SERIES 35-66

24 VAC Microprocessor-Based Hot Surface Ignition Control with Inducer Blower Relay

FENWAL®

F-35-66
August 2015

FEATURES

- Safe start with DETECT-A-FLAME® flame sensing technology
- Custom pre-purge and inter-purge timings*
- 120/240 field selectable line voltage for use with 120 VAC igniter option
- 24/120/240 VAC hot surface igniter models available
- Inducer blower control and airflow switch monitoring
- Single or three trials for ignition
- System diagnostic LED
- Flame current test points
- Local or remote flame sensing
- Automatic reset**

APPLICATIONS

- Gas furnaces
- Boilers
- Commercial cooking
- Water heaters
- Other gas-fired appliances

DESCRIPTION

The 35-66 is a 24 VAC hot surface ignition (HSI) control designed for use in all types of gas-fired appliances. The control uses a microprocessor to continually and safely monitor, analyze and control the proper operation of a gas burner and inducer blower. On-board diagnostics with LED output makes troubleshooting easy and ensures safe and efficient operation.

Export Information (USA)

Jurisdiction: EAR
ECCN: EAR99

AGENCY CERTIFICATIONS

Design certified by CSA International to ANSI Z21.20, CAN/CSA C22.2 No. 199-M89

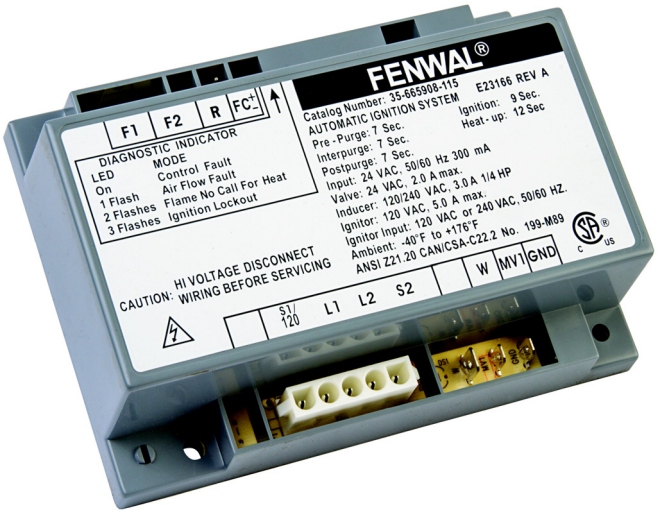
CE Approved to EN298-2003

Factory Mutual approval on select models

Code Compliant to:
AS 4625 - 2008
AS 4622 - 2004

*Pre-purge time cannot exceed inter-purge time on CE Approved models.

**Automatic reset is not allowed for CE Approved models.



SPECIFICATIONS

Input Power	Control: 18 to 30 VAC 50/60 Hz (Class 2 Transformer)
Line Voltage	Line: 24, 120 or 240 VAC (L1 and L2 only)
Input Current	300 mA max @ 24 VAC with gas valve and inducer blower relays energized (control only)
Gas Valve	2.0A max @ 24 VAC
Inducer Blower	3.0 FLA max @ 120 VAC (1/4 hp) 1.5 FLA max @ 240 VAC (1/4 hp)
Operating Temperature	-40°F to +176°F (-40°C to 80°C)
Storage Temperature	-40°F to +185°F (-40°C to +85°C)
Hot Surface Igniter	5.0A max @ 24/120/240 VAC
Flame Sensitivity	0.7 µA minimum
Flame Failure Response	0.8 seconds maximum
Flame Detector Self-check Rate	Once per second minimum
Gas Types	Natural, LP, or manufactured
Size (LxWxH) with enclosure	5.69 x 3.94 x 1.87 inches (14.45 x 10.01 x 4.75 cm)
Moisture Resistance	Conformal coated to operate non-condensing to 95% R.H. Module should not be exposed to water
Ingress Protection	Not rated, protection provided by appliance in which it is installed
Tries for Ignition	One or three try versions available
Trial for Ignition Periods	4, 7, 10, 15 seconds available
Pre-purge and Inter-purge Timings	0, 15 or 30 seconds available
Post-purge Time	0, 30 or 60 seconds available

SEQUENCE OF OPERATION / FLAME RECOVERY / SAFETY LOCKOUT

Power-Up / Standby

Upon applying power 24 VAC to the R terminal, the control will reset, perform a self-check routine, flash the diagnostic LED and enter the thermostat scan state.

