



05-14 to 35-70 Series 120 VAC Direct Spark Ignition Control

CG 05.14 to 35.70.01

Fenwal continues advancing direct spark gas ignition technology by employing its legendary design experience to develop a new line of microprocessor based ignition controls for the 120 VAC marketplace. The 35-70, 120 VAC DSI is the most recent advance in Fenwal's broad product mix to serve this market. Providing safe gas ignition control and flame monitoring for 120 VAC gas burner systems, the 35-70's microprocessor based design offers a wide range of configurations in a cost effective package.

The 35-70 is the latest in a long line of 120 VAC controls and replaces the following Fenwal analog controls: the 05-13 (circa 1960), 05-14 (circa 1970) and 05-38 (circa 1985). This conversion guide provides information to quickly and safely convert an application from the 05-14 to the 35-70.

The 35-70's microprocessor design offers significant advantages over its analog predecessors by providing:

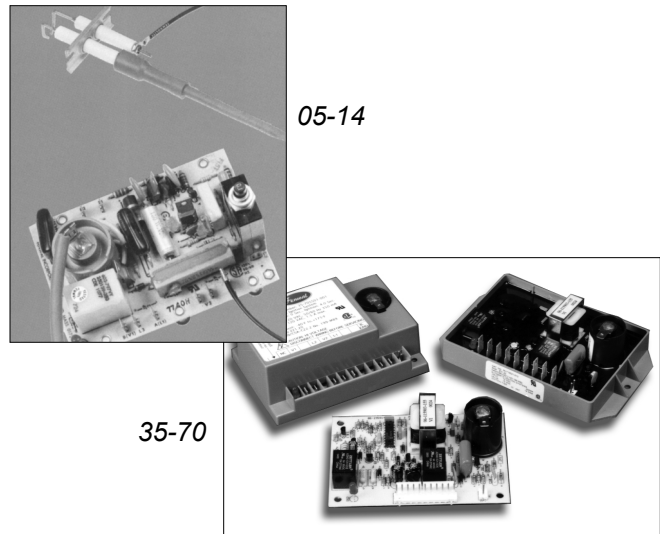
- Extremely precise ignition and purge timings
+/- 5% accuracy versus +/- 20% for the previous controls
- LED diagnostics for accurate and fast troubleshooting
- Improved flame sensitivity for difficult applications and prevention of nuisance lockouts
- Polarity insensitive wiring
- Reduced footprint for space limited applications
- Multiple methods for lockout recovery
- Software based customization for ignition and purge timings

This guide includes:

- Agency approval comparisons
- Terminal designation and size comparison
- Single Spark and Sense vs. Local Sense electrode wiring
- Control wiring comparison
- Footprint comparisons
- Conversion list for most popular controls

NOTE:

The special 05-143 series that has the pilot valve and main valve outputs will be discontinued with no corresponding 35-70 replacement.



Along with the 35-70, Fenwal is proud to offer two additional controls (35-71, 35-72) as part of the 35-7X family of 120 VAC Direct Spark Ignition Controls. These product are designed to match the features and price needs of a wide variety of applications.



- 35-72 DSI Control - The "Base Model" is ideal for commodity products where simple ignition control is required and price is a major determining factor.



- 35-71 DSI Control - Provides combustion blower relay control and monitors the pressure switch with LED diagnostics and flame sense test pins, ideal for those customers who prefer more integration to reduce component count and system wiring.

Agency Comparison

AGENCY APPROVAL	35-70	05-14
UL 372, UL 1998 Software	Approved	Approved
CSA: ANSI Z21.2, CAN/CSA	Approved	Approved
FM: Ignition Device and Flame Safeguard	*Pending	Not Approved

* The 35-70 has been submitted to FM for approval as both an ignition device and flame safeguard. FM certification allows only single trial for ignition models with up to 10 second Trial for Ignition time.

