LumaSense™ TECHNOLOGIES

MANUAL

IMPAC Pyrometers

IPE 140 • IPE 140/34 • IPE 140/39 • IPE 140/45

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Contents

1 General Information

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:** This sign indicates special information which is necessary for a correct temperature measurement.
	**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 pyrometer can be equipped with a laser targeting light. This is a visible red light has 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 (IEC 60825-1-3-4).

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 people by mirrors or shiny surfaces.

1.2.2 Electrical Connection

When connecting additional instruments to which the mains voltage is applied (for example transformers), general safety regulations for connecting e.g. to the 230 V power supply must be observed. Contact with mains voltage may have lethal consequences. Improper installation may cause extremely severe injuries, health problems, or material damage. Only qualified personnel are permitted to connect power supply units of this type.

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:	All other customers should send RMA Shipments to:
Santa Clara, California	**Frankfurt, Germany**
LumaSense Technologies, Inc. 3301 Leonard Court Santa Clara, CA 95054 USA Telephone: +1 408 727 1600 +1 800 631 0176	LumaSense Technologies GmbH Kleyerstr. 90 60326 Frankfurt Germany Telephone: +49 (0)69-97373 0
Email: support@lumasenseinc.com	**Email:** eusupport@lumasenseinc.com

1.7 Transport, Packing, 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 60 °C with non-condensing conditions. Storing the instrument 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

Series 140 pyrometers are digital pyrometers for non-contact temperature measurement:

The **IPE 140** is used for measurements on metals, graphite, or ceramics at low temperatures or if extreme long temperature ranges are required.

The **IPE 140/39** is used for non-contact temperature measurement of metal parts in flame heated furnaces. The narrow spectral range of 3.9 µm avoids the influence of humidity and CO_2 and enables a correct measurement through flames and combustion gases. Also, humidity and CO_2 do not have any influence on measurements with long measuring distances. Another application is the measurement of glass, if a small penetration into the glass is necessary (e.g. glass drop). Measurement errors caused by partially cooled down surfaces can be avoided.

The **IPE 140/34** is used for non-contact temperature measurement of plastic films; especially extremely thin Polyethylene or Polypropylene films, with a minimum material thickness of only 30 µm.

The **IPE 140/45** is used for the temperature measurement of CO_2 containing gases above approx. 500 °C. As a gas is not a solid object, a certain penetration path into the gas is necessary for an exact temperature measurement. The path length is dependent on the temperature, the concentration of CO_2 and the pressure. For example: on atmosphere condition, approximately 4% CO_2, a penetration depth of 2-3 m is necessary, for concentrations of min 10% CO_2, 0.5 m is sufficient.

2.2 Scope of delivery

Device with thru-lens sighting or laser targeting light, selectable optics, PC software "*InfraWin*", Hex key 3 mm, and operation manual.

Note: A connection cable is not included with the instrument and has to be ordered separately (see Chapter **9, Reference numbers**).

2.3 Technical Data

Temperature Ranges:	**IPE 140**	5 ... 350 °C 5 ... 500 °C 30 ... 1000 °C 50 ... 1200 °C	(MB 3.5) (MB 5) (MB 10) (MB 12)
	IPE 140/34	50 ... 400 °C 75 ... 500 °C	(MB 4) (MB 5)
	IPE 140/39	20 ... 700 °C 75 ... 1200 °C 300 ... 1450 °C 200 … 1800 °C	(MB 7) (MB 12) (MB 14.5S) (MB 18)
	IPE 140/45	400 ... 2000 °C	(MB 20)
Sub Range:	Any range adjustable within the temperature range, minimum span 51 °C		
Signal Processing:	Photoelectric current, digitized		

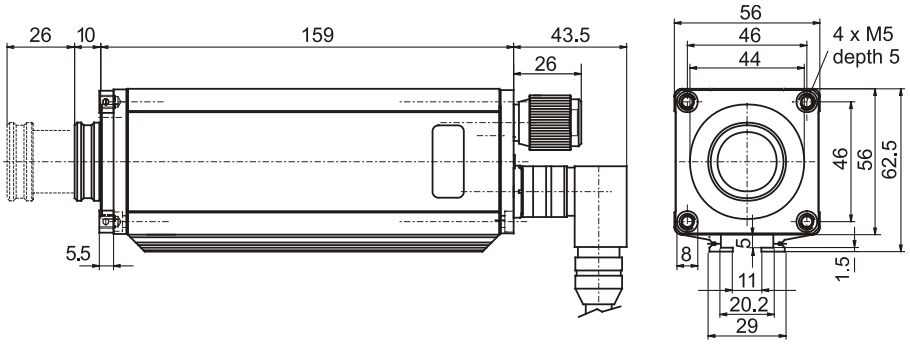
Spectral Range:	**IPE 140** **IPE 140/34**	3 ... 5 µm 3.43 µm	**IPE 140/39** **IPE 140/45**	3.9 µm CO_2 hot band
IR Detector:	PbSe			
Power Supply:	24 V AC or DC (14 to 30 V AC or DC) (AC: 48 to 62 Hz)			
Power Consumption:	Max. 6 W			
Analog Output:	0 to 20 mA or 4 to 20 mA (linear), switchable; Test current 10 mA or 12 mA by pressing test key			
Load:	0 to 500 Ω			
Digital Interface:	RS232 or RS485 addressable (half duplex), switchable; Baud rate 2400 up to 115200 Bd			
Resolution:	0.1 °C on interface and display; < 0.03% of temperature range at the analog output			
Isolation:	Power supply, analog output, and digital interface are galvanically isolated from each other			
Operation Indication:	Green LED			
LC Display:	Illuminated LC display for temperature indication or parameter settings			
Parameter:	Adjustable at the device or via interface: Emissivity ε, exposure time t_{90}, 0 … 20 or 4 … 20 mA switch for analog output, sub range, clear times for maximum value storage, automatically or external deletion of maximum value storage, address, baud rate, wait time t_W Readable at the device or via interface: Measuring temperature, internal instrument temperature.			
Emissivity ε:	10 to 100% adjustable in the instrument or via interface in steps of 0.1%			
Exposure Time t_{90}:	1.5 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} (off; 10 ms; 50 ms; 250 ms; 1 s; 5 s; 25 s), via interface, automatically with the next measuring object, hold-function			
Switch Contact:	Max. 0.15 A (only active with automatic clear mode or $t_{clear} \geq 0.25$ s)			
Measurement Uncertainty: (with ε=1, t_{90}=1 s, $T_{amb.}$= 23 °C)	**IP140, MB 3.5:**	Up to 250 °C: Above 250 °C:	1 °C 0.4% of measured value in °C + 1 °C	
	All other types:	Up to 400 °C: Above 400 °C: Above 1200 °C:	2 °C 0.4% of measured value in °C + 1 °C 0.6% of measured value in °C + 1 °C	
Repeatability: (ε = 1, t_{90} = 1 s, $T_{Umg.}$ = 23 °C)	**IPE 140, MB 3.5:** **All other types:**	0.1% of measured value in °C + 0.2 °C 0.1% of measured value in °C + 1 °C		
Ambient Temperature:	0 to 53 °C			
Storage Temperature:	-20 to 60 °C			
Protection Class:	IP65 (DIN 40050)			
Weight:	Approximately 550 g			
CE-Label:	According to EU directives about electromagnetic immunity			
Sighting:	Laser targeting light (max. power level < 1 mW, λ = 630-680 nm, CDRH class II) or built-in optimized thru-lens view finder			

