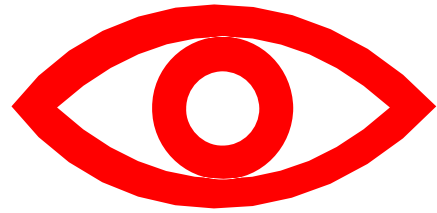


IRIS



MODEL P905 AND 950S INFRARED TEMPERATURE MEASUREMENT SYSTEM INSTALLATION AND OPERATING MANUAL



WORLD LEADER IN FLAME MONITORING

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QUICK INSTALLATION

Mounting the Instrument.

Bolt the swing-away assembly complete with viewing head to valve flange. (see Figure A)

Mount the P905 PROCESSOR in an appropriate enclosure within 50 ft. of the Viewing Head.

Mount DC power supplies with the P905 processor.

Electrical

Supply Power : +24 VDC,950mA and -24VDC, 950mA

Viewing Head Heater (if required) : 115 VAC, 150 W

Terminate as per wiring diagram. (see Figure B)

Focusing on Target

Remove the housing cover.

Loosen the field lens locking screw.

Adjust the lens housing to obtain a clear view of the target.

Hand tighten the locking screw. Caution; do not over tighten.

Calibration

Swing the viewing head 90 degrees in order to remove sighting port 7

Using CAL - 7 PROBE ASSEMBLY, place thermocouple into the target process area.

Connect K T/C to 950S VIEWING HEAD

Power up system.

Select K T/C TEMP mode. Press STORE.

Allow time for T/C to stabilize. Note temperature on display.

Remove CAL - 7 PROBE ASSEMBLY.

Swing the 950S Viewing Head back into position. (see Figure C)

Air Purge

1 SCFM instrument air flow at the view port.

Minimum 10 SCFM combustion air flow between the valve and the reactor.

Operation

Select TARGET TEMP mode. Press STORE.

Select Emissivity using the PARAMETER SEL button. Use UP/ DOWN buttons to lower the emissivity.

Press STORE. Repeat as necessary until displayed temperature matches the noted temperature of the (K) T/C.

Set ALARM TEMP, FILTER, DEGREES C or F and 0-20 mA or 4-20 mA as required.

INSTALLATION OF THE P905

Installation of the 950S Viewing Head

In order to obtain accurate readings, the minimum field of view of the 950S viewing Head must be filled by the target. The relationship between target size and the separation between the target and the 950S is,

$$\text{Target size} = \frac{\text{separation} + 4}{150} \quad ; \text{units in inches, minimum separation of 14 inches.}$$

For example, if the distance from the front of the 950S Viewing Head to the target is 71" then the target size is 1/2". The 950S Viewing Head will respond to the energy emitted from this region. The region must be of uniform temperature otherwise the 950S Viewing Head will indicate a temperature that is lower than any local hot spots within the region. The local spatial resolution can be increased by moving the instrument closer to the target.

Electrical connection to the 950S Viewing Head is made by way of cable access to the enclosure using standard electrical conduits/fittings and cable glands. The minimum cable should be a 3 conductor communications cable with overall shield.

Once installed, focus the optics by loosening the lens housing locking screw and moving the housing in or out to obtain a clear view of the target area. Hand tighten the screw. Caution; do not over tighten.

Installation of the P905 Remote Display

A minimum of a Nema 4 enclosure is required for outdoor installation unless adverse environmental conditions or area classification dictates.

Electrical connection to the P905 is made by terminat-

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ing the cabling to the screw clamp connectors provided at the base of the P905. Terminate the 950S Viewing Head cable (above). This is the minimum connection necessary for providing simple “readout” operation.

Connect the SELF-CHECK RELAY, HIGH TEMPERATURE ALARM RELAY, and CURRENT as required.

Power Requirements

The P905/950S combination requires +24 VDC, 30W. And -24 VDC, 30W. (See Figure B)

P905 OPERATION

Calibrating the 950S Viewing Head.

The 950S Viewing Head is calibrated using Blackbody sources with emissivity greater than .99. The emissivity of any other source will be less than this, so a field procedure is required in order to determine the emissivity of the surface to be measured.

Proceed as follows:

Connect a K thermocouple to the 950S Thermocouple input.