Call for Heat

When a call for heat is received from the thermostat supplying 24 VAC to the W terminal, the control will check the pressure switch for normally open contacts. The inducer blower is then energized and, once the pressure switch contacts close, an optional pre-purge period begins. After the pre-purge, the Igniter is energized for the heat-up period, and then the gas valve is energized for the Trial for Ignition (TFI) period.

When the flame is detected during the TFI, the igniter is de-activated and the gas valve and inducer blower remain on. The thermostat, pressure switch and burner flame are constantly monitored to assure proper system operation. When the thermostat is satisfied and the demand for heat ends, the gas valve is immediately de-energized, the control verifies the loss of flame signal and initiates an optional post-purge period before de-energizing the inducer blower.

Failure to Light - Lockout

SINGLE TRIAL MODEL

Should the burner fail to light, or a flame is not detected during the TFI period, the gas valve will be de-energized and the control will go into lockout. The inducer blower will turn off following the optional post-purge period. The LED will indicate the fault code for ignition lockout.

MULTI-TRIAL MODEL

Should the burner fail to light or the flame is not detected during the first TFI period, the gas valve will de-energize. The control will then go through an inter-purge delay before attempting another TFI period. The control attempts two additional ignition trials before de-energizing the gas valve and entering lockout. The inducer blower will turn off following the optional post-purge period. The LED will indicate the fault code for ignition lockout.

FLAME FAILURE-RECYCLE MODE

Upon loss of flame, the gas valve is de-energized and the control proceeds to inter-purge before attempting to relight the flame. Multi-try models permit three tries for ignition including inter-purges. If the burner relights, normal operation resumes. If the burner does not relight, the control will enter lockout and the inducer blower will turn off following the optional post-purge period.

Lockout Recovery

Recovery from lockout requires a manual reset by either resetting the thermostat, or removing 24 VAC for a period of 5 seconds. On models with automatic reset, if the thermostat is still calling for heat after one hour, then the control will automatically reset and attempt to ignite the burner.

Combustion Airflow Fault

Combustion airflow is continually monitored during an ignition sequence by the pressure switch (PS terminal). If the pressure switch contacts remain closed for 30 seconds at the start of the ignition sequence without an output signal to the inducer blower, the LED will indicate an airflow fault and the control will remain in this mode with the inducer blower off. If the pressure switch contacts later open while there is still a call for heat, the control will begin the pre-purge period followed by a normal ignition sequence.

If the pressure switch contacts remain open for more than 30 seconds after the inducer blower output (F1 and F2 terminals) is energized the LED will indicate an airflow fault and the control will remain in this mode with the inducer blower on. If proper airflow is later detected from the pressure switch input (PS terminal), the control begins the pre-purge period followed by a normal ignition sequence.

If the airflow signal is lost while the burner is firing, the control will immediately de-energize the gas valve and the LED will indicate an airflow fault. The inducer blower will remain on for the post-purge period and the control continues to monitor the PS input waiting for airflow to return. If proper airflow is detected during the post-purge period, a normal ignition sequence will begin with the pre-purge period. Otherwise, the control will remain in an airflow fault as indicated by the LED with the inducer blower off.

MOUNTING AND WIRING

The Series 35-66 control is not position sensitive and can be mounted vertically or horizontally. The case may be mounted on any surface with #6 sheet metal screws. The control also supports direct mounting to a standard NEC 4-in. junction box.

CAUTION	All wiring must be performed in accordance with both local and national electrical codes.

CAUTION	Label all wires prior to disconnection when servicing controls. Wiring errors may cause improper and dangerous operation. A functional checkout of a replacement control should always be performed.

WARNING	This product uses voltages of shock hazard potential. Wiring and initial operation must be performed by a qualified service technician.

WARNING	Operation outside specifications could result in failure of the Fenwal product and other equipment with potential for injury to people and property.

