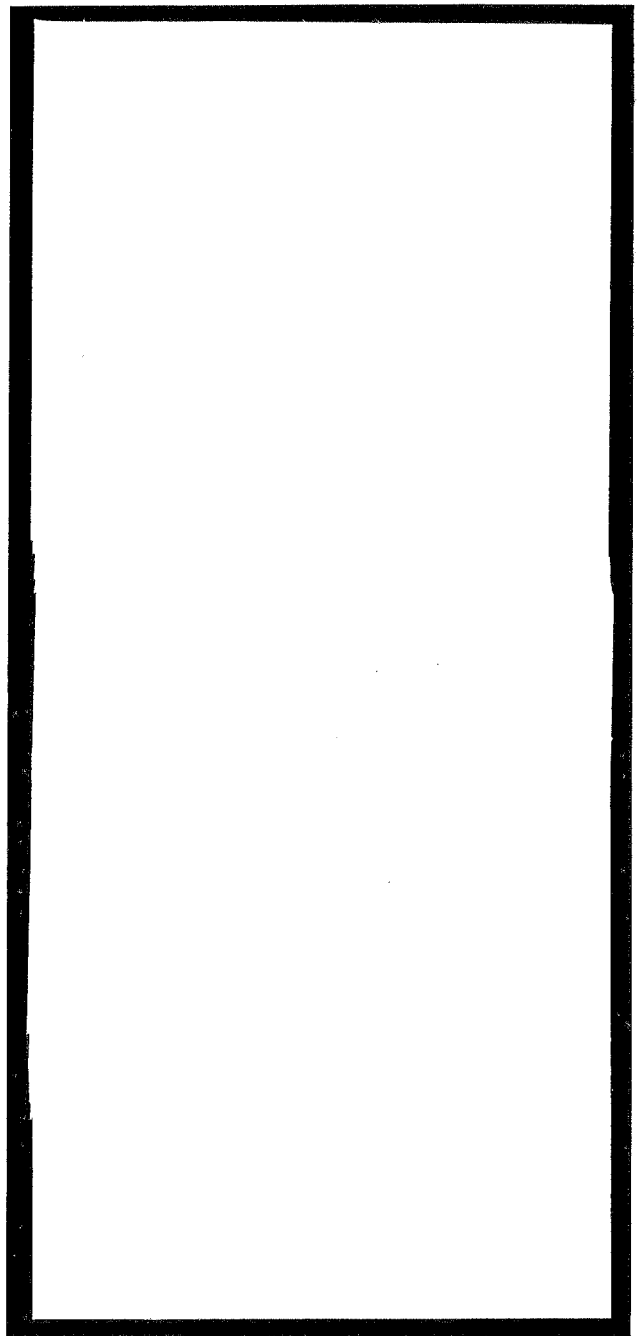


DET _____

TRONICS



INSTRUCTIONS

Flame Safeguard System
C9501N, C9502N, C9503M, C9507 Flame Scanners
R9005P Controller



WARRANTY POLICY

Detector Electronics Corporation products are manufactured from high quality components and the completed device is rigorously inspected and tested before shipment; however, any electronic device is subject to failure beyond the control of the manufacturer. To ensure system reliability, it is important for the user to maintain the system as recommended by the instruction manuals and to determine the frequency of functional checking of the system required for each specific installation. The more frequent the checking, the greater the system reliability. For the highest reliability, a completely redundant system is necessary. The manufacturer warrants its products against defective parts and workmanship, and will replace or repair equipment returned to the manufacturer for these reasons within 12 months after purchase date. See manufacturer's Standard Terms and Conditions on the invoice for complete details. Please note that no other warranties, written or implied, will be honored by the manufacturer.

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Flame Safeguard System C9501N, C9502N, C9503M, C9507 Flame Scanners R9005P Controller

SYSTEM APPLICATION

Detector Electronics flame safeguard systems provide recognition and continuous monitoring of fossil fuel flames in semiautomatically controlled boilers and furnaces. The R9005P Controller monitors signals from one flame scanner, and provides relay switching in response to flame loss. In conjunction with solid state or microprocessor-based control logic and the appropriate interlock and limit sensing devices, the R9005P Controller prevents burner start-up unless required conditions have been verified, and initiates immediate shutdown if limit conditions are exceeded during burner operation.

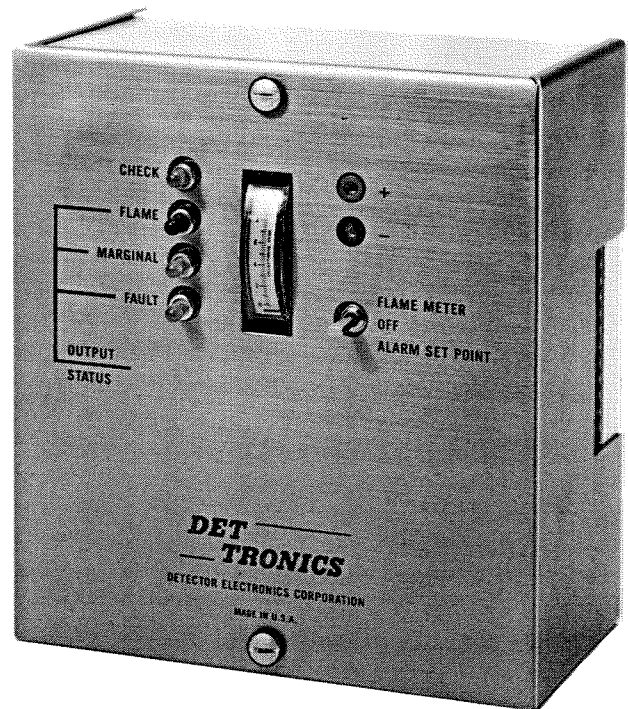
Flame scanners to meet almost any boiler need are available for use with the R9005P Controller:

The C9501N Ultraviolet Flame Scanner responds to ultraviolet (UV) radiation wavelengths between 1850 and 2650 angstroms, which are emitted by gaseous and liquid fuel flames.

The C9502N Infrared Flame Scanner responds to infrared (IR) radiation wavelengths between 5,000 and 10,000 angstroms, enabling the detection of coal, oil and other residual fuel flames that tend to mask or absorb UV radiation, making UV flame detection difficult.

