PROCESS SENSORS CORPORATION
a KPM brand

M3 Fiber Optic Pyrometer Heavy-Duty Measuring System

PYROMETER TEMPERATURE MEASURING SYSTEM IN A HEAVY STAINLESS STEEL DESIGN

OVERVIEW

The heavy-duty fiber optic measuring system is the successor of our proven rolling mill and continuous casting series Metis MW, designed for continuous temperature measurement in rolling mills, continuous casting processes and under similarly harsh industrial conditions in other markets.

The system is optimally adapted to the application conditions in the steel industry. The stainless steel lens assembly is designed for ambient temperatures up to 250°C (482°F) with purge air that provides additional cooling to keep the optics sight tube and the pyrometer's field of vision free from contamination.

The electronics of the temperature measuring system can be mounted remotely up to 30 meters.

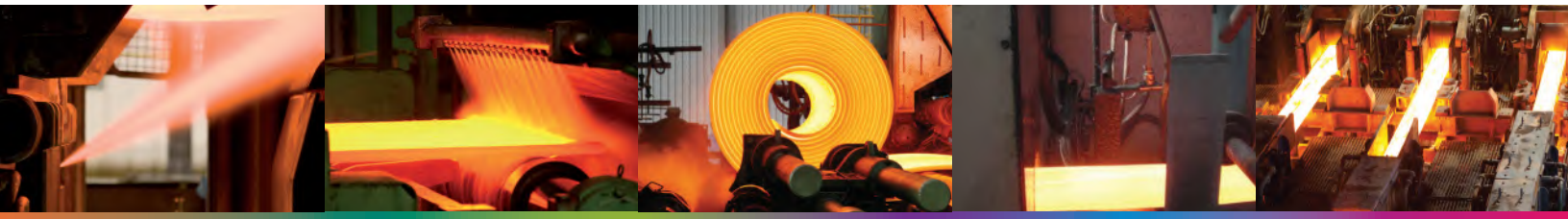
- Flexible application by remotely adjustable emissivity and innovative automatic process adaptation (APA)
- Special molten metal pouring stream mode available as an option
- Highly accurate measurements by latest processor technology and fully digital signal processing
- Fast response times with small spot sizes
- Activating the peak picker allows detection of the smallest scale cracks which represent the "real" temperature to be measured

APPLICATIONS

- Disamatic metal pouring machines
- Continuous casting area
- Ethylene cracker furnaces
- Glass melt tank furnaces
- Gasifiers
- Hot strip rolling mills
- Kilns
- Ladle reheat
- Pipe welding machines
- Reactors
- Reformers
- Smelting furnaces

M3 FIBER OPTIC HEAVY-DUTY MEASURING SYSTEM FEATURES

- Protection sight tube in lengths up to 630 mm
- Stainless steel braided fiber optic hose lengths up to 30 m
- Measuring distance focus adjustable up to 4.5 m
- Combination with 1-color or ratio pyrometers for measurements through dust and dirty windows
- Pyrometers in the short wavelength range for accurate measurements on metals and shiny materials
- High-speed response (1 ms)

