

**INSIGHT**  
scanners**TYPE 95IR/95UV/95DS****MODEL S1, S2****Integrated Flame Scanner  
with Internal Flame Relay****TUV  
SIL2**

RoHS Compliant to EU Directive 2002/95/EC

**DESCRIPTION**

The FIREYE InSight Type 95IR, 95UV, and 95DS flame scanners are micro-processor based flame scanners utilizing solid state infrared (IR) or ultraviolet (UV) or dual (IR and UV) sensors.

The FIREYE InSight Type 95 flame scanners incorporate an internal flame relay with adjustable ON/OFF thresholds, thereby eliminating the need for a remote flame amplifier.

The InSight scanners are now a replacement to the FIREYE Type 45FS1 and 45UVFS1 Signature Scanners™ as well as the Type 45RM4 to detect the presence or absence of a target flame in single or multi-burner applications.

The InSight scanners measure the amplitude of the modulations (the flame “flicker”) that occur within the targeted flame. During the scanner set-up procedure, the modulation frequency that yields the best flame ON/OFF discrimination is selected. The appropriate modulation frequency and sensor gain is either manually selected (S1 models), or automatically selected with manual override capability (S2 models).

The InSight 95IR, 95UV, and 95DS scanners are each available in two models differentiated by feature levels.

The Standard Model S1 has three choices of modulation frequency, adjustable sensor gain, adjustable flame relay ON/OFF thresholds, 4-20 mA analog signal strength output, fault relay, and two selectable programmable files to store setpoints (for two different fuels or firing rates).

The Expanded Model S2 adds automatic programming (AutoTune) with manual override capability, 21 choices of flame flicker frequency, a total of four selectable programmable files to store setpoints, plus adds remote communication capability via Fireye Windows 95/98/NT user software.

All FIREYE InSight scanner models are powered by 24 Vdc and contain electronic self-checking (no mechanical shutter required). The scanners contain an eight character alpha-numeric LED display and a four (4) push-button keypad to enable the user to view operating parameters and select setpoints.

“CG” models include a 10 ft. (3m) captive cable and gland. Non-“CG” models have a twelve-pin electrical quick-disconnect. Fiber optic-mount versions of the InSight scanners are also available. Refer to bulletin CU-101 for installation instructions.



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## OPERATION

The InSight scanners measure the amplitude of the modulations that occur within the targeted flame. During the scanner set-up procedure, the modulation frequency that yields the best flame ON: OFF discrimination is selected. The appropriate modulation frequency and sensor gain is either manually selected (S1models), or automatically selected with manual override capability (S2 models).

With the appropriate modulation frequency selected, the flame relay's ON and OFF thresholds are then entered. (This selection is set automatically with S2 models). The scanner's 4-20 mA signal strength output is at minimum (4 mA) with a signal strength of "0", and at maximum (20 mA) at a signal strength of 100.

The **FLAME RELAY** is energized (and its normally open contacts close) when the signal strength is at or above the programmed flame ON threshold. The flame relay is de-energized when the signal strength is at or below the programmed flame OFF threshold. The flame relay contact circuit will also open upon a power interruption or the detection of an internal fault (see below).

The **FAULT RELAY** is energized when the scanner is powered (24 vdc) *and* when the scanner had successfully passed all internal self-checking routines. The Fault relay is de-energized if there is a power interruption to the scanner *or* if the scanner has detected an internal fault. A normally open (fault relay) contact is wired in series with the flame relay contact (internally), and a normally closed contact is available for alarm indication.

## APPLICATION

**Type 95IR** contains an infrared flame sensor, responding to infrared radiation from 700 to 1700 nanometers wavelength. This sensor is best suited to coal and oil applications.

**Type 95UV** contains an ultraviolet flame sensor, responding to ultraviolet radiation from 295 to 320 nanometers wavelength. This sensor is best suited to gas applications.

**Type 95DS** (Dual sensor) contains both the infrared and ultraviolet flame sensors described above. This sensor is best suited to multi-fuel applications.

**The Standard Model S1** is best suited to the many applications that do not require the level of sophistication, or the remote communications capability of the Expanded Model S2 (e.g. single burner boilers and furnaces, duct burners, etc.)

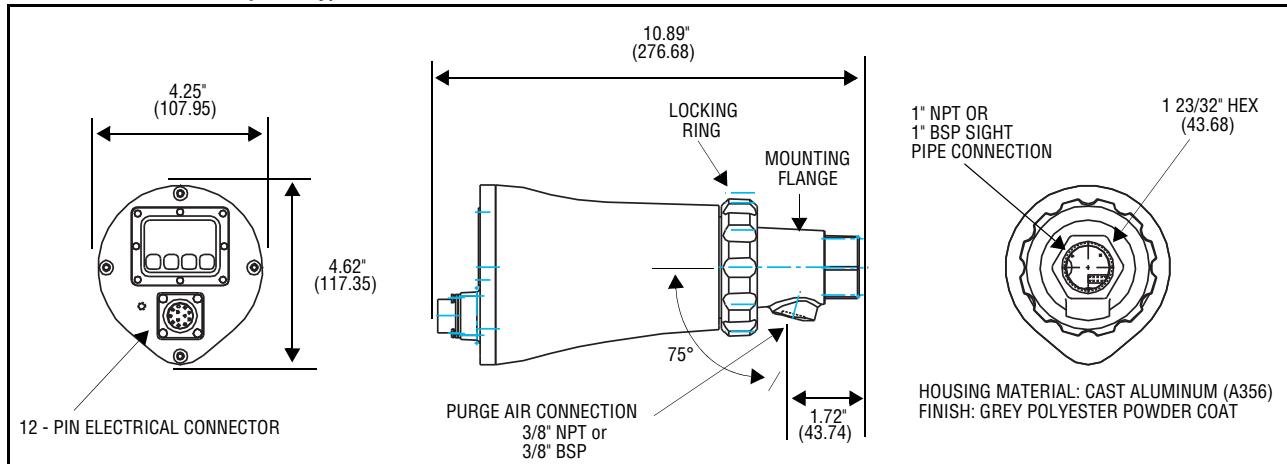
**The Expanded Model S2** is best suited to the applications that require the highest level of sophistication and flexibility (addition choices of modulation frequencies, and the time-saving AutoTune function), and remote communications capability (e.g. larger multi-burner boilers and furnaces).

## InSight SCANNER FEATURES

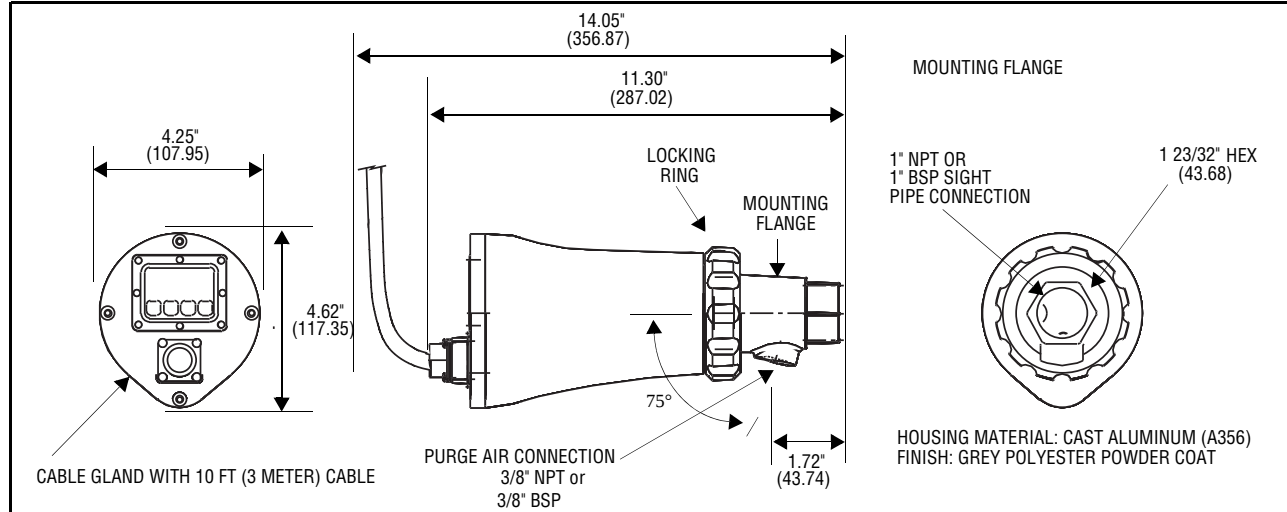
| Features                        | Basic Models (S1) |        |        | Expanded Models (S2) |        |        |
|---------------------------------|-------------------|--------|--------|----------------------|--------|--------|
|                                 | 95IRS1            | 95UVS1 | 95DSS1 | 95IRS2               | 95UVS2 | 95DSS2 |
| Infrared Sensor                 | X                 |        | X      | X                    |        | X      |
| Ultraviolet Sensor              |                   | X      | X      |                      | X      | X      |
| Flame Relay                     | X                 | X      | X      | X                    | X      | X      |
| Fault Relay                     | X                 | X      | X      | X                    | X      | X      |
| 4-20 mA Output                  | X                 | X      | X      | X                    | X      | X      |
| Modulation Frequency Selections | 3                 | 3      | 3      | 21                   | 21     | 21     |
| Memory Files                    | 2                 | 2      | 2      | 4                    | 4      | 4      |
| Communications                  |                   |        |        | X                    | X      | X      |
| AutoTune                        |                   |        |        | X                    | X      | X      |
| Pre-Edit                        | X                 | X      | X      |                      |        |        |

## DIMENSIONS

**FIGURE 1. TYPE 95IR/95UV/95DS SCANNER, with ELECTRICAL QUICK-DISCONNECT (mounting flange ordered separately)**

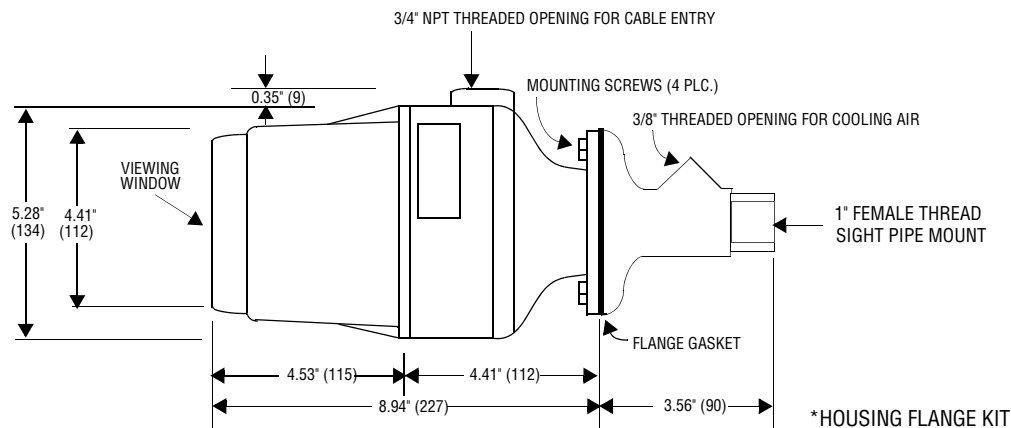


**FIGURE 2. TYPE 95IR/95UV/95DS SCANNER, "CG" MODEL with 10 FT CABLE (mounting flange ordered separately)**



**FIGURE 3. INSIGHT SCANNER in CENELEC HAZARDOUS AREA HOUSING (mounting flange kit ordered separately)**

FOR WIRING INSTRUCTIONS REFER TO FIGURE 18



DIMENSIONS IN INCHES (MM)  
ASSEMBLY SHOWN WITH HOUSING FLANGE KIT, ORDERED SEPARATELY

\*HOUSING FLANGE KIT, ORDERED SEPARATELY  
(INCLUDES NPT OR BSP FLANGE, GASKET, MOUNTING SCREWS)  
P/N 129-168-1 (NPT)  
P/N 129-168-2 (BSP)

## MODEL LISTING

| PART<br>NUMBER<br><br>(see note 4) | SENSOR  | FEATURES | FIBER<br>OPTIC<br>MOUNT | 12-PIN<br>CONNECTOR | 10 FT (3M)<br>CABLE &<br>GLAND | MAXIMUM<br>CONTACT<br>RATING | HOUSING<br>RATING<br>(see note)                                                                                                           | AGENCY APPROVALS |     |          |     |
|------------------------------------|---------|----------|-------------------------|---------------------|--------------------------------|------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|------------------|-----|----------|-----|
|                                    |         |          |                         |                     |                                |                              |                                                                                                                                           | UL<br>C/US       | FM  | DIN-DVGW | CE  |
| 95IRS1-1                           | IR      | BASIC    | NO                      | YES                 | NO                             | 240 vac                      | NEMA 4X,<br>IP66<br>CLASS I<br>DIV. 2<br>GROUPS<br>A, B, C & D<br>CLASS II<br>DIV. 2<br>GROUPS<br>F & G                                   | YES              | YES | NO       | NO  |
| 95UVS1-1                           | UV      |          |                         |                     |                                |                              |                                                                                                                                           |                  |     |          |     |
| 95DSS1-1                           | IR & UV |          |                         |                     |                                |                              |                                                                                                                                           |                  |     |          |     |
| 95IRS2-1                           | IR      | EXPANDED |                         |                     |                                |                              |                                                                                                                                           |                  |     |          |     |
| 95UVS2-1                           | UV      |          |                         |                     |                                |                              |                                                                                                                                           |                  |     |          |     |
| 95DSS2-1                           | IR & UV |          |                         |                     |                                |                              |                                                                                                                                           |                  |     |          |     |
| 95IRS1-1CG                         | IR      | BASIC    | NO                      | NO                  | YES                            | 240 vac                      | NEMA 4X,<br>IP66<br>CLASS I<br>DIV. 2<br>GROUPS<br>A, B, C & D<br>CLASS II<br>DIV. 2<br>GROUPS<br>F & G                                   | YES              | YES | NO       | NO  |
| 95UVS1-1CG                         | UV      |          |                         |                     |                                |                              |                                                                                                                                           |                  |     |          |     |
| 95DSS1-1CG                         | IR & UV |          |                         |                     |                                |                              |                                                                                                                                           |                  |     |          |     |
| 95IRS2-1CG                         | IR      | EXPANDED |                         |                     |                                |                              |                                                                                                                                           |                  |     |          |     |
| 95UVS2-1CG                         | UV      |          |                         |                     |                                |                              |                                                                                                                                           |                  |     |          |     |
| 95DSS2-1CG                         | IR & UV |          |                         |                     |                                |                              |                                                                                                                                           |                  |     |          |     |
| 95IRS1E-1                          | IR      | BASIC    | NO                      | YES                 | NO                             | 50 vac                       | NEMA 4X,<br>IP66<br><br><br>II 3 G/D<br>Ex nA IIC T6   | NO               | YES | YES      | YES |
| 95UVS1E-1                          | UV      |          |                         |                     |                                |                              |                                                                                                                                           |                  |     |          |     |
| 95DSS1E-1                          | IR & UV |          |                         |                     |                                |                              |                                                                                                                                           |                  |     |          |     |
| 95IRS2E-1                          | IR      | EXPANDED |                         |                     |                                |                              |                                                                                                                                           |                  |     |          |     |
| 95UVS2E-1                          | UV      |          |                         |                     |                                |                              |                                                                                                                                           |                  |     |          |     |
| 95DSS2E-1                          | IR & UV |          |                         |                     |                                |                              |                                                                                                                                           |                  |     |          |     |
| 95IRS1E-1CG                        | IR      | BASIC    | NO                      | NO                  | YES                            | 240 vac                      | NEMA 4X,<br>IP66<br><br><br>II 3 G/D<br>Ex nA IIC T6 | NO               | YES | YES      | YES |
| 95UVS1E-1CG                        | UV      |          |                         |                     |                                |                              |                                                                                                                                           |                  |     |          |     |
| 95DSS1E-1CG                        | IR & UV |          |                         |                     |                                |                              |                                                                                                                                           |                  |     |          |     |
| 95IRS2E-1CG                        | IR      | EXPANDED |                         |                     |                                |                              |                                                                                                                                           |                  |     |          |     |
| 95UVS2E-1CG                        | UV      |          |                         |                     |                                |                              |                                                                                                                                           |                  |     |          |     |
| 95DSS2E-1CG                        | IR & UV |          |                         |                     |                                |                              |                                                                                                                                           |                  |     |          |     |
| 95UVS2-3                           | UV      | EXPANDED | NO                      | YES                 | NO                             | 240 vac                      | NEMA 4X,<br>IP66<br>CLASS I<br>DIV. 2<br>GROUPS<br>A, B, C & D<br>CLASS II<br>DIV. 2<br>GROUPS<br>F & G                                   | YES              | YES | NO       | NO  |
| 95UVS2-3CG                         | UV      |          |                         | NO                  | YES                            |                              |                                                                                                                                           |                  |     |          |     |

**Note: Class I Division 2 Hazardous Area requirements for InSight scanners with electrical connectors (non-CG models):**

1. The connector coupling nut setscrew must be tightened after mating the cable to the scanner.
2. The red warning label must be adhered to the connector housing.
3. Evaluated by TUV that the flame detector device is suitable to be used as single device for safety instrumented functions (SIF) according to DIN EN 61511-1 up to SIL2. The flame detector device also fulfills the applicable requirements of DIN EN 61508:2002 parts 2-3 for safety integrity level SIL2



## MODEL LISTING

| PART<br>NUMBER<br><br>(see note 4) | SENSOR  | FEATURES | FIBER<br>OPTIC<br>MOUNT | 12-PIN<br>CONNECTOR                                    | 10 FT (3M)<br>CABLE &<br>GLAND | MAXIMUM<br>CONTACT<br>RATING | HOUSING<br>RATING<br>(see note)                                                                                                      | AGENCY APPROVALS |     |                      |     |  |  |  |  |  |  |  |  |
|------------------------------------|---------|----------|-------------------------|--------------------------------------------------------|--------------------------------|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|------------------|-----|----------------------|-----|--|--|--|--|--|--|--|--|
|                                    |         |          |                         |                                                        |                                |                              |                                                                                                                                      | UL<br>C/US       | FM  | DIN-<br>DVGW         | CE  |  |  |  |  |  |  |  |  |
| 95IRS1-2                           | IR      | BASIC    | YES                     | YES                                                    | NO                             | 240 vac                      | NEMA 4X,<br>IP66<br>CLASS I DIV.2<br>GROUPS<br>A, B, C & D<br>CLASS II<br>DIV. 2<br>GROUPS<br>F & G                                  | YES              | YES | NO                   | NO  |  |  |  |  |  |  |  |  |
| 95IRS2-2                           |         | EXPANDED |                         | NO                                                     | YES                            |                              |                                                                                                                                      |                  |     |                      |     |  |  |  |  |  |  |  |  |
| 95IRS1-2CG                         |         | BASIC    |                         |                                                        |                                |                              |                                                                                                                                      |                  |     |                      |     |  |  |  |  |  |  |  |  |
| 95IRS2-2CG                         |         | EXPANDED |                         |                                                        |                                |                              |                                                                                                                                      |                  |     |                      |     |  |  |  |  |  |  |  |  |
| 95IRS1E-2                          | IR      | BASIC    | YES                     | YES                                                    | NO                             | 50 vac                       | NEMA 4X,<br>IP66<br><br>II 3 G/D<br>Ex nA IIC T6  | NO               | YES | YES                  | YES |  |  |  |  |  |  |  |  |
| 95IRS2E-2                          |         | EXPANDED |                         | NO                                                     | YES                            | 240 vac                      |                                                                                                                                      |                  |     |                      |     |  |  |  |  |  |  |  |  |
| 95IRS1E-2CG                        |         | BASIC    |                         |                                                        |                                |                              |                                                                                                                                      |                  |     |                      |     |  |  |  |  |  |  |  |  |
| 95IRS2E-2CG                        |         | EXPANDED |                         |                                                        |                                |                              |                                                                                                                                      |                  |     |                      |     |  |  |  |  |  |  |  |  |
| 95UVS2-2                           | UV      | EXPANDED | YES                     | YES                                                    | NO                             | 240 vac                      | NEMA 4X,<br>IP66<br>CLASS I DIV.2<br>GROUPS<br>A, B, C & D<br>CLASS II<br>DIV. 2<br>GROUPS<br>F & G                                  | YES              | YES | NO                   | NO  |  |  |  |  |  |  |  |  |
| 95UVS2-2CG                         |         |          |                         | NO                                                     | YES                            |                              |                                                                                                                                      |                  |     |                      |     |  |  |  |  |  |  |  |  |
| 95UVS2E-2                          | UV      | EXPANDED | YES                     | YES                                                    | NO                             | 50 vac                       | NEMA 4X,<br>IP66<br><br>II 3 G/D<br>Ex nA IIC T6 | NO               | YES | YES                  | YES |  |  |  |  |  |  |  |  |
| 95UVS2E-2CG                        |         |          |                         | NO                                                     | YES                            | 240 vac                      |                                                                                                                                      |                  |     |                      |     |  |  |  |  |  |  |  |  |
| 95IRS1-1CEX                        | IR      | BASIC    | NO                      | NO<br>(TWO INTER-<br>NAL 8-POLE<br>TERMINAL<br>BLOCKS) | NO                             | 240 vac                      | IP66<br>CENELEC<br>Ex d IIC T6                                                                                                       | NO               | NO  | NO<br>(see<br>Note)  | NO  |  |  |  |  |  |  |  |  |
| 95UVS1-1CEX                        | UV      |          |                         |                                                        |                                |                              |                                                                                                                                      |                  |     |                      |     |  |  |  |  |  |  |  |  |
| 95DSS1-1CEX                        | IR & UV |          |                         |                                                        |                                |                              |                                                                                                                                      |                  |     |                      |     |  |  |  |  |  |  |  |  |
| 95IRS2-1CEX                        | IR      | EXPANDED |                         |                                                        |                                |                              |                                                                                                                                      |                  |     |                      |     |  |  |  |  |  |  |  |  |
| 95UVS2-1CEX                        | UV      |          |                         |                                                        |                                |                              |                                                                                                                                      |                  |     |                      |     |  |  |  |  |  |  |  |  |
| 95DSS2-1CEX                        | IR & UV |          |                         |                                                        |                                |                              |                                                                                                                                      |                  |     |                      |     |  |  |  |  |  |  |  |  |
| 95IRS1E-1CEX                       | IR      | BASIC    | NO                      | NO<br>(TWO INTER-<br>NAL 8-POLE<br>TERMINAL<br>BLOCKS) | NO                             | 240 vac                      | IP66<br>CENELEC<br>Ex d IIC T6                                                                                                       | NO               | NO  | YES<br>(see<br>Note) | YES |  |  |  |  |  |  |  |  |
| 95UVS1E-1CEX                       | UV      |          |                         |                                                        |                                |                              |                                                                                                                                      |                  |     |                      |     |  |  |  |  |  |  |  |  |
| 95DSS1E-1CEX                       | IR & UV |          |                         |                                                        |                                |                              |                                                                                                                                      |                  |     |                      |     |  |  |  |  |  |  |  |  |
| 95IRS2E-1CEX                       | IR      | EXPANDED |                         |                                                        |                                |                              |                                                                                                                                      |                  |     |                      |     |  |  |  |  |  |  |  |  |
| 95UVS2E-1CEX                       | UV      |          |                         |                                                        |                                |                              |                                                                                                                                      |                  |     |                      |     |  |  |  |  |  |  |  |  |
| 95DSS2E-1CEX                       | IR & UV |          |                         |                                                        |                                |                              |                                                                                                                                      |                  |     |                      |     |  |  |  |  |  |  |  |  |

**Note:** The housing into which the Model CEX InSight electronics are installed has been approved by CENELEC and ATEX for use in Exd IIC T6 hazardous areas.

