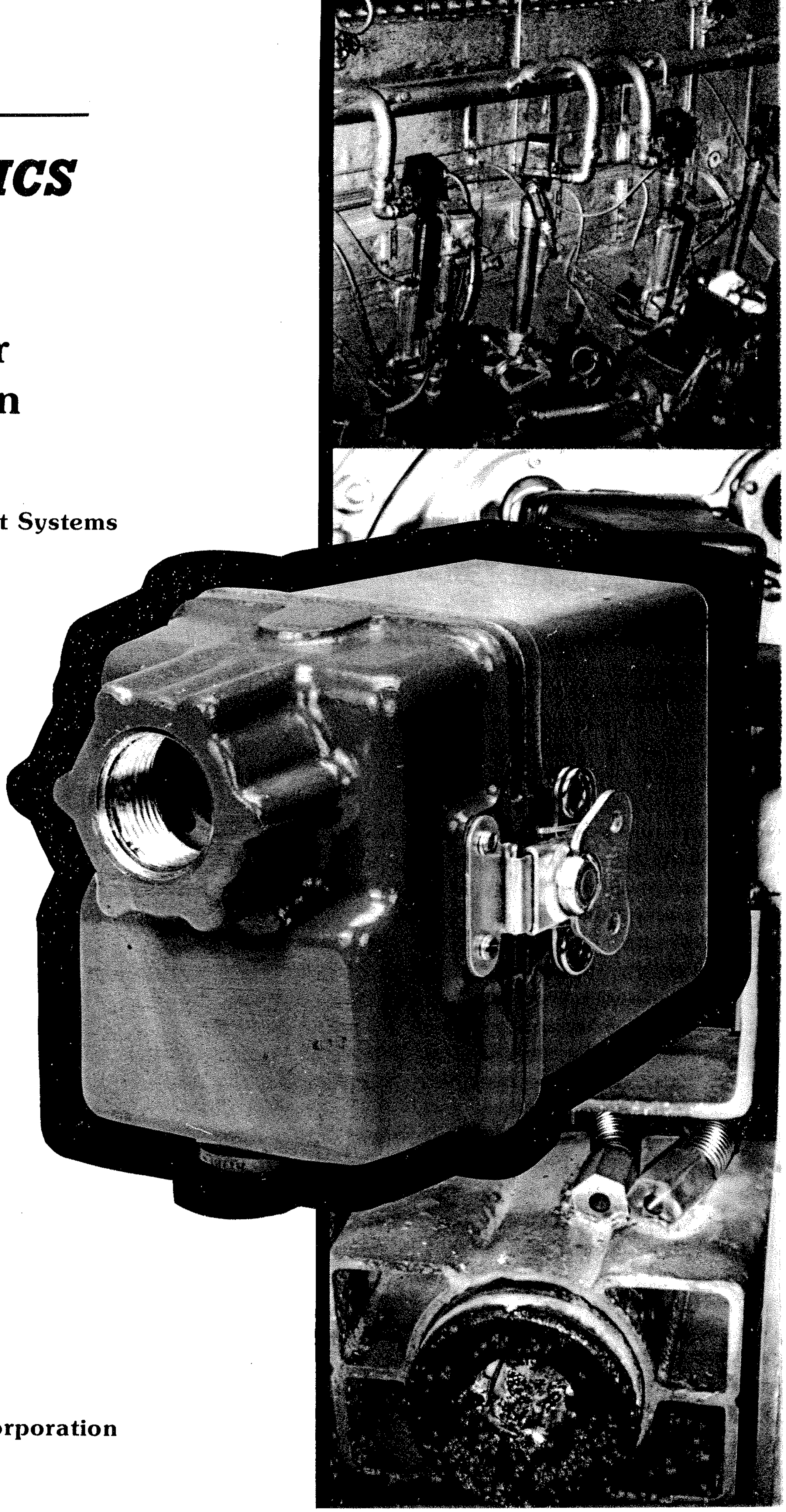
DET
TRONICS

Scanner Selection Guide

for Burner Management Systems



Detector Electronics Corporation

DET TRONICS

SCANNER SELECTION GUIDE for Burner Management Systems

INTRODUCTION

Utility and Industrial boiler users worldwide are facing problems caused by fuel scarcity and escalating costs. As a result, they are burning more and more industrial waste and byproducts in an effort to reduce costs. Among the many fuels used are tar, pitch, waste and crude oil, coke, wood chips, sawdust, and corn cobs. In addition to these considerations the varying prices of fuel at any given period of time has made it prudent to choose and use main fuels (oil, gas, and coal) when they can be supplied at their lowest prices. In order to do this, furnaces, burners and boilers have been built with, or retrofitted to burn a number of different fuels. Many of these boiler installations require multiple flame safeguards to be installed. These can include ultraviolet, infrared and visible light flame scanners individually or in combinations on the same boiler. This is especially necessary since no single flame scanner can be suitable for all conditions. Scanners are fitted to a boiler to handle a particular spectral range of the fire and are adjusted and tailored to specific conditions. Det-Tronics flame scanners are available to monitor most burner and furnace applications. Systems are currently applied to most types of utility and industrial boilers and many processing situations - petroleum processing, pulp and paper, kilns, direct fired heaters as well as recovery and power boilers.

In order to determine the type and number of scanners needed for a given application, some basic information must be obtained. Scanners are chosen after carefully examining factors such as boiler type, burner type and the number of burners, fuel type, scanner adaptability to the burner front and other special considerations particular to each installation.

In this guide some of these factors will be examined more closely. (Keep in mind that these basic factors are not presented to replace the valuable installation supervision provided by an experienced and skilled Det-Tronics field engineer.)

HISTORY OF FLAME MONITORING

Flame safeguard systems have gone through a long technological evolution since their early beginnings. The first notable use of flame safeguard equipment was a "beam scale" used in industrial boilers to measure the amount of fuel dripping from the unlit burner. The unburned fuel accumulated until it tripped a valve in the oil line and discontinued the feed of oil.

The beam scale was later followed by thermocouples, bimetallic strips and diaphragms. Each opened and closed automatically when heat of a predetermined level was present. A response time of 20 seconds was typical for this type of detection.

In the 1930's, the flame rod was introduced. The flame rod element was placed directly into the flame. Since flame influences electrical current, a current would be induced in the flame rod allowing detection of the flame.

