LumaSense Technologies

MANUAL

Series 12

ISR 12-LO • IGAR 12-LO IMPAC Pyrometer

certified ISO 9001

Service Centers

LumaSense Technologies, Inc.
North America
Sales & Service
Santa Clara, CA, USA
Ph: +1 800 631 0176
Ph: +1 408 727 1600
Fax: +1 408 727 1677

LumaSense Technologies GmbH
Other Than North America
Sales & Support
Frankfurt, Germany
Ph: +49 (0) 69 97373 0
Fax: +49 (0) 69 97373 167

Global and Regional Centers

Our Headquarters
LumaSense Technologies, Inc.
Santa Clara, CA, USA
Ph: +1 800 631 0176
Fax: +1 408 727 1677

Americas, Australia, & Other Asia
LumaSense Technologies, Inc.
Santa Clara, CA, USA
Ph: +1 800 631 0176
Fax: +1 408 727 1677

Europe, Middle East, Africa
LumaSense Technologies GmbH
Frankfurt, Germany
Ph: +49 (0) 69 97373 0
Fax: +49 (0) 69 97373 167

France
LumaSense Technologies Sarl
Erstein, France
Ph: +33 3 8898 9801
Fax: +33 3 8898 9732

India
LumaSense Technologies, India
Mumbai, India
Ph: + 91 22 67419203
Fax: + 91 22 67419201

China
LumaSense Technologies, China
Shanghai, China
Ph: +86 133 1182 7766
Ph: +86 21 5877 2383

E-mail info@lumasenseinc.com
support@lumasenseinc.com
eusupport@lumasenseinc.com

Website http://www.lumasenseinc.com

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Contents

1 General

1.1 Information about the user manual

Congratulations on choosing the high quality and highly efficient IMPAC pyrometer.

This manual provides important information about the instrument and can be used as a work of reference for installing, operating, and maintaining your IMPAC pyrometer. It is important that you carefully read the information contained in this manual and follow all safety procedures before you install or operate the instrument.

To avoid handling errors, keep this manual in a location where it will be readily accessible.

1.1.1 Legend

	**Note:** The note symbol indicates tips and useful information in this manual. All notes should be read to effectively operate the instrument.
	**Attention**: **Security note laser beam:** Indicates to the danger of a built-in laser targeting light.
	**Warnings and Cautions:** The general warnings and cautions symbol signifies the potential for bodily harm or damage to equipment.
MB	Shortcut for Temperature range (in German: **M**ess**b**ereich).

1.1.2 Terminology

The terminology used in this manual corresponds to the VDI- / VDE-directives 3511, Part 4.

1.2 Safety

This manual provides important information on safely installing and operating the IMPAC pyrometer. Several sections of this manual provide safety warnings to avert danger. These safety warnings are specified with a warning symbol. You must read and understand the contents of this manual before operating the instrument even if you have used similar instruments or have already been trained by the manufacturer.

It is also important to continually pay attention to all labels and markings on the instrument and to keep the labels and markings in a permanent readable condition.

	**Warning:** The pyrometer is only to be used as described in this manual. It is recommended that you only use accessories provided by the manufacturer.

In addition, signs and markings on the device are to be observed and maintained in legible condition.

1.2.1 Laser targeting light

For easy alignment to the measuring object the pyrometers can be equipped with a laser targeting light. This is a visible red light with a wavelength between 630 and 680 nm and a maximum power of 1 mW. The laser is classified as product of laser class II.

Warning: To reduce the risk of injury to the eyes, do not look directly into the targeting laser and do not point the targeting laser into anyone's eyes. The instrument is equipped with a class II laser that emits radiation.

Safety regulations:

- Never look directly into the laser beam. The beam and spot can be watched safely from side.
- Make sure that the beam will not be reflected into eyes of persons by mirrors or shiny surfaces.

1.2.2 Electrical connection

Follow common safety regulations for mains voltage (e.g. 230 or 115 V AC) connecting additional devices operating with this mains voltage (e.g. transformers). Touching mains voltage can be mortal. A non-expert connection and mounting can cause serious health or material damages.

Only qualified specialists are allowed to connect such devices to the mains voltage.

1.3 Limit of liability and warranty

All general information and notes for handling, maintenance, and cleaning of this instrument are offered according to the best of our knowledge and experience.

LumaSense Technologies is not liable for any damages that arise from the use of any examples or processes mentioned in this manual or in case the content of this document should be incomplete or incorrect. LumaSense Technologies reserves the right to revise this document and to make changes from time to time in the content hereof without obligation to notify any person or persons of such revisions or changes.

All instruments from LumaSense Technologies have a regionally effective warranty period. Please check our website at http://info.lumasenseinc.com/warranty for up-to-date warranty information. This warranty covers manufacturing defects and faults, which arise during operation, only if they are the result of defects caused by LumaSense Technologies.

The *Windows compatible software* was thoroughly tested on a wide range of Windows operating systems and in several world languages. Nevertheless, there is always a possibility that a Windows or PC configuration or some other unforeseen condition exists that would cause the software not to run smoothly. The manufacturer assumes no responsibility or liability and will not guarantee the performance of the software. Liability regarding any direct or indirect damage caused by this software is excluded.

The warranty is VOID if the instrument is disassembled, tampered with, altered, or otherwise damaged without prior written consent from LumaSense Technologies; or if considered by LumaSense Technologies to be abused or used in abnormal conditions. There are no user-serviceable components in the instrument.

1.4 Unpacking the Instrument

Thoroughly inspect the instrument upon delivery to purchaser. Check all materials in the container against the enclosed packing list. LumaSense Technologies cannot be responsible for shortages against the packing list unless a claim is immediately filed with the carrier. The customer must complete final claim and negotiations with the carrier.

Save all packing materials, including the carrier's identification codes, until you have inspected the pyrometer and find that there is no obvious or hidden damage. Before shipment, the pyrometer was examined and has been tested. If you note any damage or suspect damage, immediately contact the carrier and LumaSense Technologies, Inc.

1.5 Service Request, Repair, or Support

Contact LumaSense Technologies Technical Support in case of a malfunction or service request. Provide clearly stated details of the problem as well as the instrument model number and serial number. Upon receipt of this information, Technical Support will attempt to locate the fault and, if possible, solve the problem over the telephone.

If Technical Support concludes that the instrument must be returned to LumaSense Technologies for repair, they will issue a Return Material Authorization (RMA) number.

Return the instrument upon receipt of the RMA number, transportation prepaid. Clearly indicate the assigned RMA number on the shipping package exterior. Refer to Section 1.6, Shipments to LumaSense for Repair, for shipping instructions.

Technical Support can be contacted by telephone or email:

Santa Clara, California

- Telephone: +1 408 727 1600 or +1 800 631 0176
- Email: support@lumasenseinc.com

Frankfurt, Germany

- Telephone: +49 (0) 69 97373 0
- Email: eusupport@lumasenseinc.com

Erstein, France

- Telephone +33 (0)3 88 98 98 01
- Email: eusupport@lumasenseinc.com

1.6 Shipments to LumaSense for Repair

All RMA shipments of LumaSense Technologies instruments are to be prepaid and insured by way of United Parcel Service (UPS) or preferred choice. For overseas customers, ship units air-freight, priority one.

The instrument must be shipped in the original packing container or its equivalent. LumaSense Technologies is not responsible for freight damage to instruments that are improperly packed.

Contact us to obtain an RMA number (if Technical Support has not already assigned one). Clearly indicate the assigned RMA number on the shipping package exterior.

Send RMA Shipments to your nearest technical service center:

Customers in **North America** should send RMA Shipments to:

Santa Clara, California

LumaSense Technologies, Inc.
3301 Leonard Court
Santa Clara, CA 95054 USA
Telephone: +1 408 727 1600
+1 800 631 0176

Email: support@lumasenseinc.com

All other customers should send RMA Shipments to:

Frankfurt, Germany

LumaSense Technologies GmbH
Kleyerstr. 90
60326 Frankfurt
Germany
Telephone: +49 (0)69-97373 0

Email: eusupport@lumasenseinc.com

1.7 Transport, packaging, storage

With faulty shipping, the instrument can be damaged or destroyed. To transport or store the instrument, please use the original box or a box padded with sufficient shock-absorbing material. For storage in humid areas or shipment overseas, the device should be placed in welded foil (ideally along with silica gel) to protect it from humidity.

The pyrometer is designed for a storage temperature of -20 to 70 °C with non-condensing conditions. Storing the insturment out of these conditions can cause damage or result in malfunction of the pyrometer.

1.8 Disposal / decommissioning

Inoperable IMPAC pyrometers must be disposed of in compliance with local regulations for electro or electronic material.

2 Introduction

2.1 Appropriate use

The pyrometers ISR 12-LO and IGAR 12-LO are digital, highly accurate 2-color pyrometers with fiber optic for non-contact temperature measurement on metals, ceramics, graphite etc. between 300 and 3300 °C.

