Infrared
Measurement

Products and application solutions

ΩΞ OMEGA™

CONTENTS

When to use an infrared thermometer

Infrared measuring devices have many advantages over other temperature measurement thermometers. These include taking high temperature measurement in environments that do not allow the use of thermocouples, and also measurements which must not be in direct contact with devices.

Infrared devices also allow the measurement of moving objects and also can measure surfaces with low thermal conduction and capacity.

How do infrared devices work?

Substances with temperatures above absolute zero emit infrared radiation (spectral range of wavelengths from 0.7 to $1000\mu m$). This range is not visible to the human eye. The most useful infrared measurements are located between 0.7 and $20\mu m$.

The optical system of an infrared thermometer captures the energy emitted from an object. This is performed from a circular measuring spot and is then focused onto a detector. The energy captured by the detector is electronically amplified and converted into an electrical signal. The optical resolution results from the ratio of the measuring distance to the size of the measuring spot. The measuring spot must always be smaller than the test object or the measuring point of interest. The higher the optical resolution the smaller the measuring spots can be measured at further distances

Types of infrared sensors

Infrared Thermocouples

An infrared thermocouple is a low-cost infrared thermometer that measures surface temperature of materials without contact. It can be directly installed on conventional thermocouple controllers, transmitters and digital readout devices as if it were a replacement thermocouple. An infrared thermocouple can be installed in a fixed, permanent location, or used with a hand-held probe.

Hand-held Infrared Thermometers

Infrared thermometer guns are one of the most popular type of units. They are commonly used for portable applications although some models also feature an integral

tripod mount. OMEGA offers a large variety of laser thermometers in various shapes and form factors. Many of OMEGA hand-held devices feature OMEGA's patented Circle Dot/Circle Laser infrared thermometer which clearly outlines the field of view of the gun. Hand-held units with an attached thermocouple probe is another option.

Fixed Mount IR Thermometers

A fixed mount infrared thermometer is commonly used in industrial processes where the thermometer can be mounted in a stationary position, and output their temperature signals to a control or data acquisition system. For very hot or dirty environments, instruments can be equipped with water or thermoelectric cooling to keep internal electronics cool. Units can also be supplied with optional air or water jackets.

Integrated Systems

Compete IR systems are also available, they consist of an infrared sensor, display and alarms.

These systems are compact, making them ideal for mounting in tight spaces. High ambient versions are capable of withstanding temperatures of up to 180°C without water or air cooling, allowing significant energy and cost savings to be made.

Many different outputs are available to suit the needs of different users and environments.

Two-Color Systems

For use in applications where the target may be obscured by dust, smoke or similar contaminants, or changing emissions as in "pouring metals," a two-color infrared thermometer is ideal. It measures temperature independently of emissivity. Systems are available with fiber optic sensors, or can be based on a fixed or hand-held configurations.

Considerations when selecting an infrared device

Before choosing an infrared device, it is important to have a clear understanding of the application requirements.

What is the temperature range of your process?

What size is the target?

How close to the target can the instrument be installed?

Does the target fill the field of view?

What is the emissivity of the target material?

How fast is the target moving?

What is the ambient temperature?

Is there any steam, smoke or dusty in the application?

Do you want to connect control equipment?

Do you need a data logging function?

Field of View

The field of view of an infrared sensor defines the size of the measurement target at a specified distance from the sensor.

Each type of IR sensor has a specific field of view, such as 10:1, 20:1 or 40:1. These numbers show the ratio between: the distance of the sensor from the measurement target (the number on the left); and the target spot size (the number on the right).
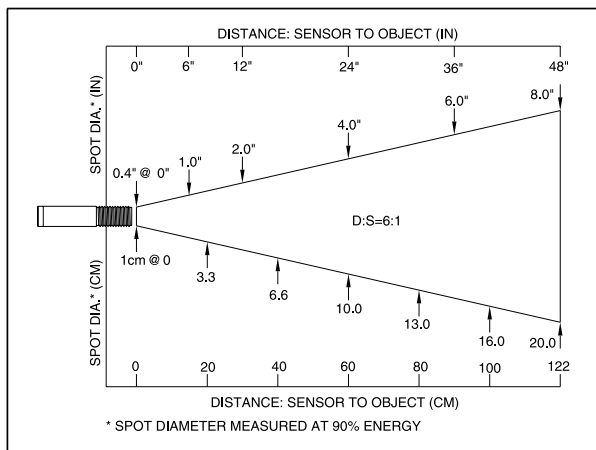
For example, a 20:1 IR positioned 200cm from a brake can 'see' a target spot of diameter 10cm. At 300cm away, the spot size would be 15cm. This is the sensor's field of view.