After the Second World War, the flame rod was joined by the photocell. The photocell allowed visible flame to be monitored. Based on this new technology, infrared detectors were introduced, and finally ultraviolet detectors.

Today the visible, infrared, and ultraviolet portions of the spectrum are the basis for continuing development of reliable high speed flame detectors.

One key to determining flame monitoring needs is the type of fuel being burned. The following is a brief summary of fuels currently in use.

FUELS

Fuels for boilers are changing as the cost and availability of traditional fuels is changing. Increased prices and decreased availability have become important factors in the move toward using waste byproducts and recovery fuels for burning.

Still, by far the most typical fuels in use today are oil, gas, and coal.

Oil, a liquid fuel, is graded according to characteristics such as viscosity and flash point. Each grade can be categorized according to its usefulness for burning. Oil is graded one through six with one being the lightest. Heavier grades, used in furnaces, require preheating and atomization for most effective burning. The greatest number of BTU/lb are produced in the heavier grade of this fuel.

Some oil requires preheating in order to be introduced into the furnace most effectively. Steam and air are the most common atomizing media. In this type of atomization, steam or air is combined with the oil inside the burner and forced into the furnace where the mixture rapidly expands.

In the case of mechanical atomization, fuel flows under pressure through a "whirl chamber" and an orifice into the furnace to produce a fine mist of particles. In most instances these particles will then be burned in suspension.

Gas or gaseous fuels are categorized according to the manner in which they are produced. Four categories are:

Natural gas - obtained from geographic formations and tapped for use and storage.

Manufactured gases - are produced by the cracking of coal or oil and similar processes.

Mixed gases - are aimed at lowered costs by mixing quantities of natural gas with locally available manufactured gas.

Liquified petroleum - is the byproduct of natural gas and oil refining. The gas is stored under pressure in a liquid state and becomes gaseous when released.

Coal, a solid fuel, can be burned on a grate, in suspension, or in a fluidized bed. Coal is classified as:

Anthracite
Bituminous
Sub-Bituminous
Lignite

Lignite is the softest coal. The harder coal, anthracite, though having a higher BTU per pound output, is used less than the more available and abundant lignite, bituminous and sub-bituminous coals. Coal generally requires more mechanical transport and preparation equipment than the other mentioned fuels.

Byproduct fuels including bagasse (sugar cane processing) wood chips, coal char, corn cobs, refuse derived fuel (RDF) and coke are typically burned on a grate.

Along with differing preparation and physical characteristics, these fuels vary greatly in the way they are most effectively ignited, the amount of stoichiometric air needed and flash point temperatures necessary for effective burning. In addition, and most important to scanner selection and sighting, each of these fuels exhibits particular burning characteristics including flame characteristics, spectral radiation emission, and production of heat and byproducts (including ash, flyash and chemical compounds).

Because all flames produce electromagnetic radiation, flame characteristics are the most important elements in scanner selection. The flame base is rich in ultraviolet radiation, burning clean and hot (Figure 1). The remaining 90% of the flame envelope emits radiation in the infrared and visible range.

As well as producing radiation in three distinct parts of the spectrum, the flame is constantly "flickering". The flickering is caused because combustion is actually a chain of small explosions causing the flame to change in size and shape. The most typical usable flicker frequency is found in the 300 to 600 hertz range. Flicker is an important factor in infrared flame scanner design because it is used to discriminate actual flame from hot refractory radiation and other background infrared radiation sources.

Refractory radiation does not flicker. However, refractory radiation will appear to flicker when its path is bent, reflected or blocked by ash, carbon, unburned fuel, steam, mist or air movement within the furnace.

DET-TRONICS SCANNERS SOLVE PROBLEMS

Detector Electronics has innovatively met both the traditional and new needs of the steam industry by offering a wide selection of relay, solid state, programmable logic controller (PLC) and microprocessor-based burner management systems coupled with a complete, industry-proven line of scanners. Each system can be tailored to meet the special requirements of individual burner and boiler systems.

The Det-Tronics scanner/controller system is designed to provide years of excellent performance, with high resistance to environmental contaminants and heat. Each system provides a safe and efficient means to monitor the startup, running and shutdown of boiler functions,

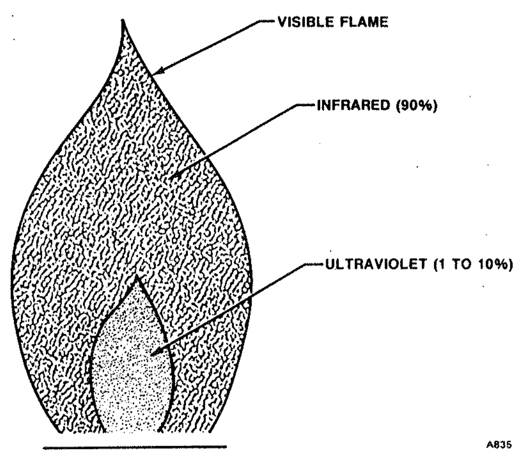


Figure 1—Flame Diagram

while allowing the operator to control the sequence of events of these critical operations.

Convenience is a must when equipping a new installation or retrofitting existing boilers. The Det-Tronics family of components is designed to provide the basic ingredients for a complete burner management system that can be provided and installed under the supervision of Det-Tronics engineers. All necessary design engineering, documentation, training, cabling and field engineering is provided at your request and tailored for your specific requirements.

SCANNER AND CONTROLLER - A TEAM

The scanner functions as the eye into the boiler, feeding electrical information to the flame controller for interpretation. Basically, the appropriate Det-Tronics scanner for a given installation is chosen on the basis of its sensitivity to the light spectrum. Scanners are available in sensitivity ranging from ultraviolet through visible light and infrared. The ultraviolet scanner is sensitive to radiation from 1,850 to 2,650 angstroms. The range of the infrared scanner is 5,000 to 10,000 angstroms. In its simplest application, the sensor module "sees" a flame and generates a small electrical current to activate a relay controlling a valve. When the current is not present, the relay de-energizes and allows the valve to close. Fuel is no longer provided to the burner.

On the following pages each scanner will be discussed individually, as will its associated flame controllers.

