

Metis M313

Narrow-Band High-End 1-Color Radiation Pyrometer



Pyrometer for non-contact temperature measurement in short-wave and narrow-band spectral range for special applications.

- Wavelength matched to measurements of tungsten in vacuum and under inert gas
- Highest accuracy and repeatability, even at high temperatures and up to 80°C without cooling
- Fully digital and very fast with response time <1 ms
- Adjustable or motorized focus optics with small spot sizes from 0.3 mm available
- 10-digit matrix display for temperature and IR sensor parameters
- Push button device configuration or via software
- 2 high resolution 16 bit analog 0/4 to 20 mA outputs
- 3 versatile configurable inputs or outputs
- Analog input for external setpoint or emissivity setting
- Laser targeting, color video or through lens sighting
- Serial interfaces RS232 and RS485 (switchable)
- Optional equipment: PID controller or fieldbus systems

Technical Data

Model	M313
Temperature ranges	400 – 1400°C 450 – 1800°C 500 – 2200°C 550 – 3000°C 600 – 3800°C
Temperature sub range	Any temperature sub-range adjustable within the temperature range (minimum span 50°C)
Spectral range	1.27 µm
Detector	InGaAs
Response time t_{90}	< 1 ms (with dynamical adaptation at low signal levels), adjustable up to 10 s
Exposure time	< 0.5 ms
Uncertainty ($\epsilon = 1$, $t_{90} = 1$ s, $T_A = 23^\circ\text{C}$)	Full-scale temp. up to 2500°C: 0.25% of reading in °C+1K Full-scale temp. above 2500°C: 0.5% of reading in °C
Repeatability ($\epsilon = 1$, $t_{90} = 1$ s, $T_A = 23^\circ\text{C}$)	0.1% of reading in °C + 1 K
Temperature coefficient (deviations from 23°C)	From 10 to 60°C: 0.02%/K From 0 to 10°C and 60 to 80°C: 0.04%/K
Emissivity ϵ	0.050–1.200 (corresponds 5–120% in 0.1% steps)
Transmission	0.050–1.000 (corresponds 5–100% in 0.1% steps)
Fill factor of spot size	0.050–1.000 (corresponds 5–100% in 0.1% steps)
Analog output	2 configurable analog outputs 0 or 4–20 mA, max. load: 500 Ω. Resolution 0.0015% of the adjusted temperature (16 Bit). Outputs can be set individually, inside or outside the measuring range.
Serial interface	RS232 (max. 115 kBd) or RS485 (max. 921 kBd), switchable. Resolution 0.1°C or 0.1°F
3 configurable Inputs / outputs	<ul style="list-style-type: none"> ■ Digital inputs (max. 3 inputs, protected against reverse polarity): laser targeting light on/off, clearing of peak picker, controller start (when equipped with PID controller), load pyrometer configuration, trigger input for start / stop of measured value recording. ■ Digital outputs (max. 3 outputs, max. 50 mA, protected against short circuit): limit switch, exceeding the beginning of temperature range (for material recognition), device ready after self-test, device over-temperature, signal strength too low. When equipped with PID controller: controller active, control process within limits, control process finished. ■ Analog input (0–20 mA, protected against reverse polarity and incorrect connection): analog adjustment of emissivity, measuring distance (devices with motorized focus) or setpoint (devices with PID controller).
Peak picker	Automatic hold mode or manual time settings to clear (reset) or external clear via configurable input
Display	Dot Matrix, greenyellow, 128x32 Dots (5.6 mm high) for temperature or parameter settings, resolution 0.1°C / °F
Parameter settings	Push buttons on the device, serial interface, PC software <i>SensorTools</i> or via self-compiled communication program: Emissivity, transmission, fill factor, temperature sub range, settings for peak picker, device address, baud rate, response time, selecting analog outputs 0/4–20 mA, interface RS232/RS485 (selection on the device only), °C/°F, language (English / German), measuring distance with motorized focus optics.
Power requirement	24 V DC (18–30 V DC), max. 6 VA; protected against reverse polarity
Isolation	Voltage supply, analog outputs and serial interface are galvanically isolated from each other
Sightings (optional)	<ul style="list-style-type: none"> ■ Thru-the-lens sighting with adjustable attenuation filter for eye protection of bright targets ■ Laser targeting light (red, $\lambda=650$ nm, $P < 1$ mW, class II to IEC 60825-1) ■ High dynamic color CCD camera, field of view: ca. 3.6% x 2.7% of measuring distance output signal: FBAS signal ca. 1 V_{pp}, 75 Ω, CCIR, NTSC / PAL switchable Resolution: NTSC: 720 x 480 pixel; PAL: 720 x 576 pixel; frame rate: PAL: 50 Hz, NTSC: 60 Hz
Optics (optional)	Manual focusable or optional motorized focus optics (only with integrated optics)
Ambient temperature	0 to 80°C, fiber optic devices: fiber and optics on optics side: -20 to 250°C (-4 to 482°F) (The laser targeting light is deactivated at a device temperature from 60°C, the camera module from 55°C to prevent its overheating)
Storage temperature	-20 to 85°C
Relative humidity	No condensing conditions
Housing / protection class	Aluminum, IP65 to DIN 40 050 with connector
Weight	650 g
CE label	According to EU directives for electromagnetic immunity

