

## LUMASENSE IMPAC PYROMETERS

### Product Overview

#### *Highly Accurate Infrared Thermometers for Non-contact Temperature Measurements*

LumaSense's IMPAC pyrometers are temperature measurement instruments that operate on the principle of infrared radiation, i.e. they detect infrared radiation of objects to determine the temperature.

In many industry sectors, the use of non-contact temperature measurement instruments is an important technology. For example, it is used for controlling complete factory processes or measuring even the smallest components to ensure a consistent quality level.

With a huge pyrometer product portfolio developed from years of research and customer contact, LumaSense Technologies provides solutions for nearly every application request. Special solutions that are not listed in this brochure can also be quickly adapted to customer or application specific specifications.

This overview gives an impression of the possibilities that pyrometry provides. The instruments are classified in application areas and by instrument grades, starting from the smallest and moving up to instruments for harsh industries.



# STANDARD METALLIC, CERAMIC, AND GRAPHITE SURFACES

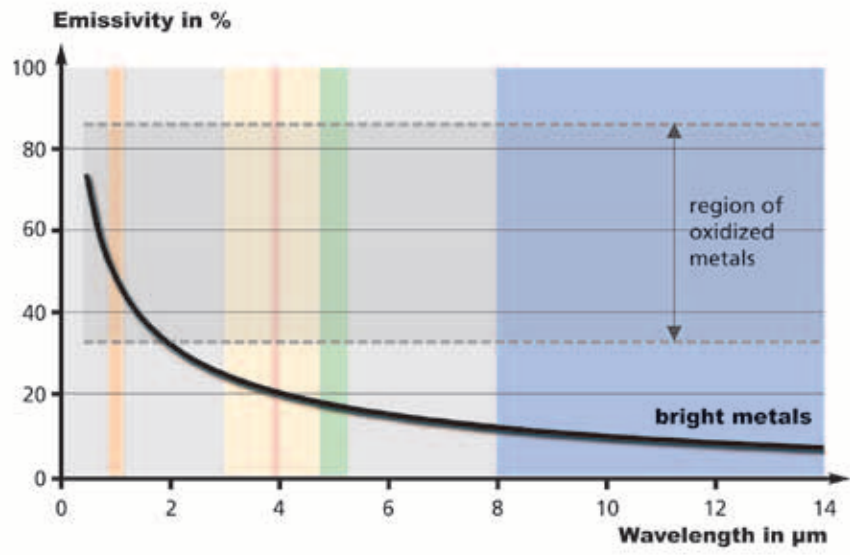
## Emissivity of Metals

The emissivity of bright metal surfaces is high at short wavelengths and decreases with lengthening wavelengths. In the presence of oxidized and soiled metal surfaces, results are not necessarily consistent; emissivity may be strongly influenced by temperature and/or wavelength.

Metal components are often bright after machining, and their surfaces change when heated. At temperatures above 300 °C, tarnishing colors and increasing oxidation scale usually appear. This needs to be taken into consideration to avoid measurement errors.

Shiny metal surfaces strongly reflect infrared radiation, i.e. their reflection coefficient is high and their emission coefficient is low.

A hot object has a high reflection coefficient and, if it is close to where a temperature reading needs to be taken, it affects the value of that reading (especially with hotter objects).



*Example emissivity of metals*

## PORTABLES



Model	IGA 15 plus	IS 8 pro	IS 8-GS pro	IGA 8 pro
<b>Description</b>	Measurement of metals, ceramics, graphite, etc. Laser targeting light, min./ max./ avg., data storage, close-up lens for spot sizes up to 1.25 mm.	Very fast portables for measurements on metals and ceramics. Very small spot sizes, maximum value storage, temperature indicator.	Especially designed for measurements on molten metals in the pouring stream.	Very fast portables for measurements on metals and ceramics. Very small spot sizes, maximum value storage, temperature indicator.
<b>Temperature Ranges (between... and...)</b>	250...1800 °C	600...2500 °C	1000...2000 °C	250...2000 °C
<b>Spectral Range</b>	1.45...1.8 µm	0.78 ...1.1 µm	0.55 µm	1.45...1.8 µm
<b>Field of View (Minimum spot size Ø in mm)</b>	200:1 (min 1.25)	min 500:1 (min 0.5)	min 180:1 (min 1.4)	min 310:1 (min 0.8)
<b>Exposure time <math>t_{90}^{(1)}</math></b>	20 ms	1 ms	500 ms	1 ms
<b>Output</b>	USB	USB	USB	USB

## INFRARED SWITCH

## SMALL, LOW-PRICED



Model	KTS 218	KTG 218	IS 310	IGA 310
<b>Description</b>	Infrared temperature switch. Recognizes hot objects located in its measuring beam without contact and triggers a switch process.		Good value, small, fast, medium / high temperature 2-wire pyrometers with fixed focus, adjustable emissivity and LED targeting light.	
<b>Temperature Ranges (between... and...)</b>	700...1500 °C	400...1400 °C	650...2500 °C	300...1500 °C
<b>Spectral Range</b>	0.85...1.05 µm	0.85...1.8 µm	0.8...1.1 µm	1.45...1.8 µm
<b>Field of View (Minimum spot size Ø in mm)</b>	10 fixed optics 68-85:1 (min 2.5)	10 fixed optics 68-85:1 (min 2.5)	3 fixed optics min 310:1 (min 1)	3 fixed optics min 155:1 (min 2)
<b>Exposure time <math>t_{90}^{(1)}</math></b>	600 µs (switch time)	600 µs (switch time)	10 ms	10 ms
<b>Output</b>	Switch output 20 V, max. 30 mA	Switch output 20 V, max. 30 mA	4 - 20 mA	4 - 20 mA

1) According to IEC/TS 62492-1

## SMALL, LOW-PRICED

## COMPACT CLASS



Model	IS 210	IGA 210	M67S	M67S
<b>Description</b>	Fast medium / high temperature digital pyrometers in 2-wire design with analog output, service interface (for programming emissivity, response time and temperature range), and LED targeting light.		Analog 2-wire pyrometers with view finder for high temperature applications.	
<b>Temperature Ranges (between... and...)</b>	650...2500 °C	300...1800 °C	220...1100 °C	525...3000 °C
<b>Spectral Range</b>	0.8...1.1 μm	1.45...1.8 μm	1...1.6 μm	0.78...1.06 μm
<b>Field of View (Minimum spot size Ø in mm)</b>	3 fixed optics min 240:1 (min 2.5)	3 fixed optics min 175:1 (min 1.8)	2 fixed optics <400 °C: 30: 1 (min 1.8) >400 °C: 90: 1 (min 1.8)	2 fixed optics 90:1 or 180:1 (min 1.8)
<b>Exposure time <math>t_{90}^{(1)}</math></b>	20 ms adjustable up to 10 s	20 ms adjustable up to 10 s	50 ms up to 10 s	50 ms up to 10 s
<b>Output</b>	4 - 20 mA	4 - 20 mA	4 - 20 mA	4 - 20 mA

