DASTEC
30 años de soluciones para la industria

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 0.9 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 RS232 and RS485 (switchable)
- Optional fieldbus connection: Profinet or Profibus

Technical Data

Model	M311	M322
Temperature ranges	600 to 1400°C (1112 to 2372°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: 0.75–0.93 µm / Channel 2: 0.93–1.1 µm *) Channel 1: 0.78 µm/ Channel 2: 0.99 µm	Channel 1: 1.45–1.65 µm / Channel 2: 1.65–1.8 µm *) Channel 1: 1.4 µm / Channel 2: 1.64 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 + 1 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. 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, 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 emissivity adjustment	
Peak picker	Automatic hold mode or manual time settings to clear (reset)	
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, settings for max. value storage, device address, baud rate, response time, selecting analog outputs 0/4–20 mA, interface RS232/RS485 (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 and digital outputs 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. 14% x 10% 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	
Optics	Manual focusable or optional motorized focus	
Ambient temperature	Operation: 0 to 80°C (32 to 176°F), storage: -20 to 85°C (-4 to 185°F), Fiber optic version: focusable lens assembly: -20 to 250°C (-4 to 482°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 Specify with temperature range, sighting method and optics
Metis M322 Specify 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.
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 targeting
- 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)

A variety of models:
- Motorized focus optics
- Optics with manual adjustment of focus
- Fiber optic version with small optical heads

Comprehensive Settings

For Material Properties

- **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.
- **Fill factor measurement field:** Measuring on cold background, the measurement object can be smaller than the spot size. At this point you can enter the percentage of the pyrometer's spot size that is filled.

Measuring Mode

- 2-color mode
- Switchable in 1-color modes (channel 1 or 2) 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 at which the temperature measurement is switched off, due to low level signal strength (e.g. if too much of the pyrometer's field of view is blocked).

Maximum Value Storage (Peak Picker)

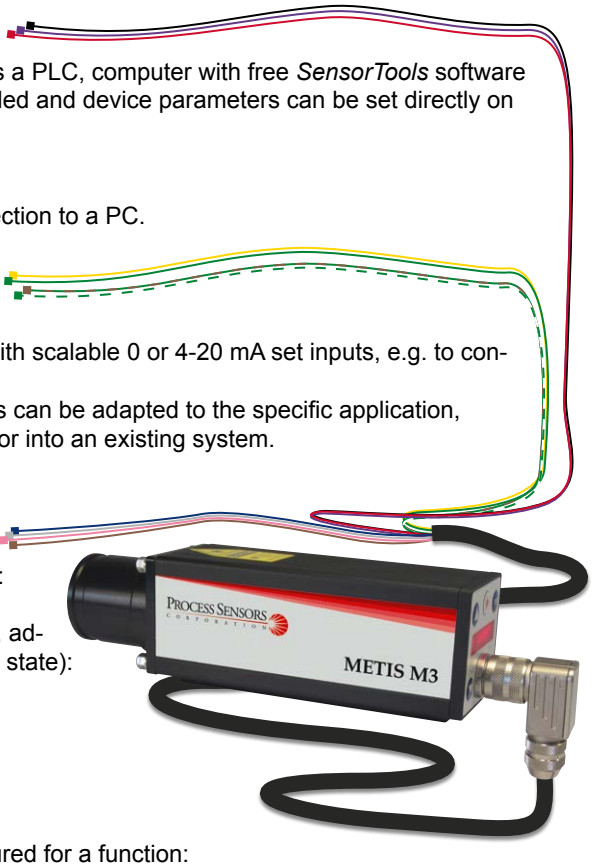
The maximum value storage is a useful feature when the measured object appears only briefly in the pyrometer's field of view, or to capture peak temperatures while measuring a series of objects. The hottest value of the measured object is stored and disregards temperature valleys, e.g. steel surfaces 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

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 scalable 0 or 4-20 mA set inputs, e.g. to connect additional temperature displays, chart recorders 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

Sighting Method Selection

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

- **Devices with integrated optics:** Thru-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.

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.

Targeting light on / off

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.