The pyrometers measures in the 2-color principle (ratio principle) in which two adjacent wavelengths are used to calculate the temperature. This technique offers the following advantages compared with the standard one-color pyrometers:

- The temperature measurement is independent of the emissivity of the object in wide ranges.
- The measuring object can be smaller than the spot size.
- Measurements are unaffected by dust and other contaminants in the field of view or by dirty viewing windows.

Additionally, the pyrometer can be switched to 1-color mode and used like a conventional pyrometer.

The metal mode allows measurements of metals and alloys with unknown K-factor (emissivity slope).

The instrument is equipped with an optical fiber (length up to 30 m), which can be used in very high ambient temperatures up to 250 °C without cooling and it is unaffected by electromagnetic interferences.

2.2 Scope of delivery

Pyrometer, optical fiber and optical head as per configuration, works certificate, PC software InfraWin, and user manual.

Note: The connection cable is not included with the instrument and must be ordered separately (see section **8**, **Reference numbers**).

2.3 Technical data

Temperature ranges:	ISR 12-LO:	MB 13:	600 … 1300 °C
		MB 17:	450 … 1700 °C
		MB 18:	750 … 1800 °C
		MB 25:	900 … 2500 °C
		MB 33:	1000 … 3300 °C
	IGAR 12-LO:	MB 10:	300 … 1000 °C
		MB 13:	350 … 1300 °C
		MB 22:	500 … 2200 °C
		MB 25:	550 … 2500 °C
Sub range:	Any range adjustable within the temperature range minimum span 51 °C		
Signal processing:	Photoelectric current, digitized		

Spectral range:	ISR 12-LO: λ_1: 0.8 µm/λ_2: 1.05 µm IGAR 12-LO: MB 10: λ_1: 1.52 µm/λ_2: 1.64 µm All other MB: λ_1: 1.28/$\lambda_2$2: 1.65 µm

Measuring modes:	Ratio- (2-color-) / mono- / metal mode switchable
Power supply:	24 V DC (15 to 40 V DC) or 24 V AC (12 to 30 V AC), 48 to 62Hz
Power consumption:	Max. 10 W
Analog output:	0 to 20 mA or 4 to 20 mA switchable, load 0 to 500 Ohm Test current 10 mA by pressing test key
Load:	0 to 500 Ω
Switch contact:	Max. 0.15 A (only active with automatic clear mode or $t_{CL} \geq 0.5$ s)
Digital Interface:	Switchable: RS232 or RS485 addressable (half duplex), baud rate 2.4 up to 115.2 kBd
Resolution:	Display: 1 °C Interface: 0.1 °C Analog output: < 0.025% of temperature range
Isolation:	Power supply, analog output and digital interface are galvanically isolated from each other

Parameters:	Adjustable or readable at the device or via interface: Emissivity ε, emissivity slope K, exposure time t_{90}, clear times for maximum value storage t_{CL}, automatically or external deletion of maximum value storage, switching measuring mode, switch-off limit, warning level dirty window, 0 to 20 or 4 to 20 mA, sub range, address, baud rate, °C/°F Readable at the device or via interface: Measuring temperature Adjustable only via interface commands: Wait time t_W, keyboard lock
Emissivity slope K:	ε_1 / ε_2: 0.8 to 1.2 adjustable in steps of 0.001
Emissivity ε:	0.1 to 1 adjustable in steps of 0.001
Exposure time t_{90}:	2 ms (with dynamical adaptation at low signal levels), adjustable at 0.01 s; 0.05 s; 0.25 s; 1 s; 3 s; 10 s
Maximum value storage:	Built-in single or double storage. Clearing with adjusted time t_{clear} (0.00 s; 0.01 s; 0.05 s; 0.25 s; 1 s; 5 s; 25 s), extern, via interface or automatically with the next measuring object

Uncertainty: * (ε =1, t_{90}=1 s, $T_{amb.}$ = 23 °C)	ISR 12-LO:	0.4% of reading in °C + 1 °C (< 1500 °C) 0.6% of reading in °C + 1 °C (> 1500 °C)
	IGAR 12-LO:	0.5% of reading in °C + 1 °C (< 1500 °C) 0.7% of reading in °C + 1 °C (> 1500 °C)
Repeatability: * (ε =1, t_{90}=1 s, $T_{amb.}$ = 23 °C)	ISR 12-LO: IGAR 12-LO:	0.2% of reading in °C + 1 °C 0.3% of reading in °C + 1 °C

* The temperature of fiber and optical head must be at least 30 °C lower than the measuring temperature to get a correct temperature reading

Protection class:	IP65 (DIN 40 050)
Ambient temperature:	Converter housing: 0 to 60 °C (ISR 12-LO); 0 to 50 °C (IGAR 12-LO)
Storage temperature:	-20 to 70 °C
Rel. humidity:	Non-condensing conditions
Weight:	Converter: 2.2 kg; optical head II: 140 g; fiber (2.5 m): 250 g
Connector:	12 pin Connector

Sighting:	Laser targeting light (max. power level < 1 mW, λ = 630-680 nm, CDRH class II). (With IGAR 12-LO measurements are possible while laser targeting light is switched on, with ISR 12-LO measuring is stopped)
CE-label:	According to EU directives about electromagnetic immunity

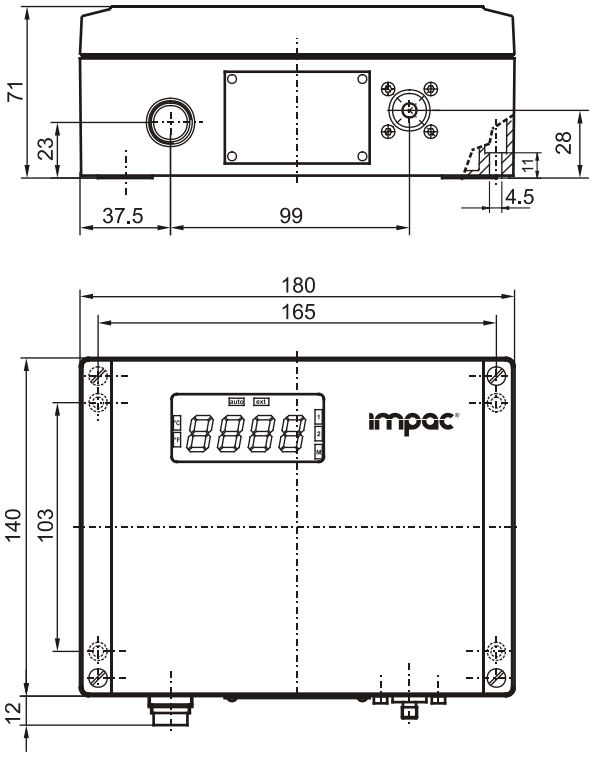
Note: The determination of the technical data of this pyrometer is carried out in accordance with VDI/VDE directive IEC TS 62942-2, "Determination of the technical data for radiation thermometers".

The calibration / adjustment of the instruments was carried out in accordance with VDI/VDE directive "Temperature measurement in industry, Radiation thermometry, Calibration of radiation thermometers", VDI/VDE 3511, Part 4.4.

For additional details on this directive, see http://info.lumasenseinc.com/calibration or order the directive from "Beuth Verlag GmbH" in D-10772 Berlin, Germany.

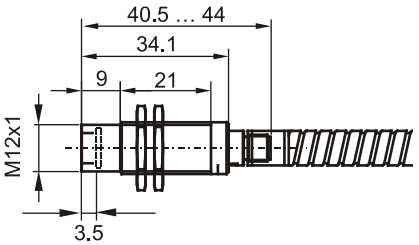
2.4 Dimensions

Pyrometer housing:

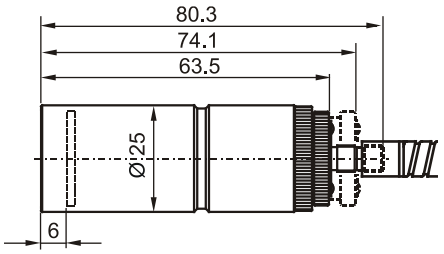


Optical heads:

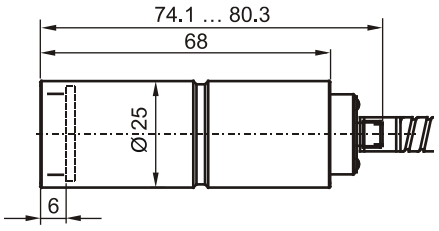
Type I (small optics):



Type II (focusable optics):



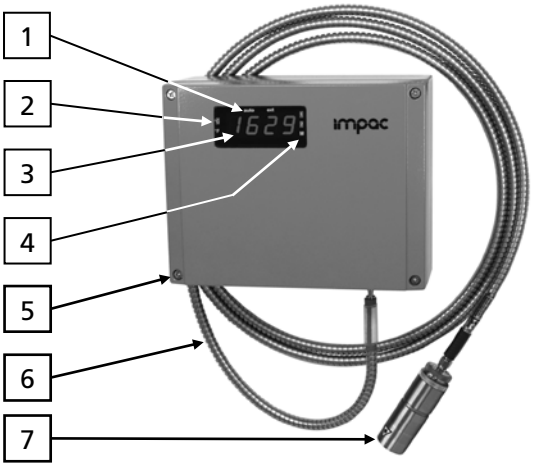
Type II (fixed adjusted):