Terminal Designation and Size Comparison

DESCRIPTION	Terminal Designation		QUICK CONNECT TERMINAL		MULTIPIN CONNECTOR	
	35-70	05-14	35-70	05-14	35-70 ONLY	
					PIN LOCATION	WIRE COLOR
Alarm	NC	N/A	1/4"	N/A	11	Lt. Blue
Valve Power	V1	V1	3/16"	1/4"	10	Brown
120 VAC (Neutral)	L2	L2	3/16"	1/4"	8	White
Valve Neutral	V2	V2	3/16"	1/4"	7	Yellow
120 VAC Input (Hot)	L1	L1	1/4"	1/4"	6	Black
Burner Ground	B. GND	N/A	3/16"	N/A	2	Purple
Remote Flame Sensor	S1	S1	1/4"	1/4"	1	Gray
Local Sense	N/A	E2	N/A	1/4"	N/A	N/A
Flame Sense Test	FC+,FC-	N/A	.045" SQ.	N/A		2 Pin Header
Pins	L3	L3	1/4"	1/4"	N/A	N/A
Isolated Valve Models	V2	V2	3/16"	1/4"	N/A	N/A

Terminology - Single Spark and Sense vs. Local Sense

One important note on wiring the 35-70 has to do with terminology and wiring for flame sense. In all of the new 120 VAC control literature, especially that for the 35-70, we have made a point to use the term "Single Spark and Sense" rather than the more colloquial "Local Sense" when referring to sensing flame on the spark electrode. The 05-14s have local sense where the flame sense signal travels to the board along a separate wire (not the H.V. wire) to a terminal on the control typically identified as E2. This is a very important distinction. Single Spark and Sense is easier to wire as it eliminates the need for an additional sense wire, because the high voltage wire serves the dual role of supplying spark energy to the electrode and passing the flame sense current to the control.

New Grounding Scheme

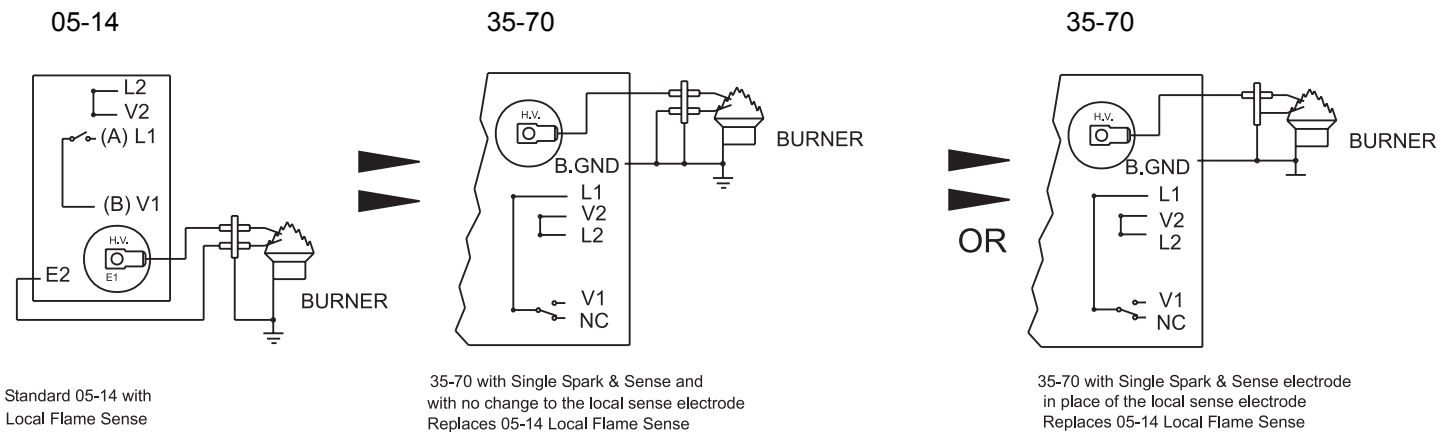
For all models of the 35-70, the B.GND terminal is used to ground the burner and to complete the flame current signal circuit. This terminal is new for systems that used the 05-14. This terminal must be connected to the burner (chassis) ground not only to ensure the best, long term, stable flame signal, but also to ground the burner for proper sparking, especially in the case of single spark and sense. See wiring diagrams for conversion of 05-14 wiring.

The use of a burner ground terminal eliminates the problem of loss of flame sense signal due to a missing or loose neutral or ground (green) wire at the 120 VAC power source. The 35-70 has been designed such that reversing the polarity of the 120 VAC line does not cause a loss of flame signal. Thus, the 35-70 provides a more reliable flame signal along with a reduction of nuisance lockouts, due to its design and the use of the B.GND terminal.