Emissivity

All values of emissivity fall between 0.0 and 1.0. Emissivity is defined as the ratio of the energy radiated by an object at a given temperature to the energy emitted by a perfect radiator, or blackbody, at the same temperature. The emissivity of a blackbody is 1.0. Most infrared thermometers can compensate for different emissivity values, for different materials. In general, the higher the emissivity of an object, the easier it is to obtain an accurate temperature measurement using infrared.

Objects with very low emissivity (below 0.2) can be difficult applications. Some polished, shiny metallic surfaces, such as aluminum, are so reflective in the infrared that accurate temperature measurements are not always possible.

Spectral response

The spectral response of the unit is the width of the infrared spectrum covered. Most general purpose units use a wide-band filter in the 8 to 14 micron range. This range is preferred for most measurements, as it will allow measurements to be taken without the atmospheric interference.
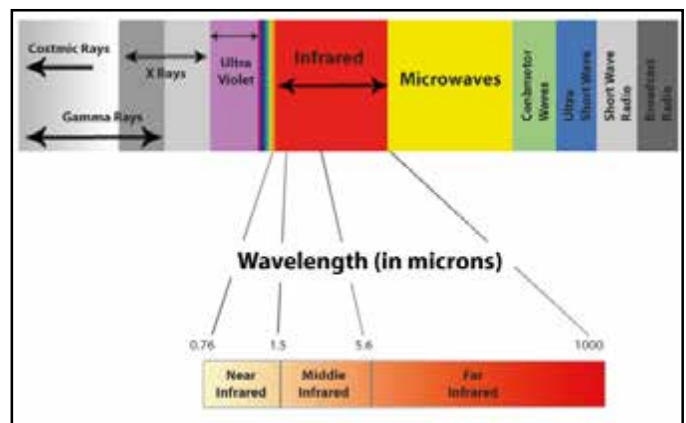
Some units use wider filters such as 8 to 20 microns, which can be used for close measurements, but are ''distance-sensitive'' against longer distances.

For special purposes, very narrow bands may be chosen. These can be used for higher temperatures, and for penetrations of atmosphere, flames, and gases. Typical low band filters are at 2.2 or 3.8 microns. High temperatures above 800°C are usually measured with 2.1 to 2.3 micron filters.

If the temperature is measured through a glass or quartz window, the infrared device must have a wavelength where the glass is somewhat transparent, which means they can only be used for high temperature.

See our Emissivity and Spectral response table on the next page for a better idea of your applications properties.

Spectral Response/Emissivity Application Table

This table can be used to gain an idea of what values your application may have.

For example,a mirror has a low emissivity of 0.1 while a so-called ´black body´ has a high emissivity of 1.
A black body is an ideal radiator, which absorbs the whole radiation of all wavelengths and which does not reflect nor transmit any radiation. The surface of a full radiator has a uniform emissivity of 1.

Many non-metals such as wood, rubber, stone, and organic materials have only low reflecting surfaces and, as a result, high emissivities between 0.8 and 0.95. However, metals, especially if they have glossy surfaces, can have emissivity values of 0.1.

This table data only represents average values, as the emissivity of a material is influenced by various factors. These include: temperature and surface geometry.

Spectral Response	Emissivity	Application
8 to 14 μm	1	Black body object (no reflective properties)
8 to 14 μm	0.95	Wood and paper
8 to 14 μm	0.91	Concrete
8 to 14 μm	0.87	Oxidised copper
3 to 5 μm	0.7	Heated up glass, sealing, laminating
2 to 3 μm	0.5	Ferrous and non-ferrous metals, induction furnaces, glass
1 to 6 μm	0.10	Polished ceramics
1 μm	0.3	Polished Chrome
1 μm	0.01	Polish Silver (or other highly reflective object)

Applications for infrared devices

OMEGA infrared products are used in many applications in manufacturing, food processing, medicine, aerospace, and science, to name a few. Our highly qualified sales and application engineers are at your service to guide you through our extensive range of products. Give us a call to discuss your application needs.

