

Honeywell

# Honeywell P531, P532 and P532UI Flame Monitors

TECHNICAL CATALOG

## SPECIFICATIONS

### Models P531, P532 and P532 UI

#### Electrical - Model P531AC, P532AC

Primary Input Power: 100-240 VAC, 50/60 Hz

Battery Backup Voltage: 24 VDC (voltage above 24 volt will be the power source)

#### Electrical - Model P531DC, P532DC

Primary Input Power: 24 VDC

Battery Backup Voltage: 24 VDC (power source is taken from the highest voltage)

Power: (DC unit tested at 100 ms sampling time)

13.2 Watts. Average (including 3 viewing heads)

16.2 Watts. Peak (including 3 heads in normal operation)

#### Outputs

Flame Relays, Channel A, B and C: 2 each Form C Contacts (DPDT)

Flame Contact Rating: 5A at 32 VDC and at 250VAC

Self-Check Relay: 1 common Form C Contact (SPDT)

Self-Check Contact Rating: 5A at 32 VDC and at 250 VAC

Alarm Relays, Channel A, B and C: 1 each Form A Contact (SPST-N.O.), for marginal alarms, isolated contact NO on alarm

Alarm Contact Rating: 2 A at maximum 250 VDC or 230 VAC

Analog Flame Signal: 0 – 20 mA or 4 – 20 mA 1000 ohm maximum resistance

Power To Viewing heads: Supplied internally by processor.

24V output:

24-volt output 50 mA

For instrumentation use only

Provided for use with Isolated Select inputs

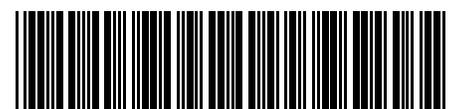


## APPLICATION

The Honeywell models P531 and P532 feature a dual processor system which is capable of monitoring two S55XB/BE and one S70X/S80X viewing heads simultaneously. It can also display both UV and IR separately from one S55XB/BE viewing head. In addition, three marginal alarm relays can be configured to provide a secondary indication if the flame count falls below set point or if a viewing head temperature reaches 70° C (158° F). Both models are available in either DC or AC input voltage: P531DC, P531AC, P532DC and P532AC. The P532UI detachable user interface or FlameTools software is required to program P531 signal processors.

### Contents

Application	1
Specifications	1
Features	2
Installation	5
Overview	10
Operation	12
Lockout	16
Troubleshooting	17
Modbus Protocol	18
Safety Manual	27



66-2068-05

### Inputs

Channel or file select contact, normally open (ALT):  
One set for each viewing head  
7.5 – 30 VDC  
Input Resistance: 3900 ohm

### Serial Communications

RS-422 / 4 wire (two twisted pair):  
Baud: 38400, 19200, 9600 or 4800  
Parity: None, Even or Odd  
Protocol: Modbus (RTU)  
RS-232 (P531 front panel port only):  
Baud 19200  
Parity None  
Protocol Modbus (RTU) fixed address of 64

**Dimensions: See Fig. 1.**

### Flame

Minimum flame detector self-checking rate: 1 second  
Maximum flame failure “lock-out” time: 2 to 4 seconds (adjustable)  
Flame failure response time: 1, 2 or 3 seconds (adjustable)  
Signal for presence of flame: FLAME ON set point (adjustable)  
Signal for absence of flame: FLAME OFF set point (adjustable)

### Compatibility

Viewing head #3: S702, S706, S802 or S806 (and –PF and –HF versions)  
Viewing head #1 or #2: S550B/BE, S552B/BE, S556B/BE (and –PF versions)

### Fuses

Self-resetting fuses are provided internally on the following connections:  
+24 PWR DC input voltage supply (DC units only)  
+24 BATT Battery input voltage supply  
These require cooling off period (of no load) to reset.

### Cleaning

Turn power off before cleaning.  
Only wipe Panel front with a soft cloth (dry or slightly dampened with water).

### Cable & Connectors - S55xBE Viewing Heads

New installations - highest level of EMI shielding available:  
ASY55XBE --> 50 foot C330S cable with molded connector.  
ASY55XBE-200 --> 200 foot C330S cable with molded connector.  
Field Wire-able Connector w/sleeve options - S55xBE Viewing Heads  
Not recommended for new installations.  
R-518-09 --> Field wireable connector accepts 10-12mm cable (existing C328 cable).  
R-518-11 --> Field wireable connector accepts 6-8mm cable (C330 or C330S cable).

### Cable & Connectors - S70x/S80x Viewing Heads

New installations - highest level of EMI shielding available:  
ASY785 --> 50 foot C330S cable with pre-wired ASY786 connector.  
ASY785-200 --> 200 foot C330S cable with pre-wired ASY786 connector.  
ASY786 --> Field wireable connector with shield.

### Environmental

Ambient Temperature: -40° C to 60° C (-40° F to 140° F) [FM] or 0° C to 52° C (32° F to 125° F) [CSA]  
Enclosure: NEMA 1  
Humidity:  
Non-condensing  
Maximum 80% for temperatures below 31° C, decreasing to 50% maximum at 40° C and above  
Vibration: +1 g at 10 to 150 Hz

### Approvals

FM:  
7610  
SIL 3 “Fit for Use”; IEC61508 Part 1/2/3  
CSA:  
C22.2 No. 205-M1983  
CAN/CSA - C22.2 No. 199-M89 (R1999)

### Software

ANSI/UL 1998 Edition 2  
CSA TIL H18A, Sept 15, 2006

## FEATURES

The P532 and P532UI makes use of three scrolling dot matrix displays capable of displaying alphanumeric characters in three different colors as follows:

- Red indication for IR
- Green indication for UV
- Orange indication for mixture of UV and IR

The P532 Signal Processor or P531 with P531UI uses seven discrete LEDs for display. These include:

- Tricolor flame strength indicators for each channel.
- Relay and status indicators.

In addition to automatic viewing head detection, each channel and viewing head can be associated with two sets of configurable data as follows:

1. Primary: This is the normal viewing head configuration.
2. Alternate: This is a set of alternate settings that can be activated by applying a voltage across the alternate select terminals for each specific channel or writing to the appropriate Modbus register.

Automatic set up functionality is a feature whereby each channel can be configured automatically in one of three ways:

1. Auto Fit: The flame is monitored and the gain is adjusted to produce an optimal count of between 1100 and 1300. The flame on will then be set at 800 and flame off will be set to 600.
2. Auto Sequence: The gain will first be adjusted as in the Auto Fit routine and then the flame on and flame off settings will be adjusted. Auto Sequence requires burner to be turned ON and turned OFF to complete setup.

- Auto Filter: Used for definitive infrared calibration. The sequence procedure (above) is performed on each of the 8 filter settings. The best differentiated filter is chosen and configured for gain, flame on and flame off settings.

The P531 and P532 are compatible with RS-422 and Modbus protocol.

### Compatible Viewing Heads

Honeywell models S702 / S802 IR and the S706 / S806 UV viewing heads can be connected to Viewing Head #3.

- Viewing head #3 will default to be assigned to channel "A" and its display.

The P532 provides a feature to lock the front panel for restricting unauthorized access. The P531 uses the removable P532UI to achieve this feature.

Both Signal Processors have viewing head error detection with viewing head lockout capabilities (this requires user intervention).

Honeywell models S552BE IR and S556BE UV and the S550BE that utilizes both UV and IR sensors can be connected to Viewing Head #1 and #2.

A P522 operation mode can be achieved by installing a jumper between the two P522 terminals.

- Viewing Head #1 will default to be assigned to channel "B" and its display.
- Viewing Head #2 will default to be assigned to channel "C" and its display.

Changing viewing head types (while the system is operational) will cause the processor to go into lockout mode. (This is a safety feature).

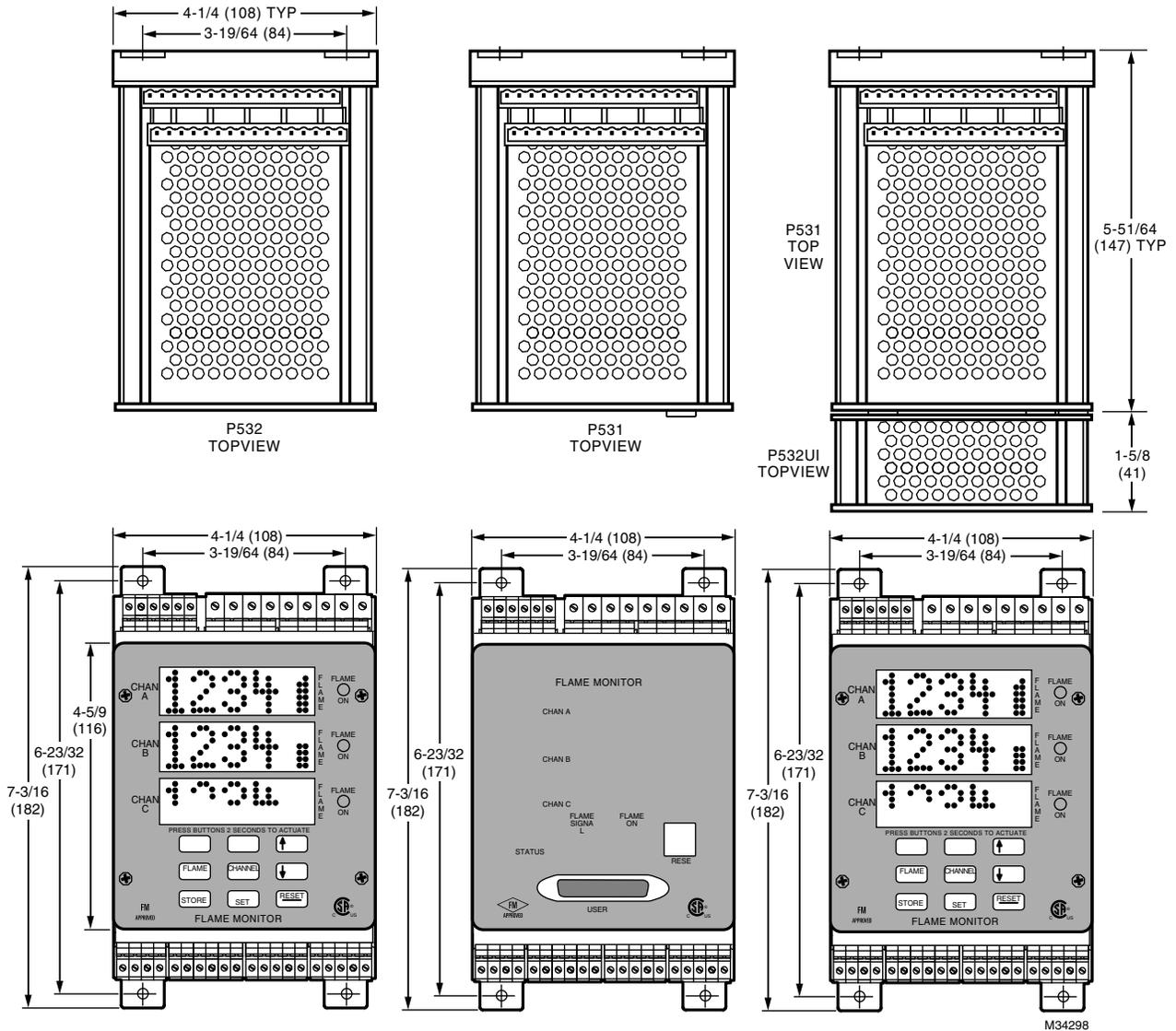


Fig. 1. P531, P532, P532UI Dimensions.

## INSTALLATION

### When Installing this Product...

1. Read these instructions carefully. Failure to follow them could damage the product or cause a hazardous condition.
2. Check the ratings given in the instructions and on the product to make sure the product is suitable for your application.
3. Installer must be a trained, experienced, flame safe-guard control technician.
4. After installation is complete, check out product operation as provided in these instructions.

### S55xBE Viewing Head Hazardous Location Installation of Cables and Connectors

The S55xBE viewing heads must be installed with a connector and cable assembly that maintains an IP64 seal at the S55xBE viewing head. Additionally, ITC/CIC approved cable installed in cable tray, or ITC/CIC approved cable in metal conduit must be used between the S55xBE and Signal Processor. Pre-assembled molded cable assemblies are listed below that provide the proper seal at the viewing head, and meet ITC/CIC approvals. A field wire-able connector that provides a proper seal at the S55xBE viewing head, along with ITC/CIC rated raw cable are also available and listed below. The cable installation must conform to the latest version of the National Electric Code, or Canadian Electrical Code for Class I, Division 2 hazardous locations.

