PROCESS SENSORS CORPORATION

Metis M311 / M322

Highly Advanced, Full Featured 2-Color Pyrometer Series

The Advantages and benefits for using a self-contained 2-color pyrometer:

- Automatic compensation for viewing through dirty windows, dust and partial smoke
- Compensates for changes in target emissivity
- Measures smaller target than sensor's field of view (FOV)
- Unaffected by moving targets within FOV

APPLICATIONS

- Induction heating
- Steel/metals
- Metal pour streams
- Kilns
- Vacuum furnaces
- Welding
- Ceramics
- Composites
- Sintering
- Nuclear
- Research and development.

FEATURES

- Highest accuracy and repeatability even at high ambient temperatures up to 80°C (176°F) without cooling
- Temperature ranges between 300°C and 3300°C (572°F and 5972°F)
- Fully digital and very fast with response time <1 ms
- Adjustable or motorized focus optics
- Small spot sizes from 0.8 mm
- Laser, color video or thru-lens sighting
- Dirty window programmable alarm
- 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 20mA outputs
- 3 versatile configurable inputs or outputs
- Analog input for external emissivity setting
- Serial interfaces RS-232 and RS-485 (switchable)
- Optional fieldbus connection: Profinet or Profibus

Technical Data

Model	M311	M322
Temperature ranges	600 to 1400°C (1112 to 2552°F) 650 to 1500°C (1202 to 2732°F) 750 to 1800°C (1382 to 3272°F) 900 to 2500°C (1652 to 4532°F) 1000 to 3000°C (1832 to 5432°F) *) 1100 to 3300°C (2012 to 5972°F) *)	300 to 1000°C (572 to 1832°F) 350 to 1300°C (662 to 2372°F) 400 to 1600°C (752 to 2912°F) 500 to 1800°C (932 to 3272°F) 800 to 3000°C (1472 to 5432°F) **) 1000 to 3300°C (1832 to 5972°F) **)
Temp. sub ranges	Any temperature sub-range adjustable within the temperature range (minimum span 50°C)	
Spectral range	Channel 1: 0.93–1.1 µm / Channel 2: 0.75–0.93 µm *) Channel 1: 0.99 µm / Channel 2: 0.78 µm	Channel 1: 1.65–1.8 µm / Channel 2: 1.45–1.65 µm **) Channel 1: 1.64 µm / Channel 2: 1.4 µm
Detector	2 x Silicon	2 x 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 (ε = 1, t_{90} = 1s, T_A = 23°C)	Full-scale temperature up to 2500°C: 0.3% of measured value in °C + 2 K Full-scale temperature above 2500°C: 0.5% of measured value in °C	
Repeatability (ε = 1, t_{90} = 1s, T_A = 23°C)	0.1% of measured value in °C + 1 K	
Temperature coefficient (deviations from 23°C)	From 10°C to 60°C: 0.04%/K From 0 to 10°C and 60 to 80°C: 0.06%/K	
Slope / ratio	0.800–1.200	
Emissivity ε	0.050–1.200 (per channel, corresponds 5–120% in 0.1% steps)	
Transmission	0.050–1.000 (per channel, corresponds 5–100% in 0.1% steps)	
Fill factor spot size	0.050–1.000 (per channel, corresponds 5–100% in 0.1% steps)	
Analog output signal	2 configurable analog outputs 0 or 4–20 mA, max. load: 500 Ω Resolution 0.0015% of the adjusted temperature (16 Bit). User selectable: 2-color temperature, 1-color channel 1 or 1-color channel 2 temperature, device temp. Outputs can be set within or outside the temperature range.	
Serial interface	RS-232 (max. 115 kBd) or RS-485 (max. 921 kBd), switchable. Resolution 0.1°C or 0.1°F	
3 configurable Inputs / outputs	■ Digital inputs (max. 3 inputs, protected against reverse polarity): laser targeting light on/off, peak picker clearing, load pyrometer configurations, 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. ■ Analog input (0–20 mA, protected against reverse polarity and incorrect connection): analog adjustment of emissivity slope, emissivities in 1-channel use, meas. distance (devices with motorized focus)	
Peak picker	Automatic hold mode or manual time settings to clear (reset) or external clear via configurable input	
Display	10-digit LED display (5 mm high) for temperature or settings of IR sensor parameters Resolution 0.1°C or 0.1°F	
Parameter settings	Push buttons on the device, serial interface, PC software *SensorTools* or via self compiled communication program: Slope/ratio, switch-off level for measurement, switch-off level for dirty window alarm, emissivity, transmission, fill factor, temperature sub range, peak picker settings, device address, baud rate, response time, selecting analog outputs 0/4–20 mA, interface RS-232/RS-485 (selection on 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)	■ Thru-the-lens sighting with adjustable attenuation filter for eye protection of bright targets ■ Laser aiming light (red, λ=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: NTSC: 60 Hz, PAL: 50 Hz	
Optics	Manual focusable or optional motorized focus	
Ambient temperature	0 to 80°C (32 to 176°F), focusable lens assembly of fiber optic versions: -20 to 250°C (-4 to 482°F) Storage: -20 to 85°C (-4 to 185°F)	
Relative humidity	No condensing conditions	
Housing / protection class	Aluminum, IP65 to DIN 40 050 with connector	
Weight	650 g (1 lb. 6.9 oz.)	
CE label	According to EU directives for electromagnetic immunity	

Reference Numbers

Metis M311 / Metis M322 Specify each with temperature range, sighting method and optics

Note: *SensorTools* software is included as standard equipment. Connection cables must be ordered separately.

Power Up and Measure Temperature

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.

The short-wave spectral ranges of the various models are specially designed for accurate temperature measurements of metals and other bright, reflective materials.

In comparison to radiation pyrometers, 2-color pyrometers measure in two spectral ranges simultaneously (at two wavelengths) and determine the temperature by forming the radiation ratio (quotient).
In this method it is not necessary to know the emissivity of the target material or fulfill the sensor's spot size with the target.

Features

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 measurement settings directly on the device
- LEDs for the display of active 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

A Variety of Models:
- Motorized focus optics
- Optics with manual adjustment of focus
- Optical fiber version with small optical heads

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

Additional Equipment:
- Fieldbus interfaces: Profinet, Profibus

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

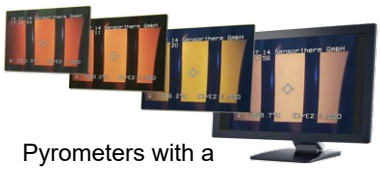
The **view finder** provides upright imagery so that the target under measurement can be viewed visually. A circular reticle shows the measuring spot. Recommended for glowing measurement objects, as a red laser is difficult to detect.

For devices with measuring range above 1800°C, the eyepiece can be darkened for eye protection.

Focus

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.

Targeting light on / off



Pyrometers with a **color camera module** provide a composite video output that can be connected to a video monitor or PC with a converter. 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.

Intelligent Installation Possibilities

Serial Interface RS-232 or RS-485 (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 RS-232 or RS-485.

- RS-232 for short distances to the PC.
  Transfer rates of max. 115 kB
- RS-485 for long distance connection.
  Max. of 921 kB, use in bus configuration.

An interface converter RS-232 or RS-485 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 display.
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.

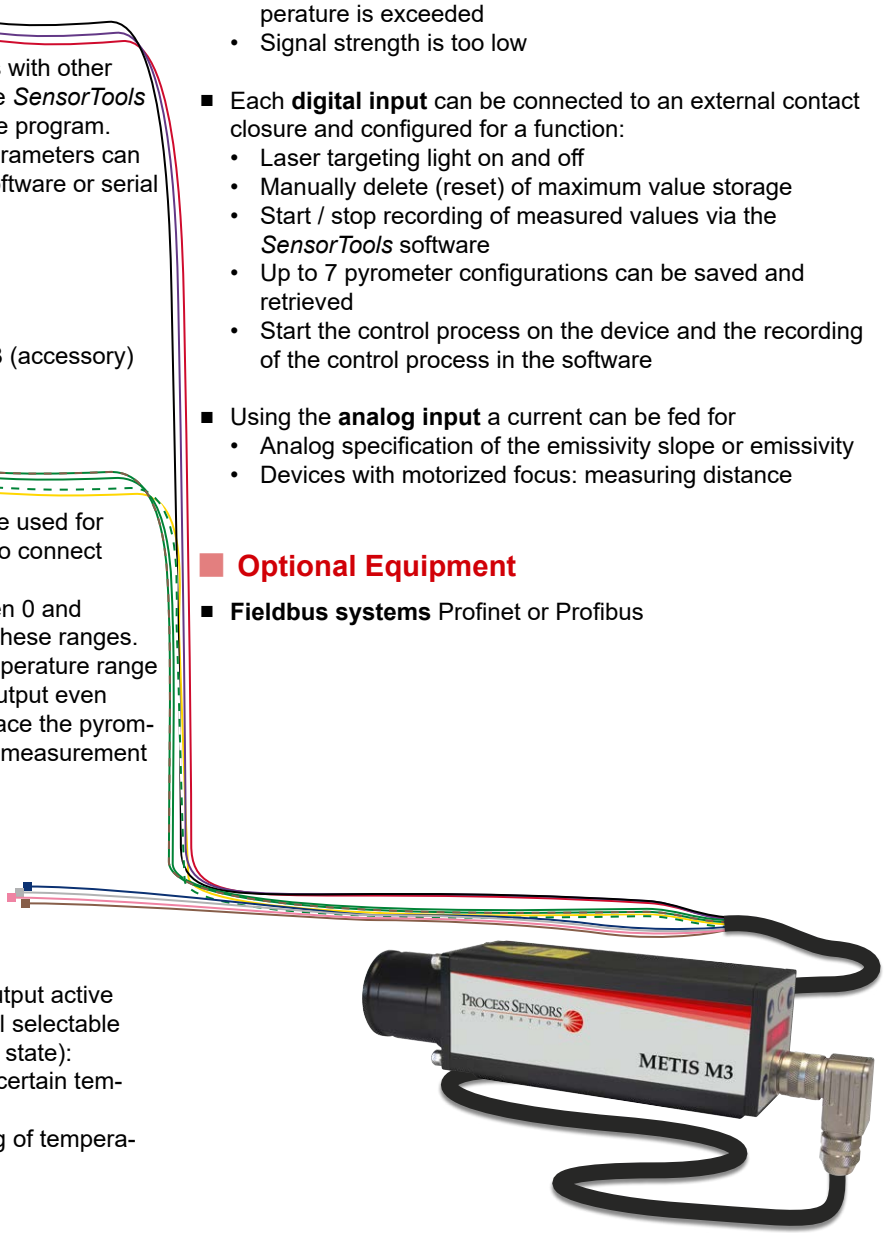
3 Configurable Inputs / Outputs

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 (rear panel LEDs indicate the switching state):
  - Limit switch for decreasing or exceeding a certain temperature threshold
  - 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
- 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 can be saved and retrieved
  - 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 the emissivity slope or emissivity
  - Devices with motorized focus: measuring distance

Optional Equipment

- **Fieldbus systems** Profinet or Profibus



Comprehensive Settings

Measuring Mode

2-color mode, switchable to 1-color modes (channel 1 or 2 selectable) for use as a standard radiation pyrometer.

Dirty Window Alarm

A signal strength monitoring function detects the degree of contamination of the pyrometer's optics, viewing window or identify interferences (dust...) in the IR sensor's sight path and triggers an alarm if activated.

Switch-off Level

The switch-off level defines a signal level, the temperature measurement is switched off, due to low level signal strength (e.g. if the contamination in the pyrometer field of view is too strong).

Peak Picker / Maximum Value Storage

The peak picker also detects the temperature when the measurement object appears only briefly in the pyrometer's field of view. Application example: rolling mills with scaled surfaces.

Material Properties

The input options for material entry have been simplified:

- **Emissivity slope:** Measuring objects whose emissivity is different at the two wavelengths (e.g. bright, unoxidized metal surfaces), the emissivity ratio can be adjusted. Targets with the same emissivity at the two wavelengths can be measured without adjustment of the slope/ratio setting.
- **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 can be adjusted based on the window material.

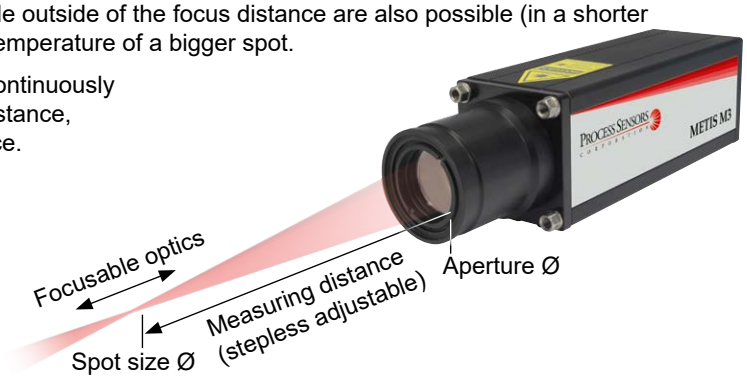
Device Designs / Optics

Process Sensors 2-color pyrometers are equipped with two separate silicon or indium-gallium-arsenide detectors, which differ from sandwich detectors with very high signal strengths on both channels, ensuring high stability and accuracy.
Specially designed lenses compensate the color aberration at the two measurement wavelengths and ensure that the focal distances of the two wavelengths are collimating at the same position.

