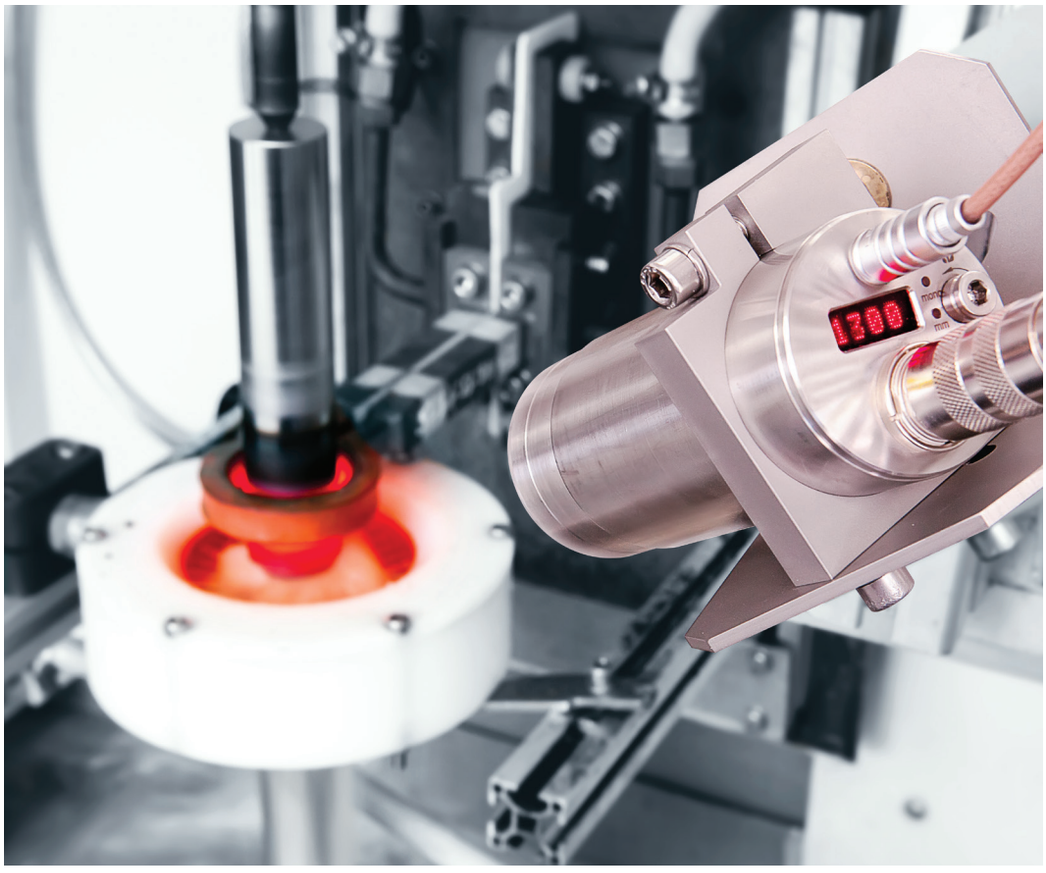


PYROMETER OVERVIEW

Highly Accurate Infrared Thermometers for Non-contact Temperature Measurements

Advanced Energy's 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, Advanced Energy 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 requirements.

This overview gives an impression of the broad variety of pyrometers and the possibilities that they provide. The instruments are classified in application areas and thereunder in product series.

NON-CONTACT TEMPERATURE MEASUREMENT

METALLIC, CERAMIC, AND GRAPHITE SURFACES

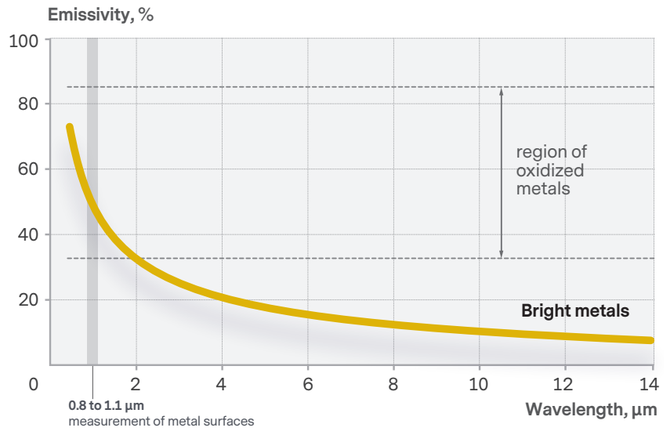
EMISSIVITY OF METALS

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).



FEATURED PRODUCT

PORTABLE PYROMETERS SERIES 8

Portable pyrometers suitable for measuring metals, ceramics, graphite, etc. or special applications such as pouring streams or in coke ovens.

- Precision optics for small spot sizes
- Robust die cast housing for use in harsh environments
- Large data storage
- Short response time for measurements of fast processes
- Temperature display on housing, in view finder, and multifunctional display



SERIES 8 PORTABLE SERIES 15






Model	IS 8 pro	IS 8-GS pro	IGA 8 pro	IGA 15 plus
Brief Description	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.	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.
Temperature Ranges	600 to 1800°C 750 to 2500°C	1000 to 2000°C	250 to 1600°C 280 to 2000°C	250 to 1800°C
Spectral Range	0.78 to 1.1 µm	0.55 µm	1.45 to 1.8 µm	1.45 to 1.8 µm
Measurement Uncertainty	0.4% oR + 1°C	0.4% oR + 1°C	0.4% oR + 1°C	0.6% oR
Repeatability	0.1% oR or 0.8°C	0.1% oR or 0.8°C	0.1% oR or 0.8°C	0.2% oR
Optics	Focusable optics: 500 to 9000 mm Optional: close-up-lens 250 to 500 mm	Focusable optics: 500 to 9000 mm Optional: close-up-lens 250 to 500 mm	Focusable optics: 500 to 9000 mm Optional: close-up-lens 250 to 500 mm	Fixed optics: a=800 mm Optional: close-up-lens a=250 mm
Field of View (Min spot size Ø in mm)	min 500:1 (1 mm) w. close-up-lens: 0.5 mm	180:1 (2.8 mm) w. close-up-lens: 1.1 mm	min 310:1 (1.6 mm) w. close-up-lens: 0.8 mm	min 200:1 (4 mm) w. close-up-lens: 1.25 mm
Alignment	Through lens sighting	Through lens sighting	Through lens sighting	Laser targeting
Exposure time t_{90}	1 ms	500 ms	1 ms	20 ms
Output	USB	USB	USB	USB

METALS

FEATURED PRODUCT

ISR 6-TI ADVANCED

—

First industrial grade hybrid pyrometer – combination of pyrometry and thermal imaging in a single solution.

- Built-in video camera with short wavelength infrared filter
- Auto calibration of thermal image relative to accurate pyrometer temperature reading
- Definition and evaluation of ROIs (Regions of Interest) in the thermal image
- Inclusive video cable and Video-to-USB grabber



FEATURED PRODUCT

IGAR 6 ADVANCED

—

Digital ratio pyrometer with possible combination of 1-color and 2-color measurement.

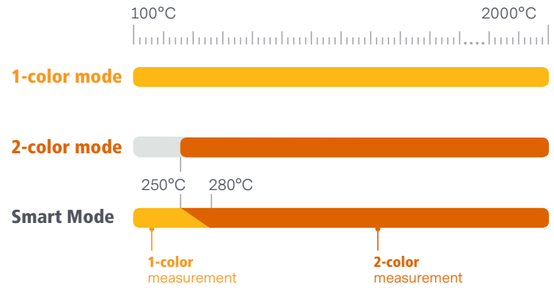
Wide temperature ranges and various operating modes:

- 1-color mode: 100 to 2000°C
- 2-color mode: 250 to 2000°C
- Smart mode: automatic (temperature-dependent) transition from 1-color to 2-color mode

Very fast response time for highly dynamic processes. Automatic emissivity determination. 4 digit LED display. Fully digital core for sub-ranging and adopted analog output.

OPERATING MODES

—



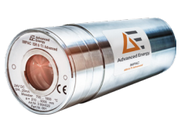
SERIES 5

SERIES 6










Model	IS 5	IGA 5	IS 6 Advanced	IGA 6 Advanced
Brief Description	Stationary, fully digital and fast compact pyrometer with analog output and RS232 or RS485 interface, available with laser pilot light or through lens sighting system.	Stationary, fully digital and fast compact pyrometer with analog output and RS232 or RS485 interface, available with laser pilot light or through lens sighting system.	Extremely fast and highly accurate digital pyrometer with very long temperature ranges, analog output, digital interface, focusable optics, and integrated LED display.	Extremely fast and highly accurate digital pyrometer with very long temperature ranges, analog output, digital interface, focusable optics, and integrated LED display.
Temperature Ranges	600 to 2000°C 800 to 2500°C 1000 to 3000°C	350 to 1800°C 250 to 2000°C 400 to 2500°C 500 to 3000°C	600 to 1800°C 600 to 3000°C	250 to 1800°C 250 to 2500°C
Spectral Range	0.8 to 1.1 µm	1.45 to 1.8 µm	0.7 to 1.1 µm	1.45 to 1.8 µm
Measurement Uncertainty	< 350°C: 0.5% oR + 1°C 350 to 1500°C: 0.3% oR + 1°C > 1500°C: 0.5% oR + 1°C	< 350°C: 0.5% oR + 1°C 350 to 1500°C: 0.3% oR + 1°C > 1500°C: 0.5% oR + 1°C	< 1500°C: 0.3% oR + 2°C > 1500°C: 0.6% oR	< 1500°C: 0.3% oR + 2°C > 1500°C: 0.6% oR
Repeatability	0.2% oR + 1°C	0.2% oR + 1°C	> 300°C: 0.15% oR + 1°C	> 300°C: 0.15% oR + 1°C
Optics	2 optical heads: Optics F: 220 to ∞ mm Optics N: 90 to 250 mm	2 optical heads: Optics F: 220 to ∞ mm Optics N: 90 to 250 mm	Manually focusable between 210 to 5000 mm	Manually focusable between 210 to 5000 mm
Field of View (Min spot size Ø in mm)	Approx. 10% x 14% of focused distance	Approx. 10% x 14% of focused distance	min 350:1 (min 0.6 mm)	min 350:1 (min 0.6 mm)
Alignment	Laser targeting or Through lens sighting	Laser targeting or Through lens sighting	Laser targeting or Through lens sighting or color TV camera	Laser targeting or Through lens sighting or color TV camera
Exposure time t_{90}	≤ 2 ms, adjustable up to 10 s	≤ 2 ms, adjustable up to 10 s	120 µs, adjustable up to 10 s	120 µs, adjustable up to 10 s
Output	0/4 to 20 mA, (RS232 or RS485 optional)	0/4 to 20 mA, RS485, (RS232 optional)	0/4 to 20 mA, RS485, (RS232 optional)	0/4 to 20 mA, RS485, (RS232 optional)