The C9503M Flame Scanner uses a fiber optic link to transmit the burner flame radiation to the scanner electronics. Encased in a flexible steel carrier, the fiber optic transmission link allows the scanner head to move up and down, tracking a moving burner such as that found in a tangentially-fired tilting-burner boiler. The C9503M Scanner responds to radiation wavelengths within the range of 5,000 to 10,000 angstroms, suitable for monitoring coal and oil flames.

The C9507 All Fuel Scanner uses sensors that respond to radiation in the range of 1,850 to 10,000 angstroms, making it suitable for monitoring the flames of natural gas, No. 2 oil, No. 6 oil, pulverized coal and bark.



FEATURES

- Adjustable flame threshold.
- Selectable flame on delay time - 1 or 2 seconds.
- Selectable flame off and marginal flame delay time - 3.25 or 6.0 seconds. Use of 6.0 second delay voids FM approval.
- External output for remote flame intensity voltmeter (0 to 10 vdc, standard).
- Optional 4 to 20 milliampere flame intensity output for connection to remote devices.
- Accommodates ultraviolet, infrared, all fuel and fiber optic flame scanners to provide a choice of application solutions. (Configured with on-board jumpers.)
- Self-checking light chopper simulates flame loss once every 11 seconds to thoroughly test scanner for proper operation.
- Check Fault relay energizes if response to simulated flame loss is improper.
- Two separate user-adjustable gain settings provide enhanced discrimination in multiburner applications.
- Two independent gain channels selectable by external contacts.
- Front panel analog voltmeter and select switch allow indication of the flame threshold of the controller or the flame intensity monitored by the scanner.
- When the flame signal falls to marginal level (within 2 volts of flame threshold setting), a marginal relay is de-energized.
- Controller to scanner power is fused for system protection.

DESCRIPTION

The R9005P Controller processes signals from one flame scanner and energizes the Flame and Marginal relays in response to flame conditions. The R9005P includes a self-checking feature that tests response to a loss of flame once every 11 seconds. This test is accomplished by mechanically blocking light from the flame, then checking the controller for the appropriate response. In the event of a failure, the Fault

relay will energize and the FAULT LED will illuminate. The faceplate indicators, consisting of four LED status outputs and one analog flame intensity meter, allow remote monitoring while the self-checking feature ensures constant system reliability. The following list summarizes the front panel controls and indicators. Refer to Figure 1 for the R9005P faceplate.

CHECK LED — illuminated during the scanner test.

MARGINAL LED — illuminated when the flame intensity signal is below the marginal flame setpoint and the Marginal relay is energized.

FLAME ON LED — illuminated when the flame intensity signal exceeds the flame-on setpoint and the Flame relay is energized.

FAULT LED — illuminated when the system is not responding to self-test properly and the Fault relay is energized.

Meter Select Switch — switch allows monitoring of either the user-adjusted flame threshold (SETPOINT) on the controller or the flame intensity monitored by the scanner (METER).

Three potentiometers are located inside the cover of the R9005P. Their functions are described below:

SETPOINT — adjusts the flame threshold setpoint

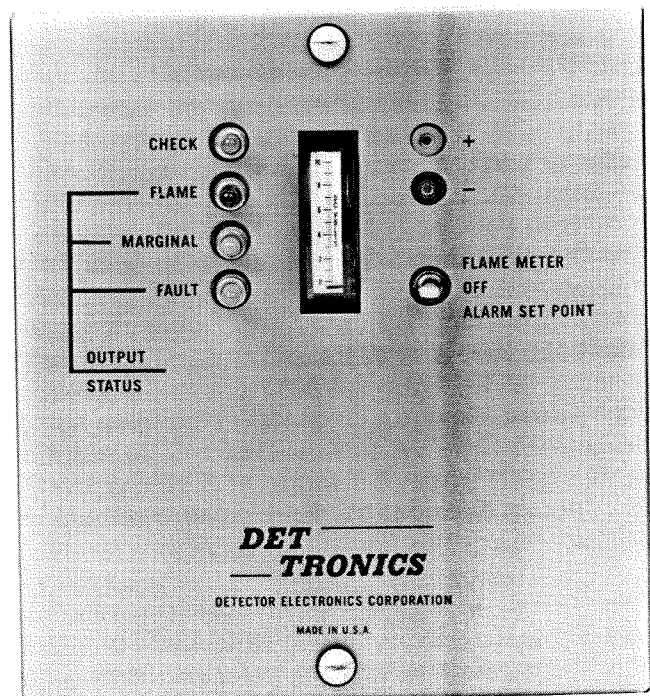


Figure 1—R9005P Faceplate

GAIN 1 — adjusts the Channel 1 flame signal amplitude.

GAIN 2 — adjusts the Channel 2 flame signal amplitude.

NOTE

When two different flames may be viewed by the scanner (for example a pilot and a main flame), the gain controls can be set so that the controller responds appropriately to each flame. A signal from an external switch applied to the backplate of the controller determines which gain setting is used. Only one gain setting can be used at a time. Refer to the "Gain Adjustment" section of this manual for further information.

THEORY OF OPERATION

The Detector Electronics R9005P Controller monitors signals from a flame scanner and generates relay output switching in response to changes in flame status. Burner flame discrimination is accomplished by incorporating an adjustable flame threshold to compensate for background radiation and adjacent burner interference. Two gain channels allow the con-

troller to respond appropriately to the selected flame. An input from an external switch determines which channel will be used. The flame response circuitry monitors the signal from the flame scanner and energizes the Flame relay when the scanner signal exceeds the flame setpoint. At ten second intervals, a mechanical light chopper in the scanner blocks the signal from the flame to simulate a flame loss. If response to the simulated flame loss is improper, the Fault relay is energized.

Referring to Figure 2:

- Scanner signal pulses, periodically interrupted by the self-test, are transmitted through the selected gain channel to the integrator buffer circuit.
- The flame signal is sent to the flame meter and to terminals for connection to a remote meter.

NOTE

The R9005P can be equipped with both a 0 to 10 vdc meter output and a 4 to 20 millampere current output.

- The flame signal is sent to the marginal flame threshold detector.

