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User's Guide

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ALUMINUM CASE - OS550AM (OPTIONAL)

OS550A/OS550AM/ OS550A-BB Series Industrial Infrared Thermometer/Transmitter

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OS550A or OS550A-BB Series Infrared Thermometer with Sensor Head (1)
RS-232 Cable with connector/adapter (OS552A, thru OS555A) only (1)
CD Software (OS552A, thru OS555A) only (1)
User's Guide (1)
Optional Accessories:

Model No.	Description
OS550-MN	Mounting Nut
OS550-MB	Mounting Bracket
OS550-AP	Air Purge Collar
OS550-MF	Mounting Flange
OS550-WC	Water Cool Jacket
OS550-LS	Laser Sight
PSS-12	Power Supply, 12V regulated
PSR-24S	Reg. 24 Vdc Power Supply Screw Terminals
PSR-24L	Reg. 24 Vdc Power Supply Stripped Leads
WRS232-USB	Wireless RS-232 Transceiver
OS550A-PCAB-15	Power/output cable connector 15 ft
OS550A-PCAB-100	Power/output cable connector 100 ft

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CAUTION & SAFETY INFORMATION

If the equipment is used in a manner not specified in this manual, the protection provided by the equipment may be impaired.

The Installation category is one (1).

The output terminals of this product are for use with equipment (digital meters, chart recorders, etc.) which have no accessible live parts. Such equipment should comply with all the applicable safety requirements.

Do not operate the equipment in flammable or explosive environments.

The unit comes with two 4.6 m (15') shielded multi-conductor cables. The sensor cable is a five conductor, 24 AWG stranded wire with a rating of 600 Vdc, 205°C (401°F) PTFE insulation. The power/output cable is an eight conductor 24 AWG stranded wire with rating of 300 Vdc, 105°C (221 °F) PVC insulation.

Power must be disconnected before making any electrical connections.

The recommended power supply should be VDE or UL approved. Rating: 8-24 Vdc @ 100 mA minimum power with overload protection, current limited to 500 mA.

The supply voltage to the transmitter should not exceed 24 VDC.

There is only one fuse in the OS550A. Disconnect power before replacing the fuse. The fuse must be replaced with one of identical size and rating. Fuse Specifications: 125 mA/250 Vac, Time-lag, 5 x 20 mm with UL and/or VDE Approvals such as Wickmann No. 19195-028.

All connections made to the thermometer should be made via a stranded wire, shielded cable, 24 AWG (min), such as OMEGA Engineering's Model TX4 or TX8 series. Wiring requirements for this unit are Class II.

SAFETY WARNINGS AND IEC SYMBOLS

This device is marked with international safety and hazardous symbols in accordance with IEC1010. It is important to read and follow all the precautions and instructions in this manual before operating or commissioning this device as it contains important information relating to safety and EMC. Failure to follow all the safety precautions may result in injury and/or damage to your equipment.

IEC Symbol	Description
	Caution - Refer to the accompanying document(s).
	Direct Current
	Laser Symbol

1.1 Introduction

The OS550A Series Industrial Infrared (IR) Thermometers provide non-contact temperature measurement up to 4500°F (2482°C). They offer effective solutions for many non-contact temperature applications, including the following:

- **Predictive Maintenance:** Tracking temperature shifts which indicate pending failure in solenoid valves.
- **Energy Auditing:** Locating wall insulation voids to reduce building heating costs.
- **Food Processing:** Taking accurate temperature readings without direct contact with the food or packaging material.
- **Annealing Processing:** Monitoring surface temperatures of metals while it is inside an oven by seeing through glass window.

The IR thermometer provides a custom backlit dual digital LCD that displays both current and minimum, maximum, average or differential temperatures. This versatile instrument provides:

- Measurable target distances from 5 inches (12.7 cm) to approximately 200 feet (61 m)
- Emissivity adjustable from 0.1 to 1.00 in 0.01 steps provides ease of use when measuring a variety of surfaces.
- Continuous temperature measurement up to 10 times per second.
- Audible and visual alarms. The high and low alarm points are set via the keypad.
- Analog output, 1 mV/degree, 4-20mA or 0-5VDC which allows interfacing with data acquisition equipment (including chart recorders, data loggers and computers)
- Two way RS232 serial communication to a PC. This allows downloading data for further analysis (OS552A, OS553A and OS554A, OS555A).
- Ambient target temperature compensation. This provides more accuracy for measuring low emissivity targets.
- Record up to 800 temperature data points either continuos or on demand. Review the recorded data on the thermometer LCD, as well as downloading the data to a PC (OS553A and OS554A, OS555A).
- Backlit display useful in low ambient light conditions
- Laser Sighting is optional.
- High and Low Alarm outputs to drive external Mechanical Relays

1.2 Thermometer Features

The thermometer is easy to use:

- Temperature readings are switchable from °F to °C via the keypad.
- Parameters, such as target material emissivity and alarm setpoints, can be set and remain in non-volatile memory until reset.

This instrument has a rugged and functional design, including:

- Sealed keypad display.

Table 1-1. OS550A Series Industrial Infrared Thermometer Features

Features	OS551A	OS552A	OS553A	OS554A	OS555A
Accuracy*	±1% rdg	±1% rdg	±1% rdg	±1% rdg	±1% rdg
Range	-10 to 750°F (-23 to 400°C)	-10 to 1000°F (-23 to 538°C)	-10 to 1600°F (-23 to 870°C)	0 to 2500°F (-18 to 1371°C)	1000 to 4500°F (538 to 2482°C)
Emissivity	adjustable	adjustable	adjustable	adjustable	adjustable
Backlit Dual Display	standard	standard	standard	standard	standard
Distance to Spot Ratio	See Field of View Charts, pages 3-4, 3-5, 3-6, 3-7				
Differential Temperature	standard	standard	standard	standard	standard
Min/Max Temperature	standard	standard	standard	standard	standard
Average Temperature	standard	standard	standard	standard	standard
High Alarm	standard	standard	standard	standard	standard
Low Alarm	–	standard	standard	standard	standard
Ambient Target Temperature Compensation	–	standard	standard	standard	standard
RS-232 Interface	–	standard	standard	standard	standard
Data Storage	–	–	standard	standard	standard
Audible Alarm & Output	standard	standard	standard	standard	standard
Analog Outputs	1 mV/Degree or 0/5 Vdc or 4/20 mA				

*or 3°F whichever is greater - 2% of rdg for temps > 2000°F on OS555A

1.2.1 Display Details

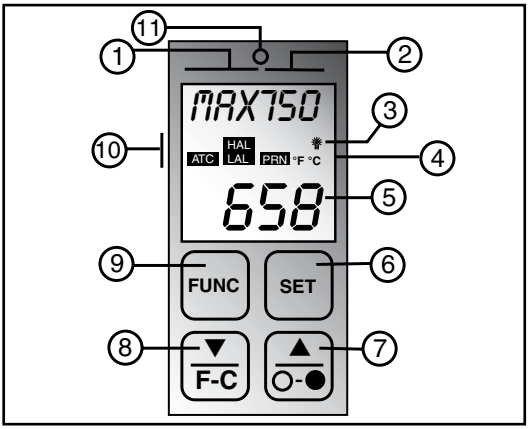


Figure 1-1. Display and Keypad View

Table 1-2. Display Details

Key	Description
1	Display Mode displays one of the following: **E** (Emissivity) **HAL** (High Alarm Setpoint) **MAX** (Maximum Temperature) **LAL** (Low Alarm Setpoint - OS552A thru OS555A) **MIN** (Minimum Temperature) **AMB** (Ambient Target Temp - OS552A thru OS555A) **dIF** (Differential Temperature) **PRN** (Print Data - OS552A, thru OS555A) **AVG** (Average Temperature) **MEM** (Store Temperature Data - OS553A thru OS555A) **LOG** (Log Temp Data- OS553A thru OS555A)
2	Data associated with one of the Display Modes
3	Backlighting Icon - allows the display to be viewed under low ambient light
4	Displays the units of measure in either °F or °C
5	Main display - displays the current temperature
6	Enables or Disables alarms or LOG. Resets MAX, MIN, DIF,AVG, temperatures
7	▲ for incrementing data; O-● is for turning on/off the backlighting
8	▼ for decrementing data; °F-°C is for changing the units of measure from °F to °C or vice versa
9	Function key for scrolling through the display modes
⑩	Display Icons ATC Ambient Target Temperature LAL Low Alarm HAL High Alarm PRN Data Transmisson thru RS232
⑪	High or Low Alarm condition LED

1.2.2 Parts of the Thermometer/Transmitter

Figure 1-2.
OS550A/OS550AM/OS550A-BB Series Industrial Infrared Thermometer Front View

The display is shown in more detail in Figure 1-1 and described in Table 1-2.
Note: There are no user-serviceable parts in the thermometer.

2.1 Installation

2.1.1 Sensor Head Installation

The OS550A's sensor head is made of black anodized aluminum. Both ends of the sensor head come with a 1½ - 20 standard threaded mounting connection. The sensor head is connected to the main display electronics via a 15' shielded cable and environmentally sealed twist lock connector. Mounting accessories are available. See page 2-2 for sensor head dimensions.

NOTE

If the sensor head is used in an environment where the ambient temperature is above 122°F (50°C), the water cool jacket accessory (OS550-WC) must be used to maintain accuracy and prevent damage to the sensor head. See Chapter 3.1.

2.1.2 OS550A Series NEMA Plastic Housing Installation

The OS550A Series' main display and electronic's housing is environmentally sealed and weather tight. Mounting ears are provided making mounting easy. Mount the main electronics assembly in a location that you can easily access to view the LCD and make program changes to the unit. See case and mounting plate dimensions on page 2-3.

2.1.2A OS550AM Series NEMA Aluminum Housing

The OS550AM Series is available in a NEMA Aluminum Housing as an option. Refer to figure 2-2A for case and mounting hole dimensions.

2.1.3 OS550A-BB OEM Style Display Installation

The main display and electronics assembly is provided with an aluminum mounting plate making installation of this OEM style system economical and easy to customize. Assembly should be mounted in a location that is free of dirt, grease, oils, and other liquids. See mounting dimension on page 2-5.