Food

The temperature of food products is easy to measure using infrared devices, as they are usually non-reflective.

OMEGA fixed mount laser thermometers can be installed in a location to continuously monitor a process.
Permanently mounted devices are generally installed on a manufacturing or process control line, and output their temperature signals to a control or data acquisition system.

Omega OS136 is an ideal solution for process lines. This sensor comes with measurement ranges

18 to 202°C or 149 to 538°C.

https://www.omega.co.uk/OS136

Iron and Steel

The surface condition of iron and steel can vary during the manufacturing process, even when viewed at the same position. Along with the reflective metal surface, this has traditionally made it difficult to measure the temperature of reflective materials. OMEGA has a range of short-wavelength sensors designed for the task of iron and steel manufacture.

The OS-MINI has a miniature sensing head to fit most applications. This uses short wavelength measurement for low-emissivity targets such as steel rollers and other metal surfaces.

https://www.omega.co.uk/OS-MINI22

Automotive Testing

OMEGA provides a comprehensive range of thermal cameras, infrared guns and infrared transmitters suitable for remote temperature measurement and analysis. The featured OS730K unit has a range of -50 to 800°C, a Type K thermocouple input, and is ideal for engine temperature monitoring. Many different styles are available on our website.

https://www.omega.co.uk/automotive

Fixed Mount Infrared Sensors with Optional Touch Screen Display

OS-MINI Series

MINIATURE SENSOR WITH OPTIONAL TOUCH SCREEN DISPLAY

The OS-MINI has adjustable emissivity setting on all models, suitable for a wide range of target materials such as paper, plastics, food, painted surfaces, and many more. Optional touch screen display available.

Range	-20 to 1000°C
Accuracy	± 1%
Emissivity	0.20 to 1.00
Spectral response	8 to 14 μm
Field of view	up to 30:1
Output	4 to 20 mA or RS485 Modbus®

es.omega.com/os-mini

OS-MINI22 Series

HIGH TEMPERATURE MINIATURE SENSOR WITH OPTIONAL TOUCH SCREEN DISPLAY

Ideal for extreme temperature environments, the OS-MINI22 has short wavelength measurement for low-emissivity targets such as steel rollers and other Metal surfaces. Optional touch screen available.

Range	100 to 2000°C
Accuracy	± 1%
Emissivity	0.20 to 1.00
Spectral response	2.0 to 2.6 μm
Field of view	up to 75:1
Output	4 to 20 mA or RS485 Modbus®

es.omega.com/os-mini22

Fixed Mount Infrared Sensors with Optional Touch Screen Display

OS-PC

HIGH SPEED INFRARED SENSOR WITH SMALL MEASURED FIELD OF VIEW SIZE

The OS-PC cube is an infrared pyrometer with an extremely fast response time and a very small measurement area size. Designed for extremely fast response times, or where the object to be measured is very small.

Range	0 to 500°C
Accuracy	± 1%
Emissivity	0.3 to 1.0
Spectral response	82 to 7 μm
Field of view	up to 30:1
Output	4 to 20 mA or RS485 Modbus®

www.omega.co.uk/os-pc

OS-MINIHUB

MULTI-CHANNEL INFRARED TEMPERATURE MONITORING SYSTEM RS485/MODBUS

OS-MINIHUB sensors are designed to measure the surface temperature of non-reflective materials, from -20 to 1000°C. They are sealed to IP65, built from 316 stainless steel, and fully tested to industrial EMC standards.

Range	-20 to 1000°C
Accuracy	± 1%
Emissivity	0.2 to 1.0
Spectral response	8 to 14 μm
Field of view	up to 75:1
Output	4 to 20 mA or RS485 Modbus®

www.omega.co.uk/os-minihub

Fixed Mount Infrared Sensors for Integrated Systems

OS-MINIUSB

MINIATURE SENSOR THAT MEASURES THE SURFACE TEMPERATURE OF A SOLID OR LIQUID

The OS-MINIUSB is a miniature infrared sensor that measures the surface temperature of a solid or liquid without contact. It can measure non-metal surfaces between -20 and 1000°C, with a response time of just 125 ms.