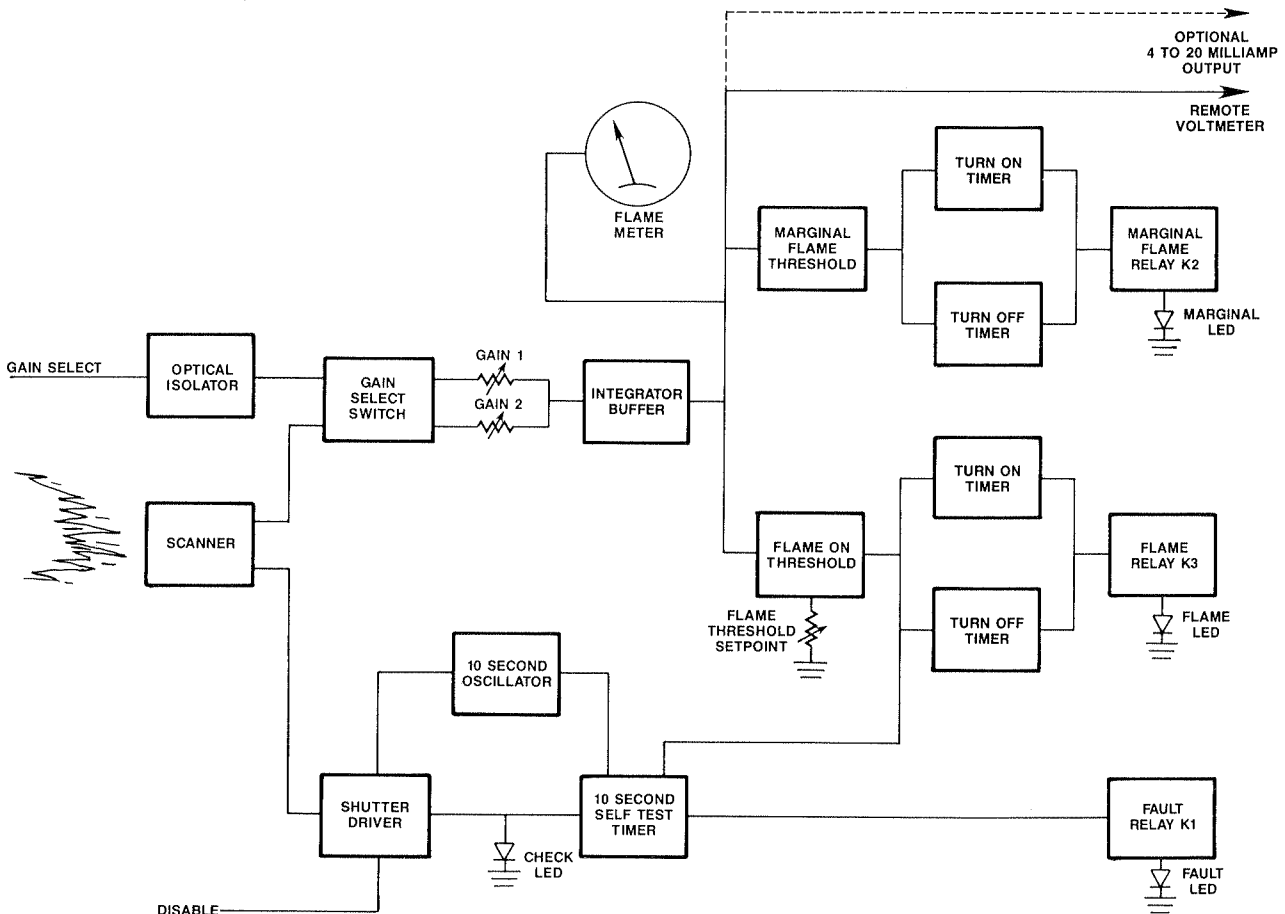


Figure 2—Flame Response Circuitry Block Diagram

A1091

- If the flame signal exceeds the marginal flame setpoint, the flame controller initiates the turn on timer (selectable between 1 or 2 seconds).
- If the flame signal remains above the setpoint for the selected amount of time, the MARGINAL LED is turned off and the Marginal relay is de-energized.
- If the flame signal falls below the marginal flame setpoint, the flame controller initiates the turn off timer (selectable between 3.25 or 6.0 seconds). Use of 6.0 second delay (W2 installed) voids FM approval.
- If the flame signal remains below the setpoint for the selected amount of time, the marginal flame timer "times out" causing the Marginal relay (K2) and the MARGINAL LED to turn on.
- The flame signal is sent to the flame-on threshold circuit.
 - If the flame signal exceeds the user-adjusted flame-on threshold setpoint, the signal initiates the turn on timer (selectable between 1 or 2 seconds).
 - If the flame signal remains above the threshold setpoint for the selected amount of time, the FLAME LED is turned on and the Flame relay (K3) is energized.
 - If the flame signal falls below the flame on threshold setpoint, the flame detector initiates a turn-off timer (selectable between 3.25 or 6.0 seconds). Use of 6.0 second delay (W2 installed) voids FM approval.
 - If the flame signal remains below the setpoint for the selected amount of time, the turn off timer "times out" causing the Flame relay (K3) to de-energize and the FLAME LED to turn off.
- When the flame signal exceeds the flame on threshold setpoint, the signal is passed to the self-test timer.
 - If the flame signal does not drop below the flame on threshold setpoint (in response to a successful scanner self-test) on any two successive check cycles, the fault test timer will "time out" causing relay K1 to energize and the FAULT LED to illuminate.

NOTE

Since the Flame relay and the FLAME LED are controlled by a timer that is set at either 3.25 or

6.0 seconds, they are unaffected by the 1.0 second check period in which the flame is blocked during the scanner self-test.

- Front panel indicators reflect normal system operation in the following manner:
 - When the Meter Select switch is set in the METER position, the front panel displays flame intensity. (If a remote meter is connected, it will display flame intensity regardless of Meter Select switch position.)
 - When the Meter Select switch is in the OFF position, no signal is displayed.
 - When the Meter Select switch is set in the ALARM SETPOINT position, the user-adjusted Flame On threshold setpoint is displayed.
 - The green CHECK LED is illuminated for 1 out of every 11 seconds by the self-check circuitry.
 - The amber MARGINAL LED is off, indicating that the marginal flame setpoint has been exceeded, and K2 is de-energized.
 - The red FLAME ON LED is illuminated, indicating that the flame on threshold has been exceeded, and K3 is energized.
 - The amber FAULT LED is normally not illuminated. When the LED is on, it indicates improper response during self-test and that relay K1 is energized.