Note: 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.

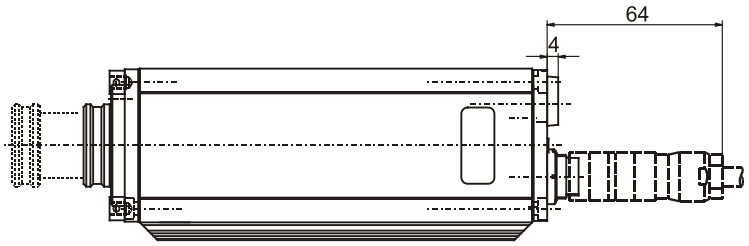
The directive can be ordered from: "Beuth Verlag GmbH" in D-10772 Berlin, Germany.

2.4 Dimensions

Pyrometer with
thru-lens view finder

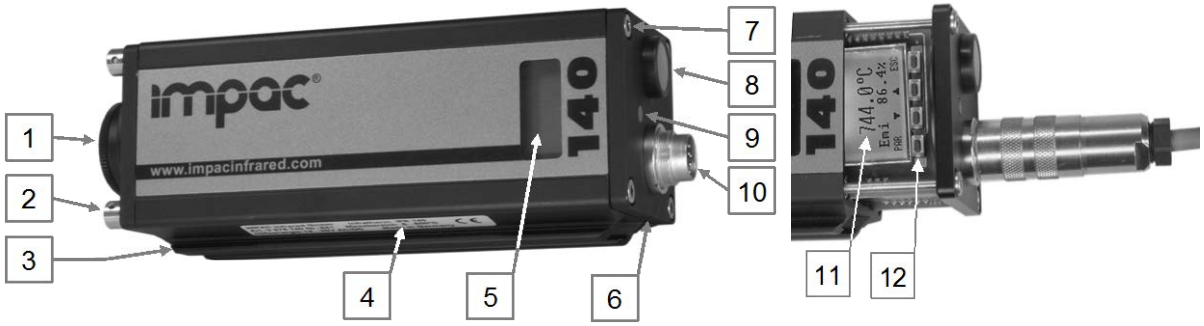


Pyrometer with
laser targeting light



All dimensions in mm

2.5 Physical User Interface



1 Focusable optics (with label with optical data)
2 4 threads for fixing the pyrometer or accessory parts
3 Mounting rail
4 Type label
5 LC Display
6 Extendable back cover
7 Screws for rear cover (3 mm hex screws)
8 Laser targeting light on/off switch or parallax free view finder, dependent on the instrument's type)
9 Operating status for targeting light / laser (only instruments with laser targeting light)
10 Male socket for electrical connections
11 LC Display, extended
12 Setting keys

Caution: The radiation temperature in the spot area of the pyrometer is not allowed to be higher than 150 °C above the end of the basic range because the temperature sensor can be damaged.

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 **9, Reference numbers**.

Mounting
For mounting and aligning the pyrometer to the measured object a **mounting angle** 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 quick clamping screws of the ball and socket mounting enable an easy and fast adjustment of the pyrometer in all directions.

Ball and socket mounting

Mounting angle

Cooling
The pyrometer can be used in ambient temperatures outside of the specifications, if preventive maintenance is taken.

The **cooling plate** is used to protect the pyrometer from heat coming from the front. The completely covered water cooling jacket made from stainless steel protects the pyrometer, if exposed to a hot environment. It is designed for ambient temperatures up to 180 °C.

Water cooling jacket

Cooling plate

Displays
In addition 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

Miscellaneous
The **air purge** protects the lens from contamination with dust and moisture. It must be supplied with dry and oil-free pressurized air and generates an air stream shaped like a cone.

The **scanning attachment SCA 140** moves the measuring beam of the pyrometer from 0 to 12°. This angle is adjustable to smaller values. The scanning frequency is as well adjustable from 1 to 5 Hz. In most cases the scanning attachment SCA 140 is used as a peak picker for measuring smaller objects like thin wires, which may be moving.

Air purge

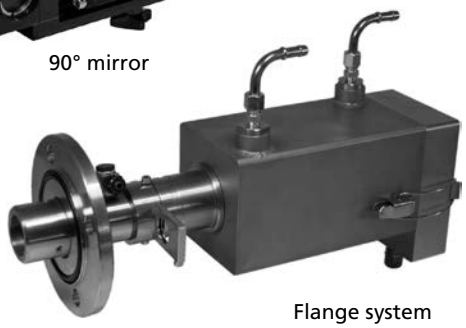
Scanning attachment SCA 140

The **90° mirror** enables the capture of objects at an angle of 90° to the pyrometer axis.

90° mirror

Example for a typical furnace mounting assembly:

The **flange system** with air purge, window slide (easy and fast cleaning of sighting window) and cooling jacket is used for the mounting onto the wall of a combustion chamber.