Insert the thermocouple into the process in the vicinity of the intended target.

Select “K Thermocouple” mode at the P905 Remote Display Panel. Press “STORE”.

Allow sufficient time for the thermocouple to stabilize.

Note the reading on the display. This is the actual process temperature.

Remove the thermocouple and install the 950S Viewing Head. Focus as necessary.

Select “Target Temp” mode at the Panel. Press “STORE”.

Select “Emissivity” using the Parameter “SELECT” button. Use “UP/DOWN” buttons to lower the emissivity. Press “STORE”. Repeat as necessary until the displayed temperature matches the noted temperature of the K thermocouple.

Changing P905 Remote Display Panel Settings.

The P905 Remote Display and Control Panel is divided into four zones. (See Figure D). Purpose and usage of the zones are as follows:

Zone 1: Four Digit Display

During normal operation the display indicates the Target temperature. When other modes are chosen the display shows information relevant to the mode or parameter that is selected.

Zone 2: Display Mode Zone

One of four operational modes can be selected in the Display Mode Zone. Selection is made using the Display Mode “SELECT” button and then pressing “STORE”

MODE 1, TARGET TEMP. Target Temperature sent by the 950S is displayed.

MODE 2, AMBIENT TEMP. The internal temp of the 950S Viewing Head is displayed.

MODE 3, K T/C TEMP. K T/C temp is displayed. (K T/C connected to 950S)

MODE 4, DIAGNOSTICS. 950S internal diagnostic data is displayed.

The AMBIENT TEMP mode automatically returns to the previously selected temperature mode after displaying the ambient temp for five seconds. The diagnostics mode also returns to the previously selected temperature mode once all of the diagnostic data has been displayed.

Zone 3: Status Zone

There are four LED indicators in the status zone.

READY: Indicates that the 950S is operating within its normal parameters. There is a warm up delay of one to two minutes on power up. The SELF-CHECK ALARM contacts are open when the system is not in the READY condition.

SELF-CHECK: Indicates that operating parameters and data integrity have been verified. The indicator flashes once per second at the end of the automatic SELF-CHECK cycle. A SELF-CHECK failure causes the SELF-CHECK ALARM contacts to open.

TARGET ALARM: Indicates that the TARGET temperature is above the alarm set point. A TARGET ALARM causes the TARGET ALARM contacts to open.

AMBIENT ALARM: Indicates that the internal temperature of the 950S has exceeded the safe operating limits of 32° F - 122° F (0° C to 50° C). An AMBIENT ALARM causes the SELF-CHECK ALARM contacts to open.

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Zone 4: Parameter Zone.

Six adjustable parameters are available in the Parameter Zone. Selection is made by pressing the Parameter "SELECT" button. An LED indicates which parameter has been selected. The current parameter value is shown on the display. Adjust the parameter using the "UP/DOWN" buttons.

Press the "STORE" button to save the new parameter value.

EMISSIVITY: This parameter is adjusted to correct for the emissivity of the target. Refer to the section on "Calibrating the 950S Viewing Head" for

calibration procedure.

ALARM TEMP: Adjusts the set point for the HIGH TEMPERATURE ALARM.

FILTER: Selects one of ten time constants used for filtering the temperature output of the 950S Viewing Head. The same time constant is used for filtering the P905's current loop output.

DEG. C OR F: Sets the display units to degrees in Fahrenheit or Celsius.

0-20 OR 4-20: Selects the current loop output range. The temperature to current transfer functions are,

- i) 4-20, $\text{current} = ((\text{temp} - 50) / 100) + 4 \text{ mA}$.
- ii) 0-20, $\text{current} = ((\text{temp} - 50) / 80) \text{ mA}$.

PANEL LOCK : This feature is used to prevent undesired changes to the operating parameters. When activated, the PANEL LOCK LED will be on. The current parameter settings can be checked, but not changed. The Display Mode will be locked to TARGET TEMP or K T/C TEMP, whichever was selected before the panel was locked. AMBIENT TEMP and DIAGNOSTIC modes are not locked out. Contact IRIS Systems for information on the panel lock procedure.

Power Up Options.

