Every part matters

EN

Instruction Manual

RS Pro Infrared Temperature Sensor with Voltage Output and UART

Stock Number: 238-7241

Introduction

The RS Pro UART Infrared Temperature Sensor is a device for measuring the temperature of the surface of a solid or liquid without contact. Its extremely small size makes it ideal for installation where space is restricted.

The sensor works by detecting infrared energy that is emitted by the target object. The temperature is available digitally via UART using the Modbus RTU protocol, or it can be monitored continuously via the DC voltage output, e.g. with industrial process instrumentation. The sensor also has a configurable alarm output.

Specifications

GENERAL

Measurable Temperature Range	0 to 1000°C
Analogue Output	0-5 V DC, linear with measured temperature
Alarm Output	Open collector with adjustable temperature threshold and hysteresis, configurable via UART
Field of View	15:1 divergent optics
Accuracy	± 1.5% of reading or ± 1.5°C, whichever is greater
Repeatability	± 0.5% of reading or ± 0.5°C, whichever is greater
Response Time	250 ms
Emissivity	Default setting 0.95, adjustable via UART
Emissivity Setting Range	0.20 to 1.00
Max Temperature Span (Linear Output)	1000°C
Min Temperature Span (Linear Output)	100°C
Spectral Range	8-14 µm
Supply Voltage	24 V DC (max 28 V DC)
Min. Supply Voltage (at Sensor)	6 V DC when using voltage output 5 V DC when using UART only
Max Current Draw (Sensor)	30 mA
Open Collector Alarm Output	6 to 24 V DC, 50 mA max (see Electrical Installation)

ENVIRONMENTAL

Environmental Rating	IP65
Ambient Temperature Range	0°C to 70°C
Relative Humidity	95% max. non-condensing

CONFORMITY

Electromagnetic Compatibility (EMC)	EN61326-1, EN61326-2-3 (Electrical Equipment for Measurement, Control and Laboratory Use - EMC Requirements)
RoHS Compliant	Yes

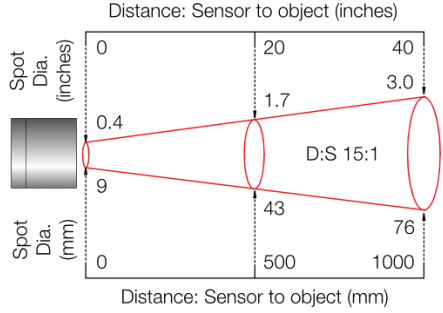
CONFIGURATION

Configurable Parameters	Temperature range (linear analogue output) Alarm output threshold and hysteresis Emissivity setting Reflection compensation (e.g. target in oven/furnace)
Temperature Units	°C / °F
Signal Processing	Averaging Period (0.25 to 60 seconds)
Peak / Valley Hold	Hold Period (0.25 to 1200 seconds)

MECHANICAL SPECIFICATIONS

Construction	Black anodised aluminium and red ABS
Cable Length	1 metre
Weight with Cable	65 g

Optics (Field of View)



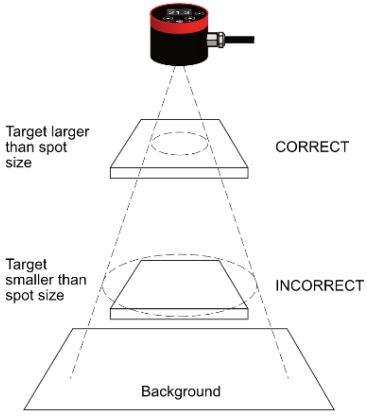
The sensor measures the average temperature within a spot. The size of this spot depends on the distance between the sensor and the target surface.

The sensor may be used at longer distances than shown, and will measure a larger spot.

The measurement accuracy is not affected by the measurement distance.

Target Size

The size of the measured spot must not be larger than the target. The sensor should be positioned so that the measured spot size is smaller than the target.



Ambient Temperature

The sensing head may be used in ambient temperatures of up to 70°C. Avoid thermal shock. Allow 20 minutes for the unit to adjust to large changes in ambient temperature.

Atmospheric Quality

Smoke, fumes, dust and steam can contaminate the lens and cause errors in temperature measurement. In these types of environment, the optional air purge collar should be used to help keep the lens clean.