The pyrometer must be properly aligned to the measurement object to detect the temperature correctly. At the focal point of the lens (focal distance) the spot size diameter is smallest. Measurements made outside of the focus distance are also possible (in a shorter or longer distance than the focus distance) to determine the average temperature of a bigger spot.

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.

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.



Integrated Optics (with motorized focus or manually focusable)

Optics (focusable)	Measuring distance a [mm] adjustable		Spot size M [mm] M322 300–1000°C	Spot size M [mm] M311 / M322 All other temp. ranges	Aperture Ø D [mm]
M311: OQ11-**A**1 M322: OQ22-**A**2	from	340 mm	1.4 mm	0.8 mm	16 mm (FSC≤1400°C) 8 mm (FSC >1400°C)
		500 mm	2.7 mm	1.5 mm	
		700 mm	3.7 mm	2 mm	
	...	1000 mm	5.6 mm	2.8 mm	
		2000 mm	10 mm	5.8 mm	
	to	3000 mm	14 mm	7.8 mm	
M311: OQ11-**F**1 M322: OQ22-**F**2	from	1000 mm	5.6 mm	2.8 mm	
		2000 mm	10 mm	5.8 mm	
		3000 mm	14 mm	7.8 mm	
	...	4000 mm	19 mm	11 mm	
		5000 mm	24 mm	14 mm	
	to	10000 mm	51 mm	29 mm	

FSC = Full scale temp. range

Manual Focus

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

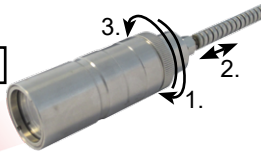
Motorized focus

- Via push buttons
- Via PC software

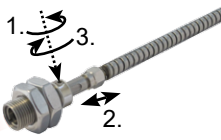
Fiber Optics (Standard 25 mm outside diameter or Miniature 12 mm)

Optics (focusable)	Measuring distance a [mm] adjustable		Spot size M [mm] M322 300–1000°C	Spot size M [mm] M311 / M322 All other temp. ranges	Aperture Ø D [mm]
M311: OQ25-**B**1 M322: OQ25-**B**2	from	240 mm	2 mm	1 mm	13 mm
		500 mm	3.7 mm	2.5 mm	
		700 mm	5.2 mm	3.5 mm	
	...	1000 mm	7.7 mm	5 mm	
		2000 mm	15.4 mm	10 mm	
	to	3000 mm	23 mm	15 mm	
M311: OQ12-**C**0 M322: OQ12-**C**0	from	120 mm	2.2 mm	1.2 mm	7 mm
	...	250 mm	5 mm	2.5 mm	
	to	500 mm	12 mm	6 mm	
			Fiber Ø 0.4 mm	Fiber Ø 0.2 mm	

Standard: OQ25



Miniature: OQ12



Typical Applications

Model Selection Table - M311 / M322

1		2		3		4		5		6		7		8		9		10		11		12
M3xx	-	xxxx	-	xxxx	-	x	-	x	-	x	-	xx	-	x	-	x	-	x	-	x	-	x

1 **Model, Detector, Spectral Range:**
M311 = Silicon, 0.7 – 1.1 µm
M322 = InGaAs, 1.45 – 1.8 µm

2 **Zero Scale Temperature:**
e.g. 0600 = 600°C

3 **Full Scale Temperature:**
e.g. 1300 = 1300°C

4 **Sighting Method:**
1 = Laser targeting
2 = Through lens sighting
4 = Color camera module

5 **Serial Interface:**
3 = Profinet internally
4 = Profibus internally
5 = Switchable RS485 / RS232

6 **Optics:**
2 = Manual focusable optics
3 = Fiber Ø 0.2 mm (refer to brochure)
4 = Fiber Ø 0.4 mm (refer to brochure)
8 = Motorized focusable optics
B = Heavy-duty stainless steel braided hose assy for 0.2 mm fiber with OQ25
C = Heavy-duty stainless steel braided hose assy for 0.4 mm fiber with OQ25

7 **Response Time:**
13 = 1 ms, adjustable to 10 s

8 **Version:**
0 = Standard (12 pin connector, display, push buttons, 3 digital inputs / outputs)
5 = 17 pin connector (no display), 4 digital inputs, 2 digital output, (no push button)

9 **Display:**
4 = With display (12 pin connector)
0 = Without display (17 pin connector)

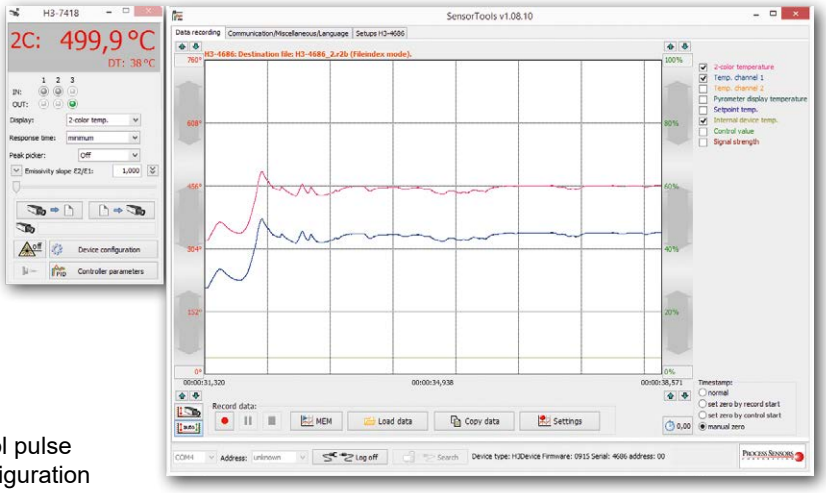
10 **Analog Output:**
2 = Two 0/4-20 mA analog outputs, standard

11 **Digital Input / Output:**
3 = 3 digital inputs / outputs / 1 analog input 0–20 mA (12 pin connector)
4 = 4 digital inputs + 1 analog input + 2 digital outputs (17 pin connector, no display)

12 **Optics Type:**
A,B, C or F
(Refer to product brochure)
Example for M311:
A = OQ11-**A**1

Example: M311-0600-1400-1-5-2-13-0-4-2-3-A
This model refers to: Model M311, temperature range of 600-1400°C, laser targeting, RS232 & RS485 communication, manual focus optics, 1 ms response time, std. version sensor, onboard temperature display,
two 0/4-20 mA outputs, 3 digital inputs/outputs, optics type A.

SensorTools Software

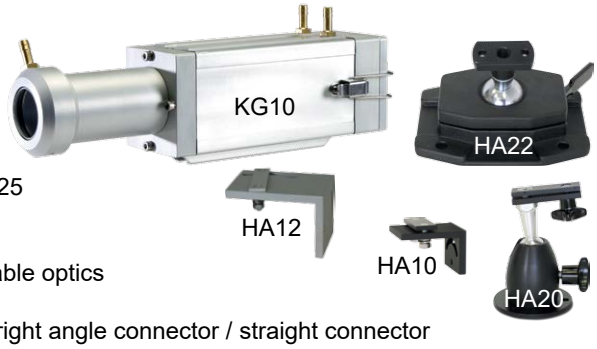


- Measured values of all channels:
  2-color temperature + 1-color temperatures,
  at the same time, graphical and numerical
- Measured value recording
- Processing the results
- Displaying internal devices temperature
- Changing pyrometer parameters

Program functions:

- Change pyrometer parameters
- Playback of recorded data
- Adapted graphics mode to computer performance
- Export measured values in csv files
- Record interval setting for acceptable data size.
- Back time recording of measured values after control pulse
- Laser targeting light activation / camera display configuration
- External start and stop of the recording measured values (via control input on the pyrometer)
- Create a service file with settings for remote diagnostics

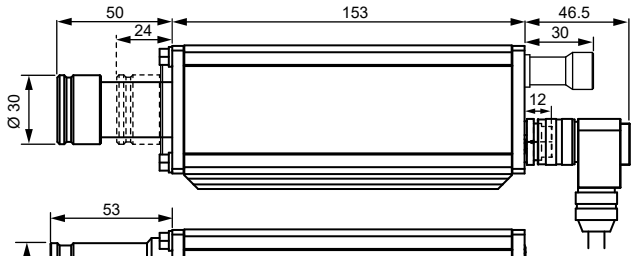
Recommended Accessories

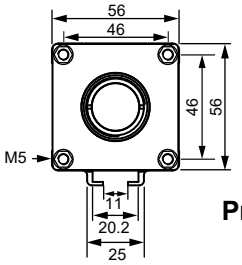


HA20	Ball and socket swivel mount for sensor alignment
HA22	Ball and socket swivel mount for water cooling housing
HA10	Mounting bracket for sensor alignment
HA12	Mounting bracket for water cooling housing
HA14 / 15	Adjustable mounting bracket for fiber optics OQ12 / OQ25
KG10	Aluminum water cooling housing
KG20	Aluminum cooling plate
BL10 / 11	Air purge for devices with motor focus / manually focusable optics
BL13 / 14	Air purge for fiber optics OQ12 / OQ25
AL11 / 43	Connection cable, 14-wire (available in 5 m steps) with right angle connector / straight connector
AU11 / 43	Connection cable, 14-wire, interface converter RS-232⇔USB with right angle connector / straight connector
AV11 / 43	Connection cable, 14-wire, interface converter RS-485⇔USB with right angle connector / straight connector
AK50	Connection cable for camera module (Limosa-plug⇔Cinch-plug, available in 5 m steps)
AK54	Profinet netwok cable, Ethernet CAT6 (available in 5 m steps)
AK72 / 73 / 76 / 81	Profibus connection cable (input cable / output cable / devices connection cable / terminating resistor)
IF00	LED digital indicator for remote adjustment of IR sensor parameters
950-004	Power supply 24 V DC

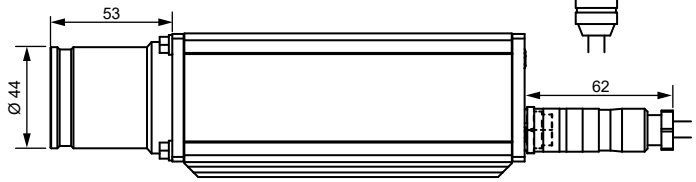
Dimensions

Manual focusable optics

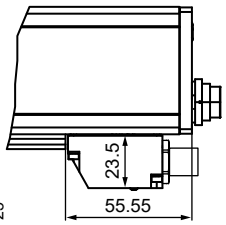




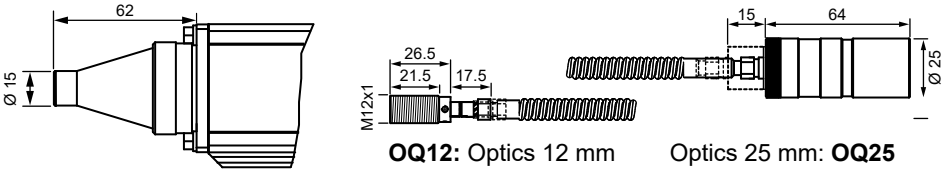
Motorized focus optics



Profibus / Profinet



Fiber optic devices, focusable optics



OQ12: Optics 12 mm Optics 25 mm: **OQ25**

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

Metis_M311_M322 (Feb. 05, 2018)

