

2 YEAR
WARRANTY

Ω OMEGA™ User's Guide



OS101



OS102

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OS100 SERIES Mini-Infrared Transmitter



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Safety Warnings and IEC Symbols

This device is marked with international safety and hazard symbols in accordance with IEC 1010. It is important to read and follow all 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 safety precautions may result in injury and or damage to your calibrator.

IEC symbols	Description
	Caution, refer to accompanying documents
	Direct Current
	Laser Symbol
	Frame or Chassis

Caution and 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).
- There are no user replaceable fuses in this product
- 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.
- All connections to the thermometer should be made via a shielded cable, 24 AWG stranded wire with the following ratings: 300V, 105°C (221°F), PVC insulation.
- 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: 12 to 24vdc @150mA with overload protection of 500mA.



NOTES:

Section 1 - Introduction

The low cost OS101 mini-infrared transmitter provides non-contact temperature measurement for industrial applications. The unit measures a temperature range of -18 to 538°C (0-1000°F) and provides a linear analog output of either 4-20 mA, 0-5 VDC, K type TC, 1 mV/°C, or 1 mV/°F.

The new OS102 mini-infrared transmitter has all the functions of OS101 plus a built-in LED display that shows the measured temperature in degrees F or degrees C which is switchable in the field.

The miniature sensor head design 2.5 cm dia. x 6.3 cm Length (1" x 2.5") is ideal for measuring temperature in confined, and hard to reach places. The aluminum sensor head as well as the rugged electronic housing (Die cast Aluminum) are NEMA-4 rated.

The sensor head is connected to the electronic housing via a 1.82 m (6 feet) shielded cable as standard. The unit provides field adjustable alarm output.

Section 2 - Installation

2.1 Unpacking

Remove the packing list and verify that you have received all your equipment. If you have any questions about the shipment, please call Customer Service at:

1-800-622-2378 or 203-359-1660. We can also be reached on the internet: **omega.com** e-mail: **info@omega.com**

When you receive the shipment, inspect the container and equipment for any signs of damage. Note any evidence of rough handling in transit. Immediately report any damage to the shipping agent.

NOTE:

The carrier will not honor any damage claims unless all the shipping materials are saved for inspection. After examination and removing contents, save packing material and carton in the event reshipment is necessary.

The following items are supplied in the box:

- The infrared transmitter including the sensor head and the 1.82 m (6 feet) shielded cable
- User's Manual
- Mounting Nut

The following describes the ordering information:

OS102 or OS101 - MA - *, **, where

MA - 4/20 mA output	C - 1 mV/°C output	HT- High temperature sensor head
V1 - 0 to 5 VDC output	F - 1 mV/°F output	
K - Thermocouple output, K type		
MV - Millivolt output		

The following optional accessories are available:

Model No.	Description
OS100-MB	Mounting Bracket
OS100-DR	DIN Rail Mounting adapter
OS100-WC	Water Cooling jacket
OS100-AP	Air purge collar
OS100-LS	Laser Sighting
OS100-CA15FT	Sensor Head Extension Cable (4.6 m, 15")
OS100-CA25FT	Sensor Head Extension Cable (7.6 m, 25")
TX8-100	8 Conductor stranded Shielded cable (30 m, 100')
PSU-93	Unregulated 16-24 VDC Power Supply
CAL3-IR	NIST Traceable Calibration

Here are the Features of OS101 and OS102 infrared transmitters:

Features	OS101	OS102
Accuracy	2% Rdg or 4°F (2.2°C)	
Temp Range	0-1000°F (-18 to 538°C)	
Emissivity	0.1 to 0.99 Adj.	
Field of View	6 to 1	
Alarm Output	Standard	
1mV/Deg. Output	Standard	
4-20mA Output	Standard	
0/5 VDC Output	Standard	
K Type T/C	Std.	—
LED Display	—	Std.
Main Housing	65.5 x 30.5 x 115.3 mm (2.58" x 1.2" x 4.54")	65.5 x 55.9 x 115.3 mm 2.58" x 2.2" x 4.54"

2.2 Electrical Connection

Sensor Head Cable - The Sensor head is pre-wired to a 1.8 m (6 feet) shielded cable. Plug & lock-in the male connector to the mating female connector on the aluminum housing.

Power & Output Connection - Open the cover of the main aluminum housing. Slide the cable through the strain relief and connect the wires to the terminal block on the board as shown in Fig. 2-1. For Alarm output connection, refer to Fig. 2-2.

