

E340 BOILER CONTROL INSTALLATION MANUAL

DESCRIPTION

The E340 Boiler Room Control is a microprocessor-based Boiler Management System designed to interface with existing Fireye "D" Series and FLAME-MONITOR Flame Safeguard control systems, as well as competitive flame safeguard systems. The E340 Boiler Room Control system consists of a Chassis, Plug-in Programmer Module, Plug-in Keypad/Display Module (for system configuration and display of system setpoints and operating parameters), Wiring Base, Solid State Sensors (gas, steam, and oil pressure, fuel oil and water temperature), and remote communications software.

Functions provided by the E340 include operating control function, modulating control function, safety limits (with the exception of high steam pressure or high hot water temperature), cold start thermal shock protection, lead/lag operation of two boilers, time-of-day clock for setback operation, remote communications capability using an IBM compatible PC, etc.

Refer to Bulletin E-3401 for a complete technical description of the monitoring and control capabilities of the E340, as well as information on the set-up and programming of the control. This bulletin provides information on system specifications, component dimensions, and the installation and wiring of the E340 Boiler Room Control. Refer to Bulletin ES-3481 for information on the installation and wiring of the pressure and temperature sensors. Refer to Bulletin E-7201 for information on the installation, set-up, and operation of the remote communication software program.

SYSTEM SPECIFICATIONS

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

OPERATING TEMPERATURE LIMITS:

-40°F (-40°C) to 140°F (60°C) (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, 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.

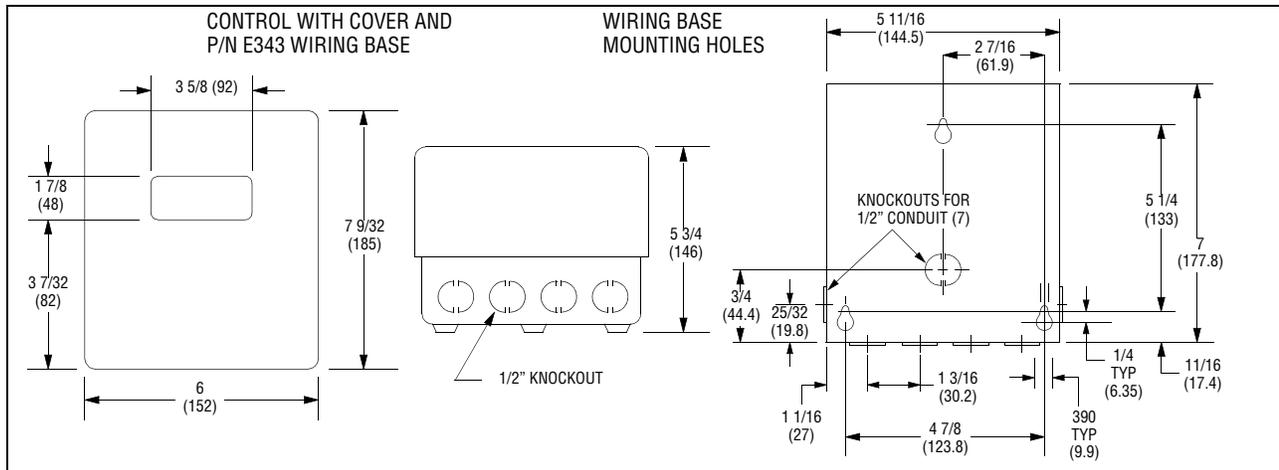
POWER REQUIREMENTS:

20 Watts (All relays energized)

STORAGE TEMPERATURE LIMITS:

-40°F (-40°C) to 158°F (70°C)

COMPONENT DIMENSIONS



SENSOR SPECIFICATIONS

OIL/GAS/STEAM PRESSURE RANGES:

- 0 to 16" water column
- 0 to 32" water column
- 0 to 160" water column
- 1.0 PSI to 17.0 PSI
- 1.0 to 33.0 PSI
- 10 to 170 PSI
- 10 to 330 PSI
- 50 to 850 PSI

All Pressure Sensors are 3-wire sensors.
Control signal: 1-5 VDC
Accuracy: ± 1% full scale



TEMPERATURE RANGES

- 32°F to 750°F
- 0°C to 400°C

Reference resistance: 1000 ohms @ 0°C

Temperature coefficient: .00385/Ω/Ω/°C

Accuracy: ± 2°F (1°C)

