User's Guide

OS550/OS550-BB Series
Industrial Infrared
Thermometer/Transmitter

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OS550 or OS550-BB Series Infrared Thermometer with Sensor Head (1)

RS-232 Cable with connector/adapter (OS552, OS553, OS554) only (1)

CD Software (OS552, OS553, OS554) 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
PSU93	24V Power Supply, unregulated

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Page

1.1 Introduction

The OS550 Series Industrial Infrared (IR) Thermometers provide non-contact temperature measurement up to 2500°F (1371°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.

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" to approximately 200'
- 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 4 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, dataloggers and computers)
- RS232 serial communication to a PC or printer. This allows downloading data for further analysis (OS552, OS553 and OS554 only).
- Ambient target temperature compensation. This provides more accuracy for measuring low emissivity targets.
- Record up to 100 temperature data points. Review the recorded data on the thermometer LCD, as well as downloading the data to a PC (OS553 and OS554 only).
- Last temperature recall.
- Backlit display useful in low ambient light conditions
- Laser Sighting is optional.

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 memory until reset.

This instrument has a rugged and functional design, including:

- Sealed keypad display.

Table 1-1. OS550 Series Industrial Infrared Thermometer Features				
Features	**OS551**	**OS552**	**OS553**	**OS554**
Accuracy*	±1% rdg	±1% rdg	±1% rdg	±1% rdg
Range	0 to 750°F (-18 to 400°C)	0 to 1000°F (-18 to 538°C)	0 to 1600°F (-18 to 870°C)	0 to 2500°F (-18 to 1371°C)
Emissivity	adjustable	adjustable	adjustable	adjustable
Backlit Dual Display	standard	standard	standard	standard
Distance to Spot Ratio	See Field of View Charts, pages 3-4, 3-5, 3-6			
Differential Temperature	standard	standard	standard	standard
Min/Max Temperature	standard	standard	standard	standard
Average Temperature	standard	standard	standard	standard
High Alarm	standard	standard	standard	standard
Low Alarm	–	standard	standard	standard
Ambient Target Temperature Compensation	–	standard	standard	standard
RS-232 Output	–	standard	standard	standard
Data Storage	–	–	standard	standard
Last Temperature Recall	standard	standard	standard	standard

*or 3°F whichever is greater

1.2.1 Display Details
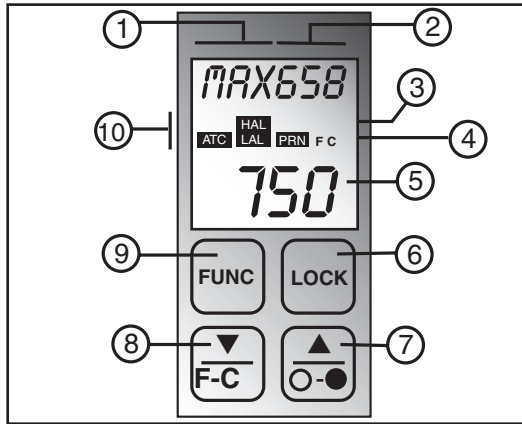
Figure 1-1. Display and Keypad View

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 - only on OS552/OS553/OS554) **MIN** (Minimum Temperature) **AMB** (Ambient Target Temp - only on OS552/OS553/OS554) **dIF** (Differential Temperature) **PRN** (Print Data - OS552, OS553 and OS554 only) **AVG** (Average Temperature) **MEM** (Store Temperature Data - only on OS553/OS554)
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	Power On Lock / Enables or Disables alarms
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 Print Data

1.2.2 Parts of the Thermometer/Transmitter

NEMA Housing,
Keypad, Display and
Output Electronics
(OS550 Series)

OEM Style
Keypad, Display,
and Electronics
(OS550-BB Series)

Sensor Head

Shown with optional mounting bracket,
OS550-MB and mounting nut OS550-MN

Figure 1-2.
OS550/OS550-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 OS550'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 pages 2-4, 2-5 for model numbers and dimensions. Also 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 OS550 Series Display NEMA Housing Installation

The OS550 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.

2.1.3 OS550-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 2-4.

2.2 Sensor Head Dimensions

29.2
(1.15)

1½ x 20 THREAD

160.3
(6.31)

109.2
(4.30)

29.2
(1.15)

1½ x 20 THREAD

38.1
(1.50) DIA.

41.1
(1.62) DIA.
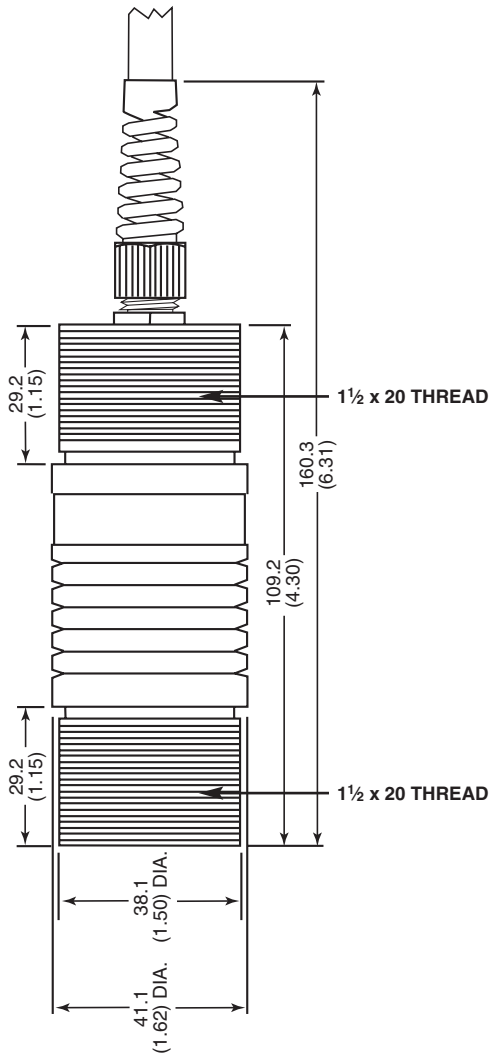
Fig. 2-1. Sensor Head Dimensions

2.3 OS550 Display Electronics Dimensions

131.3
(5.17) TYP.

Ø 4.37 (0.172) MOUNTING HOLE
(4 PLACES)

50.0
(1.97) TYP.

**Fig. 2-2. Main Display NEMA Housing with
Mounting Brackets Dimensions**

2.4 OS550-BB Series Display Mounting Dimensions
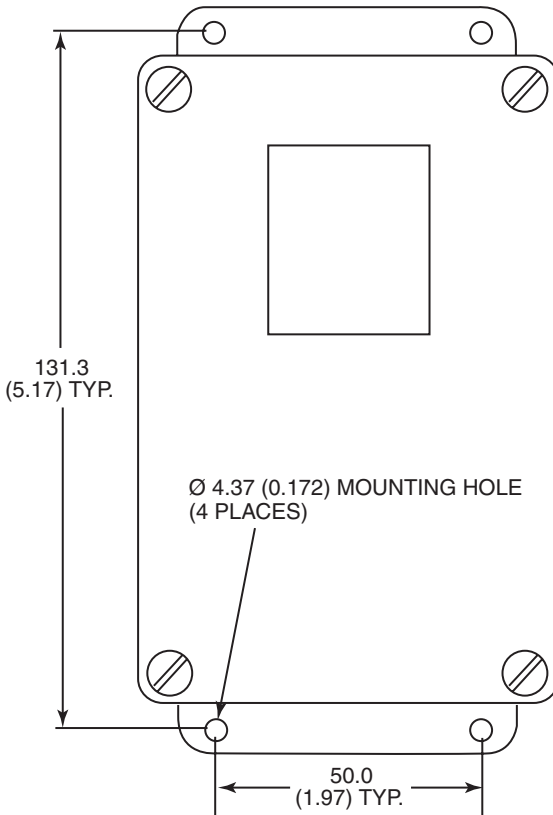
Ø 5.16 (0.203) THRU TYP. (4 PLACES)
WILL FIT UP TO A
#10 SCREW OR BOLT

26.4 (1.04)

57.4 (2.26)

118.4 (4.66)

31.0 (1.22)

26.4 (1.04)
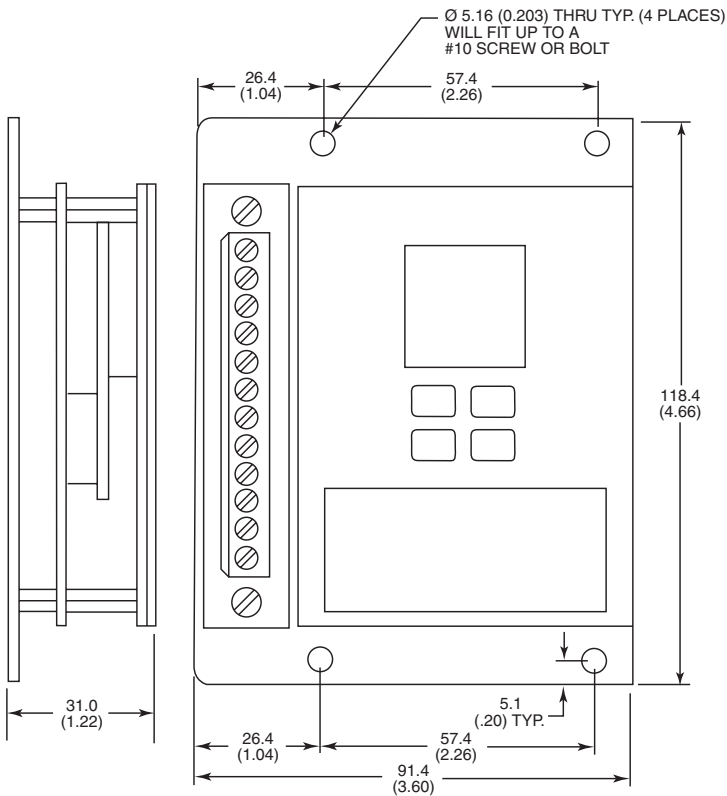
57.4 (2.26)

5.1 (.20) TYP.