Terminal Designations		
Terminal	**Description**	**Termination (inch)**
F1	Inducer Blower Power	1/4" Quick Connect (or 2-pin Mate-N-Lok)
F2	Inducer Blower Output	1/4" Quick Connect (or 2-pin Mate-N-Lok)
S1-240	240 VAC Igniter	1/4"Quick Connect
S1-120	120 VAC Igniter	1/4" Quick Connect (or 5-pin Mate-N-Lok)
R	24 VAC supply to processor (optional full time power)	1/4" Quick Connect
L1	120/240VAC Input (Hot)	1/4" Quick Connect (or 5-pin Mate-N-Lok)
L2	Neutral	1/4" Quick Connect (or 5-pin Mate-N-Lok)
S2/FS	Igniter/Remote Flame Sense	1/4" Quick Connect (or 5-pin Mate-N-Lok)
PS	Pressure Switch Input	1/4" Quick Connect
W	Thermostat Input	1/4" Quick Connect
MV1	Main Valve Power	3/16" Quick Connect
GND	System Ground	3/16" Quick Connect
FC+ & FC-	Flame Current Test Points	Varies by model

LOCAL FLAME SENSING
(SENSING THROUGH HOT SURFACE IGNITER)

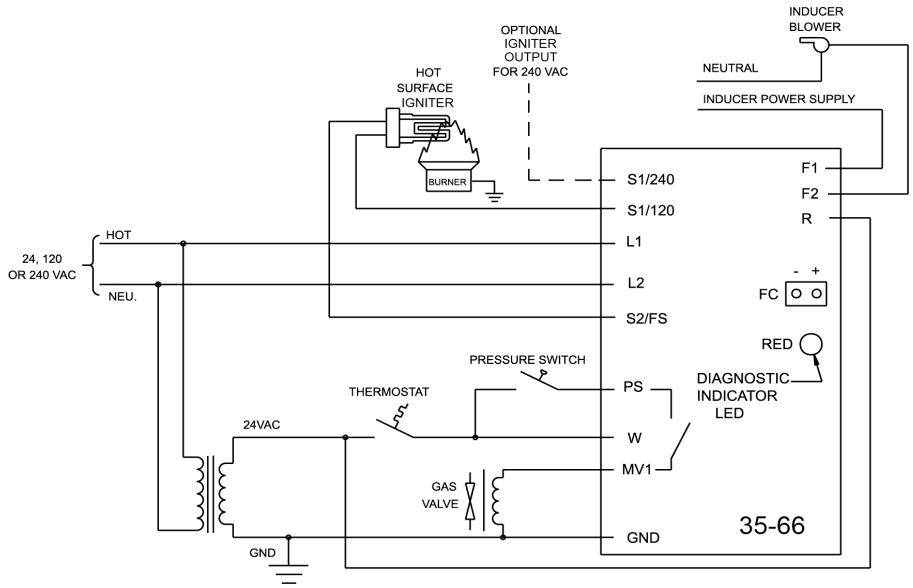


Figure 1. Local Sense

REMOTE FLAME SENSING
(SENSING THROUGH INDEPENDENT FLAME ROD)