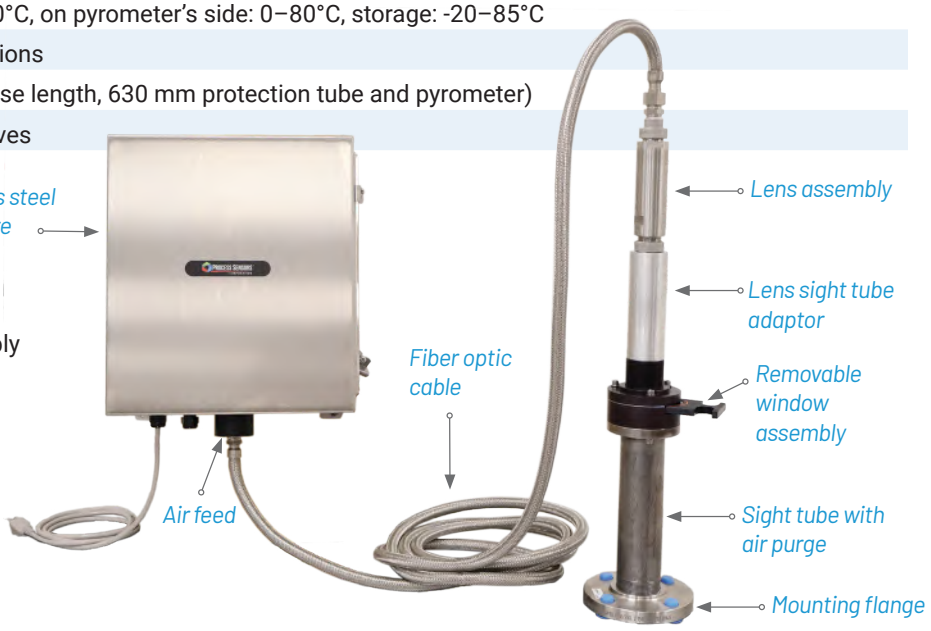


M3 Heavy-Duty Measuring System

TECHNICAL DATA

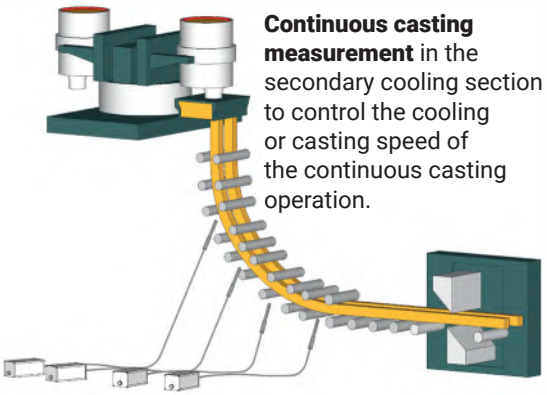
Model	1-color pyrometers			2-color pyrometers	
	M309	M316	M318	M311	M322
Temperature ranges	550 – 1400°C 600 – 1600°C 650 – 1800°C 750 – 2500°C	200 – 1300°C 250 – 1300°C 350 – 1800°C 400 – 2500°C	100 – 700°C 150 – 1200°C 180 – 1300°C	600 – 1400°C 650 – 1500°C 750 – 1800°C 900 – 2500°C	300 – 1000°C 350 – 1300°C 500 – 1800°C
Temp. sub ranges	Any temperature sub-range adjustable within the temperature range (minimum span 50°C)				
Spectral range	0.7–1.1 µm	1.45–1.8 µm	1.65–2.1 µm	0.75–0.93 µm / 0.93–1.1 µm	1.45–1.65 µm / 1.65–1.8 µm
Detector	Silicon	InGaAs	InGaAs	2 Silicon Detectors	2 InGaAs Detectors
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)	0.25% of measured value in °C + 2 K		0.4% of measured value in °C + 2 K	0.3% of measured value in °C + 3 K	0.5% of measured value in °C + 3 K
Repeatability (ε = 1, t_{90} = 1s, T_A = 23°C)	0.1% of measured value in °C + 1 K				
Emissivity	Adjustable 0.050–1.200			0.800–1.200 (emissivity slope)	
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).				
Serial interface	RS232 (4.8–115.2 kBd) or RS485 (4.8–921.6 kBd), switchable. Resolution 0.1°C / °F. Optionally additionally with PROFIBUS, PROFINET or Ethernet.				
3 configurable Inputs / outputs	• Digital inputs: laser targeting light on/off, external clearing of peak picker, trigger input for start / stop of measured value recording, load pyrometer configuration. • Digital outputs: limit switch, exceeding the beginning of temperature range (for material recognition), device ready after self-test, device over-temperature. • Analog input (0–20 mA): analog adjustment of emissivity / slope signal strength intensity too low				
Peak picker	Automatic hold mode or manual time settings to clear (reset)				
Display	Dot Matrix, green-yellow, 128 x 32 dots, 5.6 mm high, resolution 0.1°C / °F				
Parameter settings	Device parameters via push buttons on the device or via serial interface and PC software SensorTools or via self compiled communication program				
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	Laser targeting light (red, λ=650 nm, P<1 mW, laser class 2 to IEC 60825-1)				
Ambient temperature	On optics side: -20–250°C, on pyrometer's side: 0–80°C, storage: -20–85°C				
Relative humidity	Non-condensing conditions				
Weight	ca. 10 kg (with 10 m hose length, 630 mm protection tube and pyrometer)				
CE label	According to EU directives				

