

Product Overview

Infrared measuring technology for industrial applications



Pyrometers

- 1-color pyrometers
- 2-color pyrometers
- Transfer pyrometers



System Components

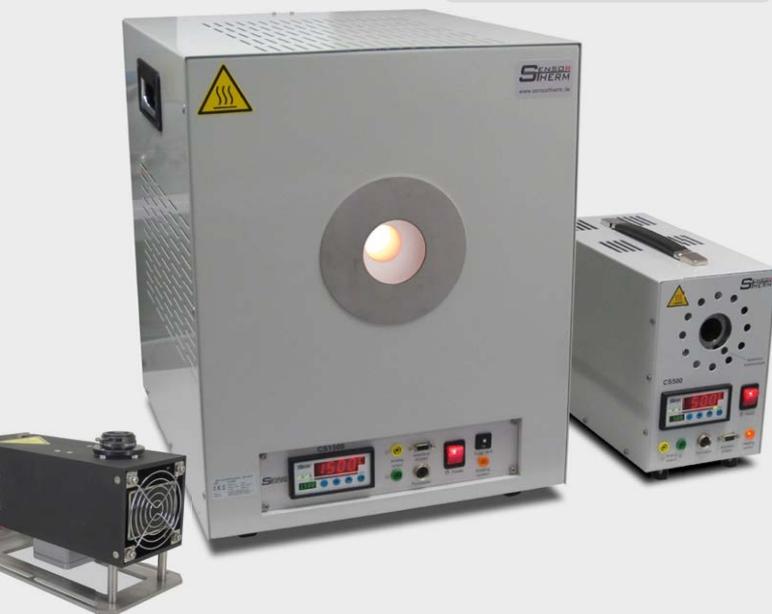
- Temperature displays
- PID program controller
- Line scanner

Calibration Sources

- High temperature
- Mid temperature
- Temperature sources

Software

- Adjustment
- Evaluation
- Calibration



Measuring, controlling, calibration – Complete IR systems

Device Designs

Model Variety in Robust Industrial Housings

CAPELLA

Handheld pyrometers in shock-proof aluminum housing.



METIS / METIS M3 / METIS H3 / METIS Vision / DIADEM

Stationary devices in a cuboid aluminum housing with integrated optics or as optical fiber version.



METIS HD

Heavy-duty stainless steel measuring system for M3 and H3 pyrometers. For measurements under harshest conditions in the steel industry.



SIRIUS / POLARIS

Compact stainless steel housing with thread.



Optics Options for the Adapted Object Focusing

Manually adjustable optics are integrated in the pyrometer or designed as fiber optics. They are adjusted to the required measuring distance or focus distance by moving the optics tube.

Motorized focus optics are integrated in the pyrometer. The focus distance is displayed on the device and changed there or on the PC. Then the optics is focused by motor.

Fixed focus optics have a fixed set focus distance.

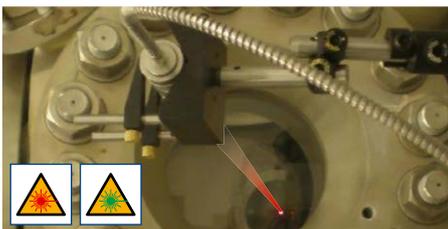


Sighting Methods for Simple Measurement Object Detection

The **laser targeting light** shows a red or green light spot indicating the focus distance and center of the measuring field. At the focus point of the optics the light spot is the smallest..

The **through lens sighting** provides upright imagery so that the target under measurement can be viewed visually. For stationary devices, the focus point is found on the sharp adjusted eyepiece, handhels show the spot size.

The **color camera** can be used to connect a TV or monitor. A target circle in the TV picture is used for alignment. With the automatic, highly dynamic image brightness adjustment, the camera is also ideal for process monitoring.