Range	-20 to 1000°C
Accuracy	± 1%
Emissivity	0.2 to 1.0
Spectral response	8 to 14 μm
Field of view	2:1 or 20:1
Output	USB

www.omega.co.uk/os-miniusb

OS301A-USB

COMPACT INFRARED TEMPERATURE TRANSMITTER

OS301A-USB is specially designed for distant targets and has an optical resolution of 30:1. It measures temperatures from -40 to 1000°C accurately and consistently, with an outstanding response time of 240 mS.

Range	- 40 to 1000°C
Accuracy	± 1%
Emissivity	1.0
Spectral response	2.0 to 2.4 μm
Field of view	30:1
Output	USB, 4 to 20 mA

www.omega.co.uk/os151-usb

Fixed Mount Infrared Sensors for Integrated Systems

OS150-2USB

PC CONFIGURABLE INFRARED TEMPERATURE SENSOR

PC configurable temperature range, short-wavelength measurement for low emissivity targets such as steel rollers and other metal surfaces, even at low temperatures.

Range	45 to 2000°C
Accuracy	± 1%
Emissivity	0.1 to 1.0
Spectral response	2.0 to 2.4 μm
Field of view	up to 75:1
Output	0 to 20 mA or 4 to 20 mA

www.omega.co.uk/os150-2usb

OS210

LOW-COST INFRA RED TEMPERATURE SENSOR/TRANSMITTER

This Series is a range of high quality, low cost, compact sensors which measure the temperature of inaccessible or moving objects and materials with an outstanding response time of 240 ms

Range	-20 to 500°C
Accuracy	± 1%
Emissivity	Fixed at 0.95
Spectral response	8 to 14 μm
Field of view	up to 30:1
Output	0 to 20 mA or 4 to 20 mA

www.omega.co.uk/OS210-150-300-800

Fixed Mount Infrared Sensors for Integrated Systems

OS136A

LOW-COST FIXED INFRARED TEMPERATURE SENSOR AND TRANSMITTER

This mini transmitter is ideal for applications that require measuring temperature in hard-to-reach, confined or harsh environment areas. Comes with a shielded cable.

Range	-18 to 202°C or 149 to 538°C
Accuracy	± 3%
Emissivity	Fixed at 0.95
Spectral response	5 to 14 μm
Field of view	6:1
Output	4 to 20 mA, 0 to 5 Vdc, 0 to 10 Vdc, type K thermocouple, 10 mV/degree analogue

www.omega.co.uk/os136a

OS137A

FIXED INFRARED TEMPERATURE SENSOR AND TRANSMITTER

3 Temperature Ranges Available: OS137A-1: 0 to 100°C (32 to 212°F) OS137A-2: -18 to 260°C (0 to 500°F) OS137A-3: -18 to 538°C (0 to 1000°F)

Range	-18 to 538°C
Accuracy	± 1.5%
Emissivity	0.5 to 1.0
Spectral response	8 to 14 μm
Field of view	10:1
Output	4 to 20 mA, 0 to 5 Vdc, 0 to 10 Vdc, type K thermocouple, 10 mV/degree analogue

www.omega.co.uk/os137a

Fixed Mount Infrared Sensors
for Integrated Systems

OS36-2

COMPACT INFRARED SENSOR AND AIR PURGE HEAD

The OS36-2 internal air purge passages provide a convenient and highly efficient method of maintaining optical cleanliness in harsh environments.

Range	-18 to 250°C
Accuracy	± 2%
Emissivity	0.8 to 1.0
Spectral response	6.5 to 14 μm
Field of view	2:1
Output	J, K, E, or T Thermocouple

www.omega.co.uk/os36-2

OS36 Series

INFRARED THERMOCOUPLES

The OS36 produces a thermocouple output signal that can be used with any standard J, K, T or E thermocouple instrumentation. The thermocouple's accuracy is specified for target emissivity between 0.8 and 1.0.