Configuration with protective sapphire sealed window assembly with flange mounting.



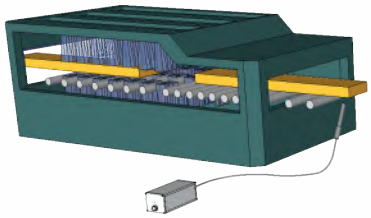
M3 Heavy-Duty Measuring System

TYPICAL APPLICATIONS

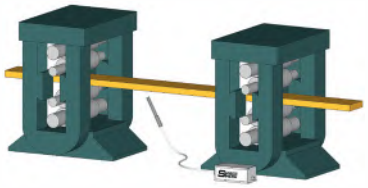


Continuous casting measurement in the secondary cooling section to control the cooling or casting speed of the continuous casting operation.

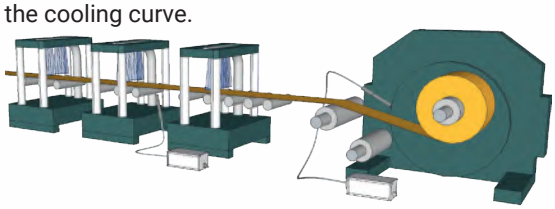
Measurements at the **descaling** of slab and billet temperatures.



Bottom side strip measurement through the roller table on slabs, strips and billets, so that the measurement result is not affected by scale or water puddles on the strip.



At the **cooling section** of the hot strip mill for determining the cooling curve.



For quality control during winding of the **rolled steel strips** at the hot coil box.

FEATURES

Operate in harsh environmental conditions

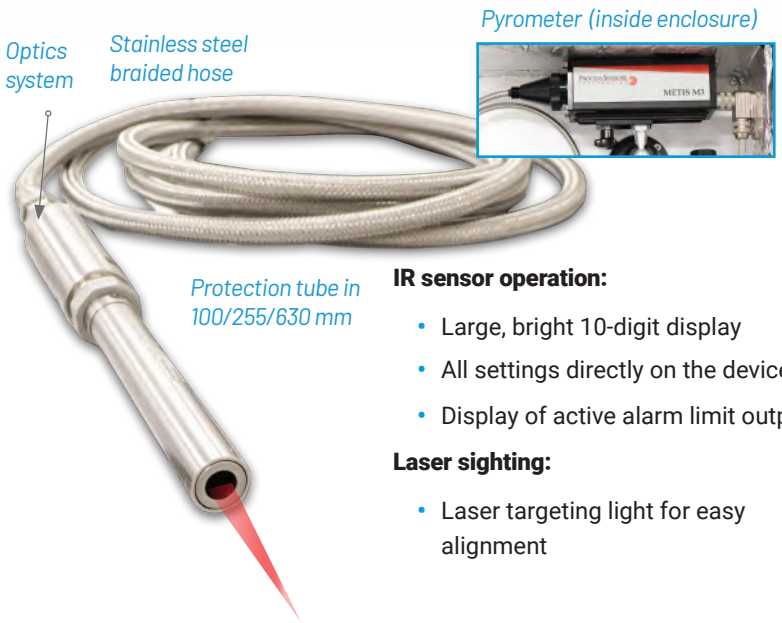
- Ambient temperatures on the optics up to 250°C (482°F).
- On pyrometer side up to 80°C (176°F)