SPECIFICATIONS

GAIN SELECT (from external switch)—

No voltage applied selects Channel 1 gain setting. Line voltage (see OPERATING VOLTAGE specifications) applied selects Channel 2 gain setting.

OUTPUTS—

Relay contact ratings - Fault relay K1, Marginal relay K2 and Flame relay K3: (Form C) 4 amperes at 125 vac or 240 vac; 3 amperes at 30 vdc or 1/20 HP at 125 or 250 vac.

FLAME METER OUTPUT —

0 to 10 vdc.
4 to 20 milliamperes (optional).

NOTE

The R9005P controller can have both the 0 to 10 vdc and the optional 4 to 20 millampere outputs.

OPERATING VOLTAGE—
120 vac, 50/60 Hz (+15 vac, -18 vac), standard.
240 vac, 50/60 Hz (+30 vac, -36 vac), selectable by jumpers.

POWER CONSUMPTION—
12 watts typical.

TEMPERATURE RANGE—
Operating: -40°F to +167°F (-40°C to +75°C).
Storage: -40°F to +220°F (-40°C to +105°C).

HUMIDITY—
5 to 95% relative (non-condensing).

SHIPPING WEIGHT (Approximate)—
4 pounds (1.8 kilograms).

FLAME FAILURE AND MARGINAL FLAME RESPONSE TIME—
User-selectable models - 3.25 or 6.0 seconds.

FAULT RECOGNITION TIME—
22 seconds (typical).

SELF-CHECK PERIOD—
11 seconds (10 seconds viewing, 1 second blocked).

FLAME-ON THRESHOLD—
User-adjustable, 2 to 6 volts relative meter reading.

MARGINAL-ON THRESHOLD—
2 volts greater than the Flame On threshold setting (4 to 8 volts relative meter reading).

FLAME RECOGNITION TIME—
User-selectable - 1 or 2 seconds.

DIMENSIONS—
See Figure 3 for the R9005P dimensions.

MOUNTING —
The R9005P is surface mounted, see Figure 3.

WARNING

Use of 6.0 second delay voids FM approval.

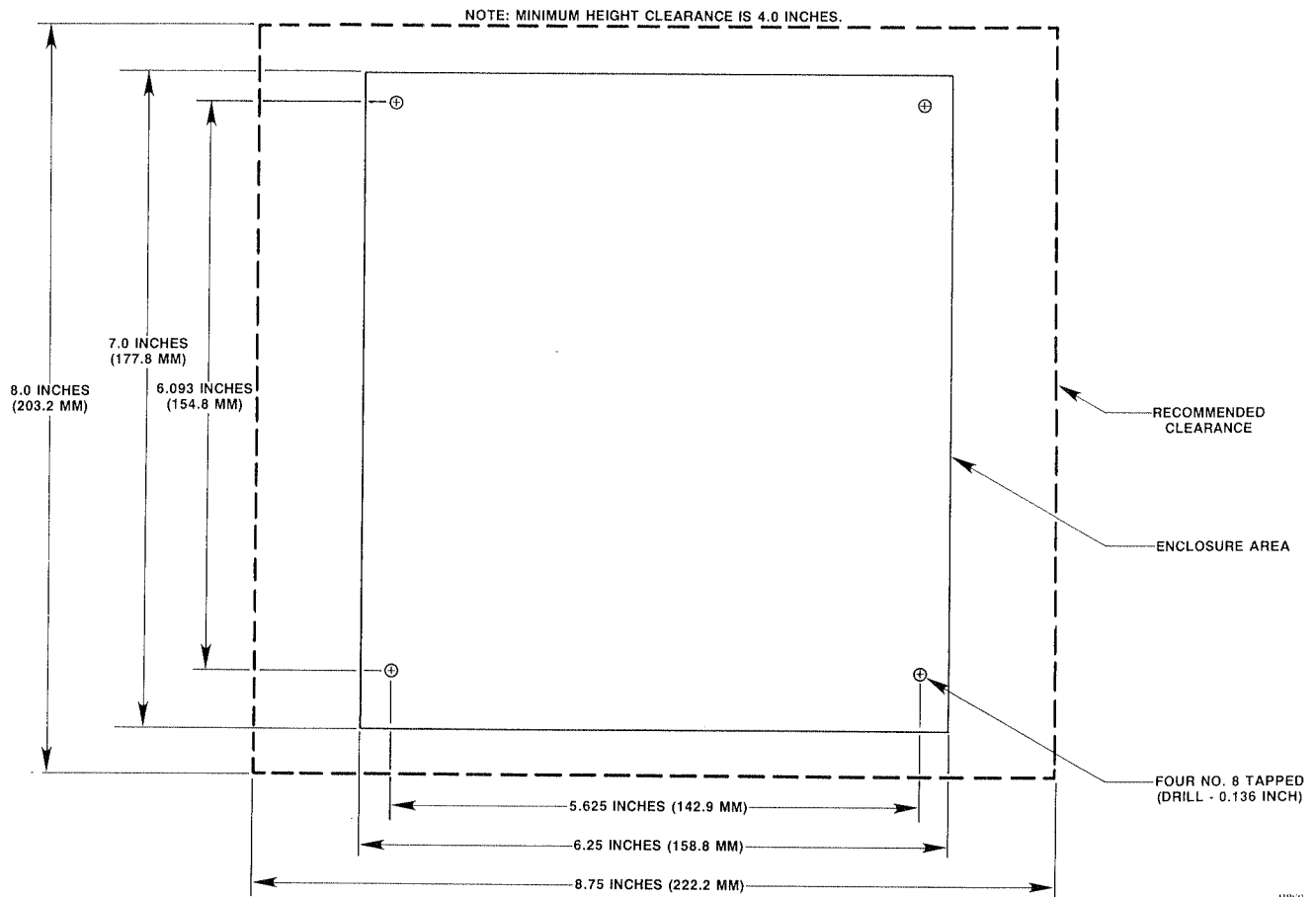


Figure 3—R9005 Controller Mounting Dimensions

FLAME SCANNERS

ELECTRICAL—

Choice of a front mounting base or a fiber optic base. Standard 8 foot long nonshielded 18 awg wires (five), insulation rated at 220°F (105°C), 600 vdc breakdown, oil-resistant. Military connector or special wire lengths also available.