## COMPACT CLASS



Model	M67S	IGA 6 Advanced	IGA 6 Advanced	IGA 6/23 Advanced
<b>Description</b>	Special version for measurement of objects in flame heated furnaces, sees through clean combustion flames and hot gases.	Extremely fast and highly accurate digital pyrometers with very long temperature ranges, analog output, digital interface, focusable optics, and integrated LED display with laser targeting light, view finder, or integrated color-TV camera.		Low temperature version of the IGA 6 Advanced for temperature measurement on metals starting at 50 °C.
<b>Temperature Ranges (between... and...)</b>	300...1750 °C	600...3000 °C	250...2500 °C	50...1800 °C
<b>Spectral Range</b>	3.86 μm	0.7...1.1 μm	1.45...1.8 μm	2...2.6 μm
<b>Field of View (Minimum spot size Ø in mm)</b>	Fixed optics 30:1 (min 11.9)	min 350:1 (min. 0.6)	min 350:1 (min. 0.6)	min 350:1 (min. 0.6)
<b>Exposure time <math>t_{90}^{(1)}</math></b>	100 ms up to 10 s	120 μs adjustable up to 10 s	120 μs adjustable up to 10 s	0.5 ms adjustable up to 10 s
<b>Output</b>	4 - 20 mA	0/4 - 20 mA, RS485	0/4 - 20 mA, RS485	0/4 - 20 mA, RS485

1) According to IEC/TS 62492-1

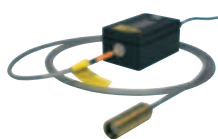
## COMPACT CLASS

## COMPACT CLASS WITH FIBER OPTICS



Model	IS 320	IGA 320	IGA 320/23	IGA 320/23-LO
<b>Description</b>	Small and very fast digital pyrometers with fixed focus and LED targeting light.		Low temperature version of the IGA 320 for temperature measurement on metals starting at 75 °C.	Small, short wavelength digital infrared thermometer with fiber optics for temperature measurement on metals starting at 100 °C.
<b>Temperature Ranges (between... and...)</b>	550...1800 °C	300...1800 °C	75...1800 °C	100...1200 °C
<b>Spectral Range</b>	0.8...1.1 μm	1.45...1.8 μm	2...2.6 μm	2.6 μm
<b>Field of View (Minimum spot size Ø in mm)</b>	3 fixed optics min 200 : 1 (min 1.3)	3 fixed optics min 230 : 1 (min 1.2)	2 fixed optics min 200 : 1 (min 0.25)	optical head I min 90:1 (min 1.3), optical head II min 180:1 (min 0.5)
<b>Exposure time <math>t_{90}^{(1)}</math></b>	2 ms adjustable up to 10 s	2 ms adjustable up to 10 s	2 ms adjustable up to 10 s	2 ms adjustable up to 10 s
<b>Output</b>	0/4 - 20 mA, RS485	0/4 - 20 mA, RS485	0/4 - 20 mA, RS485	0/4 - 20 mA, RS485

## COMPACT CLASS WITH FIBER OPTICS



Model	IS 50-LO plus	IGA 50-LO plus	IS 50/055-LO plus	IS 50/067-LO plus
<b>Description</b>	Very fast, digital fiber optic pyrometers. Two optical heads available, very small spot sizes. Laser targeting light, display, and buttons for instrument settings.		Special versions of the IS 50-LO plus with extremely short wavelength for metal measurements with high emissivity and little dependency on emissivity variations.	
<b>Temperature Ranges (between... and...)</b>	550...3300 °C	250...2500 °C	1000...2300 °C	1100...3500 °C
<b>Spectral Range</b>	0.7...1.1 μm	1.45...1.8 μm	0.55 μm	0.676 μm
<b>Field of View (Minimum spot size Ø in mm)</b>	optical head I min 100 : 1 (min 1.2), optical head II min 200 : 1 (min 0.45)	optical head I min 100 : 1 (min 1.2), optical head II min 200 : 1 (min 0.45)	optical head I min 100 : 1 (min 1.2), optical head II min 200 : 1 (min 0.45)	optical head I min 100 : 1 (min 1.2), optical head II min 200 : 1 (min 0.45)
<b>Exposure time <math>t_{90}^{(1)}</math></b>	< 1 ms adjustable up to 10 s	< 1 ms adjustable up to 10 s	< 1 ms adjustable up to 10 s	< 1 ms adjustable up to 10 s
<b>Output</b>	0/4 - 20 mA, RS232 or RS485 (switchable)	0/4 - 20 mA, RS232 or RS485 (switchable)	0/4 - 20 mA, RS232 or RS485 (switchable)	0/4 - 20 mA, RS232 or RS485 (switchable)

1) According to IEC/TS 62492-1

## COMPACT CLASS WITH DIFFERENT OPTICS



## RATIO PYROMETERS (ALSO SUITABLE FOR GLASS APPLICATIONS)



Model	PhotriX Series	M 90-R1	M90-R2
<b>Description</b>	Digital, extremely sensitive pyrometer to measure small signals and lower temperatures. Configurable collection optics: lens optic, lightpipe optics, fiber optics to remote lens, fiber optics to lightpipe.	Portable ratio pyrometers with precision optics. Data logger, peak, valley and variable averaging functions of a measurement series. (Metal Housing available as an option).	
<b>Temperature Ranges (between... and...)</b>	30...2600 °C	700...2000 °C	900...3000 °C
<b>Spectral Range</b>	5 ranges: between 0.7 and 1.65 μm	channel 1: 0.92 μm; channel 2: 0.98 μm	channel 1: 0.92 μm; channel 2: 0.98 μm
<b>Field of View (Minimum spot size Ø in mm)</b>	Optics or lightpipes adapted to customer's request: min 0.5 mm	60:1 (min 8.4)	180:1 (min 2.8)
<b>Exposure time <math>t_{90}</math><sup>(1)</sup></b>	1 ms adjustable up to 60 s	500 ms	500 ms
<b>Output</b>	4 - 20 mA, 0 - 10 V, RS232, RS422	analog output 1 mV / °C or 0 - 1 V, RS232	analog output 1 mV / °C or 0 - 1 V, RS232

## RATIO PYROMETERS (ALSO SUITABLE FOR GLASS APPLICATIONS)



Model	ISR 320	ISR 6 Advanced	ISQ 5-LO	ISR 50-LO
<b>Description</b>	Small, good value, stationary ratio pyrometer with LED targeting light.	Highly accurate digital, fast pyrometers in 2-color design (switchable to mono mode) with analog output and digital interface, LED display, focusable optics, laser targeting light or view finder or integrated color-TV camera.	Digital, fast fiber optic pyrometers in 2-color design (switchable to mono mode) with analog output and digital interface, max. value storage, adjustable temp. range. Two optical heads available.	Digital, fast fiber optic pyrometer in 2-color design (switchable to mono mode). Analog output, digital interface, maximum value storage. Small spot sizes.
<b>Temperature Ranges (between... and...)</b>	700...1700 °C	600...3000 °C	700...2500 °C	700...3000 °C
<b>Spectral Range</b>	channel 1: 0.9 μm, channel 2: 1.05 μm	channel 1: 0.9 μm channel 2: 1.05 μm	channel 1: 0.9 μm channel 2: 1.05 μm	channel 1: 0.9 μm channel 2: 1.05 μm
<b>Field of View (Minimum spot size Ø in mm)</b>	2 fixed optics min 100:1 (min 3)	min 360:1 (min 0.7)	opt. head I: min 100:1 (min 1.2); II (focusable): min 200:1 (min 0.45)	optical head II-HD min 200:1 (min 1.7)
<b>Exposure time <math>t_{90}</math><sup>(1)</sup></b>	10 ms adjustable up to 10 s	2 ms adjustable up to 10 s	< 10 ms adjustable up to 10 s	10 ms adjustable up to 10 s
<b>Output</b>	0/4 - 20 mA, RS485	0/4 - 20 mA, RS485	0/4 - 20 mA, RS232 or RS485, PID controller (option)	0/4 - 20 mA, RS232 or RS485 (switchable)