Electrode requirements for Single Spark and Sense vs. Local Sense Applications

Since 05-14s with Local Sense are replaced by 35-70s with Single Spark and Sense, the electrode must be re-wired or replaced with a simpler electrode configuration. Typically, a local sense electrode, see figure below, has two electrodes on the same bracket. This type of electrode assembly requires that a high voltage wire and flame sense wire be attached to each electrode and wired back to the control. A single spark and sense electrode has only one electrode on the bracket and requires just the high voltage wire and a grounded burner. See figure below.

SINGLE SPARK AND SENSE VS. LOCAL SENSE WIRING



05-14 to 35-70 Wiring Comparison

LOCAL SENSE

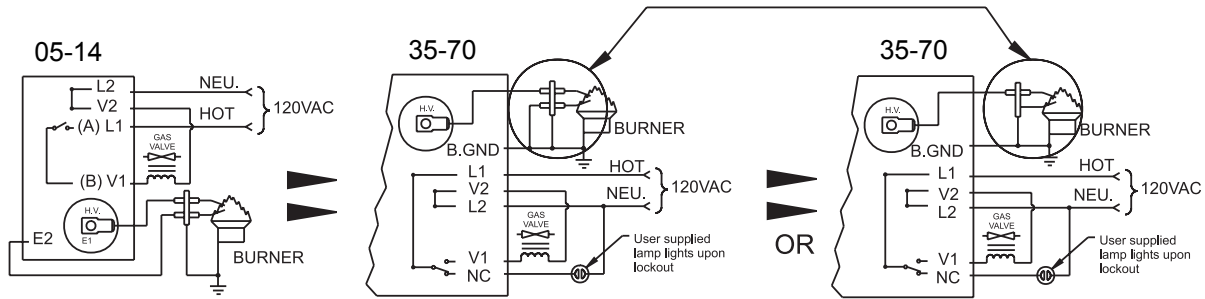


Figure 1:a Standard 05-14 with Local Flame Sense

Figure 1:b 35-70 with Single Spark & Sense and with no change to the local sense electrode Replaces 05-14 Local Flame Sense

Figure 1:c 35-70 with Single Spark & Sense electrode in place of the local sense electrode Replaces 05-14 Local Flame Sense

REMOTE SENSE

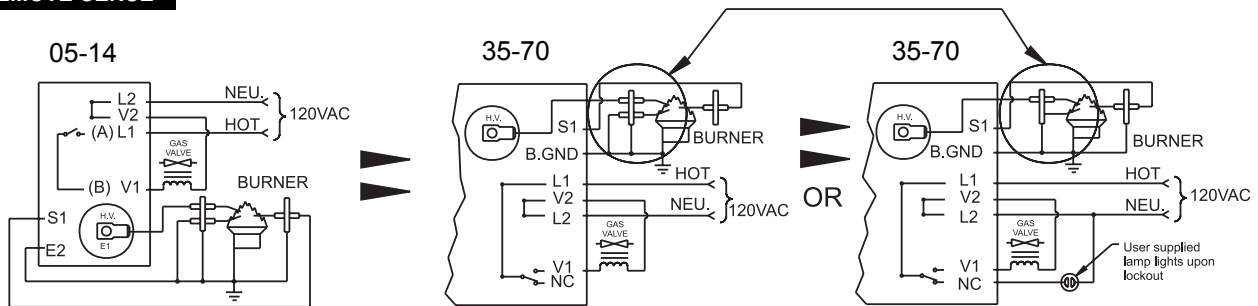


Figure 2:a 05-14 with Remote Flame Sense

Figure 2:b 35-70 with Remote Sense using existing spark and remote sense electrodes Replaces 05-14 with Remote Flame Sense

Figure 2:c 35-70 with Remote Flame Sense. Using Single Spark Electrode in place of Local Sense Electrode Replaces 05-14 Remote Sense.

