Product Overview

Pyrometers, Accessories, Software

Digital Self-Contained Pyrometer Series:

- **Polaris / Sirius** (Compact series)
- **Metis** (in many different versions)
- **Metis M3** (High-end pyrometers of the latest generation)
- **Metis H3** (High-speed pyrometers for fastest data capturing)

Areas of application:

- **Temperature measurement**
- **Temperature monitoring**
- **Temperature control**
- **Quality controls**

Features and Benefits:

- **All over digital signal processing**
- **Analog and digital outputs including peak picker**
- **Software support for measured value display, recording, analysis, pyrometer parameterization**

Device Designs

Housing

Sirius / Polaris

Compact stainless steel housing Ø40x130 mm with threads and 2 lock nuts for mounting.

Metis / Metis M3 / Metis H3

Extruded aluminum housing ca. 56x56x240 mm with mounting rail (standard or fiber optic versions).

Metis MW

Special hot rolling mill and continuous casting version with integrated air purge rugged stainless steel construction. Remote lens assembly separated from sensor head.

Optics

Sirius

- 2 models with integrated fixed optics (with customer changeable lens position for adjusting the focus distance on 8 different ranges 150-650 mm) or 3 focusable optics for distances between 170 and 2000 mm.

Metis with Integrated Fixed or Focusable Optics for Very Small Spot Sizes

- Fixed focus optics for different preset focus distances for smallest spot sizes at a specific measuring distance.
- With the focusable optics focal distances can be continuously adjusted by moving the tube. Depending on the model possible ranges are from 83 up to 4000 mm.

Metis M3 with Integrated Fixed or Motorized Focusable Optics

- Measurement distance for motorized focusable optics is controlled at the device or PC.

Metis M3 / Metis H3 with Fiber Optic Cable Design

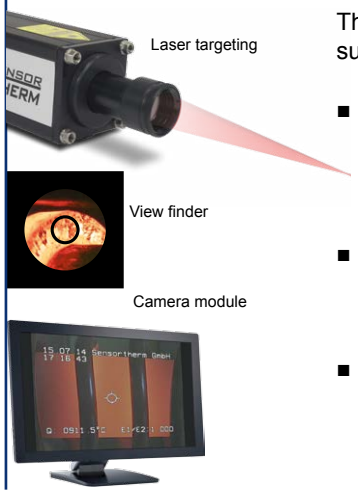
- The temperature is detected by a focusable optics and passed through an optical fiber to the pyrometer.

The pyrometer's lens is selected according to the required spot size and measuring distance.

At the focal point the spot size diameter is the smallest. De-focusing the optics will provide an average temperature of a larger spot. If the target under measurement is smaller than the spot size produced by the lens, the surrounding area is within the measuring field. This results in a lower or higher temperature (this issue can be solved by choosing a 2-color / ratio pyrometer).

The distance ratio (DR) is the ratio of measuring distance to spot size and provides information about the quality of the lens. The larger the value, the smaller spot size can be achieved.

Sighting Methods



The sighting is used to pinpoint the location of the measured target.

- **Laser targeting** shows a red laser dot indicating the center of the measuring field. At the focus point of the lens the laser dot is the smallest and sharpest, so that the measuring distance for the smallest spot size can be determined easily.
- The **view finder** provides upright imagery so that the target under measurement can be viewed visually. A circular reticle shows the measuring spot when the target is in focus.
- Pyrometers with a **color camera module** provide a composite video output that can be connected to a TV or monitor. The pyrometer is focused and aligned via a target circle on the TV screen.