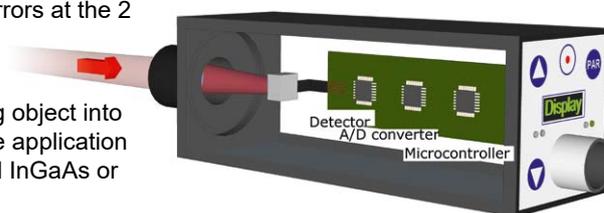
Inner Values for Best Performance

The **optics lenses** are optimized according to the infrared range to be measured in the various applications of the industry. 2-color pyrometers use specially calculated achromatic lenses to compensate for color errors at the 2 measurement wavelengths.

Detectors convert the infrared energy radiated by the measuring object into a photocurrent. Depending on the application high quality Si, InGaAs, extended InGaAs or PbSe detectors are used.

Especially our 2-color pyrometers are equipped with two separate InGaAs or Si detectors for accurate wavelength approximation and maximum signal strength.

The measuring signal is **digitized directly** behind the detector and then digitally linearized (Sensortherm development).



Measurement parameters, such as the emissivity can thus be calculated digitally in the microcontroller without additional errors, instead of being corrected with analog compensating currents, that are subjects to error.

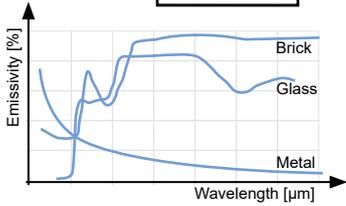
Therefore very high measurement speeds and signal outputs (response time) are reached with high accuracy, both on the serial interface and the analog output.

Criteria selecting a Sensortherm Pyrometer



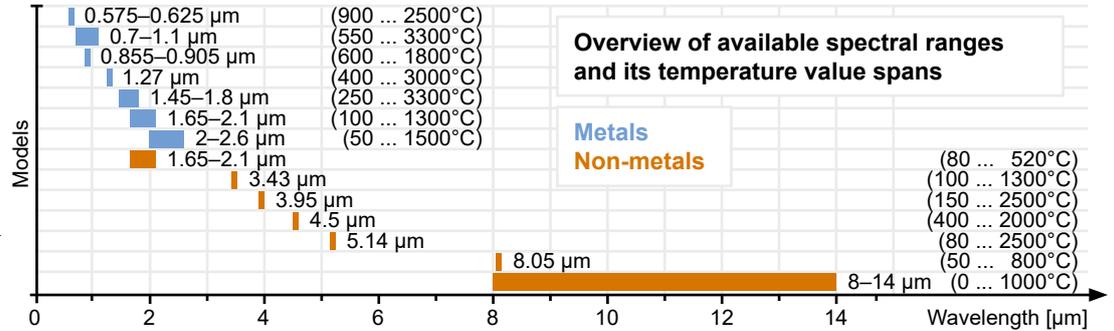
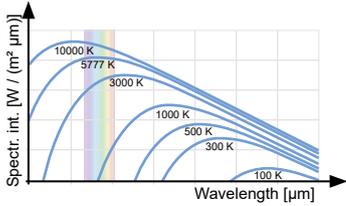
Measuring Temperature

The pyrometer measuring range is selected according to the required temperature of the object.

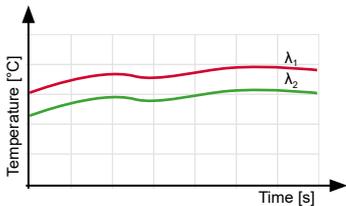


Material / Spectral Range

The material to be measured largely determines which spectral range of the pyrometer should be selected. For metal measurements, the shortest possible spectral range for a precise measurement is advantageous. Due to technical reasons the beginning of a temperature range may be limited, to a higher starting temperature therefore a model must be selected with a slightly higher spectral range, e.g. longer wavelength.



