate motor based on system demand. Once the E340 takes control of the firing rate motor from the flame safeguard control, the position of the firing rate motor will operate according to the following setpoints:

STM SP[1] (Steam Pressure Setpoint) - This determines the steam pressure the E340 will maintain the boiler. When the steam pressure is at this setpoint value, the firing rate motor is at the low fire position.

    or

WTR SP [1] (Water Temperature Setpoint) - This determines the water temperature the E340 will maintain the boiler. When the water pressure is at this setpoint value, the firing rate motor is at the low fire position.

MOD RNGE (Modulating Range) - This determines the range of steam pressure (or water temperature) in which the firing rate motor is commanded from its low fire to its high fire position. This is a differential value that is **subtracted** from the steam pressure setpoint (**STM SP**) or water temperature setpoint (**WTR SP**).

MOD MAX (Maximum Modulating Firing Rate Position) - This restricts the 4-20mA control signal to the firing rate motor.

*Note: The modulating range setpoint (**MOD RNGE**) is a differential value. Point "C" (Steam pressure or water temperature in which the firing rate motor is at the high fire position) is determined by subtracting the programmed value of the modulating range (**MOD RNGE**) from the Steam Pressure Setpoint (**STM SP**) or Water Temperature Setpoint (**WTR SP**).*

If the steam pressure (or water temperature) is:

— Between Points D and E, the firing rate motor is in the low fire position.

— Between points C and D, the firing rate motor position is determined by the slope of the line C-D. The slope of this line is determined by the value programmed for the setpoint **MOD RNGE**.

— Lower than Point C, the firing rate motor is in the high fire position.

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[1]   At low fire position, the fuel/air ratio should be sufficient to maintain reliable combustion. Only one of these setpoints will be displayed as the controlled variable, depending on which sensor is selected for that function: Steam Pressure (**STM PRES**) selected with the appropriate range, or Primary Temperature (**PRI TEMP**) selected as **WATER**.

Whenever the steam pressure (or water temperature) is within the Modulating Range, an increase in their value will reduce the control signal to the firing rate motor, causing the motor (or valve actuator) to drive towards its closed position. Similarly, a decrease in the steam pressure (or water temperature) will increase the control output signal, causing the valves and dampers to move toward their open position, increasing the firing rate, and increasing the steam pressure (or water temperature).

Note: The 4-20 mA output of the E340 (terminals 45 and 46) will remain at low fire (4 mA - 0% output) until 15 seconds after the fuel valve is detected open (terminal 55) before releasing to full modulating control.

The value of the modulating range **(MOD RNGE)** determines how the E340 responds to changes in the measured variable (steam pressure or water temperature). A small modulating range will cause the control to respond quickly to small changes in steam pressure or water temperature, which might result in the firing rate motor to cycle excessively. A large value would reduce the cycling of the firing rate motor, but may cause the system to be somewhat sluggish in response to a change in steam pressure or water temperature. Load matching the capacity of the boiler and typical system demand are important considerations in setting the **MOD RNGE** setpoint. Care should be taken when selecting this variable.

The E340 control also provides Integral control (Proportional + Integral) to improve system response to varying load changes. Refer to "Proportional plus Integral control."

Maximum Modulating Firing Rate Position (MOD MAX)

The Maximum Modulating Firing Rate Position is a programmable setpoint which will restrict the control signal to the Firing Rate Motor. This setpoint will also affect the cycling rate of the boiler. This setpoint is programmed as a percentage, from 0% to 100%.

For example, if you wish to measure this on the output terminals (Terminals 45 and 46), programming a value of 80% for **MOD MAX**, the maximum control signal from the E340 to the firing rate motor would be 16.8mA.   .80 x (20-4 mA) = 12.80mA.   4 mA + 12.8mA = 16.8mA.

Manual Positioning of the Firing Rate Motor

The E340 provides two methods to manually control the command signal to the firing rate motor (the setpoint **MOD USE** or **System Test 7**). Both methods provide a convenient method to position the firing rate motor when setting up the damper linkage for the motor. These functions are similar to a manual potentiometer positioner.

Modulate Motor Position (MOD USE)

The **MOD USE** setpoint allows the user to manually position the firing rate motor. This setpoint has two selections: **AUTO** and **MANUAL**. The **AUTO** selection will have the E340 modulate the firing rate motor based on system demand (See SEQUENCE OF OPERATION - MODULATING CONTROL). The **MANUAL** selection will allow the user to manually command the firing rate position.

> ⚠ **CAUTION: As long as the setpoint MOD USE is programmed MANUAL, the E340 WILL NOT control the firing rate motor based on system demand, but will remain in manual control indefinitely. See System Test 7 for a time out option.**

To manually position the firing rate motor:

Press the setpoints key ▢ **Set Points**   and the screen will display: **PRI FUEL** followed by

Press the **Back** key ▢ **Back**   until the screen displays: **MOD USE** followed by **AUTO**.

Press the **Modify** key. ▢ **Modify**   The **Prog** indicator lights up.

Press the **Up** or **Down** key ▢ **Up** ▢ **Down** until the screen displays **MANUAL**.

Press the **Enter** key. | Enter | and the screen will display: **MOD USE** followed by **MANUAL.**

Note: The mod motor will start to move to the position indicated in the next step as soon as the Enter key is pressed.

Press the **Next** key | Next | and the screen will display **MOD POS** followed by the position.

Press the **Modify** key. | Modify | The **Prog** indicator lights up.

Press the **Up** or **Down** key | Up | | Down | to the desired position for the mod motor.

Press the **Enter** key | Enter | and the E340 will send out the appropriate 4-20ma signal to position the mod motor to the desired position.

⚠ **CAUTION: As long as the setpoint MOD USE is programmed MANUAL, the E340 WILL NOT control the firing rate motor based on system demand, but will remain in manual control indefinitely. See System Test 7 for a time out option.**
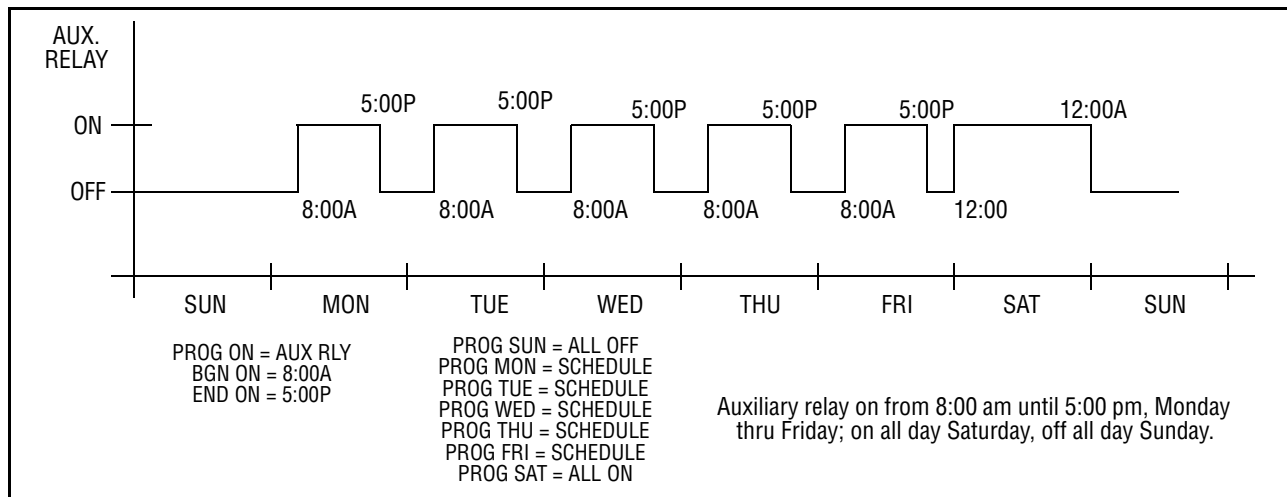
FIGURE 5.

SEQUENCE OF OPERATION - PROGRAM CONTROL OF AUXILIARY RELAY

The E340 has an auxiliary relay (Terminal 44) that can be programmed based on its own time-of-day schedule. This relay is rated for 5 amps @ 24 VAC or VDC. This output is a normally open (NO) output, but can be controlled based on a programmed time schedule. The common side of the auxiliary relay is internally wired to Terminal 41. See Bulletin E-3451. The user programs the following setpoints which are found under TIME/SCHEDULE:

- **PROG ON** (Program Relay On Time): This setpoint programs the E340 to activate the programmed schedule of the auxiliary relay (or the operating control - see PROGRAM CONTROL OF OPERATING CONTROL section below). Select **AUX RLY**.

- **BGN ON** (Begin On Time Period): This setpoint programs the time the auxiliary relay is energized On.

- **END ON** (End On Time Period): This setpoint programs the time the auxiliary relay is de-energized Off.

- **PROG SUN** (Sunday Program On Time Options): This selects the options for operating the auxiliary relay in the Program On mode for Sunday. These options are:

    — **ALL ON** (On All The Time): The auxiliary relay is energized the entire day (24 hours). This is the default value.

— **ALL OFF** (Off All The Time): The auxiliary relay is turned off the entire day (24 hours).

— **SCHEDULE** (Program On Time Schedule): The auxiliary relay is turned on according to the Program On Schedule.

- **PROG MON** (Monday Program On Time Options): See PROG SUN.

    through

- **PROG SAT** (Saturday Program On Time Options): See PROG SUN.

SEQUENCE OF OPERATION - PROGRAM CONTROL OF OPERATING CONTROL

The operating control function of the E340 (Terminals 52 and 53) can be programmed to operate (respond to system demand) based on a time-of-day schedule. The operating control function still depends on the steam pressure (or water temperature) in reference to the programmed setpoint, but the user can prevent the operation of the operating control function (Terminals 52 and 53 remain open), or only operate on system demand during certain scheduled hours. The LCD indicator Run will blink when the operating control is forced to remain open on system demand due to "Program On" schedule. The user programs the following setpoints found under TIME/SCHEDULE:

- **PROG ON** (Program Relay On Time): This setpoint programs the E340 to activate the programmed schedule of the operating control (or the auxiliary relay - see PROGRAM CONTROL OF AUXILIARY RELAY section above). Select **OPR CNTL**.

- **BGN ON** (Begin On Time Period): This setpoint programs the start time the operating control will respond to system demand.

- **END ON** (End On Time Period): This setpoint programs the time the operating control **will not** respond to system demand.

- **PROG SUN** (Sunday Program On Time Options): This selects the options for controlling the operating control in the Program On mode for Sunday. These options are:

    — **ALL ON** (On All The Time): The operating control will respond to system demand the entire day (24 hours). This is the default value.

    — **ALL OFF** (Off All The Time): The operating control will not respond to system demand the entire day (24 hours).

    — **SCHEDULE** (Program On Time Schedule): The operating control will respond to system demand according to the Program On Schedule.

- **PROG MON** (Monday Program On Time Options): See PROG SUN.

    through

- **PROG SAT** (Saturday Program On Time Options): See PROG SUN.

Assured Low Fire Cutoff - If the firing rate motor is at a position greater than 25% open at the End On Time period (**END ON**), the E340 will delay opening the operating control output (Terminals 52 and 53), command the firing rate motor to its low fire position, wait 30 seconds, and then open the operating control output.

SEQUENCE OF OPERATION - HIGH AND LOW ALARM LIMITS

The solid state sensors installed with the E340 provide both the high and low safety limits functions.

⚠	**WARNING: The electro-mechanical steam pressure or water temperature high limit switch MUST remain in the running interlock circuit of the Flame Safeguard Control.** **WARNING: Programming a sensor range that is different from the actual range of the installed sensor could result in improper operation.**

The user can program both high and low temperature or pressure limits based on the input signal received from these solid state sensors. These high and low alarm limits should be programmed so that if any of the limits are exceeded, it would indicate an unsafe burner operation. Following are the high and low alarm limit setpoints.