Reference Numbers

Metis M313, to specify optics type, temperature range and sighting method

Note: *SensorTools* software is included in scope of delivery,
Connection cables are not included in scope of delivery and have to be ordered separately.

Narrow-band for Special Applications

In principle the M3 series only requires connection to a power supply to start a measurement.

Metis M3 pyrometers are stand alone, self contained IR thermometers with direct outputs for easy integration in nearly all application environments.


Some materials can only be measured at a certain wavelength, in which uniformly constant emission characteristics are present. At this point our narrow-band pyrometers are used, they are optimized for such special material properties.

M313: For measuring of tungsten in vacuum and under inert gas.

The narrow-band spectral range of $1.27\ \mu\text{m}$ is ideally suited for measurements under these conditions and is preferable to use instead of ratio pyrometers.

For further applications of the M313 please consult our application specialists.

Features



A Variety of Models:

- Motorized focus optics
- Optics with manual adjustment of focus
- Fixed focus optics for smallest spot sizes
- Optical fiber version with small optical heads

Proven Sighting:

- More precise laser target marking
- Enhanced view finder
- New high dynamic color camera module

Clear Device Operation:

- Large, bright 10 digit display
- All settings directly on the device
- Display of active alarm limit outputs
- Simple setting of the measuring distance with motor focus

Fast, Accurate Outputs:

- Serial high-speed interface up to 921 kBaud
- 2 high resolution 16 bit analog 0/4 to 20mA outputs


Harsh Environmental Conditions:

- Advanced ambient temperature up to 80°C
- Fiber optic models up to 250°C (lens and fiber optic cable)
- With Sapphire protection window (devices with integrated optics)


Sighting Method Selection

Sighting is used to pinpoint the location of the measured target.


- **Devices with integrated optics:** Through lens view finder, laser targeting light or color camera module
- **Devices with fiber optics:** Laser targeting light



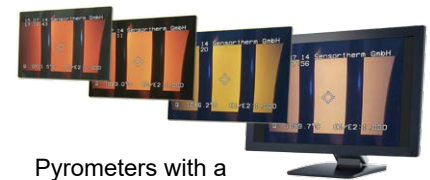
The **view finder** provides upright imagery so that the target under measurement can be viewed visually. A circular reticle shows the measuring spot. Recommended for glowing measurement objects, as a red laser is difficult to detect. For devices with measuring range above 1800°C , the eyepiece can be darkened for eye protection.




Laser targeting uses a red laser dot showing the center of the measuring field. At the focus point, the laser dot is the smallest and provides the sharpest image, so that the measuring distance for the smallest spot size can be easily determined.



Pyrometers with a color camera module provide a composite video output that can be connected to a video monitor or via video grabber to a PC. The pyrometer is aligned via a circular reticle on the TV screen and is recommended for remote observation of glowing hot targets or viewing down sight tubes. The camera provides automatic, highly dynamic adjustment of the picture brightness. Only available with optics OV09-D1 (340–3000 mm).



Targeting light on / off



Intelligent Installation Possibilities

■ Serial Interface RS232 or RS485 (Selectable)

Via serial interface, the pyrometer communicates with other digital devices such as a PLC, computer with free *SensorTools* software or a self-written communication software program. Measured values can be recorded and device parameters can be set directly on the device, via *SensorTools* software or serial interface RS232 or RS485.

- RS232 for short distances to the PC. Transfer rates of max. 115 kB
- RS485 for long distance connection. Max. of 921 kB, use in bus configuration.

An interface converter RS232 or RS485 to USB (accessory) allows for easy connection to a PC.