ULTRAVIOLET FLAME SCANNERS

Gas flame is richest in ultraviolet radiation in the base of the flame, that is, nearest the burner and is typically associated with high heat and clean burning. In many instances ultraviolet detection is preferred because of its response to only the flame and not the hot refractory. As with any scanner, they have limitations and have not been totally successful in applications where shrouding or blocking of the UV radiation can take place, such as coal burning in suspension, oil mist, and some waste fuel applications.

The C9501N Ultraviolet (UV) Flame Scanner (Figure 2) and the C9506M UV Flame Scanner (Figure 3) have proved to be exceptional choices for applications where burning fuel flames tend to be rich with ultraviolet radiation. (Refer to Table 1.) Radiation from hot refractory does not extend into the scanner's spectral range. As a result, the C9501N and C9506M Scanners are not sensitive to these forms of radiation.

The C9501N Flame Scanner incorporates an ultraviolet sensitive detector tube with a response range of 1850 to 2650 angstroms, electronic circuitry to generate and transmit an output signal, a viewing window and a mechanical, light-blocking chopper, which is used to test detector tube response to absence of flame.

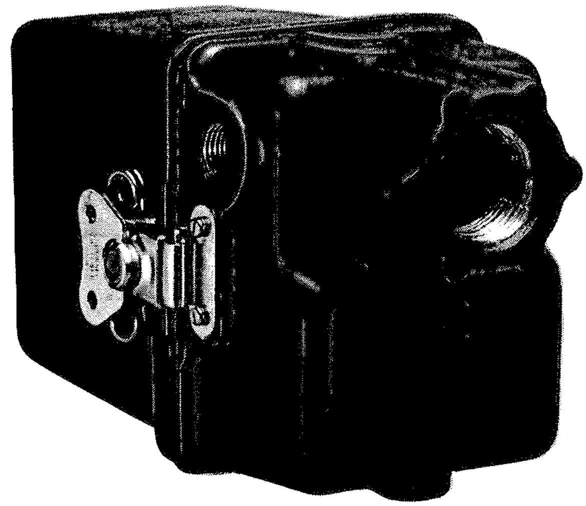


Figure 2—C9501N Ultraviolet Scanner

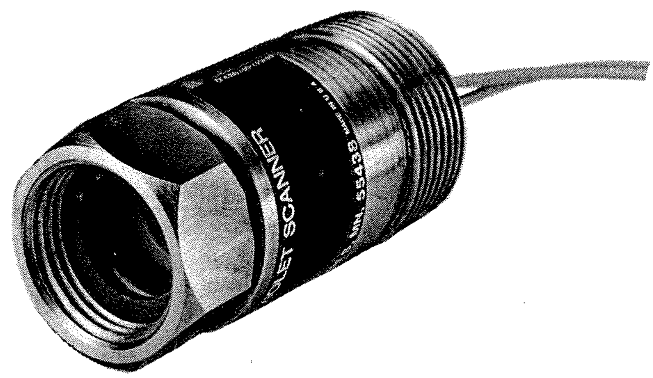


Figure 3—C9506M Ultraviolet Scanner

The C9501N scanner chassis is mounted in a weatherproof, cast metal enclosure. A base casting and a cover casting fit together and are secured with spring-loaded, half-turn fasteners. The base casting has a 1 inch NPT (American National Standard taper pipe thread) tapping for mounting onto a threaded, 1 inch API (American Petroleum Industry) standard 5L sight pipe. The base also includes a 1/2 inch NPSM (American National Standard straight pipe thread for free-fitting mechanical joints) tapping for an electrical connector and a 3/4 inch NPT tapping for connection of a purge air line.

The C9506M Ultraviolet Flame Scanner responds to ultraviolet (UV) radiation wavelengths between 1850 and 2650 angstroms. Because it is not a self-checking scanner, it should be used only in applications that require temporary monitoring of flame presence such as igniters that turn off as soon as a burner is ignited.

Table 1—Recommended Scanner Selection

Application	C9501N	C9502N	C9503M	C9506M
Gas	●			●
Gas Igniters	●			●
Light Oil	●	●		●
Heavy Oil		●	●	
Oil (No. 2) Warmup Guns	●			●
Coal		●	●	
Coal On Grate		●	●	
Pulverized Coal		●	●	
Clean Waste	●			●
Heavy Waste		●		
Spectral Range (Angstroms)	1,900 to 2,650 (UV)	5,000 to 10,000 (IR)	5,000 to 10,000 (IR)	1,850 to 2,650 (UV)

The C9506M Flame Scanner consists of a UV detector encased in an aluminum housing that is designed to mount directly onto a 1.0 inch NPT sight pipe. Eight foot non-shielded electrical conductors exit from the rear of the housing. Using a reducer, electrical conduit can be connected to the 1.25 inch wiring connector.

INFRARED SCANNERS

The Det-Tronics C9502N Infrared Flame Scanner (Figure 4) has a spectral range of 5,000 to 10,000 angstroms. The sensor of this module is a silicon photo diode.

Basically, this silicon semiconductor has an output that will vary as the amount of radiation varies. The greater the intensity, the greater the number of free electrons. This situation sets in motion a flow of electrons to its positive electrode and thus a current to the controller module. In order to discriminate between the reflections from hot refractory and a true flame, the scanner is designed to function on a "flicker" frequency, of 100 to 400 hertz, effectively sensing infrared radiation only from a true flame.

A unique feature of the C9502N Infrared Scanner is automatic gain control (AGC). AGC automatically compensates for variance in flame rate or intensity. This makes it very useful in instances where the flame is unstable or where clouding of unburned fuel obstructs the view of the flame. It is also used to discriminate between the flames of different burners and is able to automatically adjust to flame variations resulting from different load firing rates.

When properly sighted, this scanner will provide discrimination between flames in the same furnace. If improperly applied, however, any scanner may not recognize when the flame of interest has dropped out. Great care must be taken when sighting the scanner in order to avoid this situation.

