

**IRtec Rayomatic 4/6**  
**IRtec Rayomatic 10/12**  
Process IR temperature transmitters  
Instruction Manual MM850440 ed.06a



## INTRODUCTORY NOTE

**ATTENTION: THIS MANUAL IS VALID FOR IRTEC RAYOMATIC 4/6/10/12.**

*This publication contains operating instructions, as well as a description of the principles of operation, of **IRtec® Rayomatic 4/6/10/12** IR thermometers.*

*This information covers all models of the instrument, including the basic equipment and its options and accessories. This manual is a complete "USER GUIDE", providing step-by-step instructions to operate the instrument in each of its designed functions.*

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***IRtec** IR thermometers uses sophisticated analogic and digital technologies. All maintenance operation must be carried out by qualified personnel ONLY. We recommend contacting our engineers for any support requirements.*

***IRtec** is fully tested in conformity with the directive n°89/336/CEE Electromagnetic Compatibility and therefore had the CE mark. **Eurotron** shall not be liable in any event, technical and publishing error or omissions, for any incidental and consequential damages, in connection with, or arising out of the use of this book.*





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## 1 GENERAL DESCRIPTION

Eurotron **IRtec Rayomatic 4/6/10/12** family of IR non-contact smart temperature transmitters represents the ideal solution when high performance and advanced functionality are required in a confined space.

Rayomatic operations are based on the physical propriety that all object surfaces, above the absolute zero emits infrared energy. The hotter an object is, the more active its molecules are, and the more infrared energy it emits. A built-in optical system collects the radiant infrared energy from the object and focus it onto a detector. The temperature of the object under measurement can therefore be determined by intensity of this infrared energy. The detector converts the energy into an electrical signal, which is amplified, digitally converted and linearized to generate a linear electrical output signal.

### Available Models

The **IRtec Rayomatic 4/6/10/12** IR thermometers includes instrument with different measuring ranges and spectral bands to solve different application.

The table shown in the following pages indicates the available models and the relevant spectral band, the measuring range and the distance to target size ratio (D:S).



**IRtec Rayomatic 4/ 6** low cost infrared temperature sensor represents the ideal solution to replace traditional contact probes J & K with the advantage of a non-contact measurement. The output impedance as a thermocouple does not create any problem of connection to any device (indicator, controller and recorder) also with "open TC" test active.

The sensor with 0-5V (mV/°C) output can be used for easy PLC or control system connection and allows long distance cable minimizing noise and error.

**IRtec Rayomatic 10** infrared temperature transmitter represents the solution for automation non-contact temperature measurement with the standard 4-20 mA output.

**IRtec Rayomatic 12** infrared temperature transmitter represents the compact solution for automation non-contact temperature measurement with the standard 4-20 mA output.

A complete set of accessories is available to fix and to purge the IRtec Rayomatic IR thermometers.

### Report of Calibration

IRtec Rayomatic is delivered, on request, with a Report of Calibration, traceable to the International Standards stating the nominal and actual values and the deviation errors.

### RS232 & Software

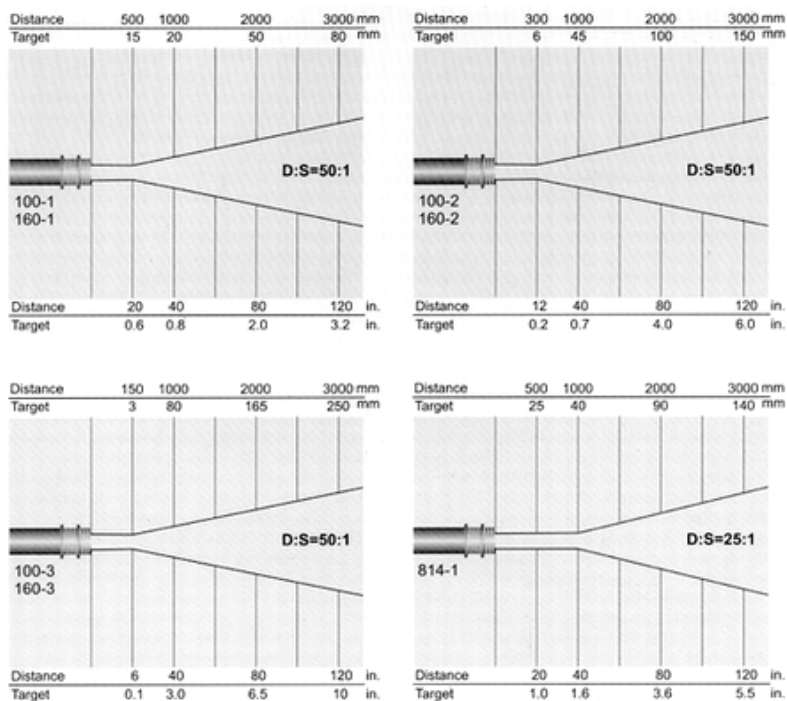
An optional RS232 PC adapter (not available for IRtec Rayomatic 4 model) allows the changes of the configuration parameters (emissivity, response time, measuring span, average, peak-picker, decay, etc) and digital communication for remote PC display of temperature.

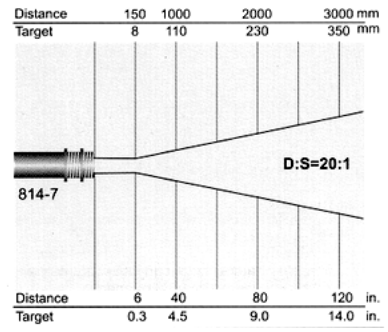
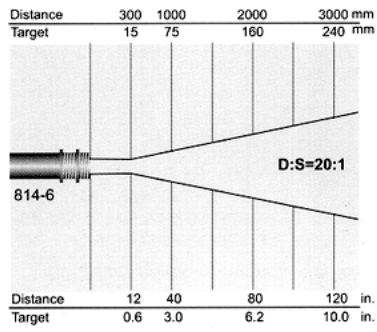
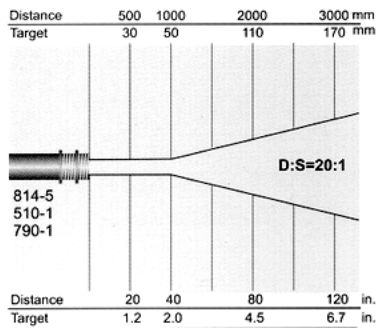
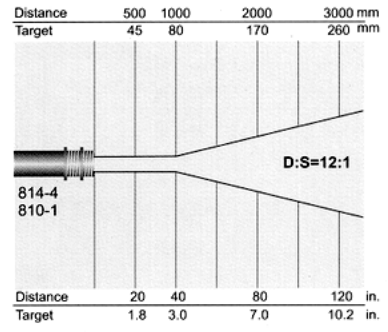
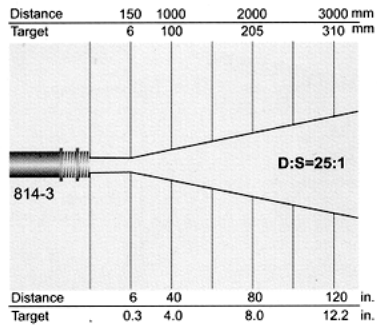
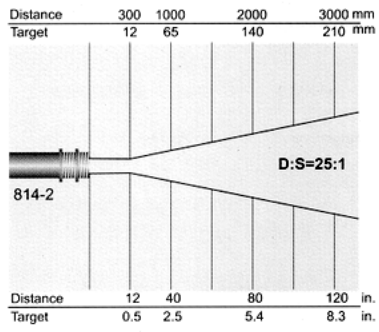


## 1.1 Specifications

### 1.1.1 Rayomatic 10

- **Output current:** 4 to 20 mA 2-wire current loop
- **Response time:**
  - 100 - 160 Models:* 50 ms (t95)
  - 814 Model:* 150 ms (t95)
  - 810 Model:* 250 ms (t95)
- **Emissivity:** software adjustable from 0.10 to 1.00 (pre-set to 0.95)
- **Accuracy:**
  - 100 - 160 Models:*  $\pm 0.5\%$  of rdg or  $\pm 1^\circ\text{C}$
  - 810 Model:*  $\pm 1\%$  of rdg or  $\pm 2^\circ\text{C}$
  - 814 Model:*  $\pm 1\%$  of rdg or  $\pm 1^\circ\text{C}$Relative accuracy data are stated for operative conditions  $+23^\circ\text{C} \pm 5^\circ\text{C}$  and emissivity = 1
- **Temperature drift:**  $\pm 0.02\%$  rdg/ $^\circ\text{C}$  for temperatures exceeding the band  $+23^\circ\text{C} \pm 5^\circ\text{C}$
- **Repeatability:**
  - 100 - 160 Models:*  $\pm 0.25\%$  of rdg or  $\pm 0.5^\circ\text{C}$
  - 810 Model:*  $\pm 1\%$  of rdg or  $\pm 1^\circ\text{C}$
  - 814 Model:*  $\pm 0.5\%$  of rdg or  $\pm 0.5^\circ\text{C}$
- **Signal processing:**  $^\circ\text{C}/^\circ\text{F}$ , Peak, Valley, emissivity, range, response time (configurable from PC)
- **Working temperature:**  $-20$  to  $+60^\circ\text{C}$  / 10-95% RH non condensing
- **Environmental rating:** IP65 (NEMA-4)
- **Power supply:** nominal 24 Vdc  $\pm 10\%$  (from 4-20 mA loop power supply)
- **Storage temperature:**  $-30^\circ\text{C}$  to  $+70^\circ\text{C}$
- **Thread:** M18x1
- **Dimensions and weight:**  $\phi$  18 mm x 127 mm - 100 g net



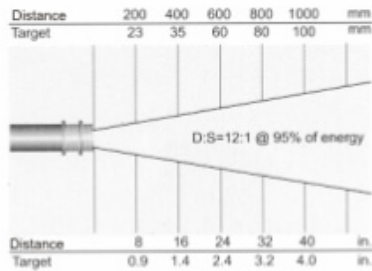
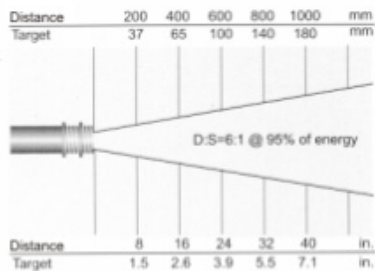