■ 2 Analog Outputs

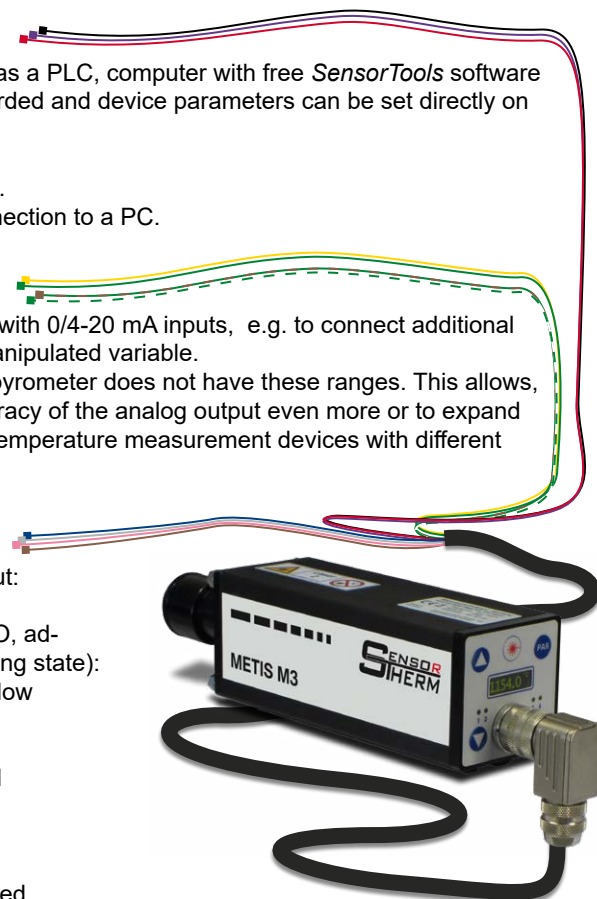
Each of the high-resolution analog outputs can be used for independent devices with 0/4-20 mA inputs, e.g. to connect additional temperature displays or at devices with PID controller (optional) for output the manipulated variable.

The outputs allow measuring range limits between 0 and 6000°C/°F, even if the pyrometer does not have these ranges. This allows, for example, the limitation of the temperature range in order to increase the accuracy of the analog output even more or to expand the temperature range to replace the pyrometer in systems that work with other temperature measurement devices with different temperature ranges.

■ 3 Configurable Inputs / Outputs

3 pyrometer connectors are available as digital input, digital output or analog input:

- Each **digital output** switches a low voltage output active or inactive (NC or NO, adjustable) with several selectable states (LEDs at the back indicates the switching state):
 - Limit switch when a certain temperature threshold is exceeded or falling below
 - Material detection (exceeding the beginning of temperature range)
 - Device state (device is ready for operation)
 - Over temperature, if the maximum allowed device temperature is exceeded
 - Signal strength is too low
 - Devices with PID controller: Controller active
 - Devices with PID controller: Control within defined setpoint limits
 - Devices with PID controller: Controlling finished successful, hold time finished
- Each **digital input** can be connected to an external contact closure and configured for a function:
 - Laser targeting light on and off
 - Manually delete (reset) of maximum value storage
 - Start / stop recording of measured values via the *SensorTools* software
 - Up to 7 pyrometer configurations (devices with PID controller also control parameters) can be saved and retrieved
 - Devices with PID controller: Start the control process on the device and the recording of the control process in the software
- Using the **analog input** a current can be fed for analog specification of:
 - Emissivity
 - Measuring distance at devices with motorized focus
 - Setpoint value at devices with PID controller



■ Ambient Temperature

The devices of the M3 series are designed with a very small temperature coefficient for ambient temperatures up to 80°C. Thus, many new applications can be entered and solved without external cooling equipment.

■ Material Properties

The entry options for material settings have been simplified:

- **Emissivity:** Each material has a max. emissivity of 1.00 which can be set, an adjustment up to 1.20 can be used. The emissivity adjustment above 1.00 allows for temperature corrections due to higher background reflection.
- **Transmittance:** For measurements through windows signal losses occur by transmission of the window. This value is included with each window and can be entered easily.
- **Fill factor measurement field:** Measuring on cold background, the measurement object can be smaller than the spot size. At this point you can enter how many percent the pyrometer's spot size is filled.

■ Peak Picker (Maximum Value Storage)

The peak picker is a useful feature when the measured object appears only briefly in the pyrometer's field of view, or to capture peak temperatures while measuring a series of objects. The hottest value of the measured object is stored and disregards temperature valleys. The maximum value can be reset automatically or manually or by a selectable clear time.