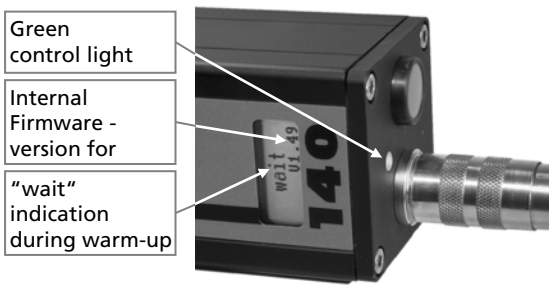


Flange system

3 Controls and Installation

3.1 Electrical Installation

The series IPE 140 is powered by a voltage of 24 V (14 to 30 V) DC or AC (48 to 62 Hz). The instrument needs some time to warm up. This time depends on the ambient temperature and connected power supply. During this time, the display indicates “wait”. The analog output is 0 mA. After the warm up time, the display shows the measuring temperature. To switch off the instrument, interrupt the power supply or unplug the electrical connector.



After connecting the power supply, the display shows the internal firmware version for approximately 1 s. The green control light on the rear cover is switched on. The control light blinks as long as the laser targeting light is switched on (only for instruments equipped with a targeting light).

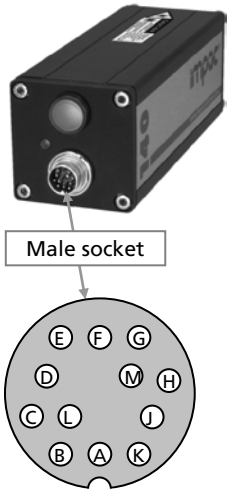
To meet electromagnetic requirements (EMV), a shielded connecting cable must be used. The shield of the connecting cable has to be connected only on the pyrometer's side. One side of the power supply (switch board) the shield must be open to avoid ground loops.

LumaSense offers connecting cables, which are not part of standard scope of delivery. The connecting cable has wires for the power supply, interface, analog output, external laser switch, and external clear of maximum value storage via contact (see section **9, 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 the RS485 interface.

Note: At object temperatures below 150 °C and emissivity smaller than 90%, the pyrometer needs another half an hour for warm-up until the final accuracy is reached. Otherwise a sufficient accuracy is reached after approximately 10 min.

3.1.1 Pin assignment of the connector on the back of the pyrometer

Pin	Color	Function
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 below, operating mode contact or external clearing of maximum value storage or hold function
G	red	DGND (Ground for interface)
F	black	RxD (RS232) or B1 (RS485)
C	violet	TxD (RS232) or A1 (RS485)
D	gray/pink	RxD (RS232) or B2 (RS485) (bridge to F)
E	red/blue	TxD (RS232) or A2 (RS485) (bridge to C)
M	orange	Screen only for cable extension, don't connect at the switchboard



Pin-assignment
(side of male inserts)

The connector pin J can be used for 3 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 "wait"), the pin J is connected to the power supply voltage. This voltage is connected by a relays switch (max. 0.2 A at 50 V) 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 **5.4**). 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 "wait" indication on the display)
   - The clear time is set to "extern" (see section **5.4**)
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 section **5.4 clear time for the maximum value storage**).

3.1.2 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. Only 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. The RS485 transmission is relatively free of problems, allows long transmission distances, and enables you to connect several pyrometers to a bus system.

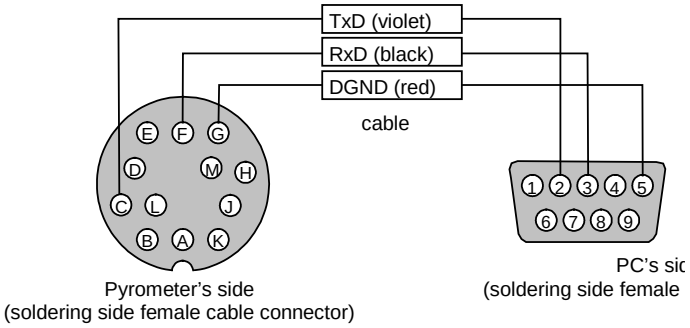
If RS485 is not available at the PC, it can be realized with an external converter which converts the RS485 to RS232 for a standard connection to a PC. When using a converter RS485 ⇔ RS232, ensure that the converter is fast enough to receive the pyrometer's answer to an instruction of the master. Most of the commonly used converters are too slow for fast measuring equipment. It is recommended to use the LumaSense converter I-7520 (order no. 3 852 430). With a slow RS485 connection, it is also possible to set a wait time at the pyrometer to delay the response of a command to the pyrometer (see **5.10 Wait time tw**).

3.1.3 Connection 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 has to be reduced by 50% when the transmission distance is doubled (see also **5.8 Baud rate**).

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

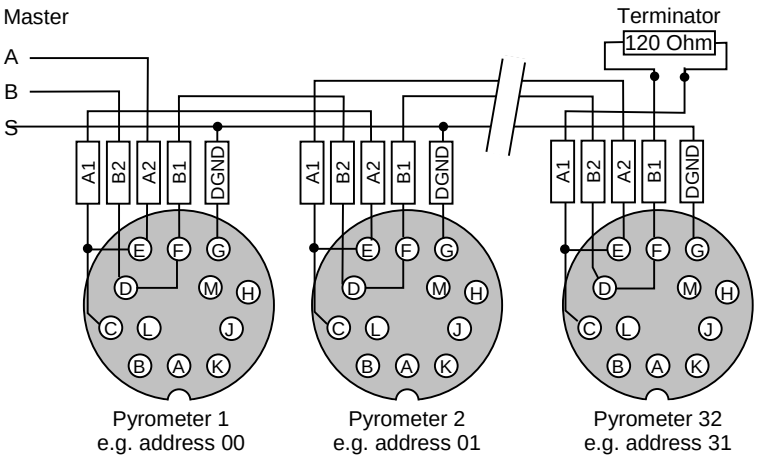


3.1.4 Connection to RS485 interface

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 2400 and 115200 Bd may be set.

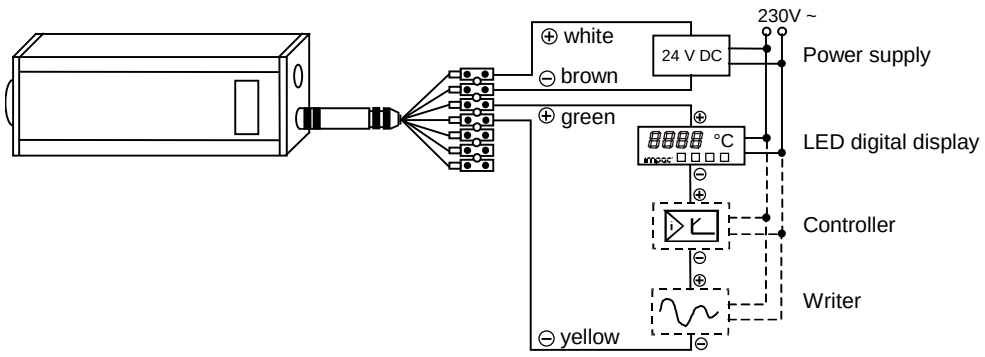
The baud rate is reduced by 50% when



the transmission distance is doubled (see Section **5.8 Baud rate**). Typical cable length for 19200 Bd is 2 km.