91.4 (3.60)

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

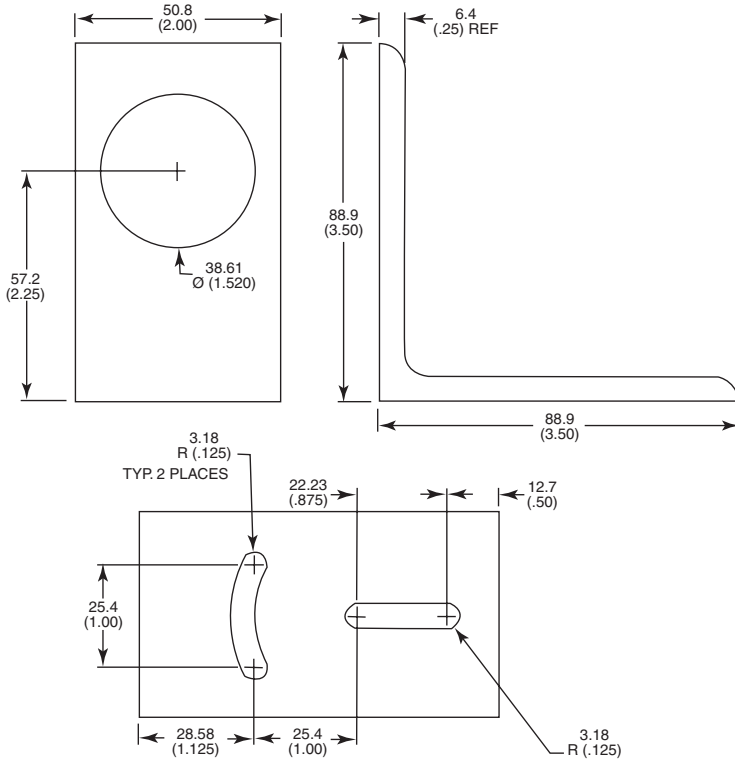## 2.5 Mounting Bracket Dimensions (OS550-MB)

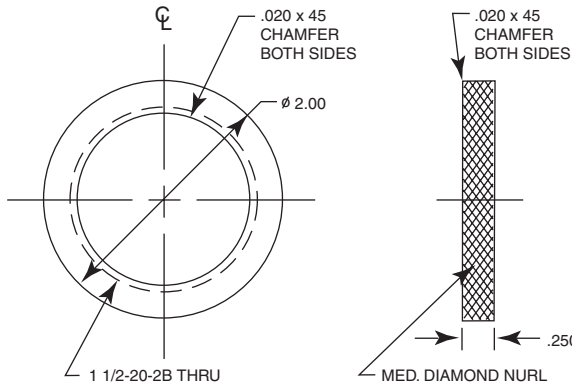Fig. 2-4

2.6 Mounting Nut Dimensions (OS550-MN)
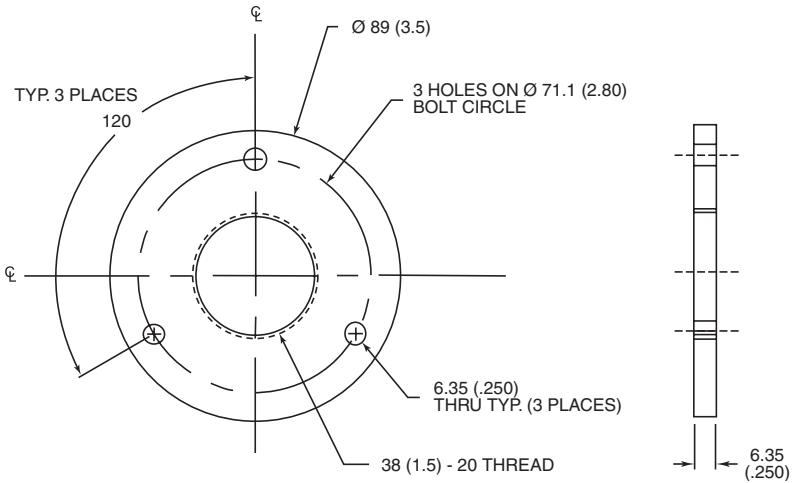

Fig. 2-5

2.7 Mounting Flange Dimensions (OS550-MF)

Fig. 2-6

2.8 Air Purge Collar Dimensions (OS550-AP)
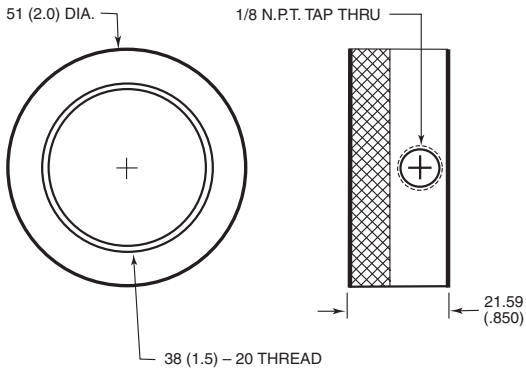
Fig. 2-7

3.1 Using the Infrared Thermometer
3.1.1 Water Cool Jacket Accessory

When using the OS550 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.

Ø 70.4 (2.77)

63.5 (2.50)

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

3.2 How To Power the Thermometer

3.2.1 OS550 Series Cable Connection

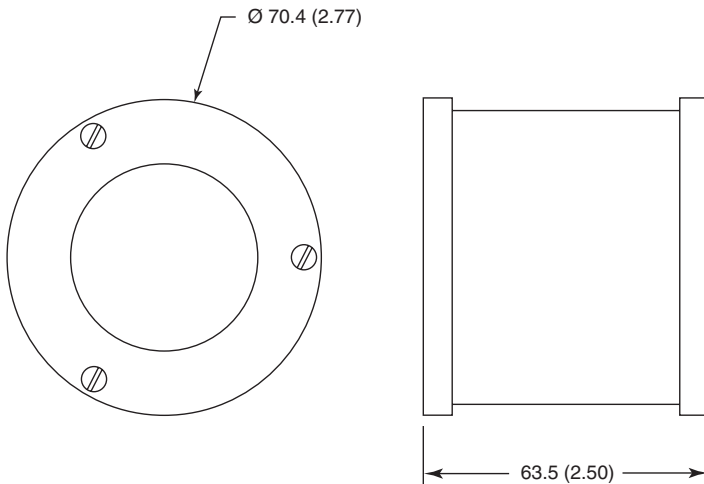The OS550 Series thermometer comes with a built-in 4.5 m (15')
power/output cable. Power and output connections are made to the
cable via stripped wire ends located at one end of the cable. The
power/output cable can be shortened or extended in the field if needed.
See table 3-1 below for wire Connection.

Power Cable Connections – Table 3-1

Power Connection: 7-24 VDC@80Ma		
(+) Red Wire	(-) Black Wire	Earth Ground-Barewire

Output Cable Connections

Model	-MV	-MA	-V1
Analog Output	1mV/°C or °F	4 to 20 mA	0-5 VDC
Connection	(+) White Wire	(-) Green Wire	

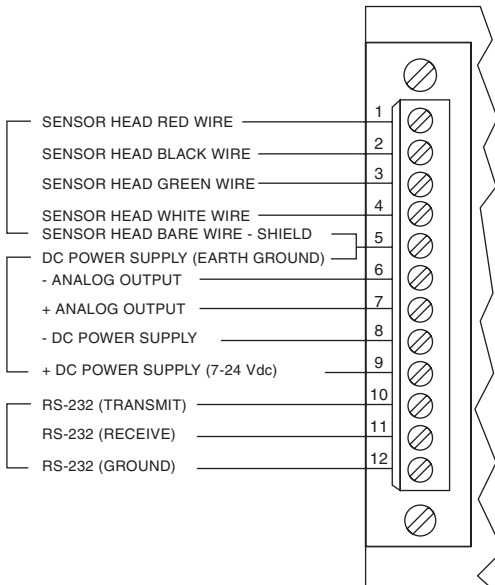### 3.2.2 OS550-BB Series Terminal Block Wire Connections

Figure 3-1

3.3 Operating The Thermometer

1. After installing the thermometer (see section 2.1) and connecting power (see section 3.2), your unit will be ready for use.
Your unit has been shipped to you with the SLEEP/ON switch in the "SLEEP" position. Place the switch in the "ON" position to turn your unit on and begin to make measurements.