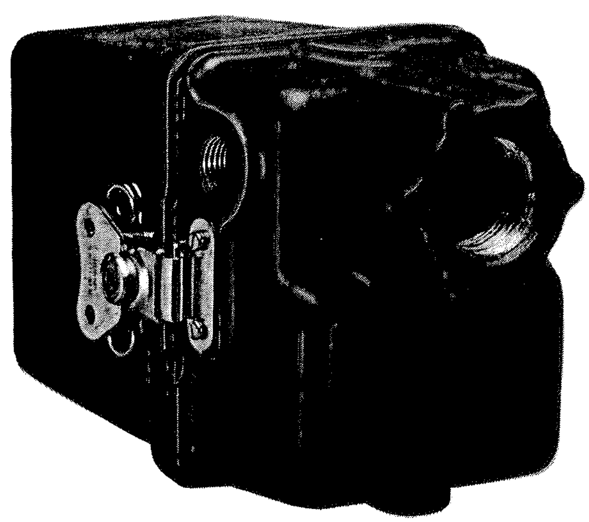


Figure 4—C9502N Infrared Scanner

A slide switch on the module allows for disabling of the automatic gain control.

The application of the C9502N Scanner is recommended for installations using oil, coal or other solid fuels.

Figure 5 represents a typical example of a C9501N Ultraviolet and a C9502N Infrared Flame Scanner mounted on a relatively unobstructed boiler front.

C9501N AND C9502N FLAME SCANNER MOUNTING

1. Choose a sighting location where the scanner will have an unobstructed view of the flame under all firing conditions. Also keep in mind that the greatest UV radiation is produced in the area immediately ahead of the burner. Greatest infrared radiation is produced in the later (cooler) stages of combustion, that is, farther away from the burner tip.

   A scanner monitoring a pilot flame must sight at a point where pilot and main flames intersect to ensure that a detectable pilot flame will ignite the main flame. In multiple burner furnaces, take care to choose a sighting angle with the best possible view of the flame of interest and the poorest view of other flames in the furnace. The sight pipe should be inclined at least slightly downward toward the furnace so that unburned particles or condensed moisture will not fall or drain into the scanner sight pipe.

2. Prepare a hole in the burner front or windbox wall to clear the sightpipe at the angle of approach selected. Select a length of 1 inch standard pipe (with NPT thread on one end) no longer than is necessary to place the scanner housing in an unobstructed and accessible area.

   If a sight pipe longer than 12 to 18 inches is required, the sight pipe should be of larger diameter (2 inch pipe, for example) with the reduction to 1 inch occurring as close to the scanner as practical.

3. Thread the scanner base assembly onto the sight pipe until tight, making certain that, in the final position, the wiring entrance faces downward.

4. Tack weld the unthreaded end of the sight pipe at the selected location and angle.

5. In many instances it will be convenient to attach the sight pipe to a swivel mount that, in turn, is attached to the sight pipe mounting surface. This mount allows angular adjustment within a cone of approximately 20 degrees. If the mount is to be used with sight pipes larger than 1 inch, an adapter must be used.

6. Install an electrical fitting in the housing base tapping and encase the extension leadwires in 1/2 inch flexible metal conduit or other flexible conductors meeting local standards. Terminate the assembly at a junction box and run cables to the controller. For a watertight connection, use an appropriate fitting and watertight conduit arranged to pitch downward from the scanner in most cases.

Note
Scanners with quick-connect military connectors are available. Wiring instructions for those types of scanner connections are included with the scanner.

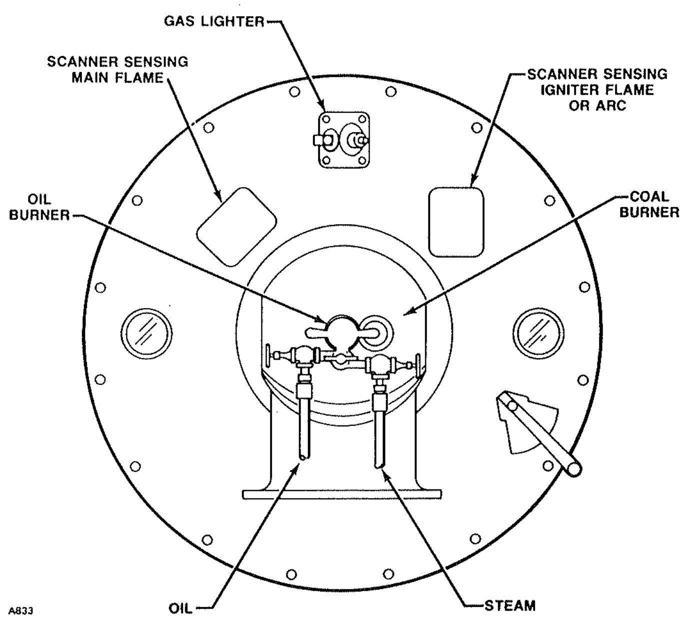


Figure 5—Scanner Mounting on Boiler Front

7. The introduction of cooling and/or purging air will be required if operating temperatures are likely to exceed ratings and is highly desirable even if temperature will not be excessive. A positive flow of air down the sight pipe can eliminate the necessity for frequent lens cleaning and prevent transmission losses caused by products of combustion in the sight path. The purge air source must be oil free and dry and its pressure should be slightly higher than furnace pressure. The purge line should be at least one inch in diameter, flexible, and reduced at the scanner base only.

C9506 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. A scanner monitoring a pilot flame must sight at a point where pilot and main flames intersect to ensure that a detectable pilot flame will reliably ignite the main flame.

   In multiple burner furnaces, choose a sighting angle with the best possible view of the flame to be monitored and the poorest possible view of other flames in the furnace. The sight pipe should be inclined slightly downward toward the bottom of the furnace so that unburned particles or condensed moisture will not fall or drain into the sensor assembly.

2. Prepare holes in the burner front and windbox to clear the sight pipe at the angle of approach selected. Select a length of 1-inch standard pipe (with NPT thread on one end) no longer than is necessary to place the scanner in an unobstructed and accessible area.

3. Place a reducer tee fitting and close nipple at the end of the sight pipe (refer to Figure 6). Attach the purge air source to the tee. The purge air supply must be oil-free and dry. The air pressure should be two inches water column above furnace pressure to keep debris out of the sight pipe and away from the sensor tube surface. Special precautions should be taken in pressurized furnace applications. Consult the factory for further assistance.

4. Verify the proper location by viewing through the sight pipe.

5. Thread the sensor assembly onto the close nipple until tight.

6. Tack weld the sight pipe to the burner front at the selected location and angle. Due to head expansion, it is recommended that the sight pipe is not fixed at the burner wall.