**Note:** Class I Division 2 Hazardous Area requirements for InSight scanners with electrical connectors (non-CG models):

1. The connector coupling nu8t setscrew must be tightened after mating the cable to the scanner.
2. The red warning label must be adhered to the connector housing.
3. Evaluated by TUV that the flame detector device is suitable to be used as single device for safety instrumented functions (SIF) according to DIN EN 61511-1 up to SIL2. The flame detector device also fulfills the applicable requirements of DIN EN 61508:2002 parts 2-3 for safety integrity level SIL2



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## SPECIFICATIONS

### MECHANICAL:

|                             |                                                                                                                                                                                                                                                                                                                  |
|-----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Housing Material:</b>    | Cast aluminum with gray polyester powder coat finish                                                                                                                                                                                                                                                             |
| <b>Housing Weight:</b>      | 4.3 lbs (1.96kg), non-“CG” models<br>5.9 lbs. (2.69kg) “CG” models<br>6.3 lbs. (2.89kg) “CEX” models                                                                                                                                                                                                             |
| <b>Environmental:</b>       | NEMA 4X, IP66, Class I Division 2, Groups A, B, C & D, Class II Division 2, Groups F& G (refer to agency approvals table)                                                                                                                                                                                        |
| <b>Mounting:</b>            | Requires one of two threaded mounting flanges, ordered separately (see below). For fiber optic mount, refer to bulletin CU-101                                                                                                                                                                                   |
| <b>Mounting Flange Kit:</b> | P/N 60-2692      1" NPT female pipe mount with 3/8" NPT female cooling air connection, includes 1" NPT x 3" long heat insulating nipple (P/N 35-127-1)<br>P/N 60-2693      1" BSP female pipe mount with 3/8" BSP female cooling air connection, includes 1" BSP x 3" long heat insulating nipple (P/N 35-127-3) |

### Mounting Flange

**Shipping Weight:** 0.62lbs. (0.28kg)

### Cooling / Purge Air Requirements:

**Source:** Clean, dry, cool

**Volume:** 4 SCFM (113 l/min) at 3/8" threaded mounting flange, or 1 inch “Y” fitting, mounted on scanner sight pipe. Temperature near the upper limit of the scanner operating range and/or use with dirty/dusty fuels may require up to 15 SCFM (425 l/min).

**Pressure:** Adequate to overcome furnace or windbox pressure

**Temperature Rating:** -40°F to + 150°F (-40°C to +65°C), ambient; -40°F to 178°F (-40°C to 81°C), scanner internal temperature

**Humidity:** 0% to 95% relative humidity, non-condensing

### ELECTRICAL:

**Input Power:** 24 Vdc, +10%, -15% supply current: 0.35 A, 8.5 VA

**Electrical Connection:** 12-pin quarter-turn quick-disconnect.  
“CG” models have cable gland and 10 ft (3m) of captive cable  
“CEX” models have 3/4" threaded opening and internal terminal blocks

**Relay Output** FLAME RELAY, SPST (N.O.)  
FAULT RELAY, SPST (N.C.)

**Contact Rating:** Minimum: 10 mA @ 5 Vdc  
Maximum: 2 A @ 30 Vdc  
2 A @ 50 Vac (CE approved models)  
2 A @ 240 Vac (FM & UL models and all “CG” models)

**Analog Output:** 4-20 mA dc current, referenced to 24Vdc common, maximum connected load: 750 ohms

**Status Indication:** Eight (8) character alpha-numeric LED display (scrolling capability)

**Operator Interface:** Four (4) pushbutton style keys

**Cable Specification:** P/N 59-497:

Multi-core, 12 conductor (color coded), with foil wrap and overall braided shield  
Six #18 AWG and four #22 AWG conductors, plus one #22 AWG twisted pair  
Cable Jacket: Irradiated Modified Polyolefin (flame-retardant, low smoke, zero halogen)  
Maximum Temperature: 257°F (125°C)  
Nominal O.D. 0.41" (10.4 mm), Maximum O.D. 0.43" (10.9 mm)  
Maximum cable length 1000 feet (305 meters)

## INSTALLATION NOTES

The InSight flame scanners determine the presence or absence of flame by monitoring the frequency spectrum of the flame. The scanner should initially be mounted so that the primary combustion zone is within the scanner's line of sight.

The location and sighting instructions listed in the following sections are rough guidelines for the location of the scanner. The scanner provides feedback via its LED display to assist in the adjustment and proper alignment of the flame scanner. Refer to the setpoint procedures described in this bulletin.

**Note:** An acceptable scanner location must ensure the following:

Reliable main flame and/or ignitor flame detection at all air flow and furnace loads (ranges of fuel firing).

Rejection of the ignitor flame if too short or in the wrong position to ignite the main flame reliably, thus prohibiting the delivery of fuel to the burner.

**Note:** Due to the microprocessor based design of the InSight scanner, the heat insulating nipple (P/N 35-127-1 or 35-127-3) must be used to isolate the scanner from ground and to reduce conducted energy and noise. See Figure 7. The nipple is included in mounting flange kit P/N 60-2692, 60-2693.

## INSTALLATION PROCEDURE



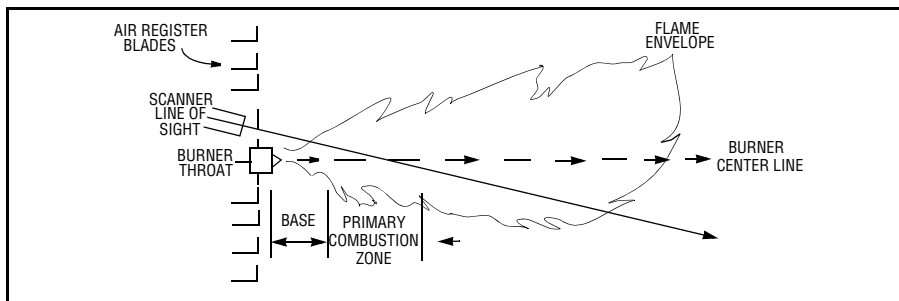
**WARNING:** Protective filtered lenses should be worn when viewing flame. Infrared and ultraviolet energy from the flame can be damaging to the eyes.

1. The best results are obtained when the scanner is aimed so that the scanner's line of sight intersects the burner center at a slight angle (e.g. 5 degrees) and sees a maximum of the primary combustion zone, as shown in Figure 4. If only one scanner is used per burner, the line of sight should also intersect the igniting flame.
2. For installations where separate scanners are used to monitor main and ignitor flames, the main flame scanner should be sighted so it does not detect the ignitor flame.
3. The scanner should have an unrestricted view of flame as far as possible. Physical obstructions such as air register blades, interfering vanes, or other hardware should be cut away or notched so they do not fall within the scanner's line of sight as shown in Figure 6.

**Note:** Always check with the burner manufacturer **before** you trim the register blades.

FIGURE 4.

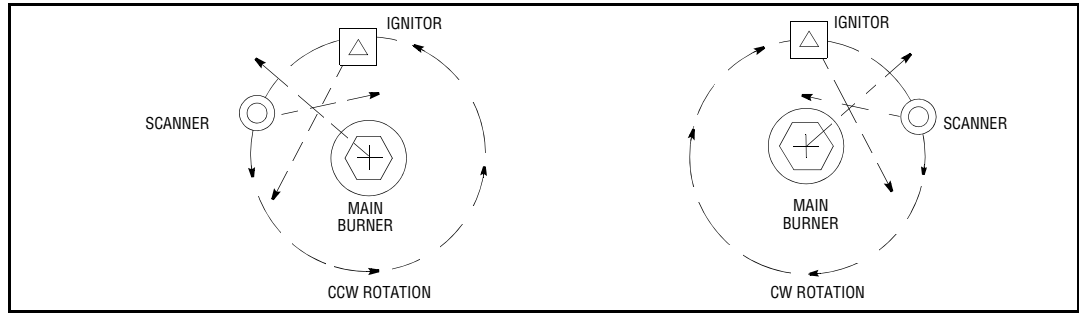
### SINGLE BURNER SCANNER SIGHTING



4. Consideration must be given to burner secondary air rotation, some burners have clockwise (CW) air rotation and others have counterclockwise (CCW) air rotation. If combustion air enters the furnace with a rotational movement of sufficient velocity to deflect the ignitor flame in the direction of rotation, position the scanner 10 to 30 degrees downstream of the ignitor as shown in Figure 5 and close to the periphery of the burner throat (See Figure 4).

FIGURE 5.

### SCANNER LOCATION VS. SECONDARY AIR ROTATION

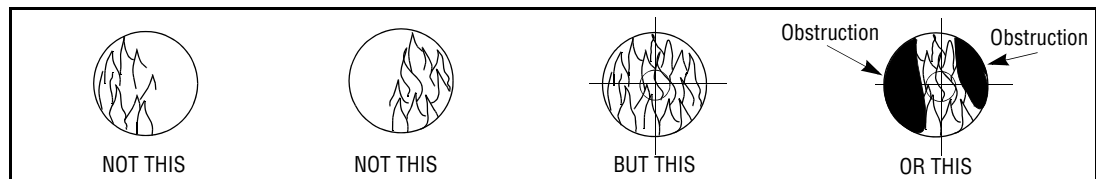


5. Having determined the approximate location for the sight pipe, cut a clearance hole for a 2 inch pipe through the burner plate. Look through the hole. If register vanes interfere with the desired line of sight, the interfering vane(s) should be trimmed to assure an unrestricted viewing path at all firing levels as indicated in Figure 6.

**Note:** Always check with the burner manufacturer **before** you trim register vanes.

FIGURE 6.

### IF POSSIBLE FLAME SHOULD COMPLETELY COVER SIGHT OPENING



6. The preferred method for mounting surface mounted scanners requires the use of a swivel mount, P/N 60-1664-3 (NPT), shown in Figures 7, 8 and 9. Center the swivel mount over the two inch hole in the burner plate and secure using three hexed cap screws (not provided). Install the sight pipe on the swivel mount. If a swivel is not used, insert the end of the sight pipe into the hole, align the hole to the desired viewing angle and tack weld (welding must be adequate to temporarily support the weight of the installed scanner). The sight pipe should be arranged to slant downward so that dirt and dust will not collect inside.



**CAUTION:** Use no more than one foot of one inch diameter sight pipe. Increase the sight pipe diameter one inch for every additional foot of sight pipe length used to avoid restricting the scanner's field of view.

7. When a satisfactory sighting has been confirmed by operational testing, secure the swivel mount's ball position in place by tightening the three hex head cap screws located on the swivel mount ring.
8. In larger multi-burner type applications such as power, kiln or refinery burners, it is recognized that there may be several obstructions within the scanner overall range of view. The same principle of adjusting the scanner such that the flame is within the center of its field of view applies. Use of a swivel mount allows the scanner to be adjusted to target the flame within the center of the scanner range of view. (see obstructed view in figure 6 above)
9. For ease of use, the scanner should be installed on the sight pipe so the LED display can easily be read.

**Note:** Operation of the LED display is independent of position.

**Note:** Due to the microprocessor based design of the InSight scanner, the heat insulating nipple (P/N 35-127-1 or 35-127-3) must be used to isolate the scanner from ground and to reduce conducted energy and noise. See Figure 7.

10. The scanner lens must be kept free of contaminants (oil, ash, soot, dirt) and the scanner housing temperature must not exceed its maximum rating of 150° F (65° C). Excessive temperatures will shorten scanner life. Both requirements will be satisfied by a continuous injection of purge air at either the 3/8" housing inlet or the 1" "Y" connection ahead of the swivel mount as shown in Figures 7, 8 and 9.

**Note:** Internal scanner temperature is available via the LED display. See "Status Menu" under "Programming the Scanner."



The scanner mounting may be made with provision for purge air through only the 3/8" opening as shown in Figure 9 or for purge air through either the 3/8" opening or the 1" "Y" connection as shown in Figure 8. In the latter arrangements, normally only one of the two connections is provided with purge air and the other connection is plugged. When a sealing coupling is used as shown in Figure 7, the 1" "Y" connection is used for the purge air and the 3/8" opening is plugged.

It is good practice to use the sealing coupling (P/N 60-1199-1 with NPT threads) on all installations to insure against unwanted furnace pressures from damaging the scanner lens.

Under normal conditions, with clean burning fuels and moderate ambient temperature conditions, purge air flow of approximately 4 SCFM (133l/min) is generally adequate. Up to 15 SCFM (425 l/min) may be required for fuels that produce high levels of ash or soot, or for hot environments to maintain the scanner's internal temperature within specification. Flexible conduit should be used to wire the scanner from a grounded service box to the scanner.

---

## MECHANICAL ACCESSORIES

### Surface Mounting Flange (Required)

P/N 60-2692 1" NPT female pipe mount with 3/8" NPT female cooling air connection, includes 1" NPT x 3" long heat insulating nipple (P/N 35-127-1).

P/N 60-26931" BSP female pipe mount with 3/8" BSP female cooling air connection, includes 1" BSP x 3" long heat insulating nipple (P/N 35-127-3).

### Swivel Mount (Optional)

The scanner swivel mount, P/N 60-1664-3 (NPT) (see Figure 10, Item A), is used to adjust the scanner sighting angle after the scanner has been installed. The swivel mount is shown in Figures 7, 8, and 9.

### Heat Insulating Nipple (Required)

Heat Insulating nipple, P/N 35-127-1 (NPT), or P/N 35-127-3 (BSP) (see Figure 7, Item E), is used to prevent heat transfer from the hot sight pipe to the scanner head as well as electrically isolate the scanner from ground. The appropriate nipple (NPT or BSP) is shipped *with* the surface mounting flange.

### Sealing Coupling with Quartz Window (Optional)

The sealing coupling, P/N 60-1199-1 (see Figure 7, Item D), is used whenever a coupling or a seal is required for scanner piping. The quartz window blocks furnace pressure, hot gases and soot from coming in contact with the scanner and contaminating the lens. The size is one inch U.S. standard taper pipe thread (Schedule 40, 1" - 1 1/2 NPT). When the sealing coupling is used, a 1 inch "Y" fitting must be used downstream of it for connection of a purge air supply (plug 3/8" opening).

### Orifice Kit (Optional)

An orifice may be used to restrict the scanner's field of view aiding discrimination between the target flame and other flames in the combustion chamber. An orifice may also be used to reduce the total amount of radiation reaching the scanner, thereby avoiding the chance of saturation. Orifice kit (P/N 53-121) contains nine different orifice sizes, and two retaining clips. The orifice can be installed either within the 60-1664 swivel mount, within the 60-1199-x coupling, or within the 60-2692,-2693 surface mounting flange. Refer to figures 11 and 12.

### Insulating Jacket/Vortex-Tube Cooler Kit (Optional)

For high ambient temperature applications, an insulating jacket (P/N 97-1048) and vortex-tube cooler kit (P/N 60-2720) are available. Refer to bulletin CU-103 for details.

FIGURE 7.

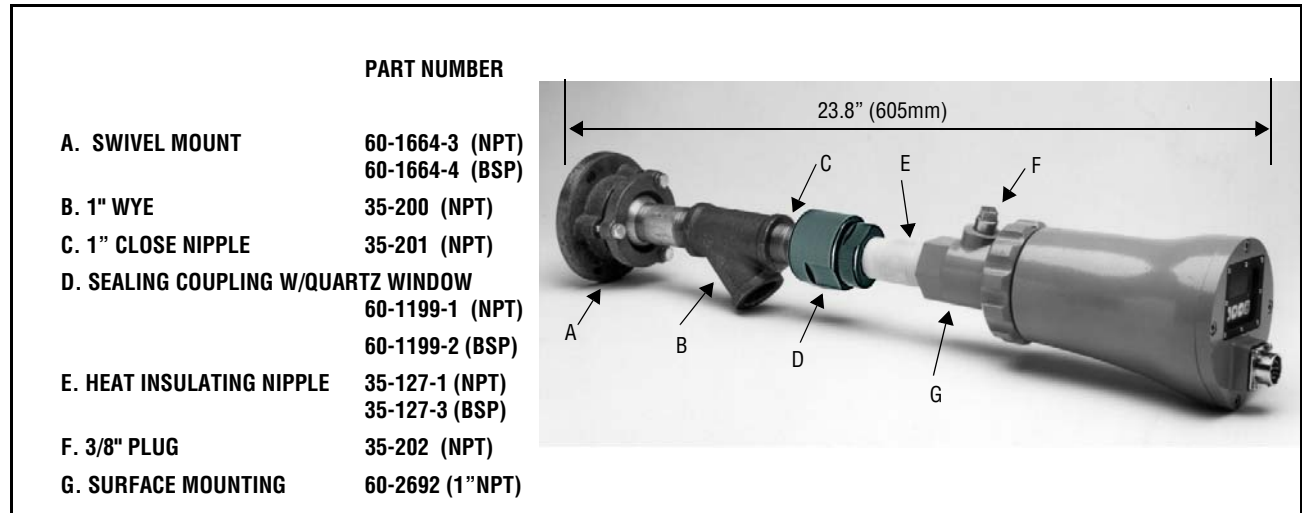


FIGURE 8.