Sirius / Polaris

- Laser targeting

Metis / Metis M3 / Metis H3

Depending on model:

- View finder
- Laser targeting
- Color camera module (optional)

Metis / Metis M3 / Metis H3 with optical fiber

- Laser targeting

Connections

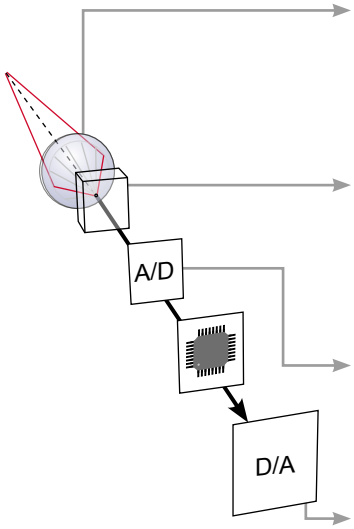
All Models

- Power supply
- Analog current output
- Serial interface RS232 / RS485

Depending on Model

- PID controller output
- Digital inputs / outputs
- Profibus

Internal Values (representative for all models using the example of Metis)



Optics / Lenses

The lenses are made of special glass in accordance with the measured infrared range. For example at measurements through a window the glass material must have similar transmission properties. 2-color pyrometers are equipped with specially calculated lenses to compensate the color aberration at the two measurement wavelengths.

Detectors

Detectors convert the infrared energy radiated by the measuring object into a photocurrent. Depending on the application high quality Si, InGaAs, extended InGaAs, PbS or PbSe detectors are used. Especially our 2-color pyrometers are equipped with two InGaAs or two Si detectors for accurate wavelength approximation and maximum signal strength.

Direct Signal Digitization

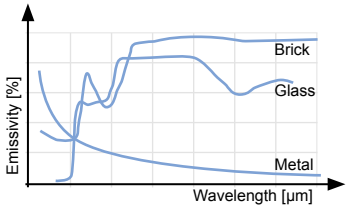
The measuring signal is digitized directly behind the detector and then digitally linearized. (Sensortherm development). No logarithmic amplifiers and other analog circuits are used, this eliminates errors that otherwise arise in analog circuits. Therefore very high measurement speeds and signal outputs (response time) are reached with high accuracy, both on the **serial interface** and the **analog output**.

Criteria for Selecting a Sensortherm Pyrometer

Measuring Temperature

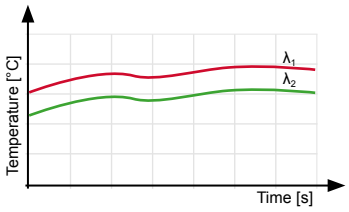
The pyrometer measuring range is selected according to the required temperature of the object.

Material / Spectral Range



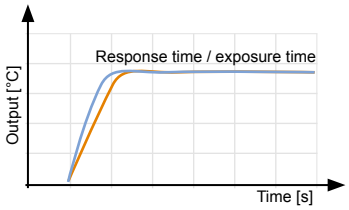
The material to be measured largely determines which spectral range of the pyrometer should be selected. For metal measurements, the shortest possible spectral range for a precise measurement is advantageous. Due to technical reasons the beginning of a temperature range may be limited, to a higher starting temperature therefore a model must be selected with a slightly higher spectral range, e.g. longer wavelength. To compensate for inaccuracies of temperature all devices are equipped with an adjustable emissivity setting to compensate for product temperature differences. Other materials are usually 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



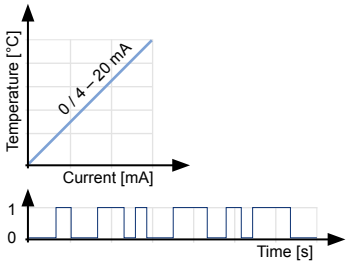
Most measuring object temperatures can be determined well with standard 1-channel pyrometers. However, in some cases the choice of a ratio pyrometer (2-channel pyrometer) may be required, which simultaneously measures in two spectral ranges and determines the temperature by quotient formation. The common use of such devices is at measurements through polluted viewing glasses or at measuring objects that are smaller than the pyrometer's spot size. However, for an error-free measurement an increasingly polluting of the viewing window must run with the same absorption factor in the two spectral ranges, otherwise varying degrees of deviations will arise at different measuring temperatures.

Response Time / Exposure Time



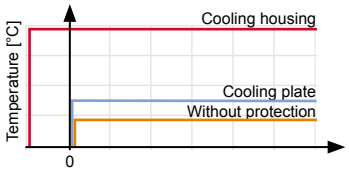
For all Sensortherm pyrometers the response time t_{90} is specified. It specifies the time after which 90% of the measured value is available to the pyrometer's outputs. The shorter exposure time is only relevant when using a maximum value storage (peak picker), as this executes his calculations faster prior to signal output. The faster the response time of a pyrometer, the faster a measured value is 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



Depending on the application, different outputs are required. All pyrometers are equipped with a 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 pyrometer be connected in a bus system to an interface. Some devices can also be supplied with an integrated PID controller or a Profibus interface.