1) According to IEC/TS 62492-1

## RATIO PYROMETERS

(ALSO SUITABLE FOR GLASS APPLICATIONS)

## ROBUST INDUSTRY DESIGN



Model	ISR 12-LO	IGAR 12-LO	IS 12, IS 12-S	IGA 12, IGA 12-S
<b>Description</b>	Fully digital, very fast pyrometers in 2-color design (switchable to mono mode), with long fiber optic cable lengths up to 30 m, display and laser targeting light, very small spot sizes, analog output and digital interface, maximum value storage.		Fully digital, highly accurate, very fast pyrometers. Built-in digital display, view finder and optional targeting light, very small spot sizes, variable or fixed optics, analog output, digital interface, maximum value storage. Option: built-in scanner (-S).	
<b>Temperature Ranges (between... and...)</b>	600...3300 °C	300...2500 °C	550...3500 °C	250...2300 °C
<b>Spectral Range</b>	channel 1: 0.8 µm channel 2: 1.05 µm	channel 1: 1.52 µm, channel 2: 1.64 µm or 1.28 µm and 1.65 µm	0.7...1.1 µm	1.45...1.8 µm
<b>Field of View (Minimum spot size Ø in mm)</b>	optical head I min 100:1 (min 1.2) optical head II (focusable) min 200:1 (min 0.45)	optical head I min 100:1 (min 1.2) optical head II (focusable) min 200:1 (min 0.45)	6 fixed optics min 900:1 (min 0.1); 3 focusable optics min 900:1 (min 0.4)	6 fixed optics min 900:1 (min 0.1); 3 focusable optics min 900:1 (min 0.4)
<b>Exposure time <math>t_{90}</math><sup>(1)</sup></b>	2 ms <sup>(2)</sup> adjustable up to 10 s	2 ms <sup>(2)</sup> adjustable up to 10 s	< 1 ms adjustable up to 10 s <sup>(2)</sup>	< 1 ms adjustable up to 10 s <sup>(2)</sup>
<b>Output</b>	0/4 - 20 mA, RS232 or RS485 (switchable)	0/4 - 20 mA, RS232 or RS485 (switchable)	0/4 - 20 mA, RS232 or RS485 (switchable)	0/4 - 20 mA, RS232 or RS485 (switchable)

## COMFORT CLASS



Model	IS 140	IGA 140	IS 140/055	IS 140/067
<b>Description</b>	Fully digital, very fast pyrometers. View finder, laser targeting light, or color TV camera. Very small spot sizes, focusable optics. Display, buttons for instrument settings, analog output, digital interface, maximum value storage.		Special versions of the IS 140 with extremely short wavelength for measurements of metals with high emissivity and little dependency on emissivity variations.	
<b>Temperature Ranges (between... and...)</b>	550...3300 °C	220...3000 °C	1000...2400 °C	1100...3500 °C
<b>Spectral Range</b>	0.7...1.1 µm	1.45...1.8 µm	0.55 µm	0.676 µm
<b>Field of View (Minimum spot size Ø in mm)</b>	3 focusable optics min 380:1 (min 0.35)	3 focusable optics min 380:1 (min 0.35)	3 focusable optics min 380:1 (min 0.35)	3 focusable optics min 380:1 (min 0.35)
<b>Exposure time <math>t_{90}</math><sup>(1)</sup></b>	< 1 ms adjustable up to 10 s	< 1 ms adjustable up to 10 s	< 1 ms adjustable up to 10 s	< 1 ms adjustable up to 10 s
<b>Output</b>	0/4 - 20 mA, RS232/485 (switchable), Profibus-DP (option), Profinet (option), PID controller (option)	0/4 - 20 mA, RS232/485 (switchable), Profibus-DP (option), Profinet (option), PID controller (option)	0/4 - 20 mA, RS232 or RS485 (switchable), Profibus-DP (option)	0/4 - 20 mA, RS232 or RS485 (switchable), Profibus-DP (option)

1) According to IEC/TS 62492-1

2) With dynamic adaption at low signal levels

## COMFORT CLASS



Model	IP 140	IPE 140	IP 140-LO	IPE 140/39
<b>Description</b>	Fully digital, very fast pyrometers for measurements of low temperatures on metals. View finder or laser targeting light, very small spot sizes, focusable optics. Display, setting keys, max.value storage. Analog output, digital interface.	Fully digital, very fast pyrometers for measurements of low temperatures on metals. View finder or laser targeting light, very small spot sizes, focusable optics. Display, setting keys, max.value storage. Analog output, digital interface.	Fiber optics version of the IP 140. Two available optics for very small spot sizes and laser targeting light.	Special version of the IPE 140: For measurement of objects in flame heated furnaces, sees through clean combustion flames and hot gases.
<b>Temperature Ranges (between... and...)</b>	50...1300 °C	5...1200 °C	100...750 °C	20...1800 °C
<b>Spectral Range</b>	2...2.8 μm	3...5 μm	2...2.6 μm	3.9 μm
<b>Field of View (Minimum spot size Ø in mm)</b>	4 focusable optics min 400:1 (min 0.3)	4 focusable optics min 150:1 (min 0.9)	optical head I min 35:1 (min 3.4); optical head II min 80:1 (min 1.1)	3 focusable optics min 200:1 (min 0.7)
<b>Exposure time <math>t_{90}</math> <sup>(1)</sup></b>	1.5 ms adjustable up to 10 s <sup>(2)</sup>	1.5 ms adjustable up to 10 s <sup>(2)</sup>	1.5 ms adjustable up to 10 s <sup>(2)</sup>	1.5 ms adjustable up to 10 s <sup>(2)</sup>
<b>Output</b>	0/4 - 20 mA, RS232 or RS485 (switchable)	0/4 - 20 mA, RS232 or RS485 (switchable)	0/4 - 20 mA, RS232 or RS485 (switchable)	0/4 - 20 mA, RS232 or RS485 (switchable)