OS550 SERIES KEYPAD PARTIAL VIEW
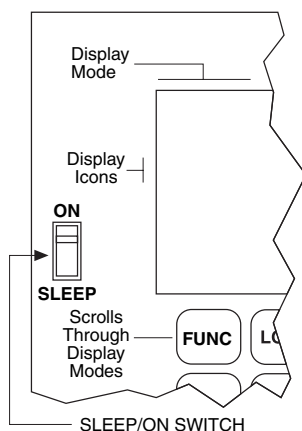
2. The optical field of view of the thermometers sensor head should fall within the area of the target being measured.
See Figure 3-2. Figures 3-3 through 3-8 show the fields of view vs. distance for the various thermometers.
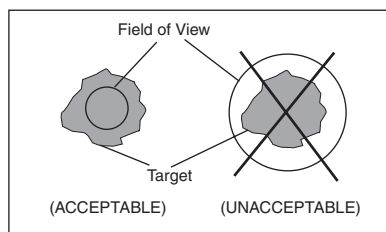

Figure 3-2. Field of View Positions

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 ⬇ key to decrement the target emissivity.

3.3.1 Field of View Charts

DISTANCE: SENSOR TO OBJECT (FT)

SPOT DIA.* (IN)

| 0 | 2 | 3 | 5 | 10 | 16 |

.35" @ 24"

4.0   7.0

1.6

.8   .9

D:S = 68:1

21   22   42

9mm @ 610 mm   101   181

*SPOT DIAMETER MEASURED AT 90% ENERGY

SPOT DIA.* (MM)

| 0 | .61 | 1.0 | 1.5 | 3.0 | 5.0 |

DISTANCE: SENSOR TO OBJECT (M)

Figure 3-3. OS550 Series (-1 FOV)

0**

DISTANCE: SENSOR TO OBJECT (FT)

SPOT DIA.* (IN)

| 1' | 2' | 4' | 6' | 8' |

9.7"

7.3"

5.0"

.5" @ 0" to 3"

2.5"

1.3"

D:S = 10:1

4.3

8.3

12

1.3cm@ 7.6cm   16

20

* SPOT DIAMETER MEASURED AT 90% ENERGY   24.8

SPOT DIA.* (CM)

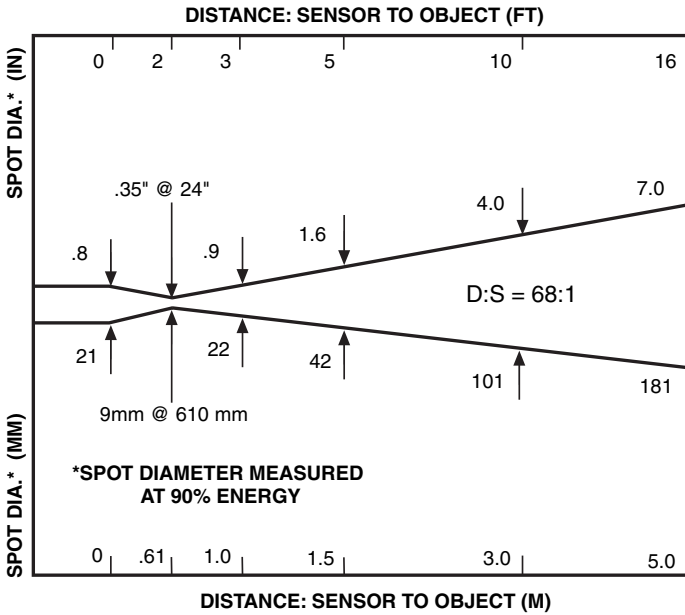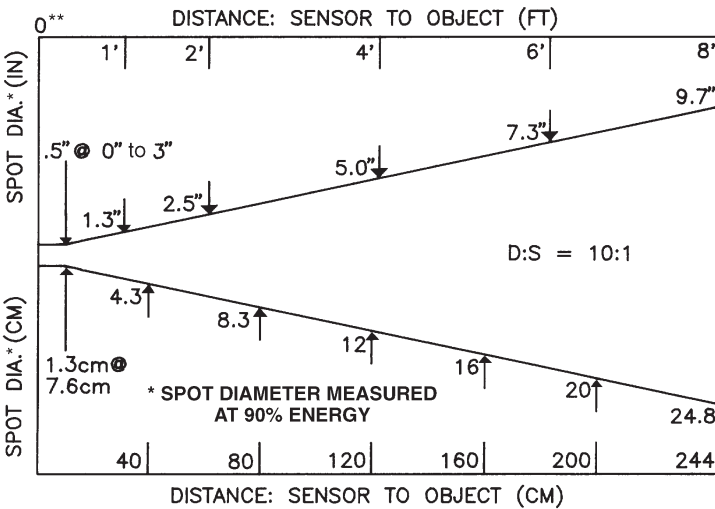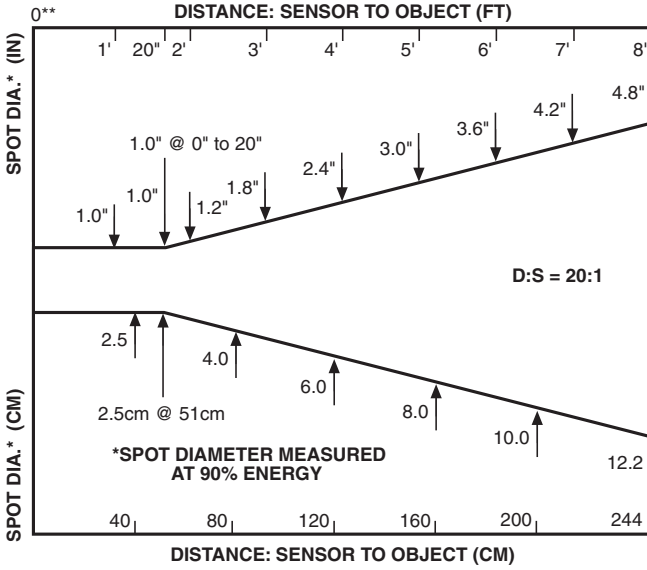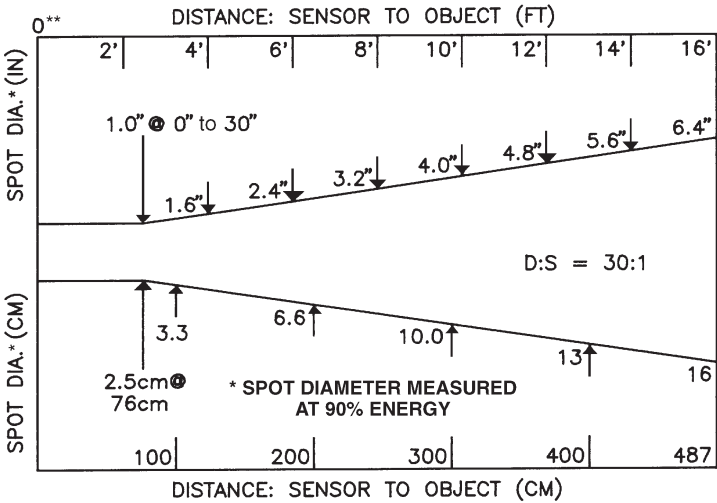| 40 | 80 | 120 | 160 | 200 | 244 |

DISTANCE: SENSOR TO OBJECT (CM)

Figure 3-4. OS550 Series (-2 FOV)

Figure 3-5. OS550 Series (-3 FOV)

Figure 3-6. OS550 Series (-4 FOV)

DISTANCE: SENSOR TO OBJECT (FT)

SPOT DIA.* (IN)

| 0 | 3 | 5 | 10 | 16 |

0.9" @ 0

0.9

1.0

1.2

1.9

2.9

D:S = 60:1

22mm @ 0

26

31

48

75

*SPOT DIAMETER MEASURED
AT 90% ENERGY

SPOT DIA.* (MM)

| 0 | 1.0 | 1.5 | 3.0 | 5.0 |

DISTANCE: SENSOR TO OBJECT (M)
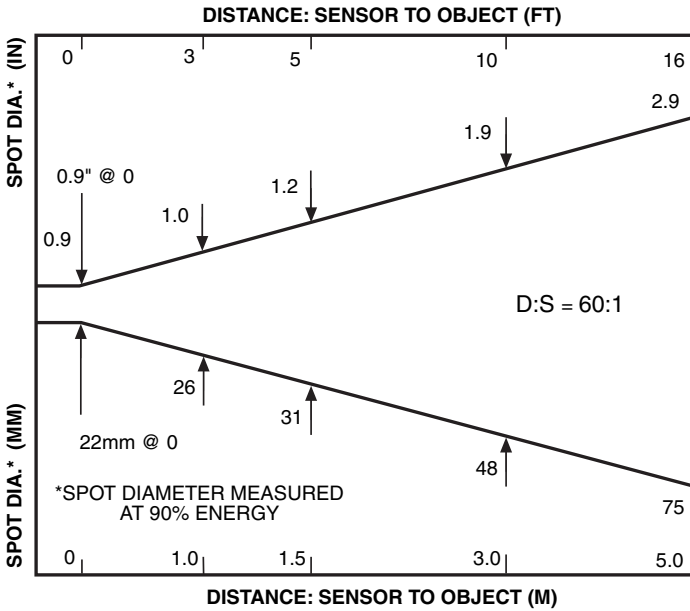
Fig. 3-7. OS550 Series- (-5FOV)

DISTANCE: SENSOR LENS TO OBJECT (in.)