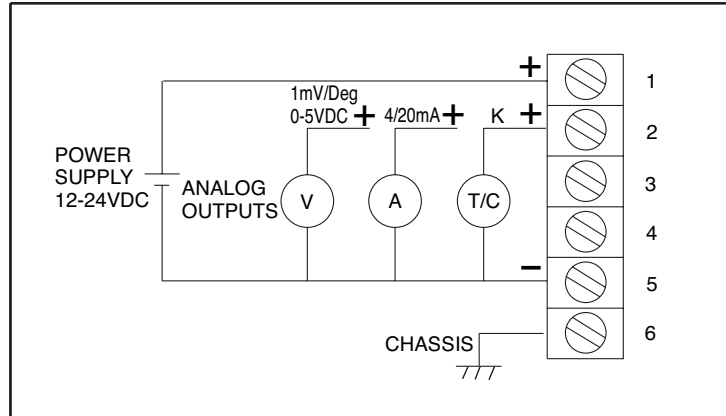


Figure 2-1. Power Supply & Analog Output Connections

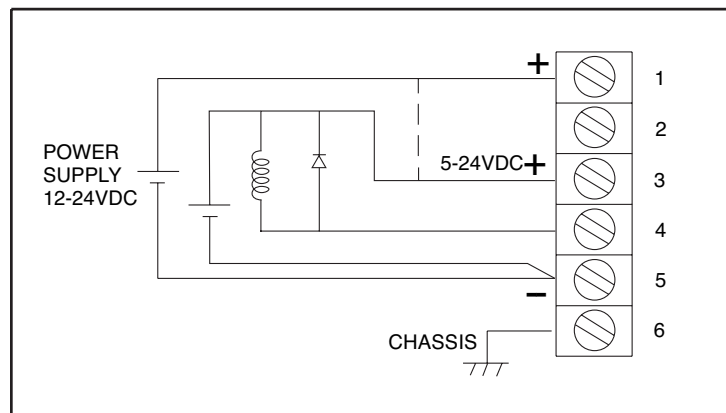


Figure 2-2. Alarm Output Connection

Section 3 - Operation

3-1 Main Board

The Main Board is shown in Fig. 3-1. Here are the important components on the board:

- (1) - Terminal Block for Power & Output connections
- (2) - Single Turn Potentiometer to adjust Emissivity in tenths (0.x_)
- (3) - Single Turn Potentiometer to adjust Emissivity in hundreds (0._x)
- (4) - Slide switch to select between real time (Normal Operation) and alarm set point
- (5) - Alarm set point adjust, P4
- (6) - Sensor Head connection
- (7) - Input Zero adjust, P3
- (8) - Input Span adjust, P2
- (9) - Output Zero adjust, P5
- (10) - Output Span adjust, P6

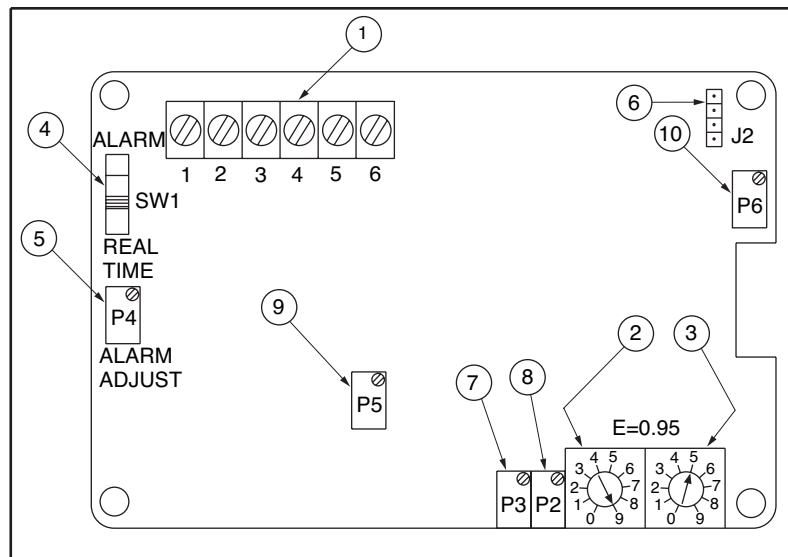


Figure 3-1. Main PC Board

3.2 Ambient Temperature

The Sensing head can operate in an ambient temperature of 0 to 70°C (32 to 158°F). The Sensing head in the high temperature model (-HT) can operate in an ambient temperature of 0 to 85°C (32 to 185°F) without any cooling required. The Sensing head can operate up to 200°C (392°F) using the water cool jacket accessory OS100-WC (See Fig. 3-6).

There is a warm up period of 3 minutes after power up. After the warm up period, temperature measurement can be made.