Range	-18 to 250°C
Accuracy	± 2%
Emissivity	0.8 to 1.0
Spectral response	6.5 to 14 μm
Field of view	1:1
Output	J, K, E, or T Thermocouple

www.omega.co.uk/OS36

OS36-APC

COOLING JACKET KIT FOR OS36 AND OS36-2 INFRARED THERMOCOUPLES

The OS36-APC needs water flow rate of only 0.05 gpm (190 cc/min.) to protect an infrared thermocouple at 540°C (1000°F). This kit makes it possible to use either the OS36 or OS36-2 with air, water or both for service in harsh environments.

Range	0 to 540°C
Accuracy	NA
Emissivity	NA
Spectral response	NA
Field of view	NA
Output	NA

www.omega.co.uk/os36-apc

OS36-GMK

GOOSE NECK MOUNTING KIT FOR OS36 SERIES INFRARED THERMOCOUPLES

For fast and convenient mounting of OS36 Series infrared thermocouples. Heavy duty design provides excellent stiffness for reliable positioning.

Range	0 to 540°C
Accuracy	NA
Emissivity	NA
Spectral response	NA
Field of view	NA
Output	NA

www.omega.co.uk/os36-gmk

Fixed Mount Infrared Sensors for Integrated Systems

OS36-01

FIXED MOUNT INFRARED THERMOCOUPLES WITH ABS PLASTIC HOUSING

These units feature an exceptionally strong, hermetically sealed ABS plastic housing that makes non-contact infrared temperature measurement more economical.

Range	-18 to 250°C
Accuracy	± 2%
Emissivity	0.8 to 1.0
Spectral response	6.5 to 14 μm
Field of view	1:1
Output	J, K, E or T Thermocouple Output Signal

www.omega.co.uk/os36-01

OS36-3-K-1200F

RUGGED INFRARED NON-CONTACT TEMPERATURE SENSOR

The OS36-3-K-1200 is ideal for use in extreme ambient temperature applications. Maintains accuracy with thermal shock. High pressure and vacuum compatible.
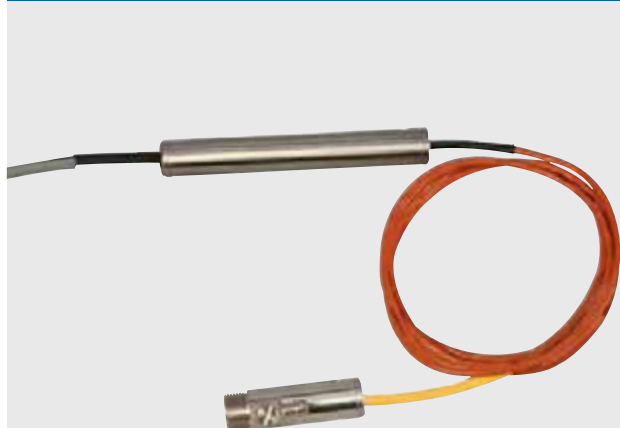
Range	-45 to 650°C
Accuracy	± 1%
Emissivity	0.90
Spectral response	6.5 to 14 μm
Field of view	3:1
Output	Type K thermocouple output

www.omega.co.uk/os36-3-k-1200f

Fixed Mount Infrared Sensors for Integrated Systems

OS36-3-RF

### REFRIGERATED FOODS ENVIRONMENTS INFRARED TEMPERATURE SENSOR

Idea for use in refrigerated foods environments. Highly reliable (minimal downtime), hermetically sealed, immersible for wash downs, and with built-in air purge.

Range	-18 to 38°C
Accuracy	± 3.5%
Emissivity	0.90
Spectral response	6.5 to 14 μm
Field of view	3:1
Output	0 to 10 Vdc