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	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 psig
PS348-5	Pressure Sensor. Range: 1-33 psig
PS348-6	Pressure Sensor. Range: 10-170 psig
PS348-7	Pressure Sensor. Range: 10-330 psig
PS348-8	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

E340 ORDERING INFORMATION



60-2223 Dust Cover



Mounting Screw
48-1805

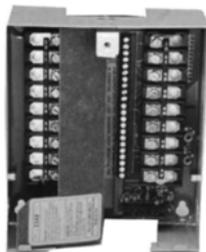
E340 consists of:
EB342 - Chassis
EB342 - Keypad/ Display Module
60-2223 - Dust Cover
Mounting Screw



EP340 Programmer Module



E345 Keypad/ Display Module



Wiring Base
E343 Surface Mounted
E344 Cabinet Mounted (shown)



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 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.
- Position of the **Firing Rate Damper Motor**. Resistive input (0-135Ω).
- 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	PRESSURE SENSORS	MARGINAL ALARMS & ALARM LIMITS
1	Gas Pressure	High and Low
2	Oil Pressure	High and Low
3	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) 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.

WIRING CONNECTIONS

All wiring must meet local and National Electrical Codes. The fish paper insulator covering the Left Terminal block is provided to isolate its line voltage loads from the low voltage loads connected to the Right Terminal Block and Sub-miniature Terminal block. (Shaded area denotes line voltage connections).

TERMINAL	LEFT TERMINAL BLOCK - LINE VOLTAGE
50	Running Interlock - FSG Control (Relay Output)
51	Running Interlock - FSG Control ¹ (Relay Output)
52	Operating Control - FSG Control ² (Relay Output)
53	Operating Control - FSG Control ² (Relay Output)
54	L2 (Neutral) - FSG Control ³
55	Main Fuel Valve - FSG Control ⁴ (Digital Input)
56	Fuel Selector Switch - Hvy Oil (Digital Input)
57	Fuel Selector Switch - Oil (Digital Input)
58	Fuel Selector Switch - Gas (Digital Input)
¹ Terminals 3 and P of Fireye FLAME-MONITOR and D-Series Flame Safeguard Controls. ² Terminals L1 and 13 of Fireye FLAME-MONITOR and D-Series Flame Safeguard Controls. ³ Terminal L2 of Fireye FLAME-MONITOR and D-Series Flame Safeguard Controls. ⁴ Terminal 7 of Fireye FLAME-MONITOR and D-Series Flame Safeguard Controls.	
TERMINAL	RIGHT TERMINAL BLOCK - LOW VOLTAGE
40	Earth Ground
41	24 VAC (Hot)
42	24 VAC (Common)
43	Alarm Output (Marginal and Alarm)
44	Auxiliary Relay Output
45	4 - 20 mA Analog Output - Firing Rate Motor (+)
46	4 - 20 mA Analog Output - Firing Rate Motor (-)
47	4 - 20 mA Selectable Analog Output (+)
48	4 - 20 mA Selectable Analog Output (-)
TERMINAL	SUB-MINIATURE BLOCK - LOW VOLTAGE
60	+24 VDC (Gas Pressure)
61	Sensor Return Line (Gas Pressure)
62	Gas Pressure Sensor
63	+ 24 VDC (Oil Pressure)
64	Sensor Return Line (Oil Pressure)
65	Oil Pressure Sensor



66	+ 24 VDC (Steam Pressure)
67	Sensor Return Line (Steam Pressure)
68	Steam Pressure Sensor
69	Water Temperature (or Outdoor Air, Stack, or standby Temp.) Sensor
70	Water Temperature (or Outdoor Air, Stack, or standby Temp.) Return Line
71	Auxiliary Temperature Sensor (for Oil Temp. Stack Temp., or Outdoor Air Temp.)
72	Auxiliary Temperature Return Line (for Oil Temp. Stack Temp., or Outdoor Air Temp.)
73	Damper Motor Position Feedback
74	Damper Motor Position Feedback
75	Forced Setback
76	Return Line - Digital Inputs
77	Lead/Lag Selector
78	Return Line - Digital Inputs
79	Setback Override
80	RS-485 Remote Communication Line (B)
81	RS-485 Remote Communication Line (A)