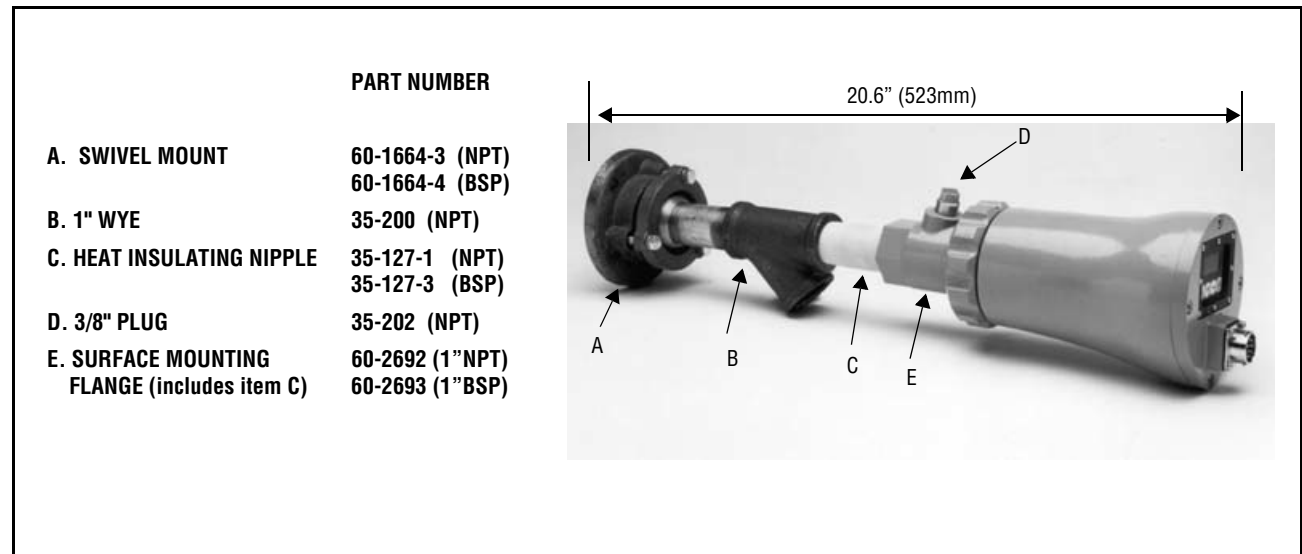


FIGURE 9.

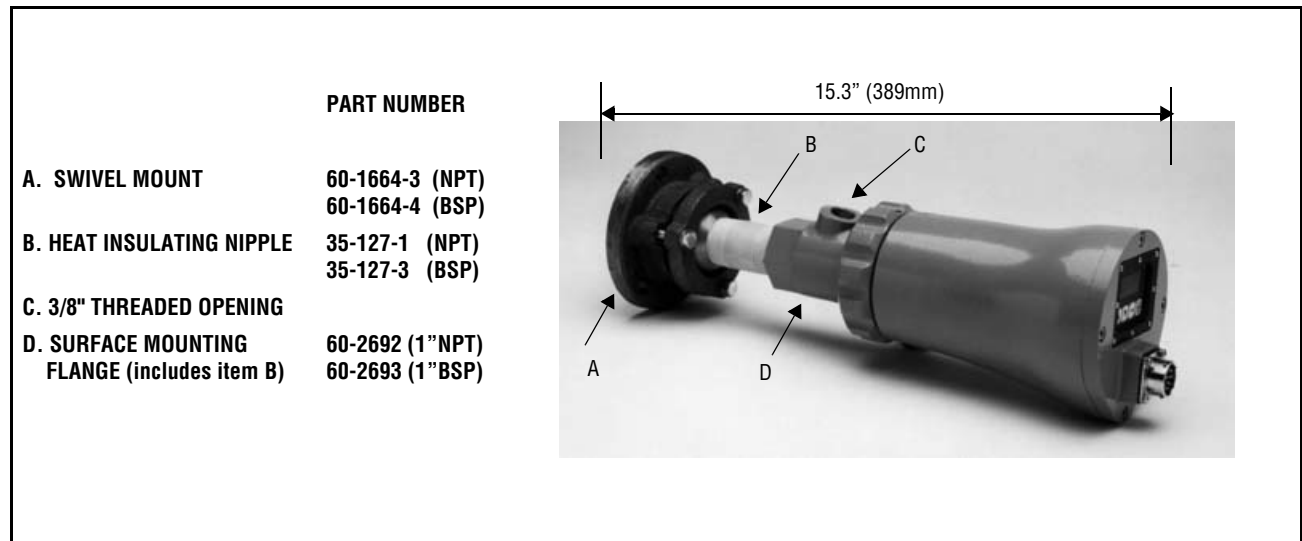


FIGURE 10.

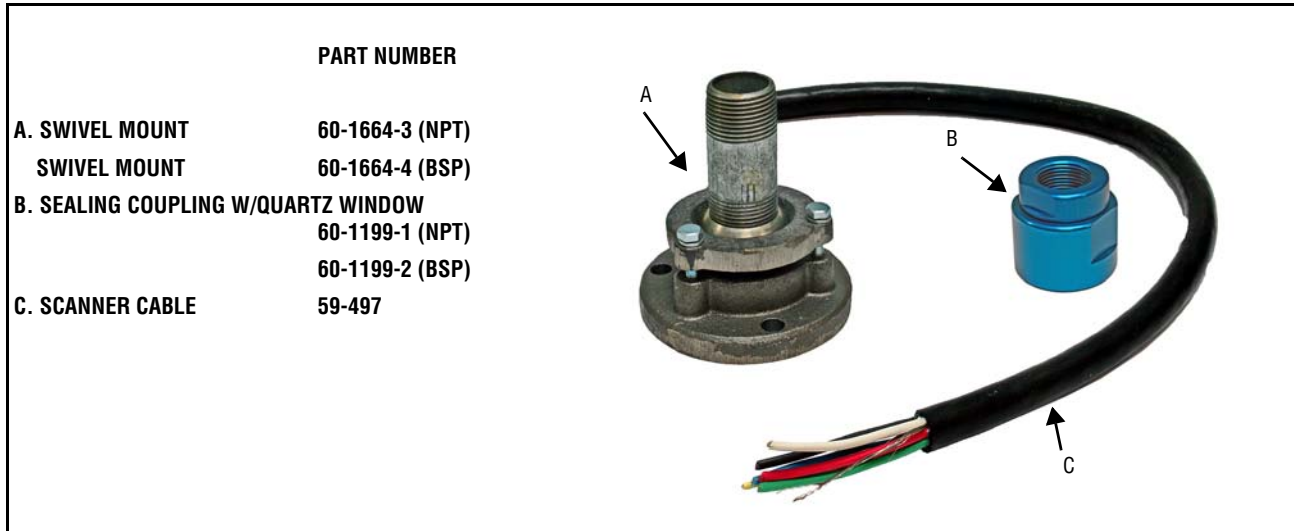
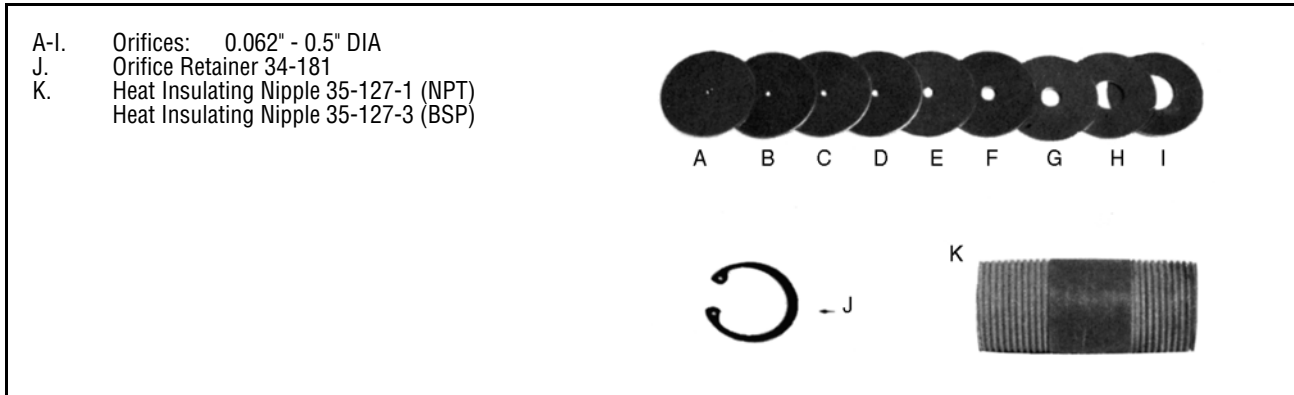


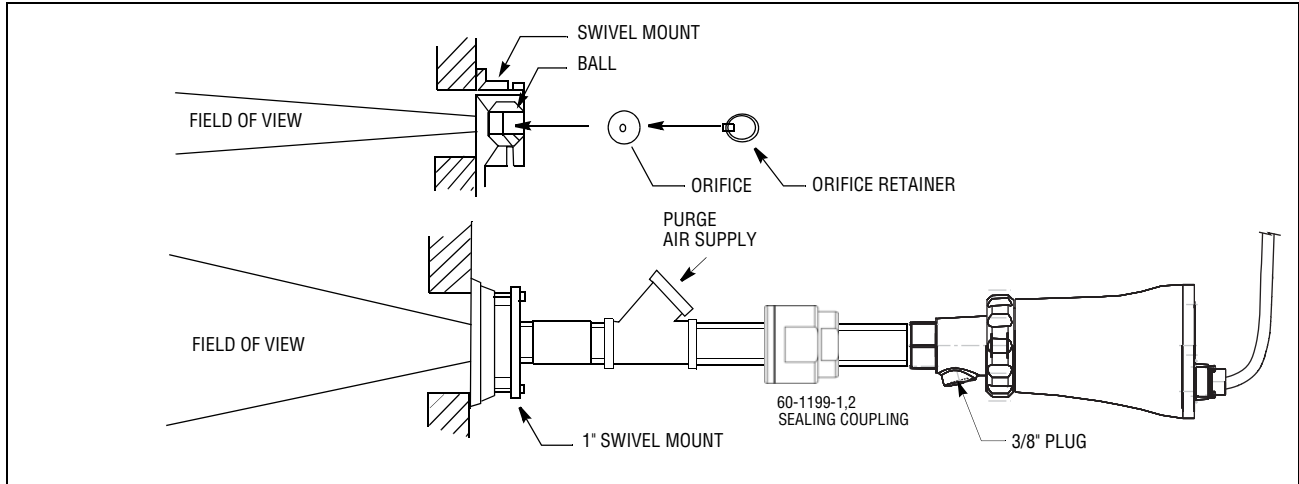
FIGURE 11.



## ORIFICES

| Figure | Qty. | Part Number | Description                            |
|--------|------|-------------|----------------------------------------|
| 11     | 1    | 53-121      | Orifice Kit: Contains following items: |
| 11A    | 1    | 53-121-2    | Orifice: Diameter = 0.062"             |
| 11B    | 1    | 53-121-3    | Orifice: Diameter = 0.078"             |
| 11C    | 1    | 53-121-4    | Orifice: Diameter = 0.093"             |
| 11D    | 1    | 53-121-5    | Orifice: Diameter = 0.109"             |
| 11E    | 1    | 53-121-6    | Orifice: Diameter = 0.125"             |
| 11F    | 1    | 53-121-7    | Orifice: Diameter = 0.187"             |
| 11G    | 1    | 53-121-8    | Orifice: Diameter = 0.250"             |
| 11H    | 1    | 53-121-9    | Orifice: Diameter = 0.375"             |
| 11I    | 1    | 53-121-10   | Orifice: Diameter = 0.500"             |
| 11J    | 2    | 34-181      | Orifice Retainer                       |

**FIGURE 12.**



## ELECTRICAL ACCESSORIES (see note)

**Note: Class I Division 2 Hazardous Area requirements for InSight scanners with electrical connectors (non-CG models):**

1. The connector coupling nut setscrew must be tightened after mating the cable to the scanner.
2. The red warning label must be adhered to the connector housing.

### Scanner Cable, P/N 59-497

Fireye recommends P/N 59-497 multi-core, 12 conductor (color coded), foil wrap and overall braided shield cable. This cable includes six #18 AWG and four #22 AWG conductors, plus one #22 AWG twisted pair. The cable jacket is Irradiated Modified Polyolefin (flame-retardant, low smoke, zero halogen) with a maximum diameter of 0.43" (10.9 mm). Maximum temperature: 257°F (125°C). The maximum cable length is 1000 feet (305 meters) per scanner. This raw stock cable requires the Quick-Disconnect Kit described below. Refer to Figure 14 for color code and connection information.

### Quick-Disconnect Kit, P/N 129-164, 129-164R, 129-164C, 129-164RC

A twelve-pin (male) electrical connector is factory installed on non-“CG” InSight scanners. Fireye offers the mating (female) connector for field installation onto the 59-497 cable. Refer to Quick-Disconnect assembly instructions. P/N 129-164 is straight, P/N 129-164R is right-angle. P/N 129-164C and 129-164RC are supplied with fittings for use with 1/2" flexible conduit.

### Scanner Cable with Female Connector, P/N 59-497-XXX, -XXXR, -XXXC, -XXXRC

Fireye offers the 59-497 12-conductor cable in pre-cut lengths with the female quick-disconnect factory installed. These assemblies are offered in lengths from 10 feet (3m) to 300 feet (91m). P/N 59-497-XXXR has a right-angle connector. P/N 59-497-XXXC and 59-497-XXXRC are supplied with fittings for use with 1/2" flexible conduit.

### Wiring Harness Assembly, P/N 61-6944-XXX, -XXXR

If remote communication is required (Model S2 only), and the distance between the InSight scanner and the control room exceeds 200 feet (61m), then a small junction box must be installed near each scanner.

The two communications wires must be separated out of the twelve-conductor scanner cable at the junction box and wired independently in a multi-drop (“daisy-chain”) configuration to each scanner in the loop, and finally to the computer. The Fireye Wiring Harness Assembly, available in lengths from 3 to 50 feet (0.9 to 15.2m), provides a convenient method to accomplish this.

On one end, the harness has a female quick-disconnect to connect to the non-“CG” InSight scanner. Harness part numbers ending in “R” have a 90° quick-disconnect. Fireye twelve-conductor cable, P/



N 59-497 is factory wired to the quick-disconnect, run through flexible conduit and connected to a terminal strip within a junction box at the other end of the harness. The terminal strip accepts up to 14 AWG wires and uses push-type cage clamp connectors for quick and secure connections.

From the junction box, the installer would connect all but two wires of a length of Fireye 59-497 twelve-conductor cable that is run to the burner management system. The two communications wires originating from the scanner would be connected from one junction box to the next, and finally to the computer using a two-conductor communications cable (Belden #8761, 22 AWG or equal).

#### 24 Volt DC Power Supplies

Fireye offers two DIN rail mounted 24 vdc power supplies for use with the InSight Integrated flame scanner. Model 60-2685-25 (2 amp) can power up to five InSight scanners, model 60-2685-50 (4 amp) can power up to ten InSight scanners (see note 1). Refer to bulletin CU-118 for details.

| PART NUMBER | DESCRIPTION                                                                                                                                                                         | NOTES |
|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 60-2685-25  | 24 VDC Switching Power Supply, 100-240 vac 50/60 Hz. input, 2.5 A output at 24 vdc. Powers up to five scanners. Dimensions: 3.7"(95mm) high x 1.6" (40mm) wide x 4.3"(108mm) deep   | 1     |
| 60-2685-50  | 24 VDC Switching Power Supply, 100-240 vac 50/60 Hz. input, 5.0A output at 24 vdc. Powers up to ten scanners. Dimensions: 4.5" (115mm) high x 2.0" (50mm) wide x 4.8" (121mm) deep. | 1     |

#### Notes:

1. Rated output is when power supply is vertically mounted, and with an ambient temperature of 104F (40C) maximum.

## SCANNER WIRING

To reduce electrical noise interference, the scanner cable should be installed in rigid or flexible conduit. Take precautions to keep the scanner cable away from any high inductive wiring associated with high inductive loads or high voltage, high energy spark ignition systems.

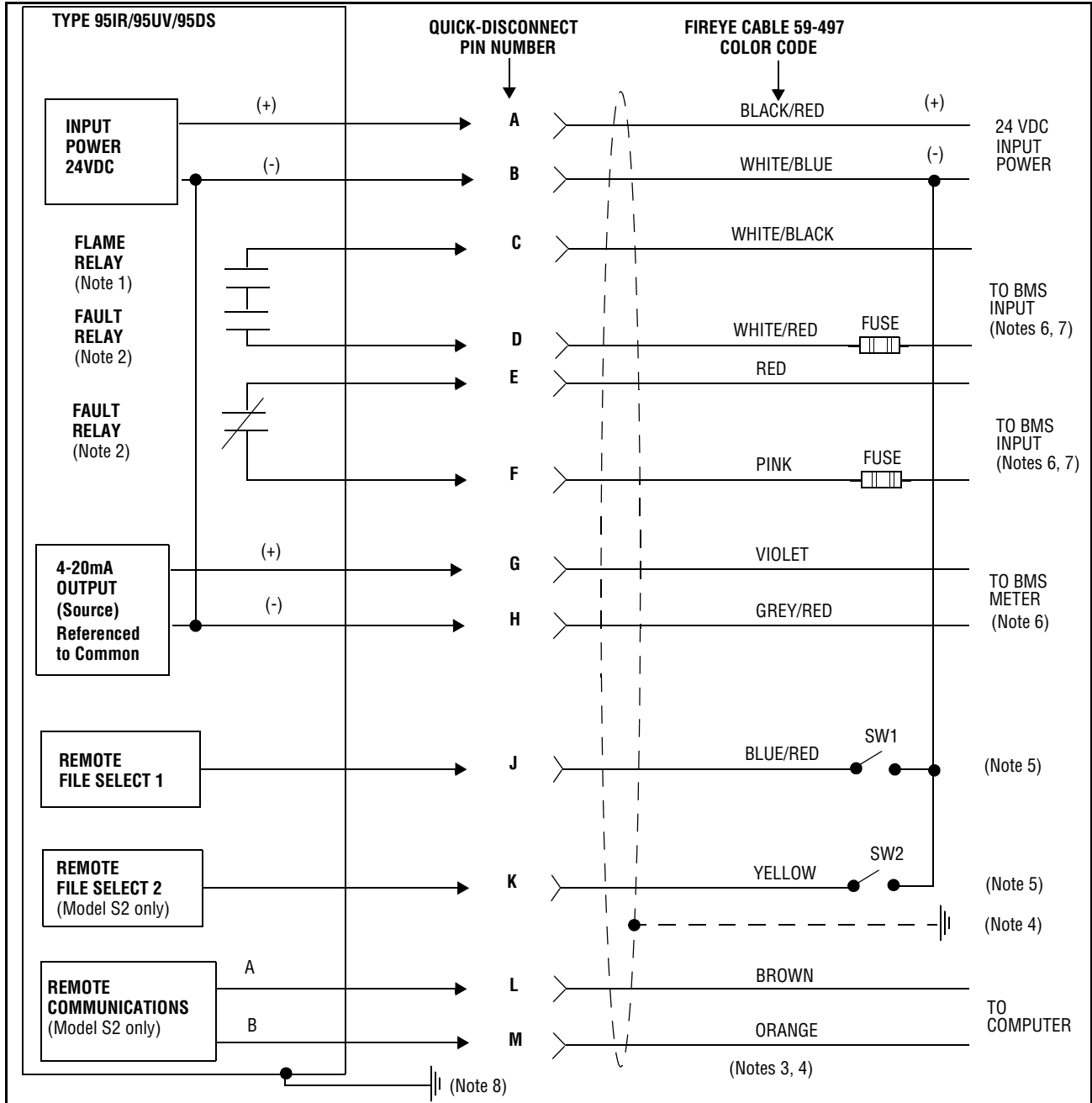


**CAUTION: The InSight flame scanner requires 24 Vdc power for operation. Connection to a 24 Vac or 120 Vac power source will damage the scanner. Refer to wiring diagrams.**

**External 2.0 Amp fuses are recommended to protect Flame Relay and Fault Relay contacts**

**All wiring to the scanner should be rated at 90°C. For runs less than 1000 feet, the use of Fireye Scanner Cable, P/N 59-497, (12 wire) is recommended. For runs in excess of 1000 feet, consult the factory.**

FIGURE 13. WIRING DIAGRAM, INSIGHT INTEGRATED FLAME SCANNER



**Notes:**

1. Flame relay contacts are shown in de-energized (no flame) condition.
2. Fault relay contacts are shown in de-energized (fault) condition.
3. Brown and orange wires are a twisted pair.
4. **Connect cable shield to earth ground at power source.**
5. With Remote File Select programmed as "LINE", external switches SW1/SW2 (not furnished) will select between two (S1 Models) or four (S2 Models) internal memory files, when connected to 24Vdc (-) supply.
6. BMS = Burner Management System (by others).
7. External 2.0 Amp fuses recommended.
8. **A ground screw is provided on the scanner end plate. An external ground wire must be installed if line voltage is applied to the relay contacts.**

## REMOTE FILE SELECTION

The InSight scanners have more than one internal memory file. The user has the option of storing different scanner setpoints for different operating conditions (e.g. Gas / Oil, Pilot / Main, Low Fire / High Fire, etc.) in these files. The “S1” models have two programmable files (A & B), and “S2” models have four (A,B,C, & D). With RFS selected as “LINE”, one or two external switches (supplied by user) will select between the files when the RFS1 or RFS2 wires are connected to 24 vdc (-).

| RFS1 (Blue) | RFS2 (Yellow) | File Selected |
|-------------|---------------|---------------|
|             | (Note 1)      |               |
| Open        | Open          | A             |
| Closed      | Open          | B             |
| Open        | Closed        | C             |
| Closed      | Closed        | D             |

**Note 1:** RFS2 function is available in the “S2” models only.

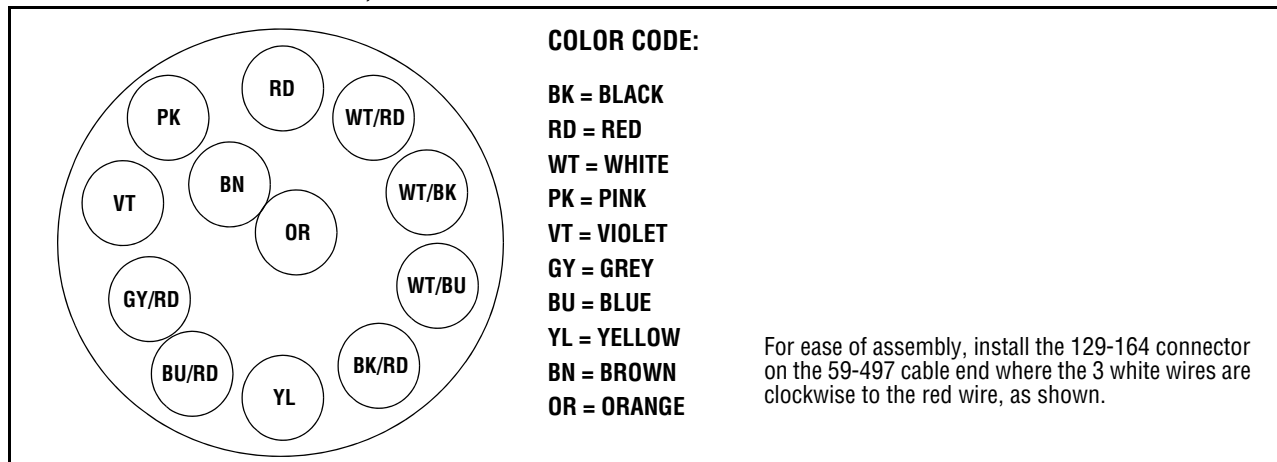
**Note 2:** The user may also select RFS as “KEY” which will allow manual file selection at the scanner keypad.