Ambient Temperature

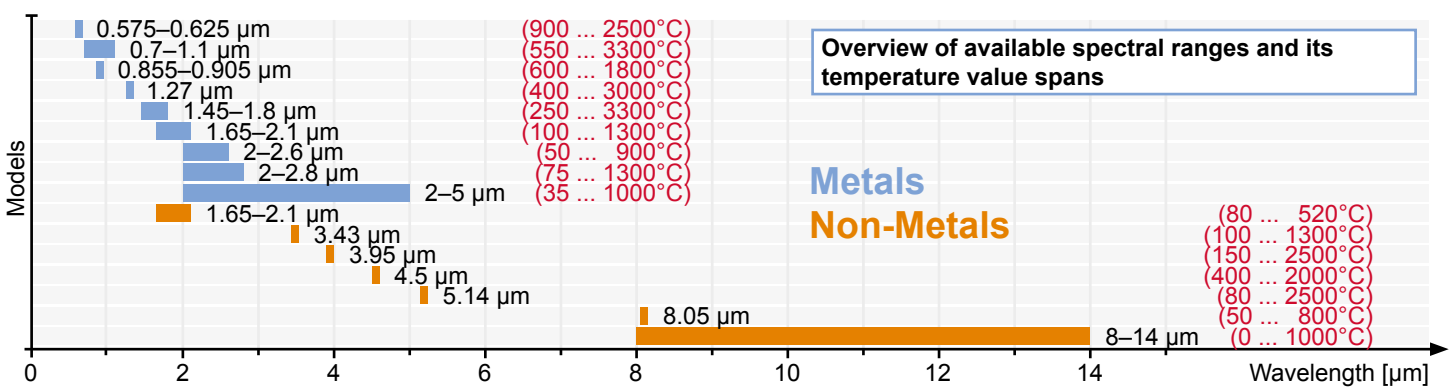


The device temperature must be within the specified limits in order to avoid inaccuracies or failures. At operations outside the ambient temperature the pyrometer must be installed in an appropriate protective housing (accessory).

Pyrometer Overview

Model		Temperature ranges	Spectral response	Response time t_{90}	DR / smallest spot size	Features	Typical Applications
Polaris	PS09	550–1400°C 650–1800°C	0.7–1.1 µm	4 ms [1]	130:1 / 1.3	Infrared temperature switch (hot metal detector) in a compact stainless steel housing	Metals, ceramics, composites, semiconductor, wafers, molten glass, graphite
	PI16	250–1000°C 300–1300°C 350–1800°C	1.45–1.8 µm				
Sirius	SS09	550–1400°C 650–1800°C	0.7–1.1 µm	5 ms [1]	130:1 / 1.3	Compact, easy to install pyrometers that measure in short-wave infrared range with a Si detector (SS09) or Extended InGaAs detector (SI16 + SI23) and offer a perfect balance between optical and electronic properties.	
	SI16	250–1000°C 300–1300°C 350–1800°C	1.45–1.8 µm				
	SI23	50–400°C 100–600°C 150–900°C	2–2.6 µm		115:1 / 1.3		
Metis	MB35	35–700°C 50–700°C 100–1000°C	2–5 µm	3 ms [2]	115:1 / 1.3	Pyrometers with PbSe (MB35) or PbS detector (MP23 and MP25) and somewhat wider spectral range can be used for temperature measurements on metal surfaces even at very low temperatures from 35°C.	
	MP23	130–700°C	2–2,6 µm		400:1 / 0.25		
	MP25	75–550°C 100–700°C 160–1200°C 200–1300°C	2–2.8 µm				
Metis M3	M306	900–2500°C	0.575–0.625	< 1 ms [2]	430:1 / 0.3	Narrow-band pyrometer with silicon detector, optimized for specific materials. M306: molten metal M308: Titanium	
	M308	600–1400°C 700–1800°C	0.855–0.905		137:1 / 0.75		
	M309	550–1400°C 600–1600°C 650–1800°C 750–2500°C	0.7–1.1 µm		325:1 / 0.4	Pyrometers with silicon detector (M309) or Indium Gallium Arsenide detector (M316, M318) work narrow band in the shortwave infrared, and therefore are particularly well suited to measure temperatures on metal surfaces, because metals have high emissivities at high temperatures. M318: measurements on metals at low temperatures.	
		900–3000°C 1000–3300°C	0,78 µm				
	M316	250–1300°C 350–1800°C 400–2500°C	1.45–1.8 µm				
		500–3300°C	1.4 µm				
	M318	100–700°C 180–1300°C	1.65–2.1 µm				
Metis H3 High-Speed	H309	550–1200°C 600–1400°C 650–1600°C 700–1800°C 750–2000°C	0.7–1.1 µm	< 40 µs	325:1 / 0.4	The H3 models are high-speed pyrometers and measure in the short wave infrared with silicon detector (H309) or indium gallium arsenide detector (H316, H318) and are particularly well suited to measure temperatures on metal surfaces at very fast exposure times and response times. H318: Extremely fast measurements on metals at low temperatures as well as laser power control in laser soldering, laser radiation welding, contour welding, simultaneous, quasi simultaneous welding.	
	H316	250–800°C 300–900°C 350–1100°C 400–1200°C 500–1600°C 600–1800°C 700–2500°C	1.45–1.8 µm				
	H318	120–520°C 180–800°C	1.65–2.1 µm		185:1 / 0.7		