ISOLATED VALVE POWER WITH LOCAL SENSE

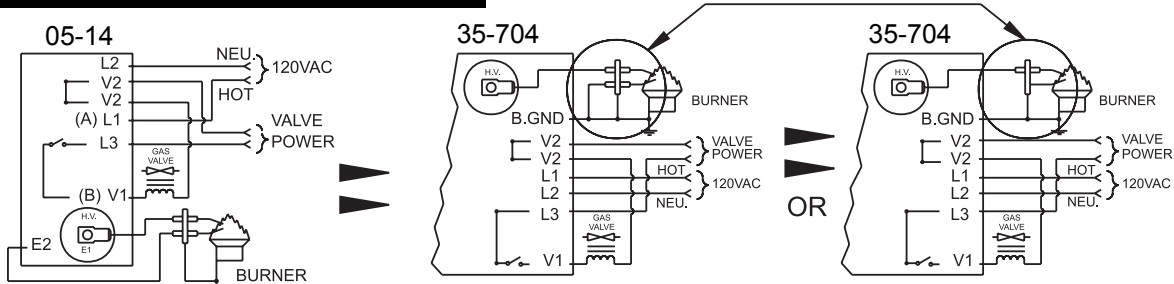


Figure 3:a 05-14 with Isolated Valve Power. Local Flame Sense shown

Figure 3:b 35-704 with Isolated Valve Power. Single Spark and Sense Replaces Local Sense Replaces 05-14 with local sense.

Figure 3:c 35-704 with Isolated Valve Power. Single Spark and Sense Replaces Local Sense Replaces 05-14 with local sense.

ISOLATED VALVE POWER WITH REMOTE SENSE

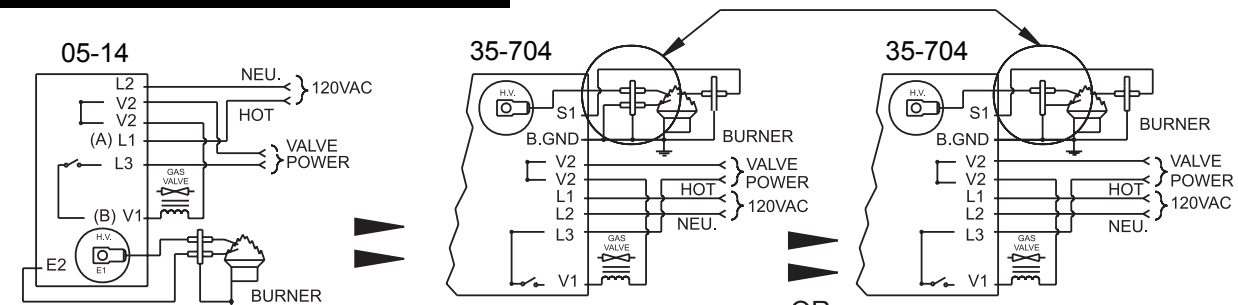
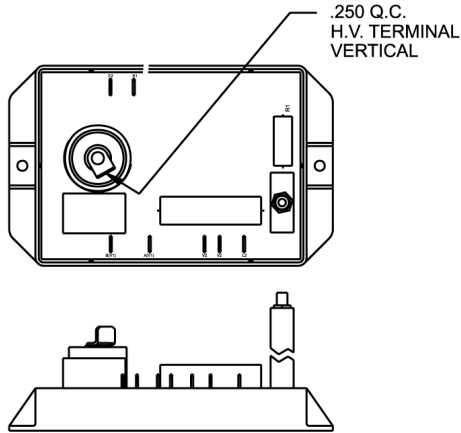


Figure 4:a 05-14 with Isolated Valve Power. Remote Flame Sense

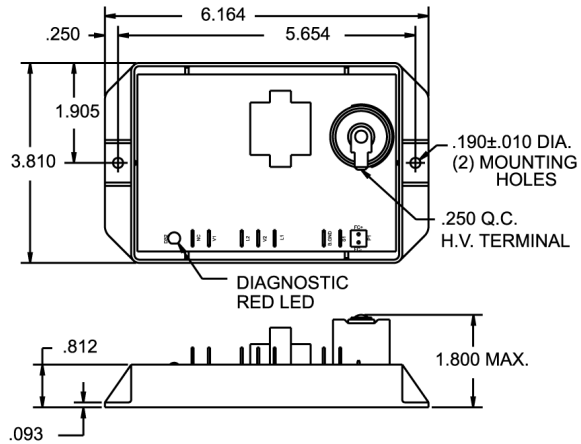
Figure 4:b 35-704 with Isolated Valve Power, using existing spark and remote sense electrodes Replaces 05-14 with Remote Flame Sense