IGA 6/23 Advanced	ISR 6 Advanced	ISR 6-TI Advanced	IGAR 6 Advanced
Low temperature version of the IGA 6 Advanced for temperature measurement on metals starting at 50°C.	Highly accurate digital, fast pyrometer in 2-color design (switchable to mono mode) with analog output and digital interface, focusable optics, and integrated LED display.	Highly accurate digital pyrometer in 2-color design with built-in video camera system and infrared filter for non-contact measurement and display of thermal images.	Highly accurate digital pyrometer in 2-color design with possible combination of 1-color and 2-color measurement.
50 to 1000°C 75 to 1300°C 150 to 1800°C	600 to 1400°C 700 to 1800°C 800 to 2500°C 1000 to 3000°C	700 to 1800°C	1-color & smart mode: 100 to 2000°C 2-color mode: 250 to 2000°C
2 to 2.6 µm	Ch. 1: 0.9 µm Ch. 2: 1.05 µm	Ch. 1: 0.9 µm Ch. 2: 1.05 µm	Ch. 1: 1.5 to 1.6 µm Ch. 2: 2.0 to 2.5 µm
< 1500°C: 0.3% oR + 2°C > 1500°C: 0.6% oR	< 1500°C: 0.3% oR + 2°C > 1500°C: 0.6% oR	< 1500°C: 0.3% oR + 2°C > 1500°C: 0.6% oR	< 1500°C: 0.4% oR + 2°C > 1500°C: 0.8% oR in°C
0.15% oR + 1°C	0.15% oR + 1°C	0.15% oR + 1°C	0.2% oR + 1°C
Manually focusable between 210 to 5000 mm	Manually focusable between 210 to 5000 mm	Manually focusable between 210 to 5000 mm	Manually focusable between 210 to 5000 mm
min 350:1 (min 0.6 mm)	min 350:1 (min 0.6 mm) Option: line optics	min 190:1 (min 1.1 mm) FOV thermal image: 6.0° x 4.5° Pixels: 768 x 576	min 100:1 (min 2.1 mm) Option: line optics
Laser targeting or Through lens sighting or color TV camera	Laser targeting or Through lens sighting or color TV camera	Thermal image or video image (b&w)	Laser targeting or Through lens sighting or color TV camera
0.5 ms, adjustable up to 10 s	2 ms, adjustable up to 10 s	2 ms, adjustable up to 10 s Thermal image: up to 25 Hz	2 ms, adjustable up to 10 s
0/4 to 20 mA, RS485, (RS232 optional)	0/4 to 20 mA, RS485, (RS232 optional)	0/4 to 20 mA, RS485 (RS232 optional), Video signal	0/4 to 20 mA, RS485, (RS232 optional)

METALS

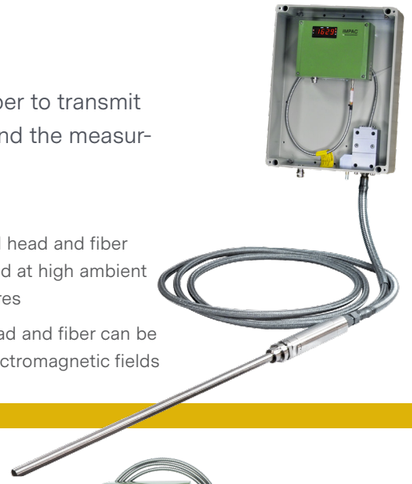
FIBER OPTIC PYROMETERS

—

Fiber optic pyrometers use an optical fiber to transmit the radiation between an optical head and the measuring transducer.

Examples:

- Various optical heads available
- Can be used for measurements in vacuum chambers using feed through flanges
- The optical head and fiber can be used at high ambient temperatures
- Optical head and fiber can be used in electromagnetic fields



FEATURED PRODUCT

SERIES 12-TSP

—

Transfer Standard Pyrometers for verification of blackbody calibration source temperatures.

The accuracy of a calibration source (blackbody) is likely to drift over the course of time from the defined specification. Special Transfer Standard Pyrometers meet extreme high accuracy specifications and are used to transfer temperature data from a primary infrared source to other calibration sources.



SERIES 12











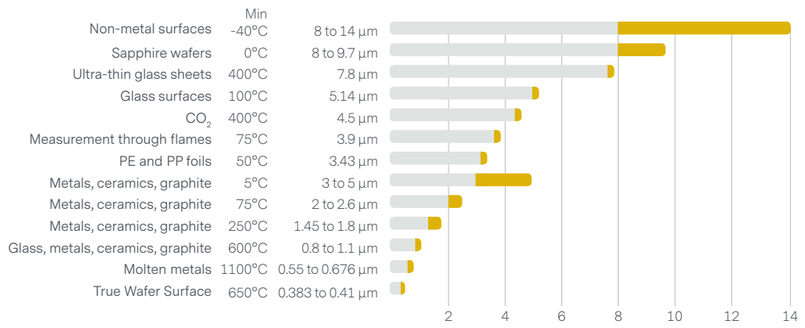




Model	ISR 12-LO	ISR 12-LO/GS	IGAR 12-LO	IS 12, IS 12-S	IGA 12, IGA 12-S	IS 12-TSP	IGA 12-TSP
Brief Description	Fully digital, very fast pyrometer in 2-color design (switchable to mono mode), with fiber optic cable lengths up to 30 m, display and laser targeting light, very small spot sizes, analog output and digital interface, maximum value storage.	Special version of ISR 12-LO for measurement of pouring streams.	Fully digital, very fast pyrometer in 2-color design (switchable to mono mode), with 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).	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).	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.
Temperature Ranges	600 to 1300°C 750 to 1800°C 900 to 2500°C 1000 to 3300°C	600 to 1300°C 750 to 1800°C 900 to 2500°C	300 to 1000°C 500 to 2200°C 350 to 1300°C 550 to 2500°C 450 to 1700°C	550 to 1400°C 750 to 2500°C 600 to 1600°C 550 to 2000°C 650 to 1800°C 700 to 3500°C	250 to 1000°C 400 to 2300°C 300 to 1300°C 250 to 1400°C 350 to 1800°C	600 to 2520°C 850 to 2520°C 600 to 3000°C	200 to 1020°C 250 to 1400°C
Spectral Range	Ch. 1: 0.8 µm Ch. 2: 1.05 µm	Ch. 1: 0.8 µm Ch. 2: 1.05 µm	Ch. 1: 1.52 µm (MB 22: 1.28 µm) Ch. 2: 1.64 µm (MB 22: 1.65 µm)	0.7 to 1.1 µm	1.45 to 1.8 µm	0.94 µm (600 to 2520 / 3000°C) 0.65 µm (850 to 2520°C)"	1.57 µm
Measurement Uncertainty	< 1500°C: 0.4% oR + 1°C > 1500°C: 0.6% oR + 1°C	< 1500°C: 0.4% oR + 1°C > 1500°C: 0.6% oR + 1°C	< 1500°C: 0.5% oR + 1°C > 1500°C: 0.7% oR + 1°C	< 1500°C: 0.3% oR + 1°C > 1500°C: 0.5% oR	< 1500°C: 0.3% oR + 1°C > 1500°C: 0.5% oR	< 1500°C: 0.15% oR + 1°C 1500 to 2700°C: 0.25% oR > 2700°C: 0.35% oR	< 1500°C: 0.15% oR + 1°C 1500 to 2700°C: 0.25% oR > 2700°C: 0.35% oR
Repeatability	0.2% oR + 1°C	0.2% oR + 1°C	0.3% oR + 1°C	0.1% oR + 1°C	0.1% oR + 1°C	1°C	1°C
Optics	3 optical heads: Optics I: 3 fixed distances Optics II: 4 fixed distances Optics II: 6 focusable optics	5 fixed optics: lines shaped spot (5% or 12% of distance) a = 340 mm a = 500 mm a = 750 mm a = 1000 mm a = 2000 mm	3 optical heads: Optics I: 3 fixed distances Optics II: 4 fixed distances Optics II: 6 focusable optics	6 fixed optics: 3 focusable optics: a = 80 mm 277 to 533 mm a = 160 mm 388 to 1170 mm a = 250 mm 550 to 9500 mm a = 660 mm a = 1300 mm a = 5600 mm	6 fixed optics: 3 focusable optics: a = 80 mm 279 to 520 mm a = 160 mm 390 to 1190 mm a = 250 mm 550 to 5600 mm a = 660 mm a = 1300 mm a = 5600 mm	3 focusable optics: 275 to 520 mm 385 to 1125 mm 540 to 9000 mm	3 focusable optics: 275 to 520 mm 385 to 1125 mm 540 to 9000 mm
Field of View (Min spot size Ø in mm)	Optics I: 100:1 (2.2 mm) Optics II: min 200:1 (0.45 mm)	min 210:1 (1.6 mm)	Optics I: 100:1 (2.2 mm) Optics II: min 200:1 (0.45 mm)	Fixed Optics: min 900:1 (0.1 mm) Focusable Optics: min 900:1 (0.4 mm)	Fixed Optics: min 900:1 (0.1 mm) Focusable Optics: min 900:1 (0.4 mm)	400:1 (0.7 mm)	250:1 (1.1 mm)
Alignment	Laser targeting	Laser targeting	Laser targeting	Through lens sighting and laser targeting	Through lens sighting and laser targeting	Through lens sighting and laser targeting	Through lens sighting and laser targeting
Exposure time t_{90}	2 ms, adjustable up to 10 s	2 ms, adjustable up to 10 s	2 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	< 1 ms, adjustable up to 10 s
Output	0/4 to 20 mA, RS232 or RS485 (switchable)	0/4 to 20 mA, RS232 or RS485 (switchable)	0/4 to 20 mA, RS232 or RS485 (switchable)	0/4 to 20 mA, RS232 or RS485 (switchable)	0/4 to 20 mA, RS232 or RS485 (switchable)	0/4 to 20 mA, RS232 or RS485 (switchable)	0/4 to 20 mA, RS232 or RS485 (switchable)