When the ambient temperature around the sensor head changes abruptly, the sensor head goes through thermal shock. It takes a certain amount of time for the sensor head to stabilize to the new ambient temperature. For example, it takes about 30 minutes for the sensor head to stabilize going from 25°C to 50°C (77 to 122°F) ambient temperature.

The sensor head dimensions are shown in Fig. 3-2.

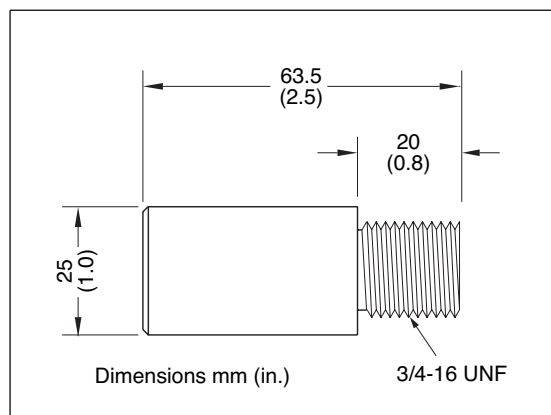


Figure 3-2. Sensor Housing

3.3 Atmospheric Quality

Environments with smoke, dust, and fumes dirty up the optical lens, and cause erroneous temperature readings. To keep the surface of the optical lens clean, the air purge collar accessory is recommended, OS100-AP, See Fig. 3-7.

3.4 Measuring Temperature

Before starting to measure temperature, make sure that the following check list is met:

- ✓ The power and analog output connections are made (Fig. 2-1).
- ✓ The sensor head is connected to the main unit.
- ✓ The slide switch (SW1) on the main board is set to real time (Fig. 3-1).
- ✓ The target is larger than the optical field of view of the sensor head (Fig. 3-3).
- ✓ The emissivity adjustment on the main board is set properly (Fig. 3-1).
- ✓ The output load is within the product specification.

On OS102 transmitters, follow these additional steps:

- ✓ The temperature display is set to °F or °C (Fig. 3-4)
- ✓ For 4-20mA output models, make sure an output load is added, ie. 250 ohms.

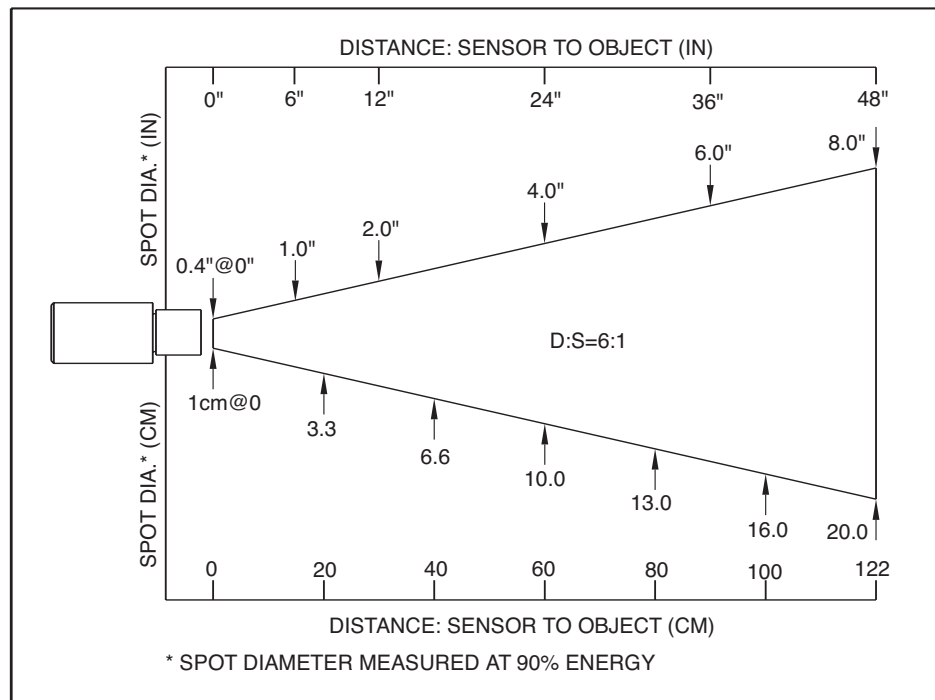


Figure 3-3. Optical Field Of View

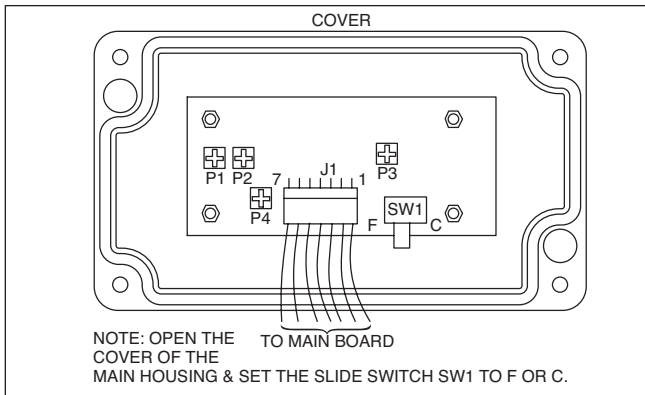


Figure 3-4. Setting the Temperature Engineering Unit

3.5 Alarm Setting

The unit provides 0-100% alarm set point adjustment. Here is an example of an alarm setting.