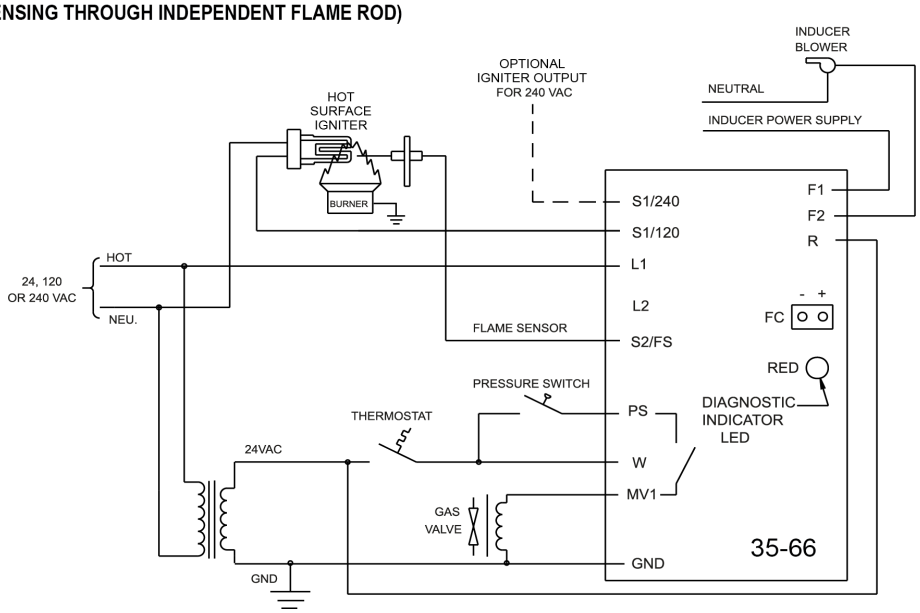


Figure 2. Remote Sense

TROUBLESHOOTING

Troubleshooting Guide	
Symptom	**Recommended Actions**
1. Control does not start	A. Miswired B. 24 VAC transformer fault C. Fuse circuit breaker fault D. Faulty control, check LED for steady on or flashing codes
2. Thermostat on - no ignition	A. Miswired B. Faulty thermostat, no voltage at thermostat terminal W C. Failed igniter
3. Blower on - no TFI after purge delay	A. Miswired B. Flame fault C. Airflow fault (check voltage at PS) D. Faulty control (check voltage between F1 & F2)
4. Valve on - no igniter	A. Defective igniter B. Miswired C. Faulty control, check voltage at igniter
5. Igniter on - no valve	A. Valve coil open B. Valve wire disconnected C. Faulty control, check voltage at gas valve terminal
6. Flame okay during TFI - no flame sense after TFI	A. Faulty igniter B. Faulty S1 wire C. Poor ground at burner D. Poor flame, check flame current

Fault Conditions	
LED Indication	**Fault Mode**
Steady On	Internal Control Failure
1 Flash	Airflow Fault
2 Flashes	Flame without call for heat
3 Flashes	Ignition Lockout

Note: During a fault condition, the LED will flash on for 1/4 second and off for 1/4 second as needed to indicate the fault code. The code will repeat every 3 seconds. Removing power from the control will clear the fault code.

Flame Fault

If at any time the main valve fails to close completely and maintains a flame, the flame sense circuit will detect it and energize the inducer blower. Should the main valve later close completely removing the flame signal, the inducer blower will be turned off following the optional post purge period.

Flame Current Measurement

Flame current is the current that passes through the flame from sensor to ground. To measure flame current, connect a True RMS or analog DC micro-ammeter to the FC+ and FC- terminals. Readings should be 1.0 µA DC or higher. If the meter reads negative or below "0" on scale, meter leads are reversed. Reconnect leads with proper polarity.

Alternately, a Digital Voltmeter may be used to measure DC voltage between FC+ and FC- terminals. Each micro-amp of flame current produces 1.0 VDC. For example, 2.6 VDC equates to 2.6 µA.

A good burner ground that matches the control ground is critical for reliable flame sensing.