Robust optics system:

- Preset measuring distance
- Protection sight tubes in different lengths

Fast, accurate outputs:

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



IR sensor operation:

- Large, bright 10-digit display
- All settings directly on the device
- Display of active alarm limit outputs

Laser sighting:

- Laser targeting light for easy alignment

OPTICS SYSTEM

The measuring distance must be set ex works to a value within the variable optics focus range limits. (The measuring distance is measured from the mark on the lens system).

Measuring distances 1-color pyrometers

Optics	Measuring distance a [mm] Adjustable ex works		Spot size diameter M [mm]	
			M318 (100–700°C)	**M309** (all temp. ranges) **M316** (all temp. ranges) **M318** (150–1200°C 180–1300°C)
OL25-H0	from	170 mm	1.6 mm	1 mm
		500 mm	5 mm	3.2 mm
	...	700 mm	7.5 mm	4.8 mm
		1000 mm	11 mm	7 mm
		2000 mm	23 mm	15 mm
	to	4500 mm	52 mm	34 mm
Fiber Ø			0.4 mm	0.2 mm

Measuring distances 2-color pyrometers

Optics	Measuring distance a [mm] Adjustable ex works		Spot size diameter M [mm]	
			M322 300–1000°C	**M311 / M322** (all other temp. ranges)
M311: OQ25-B1 M322: OQ25-B2	from	240 mm	2 mm	1 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
Fiber Ø			0.4 mm	0.2 mm

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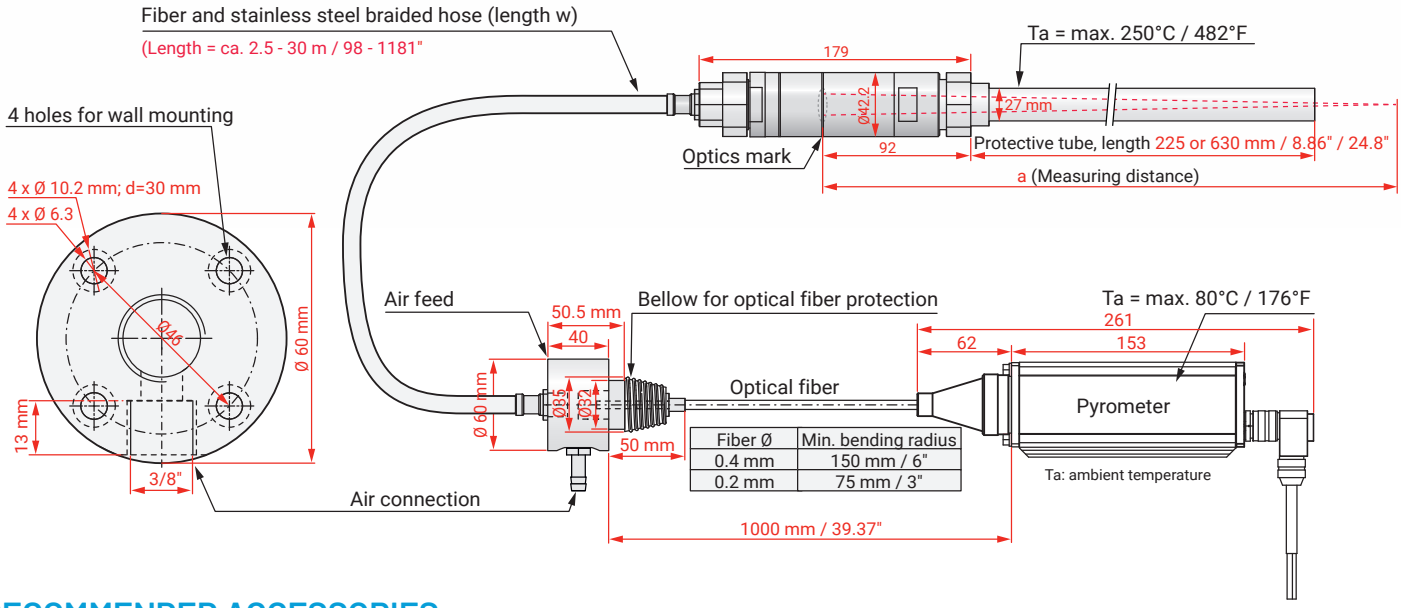
SENSORTOOLS SOFTWARE