- An OS101-MA (4/20 mA output), the alarm is to be set at 400°F temperature.
- Connect the alarm output as shown in Fig. 2-2.
- Set the slide switch (SW1) on the main board to the Alarm position.
- Measure the analog output, and set the Potentiometer P4 until the output reads 10.4 mA which is 40% (400°F) of the temperature range.

$$[10.4\text{mA} = \frac{40 \times (20-4)}{100} + 4]$$
- Set the slide switch (SW1) back to the Real Time position.
- If the temperature reading is below the alarm set point, the alarm output stays high, otherwise it goes low.

On the OS102, you can set the alarm set point directly based on the temperature display.

3.6 Adding Extension Cable

You can add extension cable between the Sensor Head and the main electronic housing up to 15.2 m (50 feet). After adding the extension cable, the Zero input potentiometer, P3 may be re-adjusted. (See Fig. 3-1, for proper analog output reading)

The following figures show the mounting bracket (OS100-MB), Water cooling jacket (OS100-WC), Air purge collar (OS100-AP), DIN Rail Mounting adapter (OS-100-DR), and the main aluminum enclosure. The DIN Rail Mounting adapter (OS100-DR) is mounted to the bottom of the main aluminum enclosure using two 4-40 screws.

A typical water cool jacket assembly is shown in Fig. 3-7, on the following page.