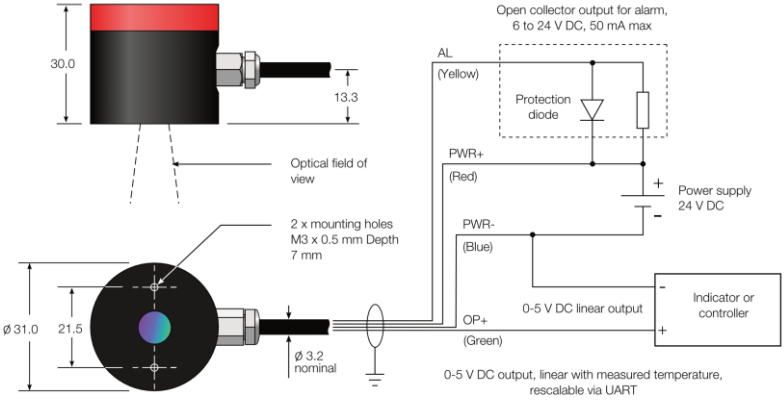
Optional Accessories

An adjustable mounting bracket and air purge collar are available. These may be ordered at any time and added on-site.

Mechanical Installation

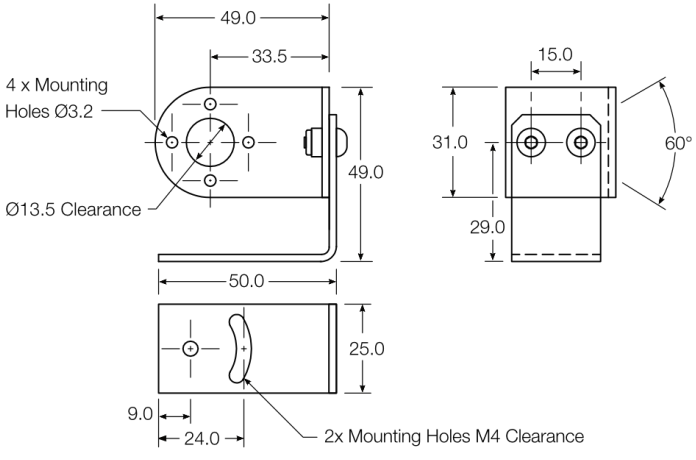
The sensor can be attached to brackets or mountings of your own design, or you can use the optional mounting bracket accessories shown below. Use two M3 mounting screws (included) to fix the sensor to a mounting plate or bracket with a third, central hole for the sensor to “see” through. We recommend a hole of diameter 13 to 16 mm in a mounting plate of up to 2 mm thickness. Ensure the mounting does not obstruct the sensor’s field of view (FOV); refer to the optical diagram in Specifications and allow a clear area twice the size of the FOV cone for maximum accuracy.

Dimensions and Connections (Analogue Output)



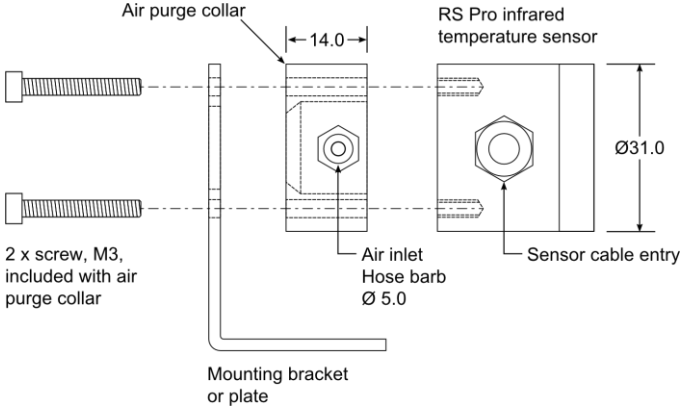
For UART connections, see “Connections (UART)”.

Mounting Bracket (RS Stock No. 905-8777)



Air Purge Collar (RS Stock No. 905-8770)

The optional air purge collar is used to keep dust, fumes, moisture and other contaminants away from the lens. Air flows into the hose barb fitting and out of the front aperture. Air flow should be 5 to 15 litres per minute. Clean or “instrument” air is recommended.



Two M3 screws (included) secure both the air purge collar and the sensor to the mounting.