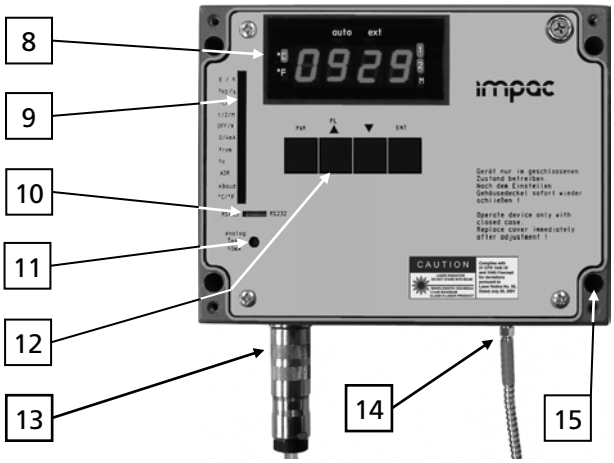
all dimensions in mm

2.5 Physical User Interface

Pyrometer



Interior view pyrometer housing



1 Display for clear mode
2 Display °C or °F
3 LED display for temperature or parameters
4 Display for measuring mode
5 Mounting screws for cover (4 units)
6 Fiber optic
7 Optical head
8 Display
9 Parameter indicator
10 Interface switch
11 Push button for test current
12 Setting keys
13 Electrical connection
14 Connection for fiber optic
15 Mounting holes

2.6 Accessories (Optional)

Numerous accessories guarantee easy installation of the pyrometer. The following overview shows a selection of suitable accessories. You can find the entire accessory program with all reference numbers in Chapter **8**, **Reference numbers**.

Mounting:
For mounting and aligning the pyrometer to the measured object *mounting angles* or a *ball and socket mounting* is available. The ball and socket mounting is an easy way to align the pyrometer to the measured object. The clamping-screws of the ball and socket mounting enable an easy and fast adjustment of the pyrometer in all directions.

Mounting angle

Ball and socket mounting

Air purge:
The *air purge* protects the lens from contamination with dust and moisture. It must be supplied with dry and oil-free pressurized air (1,5 m³ / h) and generates an air stream shaped like a cone.

Air purge

Displays:
Additionally, to the built-in temperature indicator of the pyrometer LumaSense offers several digital displays which can also be used for remote parametrizing of the pyrometer.

Digital display
DA 6000

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3 Controls and Connections

3.1 Electrical Installation

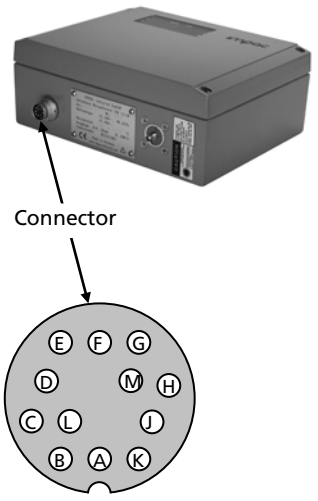
The ISR 12-LO and the IGAR 12-LO are powered by a voltage of 24 V DC (15 to 40 V DC) or 24 V AC (12 to 30 V AC). As the instrument is operating with heated and thermostatically controlled sensors, it needs a warm-up of up to 5 minutes (during this warm-up period the LED display indicates "7777"), after that the instrument is ready for use. To switch off the instrument, interrupt the power supply or unplug the electrical connector.

To meet the electromagnetic requirements (EMV), a shielded connecting cable must be used. The shield of the connecting cable must be connected only on the pyrometer's side. On side of the power supply (switch board) the shield must be open to avoid ground loops.

LumaSense offers connecting cables; they are not part of standard scope of delivery. The main connecting cable has wires for power supply, interface, analog output, external laser switch and external clear of maximum value storage via contact (see section **8, Reference numbers**) and 12 pin connector. The cable includes a short RS232 adapter cable with a 9 pin SUB-D connector for direct PC communication. This adapter is not used in combination with RS485 interface.

3.2 Pin assignment of the male socket on the back of the pyrometer

Pin	Color	Indication
K	white	+ 24 V power supply (or 24 V AC)
A	brown	0 V power supply
L	green	+ $I_{outp.}$ analog output
B	yellow	– $I_{outp.}$ analog output
H	gray	External switch for targeting light (bridge to K)
J	pink	See **3.2.1**: operating mode contact, external clearing of maximum value storage (bridge to K) or output for dirty window monitoring
G	red	DGND (Ground for interface)
F	black	RxD (RS232) or B1 (RS485)
C	violet	TxD (RS232) or A1 (RS485)
D	gray/pink	B2 (RS485) (bridge to F)
E	red/blue	A2 (RS485) (bridge to C)
M	orange	Screen only for cable extension, don't connect at the switchboard



Pin assignment
(side of male inserts)

3.2.1 Connector pin J

The connector pin J can be used for 4 different functions:

1. **Operating mode contact:** During the warm-up of the pyrometer (after connection to the power supply, the LED display on the converter indicates "7777") pin J is connected to the power supply voltage. This voltage is connected by a relays switch (max. continuous current 0.4 A) to pin K (power supply voltage). This relays switch opens when the warm-up is finished, and the pyrometer is in operating mode. For that reason, this pin can be used as operating mode contact.
2. **External clearing of the maximum value storage:** When the pyrometer is in operating mode, pin J can be used for external clearing of maximum value storage (see section **4.8**). To clear the maximum value storage, connect pin J for a short time to pin K (power supply voltage).

   The function "external clearing" is activated with the following conditions:

   - Warm-up is finished (no display "7777")
   - The clear time is set to "extern" (see section **4.8**).
   - The lens contamination monitoring is switched off. This can be done via software InfraWin in "color-bar" window. The warning level "dirty window" must be set to 0% (see section **4.1**).
3. **Hold function:** When the hold function mode is activated the current temperature, reading is frozen as long as J and pin K are connected (see **4.8** clear time for the maximum value storage).
4. Lens contamination monitoring system: The pyrometers are equipped with a contamination monitoring system. Contamination of lens or sighting window or dust in the sighting path of the pyrometer can interfere the signal in such a high level that a correct temperature measurement will be impossible (this can also happen if the object is smaller than the spot size of the pyrometer). To avoid wrong measurements in advance, a warning signal can be set to a certain contamination level. If contamination reaches this level (or at a certain too low signal level), a built-in relay (max. continuous current 0.4 A) connects pin J to pin K (power supply voltage). The setting of the switch level (0 … 99%) can be done via software InfraWin in "color-bar" window. If the warning level "dirty window" is set to 0% (see section **4.1**) the lens contamination monitoring system is switched off and pin J has the function "external clearing" of maximum value storage (factory setting).

   The lens contamination monitoring system is activated with the following conditions:

   - Warm-up is finished (no display "7777")
   - The clear time is not set to "extern" (see sections **4.1** and **4.8**).
   - The pyrometer is operating in "2-color mode" (see section **4.9**)

3.3 Connecting the pyrometer to a PC

The pyrometers are equipped with a serial interface RS232 or RS485 (switchable at the pyrometer). Standard on a PC is the RS232 interface. At this interface one pyrometer can be connected if the interface is set to RS232. Only short distances can be transmitted with RS232 and electromagnetic interferences can affect the transmission.

With RS485 the transmission is to a large extend free of problems, long transmission distances can be realized, and several pyrometers can be connected in a bus system. If RS485 is not available at the PC, it can be realized with an external converter which converts the RS485 in RS232 for a standard connection to a PC.

When using a converter RS485 / RS232 take care, that the converter is fast enough to receive the pyrometer's answer to an instruction of the master. Most of the commonly used converters are too slow for fast measuring equipment. So, it is recommended to use the LumaSense converter (order no. 3 852 430).

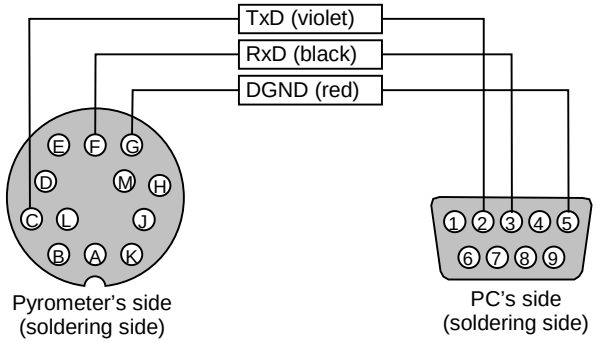
With a slow RS485 connection it is also possible to set a wait time at the pyrometer which delay the response of a command to the pyrometer (see **3.4.3 Wait time**).

3.3.1 Connecting to RS232 interface

The transmission rate (in baud) of the serial interface is dependent on the length of the cable. Values between 2400 and 115200 Bd may be set.