2.2 Sensor Head Dimensions

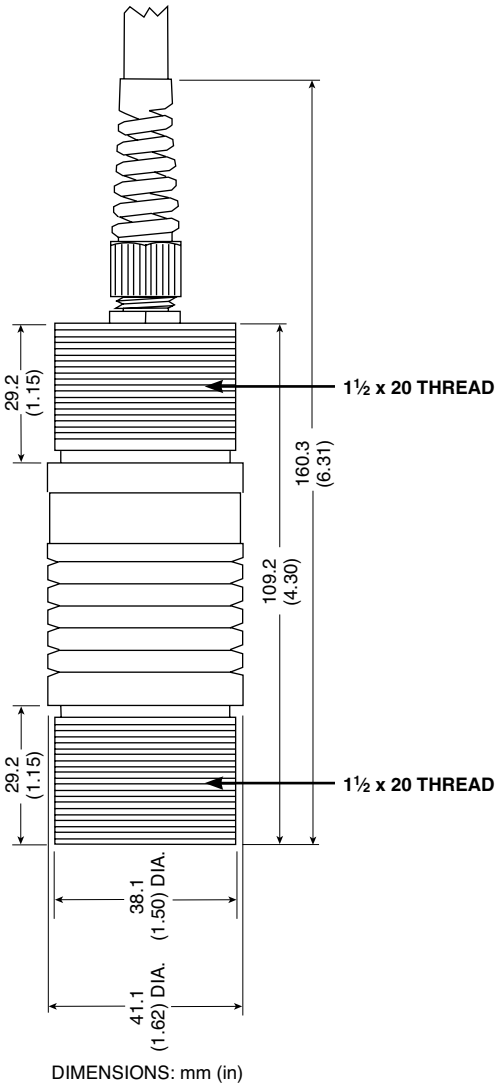


Fig. 2-1. Sensor Head Dimensions

2.3 OS550A Main Display Standard Plastic Housing Dimensions

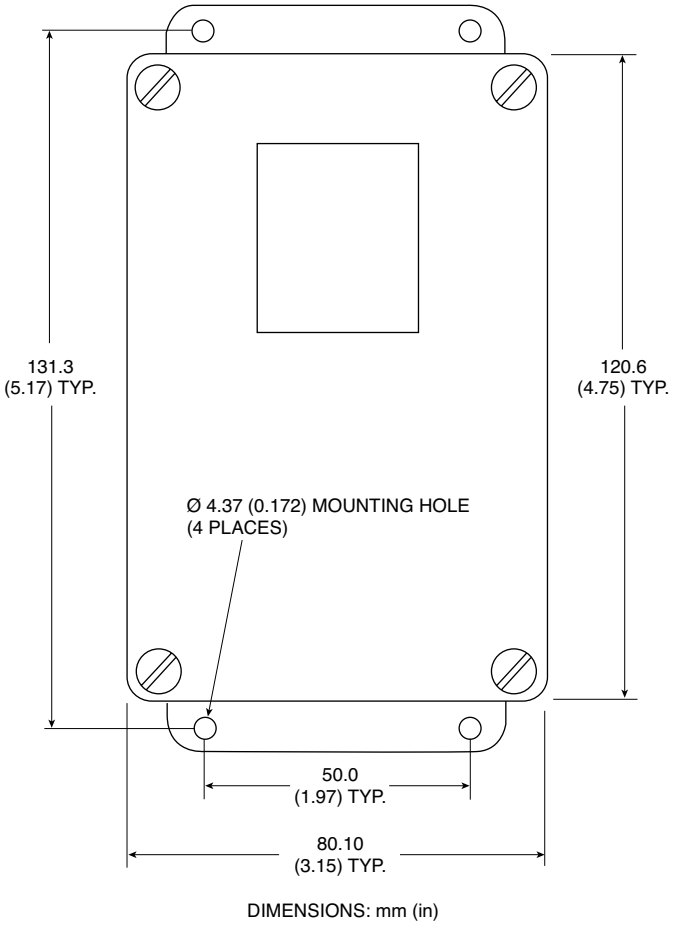


Fig. 2-2. Plastic Housing Dimensions

2.3A OS550AM Aluminum Housing Dimensions

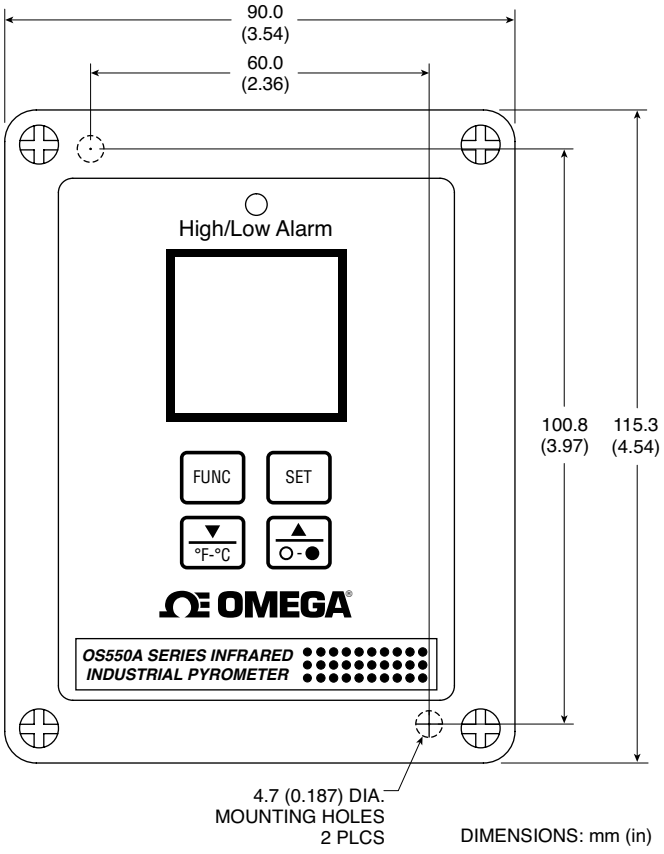


Fig. 2-2A. Aluminum Housing Dimensions

2.4 OS550A Display Electronics Dimensions

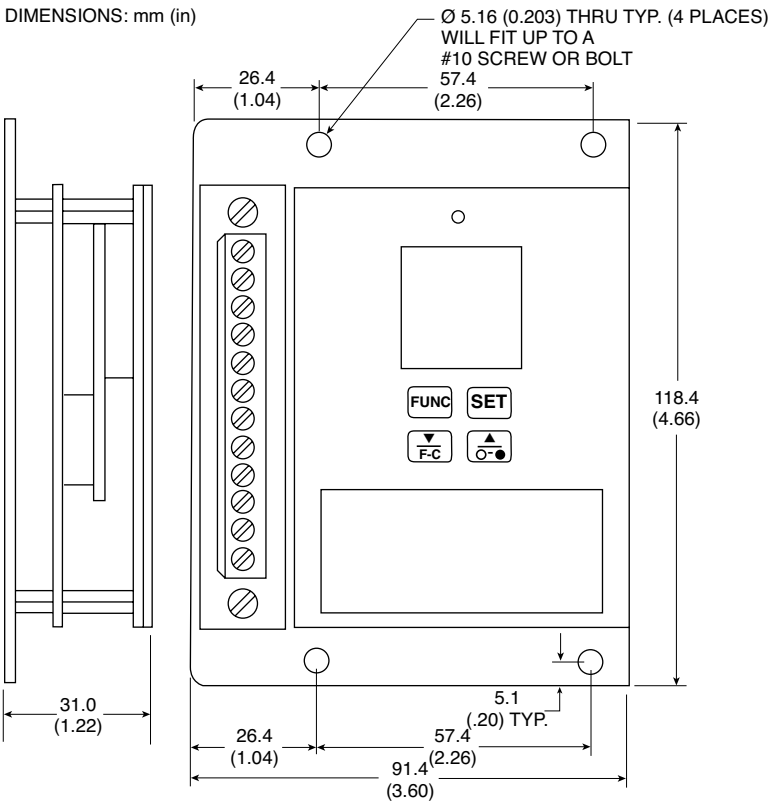


Fig. 2-3. OEM Style Main Display with Mounting Plate

2.4 Mounting Bracket Dimensions (OS550-MB)

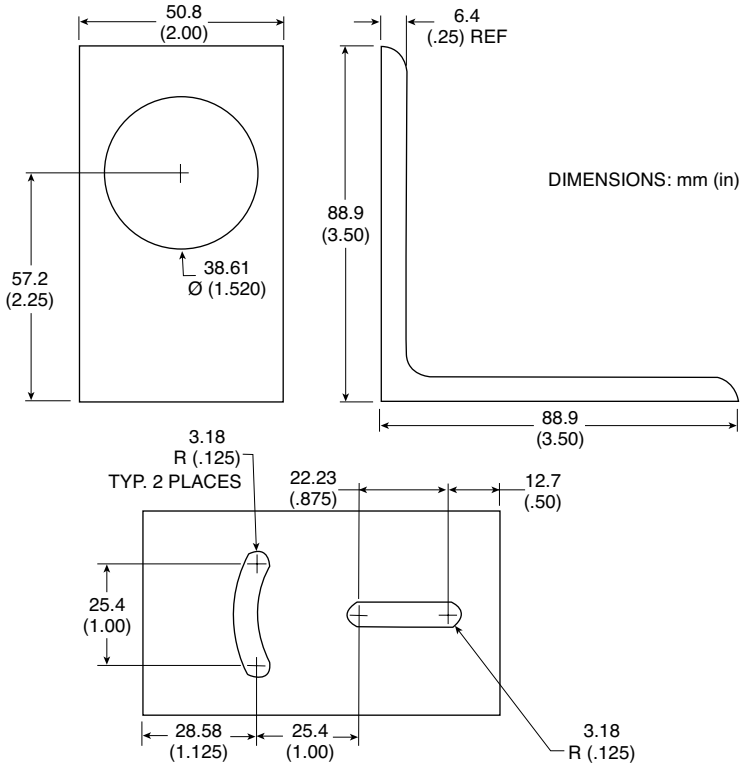


Fig. 2-4. Mounting Bracket Dimensions

2.5 Mounting Nut Dimensions (OS550-MN)

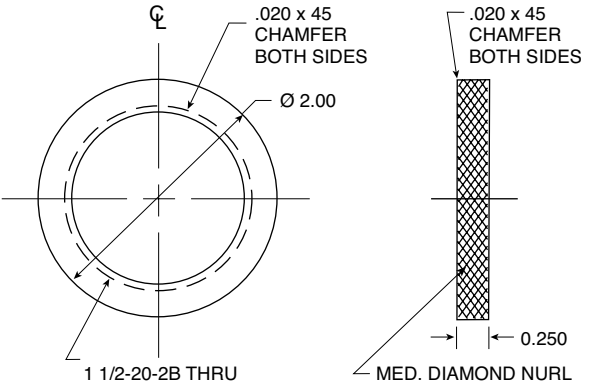


Fig. 2-5 Mounting Nut Dimensions

2.6 Mounting Flange Dimensions (OS550-MF)

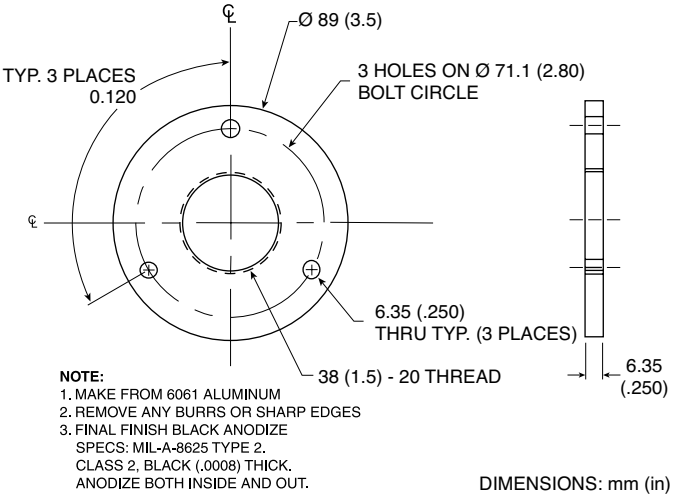


Fig. 2-6 Mounting Flange Dimensions

2.7 Air Purge Collar Dimensions (OS550-AP)

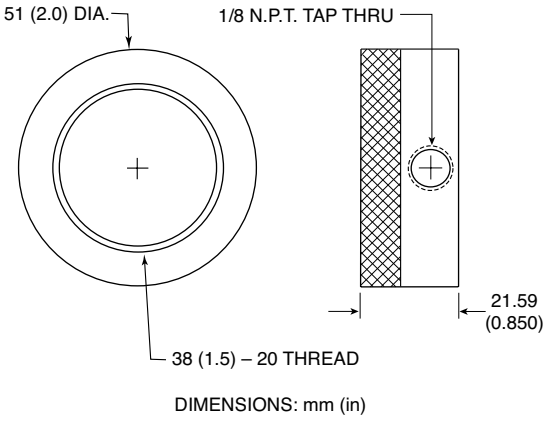


Fig. 2-7 Air Purge Collar Dimensions

Notes

3.1 Using the Infrared Thermometer

3.1.1 Water Cool Jacket Accessory

When using the OS550A sensor head in an ambient temperature environment above 50°C (122°F), the OS550-WC Water Cooling Jacket option must be used to maintain the accuracy and response time of the unit. Two ⅛" N.P.T. compression fittings are provided for connection to copper water lines. A constant flow of approx. 0.5 GPM of clean, room temperature water is sufficient to protect the instrument and maintain accuracy up to 85°C (185°F). This option can be installed in the field.