WIRING CONNECTIONS - LEFT TERMINAL BLOCK

Safety Circuit - Terminals 50 and 51

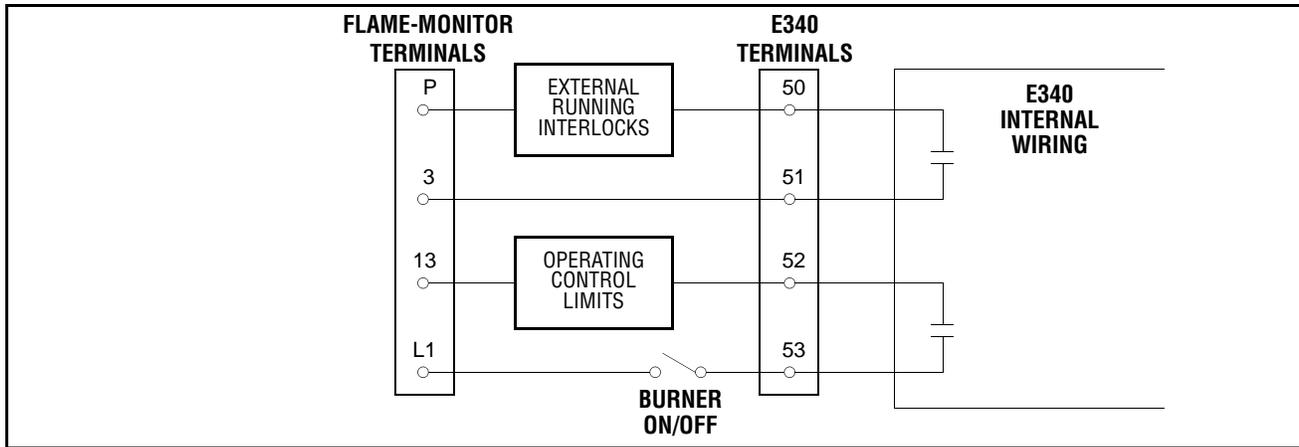
The Safety Circuit relay (Terminals 50 and 51) is wired in the running interlock circuit of the Flame Safeguard Control (Terminals 3 and P of the FLAME-MONITOR and D-Series controls). The safety circuit relay is wired **in series** with any other running interlock circuit (e.g.: high and low water cut-off, etc.). To help limit electrical noise frequencies, the safety circuit relay should be the **first circuit** wired in the running interlock circuit of the flame safeguard control. Refer to diagram below. See SEQUENCE OF OPERATION - HIGH AND LOW ALARM LIMITS section in Bulletin E-3401.



WARNING: An electro-mechanical steam pressure (or hot water) high limit switch MUST REMAIN in the running interlock circuit of the flame safeguard control.

Operating Control Circuit - Terminals 52 and 53

The Operating Control (Terminals 52 and 53) is wired in the operating control circuit of the Flame Safeguard Control (Terminals L1 and 13 of the FLAME-MONITOR and D-Series controls). The operating control is wired **in series** with any other operating control limit (e.g. burner on/off switch). The operating control should be the first circuit wired in the operating control circuit of the flame safeguard control after the burner on/off switch (if applicable). **Terminals 52 and 53 should be wired in the same location as the operating control would normally be found.** Refer to diagram below. See SEQUENCE OF OPERATION - OPERATING CONTROL section in Bulletin E-3401.



120 VAC Neutral (L2) - Terminal 54

To insure proper voltage reference between the E340 and flame safeguard control, Terminal 54 is wired to the 120 VAC Neutral connection of the flame safeguard control (Terminal L2 of the FLAME-MONITOR and D-Series control).

Main Fuel Valve - Terminal 55

Terminal 55 is wired to the main fuel valve connection of the flame safeguard control. (Terminal 7 of the FLAME-MONITOR and D-Series control).

Fuel Selector Switch - Terminals 56, 57, and 58

The E340 has three line voltage inputs (Terminals 56, 57, and 58) to monitor the status of a fuel selector switch that determines which pressure and temperature sensors the E340 control will monitor. For example, if the selector switch is in the position for "Oil", the E340 control will disregard the high and low alarm limits for gas pressure.

*Note: When "Heavy Oil" is selected, both the Oil and Heavy Oil inputs **must** be made.*

Note: If the associated sensor is programmed as UNUSED, the input is ignored.

Note: If fuel selection is not detected (all inputs open, E340 displays NONE for Fuel Selected), the E340 will remain at low fire.

WIRING CONNECTIONS - RIGHT TERMINAL BLOCK

Earth Ground - Terminal 40

A good earth ground is essential in the proper operation of the E340 Control.