The baud rate must be reduced by 50% when the transmission distance is doubled (see also **4.14 Baud rate**).

Typical cable length for RS232 at 19200 Bd is 7 m.

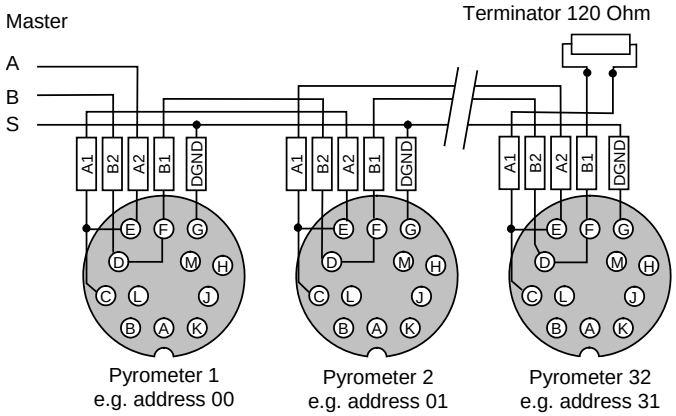


3.3.2 Connecting to RS485 interface / baudrate

Half-duplex mode:

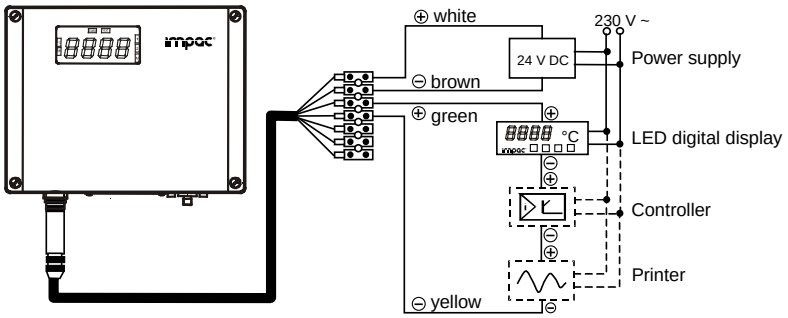
A1 and A2 as well as B1 and B2 are bridged in the 12-pin round connector of the connecting cable, to prevent reflections due to long stubs. It also safeguards against the interruption of the RS485 Bus system should a connecting plug be pulled out. The master labels mark the connections on the RS485 converter. The transmission rate of the serial interface in Baud (Bd) is dependent on the length of the cable. Values between 1200 and 115 kBd may be set.

The baud rate is reduced by 50% when the transmission distance is doubled (see **4.14 Baud rate**). Typical cable length for 19200 Bd is 2 km.



3.3.3 Connection of additional analyzing devices

Additional analyzing instruments, for example a LED digital display instrument only needs to be connected to a power supply and the analog outputs from the pyrometer. Other instruments like a controller or printer can be connected to the display in series as shown above (total load of resistance max. 500 Ohm).



3.3.4 Wait time t_w

Using a pyrometer with RS485 it is possible that the connection is not fast enough to receive the pyrometer's answer to an instruction of the master. In this case a wait time can be set to slow down the data transfer (e.g.: t_w = 02 at a baud rate 9600 means a wait time of 2/9600 sec).

Settings:
00 Bit
⋮
99 Bit

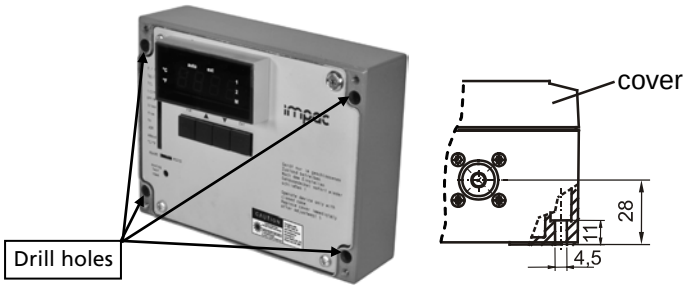
Note: Only available via interface commands, see **7, Data format UPP**.

3.4 Mechanical Installation

3.4.1 Pyrometer

To fix the converter, 4 drill holes for screws with 4 mm diameter are visible after removing the cover.

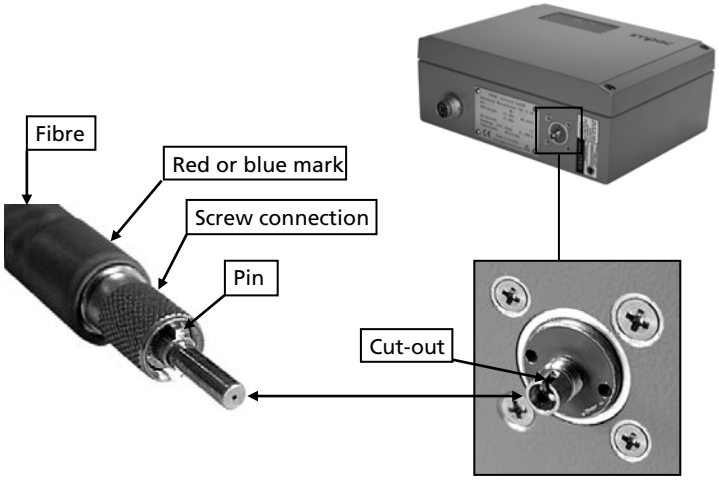
For fixing the optical heads different mounting supports are available (see **2.6 Accessories (Optional)**).



3.4.2 Fiber optic

The fiber has a blue or red mark for correct connection to the pyrometer. The color mark must be mounted on the pyrometer's side.

The fiber optic is equipped with a special connector which allows it to fix the fiber only in one position. Please notice that the connector of the fiber with the pin is fixed in the correct position before plug and socket can be bold together.



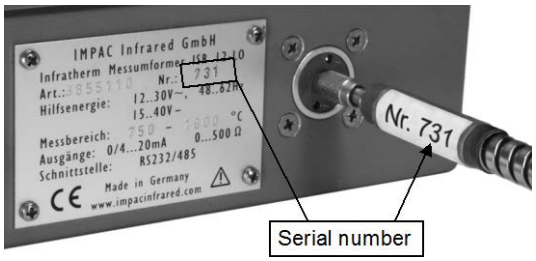
Note: The light guide end of the fiber optic cable as well as the socket/connector and the optical head must always be protected with the caps when not connected.

Ambient temperature
The fiber and optical head can withstand ambient temperatures up to 250 °C without cooling on the side of the optical head.

Serial number / fiber replacement
The original fiber has a serial number which is also on the pyrometer's housing. If required, the fiber can be replaced by a new original IMPAC-brand fiber. In this case, the pyrometer has to be calibrated together with the fiber (service).

The original fiber has a serial number which is also on the pyrometer's housing.

If required, the fiber can be replaced by a new original IMPAC fiber. In this case the pyrometer must be calibrated together with the fiber (service).

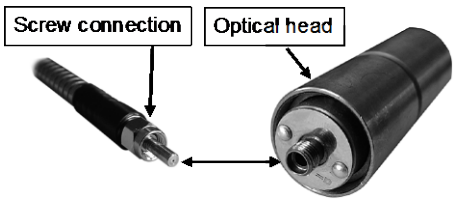


Minimum Bending Radius		
	ISR 12-LO: MB 13; IGAR 12-LO: MB 10 (blue mark)	ISR 12-LO: MB 18, 25, 33; IGAR 12-LO: MB 13, 17, 22, 25 (red mark)
Short time (max. 200 °C)	100 mm	50 mm
Permanent (max. 200 °C)	300 mm	120 mm

Attention: A hot fiber optic cable should not be exposed to continual movement!

3.4.3 Optical head

The FSMA connector on the side of the optical head doesn't need a special justification if bold together.



3.5 Optical head

Depending on the application, the instrument will be delivered with a small or a big optical head.

Type I (small optical head): With the very small dimensions the optical head I is suited for use in confined spaces. The optics is adjusted to one of the measuring distances mentioned in the table **3.5.1**. The mentioned spot size will be achieved in exactly this distance (other distances on request).

Type II (optical head, focusable): With the focusable optical head II each measuring distance can be adjusted within the mentioned limits to achieve the smallest spot size in the required distance. The spot size at the shortest and longest distance is mentioned in the following table **3.5.1** Spot sizes at intermediate distances must be calculated by interpolation.

Type II (optical head, fixed adjusted): The fixed adjusted optical head II has a similar size as the focusable optical head but with a fixed focusing distance similar to type I (see table **3.5.1**).

Note: The optical heads can be changed against another from the same type. A recalibration of the pyrometer is not necessary.