■ Additional Equipment

- Pyrometers with integrated **PID controller** measure the temperature and thus control a given temperature level. The setpoint value is set to an analog output, the second analog output e.g. can be used to output the actual value.
- **Fieldbus systems:** Profinet or Profibus.

Device Designs / Optics

The following tables show the optical data of the different device types. For reliable measurement the measurement object should be at least as large as the spot size.

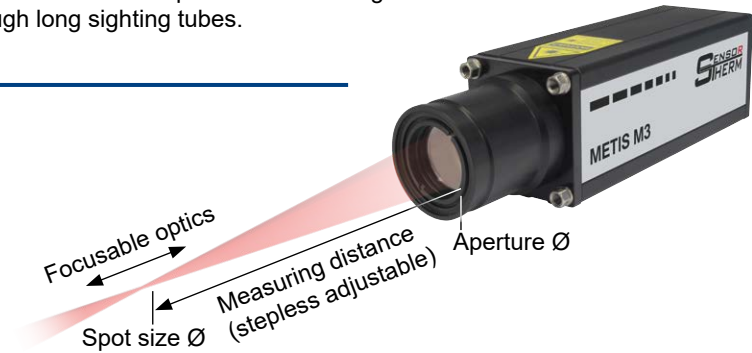
Values in the optics tables illustrate the focused measuring distances and respective spot sizes. The spot size diameter for distances not given in the table can be interpolated.

The pyrometer can be used at distances other than its' focal distance, however the spot size is generally larger and therefore the target size must be larger.

Focusable optics (manual or motorized focus) can be continuously adjusted within the minimum and maximum specified measurement distance, providing the smallest possible spot size diameter at that focus distance.

Fixed focus optics are factory-set to a certain measurement distance reaching there the smallest possible spot size. The robust and precise design provides minimal axial deviations between mechanical and optical axis. This alignment is maintained even the device is rotated, useful in measurements through long sighting tubes.

The pyrometer must be properly aligned to the measurement object to detect the temperature correctly. In the focus point of the lens (focal distance) the spot size diameter is smallest. Measurements out of the focus distance are also possible (in front of or behind the focus distance) to determine the average temperature of a bigger spot.



Integrated Optics (manually adjusted or motorized focus)
- with sighting method laser targeting light or view finder

Optics (focusable)	Measuring distance a [mm] adjustable		Spot size M [mm]			Aperture Ø D [mm]
			400-1400°C	450-1800°C 500-2200°C	550-3000°C 600-3800°C	
OM09-A0	from	130 mm	0.7 mm	0.45 mm	0.3 mm	15 mm (FSC≤1400°C) 8 mm (FSC>1400°C)
	...	160 mm	0.9 mm	0.6 mm	0.4 mm	
	to	200 mm	1.3 mm	0.8 mm	0.6 mm	
OM09-B0	from	190 mm	0.9 mm	0.55 mm	0.4 mm	
	...	300 mm	1.6 mm	0.95 mm	0.75 mm	
	to	420 mm	2.6 mm	1.45 mm	1.15 mm	
OM09-C0	from	340 mm	1.5 mm	0.8 mm	0.7 mm	
		500 mm	2.4 mm	1.4 mm	1.2 mm	
		700 mm	3.6 mm	2.1 mm	1.6 mm	
	...	1000 mm	5.3 mm	2.9 mm	2.4 mm	
		2000 mm	10.7 mm	6.3 mm	4.9 mm	
	to	4000 mm	23.1 mm	12.6 mm	10.5 mm	
- with sighting method color camera module						
OV09-D1	from	340 mm	1.4 mm	0.8 mm	0.7 mm	FSC = Full scale temperature
		500 mm	2.2 mm	1.2 mm	1.1 mm	
		700 mm	3.2 mm	1.7 mm	1.6 mm	
	...	1000 mm	4.6 mm	2.5 mm	2.3 mm	
		2000 mm	9.5 mm	4.8 mm	4.7 mm	
	to	3000 mm	14.7 mm	7.4 mm	7.1 mm	

**Manual
Focus**

1. Turn counterclockwise
2. Pull / push in
3. Lock turn clockwise

**Motorized
focus**

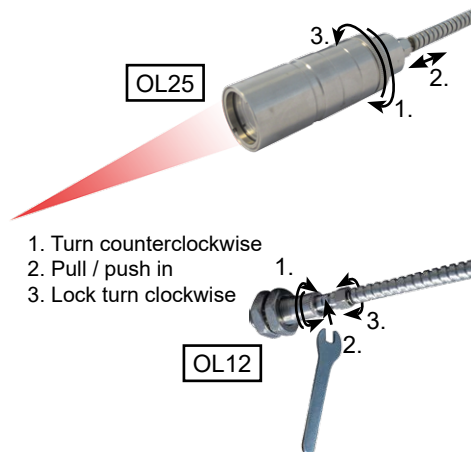
- Via push buttons
- Via PC software



Sighting method
color camera
module only with
optics D

Fiber Optics with sighting method laser targeting light (25 mm outside diameter or 12 mm)