7. In many instances it is convenient to attach the sight pipe to a swivel mount (part number Q2625), that, in turn, is attached to the sight pipe mounting surface. This mount allows angular adjustment within a cone of approximately 40 degrees.

8. Electrical connections are made on the threaded end of the scanner housing. This threaded end is 1.25 inches NPT. The use of a 1.25 inch to 0.5 inch reducer is recommended so that 0.5 inch flexible metal conduit can be used. Terminate the electrical connections at a junction box and splice the leadwires to conductors extending to the controller. For a watertight connection, use an appropriate fitting and a liquid-tight conduit arranged to angle downward from the scanner. For any wiring runs on or near hot surfaces, use wire rated for the higher temperatures.

FIBER OPTIC SCANNER - SPECIAL TOOLS FOR SPECIAL PROBLEMS

Aimed at providing the best flame discrimination possible, the C9503M Fiber Optic Flame Scanner provides the user with equipment designed to solve the special prob-

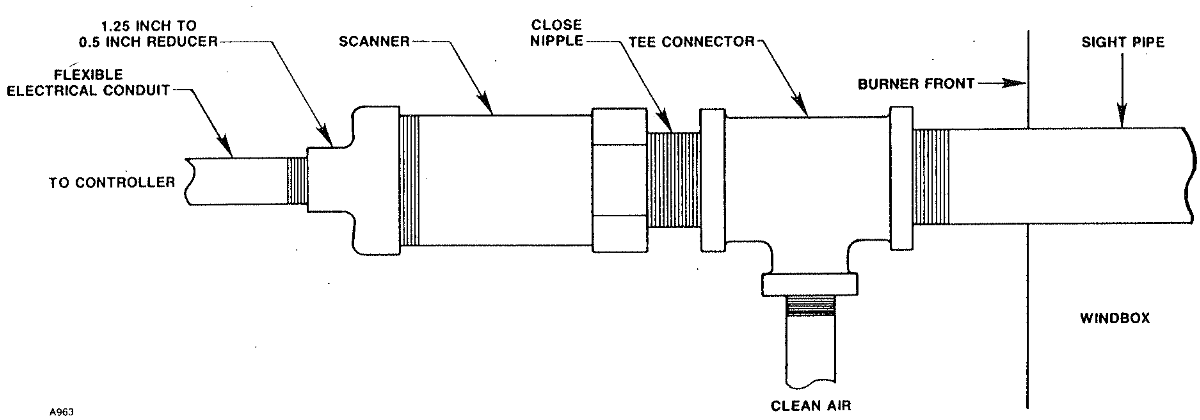


Figure 6—C9506M Scanner Mounting

lems of pulverized coal - tilting coal nozzle configurations typically found on the tangentially-fired boiler. This infrared scanner has an added feature of flexibility provided by the fiber optic and lens options allowing varying sighting angles. The fiber optic scanner should be considered for any application where a direct line of sight is unobtainable.

The Fiber Optic Scanner allows the scanner lens assembly to follow the flame as the burner nozzles are tilted to meet the varying furnace load requirements. An added feature is its flexibility in sighting that provides a previously unachievable discrimination between flames, reflection and hot refractory during continuous boiler operation.

The C9503M Fiber Optic Scanner (Figure 7), with a spectral range of 5,000 to 10,000 angstroms, is basically the same as the C9502N Infrared Scanner with the addition of a length of flexible stainless steel inner and outer carriers and a fiber optic cable. In addition, a rigid sight pipe and hexagonal pressure fitting are provided to assure a stationary scanner module at final installation (Figure 8). (When properly installed, the rigid portion of the outer carrier remains stationary and the flexible carriers are allowed to travel with the tilt of the bucket/burners.) Also, the inner carrier provides a means by which purge air can reach the fiber optic cable and the lens.

The lenses (Figure 9) are available in 0°, 5°, 9°, and 14° offset to allow a more precise scanner alignment.

SCANNER APPLICATION TO A TANGENTIALLY-FIRED FURNACE

Figure 10 is a diagram of the tilting coal nozzle burner used on Combustion Engineering's tangentially-fired coal boiler. The nozzle can be pivoted up and down. In the typical tangential-firing boiler, all of the burner nozzles are raised or lowered in unison to provide controlled firing as load requirements change.