Additionally, the connector must be secured as follows: hand-tighten the connector at viewing head, until it can no longer be turned. Continue tightening the connector an additional 180 degrees using pliers, or similar tool. Verify that connector cannot be loosened by hand. If necessary, tighten in additional 180 degree steps until hand loosening is impossible. This is required for hazardous location installations.

ASY55XBE – Pre-assembled over-molded connector and 50 foot cable assembly, >IP64 rated with CIC/ITC approved cable.

ASY55XBE-200 – Pre-assembled over-molded connector and 200 foot cable assembly, >IP64 rated with CIC/ITC approved cable.

R-518-11 Field-wireable connector may be used with C330S cable to provide >IP64 rating at viewing head.

C330S – ITC/CIC rated 4 conductor 22g cable with drain wire, and overall shield.

### S55xBE Non- Hazardous Location Installation of Cables and Connectors

Below are options available for non-hazardous location installations.

R-518-11 Field-wireable connector may be used with 6-8mm (C330S) cable to provide >IP64 rating at viewing head

C330S – ITC/CIC rated 4 conductor 22g cable with drain wire, and overall shield.

R-518-09 Field-wireable connector may be used with existing installations of C328 cable to provide > IP64 rating at viewing head.

### S70x/S80x Viewing Head Hazardous Location Installation of Cables and Connectors

The S70x/S80x viewing heads must be installed with a connector and cable assembly that maintains the ingress protection at the S70x/S80x viewing head. Additionally, ITC/CIC approved cable installed in cable tray, or ITC/CIC approved cable in metal conduit must be used between the S70x/S80x and Signal Processor. Pre-assembled connector/cable assemblies are listed below that provide the proper seal at the viewing head, and meet ITC/CIC approvals. A field wire-able connector that provides a proper seal at the viewing head, along with ITC/CIC rated raw cable are also available and listed below. The cable installation must conform to the latest version of the National Electric Code, or Canadian Electrical Code for Class I, Division 2 hazardous locations.

Additionally, the connector must be secured as follows: hand-tighten the connector at viewing head, until it can no longer be turned. Continue tightening the connector an additional 180 degrees using pliers, or similar tool. Verify that connector cannot be loosened by hand. If necessary, tighten in additional 180 degree steps until hand loosening is impossible. This is required for hazardous location installations.

ASY785 – Pre-assembled connector with LED indicators and 50 foot cable assembly, IP67 rated with CIC/ITC approved cable.

ASY785-200 – Pre-assembled connector with LED indicators and 200 foot cable assembly, IP67 rated with CIC/ITC approved cable.

C330S – ITC/CIC rated 4 conductor 22g cable with drain wire, and overall shield.

ASY786 – Field wireable connector with LED indicators, IP67 rated.

### Mounting

The P531 or P532 Signal processor should be mounted (using the 4 holes in the corners of the base) to a vertical surface inside a suitable enclosure approved for the environment. Mounting holes are 3-19/64 in. (84mm) wide apart by 6-23/32 in. (171mm) high. Refer to Fig. 1 for details.

## Grounding and Shielding

**NOTE:** Installer must be a trained, experienced flame safeguard service technician and should be familiar with the equipment operation and limitations and be aware of any applicable local codes and regulations.

1. The viewing head and all associated cable/conduit must be at least 12 inches (31 cm) from any source of high energy or voltage (for example, igniter equipment).
2. Install a ground wire from the ignition transformer case to the igniter assembly.
3. Minimize length of the igniter cable between ignition transformer and point of spark. Ensure all igniter wires and cables show no signs of wear. Replace any igniter cables or wires that are frayed or cracked.
4. The viewing head must be electrically isolated from the burner front.
  - a. Electrical isolation can be accomplished by installing an Ultem nipple or an Ultem locking coupler adapter in conjunction with a locking coupler between the viewing head flange and the burner mount.
  - b. The purge air line should also be isolated from the viewing head. This can be accomplished by installing any insulating material, for example a rubber hose, in between the purge air line and the viewing head.
  - c. The viewing head housing may be attached to earth ground, but care must be taken to ensure earth ground at housing and ground at signal processor are the same AC and DC potential. Damage to the signal processor or cable can result if these two potentials are different.

## Power connection

DC units should be connected to a stable 24-volt DC supply.

AC units should be connected to an AC mains supply.

Battery backup can be connected to the +24 BATT terminal.

## Remote 20 mA

Current meters can be connected to the remote meter outputs with the RET as a common return.

## Relays (See Figs. 4 and 5)

Self-check contacts SPDT (NO-NC). This relay is normally energized when powered and de-energized when a fault occurs.

The self-check relay is internally interlocked with the flame relays so that whenever the self-check relay opens all of the flame relays are also de-energized.

## Flame Relays

Each of the flame relays provides 2 sets of normally open and normally closed positions.

## Alarm Relays

Alarm contact is a normally open contact that will provide a connection to its RET when the flame count falls below the set point. Or (if configured) the viewing head temperature exceeds 70° C (158° F).

## Wiring the Viewing head (See Figs. 2 and 3)

Viewing heads are connected to the appropriate signal processor terminals (see Figs. 4 and 5).

For S55XBE viewing heads with cable runs below 300 feet (91m), no source impedance resistor is required. For cable runs between 300 and 700 feet (91-213m), a 470 Ohm, 1/4 Watt source impedance resistor must be installed between SC and SIG GND terminals for proper signal transmission. Refer to Fig. 2. S70X/S80X viewing heads do not require impedance resistors.

The shield is connected to the SIG GND terminal of signal processor. The shield must be foil and braid type with drain wire >22g in order to maintain electrical path. It is recommended that Honeywell C330S cable be used for all new installations.

For detailed instructions on cable preparation and wiring the viewing head connector, refer to the applicable manual for the viewing head being installed.

## Alternative Setting Selection (ALT)

For each of the 3 viewing heads:

Connect SEL+ through isolated contacts from a burner management system or other source to a DC+ supply and SEL RET to DC- supply for selecting the alternate configuration file for the connected viewing head.

On AC operating units, the +24v OUT source can be used to supply power for this purpose.

## P522 Mode

To simulate the P522 on the P532 (reduced feature mode), install a jumper between the P522 mode terminal and ground.

Power must then be cycled for the change to take effect.

# WARNING

Do NOT connect P522 mode terminal to a power source.

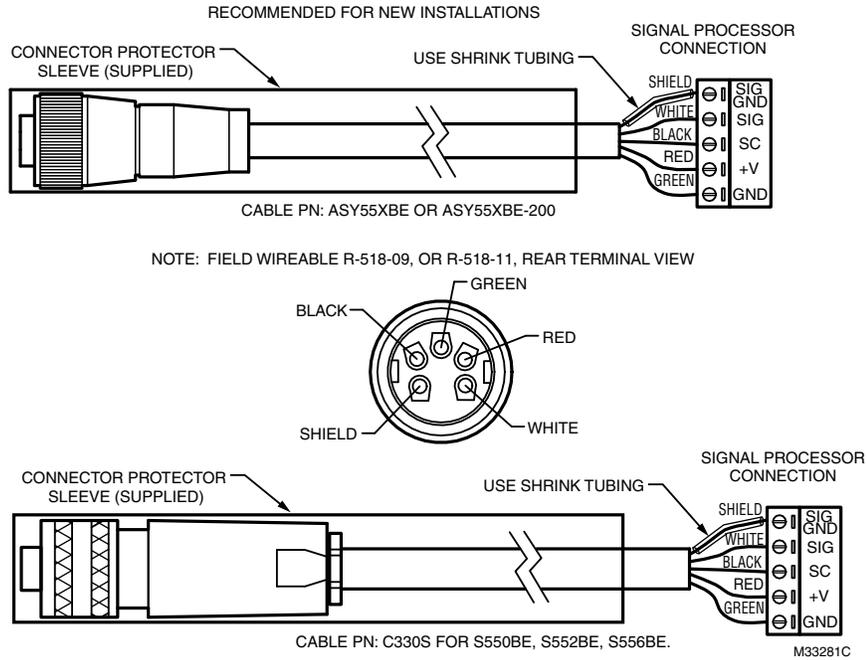
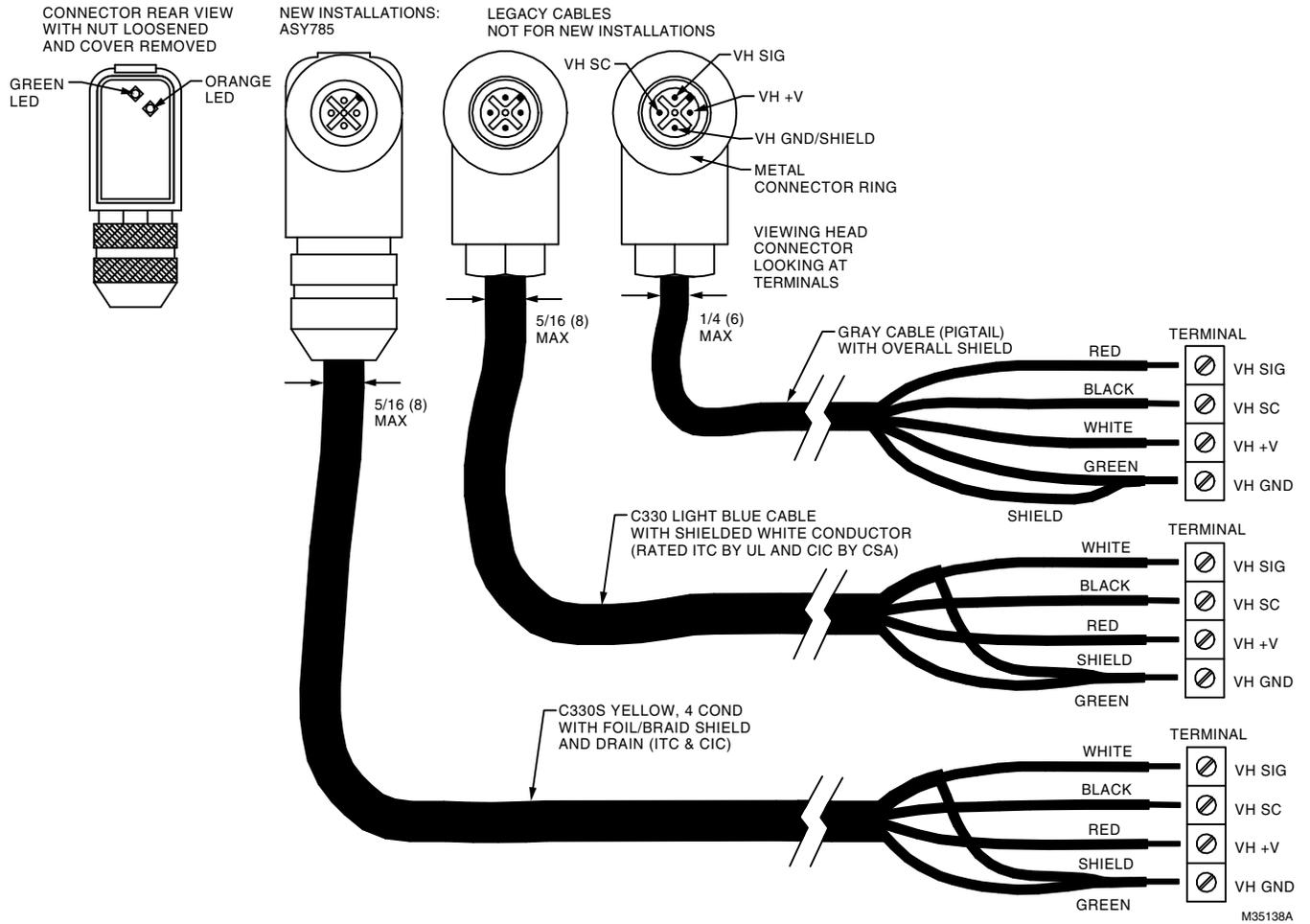


Fig. 2. Wiring connections for S550BE, S552BE, and S556BE viewing heads.