Powering the Control (24 VAC) - Terminals 41 (Hot) and 42 (Common)

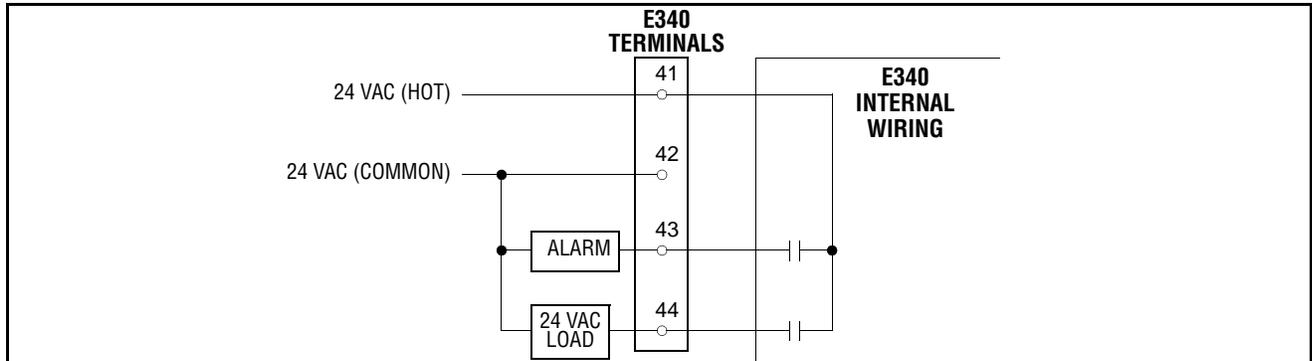
The E340 control is powered by 24 VAC connected to Terminals 41 (Hot) and 42 (Common). The power requirements of the E340 control is 20 VA. The alarm output (Terminal 43) and the auxiliary relay output (Terminal 44) are internally connected to Terminal 41, so the total connected load to Terminals 43 and 44 should be considered when determining the total VA rating of the control transformer. The additional load of the mod motor should also be taken into account if powered by the same control transformer.



CAUTION: To insure proper operation, a ZTAH Transient Voltage Surge Suppressor by Power Integrity Corp., Greensboro, NC, or equivalent should be installed.

Alarm Output - Terminal 43

The E340 has a low voltage output (Terminal 43) internally connected to Terminal 41 to serve as a marginal alarm (pulsed output) and lockout alarm (maintained output) if any of the marginal alarm or lockout alarm limits are exceeded. See SEQUENCE OF OPERATION - HIGH AND LOW ALARM LIMITS section in Bulletin E-3401.



Auxiliary Relay - Terminal 44

The E340 has a low voltage output relay (Terminal 44) internally connected to Terminal 41 which can be programmed to operate according to a time of day schedule. See SEQUENCE OF OPERATION - PROGRAM ON section in Bulletin E-3401.

Firing Rate Damper Motor - Terminals 45 and 46

The E340 provides a 4-20mA analog output (Terminals 45 and 46) to control a firing rate damper motor in response to system demand. See SEQUENCE OF OPERATION - MODULATING CONTROL section in Bulletin E-3401. This analog output controls the firing rate motor after the flame safeguard control releases the firing rate motor to automatic control (Terminals 10 and 11 of the FLAME-MONITOR made).

The E340 can directly control a firing rate damper motor that will accept a 4-20mA control input signal, or control an industry standard 135 ohm slide wire firing rate damper motor by using a 4-20mA to 135 ohm transducer. These transducers are commercially available from a number of vendors. Terminal 45 is the positive reference for the 4-20mA output signal, and Terminal 46 is the negative reference.

Selectable 4-20mA Analog Output - Terminals 47 and 48

The E340 provides a 4-20mA analog output (Terminals 47 and 48) which allows the user to select one of the five pressure or temperature sensors or command rate output to provide a 4-20mA output signal that is directly proportional to the value of the selected sensor. Terminal 47 is the positive reference for the 4-20mA output signal, and Terminal 48 is the negative reference. The chart recorder or similar device connected to these outputs should not have a maximum impedance greater than 750 ohms.

FIGURE 1.