Electrical Installation

Check the length of the cable run between the temperature sensor and the measurement instrument. If necessary, the cable can be extended using a shielded cable with 4 or more cores (3 if the alarm output is not used). Ensure the shield is also extended.

Connect power between the PWR+ and PWR- wires. Do not apply voltage to the incorrect wires as this will damage the sensor. See “Dimensions and Connections (Analogue Output)” and “Connections (UART)” for wiring.

Ensure the supply voltage is suitable for the selected output type.

Alarm

The sensor has an open collector alarm output. In an alarm condition, the alarm wire AL will sink current to ground through the attached load (e.g. a relay).

The alarm is deactivated for 30 seconds after power-up to allow for UART communication.

If using the alarm output, choose a load that draws no more than 50 mA when powered from 12 to 24 V DC. For example, if the alarm supply voltage is 24 V DC, ensure the load is at least 480 Ω (24 V / 0.05 A = 480 Ω).

Analogue Output

If using the analogue output, use a 12 to 24 V DC power supply.

The temperature output is a 0-5 V DC signal measured between OP+ and PWR-. The output voltage is linear with measured temperature. The temperature range is configurable via UART.

UART Interface

The sensor's UART interface has a level of 5 V. If the UART interface of the connected device is not 5 V tolerant, we recommend connecting a suitably rated Zener diode between OP+ and PWR- with polarity as shown below.

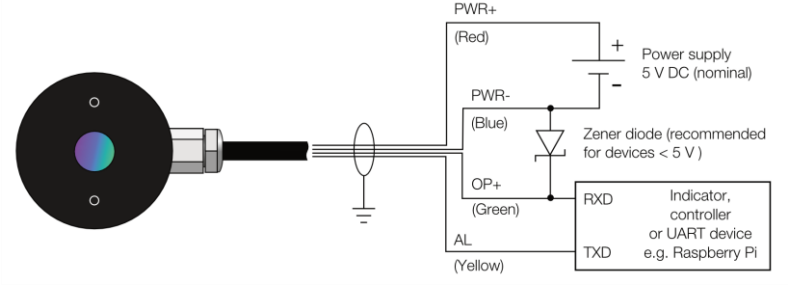
The sensor can also communicate over a UART, with the alarm output (AL) becoming the Receive line and the voltage output (OP+) becoming the Transmit line. The sensor's alarm output is deactivated for 30 seconds after power-up to allow for UART communication. Once a valid Modbus command has been received, the sensor will remain in UART mode until powered down.

The UART interface uses 3.3 V levels, however due to the possibility of the OP+ pin reaching 5 V we recommend connecting a suitably rated Zener diode between OP+ and PWR- for protection. Alternatively, use a 5 V tolerant UART for the master interface.

Connections (UART)

With power off, connect the sensor wires as follows:

Sensor wire	Direction	Function	Zener diode
PWR+ (Red)	Power	+5 V DC	*not connected*
PWR- (Blue)	Power	0 V	Anode (+)
AL / RXD (Yellow)	Input	Receive	*not connected*
OP+ / TX (Green)	Output	Transmit	Cathode (-)



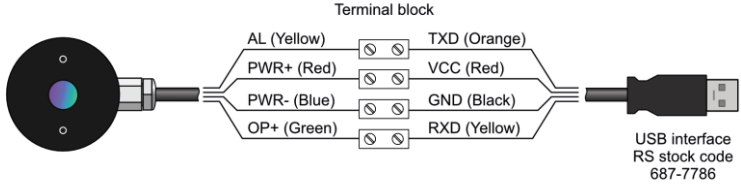
Ensure all connections are secure before applying power.

USB Adapter

The sensor is compatible with the FTDI USB adapter (RS Stock No. 687-7786).

Power is provided by the USB connection - no separate power supply is required when using the USB interface.

Connections (USB Adapter)



Use a terminal block to connect the sensor to the USB adapter. Ensure the USB adapter is not connected to the computer while making or breaking wire connections.

Connect the wires as follows:

Sensor wire	FTDI USB interface wire
AL (Yellow)	Orange
PWR+ (Red)	Red
PWR- (Blue)	Black
OP+ (Green)	Yellow

Ensure all connections are secure, then connect the USB interface to the PC.