There are three options available as follows:

- 1) After the power is applied, the P905 runs a power-up sequence to test the Display and Indicator LED's. Verify that all elements illuminate correctly. The sequence proceeds with a count down from nine to zero and then displays the Panel ID, P905, the Viewing Head ID, H950, the Panel location number, id N, and the software rev number, r 1.0. The last step in the sequence is the contact number for IRIS SYSTEMS. The sequence can be aborted by pressing the Display Mode "SELECT" button after the count down has finished.

- 2) The operating parameters can be pre-loaded with Factory Default Settings. Proceed as follows,
 - i) Remove power.
 - ii) Wait five seconds.
 - iii) Press and hold both the Parameter "SELECT" and "STORE" buttons.
 - iv) Apply power while still pressing the Parameter "SELECT" and "STORE" buttons.
 - v) Wait for "def" to be displayed.
 - vi) Release the buttons.
 - vii) Press "STORE".

The system will automatically load the Factory Default Settings.

The Factory Default Settings are,

- | | |
|--------------------|---------------|
| i) Emissivity | 1000. |
| ii) Alarm Temp | 1650° C. |
| iii) Filter | 0, no filter. |
| iv) Deg C or F | Deg C. |
| v) 0-20 or 4-20 mA | 4-20 mA. |
| vi) Panel Lock | Unchanged. |

SYSTEM DIAGNOSTICS

The P905 performs an automatic System Diagnostic self-check. During normal operation, the READY led will be on, the SELF - CHECK led will be flashing once per second, and the SELF - CHECK ALARM contacts will be closed. If an error is detected during the self-check cycle or the diagnostic cycle then the READY led will be off, the SELF - CHECK led will stop flashing and the SELF - CHECK ALARM contacts will open. If accurate temperature data is available then the temperature and current loop outputs will continue to function.

The automatic diagnostic cycle is performed once every two minutes. The cycle can also be manually initiated by selecting DIAGNOSTICS mode. The DIAGNOSTICS led will be on during the cycle. The 950S internal temperature is automatically checked once every minute. The internal temperature check can be manually initiated by selecting "AMBIENT TEMP" mode. The AMBIENT TEMP led will be on during the cycle. During normal operation, the DIAGNOSTIC led and the AMBIENT TEMP led will flash when their respective automatic cycles are running.

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Operations personnel can verify that the P905 is operating correctly by confirming that the READY led is on, the SELF - CHECK led is flashing and that the AMBI-ENT ALARM and TARGET ALARM leds are off. It is a much better and highly advisable practice to monitor the SELF - CHECK ALARM contacts with a higher level control system. If the higher level system detects that these contacts have opened then the plant control centre will be informed of the failure immediately. This is the safe and recommended way of operating the P905.

Diagnostic results are shown on the P905 display by selecting the DIAGNOSTICS mode. A simple "PASS/FAIL" indication is given for each operational check (OP CODE). More detailed information for OP CODES five through ten is given by pressing the Parameter SEL button after the diagnostic function begins. The OP CODE designations are shown in the table below.

	OP CODE	DIAGNOSTIC FUNCTION
0	ERR1	Communications Failure. Display will automatically show "FAIL/ERR1"
1	OP1	Ready. All systems GO, information correct.
2	OP2	Ambient Alarm. 950S internal temperature.
3	OP3	Current Loop Terminated.
4	OP4	K T/C Connected. Self-Check contacts open only if K T/C mode is selected.
5	OP5	Chopper Motor Speed. 3300 - 3520 RPM. Ideal = 3413 RPM, 512Hz.
6	OP6	Chopper Motor Current. 15 - 60 mA . Ideal = 25 mA.
7	OP7	Chopper Motor Drive. 5% - 98%
8	OP8	Detector Cooler Thermistor Value. 40 – 60. Ideal = 50
9	OP9	Detector Cooler Drive. 0% - 98%
10	OP10	Main Amplifier Offset. 312 – 712. Ideal = 512

NOTES: OP CODE 4 is useful for detecting a burned out thermocouple during bake out. A preventative maintenance cycle can be developed by recording the data for OP CODES five through ten at regular intervals.