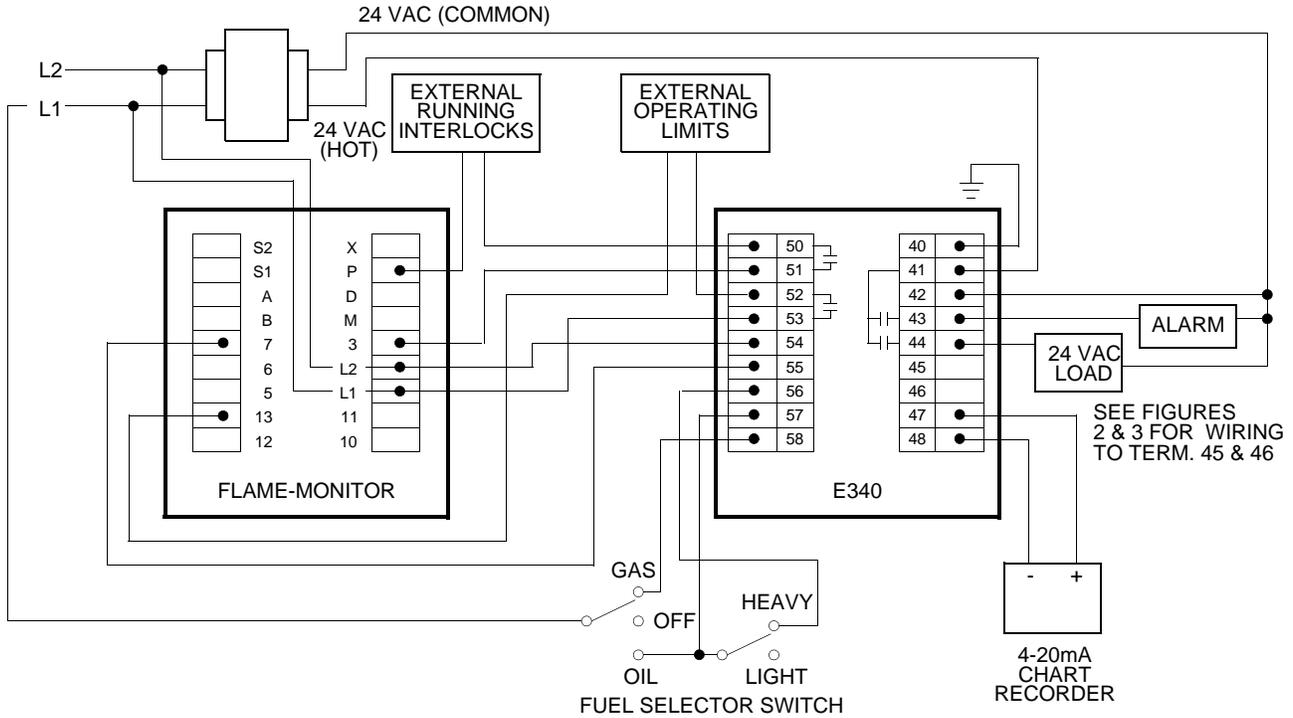


FIGURE 2. Wiring E340 and E100 to a 4-20mA Firing Rate Damper Motor

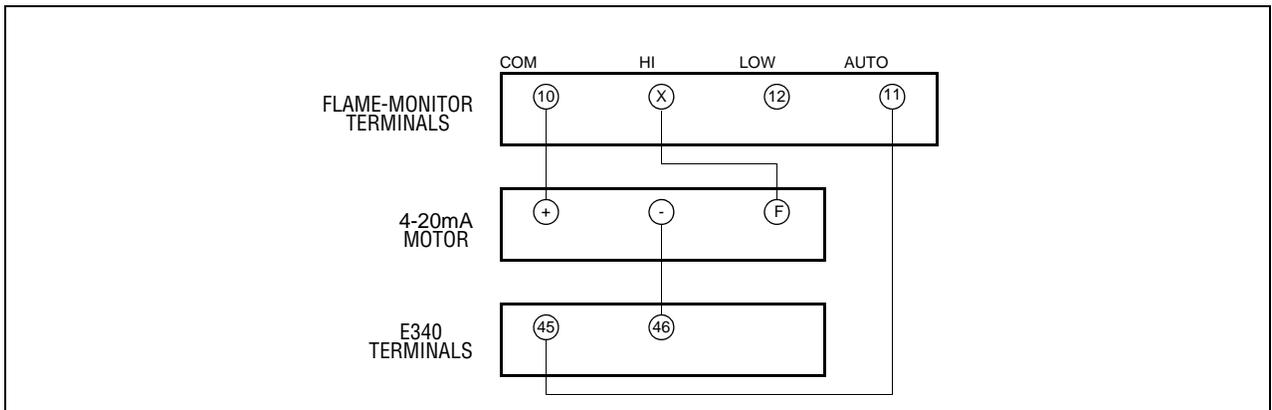
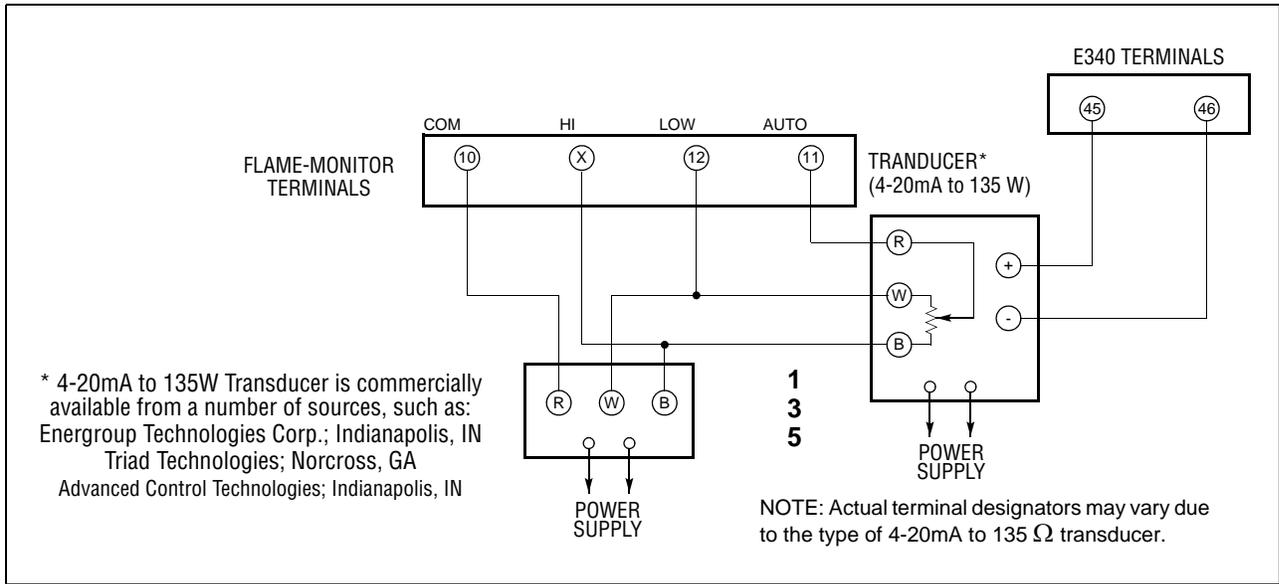


FIGURE 3. Wiring E340 and E100 to 135Ω Slide Wire Firing Rate Damper Motor Using a 4-20mA to 135Ω Transducer



WIRING CONNECTIONS - SUB-MINIATURE TERMINAL BLOCK

Note: Flat Ribbon Cable - The E340 is packaged with a flat ribbon cable that must be connected between the E340 control and the wiring base. Refer to “INSTALLING THE CONTROLLER” for a detailed description.

Note: Removable Terminal Strip - To provide ease of wiring, the sub-miniature terminal block is equipped with removable / repluggable spring loaded terminal strips. To unplug the terminal strips, grab the terminal strip firmly and pull straight up. Insert wire and tighten down with screw adjustment. To replug terminal strip align terminals with appropriate header posts and push down.



WARNING: The E340 must be used only with the approved pressure and temperature sensors (e.g. PS348-1, TS348-4, etc.) Do not use with any other types of pressure or temperature sensors. U.L. Approval requires these sensors.

Pressure Sensors