METALS

TYPICAL SPECTRAL RANGES



FEATURED PRODUCT

SERIES 140 WITH PROFIBUS, PROFINET, OR ETHERNET INTERFACE

—

Next to the standard interfaces RS232 and RS485, the IS 140, IGA 140, and IGA 140/23 pyrometers are also available with internal Profibus, Profinet, or Ethernet interface.

Easy integration into existing Profibus or Profinet systems or into the existing local network.

- PB types are equipped with a Profibus-DP interface
- PN types are equipped with a Profinet interface
- ET types are equipped with an Ethernet interface



SERIES 50



Model	IS 50-LO plus	IS 50/055-LO plus	IS 50/067-LO plus	IGA 50-LO plus	ISR 50-LO
Brief Description	Very fast, digital fiber optic pyrometer. Different optical heads available, very small spot sizes. Laser targeting light, display, and buttons for instrument settings.	Special version of the IS 50-LO plus with extremely short wavelength for metal measurements with high emissivity and little dependency on emissivity variations.	Special version of the IS 50-LO plus with extremely short wavelength for metal measurements with high emissivity and little dependency on emissivity variations.	Very fast, digital fiber optic pyrometer. Different optical heads available, very small spot sizes. Laser targeting light, display, and buttons for instrument settings.	Digital, fast fiber optic pyrometer in 2-color design (switchable to mono mode). Analog output, digital interface, maximum value storage. Small spot sizes.
Temperature Ranges	550 to 1400°C 600 to 2000°C 600 to 1600°C 750 to 2500°C 550 to 1800°C 900 to 3300°C 650 to 1800°C	1000 to 2300°C	1100 to 3500°C	300 to 1300°C 450 to 2500°C 250 to 1350°C 350 to 2500°C 350 to 1800°C 300 to 2000°C	600 to 1400°C 700 to 1800°C 800 to 2500°C 1000 to 3000°C
Spectral Range	0.7 to 1.1 µm	0.55 µm	0.676 µm	1.45 to 1.8 µm	Ch. 1: 0.9 µm Ch. 2: 1.05 µm
Measurement Uncertainty	< 1500°C: 0.3% oR + 1°C > 1500°C: 0.5% oR	< 1500°C: 0.3% oR+1°C > 1500°C: 0.5% oR	< 1500°C: 0.3% oR+1°C > 1500°C: 0.5% oR	< 1500°C: 0.3% oR+1°C > 1500°C: 0.5% oR	< 1500°C: 0.5% oR + 2°C > 1500°C: 1% oR
Repeatability	0.1% oR + 1°C	0.1% oR + 1°C	0.1% oR + 1°C	0.1% oR + 1°C	0.2% oR + 2°C
Optics	3 optical heads: Optics I: 3 fixed distances Optics II: 4 fixed distances Optics II: 6 focusable optics	3 optical heads: Optics I: 3 fixed distances Optics II: 4 fixed distances Optics II: 6 focusable optics	3 optical heads: Optics I: 3 fixed distances Optics II: 4 fixed distances Optics II: 6 focusable optics	3 optical heads: Optics I: 3 fixed distances Optics II: 4 fixed distances Optics II: 6 focusable optics	4 fixed optics: a = 340 mm a = 600 mm a = 1000 mm a = 4500 mm
Field of View (Min spot size Ø in mm)	Optics I: 100:1 (1.2 mm) Optics II: min 200:1 (0.45 mm)	Optics I: 100:1 (1.2 mm) Optics II: min 200:1 (0.45 mm)	Optics I: 100:1 (1.2 mm) Optics II: min 200:1 (0.45 mm)	Optics I: 100:1 (1.2 mm) Optics II: min 200:1 (0.45 mm)	min 200:1 (min 1.7 mm)
Alignment	Laser targeting	Laser targeting	Laser targeting	Laser targeting	—
Exposure time t_{90}	< 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	10 ms, adjustable up to 10 s
Output	0/4 to 20 mA, RS232 or RS485 (switchable)	0/4 to 20 mA, RS232 or RS485 (switchable)	0/4 to 20 mA, RS232 or RS485 (switchable)	0/4 to 20 mA, RS232 or RS485 (switchable)	0/4 to 20 mA, RS232 or RS485 (switchable)

SERIES 140



	IS 140	IS 140/055	IS 140/067	IS 140 Forging	IGA 140
Brief Description	Fully digital, very fast pyrometer. Very small spot sizes, focusable optics. Display, buttons for instrument settings, analog output, digital interface, maximum value storage.	Special version of the IS 140 with extremely short wavelength for measurements of metals with high emissivity and little dependency on emissivity variations.	Special version of the IS 140 with extremely short wavelength for measurements of metals with high emissivity and little dependency on emissivity variations.	Special version of the IS 140 for measurement of Forging processes.	Fully digital, very fast pyrometer. Very small spot sizes, focusable optics. Display, buttons for instrument settings, analog output, digital interface, maximum value storage.
Temperature Ranges	550 to 1400°C 900 to 3300°C 600 to 1600°C 550 to 1800°C 650 to 1800°C 750 to 3500°C 750 to 2500°C	1000 to 2000°C	1100 to 3500°C	650 to 1800°C	300 to 1300°C 250 to 1350°C 350 to 1800°C 300 to 2000°C 450 to 2500°C 350 to 2500°C 220 to 1500°C 300 to 3000°C
Spectral Range	0.7 to 1.1 µm	0.55 µm	0.676 µm	0.7 to 1.1 µm	1.45 to 1.8 µm
Measurement Uncertainty	< 1500°C: 0.3% oR + 1°C > 1500°C: 0.5% oR	< 1500°C: 0.3% oR + 1°C > 1500°C: 0.5% oR	< 1500°C: 0.3% oR+1°C > 1500°C: 0.5% oR	< 1500°C: 0.3% oR+1°C > 1500°C: 0.5% oR	< 1500°C: 0.3% oR + 1°C > 1500°C: 0.5% oR
Repeatability	0.1% oR + 1°C	0.1% oR + 1°C	0.1% oR + 1°C	0.1% oR + 1°C	0.1% oR + 1°C
Optics	3 focusable optics: a = 130 to 200 mm a = 190 to 420 mm a = 340 to 4000 mm	3 focusable optics: a = 130 to 200 mm a = 190 to 420 mm a = 340 to 4000 mm	3 focusable optics: a = 130 to 200 mm a = 190 to 420 mm a = 340 to 4000 mm	1 fixed optics: a = 660 mm	3 focusable optics: a = 130 to 200 mm a = 190 to 420 mm a = 340 to 4000 mm
Field of View (Min spot size Ø in mm)	min 380:1 (min 0.35 mm)	min 380:1 (min 0.35 mm)	min 380:1 (min 0.35 mm)	330:1 (min 2 mm)	min 380:1 (min 0.35 mm)
Alignment	Laser targeting or through lens sighting	Laser targeting	Through lens sighting	Laser targeting	Laser targeting or through lens sighting
Exposure time t_{90}	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	1 ms, adjustable up to 10 s
Output	0/4 to 20 mA,RS232/RS485 (switchable). Opt. Profibus, Profinet, or Ethernet	0/4 to 20 mA, RS232/ RS485 (switchable)	0/4 to 20 mA, RS232/ RS485 (switchable)	0/4 to 20 mA, RS232/ RS485 (switchable)	0/4 to 20 mA, RS232/RS485 (switchable), Opt. Profibus, Profinet, or Ethernet

METALS

SOFTWARE

TQCS: TEMPERATURE QUALITY CONTROL SYSTEM

—

Complete recording and archiving of process temperatures.

