

OSAT Series

Intrinsically Safe Infrared Temperature Sensor

Operator's Guide



Introduction

OSAT Series intrinsically safe non-contact infrared temperature sensors measure the temperature of an area of the surface of a solid or liquid, and transmit this as a two-wire, linear 4-20 mA output.

Temperature ranges from -20°C to 1000°C are available. Models are available with a fixed or adjustable emissivity setting, and may be used to measure a wide variety of target materials, including food, paper, textiles, plastics, leather, tobacco, pharmaceuticals, chemicals, rubber, coal, asphalt and paint.

A choice of precision optics is available to measure small or large targets at short or long distances.

The optional USB adapter and included software allow configurable models to be connected to a PC for temperature indication, sensor configuration and data acquisition.

These sensors are designed primarily for use in hazardous areas in conjunction with a suitable safety barrier or isolator. All models have been certified Intrinsically Safe for use in gas and dust hazardous areas by Certification Management Ltd. They comply with the European ATEX Directive 94/9/EC.

Important Information for Use:

- Voltage **MUST** be supplied by a suitably rated safety barrier or isolator.
- For re-configuration of the sensor ('-C' models only), the USB adapter **MUST** be connected in the safe area, behind the protection of a safety barrier or isolator.
- The OSAT Series dust certification relies upon the ingress protection provided by the device enclosure and therefore the device **MUST NOT** be opened. Care should be taken to avoid inadvertently loosening the cable gland when tightening locknuts.
- Do not attempt to repair a faulty unit. Contact the vendor to arrange a return.

Conformance to Requirements

- This product has passed a high voltage withstand test up to 500 VAC or 700 VDC.
- This product utilises the reduced creepage and clearance distances of ANNEX F by meeting the requirements of **IP65** and an **Overvoltage Category I**.

Safety Parameters:

The device must not be used outside of the ambient temperature range (T_a) or subjected to voltages, current or power greater than those listed below, in order to ensure safe operation of the device:

$U_i = 28 \text{ V}$
 $I_i = 93 \text{ mA}$
 $P_i = 650 \text{ mW}$

$T_a = -20^\circ\text{C to } +70^\circ\text{C}$
 $C_i = 8 \text{ nF}$
 $L_i = 0 \text{ mH}$

Intrinsic Safety Certification

All models of the OSAT Series have been issued an ATEX (CML 14ATEX2079) Certificate for use in both gas and dust explosive atmospheres in above ground installations.

Given the OSAT Series conforms to the highest level of protection 'ia', it is suitable for use in all Zones. The maximum energy stored in the device and the maximum surface temperature in both normal operation, and under fault conditions, also make the OSAT Series suitable for use within all Gas and Dust Groups with a temperature rating of T4 or lower.

	Zone	Description	Supported?
Gas	0	Explosive gas air mixture continuously present.	✓
	1	Explosive gas air mixture likely to occur in normal operation.	✓
	2	Explosive gas air mixture not likely to occur, and if it does it will only exist for a short time.	✓
Dust	20	Explosive atmosphere in the form of a cloud of combustible dust in air is continuously present, or for long periods or frequently.	✓
	21	Explosive atmosphere in the form of a cloud of combustible dust in air is likely to occur occasionally in normal operation.	✓
	22	Explosive atmosphere in the form of a cloud of combustible dust in air is not likely to occur in normal operation, but if it does occur, will only persist for a short period.	✓

Figure 1: Gas and Dust Zones in which the OSAT Series may be used

	Group	Definition	Supported?
Gas	IIA	e.g. Propane	✓
	IIB	e.g. Ethylene	✓
	IIC	e.g. Hydrogen	✓
Dust	IIIA	Combustible flyings	✓
	IIIB	Non-conductive dusts	✓
	IIIC	Conductive dusts	✓

Figure 2: Gas and Dust groups in which the OSAT Series is suitable for use

Gas Ignition Temperature	Classification	Supported?
450 °C	T1	✓
300 °C	T2	✓
200 °C	T3	✓
135 °C	T4	✓
100 °C	T5	✗
85 °C	T6	✗

Figure 3: Gas ignition temperature classifications to which the OSAT Series conforms

Model Numbers

OSAT-FFF-TT-C-LL

e.g. OSAT-151-MT-C-5

Cable Length

5 = 5 m

10 = 10 m

25 = 25 m

Custom lengths also available

User Configurable

C = Configurable via optional USB adapter

Temperature Range

LT = -20°C to 100°C

MT = 0°C to 250°C

HT = 0°C to 500°C

XT = 0°C to 1000°C

ST = Special temperature range

Temperature range may be re-scaled between limits -20°C and 1000°C via optional USB adapter and software