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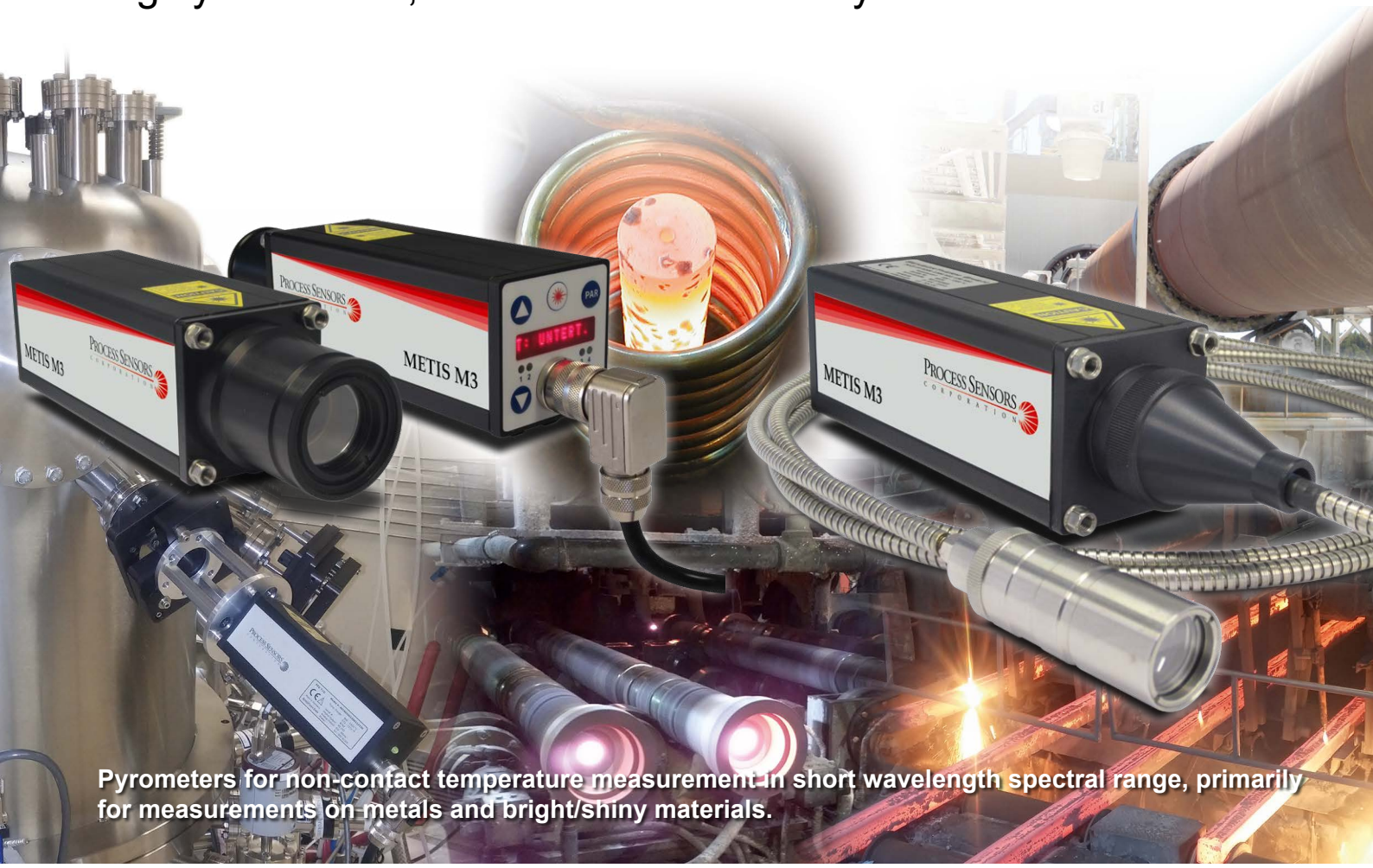
PROCESS SENSORS CORPORATION

Metis M309 / M316 / M318

Highly Advanced, Full Featured 1-color Pyrometer



Pyrometers for non-contact temperature measurement in short wavelength spectral range, primarily for measurements on metals and bright/shiny materials.

APPLICATIONS

- Induction heating
- Steel/metals
- Metal pour streams
- Kilns
- Vacuum furnaces
- Welding
- Ceramics
- Composites
- Sintering
- Nuclear
- Research and development.

FEATURES

- Highest accuracy and repeatability, even at high temperatures and up to 80°C (176°F) without cooling
- Wide temperature ranges between 100°C and 3300°C (212°F and 5972°F)
- Fully digital and very fast with response time <1 ms
- Different optics with extremely small spot sizes from 0.4 mm can be selected
- 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
- Analogue input for external setpoint or emissivity setting
- Laser targeting, color video or thru-lens sighting
- Serial interfaces RS232 and RS485 (switchable)
- Optional fieldbus connection: Profinet or Profibus

Technical Data

Model	M309	M316	M318
Temperature ranges	550 – 1400°C 600 – 1600°C 650 – 1800°C 750 – 2500°C 900 – 3000°C *) 1000 – 3300°C *)	200 – 1300°C 250 – 1300°C 350 – 1800°C 400 – 2500°C 500 – 3300°C **)	100 – 700°C 150 – 1200°C 180 – 1300°C
Temp. sub ranges	Any temperature sub-range adjustable within the temperature range (minimum span 50°C)		
Spectral range	0.7–1.1 µm *) 0.87 µm	1.45–1.8 µm **) 1.4 µm	1.65–2.1 µm
Detector	Silicon	InGaAs	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 (ε = 1, t_{90} = 1s, T_A = 23°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		0.4% of reading in °C + 1 K or 2°C (the higher value is valid)
Repeatability (ε = 1, t_{90} = 1s, T_A = 23°C)	0.1% of reading in °C + 1 K		0.2% of reading in °C + 1 K or 1.6°C (the higher value is valid)
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		10 to 60°C: 0.02%/K 0 to 10°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 spot size	0.050–1.000 (corresponds 5–100% in 0.1% steps)		
Analog output signal	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	■ Digital inputs (max. 3 inputs, protected against reverse polarity): laser targeting light on/off, clearing of peak picker, 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. ■ Analog input (0–20 mA, protected against reverse polarity and incorrect connection): analog adjustment of emissivity, or measuring distance (devices with motorized focus).		
Peak picker	Automatic hold mode or manual time settings to clear (reset) or external clear via configurable input		
Display	10-digit LED display (5 mm high) for temperature or settings of IR sensor parameters Resolution 0.1°C or 0.1°F		
Parameter settings	Push buttons on the device, serial interface, PC software *SensorTools* 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)	■ Thru-the-lens sighting with adjustable attenuation filter for eye protection of bright targets ■ Laser targeting light (red, λ=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: NTSC: 60 Hz, PAL: 50 Hz		
Optics (optional)	Manual focusable or optional motorized focus or fixed focus optics		
Ambient temperature	0 to 80°C, focusable lens assembly: -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 (-4 to 185°F)		
Relative humidity	No condensing conditions		
Housing / protection class	Aluminum, IP65 to DIN 40 050 with connector		
Weight	650 g (1 lb. 6.9 oz.)		
CE label	According to EU directives for electromagnetic immunity		

Reference Numbers

Metis M309 / M316 / M318 Specify each with temperature range, sighting method and optics

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

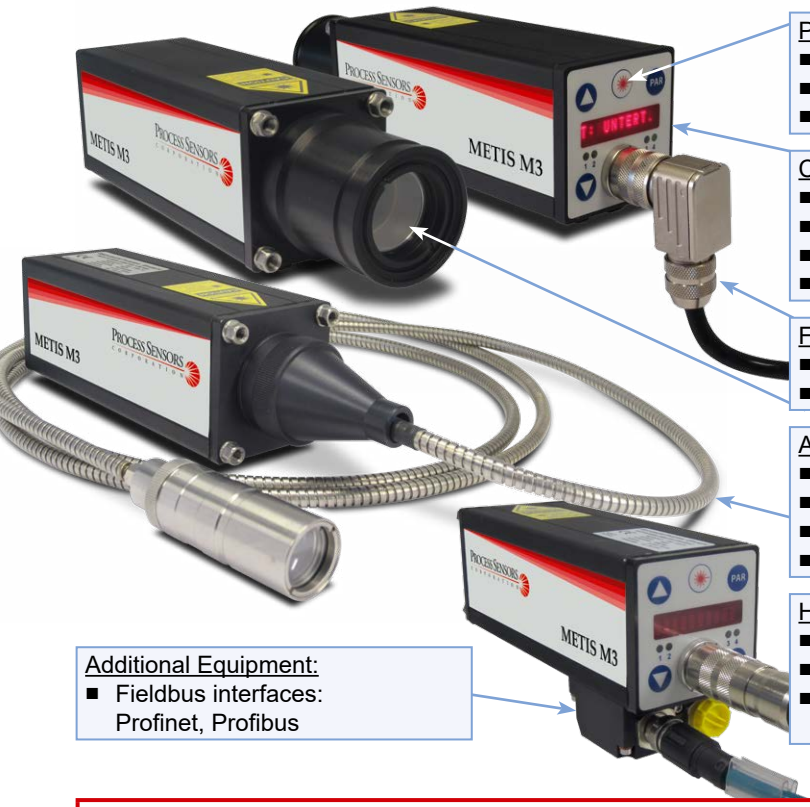
Power Up and Measure Temperature

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.

The short-wave spectral ranges of the various models are specially designed for accurate temperature measurements of metals and other bright, reflective materials.

The models M309, M316 and M318 differ in their spectral ranges and associated in their ranges.
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.

Features



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 measurement settings directly on the device
- LEDs for the display of active 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

A Variety of Models:
- Motorized focus optics
- Optics with manual adjustment of focus
- Fixed focus optics for smallest spot sizes
- Fiber optic version with small optical heads

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

Additional Equipment:
- Fieldbus interfaces: Profinet, Profibus

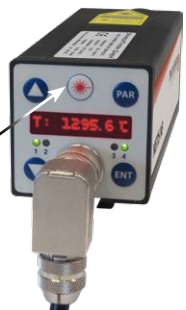
Sighting Method Selection

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

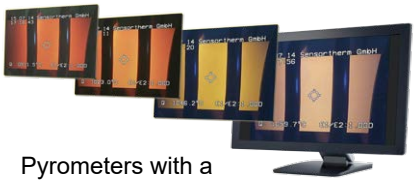
The **view finder** provides upright imagery so that the target under measurement can be viewed visually. A circular reticle shows the measuring spot. Recommended for glowing measurement objects, as a red laser is difficult to detect. For devices with measuring range above 1800°C, the eyepiece can be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

Focus

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.



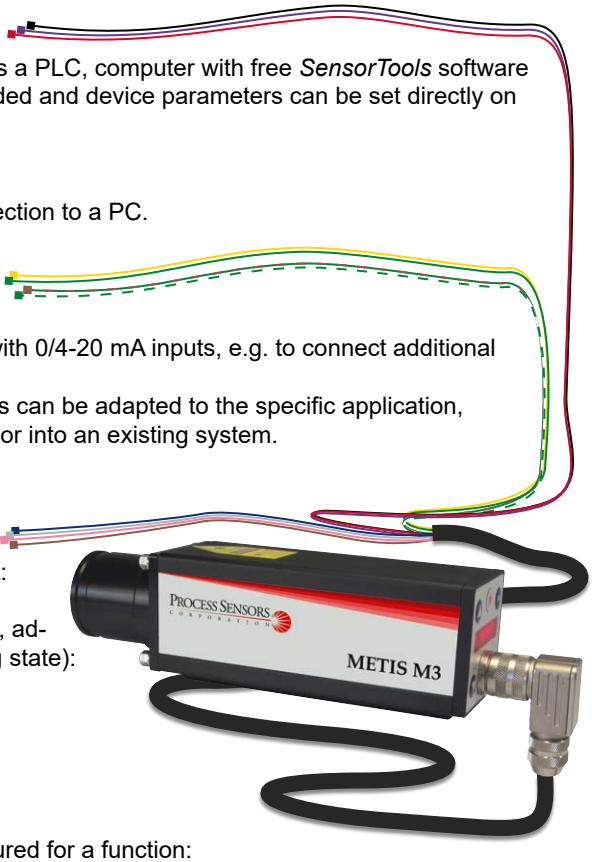
Targeting light on / off



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/-D2 (340–4000 mm).

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 other devices.
By “scalable” it is meant that the temperature range assigned to the analog outputs can be adapted to the specific application, allowing reduction or expansion of the range as needed when integrating the sensor into an existing system.

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 (Rear panel LEDs indicate the switching state):
  - Limit switch for decreasing or exceeding a certain temperature threshold
  - 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 (dirty window alarm)
- 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 can be saved and retrieved
- Using the **analog input** (available soon and to install via firmware update) a current can be fed for
  - Analog specification of the emissivity

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. To maintain the accuracy, M318 models should be used only up to 60°C ambient temperature due to the low initial temperature measurement.

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.

Maximum Value Storage (Peak Picker)

The maximum value storage 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, e.g. steel surfaces with scale in hot rolling mill application. The maximum value can be reset automatically or manually or by a selectable clear time.