The E340 provides nine terminals (Terminals 60 through 68) for the connection of three (3) pressure sensors. Each pressure sensor is a three wire sensor with one connection for 24 VDC power (supplied by E340 control, sensor input signal, and sensor return line). **See Bulletin ES-3481 for the proper location, mounting, and wiring of the temperature sensors.**

	24 VDC POWER	SENSOR RETURN	SENSOR INPUT SIGNAL
Gas	60	61	62
Oil	63	64	65
Steam	66	67	68

24 VDC Power = Red wire
 Sensor Return = White wire
 Sensor Input Signal = Green wire



Temperature Sensors

The E340 provides four terminals (Terminals 69 through 72) for the connection of two (2) temperature sensors. Each temperature sensor is a two wire sensor: sensor input signal and sensor return line. **See Bulletin ES-3481 for the proper location, mounting, and wiring of the temperature sensors.**

	SENSOR INPUT SIGNAL	SENSOR RETURN
Primary	69	70
Auxiliary	71	72

Sensor Input Signal = Red wire
Sensor Return = Black wire

The **Primary Temperature Sensor** (Terminals 69 & 70) is used to monitor one of the following:

- Water temperature of a hot water boiler
- Boiler water temperature of a steam boiler (Standby Water)
- Stack temperature
- Outdoor air temperature

The **Auxiliary Temperature Sensor** (Terminals 71 & 72) is used to monitor one of the following:

- Oil temperature
- Stack temperature
- Outdoor air temperature

The functions of these temperature sensors is determined by programming the E340 control. Refer to Bulletin E-3401.