Additional Notes

THEORETICAL BACKGROUND

The emission of infrared energy by hot objects is an important phenomenon that was studied during the later part of the 19th and early part of the 20th centuries. Various mathematical models were tested for their ability to correctly predict the intensity of infrared emissions as a function of temperature and wavelength. The research used information gathered from Maxwell's radiation theory as well as the laws derived by Stefan, Boltzmann, Wein, Rayleigh, and Jeans. In 1900,

Max Planck formulated his radiation law that serves as the theoretical foundation for understanding and measuring the energy emitted by an object. Some of the aspects of Planck's theory are:

- A) Electromagnetic energy is emitted by all objects. Emission occurs for temperatures all the way down to absolute zero. (-459° F or -273° C)
- B) The emissions include infrared wavelengths that are associated with temperature.
- C) The intensity of the radiated energy is proportional to the objects temperature.
- D) The intensity is also proportional to the objects composition. Radiative efficiency is described by an objects "emissivity". Emissivity is given as a number between zero and one. A "Blackbody" is a perfect absorber/emitter and has emissivity equal to one.

Pyrometers are instruments that infer an objects temperature by measuring the amount of infrared energy emitted from the surface of the object. Development research for the P905 was conducted with due emphasis placed on the peculiarities of infrared emission. An accurate and dependable measurement technique was proposed, designed, and tested over a three year period. Standard instrument design cycles were employed throughout the process – from lab to prototype to final production.

The P905 performs an absolute measurement of temperature. Calibration with a known radiative source is required as a final manufacturing step. The calibration is performed with the aid of NIST traceable Blackbody Radiators that have an emissivity above .99. Results of the calibration procedure are permanently stored in each instrument in non-volatile EEPROM memory.

For those interested, most of the theory can be found

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in a book that has earned industry acceptance as the preferred source of information regarding infrared instrumentation,

“THE INFRARED HANDBOOK”, edited by Wolfe and Zissis, prepared by the Infrared Information Analysis Center for the Office of Naval Research, Department of the Navy, 1978, 1985, 1989.

CONTACT INFORMATION

For further information contact:

Sales and applications support:

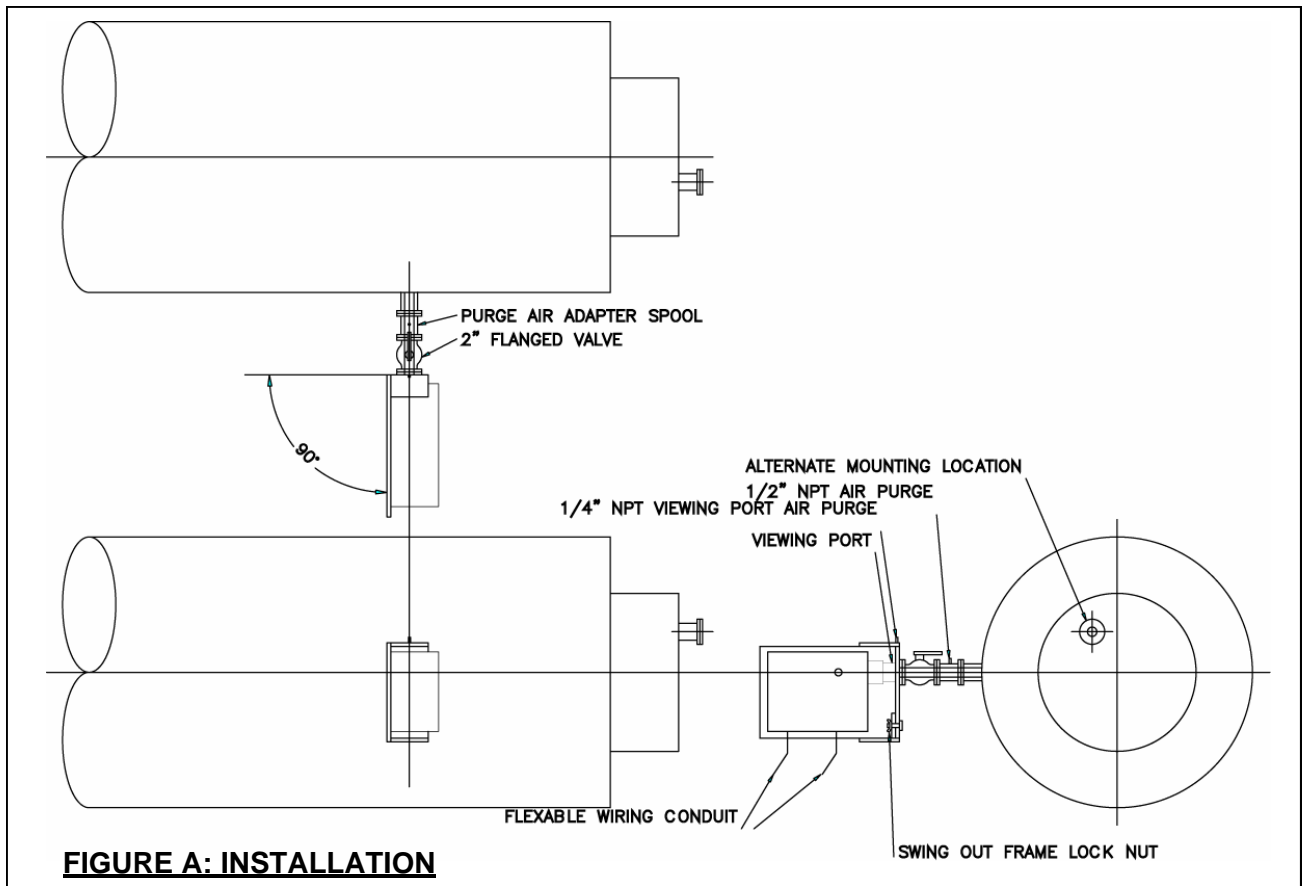
IRIS Systems Inc.
#205, 19138 26th Ave.
Surrey, B.C. V3S 3V7
Canada