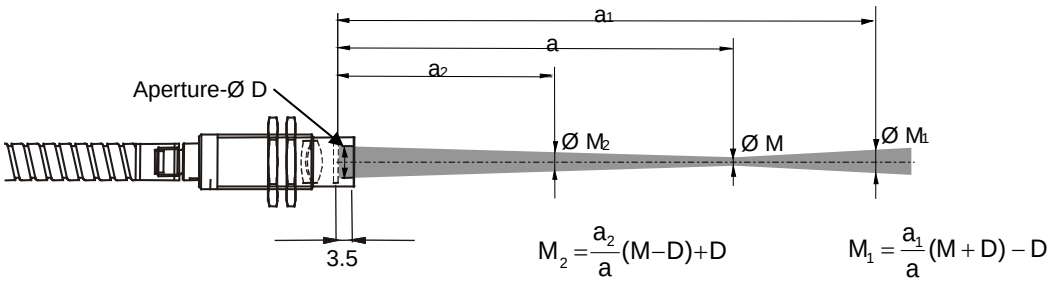
3.5.1 Spot size data (measuring distance from the front of the lens)

Optical head	Meas. Distance a (mm)	Spot size ISR 12-LO: MB 13 IGAR 12-LO: MB 10 M [mm]	Spot size ISR 12-LO: MB 18, 25, 33 IGAR 12-LO: MB 13, 17, 22, 25 M [mm]	Aperture D (mm)*
Type I (small optics)	120 260 700	2.2 5 14	1.2 2.6 7.2	7 7 7
Type II (focusable optics)	88 to 110 95 to 129 105 to 161 200 to 346 247 to 606 340 to 4500	0.8 to 1.1 0.9 to 1.3 1.1 to 1.7 1.5 to 2.8 2.0 to 5.2 2.8 to 42	0.45 to 0.6 0.5 to 0.75 0.6 to 1.0 0.8 to 1.5 1.1 to 2.7 1.5 to 22	17 16 15 17 16 15
Type II (fixed adjusted)	87 200 600 4500	0.75 1.5 5.3 42	0.45 0.8 2.7 22	17 17 15 15
Color mark of fiber		Blue	Red	

*) The aperture is the effective lens diameter of the optics. It is depending on the objective length which is changing if the measuring distance will be adjusted. The biggest aperture value belongs to the fully extended objective, the smallest aperture value if the objective is turned to its smallest size. Intermediate values have to be interpolated (e.g. calculating the spot size if the measuring distance varies from the adjusted value).

The spot sizes, mentioned in the table above, will be only achieved at the measuring distances of the corresponding optics or with the focusable optics at the adjusted distance. Decreasing or increasing the measuring distance enlarges the spot size.

Spot sizes for intermediate distances, that are not shown on the optical profiles, may be calculated using the following formula:



Note: The *InfraWin* program includes a calculator ("IR calculator") that roughly estimates the unknown values.

Note: The pyrometer can measure objects at any distance, but it has to be at least as big as the spot size of the pyrometer.

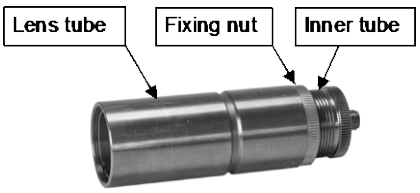
3.5.2 Adjusting the required measuring distance with optical head I or II, fixed adjusted

A tape can be used to determine the distance between the object and pyrometer. The measuring distance is always measured from the front of the lens.

If the laser is switched on, its smallest spot is in the measuring distance of the corresponding optics or adjusted distance and it marks the center as well as the size of the spot.

3.5.3 Adjusting the required measuring distance with optical head II, focusable

For adjustment of the correct distance, untighten the fixing nut and vary the length of the optical head by turning the lens tube. In the correctly focused distance the laser has its smallest spot size (sharpest image). After adjustment tighten the fixing nut.



3.6 Laser targeting light

For easy alignment to the measuring object the pyrometers are equipped with a laser targeting light. The laser marks the center of the measuring spot and corresponds to the spot size. With the IGAR 12-LO the measurement is not effected by the laser targeting light. As the laser targeting light influences the measurement of the ISR 12-LO the last measured value is hold in the analog output. The display shows during this time the intensity of the relative signal. In mono mode the display shows a blinking “8000”. The laser targeting light is switched off automatically after approx. 2 min or after a further push of the PL key.

Note: The smallest diameter of the laser spot indicates the correctly focused measuring distance. The diameter corresponds to the spot size!

The laser targeting light can be switched on and off either by pressing the button at the housing (see also section **3.6** Key panel operation) or by using an external contact (see **3.2 Pin assignment** for the connector on the bottom side of the pyrometer) or via PC and the software InfraWin. After two minutes the laser targeting light is switched off automatically.

Warning: To reduce the risk of injury to the eyes, do not look directly into the targeting laser and do not point the targeting laser into anyone's eyes. The instrument is equipped with a class II laser that emits radiation.

Note: The laser warning signs on the pyrometer should be easily viewable at all times, even after it has been installed.

Note: To prevent the damage of the laser, the pilot light switches off automatically if the internal temperature of the device exceeds approx. 55 °C (it can be switched on again, if the internal temperature is lower than 55 °C)!

4 Settings / Parameter Descriptions

Certain settings must be done for use of the entire specifications of the pyrometer. The most settings can be done at the instrument directly, a few (e.g. setting of contamination level) only via software InfraWin.

After removing the cover of the housing, the setting keys of the pyrometer are accessible.

Note: Please make sure that the pyrometer is not contaminated while open.

4.1 Factory settings

Temperature display (°**C** / °**F**) = °C

Emissivity (**ε**) = 1.000

Emissivity slope (K) = 1.000

Exposure time ($\mathbf{t_{90}}$) = 0.00

Clear time ($\mathbf{t_{Clear}}$) = 0.00

Operating mode (1 / 2 / M) = 2

Max / min = maximum value storage preset

Analog output (0 / 4 mA) = 0 ... 20 mA

Sub range (from / to) same as basic temperature range

Address = 00

Switch-off limit = 10%

Baud rate (kBaud) = 19.2 kBd

Switch for interface (RS485 / RS232) = RS232

Warning level “dirty window“ = 0% (equivalent to “off”)

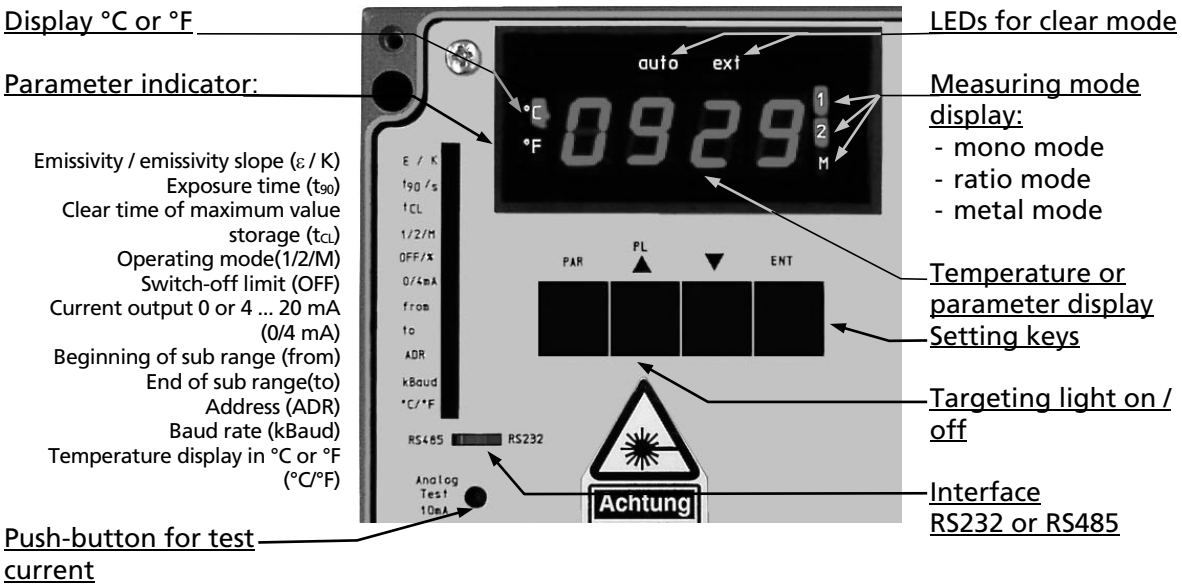
4.2 Instrument settings

Certain settings must be done for use of the entire specifications of the pyrometer. The most settings can be done at the instrument directly, a few (e.g. setting of contamination level) only via software InfraWin.

After removing the cover of the housing, the setting keys of the pyrometer are accessible.

Note: Please make sure that the pyrometer is not contaminated while open.

4.2.1 Key panel operation



Scale °C or °F: The LED indicates the temperature scale in °C or °F.

Parameter indicator: LED's indicate which pyrometer parameter is selected for reading or changing.

Push button for test current: The test button activates a test current of 10 mA on the analog output, independent if the instrument is adjusted to 0 ... 20 mA or 4 ... 20 mA. This enables to test external indicators for correct scaling. The readings of the internal indicator should correspond to the reading of the external indicator. If both displays show different readings the external indicator has a wrong temperature range or input current. This test current can be switched off by pushing the test button again or any other setting key or it is switched off automatically after 30 seconds and the instrument is working in the measuring mode.