Field of View

21 = 2:1 divergent optics

151 = 15:1 divergent optics

301 = 30:1 divergent optics

CF = Close focus optics

(Spot Ø 5 mm at distance 100 mm)

Specifications

General

Temperature Range	-20°C to 1000°C (see table of Model Numbers)
Output	4 to 20 mA
Minimum Temperature Span	100°C
Maximum Temperature Span	1000°C
Field of View	See table of Model Numbers
Accuracy	± 1°C or 1%, whichever is greater
Repeatability	± 0.5°C or 0.5%, whichever is greater
Emissivity Setting Range	0.20 to 1.00 (pre-set to 0.95)
Emissivity Setting Method	User configurable via optional USB interface
Response Time, t_{90}	240 ms (90% response)
Spectral Range	8 to 14 μm
Supply Voltage	12 to 24 V DC \pm 5%
Minimum Sensor Voltage	11.4 V DC
Maximum Current Draw	25 mA

Mechanical

Construction	Stainless Steel 316
Major Dimensions	Ø 20 x length 150 mm (see Dimensions)
Mounting	M20 x 1.5 mm thread, length 46 mm, supplied with two mounting nuts
Cable Length	5 m, 10 m or 25 m as standard (custom lengths also available)
Weight with 5 m Cable	475 g

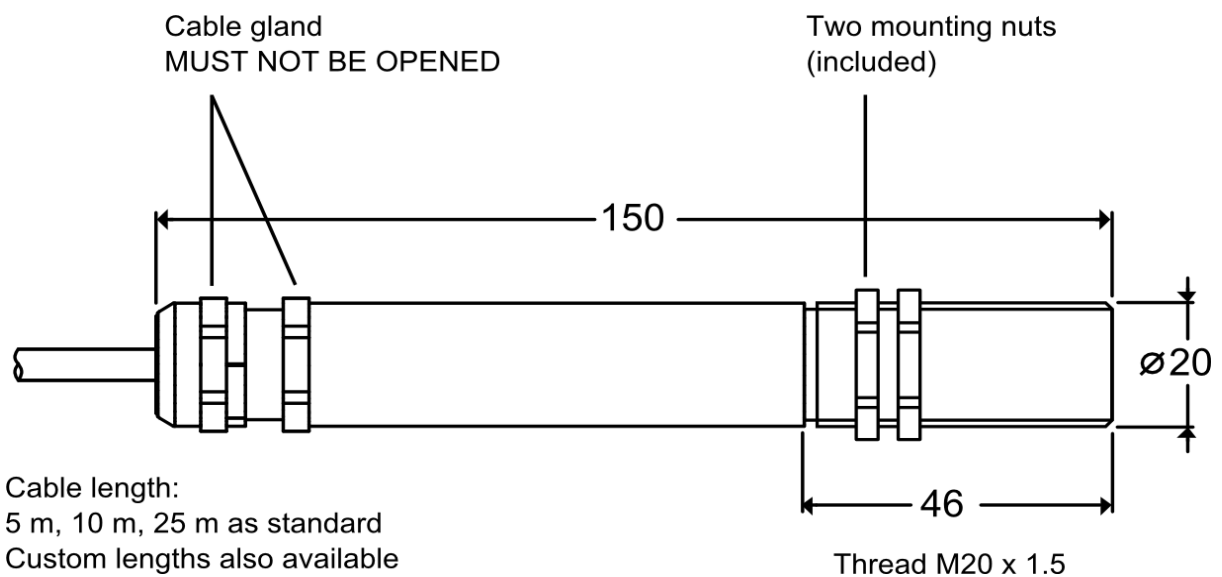
Environmental

Environmental Rating	IP65 (NEMA 4)
Ambient Temperature Range	0°C to 70°C (Operating range)
Relative Humidity	Max. 95% non-condensing
CE Marked	Yes
RoHS Compliant	Yes

Hazardous Area Classification

ATEX Classification	Ex II 1GD
IECEX Classification (Gas)	Ex ia IIC T4 Ga
IECEX Classification (Dust)	Ex ia IIIC T135°C IP65 Da
Ambient Temperature Rating	-20°C ≤ Ta ≤ 70°C
Maximum DC Input Voltage	U _i = 28 V
Maximum Input Current	I _i = 93 mA
Maximum Input Power	P _i = 650 mW
Maximum Internal Capacitance	C _i = 8 nF
Maximum Internal Inductance	L _i = 0 mH
ATEX Certificate Number	CML 14ATEX2079
IECEX Certificate Number	IECEX CML 14.0032