SPOT DIA.* (IN)

0

| 3" | 6" | 9" | 12" | 15" |

0.9"

.45"

.15"

.39"

.78"

1.17"

D:S = 40:1

22

11.5

3.9

9.9

19.9

29.9

*SPOT DIAMETER MEASURED
AT 90% ENERGY

SPOT DIA.* (MM)

0

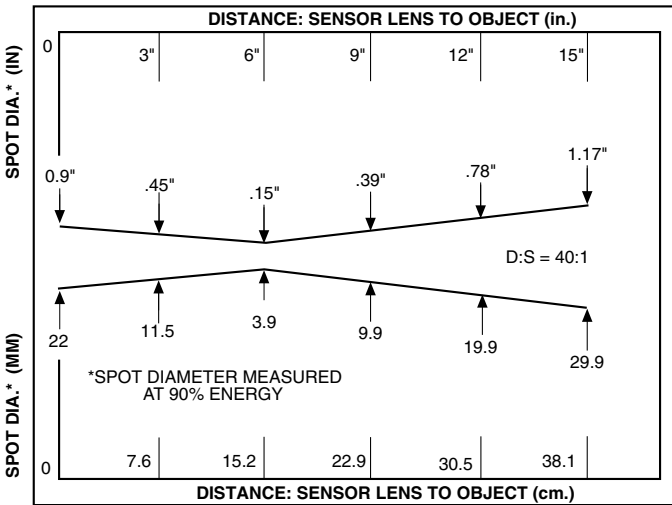| 7.6 | 15.2 | 22.9 | 30.5 | 38.1 |

DISTANCE: SENSOR LENS TO OBJECT (cm.)

Figure 3-8. OS550 Series- (-6FOV)

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 ⬇️ 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.

• **Moving Surface Scan** - Measures the Temperature of Points on a Moving Surface:
  1. Mount the sensor head and aim at your target.
  2. If necessary, adjust the emissivity. The thermometer is now set up for measuring the temperature of a moving surface.
  3. To record the temperature profile of the moving surface, connect the IR thermometer to a strip chart recorder or Data logger.

• **Fixed Point Monitoring Over Time** - Monitors the temperature at a fixed point over time:
  1. Mount the sensor head and aim at your target
  2. If necessary, adjust the emissivity.
  3 Connect the analog output of the thermometer to a strip chart recorder or datalogger
  4. The thermometer is now set up for unattended monitoring of temperature over time. You can also download the temperature readings to a serial printer or computer.

3.4.1 Real Time Mode (Active Operation)

Definition: Real Time Mode is the active operational mode of the thermometer. In this mode, the thermometer constantly measures and displays temperature.
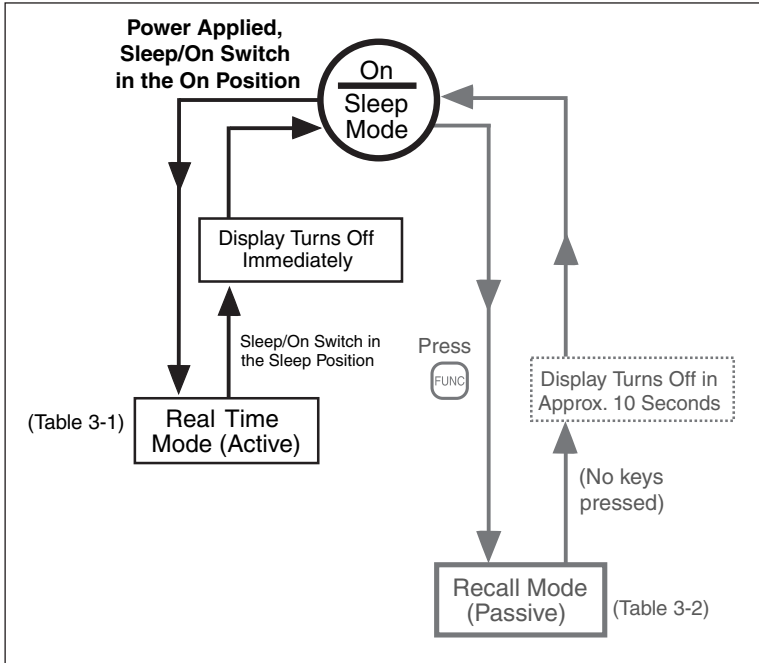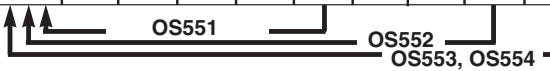

Fig. 2-11. General Operational Block Diagram

Table 3-1. Functional Flow Chart when the Unit is On (Real Time Mode)

Real Time Mode

Display Mode:	Display shows:	Press FUNC to...	Press LOCK to...	Press ▼°F°C or ◄○-● to...
E	Current temperature / Emissivity			Set emissivity
MAX	Current temperature / Maximum temperature	Go to MAX		Press ►°F°C to change between F/C
MIN	Current temperature / Minimum temperature	Go to MIN		
dIF	Current temperature / Differential temperature	Go to dIF		Press ◄○-● to turn backlight ON or OFF
AVG	Current temperature / Average temperature	Go to AVG		
HAL	Current temperature / High alarm setpoint	Go to HAL	ACTIVATE/DEACTIVATE HAL	Set High alarm value
LAL	Current temperature / Low alarm setpoint	Go to LAL or E	ACTIVATE/DEACTIVATE LAL	Set Low alarm value
AMB	Current temperature / Ambient target temperature	Go to AMB	ACTIVATE/DEACTIVATE AtC	Set target ambient temperature
PRN	Current temperature / Print interval	Go to PRN	ACTIVATE/DEACTIVATE PRN	Set printing interval
MEM	Current temperature / Memory location	Go to MEM or E	Store temperature data	Set memory location

OS551
OS552
OS553, OS554

NOTE: The unit of measure (F or C) flashes in the Real Time Mode.

MODE DISPLAY   DISPLAY MODE

E 0.95
LCK
°F
346
E

LAL 225
LCK
LAL
°F
346
LAL

☞ FUNC ↓

☞ FUNC ↓

* MAX
MAX 572
LCK
°F
346

AMB 75
LCK
ATC
°F
346
AMB

☞ FUNC ↓

☞ FUNC ↓

* MIN
MIN 284
LCK
°F
346

PRN 005
LCK
PRN °F
346
PRN

☞ FUNC ↓

☞ FUNC → E
Model OS552

* dIF
dIF 288
LCK
°F
346

↓

☞ FUNC ↓

MEM 24
LCK
°F
346
MEM

* AVG
AVG 403
LCK
°F
346

☞ FUNC

☞ FUNC ↓

E
Model OS553, OS554

HAL
HAL 675
LCK
HAL
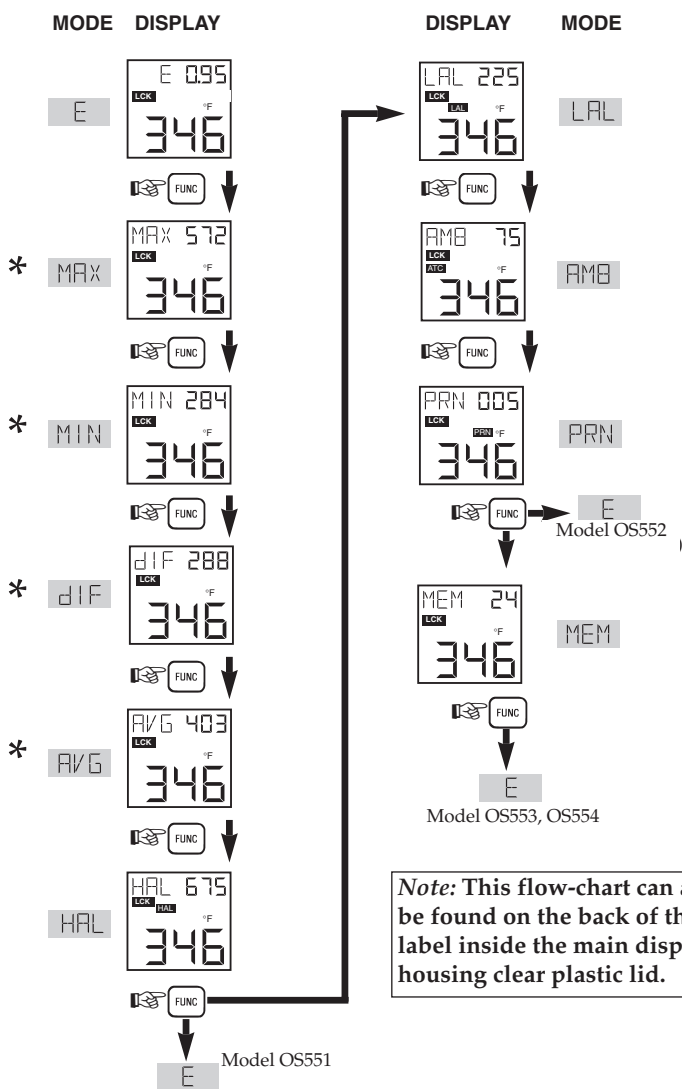°F
346

Note: **This flow-chart can also be found on the back of the label inside the main display housing clear plastic lid.**

☞ FUNC

E Model OS551

Figure 3-9 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 the display backlighting.