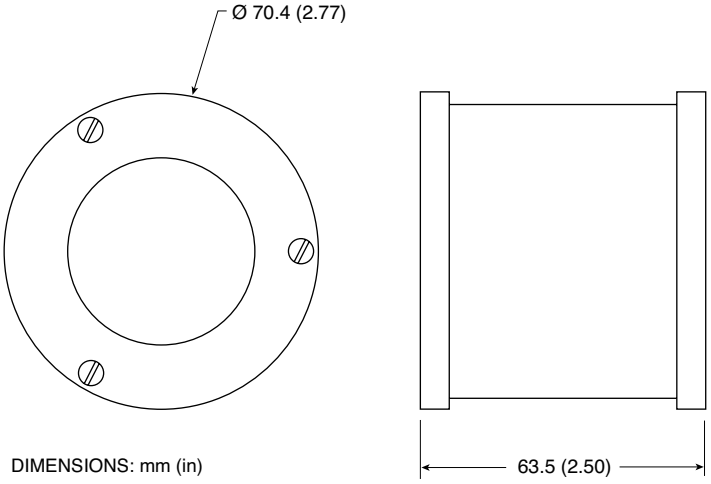


Fig 3-1. Water Cool Jacket Dimensions (OS550-WC)

3.2 How To Wire the Thermometer

3.2.1 OS550A Series Cable Connection

The OS550A Series thermometer comes with a built-in 4.5 m (15') sensor cable and power/output cable. Plug in the two cables to the mating connectors on the Enclosure. Power and output connections are made to the cable via stripped wire ends located at the other end of the cable. The power/output cable can be shortened or extended in the field if needed. See table 3-1 below for wire Connection.

Cable Wire	Connection	
Red	+ Power Input	} 8-24 Vdc
Black	– Power Input	
White	+ Analog Output	} 1mV/Deg, 0/5 Vdc 4/20 mA
Green	– Analog Output	
Yellow	High Alarm Output	
Blue	Low Alarm Output	
Orange	No Connection	
Shield	Earth Ground	

Note: Power Input and Analog output share the same common ground.

Table 3-1 Power/Output Cable Connection

3.2.2 OS550-BB Series Terminal Block Wire Connections

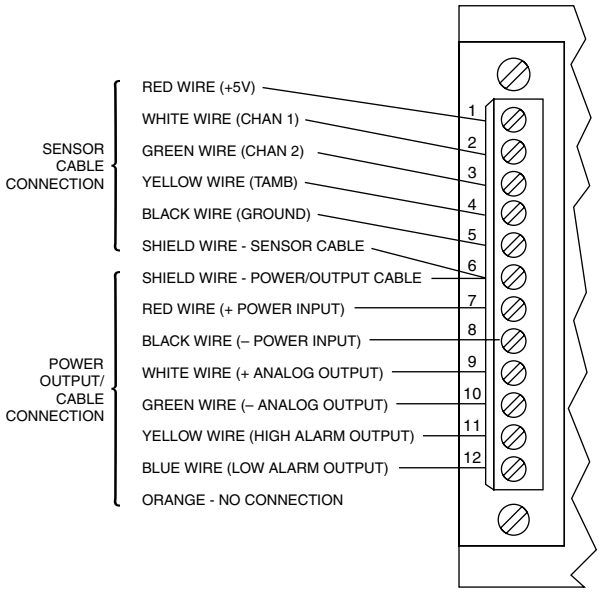


Figure 3-2. OS550A-BB Wire Connection

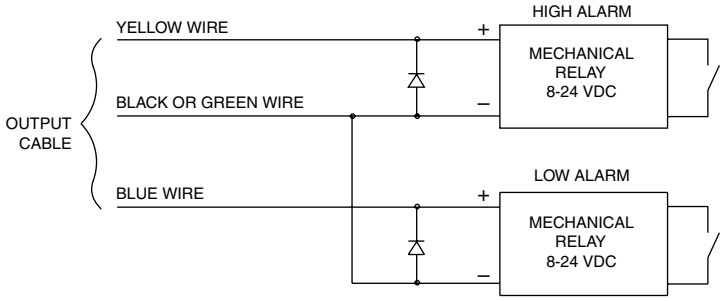


Figure 3-3. External Relay Wiring Diagram

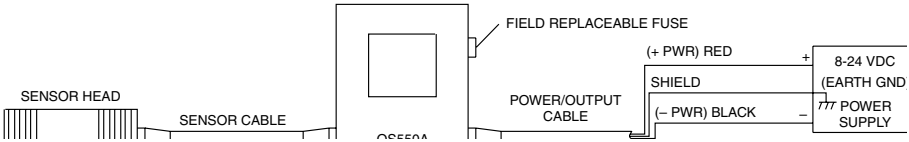


Figure 3-4. Typical Transmitter Installation

3.3 Operating The Thermometer

1. After installing the thermometer (see section 2.1) and connection for sensor cable and power/output (see section 3.2), your unit is ready for use.
2. The optical field of view of the thermometers sensor head should fall within the area of the target being measured. See Figure 3-2. Figures 3-3 through 3-8 show the fields of view vs. distance for the various thermometers.

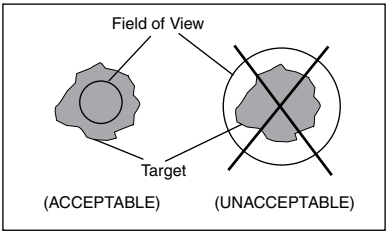


Figure 3-5. Field of View Positions

3. The target temperature and emissivity are displayed on the LCD. Determine the emissivity of the target (refer to Appendix B).

   Press the ▲ key to increment the target emissivity.

   Press the ▼ °F·°C key to decrement the target emissivity

3.3.1 Field of View Charts

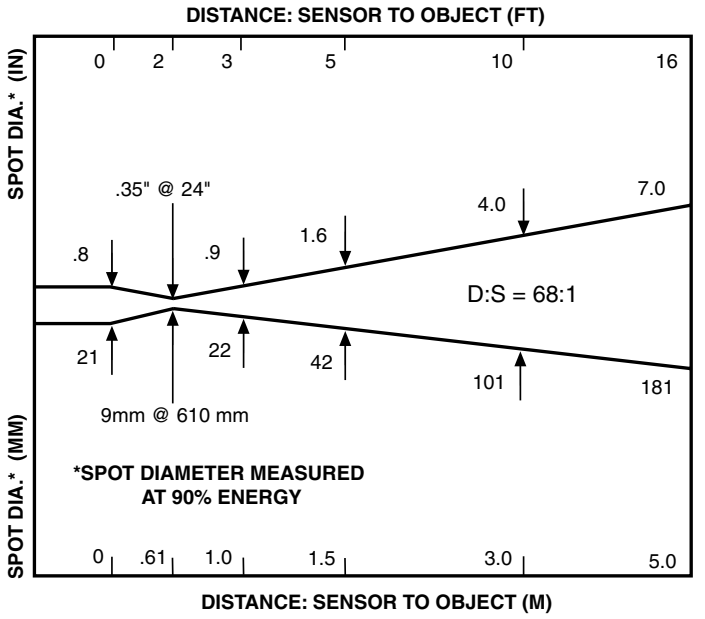


Figure 3-6. OS550A Series (-1 FOV)

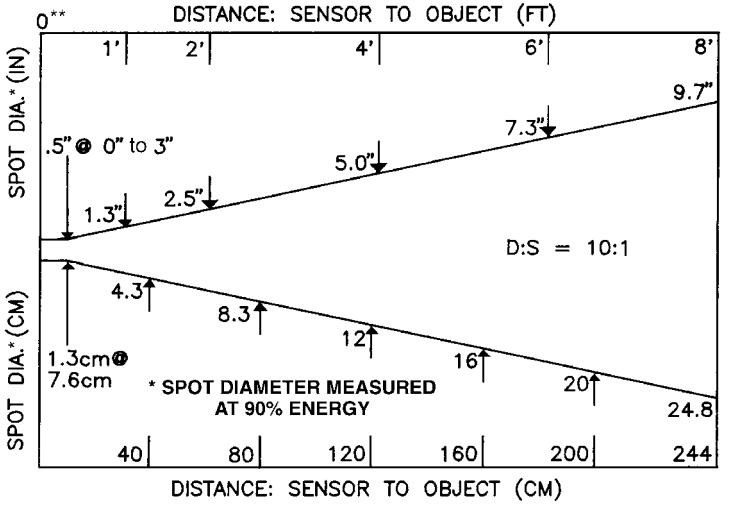


Figure 3-7. OS550A Series (-2 FOV)

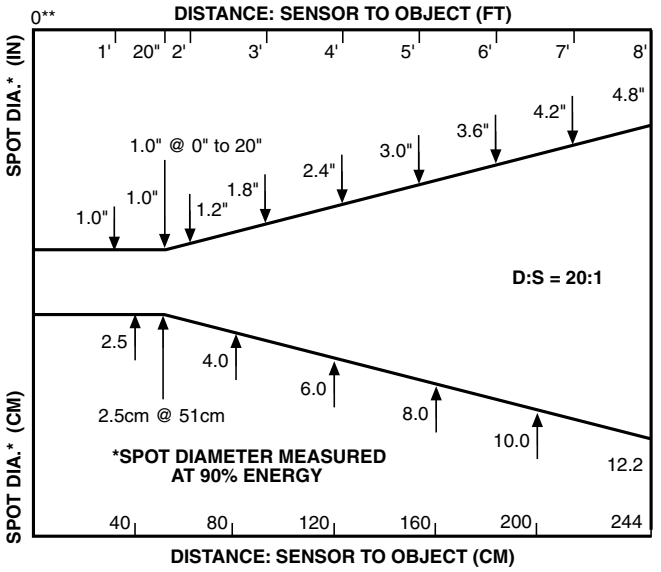


Figure 3-8. OS550A Series (-3 FOV)

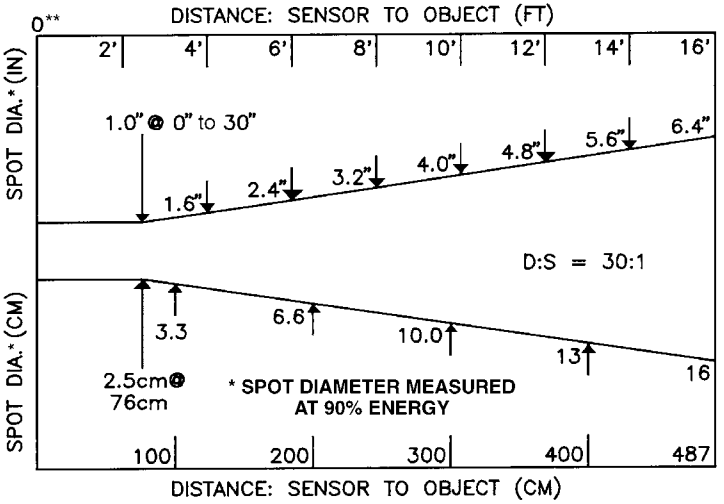


Figure 3-9. OS550A Series (-4 FOV)