MNEMONIC	FULL LENGTH DESCRIPTOR
LPF ALRM	Low Limit Primary Fuel [1]
HPF ALRM	High Limit Primary Fuel [1]
LSF ALRM	Low Limit Secondary Fuel [1]
HSF ALRM	High Limit Secondary Fuel [1]
LAT ALRM	Low Limit Auxiliary Alarm Temperature (for oil temperature only)
HAT ALRM	High Limit Auxiliary Alarm Temperature (for oil or stack temperature)
HSP ALRM	High Limit Alarm Steam Pressure
HPT ALRM	High Limit Alarm Primary Temperature (for water or stack temperature)
[1] Primary and secondary fuel can be programmed for gas or oil	

Note: The appropriate sensor must first be programmed with a function and range (pressure sensors) or function (temperature sensors) before the alarm setpoints are displayed. See GETTING STARTED section.

Note: There is no Low Limit Alarm Steam Pressure or Low Limit Alarm Primary Temperature Setpoints. Marginal Low Limit Alarms for steam pressure and primary temperature are allowed.

In the event any of the high or low alarm limits are exceeded, the E340 shall close its alarm output relay (Terminal 43) and open its safety interlock circuit (Terminals 50 and 51) which is wired in series with the running interlock circuit of the Flame Safeguard Control, causing the Flame Safeguard Control to lock out[1] and initiate a safety shutdown. (The indicator **UNOCC** is lit when the safety interlock circuit is opened). An appropriate message will be displayed on the LCD display of the E340, indicating which limit exceeded its programmed value. The alarm message will remain on the display of the E340 until either:

1. The E340 detects voltage on the main fuel valve of the flame safeguard control (Terminal 55).
2. The message is cleared when any key on the keypad/display is pressed. The System Test key can review the last 10 lockout conditions. See below.

[1]The Programmer Module of the Flame Safeguard Control will determine its action (e.g. lockout, recycle, etc.) when its running interlock circuit is opened.

Alarm Messages

The following alarm messages are displayed when the indicated conditions occur:

E340 ALARM MESSAGES	DESCRIPTION
HIGH LIMIT PRIMARY FUEL	High primary fuel pressure alarm limit exceeded.[1]
HIGH LIMIT SECNDARY FUEL	High secondary fuel pressure alarm limit exceeded.[1]
HIGH LIMIT STEAM PRESSURE	High steam pressure alarm limit exceeded
HIGH LIMIT PRIMARY TEMPERATURE	High primary temperature alarm limit exceeded (water or stack temperature)
HIGH LIMIT AUXILIARY TEMPERATURE	High auxiliary temperature alarm limit exceeded (oil or stack temperature)
LOW LIMIT PRIMARY FUEL	Low primary fuel pressure alarm limit exceeded.[1]
LOW LIMIT SECNDARY FUEL	Low secondary fuel pressure alarm limit exceeded.[1]
LOW LIMIT AUXILIARY TEMPERATURE	Low auxiliary temperature alarm limit exceeded (oil temperature only)
[1] Primary and secondary fuel can be programmed for gas or oil.	

Note: The alarm message will continue to be displayed until the alarm condition is cleared.
Note: There is no Low Limit Steam Pressure or Low Limit Primary Temperature Setpoints.

The E340 stores the last (10) alarm message. To review the last 10 alarm messages via the System Test key:

1. Press the **System Test** key. `System Test`

2. Press the **Modify** key. `Modify` The **Prog** indicator is lit.

3. Press the **Up** or **Down** key `Up` `Down` until the display reads **17**.

4. Press the **Enter** key `Enter` to display the most recent lockout alarm message,

5. Press the **Next** key `Next` to display the next lockout alarm message,

6. Pressing the **Next** key `Next` will display all lockout alarm messages up to number (9).

7. Pressing the **Back** key `Back` will display all lockout alarm messages down to number (0).

8. Press any key in the top row of the keypad (e.g. Setpoints, Time/Sched.) to exit this alarm message screen. The E340 will exit this System Test mode if no key is pressed for 30 seconds.

Lockout alarm message number (0) is the most recent lockout alarm. Lockout alarm message number (9) is the oldest lockout alarm.

SEQUENCE OF OPERATION - MARGINAL HIGH AND LOW ALARM LIMITS

The solid state sensors installed with the E340 also provide marginal high and low alarm limits. These programmable limits provide an indication that the sensor value is **approaching** the high and low alarm limits before those limits are actually reached. Following are the marginal alarm limit setpoints:

MNEMONIC	FULL LENGTH DESCRIPTOR
LPF MARG	Marginal Low Limit Primary Fuel.[1]
HPF MARG	Marginal High Limit Primary Fuel. [1]
LSF MARG	Marginal Low Limit Secondary Fuel.[1]
HSF MARG	Marginal High Limit Secondary Fuel.[1]
LAT MARG	Marginal Low Limit Auxiliary Temperature **(for oil temperature only)**
HAT MARG	Marginal High Limit Auxiliary Temperature **(for oil or stack temperature)**
LSP MARG	Marginal Low Limit Steam Pressure
HSP MARG	Marginal High Limit Steam Pressure
LPT MARG	Marginal Low Limit Primary Temperature
HPT MARG	Marginal High Limit Primary Temperature **(for water or stack temperature)**
	[1] Primary and secondary fuel can be programmed for gas or oil.

*Note: The setpoint Marginal Alarm s (**MARG ALRM**) must be programmed as **USED** to display the Marginal Alarm setpoints.*

Note: The appropriate sensor must first be programmed with a range (pressure sensors) or function (temperature sensors) before the alarm setpoints are displayed. See GETTING STARTED section.

In the event one of the marginal alarm limits are exceeded, the E340 will pulse its alarm output relay (Terminal 43) approximately once per second and display an appropriate message.

E340 MARGINAL ALARM MESSAGES	DESCRIPTION
MARGINAL HIGH LIMIT PRIMARY FUEL	Marginal high primary fuel pressure alarm limit exceeded.[1]
MARGINAL HIGH LIMIT SECNDARY FUEL	Marginal high secondary fuel pressure alarm limit exceeded.[1]
MARGINAL HIGH LIMIT STEAM PRESSURE	Marginal high steam pressure alarm limit exceeded
MARGINAL HIGH LIMIT PRIMARY TEMPERATURE	Marginal high primary temperature alarm limit exceeded (water or stack temperature)
MARGINAL HIGH LIMIT AUXILIARY TEMPERATURE	Marginal high auxiliary temperature alarm limit exceeded (oil or stack temperature)
MARGINAL LOW LIMIT PRIMARY FUEL	Marginal low primary fuel pressure alarm limit exceeded.[1]
MARGINAL LOW LIMIT SECNDARY FUEL.	Marginal low secondary fuel pressure alarm limit exceeded.[1]
MARGINAL LOW LIMIT STEAM PRESSURE	Marginal low steam pressure limit exceeded
MARGINAL LOW LIMIT PRIMARY TEMPERATURE	Marginal low primary temperature limit exceeded (water temperature only)
MARGINAL LOW LIMIT AUXILIARY TEMPERATURE	Marginal low auxiliary temperature alarm limit exceeded (oil temperature only)
[1] Primary and secondary fuel can be programmed for gas or oil.	

Note: The alarm message will continue to be displayed until the alarm condition is cleared.

*Note: If the marginal alarm setpoint (**MARG ALRM**) is programmed **USED**, the marginal alarm setpoints must be programmed in between the high and low alarm setpoints (see below). Otherwise, the E340 will display the marginal alarm error message of the sensor with the improper marginal alarm setpoints.*

Example of Alarm Limits and Marginal Alarm Limits programmed correctly:

Primary Fuel (**PRI FUEL**): 0-32" w.c.

Primary Fuel (**PRI FUEL**): GAS

Low Limit Primary Fuel Alarm (**LPF ALRM**): 3.0" w.c.

Marginal Low Limit Primary Fuel Alarm (**LPF MARG**): 6.0" w.c.

Marginal High Limit Primary Fuel Alarm (**HPF MARG**): 20.0" w.c.

High Limit Primary Fuel Alarm (**HPF ALRM**): 25.0" w.c.

PS348-2 Gas Pressure Sensor installed. Range: 0-32" w.c.

ADDITIONAL ALARM MESSAGES

There are additional alarm messages associated with the operation of the E340 control. In the event any of these alarms occur, the E340 will open the safety circuit (terminals 50 and 51) and close the alarm output (terminal 43) **for as long as the alarm condition exists**. The alarm message will remain on the display of the E340 until either:

1. The E340 detects voltage on the main fuel valve of the flame safeguard control (terminal 55).

2. The message is cleared when any key on the keypad/.display is pressed. The System Test key can review the last 10 alarm conditions. See SYSTEM TEST KEY.

ERROR MESSAGES	DESCRIPTION
HIGH LIMIT PRIMARY FUEL OVR RNG	Gas or oil pressure is over the range of the installed primary fuel pressure sensor.
LOW LIMIT PRIMARY FUEL UNDR RNG	Gas or oil pressure is under the range of the installed primary fuel pressure sensor, or the signal wire (term 62) is open or shorted or +24 VDC (term 60) is open or sensor is improperly wired
HIGH LIMIT SECNDARY FUEL OVR RNG	Gas or oil pressure is over the range of the installed secondary fuel pressure sensor.
LOW LIMIT SECNDARY FUEL UNDR RNG	Gas or oil pressure is under the range of the installed secondary fuel pressure sensor, or the signal wire (term 65) is open or shorted or +24 VDC (term 63) is open or sensor is improperly wired.
HIGH LIMIT STEAM PRESSURE OVR RNG	Steam pressure is over the range of the installed steam pressure sensor.
STEAM PRESSURE UNDR RNG	Steam pressure is under the range of the installed steam pressure sensor, or the signal wire (term 68) is open or shorted or +24 VDC (term 66) is open or sensor is improperly wired. Note: This message WILL NOT open up the safety circuit (term 50 & 51) of the E340.
HIGH LIMIT PRIMARY TEMP OVR RNG	Primary temperature is over 750–F.
LOW LIMIT PRIMARY TEMP UNDR RNG	Primary temperature is under 32–F.
PRIMARY TEMPERATURE SHORT	Primary temperature wires (term 69 & 70) are shorted.
PRIMARY TEMPERATURE OPEN	Primary temperature wires (term 69 & 70) are open.
HIGH LIMIT AUXILIARY TEMP OVR RNG	Auxiliary temperature is over 750–F.
LOW LIMIT AUXILIARY TEMP UNDR RNG	Auxiliary temperature is under 32–F.
AUXILIARY TEMPERATURE SHORT	Auxiliary temperature wires (term 71 & 72) are shorted.
AUXILIARY TEMPERATURE OPEN	Auxiliary temperature wires (term 71 & 72) are open.
FUEL SELECT SWITCH ERROR	No fuel type is selected. 120 VAC power is not detected on any of the fuel selection terminals (term 56, 57, & 58). Note: This message waits for the operating control (term 52 & 53) to close.
GAS TO WATER SHORT ERROR	The digital values for the gas pressure and primary temperature sensor are the same values for 10 consecutive reads, or the input lines are shorted to each other.
GAS TO OIL SHORT ERROR	The digital values for the gas pressure and oil pressure sensor are the same values for 10 consecutive reads, or the input lines are shorted to each other.
STEAM TO OIL SHORT ERROR	The digital values for the steam pressure and oil pressure sensor are the same values for 10 consecutive reads, or the input lines are shorted to each other.
ANALOG TO DIGITAL ERROR	The analog to digital converter is defective. Check programmer (EP340)
DIGITAL INPUT ERROR	The digital input multiplexer is defective. Check chassis (EB342) or signal input board on the wiring base (E343 or E344)
RAM READ WRITE ERROR	The microprocessor has detected an improper value in its RAM memory. Check programmer (EP340).

SEQUENCE OF OPERATION - COLD START THERMAL SHOCK PROTECTION

Cold Start Thermal Shock Protection is designed to slowly increase the burner firing rate on a cold start to limit mechanical stress due to thermal differences. The E340 offers two methods of thermal shock protection: Low Fire and Segment. The setpoints associated with selecting this function are:

• **THML SHK** (Thermal Shock Protection): This setpoint enables the thermal shock protection function. The selections are **UNUSED**, **LOW FIRE** and **SEGMENT**.

