



# BOILER MANAGEMENT CONTROL SYSTEM

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## DESCRIPTION

The Boiler Management Control System shall incorporate a microprocessor based design and provide the operating control function of the boiler system and modulation control of fuel and combustion air as well as the firing rate motor to meet system demand.

The control system shall be provided by Fireye Inc. or written approved equal.

### Sensors

The control shall utilize signal inputs from solid state sensors as inputs for on/off control, modulation control, and high and low alarm limits of the appropriate pressure and temperature sensors.

### Flame Safeguard Control

The Boiler Management Control System shall interface and operate in conjunction with an accompanying flame safeguard control system, relying on the Flame Safeguard Control to provide:

1. Automatic sequencing of the boiler system through prepurge, pilot trial for ignition (PTFI), main trial for ignition (MTFI), run, and post purge.
2. Flame proving and lockout on flame failure during PTFI, MTFI, and run.

### Codes and Standards

The control shall be listed by Underwriters Laboratories, Factory Mutual, and Canadian Standards Associates for its intended purposes.

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## SYSTEM HARDWARE

### Boiler Room Control

The micro-processor based control shall have the following hardware capabilities:

Two (2) normally open (NO) isolated digital outputs to provide the following functions:

**Operating Control** (wired to operating control circuit of the flame safeguard control).

**Safety Circuit Interlock** (wired to running interlock circuit of the flame safeguard control).

The contact rating for these outputs shall be 5 amps @ 120 VAC.

Two (2) normally open low voltage digital output to provide the following functions:

Alarm output relay.

Auxiliary relay (Controlled by time schedule).

The contact rating for these outputs shall be 5 amps @ 24 VAC or 24 VDC.

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Four (4) digital inputs to monitor the following functions:

- Fuel selector switch for gas operation.
- Fuel selector switch for oil operation.
- Fuel selector switch for heavy oil operation.
- Status of Main Fuel Valve from flame safeguard control.

These inputs shall be rated @ 120 volts (-15% to +10%) input.

Three (3) low voltage digital inputs to monitor the following functions:

- Input to select Lead/Lag operation
- Input to initiate Setback Mode.
- Input to override Setback Mode for a user defined time period (1 to 8 hours).
- This shall be a momentary contact.
- These inputs shall be dry contacts only.

Three (3) analog inputs to monitor:

- Steam Pressure
- Gas Pressure
- Oil Pressure

The input control signal shall be 1-5 VDC.

Two (2) analog inputs to monitor:

- Hot Water or Stack or Outdoor Air Temperature or Boiler Water Temperature of a Steam Boiler.
- Oil or Stack Temperature

The input control signal shall be resistive input. 1000 ohms @ 0°C.

Two (2) proportional analog outputs for:

- Modulation control of firing rate damper motor.
- Selectable output signal based on the value of one of the 5 analog inputs.
- Each proportional output shall be 4-20 ma.

The control shall have a built-in clock to set the time of day, day of week, and setback schedule of operating system setpoint.

Power to the control shall be 24 VAC. During an interruption of AC power, a Lithium type battery shall maintain all programmed system setpoints and clock functions for up to one year @ 77°F (25°C).

The control (without keypad/display) shall operate within the following limits:

- Temperature: -40°F to 140°F (-40°C to 60°C).
- Humidity: 0% to 85% Non-condensing.
- Supply Voltage: 24 VAC (+10%, -15%) 50/60 Hz.
- Power Consumption: 20 VA maximum.



The keypad/display module shall operate within the following temperature limits:

Temperature: 15°F to 130°F (-9°C to +54°C).

The control shall have the following storage temperature limits:

Temperature: -40°F to 158°F (-40°C to 70°C).

Humidity: 0% to 85% Non-condensing.

### **Wiring Base**

A wiring base shall be provided which will allow for all system terminations to be completely wired prior to the installation of the control. The control shall be removable or replaceable without removing any wiring terminations.