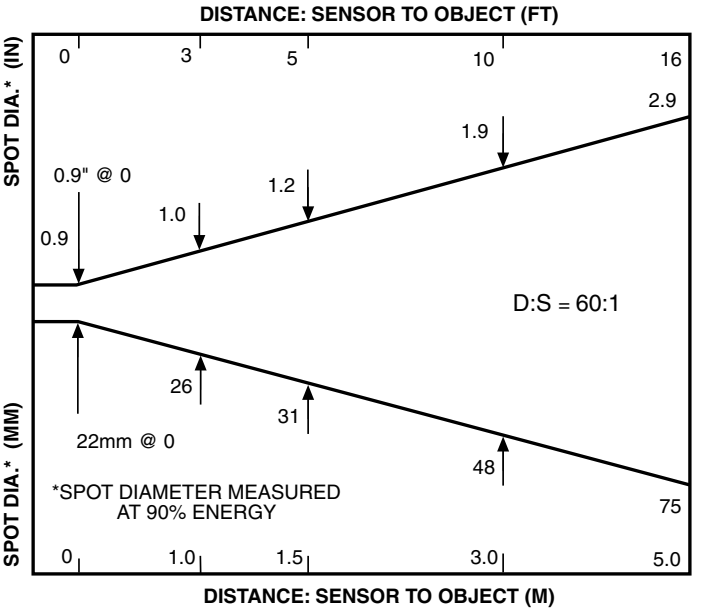


Fig. 3-10. OS550A Series- (-5FOV)

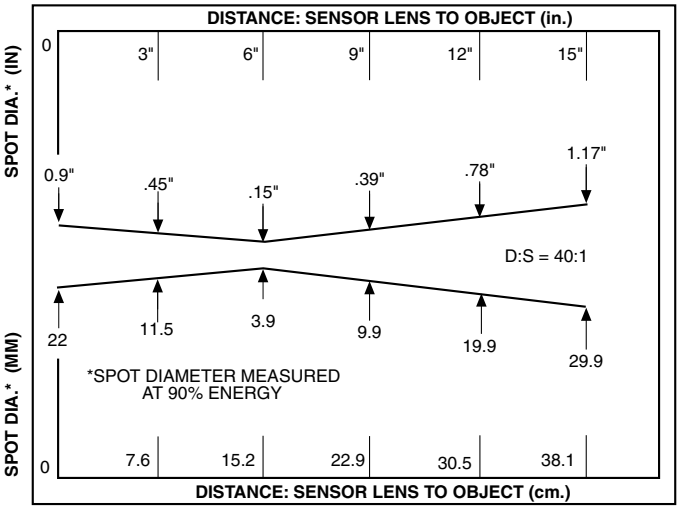


Figure 3-11. OS550A Series- (-6FOV)

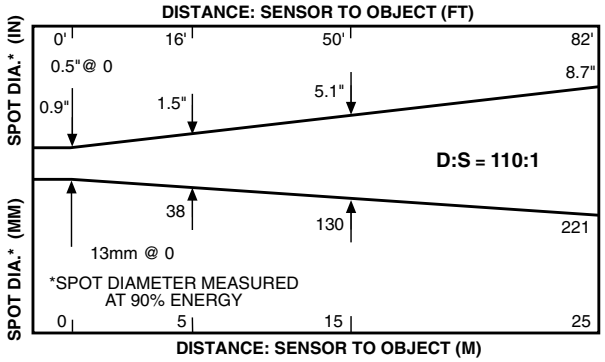


Figure 3-12. OS555A FOV

3.4 Measurement Techniques

You can use the IR Thermometer to collect temperature data in any one of five different ways:

- **Spot Measurement —** Measures the temperature of discrete objects such as motor bearings, engine exhaust manifolds, etc.:
  1. Aim the sensor head at the desired target.
  2. If necessary, adjust the emissivity using the ▲ and °F·°C keys.
  3. Read the temperature.

- **Differential Measurement —** Measures the temperature differential between two spots (the maximum and minimum temperatures viewed)
  1. Aim the thermometer at the first spot.
  2. If necessary, adjust the emissivity.
  3. Aim at the second spot.
  4. Adjust the emissivity of the second spot if required.
  5. To display the differential temperature, press the FUNC key until "dIF" appears on the display.
  6. Read the differential temperature from the upper display.

- **Static Surface Scan** – Measures the temperature across a static surface:
  1. Aim the thermometer's sensor head at a starting point.
  2. If necessary, adjust the emissivity.
  3. Slowly move the thermometer's sensor head so that the line of sight sweeps across the surface. The thermometer measures the temperature at each point on the surface.
  4. To record the temperature profile across the surface, connect the IR thermometer to a strip chart recorder that will accept an analog input matching the analog output of the model OS550 that you have selected.

Table 3-2. Functional Flow Chart

Real Time Mode				
Display Mode:	**Display shows:**	**Press FUNC to...**	**Press SET to...**	**Press ▼ °F-°C or ▲ ○-● to...**
E	Current temperature Emissivity	Go to MAX	– –	Set Emissivity
MAX	Current temperature Maximum temperature	Go to MIN	Reset MAX, MIN, DIF, AVG, temperatures	Press ▼ °F-°C to change between °F/°C Press ▲ ○-● to turn LCD backlight ON or OFF
MIN	Current temperature Minimum temperature	Go to dIF		
dIF	Current temperature Differential temperature	Go to AVG		
AVG	Current temperature Average temperature	Go to HAL		
HAL	Current temperature High alarm setpoint	Go to LAL or E	ACTIVATE/DEACTIVATE HAL	Set High alarm value
LAL	Current temperature Low alarm setpoint	Go to AMB	ACTIVATE/DEACTIVATE LAL	Set Low alarm value
AMB	Current temperature Ambient target temperature	Go to PRN	ACTIVATE/DEACTIVATE ATC	Set target ambient temperature
PRN	Current temperature Print interval	Go to MEM or E	ACTIVATE/DEACTIVATE PRN	Set data transmission interval
MEM	Current temperature Memory location	Go to E	Store temperature data	Review stored data
LOG	Current temperature Logging	Go to E	Turn ON/OFF Logging	————

OS551A: HAL → E
OS552A: PRN → E
OS553A, OS554A, OS555A: LOG → E

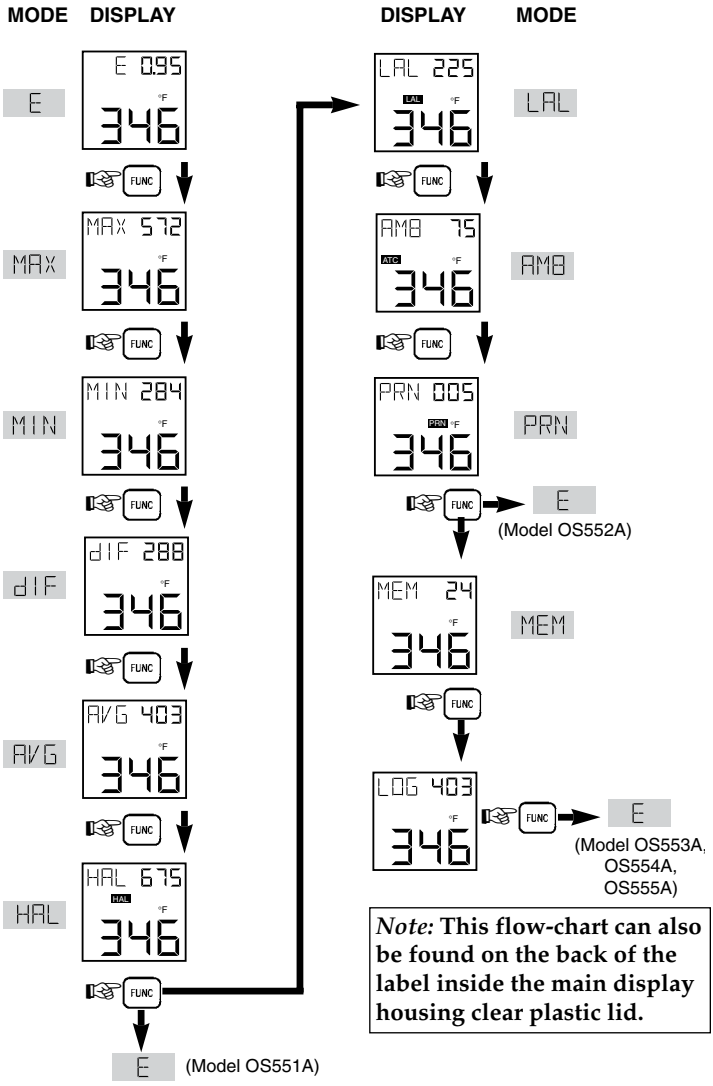


Figure 3-13 Visual Function Flow Chart

* While in these 4 modes:

Use ▼ key to change temperature from °F to °C or vice versa.

Use ▲ key to turn on/off the display backlighting.

3.5.1 Adjusting Emissivity

Refer to Appendices B and C for information on emissivity before making your adjustment.

1. When the thermometer is powered up, the default emissivity setting will be set to 0.95.
2. If necessary, press the ▲ key to increment the target emissivity or press the °F·°C key to decrement the target emissivity.

NOTE

The unit maintains the emissivity value even when the power is removed.

NOTE

At the Power Up, Display shows the Model No. (OS553A, OS552A, etc.) then the firmware revision, then the analog output, before going to

MV	1
V	0-5
MA	4-20

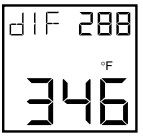
real time operation.

3.5.2 Calculating Temperature Values

The thermometer calculates the MAX, MIN, dIF, and AVG temperatures based on the current temperature.

is the maximum temperature since the temperature measurement session starts (pulling the trigger).

is the minimum temperature since the temperature measurement session starts.



is the difference between the MAX and MIN temperatures.

is the true average temperature since the temperature measurement session starts. The average temperature under continuous operation is accurate for a limited period of time (refer to the specifications). However, the AVG temperature function can be used indefinitely when the thermometer is operating intermittently.

"AVG ---" is displayed when either of the following conditions occur:

1. When the average temperature measurement reaches its time period as stated in the specifications.
2. When the thermometer is trying to measure a target temperature which is outside of its measuring temperature range.

To clear the "AVG ---" display, press the SET key to reset or turn off the thermometer.

NOTE

Pressing the SET key resets the MAX, MIN, dIF and AVG temperatures while in the same Display modes.

3.5.3 Changing the Temperature from °F to °C (or vice versa)

During the time that the thermometer displays either MAX, MIN, dIF, or AVG temperatures, press the °F-°C key to change all the temperatures from °F to °C or vice versa.

3.5.4 Turning the Display Backlighting ON/OFF

During the time that the thermometer displays either MAX, MIN, dIF, or AVG temperatures, press the key to turn the display backlighting ON/OFF.

3.5.5 Using the Alarm Functions

The thermometer provides audible and visible alarm indications, as well as alarm outputs.