MECHANICAL—

1 inch NPT to sight pipe (1 1/4 inch NPT to sight pipe on fiber optic base), 3/4 inch NPT purge air, 1/2 inch NPSM tap for electrical fitting.

TEMPERATURE RANGE—

-4°F to +200°F (-20°C to +93°C) measured at mounting hub, housing ambient air not to exceed 160°F (71°C).

SHIPPING WEIGHT—

7 pounds (3.18 kilograms).

RESPONSE RANGE—

C9501N Ultraviolet Flame Scanner: 1850 to 2650 angstroms.

C9502N Infrared Flame Scanner: 5,000 to 10,000 angstroms.

C9503M Fiber Optic Scanner: 5,000 to 10,000 angstroms.

C9507 All Fuel Flame Scanner: 1,850 to 10,000 angstroms.

DIMENSIONS—

See Figure 4.

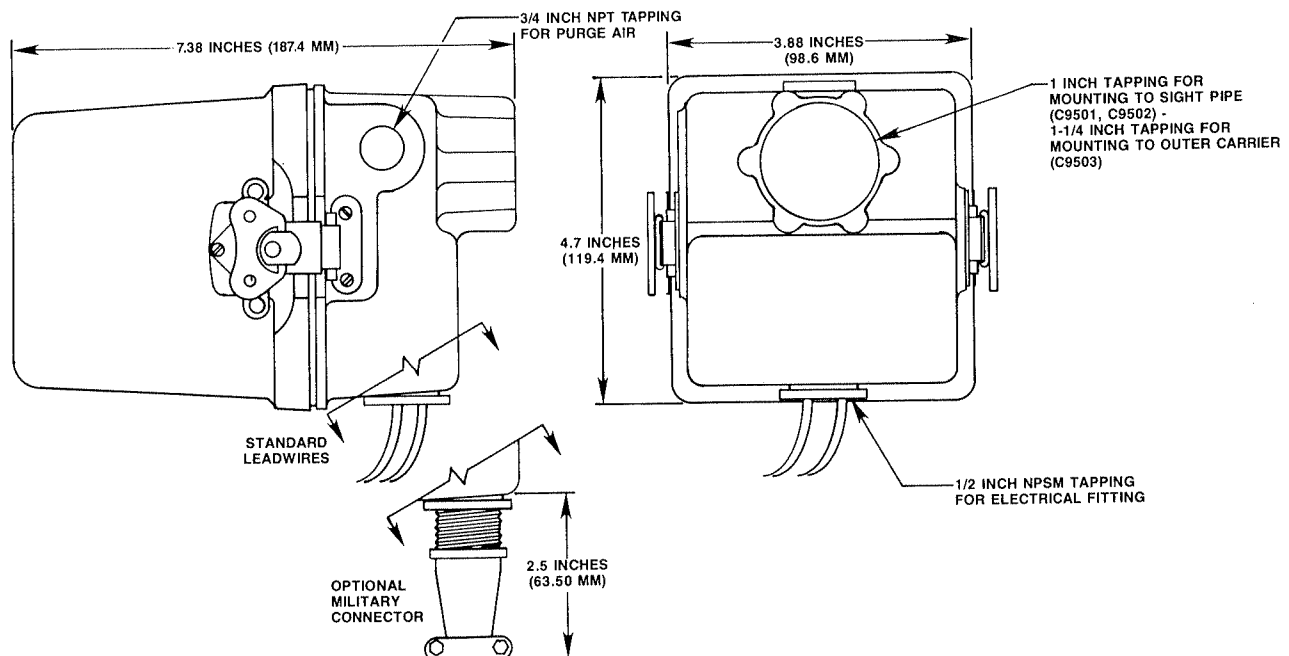


Figure 4—C9501/C9502/C9507 Dimensions

INSTALLATION

JUMPER SETTINGS

The R9005P has jumpers on the circuit board that must be set (and should be checked) for proper operation. The following procedure explains the jumpers and proper settings. To access the circuit board on the R9005P, turn the two front spring-loaded locking screws on the cover counterclockwise, then slide the cover off the base.

Refer to Table 1 for the correct jumper settings and Figure 5 for jumper locations.

NOTE

The R9005P units that are supplied as part of a Det-Tronics Burner Management System will have the required jumpers installed at the factory and will be documented in the Systems Instruction Manual that accompanies the system. If the unit is purchased as a spare for a system, refer to the Systems Instruction Manual for the proper jumper settings.

NOTE

Units purchased separately may require installation and/or removal of jumpers to fit the requirements of the specific application. The procedure below explains the jumpers and settings.