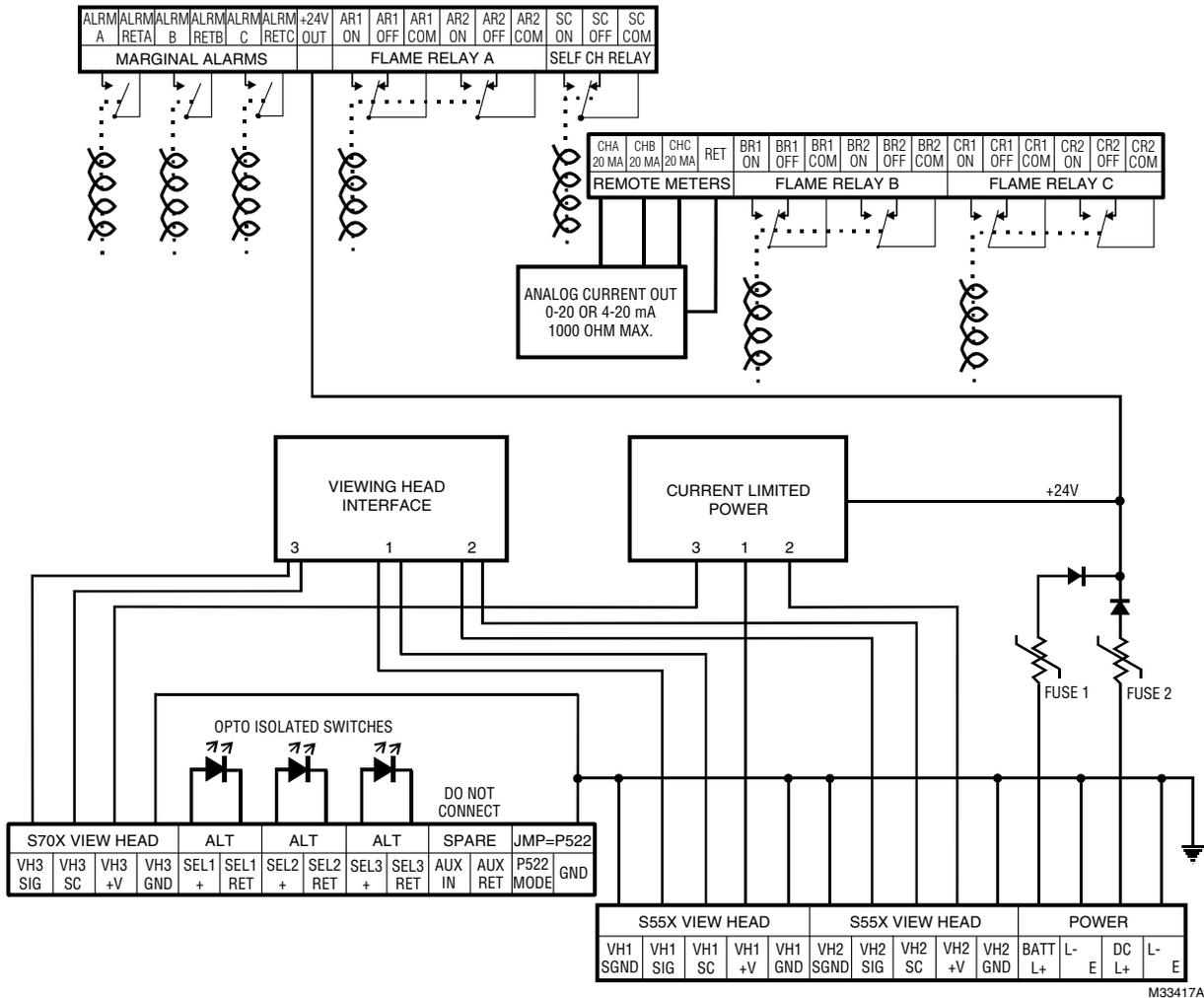
**IMPORTANT (APPLIES TO FIG. 2)**

For S55XB/BE viewing heads with cable lengths between 300 and 700 feet (91-213 meters), a source impedance resistor is required at the signal processor between SC and SIG GND terminals for proper signal transmission. Resistor value of 470

ohm, 1/4 Watt. For cable lengths over 700 feet (213 meters), contact your distributor or Honeywell. For cable lengths below 300 feet (91m), no source impedance resistor is required. S70X/S80X viewing heads do not require impedance resistors.

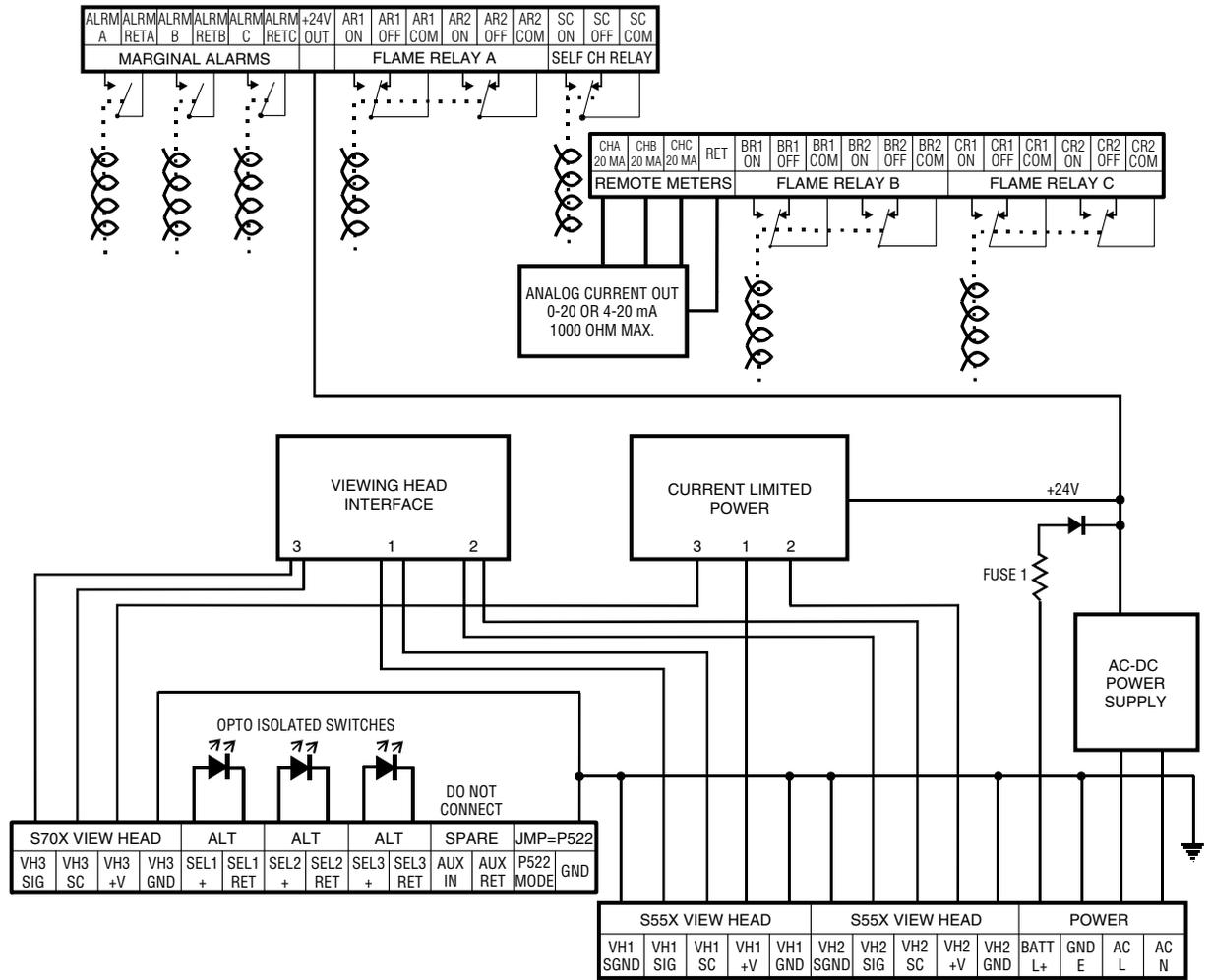


**Fig. 3. Cable and Connections for Viewing Head Models S702, S702-PF, S706, S706-PF, S802, S806.**



M33417A

Fig. 4. P532DC Wiring Diagram.



M33418A

Fig. 5. P532AC Wiring Diagram.

## OVERVIEW

### User Interface

The P532 front panel and the P532UI (User Interface) includes nine push buttons for operation and programming. Each of these buttons has at least one specific purpose.

All access to the front panel operation is initiated by pressing and holding a button for two seconds (this eliminates the possibility of inadvertent access).

In all cases, only the available options will be displayed.

There are three menu branches:

1. Channel set menu has all configuration items associated with the channel. Accessed by selecting and holding the CHANNEL SET button.
2. Viewing head set menu has all configuration items associated with the Viewing head. Accessed by selecting and holding the VIEW HEAD SET button.

3. Options menu has global and system configuration items and information. Accessed by selecting and holding the RESET/OPTIONS button.

#### NOTES:

1. The RESET button will return you to the default display from any place in the menu structure. If left for 10 seconds without intervention, the display will revert back to the default display. (Except during auto calibration modes)
2. S70X and S80X viewing heads do not include viewing head temperature indication.
3. A green display indicates a current value. When a value is changed, it will be displayed in orange.
4. Unless the STORE button is pressed after changes are completed, the new value will not be in effect.
5. Make sure changes are made to the correct file; Primary or Alternate.

6. When displaying the flame signal, Green indicates UV, Red indicates IR and Amber indicates a combination UV/IR signal.
7. IR sensor saturation is indicated by 9998 being displayed.

A channel (Primary and or Alternate) can be assigned to a viewing head (or viewing head sensor in the case of dual UV/IR viewing heads such as the S55XBE).

Refer to the OPERATION section of this manual and the four flowcharts at the end of the manual, Fig. 8-11, for details of accessing the three menu branches and the associated programming flow.

## Default Settings

Default choices are available in two menus.

1. CHANNEL SET (Primary and or Alternate) defaults all parameters under the channel menu except for the viewing head association to the display channel.
2. RESET/OPTIONS defaults all channels and viewing heads as well as resetting the system parameters and viewing head to channel association.

Factory default settings

IR Gain = 451  
 UV Gain = 32  
 IR Filter = 3  
 FFRT = 1 second  
 Flame On Delay = 3 seconds  
 Analog Gain = 50  
 Alarm = 720  
 Flame On = 800  
 Flame Off = 600  
 Communication address = 0

NOTE: The response to YES is always the STORE button.

## Numerical configuration

- Green is the current set point stored in memory.
- Orange indicates that the setting has been changed but not saved yet.

The speed of changing numerical values is accelerated as the key is held down.

The UP and DOWN buttons are used to change numerical values or to jump between configuration parameters.

The SELECT button is used to jump to the next item in all 3 of the menu structures, or to select intermediate parameters that will not be stored.

## Alternate – Primary (during configuration)

The top line will display ALT or PRIM, followed by:

- Channel letter (A, B, or C) OR
- Viewing Head number (1, 2, or 3)

The color of this line (top):

- Red indicates that this configuration is active at present
- Green indicates a non active configuration.

The CHANNEL button will toggle between these two configurations.

Alternate configurations can be activated by applying a voltage across the appropriate terminals marked ALT.

## Default Display for P532, P532UI

Each line displayed will always be associated with the same channel except when changed by the user. Channel A will be the S70X/S80X, Channel B will be VH #1 (S55XBE) and Channel C will be VH#2 (S55XBE).

## Flame count

Normal Flame counts are in the range of 0 to 3500 for the S55x viewing heads and 0 to 3000 for S70x / S80x viewing heads (viewing head #3).

- A red display indicates that channel is associated with an IR viewing head or the IR only portion of a viewing head's output (S55XBE).
- A green display indicates that channel is associated with a UV viewing head or the UV only portion of a viewing head's output (S55XBE).
- An orange display indicates that channel is associated with a mixture of both IR and UV from a S55XBE viewing head.
- A blank line indicates that *no viewing head* is associated with the channel or the gain of an associated sensor is zero.

A Bar Graph will be displayed in the last digits of the display.

The bar graph display is proportional to the flame signal analog output (20ma) and the analog gain for the channel.

## IMPORTANT

*IR sensor saturation is indicated by flame counts of 9998. Reduce gain and/or increase filter set point to alleviate this condition. In some cases with very bright flame, an orifice may be required.*

## IR Sensor Saturation

IR levels that exceed the range of the scanner will indicate flamecounts of 9998 at the P532 display, while indicating "99" on the S55xBE flamescanner. This is IR sensor saturation. Saturation may occur from large flickering IR, or extremely high non-flickering IR (high temp or high gain setting). This allows for IR discrimination in low to high IR intensity applications while preventing nuisance shutdowns. See Setup and Adjustment Procedures for more information on proper setup.