LOW FIRE METHOD: This method of cold start thermal shock protection is generally used on Water Tube Boilers. The only setpoint associated with this method of thermal shock protection is:

• **TML EXIT** (Thermal Shock Exit Setpoint): The E340 will hold the Firing Rate motor in the low fire position until the steam pressure (or water temperature) reaches the Thermal Shock Exit Setpoint (**TML EXIT**).

Once this steam pressure (or water temperature) is reached, the firing rate motor is positioned according to the modulating control algorithm. See Figure 6 .

*Note: If the setpoint Primary Temperature (**PRI TEMP**) is programmed for **STANDBY**, Thermal Shock Protection - Low Fire Method will control according to boiler water temperature (**STANDBY**) and not steam pressure. See SEQUENCE OF OPERATION - STANDBY WATER section.*

FIGURE 6.   **Cold Start Thermal Shock Protection - Low Fire Method**
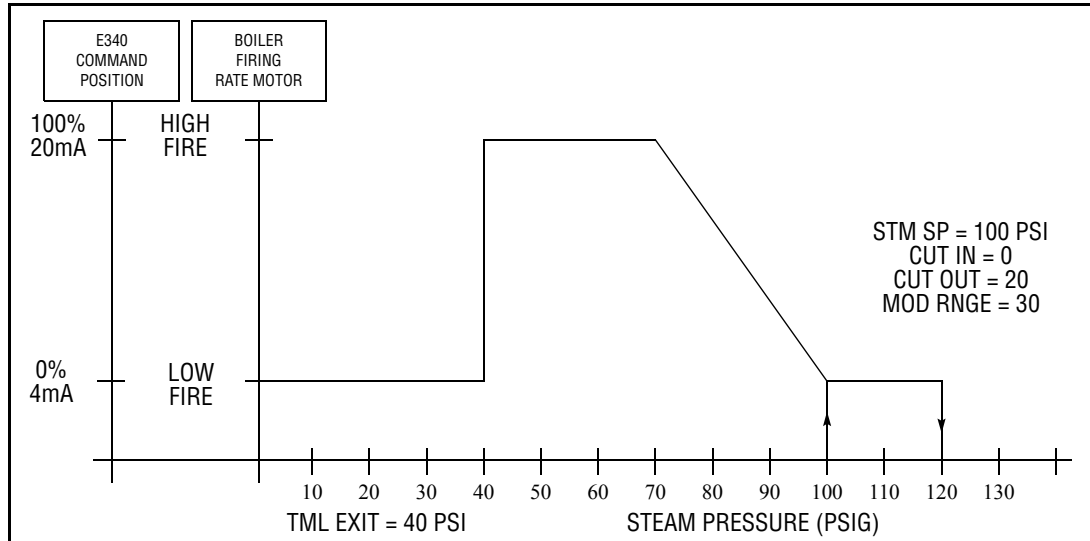
SEGMENT METHOD: This method of cold start thermal shock protection is generally used with Fire Tube Boilers, see Figure 7 . The setpoints associated with this method of thermal shock protection are:

- **TML STRT** (Thermal Shock Start Point): Determines the start point for thermal shock protection - segment method.
- **TML EXIT** (Thermal Shock Exit Point): Determines the exit point for thermal shock protection - segment and low fire method.
- **TMD OVRD** (Timed Override Per Segment Setpoint): Determines maximum time E340 holds the firing rate for each segment before increasing to the next segment.

TML STRT and TML EXIT: Once the operating control closes, the E340 will hold the firing rate motor in the low fire position until the steam pressure (or water temperature) reaches the Thermal Shock Start Point (**TML STRT**). The E340 then automatically divides the difference between the high fire position and low fire position into sixteen (16) segments. The E340 also divides the difference between the Thermal Shock Exit Point (**TML EXIT**) and Thermal Shock Start Point (**TML STRT**) into sixteen (16) segments. The E340 will increase the firing rate motor by the value of one segment, and wait until the steam pressure (or water temperature) increases by the amount of one segment.

Once the steam pressure (or water temperature) increases by the calculated amount, the E340 increases the firing rate motor by the value of one segment and repeats the process. The E340 steps the firing rate motor until the steam pressure (or water temperature) reaches the Thermal Shock Exit Point (**TML EXIT**). At that point, the firing rate motor is at the high fire position, and will remain at the high fire position until the steam pressure (or water temperature) reaches the modulating range. See SEQUENCE OF OPERATING - MODULATING CONTROL section.

*Note: If the setpoint Primary Temperature (**PRI TEMP**) is programmed for **STANDBY**, Thermal Shock Protection - Low Fire Method will control according to boiler water temperature (**STANDBY**) and not steam pressure. See SEQUENCE OF OPERATION - STANDBY WATER section.*

TMD OVRD: The Timed Override Per Segment Setpoint (**TMD OVRD**) allows the user to program a maximum time period in which the control will try to increase the steam pressure (or water temperature) at a specific firing rate position. If the steam pressure (or water temperature) DOES

NOT increase to the appropriate value, the E340 will automatically advance the firing rate position to the next position.

FIGURE 7.   **Cold Start Thermal Shock Protection - Segment Method**
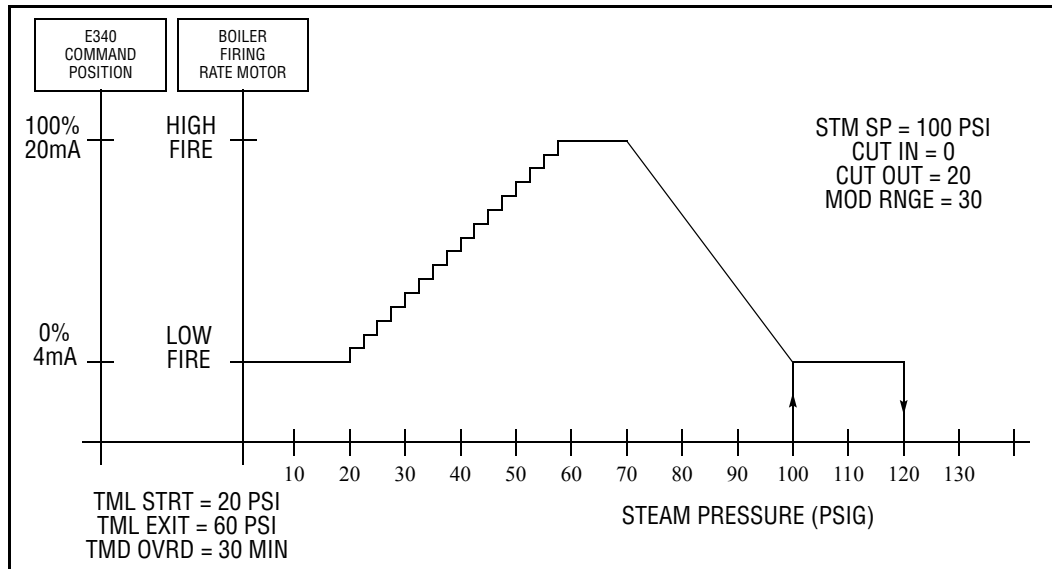
SEQUENCE OF OPERATION - SETBACK SCHEDULE

The E340 has a real-time clock which allows the user to program the E340 control to operate in a setback schedule mode. When controlling according to the Setback Schedule Setpoints, the symbol ⬛ is displayed in the 1st character of the LCD. In this manner, the E340 can maintain the steam pressure (or water temperature) at a reduced setpoint for programmed setback times during the week.

The user programs values for the following setpoints for a setback schedule which are found under TIME/SCHEDULE:

- **SETBACK** (Setback Schedule): This programs the E340 to determine if the setback function is activated or not.

> **UNUSED** (not activated)
> **USED** (activated)
> **STANDBY** - Control according to the boiler water temperature. See SEQUENCE OF OPERATION - STANDBY WATER section.

- **END STBK** (End Setback Period): This setpoint programs what time the E340 changes over from the reduced setback setpoint to the normal setpoint (**STM SP** or **WTR SP**).

- **BGN STBK** (Begin Setback Period): This setpoint programs what time the E340 starts the setback schedule.

- **STBK WTR** or **STBK STM** (Setback Water Temperature or Setback Steam Pressure): This is the system setpoint the E340 will maintain during the setback period.

- **CUT IN** (Cut In): This is the Cut In value the E340 will use during the setback period. This is a differential value that is **subtracted** from the setback water temperature (**STBK WTR**) or setback steam pressure (**STBK STM**) setpoint. See SEQUENCE OF OPERATION - OPERATING CONTROL section.

- **CUT OUT** (Cut Out): This is the Cut Out value the E340 will use during the setback period. This is a differential value that is **added** to the STBK WTR or STBK STM. See SEQUENCE OF OPERATION - OPERATING CONTROL.

- **MOD RNGE** (Modulating Range): This is the Modulating Range the E340 will use during the setback period. This is a differential value that is **subtracted** from the setback water temperature (**STBK WTR**) or setback steam pressure (**STBK STM**) setpoint. See SEQUENCE OF OPERATION - MODULATING CONTROL section.

- **STBK SUN** (Sunday Setback Options): This selects the options for operating in the setback mode for Sunday. These options are:
  - **ALL STBK** (All Setback). The E340 controls the boiler at the setback setpoint for the entire day (24 hours).
  - **NO STBK** (No Setback). The E340 DOES NOT setback the boiler for this day, but controls the boiler at the normal setpoint for the entire day (24 hours).
  - **SCHEDULE** (Setback Schedule) The E340 controls the boiler according to the Setback Schedule.
- **STBK MON** (Monday Setback Options) See STBK SUN
       through
  STBK SAT (Saturday Setback Options) See STBK SUN.
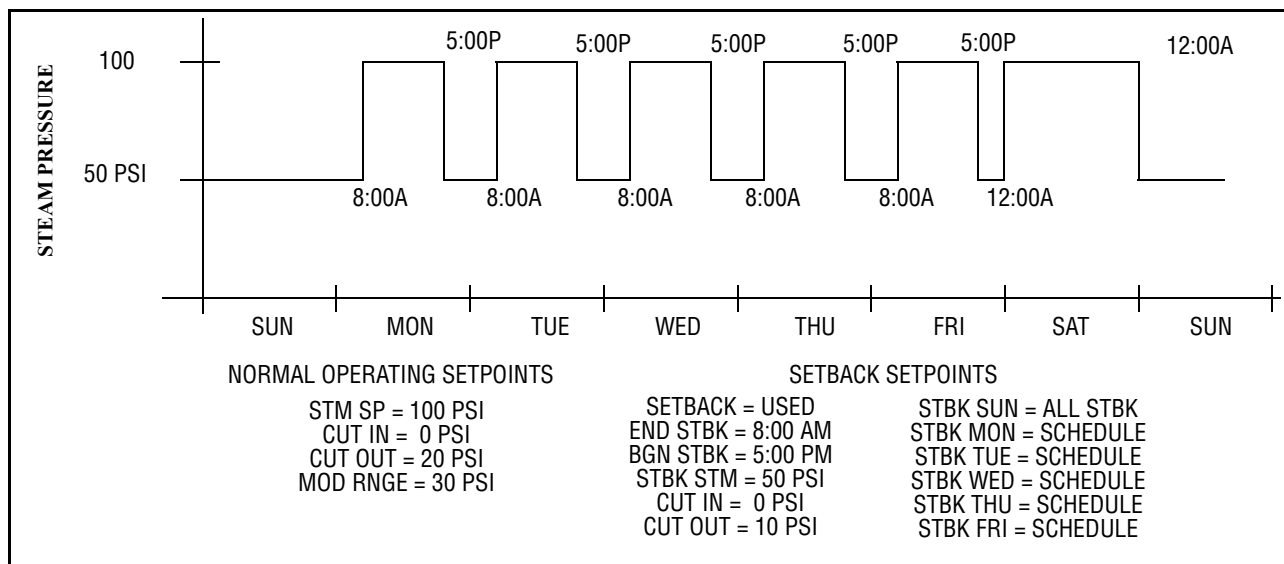
Note: See Figure 8 .

Assured Low Fire Cutoff

If the firing rate motor is at a position greater than 25% open at the Begin Setback period (**BGN STBK**) when the E340 is scheduled to operate according to the reduced setback setpoints, the E340 will delay opening the operating control output (Terminals 52 and 53), command the firing rate motor to its low fire position, wait 30 seconds, and then open the operating control output.