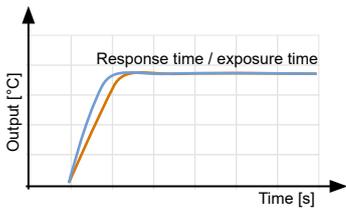
All devices are equipped with an adjustable emissivity setting for adaptation to the material properties. Some materials are measured in specially rated pyrometer wavelength that have been found by material analysis as suited for this purpose. The field of application is explained by the respective pyrometer models, but also we are pleased to advise you.



Pyrometer Type

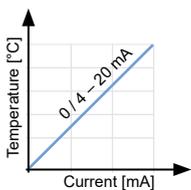
Most measuring object temperatures can be determined well with standard 1-color pyrometers. However, in some cases the choice of a 2-color pyrometer (ratio pyrometer) may be required, which simultaneously measures in two spectral ranges and determines the temperature by quotient formation. The common use of such devices is at measurements through polluting viewing windows or strong smoke or dust exposure in the field of view or even at measuring objects that are smaller than the pyrometer's spot size.

The choice of the optics also plays an important role. Optics with adjustable focus distance can be set to different measuring distances where the spot size then is always as small as possible. For measurements in the defocused area, the temperature of a larger measuring surface is determined; the accuracy of the measurement is the same.



Response Time / Exposure Time

For all Sensortherm pyrometers the response time t_{90} is specified. It indicates the time that the pyrometer needs to reach 90% signal height of a 100% temperature step event. Within the response time two measurements and the complete signal processing will be performed, so the exposure time is twice as high. The shorter the response time of a pyrometer, the faster a measured value is provided to the output. This is particularly important when measuring parts move quickly, or when using a scanner, or if the pyrometer's measuring value should be used to further system control.



Outputs / Interfaces

All stationary pyrometers are equipped with at least one standard analog output 0/4-20 mA (selectable) and a serial interface RS232 or RS485. Via interface the pyrometer can be parameterized remotely, or a measurement data evaluation or the entire system can be controlled via PC program or a PLC. The data transmission with RS232 is only possible over relatively short distances, via RS485 very long transmission distances can be realized and multiple pyrometers be connected in a bus system to an interface.



Pyrometers with an integrated PID controller are equipped with a manipulated variable output for direct connection to a heating system. Metis models can be equipped with 12-pin or 17-pin connection, depending on how many inputs and outputs are required, in addition, a connection to Profinet / Profibus is possible. Handheld devices are read out via USB.

Ambient Temperature

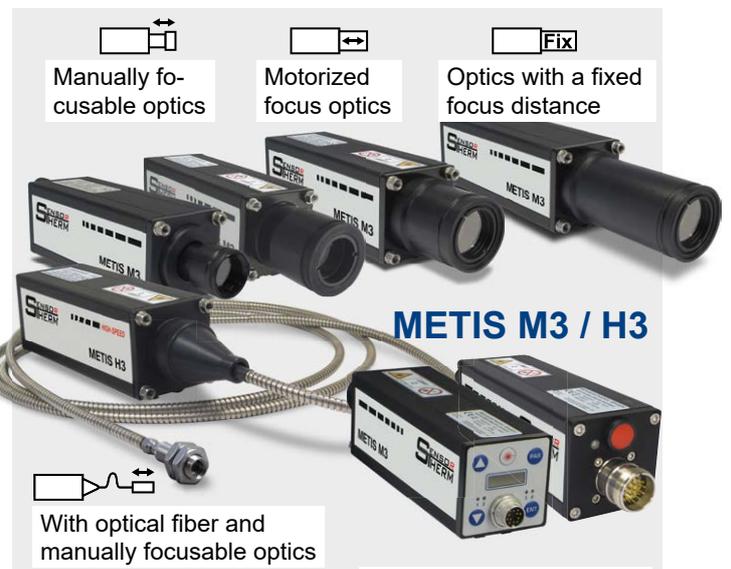
The device temperature must be within the specified limits in order to avoid inaccuracies or failures. For operations outside the ambient temperature the pyrometer must be installed in an appropriate protective housing (accessory).