**Note 3:** With FM & UL approved “S2” models, the user may also select RFS as “COMM” which will allow manual selection at a remote computer running Fireye software. This feature is not available with CE approved “S2E” models.

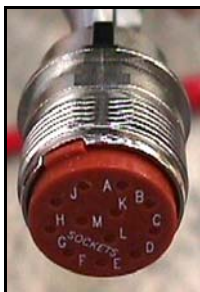
**Note 4:** Fireye recommends the use of shielded cable for the two remote file select switches (or relays). The switch contacts should be rated for low current operation (3mA dc).

## ASSEMBLY INSTRUCTIONS, QUICK DISCONNECT KIT P/N 129-164

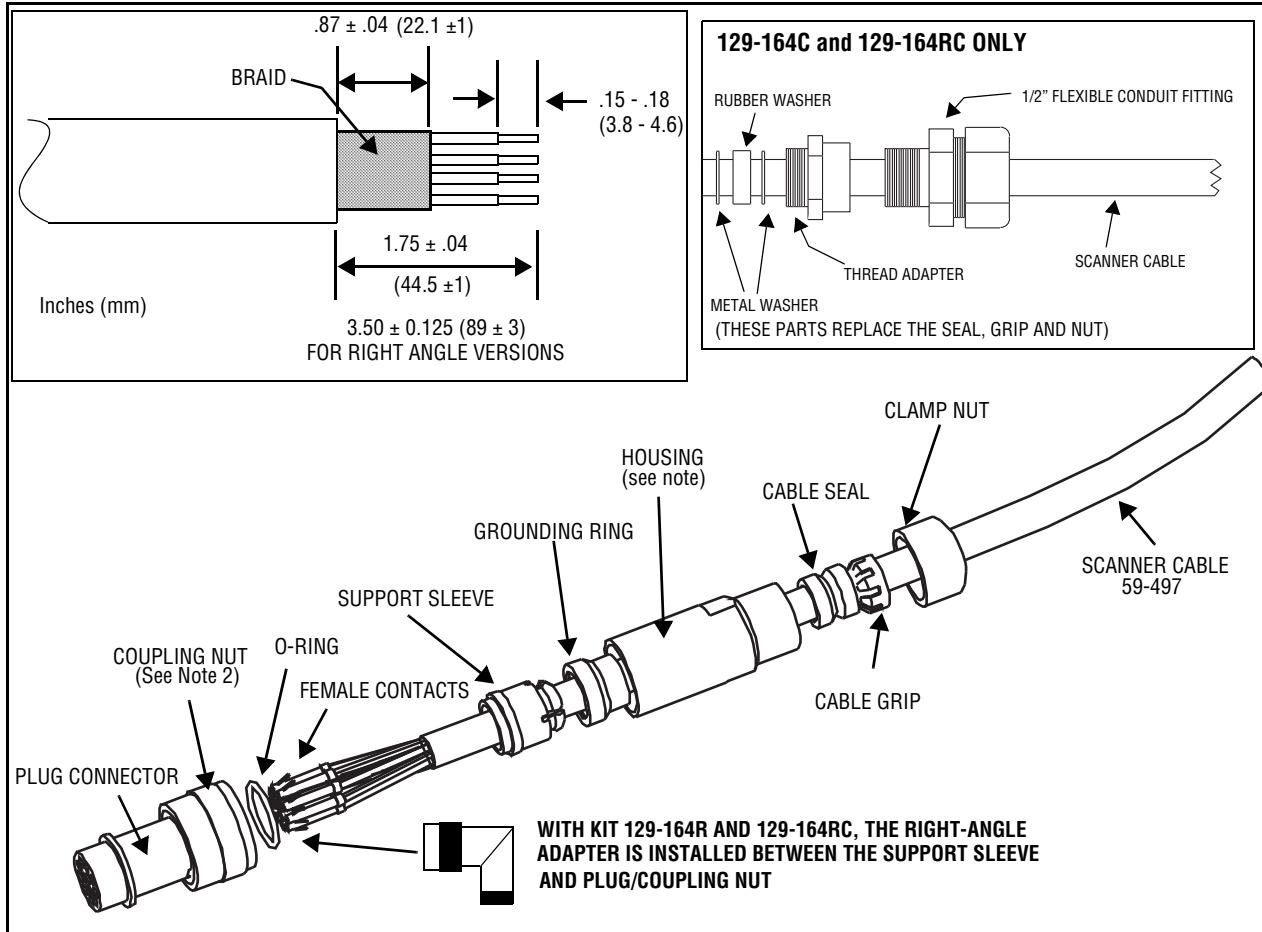
FIGURE 14. 59-497 CABLE, CONDUCTOR ORIENTATION



**PLUG CONNECTOR**  
ORANGE GROMMET INSTALLED



**FIGURE 15. CONNECTOR ASSEMBLY INSTRUCTIONS**



### CONNECTOR ASSEMBLY STEPS

1. Select 59-497 cable end with the wire color orientation as shown in Figure 14.
2. Slide items along the cable as shown, including coupling nut and O-ring.
3. Remove and discard the black thread protector from the Plug Connector. Leave the orange grommet installed (see photo, page 16).
4. Strip cable (connector end) in accordance with Figure 15. Slide braid back and forth to loosen, then fold braid back over cable jacket. Cut and discard foil tape. Solder wires to contacts.

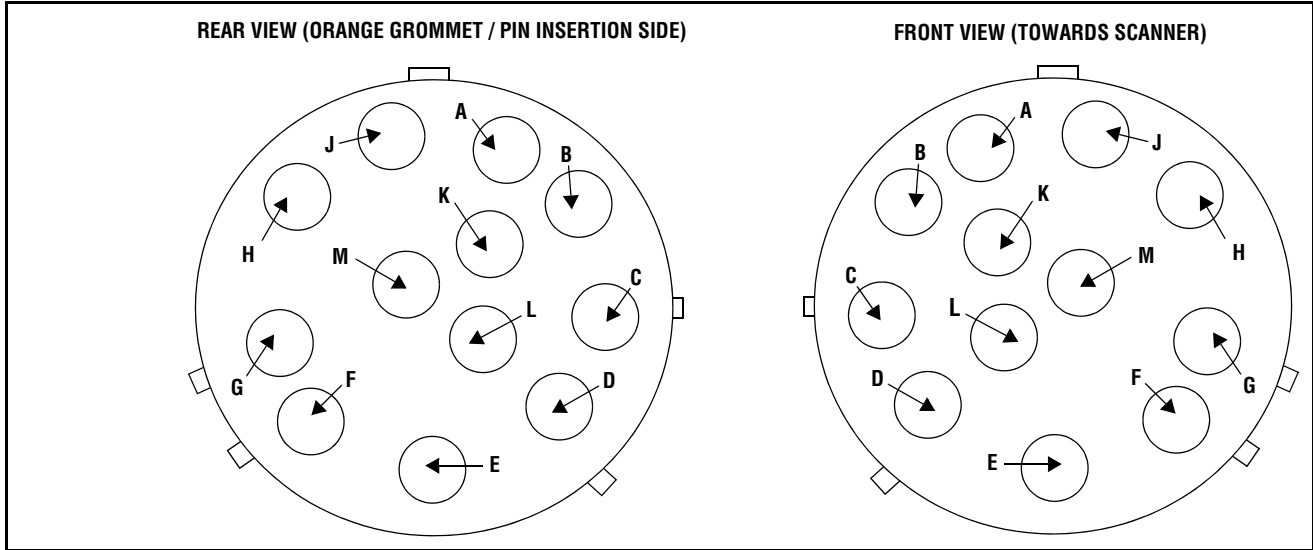
**Note 1:** To ease contact insertion, you may first pierce the orange grommet's membrane with a small pin tool.

5. Slide contacts through orange grommet and into plug connector, per Figure 16 wiring table, until contacts lock in place.
6. Slide coupling nut up to plug connector and slide O-ring into groove on plug connector.
7. Slide support sleeve back over braid and drain wire then place braid over spring elements of support sleeve. Clamp braid and drain wire by snapping on the metal grounding ring. Screw housing onto the plug connector. Torque to 27 lb-in ± .25 lb-in, (3.05N-m ± 0.03 N-m).
8. Assemble cable seal and cable grip to the housing, screw clamp nut onto housing and tighten to 27 lb-in ± .25 lb-in, (3.05N-m ± 0.03 N-m). "C" and "RC" Kits: Slide the Rubber and Metal Washers into the Housing and secure with the Thread Adapter. Install the Flexible Conduit Fitting.

**Note 2:** Class I Division 2 Hazardous Area requirements for InSight scanners with electrical connectors (non CG models):

1. The connector coupling nut setscrew must be tightened after mating the cable to the scanner.
2. The red warning label must be adhered to the connector housing.

**FIGURE 16. PLUG CONNECTOR PIN LOCATION**

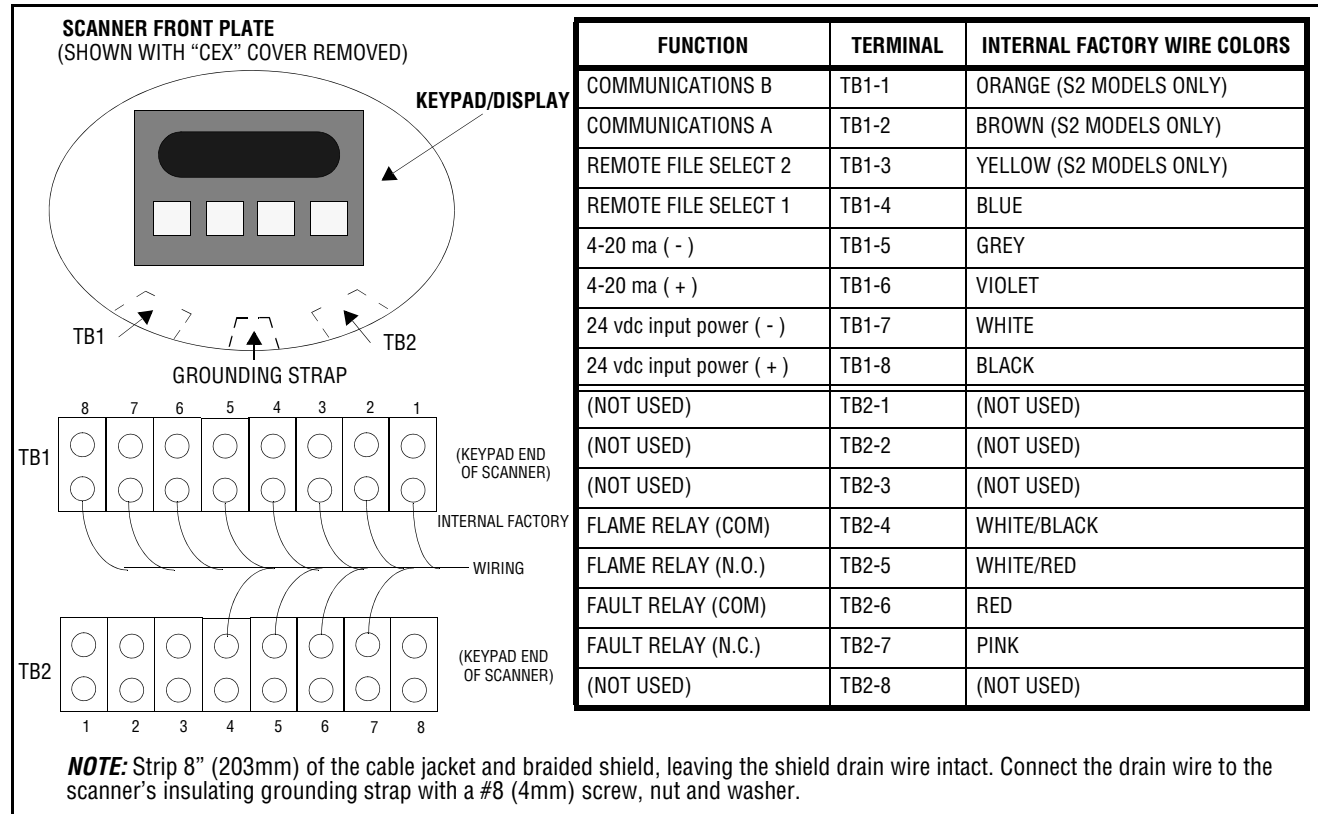


**FIGURE 17. QUICK DISCONNECT PINS**

| 59-497 Cable Color | Pin Number of Quick Disconnect | Function             |
|--------------------|--------------------------------|----------------------|
| Black/Red          | A                              | Power (+) 24 Vdc     |
| White/Blue         | B                              | Power (-) 24 Vdc     |
| White /Black       | C                              | Flame Relay (COM)    |
| White/Red          | D                              | Flame Relay (N.O.)   |
| Red                | E                              | Fault Relay (COM)    |
| Pink               | F                              | Fault Relay (N.C.)   |
| Violet             | G                              | 4-20 mA (+)          |
| Grey/Red           | H                              | 4-20 mA (-)          |
| Blue/Red           | J                              | Remote File Select 1 |
| *Yellow            | K                              | Remote File Select 2 |
| *Brown             | L                              | Communications A     |
| *Orange            | M                              | Communications B     |
| * "S2" models only |                                |                      |

**Note:** Brown and orange wires are a twisted pair.

**FIGURE 18. WIRING OF INSIGHT MODEL “CEX” SCANNERS**



## WIRING FOR REMOTE COMMUNICATIONS (“S2” models only)

Remote communications with the InSight scanner uses an RS485 Interface to carry the communication signals. An IBM compatible PC running Fireye software is required to communicate with the flame scanners. **The wiring configuration for remote communications is dependent on the distance between the scanner and amplifier. For distances less than 200 feet, wire the Fireye cable P/N 59-497 to the female quick disconnect in the manner previously described, and run the cable directly back to the burner management system.**

**For wiring distances greater than 200 feet,** remote communications requires wiring a twisted, shielded pair of wires in a “multi-drop” wiring configuration, and then use a terminating resistor at the scanner located farthest from the communication source. See “Using Fireye Wiring Harness.”

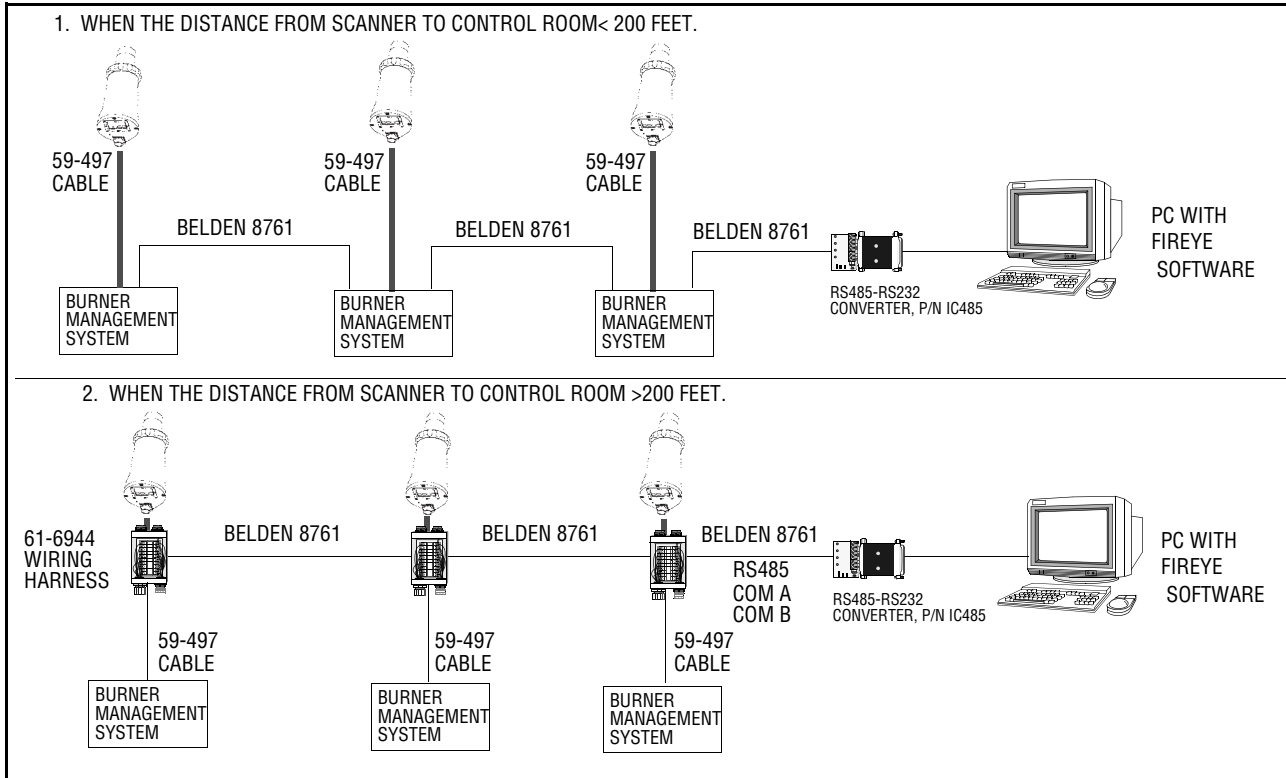
**Note:** The maximum distance for the communication wiring for all associated InSight scanners is 4,000 feet. The maximum number of scanners connected to the communication link is 32 scanners. Exceeding this total wiring length or number of scanners requires the installation of bi-directional repeaters or amplifiers. Consult factory for additional information.