Dimensions (mm)



Accessories

A range of accessories to suit different applications and industrial environments is available as follows. These may be ordered at any time and added on-site:

- Fixed mounting bracket
- Adjustable mounting bracket
- Air purge collar

Options

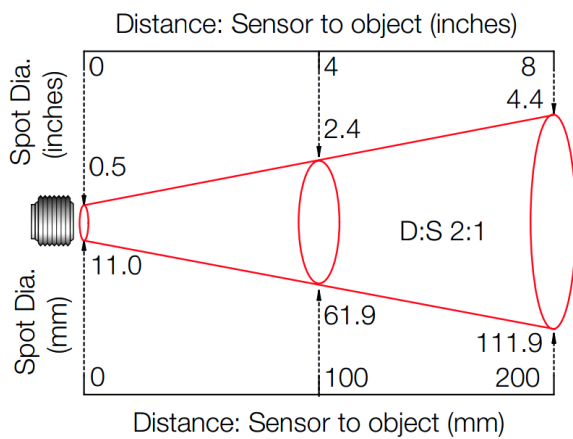
The following options are available. Options are factory installed and must be ordered with the sensor.

Certificate of calibration

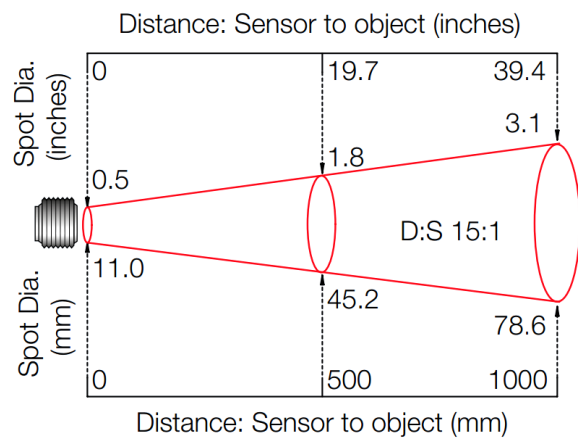
Extended cable (25 m max. factory-fitted; user may extend the cable further subject to the safety requirements)

Optics

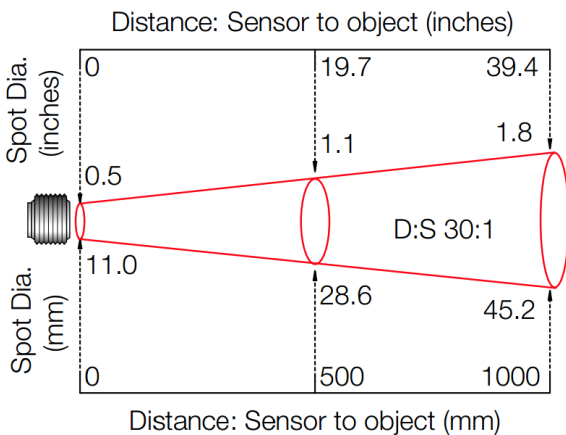
The below chart shows the measured spot diameter at the given distances from the sensing head and assumes 90% energy. The sensor may be used at longer distances than shown below, with a larger measured spot size.



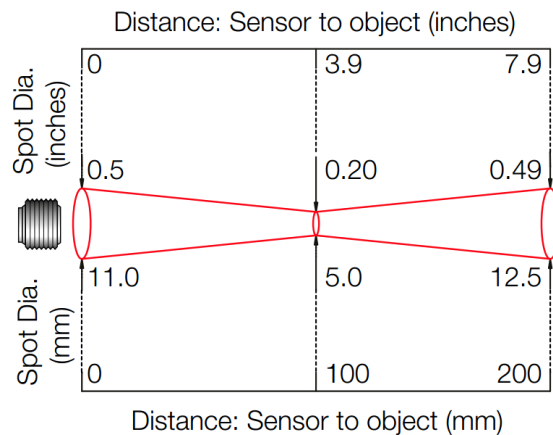
-21



-151



-301



-CF

Installation and Maintenance

The installation process consists of the following stages:

- Preparation
- Mechanical installation
- Electrical installation

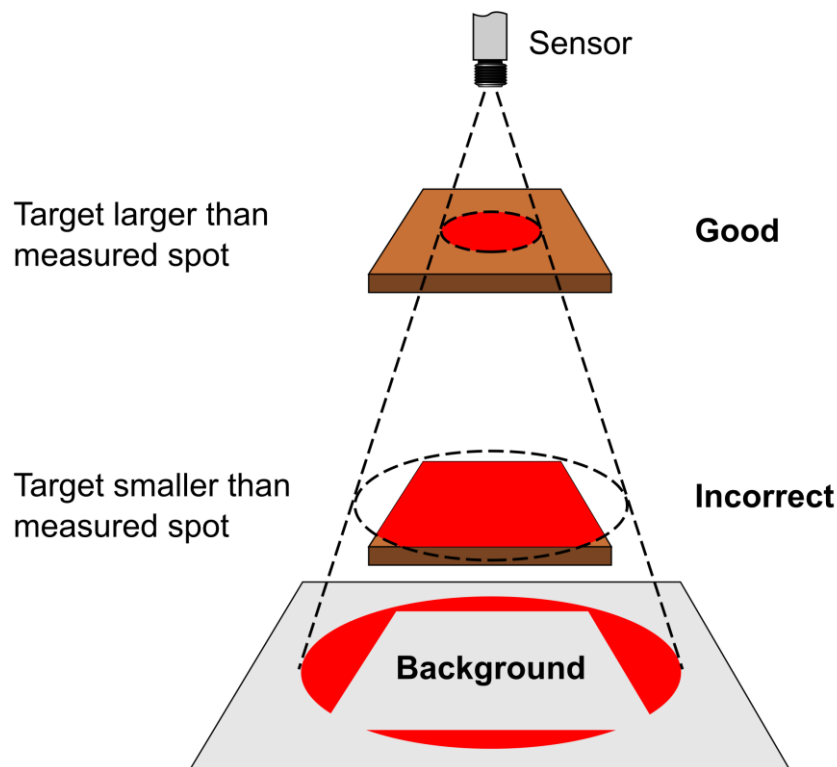
Please read the following sections thoroughly before proceeding with the installation.

Preparation

Distance and Spot Size

Ensure the sensor is positioned so that it can only detect infrared radiation from the target.

The size of the area (spot size) to be measured determines the distance between the sensor and the target. The spot size must not be larger than the target. The sensor should be mounted so that the measured spot size is smaller than the target.



Ambient Temperature

The sensor is designed to operate in ambient temperatures from 0°C to 70°C.

Avoid thermal shock. Allow 20 minutes for the unit to adjust to large changes in ambient temperature.

Atmospheric Quality

Smoke, fumes or dust can contaminate the lens and cause errors in temperature measurement.

In these types of environment the air purge collar should be used to help keep the lens clean.

Electrical Interference

To minimise electromagnetic interference or 'noise', the sensor should be mounted away from motors, generators and such like.

Wiring

Check the distance between the sensor and the indicating/controlling device. If necessary, the sensor can be ordered with a longer cable attached, or the existing cable may be extended subject to the safety requirements.

Power Supply

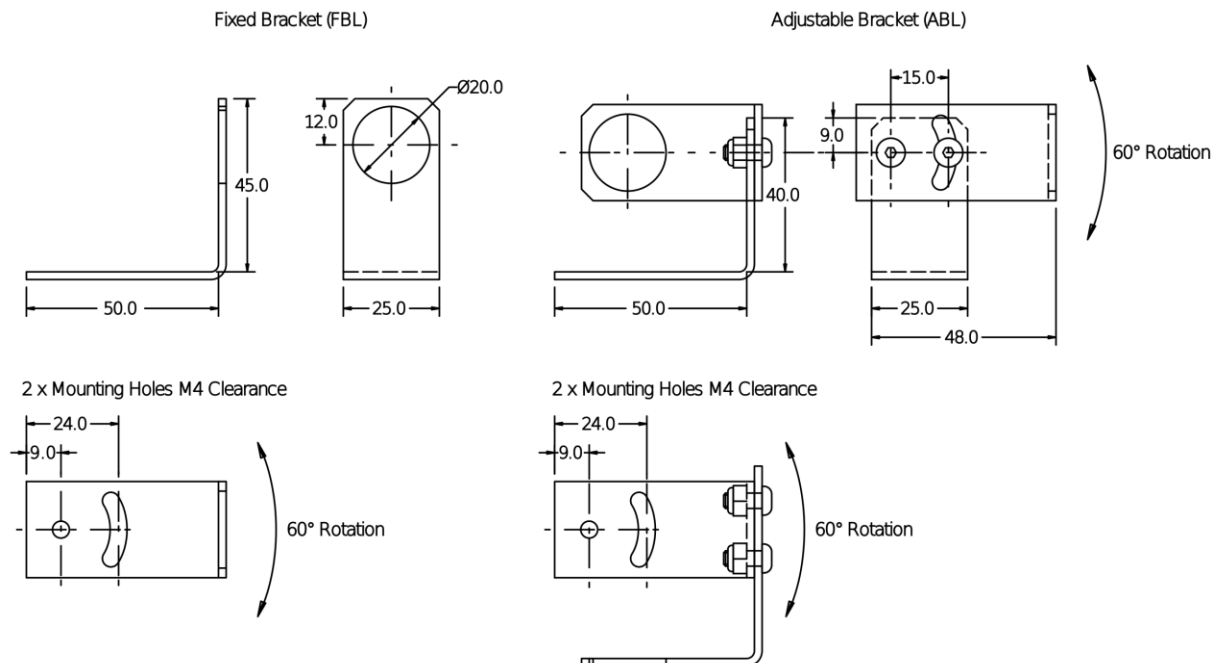
A suitable intrinsically safe barrier or isolator must be used. See Specifications - General for the supply voltage, current and safety requirements.