- To set the high alarm value:

1. Press the FUNC key until the High Alarm Display Mode (HAL) appears.
2. Press the ▲ key to increment the high alarm value. Press the ▼ °F-°C key to decrement the high alarm value.
3. Press the SET key to enable the high alarm function. The HAL icon appears.

   If the temperature exceeds the high alarm setpoint, you will hear a beep and the HAL icon on the display flashes. The high alarm output voltage goes high. The alarm LED turns on.
4. To disable the high alarm, press the SET key again, and the HAL icon disappears.

NOTE

If you are not in High Alarm Display Mode (HAL) when the high alarm goes off, you must press the FUNC key to get into the High Alarm Display Mode. Then press the SET key to disable the high alarm.

NOTE

The unit maintains its high alarm set point value even when the power is removed.

Default Values of high alarm set points are:

OS551A	750°F
OS552A	1000°F
OS553A	1600°F
OS554A	2500°F
OS555A	4500°F

- To set the low alarm value (OS552A thru OS555A):

1. Press and hold the FUNC key until the Low Alarm Display Mode (LAL) appears.
2. Press the ▲ key to increment the low alarm value. Press the °F·°C ▼ key to decrement the low alarm value.
3. Press the SET key to enable the low alarm function. The LAL icon appears.

   If the temperature drops below the low alarm setpoint, you will hear a beep and the LAL icon on the display flashes. The low alarm output voltage goes high. The alarm LED turns on.
4. To disable the low alarm, press the SET key again, and the LAL icon disappears.

NOTE

If you are not in Low Alarm Display Mode (LAL) when the low alarm goes off, you must press the FUNC key to get into the Low Alarm Display Mode. Then press the SET key to disable the low alarm.

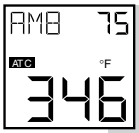
NOTE

The unit maintains its low alarm set point value even when the power is removed.

Default values of Low alarm set points are:

OS551A, 552A, 553A	-10°F
OS554A	0°F
OS555A	1000°F

3.5.6 Using Ambient Target Temperature Compensation (OS552A thru OS555A)



Use the Ambient Target Temperature Compensation (AMB) Display Mode when high accuracy readings under both of these conditions are required:

- The target has a low emissivity.
- The ambient temperature around the target is much higher than the ambient temperature around the infrared thermometer.

To set and activate the Ambient Target Temperature Compensation Mode:

1. With power applied to the unit, set the emissivity to 1.0
2. Press and hold the FUNC key until the Average Display Mode (AVG) appears.
3. Slowly move the thermometer so that the line of sight sweeps across the area surrounding the target. The thermometer measures the temperature at each point on the surrounding area.
4. Read the average temperature value from the upper display and record it here _____.
5. Press and hold the FUNC key until the Ambient Temperature Display Mode (AMB) appears.
6. Set the AMB temperature found in Step 4 by pressing the ☼ key or the °F·°C key.
7. Press the SET key to enable the ambient target temperature compensation. The ATC icon appears on the display.

NOTE

To disable this mode, press the SET key again. The ATC icon disappears.

8. Press and hold the FUNC key until the Emissivity Display Mode (E) appears.
9. Change the emissivity to the proper value for the target being measured (refer to Section 3.5.1).
10. Aim at the target. The target temperature and emissivity are displayed on the LCD.

NOTE

To disable the Ambient Target Temperature Compensation at a later time, you must press the FUNC key to get into the Ambient Target Temperature Display Mode. Then press the SET key to disable it.

NOTE

The unit maintains its target ambient temperature value even when the power is removed.

3.5.7 PC User Application, OS550 Series

This PC application software communicates with the following products:

OS530E series Infrared Thermometers
OS523E/524E series Infrared Thermometers
OS550A series Infrared Transmitters

This Windows based user application allows you to do the following:

- Monitor and log your temperature in real time.
- Save the temperature data with time stamping to a text file.
- Print the temperature line graph to a printer.
- Display other parameters in real time as explained below.
- Set different parameters such as Emissivity, high & low alarm set points, etc.
- Select your Chart time base (On the PC) from one minute up to one day.
- Select the Upper & Lower values of the Y axis of the temperature graph, or Automatic scale.
- Download the recorded temperature data from the thermometer to a text file.
- Erase the recorded temperature data from the thermometer.
- COM port auto detect.
- Enable/disable audible indications

Operation

The user application runs on Windows 2000, XP, Vista, and Seven.
After installing the application, run the application, and you will see the following on the main menu:

- The line graph of the temperature in real time and the Engineering unit (ºF or ºC).
- The high & low alarm lines on the chart.
- The digital display of the infrared temperature in real time.
- The high & low alarm set points and the alarm LED indicators.
- Communication & over-range LED indicators.
- Displays the following parameters in real time:
    1. Emissivity
    2. Min/Max/Average/Differential Temperatures
    3. Thermocouple Temperature (if applicable)
    4. Distance Measurement (if applicable)
    5. Elapsed time or Chart time
- Displays the data transmission interval (PRN) in seconds.
- Print icon. You can print the temperature line graph to a printer (By clicking on the Print icon) after stopping the recording process.

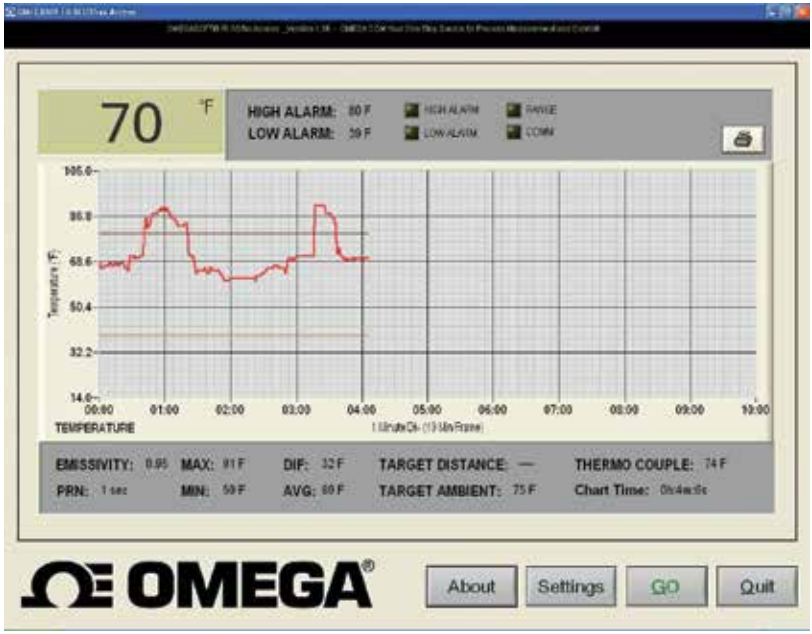


Figure 3-14. Main Menu

You can also initiate data transmission from the thermometer. If the application does not establish communication with the thermometer, it will show an error text message box, and the Find button will flash. Please check the following for communication error:

- The thermometer is connected to a serial port on the PC.
- The thermometer is turned on and is operating normally.
- Go to the Settings menu and check the COM port number. Make sure you are using the right COM port on your PC.
- Click the Find button, and the program should be able to establish communication. The Find button will then change to Go.

Click the Go button, and the program starts to receive data from the thermometer.

Settings Menus

In the settings menu, you can do the following:

- Select audible indication. The PC will beep every time the temperature goes into alarm conditions.
- COM port auto detect. The program shows the available COM ports for your selection.
- Selecting the "Show History Viewer", provides a log of all the events happening with the application such as high & low alarm events, start & stop of the application, etc.
- Selecting the "Save to File", allows you to save the charted data coming from the thermometer to a data file. When you stop recording, the program will ask if you would like to save the data.
- Select your chart time base from 1 minute per frame up to 1 day per frame.
- Select "Auto Scale" or specify your upper & lower Y axis values for custom scaling.
- Set the following parameters:
    1. Emissivity
    2. High and Low alarm set points as well as enable/disable
    3. Temperature Engineering unit (ºF or ºC)
    4. Data transmission interval in second
    5. Target Ambient temperature
- Download the recorded temperature data from the thermometer to a text file.
- Erase the recorded temperature data from the thermometer.

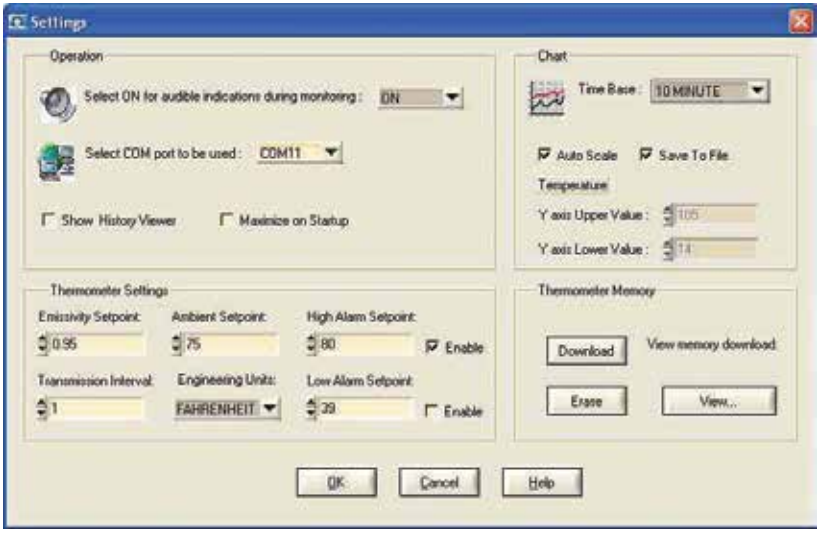


Figure 3-15. Settings Menu

The following is a typical temperature data file saved from the application. It shows the start time, the ending time, and the data transmission interval. Each data also has a time stamping attached.

test10.log - Notepad

File Edit Format View Help

```
-----------------------------------------
Report: Chart Data
Log start time:    Wed Mar 31 10:16:59 2010
Log end time:      Wed Mar 31 10:18:00 2010
Time Interval:     2 sec
-----------------------------------------

TIME                TEMPERATURE

3/31 10:17:00       69 °F
3/31 10:17:02       69 °F
3/31 10:17:04       70 °F
3/31 10:17:05       70 °F
3/31 10:17:07       71 °F
3/31 10:17:09       70 °F
3/31 10:17:11       70 °F
3/31 10:17:13       70 °F
3/31 10:17:15       72 °F
3/31 10:17:17       78 °F
3/31 10:17:19       80 °F
3/31 10:17:21       81 °F
3/31 10:17:23       81 °F
3/31 10:17:25       76 °F
3/31 10:17:27       71 °F
3/31 10:17:29       71 °F
3/31 10:17:30       70 °F
3/31 10:17:32       70 °F
3/31 10:17:34       70 °F
3/31 10:17:36       70 °F
3/31 10:17:38       70 °F
3/31 10:17:40       70 °F
3/31 10:17:42       71 °F
3/31 10:17:44       72 °F
3/31 10:17:46       84 °F
3/31 10:17:48       83 °F
3/31 10:17:50       71 °F
3/31 10:17:52       71 °F
3/31 10:17:54       71 °F
3/31 10:17:56       71 °F
3/31 10:17:57       71 °F
```

Figure 3-16. Typical Temperature Data File

3.5.7.1 PC Interface Commands

You can communicate directly from the PC to the infrared thermometer. Here are the Comm port settings and communication commands from the PC:

Baud rate: 9600
Data: 8 Bits
One Stop Bit
No Parity

All the PC commands to the infrared thermometer are case sensitive and terminates with a carriage return (CR). You can change parameter settings from the PC when data transmission is stopped.