Figure 4:c 35-704 with Isolated Valve Power. Using Single Spark Electrode in place of Local Sense Electrode Replaces 05-14 with Remote Flame Sense

05-14 POTTED



35-70 POTTED

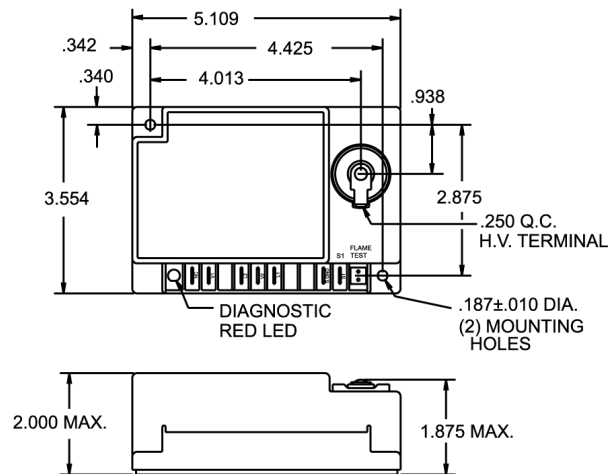


THE 05-14 AND 35-70 POTTED CONTROLS HAVE THE SAME FOOTPRINT.
PLEASE NOTE THE LOCATION AND ORIENTATION OF THE H.V. TERMINAL WHEN CONSIDERING WIRING.

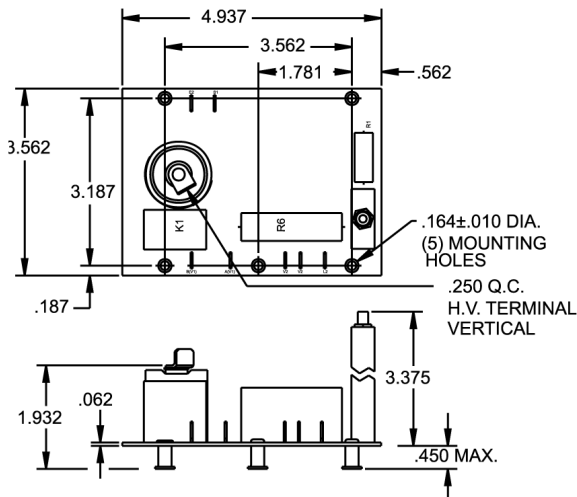
05-14 CASE AND COVER

THE 05-14 WAS NOT OFFERED WITH A CASE AND COVER.

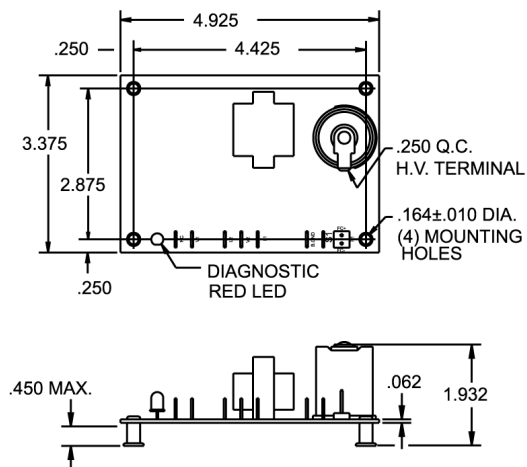
35-70 CASE AND COVER



05-14 STANDOFF



35-70 STANDOFF



PLEASE NOTE THE LOCATION OF THE H.V. TERMINAL WHEN CONSIDERING WIRING.