## HIGH SPEED



## PRECISION CLASS



Model	IGA 740	IGA 740-LO	IS 12-TSP	IGA 12-TSP
<b>Description</b>	Ultra fast pyrometer with targeting light, very small spot sizes, and variable or fixed optics. Option: view finder	Ultra fast pyrometer with fiber optics, targeting light, small spot sizes and various optical heads.	Transfer-Standard-Pyrometer specially designed for the exact verification of the temperature of a blackbody calibration source. Resolution 0.01 °C, extremely high accuracy and long term stability. Traceable works certificate with 5 measuring points.	Transfer-Standard-Pyrometer specially designed for the exact verification of the temperature of a blackbody calibration source. Resolution 0.01 °C, extremely high accuracy and long term stability. Traceable works certificate with 5 measuring points.
<b>Temperature Ranges (between... and...)</b>	160...2500 °C	200...2500 °C	600...3000 °C	200...1400 °C
<b>Spectral Range</b>	1.58...1.8; 1.58...2.2 μm or 2...2.2 μm	1.58...1.8; 1.58...2.2 μm or 2...2.2 μm	2 types: 0.94 μm / 0.65 μm	1.57 μm
<b>Field of View (Minimum spot size Ø in mm)</b>	Focusable or macro optics min 200:1 (min 0.7)	2 standard optical heads 90:1 (min 1.6); 10 special optical heads with dedicated distance to spot ratio available	3 focusable optics min 400:1 (min 0.7)	3 focusable optics min 250:1 (min 1.1)
<b>Exposure time <math>t_{90}</math> <sup>(1)</sup></b>	6 μs	6 μs	< 1 ms adjustable up to 10 s <sup>(2)</sup>	< 1 ms adjustable up to 10 s <sup>(2)</sup>
<b>Output</b>	0/4 - 20 mA, 0 - 10 V	0/4 - 20 mA, 0 - 10 V	0/4 - 20 mA, RS232 or RS485 (switchable)	0/4 - 20 mA, RS232 or RS485 (switchable)

1) According to IEC/TS 62492-1

2) With dynamic adaptation at low signal levels





# GLASS SURFACES

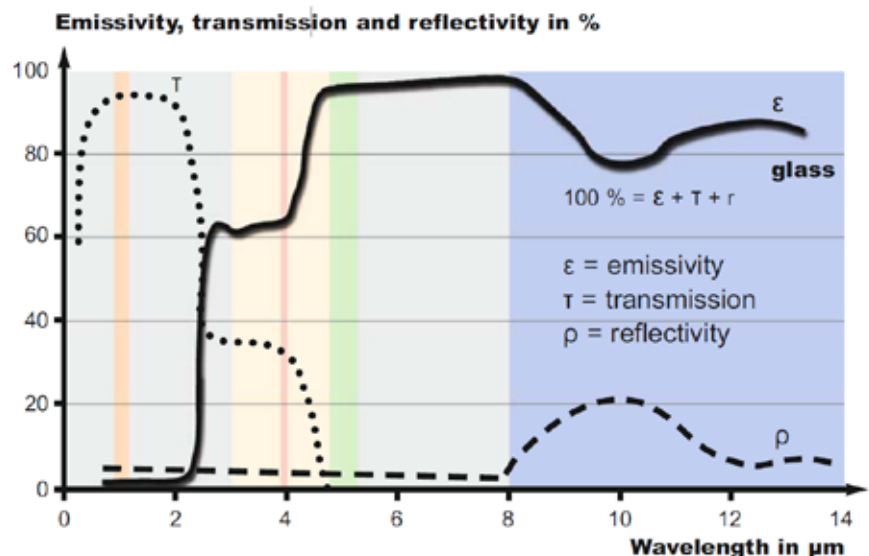
## Emissivity of Glass Surfaces

Partially transparent materials such as glass and quartz have their own unique, emissivity. The emissivity of glass is characterized by wavelength ranges where infrared radiation largely passes through the glass material (transmission), others in which it is absorbed almost completely (absorption), and where it penetrates into the glass surface depending on the glass type. In small absorption bands these materials are opaque to radiation, which is why these bands are particularly suited for temperature measurements.

Glass is transparent in the visible light and near infrared ranges (to about  $3 \mu\text{m}$ ), which means that its transmission is high, and consequently its emissivity is low. As you can see in the figure to the right, the emissivity of glass is very high in the range from  $4.5$  to  $8.5 \mu\text{m}$ , because glass has a wide absorption band in this spectral range. Above  $8 \mu\text{m}$  the reflection  $\rho$  of glass increases sharply, making accurate measurements difficult.

As a rule, the wavelength range used for temperature measurements on glass surfaces lies around  $5.14 \mu\text{m}$  (for glass thicknesses of  $1 \text{ mm}$  and more at medium to high temperatures), or  $7.75 \mu\text{m}$  (for glass thicknesses below  $1 \text{ mm}$  and low to medium temperatures).

Depending on the wavelength chosen for the measurements, there will be different values for emissivity, transmissivity, and reflectivity.



*Example emissivity of glass surfaces*

## SMALL, LOW-PRICED

## COMPACT CLASS



Model	IN 210/5	M67S	M67S	IN 5/5
<b>Description</b>	Glass surface measurement version of IN 210, 2-wire design and service interface. Programmable measuring range, spectral range 5.14 $\mu\text{m}$ .	Analog 2-wire pyrometer with view finder for measurement of glass surfaces or very thin glass.	Analog 2-wire pyrometer with view finder for measurement of glass drops.	2-wire pyrometers for glass surface measurement, spectral range 5.14 $\mu\text{m}$ .
<b>Temperature Ranges (between... and...)</b>	100...1200 °C	100...1300 °C	525...3000 °C	100...2500 °C
<b>Spectral Range</b>	5.14 $\mu\text{m}$	4.8...5.2 $\mu\text{m}$	0.78...1.06 $\mu\text{m}$	5.14 $\mu\text{m}$
<b>Field of View (Minimum spot size <math>\varnothing</math> in mm)</b>	3 fixed optics 50:1 (min 2.5)	1 fixed optic 15 or 30:1 (min 11.9)	2 fixed optics 90 or 180: 1 (min 1.8)	3 fixed optics 50:1 (min 2.5)
<b>Exposure time <math>t_{90}</math> <sup>(1)</sup></b>	120 ms adjustable up to 10 s	100 ms up to 10 s	50 ms up to 10 s	80 ms adjustable up to 5 s
<b>Output</b>	4 - 20 mA	4 - 20 mA	4 - 20 mA	4 - 20 mA