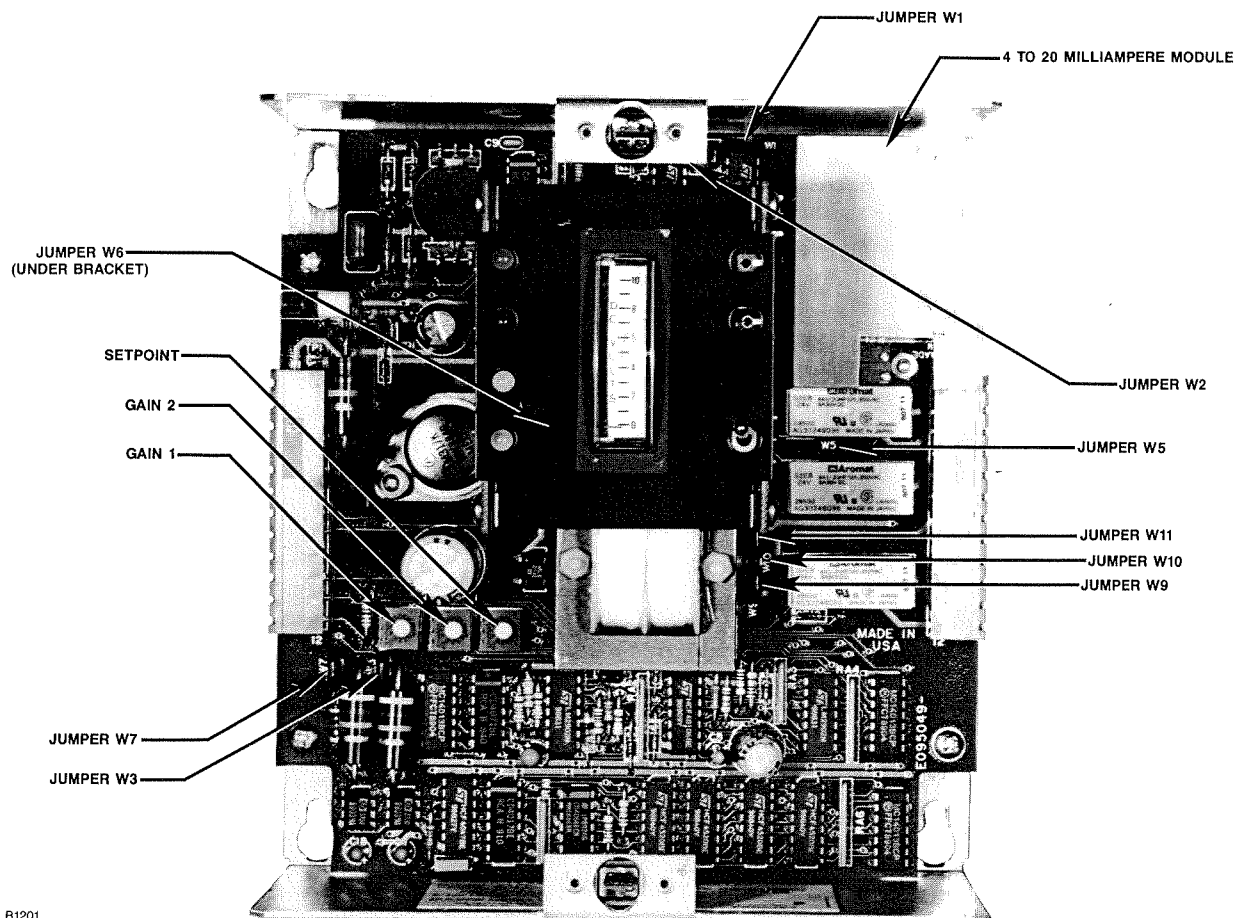


Figure 5—R9005P Jumper Locations

Table 1—R9005P Jumper Installation (Note 2)

Feature	Jumper No. W-										
	1	2	3	5	6	7	9	10	11		
Power Input 120 vac							X		X		
240 vac							O	X	O		
Gain Select 120 vac			X								
Input 240 vac			O								
Disable Input 120 vac						X					
240 vac						O					
Use with C9507				X							
Flame On 1.0 sec.	O										
Delay 2.0 sec.	X										
Flame Off 3.25 sec.		O									
Delay (See 6.0 sec. Note 1)		X									
Factory Used					X						
Note 1: Use of jumper W2 voids FM approval.											
Note 2: Jumpers W1, W3, W6, W7, W9, and W11 are factory installed on units not included in systems.											
X = Installed O = Omitted											

WARNING

Incorrect installation of jumpers can impair operation and cause damage to the unit. Contact the Customer Service Department for assistance with questions or problems.

WARNING

Use of the 6.0 second delay time voids FM approval. If not used, it is suggested that jumper W2 pins be clipped to avoid inadvertent use.

Power Input

The R9005P is set for 120 vac operation when shipped (jumpers W9 and W11 installed). To convert the R9005P to 240 vac operation, remove jumpers W9 and W11, and install jumper W10.

Gain Select Input

The R9005P is set for a 120 vac Gain Select Input when shipped (jumper W3 installed). To use the R9005P with a 240 vac Gain Select Input, remove jumper W3.

NOTE

Use the same ac source as the power input.

Disable Input

The R9005P is set for a 120 vac Disable Input when shipped (jumper W7 installed). To use the R9005P with a 240 vac Disable Input, remove jumper W7.

NOTE

Use the same ac source as the power input.

Use With the C9507 All Fuel Scanner

If the R9005P is to be used with the C9507 All Fuel Scanner, install jumper W5.

Flame On Delay

The R9005P is set for a 2.0 second Flame On Delay when shipped (jumper W1 installed). To set the R9005P for a 1.0 second time delay, remove jumper W1.

Flame Off Delay

The R9005P is set for a 3.25 second Flame Off Delay when shipped. The Flame Off Delay can be increased to 6.0 seconds by installing jumper W2. Installation of W2 voids FM approval.

Optional 4 to 20 Milliampere Module Assembly

The DE4643-001 includes the 4 to 20 milliampere module and mounting hardware. Refer to Figure 5 and the instructions below to install the DE4643-001.

NOTE

The R9005P units that have the 4 to 20 milliampere option and are supplied as part of a Det-Tronics Burner Management System will have the 4 to 20 Milliampere Module Assembly installed at the factory.

1. Plug the 4 to 20 Milliampere Module into the socket on the R9005P.
2. Screw the mounting standoffs to the control board through the mounting holes.
3. Tighten the nuts on the top of the 4 to 20 milliampere module.

Specifications (4 to 20 Milliampere Module)

Output Type—
Isolated two-wire current loop.

Power Source—

External dc power supply with an supply voltage between 12.1 and 40 vdc is required.

Loop Resistance—

The maximum loop resistance which can be driven is a function of the power supply output voltage and can be calculated with the following formula:

$$R_{max} = \frac{V_{ps} - 12.1}{0.02}$$

R_{max} = maximum loop resistance
 V_{ps} = power supply output voltage

R9005P CONTROLLER MOUNTING

1. Select a vertical mounting surface that is relatively free of vibration and where operating temperatures will be within the specified tolerance (see "Specifications" section for temperature limits).
2. The actual width of the R9005P is 6-1/4 inches. However, because connectors P1 and P2 are located on either side of the controller, it is recommended that the minimum width allowed be 8-3/4 inches.
3. The R9005P consists of three parts: base, circuit board and cover. To remove the cover, turn the two front spring-loaded locking screws counter-clockwise, then slide the cover off the base.
4. Refer to Figure 3 for the mounting dimensions of the base. Use a No.8 screw with a lockwasher in each of the four holes to mount the base.

R9005P CONTROLLER WIRING

1. The electrical connections of the R9005P Controller are shown in Figure 6.
2. From the front of the controller, connector P1 is located on the left side and connector P2 is located on the right side of the cover.
3. Each terminal is designed for a maximum of one 12 awg wire. Rather than connecting a greater number, make splices in a junction box. Do not make splices in conduit or fittings.
4. For any wiring runs on or near hot surfaces, use wire rated for 220°F (105°C) or higher.
5. Wire in accordance with the National Electrical Code and local code requirements.