## Lockout

LKOUT will be displayed on the panel if a viewing head error has occurs. (Flame relays will trip and the channels will remain locked out until any button is pressed on the front panel. Lockout will also occur when an unexpected viewing head is detected. This will occur when changing head types or attaching new viewing heads to a system. To clear a LKOUT, press any button.

NOTE: Power reset will not clear a lockout condition and will de-energize all flame relays.

*Verification of all viewing head and channel parameters is required after a lockout and reset.*

### Alternate Indicator

The middle pixel of the rightmost column will be illuminated if the Alternate configuration for that channel is currently in operation.

### High Temperature Viewing Head Indication

A warning will be displayed for 1 second in each 4 seconds if a viewing head connected to Viewing Head #1 or Viewing Head #2 terminals exceeds a temperature of 70° C (158° F).

Since the viewing head number may not be associated with a particular channel, the number of the high temperature viewing head will be displayed instead.



### CAUTION

**Corrective action to reduce ambient temperature must be taken immediately to prevent permanent damage to the viewing head.**

*Except for this notification, no other action is taken by the signal processor when a viewing head is hot.*

### Primary / Alternate selection

Two sets of configuration data can be stored and used for each of the 3 channels.

*Both the alternate and primary configurations can be viewed and adjusted from the panel.*

### Using the Prim/Alt switch.

The Alternate configuration is used for operation if:

- A voltage is applied across the associated alternate select terminals, OR
- The configuration is written to Modbus register

The Primary configuration will be used for operation if:

- No voltage is present and Modbus is configured for Primary (default)

### To reset Modbus Prim/Alt register

Use the serial RS-422 communications port (see Modbus register map)

Performing a system default (Options / Default) will set this register to Primary for all channels.

### Replacing viewing heads

If a viewing head is replaced with a different type (model), all channels using the head will lockout.

Press any button to clear all lockouts.

If more than one channel or Alternate/Primary configuration was using the head then the channel assignments will be set to none. The user must re-configure the channel setups.

A viewing head will be assigned to Primary for one of the previously used channels only.

Viewing head gains and filters will be set to default values.

Both Primary and Alternate settings will be defaulted.

NOTE: Changing viewing heads (to that of the same Model) while the unit is operating may cause a lockout. (Cleared by pressing any button).

## OPERATION

### Self-checking

The self-check circuitry guards against internal component failure. There are several tasks that require intelligent interaction between the viewing heads and the signal processor. If all of the interactions do not occur properly, the viewing head will not send pulses back to the signal processor and the flame relay will open.

### Menu Structure

Three menus are accessible from the front panel. Pressing and holding the appropriate button for 2 seconds will open the menu.

The three main menus are: VIEW HEAD SET, CHANNEL SET, and RESET/OPTIONS. There are also four secondary menus: FLAME ON, FLAME OFF, #1 V.H. TEMP and #2 V.H. TEMP.

There are nine buttons on the front of the P532 and P532UI for operation and programming.

Refer to text in this manual section and the four flowcharts at the end of this manual, Fig. 8-11, for details of accessing the three menu branches and the associated programming flow.

### Viewing Head Set Menu

Viewing head selection: (See Flowchart 1, Fig. 8). Enter this menu by pressing and holding the VIEW HEAD SET button for 2 seconds.

All attached viewing heads can be scrolled through using the UP and DOWN or the VIEWING HEAD SET buttons.

The viewing head to be accessed can be selected with the SELECT button.

The top line of the display will indicate either PRIM or ALT and with the viewing head number.

Toggle primary and alternate viewing head parameters using the CHANNEL button.

The appropriate configuration can be selected with the SELECT button.

Display of (PRIM/ALT) in Red indicates that the displayed parameter is being used by the channel selection (for the control of the channel relays).

**VIEWING HEAD PARAMETERS (GAINS AND FILTERS)**

Once inside the VIEW HEAD SET menu with the required viewing head selected (1, 2 or 3) via the UP and DOWN buttons and the primary or alternate selection made via the CHANNEL SET button, the valid parameters for the viewing head can be scrolled through using the SELECT button. The current stored setting will be displayed in green.

To adjust the gains and filters the UP and Down buttons will be used.

The STORE button must be pressed to store the appropriate setting.

**Channel Set Menu**

Channel selection: (See Flowchart 2, Fig. 9). Enter this menu by pressing and holding the CHANNEL SET button for 2 seconds.

Scroll between channels “A”, “B”, and “C”, using the UP, DOWN, or CHANNEL SET buttons.

Select the Channel to view or configure with the SELECT button. The viewing head associated with the channel will now be displayed.

The top line of the display will indicate either PRIM or ALT along with the channel letter. Toggle between these using the CHANNEL SET button.

Scroll through the channel menu items using the SELECT button.

**ASSOCIATE VIEWING HEAD WITH CHANNEL**

Once inside the CHANNEL SET menu with the required channel selected (A, B or C) via the UP or DOWN buttons and then the SELECT button, associating a viewing head with the channel can be done by scrolling through the viewing heads using the UP and DOWN buttons. Then select the viewing head by pressing the STORE button.

NOTE: If a S55XBE viewing head is used, upon pressing the STORE button another menu choice will appear: IR UV.

Using the UP or DOWN buttons scroll among

1. IR UV - both IR and UV will be mixed for this channel
2. IR? - Only IR will be used for this channel
3. UV? - Only UV will be used for this channel

NOTE: The selected value must be stored with the STORE button.

If association is invalid (the sensor is associated with another channel and Alt) “IN USE” will be displayed.

NOTE: To correct the situation, the channel that is using the sensor must be disassociated, either by selecting another sensor for that channel or setting it's sensor association to NONE.

**FLAME FAILURE RESPONSE TIME (FFRT)**

Using the UP and DOWN and STORE buttons allows selection of the Flame Failure Response time for a particular viewing head selection.

FFRT	Nominal Opening	Maximum FFRT
1	1 sec	2 sec
2	2 sec	3 sec
3	3 sec	4 sec

**DELAY ON**

Using UP and DOWN and STORE buttons allows selection of the Delay relay on time (1, 2 or 3 seconds) for a particular viewing head selection.

**ANALOG OUT GAIN**

Selecting this parameter (with either the UP or DOWN button) will cause the display to change.

The Gain (0 – 100) will be displayed on the line associated with the channel being adjusted in the color associated with the flame count. The bar graph is proportional to the analog (20ma) output for the selected channel only. This adjustment only changes (multiplies) the analog output signal and has no effect on other parameters.

Adjusting the gain using the UP and DOWN buttons will (in real time) produce outputs on the analog output terminals and on the bar graph proportional to the current flame count.

Real time bar graph display of the analog gain setting will be calculated from the fame count of the channel selection

**ALARM SET POINT**

Using the UP and DOWN and STORE buttons allows selection of the marginal flame count Alarm set point for a particular viewing head selection.

The alarm relay can be disabled by setting this parameter to zero.

**VIEWING HEAD TEMPERATURE ALARM**

The Alarm relays can be configured to energize if a viewing head temperature sensor exceeds 70C / 158F.

- Set both Primary and Alternate Alarm set points to ZERO
- Channel A alarm is for Viewing head #1
- Channel B alarm is for Viewing head #2
- Viewing head #3 (S70X/S80X) has no temperature feature.

To set both Alarm set points for one channel, first set one of the set points to zero then press the CHANNEL SET button to access the second alarm (note the change in the top line of the display).

**DEFAULT (CHANNEL)**

To return the selected channel to the factory default values (see Flowchart 2, Fig. 9):

Scroll to YES using the UP or DOWN buttons and then press the STORE button. The STORE button must be pressed again to answer the “are you sure?” question.

## Options Menu

The P531/P532 is capable of communication with external controls, computers or FlameTools software via Modbus RTU. Refer to Fig. 6 and Fig. 7 for typical communication wiring and addressing scheme as well as the required wiring of the COMMOD communication converter.

For communication with external controls or computers, refer to Table 1 for the Modbus registers map.

System wide configuration parameters (Modbus, panel lock, mA output, defaults)—see Flowchart 3, Fig. 10. Enter the Options menu by pressing and holding the RESET/OPTIONS button for 2 seconds. Toggle between the programmable items with the SELECT button. (See Flowchart 3, Fig. 10.)

### ADDRESS

Using the UP and DOWN buttons, enter the value for the RS-422 node address. (Default is zero)

The P532 will not respond to the Zero “Broadcast” address.

### BAUD

Using the UP and DOWN buttons, toggle between baud rates for the RS-422 press then STORE to accept. (Default is 9600)

### POWER RESET

To reset the power:

Scroll to YES using the UP or DOWN buttons and then press the STORE button. The STORE button must be pressed again to answer the “are you sure?” question. This cycles power to all the viewing heads and restarts both processors.

### PANEL

The front panel can be disabled for configuration changes by entering a LOCK CODE. The lock code is available from Honeywell.

*If panel is locked: All parameters are viewable but none can be changed.*

### PARITY

Using the UP and DOWN buttons, toggle between parities for the RS-422 press then STORE to accept. (Default is none.)

### 20MA OUTPUT

Using the UP and DOWN buttons, toggle between the 0 to 20 ma output or the 4 to 20 ma output then STORE to accept. (Default is 4 to 20).

### DEFAULT (GLOBAL DEFAULT)

To reset the system to default values:

Scroll to YES using the UP or DOWN buttons and then press the STORE button. The STORE button must be pressed again to answer the “are you sure?” question.

**NOTE:** All channels will be associated with the default viewing heads, all channel set points will be defaulted, and all viewing head parameters will be set to default values (both Primary and Alternate). Channels will be set to 4 – 20 ma output mode.

## Flame Relay Control

The main flame relays are controlled by the Flame On and Flame Off settings. The relays are energized once the flame count has exceeded the Flame On setting for Delay ON consecutive seconds. Conversely the relays are de-energized once the flame count has been less than Flame Off setting for FFRT consecutive seconds. (See flowchart 4, Fig. 11)

## Flame ON, Flame OFF Menus

Flame on and flame off configuration parameters for all attached viewing heads (see Flowchart 4, Fig. 11):

Hold either of these buttons for 2 seconds to enter the FLAME ON OR FLAME OFF relay menu.

Push the SELECT button at any time to change to the next available channel.

Pushing the CHANNEL button will toggle between ALT and PRIM settings (red display of Prim/Alt will indicate parameter is currently active).

Pushing either the FLAME ON or FLAME OFF will display the current set value in green.

Use the UP and DOWN buttons to change the settings of these parameters and STORE to save the values.

## Temperature Display Menus

See Configuration control charts 1 and 2 (see Table 2 and 3).

The P532 and P531 with P532UI can provide viewing head current temperatures. The temperature of a supported viewing head will be displayed when the #1 V.H. TEMP OR #2 V.H. TEMP buttons are held for 2 seconds. This display will also show the model of the viewing head.

Only the S55XBE models have the internal temperature sensor. The S70X/S80X models do not have the internal temperature sensor. Certain legacy versions of the S550 were produced without a temperature sensor. These will display zero for temperature.

## AUTOMATIC SETUP FOR P532

The flame monitor can be configured automatically in two different ways; Auto Fit and Auto Sequence. Since the configuration is for a specific channel it therefore falls under the channel menu.

*Only a currently selected channel can be set up automatically, as indicated by a red Prim/Alt display.*

**NOTE:** Auto setup procedures should only be used for single burner systems. Multiple burners require several manual adjustments to obtain the proper discrimination. Auto setup provides for gain and

filter settings and other parameters for a given condition. For complete set up and flame discrimination, final manual adjustments are required.



## CAUTION

**ALL ADJUSTMENTS SHOULD BE CARRIED OUT BY A QUALIFIED PERSON.**

**Automatic setup requires burner(s) to be turned on and off. BMS interlock(s) may require temporary bypass during configuration. This operation should be carried out under supervised conditions and limited to minimum time.**

**Remove bypasses as soon as configuration and setup is completed.**

## Auto Fit

The auto fit menu is entered by selecting AUTOMATIC from the channel menu.

(The auto fit configuration only affects the gain of the specific sensor selected and Flame On and Flame Off set points).

**NOTE:** A channel using both the UV and IR sensors of a S55XBE viewing head cannot be calibrated with this procedure unless one of the sensors is disabled by manually changing its gain to zero (0). If one of the sensors is not disabled before beginning the procedure, the display will prompt the user to do so before continuing.

It is necessary to have a flame present to use auto set.

In Auto Fit mode, the gain will be set so that the flame count for the specific sensor is between 1100 and 1300. The Flame On will be set to 800 and Flame Off to 600.