SETBACK OVERRIDE: In addition, the E340 provides the ability to wire in a momentary push-button contact to Terminals 78 and 79 which will override the setback mode of the E340 control for a programmed period of time from 1 to 8 Hours (Setpoint = **OVRD HRS**). If the E340 is operating in the setback mode and the contact is pressed, the E340 will exit the setback mode and control according to the steam pressure (or water temperature) setpoint (**STM SP** or **WTR SP**) for the programmed period of time (1 to 8 Hours). If the contact is pressed a second time BEFORE the programmed time period expires, the E340 will return to the setback mode, and the symbol ⊥ is again displayed in the first character of the LCD Display.

FORCED SETBACK: The E340 provides the ability to wire in a maintained contact to Terminals 75 and 76. When this contact is closed, the E340 controls according to its setback setpoints for as long as this contact is closed, regardless of the programmed setback schedule.

FIGURE 8.

NORMAL OPERATING SETPOINTS

STM SP = 100 PSI
CUT IN = 0 PSI
CUT OUT = 20 PSI
MOD RNGE = 30 PSI

SETBACK SETPOINTS

SETBACK = USED
END STBK = 8:00 AM
BGN STBK = 5:00 PM
STBK STM = 50 PSI
CUT IN = 0 PSI
CUT OUT = 10 PSI

STBK SUN = ALL STBK
STBK MON = SCHEDULE
STBK TUE = SCHEDULE
STBK WED = SCHEDULE
STBK THU = SCHEDULE
STBK FRI = SCHEDULE

Standby Water

In addition, a steam boiler can also be programmed to shut down and control according to boiler water temperature instead of steam pressure. This is covered in more detail under its own separate section. See SEQUENCE OF OPERATION - STANDBY WATER.
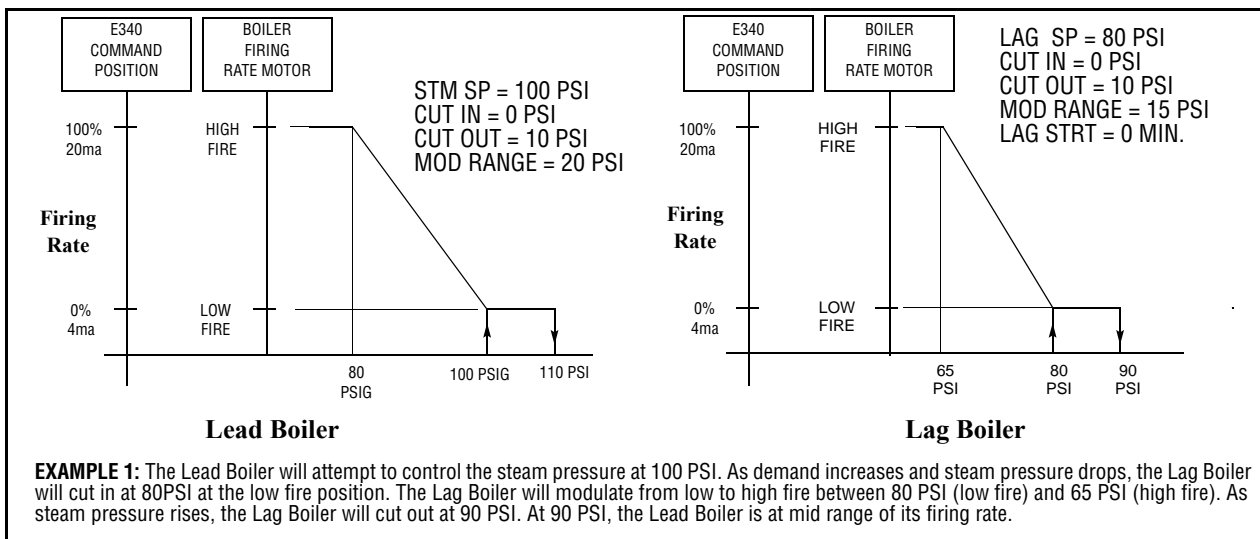
SEQUENCE OF OPERATION - LEAD/LAG CONTROL

Two boilers, each one controlled by an E340 control, can be set up to operate in a Lead/Lag mode of operation. The function of Lead or Lag operation is determined by the status of a maintained contact wired to Terminals 77 and 78. With the contact OPEN, the E340 operates in the Lead mode. With the contact CLOSED, the E340 operates in the Lag mode. An asterisk * is displayed in the 1st LCD display when selected for Lag operation. The E340 selected for Lag Operation will control according to the following setpoints:

- **LAG SP** (Lag Setpoint for Water Temperature or Steam Pressure): This is the system setpoint the E340 will maintain when it is selected for Lag Operation.

- **CUT IN** (Cut In): This is the setpoint where the E340 will close its operating control when operating as the Lag Boiler. This is a differential value that is **subtracted** from the Lag Setpoint (**LAG SP**). When this value is set to zero, the Lag Boiler will close its operating control contacts at the programmed Lag Setpoint (**LAG SP**).

- **CUT OUT** (Cut Out): This is the Cut Out value the E340 will use during Lag Operation. This is a differential value that is **added** to the Lag Setpoint **LAG SP**). See SEQUENCE OF OPERATION - OPERATING CONTROL section.

- **MOD RNGE** (Modulating Range): This is the Modulating Range the E340 will use during Lag Operation. This is a differential value that is **subtracted** from the Lag Setpoint (**LAG SP**). See SEQUENCE OF OPERATION - MODULATING CONTROL section.

- **LAG STRT** (Lag To Start Delay): When an E340 is selected for Lag Operation (based on the status of Terminal 77) and the operating control is commanded to close, this setpoint will delay the Lag boiler from firing (closing the operating control) for this programmed time period (0 to 15 minutes) to allow the Lead boiler to meet demand.

- **LAG DLY** (Lead to Lag Delay): When an E340 control is commanded to go from Lead Operation to Lag Operation (based on the status of Terminal 77), the "New Lag" E340 will continue to control as if it still was operating in Lead Operation for this programmed time period (0 to 15 minutes). This allows time for the "New Lead" Boiler to prepare to meet demand.
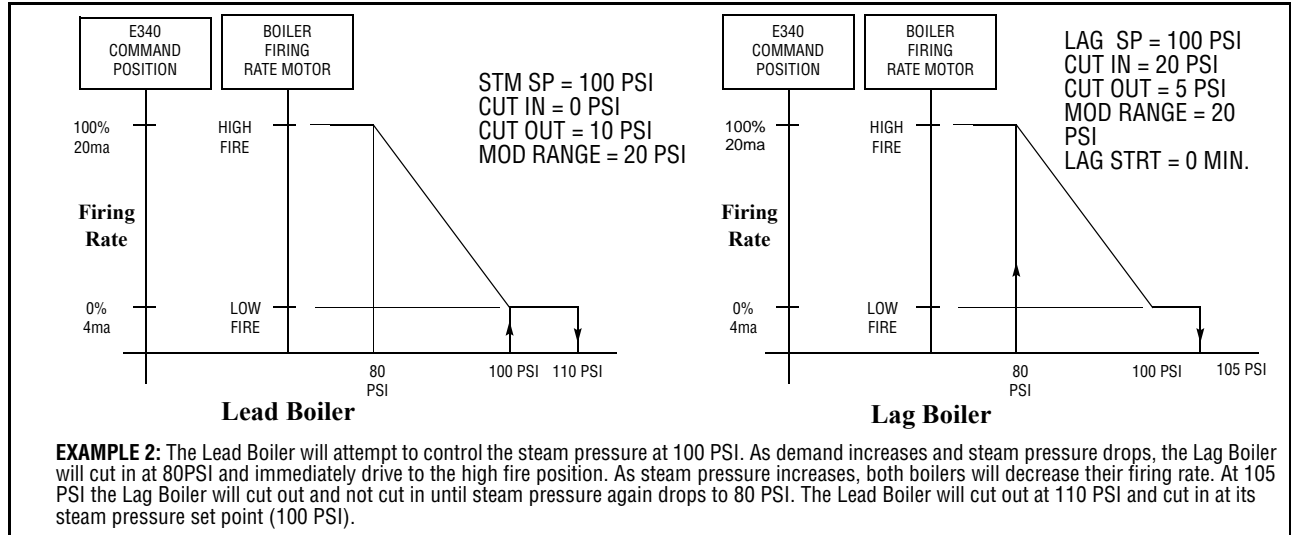
Lag Cut In: The cut in setpoint (**CUT IN**) provides the two options for programming how the Lag Boiler will respond to a call in demand. Programming the cut in setpoint to zero will close the operating control at the Programmed Lag Setpoint for Steam Pressure or Hot Water (**LAG SP**). This would cause the lead and lag boilers to operate as shown in Figure 9 .

FIGURE 9.

Lead Boiler

STM SP = 100 PSI
CUT IN = 0 PSI
CUT OUT = 10 PSI
MOD RANGE = 20 PSI

Lag Boiler

LAG SP = 80 PSI
CUT IN = 0 PSI
CUT OUT = 10 PSI
MOD RANGE = 15 PSI
LAG STRT = 0 MIN.

EXAMPLE 1: The Lead Boiler will attempt to control the steam pressure at 100 PSI. As demand increases and steam pressure drops, the Lag Boiler will cut in at 80PSI at the low fire position. The Lag Boiler will modulate from low to high fire between 80 PSI (low fire) and 65 PSI (high fire). As steam pressure rises, the Lag Boiler will cut out at 90 PSI. At 90 PSI, the Lead Boiler is at mid range of its firing rate.

By programming a value greater than zero for this setpoint, the user can program the Lag Setpoint for Steam Pressure or Hot Water (**LAG SP**) the same as the Steam Pressure Setpoint (STM SP) or Water Temperature Setpoint (**WAT SP**) as the Lead Boiler. This would cause the lead and lag boilers to operate as shown in Figure 10).

FIGURE 10.

EXAMPLE 2: The Lead Boiler will attempt to control the steam pressure at 100 PSI. As demand increases and steam pressure drops, the Lag Boiler will cut in at 80PSI and immediately drive to the high fire position. As steam pressure increases, both boilers will decrease their firing rate. At 105 PSI the Lag Boiler will cut out and not cut in until steam pressure again drops to 80 PSI. The Lead Boiler will cut out at 110 PSI and cut in at its steam pressure set point (100 PSI).

Standby Water

When a steam boiler is operating as the Lag Boiler in a Lead/Lag setup, the E340 can be programmed to monitor the boiler water of the Lag steam boiler and bring the boiler on-line when the boiler water temperature falls below a programmed setpoint. This way, the Lag boiler will be ready to come on-line to support the Lead boiler and be ready to generate steam pressure. See SEQUENCE OF OPER-ATION - STANDBY WATER section.

SEQUENCE OF OPERATION - STANDBY WATER

When the E340 is controlling a steam boiler, the water temperature sensor connected to Terminals 69 and 70 can be installed and programmed to operate in a:

1. **Standby Lag Mode** to monitor the boiler water of a steam boiler operating as the Lag boiler in a Lead/Lag setup and cycle the boiler "on" (close operating Terminals 52 and 53) to maintain the boiler water at a "Standby" temperature so the boiler is ready and available to come online and deliver steam to support the Lead boiler.

2. **Standby Setback Mode** to monitor the boiler water of a steam boiler and cycle the boiler "on" (close operating Terminals 52 and 53) to maintain the boiler water at a "Standby" temperature when the boiler is operating during its Setback hours of operation instead of a reduced steam pressure.

3. **Standby Thermal Shock Protection Mode** to monitor the boiler water of a steam boiler and slowly increase the burner firing rate on a cold start to limit mechanical stress based on the boiler water temperature instead of steam pressure.