RS Pro Config Software

The sensor is compatible with the RS Pro Config software, available as a free download from the RS website (note: alternatively, third-party Modbus software may be used).

System Requirements

- Windows 7 or newer
- USB 2.0 port, Internet access (for software download)

Installation

1. Download and run the software installer from the RS website
2. Follow the on-screen instructions.

Accessing the Settings Menu

Configuration settings are password protected. To access the Settings menu, go to the Unlock screen and enter the password. **The default password is 1234.**

Grounding

The sensor is tested for electromagnetic compatibility (EMC) as shown in Specifications. For maximum protection against electromagnetic interference, the sensor must be connected to earth at one point, either the cable shield termination or the metal sensor housing, but not both.

To minimise electromagnetic interference or “noise”, the sensor should be mounted away from sources of electromagnetic interference such as motors and generators.

Operation

Once the sensor is in position and the appropriate power, air, water 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 connected measurement instrument
3. Read or monitor the temperature

IMPORTANT

- If the sensor is exposed to significant changes in ambient temperature (hot to cold, or cold to hot), allow 20 minutes for the sensor body temperature to stabilise before taking or recording measurements.
- Do not operate the sensor near strong electromagnetic fields (e.g. around arc welders or induction heaters). Electromagnetic interference can cause measurement errors.
- Wires must be connected only to the correct terminals. Check all connections before applying power.
- Do not damage the cable, as this could provide a path for moisture and vapour into the sensor.
- Always turn off the power before modifying electrical connections.
- Do not attempt to open the sensor. There are no user-serviceable parts inside. This will damage the sensor and invalidate the warranty.

Modbus over Serial Line

Interface

Modbus address	1
Baud rate	9600
Format	8 data, No parity, 1 stop
Reply delay (ms)	20

Supported functions

Read register	0x03, 0x04
Write single register	0x06
Write multiple register	0x10
Read write multiple registers	0x17

The list below includes all available addresses. R = Read; W = Write

Address	Length (words)	Description	R/W
0x00	1	Sensor Type (31 for RSPro-UART)	R
0x01	1	Field of view (0 for 15:1)	R
0x02	2	Serial number	R
0x04	1	Modbus slave address (1)	R
0x05	1	Output type (0 for Voltage)	R
0x06	1	Reflected Energy Compensation (0 for Off; 1 for On)	R/W
0x07	1	Reflected Temperature	R/W
0x08	1	Emissivity Setting (1 LSB = 0.0001) Minimum 0.2000, Maximum 1.0000	R/W
0x09	1	Transmissivity Setting (1 LSB = 0.0001) Minimum 0.2000, Maximum 1.0000	R/W
0x0A	1	Output range low (Temperature @ 0 V)	R/W
0x0B	1	Output range high (Temperature @ 5 V)	R/W
0x0C	1	Alarm settings 0/1 for Off; 2 for Low alarm; 3 for High alarm	R/W

Address	Length (words)	Description	R/W
0x0D	1	Alarm setpoint (1 LSB = 0.1°C) Minimum 0.0°C, Maximum: 1000.0°C	R/W
0x0E	1	Alarm hysteresis (1 LSB = 0.1°C) Minimum 0.0°C, Maximum: 100.0°C	R/W
0x0F - 0x11	-	Not used	-
0x12	1	Hold Mode 0 for Off; 1 for Valley; 2 for Peak	R/W
0x13	1	Hold Period (1 LSB = 0.1 seconds) Minimum 0.1 seconds, Maximum 1200.0 seconds	R/W
0x14	1	Average Period (1 LSB = 0.1 seconds) Minimum 0.1 seconds, Maximum 60.0 seconds	R/W
0x15	1	Average Temperature	R
0x16	1	Minimum Temperature	R
0x17	1	Maximum Temperature	R
0x18	1	Filtered Temperature	R
0x19	1	Unfiltered Temperature	R
0x1A	1	Sensor Temperature	R
0x1C	1	Status (bits active high) Bit 0: Measurement error Bit 1: Sensor temperature low Bit 2: Sensor temperature high Bit 3: Object temperature low Bit 4: Object temperature high	R
0x27	1	Reflected Temperature (not saved to non-volatile memory)	R/W
0x28	1	Emissivity (not saved to non-volatile memory)	R/W