LED for clear mode: LED indicates if the maximum value storage is operating in automatic or external clearing mode.

Temperature or parameter display: In the measuring mode the display shows the actual temperature reading. After pushing the parameter key the display indicates the actual value of one selected parameter. Special indications: see **4.2.2.**

Measuring mode display: LED 1 = mono mode
LED 1 and 2 = ratio mode
LED M = metal mode

Setting keys: PAR: With the **PAR** button all available parameters are displayed in the following description. Pushing the button again changes the display to the next parameter, after the last parameter it changes to the actual temperature reading.

▼ ▲: With the arrow keys and all parameter settings can be displayed. Pushing the button longer changes the settings in fast mode (the keys and **ENT** are blocked if the keyboard is locked via the interface commands or/and during a measurement in combination with a PC and *InfraWin*).

ENT: If a parameter is changed with the arrow keys the new value must be confirmed by pushing the ENT key. If it is not confirmed with ENT, the instrument is still operating with the previous parameter value. If no key is pressed for approx. 30 s the display changes to the temperature indication.

Targeting light on / off: Pushing the PL key in measuring mode the laser targeting light is switched on.

The IGAR 12-LO measures continuously also with switched on targeting light and the display shows the actual temperature reading. As the laser targeting light influences the measurement of the ISR 12-LO the last measured value is hold in the analog output. The display shows during this time the intensity of the relative signal. In mono mode the display shows a blinking “8000”. The laser targeting light is switched off automatically after approx. 2 min or after a further push of the PL key.

Serial interface: Switch for selection of RS232 or RS485.

4.2.2 Special indications

Display	Description
7777	Warming-up time after switching on
8888	Measurement exceeds the end of sub range
0 ... 999 (Intensity „relative signal“)	Only type ISR 12-LO in ratio mode: If the laser targeting light is switched on the converter shows the intensity of the measuring signal in percent. No measurement will be done, the analog output keeps the last measurement value.
8000	Only model ISR 12-LO in mono mode: Laser targeting light on, no measurements will be done (analog output keeps the last measurement value).

4.3 Basic range

Basic range automatically displays the total range of the pyrometer and can not be changed.

4.4 Material

The **Material** setting allows you to store the names of different measuring objects with their emissivity values and to recall them from the list. You can also add and change the materials listing through the text file "mat.txt" (provided in the folder ***InfraWin*** in the standard **Documents and Settings** path of Windows, normally C:\ Documents and Settings \ <user name> \ *InfraWin*).

4.5 Temperature display in °C or °F

Choose whether the temperature should be displayed in °C (Celsius) or °F (Fahrenheit).

4.6 Emissivity ε / emissivity slope K

Emissivity (ε) setting only in mono mode.
Emissivity slope setting (K = ε_1 / ε_2) only in ratio mode.

Settings:
10%
⋮
100%

For a correct measurement it is necessary to adjust the emissivity. This emissivity is the relationship between the emission of a real object and the emission of a black body radiation source (this is an object which absorbs all incoming rays and has an emissivity of 100%) at the same temperature. Different materials have different emissivities ranging between 0% and 100% (settings at the pyrometer between 0.1 to 1, equivalent to 10 to 100%). Additionally, the emissivity is depending on the surface condition of the material, the spectral range of the pyrometer and the measuring temperature. The emissivity setting of the pyrometer must be adjusted accordingly. Typical emissivity values of various common materials for the two spectral ranges of the instruments are listed below. The tolerance of the emissivity values for each material is mainly dependent on the surface conditions. Rough surfaces have higher emissivities.

Settings:
0.8
⋮
1.2

In ratio mode (2-color mode) the pyrometer is measuring simultaneously with 2 sensors in adjacent wavelengths. It calculates the temperature by ratioing the radiation intensities of the two wavelengths. This ratio technique eliminates a number of factors that degrade the accuracy of a conventional single-color instrument e.g. measurement independent of emissivity in wide areas, unaffected by dust in the field of view, unaffected by dirty viewing windows or lenses, etc. In some cases, the emissivities of the two wavelengths can differ so that it is necessary to correct the ratio of the two emissivities (ε_1 / ε_2) to get a correct temperature reading. This correction can be done with the emissivity slope setting K. The K-factors of metals are normally higher than 1. For a correct measuring result it is recommended to make a comparison test, e.g. with a thermocouple probe. Then the K-factor must be corrected until the pyrometer shows the same temperature value.

Emissivity values and emissivity slope values of various common materials are listed below:

Measuring object	Emissivity ε (at 0.9 µm)	Emissivity ε (at 1.6 µm)	Emissivity slope K
"Black body furnace"	1	1	1
Steel heavily scaled	0.93	0.85 to 0.9	1
Steel rolling skin	0.88	0.8 to 0.88	1.00 to 1.01
Steel, molten	0.3	0.2 to 0.25	
Slag	0.85	0.8 to 0.85	1
Chromium, bright	0.28 to 0.32	0.25 to 0.3	
Brass oxidized (tarnished)	0.65 to 0.75	0.6 to 0.7	
Bronze, blank	0.03	0.03	
Copper, oxidized	0.88	0.7 to 0.85	
Zinc	0.58	0.45 to 0.55	
Nickel	0.22	0.15 to 0.2	
Gold, Silver, bright	0.02	0.02	
Porcelain glazed	0.6	0.6	1
Porcelain rough	0.8 to 0.9	0.8 to 0.9	1
Graphite	0.8 to 0.92	0.8 to 0.9	1.01
Chamotte	0.45 to 0.6	0.45 to 0.6	1
Earthenware, glazed	0.86 to 0.9	0.8 to 0.9	1
Brick	0.85 to 0.9	0.8 to 0.9	1
Soot	0.95	0.95	1

4.7 Response time / exposure time (t_{90})

Settings:
Min
0.00 s
0.01 s
0.05 s
⋮
10.00 s

The exposure time is the time interval when the measured temperature has to be present after an abrupt change so that the output value of the pyrometer reaches a given measurement value. The time taken is to reach 90% of the recorded temperature difference. In the "0.00" position, the device operates using the time constant 2 ms.

The dynamic exposure time adjustment prolongs the exposure time at the lower range limit.

4.8 Clear time of the maximum value storage (t_{CL})

Settings:
off
0.01 s
⋮
25 s
Extern
Auto
Hold

If the maximum value storage is switched on always the highest last temperature value will be displayed and stored. The storage has to be cleared at regular intervals for exchanging by a new and actual value.

This feature is particularly useful when fluctuating object temperatures cause the display or the analog outputs to change too rapidly, or the pyrometer is not constantly viewing an object to be measured. In addition, it may also be beneficial to periodically delete and reset the stored maximum values.

The following settings are possible:

Off: At clear time "off" the max. value storage is switched off and only momentary values are measured.

0.01...25 s: If any clear time between 0.01 s and 25 s is set, the maximum value is estimated and held in double storage mode. After the entered time the storage will be deleted.

Extern: The external clearing can be activated and used within an own software (see shapter **7, Data format UPP**) or via an external contact (for connection see **3.2, Pin assignment** for the connector on the bottom side of the pyrometer). In this case, the storage operates only in single storage, because only a single deletion mechanism is used.

Auto: The "auto" mode is used for discontinuous measuring tasks. For example, objects are transported on a conveyer belt and pass the measuring beam of the pyrometer only for a few seconds. Here the maximum value for each object has to be indicated. In the "auto" mode the maximum value is stored until a new hot object appears in the measuring beam. The temperature which has to be recognized as "hot" is defined by the low limit of the temperature range. The stored maximum value will be deleted when the temperature of the new hot object exceeds the low limit of the temperature range or adjusted temperature sub range by 1% or at least 2 °C.

Hold: The function "hold" enables to freeze the current temperature reading at any moment. For this an external push button or switch must be connected (see **3.2.1, Connector pin J**) which holds the temperature reading as long as the contacts are closed.

Operation note: Dependent on the settings the maximum value storage either works in single storage mode or in double storage mode:

Single storage: The single storage is used when you want to reset the stored value using an external impulse via one contact closure from an external relay (i.e. between two measured objects). The relay contact is connected directly to the pyrometer between pins J and K. This mode allows a new value to be established, after each impulse from the reset signal.

Double storage: When entering the reset intervals via push buttons or PC interface the double storage is automatically selected. This mode utilizes two memories in which the highest measured value is held and is deleted alternately in the time interval set (clear time). The other memory retains the maximum value throughout the next time interval. The disadvantages of fluctuations in the display with the clock frequency are thereby eliminated.

Note: The maximum value storage follows the function of adjustment of exposure time. This results in:

- Clear time ≤ the adjusted response time is useless.
- Clear times must be at least 3 times longer than the response time.
- Only maxima with full maximum value can be recorded, which appear at least 3 times longer than the response time.