www.omega.co.uk/os36-3-rf

OS36-3

RUGGED INFRARED THERMOCOUPLE WITH INTEGRAL AIR COOL/PURGE HEAD
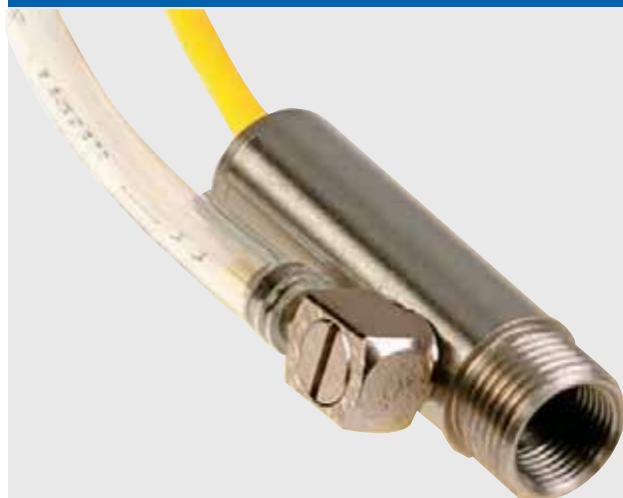
The OS36-3 Series is ideal for use in paint or ink environments in which the sensor is mounted remotely from the target. Also equipped with an internal air cool/purge system

Range	-18 to 250°C
Accuracy	± 2%
Emissivity	0.8 to 1.0
Spectral response	6.5 to 14 μm
Field of view	3:1
Output	J, K, E or T Thermocouple Output Signal

www.omega.co.uk/os36-3

OS38

ADJUSTABLE RANGE INFRARED SENSOR WITH INTEGRAL AIR COOL AND PURGE HEAD

The OS38 units offer a choice of 10:1, 20:1 or 100:1 optics. It features a built-in air purge collar that conveniently and efficiently maintains optical cleanliness in harsh environments. Great for clean metals.

Range	27 to 93°C
Accuracy	± 2%
Emissivity	0.8 to 1.0
Spectral response	0.1 to 5 μm
Field of view	10:1, 20:1 or 100:1
Output	J or K Thermocouple Output Signal; R or S Type for 100:1 Models

www.omega.co.uk/os37_os38

OSAT

INTRINSICALLY SAFE INFRARED TEMPERATURE SENSOR

Suitable for hazardous areas, zone 0, 1 and 2 (gas), and zone 20, 21 and 22 (dust), with a suitable intrinsically safe isolator

Range	-20 to 500°C
Accuracy	± 1%
Emissivity	0.20 to 1.00
Spectral response	8 to 14 μm
Field of view	up to 30:1
Output	4 to 20 mA

www.omega.co.uk/osat

Hand-held Infrared Sensors

OS-VIR50

DIGITAL INFRARED VIDEO THERMOMETER FOR EXTREME TEMPERATURES

Live video window.

Capable of making infrared and contact (thermocouple) temperature measurements, the built-in camera offers still image and video capturing functionality for documenting measurement locations.

Range	-50 to 2200°C
Accuracy	± 1% to ± 3%
Emissivity	0.1 to 1 (0.001 increment)
Spectral response	8 to 14 μm
Field of view	50:1
Output	USB, SD Card Storage

www.omega.co.uk/os-vir50

HHM-EX623

CLAMP METER 400 A DUAL INPUT WITH INFRARED THERMOMETER AND VOLTAGE

The HHM-EX623 is a True RMS Clamp Meter with built-in dual thermocouple inputs for T1, T2, and T1-T2 differential temperature measurement and non-contact infrared thermometer..

Range	-50 to 270°C
Accuracy	± 2%
Emissivity	0.95 fixed
Spectral response	6 to 16 μm
Field of view	8:1
Output	-

www.omega.co.uk/hhm-ex623

Hand-held Infrared Sensors

OS758-LS

DUAL LASER INFRARED THERMOMETER

The OS758-LS offers a rugged design that is shatter-proof at 1 metre. A Type K thermocouple input is included for contact measurements, often used to verify emissivity.

Range	-35 to 1600°C
Accuracy	± 2%
Emissivity	0.1 to 1 (0.001 increment)
Spectral response	8 to 14 μm
Field of view	60:1
Output	SPI, USB, SD Card Storage

es.omega.com/os758-ls

OS768-LS

DUAL NON-CONTACT LASER HIGH TEMPERATURE INFRARED THERMOMETER

Accurately verify surface temperatures, can also input Type K thermocouple input (free T/C included) for high precision measurement of contact surfaces, gases, and liquids.