With the burner on, if the flame signal is below 600 or above 1300, the display will indicate the flame signal is too low or too high. To correct this situation, manual intervention and setup is required.

### AUTO FIT PROCEDURE

1. Using the channel menu procedure (above) select the AUTOMATIC menu branch by toggling to yes using the UP or DOWN buttons and press STORE.
2. If prompted to turn off a sensor, use the UP or DOWN button to display the sensor that is to be turned off then press SELECT to turn it off.
3. If prompted to UNCAL a channel (see note above), press the STORE button to answer the YES? Query to acknowledge the side effect this will have on the other channel.
4. Using the UP or DOWN buttons, scroll to FIT and press SELECT to select the automatic fit procedure.
5. If TURN FLAME ON is displayed (the flame relay is not energized) turn the flame on. Calibration will not continue without the flame relay being energized.

**NOTE:** Calibration cannot be done with the flame relay off. Prior to entering the Automatic menu sufficient flame/gain combination must be available to ensure the flame relay will be energized.

6. Fit calibration will take less than 17 seconds. A countdown timer will display the maximum remaining seconds.

7. Completion of Fit calibration will display:
  - AUTO FIT OK! Completion of successful gain calibration. New gain parameters are stored and the display will revert to default display.
  - LOW FLAME SIGNAL Insufficient flame signal to allow for optimal flame count output. Install orifice with larger hole. Original calibration will be restored.
  - HIGH FLAME SIGNAL flame signal too strong to allow for optimal flame count output. Install orifice with smaller hole. Original calibration will be restored.
  - GAIN REJECTED Number. If the unit cannot attain appropriate gain calibration within the time allotted "REJECTED" will be displayed along with the type of gain being adjusted and the processors best guess for gain calibration. A rejected gain calibration can occur if fluctuations of signals are detected during calibration or if the signal is such that the gain cannot be determined automatically.

**NOTE:** In certain cases acceptable results may be obtained by manually setting the gain to the processors best guess and then re running the procedure.

## Auto Sequence

Auto Sequence configures the gain and relay set points for a specific channel.

When entering the auto sequence configuration, the auto fit procedure (above) will be automatically performed first.

Once the proper gain setting has been established, the system will take samples of the flame to eliminate flicker error.

Flame on will be sampled for 60 seconds and flame off (dark) will be sampled for 60 seconds.

**NOTE:** Flame sample times can be shortened by pressing a button. However, a minimum of 10 seconds is required. If the RESET button is held for 1 second the procedure will abort.

### AUTO SEQUENCE PROCEDURE

1. Using the channel menu procedure above, select the AUTOMATIC menu branch by toggling to yes using the UP or DOWN buttons and press STORE.
2. Using the procedure outlined in Fit Procedure above, follow all steps except SELECT SEQUENCE from step 4 above.
3. Once the Fit portion of the Sequence calibration has been successfully completed:
4. START BURN YES? Question will be asked, press the STORE button to start the 60-second count down for the flame on (bright) portion of the calibration.
5. Flame samples times can be shortened by pressing a button for 1 second. However, a minimum of 10 seconds is required.
6. A countdown clock will be displayed on the bottom line indicating the remaining time in seconds.
7. After the completion of the bright time period a TURN FLAME OFF command will be displayed followed shortly with the FLAME OFF? Question.

8. The Flame must now be turned off.
9. Once the flame is off, pressing the STORE button to start the dark period counter. (Dark sample times can be shortened by pressing a button for one second. However, a minimum of 10 seconds are required.)
10. After completion of the dark sequence portion, an evaluation will take place and a prompt will appear.

*If the setting parameters are outside of reasonable bounds, the sequence will be rejected (SEQUENCE REJECTED). The problem should be corrected before another sequence is attempted.*

A successful sequence is indicated by all green display.

A marginal sequence is indicated by an orange display.

- Top line will display Flame On set point.
  - Second line will display Flame Off set point
  - Third line will display the channel that was adjusted. In the case of a marginal sequence, a YES prompt will have to be answered with the STORE.
11. If the Sequence is rejected, either automatically or by the user, the original settings will be restored.

## Auto Filter

*Auto Filter configures the gain and relay set points for a specific infrared channel.*

When entering the auto Filter configuration, the auto fit procedure (above) will be automatically performed first.

If proper gain setting can be established, the system automatically runs a shortened version of the Sequence (above) configuration on all 8 filter levels.

The Gain will be readjusted at each filter setting and the flame will be sampled for 20 seconds at each level.

This calibration will take about 8 minutes.

Flame on will be sampled for 20 seconds and flame off (dark) will be sampled for 20 seconds.

*Flame sample times cannot be shortened in the auto Filter procedure. The filter can be aborted by holding the reset button for one second.*

## Testing for proper operation

The system must be tested after commissioning to ensure that the flamecount produced from background radiation is less than the flame off threshold when the monitored flame is extinguished. (ex. When target flame is extinguished, flamecount drops and flame relay opens).

Proper flame scanner setup is required to ensure safe operation.

## Background Burner Flame Test

Background burner flame radiation may be present when monitoring inside of a large furnace with multiple burners.

Below are example steps for testing and resolution.

1. Turn off monitored flame, while background flames are still present. Operate the background burner(s) at most intense flamecount. Flame relay should be open.
2. Restart monitored flame, and verify that flame relay closes.
3. Turn off monitored flame while background flames are present. Verify that flame relay opens.
4. If the flamerelay remains closed, then you are incorrectly detecting background flames.
5. If the scanner is detecting background flames, use one or more of the following suggestions to correct, and repeat test steps to ensure scanner is no longer sensing background flames:
  - Increase IR filter setting to reject background flames.
  - Reduce UV, or IR gains.
  - Re-position viewing head to sense high frequency of target flame, and low frequency background flame
  - Re-position head to view high intensity of monitored flame, and low intensity of background flame.

## IR Hold In Test

It is possible to setup the scanner so that hot refractory is detected as flame, causing the flame relay to “hold in” when flame has been extinguished. It is important to setup the scanner system properly so that background flame or refractory glow does not indicate flame presence when the monitored flame is extinguished.

Below are example steps for testing and resolution of hot refractory hold in.

1. Operate the burner until the refractory reaches its maximum temperature. If the installation is a multi-fuel burner, burn the heavier fuel that is most likely to reflect, bend or obscure the hot refractory steady infrared radiation.
2. When the maximum refractory temperature is reached, close all manual shutoff valves, or open the electrical circuits of all automatic fuel valves.
3. Visually observe the monitored flame, and note how long it takes from the time of flame loss, to when the scanner flamecounts fall below the off threshold, turning off the flame relay. If this time is longer than the FFRT time, then the scanner is sensing hot refractory.
4. Immediately terminate the firing cycle. Lower the setpoint to the operating controller, or set the Fuel Selector Switch to OFF. Do not open the master switch. NOTE: Some burners continue to purge oil lines between the valves and nozzles even though the fuel valves are closed. Terminating the firing cycle (instead of opening the master switch) allows purging the combustion chamber. This reduces a buildup of fuel vapors in the combustion chamber caused by oil line purging.
5. If the burner scanner is detecting hot refractory, use one or more of the following suggestions to reduce IR level, and repeat test steps to ensure scanner is no longer sensing hot refractory:
  - Reduce IR gain setting.
  - Add an orifice to the flame scanner (see accessories).

- Re-sight the scanner at a cooler, more distant part of the combustion chamber. Make sure the detector properly sights the monitored flame.
- Try lengthening the sight pipe or decreasing the pipe diameter size.

## XRAY Radiation

Xray radiation does not affect signal processor, or viewing head IR sensor performance, and does not adversely affect viewing head tube sensor performance under the following conditions:

Radiation Source of 65 Curie Iridium 192  
Distance > 5'  
Exposure type Direct  
UV tube gain set to default  
Flame off threshold >600

If viewing heads are subjected to more severe conditions, system must be tested to ensure that radiation does not cause flame-counts above flame off threshold. If this occurs, flame off threshold must be increased, UV tube gain must be reduced, or lead shielding must be used.

## P531 AND P532UI SETUP

Setup and operation of the P531 is the same as for the P532 when using the P532UI

The P532 UI can be connected to and disconnected from the P531 during operation for monitoring and configuration. Other methods of monitoring and configuration include Modbus devices (either through the RS-422 port or the RS-232 port).

### Display for P531

The 7 LED's on the P531 will provide information about status and flame signals for all channels.

### Flame On

The display indicates that the Flame relay is energized

### Flame Signal

Indication of the flame strength flashes

- From one flash every few seconds to rapid flash

The color indicates signal configuration (channel configured for):

- Red indicates IR only
- Green indicates UV only
- Orange indicates the channel is configured to detect both UV and IR

## LOCKOUT

A lockout condition is indicated when:

- Red, Green, Red, Green: Flashes once a second.
- The Flame On indicator is off.

To clear a lockout condition, push the reset button.

## Status

- A Green heartbeat (one quick green flash each second) indicates system normal (self check)
- A Red / Green heartbeat (alternating color one quick flash each second) indicates one or more viewing heads are Hot (70° C or more). Other system functions are normal.
- A Red Inverted heartbeat (Red light with one quick flash dark each second): The display processor is not receiving data from signal processor. (Inter-processor communications error.)
- A solid color light or no light or any other flash pattern indicates a system failure. No LED's illuminated could also indicate a power loss.

## P522 MODE

*The P532 can be made to behave like the P522.*

- Connect a jumper between ground and the P522 terminal.
- The unit will revert to P522 the next time it is powered up.
- There is no support for viewing head #3 in this mode.

NOTE: If the jumper is installed or removed and the power is reset then the entire system will revert back to default settings.

## P522 mode operation

Channel Viewing Head assignments:

- Channel A Only will be operational (both Prim or Alt)
- P 522 will be displayed on the second line
- Only channel A Flame relays will operate
- If power is applied across Alternate 1 terminals, the channel will revert to the Channel A Alternate configuration parameters.
- The bottom line will display the active selection.
- The channel A marginal alarm will function independently.
- The alarm can be disabled by setting the trip point to zero.
- Separation of UV and IR is supported for S55XBE viewing heads.

## INFRARED GAIN

*Analysis of the Electrical and Digital (Software) gains for the S55xx Viewing Heads.*

The Sx55x viewing heads that are IR equipped have a two stage gain system.

There is a 7 step electrical "analog" gain that is used external to the processor to amplify the signal before it enters the processor. Indicated by the left digit.

Once the signal is at the processor, a "digital" software gain can then be applied. Indicated by the last two digits. For example, an IR gain of 388 represents an analog gain of 3 and digital gain of 88.

A slight amount of non-linearity may occur when changing from one electrical gain setting to another.

During setting a hysteresis is built in to keep small changes in the digital range. If an analog gain boundary is crossed, a finer adjustment can be achieved by going back in the other direction.

NOTE: Signal processor will not accept gain adjustment that is between x00 and x37. For example, an IR gain of 125 cannot be implemented as it falls outside of this range. An exception to this rule is for the lowest range 0xx, which permits lower digital gain (i.e. 01-99).

### Gain boundaries

The following table is a list of boundaries for changing the electrical gain.

IR gain settings transitions for the S55XBE viewing heads.

From	To	Electrical Gain	Unacceptable Range
0	99	1	See above
138	199	2	100-137
238	299	4	200-237
338	399	8	300-337
438	499	16	400-437
538	599	32	500-537
638	699	64	600-637

## TROUBLESHOOTING

### If the display is blank:

- Unplug all viewing heads (should display “NO VH# DETECTED”).
- If display still blank then:
- Hold the Reset button for 2 seconds:
- If address is displayed then reset factory defaults; or else contact your distributor or Honeywell for guidance.

### If only one line is blank:

- Refer to the Channel Set Menu in the OPERATION section of this manual and Fig. 9.
- Check that the channel is associated with an operational viewing head.
- Push channel until the channel letter is displayed, then push select.
- Scroll through viewing heads, select and store the one required.

- If the Channel is associated with a viewing head, check that the viewing head’s gain is not set at zero.

### If the viewing head is not listed:

If the viewing head is not listed as a choice in either the VIEW HEAD SET or CHANNEL SET menus:

- Check that the viewing head is compatible with the P531/P532.
- Check that the viewing head cable is in good condition.
- Verify that 24 volts DC is present at the cable head.

NOTE: Note: power to VH #3 is pulsed when no viewing head has answered. Check that the viewing head is operational.