Pyrometer Overview

| METIS M3 Series | 1-color pyrometers | | | | | | |
|----------------------------------|--|---------------------------------|--|---|--|----------------------------------|--------------------------------|
| | M323 | M318 | M316 | M309 | M313 | M308 | M306 |
| Temperature ranges [°C] | 50–800 80–1200 100–1500 | 100–700 150–1200 180–1300 | 200–1300 250–1300 350–1800 400–2500 500–3300 | 550–1400 600–1600 650–1800 750–2500 900–3000 1000–3300 | 400–1400 450–1800 500–2200 550–3000 600–3800 | 600–1400 700–1800 | 900–2500 |
| Spectral range [μm] | 2–2.6 | 1.65–2.1 | 1.45–1.8 1.4 | 0.7–1.1 0.87 | 1.27 | 0.88 | 0.6 |
| Response time t_{90} | < 1 ms | | | | | | |
| Smallest spot size | 0.6 mm | | 0.4 mm | | 0.3 mm | 0.7 mm | 1.3 mm |
| Optics types and sighting method | | | | | | | |
| Typical application | Metals, ceramics, composites, semiconductor, wafers, molten glass, graphite... | | | | Tungsten in a vacuum under protective gas | Titan under oxidizing conditions | Melting metal / pouring stream |

| METIS M3 Series | 2-color pyrometers | | |
|----------------------------------|---|--|----------------------------------|
| | M322 | M311 | M3F1 |
| Temperature ranges [°C] | 300–1000 350–1300 400–1600 500–1800 600–2300 800–3000 1000–3300 | 600–1400 650–1500 750–1800 800–2100 900–2500 1000–3000 1100–3300 | 600–1300 750–1800 900–2500 |
| Spectral range [μm] | 1.45–1.65 / 1.65–1.8 1.4/1.64 | 0.75–0.93 / 0.93–1.1 0.87/0.99 | 0.7–0.93 / 0.93–1.1 |
| Response time t_{90} | < 1 ms | | 10 ms |
| Smallest spot size | 0.8 mm | | |
| Optics types and sighting method | | | |
| Typical application | Metals, ceramics, composites, semiconductor, wafers, molten glass, graphite... | | Flames |



| METIS H3 Series (High speed) | 1-color pyrometers | | | 2-color pyrometers | |
|----------------------------------|--|--|--|---|--|
| | H318 | H316 | H309 | H322 | H311 |
| Temperature ranges [°C] | 120–520 180–800 | 250–800 300–900 350–1100 400–1200 500–1600 600–1800 700–2500 | 550–1200 600–1400 650–1600 700–1800 750–2000 | 350–800 400–1200 500–1300 550–1400 600–1600 700–2300 1000–2500 1300–3000 | 600–1100 650–1300 750–1400 900–1800 1000–2000 1100–2200 1300–2500 1600–3300 |
| Spectral range [μm] | 1.65–2.1 | 1.45–1.8 | 0.7–1.1 | 1.45–1.65 / 1.65–1.8 1.4/1.64 | 0.75–0.93 / 0.93–1.1 0.87/0.99 |
| Response time t_{90} | < 40 μs | | | < 80 μs | |
| Smallest spot size | 0.4 mm | | | 0.8 mm | |
| Optics types and sighting method | | | | | |
| Typical application | Metals, ceramics, composites, semiconductor, wafers, molten glass, graphite... | | | | |

2 analog outputs 0/4–20 mA; M3: RS232+485, switchable; H3: RS485. Laser targeting light button, through lens sighting or camera connection.