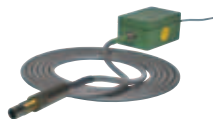
## COMPACT CLASS



Model	IN 5/5 plus	IN 5/5-H plus	IN 5/5-L plus	IN 6/78-L
<b>Description</b>	Digital pyrometers for glass surface measurement. With analog output, digital interface, max./min. value storage, adjust. sub-range, laser targeting light.	Digital pyrometers for glass surface measurement, spectral range 5.14 $\mu\text{m}$ . With analog output, digital interface, max./min. value storage, adjust. sub-range, laser targeting light.  -H: high speed version	Digital pyrometers for glass surface measurement, spectral range 5.14 $\mu\text{m}$ . With analog output, digital interface, max./min. value storage, adjust. sub-range, laser targeting light.  -L: better field of view	Digital pyrometer for the measurement of ultra-thin glass sheets with less than 1 mm thickness.
<b>Temperature Ranges (between... and...)</b>	100...2500 °C	200...2500 °C	200...2500 °C	400...1100 °C
<b>Spectral Range</b>	5.14 $\mu\text{m}$	5.14 $\mu\text{m}$	5.14 $\mu\text{m}$	7.8 $\mu\text{m}$
<b>Field of View (Minimum spot size <math>\varnothing</math> in mm)</b>	3 fixed optics 50:1 (min 2.5)	3 fixed optics 50:1 (min 2.5)	3 fixed optics 100:1 (min 1.1)	1 fixed optics 75:1 (min. 5)
<b>Exposure time <math>t_{90}</math> <sup>(1)</sup></b>	80 ms adjustable up to 30 s	10 ms adjustable up to 30 s	180 ms adjustable up to 30 s	80 ms adjustable up to 30 s
<b>Output</b>	0/4 - 20 mA, RS232 or RS485	0/4 - 20 mA, RS232 or RS485	0/4 - 20 mA, RS232 or RS485	0/4 - 20 mA, RS485

1) According to IEC/TS 62492-1

## WITH FIBER



## COMFORT CLASS



Model	IS 50-LO/GL	IN 140/5	IN 140/5-H	IN 140/5-L
<b>Description</b>	Fiber optic pyrometers for measurement of molten glass in forehearth, feeder, and gobs. Adjustable measuring ranges. 2-wire design, analog output, service interface.	Pyrometers for glass surface measurement, spectral range 5.14 $\mu\text{m}$ . Laser targeting light, thru-lens view finder, or color TV camera. Focusable optics with small spot sizes.		
			-H: high speed version	-L: better field of view
<b>Temperature Ranges (between... and...)</b>	600...1800 °C	250...2500 °C	250...2500 °C	250...2500 °C
<b>Spectral Range</b>	0.8...1.1 $\mu\text{m}$	5.14 $\mu\text{m}$	5.14 $\mu\text{m}$	5.14 $\mu\text{m}$
<b>Field of View (Minimum spot size <math>\varnothing</math> in mm)</b>	optical head min 100:1	3 focusable optics min 150:1 (min 1)	3 focusable optics min 150:1 (min 1)	focusable optics 180:1 (min 0.9)
<b>Exposure time <math>t_{90}^{(1)}</math></b>	250 ms adjustable up to 10 s	40 ms adjustable up to 10 s	10 ms adjustable up to 10 s	40 ms adjustable up to 10 s
<b>Output</b>	4 - 20 mA	0/4 - 20 mA, RS232 or RS485 (switchable)	0/4 - 20 mA, RS232 or RS485 (switchable)	0/4 - 20 mA, RS232 or RS485 (switchable)

1) According to IEC/TS 62492-1



# GENERALLY NON-METALLIC SURFACES

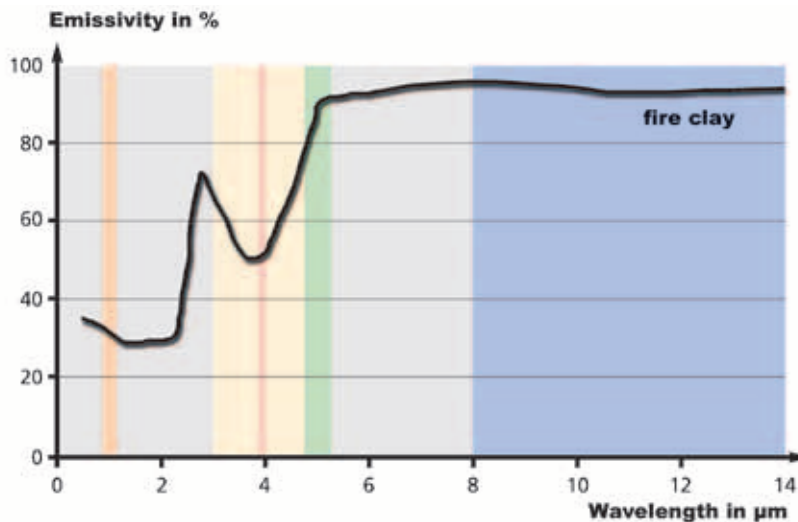
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## Emissivity of Non-Metallic Surfaces

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The group of non-metals includes organic materials, such as foodstuffs, wood or paper, as well as inorganic materials such as ceramics or fire clay.

The emissivity of non-metals rises with increasing wavelength. Generally speaking, from a certain wavelength, the emissivity is nearly constant. The color of the object as seen in the visible light spectrum, has practically no influence on the emissivity behavior in the mid-and long-wave infrared.



*Example emissivity of non-metallic surfaces*

## SMALL, LOW-PRICED



Model	IN 2000	IN 3000	IN 510, IN 510-N	IN 520, IN 520-N
<b>Description</b>	Small, good value, simple sensor, different linear measuring outputs are available.	Small, good value, simple sensor, different linear measuring outputs are available.	Digital pyrometers with separate miniature sensor head. Sensor head / cable usable in ambient temperatures without cooling up to 85 °C.	Digital pyrometers with separate miniature sensor head. Sensor head / cable usable in ambient temperatures without cooling up to 180 °C. Can also be used as a temperature switch.
<b>Temperature Ranges (between... and...)</b>	-32...900 °C	0...500 °C	-40...700 °C	-40...700 °C
<b>Spectral Range</b>	8...14 μm	8...14 μm	8...14 μm	8...14 μm
<b>Field of View (Minimum spot size Ø in mm)</b>	10:1	10:1	2:1 or 10:1	2:1 or 10:1
<b>Exposure time <math>t_{90}^{(1)}</math></b>	95 ms	300 ms	180 ms adjustable up to 30 s	180 ms adjustable up to 30 s
<b>Output</b>	4 - 20 mA, digital output	10 mV / °C, thermocouple type J or K	0/4 - 20 mA, 0 - 5 V, thermocouple J / K, RS232 / RS485 (switchable)	0/4 - 20 mA, 0 - 5 V, thermocouple J / K, RS232 / RS485 (switchable)

## SMALL, LOW-PRICED

## COMPACT CLASS



Model	IN 210	IN 300	M67S
<b>Description</b>	Digital pyrometer with analog output (2-wire design) and service interface (for programming emissivity, response time, and temperature range).	Good value, small 2-wire pyrometer with fixed focus and adjustable emissivity, easy installation.	Analog 2-wire pyrometer with view finder for general purpose and low temperature applications with high emissivity.
<b>Temperature Ranges (between... and...)</b>	-32...900 °C	-20...600 °C	0...1000 °C
<b>Spectral Range</b>	8...14 μm	8...14 μm	8...14 μm
<b>Field of View (Minimum spot size Ø in mm)</b>	3 fixed optics 50:1 (min 2)	15:1	2 fixed optics 15 or 30:1 (min 1.5)
<b>Exposure time <math>t_{90}^{(1)}</math></b>	120 ms adjustable up to 10 s	300 ms	100 ms up to 10 s
<b>Output</b>	4 - 20 mA	4 - 20 mA	4 - 20 mA