The first step is to install a water temperature sensor (P/N TS348-2, -4, or -8) on the steam boiler (see Bulletin ES-3481), wire it to Terminals 69 and 70, and program the sensor to operate in the "Standby" mode.
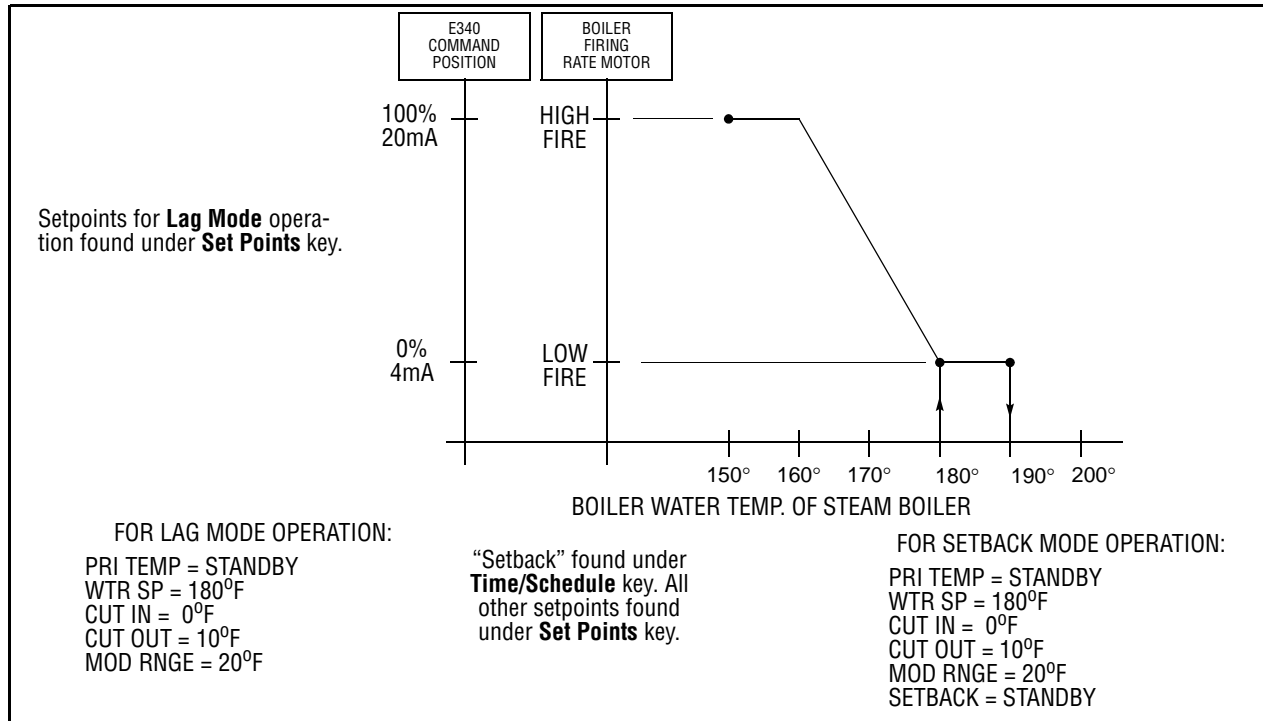
Standby Lag Mode

To program the E340 to control a steam boiler in the "Standby Lag Mode", the user programs the following setpoints which are found under SETPOINTS:

- **PRI TEMP** (Primary Temperature): This selects the temperature sensor (connected to Terminals 69 and 70) that is installed to monitor the boiler water of a steam boiler, to operate in the "Standby" mode. Program this setpoint to **STANDBY**. See GETTING STARTED - Select and Program the Pressure and Temperature Sensor Ranges section.

- **WTR SP** (Water Temperature Setpoint): This determines the boiler water temperature the E340 will maintain.

- **CUT IN** (Cut In Value): Determines the point in which the boiler water temperature must reach to close the operating control. This is a differential value that is **subtracted** from the water temperature setpoint (**WTR SP**).

- **CUT OUT** (Cut Out Value): Determines the point in which the boiler water temperature must reach to open the operating control. This is a differential value that is **added** to the water temperature setpoint (**WTR SP**).

- **MOD RNGE** (Modulating Range): This determines the range of boiler water temperature in which the firing rate motor is commanded from its low fire to its high fire position.

Once the Primary Temperature (**PRI TEMP**) is identified for Standby operation, the "Standby Lag Mode" is determined by four setpoints: Water Temperature Setpoint (**WTR SP**), Cut In setpoint (**CUT IN**), Cut Out setpoint (**CUT OUT**), and Modulating Range (**MOD RNGE**). The Standby mode of operation is similar to the operating control and modulating control functions. See SEQUENCE OF OPERATION - OPERATING CONTROL and SEQUENCE OF OPERATION - MODULATING CONTROL sections.

In Figure 11 , whenever the boiler water temperature is above 190°F (Cut out point), the Operating Control Output (Terminals 32 and 33) of the E340 are open. When the boiler water temperature falls to 180°F (Cut in point), the Operating Control Output (Terminals 52 and 53) closes and the Flame Safeguard Control will initiate a burner start-up sequence (the indicator **OCC** is lit when the operating control is closed). The E340 will modulate the firing rate damper motor based on boiler water temperature until the temperature rises above 190°F (Cut out point).

FIGURE 11.

FIGURE 11.

Standby Setback Mode

To program the E340 to control a steam boiler in the "Standby Setback Mode" using boiler water temperature (Standby Water), first program all of the setpoints associated with "Standby Lag Mode" (see above). These setpoints, found under SETPOINTS are Primary Temperature Sensor (**PRI TEMP**) programmed for Standby operation, Water Temperature Setpoint (**WTR SP**), Cut In setpoint (**CUT IN**), Cut Out setpoint (**CUT OUT**), and Modulating Range (**MOD RNGE**). In addition, program the following setpoint found under TIME/SCHEDULE:

SETBACK (Setback Schedule): This programs the E340 to determine if the setback function is activated or not. The selections for this setpoint are:

— **UNUSED** (not activated)
— **USED** (activated)
— **STANDBY:** Control according to the boiler water temperature (Standby Water).

The user programs the setpoint **SETBACK** with the value **STANDBY**. The E340 controls the steam boiler according to the setpoints above as they apply to the boiler water temperature during Setback Operation. See Figure 11 . The Standby mode for Setback Operation is similar to the operating control and modulating control functions. See SEQUENCE OF OPERATION - OPERATING CONTROL, SEQUENCE OF OPERATION - MODULATING CONTROL, and SEQUENCE OF OPERATION - SETBACK SCHEDULE sections.

If the user programs the setpoint **SETBACK** with the value **USED**, the E340 will control according to the Setback Steam Pressure (**STBK STM**) or Setback Water Temperature (**STBK WTR**) Setpoints. See SEQUENCE OF OPERATION - SETBACK OPERATION section.

Standby Thermal Shock Protection Mode:

To program the E340 to control a steam boiler in the "Standby Thermal Shock Protection Mode" to perform thermal shock protection by monitoring the boiler water temperature instead of steam pressure, the user programs the following setpoints which are found under SETPOINTS:

PRI TEMP (Primary Temperature): This selects the temperature sensor (connected to Terminals 69 and 70) that is installed to monitor the boiler water of a steam boiler, to operate in the "Standby"

mode. Program this setpoint to **STANDBY**. See GETTING STARTED - SELECT AND PROGRAM THE PRESSURE AND TEMPERATURE SENSOR RANGES section.

The following setpoints are immediately displayed once the Primary Temperature Sensor (**PRI TEMP**) is programmed for "Standby" operation (**STANDBY**): Primary Temperature Sensor (**PRI SP**), Cut In value (**CUT IN**), Cut Out value (**CUT OUT**), and Modulating Range (**MOD RNGE**). **These setpoints only apply to "Lag Mode" and "Setback Mode" operation. They have no affect on the Thermal Shock Protection mode of operation.**

If the E340 is not going to operate in a Lead/Lag operation or Setback operation, disregard these setpoints. The values programmed for these setpoints will have no affect. If the E340 will operate in a Lead/Lag operation, these setpoints **will apply**. See Lag Mode described above. If the E340 will operate in a Setback mode of operation, these setpoints **may apply**, depending if the setpoint **SET-BACK** is programmed with the value **STANDBY**. See Setback Mode described above.

Once the Primary Temperature setpoint (**PRI TEMP**) is programmed for **STANDBY**, the following setpoints associated with thermal shock protection are displayed as a function of temperature, not pressure:

- **TML STRT** (Thermal Shock Start Point): determines the start point for thermal shock protection - segment method.
- **TML EXIT** (Thermal Shock Exit Point): Determines the stop point for thermal shock protection - segment and low fire method.

Once the boiler water temperature reaches the Thermal Shock Exit Point (**TML EXIT**), the E340 will control the boiler according to steam pressure, not boiler water temperature, and the appropriate setpoints: Steam Pressure Setpoint (**STM SP**), Cut In setpoint (**CUT IN**), Cut Out setpoint (**CUT OUT**), and Modulating Range (**MOD RNGE**). Refer to Figure 12 . For a complete description, see SEQUENCE OF OPERATION - COLD START THERMAL SHOCK PROTECTION section.

FIGURE 12.

THML SHK = USED
TML MTHD = SEGMENT
TML START = 100^{0}F
TML EXIT = 220^{0}F
TML OVD = 30 MIN.

STM SP = 100 PSI
CUT IN = 0 PSI
CUT OUT = 10 PSI
MOD RNGE = 20 PSI

Once boiler water temperature reaches 220°F, E340 controls firing rate motor based on steam pressure.
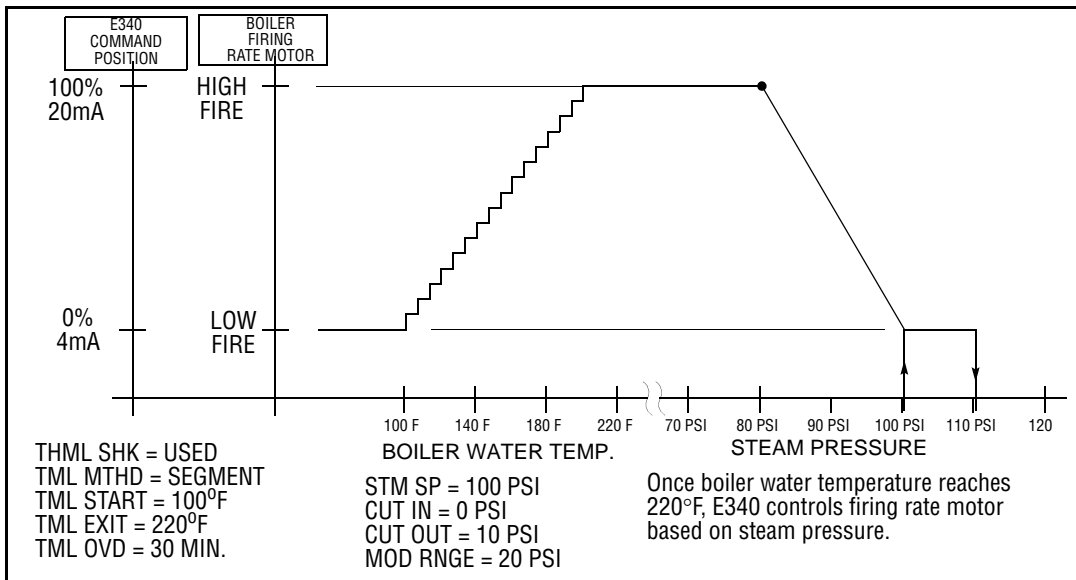
AUXILIARY ANALOG OUTPUT

The E340 provides a second 4 - 20 mA analog output (Terminals 47 and 48) which allows the user to select one of the five pressure or temperature sensors and provide a 4 - 20 mA output signal that is directly proportional to the value of the selected sensor. If Steam Pressure with a Range of 1-17PSIG is selected, then the Auxiliary Analog Output will be 4 mA @ 1 PSIG and will vary to 20mA @ 17 PSIG. No calibration is required.