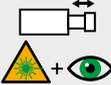
2 versions:

- With display, adjustment keys, LED's to indicate operational readiness and active switching outputs, 3 configurable inputs / outputs. Optionally with PID controller or Profinet or Profibus
- Ready-to-operate LED, 4 digital inputs, 2 digital outputs, 1 analog input, PID controller

| DIADEM Series (Transfer Standard) | 1-color pyrometers | | | |
|-----------------------------------|---|----------------------|----------|-----------|
| | DI16 | DS09 | DS06 | DI13 |
| Temperature ranges [°C] | 250–1400 300–1500 | 600–1500 700–1800 | 900–3000 | 1000–3500 |
| Spectral range [μm] | 1.45–1.8 | 0.7–1.1 | 0.65 | 1.27 |
| Response time t_{90} | 5 ms | | | |
| Smallest spot size | 1.4 mm | 1.1 mm | 1 mm | 1 mm |
| Optics types and sighting method | | | | |
| Typical application | Verifying and readjustment of calibration sources | | | |



Pyrometer Overview

| CAPELLA C3 Series | 1-color pyrometers | | | 2-color pyrometers | |
|----------------------------------|---|----------------------------------|----------|----------------------------------|----------------------------------|
| | C309 | C316 | C318 | C322 | C311 |
| Temperature ranges [°C] | 550–1400 600–1600 750–2500 900–3000 1000–3300 | 250–1300 350–1800 400–2500 | 180–1300 | 300–1000 350–1300 500–1800 | 600–1400 750–1800 900–2500 |
| Spectral range [μm] | 0.7–1.1 0.87 | 1.45–1.8 | 1.65–2.1 | 1.45–1.65 / 1.65–1.8 | 0.75–0.93 / 0.93–1.1 |
| Response time t_{90} | < 1 ms | | | | |
| Smallest spot size | 1.2 mm (0.4 mm with close-up lens) | | | | |
| Optics types and sighting method |  | | | | |
| Typical application | Metals, ceramics, composites, semiconductor, wafers, molten glass, graphite... | | | | |



With display, adjustment keys and USB connector

CAPELLA

| SIRIUS Series | 1-color pyrometers | | | | POLARIS Series | IR switches | |
|----------------------------------|---|--------------------|---|----------------------|---|----------------------------------|----------------------|
| | SI23 | SI18 | SI16 | SS09 | | PI16 | PS09 |
| Temperature ranges [°C] | 50–400 100–600 150–900 | 100–600 150–850 | 250–1000 300–1300 350–1800 | 550–1400 650–1800 | Temperature / switch ranges [°C] | 250–1000 300–1300 350–1800 | 550–1400 650–1800 |
| Spectral range [μm] | 2–2.6 | 1.65–2.1 | 1.45–1.8 | 0.7–1.1 | Spectral range [μm] | 1.45–1.8 | 0.7–1.1 |
| Response time t_{90} | 5 ms | | | | Response time t_{90} | 4 ms | |
| Smallest spot size | 1.3 mm | | | | Smallest spot size | 1.3 mm | |
| Optics types and sighting method |  | |  | |  | | |
| Typical application | Metals, ceramics, composites, semiconductor, wafers, molten glass, graphite... | | | | | | |

SIRIUS



0/4–20 mA, RS232 or RS485, switch input (clearing peak picker manually), laser targeting light button



POLARIS

2 switching outputs (transistor), service interface RS232 or RS485



| METIS Series | 1-color pyrometers | | | | | | |
|----------------------------------|---|----------------------------------|---|--|---|----------------------|----------------------|
| | MY34 | MY45 | MY46 / MY47 | MY51 | MY84 | MY80 | MB39 |
| Temperature ranges [°C] | 300–1300 | 400–1300 500–1500 500–2000 | | 80–800 100–1000 300–1300 500–2500 | 0–400 0–700 0–1000 | 50–400 300–800 | 150–1000 500–2500 |
| Spectral range [μm] | 3.43 | 4.5 | 4.6 | 5.14 | 8–14 | 8.05 | 3.95 |
| Response time t_{90} | 100 ms | 100 ms | | depends on model 5/30/100 ms | depends on model 5/100 ms | 100 ms | 3 ms |
| Smallest spot size | 1.2 mm | 2.5 mm | | 0.8 mm | 0.9 mm | 2.5 mm | 0.7 mm |
| Optics types and sighting method |  | |  | |  | | |
| Typical application | PE / PP films | Flue gas (MY47 with TÜV) | | Glass surfaces | Non-metals | Thin polyester films | Gas flames |



0/4–20 mA, RS232 or 485, switch input (clearing peak picker manually)

METIS

GALAXY scanners for all METIS pyrometers

Heavy-duty measuring system for M3 and H3 fiber optics pyrometers



All pyrometers: response time adjustable up to 10 s | METIS, M3, C3: with dynamic adaptation at low signal levels

System Components

Additional components for system integration expand the application possibilities of pyrometers.