DIMENSIONS

FRONT AND SIDE VIEWS

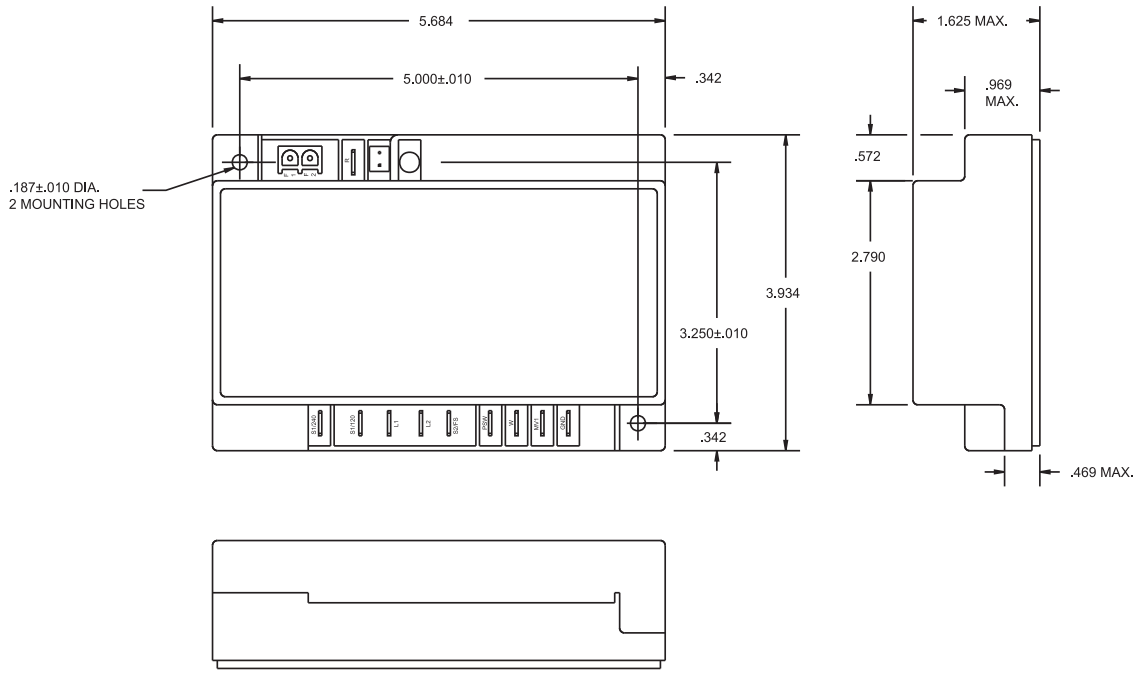


Figure 3. Standard Enclosure

Note: All dimensions are in inches.

PART NUMBER CONFIGURATION

SERIES 35 - 66 X X X X - X X X

Product Designation
1 = Dual Speed Blower
2 = 120/240 Field Selectable Line Voltage
3 = Dual Speed Blower and 120/240 Field Selectable Line Voltage
5 = Standard

Igniter Options
0 = 120/240 VAC Mini-Igniter (6 Second Heat-Up)
2 = 24 VAC Mini-Igniter (4 Second Heat-Up) CE Approved*
5 = 120/240 VAC Igniter (20 Second Heat-Up)
6 = 120/240 VAC Igniter (40 Second Heat-Up)
7 = 24 VAC Mini-Igniter (4 Second Heat-Up)

Special Configurations
3 = Special CE Approved Model*
8 = Aftermarket Kit
9 = Special Configuration

A 3, 8 or 9 in this location (i.e. 35-66 5 901 -113) indicates a special configuration. 9XX is a sequentially assigned part number and does not follow the standard part numbering configuration.

Consult Fenwal for operating characteristics of this control.

*On CE Approved models, pre-purge time cannot exceed inter-purge time and automatic reset is not permitted.

Trial for Ignition
1 = 4 Seconds
3 = 7 Seconds
5 = 10 Seconds
7 = 15 Seconds

Inter-Purge
0 = None
1 = 15 Seconds
2 = 30 Seconds

Pre-Purge
0 = None
1 = 15 Seconds
2 = 30 Seconds

Tries for Ignition
0 = Single Try without Automatic Reset
1 = Single Try with 1 Hour Automatic Reset
5 = Three Tries without Automatic Reset
6 = Three Tries with 1 Hour Automatic Reset

Termination and Post Purge
0 = No Post-Purge All Q.C. Terminals without Full Time POWER (W Only)
1 = No Post-Purge All Q.C. Terminals with Full Time POWER (R Terminal)
2 = 30 Second Post-Purge All Q.C. Terminals**
3 = 60 Seconds Post-Purge All Q.C. Terminals**
5 = No Post-Purge Mate-N-Lok (5 Pos.) with Q.C. Terminals without Full Time Power (W Only)
6 = No Post-Purge Mate-N-Lok (5 Pos.) with Q.C. Terminals with Full Time Power (R Terminal)
7 = 30 Second Post-Purge Mate-N-Lok (5 Pos.) with Q.C. Terminals**
8 = 60 Second Post-Purge Mate-N-Lok (5 Pos.) with Q.C. Terminals**

**Post-Purge Requires Full Time Power (R)

Fenwal Controls, Kidde-Fenwal Inc.
400 Main Street
Ashland, MA 01721
Tel: 800-FENWAL-1
Fax: 508-881-7619
www.fenwal.com