[1] Adjustable up to 10 s [2] With dynamic adaptation at low signal levels, adjustable up to 10 s



Pyrometer Overview

Model		Temperature ranges	Spectral response	Response time t_{90}	DR / smallest spot size	Features	Typical Applications
Metis M3 2-color pyrometer	**M311**	600–1400°C 750–1800°C 900–2500°C	0.79–0.93 / 0.93–1.1 µm	< 1 ms [2]	377:1 / 0.9	Ratio pyrometers (also called 2-color pyrometers) measure the temperature based on the ratio of the radiation intensity of two adjacent wavelengths in the shortwave infrared band. With dirty window alarm function.	Metals, ceramics, composites, semiconductor, wafers, molten glass
		1000–3000°C 1100–3300°C	0.87/0.99 µm				
	M322	300–1000°C 350–1300°C 500–1800°C	1.45–1.65/ 1.65–1.8 µm				
		800–3000°C 1000–3300°C	1.4 / 1.64 µm				
Metis H3 High-speed 2-color pyrometer	**H311**	600–1100°C 650–1300°C 750–1400°C 900–1800°C 1000–2000°C 1100–2200°C 1300–2500°C	0.79–0.93 / 0.93–1.1 µm	< 80 µs	377:1 / 0.9	The H3 models are high-speed 2-color (ratio) pyrometers with two detectors which provide the highest accuracy in unsurpassed fast response time to the digital and analog outputs.	
		1600–3300°C	0.87/0.99 µm				
	H322	350–800°C 400–1200°C 500–1300°C 550–1400°C 700–2300°C 1000–2500°C	1.45–1.65 / 1.65–1.8 µm			High-speed ratio pyrometer for temperature measurement and laser power control during laser hardening.	
		1300–3000°C	1.4 / 1.64 µm				
Metis Rolling mill / continuous casting	**MW09**	550–1400°C 600–1600°C 650–1800°C	0.7–1.1 µm	1 ms [2]	400:1 / 0.8	Extremely rugged stainless steel construction designed for continuous temperature measurement in rolling mills and continuous casting. The evaluation is external mounted, the measurement data transfer from the sensor to the electronics are wired on a digital basis (no optical fiber is used).	
	MW16	250–1000°C 300–1300°C 350–1800°C	1.45–1.8 µm				
	MW18	120–550°C 160–800°C 180–900°C	1.65–2.1 µm				
Metis TSP	**Diadem DI16**	250–1200°C 300–1300°C 400–1500°C	1.45–1.8 µm	1 ms [2]	250:1 / 1.6	High-precision digital Transfer-Standard pyrometers for the detailed examination of calibration sources.	
	Diadem DS09	600–1500°C 700–1800°C	0.7–1.1 µm				
Metis	**M313**	400–1400°C 500–2000°C 800–2500°C 1000–3000°C	1.27 µm	< 1 ms [2]	370:1 / 0.35	Tungsten measurements and other metals	
	MF11	600–1300°C 750–1800°C 900–2500°C	0.79–0.93 / 0.93–1.1 µm	10 ms [1] [2]	280:1 / 0.5	Ratio pyrometer for dirty flames in furnaces such as in coal-fired power plants or incinerators.	Non-Metals / Miscellaneous
	MY34	300–1300°C	3.43 µm	100 ms [1]	150:1 / 1.2	Semiconductor manufacturing	
	MB39	150–1000°C 500–2500°C	3.95 µm	3 ms [2]	115:1 / 0.7	Measurement through hot furnace gases and non contaminated burning gas flames. Penetrating glass measurement, ceramic glass.	
	MY45	400–1300°C 500–1500°C 500–2000°C	4.5 µm	100 ms [1]	200:1 / 3	Flue gas temperature measurement in incinerators, boilers	
	MY46		4.6 µm				
	MY47					As MY46, with TÜV certification according to DIN EN 15267-2	
	MY51	80–800°C 100–1000°C 300–1300°C 500–2500°C	5.14 µm	depending on model 5, 30 or 100 ms [1]	135:1 / 0.8	Glass surfaces	
	MY80	50–400°C 300–800°C	8.05 µm	100 ms [1]	125:1 / 0.9	Thin polyester films and fluorocarbon plastics, thin glass surfaces.	
	MY84	0–400°C 0–700°C 0–1000°C	8–14 µm	depending on model 5, 30 or 100 ms [1]		Non-metals such as painted surfaces, food, wood, rubber and thicker plastics.	