Mechanical Installation

Mounting

All sensors come with a hard-wired cable and 2 mounting nuts. The sensor can be mounted on brackets or cut outs of your own design, or you can use the fixed and adjustable mounting bracket accessories, which are shown below.

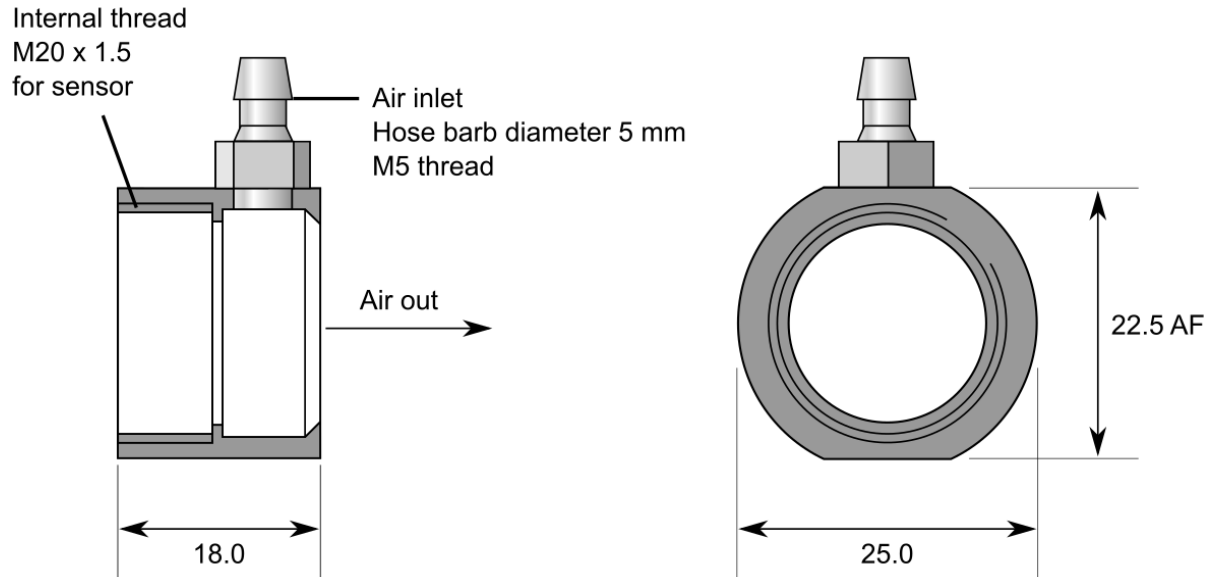
Note: The sensor must be connected to earth at one point, either the cable shield termination or the sensor housing.