4.9 Operating mode

Settings:
mono mode
ratio mode
metal mode

The series 12 pyrometers are designed for use in ratio mode. Additionally, the pyrometers can be used in two other modes:

In the mono mode the pyrometer only, measures in one wavelength and the ratio mode is off. In this case the operating mode is equivalent to a conventional 1-color pyrometer (see **4.6, Emissivity**).

The metal mode is a special mode which calculates the temperature combining the ratio and the 1-color signal with an algorithm. The metal mode can be used to determine the temperature of metals and alloys with unknown emissivity ratio (K). It should be used only for a short time to achieve a good approximation of the object temperature if the temperature reading in 2-color or 1-color mode seems to be incorrect. After this the pyrometer must be switched back into 2-color mode and the temperature reading has to be corrected with the adjustment of the emissivity slope K until the instrument shows the temperature determined in the metal mode. A condition for the use of the metal mode are settings of $\varepsilon = 1$ and K = 1.

Note: Metal mode can be affected by the setting of the switch-off level, see (**4.10**).

4.10 Switch-off level (OFF / %)

Settings:
2%
⋮
50%

The switch-off level is a function to avoid measuring errors caused by too low signals. Ratio pyrometers can measure temperatures correctly even with very low signals, i.e. for example through a dirty viewing window or if dust exists in the field of view or if the spot is not filled by the measuring object. If the signal is too low for a correct measurement, the pyrometer interrupts the measurement and displays 1° below of beginning of the temperature range. Depending of the application the switch-off limit can be adjusted between 2 and 50%, ex works at delivery set to 10%.

Note: The smaller the value the higher the chance that daylight or reflections affect a correct measurement.

4.11 Analog Output

The analog output must be selected according to the signal input of the connected instrument (controller, PLC, etc.).

Settings:
0 ... 20 mA
4 ... 20 mA

4.12 Setting of subrange (from / to)

You can choose a subrange (minimum 51 °C) within the basic measuring range of the pyrometer. This subrange corresponds to the analog output "from" describes the beginning of this measuring range, "to" the end of the range.

Additionally, with the setting of a subrange it is possible to fulfill the requirements of the "auto" clear mode of the maximum value storage (see **4.10**).

4.13 Address

Settings:
00
⋮
97

For the connecting of several pyrometers with RS485 with one serial interface it is necessary to give each instrument an individual address for communication. First it is necessary to connect each single instrument to give it an address. After that all instruments can be connected and addressed individually. If parameters may be changed simultaneously on all pyrometers, the global address 98 can be used. This allows you to program all pyrometers at the same time, regardless of the addresses that have already been assigned. If the address of a pyrometer is unknown, it is possible to communicate with it using the global address 99 (connect only one pyrometer).

Note: Only via own communication program with interface command (not possible with *InfraWin*, because *InfraWin* automatically detects a connected pyrometer): If parameters should be changed simultaneously on all pyrometers, the global **Address 98** can be used. This allows you to program all pyrometers at the same time, regardless of the addresses that have already been assigned. If the address of a pyrometer is unknown, it is possible to communicate with it using the global **Address 99** (connect only one pyrometer).

4.14 Baud rate (kBaud)

The transmission rate of the serial interface in Baud (Bd) is dependent on the length of the cable. A standard cable length with RS232 for 19200 Bd is 7 m, with RS485 2 km. The baud rate is reduced by 50% if the transmission distance is doubled.

Settings:
2.4 kBd
⋮
115.2 kBd

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5 Software InfraWin

The operating and analyzing *InfraWin* software is included with delivery of the pyrometer. In addition to allowing you to make parameter adjustments via PC, the *InfraWin* software also provides temperature indication, data logging, and measurement analysis features.

A software description can be found in the program's help menu. Click on the F1 button after loading *InfraWin* or click on the ? in the menu bar.

The latest version is available for free as download from the homepage www.lumasenseinc.com.

5.1 Connecting the pyrometer to a PC

The program *InfraWin* can operate up to two devices. Two devices using RS485 may be operated simultaneously by the same interface, if two different addresses have been properly entered (see section **4.13 Device Address** for more information).

5.2 Installation

To install the *InfraWin* software, select setup.exe from the *InfraWin*-CD or from the downloaded and unpacked zip file from the internet and then follow the installation instructions.

5.3 Program start

The first time you load *InfraWin* 5, you will be prompted to select a default language. The *InfraWin* software is available in German, English, Spanish, French, Portuguese, and Chinese. Once installed, click **Language/Languages** if you would like to select another language.

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6 Maintenance

6.1 Safety

Attention during pyrometer services: Should the pyrometer be integrated in a running machine process the machine has to be switched off and secured against restart before servicing the pyrometer.

6.2 Service

The pyrometer does not have any parts, which require regular service, only the lens has to be kept clean. The lens can be cleaned with a soft cloth in combination with alcohol (do not use acid solutions or dilution). In addition, standard cloths for cleaning glasses or photo objectives can be used.

6.3 Changing of optics

The pyrometers are equipped ex works with a small or a large optical head. The optical heads can be changed against each other. A recalibration of the pyrometer is not necessary. Replacement can be necessary if the lens is scratched or the pyrometer will be used for other measuring distances.

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7 Data format UPP (Universal Pyrometer Protocol)

The data exchange occurs in ASCII format with the following transmission parameters:

The data format is: 8 data bits, 1 stop bit, even parity (8,1,e).

The device responds to the entry of a command with: output (e.g. the measuring value) + CR (**C**arriage **R**e-turn, ASCII 13), to pure entry commands with "ok" + CR.

Every command starts with the 2-digit device address AA (e.g. "00"). This is followed by 2 small command letters (e.g. "em" for level of emissivity ε) finished with CR.

This is followed, if necessary for that command, by the ASCII parameter "X". If this parameter "X" is omitted, then the device resets with the current parameter.

A "?" after the small command letters answers with the respective settings (only at setting commands, not at enquiry commands).

Example: Entry: "00em" + <CR>

The emissivity setting (ε) of the device with the address 00 is returned

Answer: "0970" + <CR> means Emissivity = 0.97 or 97.0%

Description	Command	Parameters
Reading temperature value:	AAms	Output: XXXXX (dec., in 1/10 °C or °F) in the selected measuring mode (77770 = warm-up period of sensor or sensor heating failed 88880 = temp.-overflow, 80000 = targeting light on (only ISR 12-LO))
Reading temperature value repeated:	AAmsXXX	XXX = 001 ... 999 (XXX = number of measuring values)
Reading measuring values:	AAek	Output: XXXXXYYYYY (dec., in 1/10 °C or °F) XXXXX = mono temperature; YYYYY = ratio temperature (77770 = warm-up period of sensor or sensor heating failed 88880 = temp.-overflow, 80000 = targeting light on (only type ISR 12-LO))
Reading emissivity:	AAem	Output: XXXX (dec. 0010 ... 1000 in %)
Emissivity:	AAemXX	XX = (10 ... 99%), 00 = 100% (decimal)
Emissivity:	AAemXXXX	XXXX = (0010 ... 1000% decimal)
Emissivity slope:	AAevXXXX	XXXX = 0800 ... 1200 (equivalent to 0.8 ... 1.2)
Ratio part in metal mode:	AAmvXX	XX = 01 ... 99%
Exposure time t_{90}:	AAezX	X = 0 ... 6 (decimal) 0 = intrinsic time constant of the device 1 = 0.01 s 3 = 0.25 s 5 = 3.00 s 2 = 0.05 s 4 = 1.00 s 6 = 10.00 s

Description	Command	Parameters
Clear times of maximum value storage:	AAlzX	X = 0 ... 8 (dec.) 0 = Maximum value storage off 1 = 0.01 s 4 = 1.00 s 7 = external deletion 2 = 0.05 s 5 = 5.00 s 8 = automatically deletion 3 = 0.25 s 6 = 25.00 s 9 = hold
External deletion:	AAlx	Simulation of an external deletion contact
Operation mode:	AAkaX	X = 0 metal mode from channel 1 and 2 X = 1 mono mode X = 2 ratio temperature
Switch-off limit:	AAawXX	XX = 02 ... 50%
Analog output:	AAasX	X = 0 or 1 0 = 0 to 20 mA 1 = 4 to 20 mA
Reading basic temperature range:	AAmb	Output: XXXXYYYY (hex 8-digit, °C or °F) XXXX = beginning of temperature range YYYY = end of temperature range
Reading temperature sub range:	AAme	same as mb
Setting of temperature sub range:	AAm1XXXXYYYY	XXXX (hex. 4-digit) beginning of temp. range (°C or °F) YYYY (hex. 4-digit) end of temp. range (°C or °F)
Address:	AAgaXX	XX = (00 ... 97) 00 ... 97 = regular device addresses 99 = global address with response 98 = global address without response (only setting commands!)
Baud rate:	AAbrX	X = 0...6 or 8 (dec.) 1 = 2400 baud 4 = 19200 baud (7 is not allowed) 2 = 4800 baud 5 = 38400 baud 8 = 115200 baud 3 = 9600 baud 6 = 57600 baud
Changing °C / °F:	AAfhX	Output: X = 0: display in °C; X = 1: display in °F
Reading signal strength:	AAtr	Output: XXXX, XXXX = 0000 ... 9999 in ‰
Warning level:	AAdwXX	XX = 00 ... 99% (2 digit, hex.)
Wait time:	AAtwXX	XX = 00 ... 99 (decimal)
Error status:	AAfs	Output: XX; XX=00 … FF (00 = no error) (01 … FF: error code for LumaSense service)
Internal temperature:	AAgt	Output: XXX (dec. 000 ... 099 °C or 032 ... 210 °F)
Max. internal temperature:	AAtm	Output: XXX (dec. 000 ... 099 °C or 032 ... 210 °F)
Reading interface type:	AAin	Output: X = 1 or 2; 1 = RS232, 2 = RS485
Laser targeting light:	AAlaX	X = 0 switch off laser targeting light X = 1 switch on laser targeting light 
Lock keyboard:	AAlkX	X = 0 ... 3 1 = lock lk1, removal with command lk0 or power off-on 0 = removal of lock lk1 3 = continuous lock lk3, removal only with command lk2 2 = removal of lock lk3