The user could connect this output to a chart recorder to provide a hard copy record of the selected sensor. The setpoint for this function is **AUX AO 2** (Auxiliary Analog Output #2). The allowable options for this setpoint are **CMD RATE** (Command Rate), **GAS PRES** (Gas Pressure), **OIL PRES** (Oil Pressure), **STM PRES** (Steam Pressure), **PRI TEMP** (Primary Temperature), **AUX TEMP** (Auxiliary Temperature), and **UNUSED.**

MONITORING STACK TEMPERATURE

A temperature sensor can be installed to monitor the stack temperature of the boiler. A high limit alarm and marginal high limit alarm can be programmed for that sensor. When the high limit alarm is exceeded, the E340 will open its safety interlock circuit (Terminals 50 and 51) and the flame safeguard control will lockout the boiler[1], and an alarm message will be displayed on the LCD display of the E340. The Stack Temperature sensor can be programmed for either the Primary Temperature Sensor (**PRI TEMP**) or Auxiliary Temperature Sensor (**AUX TEMP**). See SELECT AND PROGRAM THE PRESSURE AND TEMPERATURE SENSOR RANGES - TEMPERATURE SENSORS section. The alarm message displayed when either the marginal high limit or high limit alarm is exceeded also depends on which temperature sensor was programmed to monitor Stack Temperature. See SEQUENCE OF OPERATION - HIGH AND LOW ALARM LIMITS and MARGINAL HIGH AND LOW ALARM LIMITS sections.

MONITORING OUTDOOR AIR TEMPERATURE

A temperature sensor can be installed to monitor outdoor air temperature. An operating inhibit setpoint (**OUT STPT**) can then be programmed so that when the outdoor air temperature is above this inhibit setpoint, the operating control circuit (Terminals 52 and 53) **will not respond to system demand and close**. Once the outdoor air temperature rises above the inhibit setpoint, the outdoor air temperature must fall three (3) degrees below the inhibit setpoint before the operating control circuit will respond to system demand. The setpoint **OUT SENS** is used to determine if the outdoor air sensor is assigned to the primary temperature (terminals 69 and 70) or the auxiliary temperature sensor (terminals 71 and 72).

*Note: On a hot water boiler, the outdoor temperature sensor **must** be programmed to AUX TEMP, since the PRI TEMP is required for the boiler hot water temperature sensor.See SELECT AND PROGRAM THE PRESSURE AND TEMPERATURE SENSOR RANGES - TEMPERATURE SENSORS section.*

To assign the outdoor air temperature to the auxiliary temperature sensor (terminals 71 and 72) and program an operating lockout setpoint of 60 F.

Press the **Set Points** key [Set Points] and the screen will display: **PRI FUEL** followed by

Press the **Next** key [Next] until the screen displays: **OUT SENS** followed by

Press the **Modify** key. [Modify] The **Prog** indicator lights up.

Press the **Up** or **Down** key [Up] [Down] until the screen displays: **AUX TEMP**

Press the **Enter** key [Enter] until the screen will displays: **OUT SENS** followed by **AUX TEMP.**

Press the **Next** key [Next] until the screen will displays: **OUT STPT** followed by **32 F**

[1.] **Note:** The Programmer Module of the flame safeguard control will determine its action (e.g. lockout, recycle) when its running interlock circuit is opened.

Press the **Modify** key. `Modify` The **Prog** indicator lights up.

Press the **Up** or **Down** key `Up` `Down` until the screen displays: **60 F**.

Press the **Enter** key `Enter` until the screen will displays: **OUT STPT** followed by **60 F**.

REMOTE COMMUNICATION SETPOINTS

There are a number of setpoints of the E340 that are associated with the remote communications capability of the E340. These setpoints found under the Set Points key are:

- **RTS DLY** (Request To Send Delay): Timing delay selectable in milli-seconds.
- **CMM PROT** (Communication Protocol): Selectable between MODBUS and Fireye (A-B) protocol.
- **MAST NUM** (Master Device Number): Address associated with the Supervisory "Master" Controller.
- **DEV NUM** (E340 Device Number): Address associated with each E340 connected on the Data Communication Link.
- **BAUD** (Baud Rate): Baud rate for communicating on the Data Communication Link.

These setpoints are only associated with the remote communication capability of the E340 and have no other affect on the operation of the control. The settings of these setpoints can be disregarded if remote communications is not used. These setpoints are discussed in detail in Bulletin BW-1000 which explains the set-up and operation of Remote Communications for the E340.

PROPORTIONAL PLUS INTEGRAL CONTROL

The E340 control provides the ability to program Proportional plus Integral control. This allows the user to improve on the reaction of the E340 control in response to load conditions/load changes that exceed the capability of the controlled system. The Integral control is designed to eliminate offset (variation from system setpoint) that is inherent with proportional only controls. The Integral Reset Time setpoint (RST TIME) will increase the output control signal a certain percentage at a programmed time interval or "reset rate." The Integral Reset Time setpoint (RST TIME) is programmable from 0 seconds to 60 seconds. If 0 is selected, the Integration constant is set to zero and the E340 operates as a proportional only controller. Programming a value from 1 to 60 will enable the Integral control function. The lower the programmed value for the reset time setpoint (RST TIME), the faster the system will attempt to correct any system offset.

Selecting the proper reset time (RST TIME) to match the performance of your system will be a method of trial and error. Caution should be applied when programming the RST TIME setpoint. Too low of a value could cause excessive cycling of the boiler or hunting of the firing rate motor. If Integral control is required for your application, initially program the RST TIME setpoint to 60, and observe how the system responds over time, and then lower the setpoint as necessary.

Note: The modulating range setpoint (MOD RNGE) will also affect the response of the E340 to varying load changes/conditions. Refer to MOD RNGE.

There are factors, such as the speed of the firing rate motor or the built-in hysteresis of the firing rate motor, which effect the response of the system to variations in the load that the E340 has no control over.

SOFTWARE PASSWORD PROTECTION

The E340 has software password protection with two levels of security to restrict unauthorized entry and modification of system setpoints and operating parameters. **Until the password is entered, a user can review the values of all setpoints and operating parameters, but not modify any of the setpoints.** The MODIFY key is disabled until the user enters the appropriate password. Each password level is a numeric value from 0 to 254. This offers over 64,000 possible password combinations.

IMPORTANT: THE E340 IS SHIPPED WITH THE SOFTWARE PASSWORD ENABLED. THE USER CANNOT PROGRAM ANY SETPOINTS OR OPERATING PARAMETERS UNTIL THE PASSWORD IS ENTERED, THE PASSWORDS SHIPPED WITH THE E340 ARE:

LEVEL 1 PASSWORD = 02
LEVEL 2 PASSWORD = 05

See ENTERING LEVEL 1 AND LEVEL 2 PASSWORDS section below.

ENTERING LEVEL 1 AND LEVEL 2 PASSWORDS

The E340 is shipped with the Level 1 Password set to 02, and the Level 2 Password set to 05. Anytime a user wants to program any setpoints, they will have to enter these values (or whatever password is programmed). If a password is programmed for either level, the screen will display Level 1 Password (**LV1 PASS**) and Level 2 Password (**LV2 PASS**) followed by zero, and the proper password must be entered. Once the password has been successfully entered, the mnemonic codes for the software passwords **will change** to Set Level 1 Password (**SET LVL1**) and Set Level 2 Password (**SET LV2**), allowing the user to change the passwords. See CHANGING LEVEL 1 AND LEVEL 2 PASSWORDS section. Following is an example of entering the Level 1 Password to 02 and the Level Password to 05.

Press the **Set Points** key and the screen will display: **PRI FUEL** followed by

Press the **Back** key twice and the screen will display: **LV1 PASS** followed by **0**.

Press the **Modify** key. The **Prog** indicator lights up.

Press the **Up** or **Down** key until the screen displays: **02**.

Press the **Enter** key and the screen will display: **LV1 PASS** followed by **02**.

Press the **Next** key and the screen will display: **LV2 PASS** followed by **0**.

Press the **Modify** key. The **Prog** indicator lights up.

Press the **Up** or **Down** key until the screen displays: **05**.

Press the **Enter** key and the screen will display: **LV2 PASS** followed by **05**.

Both passwords will now display Set Level 1 Password (**SET LV1**) and Set Level 2 Password (**SET LV2**), followed by their respective passwords (02 and 05). **These setpoints will continue to be displayed for five (5) minutes after the last key has been pressed.** See TIME OUT PERIOD section. The user can now change either of the two password protection levels (See CHANGING LEVEL 1 AND LEVEL 2 PASSWORDS section on page 34).

Time Out Period

Once the proper passwords have been entered, the user can modify any setpoints or operating parameters. If no key is pressed for a period of five (5) minutes, the time out period will expire and the passwords will have to be re-entered. While the user is modifying setpoints, the actual passwords will also be displayed after the setpoints **SET LV1** and **SET LV2** for a period of five (5) minutes after the last key is pressed. When leaving the E340, the Systems Test key can eliminate the five minute time out period, no longer displaying the passwords, and requiring the passwords to be re-entered to modify any system setpoints.

To eliminate the five minute time out period:

Press the **System Test** key [System Test] and the screen will display: **SYS TEST** followed by **OFF**.

Press the **Modify** key. [Modify] The **Prog** indicator lights up.

Press the **Up** key [Up] until the screen displays: **02**.

Press the **Enter** key [Enter]

The mnemonic codes now displayed for password protection are Enter Level 1 Password (**LVL1 PASS**) and Enter Level 2 Password (**LVL2 PASS**), followed by the value zero.

Note: See System Test key.

CHANGING LEVEL 1 AND LEVEL 2 PASSWORDS

Once the proper passwords have been entered, see ENTERING LEVEL 1 AND LEVEL 2 PASSWORDS section, the mnemonic codes displayed for password protection are Set Level 1 Password (**SET LV1**) and Set Level 2 Password (**SET LV2**) followed by their respective passwords. The user can now change either of the two password levels. Following is an example to change the Level 1 Password from 02 to 25, and the Level 2 Password from 05 to 41.

Enter 02 for Level 1 Password and 05 for Level 2 Password (or the appropriate passwords). See ENTERING LEVEL 1 AND LEVEL 2 PASSWORDS section.

Press the **Set Points** key [Set Points] and the screen will display: **PRI FUEL** followed by

Press the **Back** key twice [Back] and the screen will display: **SET LV1** followed by **02**.

Press the **Modify** key. [Modify] The **Prog** indicator lights up.

Press the **Up** or **Down** key [Up] [Down] until the screen displays: **25**.

Press the **Enter** key [Enter] and the screen will display: **SET LV1** followed by **02**.

Press the **Next** key [Next] and the screen will display: **SET LV2** followed by **05**.

Press the **Modify** key. [Modify] The **Prog** indicator lights up.

Press the **Up** or **Down** key [Up] [Down] until the screen displays: **41**.

Press the **Enter** key [Enter] and the screen will display: **SET LV2** followed by **41**.

Level 1 Password and Level 2 Password are now set to 25 and 41 respectively.

*Note: In order to simplify software password protection, the user can set a password for Level 1 Password (e.g. 25), and set a password of zero for Level 2 Password. In this manner, the user would only need to enter the Level 1 Password (**LV1 PASS**) to modify setpoints.*

Removing Password Protection

The user can remove software password protection by setting both Level 1 Password and Level 2 Password to zero. Any user will be able to modify any setpoint without entering a password. When a password protection has been removed, the mnemonic codes displayed are Set Level 1 Password (**SET LV1**) and Set Level 2 Password (**SET LV2**), followed by the value zero. The user can enable the password protection mode by changing Level 1 and/or Level 2 Passwords to a value other than zero.

SYSTEM TEST KEY

The System Test key offers a number of useful functions in the set-up and operation of the E340. Following is a description of those functions:

System Test 2	This function immediately disables the enabled password (e.g. time out feature of the password enables is forced to expire). The password will have to entered again to modify setpoints. This has no affect if a password has not been set. See ENTERING LEVEL 1 AND LEVEL 2 PASSWORDS - Time Out Period.
System Test 4	This function clears the number of burner cycles, burner hours, and system hours to zero. This information is found under the Sensor Values key.
System Test 7	This function allows the user to manually position the burner firing rate motor to any position to assist in the set-up and adjustment of the mod motor linkage. The flame safeguard control must be in automatic mode (Terminals 10 & 11 of the FLAME-MONITOR closed) to release the firing rate motor for movement. When this function is chosen, the E340 will display **CMD RATE**, followed by the present command signal to the firing rate motor. The **PROG** indicator will also light. Pressing the Up or Down key will manually change the command signal to the firing rate motor. If the Up or Down keys are not pressed for 5 minutes, this function will time out and the E340 will control the firing rate motor based on system demand. The user can also exit this function by depressing the Enter key or any top row key (e.g. Sensor Values, Set Points, etc.)
System Test 17	This function displays the last 10 lockout alarms of the E340 control. See SEQUENCE OF OPERATION - HIGH AND LOW ALARM LIMITS section. If no lockouts are stored, the E340 will display **SYSTEM TEST OFF**. See System Test 27.
System Test 27	This function will clear the last 10 lockout alarms of the E340 control. If no lockouts are stored, the E340 will display **SYSTEM TEST OFF**.
System Test 245	This function sets all of the setpoints back to their default values (e.g.: **GAS PRES = UNUSED**). See SYSTEM SETPOINTS - DEFAULT VALUES section. **To implement this function, select 245 fro System Test and turn off power to the control.** When power is restored, the E340 will have the factory default values.