OL25-G0	from 75 mm	0.6 mm	0.45 mm	13 mm
	... 130 mm	1.3 mm	1 mm	
	to 180 mm	1.8 mm	1.4 mm	
OL25-H0	from 170 mm	1.6 mm	1 mm	
	500 mm	5 mm	3.2 mm	
	700 mm	7.5 mm	4.8 mm	
	... 1000 mm	11 mm	7 mm	
	2000 mm	23 mm	15 mm	
	to 4500 mm	52 mm	34 mm	
OL12-A0	from 100 mm	1.5 mm	0.9 mm	7 mm
	... 350 mm	6.4 mm	3.7 mm	
	to 600 mm	10.9 mm	6 mm	
		Fiber Ø 0.4 mm	Fiber Ø 0.2 mm	



SensorTools Software

Communication and evaluation software for all pyrometers, controllers, digital displays and calibration sources.

- Measured value display, graphically and numerically, device temperature
- Measured value recording incl. parameters
- View and compare up to 4 measurement data files simultaneously in the *SensorTools Viewer*
- Make all device settings
- Special recording settings: externally start / stop, retroactive or extended recording via signal input
- Print or save pyrometer settings, or transfer settings to other devices or export to csv files
- Switch on / off laser targeting light, adjust camera settings or motorized focus (depending on features)



Recommended Accessories

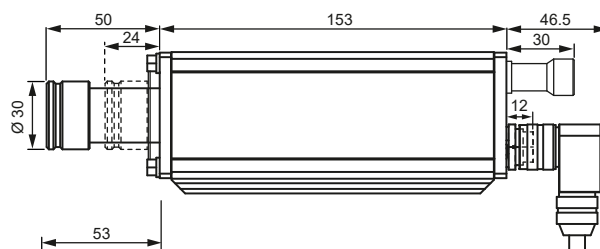
HA20	Ball and socket swivel mount for sensor alignment
HA10	Mounting bracket
HA14 / HA15	Adjustable mounting bracket for fiber optics OL12 / OL25
KG10	Aluminum water cooling housing
KG20	Aluminum cooling plate
BL10 / BL11	Air purge for devices with motor focus / manually focusable optics
BL13 / BL14	Air purge for fiber optics OL12 / OL25
AL11 / AL43	Connection cable, 14-wire (available in 5 m steps) with right angle connector / straight connector
AU11 / AU43	Connection cable, 14-wire, interface converter RS232⇌USB with right angle connector / straight connector
AV11 / AV43	Connection cable, 14-wire, interface converter RS485⇌USB with right angle connector / straight connector
AK50	Connection cable for camera module (Limosa-plug⇌Cinch-plug, available in 5 m steps)
IF0000	LED digital indicator for remote adjustment of IR sensor parameters
Regulus RD / RF	PID program controller as bench top model / for panel mounting
NG12 / 15	Power supply 24 VDC: DIN rail power supply 1.6 A / desktop power supply 2.5 A



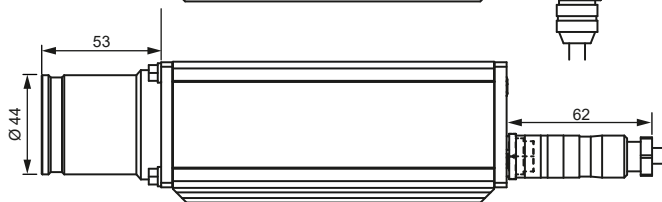
Dimensions

Dimensions in mm

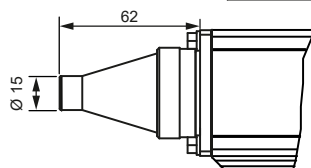
Manual focusable optics



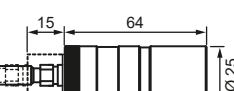
Motorized focus optics



Fiber optic devices, focusable optics



OL12: Optics 12 mm



OL25: Optics 25 mm

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

Sensortherm-Datasheet_Metis_M313 (Aug. 23, 2021)

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