1. Mounting Nut
2. Mounting Bracket
3. Water Cool Jacket
4. Sensor Head

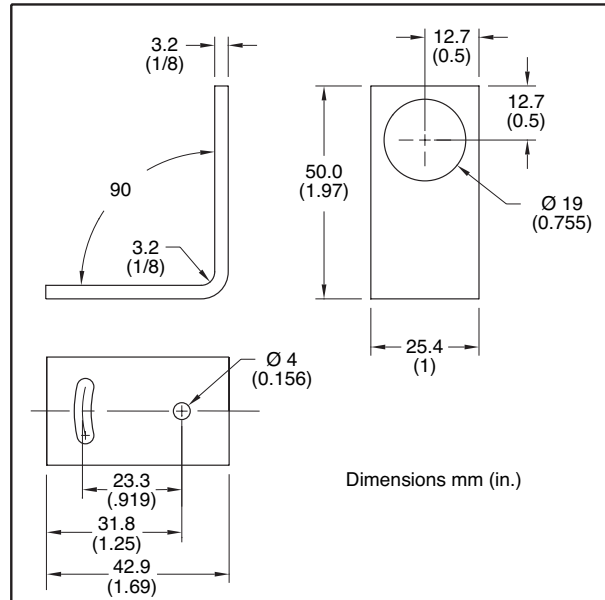


Figure 3-5. Mounting Bracket OS100-MB

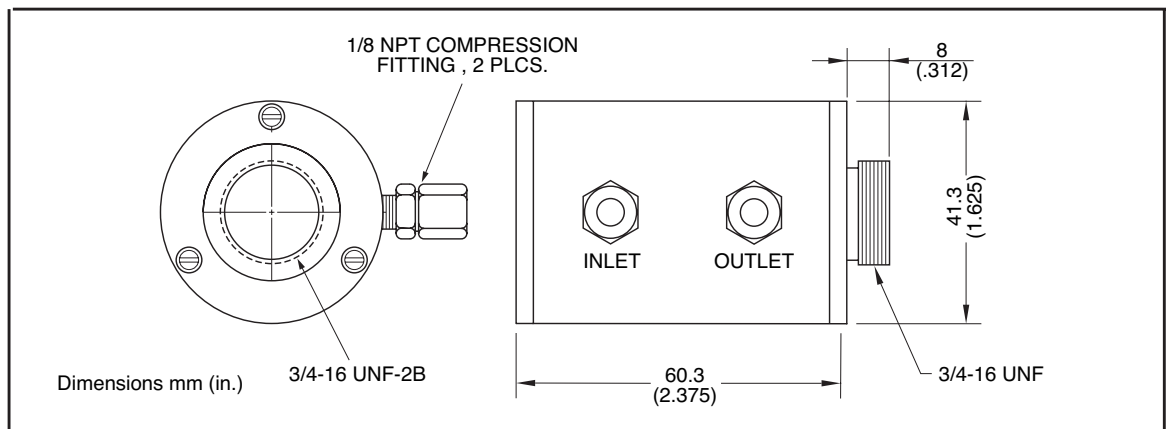


Figure 3-6. Water Cooling Jacket, OS100-WC

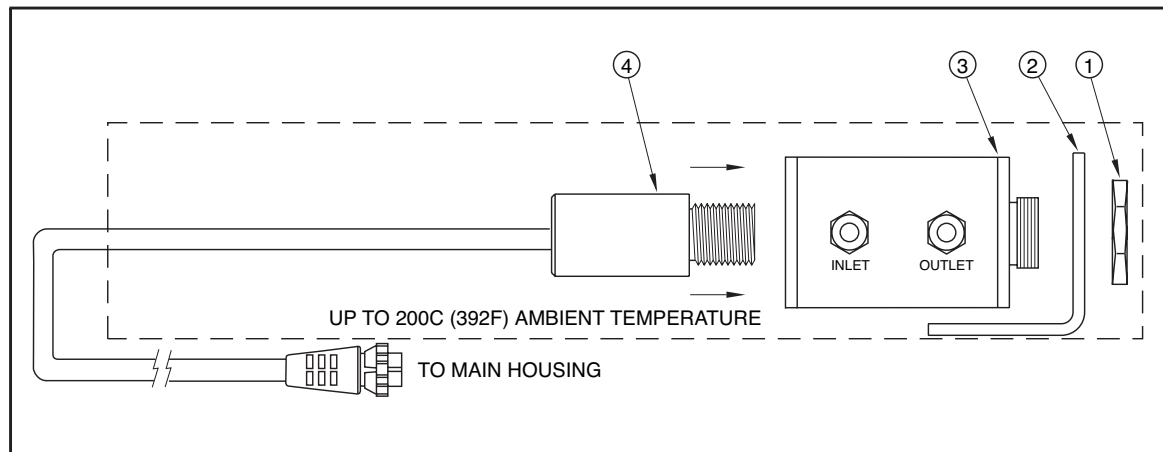


Figure 3-7. Typical Water Cool Jacket Assembly

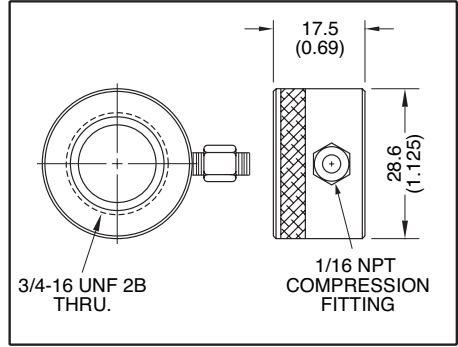


Figure 3-8. Air Purge Collar, OS100-AP

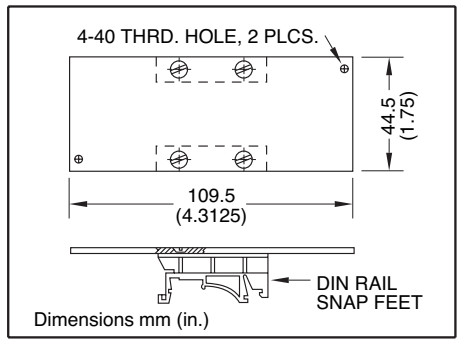


Figure 3-9. DIN Rail Mounting Adapter, OS-100-DR

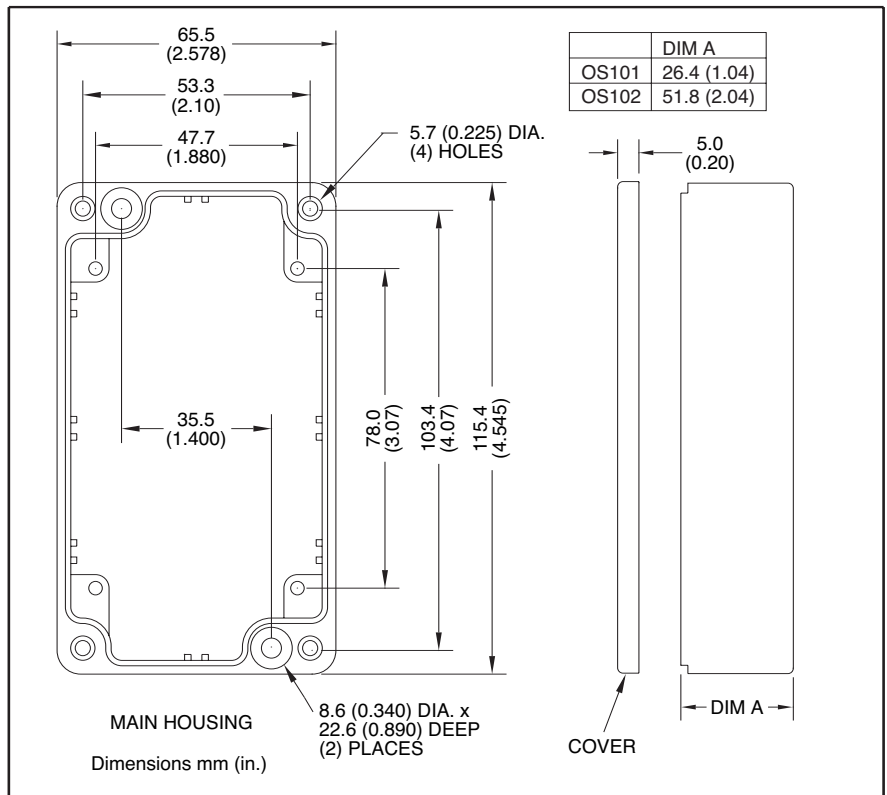


Figure 3-10. NEMA-4 Aluminum Enclosure

Section 4 - Laser Sight Accessory

4.1 Warning and Cautions

CAUTION:

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 operation the laser sight accessory
- Never point the laser accessory at a person
- Keep out of the reach of all children

WARNING:

Do not attempt to open the laser sight accessory. There are no user serviceable parts inside.

4.2 Operating the Laser Sight Accessory

The laser sight accessory screws onto the front of the sensor head. This accessory is only used for alignment of the sensor head to the target area. After the alignment process, the accessory has to be removed from the front of the sensor head before temperature measurement.

The laser sight accessory is powered from a small compact battery pack (included with the accessory). Connect the battery pack to the accessory using the cable provided. Aim at the target, and turn on the battery power using the slide switch on the battery pack. Adjust the sensor head position so that the laser beam points to the center of the target area. Turn off the battery pack, and remove the laser sighting accessory from the sensor head. See Fig. 4-1 for reference.