To manually position the command signal to the firing rate damper motor:

Press the **System Test** key **System Test**   and the screen will display: **SYS TEST** followed by **OFF**.

Press the **Modify** key. **Modify** The **Prog** indicator lights up.

Press the **Up** key **Up**   until the screen displays: **07**.

Press the **Enter** key **Enter** and the screen will display: **CMD RATE** followed by the current command signal to the firing rate motor (e.g. 36%).

Press the **Up** or **Down** key **Up** **Down** to change to command signal (and the position of the firing rate motor).

Press the **Enter** key **Enter** (or any key in the top row)

When positioning the firing rate motor, if 5 minutes pass and neither the **Up** or **Down** key is pressed, this System test function is automatically cancelled. See **MOD USE** as an alternative method to manually position the firing rate motor.

SYSTEM SETPOINTS - DEFAULT VALUES

The E340 is shipped with a number of setpoints programmed as UNUSED. The E340 DOES NOT DISPLAY a number of other setpoints associated with those setpoints until those setpoints are programmed USED. The E340 is shipped with the following default setpoints:

MNEMONIC CODE	FULL LENGTH DESCRIPTORS				DEFAULT VALUES
PRI FUEL	PRIMARY	FUEL			UNUSED
SEC FUEL	SECNDARY	FUEL			UNUSED
STM PRES	STEAM	PRESSURE			UNUSED
PRI TEMP	PRIMARY	TEMP			UNUSED
AUX TEMP	AUXILIARY	TEMP			UNUSED
OUT SENS	OUTDOOR	TEMP	SENSOR	METHOD	UNUSED
MOD FDBK	MOTOR	FEEDBACK	POSITION		UNUSED
THML SHK	THERMAL	SHOCK			UNUSED
LEAD LAG	LEAD LAG	INPUT	CONTROL		UNUSED
RTS DLY	CLEAR TO	SEND	DELAY		0 - 255 (INCREMENTS OF 5)
CMM PROT	COMMUNIC	PROTOCOL			A-B
MAST NUM	MASTER	NUMBER	DECIMAL	= * OCTAL	0= *0 / 255 =*377
DEV NUM	DEVICE	NUMBER	DECIMAL	= * OCTAL	0= *0 / 255 =*377
BAUD	BAUD	RATE			300
REV NUM	REVISION	NUMBER			9.A
STRT CHK	GAS	PRESSURE	START	CHECK	YES
CNV UNIT	UNITS OF	CNVRSION			ENGLISH
AUX AO 2	AUXILIARY	ANALOG	OUTPUT 2		UNUSED
MARG ALM	MARGINAL	ALARM			UNUSED
MOD USE	MODULATE	MOTOR	POSITION	OPTIONS	AUTO
MOD MAX	MODULATE	MOTOR	MAXIMUM	POSITION	100%
PRI FUEL	PRIMARY	FUEL	SELECTED		GAS
SEC FUEL	SECNDARY	FUEL	SELECTED		OIL
RST TIME	INTEGRAL	RESET	DELAY	TIME	0
LV1 PASS	LEVEL 1	PASSWORD			0
LV2 PASS	LEVEL 2	PASSWORD			0

Note: For a complete list of system setpoints and their allowable values. See PROGRAM/REVIEW SETPOINTS.

PROGRAM/REVIEW SETPOINTS

The user can program 53 setpoints associated with the operation of the E340. Following is a list of those setpoints in the order in which they are displayed. The list includes mnemonic code, full length descriptor and allowable ranges.

*Note: Some mnemonic codes may not be displayed until the appropriate setpoint is programmed **USED**. For example, if the setpoint Marginal Alarm (**MARG ALRM**) is programmed **UNUSED**, then all the marginal alarm setpoints associated with the pressure and temperature sensors are not displayed (e.g. **LPF MARG, HPF MARG, HSP MARG,** etc).*

MNEMONIC CODE	FULL LENGTH DESCRIPTORS					ALLOWABLE VALUES
PRI FUEL	PRIMARY	FUEL				UNUSED 0-16I / 0-32I / 0-160I / 1-17P / 10-170P / 10-330P, 50-850P
LPF ALARM	LOW	LIMIT	PRIMARY	FUEL		SEE TABLE "A"
LPF MARG	MARGINAL	LOW	LIMIT	PRIMARY	FUEL	SEE TABLE "A"
HPF MARG	MARGINAL	HIGH	LIMIT	PRIMARY	FUEL	SEE TABLE "A"
HPF ALARM	HIGH	LIMIT	PRIMARY	FUEL		SEE TABLE "A"
SEC FUEL	SECNDARY	FUEL				UNUSED, 10-170P, 10-330P, 50-850P, 0-16I, 0-32I, 0-160I, I-17P
LSF ALARM	LOW	LIMIT	SCNDARY	FUEL		SEE TABLE "A"
LSF MARG	MARGINAL	LOW	LIMIT	SCNDARY	FUEL	SEE TABLE "A"
HSF MARG	MARGINAL	HIGH	LIMIT	SCNDARY	FUEL	SEE TABLE "A"
HSF ALARM	HIGH	LIMIT	SCNDARY	FUEL		SEE TABLE "A"
STM PRES	STEAM	PRESSURE				UNUSED / 1-17P / 1-33P / 10-170P / 10-330P / 50-850P
STM SP	STEAM	PRESSURE	SETPOINT			SEE TABLE "A"
CUT IN	BOILER	CUT IN				SEE TABLE "B"
CUT OUT	BOILER	CUT OUT				SEE TABLE "B"
MOD RNGE	MODULATE	RANGE				SEE TABLE "B"
LSP MARG	MARGINAL	LOW	LIMIT	STEAM	PRESSURE	SEE TABLE "A"
HSP MARG	MARGINAL	HIGH	LIMIT	STEAM	PRESSURE	SEE TABLE "A"
HSP ALRM	HIGH	LIMIT	STEAM	PRESSURE		SEE TABLE "A"
PRI TEMP	PRIMARY	TEMP				UNUSED/WATER/STANDBY/STACK
WTR SP	WATER	TEMP	SETPOINT			SEE TABLE "A"
CUT IN	BOILER	CUT IN				SEE TABLE "B"
CUT OUT	BOILER	CUT OUT				SEE TABLE "B"
MOD RNGE	MODULATE	RANGE				SEE TABLE "B"
LPT MARG	MARGINAL	LOW	LIMIT	PRIMARY	TEMP	SEE TABLE "A"
HPT MARG	MARGINAL	HIGH	LIMIT	PRIMARY	TEMP	SEE TABLE "A"
HPT ALRM	HIGH	LIMIT	WATER	TEMP		SEE TABLE "A"
AUX TEMP	AUXILIARY	TEMP				UNUSED/OIL TEMP/STACK/MONITOR
LAT ALRM	LOW	LIMIT	AUXILIARY	TEMP		SEE TABLE "A"
LAT MARG	MARGINAL	LOW	LIMIT	AUXILIARY	TEMP	SEE TABLE "A"
HAT MARG	MARGINAL	HIGH	LIMIT	AUXILIARY	TEMP	SEE TABLE "A"
HAT ALRM	HIGH	LIMIT	AUXILIARY	TEMP		SEE TABLE "A"
OUT SENS	OUTDOOR	TEMP	SENSOR	METHOD		UNUSED/PRIMARY/ AUXILIARY
OUT STPT	OUTDOOR	SETPOINT				SEE TABLE "A"
MOD FDBK	MOTOR	FEEDBACK	POSITION			USED / UNUSED

THML SHK	THERMAL	SHOCK				UNUSED / SEGMENT / LOW FIRE
TML STRT	THERMAL	SHOCK	START	POINT		SEE TABLE "A"
TML EXIT	THERMAL	SHOCK	EXIT	POINT		SEE TABLE "A"
TMD OVRD	TIMED	OVERRIDE	PERF	SEGMENT		1 - 60 MINUTES
LEAD LAG	LEAD LAG	INPUT	CONTROL			USED / UNUSED
LAG SP or	LAG LAG	STEAM WATER	PRESSURE TEMP	SETPOINT SETPOINT		SEE TABLE "A" SEE TABLE "A"
CUT IN	LAG	BOILER	CUT IN			
CUT OUT	LAG	BOILER	CUT OUT			SEE TABLE "B"
MOD RNGE	LAG	BOILER	RANGE			SEE TABLE "B"
LAG STRT	LAG	TO	START	DELAY		1 - 15 MINUTES
LAG DLY	LEAD	TO	LAG	DELAY		1 - 15 MINUTES
OVRD HRS	TIMED	SETBACK	OVERRIDE	HOURS		1 - 8 HOURS
RTS DLY	REQUEST TO	SEND	DELAY			0 - 255 (INCREMENTS OF 5)
CMM PROT	COMMUNIC	PROTOCOL				A-B/MODBUS
MAST NUM	MASTER	NUMBER	DECIMAL	=*OCTAL		0 = *0/255 = *377
DEV NUM	DEVICE	NUMBER	DECIMAL	=*OCTAL		0 = *0/255 = *377
BAUD	BAUD	RATE				300 /1200 / 2400 / 4800 / 9600
REV NUM	REVISION	NUMBER				13.B
STRT CHK	GAS	PRESSURE	START CHECK			YES, NO
CNV UNIT	UNITS OF	CNVRSION				ENGLISH, METRIC
AUX AO 2	AUXILARY	ANALOG OUTPUT 2				UNUSED, PRI FUEL, SEC FUEL, PRI TEMP, AUX TEMP, STM PRES
MARG ALM	MARGINAL	ALARM				USED / UNUSED
MOD USE	MODULATE	MOTOR	POSITION	OPTIONS		AUTO/MANUAL
MOD POS	MODULATE	MOTOR	FIXED	POSITION		0 -100%
MOD MAX	MODULATE	MOTOR	MAXIMUM	POSITION		0 -100%
PRI FUEL	PRIMARY	FUEL	SELECTED			GAS/OIL
SEC FUEL	SECNDARY	FUEL	SELECTED			OIL/GAS
RST TIME	INTEGRAL	RESET	DELAY	TIME		0-60
SET LV1	SET	LEVEL 1	PASSWORD			0 - 254
SET LV2	SET	LEVEL 2	PASSWORD			0 - 254
LV1 PASS	ENTER	LEVEL 1	PASSWORD			0 - 254
LV2 PASS	ENTER	LEVEL 2	PASSWORD			0 - 254

ALLOWABLE VALUES

The allowable values that are displayed for the high and low alarm and marginal alarm limits will vary depending on the specific range that is selected for a pressure or temperature sensor. Table "A" lists the allowable ranges that are displayed when the indicated range is selected for the temperature or pressure sensor. Table "B" lists the allowable values for the setpoints **CUT IN**, **CUT OUT**, and **MOD RNGE** for the various pressure or temperature ranges.

TABLE A - ALLOWABLE VALUES

SELECTED SENSOR RANGES	ALLOWABLE VALUES OF SETPOINTS (STM SP, STM HI 1, etc.) FOR SELECTED SENSOR RANGES
0 - 16I	1.00I to 15.00I in appropriate increments.
0 - 32I	2.00I to 30.00I in appropriate increments.
0 - 160I	10.0I to 150.0I in appropriate increments.
1 - 17P	2.00P to 16.00P in appropriate increments.
1 - 33P	3.00P to 31.00P in appropriate increments.
10 - 170P	20.0P to 160.0P in appropriate increments.
10 - 330P	30.0P to 310.0P in appropriate increments.
50 - 850P	100P to 800P in appropriate increments.
32 - 750° F	32F to 500F in appropriate increments.
0 - 400° C	0.0C to 260.0C in appropriate increments.