3.5.1 Adjusting Emissivity

E 0.95

°F

346

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 ⬇️ key to decrement the target emissivity.

NOTE

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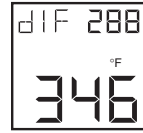

3.5.2 Calculating Temperature Values

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

| MAX 572 °F 346	MIN 284 °F 346	dIF 288 °F 346
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.

AVG 403 °F 346	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.
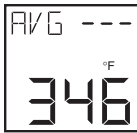
AVG --- °F 346	"AVG ---" is displayed when either of the following conditions occur: 1. When the average temperature measurement reaches its time period as stated in the specifications. 2. When the thermometer is trying to measure a target temperature which is outside of its measuring temperature range.

To clear the "AVG ---" display, turn off the thermometer.

NOTE

When the thermometer goes from the sleep mode to the real-time mode, the MAX, MIN, dIF and AVG temperatures are updated.

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.

HAL 675

HAL °F

346

- 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 [LOCK] 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.

    4. To disable the high alarm, press the [LOCK] 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 [LOCK] 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:

OS551	750°F
OS552	1000°F
OS553	1600°F
OS554	2500°F

LAL 225

LAL °F

346

• To set the low alarm value (OS552, OS553, OS554):

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 [LOCK] 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.

4. To disable the low alarm, press the [LOCK] 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 [LOCK] key to disable the low alarm.

▼
NOTE

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

3.5.6 Using Ambient Target Temperature Compensation (OS552, OS553, OS554)
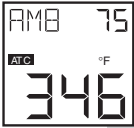
Use the Ambient Target Temperature Compensation (AMB) Display Mode when high accuracy readings under both of these conditions are required:

- 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 [LOCK] key to enable the ambient target temperature compensation. The **ATC** icon appears on the display.

> **NOTE**
>
> To disable this mode, press the [LOCK] key again.
> The **ATC** icon disappears.

```
RMB   75
346
```

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 [LOCK]

key to disable it.

NOTE

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

3.5.7 Sending Temperature Data to a Serial Printer (OS552, OS553, OS554)

The thermometer can transmit temperature data to a Serial Printer via the RS-232 phone jack and the RS-232 cable.

```
PRN  005
346
```

1. Turn on the Serial Printer and set the following parameters:

    Speed: 4800 BPS / One Stop Bit
    Data: 8 Bits   No Parity

2. Remove the whole plug located on the bottom of the unit. This will allow access to the RS-232 jack. See Figure 3-13.

3. Connect the RS-232 cable between the thermometer and the printer as shown in Figure 3-10. Be sure to install the cable strain relief to maintain the environmental seal.
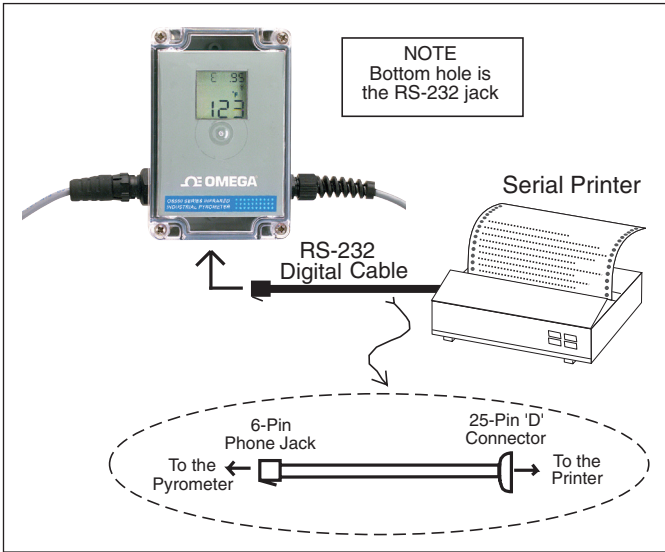
Figure 3-10. Serial Printer Hookup

3. With power applied to the unit, press and hold the `FUNC` key until the Print Data Display Mode (PRN) appears.

4. Press the `▲` key to increment the printing interval.
   Press the `▼` key to decrement the printing interval. The printing interval (from 1 to 1999 seconds) is the time between data points. The default value is 2 seconds.

5. Press the `LOCK` key to start sending data. The **PRN** icon appears on the display.

NOTE

To stop sending data, press the `LOCK` key again, and the **PRN** icon disappears.

PRN 005
346

6. After all data is taken, press and hold the [FUNC] key until
    the Emissivity Display Mode (E) appears.

3.5.8 Sending Temperature Data to a Personal Computer (OS552, OS553, OS554)

The thermometer can transmit temperature data to a
Personal Computer via the RS-232 phone jack and the
RS-232 cable.

1. Turn on the Computer.

2. Connect the RS-232 cable between the thermometer and the serial
   port (RS-232 of the Personal Computer as shown below in Figure 3-11).

PRN 005
PRN °F
346

3. With power applied to the OS550, press the [LOCK] key. The LCK
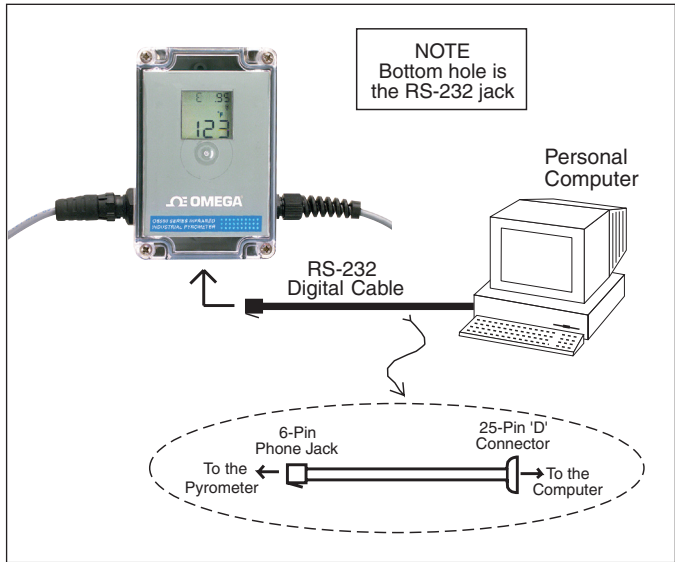   icon will appear on the display.

Figure 3-11. Personal Computer Hookup

3.5.8.1 Software Installation

System Requirements

To run IR_TEMPSOFT you must have an IBM-compatible personal
computer with these minimum specifications:

Operating System:	Win95, Win98, Win NT 4.0, Windows 2000
Processor :	Pentium Class (Any speed)
Ram:	32 Mega-Bytes
Monitor:	VGA, Or Higher Resolution
Video Card:	Supports VGA, 256 Color, 800 x 600 Resolution (Minimum)
CommPort:	4800 Baud, 8 Databits, 1 Stop, No Parity.
CD-ROM:	Any Speed
Hard Drive:	10 Mega-Bytes Available Space (For Installation Only)

How to Install IR_TEMPSOFT

Please follow this installation procedure to install IR_TEMPSOFT:

1. Place the supplied CD disk into your CD-ROM drive. Make certain that you are not running any other applications at this time. Running other applications while trying to install IR_TEMPSOFT may cause installation errors.

2. The CD will automatically start.

3. Click on Free Software. Then Click on the Software icon.

4. Now you will see a menu of Free software download for different products.

5. Click on the Infrared Thermometer picture icon. This will start the installation process.

6. Follow the installation instructions as they appear on your screen. For example, you will be asked in which directory would you like to install the IR_TEMPSOFT program. You may accept the default location provided, ("C:\Program Files\IR_TEMPSOFT\") or specify your own location.