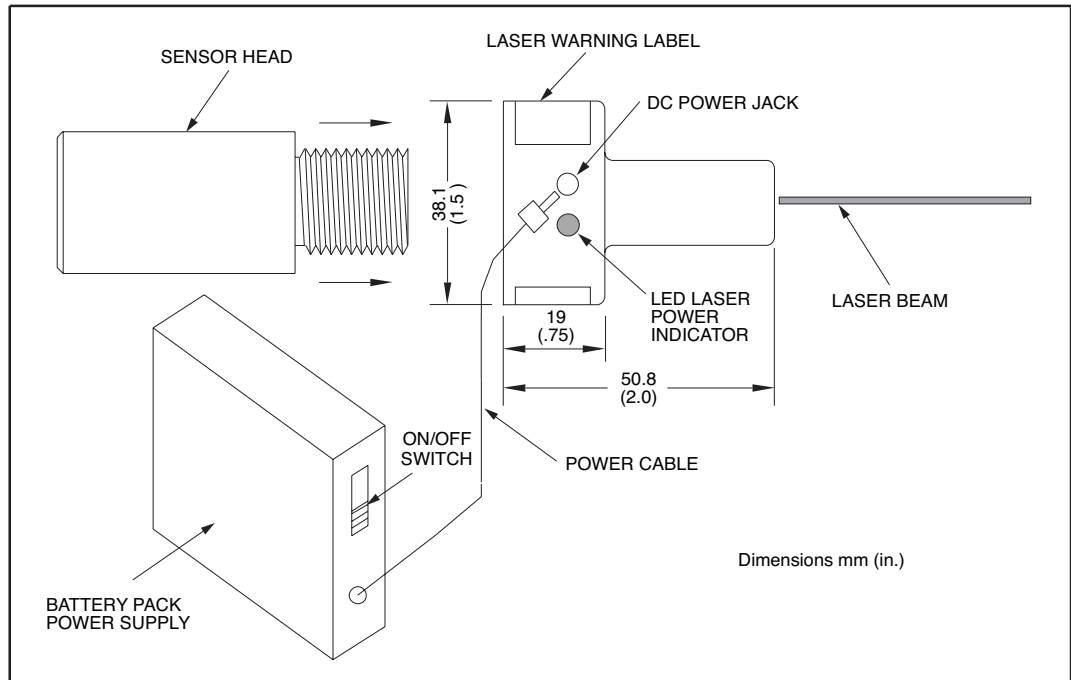


Figure 4-1. Laser Sighting Accessory, OS100-LS

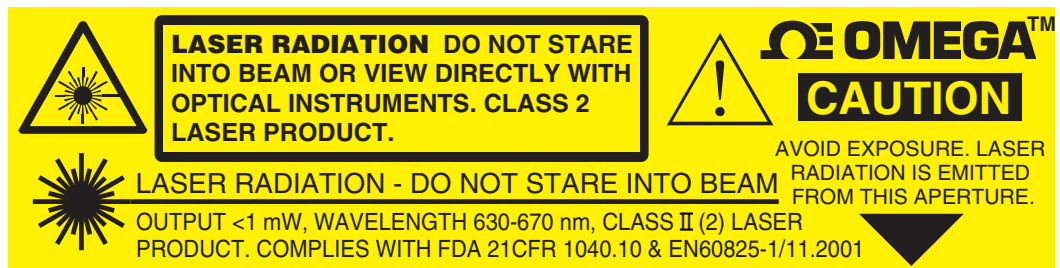


Figure 4-2. Laser Warning Label

Section 5 - Specifications

5.1 - General

Temperature Range	-18 to 538°C (0 to 1000°F)
Accuracy @ 22°C (72°F) ambient temperature & emissivity of 0.95 or greater	± 2% of Rdg. or 2.2°C (4°F) whichever is greater
Optical Field of View	6:1 (Distance/Spot Size)
Repeatability	± 1% of Rdg.
Spectral Response	5 to 14 microns
Response Time	150 msec (0 to 63% of final value)
Emissivity Range	0.1 to 0.99, adjustable
Operating Ambient Temperature	
Main Transmitter	0 to 50°C (32 to 122°F)
Sensor Head	0 to 70°C (32 to 158°F)
Sensor Head (-HT Model)	0 to 85°C (32 to 185°F)
Sensor Head with OS100-WC (Water Cooling Jacket)	0 to 200°C (32 to 392°F)
Operating Relative Humidity	Less than 95% RH, non-condensing
Water Flow Rate for OS100-WC	0.25 GPM, room temperature
Thermal Shock	About 30 minutes for 25°C abrupt ambient temperature change
Warm Up Period	3 minutes
Air Flow Rate for OS100-AP	1 CFM (0.5 Liters/sec.)
Power	12 to 24 VDC @ 100 mA
Analog Outputs	
MV-F	1 mV/°F
MV-C	1 mV/°C
K	K Type TC - OS101 only
MA	4 to 20 mA
V1	0 to 5 VDC
Output Load requirements	
Min. Load (0 to 5VDC)	1 K-Ohms
Max. Load (4 to 20 mA)	(Supply Power - 4)/20 mA
Transmitter Housing	NEMA-4 & IP65, Die Cast Aluminum
Sensor Head Housing	NEMA-4 , Aluminum
Alarm Output	Open Drain, 100 mA
Alarm Set Point	0 to 100% , Adjustable via P4
Alarm Deadband	14°C (25°F)

5.1 - General Con't.

Dimensions	
Sensor Head	25.4 OD. x 63.5 mm L (1" OD. x 2.5" L)
Main Housing, OS101	65.5 W x 30.5 H x 115.3 mm L (2.58" W x 1.2" H x 4.54" L)
Main Housing, OS102	65.5 W x 55.9 H x 115.3 mm L (2.58" W x 2.2" H x 4.54" L)
Weight	272 g (0.6 lb)

5.2 Laser Sight Accessory (OS100-LS)

Wavelength (Color)	630 - 670 nm (Red)
Operating Distance (Laser Dot)	Up to 9.1 m (30 ft.)
Max. Output Optical Power	Less than 1 mW at 22°F ambient temperature.
European Classification	Class 2, EN60825-1/11.2001
Maximum Operating current	45 mA at 3 VDC
FDA Classification	Complies with 21 CFR 1040.10, Class II Laser Product
Beam Diameter	5 mm
Beam Divergence	< 2 mrad
Operating Temperature	0 to 50°C (32 to 122°F)
Operating Relative Humidity	Less than 95% RH, non-condensing
Power Switch	ON / OFF , Slide switch on the Battery Pack
Power Indicator	Red LED
Power	Battery Pack, 3 VDC (Consists of two 1.5 VDC AA size Lithium Batteries)
Laser Warning Label	Located on the head sight circumference
Identification Label	Located on the head sight circumference
Dimensions	38 DIA x 50.8 mm L (1.5" DIA x 2" L)