Temperature display

| Model | Adjust pyrometer | Switching outputs | Pyrometer connection | Separate interface |
|-------|------------------|-------------------|----------------------|--------------------|
| IF | ✓ | 4 | Interface | ✓ |

External temperature **digital display IF** for installation in places where the display of the measuring temperature is required.



PID Program Controllers

| Model REGULUS | For Pyrometers | Additionally for thermocouple type K / S | Programs / steps | Automatic control parameter determination |
|---------------|----------------|--|------------------|---|
| RD | 2 | 2 (optional) | 26 / | |
| RF | 1 | 1 (optional) | 254 | ✓ |

REGULUS program controllers are very fast **PID temperature controllers**.

Programmable and optimized for pyrometers, they can perform complex control sequences of heating processes. They generate a direct manipulated variable from the measuring signal of the pyrometer.



Line Scanners

| Model GALAXY | Scan angle | Measuring zones | Analog region outputs | Single steps, step speed or scanning frequency |
|--------------|------------|-----------------|-----------------------|---|
| SC71/81 | 3.6–90° | 16 | – | 1600 single steps, 1–10000 steps/s or 6.25 – ca. 150 Hz |
| SC72/82 | | | 4 | |
| SC73/83 | | | 8 | |
| SC75/85 | | | 16 | |

GALAXY scanners are used for continuous scanning of measuring objects and always detects the temperatures on a line.

This results in temperature profiles of the workpieces, which provide information on temperature peaks, relevant details and possible weak points on slabs, billets or steel strips.



Calibration Sources / Temperature Sources

| Model | Temperature range | Spectral range | Opening Ø | Heating-up time |
|---------|-------------------|----------------|-----------|-----------------|
| CS500-N | 25–500°C | 0.5–14 µm | 30 mm | ca. 30 min |
| CS1500 | 250–1500°C | 0.5–3.5 µm | 40 mm | ca. 35 min |
| HE1200 | ca. 100–1200°C | 0.5–3.5 µm | 20 mm | ca. 3 min |

CS calibration sources with connectors for pyrometers and PC form a system for checking and readjusting pyrometers as well as for readjusting the calibration sources itself.

HE temperature sources are not used for calibration but are suitable for rapid on-site inspection of pyrometers.



Transfer Standard Pyrometers

| Model | Temperature ranges | Spectral ranges |
|-------|--------------------------|-----------------|
| DI16 | 250–1400°C 300–1500°C | 1.45–1.8 µm |
| DS09 | 600–1500°C 700–1800°C | 0.7–1.1 µm |
| DS06 | 900 – 3000°C | 0.65 µm |
| DI13 | 1000–3500°C | 1.27 µm |

DIADEM Transfer Standard Pyrometers are used for the exact pyrometric adjustment of a CS1500 or for the readjustment of a pyrometer by comparison measurement.

Display resolution: 0.01°C
Measurement uncertainty only 0.15% of reading + 1K



Typical Accessories

Equipment for the stable assembly, protection against environmental influences and safe electrical connections.



Software

PC software for adjusting, displaying, recording and evaluating.
All programs are continuously developed and can be downloaded for free permanently.

SensorTools

Software for communicating with pyrometers, scanners, controllers, displays and calibration sources.