1) According to IEC/TS 62492-1

## COMPACT CLASS



Model	IN 5	IN 5 Plus	IN 5-H Plus	IN 5-L Plus
<b>Description</b>	2-wire pyrometer for general applications.	Digital pyrometers for general applications. With analog output, digital interface, max. / min. value storage, adjustable measuring range, different optics, laser targeting light.		
			H: high speed version	-L: better field of view
<b>Temperature Ranges (between... and...)</b>	-32...900 °C	-32...900 °C	-32...900 °C	0...900 °C
<b>Spectral Range</b>	8...14 μm	8...14 μm	8...14 μm	8...14 μm
<b>Field of View (Minimum spot size Ø in mm)</b>	3 fixed optics 50:1 (min 2)	3 fixed optics 50:1 (min 2)	3 fixed optics 50:1 (min 2)	3 fixed optics 100:1 (min 1)
<b>Exposure time <math>t_{90}^{(1)}</math></b>	80 ms adjustable up to 5 s	80 ms adjustable up to 30 s	10 ms adjustable up to 30 s	180 ms adjustable up to 30 s
<b>Output</b>	4 - 20 mA	0/4 - 20 mA, RS232 or RS485 (switchable)	0/4 - 20 mA, RS232 or RS485 (switchable)	0/4 - 20 mA, RS232 or RS485 (switchable)

1) According to IEC/TS 62492-1



# SPECIAL MATERIALS

LumaSense produces a wide range of specialized pyrometers beyond those described in the previous sections. These pyrometers are customized to address specific applications and materials, and are often available with the needed accessories to provide a complete solution package.

Some example applications include:

- Measuring flame or gas temperature, by monitoring the CO<sub>2</sub> absorption line
- Measuring temperature on thin plastic films
- Measuring Silicon and Sapphire wafers in Semiconductor & Compound Semi processes

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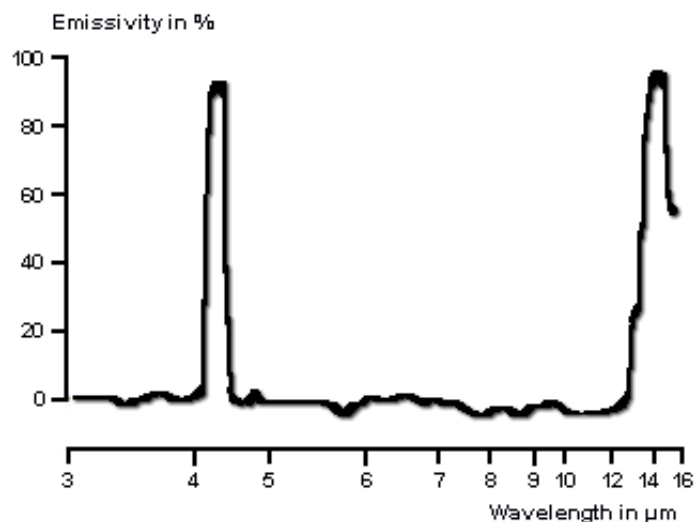
## Emissivity of Special Materials

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To measure temperatures for these specialized applications, one must carefully understand the emissivity, reflectance, and transmissions of the objects to be measured. We then select the proper detectors and filters to maximize the detected signal. For example, when measuring the temperature of a combustion flame where there is expected to be significant CO<sub>2</sub> content, we select a narrow band filter at 4.5 μm where the emission from this gas is high (see figure).

This filter coupled with a PbSe detector will provide a suitable signal to measure a flame column of 40 cm thickness. If we instead choose a 3.9 μm filter, then we can effectively avoid the CO<sub>2</sub> and H<sub>2</sub>O emission bands, and look through the flame.

If you have a specialized need, which is not covered with the pyrometers below, please consult our Applications Engineering Team.



*Emission spectrum for CO<sub>2</sub>*

## PORTABLES

For Coke Industry



**IGA 315-K**

## COMFORT CLASS

For thin PE and PP foils



**IPE 140/34**

For flames or hot gases containing CO<sub>2</sub>



**IPE 140/45**

Model	IGA 315-K	IPE 140/34	IPE 140/45
<b>Description</b>	Pyrometer for non-contact temperature measurement of nozzle bricks and air stages in coking ovens at standard distances between 1 and 12 m.	Version of the IPE 140: for measurement of thin PE and PP foils with a minimum material thickness of only 30 µm.	Version of the IPE 140: for measurement of combustion flames and hot gases containing CO <sub>2</sub> This pyrometer is used for example in the LumaSense FEGT system for continuous measurement of the Furnace Exit-Gas Temperature in boilers and furnaces.
<b>Temperature Ranges (between... and...)</b>	600...1600 °C	50...500 °C	400...2000 °C
<b>Spectral Range</b>	1.58...1.8 µm	3.43 µm	CO <sub>2</sub> absorption band
<b>Field of View (Minimum spot size Ø in mm)</b>	min 34:1 (30 at 9 m)	3 focusable optics min 50:1 (min 2.1)	3 focusable optics min 200:1 (min 1.1)
<b>Exposure time t<sub>90</sub><sup>(1)</sup></b>	10 ms	1.5 ms adjustable up to 10 s <sup>(2)</sup>	1.5 ms adjustable up to 10 s <sup>(2)</sup>
<b>Output</b>	USB interface adapter	0/4 - 20 mA, RS232 or RS485 (switchable)	0/4 - 20 mA, RS232 or RS485 (switchable)

## COMFORT CLASS

For Wafers / GaN-based Epitaxy processes



**UV 400, UVR 400**

## COMPACT CLASS

For thin plastic films or thin glass



**M67S**

For flames or hot gases containing CO<sub>2</sub>



**M67S**

Model	UV 400, UVR 400	M67S	M67S
<b>Description</b>	Digital pyrometers with extremely short wavelength (in the UV spectral range) for true Wafer Surface Temperature and Reflectance Instrumentation for GaN-based MOCVD epitaxy processes. The UVR 400 includes an additional reflectometer at 635 nm with 0.5 kHz measurement speed. This enables measurement of deposition thickness. These pyrometers are also suitable for measurements on uncoated silicon wafers.	Analog 2-wire pyrometer with view finder. Special filter for thin plastic films or thin glass.	Analog 2-wire pyrometer with view finder. For measurement of combustion flames and hot gases containing CO <sub>2</sub> .
<b>Temperature Ranges (between... and...)</b>	650...1300 °C	0...600 °C	320...2200 °C
<b>Spectral Range</b>	383...410 nm	7.9 µm	CO <sub>2</sub> hot band
<b>Field of View (Minimum spot size Ø in mm)</b>	fixed optics min 8:1 (9.8)	2 fixed optics 15 or 30:1 (min 1.5)	Fixed optics 30:1 (min 1.8)
<b>Exposure time t<sub>90</sub><sup>(1)</sup></b>	Integration Time: Min of 8 ms	100 ms up to 10 s	100 ms up to 10 s
<b>Output</b>	0/4 - 20 mA, RS485	4 - 20 mA	4 - 20 mA