7. During the process of installation, the installer program will notify you if it is about to overwrite an existing file with one that is older. Should this occur, it is advisable to keep your newer files and do not overwrite them with the supplied older files.

8. After a successful installation, the installer program will notify you with a pop-up which states "IR_TEMPSOFT from Omega Engineering Setup was completed successfully." Just click on the "OK" button.

If you have any trouble with the installation of this

PRN 005
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program please contact technical support at Omega Engineering Inc.

Connecting the IR-System to the PC

Make certain that your Infrared Thermometer is powered down before you attempt to make any connections to the personal computer. Making connections between powered devices and a powered PC can cause damage to communications ports, or other electronic circuitry in your device or computer.

1. With the thermometer device powered down, connect the enclosed serial communications cable to the device.

2. Connect the other end of the serial cable to the desired communications port of the personal computer. Usually, it is located in the back of the unit.

3. Pull the trigger and press the [LOCK] key to turn on the thermometer. Point the thermometer to your target, and make certain that you are reading a temperature. Do not begin to print (send) data at this time.

Starting The IR_TEMPSOFT Software

1. From your desktop, click on the "Start" Button.

2. Locate, and click on the "Programs" selection. A side menu will appear listing all application programs that can be run on the computer.

3. Locate and click on the "IR_TEMPSOFT" folder.

4. Click on "IR_TEMPSOFT" to start the program.

Receiving Real-Time Temperature Data

1. After the splash screen is displayed and disappears, you will be left at the main panel of the program.

2. Here you will select the "Command" menu item from the main menu bar, which will cause a drop down menu to appear. Select "Send Data In Real Time" to begin receiving data.

3. A popup will appear showing a computer searching for an IR Device with the caption "Scanning CommPort for IR Transmission". This is normal, as the program is now

waiting for the thermometer to transmit data through your RS-232 port.

4. Begin transmitting data from the thermometer by pressing and holding the [FUNC] key on the thermometer until the Print Data Display Mode (PRN) appears.

5. Press the "UP" key to increment the printing interval. Press the "Down" key to decrement the printing interval. The printing interval (from 1 to 1999) is the time between data points. The default value is 2 seconds.

6. Press the [LOCK] key on the thermometer to begin transmitting data. The "PRN" icon appears on the thermometer display. You should now see the current temperature, the downloaded parameters, and the temperature data being charted.

If instead the "Scanning CommPort for IR Transmission" popup is still visible, then there is a communications error. Check the communications cable, and its connection at both the IR device and computers comm-port. Make certain that you are connected to your configured comm-port.

From the main menu, click on Help, and select On-Line Manual. The on-line Manual has more detailed information regarding all the features of the software.

To stop the data transmission from the thermometer, press the [LOCK] key and the PRN icon will disappear.

NOTE

The transmitter temperature data is the average temperature for every printing interval period.

3.5.9 Storing the Temperature Data on Command (OS553, OS554)
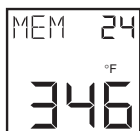
The thermometer can store up to 100 temperature data points on command. Each set of temperature data is broken down into the temperature value, emissivity, and high alarm setpoint for that temperature. This data is stored in non-volatile memory, so power loss will not affect this data. To store temperature data:

1. With power applied to the unit, place the SLEEP/ON switch to the ON position.

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 [⌾•] key to increment the memory location or press the [▼ °F-°C] key to decrement the memory location. The memory location can be from 001 to 100.

5. Press the [LOCK] key to store the target temperature at the memory location indicated. You will hear a beep to verify that the data is stored.

> **NOTE**
>
> You can write over any previously stored memory locations.

6. After all data is taken, press and hold the [FUNC] key until the Emissivity Display Mode (E) appears.

3.5.10 Erasing the Temperature Data from Memory

The user can erase all 100 temperature data points in memory at any time by using the following procedure:

1. With power applied to the unit, place the SLEEP/ON switch to the ON position.

2. Press the [LOCK] key. The █LCK█ icon will appear.

3. Place the SLEEP/ON switch to the SLEEP position.

4. Press the [LOCK] key and then the [▲⌀•⌀] key in rapid sequence.

> **NOTE**
>
> If the █LCK█ icon disappeared, repeat Steps 1 and 2.

The display freezes momentarily, and a beep sounds for about 1 second. Now the memory is cleared. The thermometer reverts to real time mode.

> **NOTE**
>
> Erasing the temperature data does not erase or reset your pre-set Emissivity, High and Low Alarm setpoints, printing interval, and Ambient Target Temperature compensation.

3.6 Recall Mode (Passive Operation)

Definition: Recall Mode is the passive operational mode of the thermometer. In this mode, you may review the most recently stored temperature data and parameters.
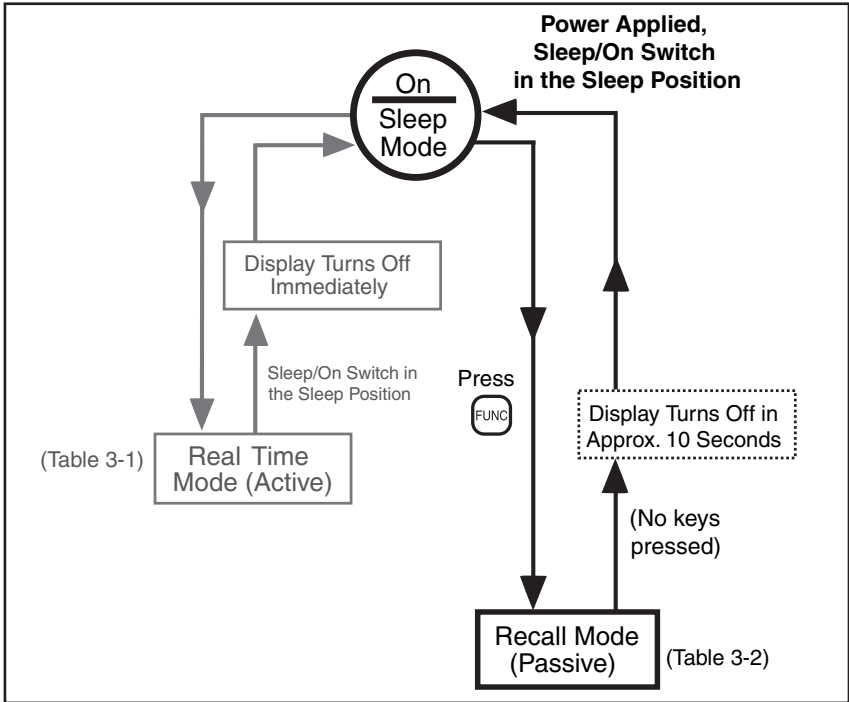
Figure 3-14. General Operational Block Diagram

NOTE

In order to get into the Recall Mode of operation, with power applied to the unit and the Sleep/On switch in the "Sleep" position press the [FUNC] key only.

Table 3-2. Functional Flow Chart (Recall Mode)

Recall Mode

DISPLAY MODE:	Display shows:	Press FUNC to...	Press LOCK to...	Press °F-°C or ▲/○-● to...
E	Last temperature / Emissivity	Go to MAX	Disabled	Disabled
MAX	Last temperature / Maximum temperature	Go to MIN		
MIN	Last temperature / Minimum temperature	Go to dIF		
dIF	Last temperature / Differential temperature	Go to AVG		
AVG	Last temperature / Average temperature	Go to HAL		
HAL	Last temperature / High alarm temperature	Go to LAL or E		
LAL	Last temperature / Low alarm temperature	Go to AMB		
AMB	Last temperature / Ambient target temperature	Go to PRN or E		
PRN	Last temperature	Go to MEM	Print stored data PRN	
MEM	Last/stored temperature / Memory location	Go to E	Display stored temperature	Set memory location

NOTE: The unit of measure (F or C) stays on (does not flash) during Recall Mode.

OS551

OS552

OS553, OS554

3.6.1 Reviewing the Last Parameters

E 0.95

°F

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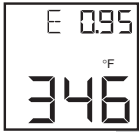
The thermometer stores the last temperature measured in the real time mode (refer to Table 3-1). This temperature can be recalled by pressing the [FUNC] key.

1. With power applied to the unit, place the SLEEP/ON switch to the SLEEP position.

2. Press the [FUNC] key to review the most recently stored temperature data and parameters. You may review:
   - MAX temperature
   - MIN temperature
   - dIF temperature
   - AVG temperature

   - HAL temperature
   - LAL temperature
   - AMB temperature
   - MEM location

3.6.2 Downloading Previously Stored Temperature Data (OS553, OS554)

Up to 100 sets of stored temperature information can be downloaded to a serial printer or a personal computer. Each set of temperature information is broken down to the temperature value, the Emissivity, and the high alarm setpoint for that temperature.

1a. Turn on the Serial Printer and set the following parameters:

    Speed: 4800 BPS
    Data: 8 Bits
    One Stop Bit
    No Parity

                    or

1b. Turn on the Personal Computer.

2. Connect the RS-232 cable between the thermometer and the Serial Printer or Personal Computer as shown in Figure 3-10 or Figure 3-11.