[1] Adjustable up to 10 s [2] With dynamic adaptation at low signal levels, adjustable up to 10 s

Features

Measuring materials	Metals, ceramics, composites, ...														Non-metals / misc.							TSP	
Typ	SS09	SI16	SI23	MB35	MP23 / 25	M309	M316 / 18	H309	H316 / 18	H311 / 22	M311 / 22	M313	MW09	MW16 / 18	MB39	MY80	MY84	MY34	MY51	MY45 / 46	MF11	Diadem DI16	Diadem DS09
Analog output 0/4–20 mA	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●		
Analog output 0(2)–10 V																						●	●
Built-in PID controller				○	○	○	○	○	○	○	○												
Interface RS232	○	○	○	○	○	●	●				●	●	○	○	○	○	○	○	○	○	○		
Interface RS485	○	○	○	○	○	●	●	●	●	●	●	●	○	○	○	○	○	○	○	○	○	●	●
Profibus				○	○	○	○				○	○	○	○							○		
Max. baud rate	M	M	M	M	M	H	H	H	H	H	H	M	M	M	L	L	L	L	L	L	M	H	H
Peak picker	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Focusable optics	●	●		○	●	○	○	●	●	●	●	●			●	○	○	●	○	○	○		
Fixed focus optics			●	○		○	○						●	●		○	○		○	○		●	●
Focusable fiber optics (FO)						○	○	○	○	○	○	○									○		
Laser aiming light (red)	●	●	●	○	○	○	○	○	○	○	○	○			○	○	○	○	○	○	○	○	○
View finder (not for FO)				○		○	○	○	○	○	○	○			○	○	○	○	○	○	○	○	○
Camera module (not for FO)						○	○	○	○	○	○	○										○	○
LED display				○	○	●	●	●	●	●	●	●	○	○	○	○	○	○	○	○	○	○	○
Software Protocol trigger [1]	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Limit value outputs						●	●	●	●	●	●	●											
Ambient temp. [°C] 0–max.	70		50	53		80 [2) 3)]		65		60	80		70		70							50	
Ambient temp. FO [°C]						0–250°															250		

● Integrated Baud rate: L=19.2 kBaud; M=57.6 kBaud; H=921 kBaud; LO: Optical fiber length available between 2.5 and 30 m
○ Optional [1] Software record start via external contact; [2] 60°C with camera module; [3] 60°C at temp. range 100–700°C

Accessories

Just as important as the right pyrometer is a stable assembly, a safe data transmission and a suitable temperature indicator or evaluation.