### Using Fireye Wiring Harness (P/N 61-6944 -003, -010, -015, -020, -030, -050)

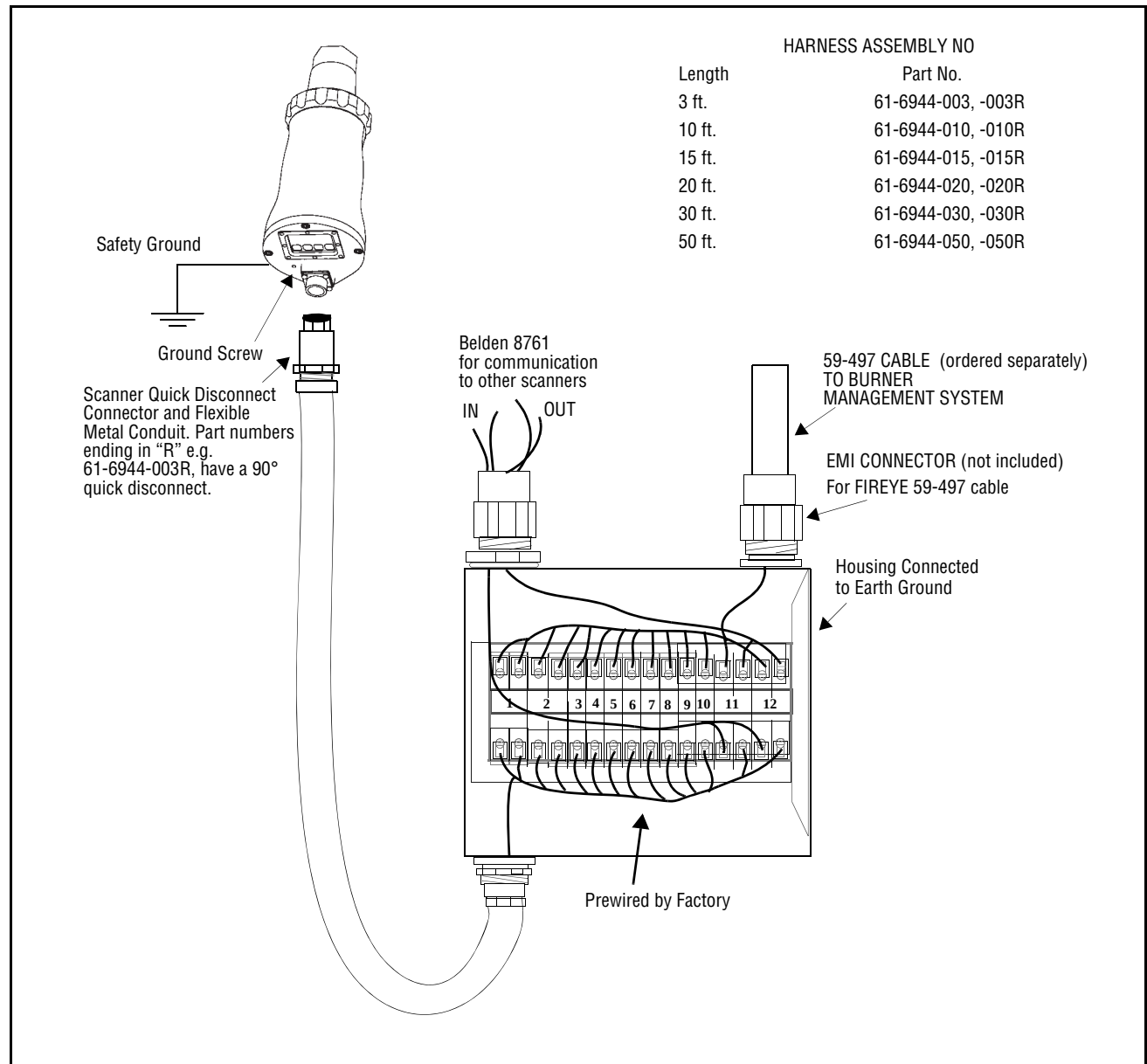
To provide an easy method to wire the non-“CG” model InSight scanners in a “Multi-drop” wiring configuration for remote communications, Fireye offers a wiring harness in 5 different lengths (3, 10, 15, 20, 30 and 50 ft.). The harness has a pre-wired female quick disconnect to plug into the quick disconnect on the scanner. The other end of the wiring harness has a conduit box with a 16 connector terminal strip. Twelve (12) connectors are pre-wired to the female quick disconnect.

| Cable        | Color        | Function           | Wiring Harness | Wire Cable                                         |
|--------------|--------------|--------------------|----------------|----------------------------------------------------|
| 59-497 Cable | Black/Red    | Power (+) 24 VDC   | 1              | Back to Control Room<br>(Burner Management System) |
|              | White/Blue   | Power (-) 24 VDC   | 2              |                                                    |
|              | White /Black | Flame Relay (N.O.) | 3              |                                                    |
|              | White/Red    | Flame Relay (N.O.) | 4              |                                                    |
|              | Red          | Fault Relay (N.C.) | 5              |                                                    |
|              | Pink         | Fault Relay (N.C.) | 6              |                                                    |
|              | Violet       | 4-20 mA (+)        | 7              |                                                    |
|              | Grey/Red     | 4-20 mA (-)        | 8              |                                                    |
|              | Blue/Red     | File Select 1      | 9              |                                                    |
|              | Yellow       | File Select 2      | 10             |                                                    |
|              | Brown        | Communications A   | 11             |                                                    |
|              | Orange       | Communications B   | 12             |                                                    |
| Belden 8761  | Black        | RS485 COM A        | 11             | To next flame scanner                              |
|              | Clear        | RS485 COM B        | 12             |                                                    |
| Belden 8761  | Black        | RS485 COM A        | 11             | To previous flame scanner<br>(or IC485 converter)  |
|              | Clear        | RS485 COM B        | 12             |                                                    |

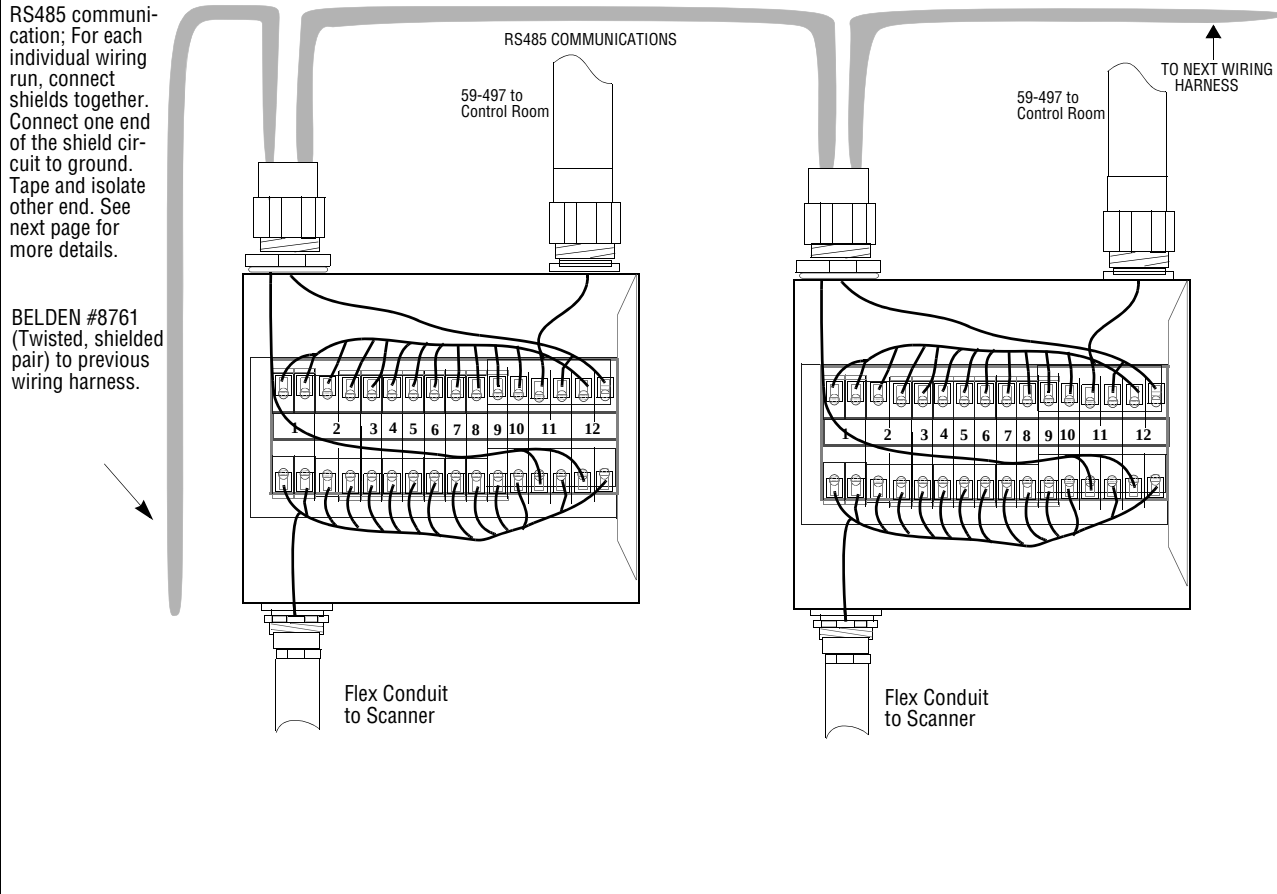
**FIGURE 19. WIRING FOR REMOTE COMMUNICATIONS**



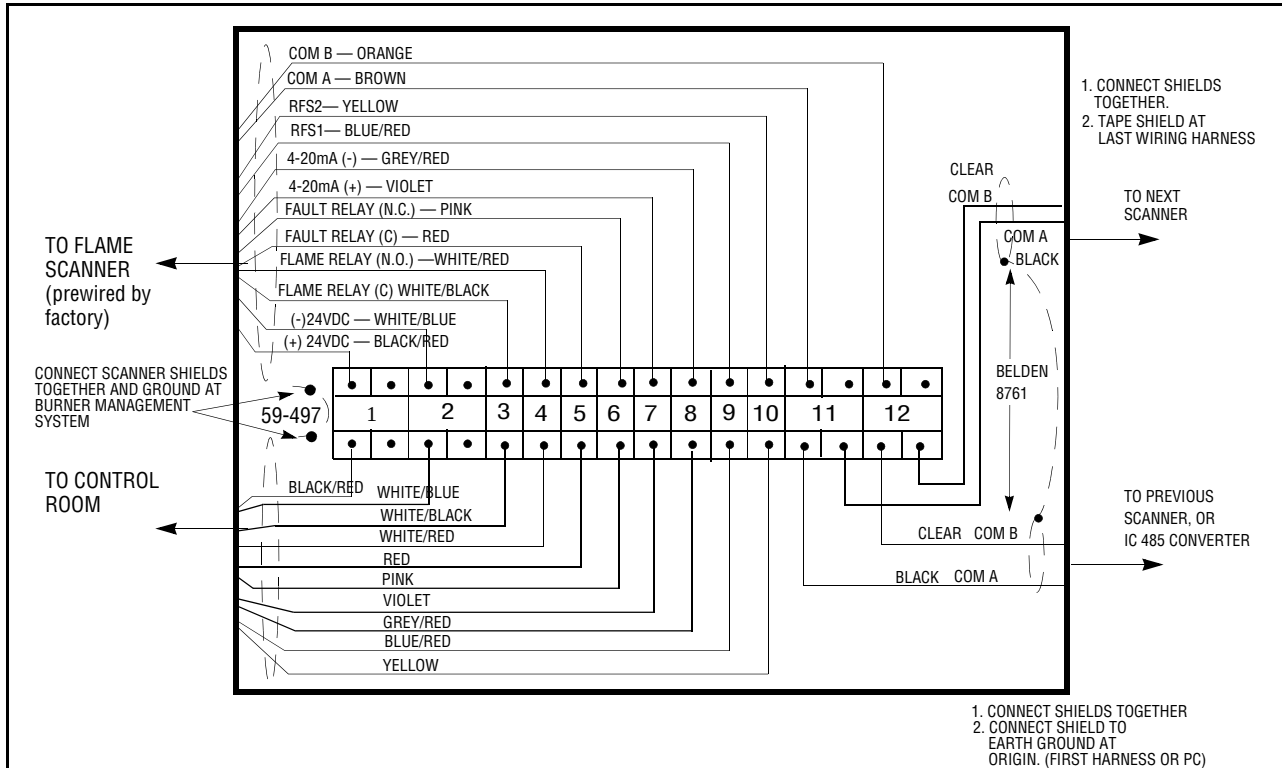
**FIGURE 20. WIRING HARNESS ASSEMBLY**



**FIGURE 21. SUGGESTED WIRING FOR COMMUNICATIONS**



**FIGURE 22. WIRING DIAGRAM FOR WIRING HARNESS**



## GROUNDING AND SHIELDING TECHNIQUES

FOR USE ON SCANNERS OR SCANNER CABLE LOCATED WITHIN 12" OF A HIGH ENERGY OR HIGH VOLTAGE SOURCE.

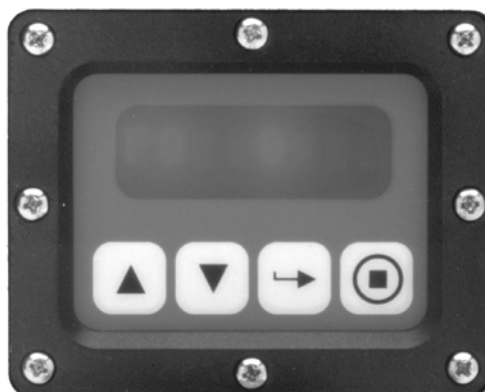
1. Connect a safety ground to scanner housing (Figure 13).
2. The scanner and scanner cable (preferably within flexible conduit) MUST be located at least 12" from the ignition source.
3. Run a ground wire from the ignition transformer chassis to the ignitor assembly.
4. Replace all frayed, cracked, or dirty (oily) ignition wire. Ignition wire must be in good working condition.
5. Electrically isolate the scanner from the burner using a heat insulating nipple provided with the surface mounting flange.
6. Cooling/Purge Air must be electrically isolated from the scanner (e.g. isolated short rubber hose).

| SCANNER TO CONTROL ROOM                                                                                                   | SHIELDING TECHNIQUES                                                                                                                                                                                                                                                                                                                                                                      |
|---------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Scanner with scanner cable (59-497) wired directly back to burner management system. See below for remote communications. | Attach braided shield of 59-497 cable to scanner quick disconnect as described. Use heat insulating nipple on scanner. Connect braided shield of 59-497 cable to earth ground at power supply.                                                                                                                                                                                            |
| <b>REMOTE COMMUNICATIONS: LESS THAN 200 FEET</b>                                                                          |                                                                                                                                                                                                                                                                                                                                                                                           |
| Scanner with scanner cable (59-497) wired directly back to control room.                                                  | Attach braided shield of 59-497 cable to scanner quick disconnect as described. Use heat insulating nipple on scanner. Connect braided shield of 59-497 cable to earth ground at power supply.                                                                                                                                                                                            |
| <b>REMOTE COMMUNICATIONS: GREATER THAN 200 FEET</b>                                                                       |                                                                                                                                                                                                                                                                                                                                                                                           |
| RS485 communications for scanners wired in a multi-drop configuration (Belden 8761) using wiring harness or junction box. | Attach braided shield of 59-497 cable to scanner quick disconnect as described. Use heat insulating nipple on scanner. Connect braided shield of 59-497 to earth ground at power supply. Twist together and tape (to electrically isolate) shield drains from Belden 8761 cables inside each wiring harness or junction box. Connect to earth ground at RS485 source (e.g. IBM computer). |

## PROGRAMMING THE INSIGHT SCANNER

### Keypad/Display:

The InSight flame scanner uses an eight (8) character alphanumeric LED Display and four (4) push-buttons to review and program the various setpoints and operating parameters. The functions of the pushbuttons are:



### UP/DOWN

The UP and DOWN buttons are used to scroll through the scanner menus. When in the EDIT menu, after selecting a setpoint to edit, (see SELECT button), the UP and DOWN buttons are used to change that setpoint.



## **SELECT**

When in the EDIT menu, the UP / DOWN buttons are used to display the setpoints. Depressing the SELECT button displays the stored value of the setpoint, allowing it to be changed.

## **PROGRAM**

The PROGRAM button saves a change made to a setpoint. It is also used to execute the Auto Tune function ("S2" Models only) or Pre-Edit function ("S1" Models only).

---

## **INSIGHT MENU STRUCTURE**

For ease of operation, the InSight scanner contains three menus (or loops) accessed via the keypad and viewed on the scanner's display.

### **STATUS MENU**

The Status menu is the default display, and appears as soon as power is applied. Use the UP and DOWN buttons to scroll through the menu and view the current operating status. No operating parameters can be changed from the Status menu. To change any setpoint, you must enter a four digit password then enter the Edit, or Pre-Edit ("S1") or AutoTune ("S2") menus.

### **EDIT MENU**

The Edit Menu contains all the user-selected setpoints for the InSight scanner. The Edit menu is entered from the Status menu after first entering a four-digit password. In the Edit menu, the user is allowed to change the setpoints to optimize the scanner performance.

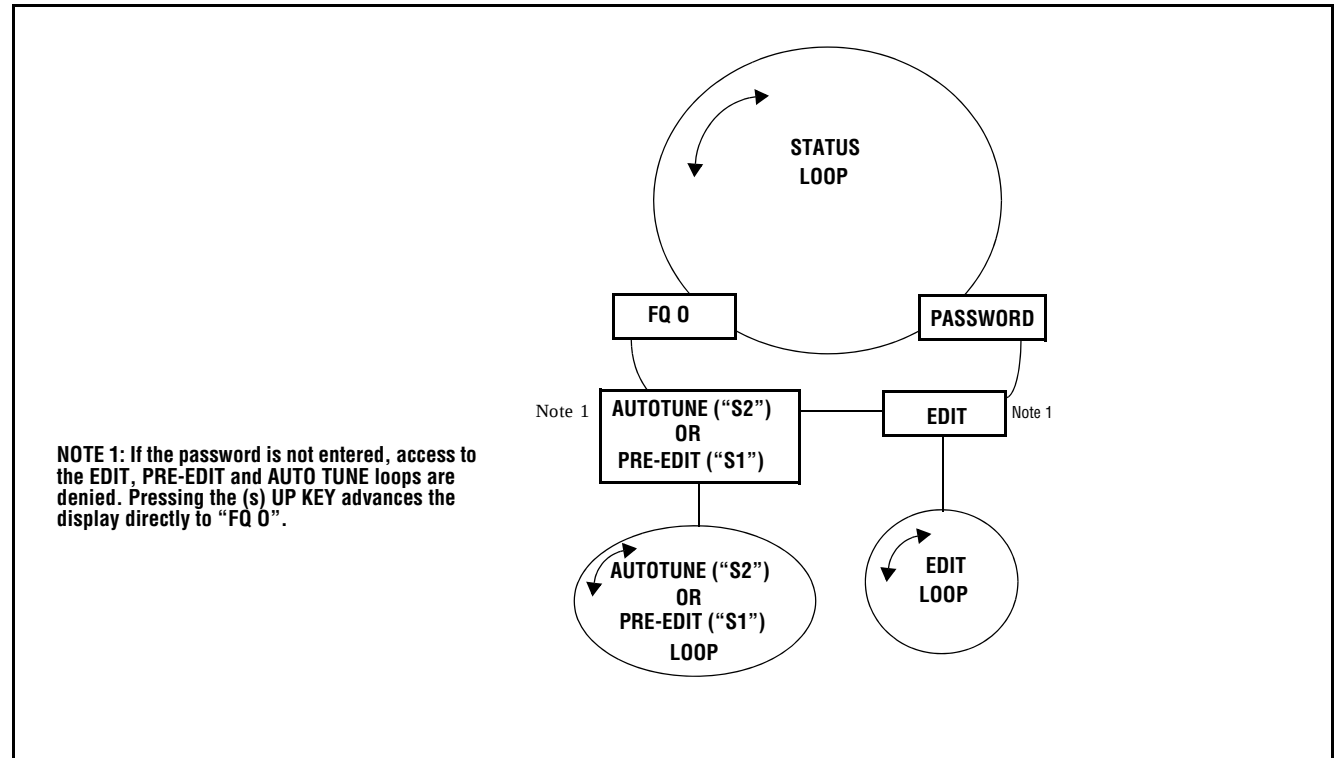
### **PRE-EDIT MENU ("S1" Models only)**

From the Pre-Edit menu, the user views the flame signal intensity and physically aims the scanner for optimum signal. The user then commands the scanner to set an appropriate internal front-end gain (FEG) level. As with the Edit menu, the Pre-Edit menu is entered from the Status menu after first entering a four-digit password.

### **AUTOTUNE MENU ("S2" Models Only)**

From the AutoTune menu, the user views the flame signal intensity and physically aims the scanner for optimum signal. The user then commands the InSight scanner to analyze the flame ON and OFF (background radiation) conditions, and automatically select the optimum setpoints. As with the Edit menu, the AutoTune menu is entered from the Status menu after first entering a four-digit password.