Rayomatic 10: Optical resolution



## 1.1.2 Rayomatic 12

- **Output current:** 4 to 20 mA 2-wire current loop
- **Response time:**  
*814 Models:* 150 ms (t95)
- **Emissivity:** software adjustable from 0.10 to 1.00 (pre-set to 0.95)
- **Accuracy:**  
*814 Model:*  $\pm 1\%$  of rdg or  $\pm 1^\circ\text{C}$   
Relative accuracy data are stated for operative conditions  $+23^\circ\text{C} \pm 5^\circ\text{C}$  and emissivity = 1
- **Temperature drift:**  $\pm 0.02\%$  rdg/ $^\circ\text{C}$  for temperatures exceeding the band  $+23^\circ\text{C} \pm 5^\circ\text{C}$
- **Repeatability:**  
*814 Model:*  $\pm 0.5\%$  of rdg or  $\pm 0.5^\circ\text{C}$
- **Signal processing:**  $^\circ\text{C}/^\circ\text{F}$ , Peak, Valley, emissivity, range, response time (configurable from PC)
- **Working temperature:**  $-20$  to  $+60^\circ\text{C}$  / 10-95% RH non condensing
- **Environmental rating:** IP65 (NEMA-4)
- **Power supply:** nominal 24 Vdc  $\pm 10\%$  (from 4-20 mA loop power supply)
- **Storage temperature:**  $-30^\circ\text{C}$  to  $+70^\circ\text{C}$
- **Thread:** M15x1
- **Dimensions:**  
head  $\phi$  15 mm x 36 mm  
electronic module  $\phi$  18 mm x 72 mm
- **Weight:** 120 g net



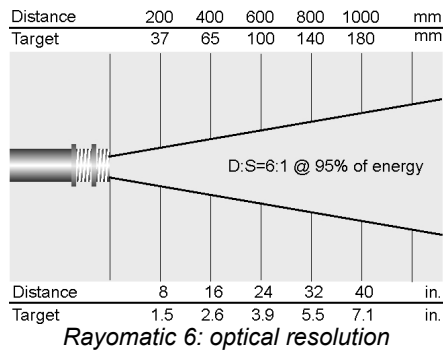
Rayomatic 12: Optical resolution



### 1.1.3 Rayomatic 6

- **Spectral band:** 8-14  $\mu\text{m}$
- **Optical resolution:** 6:1 (180mm@1000mm)
- **Response time:** 250 ms ( $t_{95}$ )
- **Emissivity:** Configurable from 0.30 to 1.00 (pre-set to 0.95)
- **Working temperature:** -20 to +60°C / 10-95% RH non condensing  
up to 90°C with air cooling  
up to 200°C with water cooling
- **Environmental rating:** IP65 (NEMA-4)
- **Temperature Stability:** Zero = 300ppm/°C - Span = 200ppm/°C
- **Accuracy:**  $\pm 2\%$  of rdg. or  $\pm 2^\circ\text{C}$
- **Repeatability:**  $\pm 1\%$  of rdg. or  $\pm 1^\circ\text{C}$
- **Temperature resolution:** 0.1°C/°F
- **Power supply:** 12 or 24 Vdc (<2.5% ripple @20mA)
- **Digital communication:** RS232 with external cable
- **Output impedance:** 50 $\Omega$
- **Load impedance:** > 50k $\Omega$
- **Storage temperature:** -30°C to +70°C / 10-95% RH non condensing
- **Dimensions and weight:**  $\phi 18$  mm x 127 mm Thread M18x1 - 90 g net weight

**NOTE:** Relative accuracy data are stated with operative conditions +23°C  $\pm 5^\circ\text{C}$  and emissivity = 1.0







### 1.1.4 Rayomatic 4

- **Spectral band:** 8-14  $\mu\text{m}$
- **Optical resolution:** 4:1
- **Response time:** 350 ms ( $t_{95}$ )
- **Emissivity:** pre-set to 0.95
- **Working temperature:** -20 to +60°C / 10-95% RH non condensing  
up to 90°C with air cooling  
up to 200°C with water cooling
- **Environmental rating:** IP65 (NEMA-4)
- **Temperature Stability:** Zero = 300ppm/°C - Span =200ppm/°C
- **Accuracy:**  $\pm 2\%$  of rdg. or  $\pm 2^\circ\text{C}$
- **Repeatability:**  $\pm 1\%$  of rdg. or  $\pm 1^\circ\text{C}$
- **Temperature resolution:** 0.1°C/°F
- **Power supply:** 12 or 24 Vdc (<2.5% ripple @20mA)
- **Digital communication:** RS232 with external cable
- **Output impedance:** 50 $\Omega$
- **Load impedance:** > 50k $\Omega$
- **Storage temperature:** -30°C to +70°C / 10-95% RH non condensing
- **Dimensions and weight:**  $\phi 18$  mm x 127 mm Thread M18x1 - 90 g net weight

**NOTE:** Relative accuracy data are stated with operative conditions +23°C  $\pm 5^\circ\text{C}$  and emissivity = 1.0



## 1.2 Ordering code

### 1.2.1 IRtec Rayomatic 10

#### Cat. 1150 - A - B - C - D - E - F

Table A-B	CWL	φ Target / Distance	Range*	D:S
100 - 1	0.9μm	20mm @ 1000mm	600 to 1600°C (1100 to 2900°F)	50:1
100 - 2	0.9μm	6mm @ 300mm	600 to 1600°C (1100 to 2900°F)	50:1
100 - 3	0.9μm	3mm @ 150mm	600 to 1600°C (1100 to 2900°F)	50:1
160 - 1	1.6μm	20mm @ 1000mm	300 to 1300°C (600 to 2400°F)	50:1
160 - 2	1.6μm	6mm @ 300mm	300 to 1300°C (600 to 2400°F)	50:1
160 - 3	1.6μm	3mm @ 150mm	300 to 1300°C (600 to 2400°F)	50:1
814 - 1	8-14μm	40mm @ 1000mm	0 to 600°C (32 to 1100°F)	25:1
814 - 2	8-14μm	12mm @ 300mm	0 to 600°C (32 to 1100°F)	25:1
814 - 3	8-14μm	6mm @ 150mm	0 to 600°C (32 to 1100°F)	25:1
814 - 4	8-14μm	80mm @ 1000mm	0 to 500°C (32 to 900°F)	12:1
814 - 5	8-14μm	50mm @ 1000mm	0 to 600°C (32 to 1100°F)	20:1
814 - 6	8-14μm	15mm @ 300mm	0 to 600°C (32 to 1100°F)	20:1
814 - 7	8-14μm	8mm @ 150mm	0 to 600°C (32 to 1100°F)	20:1
810 - 1	8-14μm	80mm @ 1000mm	0 to 500°C (32 to 900°F)	12:1

Table C	Signal Output
1	2 wires linear 4-20mA

Table D	Options
0	None
1	RS232 PC adapter + Windows software

Table E	Electrical connection
1	1m long shielded cable
2	8m long shielded cable
9	length on request

Table F	Report of Calibration
0	None
1	Eurotron NIST or EA traceable certificate with data

**NOTE :** \* Temperature range can be programmed with the cat. BB260195 configuration software and BB530202 RS232 adapter to a minimum 200°C span.

#### Accessories

The thermometer is built with a stainless steel case and can be used in the most severe industrial environments with IP65 protection.

Code	Description
EE290115	air purge
EE290104	laminar air purge device (severe application)
EE290105	radial air purge device (don't cool the target)
EE290106	90° square mounting adaptor
EE290110	2D adjustable mounting adaptor
EE290114	3D adjustable mounting adaptor
EE290108	air/water cooling jacket
EE290109	air cooling jacket with integrated air purge
BB530202	RS232 adapter cable for PC
BB260195	Rayomatic Setup software
BB260196	Rayomatic LogMan software
BB260115	LogMan data manager



## 1.2.2 IRtec Rayomatic 12

### Cat. 1152 - A - B - C - D - E - F

Table A-B	CWL	$\phi$ Target / Distance	Range*	D:S
814 - 1	8-14 $\mu$ m	65mm @ 400mm	0 to 600°C (32 to 1100°F)	6:1
814 - 2	8-14 $\mu$ m	35mm @ 400mm	0 to 600°C (32 to 1100°F)	12:1
<b>Table C</b>	<b>Signal Output</b>			
1	2 wires linear 4-20mA			
<b>Table D</b>	<b>Options</b>			
0	None			
1	RS232 PC adapter + Windows software			
<b>Table E</b>	<b>Electrical connection</b>			
1	1m long shielded cable			
2	8m long shielded cable			
9	length on request			
<b>Table F</b>	<b>Report of Calibration</b>			
0	None			
2	Eurotron NIST or EA traceable certificate with data			

**NOTE** : \* Temperature range can be programmed with the cat. BB260195 configuration software and BB530202 RS232 adapter to a minimum 200°C span.

#### Accessories

The thermometer is built with a stainless steel case and can be used in the most severe industrial environments with IP65 protection.

Code	Description
EE290124	air purge
EE290123	90° square mounting adaptor
EE290125	2D adjustable mounting adaptor
BB530018	RS232 adapter cable for PC
BB260195	Rayomatic Setup software
BB260196	Rayomatic LogMan software
BB260115	LogMan data manager



### 1.2.3 IRtec Rayomatic 6

#### Cat. 1156 - 810 - A - B - C - D

Table A	Range
1	0 to 120°C
2	0 to 300°C
3	100 to 500°C (0-500°C)
9	Special on request

Table B	Signal Output
1	10 mV/°C or 0-5V*
2	Tc type J
3	Tc type K
9	Special on request

\* scaling 0-500°C

Table C	Electrical connection
1	1m long shielded cable (PVC max. 105°C)
2	8m long shielded cable (PVC max. 105°C)
3	8m long high temperature** shielded cable (max. 200°C)
9	Special on request

\*\* available with B=1, 3 only

Table D	Report of calibration
0	none
1	NIST / EA traceable with data

#### Accessories

The thermometer is built with a stainless steel case and can be used in the most severe industrial environments with IP65 protection.

Code	Description
EE290115	air purge
EE290104	laminar air purge device (severe application)
EE290105	radial air purge device (don't cool the target)
EE290106	90° square mounting adaptor
EE290110	2D adjustable mounting adaptor
EE290114	3D adjustable mounting adaptor
EE280425	Mounting nut for measuring head
EE290108	air/water cooling jacket
EE290128	Air cooling jacket with embedded air purge
BB530018	RS232 adapter cable for PC
BB260195	Rayomatic Setup software
BB260196	Rayomatic LogMan software
BB260115	LogMan data manager



## 1.2.4 IRtec Rayomatic 4

### Cat. 1155 - 810 - A - B - C - D

Table A	Range
1	0 to 120°C
2	0 to 300°C
3	100 to 500°C (0-500°C)
9	Special on request

Table B	Signal Output
1	10 mV/°C or 0-5V*
2	Tc type J
3	Tc type K
9	Special on request

\* scaling 0-500°C

Table C	Electrical connection
1	1m long shielded cable (PVC max. 105°C)
2	8m long shielded cable (PVC max. 105°C)
3	8m long high temperature** shielded cable (max. 200°C)
9	Special on request

\*\* available with B=1, 3 only

Table D	Report of calibration
0	none
1	NIST / EA traceable with data

### Accessories

The thermometer is built with a stainless steel case and can be used in the most severe industrial environments with IP65 protection.