1) According to IEC/TS 62492-1

2) With dynamic adaptation at low signal levels



## COMPACT CLASS

For Sapphire



## COMPACT CLASS WITH FIBER OPTICS

For Aluminum



For Silicon Wafers



Model	IN 5/9 plus	IS 50-Al-LO plus	IS 50-Si-LO plus
<b>Description</b>	Digital pyrometer especially designed for measurement of sapphire. With analog output, digital interface, max. / min. value storage, different optics, laser targeting light.	Special version of the IS 50-LO plus with special wavelength for the measurement of Aluminum.	Special version of the IS 50-LO plus with special wavelength for the measurement of silicon wafers.
<b>Temperature Ranges (between... and...)</b>	0...1500 °C	400...1000 °C	400...1600 °C
<b>Spectral Range</b>	8...9.7 μm	narrow band in the near infrared	narrow band in the near infrared
<b>Field of View (Minimum spot size Ø in mm)</b>	min 50:1 (min 1.7)	Optical head I min 33 : 1 (min 3.3), Optical head II min 85 : 1 (min 1.1)	Optical head I min 50 : 1 (min 2.2), Optical head II min 130 : 1 (min 0.75)
<b>Exposure time <math>t_{90}</math><sup>(1)</sup></b>	80 ms	< 1 ms adjustable up to 10 s	< 1 ms adjustable up to 10 s
<b>Output</b>	0/4 - 20 mA, RS232 or RS485	0/4 - 20 mA, RS232 or RS485 (switchable)	0/4 - 20 mA, RS232 or RS485 (switchable)

## COMPACT CLASS WITH DIFFERENT OPTICS

For various materials and applications



## ROBUST INDUSTRY DESIGN

For Aluminum



For Silicon Wafers



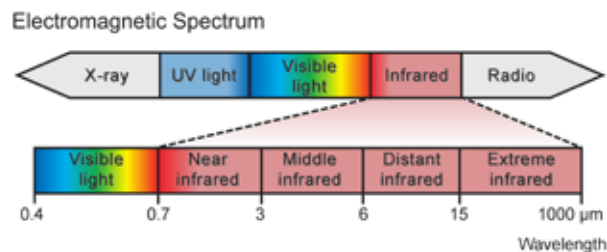
Model	PhotriX Series	IS 12-Al, IS 12-Al/S	IS 12-Si
<b>Description</b>	Digital, extremely sensitive pyrometer to measure small signals and lower temperatures. Configurable collection optics: lens optic, lightpipe optics, fiber optics to remote lens, fiber optics to lightpipe.	Special version of the IS 12, designed for the measurement of Aluminum. IS 12-Al/S with built-in scanner, scanning angle adjustable between 0...4°, scanning frequency between 0...10 Hz.	Dedicated version of the IS 12, designed for measuring silicon wafers.
<b>Temperature Ranges (between... and...)</b>	30...2600 °C	350...1050 °C	350...1800 °C
<b>Spectral Range</b>	5 ranges: between 0.7 and 1.65 μm	aluminum absorption filter	silicon absorption filter
<b>Field of View (Minimum spot size Ø in mm)</b>	Optics or lightpipes adapted to customers request: min 0.5 mm	6 fixed optics min 120:1 (min 1.1)	3 foc. optics min 130:1 (min 2.3) 6 fixed optics min 370:1 (min 0.6)
<b>Exposure time <math>t_{90}</math><sup>(1)</sup></b>	1 ms adjustable up to 60 s	< 1.5 ms adjustable up to 10 s <sup>(2)</sup>	10 ms adjustable up to 10 s
<b>Output</b>	4 - 20 mA, 0 - 10 V, RS232, RS422	0/4 - 20 mA, RS232 or RS485 (switchable)	0/4 - 20 mA, RS232 or RS485 (switchable)

1) According to IEC/TS 62492-1

2) With dynamic adaption at low signal levels

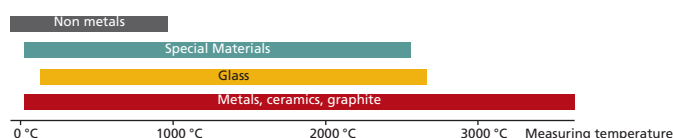
# Infrared Temperature Measurement

The non-contact temperature measurement (pyrometry) is an optical measurement based on the property of all materials to send out electromagnetic radiation (infrared radiation). The infrared thermometer (pyrometer) uses this radiation to determine the temperature. The pyrometer aims with the optics at a certain spot of the object and determines the temperature of this spot. Today, typically spectral responses of pyrometers are in the near, middle, and long infrared.



## Selection of the Appropriate LumaSense IMPAC Pyrometer

To choose the appropriate pyrometer for a specific application, different properties of the measuring object have to be taken into consideration, such as temperature, material, and size. You can also check our pyrometer search function at [www.lumasenseinc.com/EN/products/find-products/](http://www.lumasenseinc.com/EN/products/find-products/).



### Temperature Range

Our pyrometers measure temperatures from -50 to 3500 °C. The instruments are available in different temperature ranges. The ranges stated in the technical specifications do not show one single temperature range but give an overview of all available measurable temperatures.

### Spectral Range

The material of the measured object demands the correct selection of the optimum spectral range of the pyrometer for a specific application. Therefore, the correct spectral range is one of the most important parameters.

Typical spectral ranges are:

0.55 μm or 0.676 μm	Measurement of molten metals (min. 1100 °C)
0.8...1.1 μm	Measurement of molten glass, metals, ceramics (min. 600 °C)
1.45...1.8 μm	Measurement of metals, ceramics (min. 250 °C)
2.0...2.6 μm	Measurement of metals (min. 75 °C)
2.0...2.8 μm	Measurement of metals (min. 50 °C)
3...5 μm	Measurement of metals, ceramics (min. 5 °C)
3.43 μm	Measurement of PE and PP foils (min. 50 °C)
3.9 μm	Measurement in flame heated furnaces (min. 75 °C)
4.5 μm	Measurement of CO <sub>2</sub> (min. 400 °C)
5.14 μm	Measurement of glass surfaces (min. 100 °C)
8...14 μm	Measurement of non-metal surfaces and coated metals (min. -40 °C)

### Response Time

The response time is the time interval between the instant of an abrupt change in the value of the measuring temperature and the instant from which the measured value of the pyrometer remains within specified limits.

### Design

Our pyrometers are designed for the use in industry under rough conditions. The housings of the fixed pyrometers are made of stainless steel or die cast aluminum with the protection class of IP65. The housings of the portables are made of robust plastics.

Available designs include:

- Compact pyrometers with integrated lens
- Fiber optic pyrometers (LO)
- Portables

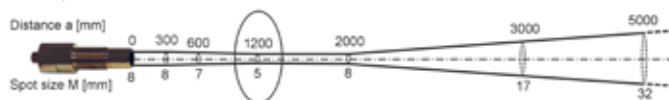
### Field of View

The dimensions of the measured object determine the required spot size of the pyrometer. The measured object must at least fill the spot size to achieve a correct temperature measurement. Spot sizes are dependent on the type of pyrometer and measuring distance and can be calculated using the distance ratio or field of view (FOV).

$$FOV = \text{measuring distance} / \text{spot size}$$

(e.g. 240:1 means: in a distance of 1200 mm the spot size is 5 mm).