Section 6 - Emissivity Table

Material	Emissivity (ϵ)
<u>Aluminum</u> – pure highly polished plate	0.04 to 0.06
<u>Aluminum</u> – heavily oxidized	0.20 to 0.31
<u>Aluminum</u> – commercial sheet	0.09
<u>Brass</u> – dull plate.	0.22
<u>Brass</u> – highly polished, 73.2% Cu, 26.7% Zn	0.03
<u>Chromium</u> – polished.	0.08 to 0.36
<u>Copper</u> – polished.	0.05
<u>Copper</u> – heated at 600°C (1112°F)	0.57
<u>Gold</u> – pure, highly polished or liquid.	0.02 to 0.04
<u>Iron and steel (excluding stainless)</u> – polished iron	0.14 to 0.38
<u>Iron and steel (excluding stainless)</u> – polished cast iron.	0.21
<u>Iron and steel (excluding stainless)</u> – polished wrought iron	0.28
<u>Iron and steel (excluding stainless)</u> – oxidized dull wrought iron	0.94
<u>Iron and steel (excluding stainless)</u> – rusted iron plate	0.69
<u>Iron and steel (excluding stainless)</u> – polished steel.	0.07
<u>Iron and steel (excluding stainless)</u> – polished steel oxidized at 600°C (1112°F).	0.79
<u>Iron and steel (excluding stainless)</u> – rolled sheet steel	0.66
<u>Iron and steel (excluding stainless)</u> – rough steel plate	0.94 to 0.97
<u>Lead</u> – gray and oxidized	0.28
<u>Mercury</u>	0.09 to 0.12
<u>Molybdenum filament</u>	0.10 to 0.20
<u>Nickel</u> – polished	0.07
<u>Nickel</u> – oxidized at 649 to 1254°C (1200°F to 2290°F)	0.59 to 0.86
<u>Platinum</u> – pure polished plate	0.05 to 0.10
<u>Platinum</u> – wire	0.07 to 0.18
<u>Silver</u> – pure and polished	0.02 to 0.03
<u>Stainless steel</u> – polished	0.07
<u>Stainless steel</u> – Type 301 at 232 to 942°C (450°F to 1725°F)	0.54 to 0.63
<u>Tin</u> – bright	0.06
<u>Tungsten</u> – filament	0.39
<u>Zinc</u> – polished commercial pure	0.05
<u>Zinc</u> – galvanized sheet.	0.23

METALS

NONMETALS

Material	Emissivity (ϵ)
<u>Asbestos Board</u>	0.96
<u>Asphalt, tar, pitch</u>	0.95 to 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 to 0.84
<u>Glass</u> - Pyrex, lead, soda	0.85 to 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 to 0.67
<u>Paints, lacquers, and varnishes</u> – flat black lacquer	0.96 to 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 to 0.92
<u>Roofing Paper</u>	0.91
<u>Tape</u> – Masking	0.95
<u>Water</u>	0.95 to 0.96
<u>Wood</u> – planed oak	0.90



NOTES:



NOTES:

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. OMEGA's WARRANTY adds an additional one (1) month grace period to the normal **two (2) year product warranty** to cover handling and shipping time. This ensures that OMEGA's customers receive maximum coverage on each product.

If the unit malfunctions, 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 having been 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 is not warranted, include but are not limited to contact points, fuses, and triacs.

OMEGA is pleased to offer suggestions on the use of its various products. However, OMEGA neither assumes responsibility for any omissions or errors nor assumes liability for any damages that result from the use of its products in accordance with information provided by OMEGA, either verbal or written. OMEGA warrants only that the parts manufactured by the company will be as specified and free of defects. OMEGA MAKES NO OTHER WARRANTIES OR REPRESENTATIONS OF ANY KIND WHATSOEVER, EXPRESSED OR IMPLIED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED. LIMITATION OF LIABILITY: The remedies of purchaser set forth herein are exclusive, and the total liability of OMEGA with respect to this order, whether based on contract, warranty, negligence, indemnification, strict liability or otherwise, shall not exceed the purchase price of the component upon which liability is based. In no event shall OMEGA be liable for consequential, incidental or special damages.

CONDITIONS: Equipment sold by OMEGA is not intended to be used, nor shall it be used: (1) as a "Basic Component" under 10 CFR 21 (NRC), used in or with any nuclear installation or activity; or (2) in medical applications or used on humans. Should any Product(s) be used in or with any nuclear installation or activity, medical application, used on humans, or misused in any way, OMEGA assumes no responsibility as set forth in our basic WARRANTY/DISCLAIMER language, and, additionally, purchaser will indemnify OMEGA and hold OMEGA harmless from any liability or damage whatsoever arising out of the use of the Product(s) in such a manner.

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

OMEGA's policy is to make running changes, not model changes, whenever an improvement is possible. This affords our customers the latest in technology and engineering.

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