**FIGURE 23. INSIGHT SCANNER MENU STRUCTURE**



## THE STATUS MENU

FIGURE 24. STATUS MENU LOOP

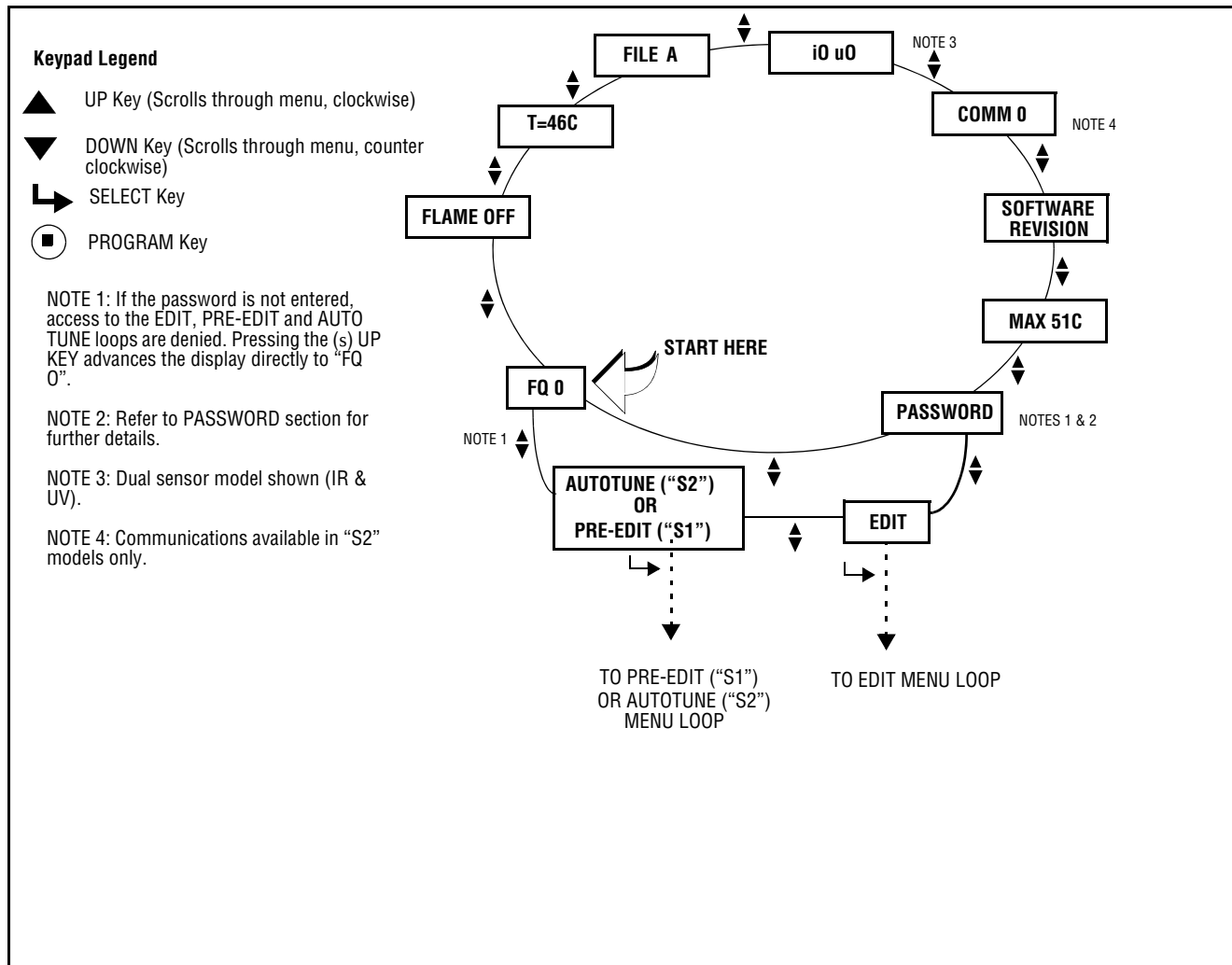


FIGURE 25. THE STATUS MENU

| TEXT DISPLAYED             | DESCRIPTION                                                                                 | POSSIBLE VALUES                  |
|----------------------------|---------------------------------------------------------------------------------------------|----------------------------------|
| FQ 0                       | Flame Quality (scanner output)                                                              | 0-100                            |
| FLAME OFF                  | Flame Relay status                                                                          | ON, OFF                          |
| T= 46C                     | Present Scanner temperature                                                                 | +32°F to 212°F (0°C to 100°C)    |
| File A                     | Scanner file in operation                                                                   | A,B,C,D                          |
| i 0 u 0                    | Signal strength, IR and UV (dual sensor models)                                             | 0-999                            |
| COMM 0                     | Communication address ("S2" models only)                                                    | 0-127                            |
| FIREYE INSIGHT 95XXXX VX.X | Scanner part number and software revision                                                   |                                  |
| MAX XXX°C (XXX°F)          | Scanner Temperature, exposure (stored) maximum                                              | -40° F to 185°F (-40°C to 85° C) |
| PASSWORD                   | A Password is required to enter the EDIT, PRE-EDIT or AutoTune menus. See PASSWORD section. | 0000-9999                        |



### **Flame Quality**

The “Flame Quality” number can range from 0 to 100. It represents the scanner’s 4-20 mA analog flame signal strength OUTPUT (in percent), and is the scale by which the internal Flame Relay ON and OFF thresholds are set.

The “Flame Quality” number is determined by the input of the IR and / or UV sensor, (in dual sensor models it is the sum of the two). This sensor signal strength value can be viewed in the Status menu as “Signal Strength”, see description below.

For clarity, the “Flame Quality” number is capped at 100, while under certain firing conditions the IR or UV “signal strength” (or their sum) may normally exceed 100 (maximum of 999).

In normal burner operation after the scanner has been properly setup, “FQ 100” will be displayed with occasional movement depending on the stability of the flame.

### **Flame ON/OFF**

This item refers to the energized / de-energized status of the internal Flame relay. “Flame ON” is displayed when the flame quality rises above the relay “On Threshold” set in the Edit menu. When the flame quality drops below the relay “Off Threshold”, “Flame OFF” will be displayed.

### **Temperature**

The scanner’s present temperature in degrees, expressed in either Fahrenheit or Centigrade depending on which was selected in the Edit menu.

### **File Selected**

The current running file is displayed. Choices are files “A, B” for S1 Models, and files “A, B, C, D” for S2 Models.

### **Signal Strength**

The Signal Strength number represents the intensity of the “flame flicker”, as sensed by the IR and / or UV sensor(s), and is a function of the individual sensor “Gain” and “Bandpass” (flicker frequency) settings. The Signal Strength number is related to the Flame Quality number (see Signal Strength expanded description on following page).

### **Comm Address (“S2” Models Only)**

This number refers to the remote communications address of the scanner. The address can range from 0 to 127, as selected in the Edit menu. No two scanners in a communications loop should have the same address.

### **Software Revision**

This displays the part number and internal software revision.

### **Maximum Temperature**

This displays the highest scanner temperature recorded.

### **Password**

A four-digit Password is required to enter the EDIT and AUTOTUNE menus. If a Password is not entered, pressing the UP key will advance directly to the “Flame Quality” display, pressing the DOWN key will return to the “Maximum Temperature” display.

To enter the EDIT or AUTOTUNE menus, you must enter the four-digit Password. **The following example is for the factory installed password of 0205:**



1. With “PASSWORD” displayed, depress the SELECT key. “0xxx” will be displayed, the first digit (“0”) is adjustable. (If the factory password was changed, use the UP/DOWN keys to select the appropriate first digit).
2. With the first digit selected (e.g. “0xxx”) depress the PROGRAM key. “00xx” will be displayed, the second digit (“0”) is adjustable. Depress the UP key twice to display “2”. (If the factory password was changed, use the UP/DOWN keys to select the appropriate second digit).
3. With the second digit selected (e.g. “02xx”) depress the PROGRAM key. “020x” will be displayed, the third digit (“0”) is adjustable. (If the factory password was changed, use the UP/DOWN keys to select the appropriate third digit).
4. With the third digit selected (e.g. “020x”) depress the PROGRAM key. “0200” will be displayed, the fourth digit (“0”) is adjustable. Depress the UP key five times to display “5”. (If the factory password was changed, use the UP/DOWN keys to select the appropriate fourth digit).
5. With all four digits selected (e.g. “0205”) depress the PROGRAM key.

If the Password was not entered correctly, the display will read “Wrong Password”. Depress the SELECT key to re-enter the password.

If the Password was entered correctly, the display will read “Valid Password. Press SELECT to change password”. If you wish to change the password at this time, see the “Change Password” section below. Otherwise, depress the UP key to advance to the EDIT and AUTOTUNE menus.

Entering the correct Password allows the user 20 minute access to the EDIT and AUTOTUNE menus. Saving any parameter will re-start this 20 minute time-out period.

### Change Password

The user may change the password (**the factory set password is “0205”**) to any four-digit code desired. To change the password, you first enter the current password as described above.

When the display reads “Valid Password. Press SELECT to change password”, press the SELECT key and “0xxx NEW” is displayed, the first digit (“0”) is adjustable. For example, enter a NEW password of “1357”. Use the UP/DOWN key and the PROGRAM key (as described in the above section) to enter the new password. When complete, in this example the display will now read “New password 1357”. Depress the UP/DOWN keys to return to the menu loops.

### Signal Strength & Flame Quality (FQ), Expanded Description

**Single sensor models** (Type 95IR, 95UV): The value of Signal Strength *is the same as* the “Flame Quality” number except that the Signal Strength value is allowed to exceed 100 (maximum of 999) while “Flame Quality” is capped at 100.

**Dual sensor models** (Type 95DS): This screen shows the *individual sensor’s contribution* to the Flame Quality number. Each value is preceded by the corresponding lower case letter indicating whether it is the IR (i) or UV (u) sensor. Under most firing conditions, the sum of these individual values will exceed 100 (maximum of 999).

**Important Note:** *The Flame Quality number is the Flame Signal number, but is capped at 100. In dual sensor (95DS) models, it is the sum of the IR + UV Signal Strength numbers, but the sum is capped at 100.*

#### Example 1 (Single Sensor Model 95IR, infrared):

If “I 80” is displayed as signal strength, you would see a Flame Quality number of “FQ 80” displayed on the Flame Quality screen.

If “I 120” is displayed as signal strength, you would see a Flame Quality number of “FQ 100” on the Flame Quality screen, because Flame Quality is capped at 100.

#### Example 2 (Dual Sensor Model 95DS):

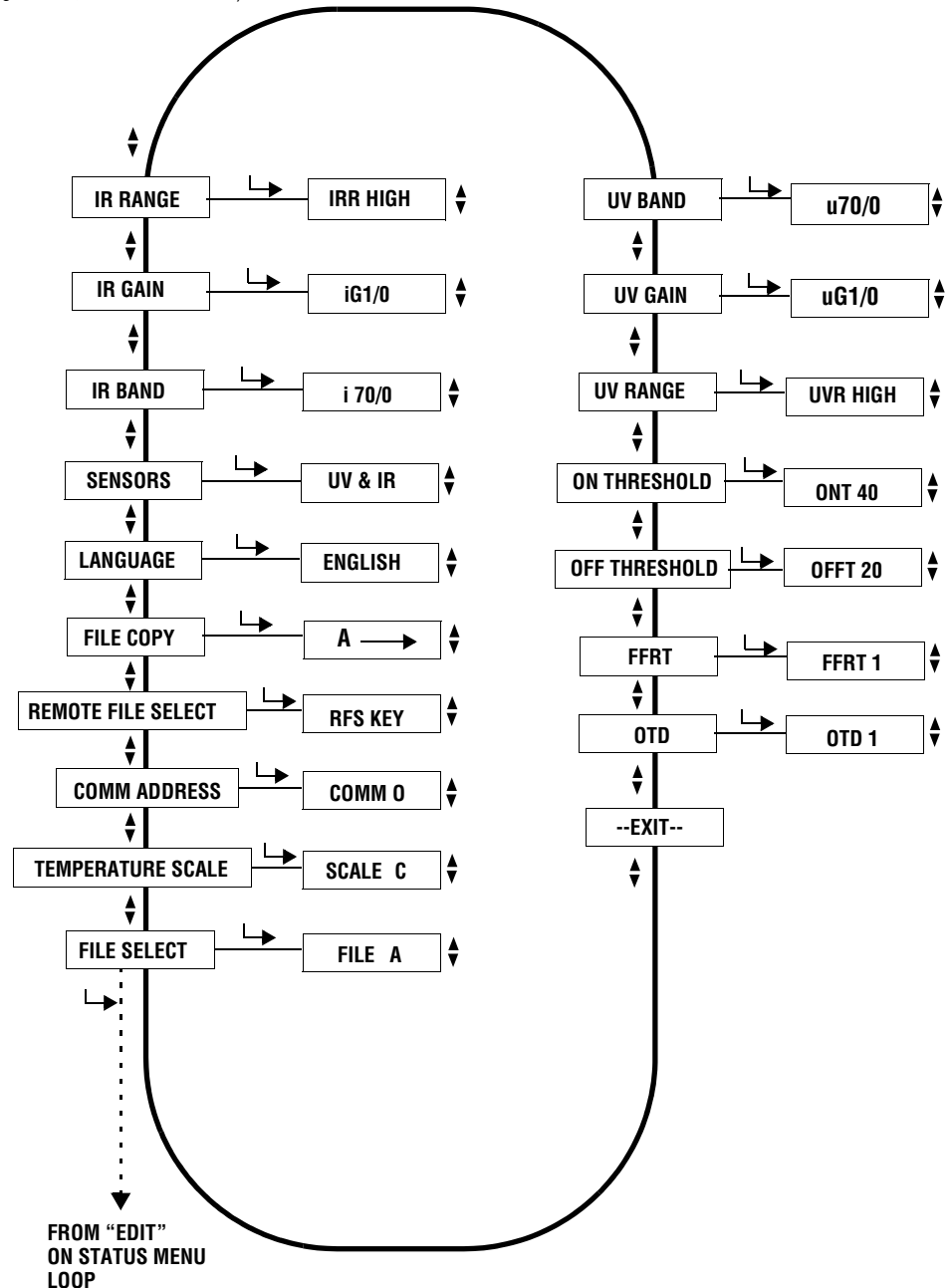
If “i80 u15” is displayed as signal strength, you would see a Flame Quality number (the IR and UV signal sum) of “FQ 95” displayed on the Flame Quality screen.

If “i70 u 40” is displayed as signal strength, although the *sum* is 110, you would see a Flame Quality number of “FQ 100” on the Flame Quality screen, because Flame Quality is capped at 100.

## THE EDIT MENU

FIGURE 26. EDIT MENU LOOP

- ▲ UP Key (Scrolls through menu, clockwise)
- ▼ DOWN Key (Scrolls through menu, counter clockwise)
- ⌞ SELECT Key
- ◼ PROGRAM Key



NOTE 1: Dual Scanner model shown. If scanner is single sensor model (IR or UV) only the appropriate parameter will be displayed (e.g. SENSORS, BAND, GAIN, RANGE).

NOTE 2: Communications available with "S2" models only.

NOTE 3: The PROGRAM Key is used to accept a value change for all parameters except IR/UV Gain and IR/UV Band. For these parameters, the value change is accepted immediately.



FIGURE 27. THE EDIT MENU

| TEXT DISPLAYED                    | DEPRESS 'SELECT' KEY, TEXT DISPLAYED           | POSSIBLE VALUES (UP/DOWN KEYS)                                                                                                            |
|-----------------------------------|------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|
| File Select                       | FILE A                                         | "S1" models: A,B<br>"S2" models: A,B, C, D                                                                                                |
| Temperature Scale                 | Scale C                                        | C, F                                                                                                                                      |
| Comm address ("S2" only)          | COMM 0                                         | 0-127                                                                                                                                     |
| Remote File Select                | RFS KEY                                        | "S1" models: KEY, LINE<br>"S2" models: KEY, LINE, COMM*<br>*(Comm not available in "E" models)                                            |
| File Copy                         | A-> (See File Copy Section)                    |                                                                                                                                           |
| Language                          | English                                        | English                                                                                                                                   |
| Sensors (Dual Sensor Models Only) | UV + IR                                        | UV + IR, IR Only, UV Only                                                                                                                 |
| IR Band                           | i70/ 0 (IR Frequency selected/Signal strength) | "S1" Models: 23, 70, 117<br>"S2" Models: 23, 31, 39, 46, 54, 62, 70, 78, 85, 93, 101, 109, 117, 125, 132, 140, 148, 156, 164, 171, 179 Hz |
| IR Gain                           | iG1 / 0 (IR Gain selected/ Signal strength)    | 1 - 31                                                                                                                                    |
| IR Range                          | IRR HIGH                                       | HIGH, LOW                                                                                                                                 |
| UV Band                           | u70/ 0 (UV Frequency selected/Signal strength) | "S1" Models: 23, 70, 117<br>"S2" Models: 23, 31, 39, 46, 54, 62, 70, 78, 85, 93, 101, 109, 117, 125, 132, 140, 148, 156, 164, 171, 179 Hz |
| UV Gain                           | uG1 / 0 (UV Gain selected/ Signal strength)    | 1 - 31                                                                                                                                    |
| UV Range                          | UVR HIGH                                       | HIGH, LOW                                                                                                                                 |
| On Threshold                      | ONT 40                                         | 5 - 100                                                                                                                                   |
| Off Threshold                     | OFFT 20                                        | 0 - 95                                                                                                                                    |
| FFRT                              | FFRT 1                                         | 1, 2, 3, 4, 5, 6 seconds                                                                                                                  |
| OTD                               | OTD 1                                          | 1, 2, 3, 4, 5, 6 seconds                                                                                                                  |
| --EXIT--                          | Edit (Returns you to STATUS loop)              |                                                                                                                                           |

## THE EDIT MENU

The values of the menu choices are viewed by pressing the SELECT button. (To exit the viewed value without changing it, press the SELECT button again). To change a value, press the UP / DOWN keys until the desired value is displayed. Depress the PROGRAM button. The display will scroll "Parameter saved", then automatically de-select the menu choice as if the SELECT button had been pressed. See important note below.

### IMPORTANT NOTE:

In order to immediately see the effect of a setpoint change upon the "Signal Strength" number, some parameter values are changed and saved immediately via the UP / DOWN keys, and do not require depressing the PROGRAM key. These parameters include IR Band, UV Band, IR Gain, and UV Gain. The "Signal Strength" number is displayed to the right of the parameter value on the same screen, providing the user instantaneous feedback.

**Note:** You may only Edit the File that the scanner is currently running. For example, to Edit file "B", you must be currently running file "B". (See File Select section below).

**Exceptions:** A change made to the Temperature Scale, Comm Address, Remote File Select, and Language parameters, can be made in any file and the new values will be automatically saved to all files.



### **File Select**

The user can manually choose which file to run (and to Edit) by selecting this menu choice *provided the Remote File Select “KEY” choice is selected* (see below). If the user wants to Edit the contents of a file, they must first select and run that particular file. (See “exceptions” in note above).

### **Temperature Scale**

(Affects all files)

The scale may be selected to be Fahrenheit “F”, or Celsius “C”.

### **Comm Address (“S2” Models Only)**

(Affects all files)

The communications address selected may range from 0 to 127. Each scanner must have a unique address. No two scanners in a communications loop can have the same address.

### **Remote File Select**

(Affects all files)

Choices are KEY, LINE, COMM\*

**KEY** allows the file selection to be made only at the scanner keypad  
(See File Select menu choice above).

**LINE** allows the file selection to be made only via an external switch or relay.

**COMM** allows the file selection to be made only via an external computer running Fireye Software. This feature is only available with FM & UL approved “S2” models. This feature is not available with CE approved “S2E” models.

### **FileCopy**

**This function allows the user to copy the contents of one internal scanner file to another. “S1” Models have two user configurable files, “A,B”, plus two factory configured files, “F1, F2”. “S2” Models add two additional user files, “C, D”.**

Refer to “FILE COPY INSTRUCTIONS” for details.

### **Language**

(Affects all files)

This allows the user to select which language the menu system will use. The available choice is “English”.

### **Sensors (dual sensor units only, Type 95DS)**

Choices include: UV only, IR only, or UV+IR

This parameter is used to manually select which sensor(s) are used in a particular file.

### **IR Band**

The display is broken into two halves. The left side displays the selected IR flicker frequency (band-pass). The right side displays the signal strength attributed to the IR sensor.

For example with a model “S2” scanner, “i 23 / 80” indicates that 23Hz is selected and the current signal strength is 80 (as viewed in the Status loop).

Frequency choices range from 23Hz to 179Hz (“S2” models), or from 23Hz, 70Hz, 117Hz (“S1” models). The signal strength number can range from 0-999.

**Note:** Remember that while the signal strength number can range to 999, the “Flame Quality” number viewed in the Status menu is capped at 100. In dual sensor models the “Flame Quality” number is the sum of the IR and UV sensor signal strengths, capped at 100.

Pressing the UP and DOWN keys changes the frequency displayed and *immediately stores the value* (pressing the PROGRAM key is not required). The user will immediately see the effect on the signal strength number displayed on the right side of the display.



## IR Gain

The display is broken into two halves. The left side displays the selected IR Gain. The right half displays the signal strength attributed to the IR sensor.

The IR sensor Gain is selectable from 1 (lowest) to 31 (highest). The signal strength number can range from 0-999.

**Note:** Remember that while the signal strength number can range to 999, the “Flame Quality” number viewed in the Status menu is capped at 100. In dual sensor models the “Flame Quality” number is the sum of the IR and UV sensor signal strengths, capped at 100.