FLAME SCANNER MOUNTING

1. Choose a sighting location where the scanner will have an unobstructed view of the flame under all firing conditions. Greatest ultraviolet radiation is produced near the base of the flame in the area immediately ahead of the burner. Greatest infrared radiation is produced in the later (cooler) stages of combustion, further out into the combustion chamber. A scanner monitoring a pilot flame and a main flame must be positioned so that it can sight both flames.

For further information refer to the applicable scanner operating manual (listed below).

C9501N - Publication 65-8037
 C9502N - Publication 65-8025
 C9503M - Publication 65-8005
 C9507 - Publication 65-8048

Sighting the Scanner

R9005P Controller - Prior to making adjustments, set both GAIN potentiometers inside the R9005P (see Figure 5) to maximum sensitivity (fully clockwise). Set the SETPOINT potentiometer to the lowest threshold setting (fully counterclockwise).

With the burner that is to be monitored by the controller off and any other burners in the boiler operat-

ing normally, place the toggle switch on the faceplate of the R9005P in the METER position. Observe the meter reading for the background radiation indication. If the meter reading is greater than 3.5 volts, the background radiation that the scanner is sighting is too high. Using the Q2625 Swivel assembly, reposition the scanner to decrease the amount of background radiation in its field of view.

Setpoint Adjustment

Once the background radiation detected is below 3.5 volts, hold the faceplate toggle switch in the ALARM SETPOINT position and observe the meter reading. This is the flame relay threshold setpoint. Adjust the SETPOINT potentiometer (on the R9005P circuit board) to obtain a reading that is 1 volt higher than the background radiation observed in the previous step.

Gain Adjustment

The R9005P has one scanner input, however, this signal can be routed through one of two gain channels. On the R9005P, connector P1, pin 2 is used to select the gain channel (see Figure 6). With no voltage applied, Gain 1 is selected. With line voltage applied, Gain 2 is selected. The two gain channels can be independently adjusted using the following procedure.

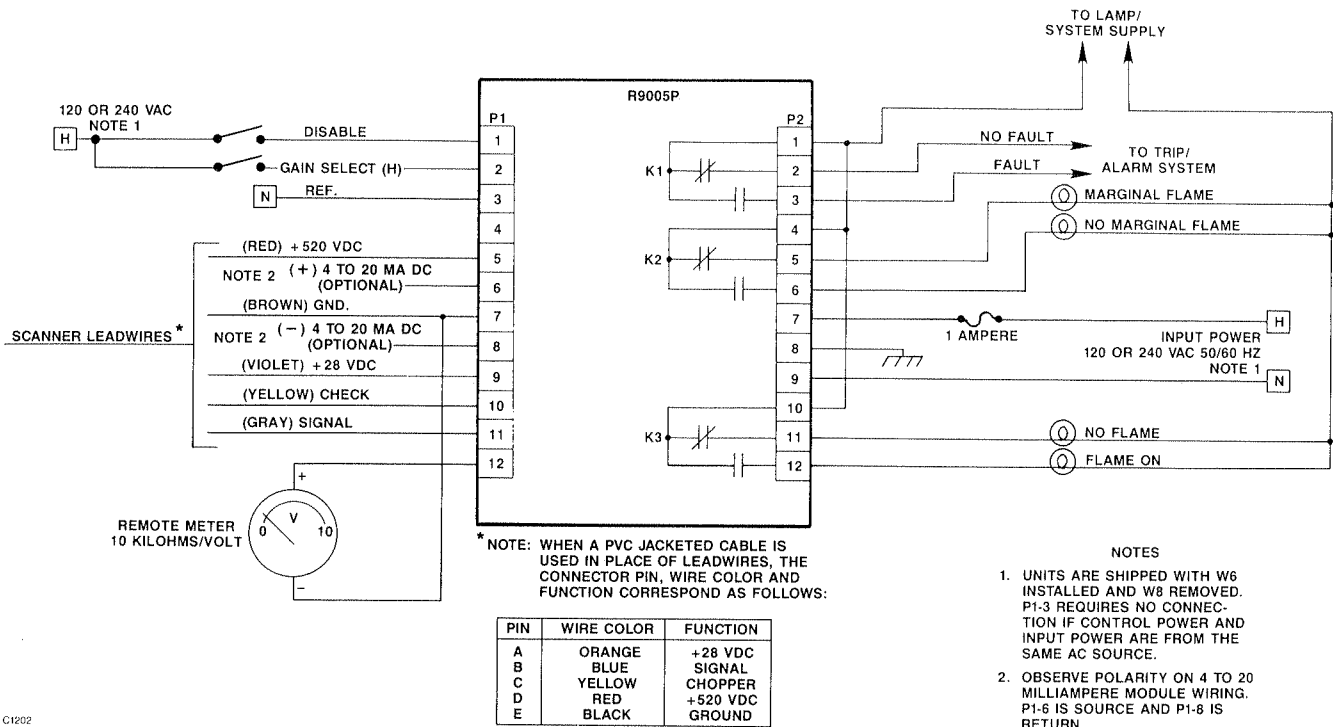


Figure 6—R9005P Electrical Connections

1. Ensure that the desired Gain channel is selected (see above).
2. Ignite the burner that is to be monitored through the selected Gain channel.
3. Place the toggle switch on the R9005P faceplate to the METER position.
4. Adjust the GAIN potentiometer that corresponds to the gain channel selected to obtain a signal reading between 7 and 8 volts on the faceplate meter.
5. If the other gain channel is to be used, select it by applying the appropriate voltage to connector P1, pin 2 on the R9005P (see above).
6. Ignite the burner that is to be monitored through the selected Gain channel.
7. Place the toggle switch on the R9005P faceplate to the METER position.
8. Adjust the GAIN potentiometer that corresponds to the gain channel selected to obtain a signal reading between 7 and 8 volts on the faceplate meter.

NOTE

When using the C9507 All Fuel Scanner, changing gain channels also changes scanner operation. When channel 1 is selected, the scanner is monitoring the ultraviolet portion of the burner flame. When channel 2 is selected, the scanner is monitoring the infrared portion of the burner flame.