Code	Description
EE290115	air purge
EE290104	laminar air purge device (severe application)
EE290105	radial air purge device (don't cool the target)
EE290106	90° square mounting adaptor
EE290110	2D adjustable mounting adaptor
EE290114	3D adjustable mounting adaptor
EE280425	Mounting nut for measuring head
EE290108	air/water cooling jacket
EE290128	Air cooling jacket with embedded air purge



## 2 PHYSICAL DESCRIPTION

**IRtec Rayomatic** radiation thermometers are designed to use the most advanced sensor technology.

The external case is made of extruded aluminum with M18x1 thread compatible with a wide range of accessory.

The case is equipped with a single lens optic system, optic filter, sensor, and electronics for signal conditioning. The instrument is IP65 protected.

There are 3 different series of **IRtec Rayomatic** thermometers available in order to satisfy all applications and using conditions:

Response time, range, and special mathematical output functions can be programmed by factory on request.



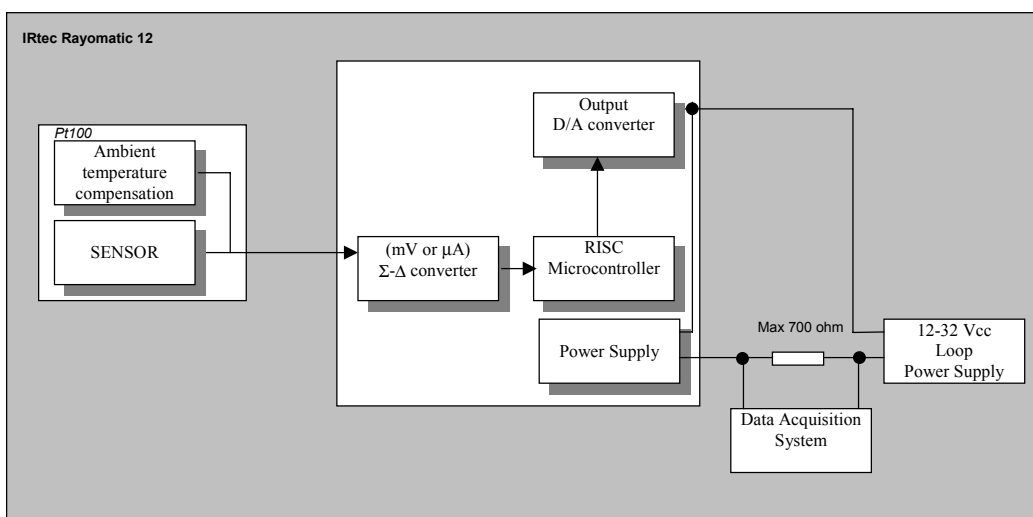
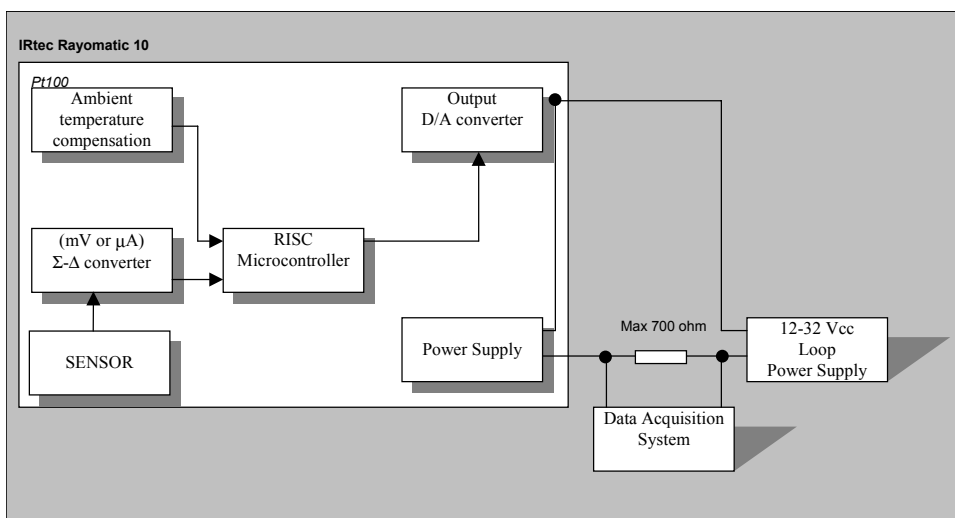
### 3 PRINCIPLE OF OPERATION

#### 3.1 Modular systems

IRtec IR temperature transmitter uses a modular structure and component interchangeability to ensure an instrument to be exactly suited for each particular application. The modular construction allows easy replacement for any option directly on the field. It also simplifies field troubleshooting, repair and calibration. Different lenses, filters, IR sensors, electronic module, target sighting systems and accessories provide over 100 possible standard instruments to exactly matching your application requirement.

#### 3.2 Basic elements

Each IRtec IR temperature transmitter contains the following basic elements: optical system, detector, and signal-processing electronic.



##### 3.2.1 Optical system

The detector is positioned at a focus distance of a high quality lens. The lens forms an image of the source in the plane of the detector.



The size of the cone of radiation accepted from an axial point of the target and is determined by the lens aperture. The field stop of the optical system on the lens position configurate the visual cone of the measuring system.

### 3.2.2 Detectors

#### Thermopile

A thermopile contain a defined number of thermocouples in a very small area. The thermocouples are connected and the output is the difference between the ambient temperature (cold junction) and the temperature collected by the optical system (hot junction).

Despite of the large number of thermocouples, the signal output is very small: few  $\mu\text{V}/^\circ\text{C}$ .

The response time of the detector is not very fast because the detector must thermally react to the received IR energy.

The spectral band is determined by an optical filter defined to reduce atmosphere absorption and to maximize the output signal.

#### Photodiode

Both Silicon and InGaAs photodiode operation is totally different from thermopile. The received energy is transformed in a electron flow. The result is a very low current proportional to the incident energy.

The response time of these sensors is very fast and is limited by electronics. The spectral band is determined by the physical characteristic of the sensor.

### 3.2.3 Electronic front-end

It is the most important part of the thermometer.

It should be able to interface the detector to the RISC micro-controller. IRtec Rayomatic series uses different kind of detectors (thermopile and photodiode) with different operating specifications.

- Thermopile models needs electronics with high impedance input and very low drift.
- Photodiode models needs fast electronics.

For the best modularity of the measuring system, Eurotron has developed special configurable electronics to meet the above requirements.

### 3.2.4 Microcontroller

The RISC Microcontroller has to manage all thermometer operative functions.

Eurotron's IRtec Rayomatic use a RISC processor with internal re-writable FLASH memory.

### 3.2.5 Output stage

This electronic section is based on a D/A converter to obtain a linear DC current signal, proportional to the temperature from the microcontroller digital output. The signal output from the thermometer is a 4 to 20 mA on a 2-wire current loop linear with the temperature range.

### 3.2.6 Temperature compensation

All IR detector are ambient temperature sensible. Detectors measure the difference between detector and target energy. To obtain the correct value of target temperature, it is necessary to measure the detector temperature and add it to the detector measurement. A thin film Pt100 sensor is installed on the detector and the microcontroller reads the temperature and makes the appropriate compensation.





## 4 UNPACKING

Remove the instrument from its packing case and remove any shipping ties, clamps or packing materials. Carefully follow any instruction given by any attached tags.

Inspect the instrument from scratches, dents, damages to case corners etc. which may have occurred during shipment.

If any mechanical damage is noted, report the damage to the shipping carrier and then notify **Eurotron** directly or its nearest agent, and save the damaged packaging for inspection.

A label, on the instrument, shows the serial number and model of the unit.

Refer to these numbers for any inquiry for service, spare parts supply or application and technical support requirements.

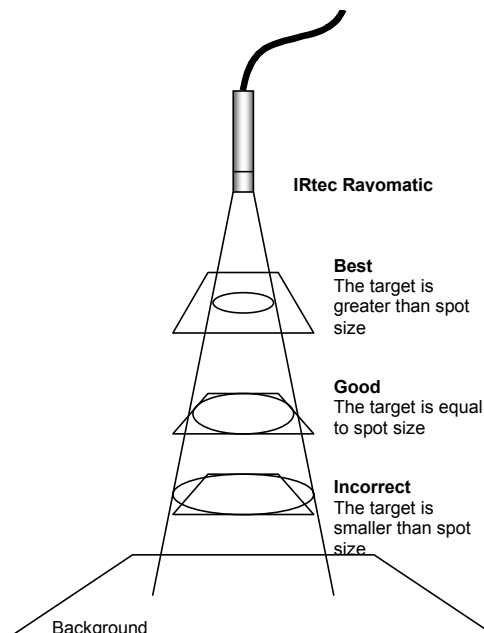


## 5 INSTALLATION

**IRtec Rayomatic** installation is quite easy. The cylindrical stainless steel case is externally threaded and allows quick installation of all available accessories.

The following procedure should help you during the installation procedure of your **IRtec Rayomatic** thermometer.

- The emissivity is standard set to 0.95 and the temperature span is set as required in the ordering table. If you need different values, read the configuration of the thermometer by using the configuration software and the Smart/RS232 converter. Connect the **IRtec Rayomatic 6/10/12** to the PC and set the mathematical function, the emissivity and the temperature span.
- Connect, if necessary, all accessories such as air purge, support, sighting tube, etc. Install and align the IRtec Rayomatic to the process.
- Connect the signal cable to the receiver (controller, indicator, etc.) paying attention to the polarity.
- Aim accurately the thermometer to your target. Refers to Target vs. distance table on the relevant section 1. Be sure that your target is well inside the measuring area.



### WARNING

**DO NOT INSTALLING THE THERMOMETER IN AMBIENT WITH TEMPERATURE HIGHER THAN +60°C WITHOUT AN ADEQUATE COOLING SYSTEM.**

### 5.1 Electrical installation

#### IMPORTANT NOTE

**THE CABLE SHIELD MUST BE GROUNDED AT ONLY ONE POINT, WHICH IS USUALLY AT THE CONTROLLER/INDICATOR SIDE. OTHERWISE, IT CAN BE DONE AT A JUNCTION BOX OR OTHER SUITABLE LOCATION IN THE FIELD AREA.**

#### 5.1.1 Electrical installation (Rayomatic 10/12)

The temperature signal is converted, amplified and linearized by the internal electronics that makes available a 4 to 20 mA linear output.