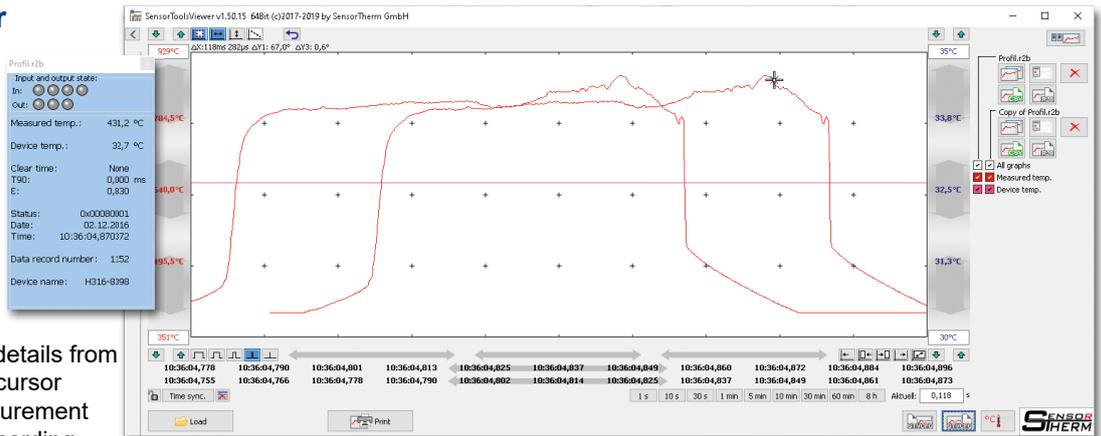
- Display measurement temperatures numerically and graphically
- Display up to 4 device measurement data simultaneously
- Record measurement curves
- Adjust time view quickly
- Read out and adjust measuring parameters
- Perform all device settings
- Single-point adjustment for adaptation measurements through windows or lenses with unknown transmittance
- Program controller Regulus: Automatically determine control parameters and define control steps



SensorTools Viewer

In the program package with SensorTools, for displaying recorded measurement data.

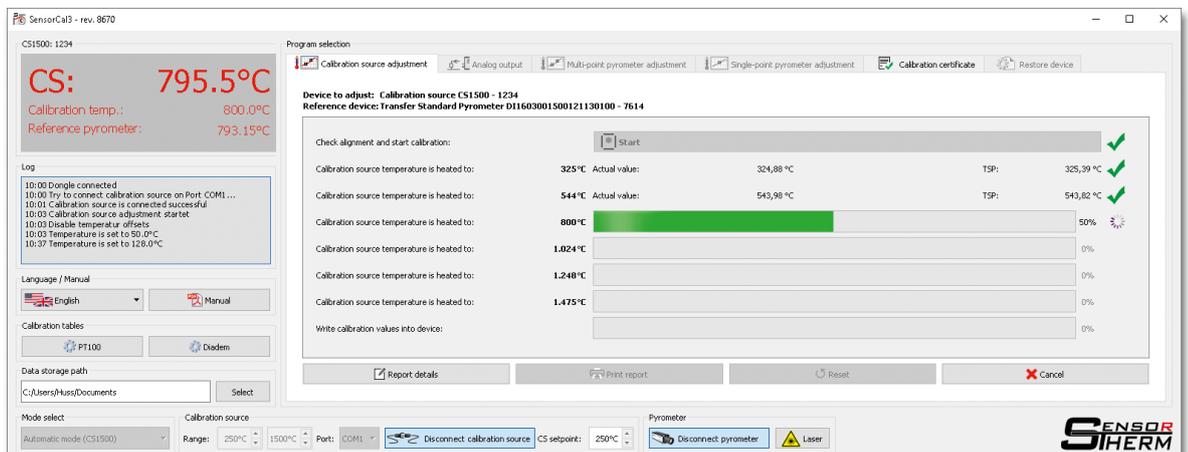
- View and compare up to 4 measurement data files simultaneously
- Duplicate, save, export measurement data
- Save current view of all graphs
- Show measurement data details from the location of the mouse cursor
- Show device model, measurement parameters and date of recording



SensorCal3

Software for accuracy check and readjustment of pyrometers and calibration sources.