Ph. 800-667-IRIS, FAX 604-581-9790
email: flame@iris-systems.com
Web: www.iris-systems.com

Factory and repairs:

IRIS SYSTEMS INC.
(JB Systems, Inc.)
4944 113th Avenue N
Clearwater, FL 33760

Ph. 727-545-3900, FAX 727-547-9589



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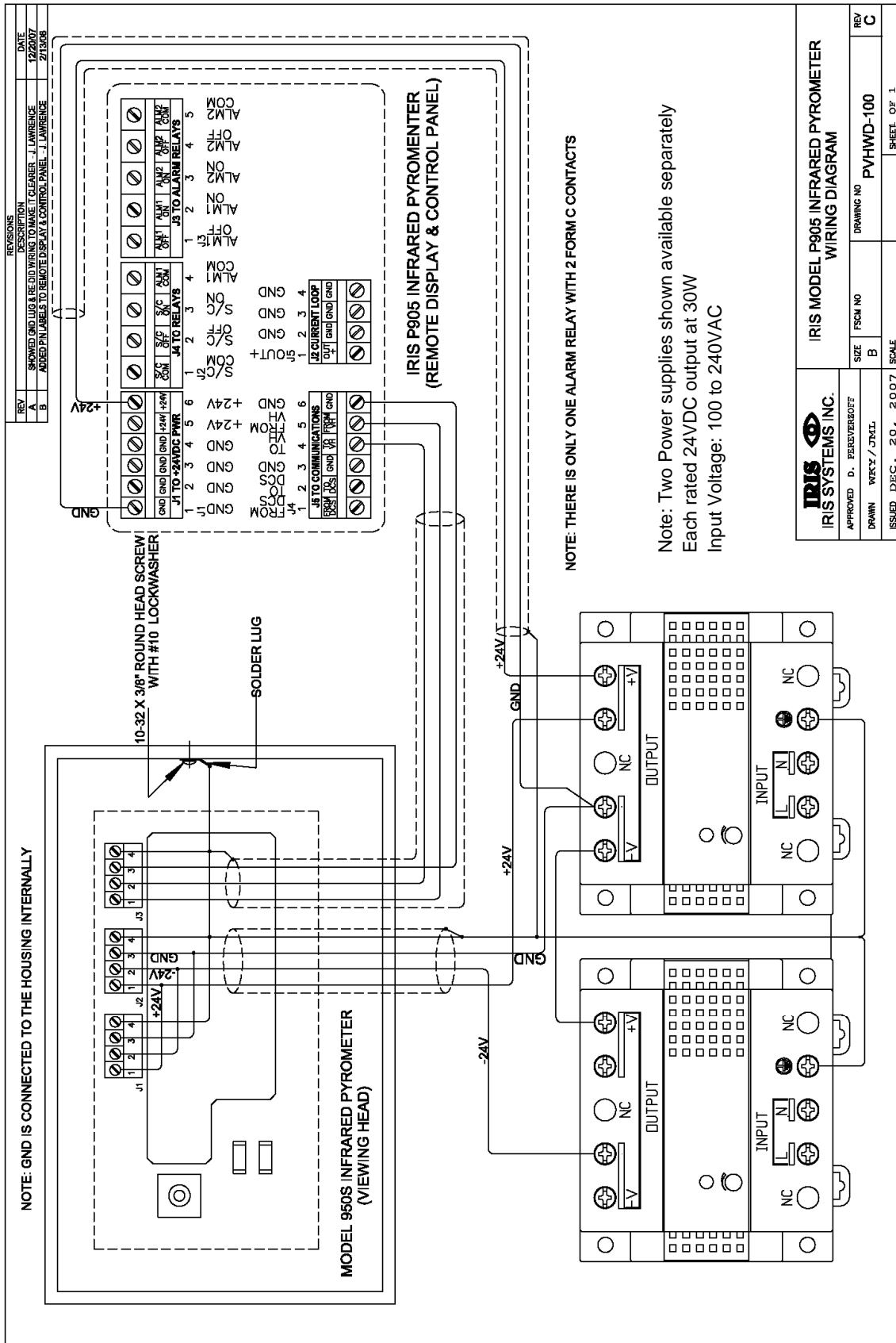
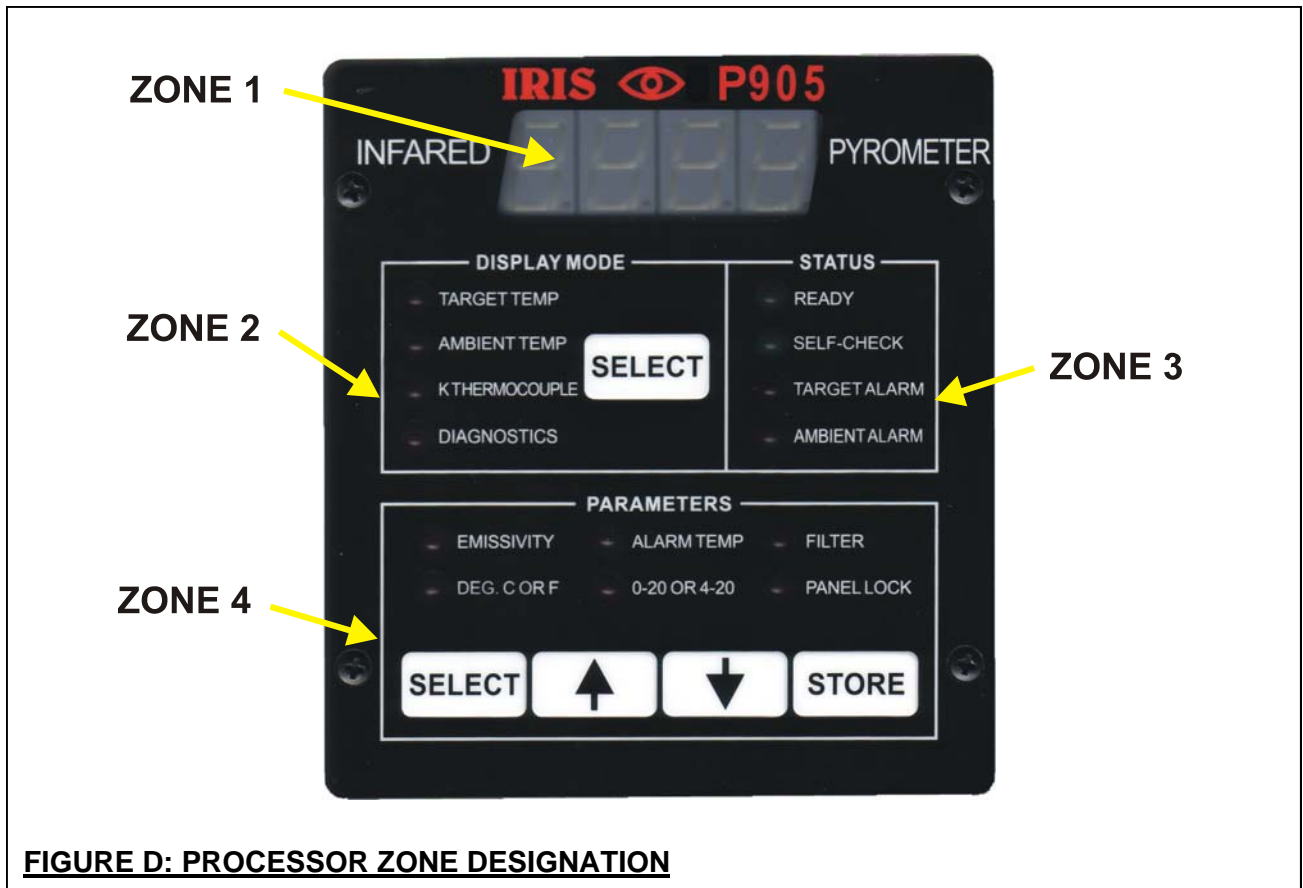
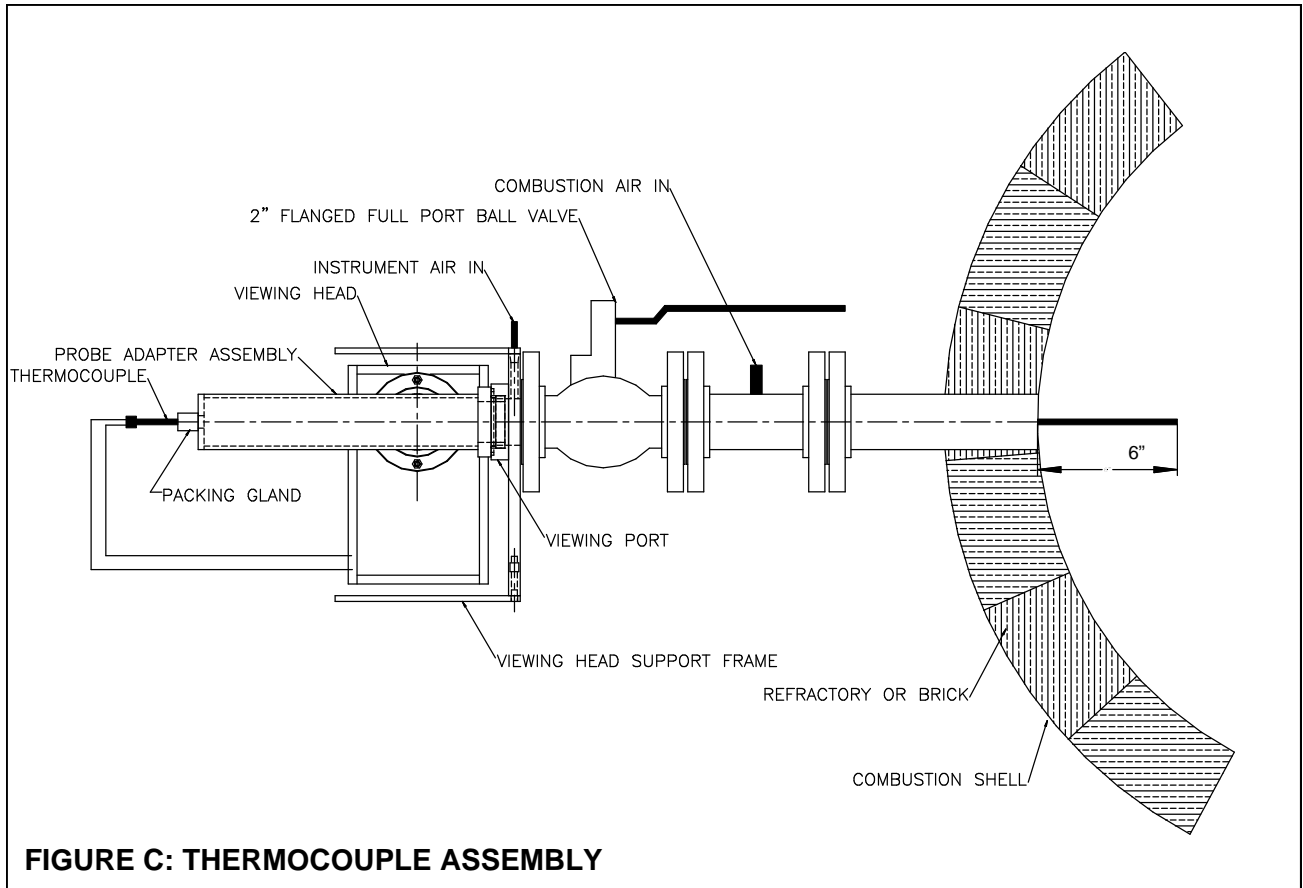