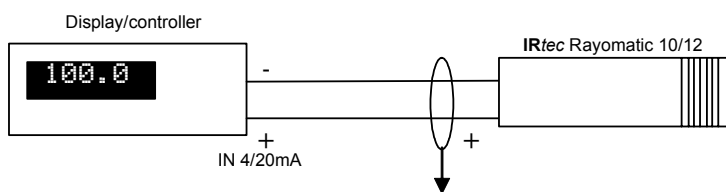
The unit is supplied complete with 1m long, shielded electrical cable.



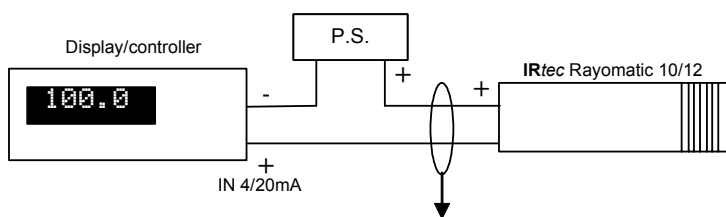
Label	Function
1	to Pin 1 of the serial interface module
2	to Pin 2 of the serial interface module
3	to Pin 3 of the serial interface module
4	to Pin 4 of the serial interface module
Loop+	Signal Output + (4-20mA)
Loop -	GND Signal Output (4-20 mA)

Connect the IR thermometer output pins (Loop+ and Loop-) to a controller/indicator signal input. The output cable incorporate 4 additional communication and shielded conductor.

**WARNING**  
TO SHIELD THE CONNECTION CABLE, CONNECT THE GROUND WIRE AS WELL WITH THE LOOP- WIRE.



Display + internal 24Vdc P.S.



Display + external 24Vdc P.S.

### 5.1.2 Electrical installation (Rayomatic 6)

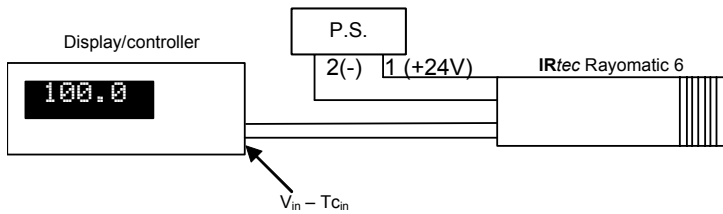
The temperature signal is converted, amplified and linearized by the internal electronics that makes available a Tc output (voltage) or linear 0-5V.

The unit is supplied complete with 1m long, shielded electrical cable.

Label	Funzione
1	to Pin 1 of the serial interface module
2	to Pin 2 of the serial interface module
3	to Pin 3 of the serial interface module
4	to Pin 4 of the serial interface module
PS+	+24V
PS-	GND 24V
Sign+	Signal Output + (4-20 mA)
Sign-	GND Signal Output (4-20 mA)

Connect the IR thermometer output pins (Sign+ and Sign-) to a controller/indicator signal input and supply the Rayomatic 6 with 24Vdc through cables labeled PS+ (+24V power supply) and PS- (Ground 24V). The output cable incorporate 4 additional communication and shielded conductor.

**WARNING**  
TO SHIELD THE CONNECTION CABLE, CONNECT THE SHIELD WIRE TO MASS.



Display + 24Vdc P.S.

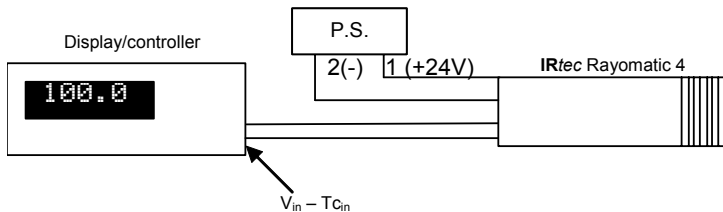
### 5.1.3 Electrical installation (Rayomatic 4)

The temperature signal is converted, amplified and linearized by the internal electronics that makes available a Tc output (voltage) or linear 0-5V.  
The unit is supplied complete with 1m long, shielded electrical cable.

Label	Funzione
PS+	+24V
PS-	GND 24V
Sign+	Signal Output + (4-20 mA)
Sign-	GND Signal Output (4-20 mA)

Connect the IR thermometer output pins (Sign+ and Sign-) to a controller/indicator signal input and supply the Rayomatic 6 with 24Vdc through cables labeled PS+ (+24V power supply) and PS- (Ground 24V).

**WARNING**  
TO SHIELD THE CONNECTION CABLE, CONNECT THE SHIELD WIRE TO MASS.

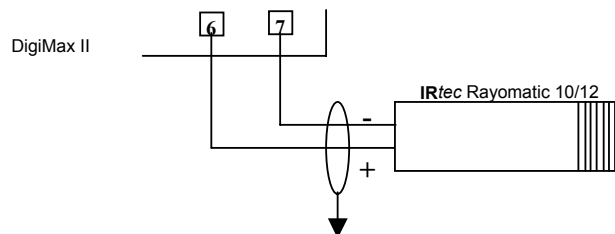


Display + 24Vdc P.S.

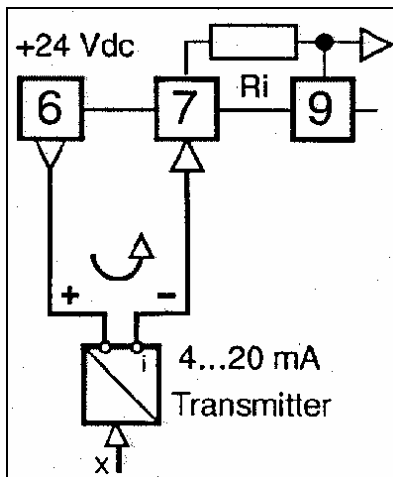
### 5.1.4 DigiMax II connections and programming (Rayomatic 10/12)

**NOTE: REFER TO DIGIMAX II MANAUL FOR PROGRAMMING DETAILS.**

The output of the pyrometer is a current signal. In any case you must power the thermometer: for this aim, use the following configuration where the pyrometer is considered as a transmitter and is powered by the Digimax itself.



- Connect the loop+ and loop- wires to clamps 6 and 7.



**DigiMax II**  
Connectors on the back side:  
use the Rayomatic as a  
transmitter.

In order to set the Digimax indicator, follow the procedure beginning from “Normal operation” and access to the subsequent pages to modify the parameters:

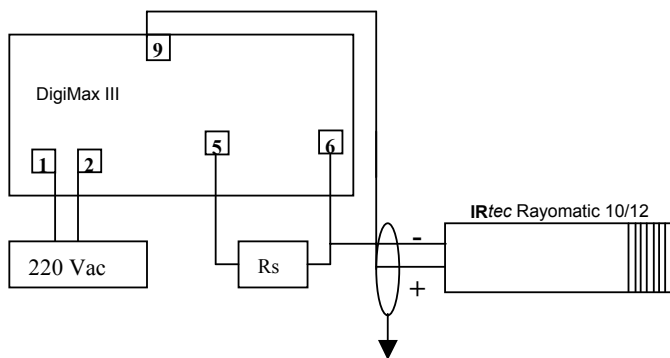
- Press ●▲, the indicator shows “Par”
- Press ●▲, the indicator shows “Conf”
- Press twice ●► to enter the configuration, the indicator shows “PASS”
- Insert the configuration password: “3333” and press ●►
- Insert the configuration code “9000”, it means a 4-20mA input and press ●►
- The indicator shows “Scdd”, set the number of decimal digits (0 to 3) and press ●►
- The indicator shows “ScLo”, set the beginning value of the scale (e.g. 0°C) and press ●►
- The indicator shows “Schi”, set the end of scale value (e.g. 600°C) and press ●►

### 5.1.5 DigiMax III connections and programming (Rayomatic 10/12)

**NOTE: REFER TO DIGIMAX III MANAUL FOR PROGRAMMING DETAILS.**

The output of the pyrometer is a current signal, hence you need to insert the proper connector (a 2.5ohm shunt resistor) to adapt the voltage input of the DigiMax. Anyway, you must power the thermometer: for this aim, use the following configuration where the pyrometer is considered as a transmitter and is powered by the Digimax itself.

- Connect the loop+ and loop- wires to clamps 6 and 9.



**DigiMax III**  
Connectors on the back side:  
notice the external shunt  
resistance between 5 and 6

**NOTE: THE SHUNT RESISTOR IS SUPPLIED WITH THE DIGIMAX**

**EXAMPLE:** how to read continuously a temperature by means of Digimax III in a range of 0-600°C and without any programming alarm.

In order to set the Digimax indicator, follow the procedure beginning from “Operator mode” and access to the subsequent pages to modify the parameters:

- Press ↵ a number of times enough to show the indication “PASS”
- Insert the password code “33” with ▲▼ keys and press ↵
- Press ↵, the indicator shows “conf” and press ↵
- The indicator shows “Conf”



- Insert the configuration code “8000” with  $\uparrow\downarrow$  keys (it means a 10-50mV input) and press  $\leftarrow$
- Press  $\leftarrow$  the indicator shows “Unit”
- Select °C or °F with  $\uparrow\downarrow$  keys
- Press  $\leftarrow$  the indicator shows “Scdd”
- set the number of decimal digits (0 to 3) with  $\uparrow\downarrow$  keys and press  $\leftarrow$
- Press  $\leftarrow$  the indicator shows “Sc.Lo”
- set the beginning value of the scale (e.g. 0°C) with  $\uparrow\downarrow$  keys and press  $\leftarrow$
- Press  $\leftarrow$  the indicator shows “Sc.Hi”
- set the end of scale value (e.g. 600°C) with  $\uparrow\downarrow$  keys and press  $\leftarrow$
- press  $\rightarrow$  to return to the actual reading

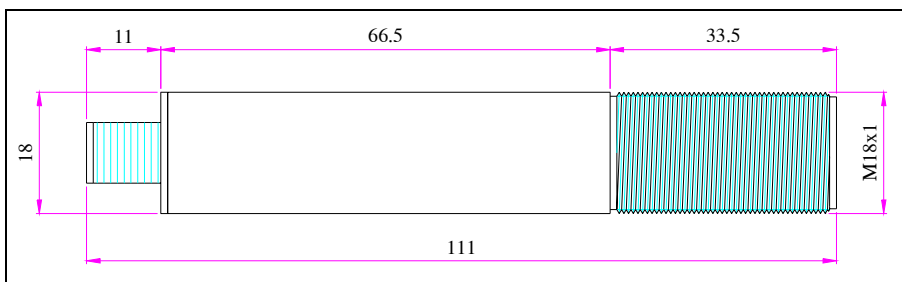
## 5.2 Mechanical installation

### 5.2.1 IRtec Rayomatic 4/6/10 installation

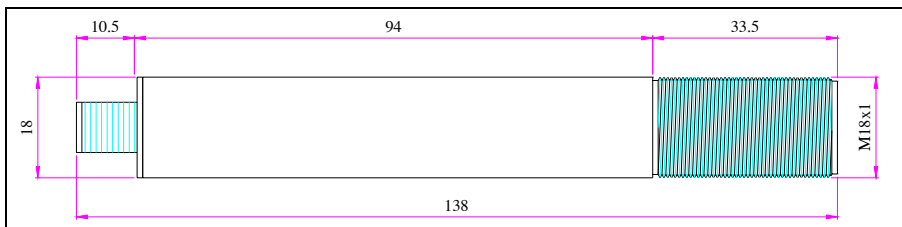
#### NOTE

IRTEC RAYOMATIC 4, 6 AND 10 USE THE SAME MECHANICAL ACCESSORIES

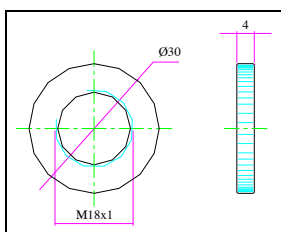
The dimensions of the pyrometers are the following:



Rayomatic 6: body



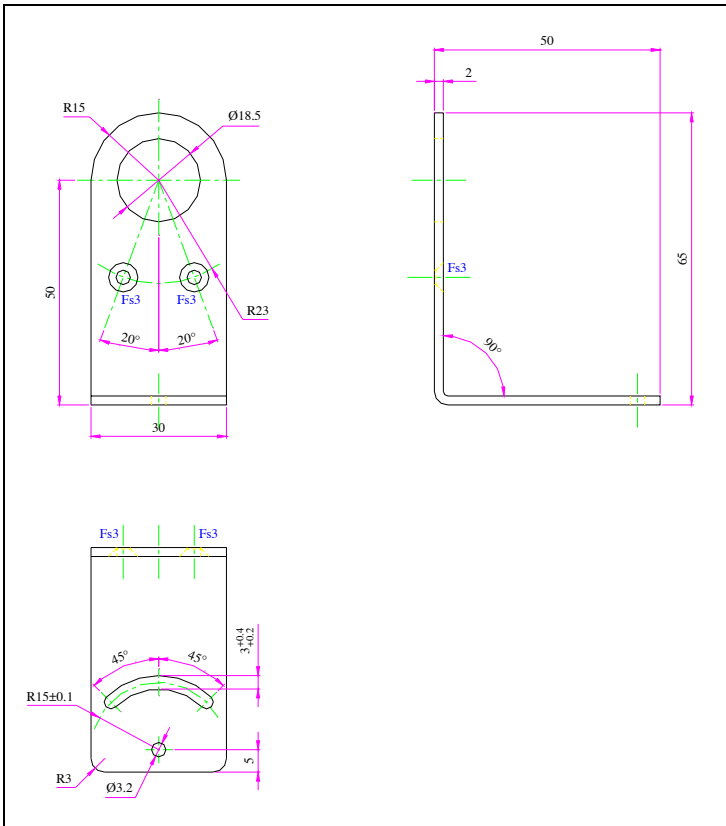
Rayomatic 10: body



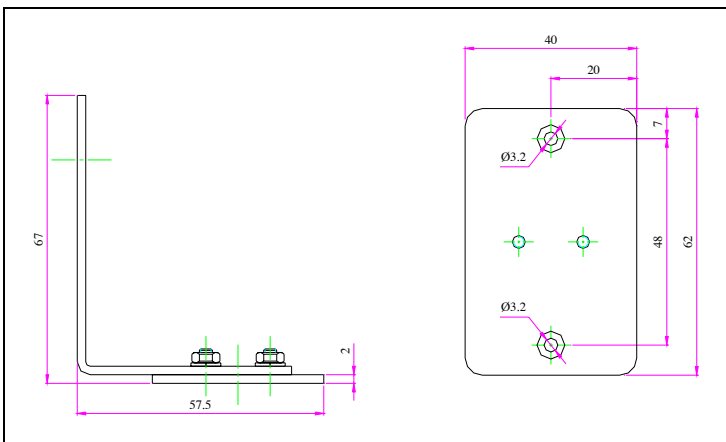
Rayomatic 6/10: mounting nut

#### **Brackets**

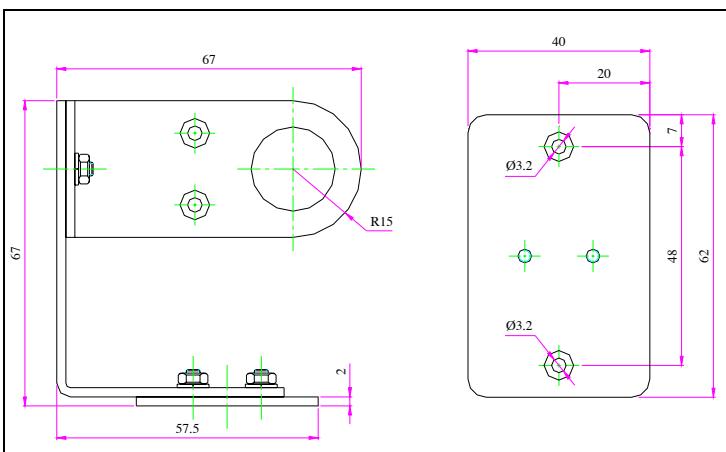
All sensors come with a 1 m cable and a mounting nut. The sensor can be installed on using the optional bracket or equivalent system.



EE290106 90° adjustable bracket



EE290110 2 axis adjustable bracket



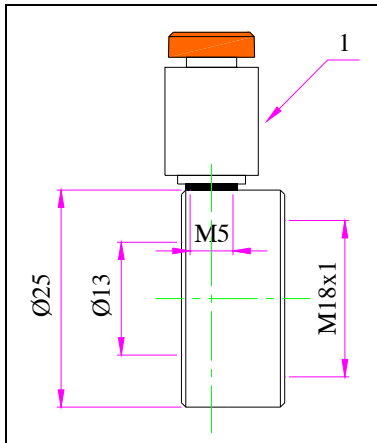
EE290114 3 axis adjustable bracket



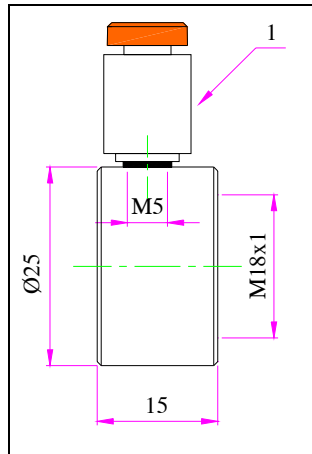
In order to align the bracket with the target, look through the support hole (without the thermometer) and find the best position. It's important for the optic path to be free from any obstruction (steam, dust, etc.). In particular, when the surface is targeted through a hole, the hole diameter has to be big enough according to the distance from the instrument. The thermometer has to be installed in an accessible place for any further maintenance operation, and it hasn't to be exposed to excessive heat, smoke and steam.

### **Air Purge collars**

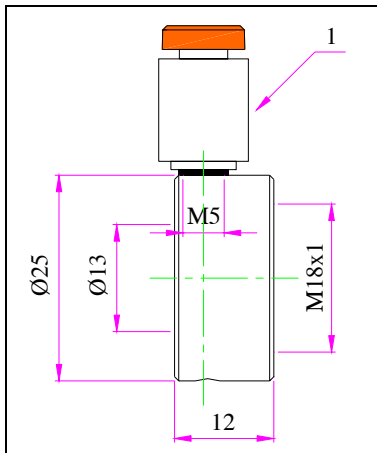
The optical path between the lens and the target, should be as much free as possible from smoke and steam. Use air purge collar to keep dust, fumes, moisture and other contaminants away from the lens.



**EE290115 Standard air purge**



**EE290104 Laminar air purge device (severe application)**



**EE290105 radial air purge device (don't cool the target)**

### **Air/Water coolers**

Anyway, install the mounting plate in a suitable place in the most favorable position from a thermal, and mechanical point of view.

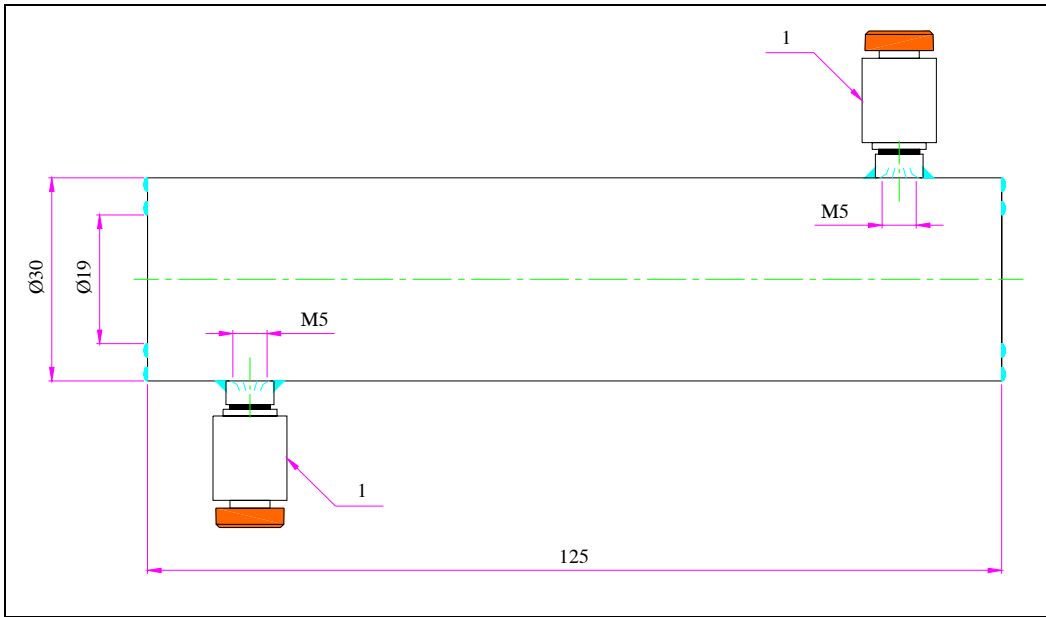
If ambient temperature is higher than 40°C, it is necessary to include one cooling device and/or the purge air ejector.

If a cooling jacket has to be used, use the water outlet on the upper part of the support in order not to create air bubbles in the jacket.