Range	100 to 1800°C
Accuracy	± 2%
Emissivity	0.1 to 1 (0.001 increment)
Spectral response	8 to 14 μm
Field of view	75:1
Output	USB

es.omega.com/os768-ls

OS-PEN9

POCKET SIZE INFRARED THERMOMETER WITH CIRCLE LASER

These Infrared pens include: 9:1 optical ratio with circular laser, an ergonomic double injection casing for comfortable holding and measuring, and a backlit LCD. Just point, press, and read the display.

Range	33 to 500°C
Accuracy	± 2%
Emissivity	0.95 (fixed)
Spectral response	6 to 14 μm
Field of view	9:1
Output	-

www.omega.co.uk/os-pen9

OM-144

TEMPERATURE/HUMIDITY DATA LOGGERS WITH USB INTERFACE

The OM-144 is a low cost, compact, battery powered temperature and humidity data logger, capable of unattended logging of the ambient temperature and relative humidity (RH) of an environment for days, weeks or months.

Range	–20 to 250°C
Accuracy	± 3%
Emissivity	0.95 (fixed)
Spectral response	-
Field of view	2:1
Output	USB, 10,000 Readings

www.omega.co.uk/om-140-series

Hand-held Infrared Sensors

OS423HT-LS

INTRINSICALLY SAFE INFRARED TEMPERATURE SENSOR

OS423HT-LS offers laser sighting, several mathematical modes, and adjustable emissivity. Long battery life, (typical 180 hours without laser or backlight), is obtained from 2 "AAA" batteries (included).

Range	-60 to 1000°C
Accuracy	± 2%
Emissivity	0.1 to 1 (0.001 increment)
Spectral response	8 to 14 μm
Field of view	30:1
Output	-

www.omega.co.uk/os423-ls

OS1327D

INFRARED THERMOMETER WITH USB INTERFACE

The OS1327D features adjustable emissivity, laser sighting, backlit LCD, 12:1 field of view, max, minimum, average, differential temperature monitoring, high/low audible alarms, temperature and data storage.

Range	-35 to 500°C
Accuracy	± 2%
Emissivity	0.17 to 1
Spectral response	6 to 14 μm
Field of view	12:1
Output	Reading Storage

www.omega.co.uk/os1327d

OS418-LS

NON-CONTACT INFRARED THERMOMETER WITH RELATIVE HUMIDITY

Accurately verify surface temperatures, can also input Type K thermocouple input (free T/C included) for high precision measurement of contact surfaces, gases, and liquids.

Range	-60 to 500°C
Accuracy	± 2%
Emissivity	0.1 to 1 (0.001 increment)
Spectral response	8 to 14 μm
Field of view	12:1
Output	-

www.omega.co.uk/os418-ls

OS543

LOW COST INFRARED THERMOMETER GUN

Low cost infrared thermometers offer solutions for many non-contact temperature measurement applications. Applications include: Electrical, Asphalt, HVAC, Automotive, In-Process Temperature Measurement, Fire and Safety.

Range	-30 to 550°C
Accuracy	± 2%
Emissivity	0.95 (fixed)
Spectral response	6 to 14 μm
Field of view	10:1
Output	-

www.omega.co.uk/os540

Handheld Infrared Sensors

OS561

LOW COST INFRARED THERMOMETER GUN

The OS561 is an economical tool for temperature measurements. It features a user-friendly 2-key operation, and max and hold modes. The backlit LCD screen and the laser stay on when the trigger is depressed.

Range	-60 to 500°C°C
Accuracy	± 2%
Emissivity	0.95 (fixed)
Spectral response	8 to 14 μm
Field of view	10:1
Output	-

www.omega.co.uk/os561

OSXL-TG165

INFRARED TEMPERATURE CAMERA

Bridging the gap between single spot infrared thermometers and infrared temperature cameras, the OSXL-TG165 gives you the advantage of thermal imaging to help you discover temperature issues you can't see with typical spot radiometers.

Range	-25 to 380°C
Accuracy	± 1.5%
Emissivity	4 pre-set levels with custom adjustment, 0.1 to 0.99
Spectral response	8 to 14 μm
Field of view	24:1

www.omega.co.uk/osxl-tg165

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