### **Keypad/Display Module**

A plug-in module shall be provided to program and/or review all system setpoints as well as all system operating parameters (e.g.: values of the analog and digital inputs and outputs).

The module shall consist of an eight (8) character liquid crystal display (LCD) and functional 12-key, positive action keypad.

A descriptive 8 character mnemonic code shall be provided for all system setpoints and operating parameters. In addition, a complete full length descriptor shall be available to the user for display on the LCD screen. Systems and codes requiring look-up tables are unacceptable.

The keypad/display module shall operate within the following temperature limits: 15°F to 130°F (-9°C to 54°C).

### **Pressure Sensors**

All pressure sensors shall be factory calibrated to provide accurate pressure control over the entire pressure range of the sensor. No field calibration or adjustment is required.

The following pressure ranges shall be available:

0-16" Water Column

0-32" Water Column

0-160" Water Column

1-17 PSI

1-33 PSI

10-170 PSI

10-330 PSI

50-850 PSI

### **Temperature Sensors**

All temperature sensors shall be factory calibrated to provide accurate temperature control over the entire temperature range of the sensor. No field calibration or adjustment is required.

The following temperature range shall be available:

0°

32°F to 752°F (0°C to 400°C)



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## SYSTEM SOFTWARE

### System Setpoints

The control shall have over 50 setpoints to configure the control to meet all requirements. These setpoints shall include but not be limited to: steam pressure setpoint, water temperature setpoint, boiler cut in, boiler cut out, modulating range, maximum firing rate position, high and low limit steam pressure alarm, high and low limit water temperature alarm, high and low limit gas pressure alarm, high and low limit oil pressure alarm, high and low limit oil temperature alarm, thermal shock method, thermal shock start point, thermal shock exit point, etc.

### Sequence of Operation

The control shall maintain the steam pressure (or water temperature) setpoint by monitoring the appropriate pressure or temperature sensors and energizing the operating control output and modulating the firing rate damper motor to meet system demand.

The control shall provide cold start thermal shock to slowly increase the burner firing rate on a cold start to limit mechanical stress due to thermal differences.

The control shall offer two methods of thermal shock protection (low fire and segment).

Low fire method shall hold the firing rate motor at low fire until the thermal shock exit point is reached. This exit point is user defined.

Segment method shall go from low fire to high fire in 16 separate segments, increasing to the next segment based on increasing steam pressure (or water temperature) values, or a user defined timed override (1-60 minutes).

Segment method shall provide user defined start point and exit point.

The user shall be able to define the maximum firing rate motor position.

The control shall provide a built-in clock to provide setback of steam pressure or water temperature.

The user shall define steam pressure (or water temperature) setpoint, boiler cut in, boiler cut out and modulating range for setback operation.

Control shall provide a timed override of the setback schedule via a momentary contact. Override period is user defined from 1 to 8 hours.

Control shall provide forced setback based on status of digital input.

The control shall provide lead/lag control of two boilers, each boiler equipped with its own control.

The user shall define steam pressure (or water temperature) setpoint, boiler cut in, boiler cut out, modulating range, lead to lag time delay, and lag start time delay for Lag Boiler operation.

Lead or Lag boiler status is determined by the status of a digital input.

The control shall be able to monitor the boiler water temperature of a steam boiler and use this input to control the boiler during setback operation, cold start thermal shock, or standby operation of the Lag boiler. (e.g.: maintain the boiler water at a "standby temperature" so the boiler is ready and available to come on-line and deliver steam to support the Lead boiler). High/Low Alarm Limits

The control shall utilize the signal inputs from solid state sensors to provide the high and low safety limit functions.

The steam pressure (or water temperature) high limit remains in the running interlock circuit of the flame safeguard control.

The following alarm limits are user defined:

High steam pressure.

High water temperature.

High and low gas pressure.

High and low oil pressure.

High and low oil temperature.

High stack temperature.