- Central, order-related, and manipulation-safe temperature recording for every single work piece—simultaneously on up to 30 machines
- Connects easily to existing machine controllers
- Reliable identification and discharge of scrap
- Modular system for easy upgrade or retrofit



FEATURED PRODUCT

SERIES 320

—

Small and fast digital pyrometers in various versions.

- Small housing dimensions for easy installation, suitable for use in confined spaces
- LED targeting light
- RS485 interface for long transmission networks for connection to a PC via USB converter or machine control (PLC)
- Analog output adjustable to 0 or 4 to 20 mA for connection of standard analyzing instruments
- Internal digital signal processing for high accuracy
- Series includes versions with fiber optics and ratio pyrometer versions



SERIES 140 CONTINUED







Model	IGA 140/23	IPE 140	IPE 140/39
Brief Description	Fully digital, very fast pyrometer for measurement of low temperatures on metals. Very small spot sizes, focusable optics. Display, setting keys, max. value storage. Analog output, digital interface.	Fully digital, very fast pyrometer for measurements of low temperatures on metals. View finder or laser targeting light, small spot sizes, focusable optics. Analog output, digital interface.	Special version of the IPE 140 for measurement of objects in flame heated furnaces, sees through clean combustion flames and hot gases.
Temperature Ranges	50 to 700°C 75 to 900°C 100 to 1300°C 150 to 1800°C	5 to 500°C 30 to 1000°C 50 to 1200°C	20 to 700°C 75 to 1200°C 300 to 1450°C 200 to 1800°C
Spectral Range	2 to 2.6 µm	3 to 5 µm	3.9 µm
Measurement Uncertainty	< 400°C: 2°C 400 to 1500°C: 0.3% oR + 2°C > 1500°C: 0.5% oR	< 400°C: 2.5°C > 400°C: 0.4% oR +1°C	< 400°C: 2.5°C > 400°C: 0.4% oR +1°C
Repeatability	0.1% oR + 1°C	0.1% oR + 1°C	0.1% oR + 1°C
Optics	3 focusable optics: a = 105 to 150 mm a = 190 to 440 mm a = 320 to 4300 mm	4 focusable optics: a = 71 to 90 mm a = 105 to 150 mm a = 200 to 440 mm a = 345 to 4300 mm	3 focusable optics: a = 105 to 150 mm a = 200 to 440 mm a = 345 to 4300 mm
Field of View (Min spot size Ø in mm)	min 340:1 (min 0.5 mm)	min 150:1 (min 0.9 mm)	min 200:1 (min 0.7 mm)
Alignment	Laser targeting or Through lens sighting	Laser targeting or Through lens sighting	Laser targeting or Through lens sighting
Exposure time t_{90}	1.5 ms, adjustable up to 10 s	1.5 ms, adjustable up to 10 s	1.5 ms, adjustable up to 10 s
Output	0/4 to 20 mA, RS232/RS485, Optional: -PB, -PN or -ET	0/4 to 20 mA, RS232/ RS485 (switchable)	0/4 to 20 mA, RS232/ RS485 (switchable)

SERIES 210





Model	IS 210	IGA 210, IGA 210-L
Brief Description	Fast high temperature 2-wire digital pyrometer with analog output, service interface (for programming emissivity, response time and temperature range), and LED targeting light.	Fast medium temperature digital pyrometers in 2-wire design with analog output, service interface (for programming emissivity, response time and temperature range), and LED targeting light.
Temperature Ranges	650 to 1800°C 800 to 2500°C	300 to 1300°C 350 to 1800°C
Spectral Range	0.8 to 1.1 µm	1.45 to 1.8 µm
Measurement Uncertainty	0.5% oR + 1°C	0.5% oR + 1°C
Repeatability	0.1% oR + 1°C	0.1% oR + 1°C
Optics	3 fixed optics: a = 600 mm a = 1000 mm a = 1500 mm	IGA 210: 3 fixed optics: a = 600 mm a = 1000 mm a = 1500 mm IGA 210-L: 3 fixed optics: a = 300 mm a = 350 mm a = 500 mm
Field of View (Min spot size Ø in mm)	min 240:1 (2.5 mm)	min 175:1 (1.8 mm)
Alignment	LED targeting light	LED targeting light
Exposure time t_{90}	20 ms, adjustable up to 10 s	20 ms, adjustable up to 10 s
Output	4 to 20 mA	4 to 20 mA

SERIES 310





Model	IS 310	IGA 310
Brief Description	Good value, small, fast, high temperature 2-wire pyrometer with fixed focus, adjustable emissivity, and LED targeting light.	Good value, small, fast, medium temperature 2-wire pyrometer with fixed focus, adjustable emissivity, and LED targeting light.
Temperature Ranges	650 to 1800°C 800 to 2300°C 1100 to 2500°C	300 to 1300°C 500 to 1500°C
Spectral Range	0.8 to 1.1 µm	1.45 to 1.8 µm
Measurement Uncertainty	< 1500°C: 0.8% oR + 1°C > 1500°C: 1% oR + 1°C	0.8% oR + 1°C
Repeatability	0.3% oR	0.3% oR
Optics	3 fixed optics: a = 250 mm a = 600 mm a = 1400 mm	3 fixed optics: a = 250 mm a = 600 mm a = 1400 mm
Field of View (Min spot size Ø in mm)	min 310:1 (1 mm)	min 155:1 (2 mm)
Alignment	LED targeting light	LED targeting light
Exposure time t_{90}	10 ms	10 ms
Output	4 to 20 mA	4 to 20 mA

SERIES 320







Model	IS 320	IGA 320	IGA 320/23
Brief Description	Small and very fast digital pyrometer with fixed focus and LED targeting light.	Small and very fast digital pyrometer with fixed focus and LED targeting light.	Low temperature version of the IGA 320 for temperature measurement on metals starting at 75°C.
Temperature Ranges	550 to 1400°C 600 to 1600°C 650 to 1800°C	300 to 1300°C 350 to 1650°C 400 to 1800°C	75 to 550°C 100 to 700°C 150 to 1200°C 200 to 1800°C
Spectral Range	0.8 to 1.1 µm	1.45 to 1.8 µm	2 to 2.6 µm
Measurement Uncertainty	< 1500°C: 0.3% oR + 1°C > 1500°C: 0.5% oR	< 1500°C: 0.3% oR + 1°C > 1500°C: 0.5% oR	< 400°C: 2°C 400 to 1500°C: 0.3% oR + 1°C > 1500°C: 0.5% oR
Repeatability	0.2% oR + 1°C	0.2% oR + 1°C	0.1% oR + 1°C
Optics	3 fixed optics: a = 250 mm a = 600 mm a = 1400 mm	3 fixed optics: a = 250 mm a = 600 mm a = 1400 mm	2 fixed optics: a = 250 mm a = 800 mm
Field of View (Min spot size Ø in mm)	min 200:1 (1.3 mm)	min 230:1 (1.2 mm)	min 200:1 (0.25 mm)
Alignment	LED targeting light	LED targeting light	LED targeting light
Exposure time t_{90}	2 ms, adjustable up to 10 s	2 ms, adjustable up to 10 s	2 ms, adjustable up to 10 s
Output	0/4 to 20 mA, RS485	0/4 to 20 mA, RS485	0/4 to 20 mA, RS485

METALS

FEATURED PRODUCT

HIGH SPEED SERIES 740

—

The High Speed Series 740 offers ultra fast pyrometers with targeting light, very small spot sizes, and variable or fixed optics with an optional view finder.

- Extremely fast response time of only 6 µs for measurements of fast moving objects or fast temperature changes.
- Models are also available as measuring stations including bench unit, display, power supply, USB interface, cables, etc.



FEATURED PRODUCT

INFRARED TEMPERATURE SWITCHES

—

Infrared temperature switches recognize hot objects (without contact) to trigger a switch process.

The switching level can be adjusted and the switch status is indicated by LED. Switches are used for recognizing, counting, or positioning hot objects, e.g. in forges or steel works.



SERIES 320 CONTINUED

HIGHSPEED SERIES

M67S

TEMPERATURE SWITCHES





















Model	IGA 320/23-LO	ISR 320	IGAR 320	IGA & IMGA 740	IGA & IMGA 740-LO
Brief Description	Small, short wavelength digital pyrometer with fiber optics for temperature measurement on metals starting at 85°C.	Small, good value, stationary ratio pyrometer with LED targeting light.	Small, good value, stationary ratio pyrometer with LED targeting light.	Ultra fast pyrometer for high speed applications with targeting light, very small spot sizes, and variable or fixed optics. Option: view finder. IMGA 740: Measuring station version.	Ultra fast pyrometer for high speed applications with fiber optics, targeting light, small spot sizes, and various optical heads. IMGA 740-LO: Measuring station version.
Temperature Ranges	85 to 600°C 100 to 700°C 150 to 1200°C	700 to 1700°C	300 to 1300°C	160 to 1000°C 300 to 1400°C 300 to 2300°C 500 to 2500°C	200 to 1000°C 300 to 1400°C 300 to 2300°C 500 to 2500°C
Spectral Range	2 to 2.6 µm	Ch. 1: 0.9 µm Ch. 2: 1.05 µm	Ch. 1: 1.5 to 1.6 µm Ch. 2: 2.0 to 2.5 µm	MB 10: 1.58 to 2.2 µm, MB 23: 2 to 2.2 µm, MB 14 + 25: 1.58 to 1.8 µm	
Measurement Uncertainty	< 400°C: 2°C > 400°C: 0.3% oR + 1°C	< 1300°C: 0.5% oR + 1°C > 1300°C: 1% oR	0.6% oR + 2°C	0.75% oR	0.75% oR
Repeatability	0.1% oR + 1°C	0.2% oR + 2°C	0.3% oR + 2°C	0.3% oR	0.3% oR
Optics	3 optical heads: Optics I: 3 fixed distances Optics II: 4 fixed distances Optics II: 6 focusable optics	2 fixed optics: a = 300 mm a = 800 mm	2 fixed optics: a = 300 mm a = 800 mm	1 focusable optics: a = 450 to 3000 mm or Macro optics	2 standard optical heads and 8 special optical heads with dedicated distance to spot ratio available
Field of View (Min spot size Ø in mm)	Optics I: 90:1 (1.3 mm) Optics II: min 180:1 (0.5 mm)	min 100:1 (3 mm)	min. 100:1 (3 mm)	Focusable optics: min 180:1 (2.5 mm), Macro optics: min 290:1 (0.7 mm)	Standard: min 70:1 (1.6 mm) Special: min 280:1 (0.3 mm)
Alignment	LED targeting light	LED targeting light and LEDs for intensity alignment	LED targeting light and LEDs for intensity alignment	LED targeting light or Through lens sighting	LED targeting light
Exposure time t_{90}	2 ms, adjustable up to 10 s	10 ms, adjsutable to 10 s	10 ms, adjustable up to 10 s	t_{90}: 6 µs via voltage output, 9 µs via current output	t_{90}: 6 µs via voltage output, 9 µs via current output
Output	0/4 to 20 mA, RS485	0/4 to 20 mA, RS485	0/4 to 20 mA, RS485	0/4 to 20 mA, 0 to 10 V	0/4 to 20 mA, 0 to 10 V