DEVICE RETURN AND REPAIR

Prior to returning devices or components, contact the nearest local Detector Electronics office so that an RMI (Return Material Identification) number can be assigned. A written statement describing the malfunction must accompany the returned device or component to expedite finding the cause of the failure, thereby reducing the time and cost of the repair to the customer.

Return all equipment transportation prepaid to the Minneapolis location.

Office Locations

Detector Electronics Corporation
 6901 West 110th Street
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 Telephone (612) 941-5665 or (800) 765-FIRE
 Telex 6879043 DETEL UW
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 Facsimile (612) 829-8750

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 Colnbrook
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 Telex 848124 GRAVIN G
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Detronics Scandinavia AB
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 S-260 83 Vejbystrand
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 Facsimile 431-52236

Detector Electronics Europe S.r.l.
 Via Carlo D'Adda, 5
 I-20143 Milan
 ITALY
 Telephone 39 2 58100401
 Facsimile 39 2 89407638

Detronics AB
 Rochussenstraat 49A
 3015 Ec Rotterdam
 HOLLAND
 Telephone 010-436-2777
 Facsimile 010-436-0296

Detectomatic S.A.
 AV17 Con Calle 72, No. 71-92
 Apartado 10055
 Maracaibo, Venezuela

ORDERING INFORMATION

When ordering specify:

R9005P Controller
DE4643-001, 4 to 20 Milliampere Module
Assembly (Optional)
C9501N Ultraviolet Flame Scanner
C9502N Infrared Flame Scanner
C9503M Fiber Optic Infrared Flame Scanner
C9507N All Fuel Scanner

004606-001
Sight Restrictor Kit (Consists of three sight restricters and one retaining ring). For more information refer to form 65-8052.

004605-001
Sight restricter with 0.125 orifice

004605-002
Sight restricter with 0.187 orifice

004605-003
Sight restricter with 0.250 orifice

101537-001
Retaining ring

ACCESSORIES

DE601-006
5 pin military connector kit for use with PVC cable. For more information refer to form 65-8027.

DE601-006A
5 pin military connector kit for use with Hypalon cable.

Q2625
Swivel mounting assembly. Specify either 2-inch NPT mounting or flange mounting.

Prefabricated Scanner Cables

When ordering scanner cables, specify the part number and the length required.

DE3667
Cable connector assembly, PVC
Available lengths: 10, 20, 40, 50, 60, 80, 100, 125, 150, 175, 200 feet.

DE4360
Cable/Connector clamp assembly, non-PVC
Available lengths: 10, 20, 40, 60, 80, 100 feet.

DE4599
Cable/Connector with conduit adapter, Non-PVC
Available lengths: 10, 20, 40, 60, 80, 100 feet.

When ordering scanners, specify whether standard 8 foot leadwires, custom length leadwires or a military connector is required.

REPLACEMENT PARTS

DE601-104E Front mounting base, 8 foot non-shielded 18 awg wires (5), insulation rated at 220°F (105°C), 600 vdc breakdown, oil-resistant.

DE601-104D Front mounting base, military connector.

DE601-112C Fiber optic base, 8 foot non-shielded 18 awg wires (5), insulation rated at 220°F (105°C), 600 vdc breakdown, oil-resistant.

DE601-112B Fiber optic base, military connector.

DE601-006 Installation kit for DE601-104D and DE601-112C (military connectors).

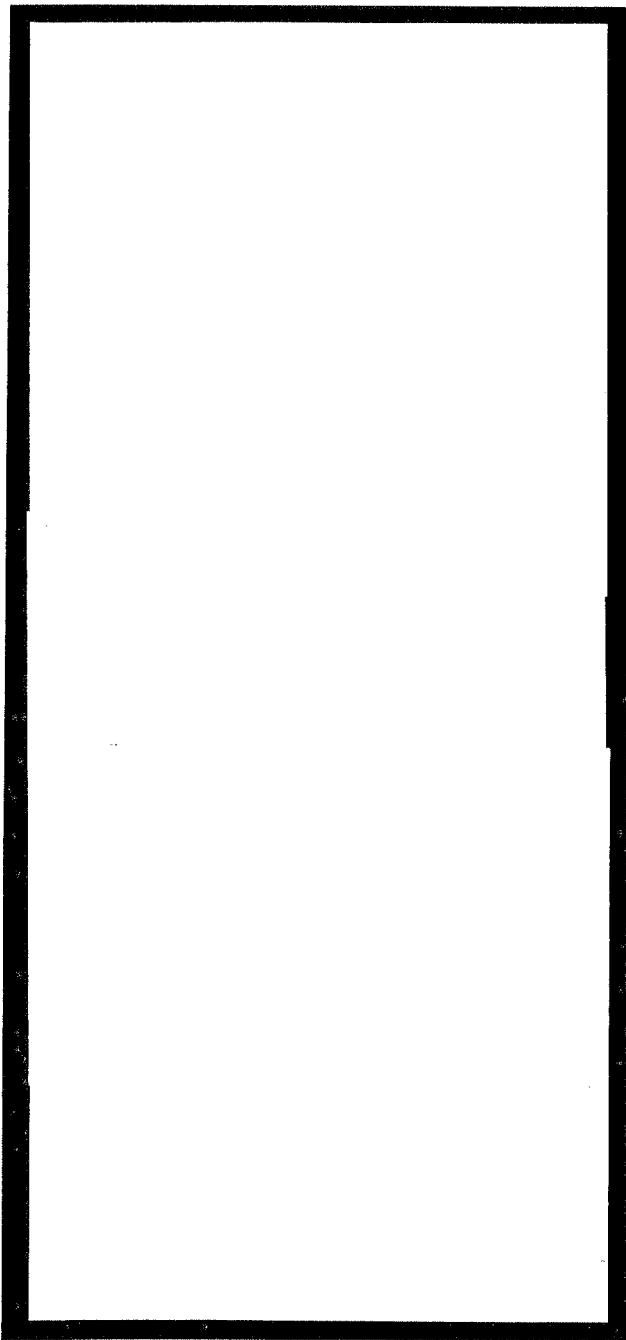
DE601-106 UV Scanner Assembly (plug-in module, without base).

DE601-108A IR Scanner Assembly (plug-in module, without base).

DE601-110 IR Fiber Optic Scanner Assembly (plug-in module, without base).

DE601-113 All Fuel Scanner Assembly (plug-in module, without base)

101363-002 Fuse (R9005P)



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Printed in U.S.A.