Command (ASCII)	Description
IR	Get the current infrared temperature from the thermometer
T	Start sending Data stings from the thermometer to the PC
P	Stop sending data to the PC
S	Reset Min, Max, Diff, Avg temperature values on the thermometer
F1 or F0	F1 = Set Engineering unit to °F , F0 = Set Engineering unit to °C
E95	Set Emissivity to 0.95 (Thermometer sends “E:95” back as confirmation)
H500	Set High Alarm set point (HAL) to 500 (It sends “HAL:500” back as confirmation)
L20	Set Low Alarm set point (LAL) to 20 (It sends “LAL:20” back as confirmation)
A125	Set Target ambient temp (AMB) to 125(It sends “AMB:125” back as confirmation)
t	Get the data transmission interval (PRN) from thermometer
t5	Set data transmission interval (PRN) to 5 seconds. Thermometer sends back “PRN:5” as confirmation.
p	Get the data transmission flag from the thermometer. PRNF:0 means no data transmission (PRN is disabled) PRNF:1 means data transmission (PRN is enabled)
D0	Start to download stored data from IR thermometer memory
De	Erase the data from the IR thermometer memory

Here is a typical data strings from the infrared thermometer to the PC when the “T” command is activated:

OS534, OS553A; E:95; MAX:78; MIN:65; DIF:13; AVG:72; HAL:900; LAL:20; AMB:125; PRN:5; PRNF:1; IR:73; CF:0; FF:1; LF: 0:

End

String	Description
E:95;	Emissivity is 0.95
MAX:78;	Maximum temperature is 78
MIN:65;	Minimum temperature is 65
DIF:13;	Differential temperature is 13
AVG:72;	Average temperature is 72
HAL:900;	High alarm set point (HAL) is 900
LAL:20;	Low alarm set point (LAL) is 20
AMB:125;	Target ambient temperature is 125
PRN:5;	Data transmission interval is every 5 seconds
PRNF:1;	PRN Flag (0: PRN disabled, No data transmission, 1: PRN enabled, Data communication active)
IR:73;	Current Infrared temperature is 73
CF:0;	Temperature engineering unit (CF:1 in Degree C, CF:0 in Degree F)
FF:1;	Temperature engineering unit (FF:1 in Degree F, FF:0 in Degree C)
LF:0	Temperature over range flag xxxx0xxx : In Range, Top xxxx1xxx : Out of Range, Top xxxxx0xx : In Range, Bottom xxxxx1xx : Out of Range, Bottom
End	End of data string

3.5.8 Storing Temperature Data on Command (OS553A, OS554A, OS555A)

The thermometer can store up to 800 temperature data points on command. This data is stored in the non-volatile memory, so removing power will not affect or erase this data. To store temperature data:

1. Aim at the target and turn on the transmitter.
2. If necessary, press the ▲ key to increment the target emissivity or press the °F·°C key to decrement the target emissivity.
3. Press and hold the FUNC key until the Memory Display Mode (MEM) appears.
4. Press the SET key to store the target temperature at the memory location indicated. You will hear a beep to verify that the data is stored. Then the memory location is incremented by one.
5. After all data is taken, press and hold the FUNC key until the Emissivity Display Mode (E) appears.

3.5.9 Reviewing Stored Temperature Data (OS553A, OS554A, OS555A):

1. Press the FUNC key to go to the MEM display mode.
2. The upper display shows the next memory location to store temperature data.
3. Press the °F·°C key to go to previous memory locations. The lower display will show the corresponding stored temperature data at that location.
4. Press the ▲ key to go to the last memory location. The lower display will show the current temperature. You can now store temperature data by pressing the SET key.

5. If you do not press any key for 5 seconds, the display goes back to real time showing current temperature and the last memory location.

3.5.10 Logging Temperature Data in Real Time (OS553A, OS554A, OS555A)

The thermometer can log temperature data in real time. The logged data is stored in the non-volatile memory, so removing the power will not affect or erase the data. The data is logged based on the data recording interval (PRN) which can be set anywhere from 1 to 1999 seconds. The thermometer can log up to 800 data points. Therefore, the logging period can be anywhere from 13 minutes (1 second recording interval) up to 18.5 days (1999 second recording interval). To log temperature in real time:

1. Aim at the target and turn on the transmitter.
2. Press the ▲ or °F·°C keys to adjust the Emissivity value for the target.
3. Press the FUNC key until the PRN display mode appears.
4. Set the data recording interval (seconds) by pressing the ▲ or °F·°C keys.
5. Press the FUNC key until the LOG display mode appears.
6. Press the SET key to start logging temperature data in real time. The display will show LOG on, and the unit starts logging data based on the recording interval set in the PRN display menu. Press the SET key again, and the unit stops logging data. The display will show LOG off.

3.5.11 Erasing the Temperature Data from Memory

The user can erase all 800 temperature data points in memory at any time by using the following procedure:

1. Turn on the transmitter.
2. Press the FUNC key until reaching the MEM or LOG display mode.
3. Press the ▲ then SET keys in rapid sequence. The display shows ERASE on the top and it will beep to indicate that the stored data is erased.

NOTE

Erasing the temperature data does not erase or reset Emissivity, High and Low Alarm setpoints, printing interval and Ambient Target Temperature compensation

Notes

Notes

4.1 Warnings and Cautions

CAUTION

When using the laser sight accessory OS550-LS, you may receive harmful laser radiation exposure if you do not adhere to the warnings listed below:

- **USE OF CONTROLS OR ADJUSTMENTS OR PERFORMANCE OF PROCEDURES OTHER THAN THOSE SPECIFIED HERE MAY RESULT IN HAZARDOUS RADIATION EXPOSURE.**
- DO NOT LOOK AT THE LASER BEAM COMING OUT OF THE LENS OR VIEW DIRECTLY WITH OPTICAL INSTRUMENTS — EYE DAMAGE CAN RESULT.
- USE EXTREME CAUTION WHEN OPERATING THE LASER SIGHT ACCESSORY.
- NEVER POINT THE LASER SIGHT AT A PERSON.
- KEEP OUT OF REACH OF ALL CHILDREN.

WARNING

DO NOT ATTEMPT TO OPEN THE LASER SIGHT ACCESSORY.
(There are no user-serviceable parts in the unit.)

Refer to the inside back cover of this manual for product warning label.

4.2 Description

A laser sighting accessory is available to aid in the sensor head installation process. When installing a line of sight Infrared transducer with a small spot size and long target distance, it is sometimes difficult to locate the center of the focused spot and the material to be measured. To solve this problem, we offer a laser sighting accessory OS550-LS that will install onto the front of the OS550 series sensor head. This compact tool provides the installer with a true line of sight laser dot up to a distance of 12.2 meters (40') in the center of the IR optical path taking the guess work out of proper alignment during the installation. The laser is powered by a power pack with replaceable batteries and interconnect cable.

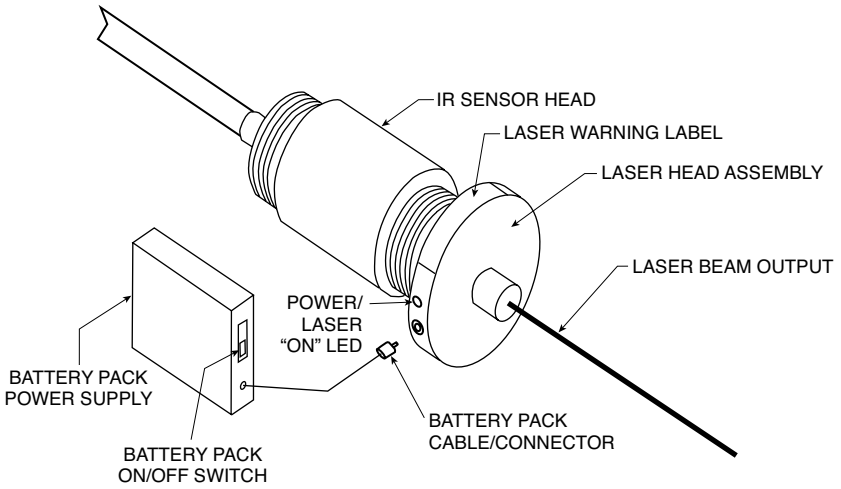


Fig. 4-1 Laser Sighting Accessory (OS550-LS)

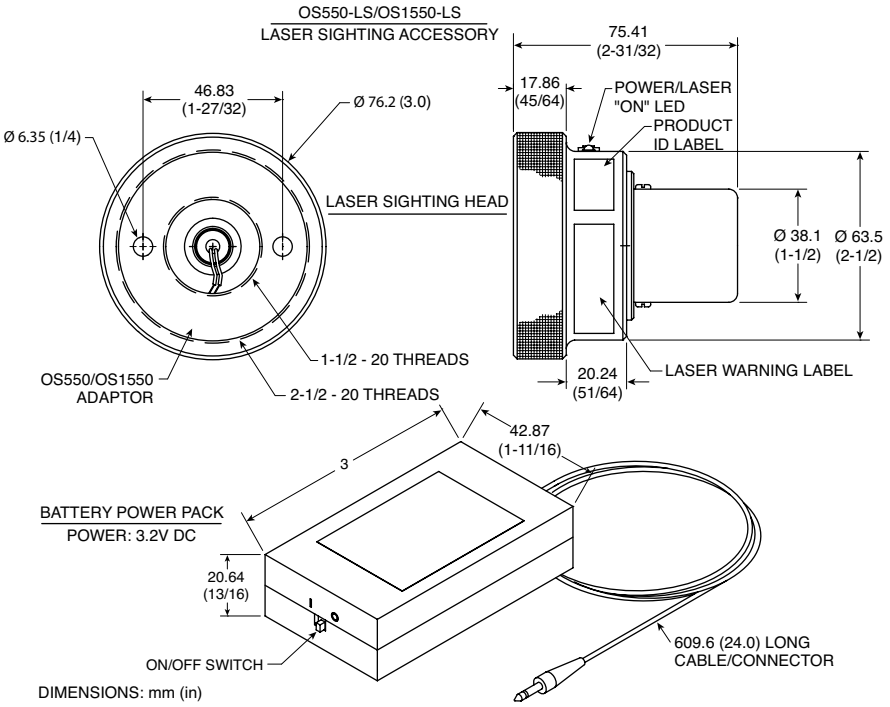


Fig. 4-2 General Dimensions

4.3 Operating the Laser Sight

4.3.1 Installing the Laser Sight onto the Thermometer

The laser sight accessory (OS550-LS) screws onto the front of the sensor head. Do not over tighten the laser sight accessory onto the sensor head. This accessory is only used during sensor head installation and then removed.

4.3.2 Powering the Laser Sight Accessory

The laser sight head is powered by a small compact battery pack supply provided with this accessory. Connections are made between the laser sighting head and the power pack via a 24" cable with mini mating connectors. Power is turned on and off to the sighting head by a slide switch on the power pack.

Notes

5.1 Cleaning the Sensor Head Lens

Although all lenses are quite durable, take care to prevent scratching when cleaning them. To clean the lens:

1. Blow off loose particles, using clean air.
2. Gently brush off remaining particles, using a camel hair brush. Alternatively, clean any remaining contaminants with a damp, soft, clean cloth. Be careful not to rub too hard.

CAUTION

Do not use any ammonia or cleaners with ammonia on the lens, as damage may result. Do not wipe the surface dry, as this may cause scratching.