3. To download stored temperature data points from the thermometer, first make certain that it is not in printing mode. Make sure that the IR_TEMPSOFT is installed properly as explained in previous section.

4. On the main menu bar, click on "Command-> Download Stored Data". The "Stored Data" window will appear.

5. The "Stored Data Points" window will appear.

6. Click on the "START RECEIVING" button to bring the program into receive mode. Release the trigger to put the thermometer into sleep mode.

7. Press and hold the FUNC key until you see the Print Display Mode (PRN) appear.

8. Press the LOCK key to start downloading the stored date to the Personal Computer. The "PRN" icon appears on the thermometer display. When the stored data is completely downloaded, you will hear a peep and the "PRN" icon disappears.

9. When the thermometer completes sending all its memory content, a pop-up will appear.

10. From the "STORED DATA" window you can save the display data to a text file or directly export it into a MS Excel file.

The on-line Manual has more detailed information on all the features of this software.

3.6.3 Reviewing Previously Stored Temperature Data (OS553, OS554)

MEM 001

°F

247
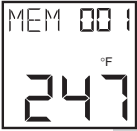
You can review all 100 stored temperature values on the thermometer display using the following procedure:

1. With power applied to the unit, place the SLEEP/ON switch to the SLEEP position

2. Press and hold the [FUNC] key until you see the Memory Display Mode (MEM) appear.

3. Press the [▲ ○•] key to increment the memory location or press the [▼ °F-°C] key to decrement the memory location.

   The memory location can be from 001 to 100.

4. Press the [LOCK] key. The stored temperature is shown in the lower portion of the display. If there is no data stored in a memory location, the display shows "----."

5. To review other stored temperatures, repeat Steps 3 and 4.

NOTE

If no keys are pressed, the thermometer goes back into sleep mode in approximately 10 second

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.

IR SENSOR HEAD

LASER WARNING LABEL

LASER HEAD ASSEMBLY

LASER BEAM OUTPUT

POWER/LASER "ON" LED

BATTERY PACK POWER SUPPLY

BATTERY PACK CABLE/CONNECTOR

BATTERY PACK ON/OFF SWITCH
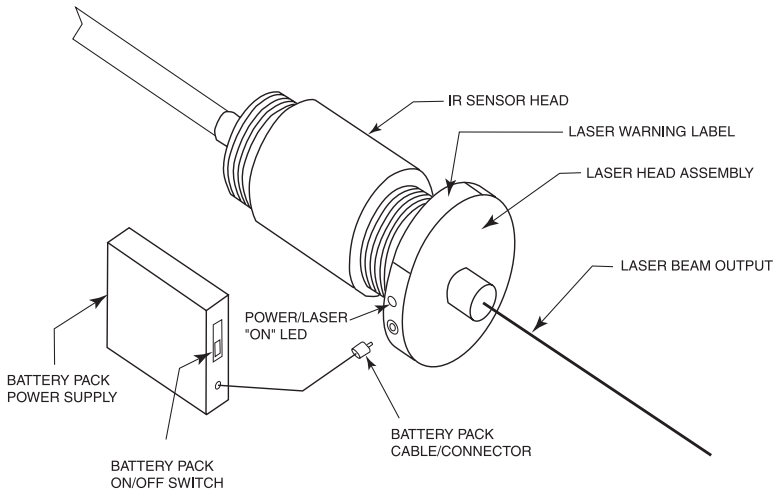
Fig. 4-1

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 power 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	a. Clean the thermometer lens. Refer to Section 5.1.
	b. Activate the Diagnostic Program in the thermometer as follows:
	c. Press the [LOCK] key.
	d. Hold down the [FUNC] key and press the [▾°F-°C] key until "VER X.X" is displayed.

You can expect to see and hear the following:

- You will see the version number "VER X.X" of the software for about 1 second.
- You will hear a beep, "TST" is displayed, and °F flashes.
- 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.

  If you see an error code, either "ERR1", "ERR2", or "ERR3", record the code and call our Customer Service Department. Provide Customer Service with the error code that is displayed in the upper left corner of the display. The Customer Service Department representative may ask you to return the thermometer to the factory.

- The display will go back to the Real Time Mode (Emissivity Display Mode).

        e. After running the diagnostic program, press the [LOCK] key to release this mode.

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.

Notes

(Specifications are for all models except where noted)

THERMOMETER

Measuring Temperature Range:	OS551:	−18°C to 400°C (0°F to 750°F)
	OS552:	−18°C to 538°C (0°F to 1000°F)
	OS553:	−18°C to 871°C (0°F to 1600°F)
	OS554:	−18°C to 1371°C (0°F to 2500°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

Distance to Spot Size Ratio:
- 10:1 (Figure 3-4) 60:1 (Figure 3-7)
- 20:1 (Figure 3-5) 40:1 (Figure 3-8)
- 30:1 (Figure 3-6) 68:1 (Figure 3-3)

Display Repeatability:	± (1% rdg + 1 digit)
Display Resolution:	1°F or 1°C
Display Response Time:	250 msec

Spectral Response:	8 to 14 microns
Operating Ambient Temperature:	
Main Electronics:	0°C to 50°C (32°F to 122°F)
Sensor Head	0°C to 50°C (32°F to 122°F)
Sensor Head with OS550-WC	0°C to 85°C (32°F 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:	7-24 Vdc @ 100 mA
Main Electronics Housing	Plastic ABS, IP65, NEMA 12 & 13 rated

Emissivity:	0.10 to 1.00 in 0.01 increments, set via keypad
Calculated Temperature Values:	Maximum (MAX), Minimum (MIN), Average (AVG), Differential (dIF)

Ambient Target Temperature Compensation:	OS552:	set and enabled via keypad
	OS553:	set and enabled via keypad
	OS554:	set and enabled via keypad

RS-232 Output (for personal computers and serial printers):	OS552:	standard
	OS553:	standard
	OS554:	standard
	4800 bits per second, 8 bits of data, 1 stop bit, no parity	

RS-232 Cable: RJ12 to 25 pin D connector, Female

RJ12 Pin #	25 pin D connector Pin #
3	3
5	7
	4 & 5 jumpered
	6 & 20 jumpered

Power/Analog Output Cable:	15' long; 4-conductor, shielded 24 AWG
Sensor Head Cable	15' long; 4-conductor, shielded 24 AWG

Alarm: Set and enabled via keypad

All models:	High alarm standard, with audible and visual indication
OS552, OS553: OS554	Low alarm standard, with audible and visual indication

Data Storage:	OS553, OS554	Up to 100 sets of data points on command. Each set of data consists of the temperature, the Emissivity and the high alarm value.

Dimensions:

Main Electronics:	120.6 x 80.0 x 50.8 mm (4.75 x 3.15 x 2")
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 referenced to the temperature display

0-5 Vdc Analog Output:

Accuracy: ± 0.25% of full scale (Referenced to display reading)

Scaling: Fixed (scaled to match full temperature range of
                          model selected)

Minimum Load: 600 ohms

4-20 mA Analog Output:

Accuracy: ± 0.25% of full scale (Referenced to display reading)

Scaling: Fixed (scaled to match full temperature range of
                          model selected)

Maximum Load: 900 ohms @ 24 Vdc

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 5.5 V
FDA Classification:	Complies with 21 CFR Chapter 1, Subchapter J
Beam Diameter:	5 mm
Beam Divergence:	<1mrad
Operating Temperature:	0°C to 50°C (32°F 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
[FUNC]	• Selects one of the following Display Modes: E , MAX, MIN, dIF, AVG, HAL, LAL, AMB, PRN, or MEM.
[LOCK]	• 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. • Displays previously stored data.
[▲/○-●]	• Increments the data or value displayed. • Turns on or off the backlighting (only in MAX, MIN, dIF, or AVG Display Modes).
[▼/°F-°C]	• 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 [FUNC] key & then press the [▼/°F-°C] key	• Allows you to go to the Diagnostic Routine.
[LOCK] and [▲/○-●] keys pressed in rapid sequence	• Allows you to erase all 100 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.
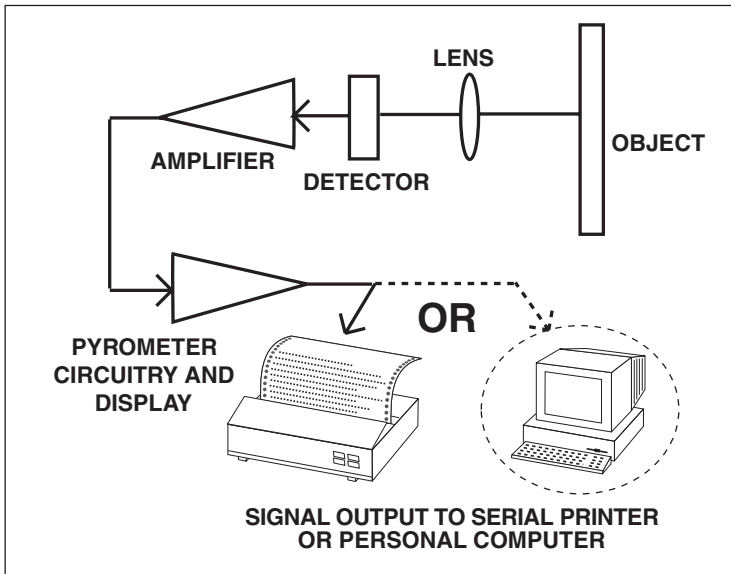