TABLE B - ALLOWABLE VALUES

SENSOR RANGES	ALLOWABLE VALUES OF SETPOINTS (CUT IN*, CUT OUT, MOD RNGE) FOR SELECTED SENSOR RANGES
1 - 17 P	.3P to 6.0P in appropriate increments.
1 - 33 P	.3P to 6.0P in appropriate increments.
10 - 170 P	3P to 60P in appropriate increments.
10 - 330 P	3P to 60P in appropriate increments.
50 - 850 P	3P to 60P in appropriate increments.
32 - 750° F	3° F to 60° F in appropriate increments.
0 - 400° C	3° C to 60° C in appropriate increments.

*Lower range for **CUT IN** setpoint is zero.
I = Inches Water Column   P = PSIG   F = Degrees Fahrenheit   C = Degrees Centigrade

REVIEW OR PROGRAM SETPOINTS - EXAMPLE

To program a High Steam Pressure Limit of 13 PSI:

Press the **Set Points** key [Set Points] and the screen will display: **PRI FUEL** followed by

Press the **Next** key [Next] until the screen displays: **HSP ALRM** followed by its current value.

Press the **Modify** key [Modify] and the **Prog** indicator will light up.

Press the **Up** or **Down** key, [Up] [Down] whichever is appropriate, until the screen displays: **13.0 P.**

*Note: If the Password Protection is enabled, the Up and Down keys **will not** respond until the password is entered. You have to enter the password to modify any setpoints. See ENTERING LEVEL 1 AND LEVEL 2 PASSWORDS.*
Press the **Enter** key [Enter] and the screen will display: **HSP ALRM** followed by **13.0P**

NOTE: Holding down the NEXT or BACK key will scroll through the mnemonic codes.

REVIEW SENSOR VALUES

The Keypad/Display Module allows the user to review the status of the sensor values (3 pressure sensors, 2 temperature sensors, 8 digital inputs, and firing rate motor position). Following is a list of those sensor values in the order in which they are displayed. The list includes the sensor's mnemonic code, its full length descriptor, and allowable values.

MNEMONIC CODE	FULL LENGTH DESCRIPTOR				ALLOWABLE VALUES
PRI FUEL[1]	GAS	PRESSURE			RANGE OF SENSOR SELECTED
SEC FUEL[1]	OIL	PRESSURE			RANGE OF SENSOR SELECTED
STM PRES	STEAM	PRESSURE			RANGE OF SENSOR SELECTED
PRI TEMP	PRIMARY	TEMP			RANGE OF SENSOR SELECTED
AUX TEMP	AUXILIARY	TEMP			RANGE OF SENSOR SELECTED
FIRE RTE	FIRING	RATE	MOTOR	POSITION	0-100%
OPER MDE	OPERATIN	MODE			LEAD/LAG / SETBACK
STBK OVR	DIGITAL	INPUT 3			ACTIVE/INACTIVE
FUEL SEL	FUEL	SELECTED			GAS / OIL / HVY OIL
FUEL VLV	MAIN	FUEL	VALVE		CLOSED / OPEN
BNR CYCS	BURNER	CYCLES			NUMBER OF BURNER CYCLES
BNR HRS	BURNER	HOURS			NUMBER OF HOURS FUEL VALVE IS OPEN
SYS HRS	SYSTEM	HOURS			NUMBER OF HOURS E340 IS POWERED

[1] The E340 will display the function selected for the primary fuel (PRI FUEL) and secondary fuel (SEC FUEL): GAS PRESS or OIL PRESS.

REVIEW SENSOR VALUES - EXAMPLE

To review the Steam Pressure:

Press the **Sensor Values** key   `Sensor Values`   and the screen will display: **GAS PRES**[1] followed by the actual gas pressure.

Press the **Next** key twice   `Next`   and the screen will display: **STM PRES** followed by the current steam pressure.

Press the **Help** key   `Help`   and the screen will display: **STEAM PRESSURE** followed by the current steam pressure.

[1] The E340 will display the function selected for the primary fuel (PRI FUEL) and secondary fuel (SEC FUEL): GAS PRESS or OIL PRESS.

REVIEW OUTPUT VALUES

The Keypad/Display Module allows the user to review the values of all of the output values (2 analog outputs and 4 digital outputs). Following is a list of those outputs in the order in which they are displayed. The list includes the output value's mnemonic code, its full-length descriptor, and allowable values.

| MNEMONIC CODE	FULL LENGTH DESCRIPTOR			ALLOWABLE VALUES
CMD RATE	FIRING	RATE	COMMAND	0 - 100%
AUX AO 2	AUXILIARY	ANALOG	OUTPUT 2	4 - 20 MA
OPER CTL	OPERATING	CONTROL		OPEN / CLOSED
SFTY CKT	SAFETY	CIRCUIT		OPEN / CLOSED
ALARM	E340	ALARM	CONDITION	OFF / ON / MARGINAL
AUX RLY	AUXILIARY	RELAY		OPEN / CLOSED

REVIEW OUTPUT VALUES - EXAMPLE

To review the status of the operating control circuit:

Press the **Output Values** key

| Output Values |

and the screen will display: CMD RATE followed by the position the firing rate motor is being commanded to move by the E340.

Press the **Next** key twice

| Next |

and the screen will display: OPER CTL followed by the status of the operating control relay of the E340 (OPEN or CLOSED).

Press the **Help** key

| Help |

and the screen will display: OPERATING CONTROL followed by the status of the operating control relay of the E340 (OPEN or CLOSED).

PROGRAM/REVIEW TIME AND SETBACK SCHEDULES

The Keypad/Display Module allows the user to program and review the values Time of Day, Day of Week, and Setback Schedule. Following is a list of those setpoints in the order in which they are displayed. The list includes the output value's mnemonic code, its full length descriptor, and allowable values.

*Note: Some mnemonic codes may not be displayed until the appropriate setpoint is programmed **USED**. For example, if the setpoint Setback Schedule (**SETBACK**) is programmed **UNUSED**, then **END STBK, BGN STBK, STBK STM,** through **STBK SAT** are not displayed*

MNEMONIC CODE	FULL LENGTH DESCRIPTOR				ALLOWABLE VALUES
TIME	TIME				12:00 AM - 12:00 PM
DAY	DAY				SUNDAY / MONDAY . . . SATURDAY
SETBACK	SETBACK	SCHEDULE			USED / UNUSED / STANDBY
END STBK	END	SETBACK	PERIOD		12:00 AM - 12:00 PM
BGN STBK	BEGIN	SETBACK	PERIOD		12:00 AM - 12:00 PM
STBK STM or STBK WTR	SETBACK SETBACK	STEAM WATER	PRESS TEMP		SEE TABLE "A" SEE TABLE "A"
CUT IN	BOILER	CUT IN			SEE TABLE "B"
CUT OUT	BOILER	CUT OUT			SEE TABLE "B"
MOD RNGE	MODULATE	RANGE			SEE TABLE "B"
STBK SUN	SUNDAY	SETBACK	OPTIONS		ALL STBK / NO STBK / SCHEDULE
STBK MON	MONDAY	SETBACK	OPTIONS		ALL STBK / NO STBK / SCHEDULE
STBK TUE	TUESDAY	SETBACK	OPTIONS		ALL STBK / NO STBK / SCHEDULE
STBK WED	WEDNESDAY	SETBACK	OPTIONS		ALL STBK / NO STBK / SCHEDULE
STBK THU	THURSDAY	SETBACK	OPTIONS		ALL STBK / NO STBK / SCHEDULE
STBK FRI	FRIDAY	SETBACK	OPTIONS		ALL STBK / NO STBK / SCHEDULE
STBK SAT	SATDAY	SETBACK	OPTIONS		ALL STBK / NO STBK / SCHEDULE
PROG ON	PROGRAM	RELAY	ON TIME		UNUSED / OPER CTL / AUX RLY
BGN ON	BEGIN	ON TIME	PERIOD		12:00 AM - 12:00 PM
END ON	END	ON TIME	PERIOD		12:00 AM - 12:00 PM
PROG SUN	SUNDAY	PROGRAM	ON TIME	OPTIONS	ALL OFF / ALL ON / SCHEDULE
PROG MON	MONDAY	PROGRAM	ON TIME	OPTIONS	ALL OFF / ALL ON / SCHEDULE
PROG TUE	TUESDAY	PROGRAM	ON TIME	OPTIONS	ALL OFF / ALL ON / SCHEDULE
PROG WED	WEDNESDAY	PROGRAM	ON TIME	OPTIONS	ALL OFF / ALL ON / SCHEDULE
PROG THU	THURSDAY	PROGRAM	ON TIME	OPTIONS	ALL OFF / ALL ON / SCHEDULE
PROG FRI	FRIDAY	PROGRAM	ON TIME	OPTIONS	ALL OFF / ALL ON / SCHEDULE
PROG SAT	SATDAY	PROGRAM	ON TIME	OPTIONS	ALL OFF / ALL ON / SCHEDULE

PROGRAM/REVIEW TIME AND SETBACK SCHEDULES - EXAMPLE

To program the E340 to operate in the setback mode from 7:00 until 5:30AM, Monday through Friday, and always operate in the setback mode on weekends:

Press the **Time/Sched** key [Time Sched] and the screen will display: **TIME** followed by the current time of day.

Press the **Next** key twice [Next] and the screen will display: **SETBACK** followed by **UNUSED**.

NOTE: If **SETBACK** *is programmed* **USED**, *skip the next three steps.*

Press the **Modify** key [Modify] and the value will remain on the display.

Press the **Up** key [Up] and the screen will display: **USED**.

Note: If the Password Protection is enabled, the UP and DOWN keys will NOT respond until the password is entered. You have to enter the password to modify any setpoints. See ENTERING LEVEL 1 and LEVEL 2 PASSWORDS.

Press the **Enter** key [Enter] and the screen will display: **SETBACK** followed by **USED**.

Press the **Next** key [Next] and the screen will display: **END STBK** followed by 12:00 AM or the last programmed time.

Press the **Modify** key. [Modify]

Press the **Up** or **Down** key [Up] [Down] until the screen displays: **5:30 AM**.

Press the **Enter** key [Enter] and the screen will display: **END STBK** followed by 5:30 AM.

Press the **Next** key [Next] and the screen will display: **BGN STBK** followed by 12:00 AM or the last programmed time.

Press the **Modify** key. [Modify]

Press the **Up** or **Down** key [Up] [Down] until the screen displays: **7:00 PM**.

Press the **Enter** key [Enter] and the screen will display: **BGN STBK** followed by **7:00 PM**

Press the **Next** key [Next] and the screen will display: **STBK SUN** followed by 12:00 AM or the last programmed time.

Press the **Modify** key. [Modify]

Press the **Up** or **Down** key [Up] [Down] until the screen displays: **SCHEDULE**.

Press the **Enter** key [Enter] and the screen will display **STBK MON** followed by **SCHEDULE**.

Program the value **SCHEDULE** for **STBK TUE**, **STBK WED**, **STBK THU**, and **STBK FRI.**

Program the value **ALL STBK** and **STBK SAT**.

Note: The above example only programmed the beginning and ending times for the setback schedules, and the days of the week to which the schedule applies. In addition, you, must also program the setpoints for Steam Pressure Setback (STBK STM) or Hot Water Setback (STBK WAT), cut In value (CUT IN), Cut Out value (CUT OUT), and Modulating Range (MOD RNGE). See SEQUENCE OR OPERATION - OPERATING CONTROL and SEQUENCE OF OPERATION - MODULATING CONTROL sections for an explanation of these functions.

NOTICE

When Fireye products are combined with equipment manufactured by others and/or integrated into systems designed or manufactured by others, the Fireye warranty, as stated it its General Terms and Conditions of Sale, pertains only to the Fireye products and not to any other equipment or to the combined system or its overall performance.

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