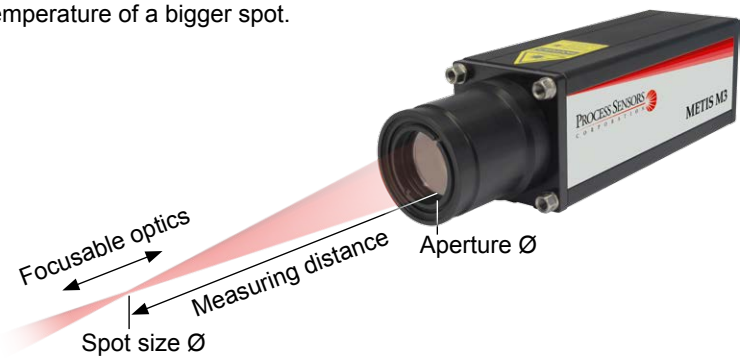
Specially designed lenses compensate the color aberration at the two measurement wavelengths and ensure that the focal distances of the two wavelengths are collimating at the same position.

The pyrometer must be properly aligned to the measurement object to detect the temperature correctly. 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 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.



Focusable Optics (manually adjusted or motorized focus)

Optics	Measuring distance a [mm]	Spot size M [mm]		Aperture Ø D [mm]
		M322 300 – 1000°C	M311 / M322 All other temp. ranges	
M311: OQ11-A1 M322: OQ22-A2	340 mm	1.5 mm	0.9 mm	17 mm (FSC<1400°C) 9 mm (FSC >1400°C)
	500 mm	3 mm	1.7 mm	
	750 mm	4 mm	2 mm	
	1000 mm	5.6 mm	2.8 mm	
	2000 mm	10 mm	4.6 mm	
	3000 mm	17 mm	8.8 mm	

FSC = Full scale temp. range

Manual Focus

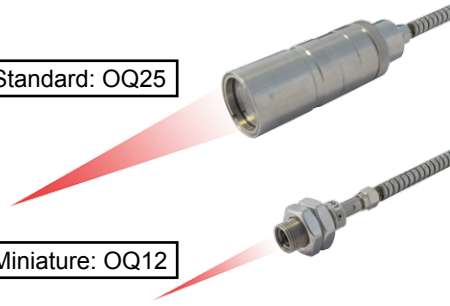
1. Turn counterclockwise
2. Pull / push in
3. Lock turn clockwise

Motor focus

- Via push buttons
- Via PC software

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

Optics	Measuring distance a [mm]	Spot size M [mm]		Aperture Ø D [mm]
		M322 300 – 1000°C	M311 / M322 All other temp. ranges	
Standard: M311: OQ25-B1 M322: OQ25-B2	240 mm	2 mm	1 mm	18 mm
	500 mm	3.7 mm	2.5 mm	
	750 mm	5.6 mm	3.8 mm	
	1000 mm	7.7 mm	5 mm	
	2000 mm	15.4 mm	10 mm	
	3000 mm	23 mm	15 mm	
Miniature: M311: OQ12-C0 M322: OQ12-C0	120 mm	2.2 mm	1.2 mm	7 mm
	250 mm	5 mm	2.5 mm	
	500 mm	12 mm	6 mm	
		Fiber Ø 0.4 mm	Fiber Ø 0.2 mm	



Standard: OQ25

Miniature: OQ12

Typical Applications


Brazing


Semiconductor


Pipe Bending

Model Selection Table - M311 / M322

A		B		C		D		E		F		G		H		M		N		P		L
M3xx	-	xxxx	-	xxxx	-	x	-	x	-	x	-	xx	-	x	-	x	-	x	-	x	-	x

A **Model, detector, spectral range:**
M311 = Silicon, 0.7 – 1.1 µm
M322 = InGaAs, 1.45 – 1.8 µm

B **Zero scale temperature:**
e.g. 0600 = 600°C

C **Full scale temperature:**
e.g. 1300 = 1300°C

D **Sighting method:**
1 = Laser targeting
2 = View finder
4 = Color camera module

E **Serial Interface:**
5 = Switchable RS485 / RS232

F **Optics:**
1 = Fixed focus
2 = Focusable optics manual
3 = Fiber Ø 0.2 mm (refer to brochure)
4 = Fiber Ø 0.4 mm (refer to brochure)
8 = Focusable optics motorized
B = Stainless steel sensor head heavy design for 0.2 mm fiber with OL/OQ25
C = Stainless steel sensor head heavy design for 0.4 mm fiber with OL/OQ25