Fieldbus Systems

Optional pyrometer control can be done with

- Profinet or Profibus

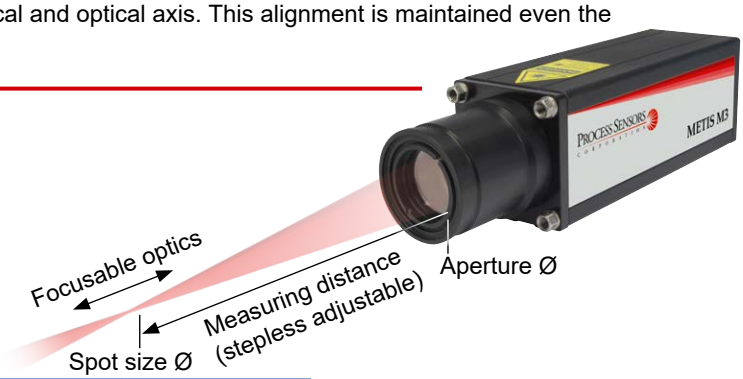
Device Designs / Optics

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.

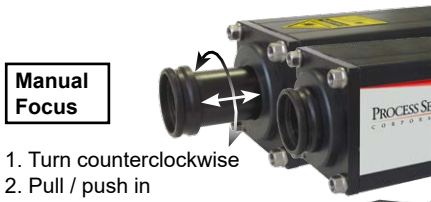
Fixed focus optics are factory-set to a certain measurement distance reaching there the smallest possible spot size. The robust and precise design provides minimal axial deviations between mechanical and optical axis. This alignment is maintained even the device is rotated, useful in measurements through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



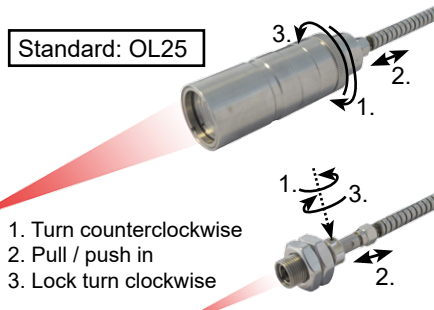
Integrated Optics (manually adjusted or motorized focus)
- with sighting method laser targeting light or view finder

Optics (focusable)	**Measuring distance a [mm]** adjustable	**Spot size M [mm]** **M318** (100–700°C)	**M309** (all ranges) **M316** (all ranges) **M318** (150–1200°C 180–1300°C)	**Aperture Ø D [mm]**
OM09-**A**0	from 130 mm	0.6 mm	0.4 mm	16 mm (FSC≤1400°C) 8 mm (FSC>1400°C) FSC = Full scale temperature
	··· 160 mm	0.8 mm	0.5 mm	
	to 200 mm	1.1 mm	0.65 mm	
OM09-**B**0	from 190 mm	0.8 mm	0.5 mm	
	··· 300 mm	1.4 mm	0.9 mm	
	to 420 mm	2 mm	1.3 mm	
OM09-**C**0	from 340 mm	1.3 mm	0.8 mm	
	500 mm	2.3 mm	1.3 mm	
	700 mm	3.3 mm	2 mm	
	··· 1000 mm	4.5 mm	2.9 mm	
	2000 mm	10.5 mm	6.1 mm	
	to 4000 mm	18 mm	13 mm	
- with sighting method color camera module				
M309: OV09-**D**1 M316/18: OV09-**D**2	from 340 mm	1.8 mm	0.9 mm	
	700 mm	3.8 mm	1.9 mm	
	··· 1000 mm	5.6 mm	2.8 mm	
	2000 mm	10 mm	4.7 mm	
	to 4000 mm	19 mm	11 mm	



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

Standard: OL25-**G**0	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	
Standard: OL25-**H**0	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	
Miniature: OL12-**A**0	from 100 mm	1.5 mm	0.9 mm	7 mm
	··· 350 mm	6.2 mm	3.7 mm	
	to 600 mm	10.9 mm	6 mm	
		Fiber Ø 0.4 mm	Fiber Ø 0.2 mm	



Integrated Fixed Focus Optics with laser targeting light or view finder

OM89	Fixed focus optics for smallest spot sizes and long measuring distances available on request. Distance ratio up to 900:1 (tube lengths 89 and 160 mm)	27 mm
OM160		

Model Selection Table - M309 / M316 / M318

1		2		3		4		5		6		7		8		9		10		11		12
M3xx	-	xxxx	-	xxxx	-	x	-	x	-	x	-	xx	-	x	-	x	-	x	-	x	-	x

1 **Model, Detector, Spectral Range:**
M309 = Silicon, 0.7 – 1.1 µm
M316 = InGaAs, 1.45 – 1.8 µm
M318 = ext. InGaAs, 1.65 – 2.1 µm

2 **Zero Scale Temperature:**
e.g. 0650 = 650°C

3 **Full Scale Temperature:**
e.g. 1800 = 1800°C

4 **Sighting Method:**
1 = Laser targeting
2 = Through lens sighting
4 = Color camera module

5 **Serial Interface:**
3 = Profinet internally
4 = Profibus internally
5 = Switchable RS485 / RS232

6 **Optics:**
1 = Fixed focus
2 = Manual focusable optics
3 = Fiber Ø 0.2 mm (refer to brochure)
4 = Fiber Ø 0.4 mm (refer to brochure)
8 = Motorized focusable optics
B = Heavy-duty stainless steel braided hose assy for 0.2 mm fiber with OL25
C = Heavy-duty stainless steel braided hose assy for 0.4 mm fiber with OL25

7 **Response Time:**
13 = 1 ms, adjustable to 10 s

8 **Version:**
0 = Standard (12 pin connector, display, push buttons, 3 digital inputs / outputs)
5 = 17 pin connector (no display), 4 digital inputs, 2 digital output, (no push button)

9 **Display:**
4 = With display (12 pin connector)
0 = Without display (17 pin connector)

10 **Analog Output:**
2 = Two 0/4-20 mA analog outputs, standard

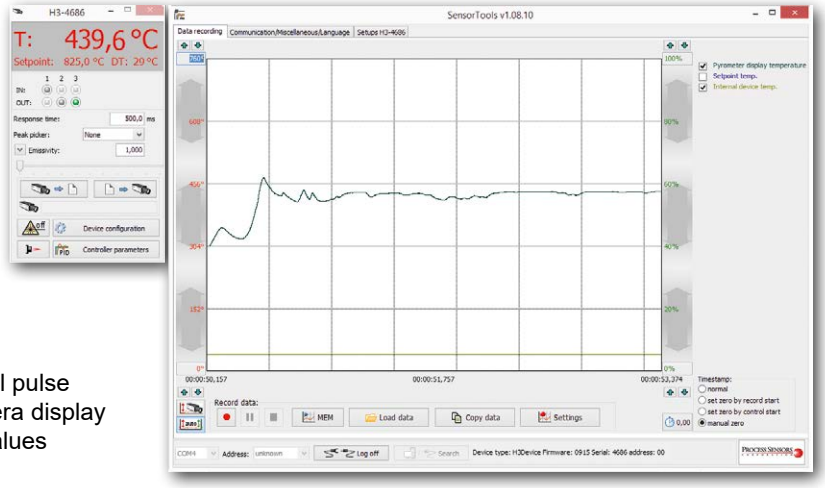
11 **Digital Input / Output:**
3 = 3 digital inputs / outputs / 1 analog input 0–20 mA (12 pin connector)
4 = 4 digital inputs + 1 analog input + 2 digital outputs (17 pin connector, no display)

12 **Optics Type:**
A, B, C, D, G or H
(Refer to product brochure)

Example: M309-0650-1800-1-5-2-13-0-4-2-3-A
This model refers to: Model M309, temperature range of 650-1800°C, laser targeting, RS232 & RS485 communication, manual focus optics, 1 ms response time, std. version sensor, onboard temperature display, two 0/4-20 mA outputs, 3 digital inputs/outputs, optics type A.

SensorTools Software

- Measurement display
- Measured value recording
- Processing the results
- Display devices inside temperature
- Changing pyrometer parameters



Program functions:

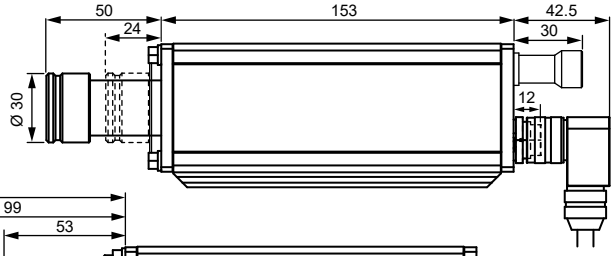
- Change pyrometer parameters
- Playback of recorded data
- Adapted graphics mode to computer performance
- Export measured values in csv files
- Record interval setting for acceptable data size.
- Back time recording of measured values after control pulse
- Laser targeting light switching / configuring the camera display
- External start and stop of the recording measured values (via control input on the pyrometer)
- Create a service file with settings for remote diagnostics

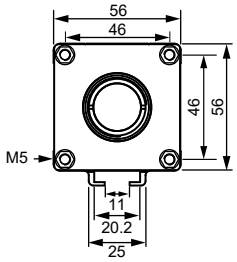
Recommended Accessories

HA20	Ball and socket swivel mount for sensor alignment
HA22	Ball and socket swivel mount for water cooling housing
HA10	Mounting bracket
HA12	Mounting bracket for water cooling housing
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 RS-232⇔USB with right angle connector / straight connector
AV11 / AV43	Connection cable, 14-wire, interface converter RS-485⇔USB with right angle connector / straight connector
AK50	Connection cable for camera module (Limosa-plug⇔Cinch-plug, available in 5 m steps)
AK54	Profinet netwok cable, Ethernet CAT6 (available in 5-m-Schritten)
AK72 / 73 / 76 / 81	Profibus connection cable (input cable / output cable / devices connection cable / terminating resistor)
IF00	LED digital indicator for remote adjustment of IR sensor parameters
950-004	Power supply 24 V DC

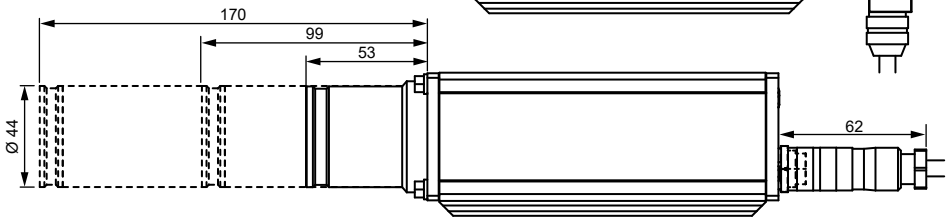
Dimensions

Manual focusable optics

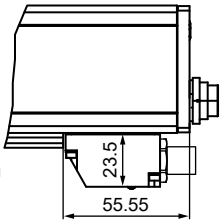




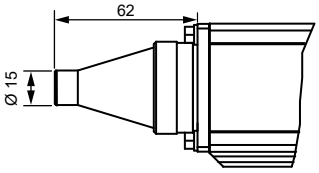
Motorized focus optics
Fixed focus optics

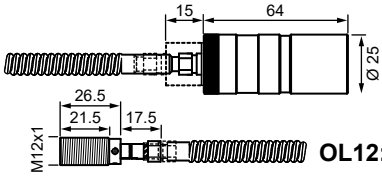


Profibus / Profinet



Fiber optic devices, focusable optics





OL25: Optics 25 mm

OL12: Optics 12 mm

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

Metis-M309_M316_M318 (Feb. 05, 2018)