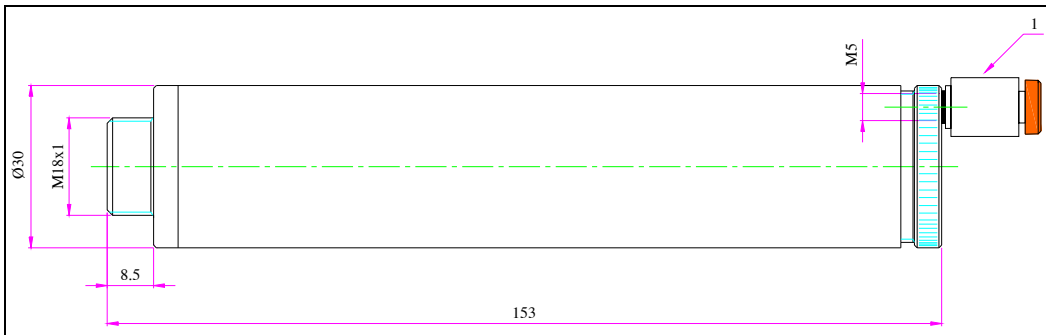
### **WARNING**

**IT ADVISABLE TO USE A PROTECTIVE SCREEN DURING THE THERMOMETER ALIGNMENT OPERATIONS IF THE TARGET HAS A STRONG RADIATION.**





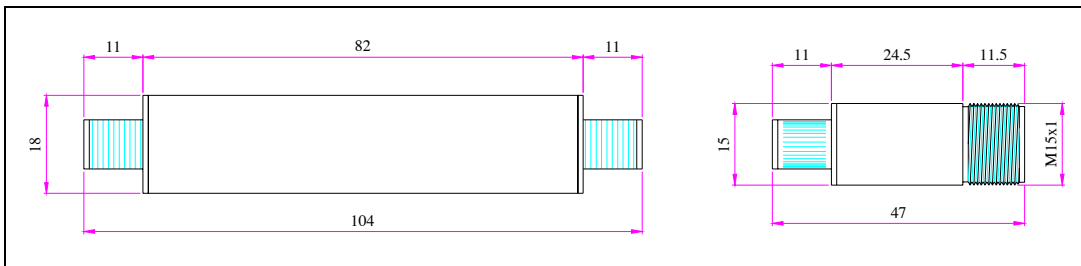
EE290108 air/water cooling jacket



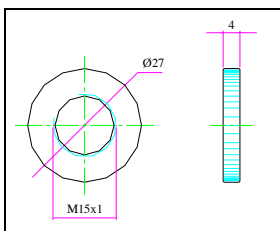
EE290109 air cooling jacket with integrated air purge

## 5.2.2 IRtec Rayomatic 12 installation

The dimensions of the Infrared thermometer are the following:



Rayomatic 12: electronic unit and remote optical head

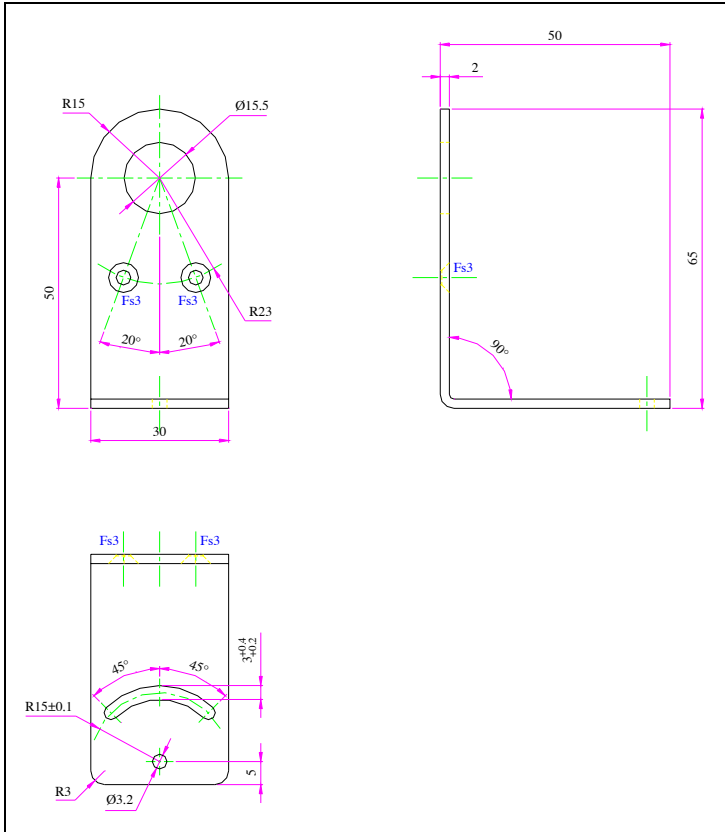


Rayomatic 12: mounting nut

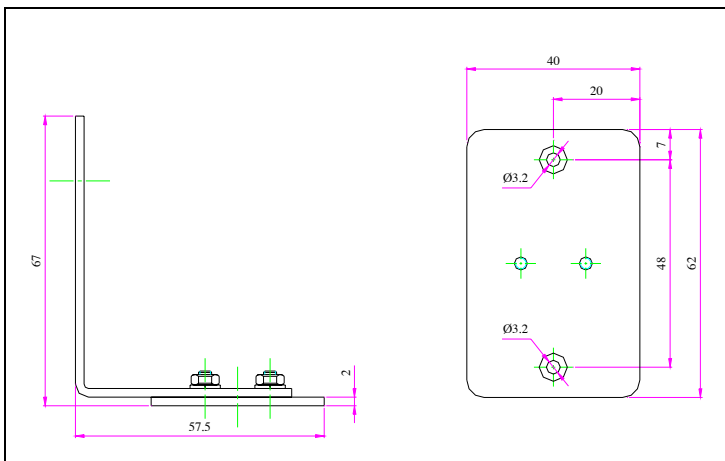


### Brackets

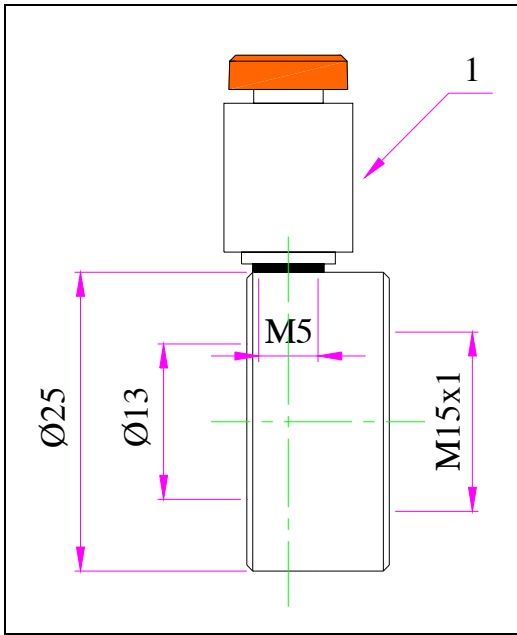
All sensors come with a 1 m cable and a mounting nut. The sensor can be installed on using the optional bracket or equivalent system.



EE290123 90° adjustable bracket



EE290125 2 axis adjustable bracket



EE290124 Standard air purge



## 6 SIGNAL PROCESSING

When a radiation thermometer is employed in an on-line system, its signal may be subjected to large fluctuations. Time function facilities are useful to retain the signal levels that are more likely to represent the true target temperature.

Eurotron IR thermometers can be factory pre-set with one of the signal processing facilities: averaging, Peak, Valley, Peak-Picking, Valley-Picking, etc.

**IRtec Rayomatic 6/10/12** functions can be set-up from user by using a Personal Computer, RS232 adapter (BB530202) and the IRSetup configuration Windows™ software (BB260295).

### IMPORTANT

**IRTEC RAYOMATIC 4 HAVE NOT SERIAL INTERFACE AND IT CANNOT BE SET BY THE USER.**

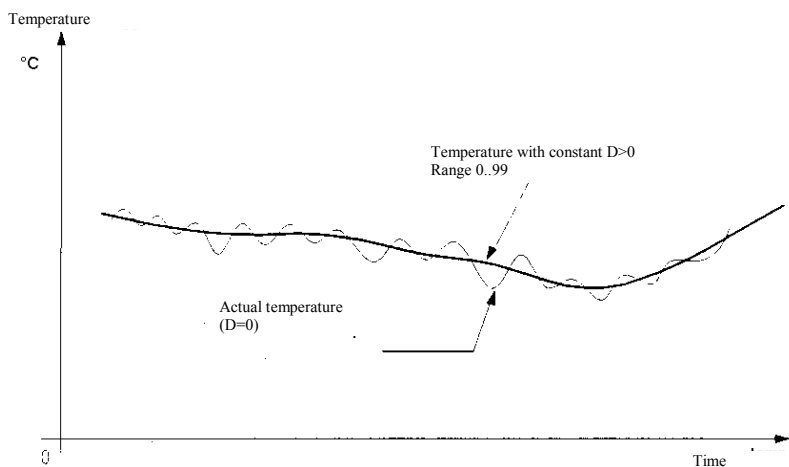
### 6.1 Average

Rapid temperature fluctuations about a true mean value can make the thermometer output unsuitable for recording and control. In these cases the average function can be used to provide a smoothed signal. The output signal  $A_{vu}$  is given by:

$$A_{vu} = A_{vp} + (M - A_{vp}) * 2 \Delta T / D$$

where:

- M** = Actual temperature
- $A_{vu}$**  = Output average
- $A_{vp}$**  = Previous average
- $\Delta T$**  = sampling time
- D** = Damping in seconds (programmable)



### 6.2 Peak

The Peak function holds a maximum temperature and retains it until a higher value appears.

### 6.3 Valley

The Valley function holds the minimum temperature and retain its until a lower value appears.