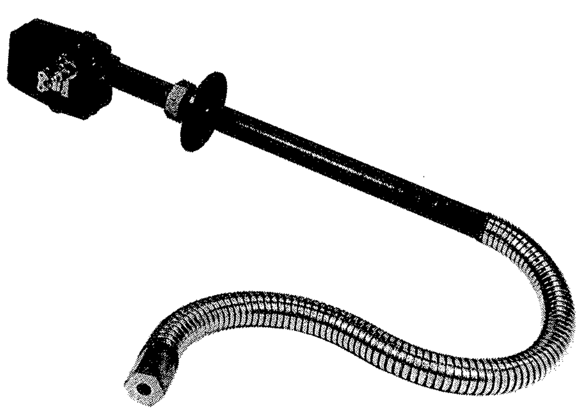


Figure 7—C9503M Fiber Optic Scanner

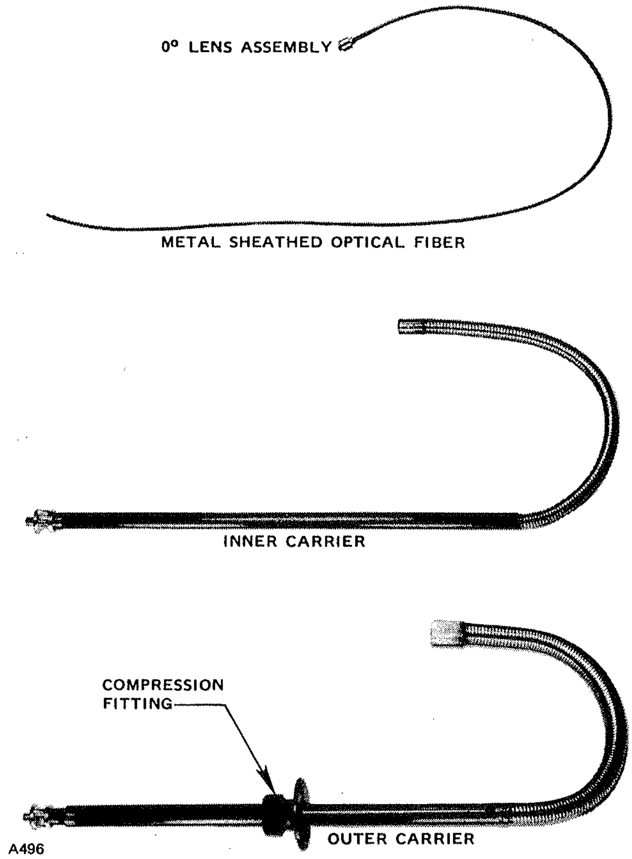


Figure 8—Fiber Optic Scanner Components

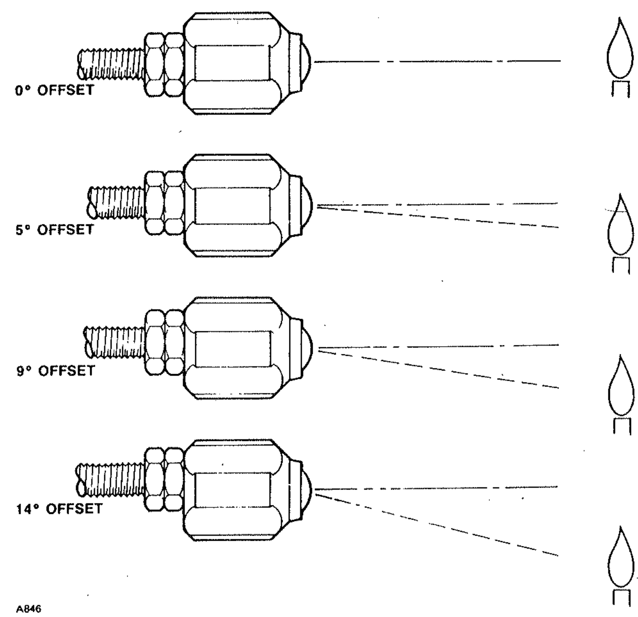


Figure 9—Fiber Optic Offset Lenses

The tilting burner nozzles (refer to Figure 11), located on several elevations on all furnace corners, are generally capable of being tilted 30° down and 30° up (coal nozzles slightly less) within the furnace. Needless to say, this range of movement creates a problem for stationary scanner mounting. The Det-Tronics scanner, fiber optic

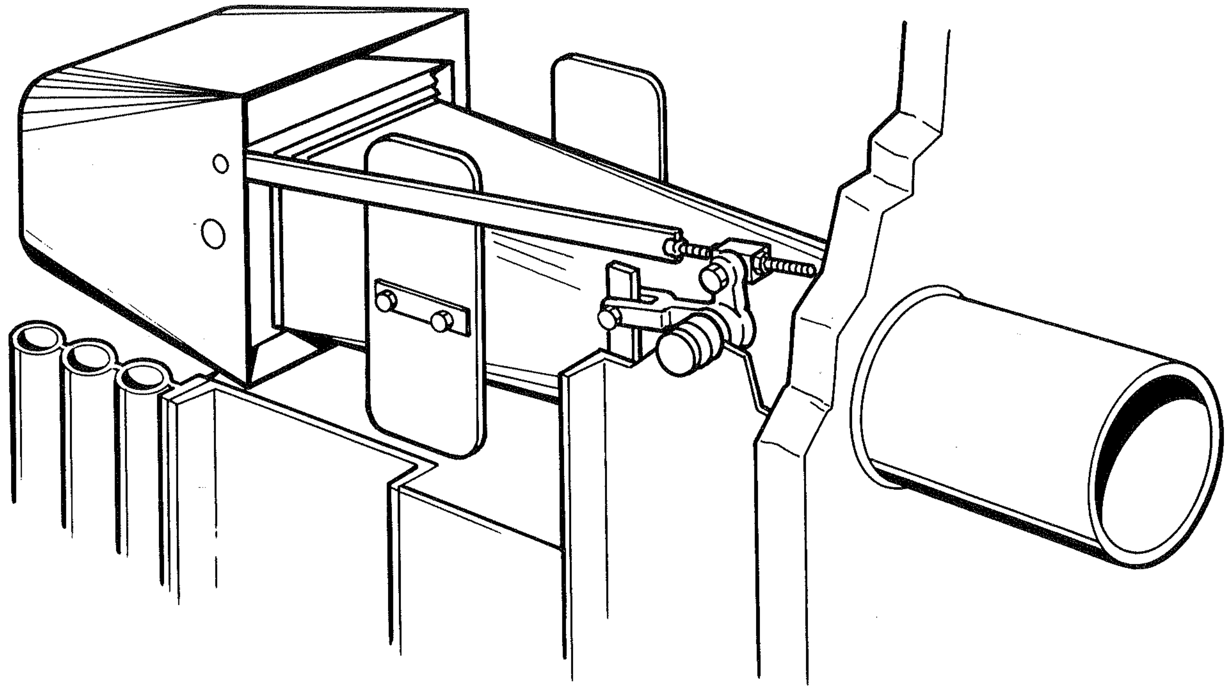


Figure 10—Tilting Coal Nozzle

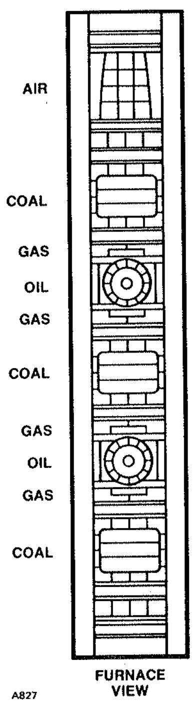


Figure 11—Tangentially-Fired Corner Arrangement

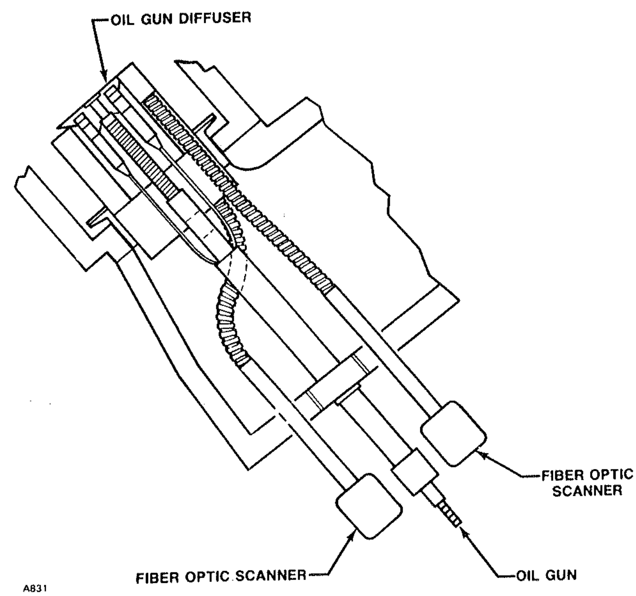


Figure 12—Front View of Corner Burners with Fiber Optic Scanners Applied

The igniters are mounted in the furnace wall at a fixed angle adjacent to the fuel nozzles and are designed to intersect the fuel and air mixture as it leaves these nozzles. A flame scanner should be mounted so it views this intersection directly where the ignition occurs.