05-14 to 35-70 Cross Reference Chart

EXISTING PART #	35-70 CROSS REFERENCE	NOTES
05-140201-000	35-705600-001	35-70 does not have a manual reset button and does not have a vertical 1/4" Q.C. terminal on high voltage spark transformer
05-140201-001	35-705600-001	35-70 does not have a manual reset button and does not have a vertical 1/4" Q.C. terminal on high voltage spark transformer
05-140201-005	35-705600-005	35-70 does not have a manual reset button and does not have a vertical 1/4" Q.C. terminal on high voltage spark transformer
05-140301-005	35-705600-005	35-70 does not have a manual reset button and does not have a vertical 1/4" Q.C. terminal on high voltage spark transformer
05-140401-000	35-705601-001	35-70 does not have a manual reset button and does not have a vertical 1/4" Q.C. terminal on high voltage spark transformer
05-140401-001	35-705601-001	35-70 does not have a manual reset button and does not have a vertical 1/4" Q.C. terminal on high voltage spark transformer
05-140401-005	35-705601-005	35-70 does not have a manual reset button and does not have a vertical 1/4" Q.C. terminal on high voltage spark transformer
05-140401-025	35-705601-005	35-70 does not have a manual reset button and does not have a vertical 1/4" Q.C. terminal on high voltage spark transformer, see Note 2
05-142201-000	35-705600-001	35-70 has a horizontal 1/4" Q.C. where the 05-14 has a vertical 1/4" Q.C. terminal on high voltage spark transformer
05-142201-001	35-705600-001	35-70 has a horizontal 1/4" Q.C. where the 05-14 has a vertical 1/4" Q.C. terminal on high voltage spark transformer
05-142201-005	35-705600-005	35-70 has a horizontal 1/4" Q.C. where the 05-14 has a vertical 1/4" Q.C. terminal on high voltage spark transformer
05-142201-025	35-705600-005	35-70 has a horizontal 1/4" Q.C. where the 05-14 has a vertical 1/4" Q.C. terminal on high voltage spark transformer, see Note 2
05-142301-001	35-704600-001	Isolated valve contacts, see Note 1, 35-70 has a horizontal 1/4" Q.C. where the 05-14 has a vertical 1/4" Q.C. terminal on high voltage spark transformer
05-142301-005	35-704600-005	Isolated valve contacts, see Note 1, 35-70 has a horizontal 1/4" Q.C. where the 05-14 has a vertical 1/4" Q.C. terminal on high voltage spark transformer
05-142401-001	35-705601-001	35-70 has a horizontal 1/4" Q.C. where the 05-14 has a vertical 1/4" Q.C. terminal on high voltage spark transformer
05-142401-005	35-705601-005	35-70 has a horizontal 1/4" Q.C. where the 05-14 has a vertical 1/4" Q.C. terminal on high voltage spark transformer
05-142401-025	35-705601-005	35-70 has a horizontal 1/4" Q.C. where the 05-14 has a vertical 1/4" Q.C. terminal on high voltage spark transformer, see Note 2
05-142501-005	35-704601-005	Isolated valve contacts, see Note 1, 35-70 has a horizontal 1/4" Q.C. where the 05-14 has a vertical 1/4" Q.C. terminal on high voltage spark transformer
05-143401-001	no cross	This 05-14 control has a special two stage start up with pilot and main valve control
05-143401-025	no cross	This 05-14 control has a special two stage start up with pilot and main valve control
05-149004-025	35-705701-005	35-70 has a horizontal 1/4" Q.C. where the 05-14 has a vertical 1/4" Q.C. terminal on high voltage spark transformer, see Notes 2 and 3, same as 05-142401-025 except potted with 6" lead wire on S1
05-149005-025	35-705700-005	35-70 has a horizontal 1/4" Q.C. where the 05-14 has a vertical 1/4" Q.C. terminal on high voltage spark transformer, same as 05-142201-005 except potted - see Note 3 - and leadwire for S1, E2 jumped to S1 to convert to local sense, see Note 2
05-149009-001	35-704600-001	Isolated valve contacts, see Note 1, customer P/N, double conformal coating, 35-70 has single conformal coat and has a horizontal 1/4" Q.C. where the 05-14 has a vertical 1/4" Q.C. terminal on high voltage spark transformer, same as 05-142301-001
05-149009-005	35-704600-005	Isolated valve contacts, see Note 1, customer P/N, double conformal coating, 35-70 has single conformal coat and a horizontal 1/4" Q.C. where the 05-14 has a vertical 1/4" Q.C. terminal on high voltage spark transformer, same as 05-142301-005
05-149013-031	35-705701-001	35-70 has a horizontal 1/4" Q.C. where the 05-14 has a vertical 1/4" Q.C. terminal on high voltage spark transformer, same as 05-142401-031, except 6" lead wire on S1 with duplex M/F terminal, Potted - see Note 3. Sometimes wired as local sense
05-149013-035	35-705701-005	35-70 has a horizontal 1/4" Q.C. where the 05-14 has a vertical 1/4" Q.C. terminal on high voltage spark transformer, same as 05-142401-035, except Potted - see Note 3
05-149014-005	no cross	Same as 05-143401-005 with customer P/N: on label, This 05-14 control has a special two stage start up with pilot and main valve control. Double conformal coat.
05-149015-000	35-705601-001	Assigned special part number because of sequential serial numbers assigned to labels. 35-70 has a horizontal 1/4" Q.C. where the 05-14 has a vertical 1/4" Q.C. terminal on high voltage spark transformer, same as 05-142401-000
05-149016-035	35-705700-005	35-70 has a horizontal 1/4" Q.C. where the 05-14 has a vertical 1/4" Q.C. terminal on high voltage spark transformer, same as 05-140201-035 except potted, see Note 3 and leadwire for S1, E2 jumped to S1 to convert to local sense, see Note 2
05-149018-001	35-705601-001	Same as an 05-142401-000 with special feature 05-982055-001 which is a horizontal 1/4" Q.C. instead of vertical 1/4" Q.C. on high voltage transformer. Use 05-128714-001 circuit breaker assembly (5 terminal), not available on the 35-70
05-149021-000	05-704600-001	Isolated Valve Contacts, same as an 05-142301-000 without R21 MOV surge suppressor - surge suppressor is standard on 35-70
05-149022-001	35-705601-001	Assigned 05-14 special feature number because this version does not use the standard vertical 1/4" Q.C. on high voltage spark transformer, same as 05-142401-001
05-149024-001	35-705600-001	Assigned 05-14 special feature number because this version does not use the standard vertical 1/4" Q.C. on high voltage spark transformer, same as 05-142201-001