Model	M67S 0.78 to 1.06 µm	M67S 1 to 1.6 µm	M67S 3.86 µm	KTS 218	KTG 218
Brief Description	Analog 2-wire pyrometer with view finder and focusable optics, for high temperature applications.	Analog 2-wire pyrometer with view finder and focusable optics, for mid / high temperature applications.	Special version of M67S for measurement of objects in flame heated furnaces, sees through clean combustion flames and hot gases.	Infrared temperature switch. Recognizes hot objects located in its measuring beam without contact and triggers a switch process.	Infrared temperature switch. Recognizes hot objects located in its measuring beam without contact and triggers a switch process.
Temperature Ranges	525 to 800°C 900 to 1600°C 600 to 900°C 1100 to 2000°C 650 to 1000°C 1500 to 3000°C 800 to 1300°C	220 to 400°C 300 to 600°C 400 to 800°C 500 to 1100°C	300 to 1000°C 450 to 1450°C 600 to 1750°C	700 to 1500°C	400 to 1400°C
Spectral Range	0.78 to 1.06 µm	1 to 1.6 µm	3.86 µm	0.85 to 1.05 µm	0.85 to 1.8 µm
Measurement Uncertainty	±0.5% of full scale or 1°C	±0.5% of full scale or 1°C	±0.5% of full scale or 1°C	0.75% oR	0.75% oR
Repeatability	±0.2% of full scale span	±0.2% of full scale span	±0.2% of full scale span	0.3% oR	0.3% oR
Optics	2 focusable optics: 350 mm to ∞ 150 to 350 mm	2 focusable optics: 350 mm to ∞ 150 to 350 mm	1 focusable optics: 350 mm to ∞	10 fixed: a = 170 mm a = 1000 mm a = 220 mm a = 1400 mm a = 400 mm a = 1600 mm a = 600 mm a = 1800 mm a = 800 mm a = 2000 mm	10 fixed: a = 170 mm a = 1000 mm a = 220 mm a = 1400 mm a = 400 mm a = 1600 mm a = 600 mm a = 1800 mm a = 800 mm a = 2000 mm
Field of View (Min spot size Ø in mm)	min 180:1 (1.8 mm)	min 90:1 (1.8 mm)	min 30:1 (11.9 mm)	min 85:1 (2.5 mm)	min 85:1 (2.5 mm)
Alignment	Through lens sighting	Through lens sighting	Through lens sighting	LED targeting light	LED targeting light
Exposure time t_{90}	50 ms	50 ms	100 ms	Switch time: 600 µs	Switch time: 600 µs
Output	4 to 20 mA	4 to 20 mA	4 to 20 mA	Switch output 20 V, max. 30 mA	Switch output 20 V, max. 30 mA

NON-CONTACT TEMPERATURE MEASUREMENT

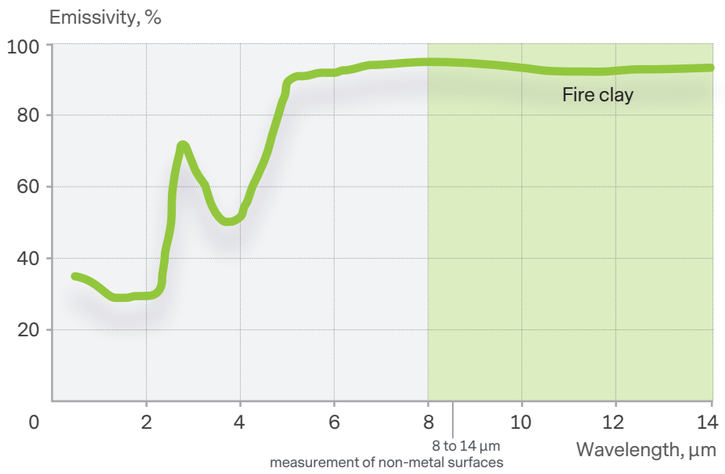
NON-METALLIC SURFACES

THE GROUP OF NON-METALS INCLUDES ORGANIC AND INORGANIC MATERIALS.

EMISSIVITY OF NON-METALLIC SURFACES

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.



ADVANCED ENERGY SERVICE AND SUPPORT

The mission of the Advanced Energy services organization is to keep you focused on your business by delivering world-class customer support.

This means keeping your assets reliable and functioning, and providing you with the knowledge and expertise required to solve complex problems quickly.

The Advanced Energy service portfolio is organized into four major areas:

- Factory Services
- Support Services
- Field Services
- Training and Consulting



SERIES 5






Model	IN 5	IN 5 plus	IN 5-H plus	IN 5-L plus
Brief Description	2-wire pyrometer with 3 fixed optics and analog output for general applications.	Digital pyrometer for general applications. With analog output, digital interface, max. / min value storage, adjustable measuring range, different optics, laser targeting light.	Like the IN 5 plus but with faster response time.	Like the IN 5 plus but with better optical performance (field of view).
Temperature Ranges	-32 to 50°C 0 to 400°C 0 to 100°C 0 to 500°C 0 to 200°C -32 to 900°C 0 to 300°C 0 to 900°C	-32 to 900°C	-32 to 900°C	0 to 900°C
Spectral Range	8 to 14 µm	8 to 14 µm	8 to 14 µm	8 to 14 µm
Measurement Uncertainty	-32 to 0°C: 1.5°C 0 to 300°C: 0.6% oR or 1°C 300 to 900°C: 1% oR	-32 to 0°C: 1.5°C 0 to 300°C: 0.6% oR or 1°C 300 to 900°C: 1% oR	-32 to 0°C: 3°C 0 to 300°C: 0.6% oR or 1.5°C 300 to 900°C: 1% oR	0 to 300°C: 0.6% oR or 2°C 300 to 900°C: 1% oR
Repeatability	0.3% oR or 0.6°C	0.3% oR or 0.6°C	0.3% oR or 0.6°C	0.3% oR or 0.6°C
Optics	3 fixed optics: a = 100 mm a = 300 mm a = 800 mm	3 fixed optics: a = 100 mm a = 300 mm a = 800 mm	3 fixed optics: a = 100 mm a = 300 mm a = 800 mm	3 fixed optics: a = 100 mm a = 300 mm a = 800 mm
Field of View (Min spot size Ø in mm)	50:1 (2 mm)	50:1 (2 mm)	50:1 (2 mm)	100:1 (1 mm)
Alignment	—	Laser targeting	Laser targeting	Laser targeting
Exposure time t_{90}	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
Output	4 to 20 mA	0/4 to 20 mA, RS232 or RS485	0/4 to 20 mA, RS232 or RS485	0/4 to 20 mA, RS232 or RS485

NON-METALS

SOFTWARE

SOFTWARE INFRAWIN

—

Easy to use measurement and evaluation software for remote configuration of fixed digital Impac pyrometers.

Freeware. Configure pyrometer settings via computer. Connect up to two pyrometers at the same time. Display temperature data as color bars and online graphics. Capture downstream evaluations as tables, graphics, or text files. Calculate spot sizes for different measuring distances, etc.



COMPREHENSIVE PYROMETER ACCESSORIES

—

Advanced Energy provides an extensive portfolio of mechanical and electrical accessories for all types of pyrometers as well as an offering of various Pyrometer Software.

The mechanical accessories e.g. include: cooling jackets, mounting devices, flange systems, laser aiming lights, air purge units, sighting tubes, optical components, etc.

The electrical accessories e.g include: power supplies, controllers, connection cables, indicators/displays, converters, protocol converters, I/O modules, scanning systems, etc.