FIGURE B: WIRING DIAGRAM



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P905 AND 950S SPECIFICATIONS

TEMPERATURE MEASUREMENT

Infrared

RANGE	Standard, 180° to 1650° C, 356° to 3000° F. Optional extended range to 2500° C, 4530° F.
ACCURACY	Calibrated to +/-1% over full temperature range.
RESOLUTION	.05 Degree internal. 1 Degree on P905 Remote Panel.
REPEATABILITY	< 1% over full range.

Thermocouple

RANGE	-50° to 1250° C, -58° to 2282° F.
LINEARIZATION	Thermocouple table loaded in non-volatile memory.
ACCURACY	Calibrated to +/-1% over full temperature range using traceable K T/C.
RESOLUTION	.02 Degree internal. 1 Degree on P905 Remote Panel.
REPEATABILITY	< 1% over full range.

OPTICAL

TARGET RANGE	14 in., (355.6 mm) to infinity.
FIELD OF VIEW	.382 degrees = .080 in. per ft. or 6.667 mm per m.
TARGET SIZE	TARGET (in.) = (separation + 4) / 150. TARGET (mm) = (separation + 101.6) / 150.

These are the specifications for the standard 950S. Other optical specifications are available. Consult factory.

ANALOG OUTPUT

METHOD	Continuously proportional, Industry Standard current loop generator with internal loop power supply, lower and upper range output limiters, and loop failure alarm.
RANGE	0 – 20 mA, or 4 – 20 mA, operator selectable.
ACCURACY	+/- .15 %.
RESOLUTION	16 BIT, (.0015 %).
TERMINATION	600 Ohms maximum loop resistance.

DIGITAL OUTPUT

P905 REMOTE PANEL	4 Digit Display, 1 degree resolution.
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RESPONSE TIME

950S VIEWING HEAD	Standard 170 ms internal response time.
P905 REMOTE PANEL	1 second updates at end of Self - Check cycle.

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FILTERING

DIGITAL, LOW PASS 1 to 32 second time constant, operator selectable.

RELAY OUTPUTS

SELF - CHECK RELAY 1 Form C contact, 2 Amp, 30 VDC.

HIGH TEMPERATURE ALARM RELAY 2 Form C contacts, 2 Amp, 30 VDC.

OPERATING TEMPERATURE

950S VIEWING HEAD
-40° to 55° C, -40° to 130° F No internal heater.
-55° to 55° C, -67° to 130° F Internal Heater, Option 1.
Upper limit increased to 85° C, 185° F with water jacket.

P905 REMOTE PANEL -40° to 55° C, -40° to 130° F No heating or cooling required.

ELECTRICAL REQUIREMENTS

Power supply

P905/950S COMBINATION +/- 24 VDC, 30 WATTS.

950S HEATER OPTION 1 115 VAC, 150 WATTS.

Cable

P905 TO 950S 3 conductor, 16 gauge, with overall shield. 300 V, PVC.

AC MAINS FOR 950S OPTIONAL HEATER. 3 conductor, 16 gauge, 300 V, PVC. Such as Belden-M-8618

COMMUNICATIONS

950S VIEWING HEAD TO P905 REMOTE PANEL RS-232, 2400 bd., full duplex.

AREA CLASSIFICATION

905S Viewing Head

STANDARD Aluminum NEMA 4/x enclosure, GENERAL CLASS.

P905 Remote Panel

STANDARD Aluminum case, GENERAL CLASS

OPTION 1 NEMA 4, windowed enclosure, GENERAL CLASS.

OPTION 2 CI 1, Div 1, Gr B, C, D with window.