Pressing the UP and DOWN keys changes the IR Gain displayed and *immediately* stores the value (pressing the PROGRAM key is not required). The user will immediately see the effect on the signal strength number displayed on the right side of the display. See MANUAL ADJUSTMENT note at the end of this section.

## IR Range

There are two selectable internal “ranges” for the IR sensor Gain, “High” and “Low”. If, when “Aiming” the scanner, a flashing IR number is observed, then the signal is over-range and the “Range” should be set to “LOW”. If, when “Aiming” the scanner, an IR number of less than 10 is observed, then the gain Range should be set to “HIGH”. **Refer to application note on page 36.**

## UV Band

The display is broken into two halves. The left side displays the selected UV flicker frequency (bandpass). The right side displays the signal strength attributed to the UV sensor.

For example with a model “S2” scanner, “u 23 / 80” indicates that 23Hz is selected and the current signal strength is 80 (as viewed in the Status loop).

Frequency choices range from 23Hz to 179Hz (“S2” models), or from 23Hz, 70Hz, 117Hz (“S1” models). The signal strength number can range from 0-999.

**Note:** Remember that while the signal strength number can range to 999, the “Flame Quality” number viewed in the Status menu is capped at 100. In dual sensor models the “Flame Quality” number is the sum of the IR and UV sensor signal strengths, capped at 100.

Pressing the UP and DOWN keys changes the frequency displayed and *immediately* stores the value (pressing the PROGRAM key is not required). The user will immediately see the effect on the signal strength number displayed on the right side of the display.

## UV Gain

The display is broken into two halves. The left side displays the selected UV Gain. The right half displays the signal strength attributed to the UV sensor.

The UV sensor Gain is selectable from 1(lowest) to 31(highest). The signal strength number can range from 0-999.

**Note:** Remember that while the signal strength number can range to 999, the “Flame Quality” number viewed in the Status menu is capped at 100. In dual sensor models the “Flame Quality” number is the sum of the IR and UV sensor signal strengths, capped at 100.

Pressing the UP and DOWN keys changes the UV Gain displayed and *immediately* stores the value (pressing the PROGRAM key is not required). The user will immediately see the effect on the signal strength number displayed on the right side of the display. See MANUAL ADJUSTMENT note at the end of this section.

## UV Range

There are two selectable internal “ranges” for the UV sensor Gain, “High” and “Low”. If, when “Aiming” the scanner, a flashing UV number is observed, then the signal is over-range and the “Range” should be set to “LOW”. If, when “Aiming” the scanner, a UV number of less than 10 is observed, then the gain Range should be set to “HIGH”. **Refer to application note on page 36.**



### On Threshold

This refers to the “pull-in” threshold of the internal Flame Relay, in terms of “Flame Quality”. The ON Threshold can be set from 5 to 100. The ON Threshold must be at least 5 units higher than the OFF Threshold.

When the Flame Quality is equal to or greater than the ON Threshold (for a time equal to the “On Time Delay setting, see below), the flame relay will energize.

### Off Threshold

This refers to the “drop-out” threshold of the internal Flame Relay, in terms of “Flame Quality”. The OFF Threshold can be set from 0 to 95. The OFF Threshold must be at least 5 units lower than the ON Threshold.

When the Flame Quality is equal to or less than the OFF Threshold (for a time equal to the “Flame Failure Response Time” setting, see below), the flame relay will de-energize.

### FFRT

When the Flame Quality drops to or below the Flame Relay OFF Threshold, the Flame relay will de-energize after the selected Flame Failure Response Time (FFRT). The choices range from 1 to 6 seconds. The maximum *allowable* FFRT setting is determined by local safety code, and is factory selected at 1 second.

### OTD

When the Flame Quality rises to or above the Flame Relay ON Threshold, the Flame relay will energize after the selected On Time Delay (OTD). The choices, range from 1 to 6 seconds.

### --EXIT--

Pressing the SELECT key will return the user to the “Edit” display in the Status menu.

---

## FILE COPY INSTRUCTIONS

### EXAMPLE:

This function allows the user to copy the contents of one internal scanner file to another. “S1” Models have two user configurable files, “A, B”, plus two factory configured files, “F1, F2”. “S2” Models add two additional user files, “C, D”.

You may copy *from* any file *to* a user file. You are not allowed to copy *from* a user file *to* a *factory* file. You must first enter the source file, then the destination file.

The **Factory Configured Files** (“F1” and “F2”) contain factory default settings.

**In File “F1”, the sensor gain is set at maximum (31) and the flicker frequency is set at 23 Hz.** At these settings the scanner will respond to flame but will not likely discriminate between the target flame and other nearby flames.

**In File “F2”, the sensor gain is set at minimum (1) and the flicker frequency is set at 70 Hz.** At these settings the scanner will not likely respond to flame until the scanner gain is increased.

**Note:** *As shipped, all user files (A, B, C, D) contain the same setpoints as factory file “F2”.*

### EXAMPLE:

With “FileCopy” displayed (EDIT menu), depress the SELECT key. The display will read “AÔ” with “A” being the source file. Use the UP/DOWN keys to select a different source file if desired.

With the desired source file displayed, press the PROGRAM key. The arrow will flash and the destination file will appear (e.g. “A Ô A”). Initially the destination is displayed is “A”. Use the UP/DOWN keys to select the desired destination file (e.g. “A Ô B”).

Press the PROGRAM key to copy the source file to the destination file. The display will read “File Copied”. (Pressing the SELECT key at any time before pressing the PROGRAM key for the second time will cancel the operation).

Press the UP/DOWN keys to scroll through the EDIT loop.

### **Manual Adjustment of IR or UV Gain**

When manually adjusting the IR and / or UV “Gain” in the EDIT loop, the display will show both the selected gain (1-31), and the Signal Strength (Sensor Flame Quality) number (0-999) associated with either the IR or UV sensor, e.g. “iG30 / 80”, “uG12 / 40”. (In this case, the total Flame Quality is “120”, and the FQ number viewed in the Status loop would be 100 [capped at 100]).

Each increment of the gain will increase the Signal Strength (Sensor Flame Quality) number for the selected sensor by 50%. In the above example, changing the UV sensor gain from 12 to 13 would increase the UV Signal Strength from 40 to 60. Decreasing the IR sensor gain from 30 to 29 would decrease the IR Signal Strength from 80 to 53. (In this case, the total Flame Quality is “113”, and the FQ number as viewed in the Status loop would be 100 [capped at 100]).

**For best scanner operation, the total Flame ON Signal Strength (IR Signal Strength + UV Signal Strength) should be between 100 and 150 or higher even though the Flame Quality display (Status Loop) is capped at 100.**

## THE PRE-EDIT MENU (“S1” Models only)

FIGURE 28. THE PRE-EDIT MENU LOOP (“S1” Models Only)

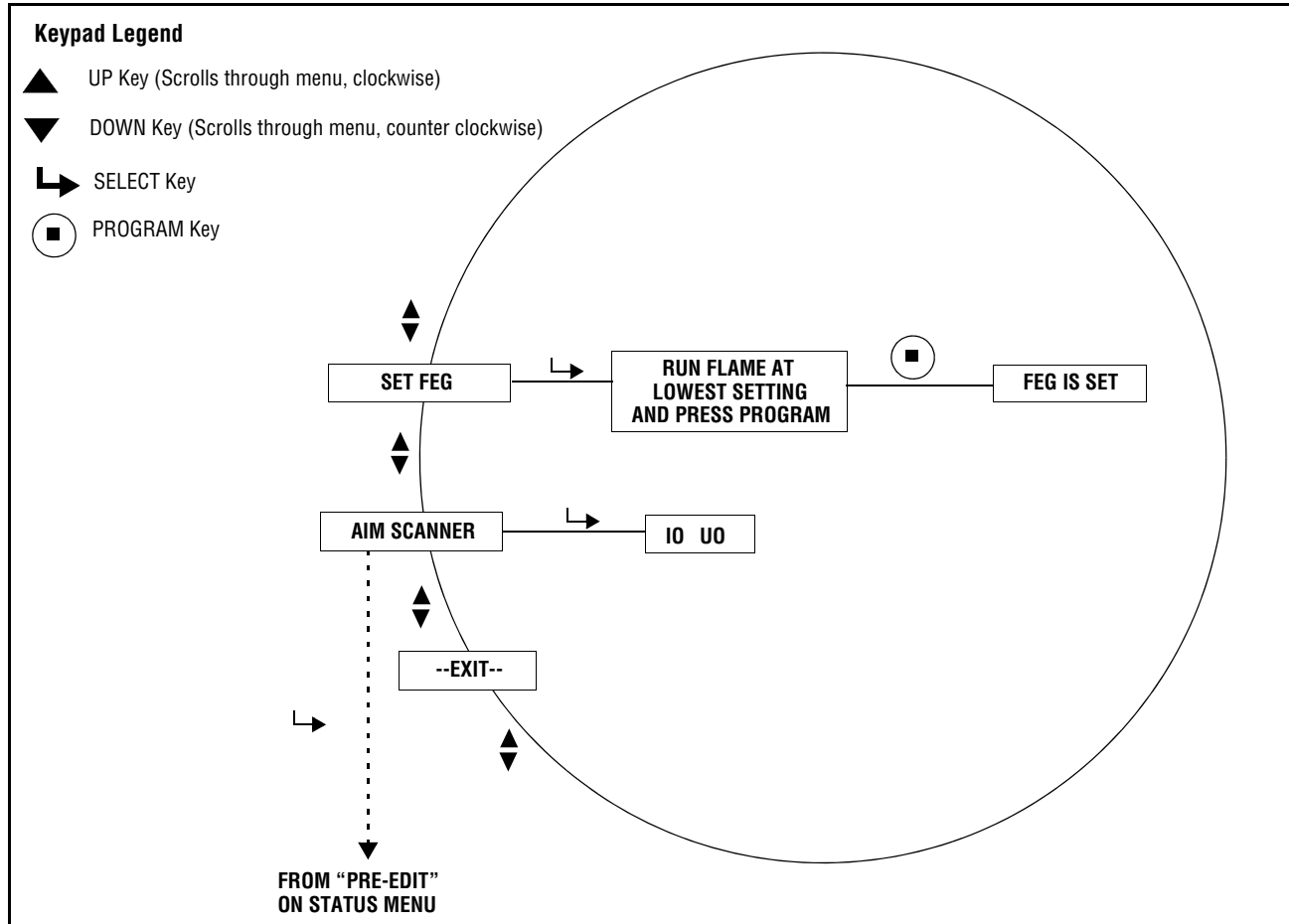


FIGURE 29. THE PRE-EDIT MENU (“S1” Models Only)

| TEXT DISPLAYED | DEPRESS “SELECT” KEY<br>TEXT DISPLAYED        | DEPRESS “PROGRAM” KEY<br>TEXT DISPLAYED |
|----------------|-----------------------------------------------|-----------------------------------------|
| Aim Scanner    | IO U0<br>(Possible values 0-60)               |                                         |
| Set FEG        | Run flame at lowest setting and press PROGRAM | FEG is set                              |
| --Exit--       | Pre-Edit (Returns you to STATUS loop)         |                                         |

Pre-Edit is an automatic calibration function whereby the scanner sets an appropriate internal front-end gain (FEG) level. The appropriate choice of modulation BAND (flame flicker frequency), and sensor GAIN is later manually set up in the EDIT menu.

### Pre-Edit and Manual Set-up is performed in 3 steps:

1. In the **PRE-EDIT** menu, run the target flame at the low firing rate and physically aim the scanner for peak signal strength (as observed at the “Aim Scanner” prompt). Depress the Program key at the “Set FEG” prompt and the scanner will set an appropriate internal front-end gain (FEG) level.
2. In the **EDIT** menu, observe and record the flame ON and flame OFF sensor signal strength and stability at each of the three modulation bands. Select the modulation band that yields the greatest Flame ON to Flame OFF signal ratio and/or yields the greatest stability.
3. Adjust the sensor GAIN and flame relay ON and OFF thresholds for reliable on/off operation.



### Aim Scanner

When SELECT is depressed, “Ix Ux” is displayed (dual sensor models). The value of “x” may range from 0 to 60. The value displayed represents the flame flicker intensity of the flame for *the entire flicker frequency spectrum* as individually sensed by the UV (U) sensor and/or IR (I) sensor(s).

The numbers should be at their peak (highest numerically) when the scanner is aimed at the primary combustion zone (first 1/3) of the flame. If the scanner is equipped with both an IR and UV sensor, priority should be given to maximizing the UV intensity.

Run the flame at low fire rate and observe the signal intensity.

Physically aim the scanner at the first 1/3 of the flame to maximize the intensity reading. (Allow the scanner reading to stabilize two seconds after each movement.)

If the reading is 10 or less, the intensity is marginal. Verify that the appropriate sensor “Range” parameter (IR Range or UV Range) in the Edit menu is set to “HIGH”.

If the reading is greater than 26 (the number will blink) the signal is excessive. Verify that the appropriate sensor “Range” parameter (IR Range or UV Range) in the Edit menu is set to “LOW”.

**Application Note:** In rare applications where the flame is extremely bright, it is possible to saturate the sensor. The symptom could be a very low signal, an erratic signal, or no signal at all. If this situation is suspected, the installation of a sight-pipe orifice (kit P/N 53-121) is recommended.

### Set FEG

Run the flame at low fire and press the PROGRAM button. The scanner will set an appropriate internal front-end gain (FEG) level based upon the flame intensity (brightness) then display “FEG is set”.

--EXIT--

Pressing the SELECT key will return the user to the “Pre-Edit” menu choice of the main status menu.

---

## Manual Set-up in Edit menu (“S1” Models only)

**In the EDIT menu with the target flame ON** (at low fire), observe and record the sensor signal strength and stability at each of the three modulation BANDS: 23, 70, and 117 Hz. The signal strength display has a range of 0-999.

During set-up it may be necessary to adjust the sensor GAIN in order to keep the signal strength value on scale. If so, observe and record the sensor GAIN value (1-31) selected.

With dual sensor models, perform this step for each sensor.

**In the EDIT menu with the target flame OFF** (leaving other burners firing), observe and record the sensor signal strength and stability at each of the three modulation BANDS: 23, 70, and 117 Hz. *Do not adjust the sensor GAIN at this time.*

With dual sensor models, perform this step for each sensor.

**At each of the three modulation frequencies, compare the recorded Flame ON signal strength to the recorded Flame OFF signal strength.** Select the modulation BAND that yielded the greatest Flame ON to Flame OFF signal ratio and/or yielded the greatest stability.

With dual sensor models, perform this step for each sensor.

**Adjust the sensor gain** (1-31) so that the flame ON signal strength is well above the flame relay ON threshold, and the flame OFF signal strength is well below the flame relay OFF threshold (see “Flame Relay Thresholds” on following page).

When manually adjusting the IR and / or UV “Gain” in the EDIT loop, the display will show both the selected gain (1-31), and the Signal Strength (Sensor Flame Quality) number (0-999) associated with either the IR or UV sensor, e.g. “iG30 / 80”, “uG12 / 40”. (In this case, the total Flame Quality is “120”, and the FQ number viewed in the Status loop would be 100 [capped at 100]).

Each increment of the gain will increase the Signal Strength (Sensor Flame Quality) number for the selected sensor by 50%. In the above example, changing the UV sensor gain from 12 to 13 would increase the UV Signal Strength from 40 to 60. Decreasing the IR sensor gain from 30 to 29 would decrease the IR Signal Strength from 80 to 53. (In this case, the total Flame Quality is “113”, and the FQ number as viewed in the Status loop would be 100 [capped at 100]).

**For best scanner operation, the total Flame ON Signal Strength (IR Signal Strength + UV Signal Strength) should be between 100 and 150 or higher even though the Flame Quality display (Status loop) is capped at 100.**

***Example:***

At the selected BAND the Flame ON signal ranged from 800 to 999, and the Flame OFF signal ranged from 50 to 130 (a 6:1 on/off ratio).

The user must reduce the sensor gain so that flame ON signal strength is well above the flame relay ON threshold (factory programmed at 40), and the flame OFF signal strength is well below the flame relay OFF threshold (factory programmed at 20).

In this example, the user may reduce the gain to have a flame OFF signal of 0, and a flame ON signal of 150.

***Special Note for Dual Sensor Models:***

With dual sensor models, the flame relay and 4-20 mA output will operate on the SUM of both the IR and UV signals. When setting the final GAIN adjustments, the user should favor the sensor (IR or UV) which exhibited the greatest flame ON:OFF signal ratio, and/or greatest stability.

If the user chooses to use the input from only one sensor and disable the input from the other, he may do so by selecting “IR ONLY” or “UV ONLY” as Sensors in the Edit menu.

**Flame Relay Thresholds**

The flame relay has a factory programmed FLAME ON threshold of 40, and a FLAME OFF threshold of 20 (0-100 scale). With these settings, it is recommended that the flame ON signal normally be at least 150. Other on and off thresholds may be selected to suit particular applications.



**CAUTION: After selecting Sensor TYPE, Sensor BAND, Sensor GAIN, and Flame Relay ON & OFF Thresholds, proper flame detection and flame discrimination must be verified by starting and stopping the burner several times. The flame relay must reliably de-energize for all flame out conditions. This testing should be done with various adjacent burners on and off, and at various load levels. This is a requirement for proper operation.**

## THE AUTOTUNE MENU (“S2” Models only)

FIGURE 30. THE AUTOTUNE MENU LOOP (“S2” Models only)

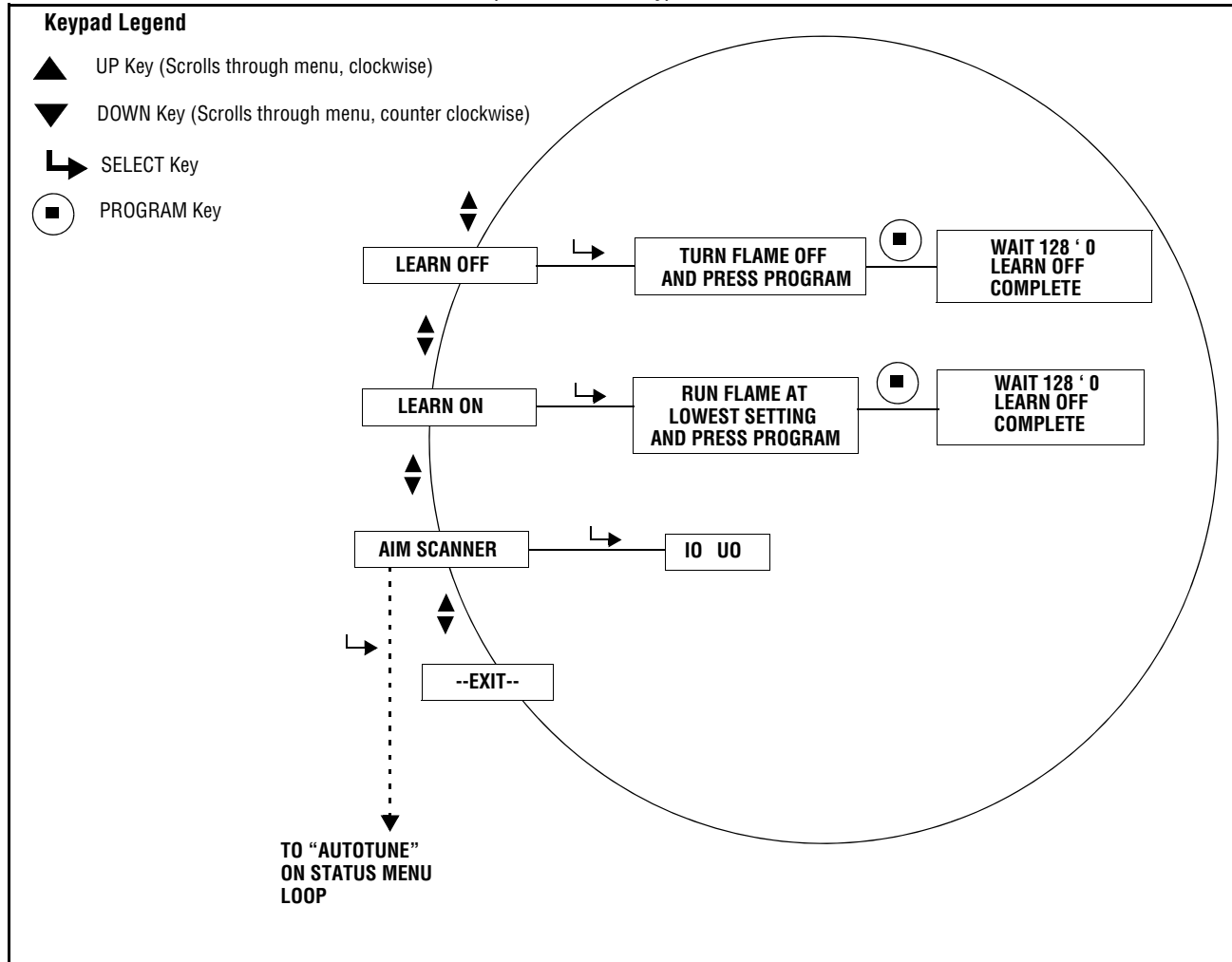


FIGURE 31. THE AUTOTUNE MENU (“S2” Models Only)

| TEXT DISPLAYED                                              | DEPRESS “SELECT” KEY<br>TEXT DISPLAYED           | DEPRESS “PROGRAM” KEY<br>TEXT DISPLAYED                                                     |
|-------------------------------------------------------------|--------------------------------------------------|---------------------------------------------------------------------------------------------|
| Aim Scanner                                                 | IO U0<br>(Possible Values 0-60)                  |                                                                                             |
| Learn On                                                    | Run Flame at Lowest setting and press<br>PROGRAM | WAIT 128 – 0<br>(Counts down to 0 within 20 seconds, then<br>displays “Learn ON complete”)  |
| LearnOff (only displayed if Learn ON had<br>been performed) | Turn Flame OFF and press PROGRAM                 | WAIT 128 – 0<br>(Counts down to 0 within 20 seconds, then<br>displays “Learn OFF complete”) |
| --Exit--                                                    | AutoTune (Returns you to STATUS loop)            |                                                                                             |

AutoTune is an automatic calibration function whereby the InSight scanner scans the flame flicker frequency spectrum with flame ON, and with flame OFF (background radiation present). The scanner will then select the appropriate sensor gain, bandpass frequency, and sensor range for optimum flame ON: OFF discrimination. The scanner will also select the optimum Flame Relay ON and OFF thresholds.