cable and offset lens combination has proven to be an outstanding solution to the problem (Figures 12 and 13). The flexible fiber optic cable and carriers move freely with the burners being sighted while also allowing accurate sighting of the fireball in the furnace. In addition, the inner and outer protective carriers of the fiber optics provide cooling and cleansing air to the lens.

Table 1 is a quick reference guide to scanner selection. The fuels are classified into those most often used. The scanners most often fit into the categories listed but many factors are involved in their selection. Det-Tronics recommends that you consult a burner management engineer for the most appropriate scanner and controller combinations for your installation.

Figure 13—Corner Burners with Fiber Optic Scanners Welded in Place

C9503M FIBER OPTIC FLAME SCANNER MOUNTING

1. Choose a sighting location on the burner where the hexagonal scanner termination will have an unobstructed view of the flame under all firing conditions. A scanner monitoring a pilot flame must sight at a point where pilot and main flames intersect to ensure that a detectable pilot flame will reliably ignite the main flame.

   In multiple burner furnaces, choose a sighting angle with the best possible view of the flame of interest and the poorest view of other flames in the furnace.

2. Disassemble flame scanner parts. Unclamp the rear part of the casting and pull inner carrier completely out of the outer carrier. Unscrew the front part of the casting from the outer carrier. Remove compression fitting from around the outer carrier. Actual welding and fitting of the scanner requires only the outer carrier and the compression fitting.

3. Prepare a hole in the windbox wall for the outer carrier. The hole need not be exact in size, but should not be much larger than 1.66 inches in diameter (the diameter of the outer carrier). Hole size must not exceed 4 inches in diameter.

4. Slide the outer carrier through the windbox hole from the inside.

5. Weld the hexagonal termination of the outer carrier to the burner in the position desired. Normally, this would be slightly angled in the direction of fireball rotation.

6. From the outside, slide the compression fitting over the outer carrier and down to the windbox, with its larger diameter toward the windbox.

7. Weld the compression fitting around its circumference to the windbox.

The C9503M Scanner is supplied with the 0° offset lens installed. Sighting the scanner is performed with the burner on, as follows:

1. With the inner and outer carriers installed as specified and with the rear casting of the scanner removed, activate the burner to be viewed.

2. Observe the light coming from the end of the optical fiber within the front part of the casting. If a strong, relatively bright light is present, scanner sighting is complete, and the rear casting of the scanner can be re-installed.

If little or no light is observed at the end of the optical fiber, use of one of the offset lenses is indicated. Lens removal and installation proceeds as follows:

1. Remove the inner carrier in its entirety from the scanner.

2. Remove the two screws on the outside of the front termination of the inner carrier's flexible tubing. This frees the lens assembly.

3. Remove the three screws holding the inner carrier's rear termination plate to the rigid pipe section. Remove the plate.

4. Gently pull the metal-sheathed optical fiber from the inner carrier. The lens assembly will be the last part to come out of the inner carrier. Do not use excessive force or the optic fiber may be damaged or destroyed.

5. Loosen the pair of lock nuts at the base of the lens assembly.

6. Unscrew the lens assembly from the end of the optical fiber.

7. Screw the 5° offset lens 5/16 of an inch onto the optical fiber. (This effectively sets the focal length.) Back the two nuts up to the lens to tighten it securely in place.

8. Re-assemble the inner carrier reversing the process of steps 1 through 5.

9. Slide the inner carrier back into the (mounted) outer carrier and front casting of the flame scanner.

10. Using a wrench on the rear of the inner carrier's fiber optic termination, rotate the inner carrier through 360 degrees of travel until a strong light is seen at the termination. If no light or a weak light is seen, remove the inner carrier again, install the 9° offset lens and repeat the aiming process. If the light at the end of the scanner is still low, remove the inner carrier again, install the 14° offset lens and repeat the aiming process. Note a key slot located on the inner carrier will allow referencing to the lens position.

FLAME CONTROLLERS

Det-Tronics controllers are available in several models to suit the needs of most burner management systems including relay, solid state, microprocessor, or programmable logic controller based systems. A brief description of available Det-Tronics flame controllers follows.

R9005N AND R9105N CONTROLLERS

The R9005N (Figure 14) and R9105N (Figure 15) Controllers monitor signals from one flame scanner and generate relay output switching in response to changes in flame status. The R9005N Controller is a panel mounted unit. The R9105N Controller is a rack mounted unit. Circuit design and features of the two controllers are identical. Both the R9005N and R9105N incorporate a self-checking feature that tests the controller response to a loss of flame once every 10 seconds. 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.

Features

- User-adjustable flame threshold.
- User-selectable flame on delay time - 1 or 2 seconds.