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In the event any of the above alarm limits are exceeded, the control shall close its alarm output, open its safety interlock circuit (which is wired into the running interlock circuit of the flame safeguard control), and display an appropriate alarm message.

High and low marginal alarm limits for all sensor inputs (see 3.3.1) shall also be user defined to annunciate approaching alarm limits. When the marginal alarm limits are exceeded, the control shall pulse its alarm output circuit.

### **Safety Provisions**

The control shall continually perform a self-check analysis for proper circuit operation and open its safety interlock should any test fail.

The control shall perform a dynamic gas and oil pressure sensor check to insure that the sensor registers zero pressure when no pressure is present.

A software password protection (two levels of security - 64,000 possible combinations) shall restrict unauthorized entry and modification of system setpoints and operating parameters.

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## **REMOTE COMMUNICATIONS**

The boiler management control shall operate either as an independent stand alone control, or as part of a distributed system network. In a distributed system network, multiple controllers are connected via a data link (a single, twisted shielded pair wire) to a Supervisory Master Controller (e.g.: IBM compatible computer).

Up to 32 boiler management controls can be connected together in a multi-drop configuration on a single data link.

The communication protocol for the distributed system network shall be DF1 or MODBUS (user selectable).

The distributed system network shall offer selectable baud rates up to 9600 baud.

A Communications Software Program (E720W or E720) shall allow the Master Controller to:

- Review or program system setpoints and operating parameters.

- Review the status of all system inputs and outputs.

- Program and review high and low alarm limits.

The Supervisory Master Controller shall also be able to communicate with a Boiler Management Controls over standard voice grade telephone lines.

### **Wiring**

All wiring shall be in accordance with the National Electrical Code and local electrical codes.

The installing contractor shall be responsible for insuring that the conduit size and wire size, type, and quantities are applicable for the installation and equipment supplied.



PRODUCT INFORMATION	
Part Number	Description:
E340	Boiler Room Control. Includes Chassis, Keypad/Display Module, and Dust Cover.
EP340	Programmer Module for E340 Boiler Room Control.
E342	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
PS348-1	Pressure Sensor. Range: 0-16" Water Column.
PS348-2	Pressure Sensor. Range: 0-32" Water Column.
PS348-3	Pressure Sensor. Range: 0-160" Water Column.
PS348-4	Pressure Sensor. Range: 1-17 PSI.
PS348-5	Pressure Sensor. Range: 1-33 PSI.
PS348-6	Pressure Sensor. Range: 10-170 PSI.
PS348-7	Pressure Sensor. Range: 10-330 PSI.
PS348-8	Pressure Sensor. Range: 50-850 PSI.
TS348-2	Temperature Sensor. Range: 32°F to 752°F / 0°C to 400°C. 2" Probe Length.
TS348-4	Temperature Sensor. Range: 32°F to 752°F / 0°C to 400°C. 4" Probe Length.
TS348-8	Temperature Sensor. Range: 32°F to 752°F / 0°C to 400°C. 8" Probe Length.
E720W-CD	Communications Software Program for IBM Compatible PC. (Windows 95, 98).

## NOTICE

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

## WARRANTIES

FIREEYE guarantees for *one year from the date of installation or 18 months from date of manufacture* of its products to replace, or, at its option, to repair any product or part thereof (except lamps, electronic tubes and photocells) which is found defective in material or workmanship or which otherwise fails to conform to the description of the product on the face of its sales order. **THE FOREGOING IS IN LIEU OF ALL OTHER WARRANTIES AND FIREEYE MAKES NO WARRANTY OF MERCHANTABILITY OR ANY OTHER WARRANTY, EXPRESS OR IMPLIED.** Except as specifically stated in these general terms and conditions of sale, remedies with respect to any product or part number manufactured or sold by Fireeye shall be limited exclusively to the right to replacement or repair as above provided. In no event shall Fireeye be liable for consequential or special damages of any nature that may arise in connection with such product or part.



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