SERIES 140, 210, 300





Model	IPE 140/34	IN 210
Brief Description	Special version of the IPE 140 for measurement of thin PE and PP foils with a minimum material thickness of only 30 µm.	Digital pyrometer with analog output (2-wire design) and service interface (for programming emissivity, response time, and temperature range).
Temperature Ranges	50 to 400°C 75 to 500°C	-32 to 900°C
Spectral Range	3.43 µm	8 to 14 µm
Measurement Uncertainty	< 400°C: 2.5°C > 400°C: 0.4% oR +1°C	1% oR + 1°C
Repeatability	0.1% oR + 1°C	0.5% oR + 1°C
Optics	3 focusable optics: a = 100 to 142 mm a = 185 to 390 mm a = 305 to 1900 mm	3 fixed optics: a = 100 mm a = 300 mm a = 800 mm
Field of View (Min spot size Ø in mm)	min 50:1 (min 2.1 mm)	min 50:1 (2 mm)
Alignment	Laser targeting or Through lens sighting	—
Exposure time t_{90}	1.5 ms, adjustable up to 10 s	120 ms, adjustable up to 10 s
Output	0/4 to 20 mA, RS232/ RS485 (switchable)	4 to 20 mA





SERIES 500

IN 300	IN 510, IN 510-N
Good value, small 2-wire pyrometer with fixed focus, adjustable emissivity, and easy installation.	Digital pyrometers with separate miniature sensor head. Sensor head / cable usable in ambient temperatures without cooling up to 85°C.
0 to 100°C 0 to 500°C 0 to 200°C 0 to 600°C -20 to 300°C	-40 to 700°C
8 to 14 µm	8 to 14 µm
1.5% of measuring range	< -20°C: 3°C -20 to 0°C: 2°C > 0°C: 0.8% oR or 1°C
1% of measuring range	0.5% oR or 0.5°C
1 fixed optics a = 300 mm	2 fixed optics (FOV 2:1 or 10:1)
min 15:1	2:1 or 10:1
—	—
300 ms	180 ms, adjustable up to 30 s
4 to 20 mA	0/4 to 20 mA, 0 to 5 V or thermocouple J / K, RS232 / RS485 (switchable)





SERIES 2000, 3000



M67S



IN 520, IN 520-N	IN 2000	IN 3000	M67S 8 to 14 µm
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.	Small, good value, simple sensor, different linear measuring outputs are available.	Small, good value, simple sensor, different linear measuring outputs are available.	Analog 2-wire pyrometer with view finder for general purpose and low temperature applications with high emissivity.
-40 to 700°C	-32 to 900°C	0 to 120°C 0 to 300°C 100 to 500°C	0 to 100°C 0 to 300°C 0 to 500°C 100 to 1000°C
8 to 14 µm	8 to 14 µm	8 to 14 µm	8 to 14 µm
< -20°C: 3°C -20 to 0°C: 2°C > 0°C: 0.8% oR or 1°C	T_{amb} 15 to 40°C: 1% oR + 1°C other T_{amb}: 1.4% oR + 1°C	1.5% oR or 2.5°C	±0.5% of full scale or 1°C
0.5% oR or 0.5°C	0.3% oR	1% oR or 1°C	±0.2% of full scale span
2 fixed optics (FOV 2:1 or 10:1)	1 fixed optics a = 50 mm	1 fixed optics a = 50 mm	1 focusable optics: 350 mm to ∞ 1 fixed optics a = 50 mm
2:1 or 10:1	min 10:1 (5 mm)	min 10:1 (5 mm)	Focusable optics: min 30:1 (11.9 mm) Fixed: min 30:1 (1.5 mm)
—	—	—	Through lens sighting
180 ms, adjustable up to 30 s	95 ms, adjustable up to 120 s	300 ms	100 ms
0/4 to 20 mA, 0 to 5 V or thermocouple J / K, RS232 / RS485 (switchable)	4 to 20 mA, digital output for USB adapter	10 mV /°C or thermocouple J / K	4 to 20 mA

NON-CONTACT TEMPERATURE MEASUREMENT

GLASS SURFACES

PYROMETERS FOR MOLTEN GLASS, FLAT GLASS, CONTAINER GLASS, TECHNICAL GLASS, ETC.

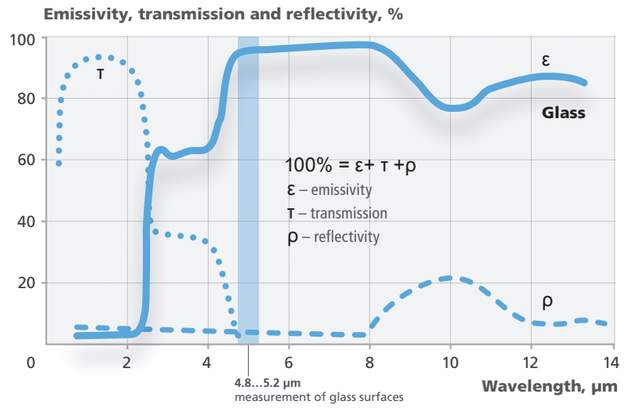
EMISSIVITY OF GLASS SURFACES

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 µm), which means that its transmission is high, and consequently its emissivity 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 µm, because glass has a wide absorption band in this spectral range. Above 8 µm the reflection 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 µm (for glass thicknesses of 1 mm and more at medium to high temperatures), or 7.75 µm (for glass thicknesses below 1 mm and low to medium temperatures).



TYPICAL WAVELENGTHS USED IN THE GLASS INDUSTRY

—

Depending on the application, Glass manufacturers may use different wavelengths to measure the glass surface or even inside the glass.

0.78 to 1.15 µm e.g. for molten glass or refractory in melting furnace, forehearth, feeder, glass gobs, etc. (penetration depth into glass: up to approx. 40 mm)

3.9 µm for measurement through flames, e.g. in heating zone of tin bath (slight penetration into glass)

5.14 µm for glass surfaces

7.8 µm for ultra-thin glass sheets (< 1 mm)



SERIES 5






Model	IN 5/5	IN 5/5 plus	IN 5/5-H plus	IN 5/5-L plus
Brief Description	2-wire pyrometer for glass surface measurement.	Digital pyrometer for glass surface measurement. With analog output, digital interface, max./min value storage, adjust. sub-range, laser targeting light.	Like IN 5/5 plus but with faster response time.	Like IN 5/5 plus but with better optical performance (field of view).
Temperature Ranges	100 to 600°C 200 to 800°C 100 to 1300°C 400 to 2500°C	100 to 1300°C 400 to 2500°C"	200 to 1300°C 400 to 2500°C	200 to 1300°C 400 to 2500°C
Spectral Range	5.14 µm	5.14 µm	5.14 µm	5.14 µm
Measurement Uncertainty	<1300°C: 0.6% oR or 2°C 1300 to 1800°C: 0.8% oR >1800°C: 1% oR	<1300°C: 0.6% oR or 2°C 1300 to 1800°C: 0.8% oR >1800°C: 1% oR	<1300°C: 0.6% oR or 2°C 1300 to 1800°C: 0.8% oR >1800°C: 1% oR	< 1300°C: 0.8% oR or 2°C 1300 to 1800°C: 0.8% oR > 1800°C: 1% oR
Repeatability	0.3% oR or 0.6°C	0.3% oR or 0.6°C	0.3% oR or 0.6°C	0.3% oR or 0.6°C
Optics	3 fixed optics: a = 100 mm a = 300 mm a = 1200 mm	3 fixed optics: a = 100 mm a = 300 mm a = 1200 mm	3 fixed optics: a = 100 mm a = 300 mm a = 1200 mm	3 fixed optics: a = 105 mm a = 370 mm a = 800 mm
Field of View (Min spot size Ø in mm)	50:1 (2.5 mm)	50:1 (2.5 mm)	50:1 (2.5 mm)	100:1 (1.1 mm)
Alignment	—	Laser targeting	Laser targeting	Laser targeting
Exposure time t_{90}	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
Output	4 to 20 mA	0/4 to 20 mA, RS232 or RS485	0/4 to 20 mA, RS232 or RS485	0/4 to 20 mA, RS232 or RS485

GLASS

FEATURED PRODUCT

IN 6/78

Pyrometer for stress-free production of thin and thinnest glass sheets.

- Measurement of ultra-thin glass sheets with less than 1 mm thickness
- Easy installation and maintenance due to compact, rugged IP65 stainless steel housing for harsh environments
- Multiple onboard digital and analog interfaces for direct and fast PLC communication
- Specially designed and coated high-end optics for high accuracy and excellent size of source effects



DID YOU KNOW?

Careful monitoring of glass temperatures and of production equipment and machinery is the only way to ensure that product quality will meet the stringent marketplace requirements.