5.2 Calibrating the Thermometer

The thermometer can not be calibrated by the user. For precise calibration of the thermometer, call our Customer Service Department. It is recommended that the Infrared Thermometer be sent to the factory once a year for recalibration.

Notes

THERMOMETER

Problem	Solution
The thermometer does not turn on (No Display)	a. Check for proper wiring connections, see Section 3.2 b. Contact our Customer Service Department, unit requires service.
The thermometer is showing an incorrect temperature	a. Make sure you have entered the correct emissivity setting. b. Make sure you are not trying to measure a temperature above the maximum temperature range of your model.
The thermometer is "locked up" (the display is "frozen").	a. Try to remove and then re-apply power to reset the unit. b. Contact our Customer Service Department, unit requires service.

Problem	Solution
The display is either erratic or stays at one reading.	1. Clean the thermometer lens. Refer to Section 5.1. 2. Activate the Diagnostic routine of the thermometer as follows (while looking at room temp): a. Turn on the transmitter. b. Press the FUNC key and SET key at the same time. You can expect to see and hear the following: • You will see the model and version number "VER X.X" of the software for about 1 second. • You will hear a beep, "TST" is displayed. • Soon after, all of the segments of the display including the backlighting will light up for about 1 second. • The display will clear and a PAS (pass) or ERR (error) code may be seen on the display. ERR1: Infrared temp reading is >150°F or < 23°F. ERR2: Ambient temp >122°F or < 32°F ERR3: Can not read from EEPROM memory EER4: Can not write to EEPROM memory

Problem	Solution
The temperature reading is erratic. The sensor head has just been moved from one extreme temperature to room temperature [0°C or 50°C (32°F or 122°F)] or vice versa.	The thermometer has to stabilize before taking temperature measurements. It takes up to 40 minutes for the thermometer to stabilize.
The temperature reading is erratic. The sensor head has just been moved from room temperature (ambient temperature) to a temperature 10°C colder or warmer.	The thermometer has to stabilize before taking temperature measurements. It takes up to 20 minutes for the thermometer to stabilize.
No Laser Beam	Check Battery pack voltage.

Notes

(Specifications are for all models except where noted)

THERMOMETER

Measuring Temperature Range:	OS551A: –23° to 400°C (-10° to 750°F) OS552A: –23° to 538°C (-10° to 1000°F) OS553A: –23° to 871°C (-10° to 1600°F) OS554A: –18° to 1371°C (0° to 2500°F) OS555A: 538° to 2482°C (1000° to 4500°F)
Accuracy @ 24°C or 75°F Ambient Temperature and at emissivity of 0.95 or greater:	±1% of reading or 3°F whichever is greater ±2% of reading for temp > 2000°F, OS555A only
Distance to Spot Size Ratio:	10:1 (Figure 3-7) 60:1 (Figure 3-10) 20:1 (Figure 3-8) 40:1 (Figure 3-11) 30:1 (Figure 3-9) 68:1 (Figure 3-6) 110:1 (Figure 3-12)
Display Repeatability:	± (1% rdg + 1 digit)
Display Resolution:	1°F or 1°C
Display Response Time:	100 msec
Spectral Response:	8 to 14 microns - OS551A thru OS554A 2 to 2.5 microns - OS555A
Operating Ambient Temperature:	
Main Electronics:	0° to 50°C (32° to 122°F)
Sensor Head	0° to 50°C (32° to 122°F)
Sensor Head with OS550-WC	0° to 85°C (32° to 185°F)
Water Flow rate for OS550-WC	0.5 GPM, room temperature
Air Flow for OS550-AP	1 to 3 CFM (0.5 to 1.5 liters/sec.)
Operating Relative Humidity:	95% or less without condensation
Display:	Backlit LCD dual display
Power Requirements:	8-24 Vdc @ 100 mA
Main Electronics	IP65, NEMA 12 & 13 rated
Standard Housing	ABS Plastic
Metal Housing	Die cast aluminum

Emissivity:	0.10 to 1.00 in 0.01 increments, set via keypad
Calculated Temperature Values:	Maximum (MAX), Minimum (MIN), Average (AVG), Differential (dIF)
Average Temp Accuracy Time Period (Under Continuous Operations)	30 Days
Ambient Target Temperature Compensation:	OS552A thru OS555A set and enabled via keypad
RS-232 Output	OS552A thru OS555A set and enabled via keypad 9600 bits per second, 8 bits of data, 1 stop bit, no parity
RS-232 Cable:	RJ12 to 9 pin D connector, Female RJ12 Pin # — 9 pin D connector Pin # 3 TX — 2 RX 4 RX — 3 TX 5 GND — 5 GND
Power/Analog Output Cable:	15' long; 8-conductor, shielded 24 AWG
Sensor Head Cable	15' long; 5-conductor, shielded 24 AWG
Alarm:	Set and enabled via keypad All models: High alarm standard, with audible and visual indication with red LED OS552A, OS553A: Low alarm standard, with OS554A, OS555A audible and visual indication with red LED
Alarm Deadband	10°F (5°C)
Alarm Outputs	Voltage; 100mA Drive
Data Storage:	OS553A, OS554A, OS555A Up to 800 sets of temperatures data points on command or continuous data logging.
Dimensions:	
Main Housing, Plastic:	120.6 x 80.0 x 50.8 mm (4.75 x 3.15 x 2.00")
Main Housing, Aluminum	115.0 x 90.0 x 55.5 mm (4.54 x 3.54 x 2.18")
Sensor Head:	41.1 dia. x 109.2 mm (1.62 dia. x 4.30")
Weight:	
Main Electronics:	2.2 kg. (1 lb.)
Sensor Head:	1.87 kg. (0.85 lb.)

1 mV/degree C or F Analog Output:

Accuracy:	± 2 mV or 2 Deg referenced to the temperature display

0-5 Vdc Analog Output:

Accuracy:	± 0.25% of full scale (Referenced to temperature display)
Scaling:	Fixed (scaled to match full temperature range of model selected)
Minimum Load:	1 K ohms

4-20 mA Analog Output:

Accuracy:	± 0.25% of full scale (Referenced to temperature display)
Scaling:	Fixed (scaled to match full temperature range of model selected)
Maximum Load:	500 ohms

LASER SIGHT ACCESSORY (OS550-LS)

Wavelength (Color):	630-670 nanometers (red)
Operating Distance:	
Laser Dot	152 mm to 12 m (6" to 40')
Max. Output Optical Power:	<1mW at 75°F ambient temperature, Class II, Laser Product
European Classification:	Class 2, EN60825-1
Maximum Operating Current:	25mA at 3 V
FDA Classification:	Complies with 21 CFR Chapter 1, Subchapter J
Beam Diameter:	5 mm
Beam Divergence:	<1mrad
Operating Temperature:	0° to 50°C (32° to 122°F)
Operating Relative Humidity:	95% or less without condensation
Power Switch:	ON/OFF (slide)
Power Indicator:	Red LED
Power:	3 Vdc
Identification Label:	Located on head assembly circumference
Warning & Certification Label:	Located on head assembly circumference

Key(s)	Key(s) Functions
	• Selects one of the following Display Modes: E , MAX, MIN, dIF, AVG, HAL, LAL, AMB, PRN, MEM or LOG.
	• Enables/disables High and Low Alarms. • Enables/disables Target Ambient Temperature Compensation. • Enables/disables sending data to the personal computer or serial printer. • Stores temperature data on command. • Enables/disables Data Logging.
	• Increments the data or value displayed. • Turns on or off the backlighting (only in MAX, MIN, dIF, or AVG Display Modes).
	• Decrements the data or value displayed. • Changes the unit of measure from °F to °C or vice versa (only in MAX, MIN, dIF, or AVG Display Modes).
Press and hold down the  key and  key at the same time	• Allows you to go to the Diagnostic Routine.
 and  keys pressed in rapid sequence	• Allows you to erase all 800 stored temperature data from the memory.

Notes

Thermal Radiation

Heat is transferred from all objects via radiation in the form of electromagnetic waves or by conduction or convection. All objects having a temperature greater than absolute zero (-273°C, -459°F, 0 K) radiate energy. The thermal energy radiated by an object increases as the object gets hotter. Measurement of this thermal energy allows an infrared thermometer to calculate the object's temperature if the emissivity (blackness) is known. Generally, it is convenient to measure the amount of radiated energy in the infrared part of an object's radiation spectrum.

Figure A-1 shows a block diagram of an infrared radiation thermometer. Energy from the object is focused by the lens onto the detector. As the detector heats up, it sends out an electrical signal, which in turn is amplified and sent to the circuitry of the thermometer. The thermometer software then calculates the temperature of the object.

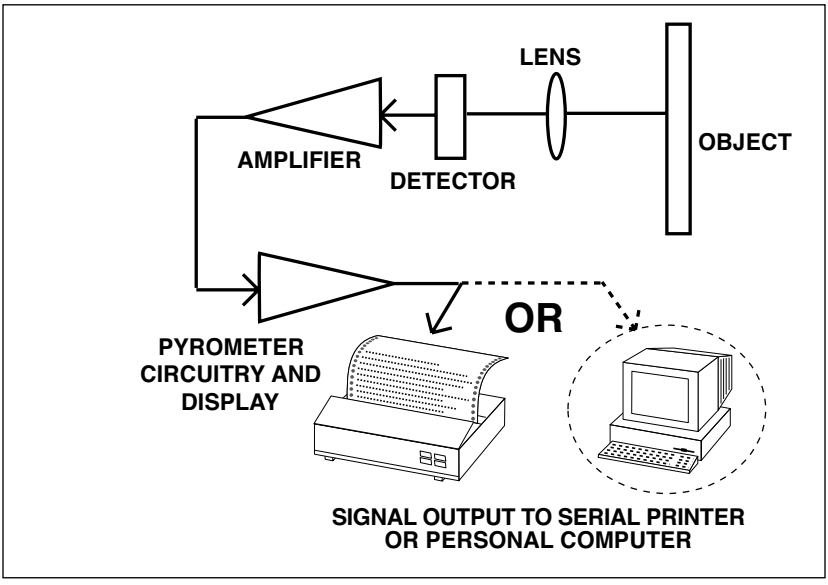


Figure A-1. Infrared Thermometer Block Diagram

Blackbody

When thermal radiation falls on an object, part of the energy is transmitted through the object, part is reflected and part is absorbed. A blackbody is defined as an ideal object that absorbs all the radiation incident upon it. The best example of a real object that acts like a blackbody is a small hole drilled deep into a large opaque cavity. Thermal radiation entering the cavity is internally reflected and has little chance of escaping the cavity before it is fully absorbed.

Emissivity is defined as the ratio of energy radiated by an object to that of the energy radiated by a blackbody. By definition, the emissivity of a blackbody is 1. Most objects are considered *gray objects* with an emissivity between 0 and 1. Various emissivities for common materials are shown in Appendix B.

Spectral Distribution

Objects radiate energy at different wavelengths, but not with constant intensity at each wavelength. Figure A-2 shows the energy radiated by a blackbody at various temperatures as a function of wavelength. As a body is heated, the intensity of the radiated energy increases and the peak of the curve shifts towards the shorter wavelength end of the spectrum. The total area under a spectral distribution curve is proportional to the total energy radiated by the blackbody at a given temperature.