Example:



### Output

Different pyrometers provide different outputs. Analog outputs and digital interfaces are available. Some pyrometers have various switchable outputs.

- Analog output 0 - 20 mA or 4 - 20 mA or 10 mV/ °C or 0 - 5 V or thermo couple type J or K
- Digital interface RS232 or RS485
- Fieldbus-connection, integrated ProfiBus, ProfiNet)
- Switch output for IR switch: 20 V, max. 30 mA

### Controller

For control processes, some pyrometers are equipped with an integrated PID controller. For digital pyrometers without a controller output, a very fast programmable PID controller is available.

### Sighting

For easy alignment of the pyrometers to the measuring object, different sighting systems are available:

- Aiming (LED or laser)
- View finder
- TV camera

# Service

The mission of the LumaSense services organization is to deliver consistent world-class customer support so you can focus on your business. Our highly trained engineers, scientists, and PhDs are ready to partner with you to deliver the right sensing solutions with the best performance and longest-life.

You expect the highest quality from your investments in LumaSense technology; therefore, our promise is to:

- Deliver responsive customer care
- Assist in keeping your assets reliable and working
- Provide you the knowledge and expertise required to solve complex problems quickly

The Customer Care Group at LumaSense Technologies is your single point of contact for:

- Technical and product support
- Order, shipment, repair and parts
- Service scheduling
- Warranty services

## Technical and Product Support

Since our pyrometers are available in many different designs and specifications for almost any application, questions regarding the correct use, the settings, or the installation of the instruments may arise. Many of these questions can only be answered in an individual dialogue. Accordingly, our experienced personnel are at your disposal to help you when you need it.

## Field Services

We understand that successful assembly of one or more pyrometers into an existing system often requires a careful inspection of your facility. Our field application engineers are available to ensure you gain optimal performance by way of on-site repairs, calibrations, and/or training.

## Order, Shipment, Repair and Parts

LumaSense Technologies produces high quality temperature measuring instruments, which operate efficiently, even under the toughest conditions. Nevertheless, a repair of an instrument may become necessary. Our repair services provides a fast turn round of your repair order so that your instruments will be available to you again as quickly as possible.

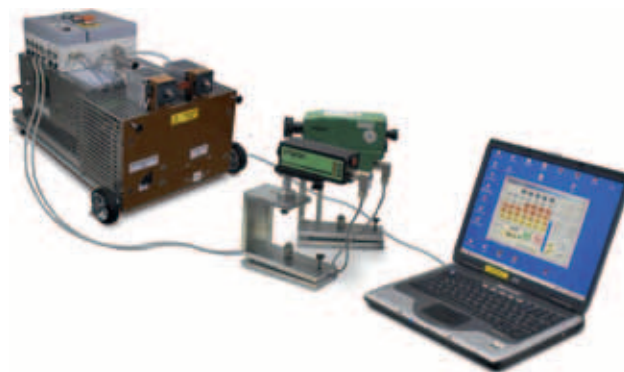


*Measurement in Hardening Processes*

## Calibration Services

LumaSense pyrometers work accurately and within their technical specifications for many years. However, periodic calibration or ISO-certification of the instruments is highly recommended.

Our adjustment and calibration services use a wide range of our own black-body calibration sources that are certified by all international standards bodies. Within France, Germany, and the USA, LumaSense also offers an on-site adjustment and calibration service for a wide range of pyrometer types.



*Mobile Calibration Unit*

In either case, if you send your pyrometer to us or take advantage of our mobile service, inspection certificates are issued. In fact, LumaSense pyrometers always include an inspection document, which confirms the operational reliability as well as measuring accuracy stated in the technical specifications.

## LumaServ™ Contract Offerings

LumaSense offers extended warranties and calibration contracts with an annual option to renew. These contracts can include preventative maintenance plus software and firmware upgrades depending on the particular contract level you choose. Additional benefits include:

- Lock in pricing per term
- Discounts on related parts, repairs, and training

If you have any questions or would like more information about our available services, please contact your local LumaSense office.

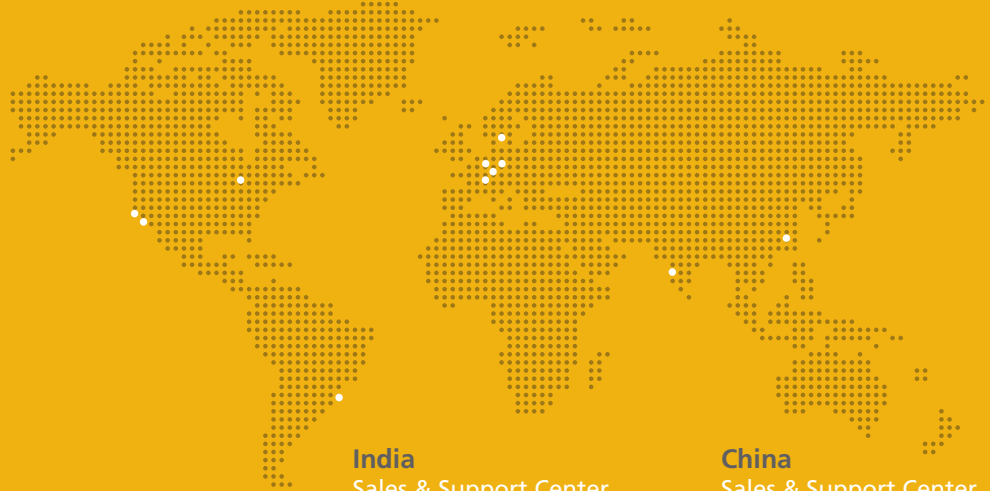
With a 50-year history of creating efficiencies through light-based measurement, LumaSense Technologies, Inc., delivers innovative temperature and gas sensing instruments for the Global Energy, Industrial Materials, and Advanced Technologies markets. Our unrivaled passion for excellence is why we have become one of the world's most trusted sensing solution providers. Beyond providing precision engineered products, our customers turn to us knowing our commitment to their success comes first. With expert application understanding and a growing portfolio of products, LumaSense can combine several technologies together into novel solutions even for the most complex environments.

**Americas and Australia**

Sales & Service  
Santa Clara, CA  
Ph: +1 800 631 0176  
Fax: +1 408 727 1677

**Europe, Middle East, Africa**

Sales & Service  
Frankfurt, Germany  
Ph: +49 69 97373 0  
Fax: +49 69 97373 167



**Brazil**

Sales  
São Paulo, Brazil  
Ph: +55 19 3367 6533  
Fax: +55 19 3367 6533

**India**

Sales & Support Center  
Mumbai, India  
Ph: +91 22 67419203  
Fax: +91 22 67419201

**China**

Sales & Support Center  
Shanghai, China  
Ph: +86 133 1182 7766  
Fax: +86 21 5877 2383

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**LumaSense Technologies**

[www.lumasenseinc.com](http://www.lumasenseinc.com)  
[info@lumasenseinc.com](mailto:info@lumasenseinc.com)