The PC software SensorTools is included in the standard delivery and helps to set up the pyrometer. It allows the

- Measured value display, both graphically and numerically
- Measured value recording
- Processing the results
- Display internal devices temperature
- Setting all pyrometer parameters

DIMENSIONS (ALL FIGURES IN MM)



RECOMMENDED ACCESSORIES

HA10	Mounting bracket
HA20	Swivel base mount
AU11 / AV43	Connection cable, 14-wire (available in 5 m steps) with right angle connector / straight connector incl. 1 m interface cable
IF00	LED digital indicator for remote adjustment of IR sensor parameters
950-004	DIN-rail power supply 24 V DC 24 V DC / 1.5 A

ORDERING INFORMATION

Heavy-Duty Temperature Measuring System, to specify with:

- M3 pyrometer and temperature range
- Protective tube length 225 or 630 mm (other lengths on request)
- Hose length 2.5–30 m in 2.5 m steps (other lengths on request)
- Optics and preset measuring distance (note: the focus distance must be at least 92 mm longer than the protective sight tube)

Notes: SensorTools software is included in scope of delivery,
Connection cables are not included in scope of delivery and have to be ordered separately,
If the protective tube length is shortened, this must be taken into account when determining the required measuring distance.

MODEL SELECTION TABLE - M3 HEAVY-DUTY MEASURING SYSTEM

1	2	3	4	5	6	7	8	9	10	11	12
M3xx	xxxx	xxxx	1	x	x	13	x	x	2	x	x

1 **Model, Detector, Spectral Range:**
M309 = Silicon, 0.7 – 1.1 µm (0.2 mm fiber)
M316 = InGaAs, 1.45 – 1.8 µm (0.2 mm fiber)
M318 = ext. InGaAs, 1.65 – 2.1 µm (100-700°C: 0.4 mm fiber, temperature ranges above: 0.2 mm fiber)
M311 = Silicon, 0.7 – 1.1 µm (0.2 mm fiber)
M322 = InGaAs, 1.45 – 1.8 µm (300-1000°C: 0.4 mm fiber, temperature ranges above: 0.2 mm fiber)

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

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

4 **Sighting Method:**
1 = Laser targeting

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

6 **Optics:**
E = Heavy-duty stainless steel braided hose assy for 0.2 mm fiber with OL25 (1-color devices)
F = Heavy-duty stainless steel braided hose assy for 0.4 mm fiber with OL25 (1-color devices)
B = Heavy-duty stainless steel braided hose assy for 0.2 mm fiber with OQ25 (2-color devices)
C = Heavy-duty stainless steel braided hose assy for 0.4 mm fiber with OQ25 (2-color devices)

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

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

11 **Digital Input / Output:**
3 = 12 pin connector: 3 configurable inputs / outputs

12 **Optics Type:**
H or B
Example for M311: OQ25-**B**1 = B

Example: M311-0600-1400-1-5-B-13-0-4-2-3-B
This model refers to: Model M311, temperature range of 600-1400°C, laser targeting, RS232 & RS485 communication, heavy-duty stainless steel braided hose assy for 0.2 mm fiber with OQ25 optics, 1 ms response time, standard 12-pin sensor version, onboard temperature display, two 0/4-20 mA outputs, 3 configurable inputs/outputs, optics type B.

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