Damper Motor Position Feedback - Terminals 73 and 74

A 135 ohm potentiometer attached to the shaft of the firing rate damper motor can be wired into the E340 control to provide positive positioning feedback on the status of the firing rate motor. The feedback potentiometer is wired into Terminals 73 and 74. Terminal 73 is the positive reference for the feedback potentiometer and Terminal 74 is the negative reference. See SEQUENCE OF OPERATION - DAMPER MOTOR POSITION FEEDBACK section in Bulletin E-3401.

Forced Setback - Terminals 75 and 76

A maintained dry contact can be wired into the E340 control (Terminals 75 and 76) so that when the contact is made, the E340 will operate according to its Setback Operation Setpoints. See SEQUENCE OF OPERATION - SETBACK SCHEDULE section in Bulletin E-3401.

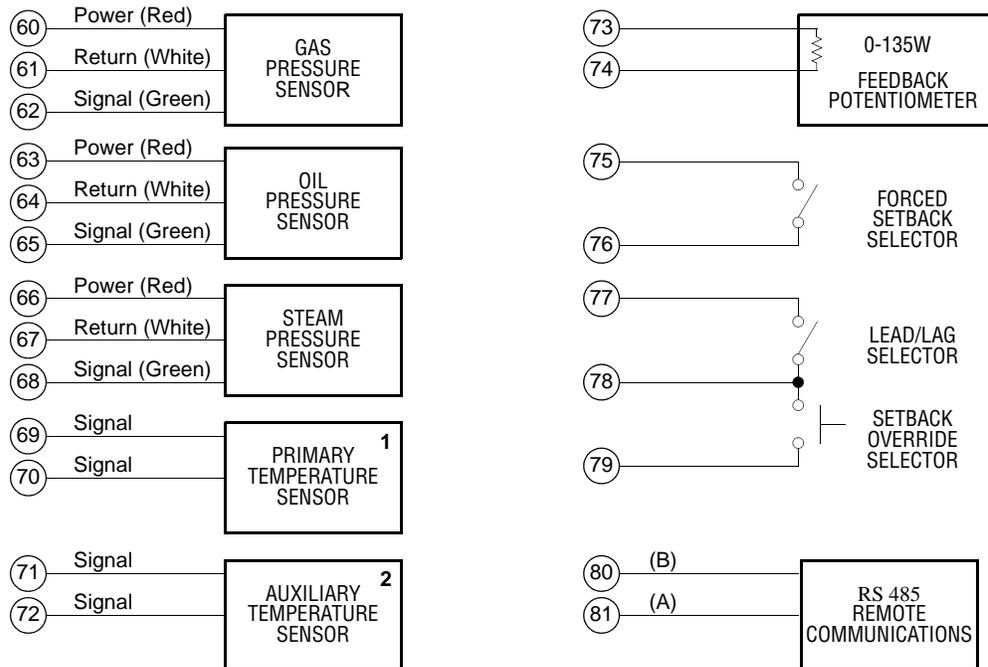
Lead/Lag Operation - Terminals 77 and 78

A maintained dry contact closure can be wired into the E340 control (Terminals 77 and 78) so that when contact is made, the E340 will operate according to its Lag Operation Setpoints. See SEQUENCE OF OPERATION - LEAD/LAG CONTROL section in Bulletin E-3401.

Setback Override - Terminals 78 and 79

A momentary dry contact closure can be wired into the E340 control (Terminals 78 and 79) so that when the contact is held for at least one second and released, the E340 will override the setback operation for a programmed time period. See SEQUENCE OF OPERATION - SETBACK SCHEDULE section in Bulletin E-3401.

FIGURE 4. Sub-miniature Terminal Block



- 1 . Primary sensor to monitor water temperature, stack temp., outdoor air temp., or stand-by temp.
- 2 . Auxiliary sensor to monitor oil temperature or stack temperature, or outdoor air temperature.