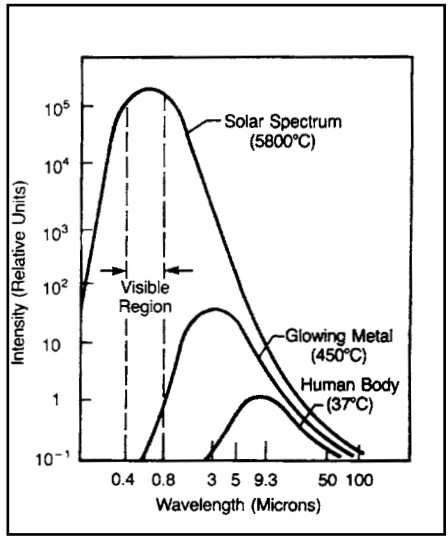


Figure A-2. Blackbody Spectral Distribution

Relative emission from a blackbody versus wavelength. The area under the curve corresponds to the total energy, and is proportional to the absolute temperature to the 4th power. The peak of the spectral distribution curve shifts to shorter wavelengths as the temperature increases.

Wien's Displacement Law describes the exact mathematical relationship between the temperature of a blackbody and the wavelength of the maximum intensity radiation.

$$\lambda_m = \frac{2.898}{T}$$

where λ_m = wavelength measured in microns
T = temperature in Kelvin

Calculating Temperature

The net thermal power radiated by an object has been shown to depend on its emissivity, its temperature and that of the ambient temperature around the object. A very useful equation known today as the Stefan-Boltzmann Law has been shown both theoretically and empirically to describe the relationship.

$$I = \varepsilon\sigma(T^4 - T_a^4)$$

I = thermal power in watts/meter^2
ε = Emissivity
$\sigma = 5.6703 \times 10^{-8}$ watts/meter^2 x K^4 (Stefan's constant)
T = temperature of object in Kelvin
T_a = temperature of ambient surroundings in Kelvin

The infrared thermometer uses this equation directly in calculating the temperature of an object. The incident power is measured by the infrared detector. The emissivity of the object is determined by the user. The ambient temperature is measured by a sensor inside the thermometer. With all quantities known, the thermometer uses the Stefan-Bolzmann Law to calculate and output the temperature of the object

Optics Field of View

Accurate measurement of temperature via infrared means depends strongly on the size of the object and the distance between the thermometer and the object. All optical devices (e.g. cameras, microscopes, infrared thermometers) have an angle of vision, known as a field of view or FOV, within which they see all objects. In particular, the thermometer will measure a fixed proportion of the energy radiated by all objects within its FOV. The user must guarantee that the distance between the thermometer and the object is defined so that only that object fills the FOV of the instrument.

Referring to Figure A-3, Objects "X" and "Y" are within the FOV of the thermometer. The measured temperature would fall somewhere between the actual temperatures of the two objects. In order to measure the temperature of Object "X" accurately, Object "Y" would need to be removed. In order to measure the temperature of Object "Y" accurately, the user would need to move closer to Object "Y" until it completely filled the FOV of the thermometer. Alternatively, the user could measure the temperature of Object "Y" with a thermometer with a smaller FOV.

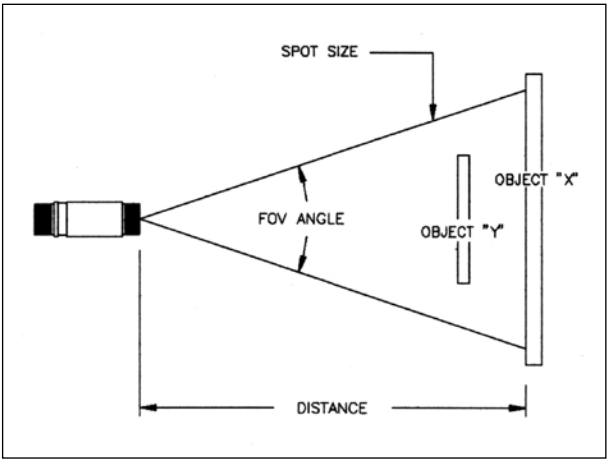


Figure A-3.
Field of View of a Thermometer/Transmitter

The distance-to-spot size ratio (D/S) defines the field of view (FOV). Thus, a D/S = 10 gives you approximately a 1' spot size at a distance of 10'. For accurate spot size values, refer to the Field of View diagrams shown in Figures 3-3 through 3-8.

Table B-1 provides *guidelines for estimating the emissivity* of various common materials. Actual emissivity, especially of metals, can vary greatly depending upon surface finish, oxidation, or the presence of contaminants. Also, emissivity or infrared radiation for some materials varies with wavelength and temperature. To determine the *exact emissivities* for most applications, follow the procedures in Appendix C.

9

METALS

Material	Emissivity (ε)
Aluminum – pure highly polished plate	0.04 – 0.06
Aluminum – heavily oxidized	0.20 – 0.31
Aluminum – commercial sheet	0.09
Brass – dull plate	0.22
Brass – highly polished, 73.2% Cu, 26.7% Zn	0.03
Chromium – polished	0.08 – 0.36
Copper – polished	0.05
Copper – heated at 1110°F (600°C)	0.57
Gold – pure, highly polished or liquid	0.02 – 0.04
Iron and steel (excluding stainless) – polished iron	0.14 – 0.38
Iron and steel (excluding stainless) – polished cast iron	0.21
Iron and steel (excluding stainless) – polished wrought iron	0.28
Iron and steel (excluding stainless) – oxidized dull wrought iron	0.94
Iron and steel (excluding stainless) – rusted iron plate	0.69
Iron and steel (excluding stainless) – polished steel	0.07
Iron and steel (excluding stainless) – polished steel oxidized at 1110°F (600°C)	0.79
Iron and steel (excluding stainless) – rolled sheet steel	0.66
Iron and steel (excluding stainless) – rough steel plate	0.94 – 0.97
Lead – gray and oxidized	0.28
Mercury	0.09 – 0.12
Molybdenum filament	0.10 – 0.20
Nickel – polished	0.07
Nickel – oxidized at 1200°F – 2290°F	0.59 – 0.86
Platinum – pure polished plate	0.05 – 0.10
Platinum – wire	0.07 – 0.18
Silver – pure and polished	0.02 – 0.03
Stainless steel – polished	0.07
Stainless steel – Type 301 at 450°F – 1725°F	0.54 – 0.63
Tin – bright	0.06
Tungsten – filament	0.39
Zinc – polished commercial pure	0.05
Zinc – galvanized sheet	0.23

NONMETALS

Material	Emissivity (ε)
Asbestos Board	0.96
Asphalt, tar, pitch	0.95 – 1.00
Brick – red and rough	0.93
Brick – fireclay	0.75
Carbon – filament	0.53
Carbon – lampblack - rough deposit	0.78 – 0.84
Glass - Pyrex, lead, soda	0.85 – 0.95
Marble – polished light gray	0.93
Paints, lacquers, and varnishes – Black matte shellac	0.91
Paints, lacquers, and varnishes – aluminum paints	0.27 – 0.67
Paints, lacquers, and varnishes – flat black lacquer	0.96 – 0.98
Paints, lacquers, and varnishes – white enamel varnish	0.91
Porcelain – glazed	0.92
Quartz – opaque	0.68 – 0.92
Roofing Paper	0.91
Tape – Masking	0.95
Water	0.95 – 0.96
Wood – planed oak	0.90

In Appendix A, we showed how emissivity is an important parameter in calculating the temperature of an object via infrared means. In this section we discuss how to determine a specific emissivity value. If you know the material of the object, use Table B-1 in Appendix B to look up its approximate emissivity. Most organic materials such as plastics, cloth, or wood have an emissivity of about 0.95. For this reason, we use 0.95 as the default emissivity setting in the OS550A Series thermometers.

For objects of unknown material or for very precise measurements, use one of the following methods to determine a specific emissivity value.

Method 1

1. Measure and record the temperature of the object using a contact temperature probe such as a thermocouple or RTD.
2. Aim the thermometer at the object.
3. Adjust the emissivity until the temperature reading of the thermometer equals the temperature measured in Step 1.

Method 2

1. Heat the object (or at least a sample of the object material) on top of a heating plate to a known temperature. Make sure the thermometer and the air surrounding the heating plate are at the same temperature.
2. Measure the temperature of the object material with the thermometer. Make sure that the object fills the FOV of the thermometer.
3. Adjust the emissivity until the temperature reading of the thermometer equals the known temperature of Step 1.

Method 3

1. Use this method to measure objects at temperatures below 500°F (260°C).
2. Place a large piece of masking tape on the object (or at least a sample of the object material). Allow time for the masking tape to reach the object temperature.
3. Set the emissivity of the thermometer to 0.95. Use the thermometer to measure and record the temperature of the masking tape - Area "A" in Figure C-1. Make sure that the area of the object covered with masking tape fills the FOV of the thermometer.

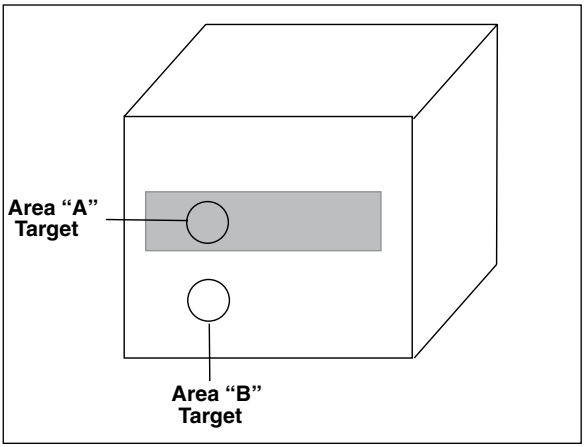


Figure C-1.

Determining Emissivity

4. Aim the thermometer at Area "B" as shown in Figure C-1 Make sure that Area "B" is as close as possible to Area "A".
5. Adjust the emissivity of the thermometer until the temperature reading equals the temperature found in Step 3.

Method 4

1. Paint a sample of the object material with flat black lacquer paint.
2. Set the emissivity to 0.97 and measure and record the temperature of the painted portion of the sample material - Area “A” in Figure C-1. Make sure that the painted area of object material fills the FOV of the thermometer.
3. Aim the thermometer at another spot on the target - Area “B” in Figure C-1.
4. Adjust the emissivity of the thermometer until the temperature reading equals the temperature found in Step 2.

Method 5

1. Use this method where practical to measure objects at temperatures above 500°F (260°C).
2. Drill a 1.5" (35 mm) diameter hole in a sample of the object material to a depth of 5" (127 mm). This hole closely resembles a blackbody (refer to Appendix A).

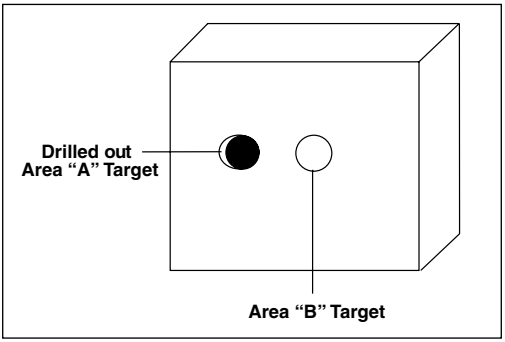


Figure C-2.
Determining Emissivity with a Drilled Hole

3. Set the emissivity to 0.97 and measure and record the temperature of the hole in the sample material - Area “A” in Figure C-2. Make sure that the hole fills the FOV of the thermometer.
4. Aim the thermometer at another spot on the target as close as possible to Area “A” (Area “B” in Figure C-2).
5. Adjust the emissivity of the thermometer until the temperature reading equals the temperature found in Step 3.

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