Advanced Energy offers more than 55 years of experience in non-contact measuring technology

The primary advantages of non-contact temperature measurements are:

- Easy handling
- Fast response
- High flexibility
- Prolonged service lives
- No contamination of the molten glass
- Increased throughput rates

SERIES 6, 50 | SERIES 140 | SERIES 210 | M67S











Model	IN 6/78-L	IN 6/78-H	IS 50-LO/GL	IN 140/5	IN 140/5-H	IN 140/5-L	IN 210/5	M67S 0.78 to 1.06 µm	M67S 4.8 to 5.2 µm
Brief Description	Digital pyrometer for the measurement of ultra-thin glass sheets with less than 1 mm thickness.	Digital pyrometer for the measurement of ultra-thin glass sheets with less than 1 mm thickness.	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. Laser targeting light or through lens view finder. Focusable optics with small spot sizes.	Like IN 140/5 but with faster response time.	Like IN 140/5 but with better optical performance (field of view)	Glass surface measurement version of IN 210, 2-wire design and service interface. Programmable measuring range.	Analog 2-wire pyrometer with view finder for high temperature applications.	Analog 2-wire pyrometer with view finder for measurement of glass surfaces or thin glass.
Temperature Ranges	400 to 1100°C	150 to 800°C	600 to 1800°C	250 to 1400°C 300 to 1600°C 450 to 1500°C 500 to 2500°C	250 to 1400°C 300 to 1600°C 450 to 1500°C 500 to 2500°C	250 to 1400°C 300 to 1600°C 450 to 1500°C 500 to 2500°C	100 to 1200°C	525 to 800°C 900 to 1600°C 600 to 900°C 1100 to 2000°C 650 to 1000°C 1500 to 3000°C 800 to 1300°C	100 to 600°C 300 to 1300°C
Spectral Range	7.8 µm	7.8 µm	0.8 to 1.1 µm	5.14 µm	5.14 µm	5.14 µm	5.14 µm	0.78 to 1.06 µm	4.8 to 5.2 µm
Measurement Uncertainty	0.7% oR or 3.5°C	0.7% oR or 3.5°C	< 1500°C: 0.3% oR + 1°C > 1500°C: 0.5% oR + 1°C	<1300°C: 0.6% oR or 2°C >1300°C: 0.8% oR	<1300°C: 0.6% oR or 2°C >1300°C: 0.8% oR	<1300°C: 0.6% oR or 2°C >1300°C: 0.8% oR	1% oR + 1°C	±0.5% of full scale or 1°C	±0.5% of full scale or 1°C
Repeatability	1°C	1°C	0.1% oR + 1°C	0.3% oR	0.3% oR	0.3% oR + 1°C	0.5% oR + 1°C	±0.2% of full scale span	±0.2% of full scale span
Optics	Fixed optics: a = 370 mm	Fixed optics: a = 350 mm	1 fixed optics	3 focusable optics: a = 100 to 128 mm a = 187 to 322 mm a = 362 to 2170 mm	3 focusable optics: a = 100 to 128 mm a = 187 to 322 mm a = 362 to 2170 mm	1 focusable optics: a = 159 to 235 mm 1 fixed optics: a = 163 mm	3 fixed optics: a = 100 mm a = 300 mm a = 1200 mm	2 focusable optics: 350 mm to ∞ 150 to 350 mm	1 focusable optics: 350 mm to ∞
Field of View (Min spot size Ø in mm)	75:1 (min 5 mm)	50:1 (min 7 mm)	min 110:1 (min 9 mm)	min 150:1 (min 1 mm)	min 150:1 (min 1 mm)	focusable: min 180:1 (min 0.9 mm) fixed: 180:1 (min 0.9 mm)	min 50:1 (2.5 mm)	min 180:1 (1.8 mm)	min 30:1 (11.9 mm)
Alignment	—	—	—	Laser targeting or through lens sighting	Laser targeting or through lens sighting	Laser targeting or through lens sighting	—	Through lens sighting	Through lens sighting
Exposure time t_{90}	80 ms, adjustable up to 30 s	30 ms, adjustable up to 30 s	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	120 ms, adjustable up to 10 s	50 ms	100 ms
Output	0/4 to 20 mA, RS485	0/4 to 20 mA, RS485	4 to 20 mA, RS232	0/4 to 20 mA, RS232/ RS485 (switchable)	0/4 to 20 mA, RS232/ RS485 (switchable)	0/4 to 20 mA, RS232/ RS485 (switchable)	4 to 20 mA	4 to 20 mA	4 to 20 mA

NON-CONTACT TEMPERATURE MEASUREMENT

SPECIAL MATERIALS

PYROMETERS FOR SPECIAL APPLICATIONS AND MATERIALS

EMISSIVITY OF SPECIAL MATERIALS

Advanced Energy 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.

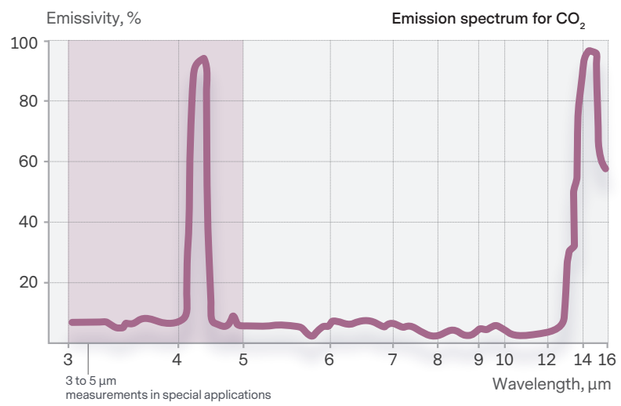
SOME EXAMPLE APPLICATIONS INCLUDE

- Measuring flame or gas temperature, by monitoring the CO_2 absorption line
- Measuring temperature on thin plastic films
- Measuring Silicon and Sapphire wafers in Semiconductor & Compound Semi processes

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_2 content, we select a narrow band filter at 4.5 µm where the emission from this gas is high (see figure).

If we instead choose a 3.9 µm filter, then we can effectively avoid the CO_2 and H_2O 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.



APPLICATION CONSULTING AND SUPPORT

—

Supporting Your Applications Needs

The Advanced Energy Global Applications Engineering team is staffed with Sr. Engineers to help develop new solutions for customers worldwide, with focus on core markets and challenging applications.

Advanced Energy is known for its ability to build products for custom applications using our temperature and gas sensing products to meet the stringent design requirements of the energy, industrial and clean technology markets.

Contact our dedicated Customer Care Team to request an application consultation.

SERIES 5, 6 | **SERIES 12**









Model	IN 5/9 plus	ISR 6 Advanced	IS 12-Al, 12-Al/S	IS 12-Si
Brief Description	Digital pyrometer especially designed for measurement of sapphire. With analog output, digital interface, max/min value storage, different optics, laser targeting light.	Highly accurate digital, fast pyrometer in 2-color design (switchable to mono mode) with analog output and digital interface, focusable optics, and integrated LED display.	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 to 4°, scanning frequency between 0 to 10 Hz.	Dedicated version of the IS 12, designed for measuring silicon wafers.
Temperature Ranges	0 to 1500°C	600 to 1400°C 700 to 1800°C 800 to 2500°C 1000 to 3000°C	350 to 900°C 400 to 1050°C	350 to 1000°C 400 to 900°C 400 to 1300°C 500 to 1800°C
Spectral Range	8 to 9.7 µm	Ch. 1: 0.9 µm Ch. 2: 1.05 µm	Aluminum absorption filter	Silicon absorption filter
Measurement Uncertainty	0.6% oR or 3°C	< 1500°C: 0.3% oR + 2°C > 1500°C: 0.6% oR	0.3% oR + 1°C	< 1500°C: 0.3% oR + 1°C > 1500°C: 0.5% oR
Repeatability	0.3% oR or 0.6°C	0.15% oR + 1°C	0.1% oR + 1°C	0.1% oR + 1°C
Optics	6 fixed optics: a = 95 mm a = 112 mm a = 160 mm a = 280 mm a = 400 mm a = 620 mm	Manually focusable between 210 to 5000 mm	MB 9 5 fixed optics: a = 112 mm a = 240 mm a = 660 mm a = 1300 mm a = 5600 mm MB 10.5 6 fixed optics: a = 80 mm a = 160 mm a = 250 mm a = 660 mm a = 1300 mm a = 5600 mm	6 fixed optics: a = 80 mm a = 120 mm a = 250 mm a = 660 mm a = 1300 mm a = 5600 mm 3 focusable optics: 275 to 520 mm 385 to 1125 mm 540 to 9000 mm
Field of View (Min spot size Ø in mm)	60:1 (1.7 mm)	min 350:1 (min 0.6 mm) Option: line optics	min 120:1 (1.1 mm)	Fixed: min 370:1 (0.6 mm) Focusable: min 130:1 (2.3 mm)
Alignment	Laser targeting	Laser targeting or through lens sighting or color TV camera	Laser targeting and through lens sighting	Laser targeting and through lens sighting
Exposure time t_{90}	180 ms, adjustable up to 30 s	2 ms, adjustable up to 10 s	< 1.5 ms, adjustable up to 10 s	10 ms, adjustable up to 10 s
Output	0/4 to 20 mA, RS232 (RS485 on request)	0/4 to 20 mA, RS485, (RS232 optional)	0/4 to 20 mA, RS232 or RS485 (switchable)	0/4 to 20 mA, RS232 or RS485 (switchable)

SPECIAL MATERIALS

FEATURED PRODUCT

IPE 140

—

Pyrometers available with various dedicated filters for specific applications.

Next to the standard versions, these pyrometers are also available with specific filters to measure dedicated materials, including thin PE and PP foils, CO_2 or the measurement through clean combustion flames and gases.



FEATURED PRODUCT

UV 400 & UVR 400

—

Next generation of temperature sensors developed specifically for GaN-based MOCVD epitaxy processes (metal-organic chemical vapor deposition).