Description	Command	Parameters
Reading parameters:	AApa	Output decimal 11-digit: Digit 1 und 2 (10...99 or 00): (emissivity) Digit 3 (0 ... 6): t_{90} (exposure time) Digit 4 (0 ... 8): t_{CL} (clear time of max. storage) Digit 5 (0 ... 1): analog output Digit 6 und 7: (00 ... 98): pyrometer's temperature Digit 8 und 9 (00 ... 97): address Digit 10 (0 ... 6 or 8): baud rate Digit 11 (0): (0 or 1): keyboard active or locked Digit 12 ... 15 (0800 ... 1200): emissivity slope
Autoreset:	AAre	Activating auto-reset, initializes the pyrometer new and resets the instrument to default settings
Reference number:	AAbn	Output: XXXXXX (hex 6-digit)
Serial number:	AAsn	Output: XXXXX (5-digit, decimal)
Device type / software version:	AAve	Output: XXYYZZ (6-digit, decimal) XX = 63 (ISR 12-LO or IGAR 12-LO) YY = month of software version ZZ = year of software version
Software version in detail:	AAvs	tt.mm.yy XX.YY tt = day; mm = month; yy = year; XX.YY = software version
Device type:	AAna	Output: "ISR 12-LO" or "IGAR 12-LO (16 ASCII-characters)

Note: The letter "l" means the lower case letter of "L".

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8 Reference numbers

8.1 Reference numbers instrument

Ordering note: The pyrometers ISR 12-LO and IGAR 12-LO can be configured with different optical fiber lengths and optical heads as well as with variious optional extras. To determine the part number and the price for the desired combination please contact LumaSense or your LumaSense sales representative.

Scope of delivery:
Converter, optical fiber and optical head as per configuration, works certificate, PC software InfraWin, and user manual.

Note: The connection cable is not included with the instrument and has to be ordered separately (see section **8**, **Reference numbers**).

Ordering details:
In order to configure your pyrometer as fast as possible, please provide the following data:

- Instrument with basic temperture range
- Desired length of optical fiber
- Desired optical head (I or II) and the desired measuring distance
- Desired add-on options (e.g. vacuum feedthrough or continuous casting system SG-LO)

8.2 Reference numbers accessories

3 820 330	Connection cable, length 5 m, straight connector
3 820 500	Connection cable, length 10 m, straight connector
3 820 510	Connection cable, length 15 m, straight connector
3 820 810	Connection cable, length 20 m, straight connector
3 820 820	Connection cable, length 25 m, straight connector
3 820 520	Connection cable, length 30 m, straight connector
3 820 740	Connection cable, length 5 m, straight connector, temperature resistant up to 200 °C
3 852 290	Power supply NG DC for DIN rail mounting; 100 to 240 V AC ⇒ 24 V DC, 1 A
3 852 550	Power supply NG 2D for DIN rail mounting; 85 to 265 V AC ⇒ 24 V DC, 600 mA with 2 settable limit switches
3 852 440	Protocol transducer RS485/RS232 (switch.) <-> Profbus-DP for 1 device
3 852 460	Protocol transducer RS485 <-> Profbus DP for 32 devices
3 852 620	Protocol converter UPP RS485 or RS232 <-> ProfNet, for 1 pyrometer
3 852 630	Protocol converter UPP RS485 <-> ProfNet, for max. 32 pyrometers
3 890 650	DA 4000: LED display, 2 wire power supply, with 2 limit contacts, 230 V AC
3 891 220	DA 4000: LED display, 2 wire power supply, with 2 limit contacts, 115 V AC
3 890 560	LED digital display DA 6000-N: with possibility for pyrometer parameter settings for digital IMPAC pyrometers; RS232 interface
3 890 570	LED digital display DA 6000-N with RS485 interface
3 890 520	LED digital display DA 6000; DA 6000-N additional with 2 limit switches and analog input and output, RS232 interface
3 890 530	LED digital display DA 6000 with RS485 interface

3 890 150	DA 6000-T, digital display, for measurement of the cool down time t8_5 from 800 °C to 500 °C (for welding processes)
3 826 510	PI 6000: PID programmable controller, very fast, for digital IMPAC pyrometers
3 838 280	Laser protection filter for fiber vario-optics (built in), 920...1100 nm, for IGAR 12-LO
3 834 370	Mounting support for optical head I (fixed)
3 834 380	Mounting support for optical head I (adjustable)
3 834 390	Ball and socket mounting with clamp for optical head I or II
3 834 230	Adjustable mounting support for optical head II
3 835 170	Air purge unit, stainless steel, for optical head I
3 835 180	Air purge unit, stainless steel, for optical head II
3 835 240	Air purge unit with 90°-mirror for optical head II

Exchangeable optical head, type I:

3 873 320	Measuring distance 120 mm
3 873 340	Measuring distance 260 mm
3 873 350	Measuring distance 700 mm

Exchangeable optical head, type II, fixed adjusted

3 873 420	Measuring distance 87mm
3 873 440	Measuring distance 200mm
3 873 460	Measuring distance 600mm
3 873 470	Measuring distance 4500mm

Exchangeable optical head, type II, focusable:

3 838 210	Measuring distance 88 to 110 mm
3 838 220	Measuring distance 95 to 129 mm
3 838 230	Measuring distance 105 to 161 mm
3 838 240	Measuring distance 200 to 346 mm
3 838 250	Measuring distance 247 to 606 mm
3 838 260	Measuring distance 340 to 4500 mm

3 838 048	Replacement fiber red, 2,5 m
3 838 049	Replacement fiber red, 5 m
3 838 051	Replacement fiber red, 6 m
3 838 052	Replacement fiber red, 7,5 m
3 838 053	Replacement fiber red, 10 m
3 838 054	Replacement fiber red, 11 m
3 838 055	Replacement fiber red, 12,5 m
3 838 056	Replacement fiber red, 15 m
3 838 057	Replacement fiber red, 16 m
3 838 061	Replacement fiber red, 17,5 m
3 838 058	Replacement fiber red, 20 m
3 838 059	Replacement fiber red, 21 m
3 838 063	Replacement fiber red, 30 m
3 838 071	Replacement fiber blue, 2,5 m
3 838 073	Replacement fiber blue, 5 m
3 838 074	Replacement fiber blue, 6 m
3 838 075	Replacement fiber blue, 7,5 m
3 838 076	Replacement fiber blue, 10 m
3 838 077	Replacement fiber blue, 11 m
3 838 078	Replacement fiber blue, 12,5 m
3 838 079	Replacement fiber blue, 15 m
3 838 081	Replacement fiber blue, 16 m
3 838 082	Replacement fiber blue, 20 m

9 Troubleshooting

Before sending the pyrometer for repair, try to find the error and to solve the problem with the help of the following list.

Temperature indication too low

- Incorrect alignment of the pyrometer to the object.
  ⇒ New correct alignment to achieve the max. temperature signal (see **3.6**).
- Incorrect focusing of the optics.
  ⇒ Focus correctly to the measuring distance if necessary change lens (see **3.5**).
- Emissivity slope set too high.
  ⇒ Set lower correct emissivity slope corresponding to the material (see **4.6**).

Temperature indication too high

- Emissivity slope set too low.
  ⇒ Set lower correct emissivity slope corresponding to the material (see **4.6**).
- The measurement is influenced by reflections of hot machine parts.
  ⇒ Use mechanical construction to avoid the influence of the interfering radiation (sighting tube).

Measuring errors

- Indicated temperature is immediately 1 °C below beginning of temperature range. Contamination of the lens or broken fiber.
  ⇒ Clean lens or control the fiber. Recommendation: use of air purge (see **2.6**).
- Indicated temperature is immediately 1 °C below beginning of temperature range, although the air purge unit is used. Probably compressed air is not clean or air failed.
  ⇒ Clean the lens and use clean, dry and oil free compressed air.
- HF-interferences.
  ⇒ Correct the connection of the cable shield (see **4**).

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