G **Response time:**
13 = 1 ms, adjustable to 10 s

H **Version:**
0 = Standard
4 = PID controller (12 pin connector)
5 = 17 pin connector, 4 digital inputs, 2 digital outputs, PID controller, no display, no push buttons

M **Display:**
4 = With, standard, not with 17 pin connector
0 = Without, only with 17 pin connector

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

P **Digital input / output:**
3 = 3x Standard
4 = 4x only with 17 pin model

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

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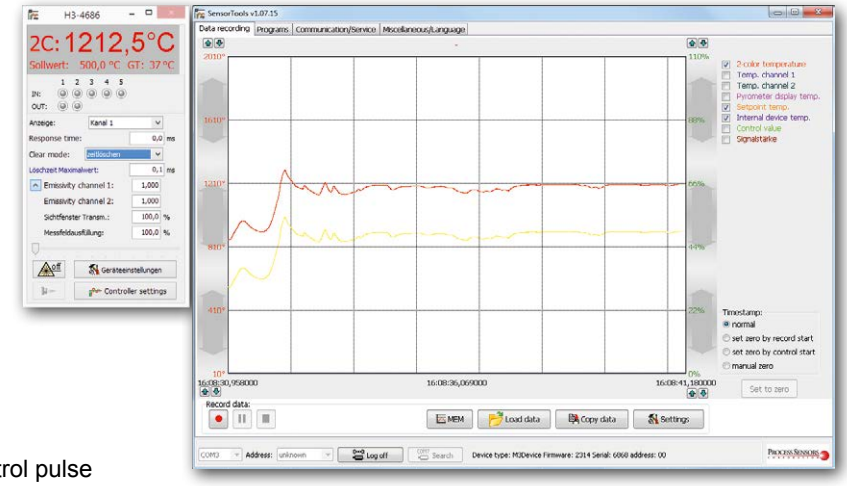
SensorTools Software

- Measured values of all channels:
  2-color temperature + 1-color temperatures,
  at the same time, graphical and numerical
- Measured value recording
- Processing the results
- Display 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 switching on and off / 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

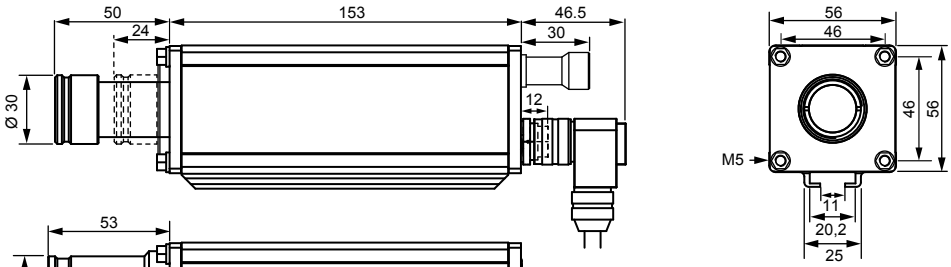
Recommended Accessories

HA20	Ball and socket swivel mount for sensor alignment
HA10	Mounting bracket
HA14 / HA15	Adjustable mounting bracket for fiber optics OQ25 / OQ12
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 OQ12 / OQ25
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
950-004	Power supply 24 V DC
950-060A-LCD	Plug & Play enclosure, with power supply and interface for setup parameters

Dimensions

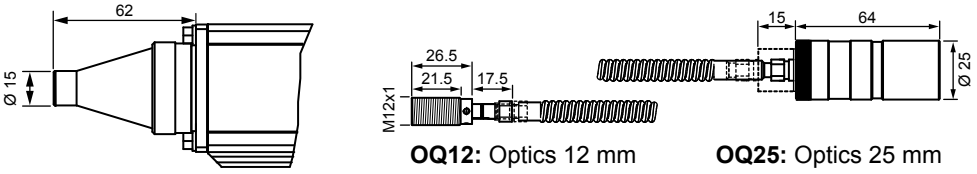
Dimensions in mm

Manual focusable optics



Motorized focus optics

Fiber optic devices, focusable optics



OQ12: Optics 12 mm

OQ25: Optics 25 mm

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

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