PROCESS SENSORS CORPORATION
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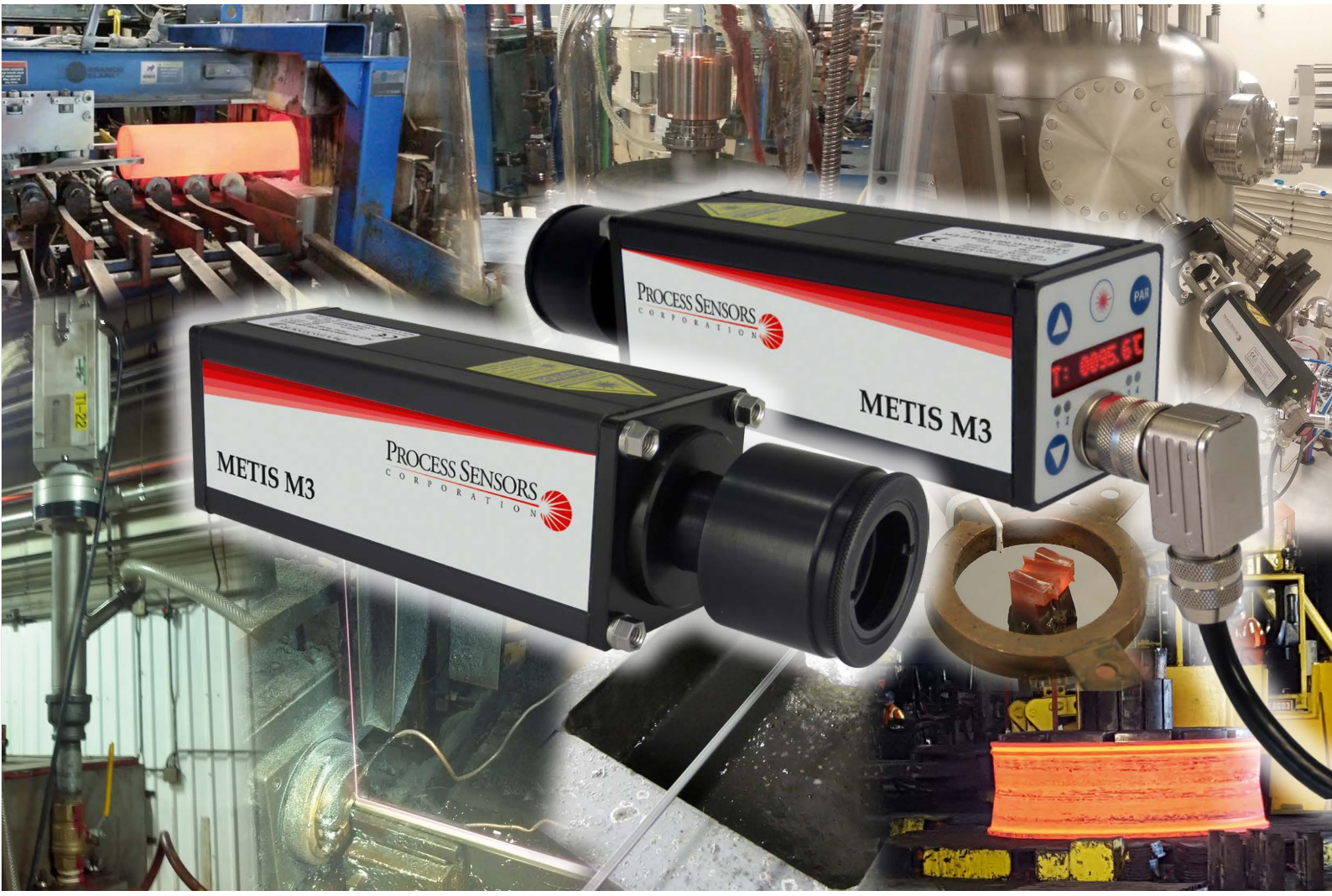
PROCESS SENSORS CORPORATION

Metis M323

High-End 1-Color Radiation Pyrometer



Pyrometers for non-contact temperature measurements from 80°C in short wavelength spectral range, primarily for measurements on metals and bright and shiny materials, ceramics and graphite.

APPLICATIONS

- Induction Heating
- Steel / Metals
- Vacuum Furnaces
- Ceramics
- Composites
- Soldering
- Research and Development

FEATURES

- Highest measuring accuracy even at low emissivity settings
- Fully digital and very fast with response time <1 ms
- Choice of optics with extremely small spot sizes from 0.6 mm
- Push button device parameter configuration, or via no-cost software
- 2 high resolution 16 bit analog 0/4 to 20 mA outputs
- 3 versatile configurable inputs or outputs
- Serial interfaces RS-232 and RS-485 (switchable)
- Analog input for external set point or emissivity setting
- 10 digit matrix display for temperature and sensor parameters
- Operates at ambient temperature of 70°C without cooling

Low Temperature Design

The Metis M323 is a short-wave, infrared radiation measuring device that detects target temperatures from 80°C with the highest possible accuracy. The combination of short-wave spectral range and a low temperature threshold enables reliable measurement of all metallic materials, especially in heating processes where early observation may be critical.

The very fast response time of only 1ms and measurement spot sizes from 0.6 mm make the M323 ideal for many exacting applications.

Integrated continuous temperature monitoring and ambient temperature compensation ensure accurate measurements, even up to ambient 70°C without cooling. As with all Process Sensors pyrometers, the M323's digital design provides precise measurement results in continuous daily use regardless of target emissivity.

Technical Data

Model	**M323**
Temperature ranges	80 to 1200°C (176 to 2172°F) 100 to 1500°C (212 to 2732°F)
Temp. sub ranges	Any temperature sub-range adjustable within the temperature range (minimum span 50°C)
Spectral range	2 – 2.6 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
Accuracy (ε = 1, t_{90} = 1s, T_A = 23°C)	0.4% of reading in °C + 1 K or 2°C (the higher value is valid)
Repeatability (ε = 1, t_{90} = 1s, T_A = 23°C)	0.2% of reading in °C + 1 K or 1.6°C (the higher value is valid)
Temperature coefficient (deviations from 23°C)	0–70°C: 0.04%/K
Emissivity ε	0.050–1.200 (corresponds 5–120% in 0.1% steps)
Transmittance	0.050–1.000 (corresponds 5–100% in 0.1% steps)
Fill factor 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	RS-232 (max. 115 kBd) or RS-485 (max. 921 kBd), switchable. Resolution 0.1°C or 0.1°F
3 configurable Inputs / outputs	■ 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 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	10-digit LED display (5 mm high) for temperature or settings of IR sensor parameters Resolution 0.1°C or 0.1°F
Parameter settings	Push buttons on the device, serial interface, PC software *SensorTools* or via self-compiled communication program: Emissivity, transmittance, 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).
Power requirement	24 V DC (18–30 V DC), max. 6 VA; protected against reverse polarity
Isolation	Power supply, analog outputs and serial interface are galvanically isolated from each other
Sighting	Laser targeting light (red, λ=650 nm, P< 1 mW, class 2 according to IEC 60825-1)
Ambient temperature	0 to 70°C (32 to 158°F) (The laser targeting light is deactivated at a device temperature from 60°C to prevent its overheating)
Storage temperature	-20 to 85°C (-4 to 185°F)
Relative humidity	No condensing conditions
Housing / protection class	Aluminum, IP65 to DIN 40 050 with connector
Weight	650 g (1.43 lb.)
CE label	According to EU directives for electromagnetic immunity

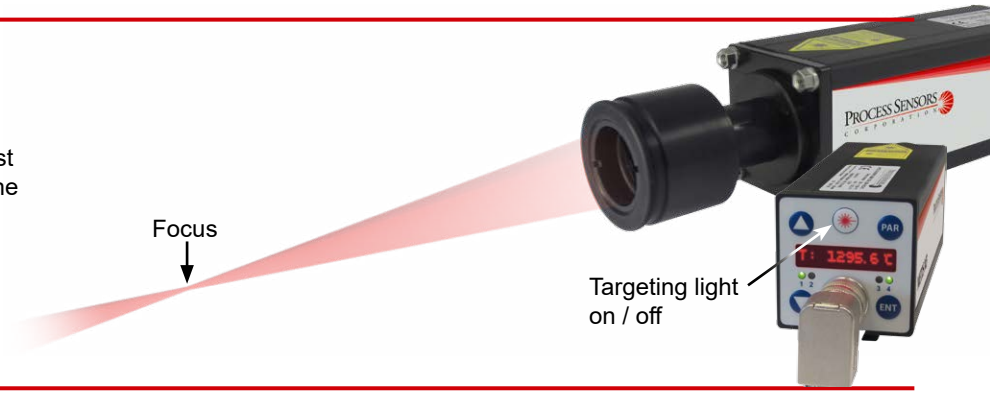
Reference Numbers

M323 Specify with temperature range and optics

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

Sighting Method

The laser targeting light is a conical red laser beam with the largest diameter directly at the IR sensor's lens and the smallest and sharpest at the focus distance, i.e. at the point where the spot size diameter is the smallest.



Features

Proven Sighting:
- Precise laser targeting light

Clear Device Operation:
- Large, bright display for temperature or parameters
- All measurement settings directly on the device
- LEDs for the display of active limit outputs

Fast, Accurate Outputs:
- Switchable serial interface RS232 or RS485 (high-speed up to 921 kBaud)
- 2 high resolution 16 bit analog 0/4 to 20mA outputs
- 3 configurable inputs / outputs

Wide-aperture fast focusable optics:
- 4 optics with adjustable measuring distance selectable

Harsh Environmental Conditions:
- Use at ambient temperatures up to 70°C with best ambient temperature compensation

As with all Metis M3 models:
- Adjustable material properties (emissivity, transmittance, spot size fill factor)
- Peak picker
- Additional equipment variants: integrated PID controller, fieldbus interface Profibus or Profinet.

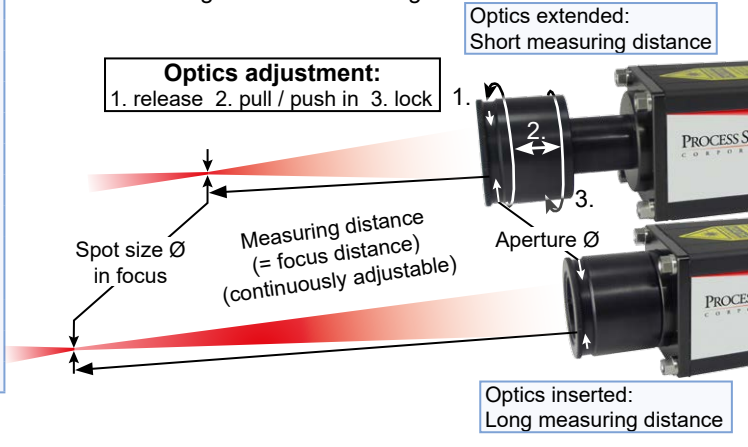
Wide-aperture Optics

For dependable measurements at low temperatures, the M323 is equipped with larger diameter optics aperture. There are 4 different types available, depending on the required focusing range/measuring distance and the spot size diameter.

Integrated manual Focusable Optics

Optics (focusable)	**Measuring distance a [mm]** adjustable focus range		**Spot size diameter M [mm]**	**Aperture Ø D [mm]**
OM23-**A**0	from	100 mm	0.6 mm	26 mm
	···	110 mm	0.7 mm	
	to	130 mm	0.9 mm	
OM23-**B**0	from	175 mm	1 mm	
	···	250 mm	1.5 mm	
	to	300 mm	1.7 mm	
OM23-**C**0	from	300 mm	1.5 mm	
		500 mm	3 mm	
	···	700 mm	4.4 mm	
	to	1000 mm	6.5 mm	
OM23-**D**0	from	1000 mm	7 mm	
		2000 mm	14 mm	
	···	4000 mm	29 mm	
		7000 mm	51 mm	
		10000 mm	73 mm	
	to	>10000 mm	divergent	

The pyrometer must be properly aligned to the measurement object to detect the temperature correctly. At the focal point of the optics (focal distance) the spot size diameter is smallest. Measurements made outside of the focus distance are also possible (in a shorter or longer distance than the focus distance) to determine the average temperature of a bigger spot.
Values in the optics table 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.



Model Selection Table

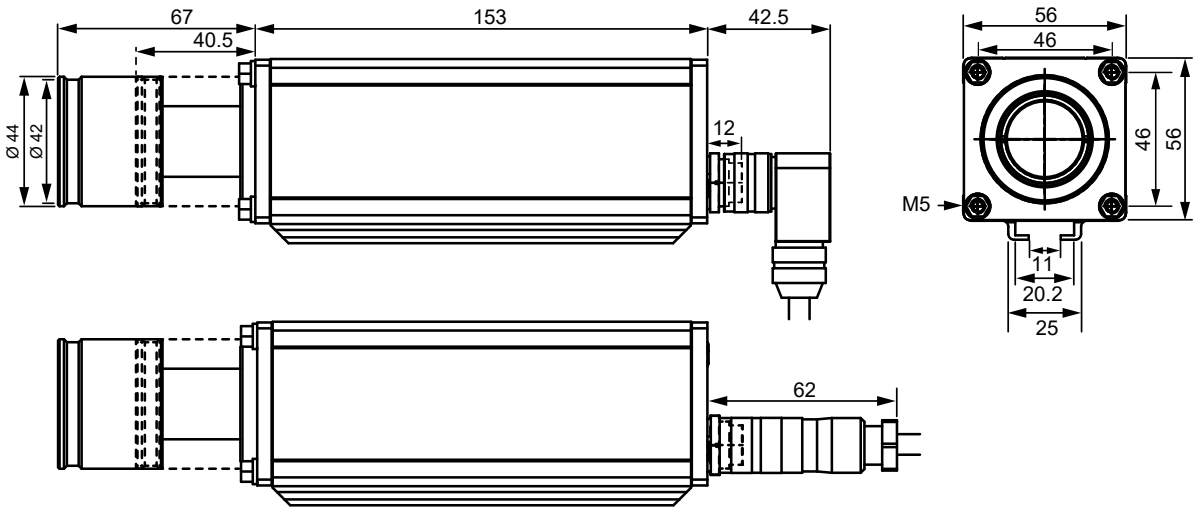
1		2		3		4		5		6		7		8		9		10		11		12
M3xx	-	xxxx	-	xxxx	-	x	-	x	-	x	-	xx	-	x	-	x	-	x	-	x	-	x

1	**Model, Detector, Spectral Range:** M323 = InGaAs, 2 – 2.6 µm
2	**Zero Scale Temperature:** e.g. 0080 = 80°C
3	**Full Scale Temperature:** e.g. 1200 = 1200°C
4	**Sighting Method:** 1 = Laser targeting
5	**Serial Interface:** 5 = Switchable RS-485 / RS-232
6	**Optics:** 2 = Focusable optics (manual)
7	**Response Time:** 13 = 1 ms, adjustable to 10 s
8	**Version:** 0 = Standard (12 pin connector, display, push buttons, 3 digital inputs / outputs)
9	**Display:** 4 = With display (12 pin connector)
10	**Analog Output:** 2 = Two analog outputs, standard
11	**Digital Input / Output:** 3 = 3 digital inputs / outputs / 1 analog input 0–20 mA (12 pin connector)
12	**Optics:** Type A 100 to 130 mm Type B 175 to 300 mm Type C 300 to 1000 mm Type D 1000 to 10000 mm

Example: M323-0080-0120-1-5-2-13-0-4-2-3-A
This model refers to: Model M323, temperature range of 80-1200°C, laser targeting, RS-232 & RS-485 communication, manual focusable optics, 1ms response time, std. version sensor, onboard temperature display, two 0/4-20 mA outputs, 3 digital inputs/outputs, optics type A.