NOTE 1: 35-704XXX-XXX is a special version of the 35-70 that has isolated valve contacts. Please see numbering scheme on Page 6 to determine the physical configuration and operating characteristics of the 35-704XXX-XXX models in this cross reference list.

NOTE 2: 05-14 controls with part numbers that end in -X2X and -X3X, i.e. 025 or 035, are not identified in the 05-14 part numbering scheme in the 05-14 data sheet. The 2 and 3 are used to indicate that a gas valve relay with higher current capacity than was standard on 05-14s was used. The 35-70s have the higher current capacity relay as standard equipment and therefore a special designation is no longer required.

NOTE 3: 05-14 controls that are enclosed in an open top potting shell and encased in dielectric potting material for protection against washdown and extreme vibration are not identified in the 05-14 part numbering scheme. These configurations were assigned special part numbers, such as 05-149XXX-XXX where the 9 signifies that the control is a special configuration.

Isolated Gas Valve Contacts

35 - 70 4 X 0 X - X X X

Isolated Gas Valve Contacts

Enclosure Configurations and Wiring Options

- 5 = Case and Cover Quick Connects
- 6 = Integral Stand-Offs Quick Connects
- 7 = Potted Quick Connects

or

Assemblies and Non-Standard Configurations

- 8 = Assemblies
- 9 = Non Standard Configuration

A 9 in this location of the part number (EXAMPLE: 35 704 901 - XXX) identifies this configuration as a non-standard design. The part number does not follow the part numbering system. Consult factory for operating characteristics of this control.

Pre-Purge Time	Inter-Purge Time	Trial for Ignition Time (TFI)
0 = None	0 = None	1 = 4 seconds
1 = 15 seconds		3 = 7 seconds
2 = 30 seconds		5 = 10 seconds
5 = 5 seconds		7 = 15 seconds
Number of Ignition Trials, Flame Sense Method and Lock Out Reset Method		
0 = 1 try, single spark and sense		Thermostat / power off reset
1 = 1 try, remote sense		Thermostat / power off reset

NOTE:

The 35-704 is a special version of the 35-70 product that has been developed to replace the 05-1403XX-XXX and 05-1405XX-XXX that have isolated valve contacts. This product will not be promoted for new applications and therefore is not mentioned in any product literature. This numbering scheme is solely used to assist customers with determining the operating characteristics of the controls identified as the replacements for 05-1403XX-XXX and 05-1405XX-XXX listed in this Conversion Guide.



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These instructions do not purport to cover all the details or variations in the equipment described, nor do they provide for every possible contingency to be met in connection with installation, operation and maintenance. All specifications subject to change without notice. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to KIDDE-FENWAL, Inc., Ashland, Massachusetts.

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