Notes:

1. All temperature are in tenths of degrees C
2. With the exception of addresses 0x27 and 0x28, all write operations are saved to non-volatile memory
3. For further information please refer to http://www.modbus.org/specs.php

Configurable Settings

Emissivity Setting	Enter the emissivity setting (between 0.2 and 1.0). The emissivity setting should match the emissivity of the target surface. This can be determined experimentally by comparing measurements with a trusted contact probe, or estimated using an emissivity table. Non-reflective non-metals, such as rubber, foods, thick plastics, organic materials and painted surfaces, generally have a high emissivity, around 0.95. This is the default setting. Bare, clean metal surfaces can have a very low emissivity, and are often difficult to measure accurately. If possible, a measurable area of the surface should be painted or coated to reduce reflections and increase the emissivity.
Transmissivity Setting	When aiming the sensor through an IR-transmissive window, this setting should be adjusted to compensate for the presence of the window. Enter the transmissivity of the window (Enter “1” if no window is present.
Reflected Energy Compensation / Reflected Temperature	In most applications, the target surface has the same surroundings as the sensor (for example, it is in the same room). In this case, Reflected Energy Compensation should remain OFF for an accurate measurement. However, if the sensor is positioned outside an oven or furnace, with the target object inside, the reflection of the hot furnace interior can affect the measurement. In this case, Reflected Energy Compensation should be ON and Reflected Temperature should be set to the temperature inside the oven or furnace.
Average Period	To slow the response time of the sensor, or to reduce fluctuations or noise on the measurement, enter an averaging period (in seconds) here.
Hold Mode / Hold Period	If required, hold processing can be applied by setting Hold Mode to “Peak” or “Valley” and setting the hold period (in seconds). This is useful if the temperature reading is interrupted by gaps between moving objects, or by an obstruction.
Output Range Low/High	Set the lower and upper temperature range limits for the voltage output. The relationship between the measured temperature and output voltage is linear.
Average Temperature	Measured temperature including averaging only (excluding hold processing).
Minimum/Maximum Temperature	Highest and lowest temperatures measured during the hold period.
Filtered Temperature	Measured temperature including averaging and hold processing.

Unfiltered Temperature	Measured temperature without averaging or hold processing.
Sensor Temperature	The temperature inside the housing of the sensor.
Alarm Set Point	The temperature at which the alarm will be triggered.
Alarm Hysteresis	The temperature difference between the Set Point and the reset level. The alarm will be reset automatically when the temperature passes the reset level.
Alarm Settings	3 (High): The alarm is triggered if the temperature is higher than the Set Point. 2 (Low): The alarm is triggered if the temperature is lower than the Set Point. 0 or 1 (Off): The alarm function is disabled.

Raspberry Pi

A command-line application is available to obtain temperature measurements from the sensor using a Raspberry Pi. For more information, and to download the software, see the guide at https://calex.co.uk/download/rsp-raspi-guide.pdf

Calibration

Every sensor is calibrated to within the published specification at the time of manufacturing.

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, call RS for further advice.

Troubleshooting

Symptom	Probable Cause	Solution
No output or display	No power to the sensor	Check the power supply and wiring
Inaccurate measured temperature	Target too small for sensor's field of view	Ensure the sensor's view is completely filled by the target. Position the sensor closer to the target to measure a smaller area.
	Incorrect emissivity setting	Choose the correct emissivity setting for the target material. See "Emissivity" for more information
	Target is a reflective metal surface	Try using a low emissivity setting, or paint or coat a measurable area of the target to make it non-reflective
	Field of view obstruction	Remove obstruction; ensure sensor has a clear view of target
	Dust or condensation on lens	Ensure lens is clean and dry. Clean gently with a soft lens cloth and water. If problem recurs, consider using an air purge collar.
Voltage output does not match displayed temperature	Output temperature scale mismatch	Check if the output temperature range has been adjusted via UART, ensure the output scale matches the input range of the measurement instrument
No alarm output	Incorrect wiring or configuration	Check electrical connections (see Installation) and Alarm Output settings

Guarantee

For RS Pro Warranty Terms & Conditions please visit our website: www.RSPro.com

Blank page

FOR MORE INFORMATION VISIT THIS SITE

www.RSPro.com