Dimensions

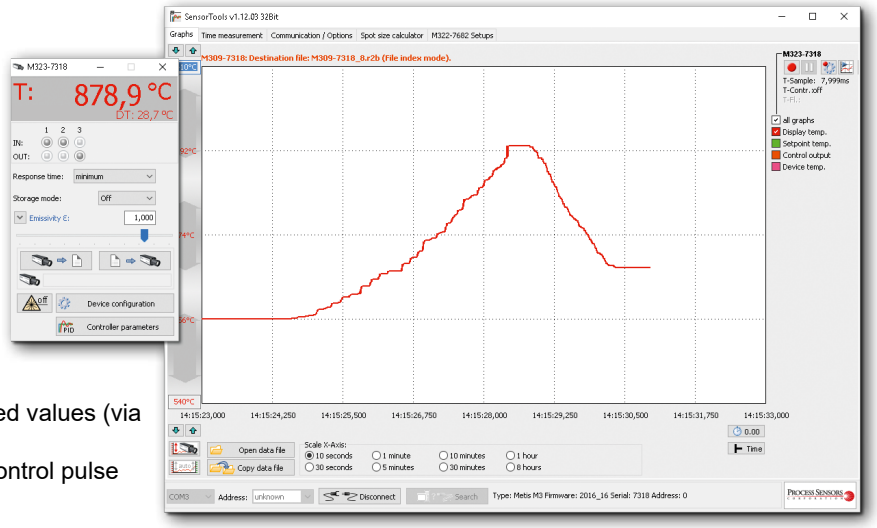
Dimensions in mm



SensorTools Software

The PC software *SensorTools* is our standard software for

- Measurement display
- Measured value recording
- Processing the results
- Display devices inside temperature
- Changing pyrometer parameters



Program functions:

- Perform advanced Pyrometer settings
- Export filtered measured values to csv files
- Define the memory interval for data recording
- External start and stop of the recording measured values (via control input on the pyrometer)
- Back time recording of measured values after control pulse or extend the recording at record stop
- Switch on and off laser targeting light
- Print, store and transfer pyrometer settings to other devices
- Create service and parameter files with devices data and software settings for remote diagnostics

System requirements: Windows 7 Prof, 8 Prof, 8.1 Prof, 10

Accessories

HA20-00	Ball and socket swivel mount for sensor alignment
HA10-00	Mounting bracket
KG10-00	Aluminum water cooling housing
KG20	Aluminum cooling plate
BL10	Air purge attachment
AL11 / AL43	Connection cable, 14-wire (available in 5 m lengths) with right angle connector / straight connector
AU11 / AU43	Connection cable, 14-wire (available in 5 m lengths), with right angle connector / straight connector and interface converter RS-232⇔USB
AV11 / AV43	Connection cable, 14-wire (available in 5 m lengths), with right angle connector / straight connector and interface converter RS-485⇔USB
IF00-00	LED digital indicator for remote adjustment of IR sensor parameters
950-004	Power supply 24 V DC
WB23-1-2-05	Wiring Box (typical standard set): Ready-made plug & play pyrometer connection set (with desktop power supply, 2.5 m connection cable for pyrometers with 12-pin connector, RS-232 interface converter)
WB23-2-2-05	Wiring Box (typical standard set): Ready-made plug & play pyrometer connection set (with desktop power supply, 2.5 m connection cable for pyrometers with 12-pin connector, RS-485 interface converter)

Cable connector pyrometer side		AL	AM (incl. Sub-D)	AU (RS232)	AV (RS485)
	with right-angle connector / push button	AL10-05 (5 m)	AM10-05 (5 m)	AU10-05 (5 m)	AV10-05 (5 m)
	with right-angle connector	AL11-05 (5 m)	AM11-05 (5 m)	AU11-05 (5 m)	AV11-05 (5 m)
	with straight connector	AL43-05 (5 m)	AM43-05 (5 m)	AU43-05 (5 m)	AV43-05 (5 m)

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

Datasheet_Metis_M323 (Feb. 19, 2018)

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PROCESS SENSORS CORPORATION

Metis M3F1

Infrared Pyrometer for Measuring Flame Temperature

APPLICATIONS

2-color pyrometer for measuring dirty flames containing soot in Power boilers (coal fired), Waste incineration, Reactors and Furnaces.

SOLUTIONS

- **Optimize firing operation and reduction of emissions in combustion chambers**
- **Adherence to minimum temperatures to protect against harmful environmental effects**
- **Avoid slagging of combustion chamber walls**

FEATURES

- **Temperature ranges between 600°C and 2500°C**
- **High blackbody accuracy of 0.3%**
- **Ambient temperature rating of 80°C without cooling**
- **Fully digital and very fast with response time < 1 ms**
- **Optics adjustable to the measuring distance**
- **Serial interfaces RS-232 and RS-485 (switchable)**
- **Device configuration via software or interface commands**
- **2 high resolution 16 bit analog 0/4 to 20 mA outputs**
- **3 versatile configurable inputs or outputs**

Dirty Flame Temperature Measurement

The Metis M3F1 is a special flame pyrometer, developed on the technology of the M311 two-color pyrometer. It is used for the non-contact temperature measurement of flames containing soot in coal-fired power plants, waste incineration plants and other combustion furnaces, enabling optimization of the firing operation, e.g. reduce the emissions in combustion chambers or to avoid the slagging of combustion chamber walls.

The measuring method utilizes a special algorithm that combines the radiation and the ratio measurement values from the specific flame properties and determines the penetration depth of the flame measurement depending on the soot concentration.

Technical Data

Model	M3F1
Temperature ranges	flame temperatures: 600 to 1400°C 650 to 1500°C 750 to 2000°C 900 to 2500°C 1112 to 2552°F 1201 to 2732°F 1382 to 3632°F 1652 to 4532°F
Temp. sub range digital	Any temperature sub-range adjustable within the temperature range (minimum span 50°C)
Spectral range	Channel 1: 0.695–0.93 µm / Channel 2: 0.93–1.1 µm
Detector	2 x Silicon
Response time t_{90}	< 1 ms (with dynamical adaptation at low signal levels), adjustable up to 10 s
Accuracy (ε = 1, t_{90} = 1s, T_A = 23°C)	0.3% of measured value in °C + 2 K
Repeatability (ε = 1, t_{90} = 1s, T_A = 23°C)	0.1% of measured value in °C + 1 K
Temperature coefficient (deviations from 23°C)	From 10°C to 60°C: 0.04%/K From 0 to 10°C and 60 to 80°C: 0.06%/K
Soot factor	0.50–2.50 (corresponds 50–250% in 0.1% steps)
Absorbance	0.000-10.000
Slope / ratio	0.800–1.200
Emissivity ε	0.050–1.200 (per channel, corresponds 5–120% in 0.1% steps)
Transmission	0.050–1.000 (per channel, corresponds 5–100% in 0.1% steps)
Fill factor spot size	0.050–1.000 (per channel, corresponds 5–100% in 0.1% steps)
Analog output signal	2 configurable analog outputs 0 or 4–20 mA, max. load: 500 Ω Resolution 0.0015% of the adjusted temperature (16 Bit). User selectable: flame temperature, 2-color temperature, sum temperature of channel 1+2 or only 1-color temperature of channel 1 or channel 2. Outputs can be set individually, within or outside the measuring range.
Serial interface	RS-232 (max. 115 kBd) or RS-485 (max. 921 kBd), switchable. Resolution 0.1°C or 0.1°F
3 configurable Inputs / outputs	■ Digital inputs (max. 3 inputs, protected against reverse polarity): clearing of peak picker, trigger input for start / stop of measured value recording in software, load pyrometer configuration. ■ 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. ■ Analog input (0–20 mA, protected against reverse polarity and incorrect connection): analog adjustment of soot factor (flame mode), emissivity slope (2-channel mode) or emissivity (1-channel mode)
Peak picker	Automatic hold mode or manual time settings to clear (reset)
Display	10-digit LED display (5 mm high) for temperature display or parameter settings Resolution 0.1°C or 0.1°F
Parameter settings	Soot factor, slope/ratio, switch-off level for measurement, switch-off level for dirty window alarm, emissivity, transmission, fill factor, temperature sub range, peak picker settings, device address, baud rate, response time, analog outputs 0 or 4–20 mA, interface RS-232/RS-485, °C/°F, language (E + G)
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
Sighting	Through lens view finder with adjustable attenuation filter for eye protection from bright targets
Ambient temperature	Operation: 0 to 80°C (32 to 176°F), Storage: -20 to 85°C (-4 to 185°F)
Relative humidity	No condensing conditions
Housing / protection class	Aluminum, IP65 to DIN 40 050 with connector
Weight	650 g (1.43 pounds)
CE label	According to EU directives for electromagnetic immunity

Reference Numbers

Metis M3F1 Specify with temperature range

Note: *SensorTools* software is included as standard equipment. Connection cables must be ordered separately.

Process Sensors 2-color Technology

Process Sensors 2-color pyrometers are equipped with two separate silicon or indium-gallium-arsenide detectors, which achieve in contrast to sandwich detectors very high signal strengths on both channels and thus ensure high stability.

Specially designed lenses compensate for the optical color aberration at the two measurement wavelengths and ensure that the focal distances of the two wavelengths are collimating at the same position.

Sighting Method

The object to be measured is targeted with the integrated through-lens view finder. The view finder provides upright images so that the target under measurement can be examined visually. The M3F1 circular reticle displays and defines the measurement spot. For devices with measuring ranges above 1800°C, the eyepiece can be darkened for eye protection.

Comprehensive Settings

Serial Interface RS-232 or RS-485 (Selectable)

The pyrometer communicates with other digital devices such as a PLC, computer with free *SensorTools* software or a self-written communication software program via serial interface.

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.

3 Configurable Digital Low Voltage Inputs or Outputs

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

Digital outputs:
- Temperature exceeded or below a limit
- Material detection (exceeding the beginning of temp. range)
- Device state (device is ready for operation)
- Device temperature is exceeded
- Signal strength is too low (dirty window alarm)

Digital inputs:
- Manually delete (reset) of peak picker
- Start / stop recording of measured values via software
- Save / retrieve up to 7 pyrometer configurations

Analog input:
- Analog specification of soot factor, emissivity slope or emissivity

Ambient Temperature

The devices of the M3 Series are designed with a very small temperature coefficient for ambient temperatures up to 80°C making it simple to enter and solve additional applications without external cooling equipment.

Maximum Value Storage (Peak Picker)

The Peak Picker feature is useful when the measured object appears only briefly in the pyrometer's field of view, or to capture temperatures while measuring a series of objects.

Device Designs / Optics

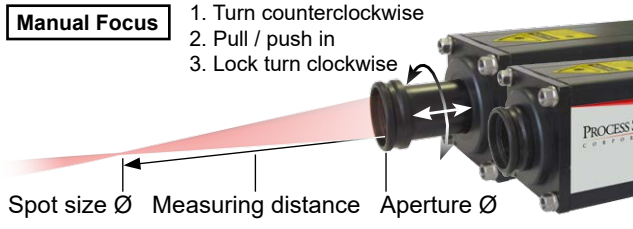
The pyrometer must be properly aligned to the measurement object to detect the temperature correctly. At the focal point of the lens (focal distance) the spot size diameter is smallest. Measurements made outside of the focus distance are also possible (in a shorter or longer distance than the focus distance) to determine the average temperature of a bigger spot.