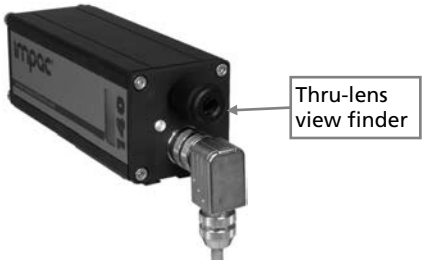
3.1.5 Connection of additional analyzing devices

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



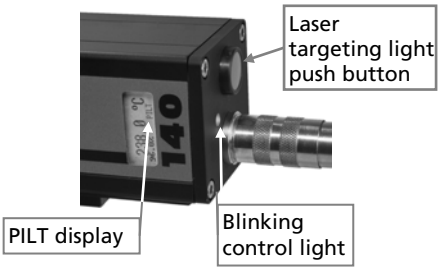
3.2 Sighting

3.2.1 Thru-lens view finder



The view finder can be used to align the measured object through direct observation. The view finder is true-sided and parallax-free; a circle marks the position of the measuring area, but not the exact size.

3.2.2 Laser targeting light



The laser targeting light is a red laser beam used to align the pyrometer at a target. The laser marks the center of the measuring spot. The laser targeting light can be used during operation without affecting the measurement.

When the laser targeting light is switched on, the green control light on the rear cover will blink and the display will show "PILT". It can be switched off by pushing the targeting light button again. After 2 minutes, the targeting light switches 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 (IEC 60825-1-3-4).

3.3 Optics

The instrument will be delivered with one of the following focusable optics. This allows the adjustment to the needed measuring distance between its smallest and largest value to offer the smallest possible spot sizes.

		IPE 140				IPE 140/39			
	Measuring distance *a* [mm]	Spot size M_{90} [mm]				Spot size M_{90} [mm]			Objective length *S* [mm]
		MB 3.5	MB 5	MB 10	MB 12	MB 7	MB 12	MB 14.5S MB 18	
Optics 0-PE	a = 71 mm	2.4	1.6	-	-	-	-	-	26
	a = 77 mm	3	2	-	-	-	-	-	13
	a = 90 mm	3.6	2.4	-	-	-	-	-	0
Optics 1-PE	a = 105 mm	3.6	2.4	1.1	0.9	2.4	0.9	0.7	26
	a = 120 mm	4.4	2.9	1.3	1.0	2.9	1.0	0.8	13
	a = 150 mm	6.2	4.1	1.7	1.4	4.1	1.4	1.0	0
Optics 2-PE	a = 200 mm	6.3	4.2	1.8	1.4	4.2	1.4	1.1	26
	a = 260 mm	8.6	5.7	2.4	1.8	5.7	1.8	1.3	13
	a = 440 mm	17.1	11.4	4.6	3.5	11.4	3.5	2.5	0
Optics 3-PE	a = 345 mm	10.2	6.8	2.9	2.3	6.8	2.3	1.7	26
	a = 580 mm	26.7	12.6	5.1	4	12.6	4	2.8	13
	a = 1000 mm	34.5	23	9.2	7.1	23	7.1	5	6.2
	a = 4300 mm	158	105	42	32	105	32	22	0
	Aperture *D* [mm]	14 … 17 *)				14 … 17 *)			

	IPE 140/34				IPE 140/45		
	Measuring distance *a* [mm]	**Spot size M_{90} [mm]**		**Objective length *S* [mm]**	**Measuring distance *a* [mm]**	**Spot size M_{90} [mm]**	**Objective length *S* [mm]**
		MB 4	**MB 5**			**MB 20**	
Optics 1-PE	a = 100 mm	3.3	2.1	26	a = 115 mm	1.1	26
	a = 114 mm	4.2	2.7	13	a = 135 mm	1.3	13
	a = 142 mm	5.9	3.8	0	a = 170 mm	1.6	0
Optics 2-PE	a = 185 mm	6	3.9	26	a = 210 mm	1.8	26
	a = 235 mm	8	5.2	13	a = 280 mm	2.6	13
	a = 390 mm	15.2	9.8	0	a = 500 mm	4.9	0
Optics 3-PE	a = 305 mm	9.6	6.2	26	a = 360 mm	3	26
	a = 480 mm	16.4	10.6	13	a = 625 mm	5,6	13
	a = 700 mm	26.4	17	6.2	a = 2000 mm	20	4
	a = 1900 mm	73	47	0	a = 10000 mm	100	0
	Aperture *D* [mm]	14 … 17 *)			14 … 17 *)		

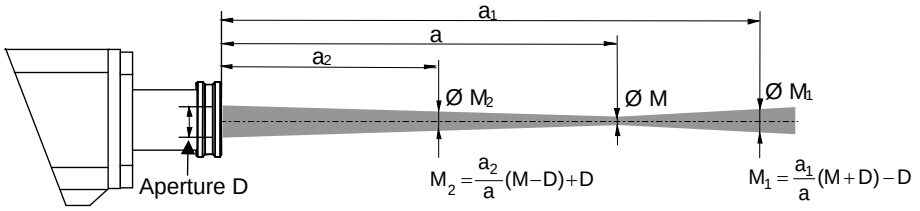
*) The aperture is the effective lens diameter. It is depending on the objective length. The biggest aperture value belongs to the fully extended objective (S = 26), the smallest aperture value for objective length S = 0. Intermediate values have to be interpolated.

The spot sizes, mentioned in the table above, will be only achieved at the adjusted distance. Decreasing or increasing the measuring distance enlarges the spot size.

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

Note: The measuring object has to be at least as big as the spot size of the pyrometer.

Spot sizes for non-focused distances (shorter or longer than the focused distance) may be calculated by using the following formula.