### AutoTune is performed in 3 steps:

1. Run the target flame at the low firing rate. Enter the AutoTune menu loop, press the UP key until “AIM SCANNER” is displayed then press SELECT. Physically aim the scanner for peak signal strength as described in the “Aim Scanner” section below. Press the UP key when complete.
2. Press the UP key until “LEARN ON” is displayed then press SELECT. Press PROGRAM and the scanner will memorize the flame ON condition as described in the “Learn ON” section below. Press the UP key when complete.
3. Turn the target flame off. Press the UP key until “LEARN OFF” is displayed then press SELECT. Press PROGRAM and the scanner will memorize the flame OFF condition as described in the “Learn OFF” section below. Press the UP key when complete.

### Aim Scanner

Scroll to “AIM SCANNER” and press the SELECT key.

When SELECT is depressed, “Ix Ux” is displayed (dual sensor models). The value of “x” may range from 0 to 60. The value displayed represents the flame flicker intensity of the flame for the *entire flicker frequency spectrum* as individually sensed by the UV (U) sensor and/or IR (I) sensor(s).

The numbers should be at their peak (highest numerically) when the scanner is aimed at the primary combustion zone (first 1/3) of the flame. If the scanner is equipped with both an IR and UV sensor, priority should be given to maximizing the UV intensity.

Run the flame at low fire rate and observe the signal intensity.

Physically aim the scanner at the first 1/3 of the flame to maximize the intensity reading. (Allow the scanner reading to stabilize two seconds after each movement).

If the reading is 10 or less, the intensity is marginal. Verify that the appropriate sensor “Range” parameter (IR Range or UV Range) in the Edit menu is set to “HIGH”.

If the reading is greater than 26 (the number will blink) the signal is excessive. Verify that the appropriate sensor “Range” parameter (IR Range or UV Range) in the Edit menu is set to “LOW”.

When scanner is properly aimed, press the UP key.

**Application Note:** In rare applications where the flame is extremely bright, it is possible to saturate the sensor. The symptom could be a very low signal, an erratic signal, or no signal at all. If this situation is suspected, the installation of a sight-pipe orifice kit (P/N 53-121) is recommended.

### Learn ON

Scroll to “LEARN ON” and press the SELECT key.

Run the flame at low fire and press the PROGRAM button. The scanner will display “Wait” followed by a number that will count down from 128 to 0 in about 20 seconds. This will temporarily store the spectrum of the monitored flame and the adjacent flames. The front-end gain number, used in the ON/OFF calculation, will be stored at this time. Press the UP key when complete.

### Learn OFF

Scroll to “LEARN OFF” and press the SELECT key.

Turn off the monitored flame leaving adjacent flames operating, then press the PROGRAM button. The scanner will display “Wait” followed by a number that will count down from 128 to 0 in about 20 seconds. This will temporarily store the spectrum of the adjacent flames.

The “ON” spectrum will then be compared to the “OFF” spectrum and the frequency and gain for optimum discrimination will be selected.

The IR and UV gain settings will be automatically selected based on the proportionality of their flame ON: OFF ratios. (On dual sensor models, the contribution of the IR and UV signal strengths to the Flame Quality is also determined at this time by the selection of their respective gain numbers. The gain settings will be selected to yield a total “signal strength” of between 100 and 150, which would yield a Flame Quality number of 100.

The Flame relay ON and OFF thresholds will be automatically set to 40 and 20, respectively, unless the “off” signal level is exceptionally high, which usually indicates poor aiming of the scanner.

**Note:** If after learning flame OFF, an insufficient on/off ratio is not found in at least one sensor, the display will show, “Warning: Poor discrimination, try re-aiming scanner”.

Press the UP key when complete.

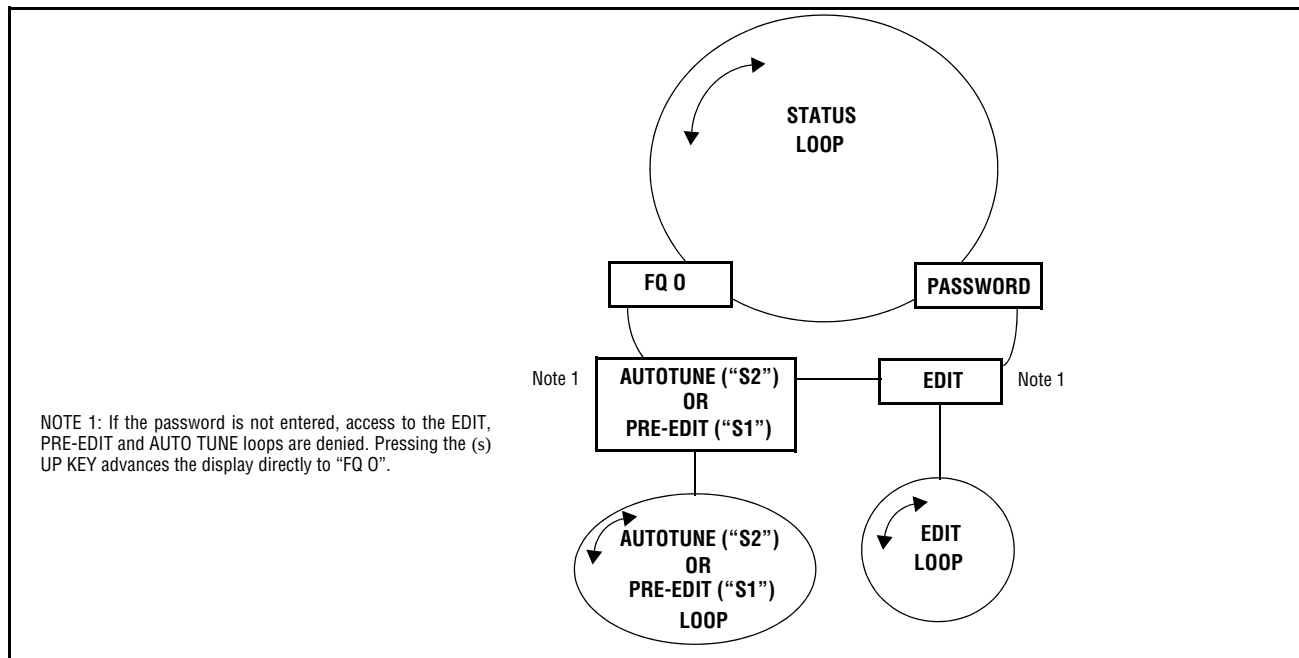
--EXIT--

Pressing the SELECT key will return the user to the “AutoTune” menu choice of the main menu.



**CAUTION:** After selecting Sensor TYPE, Sensor BAND, Sensor GAIN, and Flame Relay ON & OFF Thresholds, proper flame detection and flame discrimination must be verified by starting and stopping the burner several times. The flame relay must reliably de-energize for all flame out conditions. This testing should be done with various adjacent burners on and off, and at various load levels. This is a requirement for proper operation.

**FIGURE 32. INSIGHT SCANNER MENU STRUCTURE**



## Scanner Set-up Procedure (All Models)

The following programming steps should be taken after reading and understanding the Programming and Menu Structure sections of this document.

When changing parameter values in the EDIT loop, it is necessary to depress the "Program" button to save each change individually. (The only exceptions are when manually adjusting the IR or UV Band or Gain; these changes are saved immediately). For example, to change the Temperature Scale from "C" to "F", perform the following steps:

- With "Temperature Scale" displayed, depress the SELECT key. "Scale C" will be displayed.
- Depress either the UP or the DOWN key until "Scale F" is displayed.
- Depress the PROGRAM key. "Parameter Saved" will be displayed, then "Temperature Scale" will be again displayed.
- Depress the UP or DOWN key to advance to the next parameter.

The following procedure may be performed before placing the burner into service:

- Depress the DOWN key until "Password" is displayed.
- Depress the SELECT key and "0xxx" will be displayed. Enter the password, as described on page 27, then depress the PROGRAM key. "Valid Password" will be displayed.
- Depress the UP key and "Edit" will be displayed. Depress the SELECT key to enter the EDIT loop. The first parameter "File Select" will be displayed.
- Select the desired File (File Select), Temperature Scale, Communications (Comm) Address, and Remote File Select method.
- Select IR Range "High", and/or UV Range "High".



6. Select the desired Flame Failure Response Time (FFRT) and On-Time Delay (OTD).
7. Depress the UP key until “-Exit-” is displayed.
8. Depress the SELECT key to return to the status loop. (“Edit” will be displayed).

**“S1” Models: The following procedure is performed with the burner operating (Review the “PRE-EDIT” section of this document).**

1. Depress the UP key until “PRE-EDIT” is displayed. (Note: If “PRE-EDIT” is not displayed, it will be necessary to re-enter the password).
2. With “PRE-EDIT” displayed, depress the SELECT key to enter the Pre-Edit menu. “Aim Scanner” will be displayed.
3. Depress the SELECT key and “Ix Ux” will be displayed. With the burner OFF, “x” will equal zero, i.e. “I0 U0”.
4. Place the burner in service (at low firing rate). Physically aim the scanner until the highest AIM numbers are displayed. Secure the scanner in position, then depress the SELECT key. “Aim Scanner” will again be displayed. **Refer to application note on page 39.**
5. Depress the UP key until “SET FEG” is displayed.
6. Depress the SELECT key and “Run flame at lowest setting and press PROGRAM” will be displayed.
7. Depress the PROGRAM key and the scanner will display “FEG is SET”.
8. Depress the SELECT key and “-EXIT-” is displayed.
9. Depress the SELECT key to return to the Status menu. “PRE-EDIT” will be displayed.
10. Depress the DOWN key and “EDIT” will be displayed.
11. Depress the SELECT key to again enter the EDIT loop.
12. Record the flame signal strength at each of the three modulation BANDS (23, 70, and 117 Hz) as described in the “Manual Set-Up in Edit Menu” section on page 36.
13. Turn the burner off and again record the flame signal strength at each of the three modulation BANDS (23, 70, and 117 Hz).
14. Select the BAND and GAIN where the greatest flame ON / flame OFF signal ratio occurs.
15. Turn the burner ON then OFF again to verify proper detection and discrimination. If necessary, you may further adjust the gain, or band, or enable or disable a sensor. For future reference, list the final setpoints on the following Configuration Record.

**“S2” Models: The following procedure is performed with the burner operating (Review the “AutoTune” section of this document).**

1. Depress the UP key until “AutoTune” is displayed. (Note: If “AutoTune” is not displayed, it will be necessary to re-enter the password).
2. With “AutoTune” displayed, depress the SELECT key to enter the AutoTune menu. “Aim Scanner” will be displayed.
3. Depress the SELECT key and “Ix Ux” will be displayed. With the burner OFF, “x” will equal zero, i.e. “I0 U0”.
4. Place the burner in service (at low firing rate). Physically aim the scanner until the highest AIM numbers are displayed. Secure the scanner in position, then depress the SELECT key. “Aim Scanner” will again be displayed. **Refer to application note on page 39.**
5. Depress the UP key until “Learn ON” is displayed.
6. Depress the SELECT key and “Run flame at lowest setting and press PROGRAM” will be displayed.
7. Depress the PROGRAM key and the scanner will count down from 128 to 0 then display “Learn ON complete”.
8. Depress the SELECT key and “Learn ON” is again displayed.
9. Depress the UP key and “Learn OFF” is displayed.
10. Depress the SELECT key and “Turn flame OFF and press PROGRAM” will be displayed.
11. Press the PROGRAM key (with the target burner turned OFF) and the scanner will count down from 128 to 0, then display “Learn flame OFF complete”.
12. Depress the UP key and “-EXIT-” is displayed.



13. Depress the SELECT key to return to the Status menu. “AutoTune” will be displayed.
14. Depress the UP key and “FQ=0” will be displayed.
15. Turn the burner OFF then ON to verify proper detection and discrimination. If necessary, you may enter the Edit menu and adjust the gain, or band, or enable or disable a sensor. For future reference, list the final setpoints on the following Configuration Record.

#### InSight Configuration Record

| Parameter                                                               | FILE A | FILE B | FILE C | FILE D |
|-------------------------------------------------------------------------|--------|--------|--------|--------|
| Temperature Scale                                                       |        |        |        |        |
| Comm Address                                                            |        |        |        |        |
| Remote File Select                                                      |        |        |        |        |
| Language                                                                |        |        |        |        |
| Sensors                                                                 |        |        |        |        |
| IR Band                                                                 |        |        |        |        |
| IR Gain                                                                 |        |        |        |        |
| IR Range                                                                |        |        |        |        |
| UV Band                                                                 |        |        |        |        |
| UV Gain                                                                 |        |        |        |        |
| UV Range                                                                |        |        |        |        |
| ON Threshold                                                            |        |        |        |        |
| OFF Threshold                                                           |        |        |        |        |
| FFRT                                                                    |        |        |        |        |
| OTD                                                                     |        |        |        |        |
| Operating Conditions and Firing rate at time of “LEARN ON” or “Set FEG” |        |        |        |        |

#### InSight Replacement Procedure

This procedure may be followed when replacing a damaged InSight scanner. It assumes that the InSight Configuration Record (above) was completed and kept as a reference when the original scanner was installed and calibrated. If not, the replacement scanner must be completely reprogrammed as describes earlier in this document.

1. Install the new scanner and apply power.
2. Enter the programming password and enter the EDIT menu.
3. Manually enter the values from the InSight Configuration Record into the new scanner.  
**Important Note:** After Step 3, the scanner should detect flame ON, but may not properly indicate flame OFF until Step 4 is performed.
4. Create the burner firing conditions that existed when the scanner was originally installed and calibrated, typically the low-fire condition.

##### S1 models only:

- a. Enter the PRE-EDIT menu.
- b. Depress the Up button until “Set FEG” is displayed.
- c. Depress the Select button then the Program button
- d. The scanner will set its internal Front End Gain Reference, then display “FEG is Set”.

##### S2 models only:

- a. Enter the AUTOTUNE menu.
- b. Depress the Up button until “LEARN ON” is displayed.



- c. Depress the Select button then the Program button.
  - d. The scanner will set its internal Front End Gain Reference, count down from 128 to 0, then display “Learn On Complete”. Note: If the proper data was manually entered into the EDIT menu, it should not be necessary to learn the flame OFF condition.
5. Turn the burner OFF and ON to verify proper flame detection and discrimination.
  6. Repeat Steps 2 through 5 for each scanner memory file used (A, B, C, D).

## Error Messages

In the event that an internal scanner fault is detected, the scanner will turn off its output and a four digit error code will appear on the display. If the scanner’s internal temperature exceeds 80°C (176°F), the scanner will turn off its output and “Too HOT!” will appear on the display.

To clear the error code and re-start the scanner, the 24 vdc power must be cycled off then on.

Each time power is applied to a scanner that had experienced a fault, the display will read “Errors” followed by several digits indicating the scanner’s error history. Pressing any key will clear this message.

| ERROR CODE        | DESCRIPTION            |
|-------------------|------------------------|
| 1001 through 1027 | RAM Error              |
| 2001 through 2003 | ROM Error              |
| 3001 through 3003 | EEPROM Error           |
| 4001 through 5201 | CPU Error              |
| 6001              | Relay Error            |
| 6002              | Pulsed Output Error    |
| 6101              | Voltage Error          |
| 6102              | Fault Relay Error      |
| 6201              | Overtemp               |
| 7001 through 7008 | Program Sequence Error |

## ORDERING INFORMATION

### PART NUMBER STRUCTURE

| TYPE                                   | SENSOR                       | MODEL                                                                                    | HOUSING                                                                                                                                                                    |
|----------------------------------------|------------------------------|------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 95 = Integrated (internal flame relay) | IR = Solid state infrared    | S1 = Basic features, FM & UL, 220 Vac contact rating.                                    | -1 = NEMA 4X/IP66 housing, 12 pin electrical connector, pipe mount.                                                                                                        |
|                                        | UV = Solid state ultraviolet | S1E = Basic features, CE, 50 Vac contact rating.                                         | -1CG = NEMA 4X/IP66 housing, cable gland and ten (10) feet (3m) of captive cable, pipe mount.<br>-1CEX = CENELEC Exd IIC T6 housing, pipe mount, internal terminal blocks. |
|                                        | DS = Dual sensor, IR + UV    | S2 = Expanded features, FM & UL, 220 Vac contact rating, “Remote Command” user software. | -2 = NEMA 4X/IP66 housing, 12 pin electrical connector, fiber optic mount (not available for DS models).                                                                   |
|                                        |                              | S2E = Expanded features, CE, 50 Vac contact rating, “Read Only” user Software.           | -2CG = NEMA 4X/IP66 housing, cable gland and ten (10) feet (3m) of captive cable, fiber optic mount (not available for DS models).                                         |

### Example 1

To select the Fireye equipment meeting the following specification:

InSight scanner, dual sensor, basic features, UL & FM approved, surface mounted NEMA 4X/IP66 enclosure with male electrical connector. Accessories to include 1" NPT mounting flange, 100 ft of 12-conductor cable and female electrical connector kit, right angle.



Order the following:

| QUANTITY | PART NUMBER | DESCRIPTION                                  |
|----------|-------------|----------------------------------------------|
| 1        | 95DSS1-1    | InSight Scanner, Dual Sensor                 |
| 1        | 60-2692     | 1" NPT mounting flange kit                   |
| 100 feet | 59-497      | 12-Conductor Cable                           |
| 1        | 129-164R    | Female electrical connector kit, right angle |

#### Example 2

To select the Fireeye equipment meeting the following specification:

Integrated InSight scanner, ultraviolet sensor, expanded features, CE approved, surface mounted NEMA 4X/IP66 enclosure with cable gland and captive cable. Accessories to include 1" BSP mounting flange, 24 VDC power supply: 2.1 Amp output, 12" DIN rail for power supply.

Order the following:

| QUANTITY | PART NUMBER | DESCRIPTION                          |
|----------|-------------|--------------------------------------|
| 1        | 95UVS2E-1CG | InSight Scanner, Ultraviolet         |
| 1        | 60-2693     | 1" BSP mounting flange kit           |
| 1        | 60-2685-25  | 24VDC Power Supply<br>2.5 Amp output |
| 1        | 60-2539-12  | DIN Mounting Rail, 12"               |

## NOTICE

When Fireeye products are combined with equipment manufactured by others and/or integrated into systems designed or manufactured by others, the Fireeye warranty, as stated in its General Terms and Conditions of Sale, pertains only to the Fireeye products and not to any other equipment or to the combined system or its overall performance.

## WARRANTIES

FIREYE guarantees for *one year from the date of installation or 18 months from date of manufacture* of its products to replace, or, at its option, to repair any product or part thereof (except lamps and photocells) which is found defective in material or workmanship or which otherwise fails to conform to the description of the product on the face of its sales order. **THE FOREGOING IS IN LIEU OF ALL OTHER WARRANTIES AND FIREYE MAKES NO WARRANTY OF MERCHANTABILITY OR ANY OTHER WARRANTY, EXPRESS OR IMPLIED.** Except as specifically stated in these general terms and conditions of sale, remedies with respect to any product or part number manufactured or sold by Fireeye shall be limited exclusively to the right to replacement or repair as above provided. In no event shall Fireeye be liable for consequential or special damages of any nature that may arise in connection with such product or part.



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