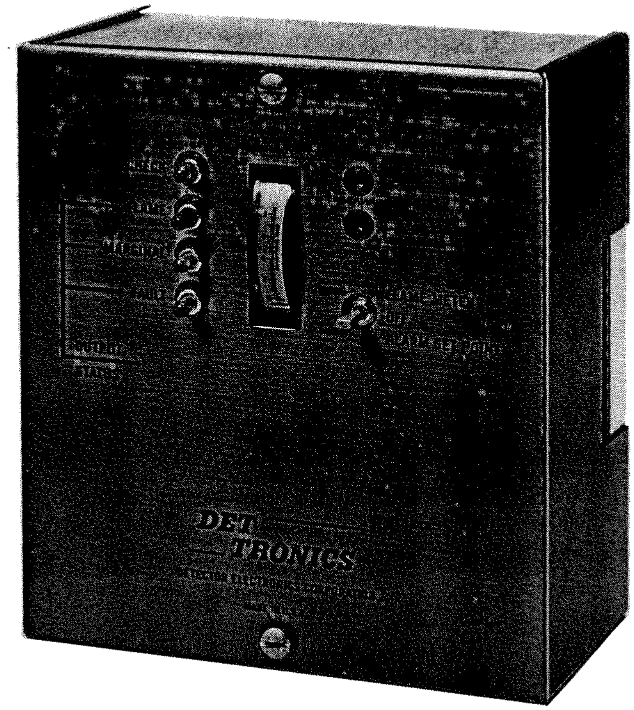


Figure 14—R9005N Flame Controller

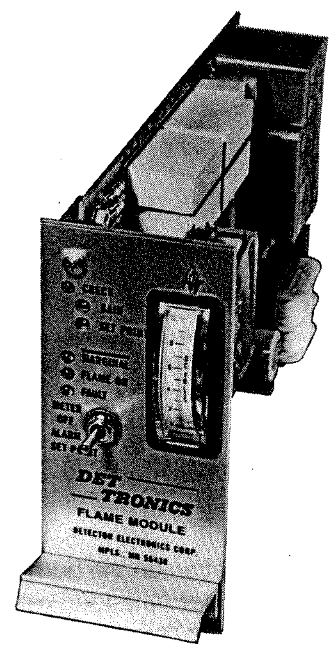


Figure 15—R9105N Flame Controller

- User-selectable flame off and marginal flame delay time - 3.5 or 6 seconds.
- External output for remote flame intensity voltmeter (0 to 10 vdc).
- Accommodates ultraviolet, infrared and fiber optic flame scanners to provide a choice of application solutions. (Different scanner types do not require controller modification.)

- Self-checking light chopper simulates flame loss every 10 seconds to thoroughly test scanner for proper operation.

- Check Fault relay energizes if response to simulated flame loss is improper.

- Two separate input channels with user-adjustable gain settings provide enhanced discrimination in multi-burner applications. Gain channels are externally switchable.

- Front panel analog voltmeter with select switch allows 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 fused for system protection.

R9103 CONTROLLER

The R9103 Flame Control Module (Figure 16) is specifically designed for use in the Allen Bradley 1771 Input/Output (I/O) Rack. The R9103 can be used as part of an Allen Bradley Programmable Control System with one or more Det-Tronics ultraviolet, infrared or fiber optic flame scanners.

To determine the model that will provide the most needed features for your application, see Table 2.

R9006M CONTROLLER

The R9006M (Figure 17) Controller monitors signals from one C9506M UV Flame Scanner and generates a relay output in response to changes in flame status. The faceplate of the R9006M Controller has two LED status indicators that display flame and power status as well as test points for monitoring the 0 to 10 vdc flame intensity signal. In addition, the R9006M Controller contains a field adjustable sensitivity potentiometer to allow greater application flexibility.

Features

- Flame relay is de-energized when flame signal drops below preset threshold.

- Four second maximum response to flame failure.

- External output for connecting flame intensity voltmeter (0 to 10 vdc).

- Front panel LEDs indicate flame and power status.

- Designed for FM and CSA approval.

- Field adjustable sensitivity.

- Selectable one or two second flame on delay to reduce spurious reaction to adjacent burners.

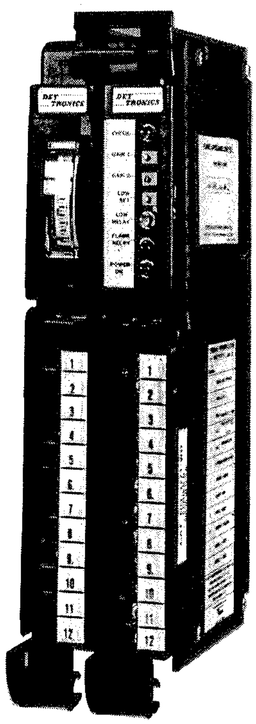


Figure 16—R9103 Series Control Module

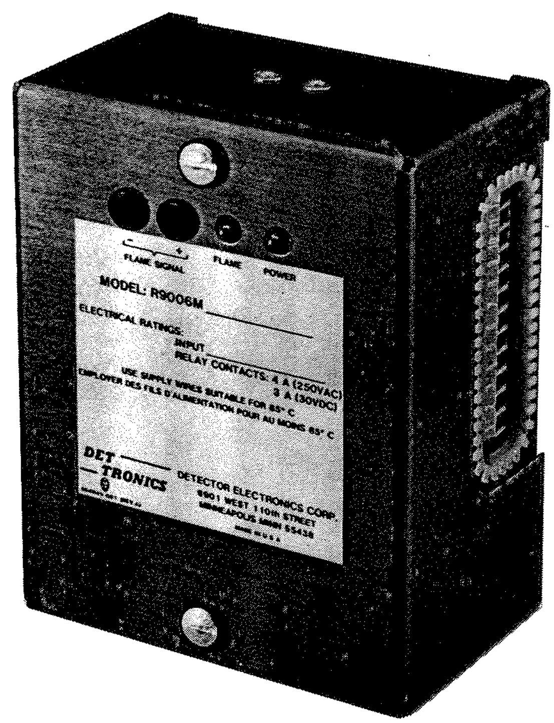


Figure 17—R9006 Flame Safeguard Controller

Table 2—R9103 Series Control Module Features

Feature	R9103M	R9103N	R9103P
Mounting in A-B rack using two slots	X	X	X
CHECK LED (Self check)	X	X	X
LOW RELAY LED	----	----	X
Low setpoint adjustment	----	----	X
FLAME RELAY LED	X	X	X
Sensitivity adjustment	1	2	2
Number of scanners	1	2	2
Flame signal meter	----	X	X
Flame signal output available on field wiring arm	X	X	X
POWER ON LED	X	X	X

Detector Electronics Corporation
6901 West 110th Street • Minneapolis, Minnesota 55438 USA • Telephone (612) 941-5665 • Fax (612) 829-8750
Telex 29-0562 DETRONICS BLTN or 6879043 DETEL UW • Cable DETRONICS
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