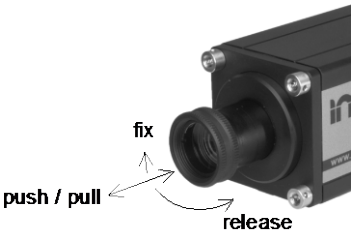
Formula for Calculating Spot Sizes

3.3.1 Adjusting the required measuring distance

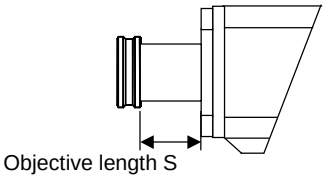
The required measuring distance must be adjusted to achieve the spot sizes mentioned in the tables above. This can be done between the smallest and the biggest limit value.

An exception is model IPE 140/45 as there is no solid object for alignment. In this case the optimal optical adjustment can only be determined by an experiment. If the pyrometer has to measure through a sighting tube, the optics has to be adjusted that the field of view (FOV) does not touch the wall.

For releasing the optics has to be turned anticlockwise. Then it can be pushed or pulled to find the correct measuring distance. For fixing the optics must be turned clockwise.



Adjusting the measuring distance with help of the table:
The table mentions the minimum and maximum measuring distance for each optic. This corresponds to the longest or the shortest objective length. As an example, a further value between max. and min. is shown. The objective length "S" can be measured with a caliper.



The following methods can be used for other measuring distances:

Adjusting the measuring distance with help of the thru-lens view finder
The focusable optics is correctly adjusted to the required distance, if the measuring object is shown as a sharp image in the view finder. A circle marks the position of the measuring spot.

Adjusting the measuring distance with help of the laser targeting light
On the focused measuring distance, the laser has its smallest spot size and is illustrated exactly.

4 Instrument Settings

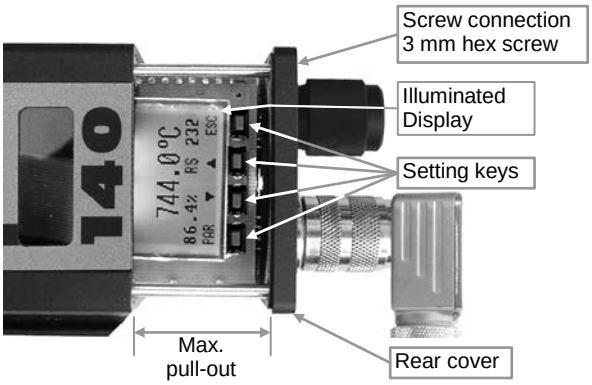
The series IPE 140 pyrometers are equipped with a wide range of settings for optimal adaption to the required measuring condition and for getting the correct measuring temperature (description of all available parameters see section **5**, **Parameter descriptions / settings**).

The digital PC interface allows you to exchange data with a PC either by using the supplied *InfraWin* software or by using the Universal Pyrometer Protocol (UPP) commands with your own communication program (see Chapter **8** for the **UPP Data Format commands**).

4.1 Settings at the instrument

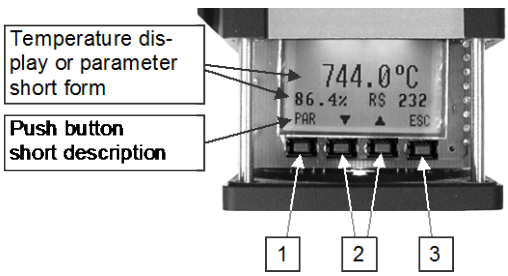
The LC-display, as well as the push buttons for displaying and setting of the parameters, is found inside the unit. The pyrometer is opened by loosening four hex screws. If unscrewed, the rear cover can be pulled out along with the attached display and push buttons. The pullout is limited by the lengths of the screws.

The backlight of the display is always powered in either status, opened or closed pyrometer.



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

4.2 Key panel operation



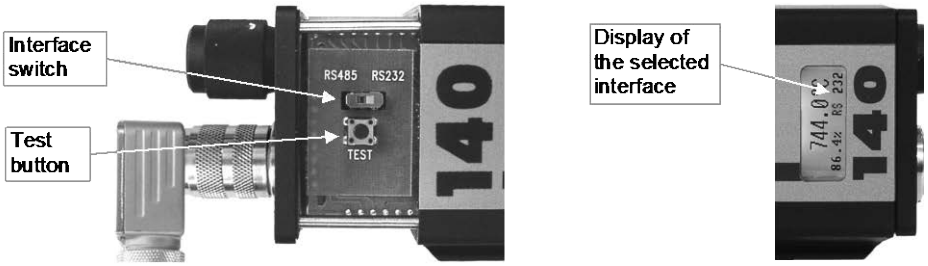
1 **PAR:** With the **PAR** button, all available parameters are displayed in the following description (Chapter 5). Pushing the button again changes the display to the next parameter and the display shows a corresponding short form (see Chapter **5**, in brackets behind the parameter names).

2 **▼▲:** With the arrow keys ▲ and ▼, all parameter settings can be displayed. Pushing the button longer changes the settings in fast mode.

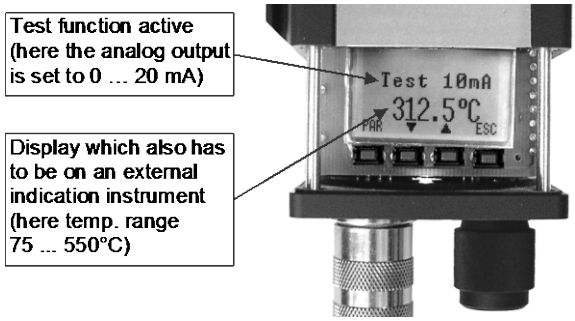
3 **ESC / ENT:** Pushing the **ESC** button changes the pyrometer to measuring mode. If a parameter is changed with the arrow keys the indication of the ESC button changes to ENT. Pressing the button again confirms the value into the pyrometer. Changing the parameters again by pushing the PAR button doesn't confirm this value in the pyrometer. If no button is pressed for 30 s, the pyrometer changes to the temperature indication without accepting the changed value.

4.3 Selection of the serial interface

Opposite to the display there is a switch to select a serial interface RS232 or RS485. The LC display shows as chosen either RS232 or RS485.