Figure A-1. Infrared Thermometer Block Diagram

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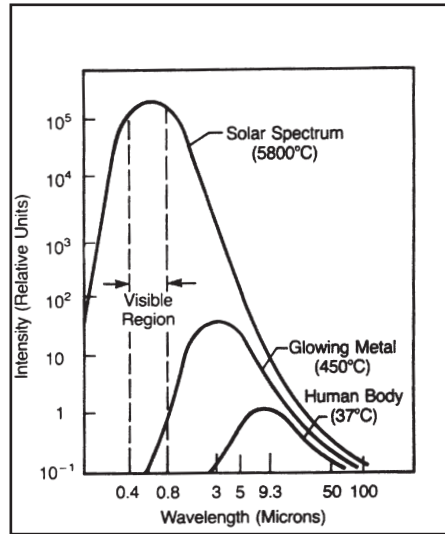
Relative emission from a blackbody versus wavelength. The area under the curve corresponds to the total energy, and is proportional to the absolute temperature to the 4th power. The peak of the spectral distribution curve shifts to shorter wavelengths as the temperature increases.

Figure A-2. Blackbody Spectral Distribution

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

σ = 5.6703 x 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 <u>a fixed proportion</u> of the energy radiated by <u>all</u> 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.
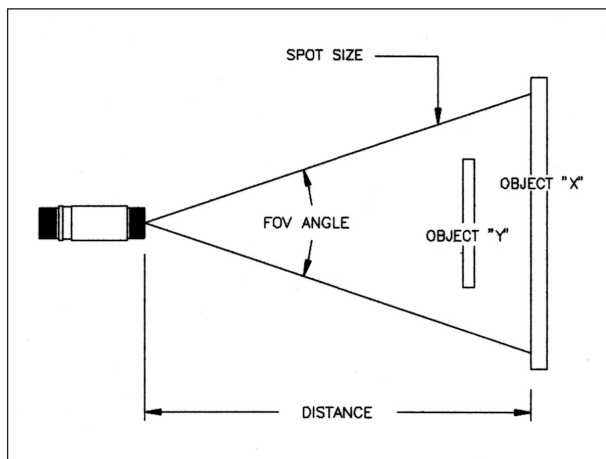

Figure A-3. Field of View of a Thermometer/Transmitter

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.

Appendix: Emissivity Values **B**

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.

Table B-1. Emissivity Table

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)
<u>Asbestos</u> Board	0.96
<u>Asphalt, tar, pitch</u>	0.95 – 1.00
<u>Brick</u> – red and rough	0.93
<u>Brick</u> – fireclay	0.75
<u>Carbon</u> – filament	0.53
<u>Carbon</u> – lampblack - rough deposit	0.78 – 0.84
<u>Glass</u> - Pyrex, lead, soda	0.85 – 0.95
<u>Marble</u> – polished light gray	0.93
<u>Paints, lacquers, and varnishes</u> – Black matte shellac	0.91
<u>Paints, lacquers, and varnishes</u> – aluminum paints	0.27 – 0.67
<u>Paints, lacquers, and varnishes</u> – flat black lacquer	0.96 – 0.98
<u>Paints, lacquers, and varnishes</u> – white enamel varnish	0.91
<u>Porcelain</u> – glazed	0.92
<u>Quartz</u> – opaque	0.68 – 0.92
<u>Roofing Paper</u>	0.91
<u>Tape</u> – Masking	0.95
<u>Water</u>	0.95 – 0.96
<u>Wood</u> – 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 OS551/OS552, OS553 and OS554 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.
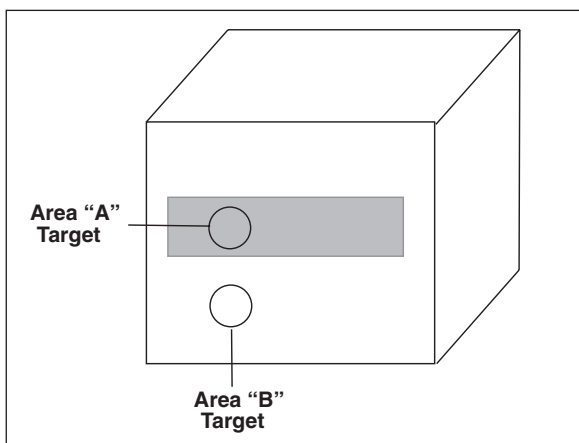

Figure C-1. Determining Emissivity

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).
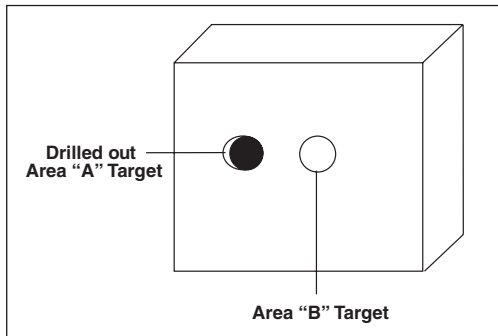

Drilled out
Area "A" Target

Area "B" Target

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.

ADDENDUM TO OS550/OS550-BB MANUAL

IMPORTANT CONSIDERATIONS BEFORE INSTALLATION

Follow all safety precautions and operating instructions outlined in this addendum and your OS550 Series manual.

- **SYMBOL KEY** -

⚠ **CAUTION:** Refer to accompanying documents. Ref. ISO 3864 NO. B.3.1

═══ **DIRECT CURRENT ONLY:** REF. IEC 417, NO. 5031

- **CAUTION** -

Section 3.2 How to Power the Thermometer

• Only experienced personnel should install and make electrical connections to the thermometer.

• Power must be disconnected before making any electrical connections.

• The power supply used to power the thermometer should be VDE or UL approved with the following ratings: Power: 7-24 Vdc @ 80 mA. Overload Protection: Current limited to 500 mA.

• There is only one fuse in the OS550. 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.

• Do not operate in flammable or explosive environments.

• This product is for professional use only. It is intended for use exclusively in laboratory or factory settings. Do not use it outdoors. Do not operate in flammable or explosive environments. There are no user serviceable parts inside this unit.

- - - - - - - - - - - - - - - **TYPICAL INSTALLATION SCHEMATIC** - - - - - - - - - - - - - - -

SENSOR HEAD

OS550

1 +PWR (RED)
2 -PWR (BLACK)
3 +O/P (WHITE)
4 -O/P (GREEN)
5 SHIELD (BARE) [DRAIN WIRE]

DC POWER SUPPLY
(INTEGRAL IMPEDENCE PROTECTED)

+

GND

(EARTH GROUND)

−

+

VOLTAGE O/P:
0-5 Vdc
CURRENT O/P:
4-20 mA

−

DIGITAL VOLTMETER/ AMMETER

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WARRANTY/DISCLAIMER

OMEGA ENGINEERING, INC. warrants this unit to be free of defects in materials and workmanship for a period of **25 months** from date of purchase on the <u>base unit</u> and **13 months** from date of purchase on <u>Laser Sight Module</u>. OMEGA WARRANTY adds an additional one (1) month grace period to the normal **product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit should malfunction, it must be returned to the factory for evaluation. OMEGA's Customer Service Department will issue an Authorized Return (AR) number immediately upon phone or written request. Upon examination by OMEGA, if the unit is found to be defective it will be repaired or replaced at no charge. OMEGA's WARRANTY does not apply to defects resulting from any action of the purchaser, including but not limited to mishandling, improper interfacing, operation outside of design limits, improper repair, or unauthorized modification. This WARRANTY is VOID if the unit shows evidence of having been tampered with or shows evidence of being damaged as a result of excessive corrosion; or current, heat, moisture or vibration; improper specification; misapplication; misuse or other operating conditions outside of OMEGA's control. Components in which wear are not warranted, include but are not limited to contact points, fuses, and triacs.

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RETURN REQUESTS / INQUIRIES

Direct all warranty and repair requests/inquiries to the OMEGA Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO OMEGA, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM OMEGA'S CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned AR number should then be marked on the outside of the return package and on any correspondence.

The purchaser is responsible for shipping charges, freight, insurance and proper packaging to prevent breakage in transit.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting OMEGA:

1. P.O. number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS, consult OMEGA for current repair charges. Have the following information available BEFORE contacting OMEGA:

1. P.O. number to cover the COST of the repair,
2. Model and serial number of product, and
3. Repair instructions and/or specific problems relative to the product.

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<u>Label Location</u> - refer to Section 4.1   <u>Warnings and Cautions</u> - refer to Section 4.1

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