- A meter or Oscilloscope on the SC with reference to ground will show:
  - At least 20% duty cycle at 15 volts Peak for S55x viewing heads.
  - At least 10% duty cycle at 24 volts Peak for S70x/S80x viewing heads.
- With S70x and S80x viewing heads the Green LED will flash once per second.
- S55xx viewing heads will show a number on the display.
- Viewing heads without numeric displays will flash if flame signal is present.
- Substitute a known good viewing head using a known good cable.

### Channels display LKOUT

Channels display LKOUT that will not stay cleared (after pressing any key).

Viewing head problem or cable problem. See above steps. (Reset OPTION defaults).

### The Display flashes “HOT”

Indicates that the viewing head listed is nearing or exceeded maximum operational temperature. The system will try to continue operating as long as it can and the flashing display is only a warning.

### CODE display

This is an indication of a processor failure.

It can be caused by a power failure during a memory store operation or another fault.

If the unit is not restored by cycling the power and setting factory defaults:

- Record the numbers on the display.
- Remove the unit from service and return it to the factory for failure analysis and repair.

# MODBUS PROTOCOL

The P531/P532 signal processors are capable of communication with host external controls, FlameTools software on a computer or other computers with an USB port that support Modbus RTU protocol. The data transmitted to and from the P531/P532 is over two twisted pairs that are differentially driven and received according to the RS-422 standard. Honeywell offers a RS485/422 to USB converter to use in conjunction with the P531/P532 signal processors. The Honeywell part number is COMM0D.

Refer to Fig. 6 and Fig. 7 for a typical communication wiring and addressing scheme as well as the required wiring of the COMM0D communication converter.

For communication with external controls or computers, refer to Table 1 for the Modbus registers map.

## Communication Setting

P531/P532 can only communicate via Modbus RTU protocol, with the following configuration:

- 9600 baud (default)

- 8 data bits (hard coded)
- no parity (default)
- 1 stop bit (hard coded)

The factory default Modbus address of the P531/P532 is 0 and must be changed in order to communicate with the signal processor. When more than one unit is in the network, ensure that each unit has a unique Modbus address.

The Modbus parameter settings can be accessed through the RESET/OPTIONS menu. For details and programming instructions, refer to the Options Menu section under OPERATIONS of this manual and Fig. 11: Flowchart 4.

## Modbus RTU Function Supported

Four Modbus functions are supported:

- 01 Output coil read
- 03 Holding register read
- 06 Preset single holding register
- 16 Preset multiple holding register

**Table 1. P531/P532 Modbus Registers Map**

Register	Description	Details	Minimum	Maximum
Legacy Modbus Support				
40001	Flame count	Flame count of active channel in P522 mode, otherwise 0	-	-
40002	Processor status	0x or discrete 000001 VH channel selected, Chan A=0 (same terminal 4 VH 1 gain select) 000002 Flame on relay status (not used for P532; reads 0) 000003 Processor lockout status, lockout=0 (any channel) 000004 Panel access disabled, disabled=0 000005 4-20mA output, 0-20mA=0	-	-
Primary Viewing Head Settings				
40003	Flame on	Flame on setting, Channel A	0	2999
40004	Flame on	Flame on setting, Channel B	0	2999
40005	Flame off	Flame off setting, Channel A	0	2999
40006	Flame off	Flame off setting, Channel B	0	2999
40007	Gain output	Channel A gain of the 0/4-20mA output (0-100 for P532)	0	99/100
40008	Gain output	Channel B gain of the 0/4-20mA output (0-100 for P532)	0	99/100
40009	IR gain	IR sensor analog gain setting for VH 1 (portion of total IR gain, R/O P532)	-	-
40010	IR gain	IR sensor digital gain setting for VH 1 (portion of total IR gain, R/O P532)	-	-
40011	IR filter	High pass IR sensor filter setting VH 1 (unsigned char). 0=8Hz, 1=16Hz, 2=24Hz, 3=33Hz, 4=52Hz, 5=75Hz, 6=100Hz, 7=155Hz, 8=215Hz	1	8
40012	UV gain	UV tube gain setting for VH 1 (unsigned char)	0	99
40013	IR gain	IR sensor analog gain setting for VH 2 (portion of total IR gain, R/O P532)	-	-
40014	IR gain	IR sensor digital gain setting for VH 2 (portion of total IR gain, R/O P532)	-	-
40015	IR filter	High pass IR sensor filter setting VH 2 (unsigned char). 0=8Hz, 1=16Hz, 2=24Hz, 3=33Hz, 4=52Hz, 5=75Hz, 6=100Hz, 7=155Hz, 8=215Hz	1	8

**Table 1. P531/P532 Modbus Registers Map (Continued)**

Register	Description	Details	Minimum	Maximum
40016	UV gain	UV tube gain setting for VH 2 (unsigned char)	0	99
40017	VH type	Viewing head type #1 R/O	-	-
40018	VH type	Viewing head type #2 R/O	-	-
40019	Temperature	Current internal temperature of Channel A R/O	-	-
40020	Temperature	Current internal temperature of Channel B R/O	-	-
40021	Time delay	Time Delay setting (in seconds); lower nibble Channel A, upper nibble Channel B (Read or Write)	0	3
40022	FFRT	FFRT (flame failure response time) setting (in seconds); lower nibble Channel A, upper nibble Channel B (Read or Write)	1	3
40023	Version	Software version R/O	-	-
40024	Model	Signal processor model number	-	-
Extensions [for P531/P532 to Modbus protocol (RS-422)]				
40025	Flame count	Flame count for Channel A, R/O	-	-
40026	Flame count	Flame count for Channel B, R/O	-	-
40027	Flame count	Flame count for Channel C, R/O	-	-
40028	Flame on	Flame on setting, Channel C Primary	-	-
40029	Flame off	Flame off setting, Channel C Primary	-	-
40030	Gain output	Channel C gain of the 0/4-20mA output Primary	0	100
40031	IR gain	IR sensor gain setting for VH 3 Primary	1	9
40032	UV gain	UV tube gain setting for VH 3 (total UV gain for P532, unsigned char)	1	9
40033	VH type	Viewing head type #3 R/O	-	-
40034	Time delay	Time Delay setting (in seconds) for Channel C Primary	-	-
40035	FFRT	FFRT (flame failure response time) setting (in seconds); lower nibble Channel C Primary	-	-
40036	IR gain	IR sensor gain setting for VH Primary (equivalent to 40009 and 40010)	-	-
40037	IR gain	IR sensor gain setting for VH 2 Primary (equivalent to 40013 and 40014)	-	-
Alternate Viewing Head #1				
40038	IR gain	IR sensor gain setting for VH 1, Alternate	-	-
40039	IR filter	High pass IR sensor filter setting VH 1, Alternate. 0=8Hz, 1=16Hz, 2=24Hz, 3=33Hz, 4=52Hz, 5=75Hz, 6=100Hz, 7=155Hz, 8=215Hz	1	8
40040	UV gain	UV tube gain setting for VH 1, Alternate	0	99
Alternate Viewing Head #2				
40041	IR gain	IR sensor gain setting for VH 2, Alternate	-	-
40042	IR filter	High pass IR sensor filter setting VH 2, alternate. 0=8Hz, 1=16Hz, 2=24Hz, 3=33Hz, 4=52Hz, 5=75Hz, 6=100Hz, 7=155Hz, 8=215Hz	1	8
40043	UV gain	UV tube gain setting for VH 2, Alternate	0	99
Alternate Viewing Head #3				
40044	IR gain	IR sensor gain setting for VH 3, Alternate	1	9
40045	UV gain	UV tube gain setting for VH 3, Alternate	1	9
Alarm Setpoints Primary				
40046	Alarm setpt	Alarm setpoint for Channel A	0	2999
40047	Alarm setpt	Alarm setpoint for Channel B	0	2999
40048	Alarm setpt	Alarm setpoint for Channel C	0	2999
Viewing Head Flame Counts				
40049	Flame count	VH 1 IR component	-	-

**Table 1. P531/P532 Modbus Registers Map (Continued)**

Register	Description	Details	Minimum	Maximum
40050	Flame count	VH 1 UV component	-	-
40051	Flame count	VH 2 IR component	-	-
40052	Flame count	VH 2 UV component	-	-
Channel "A" R/O				
40053	-	000001 bit 0, flame relay status 000002 bit 1, alarm relay status 000003 bit 2, Channel autaset (Primary or Alternate) 000004 bit 3, Channel lockout (Primary or Alternate) 000005 bit 4, Primary active=1, Alternate active=0	-	-
Channel "B" R/O				
40054	-	000001 bit 0, flame relay status 000002 bit 1, alarm relay status 000003 bit 2, Channel autaset (Primary or Alternate) 000004 bit 3, Channel lockout (Primary or Alternate) 000005 bit 4, Primary active=1, Alternate active=0	-	-
Channel "C" R/O				
40055	-	000001 bit 0, flame relay status 000002 bit 1, alarm relay status 000003 bit 2, Channel autaset (Primary or Alternate) 000004 bit 3, Channel lockout (Primary or Alternate) 000005 bit 4, Primary active=1, Alternate active=0	-	-
Channel "A" Primary Read/Write				
40056	-	000005 bit 4, bits 4 and 5 are viewing head attached to channel) 000006 bit 5, 0,0=no viewing head, 0,1=VH 1, 0,2=VH 2, 0,3=VH 3 000007 bit 6, IR 000008 bit 7, UV	-	-
Channel "B" Primary Read/Write				
40057	-	000005 bit 4, bits 4 and 5 are viewing head attached to channel) 000006 bit 5, 0,0=no viewing head, 0,1=VH 1, 0,2=VH 2, 0,3=VH 3 000007 bit 6, IR 000008 bit 7, UV	-	-
Channel "C" Primary Read/Write				
40058	-	000005 bit 4, bits 4 and 5 are viewing head attached to channel) 000006 bit 5, 0,0=no viewing head, 0,1=VH 1, 0,2=VH 2, 0,3=VH 3 000007 bit 6, IR 000008 bit 7, UV	-	-
Terminal Status R/O				
40059	-	000004 bit 3, P522 mode terminal, PORTC.3 000005 bit 4, Channel A Primary=1, Alternate=0, PORTC.4 (same as 400002 00001) 000006 bit 5, Channel B Primary=1, Alternate=0, PORTC.5 000007 bit 6, Channel C Primary=1, Alternate=0, PORTC.6	-	-
40060	Serial #	Serial number, R/O	-	-
40061	ID #	Identification number, (Read and Write, signed integer)	-	-
40062	Time	Operational time each unit=2 hours of continuous power on time, R/O		
40063	Flame on	Flame on setting, Channel A Alternate	0	2999
40064	Flame on	Flame on setting, Channel B Alternate	0	2999
40065	Flame on	Flame on setting, Channel C Alternate	0	2999
40066	Flame off	Flame off setting, Channel A Alternate	0	2999
40067	Flame off	Flame off setting, Channel B Alternate	0	2999
40068	Flame off	Flame off setting, Channel C Alternate	0	2999

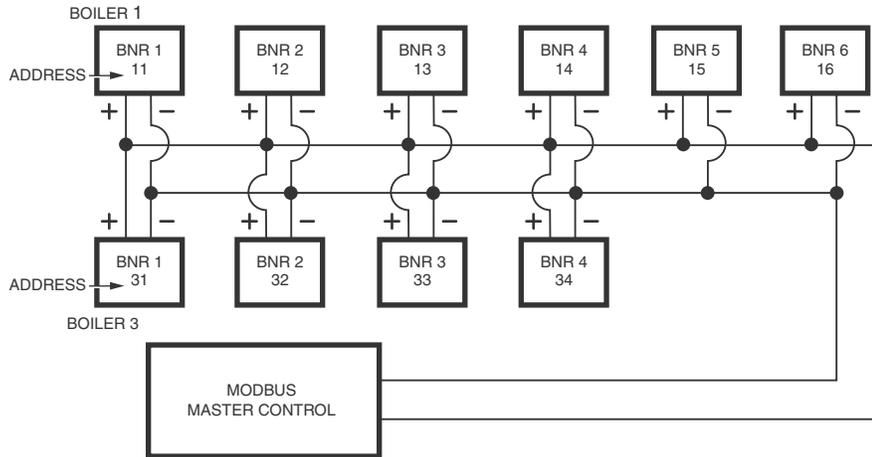
**Table 1. P531/P532 Modbus Registers Map (Continued)**