4.4 Test function



The diagnostic push button **test** generates a current on the analog output which is used to check if a connected external indicator shows the correct temperature value. The test current output is centered to the chosen analog output span, consequently 10 mA is supplied if the analog output is adjusted to 0 to 20 mA and 12 mA is supplied if the analog output span is set from 4 to 20 mA. The LC display indicates the respective current along with the corresponding temperature. For example, if a measuring range of 75 °C to 550 °C is selected the temperature shown in the display is 312.5 °C). This temperature must be reflected exactly by the indicator which is supplied by the respective current. If this is not the case, the selected analog input current span of the indicator is not equivalent to the chosen current output span of the pyrometer and one of the current spans or temperature range must be modified. By pressing the **test** push button once again or by pressing any push button of the LC-display, the test current is switched off. Also after 30 seconds idle time, the **test** current is switched off. The unit will be in the measurement mode again.

4.5 Factory settings

Emissivity (**Emi**) = 100%

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

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

Analog output (**mA**) = 0 ... 20 mA

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

Address (**Adr**) = 00

Baud rate (**Baud**) = 19200 Bd

Temperature display (**C / F**) = °C

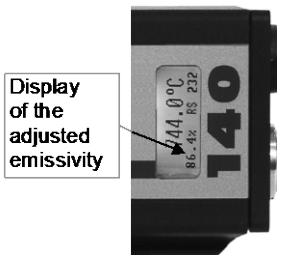
Wait time (**tw**) (for RS485) = 10

Interface (**RS485 / RS232**) = RS232

5 Settings / Parameter Descriptions

5.1 Emissivity (Emi)

For a correct measurement, it is necessary to adjust the emissivity. *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 10 and 100%, the set value is indicated on the display).



Additionally, the emissivity depends on the surface condition of the material, the spectral range of the pyrometer, and the measuring temperature. The emissivity setting of the pyrometer has to 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.

Emissivity for IPE 140 and IPE 140/39

Measuring Object	Emissivity [%]
"Black body furnace"	100
Extruded Aluminum	5 to 15
Brass	10 to 15
Brass, oxidized (tarnished)	70
Copper	3
Copper, oxidized	70
Inconel, oxidized	85

Measuring Object	Emissivity [%]
Steel, oxidized	70 to 85
Nickel	8 to 12
Molybdenum	18
Black Carbon	95
Graphite	80 to 90
Porcelain, glazed	60
Iron, oxidized	80 to 90

Emissivity for IPE 140/34

Film Thickness	Emissivity [%]									
	PE	PP	PET	PC	PVC	PA	PS	PUR	PMMA	Cell.Acetate
7 µm	76									
15 µm	92									
25 µm	95	96				96	70	90		66
75 µm	96	96			96	96			96	
125 µm	96	96	90	96	96	96			96	
250 µm	96	96	96	96	96	96	96	96	96	96

Emissivity for IPE 140/45

Measuring Object	Emissivity [%]
Hot CO_2 containing gases	100%
Hot CO_2 containing gases through sapphire window (1.6 mm thick)	85%

5.2 Compensation of ambient temperature (t_{amb})

Settings:
auto
00 °C (32 °F)
⋮
53 °C (127 °F)

The compensation of the ambient temperature can be used at low measuring temperatures (below 100 °C). This compensation is used for a very few special applications only. The standard setting of this parameter is "auto", because the temperature of the air around the pyrometer is normally the ambient temperature of the measured object. Should the measured object be placed in an area with a higher wall temperature (e.g. inside a furnace), the measurement might be falsified (probably too high temperature indication). This influence can be compensated by pre-setting the ambient temperature of the object (pre-setting within the measuring range of the instrument).

Note: This method only improves the results if the ambient temperature at the place of the measured object is always constant and the emissivity is well known.

5.3 Exposure time (t_{90})

Settings:
min
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. This is the time it takes to reach 90% of the recorded temperature difference. In the "min" position, the device operates using its time constant.

The dynamic exposure time adjustment prolongs the exposure time at the lower range limit, even if t_{90} is set to a lower value.

The following table shows the dependence of the exposure time from the measured temperature.

Switch points on increasing temperatures:

Type, Temperature Range		Switch points for ε = 1		Switch points for ε = 0.5	
		35 ms → 5 ms	5 ms → 1.5 ms	35 ms → 5 ms	5 ms → 1.5 ms
IPE 140,	MB 3.5	-	63 °C	-	67 °C
IPE 140,	MB 5	-	67 °C	-	74 °C
IPE 140,	MB 10	111 °C	162 °C	133 °C	197 °C
IPE 140,	MB 12	124 °C	183 °C	150 °C	224 °C
IPE 140/34,	MB 5	147 °C	211 °C	176 °C	252 °C
IPE 140/39,	MB 7	-	81 °C	-	95 °C
IPE 140/39,	MB 12	113 °C	168 °C	137 °C	205 °C
IPE 140/39,	MB 14.5S	Always 1.5 ms			
IPE 140/45,	MB 20	Always 1.5 ms			

If the maximum value storage is selected and the measuring object has a low emissivity and the measuring temperature is at the beginning of the range, a higher exposure time must be chosen to prevent measurement errors. Longer exposure times can be used for the measurement of objects which have rapidly fluctuating temperatures to achieve constant temperature reading.

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

Settings:
off
0.01 s
⋮
25 s
extern
auto
Hold

If the maximum value storage is always switched on, the highest last temperature value will be displayed and stored. As such, it may be beneficial to periodically clear and reset the stored maximum values in order to obtain new temperature readings.

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 **off,** the maximum 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 your own software (see section **8**, **Data format UPP**) or via an external contact (for connection see **3.1.1 Pin assignment of the male socket on the back 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, when 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 this 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 adjusted sub range. The stored maximum value will be deleted when the temperature of the new hot object exceeds the low limit **from** of the sub range by 1% or at least 2 °C. If a lower limit is not entered, the maximum value storage will be deleted whenever the lower level of the full measuring range has been exceeded.

Hold: The function **hold** enables you to freeze the current temperature reading at any moment. To use this function, anexternal push button or switch has to be connected (which holds the temperature reading as long as the contacts are closed).

Operation note: Depending 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: In the command structure, the maximum storage comes after the 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

5.5 Analog output (mA)

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

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

5.6 Subrange (from / to)

You have the opportunity to 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 above).

5.7 Address (Adr)

Settings:
00
⋮
97

When connecting several pyrometers to one serial interface with RS485, it is necessary for each instrument to have its own device address for communication purposes. First, it is necessary to connect each instrument separately 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).

5.8 Baud rate (Baud)

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, and with RS485, it is 2 km. The baud rate is reduced by 50% if the transmission distance is doubled.

Settings:
2.4 kBd
⋮
115.2 kBd

5.9 Temperature display (C / F)

The temperature can be displayed in °C or °F.