Improve yield through true wafer temperature measurement

Setting new standards for LED production processes (reliable correlation between process temperature and final product wavelength)

Measure temperature directly on the GaN layer using UV wavelength instrumentation

Real time measurement of deposition thickness using a high-speed reflectometer (UVR 400)



SERIES 50





Model	IS 50-Si-LO plus	IS 50-Al-LO plus
Brief Description	Special version of the IS 50-LO plus with special wavelength for the measurement of silicon wafers.	Special version of the IS 50-LO plus with special wavelength for the measurement of Aluminum.
Temperature Ranges	400 to 1300°C 500 to 1600°C	400 to 1000°C
Spectral Range	Narrow band in the near infrared	Narrow band in the near infrared-frared
Measurement Uncertainty	< 1500°C: 0.3% oR+1°C > 1500°C: 0.5% oR	< 1500°C: 0.3% oR+1°C > 1500°C: 0.5% oR
Repeatability	0.1% oR + 1°C	0.1% oR + 1°C
Optics	3 optical heads: Optics I: 3 fixed distances Optics II: 4 fixed distances Optics II: 6 focusable optics	3 optical heads: Optics I: 3 fixed distances Optics II: 4 fixed distances Optics II: 6 focusable optics
Field of View (Min spot size Ø in mm)	Optics I: 100:1 (1.2 mm) Optics II: min 200:1 (0.45 mm)	Optics I: 35:1 (3.3 mm) Optics II: min 85:1 (1.1 mm)
Alignment	Laser targeting	Laser targeting
Exposure time t_{90}	< 1 ms, adjustable up to 10 s	< 1 ms, adjustable up to 10 s
Output	0/4 to 20 mA, RS232 or RS485 (switchable)	0/4 to 20 mA, RS232 or RS485 (switchable)

SERIES 140





Model	IPE 140/34	IPE 140/45
Brief Description	Special version of the IPE 140 for measurement of thin PE and PP foils with a minimum material thickness of only 30 µm.	Special version of the IPE 140 for measurement of combustion flames and hot gases containing CO_2. Used e.g. in the FEGT system for continuous measurement in boilers and furnaces.
Temperature Ranges	50 to 400°C 75 to 500°C	400 to 2000°C
Spectral Range	3.43 µm	CO_2 absorption band for hot CO_2 gases
Measurement Uncertainty	< 400°C: 2.5°C > 400°C: 0.4% oR +1°C	<1300°C: 0.6% oR >1300°C: 0.8% oR
Repeatability	0.1% oR + 1°C	0.1% oR + 1°C
Optics	3 focusable optics: a = 100 to 142 mm a = 185 to 390 mm a = 305 to 1900 mm	3 focusable optics: a = 115 to 170 mm a = 210 to 500 mm a = 360 to 10000 mm
Field of View (Min spot size Ø in mm)	min 50:1 (min 2.1 mm)	min 120:1 (min 1.1)
Alignment	Laser targeting or Through lens sighting	Laser targeting or Through lens sighting
Exposure time t_{90}	1.5 ms, adjustable up to 10 s	1.5 ms, adjustable up to 10 s
Output	0/4 to 20 mA, RS232/ RS485 (switchable)	0/4 to 20 mA, RS232/ RS485 (switchable)

M67S





Model	M67S 7.9 µm	M67S CO_2
Brief Description	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_2.
Temperature Ranges	0 to 300°C 100 to 400°C 150 to 600°C	320 to 1200°C 400 to 1400°C 450 to 1900°C 800 to 2200°C
Spectral Range	7.9 µm	CO_2 hot band
Measurement Uncertainty	±0.5% of full scale or 1°C	±0.5% of full scale or 1°C
Repeatability	±0.2% of full scale span	±0.2% of full scale span
Optics	1 focusable optics: 350 mm to ∞ 1 fixed optics a = 50 mm	2 focusable optics: 350 mm to ∞ 150 to 350 mm
Field of View (Min spot size Ø in mm)	Focusable optics: min 30:1 (11.9 mm) Fixed: min 30:1 (1.5 mm)	min 30:1 (1.8 mm)
Alignment	Through lens sighting	Through lens sighting
Exposure time t_{90}	100 ms	300 ms
Output	4 to 20 mA	4 to 20 mA

SERIES UV 400, 315







Model	UV 400, UVR 400	PhotriX	IGA 315-K
Brief Description	Digital pyrometers with extremely short wavelength 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. Also suitable for measurements on uncoated silicon wafers.	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 pyrometer for non-contact temperature measurement of nozzle bricks and air stages in coking ovens at standard distances between 1 and 12 m.
Temperature Ranges	650 to 1300°C	various ranges between 30 to 2600°C	600 to 1600°C
Spectral Range	383 to 410 nm	0.65 µm, 0.88 µm, 0.9 µm, 1.55 µm, 0.7 to 1.65 µm	1.58 to 1.8 µm
Measurement Uncertainty	< 1000°C: 3°C > 1000°C: 0.3% oR	±1.5°C or 0.15% oR	0.75% oR
Repeatability	0.1% oR + 0.1°C	0.1°C	< 0.3% oR
Optics	fixed optics	Configurable collection optics: Fixed Optics, Lightpipe, or Fiber Optics with fixed optics or Lightpipe	Focusable optics: 1000 to 12000 mm
Field of View (Min spot size Ø in mm)	min 8:1 (9.8)	Optics or lightpipes adapted to customers request (min 0.5 mm)	~ 300:1 (e.g. 30 mm @ 9 m distance)
Alignment	—	—	Through lens sighting
Exposure time t_{90}	Integration Time: Min of 8 ms	1 ms, adjustable up to 60 s	10 ms
Output	0 or 4 to 20 mA, RS485	4 to 20 mA, 0 to 10 V, RS232, RS485	USB Interface adapter

SPECIAL MATERIALS

SEKIDENKO SERIES

—

Designed for Semiconductor and Thin Film Applications

Access field-proven temperature measurement technologies. Advanced Energy's Sekidenko line of optical fiber thermometers delivers real-time measurement via in-situ probes, optimizing process control.

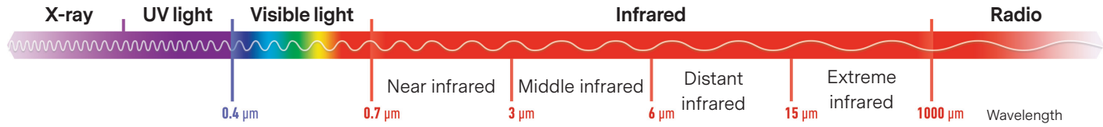


SEKIDENKO SERIES



Model	MXE	OR400T	OR400M	OR4000E	OR4000T
Brief Description	High-speed, non-contact optical temperature pyrometer with integrated reflectance measurement and emissivity compensation	Compact, single-channel optical fiber temperature pyrometer for high-volume semiconductor applications	Single-channel temperature measurement capability with selectable/fixed emissivity	Multi-channel, non-contact optical fiber temperature pyrometer that supports read rates up to 2 kHz	Multi-channel, non-contact optical fiber temperature pyrometer with configurable wavelength range and fixed-emissivity correction
Temperature Ranges	Application dependent	50 to 3500°C (Wavelength dependent)	50 to 1300°C	50 to 3500°C (Wavelength dependent)	50 to 3500°C (Wavelength dependent)
Spectral Range	Near IR	Near IR	Mid IR	Near IR	Near IR
Measurement Uncertainty	1.5°C, typical	1.5°C, typical	±3°C	1.5°C, typical	1.5°C, typical
Repeatability	±0.1°C, typical	±0.1°C, typical	±0.1°C, typical	±0.1°C, typical	±0.1°C, typical
Optics	Fixed or with external sensor	External sensor head or Sapphire lightpipe	Fixed, aligned for application	External sensor head or Sapphire lightpipe	External sensor head or Sapphire lightpipe
Field of View (Min spot size Ø in mm)	Up to 0.001°C	Up to 0.001°C	Up to 0.01°C	Up to 0.001°C	Up to 0.001°C
Alignment	Tilt stage and/or XY stage (optional)	External laser targeting available	N/A	External laser targeting available	External laser targeting available
Exposure time t_{90}	Up to 0.1 ms	50 ms	4 ms	Up to 0.5 ms	Up to 0.5 ms
Output	0 to 10 V, 4 to 20 mA, EtherCAT, USB	0 to 10V, 4 to 20 mA, RS232	0 to 10 V, 4 to 20 mA, RS232	0 to 10 V, 4 to 20 mA, RS232/422/485, Ethernet	0 to 10 V, 4 to 20 mA, RS232/422/485, Ethernet

Infrared Temperature Measurement

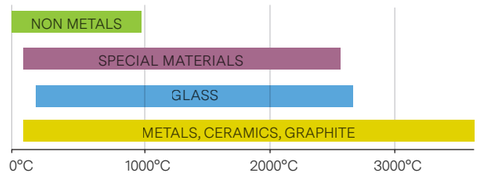


The non-contact temperature measurement (pyrometry) is an optical measurement based on the property of all materials to send out electromagnetic radiation (infrared radiation). The infrared thermometer (pyrometer) uses this radiation to determine the temperature. The pyrometer aims with the optics at 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 Advanced Energy Pyrometer

TEMPERATURE RANGE

Our pyrometers measure temperatures from -40 to 3500°C. The instruments are available in different temperature ranges. The ranges shown in the chart 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. For typical wavelengths please see page 8.

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.

SIGHTING

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

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

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 or die cast aluminum.

Available designs include:

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

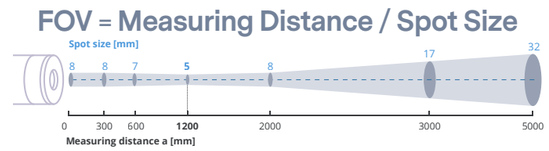
OUTPUT

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, Ethernet
- Switch output for IR switch: 20 V, max. 30 mA

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).



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

ABOUT ADVANCED ENERGY

Advanced Energy (AE) has devoted more than three decades to perfecting power for its global customers. AE designs and manufactures highly engineered, precision power conversion, measurement and control solutions for mission-critical applications and processes.

AE's power solutions enable customer innovation in complex semiconductor and industrial thin film plasma manufacturing processes, demanding high and low voltage applications, and temperature-critical thermal processes.

With deep applications know-how and responsive service and support across the globe, AE builds collaborative partnerships to meet rapid technological developments, propel growth for its customers and power the future of technology.

PRECISION | POWER | PERFORMANCE

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