Values in the optics table 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

Optics (focusable)	**Measuring distance a [mm]** adjustable		**Spot size M [mm]**	**Aperture Ø D [mm]**
OQ11-**A**1	from	340 mm	0.8 mm	16 mm (FSC≤1400°C)
		500 mm	1.5 mm	
		700 mm	2 mm	
	...	1000 mm	2.8 mm	8 mm (FSC >1400°C)
		2000 mm	5.8 mm	
	to	3000 mm	7.8 mm	

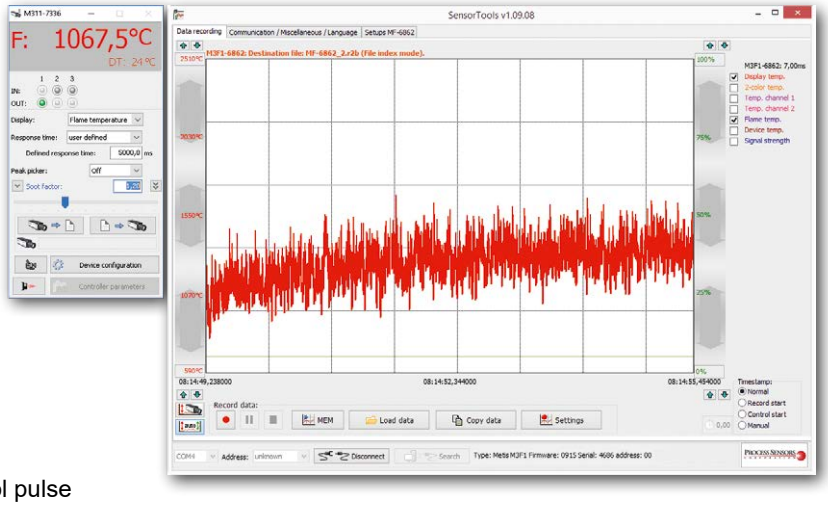
FSC = Full scale temp. range



SensorTools Software

The PC software *SensorTools* is our standard software for:

- Measured value display, both graphically and numerically
- Measured value recording
- Processing the results
- Displaying internal devices temperature
- Changing pyrometer parameters



Program functions:

- Change pyrometer parameters
- Playback of recorded data
- Adapted graphics mode to computer performance
- Export measured values in csv files
- Record interval setting for acceptable data size.
- Back time recording of measured values after control pulse
- External start and stop of the recording measured values (via control input on the pyrometer)
- Create a service file with settings for remote diagnostics

Recommended Accessories

AL11 / AL43	Connection cable, 14-wire (available in 5 m lengths) with right angle connector / straight connector
AU11 / AU43	Connection cable, 14-wire (available in 5 m lengths) with right angle connector / straight connector, and interface converter RS-232⇔USB
AV11 / AV43	Connection cable, 14-wire (available in 5 m lengths) with right angle connector / straight connector, and interface converter RS-485⇔USB
IF00-00	LED digital indicator for remote adjustment of IR sensor parameters
950-004	Power supply 24 V DC: DIN rail mount
HA20-00	Ball and socket swivel mount for sensor alignment
HA10-00	Mounting bracket for sensor
KG10-00	Aluminum water cooling jacket for ambient temperatures up to 200°C
IR Sensor System Package:	Basic Protective Hardware Assembly includes water-cooled jacket KG10-00, removable sapphire sealed window, sight tube with strong air purge and flange. Optional: vortex cooler
Advanced Protective Hardware Package:	Removable quartz sealed window assembly, air actuated ball valve, air filter / regulator and vortex cooler with strong air purge and flange.

IF00

KG10

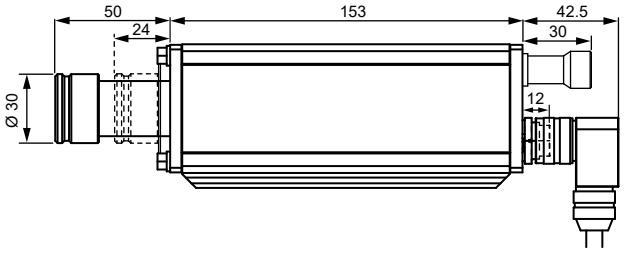
Basic Protective Hardware Package

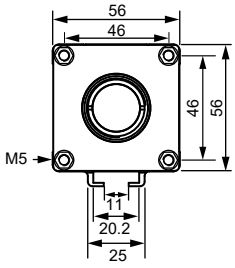
Advanced Protective Hardware Assembly. Includes air actuated shut off valve, air filter/ regulator, vortex cooler and removable sealed window assembly with strong air purge and flange.

Dimensions

Dimensions in mm

M3F1 with manual focusable optics, through lens view finder and connection cable AL11





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

Datasheet_M3F1 (Dec. 14, 2016)

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PROCESS SENSORS™
CORPORATION

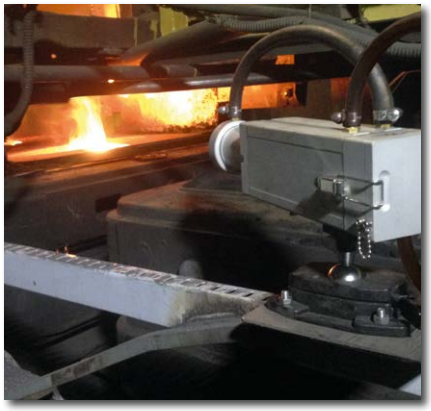
Non-contact Temperature Monitoring in the Steel Industry

Infrared Temperature Measurements in Harsh Environments

Pyrometers for Casting, Rolling and Steel Mill Applications

- Metis 1 or 2-color Heavy Duty, Fiber Optic System
- 2-color Sensor with Video Output
- Line Scanning Systems
- Rugged Portable IR Thermometers (2-color / 1-color versions)
- Protective Cooling, Purging and Mounting Accessories






Flexible Pyrometer Measuring Systems

Process Sensors pyrometers are modern infrared measuring devices for industrial applications that use state-of-the-art processor technology and fully digital signal processing to measure with the highest accuracy, even measuring objects with low emissivities. They are used for temperature monitoring or control of heating or cooling.

Many model variants with useful equipment are used:

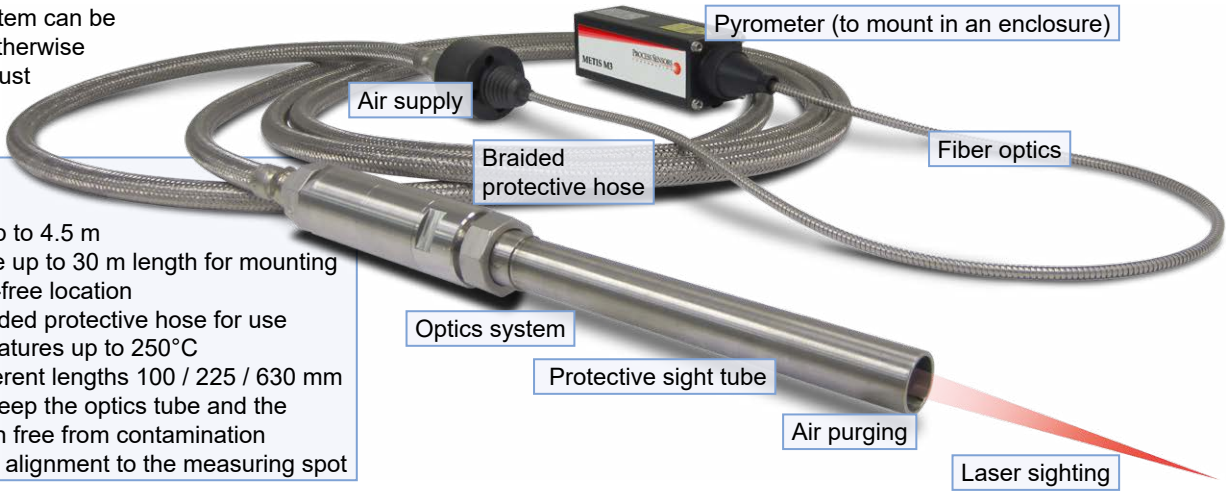
Advantages
- 2-color or standard radiation pyrometer models adaptable for all application conditions
- Minimum and average storage, peak picker for highest temperature of scale-free points on metal surfaces
- 2 high resolution 16 bit analog outputs (0/4 to 20 mA) for high accuracy temperature measurement
- High-speed digital serial interface (up to 921 kBaud) for communication to a PC or PLC
- 3 configurable inputs / outputs for remote control or alarm output functions
- Bright red LED temperature display / menu

For use in harsh conditions, the pyrometers are integrated into heavy-duty housings, allowing them to perform difficult measurements in the steel industry.

Heavy-Duty Stainless Steel Measuring System

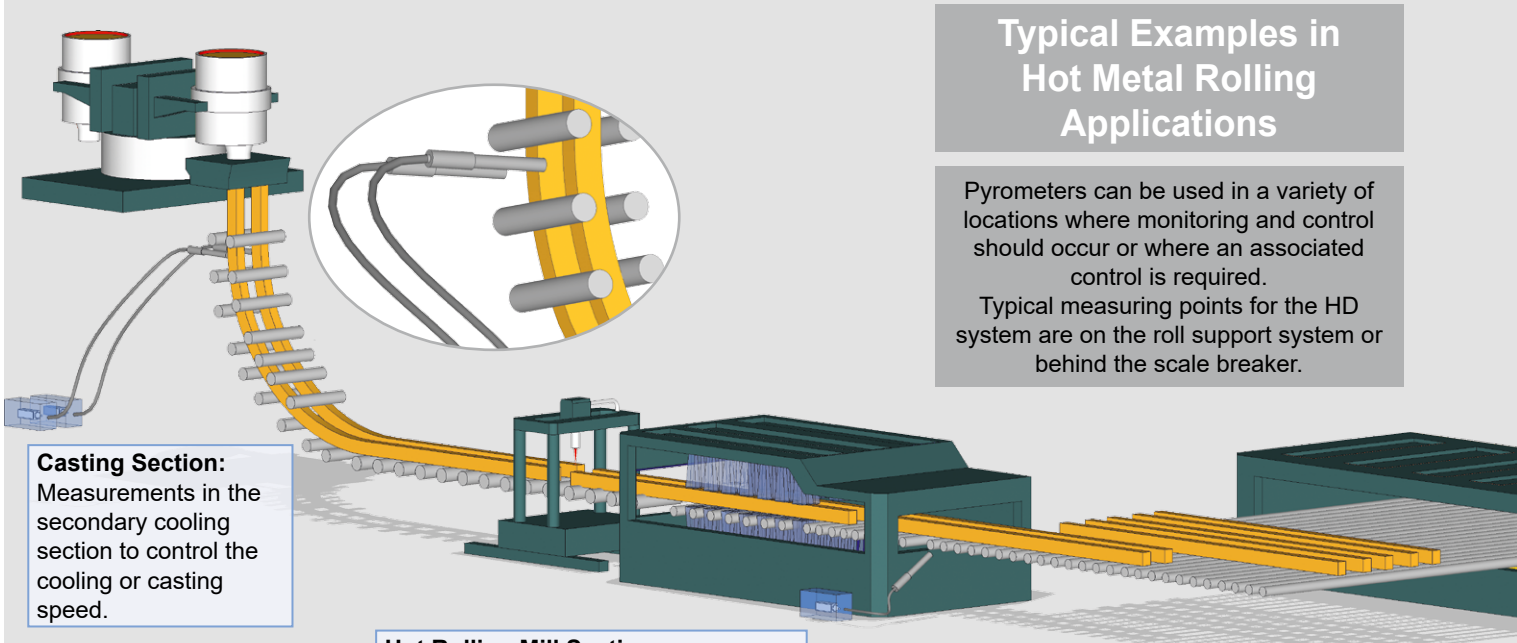
The fully encapsulated system can be installed in places where otherwise heat radiation, water and dust make it difficult to measure precisely.

Advantages
- Customizable long measuring distances up to 4.5 m
- Braided protective hose up to 30 m length for mounting electronics in a hazard-free location
- Optics system and braided protective hose for use in high ambient temperatures up to 250°C
- Protection tubes in different lengths 100 / 225 / 630 mm
- Air purging system to keep the optics tube and the pyrometer field of vision free from contamination
- Laser targeting light for alignment to the measuring spot



Typical Examples in Hot Metal Rolling Applications

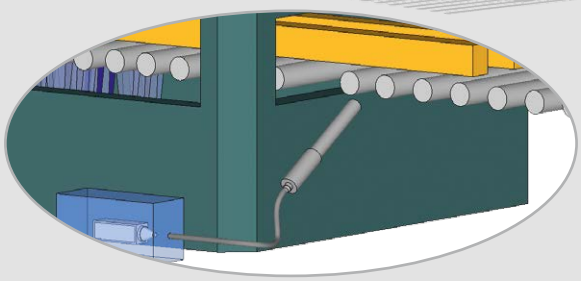
Pyrometers can be used in a variety of locations where monitoring and control should occur or where an associated control is required.
Typical measuring points for the HD system are on the roll support system or behind the scale breaker.