### 6.4 Peak-Picker

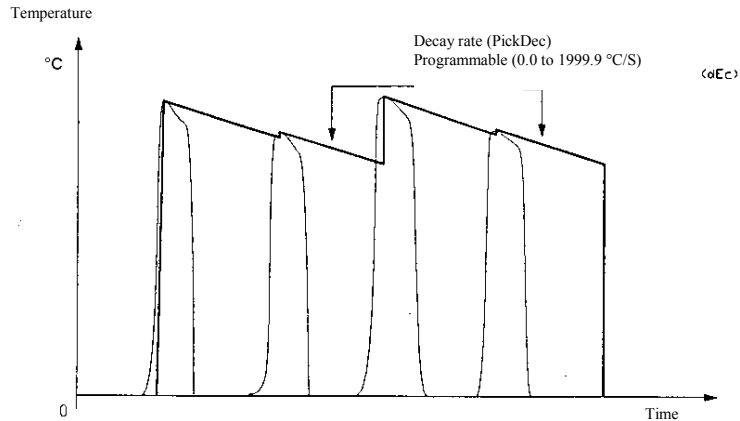
The peak-picker function holds a peak signal and allows it to decay slowly until the arrival of the next peak. It is used in such applications as rolling mills where the signal is occasionally lowered by steam, smoke, water droplets, metal scale, etc. When Peak-Picker function is programmed, the 4/20 mA output will follow the mathematical expression below:



$$U = \text{Peak} - (\text{PickDec} * 2 \Delta T)$$

dove :

- U** = output signal
- Peak** = peak signal
- PickDec** = Decay rate °C/sec (programmable)
- ΔT** = sampling time

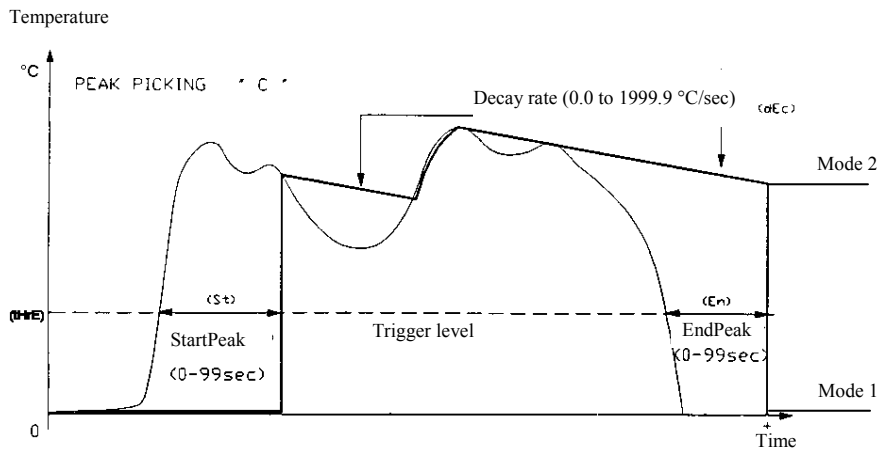


### 6.4.1 Peak-Picker delayed

When the Peak-Picker delayed function is selected, you have to set the following parameters:

- PickDec** = Decay rate
- Threshold** = Temperature threshold level
- StartPeak** = delay for starting peak-picking
- EndPeak** = delay for ending peak-picking
- Delayed Mode 2** = when selected, enable mode 2 output sustain

When the signal exceed the programmed trigger level (Threshold), the thermometer will wait the “StartPeak” delay before starting with the standard Peak-Picker function. When the input signal will decrease below the trigger level (Threshold), the thermometer will wait the “EndPeak” delay before reset the output signal. The output signal will be reduced to low scale if Mode 1 is selected or to the last calculated value if Mode 2 is selected.



### 6.5 Valley-Picker

Reverse the Peak-picker function principle to describe the Valley Picker.

$$U = \text{Valley} + (\text{PickDec} * 2 \Delta T)$$



where :

**U** = output signal  
**Valley** = Valley signal  
**PickDec** = Increasing rate °C/sec (programmable)  
 **$\Delta T$**  = sampling time



## 7 COMMUNICATION TO A PC

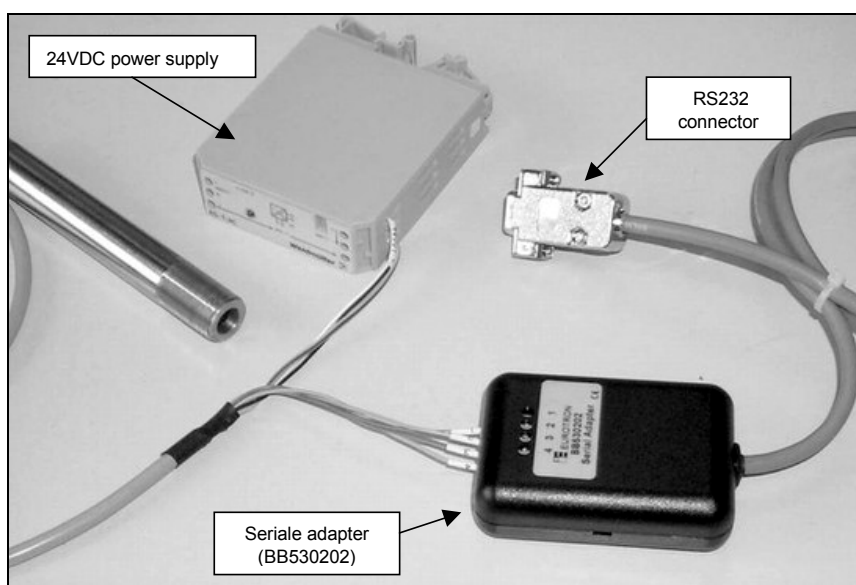
**IRtec Rayomatic 6/10/12** is an IR temperature transmitter able to communicate to a PC through a standard serial port RS232 by using the communication module (supplied with **Rayomatic** software). Hence, the instrument can be configured during its installation on the process or when you need to change configuration parameters. In any case, it is possible to connect to the pyrometer with the aim of monitoring it on a PC.

### NOTE

A SERIAL COMMUNICATION CABLE ALLOWS REACHING A DISTANCE UP TO 4m

### IMPORTANT

IRTEC RAYOMATIC 4 HAVE NOT SERIAL INTERFACE AND IT CANNOT BE SET BY THE USER.



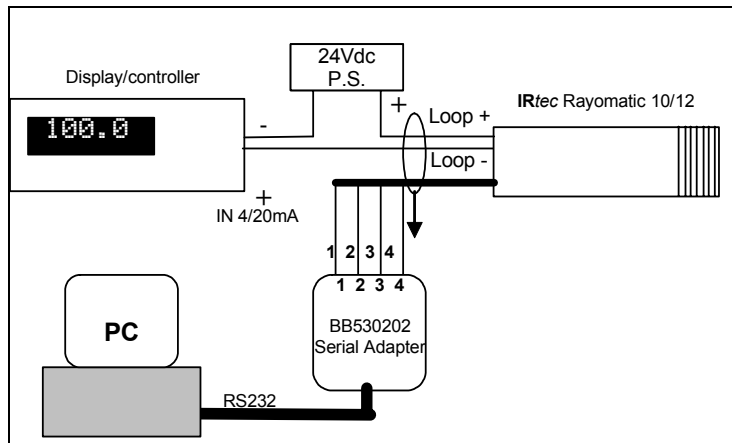
### 7.1 Connection to a PC (Rayomatic 10/12)

The cable exiting from the pyrometer shows 7 connection wires. To communicate with a PC, the pyrometer must be supplied with 24VDC on 2 wires of the loop, marked with "LOOP+" and "LOOP-".

### WARNING

TO SHIELD THE CONNECTION CABLE, CONNECT THE GROUND WIRE AS WELL WITH THE LOOP- WIRE.

Insert the other 4 wires, numbered from 1 to 4, in the serial adapter (cat. BB530202), by means of a screwdriver and respecting the numeration. Lastly, attach the serial cable of the adapter to a PC, inserting the RS232 connector in a COM port. Usually, on the back of a PC, the port COM1 and COM2 are visible. In the above figure you can see the serial adapter with 4 inputs and a 24VDC power supply (cat. F4822000) and a general scheme (with a display too).



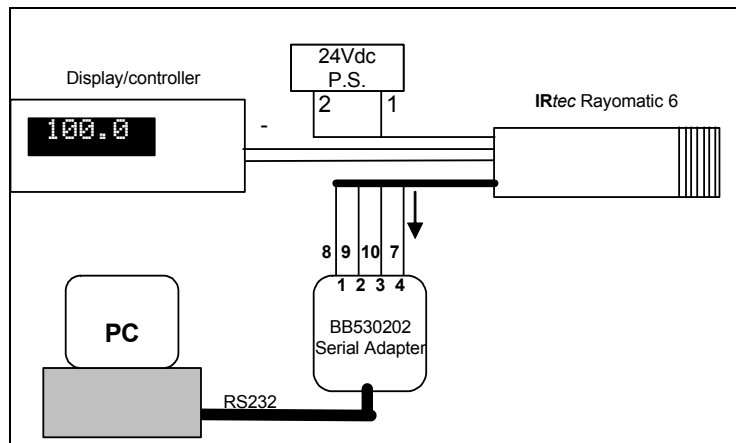
See following chapters 8,9,10 regarding configuration software (BB260195), graphic visualization software and the software for data management LogMan (BB260196).

## 7.2 Connection to a PC (Rayomatic 6)

The cable exiting from the pyrometer shows 11 wires. To communicate with a PC, the pyrometer must be supplied with 24VDC on wires marked 1 and 2.

**WARNING**  
TO SHIELD THE CONNECTION CABLE, CONNECT THE SHIELD WIRE TO MASS.

Insert the other 4 wires, numbered from 7 to 10, in the serial adapter (cat. BB530202), by means of a screwdriver and respecting the numeration. Lastly, attach the serial cable of the adapter to a PC, inserting the RS232 connector in a COM port. Usually, on the back of a PC, the port COM1 and COM2 are visible.







## 8 MAINTENANCE

Every IRtec Rayomatic is factory calibrated and certified against Eurotron Standards and shipped, on request, with a Report of calibration stating the nominal and actual values and the deviation error.

The instrument calibration has to be periodically verified.

**IRtec** uses a sophisticated analog and digital technology. All the maintenance operations must be carried on by qualified personnel. **Eurotron** supplies instructions and operative modalities for any maintenance operation. Please contact **Eurotron** for any support.

For the correct operation of the instrument, the optical system must be kept clean and it mustn't reach temperatures higher than the specified ones.

### 8.1 Purge Air Supply

The air filters cleanliness must be checked at regular intervals.

Our suggestion is to check it every day, then, according to your experience, find a correct time interval.

If the optic system reaches temperatures higher than the working one, it has to be recalibrate in **Eurotron** laboratories.

The purge air device is to be accurately checked, as the diffuser may become obstructed by non-clean air. When this happens, the air flow from the diffuser is not uniform, and dust particles appear on the lens.

In this case, the diffuser should be drowned in a detergent solution and blown with compressed air, then dried. A good air filtering can solve this problems.

### 8.2 Water Supply

Verify the water flow according to your experience: daily first, and then when the system is running well, weekly.

Check the thermometer temperature: it has to be high enough to prevent any condense formation. Once the water continuity is defined, it's enough to verify the support temperature, that has to be slightly warm.

If the thermometer reaches too high temperatures, due to water absence or to a flow partial interruption, it has to be verified and calibrated.

### 8.3 Optical system cleaning

If necessary, clean the lens with a very soft cloth and then reinstall the thermometer.

Verify the alignment and reconnect everything.

**Use an air purge system to keep the lens clean.**

### 8.4 Mounting Device

Verify at regular intervals that these devices are in good conditions and that no damage has occurred.

### 8.5 Interconnection Cable

Verify at regular intervals that it is in good conditions and that no damage has occurred. Verify also the good connections with the indicator or the acquisition system.