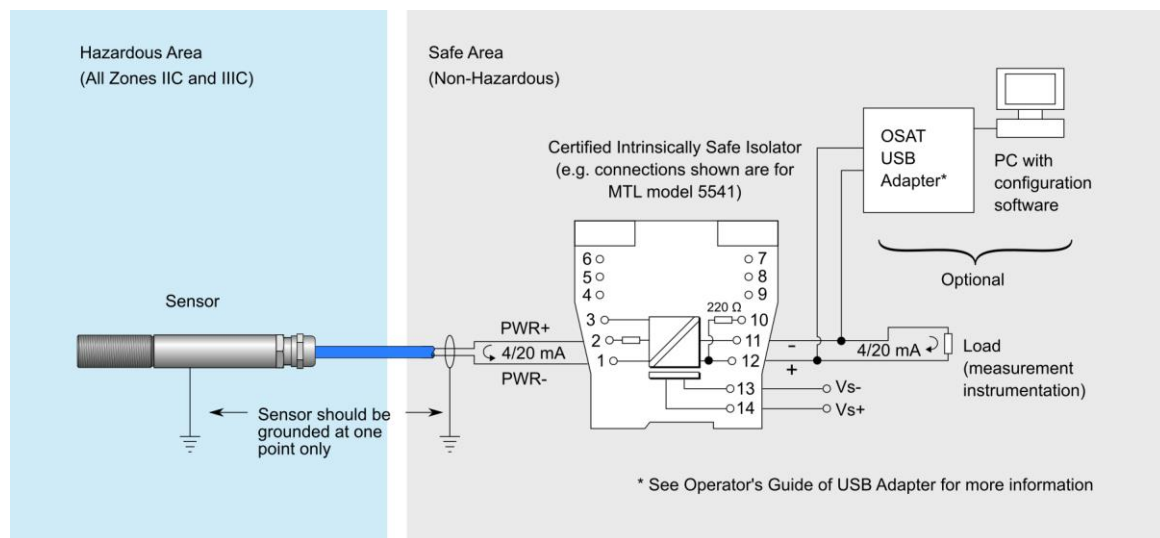
Air Purge Collar

The lens must be kept clean and dry for an accurate reading. The air purge collar is used to keep dust, fumes, moisture, and other contaminants away from the lens. It must be screwed on fully.

Air flows into the hose barb fitting and out of the front aperture. Air flow should be no more than 5 to 15 litres/min. Clean or 'instrument' air is recommended.



Electrical Installation



An alternative certified Intrinsically Safe isolator or safety barrier may be used. The connections shown above are for the suggested isolator, model MTL 5541.

Configuration

All models are configurable via the optional USB adapter (Loop Configuration Tool) and configuration software. The adapter has hook-type connectors and may be connected to the 4-20 mA loop as shown above.

The USB adapter is not certified for use in hazardous areas. It must only be connected on the safe side of the safety barrier or isolator.

The software must be installed before connecting the USB adapter to the PC.

To use the USB adapter:

1. Connect the positive (red) hook to the + side of the 4-20 mA loop.
2. Connect the negative (black) hook to the - side of the 4-20 mA loop.

Note: To ensure good communication, the total resistance on the 4-20 mA loop should be within the range specified on the connection diagrams in the Operator's Guide for the USB adapter.

3. Connect the USB adapter to the PC.
4. Use the software to configure the sensor. The software is supplied with the USB adapter.

Operation

Once the sensor is in position, a suitable safety barrier or isolator is connected and configured, and the appropriate power and cable connections are secure, the system is ready for continuous operation by completing the following simple steps:

1. Turn on the power supply
2. Turn on the meter, chart recorder or controller
3. Read or monitor the temperature

Important

Be aware of the following when using the sensor:

- If the sensor is exposed to significant changes in ambient temperature (hot to cold, or cold to hot), allow 20 minutes for the temperature to stabilise before taking or recording measurements.
- Do not operate the sensor near large electromagnetic fields (e.g. around arc welders or induction heaters). Electromagnetic interference can cause measurement errors.
- Wire must be connected only to the appropriate terminals.
- Do not damage the cable, as this could provide a path for moisture and vapour to enter the sensor.

Maintenance

Our customer service representatives are available for application assistance, calibration, repair, and solutions to specific problems. Contact our Service Department before returning any equipment. In many cases, problems can be solved over the telephone. If the sensor is not performing as it should, try to match the symptom below to the problem. If the table does not help, contact us for further advice.

Troubleshooting

Symptom	Probable Cause	Solution
No output	No power to sensor	Check power supply
Erroneous temperature	Incorrect wire connection	Check wire colour codes
Erroneous temperature	Faulty sensor cable	Verify cable continuity
Erroneous temperature	Field of view obstruction	Remove obstruction
Erroneous temperature	Incorrect 4-20 mA input scale on measurement instrument	Check input range matches temperature range of sensor

Lens Cleaning

Keep the lens clean and dry at all times. Any foreign matter on the lens would affect measurement accuracy. Blow off loose particles (if not using the air purge accessory) with an air 'puffer'.

If dust or condensation continuously forms on the lens, consider fitting an air purge collar.