- **Mounting angles** are suitable, if the pyrometer is rarely realigned.
- **Swivel mounting base:** For easy alignment of the pyrometer in multiple axis.
- **Flanges** for stable installation of pyrometer or accessories.
- **Air purge assemblies** for use in dusty and dirty environments.
- **Mounting tubes** in various lengths are used to protect the lens from dirt.

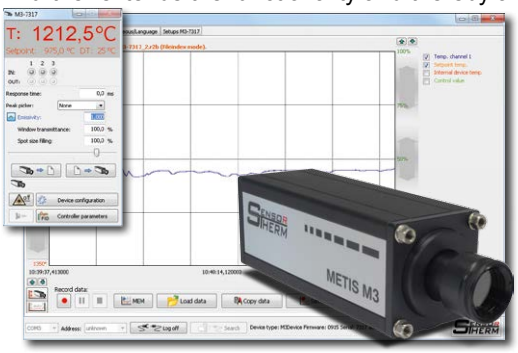
- **90° deflecting mirrors** deflect the visual axis of the pyrometer to 90°.
- A **swivel mirror** is placed in front of the pyrometer and used for linear scanning of a wider field of view range. Use, for example, in conjunction with the maximum value storage (peak picker) for finding the hottest spot when profiling linear line.
- **Scanners** extend the function of swivel mirrors with settings of oscillation frequency and speed.
- **Cooling plates** protect the front of the pyrometer from radiant heat.
- **Cooling housing** for use of the pyrometer in ambient temperatures outside the permissible ambient temperature of the pyrometer.

- **Power supplies** for our equipment.
- **Connection cables** with pre-assembled plugs / sockets or open wires as data transmission, control and connection cable for transmission of analog and digital signals.
- External temperature **digital display** and PC independent pyrometer parameterization in one device.

- Pyrometer optimized **PID program controller** for panel mounting or as compact bench top model.
- **Switching modules** can be connected to a PC COM port or via interface converter to an USB port and are used for communication with a software application.
- **Interface converter** RS232 to USB, RS485 to USB, Profibus, Profinet.
- **Reference radiation sources** for local calibration or laboratory calibration of infrared thermometers.

Software Support

All devices operate autonomously. Included in scope of delivery we supply software specially adapted to our devices. Our software further extends the functionality and thereby allows solutions of special measuring tasks.

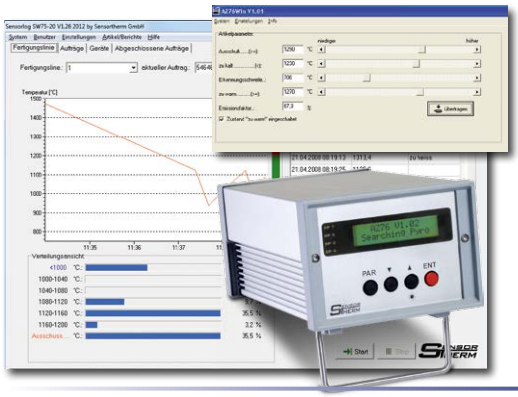


All pyrometers are delivered with a software for

- **Measurement display** (graphical and numerical temperature display)
- **Measured value recording** (manually or automatically when reaching defined temperature limits; automatically by an external trigger signal; recording intervals at pyrometers with 921.6 kBaud from 50 µs)
- **Measured value analysis** (playback of currently recorded readings or representation of a playback file; measured values output as csv file).
- **Pyrometer parameters** can be changed and are always in view