Casting Section:
Measurements in the secondary cooling section to control the cooling or casting speed.

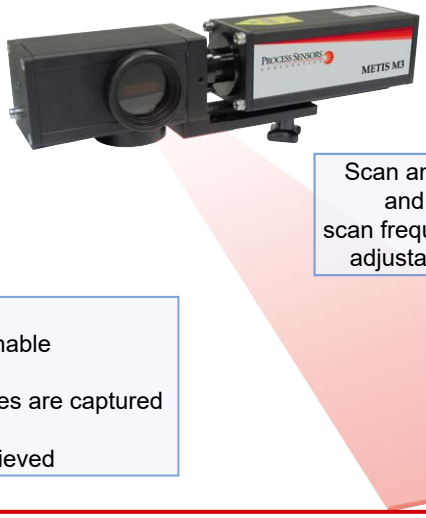
Hot Rolling Mill Section:
Bottom side strip measurement through the roller table on slabs, strips and billets.

Measurement result is not affected by scale or water accumulation after blasting by the descaling unit.



Line Scanner

Suitable for many industrial applications, line scanners with laser sighting feature measure and detect product surface profiles. Line scanners equipped with pyrometers continuously scan the measuring field in order to record all temperatures of the entire target profile on a production line. Along with the pyrometer's peak picker, it will display the maximum value of a target being scanned. Accurate temperature readings are captured despite possible development of cold scale or target movement.

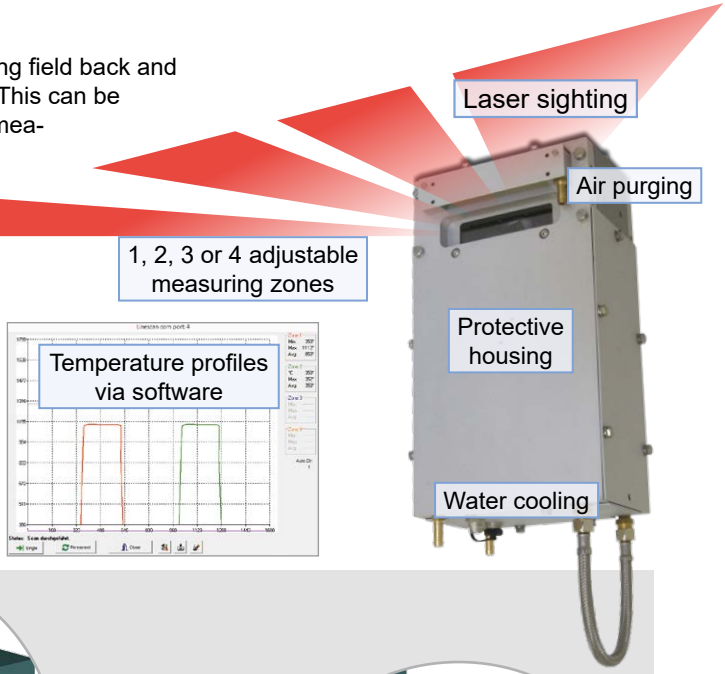


Advantages

- Peak temperature measurements over a wide scan area are attainable
- Measurement of very thin oscillating wire is possible
- Temperature detection of scale-free points on scaled metal surfaces are captured
- Hot spot temperature measurement is readily detected
- Peak temperature detection of slabs, billets and steel strips is achieved

Zone Line Scanner

Zone line scanners are continuously panning the pyrometer's measuring field back and forth and create a temperature profile of the material to be measured. This can be displayed as a temperature graph. The scanner can be set to up to 4 measuring zones, used to detect multiple billets or measure temperatures in the center or at an edge of a passing slab.

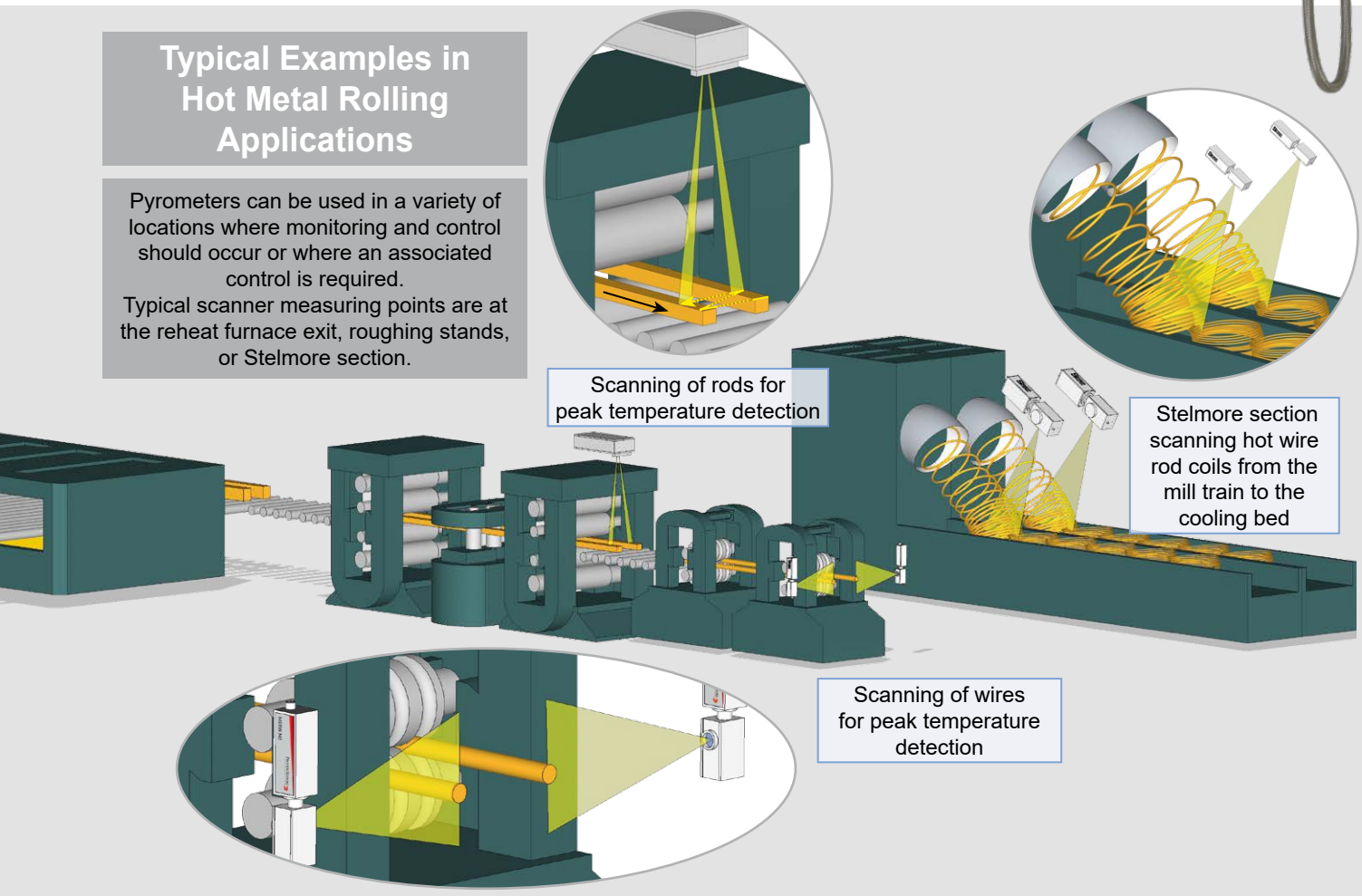


Advantages

- Up to 4 individually adjustable measuring zones according to the angular position and scanning speed required
- Separate information of maximum, minimum or average measured temperatures is provided
- Equipped with adjustable scanning speed and sighting path angle designed for continuous 24/7 operation
- Multiple analog and digital signal outputs provide separate temperature profiles of each zone

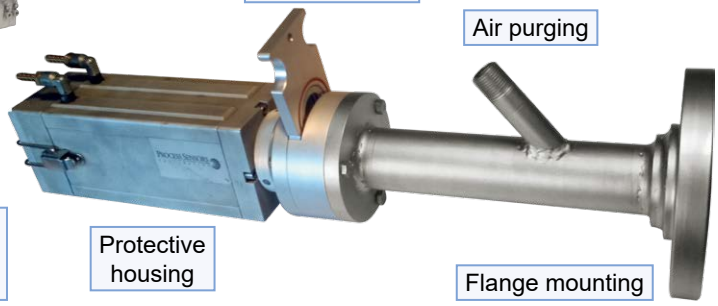
Typical Examples in Hot Metal Rolling Applications

Pyrometers can be used in a variety of locations where monitoring and control should occur or where an associated control is required.
Typical scanner measuring points are at the reheat furnace exit, roughing stands, or Stelmore section.



Heavy Duty Protection

Depending on the ambient conditions, a protective cooling housing can be cooled with air or water, thus enabling the use of the pyrometer in much higher ambient temperatures. It can be mounted directly via a mounting flange, pipe adaptor or heavy-duty swivel base mount.



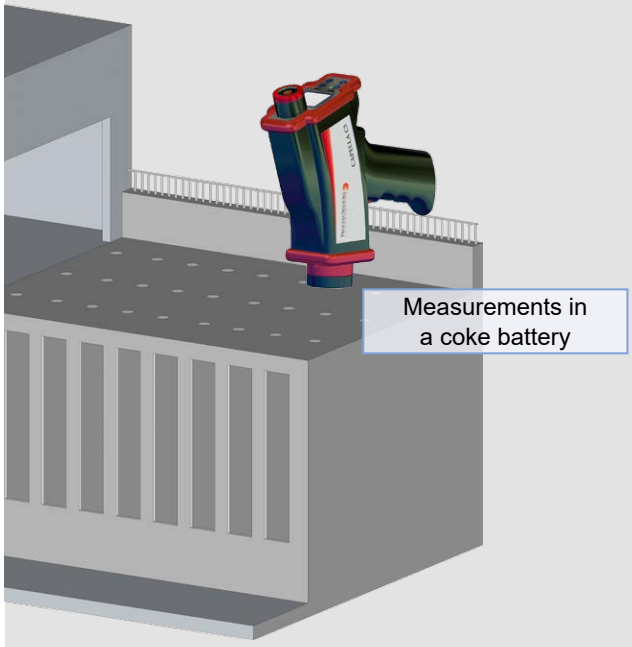
- Pyrometers can be used in ambient temperatures up to 250°C
- Air purging systems keep the optics clean and the pyrometers' fields of vision free from contamination

Handheld, Battery Operated Infrared Portables

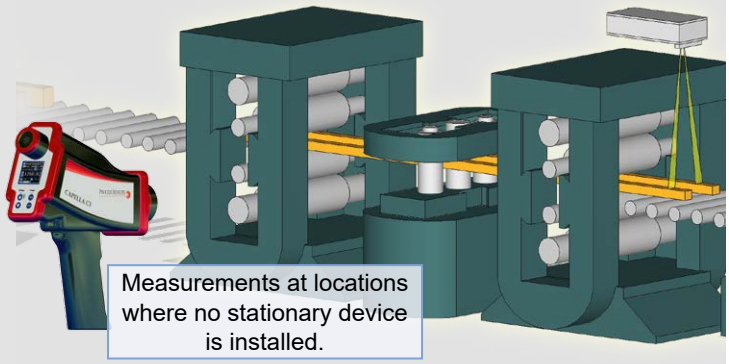
Process Sensors' new Capella 1-color/2-color handheld thermometer is ideal for accuracy verification of stationary production line pyrometers and for fast measurements on moving targets. The integrated measurement value memory allows the retention and evaluation of the temperature data.

Advantages

- Adjustable focus from 380 mm (1.25 ft) to 10 m (33 ft).
  Target under measurement can be at a greater distance than the focus range
- 2-color or 1-color radiation pyrometer models adaptable for all application conditions
- Switchable laser to thru-lens view finder sighting
- Bright green laser targeting light highly visible on hot glowing targets
- Robust aluminum housing with rubber bumpers designed for long term durability
- Huge data storage capacity for up to 32000 points of measurement
- Minimum and average storage, peak picker for highest temperature of scale-free points on metal surfaces
- Bluetooth and USB connectivity for battery charging and easy data transmission to a PC
- Modern Lithium-Ion technology for long duration operation
- Fast response speed of 1 ms
- Ultra-small spot size



Portable infrared thermometers also measure temperature over long distances and can be used to verify accuracy of fixed, online process pyrometers.



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

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