### 8.6 Storage

Store the instrument in the original package, at temperature from  $-30^{\circ}\text{C}$  to  $+70^{\circ}\text{C}$  (from  $+10$  to  $+70^{\circ}\text{C}$  for thermopile sensors) with non condensing R.H. less than 90%.



## 9 CERTIFICATES

### 9.1 Warranty Terms

**Eurotron Instruments** warrants its products against defects in materials and workmanship for the period declared from the date of the original retail purchase.

This warranty applies to the original purchaser only.

If the unit should malfunction, it must be returned during the warranty period, transportation prepaid, to **Eurotron** for evaluation. Upon examination, if the unit is found to be defective it will be repaired or replaced at no charge.

Direct all warranty and repair requests/inquiries to the **Eurotron** Customer Service Department. BEFORE RETURNING ANY PRODUCT(S) TO **EUROTRON**, PURCHASER MUST OBTAIN AN AUTHORIZED RETURN (AR) NUMBER FROM **EUROTRON'S** CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS).

Please include a copy of the original invoice or a small service charge may be applied.

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

**Eurotron'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 **Eurotron's** control.

### 9.2 Letter of Conformity

This is to certify that the instrument has been manufactured and inspected to document procedures and where applicable, calibrated against standards which are traceable to National and International Standards.

The Instrument has been found to conform in all respects to specifications, drawings, workmanship standards and work order requirements.



## **APPENDIX**

### **A1      EMC Conformity**

The instrument is designed to fulfil the provision of the directive 89/336/CEE Electromagnetic Compatibility.  
In the following page you will find the EMC declaration of conformity



# Declaration of Conformity

**We :** Eurotron Instruments S.p.A.

(Supplier's name)

Viale F.lli Casiraghi, 409/413 20099 Sesto S. Giovanni (MI) - Italy

(Address)

**declare under our sole responsibility that the product :**

IR thermometers series **IRtec** Rayomatic 10 and **IRtec** Rayomatic 12

(Name and type)

Cat. 1150 and Cat. 1152

(Model)

**to which this declaration relates is in conformity with the following normative documents :**

EN 50082-2 (3/95)

IEC 1000-4-2 / IEC 1000-4-4 / IEC 1000-4-11

ENV 50140 - ENV 50141 - ENV 50204

EN 55011

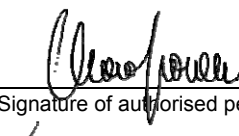
(Title, number and date of issue of normative documents)

**following the prevision of directive :**

89/336/CEE Electromagnetic Compatibility (EMC)

Sesto S. Giovanni, July 20th, 2002

(Place and date of issue)

  
(Signature of authorised person)





## A2 How to determine an object emissivity

Emissivity is the measure of an object ability to absorb, transmit, and emit infrared energy. It can have a value from 0 (shiny mirror) to 1.0 (blackbody). If a value of emissivity higher than the actual one is set, the output will read low, provided that the target temperature is above the ambient one. For example, if 0.95 is set in and the actual emissivity is 0.9, the reading will be lower than the true temperature when the target temperature is above the ambient one.

The emissivity can be determined by one of the following methods, in order of preference:

1. Determine the actual temperature of the material using a sensor such as a RTD, thermocouple or another suitable method. Next, measure the object temperature and adjust the emissivity setting until the correct value is reached. This is the correct emissivity for the measured material.
2. For relatively low temperature objects (up to 260°C or 500°F, place a piece of tape, such as a masking, on the object. Make sure the tape is large enough to cover the field of view. Next, measure the tape temperature using an emissivity setting of 0.95. Finally, measure an adjacent area on the object and adjust the emissivity setting until the same temperature is reached. This is the correct emissivity for the measured material.
3. If a portion of the surface of the object can be coated, use a flat black paint, which will have an emissivity of about 0.98. Next, measure the painted area using an emissivity setting of 0.98. Finally, measure an adjacent area on the object and adjust the emissivity setting until the same temperature is reached. This is the correct emissivity for the measured material.

### A2.1 Typical Emissivity Values

The following table provides a brief reference guide to determine emissivity and can be used when one of the above methods is not practical. Emissivity values shown in the table below are only approximate, since several parameters may effect the emissivity of an object. These include the following ones:

1. Temperature
2. Angle of measurement
3. Geometry (plane, concave, convex, etc.)
4. Thickness
5. Surface quality (polished, rough, oxidized, sandblasted)
6. Spectral region of measurement
7. Transmissivity (i.e., thin film plastics)



## A2.2 Metals - Typical Emissivity Values

	1.0 $\mu\text{m}$	1.6 $\mu\text{m}$	5.1 $\mu\text{m}$	8-14 $\mu\text{m}$
Aluminium				
Non-Oxidized	0.1-0.2	0.02-0.2	0.02-0.2	0.02-0.1
Oxidized	0.4	0.4	0.2-0.4	0.2-0.4
Alloy A 3003				
Oxidized	—	0.4	0.4	0.3
Roughened	0.2-0.8	0.2-0.6	0.1-0.4	0.1-0.3
Polished	0.1-0.2	0.02-0.1	0.02-0.1	0.02-0.1
Brass				
Polished	0.8-0.95	0.01-0.05	0.01-0.05	0.01-0.05
Burnished	—	—	0.3	0.3
Oxidized	0.6	0.6	0.5	0.5
Carbon				
Non-oxidized	0.8-0.95	0.8-0.9	0.8-0.9	0.8-0.9
Graphite	0.8-0.9	0.8-0.9	0.7-0.9	0.7-0.8
Chromium	0.4	0.4	0.03-0.3	0.02-0.2
Copper				
Polished	0.05	0.03	0.03	0-0.3
Roughened	0.05-0.2	0.05-0.2	0.05-0.15	0.05-0.1
Oxidized	0.2-0.8	0.2-0.9	0.5-0.8	0.4-0.8
Gold	0.3	0.01-0.1	0.01-0.1	0.01-0.1
Haynes Alloy	0.5-0.9	0.6-0.9	0.3-0.8	0.3-0.8
Inconel				
Oxidized	0.4-0.9	0.6-0.9	0.6-0.9	0.7-0.95
Sandblasted	0.3-0.4	0.3-0.6	0.3-0.6	0.3-0.6
Electropolished	0.2-0.5	0.25	0.15	0.15
Iron				
Oxidized	0.4-0.8	0.5-0.9	0.6-0.9	0.5-0.9
Non-oxidized	0.35	0.1-0.3	0.05-0.25	0.05-0.2
Rusted	—	0.6-0.9	0.5-0.8	0.5-0.7
Molten	0.35	0.4-0.6	—	—
Iron Cast				
Oxidized	0.7-0.9	0.7-0.9	0.65-0.95	0.6-0.95
Non-oxidized	0.35	0.3	0.25	0.2
Molten	0.35	0.3-0.4	0.2-0.3	0.2-0.3
Iron Wrought				
Dull	0.9	0.9	0.9	0.9
Lead				
Polished	0.35	0.05-0.2	0.05-0.2	0.05-0.1
Rough	0.65	0.6	0.4	0-4
Oxidized	—	0.3-0.7	0.2-0.6	0.2-0.6
Magnesium	0.3-0.8	0.05-0.3	0.03-0.15	0.02-0.1
Mercury	—	0.05-0.15	0.05-0.15	0.05-0.15
Molybdenum				
Oxidized	0.5-0.9	0.4-0.9	0.3-0.7	0.2-0.6
Non-oxidized	0.25-0.35	0.1-0.3	0.1-0.15	0.1



	<b>1.0 µm</b>	<b>1.6 µm</b>	<b>5.1 µm</b>	<b>8-14 µm</b>
Monel (Ni-Cu)	0.3	0.2-0.6	0.1-0.5	0.1-0.14
Nickel				
Oxidized	0.8-0.9	0.4-0.7	0.3-0.6	0.2-0.5
Electrolytic	0.2-0.4	0.1-0.3	0.1-0.15	0.05-0.15
Platinum				
Black	—	0.95	0.9	0.9
Silver	0.04	0.02	0.02	0.02
Steel				
Cold-Rolled	0.8-0.9	0.8-0.9	0.8-0.9	0.7-0.9
Ground Sheet	—	—	0.5-0.7	0.4-0.6
Polished Sheet	0.35	0.25	0.15	0.1
Molten	0.35	0.25-0.4	0.1-0.2	—
Oxidized	0.8-0.9	0.8-0.9	0.7-0.9	0.7-0.9
Stainless	0.35	0.2-0.9	0.15-0.8	0.1-0.8
Tin (Non-oxidized)	0.25	0.1-0.3	0.05	0.05
Titanium				
Polished	0.5-0.75	0.3-0.5	0.1-0.3	0.05-0.2
Oxidized	—	0.6-0.8	0.5-0.7	0.5-0.6
Tungsten				
Polished	0.35-0.4	0.1-0.3	0.05-0.25	0.03-0.1
Zinc				
Oxidized	0.6	0.15	0.1	0.1
Polished	0.5	0.05	0.03	0.02



## A2.3 Non-Metals - Typical Emissivity Values

	1.0 $\mu\text{m}$	2.2 $\mu\text{m}$	5.1 $\mu\text{m}$	8-14 $\mu\text{m}$
Asbestos	0.9	0.8	0.9	0.95
Asphalt	—	—	0.95	0.95
Basalt	—	—	0.7	0.7
Carborundum	—	0.95	0.9	0.9
Ceramic	0.4	0.8-0.95	0.85-0.95	0.95
Clay	—	0.8-0.95	0.85-0.95	0.95
Concrete	0.65	0.9	0.9	0.95
Cloth	—	—	0.95	0.95
Glass				
Plate	—	0.2	0.98	0.85
"Gob"	—	0.4-0.9	0.9	
Gravel	—	—	0.95	0.95
Gypsum	—	—	0.4-0.97	0.8-0.95
Ice	—	—	—	0.98
Limestone	—	—	0.4-0.98	0.98
Paint				0.9-0.95
Paper (any colour)	—	—	0.95	0.95
Plastic (opaque, over 20 mils)	—	—	0.95	0.95
Rubber	—	—	0.9	0.95
Sand	—	—	0.9	0.9
Snow	—	—	—	0.9
Soil	—	—	—	0.9-0.98
Water	—	—	—	0.93
Wood, Natural	—	—	0.9-0.95	0.9-0.95

**To optimize surface temperature measurements consider the following guidelines:**

1. Determine the object emissivity using the instrument to be used for the measurement.
2. Avoid reflections by shielding the object from surrounding high temperature sources.
3. For Higher temperature objects use shorter wavelength instruments, whenever any overlap occurs.
4. For semi-transparent materials such as plastic films and glasses, assure that the background is uniform and lower in temperature than the object.
5. Mount the sensor perpendicular to the surface whenever the emissivity is less than 0.9. In any case, do not exceed angles more than 30 degrees from incidence.





Thank you for reading this data sheet.

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