 **WARNING: An electro-mechanical steam pressure (or hot water) high limit switch MUST REMAIN in the running interlock circuit of the flame safeguard control.**

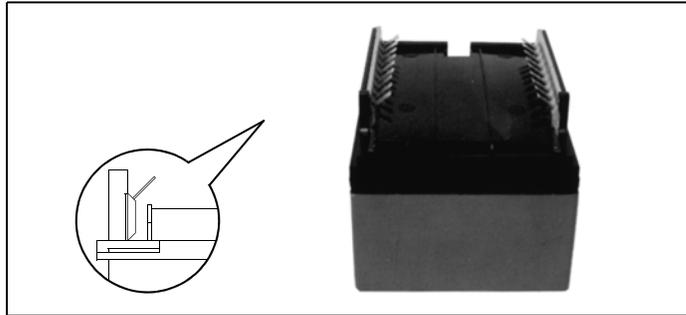
INSTALLING THE CONTROLLER

 **CAUTION: Electric power must be turned off during installation.**

 **WARNING: The wiring bases for the E340 and the FLAME-MONITOR control (or D-Series) are similar. Care must be taken so that each control is installed in its proper wiring base. Installing either control in the wrong wiring base will damage the control.**

1. The E340 Programmer Module contains the battery. In order to protect and maintain the charge during stocking and shipping, an insulator has been placed between the battery and the clip. Remove the insulator from the battery by pulling the tab on the side of the program module. **Do not proceed to step 2 until the insulator has been removed.**
2. Insert the EP340 Programmer Module into the appropriately marked slot (second guide slot) of the EP342 chassis and press into connector. The Programmer Module must be installed in the chassis before plugging into the wiring base.
3. Insert the E345 Keypad/Display Module into the first guide slot of the EB342 chassis and press into connector. The Keypad/Display Module must be installed in the chassis before plugging into the wiring base.

4. Check the electrical tabs on the bottom of the chassis. If any are bent out of position, reposition them with your fingers so that they are in line.
5. Install the flat ribbon cable onto the connector edge located in the lower right hand corner on the back of the E340 control.
6. Plug the other end of the flat ribbon cable into the connector located on the sub-miniature terminal block on the wiring base.
7. Slide the bottom of the chassis over the tabs on the wiring base and push the controller into position. Insert the mounting screw through the Keypad/Display, Programmer Module and chassis and into the wiring base and tighten down.



8. Electric power may now be turned on.
9. Place the dust cover over the controller and press into position.
10. To remove the dust cover, place your thumbs on the lower plastic corners of the display frame (not the display itself). Press down with your thumbs while pulling off with your palms and fingers. The cover will snap off and can be pressed back into position.

Replacing the Battery

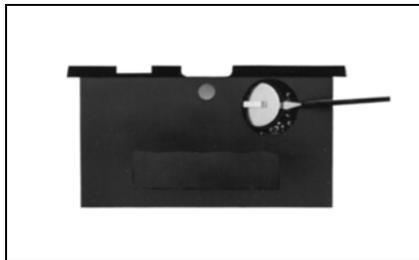


WARNING: Do not insert or remove program module with power on. Electric power to unit must be turned off.

The EP340 Programmer Module contains the battery. Carefully remove the Program Module from its slot in the chassis.

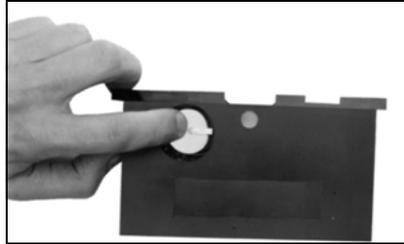
Removing the Battery

Place a non-metallic tool between the bottom part of the battery and the slots in the black plastic holder. Push up on the battery, and then remove it with your finger at an angle. Do not bend the clip during removal.



Inserting the Battery

Place the battery at an angle under the metallic clip, so that the positive (+) side is up. Push into position.



Battery Disposal

CAUTION:

- The lithium battery contains less than 100 mg. of lithium. Check your local and state regulations that deal with the disposal of lithium batteries.
 - Do not incinerate or expose the battery to high temperatures.
 - Do not solder the battery or leads; the battery could explode.
 - Do not open, puncture, or crush the battery. The battery could explode and toxic, corrosive chemicals could be exposed.
 - Do not short positive or negative terminals together. The battery will heat up.
 - Do not attempt to charge the battery. An explosion might result or the cell might overheat and cause burns.
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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

FIREYE 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 FIREYE 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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