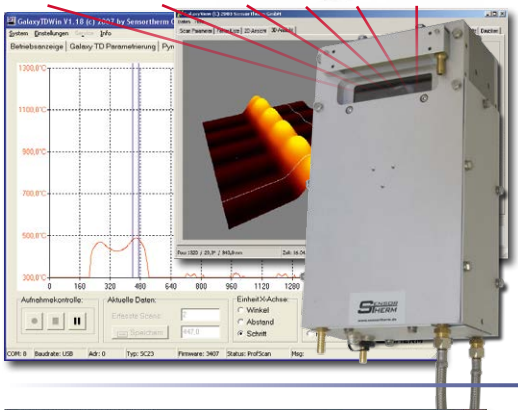
Regulus is a PID program controller (for panel-mounting or as a compact bench top model) optimized for use with pyrometers. Programming will be done via control software ***SensorTools***, the program execution is performed completely self-sustaining by the Regulus.
Additionally, operation with PC interface allows direct visual control of a running process.

- Configuring the controller
- Creating and storing programs
- Recording and storing of regulating and temperature processes for documentation purposes
- Presentation and interpretation of stored events
- AutoTune function for automatically determining the P and I parameters



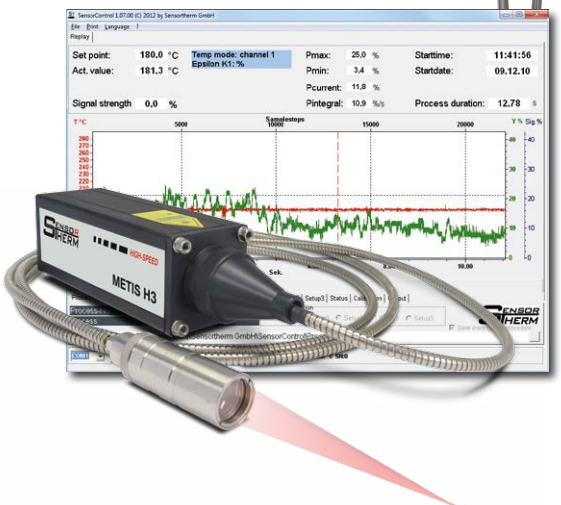
The **AZ76** measures the temperatures of passing measuring objects with a pyrometer and determines their maximum temperature. These values are compared with a predetermined temperature range and supplies a corresponding control signal (via 4 switching outputs for the states overheated, too warm, good or too low) if temperatures are in accordance or deviation. Each measured value is stored in the device with evaluation result, date and time (max. 32000 records).

- Standard software ***AZ76Win*** to set the temperature thresholds
- Optional software ***SchmiedeWin*** to read and display the data



The line scanners **Galaxy SC11** and **SC12** steer the pyrometer's field of view continuously back and forth. They enable a linear line recording of measured values with recognition of critical temperature ranges. Scan angle and speed are adjustable.

- In ***GalaxyWin*** scan speed, scan angle and various scan zones are defined.
- All measurement data are stored automatically.
- ***GalaxyView*** is an included 2D and 3D image viewer software to illustrate and print recorded data graphically in 2 or 3 dimensions.



High-speed pyrometers with integrated laser power controller for laser hardening (model H322) or plastic welding (model H318) can be optimally adjusted to the process.
The software allows parameters setting required for the laser control process. These values are written directly into the pyrometer and thus ensuring a fast and error-free integration into the measurement process.

- Laser system PLC controls pyrometer:
  - Control start and stop
  - External setpoint setting
  - Selection of stored process parameters
  - Calling of stored parameter sets
- Visual monitoring of the current measurement and control process
- Data recording for later analysis
- 1-click recalibration of the pyrometer with a calibration source in the field (e.g., if the objective is coupled coaxial into the laser).

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 endurance test

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

- A work 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 9001:2008

Services

- Regular pyrometer maintenance / calibration
- Quick repairs
- Create inspection sheets for specifying the measurement error or creating work certificates with possible readjustment
- Creating work certificates with other or more than our specified temperatures
- Advice to measurement problems, if necessary on-site
- Support at commissioning

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 Sulzbach/Ts. is one of the technology leaders in digital pyrometer technology. Especially our 2-color pyrometer 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 thermal imaging systems are manufactured by Sensortherm “Made in Germany” at our headquarter in Sulzbach / Taunus. 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.

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