Register	Description	Details	Minimum	Maximum
Channel "A" Alternate Read/Write				
40069	-	000005 bit 4, bits 4 and 5 are viewing head attached to channel) 000006 bit 5, 0,0=no viewing head, 0,1=VH 1, 0,2=VH 2, 0,3=VH 3 000007 bit 6, IR 000008 bit 7, UV	-	-
Channel "B" Alternate Read/Write				
40070	-	000005 bit 4, bits 4 and 5 are viewing head attached to channel) 000006 bit 5, 0,0=no viewing head, 0,1=VH 1, 0,2=VH 2, 0,3=VH 3 000007 bit 6, IR 000008 bit 7, UV	-	-
Channel "C" Alternate Read/Write				
40071	-	000005 bit 4, bits 4 and 5 are viewing head attached to channel) 000006 bit 5, 0,0=no viewing head, 0,1=VH 1, 0,2=VH 2, 0,3=VH 3 000007 bit 6, IR 000008 bit 7, UV	-	-
40072	Gain output	Channel A gain Alternate of the 0/4-20mA output (0-100 for P532)	0	100
40073	Gain output	Channel B gain Alternate of the 0/4-20mA output (0-100 for P532)	0	100
40074	Gain output	Channel B gain Alternate of the 0/4-20mA output (0-100 for P532)	0	100
Alarm Setpoints Alternate				
40075	Alarm setpt	Alarm setpoint for Channel A	0	2999
40076	Alarm setpt	Alarm setpoint for Channel B	0	2999
40077	Alarm setpt	Alarm setpoint for Channel C	0	2999
40078	Time delay	Time Delay setting (in seconds); lower nibble Channel A, upper nibble Channel B (Read or Write)	-	-
40079	FFRT	FFRT (flame failure response time) setting (in seconds); lower nibble Channel A, upper nibble Channel B (Read or Write)	-	-
40081	Time delay	Time Delay setting (in seconds); Channel C Alternate	-	-
40082	FFRT	FFRT (flame failure response time) setting (in seconds); Channel C Alternate	-	-
Alternate/Primary Switch Register Read/Write (Write is RS-422 only)				
40083	Switch register	000001 000002 000003 000004 000005 bit 4, Channel A Primary = 1, Alt = 0 000006 bit 5, Channel B Primary = 1, Alt = 0 000007 bit 6, Channel C Primary = 1, Alt = 0 000008 NOTE: To reset factory defaults for P531 front port write 30064 (RS-232)	-	-
40084	Error code	Error code RS-422 port only (P531 front port is undefined)	-	-
40085	Baud	Baud rate for the RS-422 port (P531 front panel access only, RS-232)	-	-
40086	Parity	Parity setting for the RS-422 port (P531 front panel access only, RS-232)	-	-
40087	Address	Modbus address for the RS-422 port (P531 front panel access only, RS-232)	-	-

**Table 1. P531/P532 Modbus Registers Map (Continued)**

Register	Description	Details	Minimum	Maximum
Modbus Function Support				
03	-	Holding register read	-	-
06	-	Preset single holding register	-	-
16	-	Preset multiple (maximum 5 consecutive locations per message)	-	-

NOTE: If writing multiple presets a failure message may occur if one of the presets does not fall within parameters. Presets before the invalid data will be written correctly to the register. All parameters after invalid parameter are ignored and an "illegal data value" message is returned.



NOTES: A CONVERTER MAY BE NECESSARY FOR COMMUNICATION WITH THE MODBUS MASTER CONTROL.

USE SHIELDED CABLE FOR COMMUNICATION WIRING.

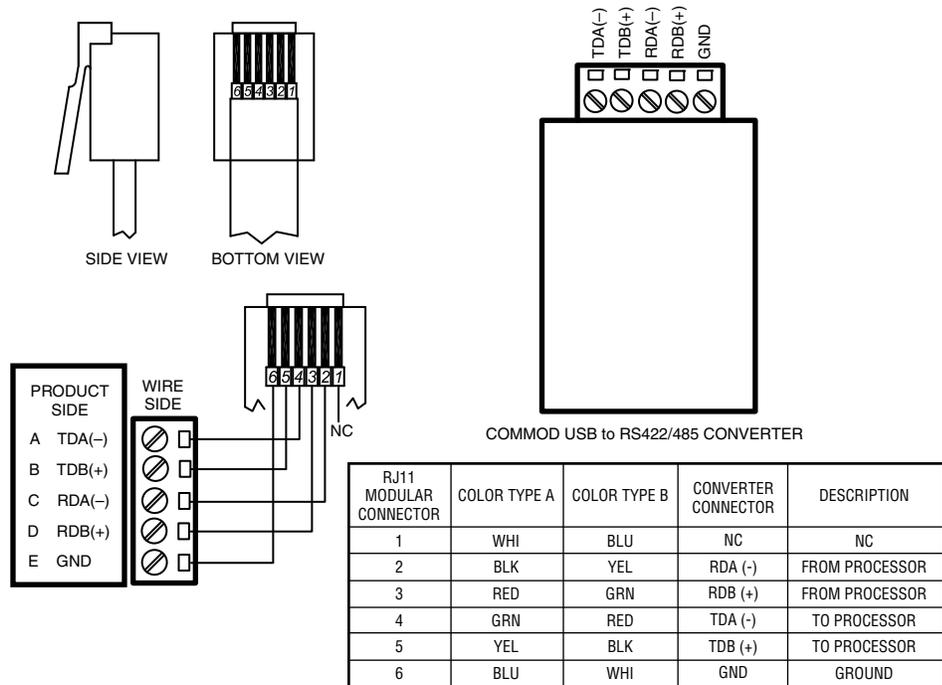
DRAWING IS FOR GENERAL REFERENCE ONLY.

FOR RS422 COMMUNICATION WITH THE P531/P532, AN RJ11 CONNECTOR WITH 5 WIRES FROM EACH SIGNAL PROCESSOR WILL BE REQUIRED (RDA-, RDB+, TDA-, TDB+, GND), FOLLOWING POLARITY FROM EACH SIGNAL PROCESSOR.

M33521A

**Fig. 6. Typical Communications Wiring and Recommended Addressing.**

NOTE: Refer to Fig. 7 below for converter to RJ11 wiring details.



NOTES:

SELECT THE APPROPRIATE DIP SWITCH SETTINGS FOR RS-422 COMMUNICATION PER THE VENDOR'S INSTRUCTION SHEET.

RJ11 CONNECTOR IS CUSTOMER SUPPLIED AND WIRED.

SOFTWARE DRIVERS MAY BE DOWNLOADED FROM B&B ELECTRONICS' WEBSITE.

M33831

CAUTION: THE ORDER OF THE COLORS IN THE CABLE CAN BE TYPE A OR TYPE B. CHECK COLORS AT THE CONNECTOR.

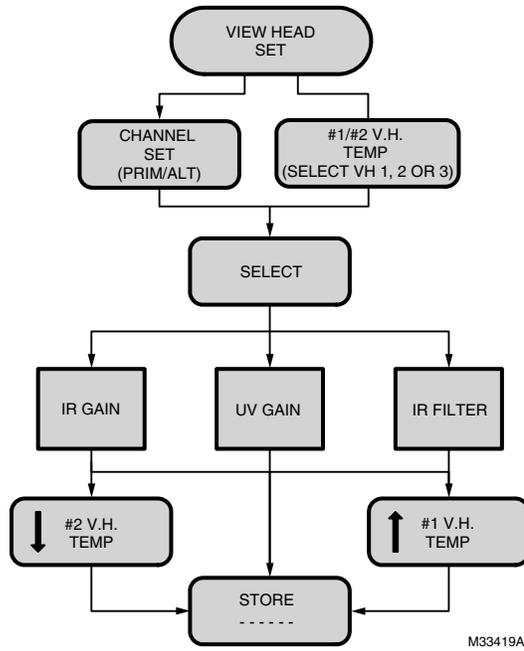
**Fig. 7. COMMOD communication converter wiring.**

**Table 2. Viewing Head Configuration Control Chart 1**

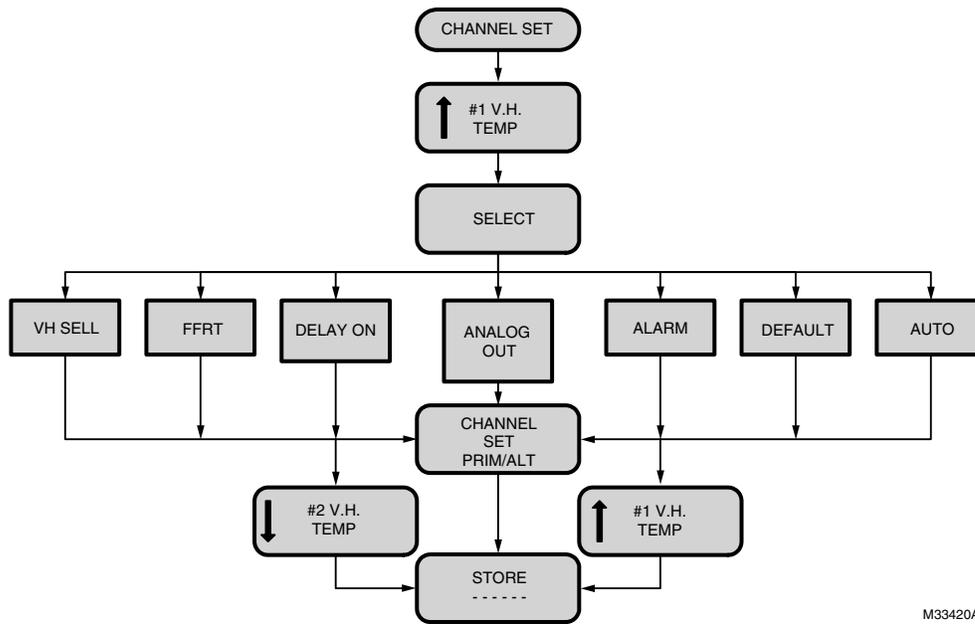
Channel	VH #	Sensor	Flame ON	Flame OFF	FFRT	Time Delay	Analog Gain	Alarm
A Prim.								
A Alt.								
B Prim.								
B Alt.								
C Prim.								
C Alt.								

**Table 3. Viewing Head Configuration Control Chart 2**

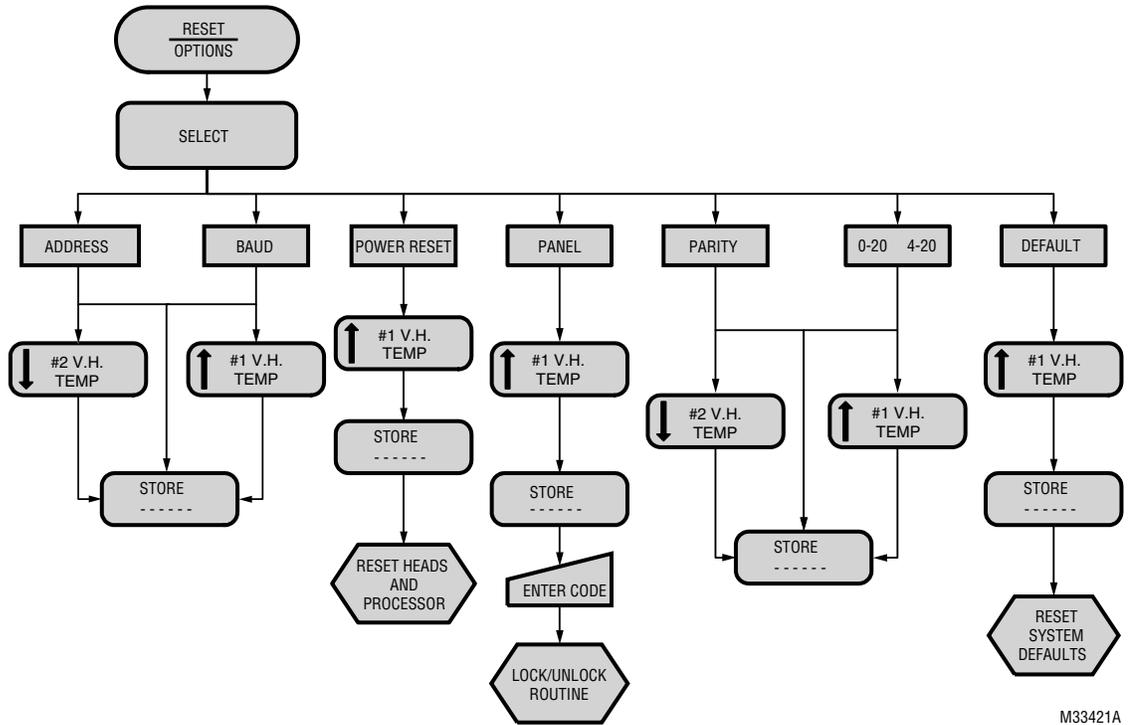
	IR Gain	IR Filter	UV Gain	Channel Association
VH#1 Prim.				
VH#1 Alt.				
VH#2 Prim.				
VH#2 Alt.				
VH#3 Prim.	N/A			
VH#3 Alt.	N/A			



**Fig. 8. Flowchart 1: Viewing Head Set, Channel Set and Option.**

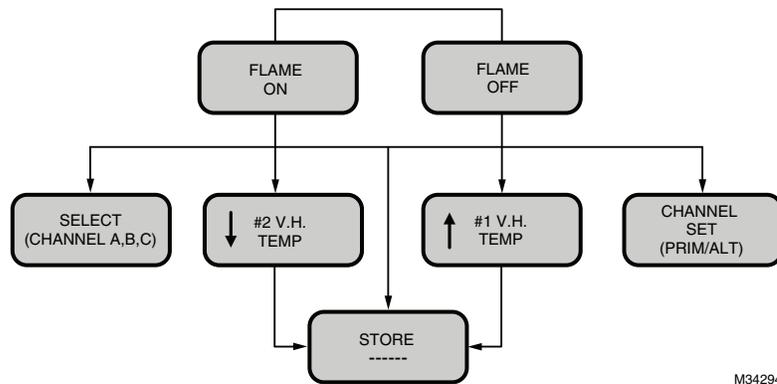


**Fig. 9. Flowchart 2: Channel Set.**



M33421A

Fig. 10. Flowchart 3: Option Menu - System-wide Configuration Parameters.