Settings:
°C
°F

5.10 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 a command of the master. In this case, a minimum delay time (t_w) can be set. The pyrometer waits this time until it answers a master inquiry (e.g.: t_w = 02 at a baud rate 9600 means a wait time of $^2/_{9600}$ sec).

Settings:
00 Bit
⋮
99 Bit

Note: the setting of a delay time (t_w) does not guarantee an answer to some commands directly after this time. Certain commands require an internal operation time of max. 3 ms.

5.11 Maximum internal temperature (Max Int Temp)

Shows the maximum internal temperature the device ever reached.

5.12 Error status (Status)

In case of a device error, the pyrometer displays a hex code which identifies this error to service. The standard display at this point is **ok**.

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6 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.

6.1 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 **5.2.7** for more information).

6.2 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.

6.3 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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7 Maintenance

7.1 Cleaning the window

Because there are no moving parts in the Series 140 pyrometer, the only regular maintenance required is a periodic inspection of the front window for build-up of foreign particles which, in time, can influence the energy received by the instrument.

The Series 140 pyrometer window is not water soluble and can be cleaned with standard lens tissue dampened with a camera-store lens-cleaning solution. A soft blower/brush (also at camera stores) should be used to remove any grit on the window before you rub the lens with lens tissue and solution.

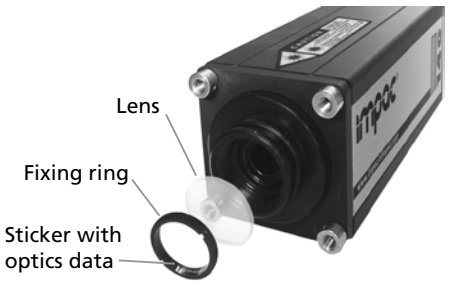
Attention: NEVER CLEAN A SERIES 140 PYROMETER WINDOW WITH A DRY TISSUE OF ANY KIND! The only time dry lens tissue may be used is to dry a window which has already been cleaned with wet lens tissue.

7.2 Optics replacement

Series 140 pyrometers are equipped with a focusable optics. This optics can be changed against another. Replacement optics for different measuring distances can be used without recalibration of the instrument. However, replacement may be necessary if the lens is scratched or the pyrometer will be used for other measuring distances.

Replacement:

Only the lens will be replaced for changing the focusable optics. The fixing ring has to be removed with a suitable objective wrench. After removing the old lens, put in the new one with the convex side to the front. Fix the lens with a new fixing ring. On the inside of this ring is the sticker with the optics data.



For differentiation they are marked with a color mark at the border of the lens:

Focusable optics 0-PE (without color mark)
Focusable optics 1-PE (red/green)
Focusable optics 2-PE (black/green)
Focusable optics 3-PE (yellow/red)

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8 Data format UPP (Universal Pyrometer Protocol)

Software commands can be exchanged directly with the pyrometer through an interface using suitable communication software or by using the **Test** function located in the **Pyrometer Parameters** window of the InfraWin software package.

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) no handshake;
- The device responds to the entry of a command with output (such as the measuring value) + CR (**C**arriage **R**eturn, ASCII 13), to pure entry commands with **ok** + **CR**, or **no** + **CR**.
- Every command starts with the 2-digit device address AA followed by two lower case command letters and finished with CR.

  Example Read Command: 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%
- The ASCII parameter "X" indicates a change to be made in a parameter. When used, the command contains the new value.

  Example Write Command: Entry: "00emXXXX" + CR

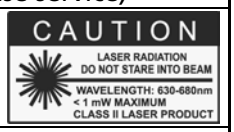
  The parameter used for the emissivity setting (ε) with the address 00 is changed.

  Answer: "00em0853" + <CR> changes the Emissivity to 0.853 or 85.3%
- A "?" after the lower case command letters answers with the limits of the respective settings (only at setting commands, not at query commands).

  Example Read Limits Command: Entry: "00em?" + ˜CR!

  Answer: Could be 00501000 + <CR>, which means that E can vary between 0.050 and 1.000 (or 5% and 100%)

Description	Command	Parameters
Reading temperature value:	AAms	Output: XXXXX (dec., in 1/10 °C or °F) (77770 = Instrument's temperature too high or chopper wheel rotates with wrong speed 88880 = Temperature overflow)
Reading temperature value repeated:	AAmsXXX	XXX = 000...999 (XXX = Number of measuring values)
Emissivity:	AAemXXXX	XXXX = (0010 ... 1000‰) (decimal)
Ambient temperature compensation:	AAutXXXX	XXXX = Value of ambient temperature, 4-digit, hex XXXX e.g. FFEC corresponds to -20 degrees - 99_{dez} = $FF9D_{hex}$ means: automatic, no manual compensation

Description	Command	Parameters
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
Clear times of the maximum value storage:	AAlzX	X = 0 ... 9 (dez.) 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 clearing:	AAlx	Clearing the max. value storage (only with lz = 7, external)
Analog output:	AAasX	X = 0...1 0 = 0...20 mA 1 = 4...20 mA
Reading basic temperature range:	AAmb	Output: XXXXYYYY (hex 8-digit, °C or °F) XXXX = Beginning of temp. range YYYY = End of temp. range
Reading temperature sub range:	AAme	Output: XXXXYYYY (hex 8-digit, °C or °F) XXXX = Beginning of temp. range YYYY = End of temp. range
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 = 1...6 or 8 (dez.) 1 = 2400 baud 5 = 38400 baud 2 = 4800 baud 6 = 57600 baud 3 = 9600 baud (7 is not available) 4 = 19200 baud 8 = 115200 baud
Temp. display °C / °F	AAfhX	Output: X = 0: Display in °C; X = 1: Display in °F
Wait time:	AAtwXX	XX = 00 ... 99 (decimal, in bit time of the current baud rate)
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)
Error status:	AAfs	Output: XX; XX=00…FF (00 = no error) (01…FF: error code for LumaSense service)
Laser targeting light:	AAlaX	X = 0 Switch off laser X = 1 Switch on laser 
Reading interface:	AAin	Output: 1 or 2 (1 = RS232, 2 = RS485)