- Adjust pyrometer series METIS MS / MI / MB / MP and M3:
 - automatically on the CS1500 or CS500-N
 - semi-automatically or manually by comparison measurement with a high precision Transfer Standard Pyrometer DIADEM or by measurement on any calibration source
- Adjust the calibration source CS1500 pyrometrically: automatically with high precision Transfer Standard Pyrometer DIADEM or manually by measuring result of any reference pyrometer
- Adjust the calibration source CS500-N thermometrically or pyrometrically: automatically with temperature probe or manually by measuring result of any reference pyrometer



Quality Control

All assemblies are subjected to extensive testings before mounting and ready for shipping:

- Circuit board scan for assembly error detection
- Electrical function test of electronic components
- Microscopic examination of the optical components
- Initial functional testing of the assembled unit
- Climate chamber heating
- Vibration test
- Re-function test with check for deviations from the initial test
- 48-hour long time test

After all tests are passed, the pyrometers are checked again on calibration sources at several predetermined temperatures.

- A factory certificate is enclosed with all our pyrometers. It confirms the full functionality and traceability to national standards.

Now the devices are ready for delivery.

We are certified according to DIN EN ISO 9001:2015



Services

- Regular pyrometer maintenance / calibration
- Creation of factory certificates indicating the measurement deviation
- Device readjustment at measured value deviations, incl. factory certificate
- Creation of factory certificates at standard temperature measuring points or with self-defined or additional ones
- IEC 17025 calibration certificates at standard temperature measurement points or with self-defined or additional ones
- Advice to measurement problems, if necessary on-site
- Support at commissioning
- Quick repairs



Individual Advice

The non-contact temperature measurement with pyrometers is the contact measurement superior in many areas. However, often questions arise that can not be solved due to lack of experience. There is the spectral range that must be selected suitable to the material, the response time to the speed of a passing material or any interference at the site of installation has to be considered.

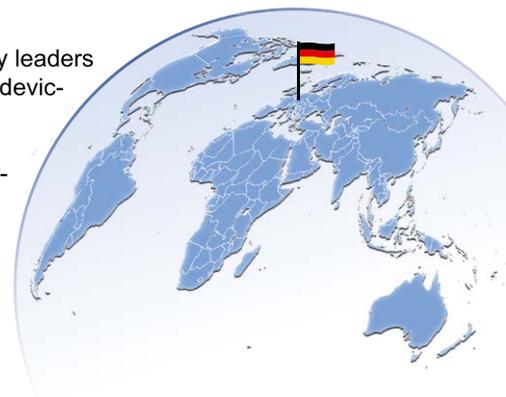
Let advise you individually when the measurement task raises too many questions. We are interested in the long and trouble-free operation of our products at your measurement tasks.

Made in Germany / International Sales

Sensortherm infrared measurement and control GmbH in Steinbach/Ts. is one of the technology leaders in digital pyrometer technology. Especially our 2-color pyrometers which are the world's fastest devices with digital output signals.

With more than 30 years of experience in development and production of infrared radiation thermometers, Sensortherm is constantly setting new standards in the digital pyrometry. Sensortherm provides its customers advanced economical and technical solutions from a single source.

All pyrometers and calibration sources are manufactured by Sensortherm "Made in Germany" at our headquarter in Steinbach. Our international sales contacts can be found across the globe, they are listed on our website www.sensortherm.com.



Sensortherm reserves the right to make changes in scope of technical progress or further developments.

Sensortherm-ProductOverview_Pyrometers (Sept. 09, 2021)

Sensortherm GmbH

Infrared Temperature Measurement and Control
Weißkirchener Str. 2-6 • D-61449 Steinbach/Ts.
Tel.: +49 6171 887098-0 • Fax: -989
www.sensortherm.com • info@sensortherm.com