M34294

Fig. 11. Flowchart 4: Flame On / Flame Off.

# SAFETY MANUAL

## P53x Product Declaration

### FIT FOR USE IN LOW DEMAND SAFETY APPLICATION

Models: P531AC, P531DC, P532AC, P532DC

Models	SIL	HFT	PFD	SFF	$\lambda S$	$\lambda DD$	$\lambda DU$
P531AC, P531DC, P532AC, P532DC	3	0	$1.94 \times 10^{-4}$	>99%	$5.75 \times 10^{-6}$	$8.07 \times 10^{-9}$	$8.89 \times 10^{-9}$

System Architecture	1oo1
MTTR	8 hours
Proof Test Interval	5 years
Fit for use in	SIL 3 environment

## Definitions

Term	Definition
Dangerous Failure	Failure that has the potential to put the safety-related system in a hazardous or fail-to-function state.
Safety-Related System	A system that implements the safety functions required to achieve or maintain a safe state and is intended to achieve on its own or with other systems the necessary safety integrity for the required safety functions.
Safety Function	Defined function that is performed by a safety-related system with the aim of achieving or maintaining a safe state for the plant, in respect of a specified hazardous event.
Proof Test	Periodic test performed to detect failures in a safety-related system so that, if necessary, the system can be restored to an "as new" condition or as close as practical to this condition.
MTTR (mean time to restoration)	The average duration required for restoration of operations after a failure.
$\lambda_{sd}$	Rate of safe detectable failures per one billion hours. For example, if $\lambda_{sd} = 3000$ , then it is estimated that there will be about 3000 safe detectable failures during every one billion hours of operation. For $\lambda_{sd} = 3000$ , this is about one safe detectable failure every 38 years.
$\lambda_{su}$	Rate of safe undetectable failures per one billion hours.
$\lambda_{dd}$	Rate of dangerous detectable failures per one billion hours.
$\lambda_{du}$	Rate of dangerous undetectable failures per one billion hours.
System Architecture	Specific configuration of hardware and software elements in a system.
PFD <sub>AVG</sub> (Average Probability of Failure on Demand)	Average Probability of Failure on Demand. In this case regarding P531AC, P531DC, P532AC, and P532DC Signal Processors.
FIT (failures in time)	A unit of measurement representing one failure per one billion hours. 1,000,000,000 hours is approximately 114,155.25 years.

## Safety Function of P531AC, P531DC, P532AC, and P532DC

The safety function of the P531AC, P531DC, P532AC, and P532DC consists of three Flame Relays, Flame Relay A for Channel A, Flame Relay B for Channel B, and Flame Relay C for Channel C, which comprise their safety function and behave as follows:

The Flame Relays (Normally Open)

- Each Flame Relay will be energized when the product is powered and a flame on condition is detected and the Delay On time has elapsed for its corresponding channel.
- Each Flame Relay will be de-energized when the product is powered, a flame off condition is detected, and the FFRT (Flame Failure Response Time) has elapsed for its corresponding channel.
- All of the Flame Relays will be de-energized when the product is powered and detects a fault condition.

As an added safety feature, the circuitry which energizes the coils of each Flame Relay is wired in series with a second pole of contacts on a Self Check Relay. The Self

Check Relay is designed to be closed during normal operation of the signal processor and open during detection of a fault or power down. It is physically impossible for any of the Flame Relays to be closed if the Self Check Relay is open, unless the contacts of one of the Flame Relays are welded closed or the contacts of the Self Check relay are welded closed. It is recommended that the user wire the Flame Relays individually in series with the Self Check Relay.

## Proof Test Interval

The Proof test must be conducted every 1 to 5 years. This range is given to allow for the test to be performed during the normally scheduled burner shutdown period. It is the responsibility of the user to perform the proof test in the specified time frame.

The following diagram for P531 is an example to show the dependence of  $PFD_{AVG}$  on proof test interval.  $PFD_{AVG}$  increases as proof test interval increases.

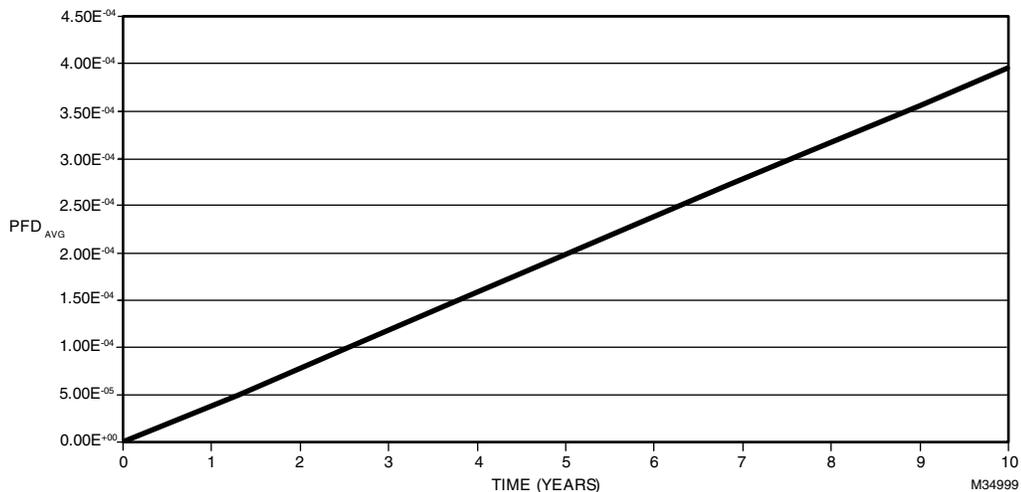


Fig. 12. P531 AC PFD<sub>AVG</sub> vs Time.

## Proof Test Procedure

### Equipment

- Powered P531AC, P531DC, P532AC, or P532DC correctly connected to its compatible viewing heads. If a P531 is used, a P532 UI module is required.
- Multimeter able to take voltage and resistance measurements.
- For P531DC and P532DC signal processors, a DC power supply between 22V DC and 26V DC.
- For P531AC and P532DC signal processors, an AC power source between 85V AC and 264V AC.
- Light source capable of generating a flame on condition.

NOTE: Generally an incandescent bulb will work for IR viewing head sensors and a deep UV light or flame will work for UV viewing head sensors.

### Setup

1. Ensure the P531AC, P531DC, P532AC, or P532DC signal processor under test is correctly connected to its compatible viewing heads and is fully operational.
2. While performing the proof test, disconnect or disregard the signal processor outputs so that any outputs due to testing do not affect the overall safety system and potentially cause a hazardous situation.
3. Record all previously entered user programmable settings so that you can restore them to their desired values after the proof test.

## Tests

1. Apply 7.5-30V DC across the 'SEL1 +' and 'SEL1 RET' terminals, being sure to obey polarity, then cycle power to the signal processor.
  - a. Ensure the middle pixel of the right most column of the 'CHAN A' display lights up.
2. Remove the voltage across the 'SEL1 +' and 'SEL1 RET' terminals and cycle power to the signal processor.
  - a. Ensure the middle pixel of the right most column of the 'CHAN A' display turns off.
3. Apply 7.5-30V DC across the 'SEL2 +' and 'SEL2 RET' terminals, being sure to obey polarity, then cycle power to the signal processor.
  - a. Ensure the middle pixel of the right most column of the 'CHAN B' display lights up.
4. Remove the voltage across the 'SEL2 +' and 'SEL2 RET' terminals and cycle power to the signal processor.
  - a. Ensure the middle pixel of the right most column of the 'CHAN B' display turns off.
5. Apply 7.5-30V DC across the 'SEL3 +' and 'SEL3 RET' terminals, being sure to obey polarity, then cycle power to the signal processor.
  - a. Ensure the middle pixel of the right most column of the 'CHAN C' display lights up.
6. Remove the voltage across the 'SEL3 +' and 'SEL3 RET' terminals and cycle power to the signal processor.
  - a. Ensure the middle pixel of the right most column of the 'CHAN C' display turns off.
7. Remove power to the signal processor and, using a multimeter, ensure continuity between 'SC COM' and 'SC OFF'.
8. Reapply power to the signal processor and, using a multimeter, ensure continuity between 'SC COM' and 'SC ON'.
9. Use a light source to generate a flame on condition for each viewing head or individual viewing head sensor connected to the signal processor. After the Delay On time has elapsed, use a multimeter to ensure continuity between 'xR1 COM' and 'xR1 ON', and to ensure continuity between 'xR2 COM' and 'xR2 ON'. The variable x equals A, B, or C, depending on which channel each viewing head or individual viewing head sensor is associated with.
10. Remove any light source to create a flame off condition for each viewing head or individual viewing head sensor connected to the signal processor. After the FFRT (Flame Failure Response Time) has elapsed, use a multimeter to ensure continuity between 'xR1 COM' and 'xR1 OFF', and to ensure continuity between 'xR2 COM' and 'xR2 OFF'. The variable x equals A, B, or C, depending on which channel each viewing head or individual viewing head sensor is associated with.
11. Measure the current draw of the signal processor with its viewing heads attached and ensure it is less than 800 mA.
12. Measure the DC voltage between 'VH1 GND' and 'VH1 +V', between 'VH2 GND' and 'VH2 +V', and between 'VH3 GND' and 'VH3 +V' going to the three possible viewing heads. Ensure it is between 20 and 26 V DC.
13. Change one of the settings of the signal processor and store the changed setting. Remove power to the signal processor for 10 seconds. Restore power to the signal processor and ensure the settings value was stored correctly (remains unchanged).
14. Use your light source to generate flamecounts of between 1200 and 2800 on the signal processor for each viewing head. Note the flamecount.
  - a. Increase the UV or IR gain (whichever is appropriate for each of your viewing heads and light source) and store the settings. Ensure the flamecounts increased.
  - b. Decrease the UV or IR gain (whichever is appropriate for each of your viewing heads and light source) and store the settings. Ensure the flamecounts decreased.
15. Restore all original settings as recorded in Setup and reconnect the signal processor to the safety system.

## Product Decommissioning

When required, decommissioning of P53x signal processors should be performed in accordance with the requirements of the overall safety system.

## Disposal

Devices with electronic components:  
WEEE Directive 2012/19/EU – Waste Electrical and Electronic Equipment Directive



At the end of the product life (number of operating cycles reached), dispose of the packaging and product in a corresponding recycling centre. Do not dispose of the unit with the usual domestic refuse. Do not burn the product. On request, old units may be returned carriage paid to the manufacturer in accordance with the relevant waste legislation requirements.

## For More Information

The Honeywell Thermal Solutions family of products includes Honeywell Combustion Safety, Eclipse, Exothermics, Hauck, Kromschröder and Maxon. To learn more about our products, visit [ThermalSolutions.honeywell.com](http://ThermalSolutions.honeywell.com) or contact your Honeywell Sales Engineer.

## Honeywell Process Solutions

Honeywell Thermal Solutions (HTS)  
2101 CityWest Blvd  
Houston, TX 77042  
[ThermalSolutions.honeywell.com](http://ThermalSolutions.honeywell.com)