Description	Command	Parameters
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
Reading parameters:	AApa	Output 11-digit, decimal: Digit 1 und 2 (10...99 or 00): Emissivity Digit 3 (0 ... 6): Exposure time Digit 4 (0 ... 8): Clear time max. storage Digit 5 (0 ... 1): Analog output Digit 6 und 7: (00 ... 98): Internal temperature Digit 8 und 9 (00 ... 97): Address Digit 10 (0 ... 6 or 8): Baud rate Digit 11 (0,1, 3): Keyboard lock
Device type:	AAna	Output: “IPE 140”, “IPE 140/34”, “IPE 140/39” or “IPE 140/45” (16 ASCII-characters)
Serial number:	AAsn	Output: XXXXX (dec. 5-digit)
Device type / software version:	AAve	Output: XXYYZZ (6-digit decimal) XX = 63 (for all series IPE 140 pyrometers) YY = Month of software version ZZ = Year of software version
Detailed Software version:	AAvs	tt.mm.yy XX.YY tt = day; mm = month; yy = year; XX.YY = software version
Reference number:	AAbn	Output: XXXXXX (hex 6-digit)

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

Additional instruction for the RS 485 interface:

Requirements to the master system during half-duplex operation:

1. After an inquiry, the bus should be switched into a transmission time of 3 bits (some older interfaces are not fast enough for this).
2. The pyrometer's response will follow after 5 ms at latest.
3. If there is no response, there is a parity or syntax error and the inquiry has to be repeated.

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9 Reference Numbers

9.1 Reference numbers instrument

Type	Temperature range	With laser targeting light	With thru-lens view finder
IPE 140	MB 3,5: 5 ... 350 °C	3 875 900	-
	MB 5: 5 ... 500 °C	3 875 740	3 875 750
	MB 10: 30 ... 1000 °C	3 875 720	3 875 730
	MB 12: 50 ... 1200 °C	3 875 700	3 875 710
IPE 140/34	MB 5: 75 ... 500 °C	3 875 800	3 875 810
IPE 140/39	MB 4: 50 ... 400 °C	3 875 820	3 875 830
	MB 7: 20 ... 500 °C	3 875 840	3 875 850
	MB 12: 75 ... 1200 °C	3 875 760	3 875 770
	MB 14.5S: 300 ... 1450 °C	3 875 860	3 875 870
	MB 18: 200 ... 1800 °C	3 875 960	–
IPE 140/45	MB 20: 400 ... 2000 °C	3 875 880	3 875 890

Ordering note:

When ordering, please select one focusable optics (0-PE, 1-PE, 2-PE or 3-PE) (see section 3.3 Optics). A connection cable is not included in scope of delivery and has to be ordered separately.

9.2 Reference numbers accessories

3 820 340	Connection cable, length 5 m, 90° connector
3 820 530	Connection cable, length 10 m, 90° connector
3 820 540	Connection cable, length 15 m, 90° connector
3 820 830	Connection cable, length 20 m, 90° connector
3 820 840	Connection cable, length 25 m, 90° connector
3 820 550	Connection cable, length 30 m, 90° connector
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
3 820 750	Connection cable, length 5 m, 90° connector, temperature resistant up to 200 °C
3 852 290	Power supply for DIN rail mounting NG DC (100 to 240 V AC ⇒ 24 V DC, 1 A)
3 852 550	Power supply NG 2D, as NG 0D: additionally, with 2 limit switches (not for US sales)

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
3 825 430	I-7520, RS232 ⇔ RS485 converter
3 891 220	DA 4000: LED-display, 2-wire power supply,2 limit switches (relay contacts), 115 V AC
3 890 650	DA 4000, LED-display, 2-wire power supply, 2 limit switches(relay contacts), 230 V AC
3 890 560	LED digital display DA 6000-N: with possibility for Pyromet parameter settings for digital IMPAC pyrometers; RS232 interface
3 890 520	LED digital display DA 6000; DA 6000-N additional with 2 limit switches and analog input and output, RS232 interface
3 826 500	HT 6000, portable battery driven indicator and instrument for pyrometer parameter setting
3 826 510	PI 6000 programmable PID-controller (external), for fixed digital IMPAC pyrometers
3 843 530	Rugged scanner SCA 140 with CaF_2 glass window (scanning angle 0...12°, scanning frequency 1...5 Hz)
3 835 290	Air purge for scanner SCA 140
3 834 280	Adjustable mounting angle
3 834 270	Ball and socket mounting
3 835 230	Air purge
3 837 290	Cooling jacket, stainless steel
3 834 200	Ball and socket mounting for cooling jacket
3 837 240	Cooling plate
3 835 460	90° mirror with CaF_2 glass window
3 848 600	Replacement optics 0-PE
3 848 370	Replacement optics 1-PE
3 848 380	Replacement optics 2-PE
3 848 390	Replacement optics 3-PE

10 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 maximum temperature signal (see **3.2**)
- Measuring object smaller than spot size
  ⇒ Check measuring distance, smallest spot size is at nominal measuring distance (see **3.3**)
- Measuring object is not always in the measuring spot of the pyrometer
  ⇒ Use max. value storage (see **5.4**)
- Emissivity set too high
  ⇒ Set lower correct emissivity corresponding to the material (see **5.1**)
- Lens contaminated
  ⇒ Clean lens carefully (see **7.1**)

Temperature indication too high

- Emissivity set too low
  ⇒ Set lower correct emissivity corresponding to the material (see **5.1**)
- The measurement is influenced by reflections of hot machine parts
  ⇒ Use mechanical construction to avoid the influence of the interfering radiation

Measuring errors

- Indicated temperature is decreasing during the use of the pyrometer, contamination of the lens
  ⇒ Clean lens. Recommendation: use of air purge (see **7.1**)
- Indicated temperature is decreasing during the use of the pyrometer, 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
- Air contamination in the sighting path between pyrometer and object
  ⇒ Change position of the pyrometer with a clean sighting path (if necessary use a ratio pyrometer)
- HF-interferences
  ⇒ Correct the connection of the cable shield (see **3.1**)
- Instrument overheated
  ⇒ Use cooling jacket with air or water cooling (see **3.1**)
- Temperature Indication is fluctuating, probably caused by changing emissivity
  ⇒ Wrong pyrometer type, use of ratio pyrometer recommended

Laser targeting light

- Laser targeting light fails
  ⇒ Instruments max. Temperature is exceeded. Use cooling jacket (see **2.6**)

Note: The wavelength band of the IPE 140 series reacts at low measuring temperatures to incandescent lamps or very bright daylight (not valid for fluorescent tube). For a correct measurement strong external light to the measured object should be avoided.

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