SENSOR THERM
MEMBER OF THE NYNOMIC GROUP

# METIS M3F1

## Infrared Pyrometer for Flame Temperature Measurements


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

- For optimizing the firing operation and reduction of emissions in combustion chambers
- Adherence of minimum temperatures to protect against harmful environmental effects
- To avoid slagging of combustion chamber walls

- Temperature ranges between 600°C and 2500°C
- Very low measurement uncertainty of only 0.25%
- Permissible ambient temperature of 80°C without cooling
- Fully digital and very fast with response time < 1 ms
- Optics adjustable to the measuring distance
- Serial interfaces RS232 and RS485 (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

## Especially for Sooting Flames

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 |
| 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 |
| Uncertainty ($\varepsilon$ = 1, $t_{90}$ = 1s, $T_A$ = 23°C) | 0.3% of measured value in °C + 2 K |
| Repeatability ($\varepsilon$ = 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<br>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) |
| Transmittance | 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<br>Resolution 0.0015% of the adjusted temperature (16 Bit).<br>User selectable: flame temperature, 2-color temperature, sum temperature of channel 1+2 or only 1-color temperature of channel 1 or channel 2.<br>Outputs can be set individually, within 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): clearing of peak picker, trigger input for start / stop of measured value recording in software, load pyrometer configuration.<br>■ 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.<br>■ 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 | Dot Matrix, greenyellow, 128 x 32 Dots (5.6 mm high) for temperature or parameter settings, resolution 0.1°C / °F |
| Parameter settings | Soot factor, slope/ratio, switch-off level for measurement, switch-off level for dirty window alarm, emissivity, transmittance, fill factor, temperature sub range, peak picker settings, device address, baud rate, response time, analog outputs 0 or 4–20 mA, interface RS232/RS485, °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 – 80°C, Storage: -20 – 85°C |
| Relative humidity | No condensing conditions |
| Housing / protection class | Aluminum, IP65 to DIN 40 050 with connector |
| Weight | 650 g |
| CE label | According to EU directives for electromagnetic immunity |

## Reference Numbers

**Metis M3F1** Specify with temperature range

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

# Sensortherm 2-Color Technology

Sensortherm 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 RS232 or RS485 (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 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

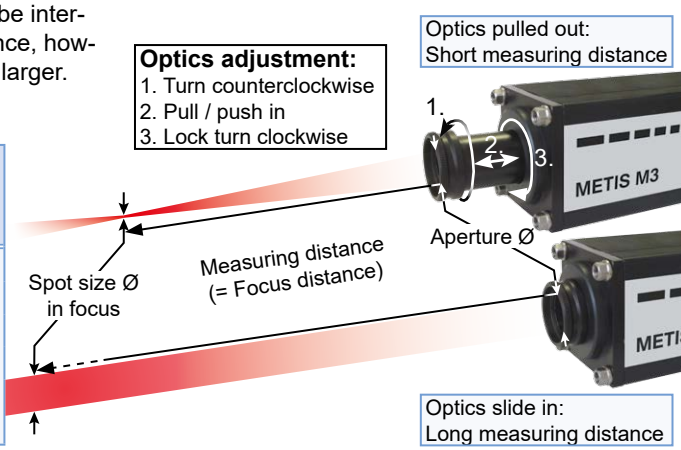
The pyrometer must be properly aligned to the measurement object to detect the temperature correctly. At the focal point of the lens (focal distance) the spot size diameter is smallest. Measurements made outside of the focus distance are also possible (in a shorter or longer distance than the focus distance) 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 | |
| | | 2000 mm | 5.8 mm | 8 mm (FSC >1400°C) |
| | to | 3000 mm | 7.8 mm | |

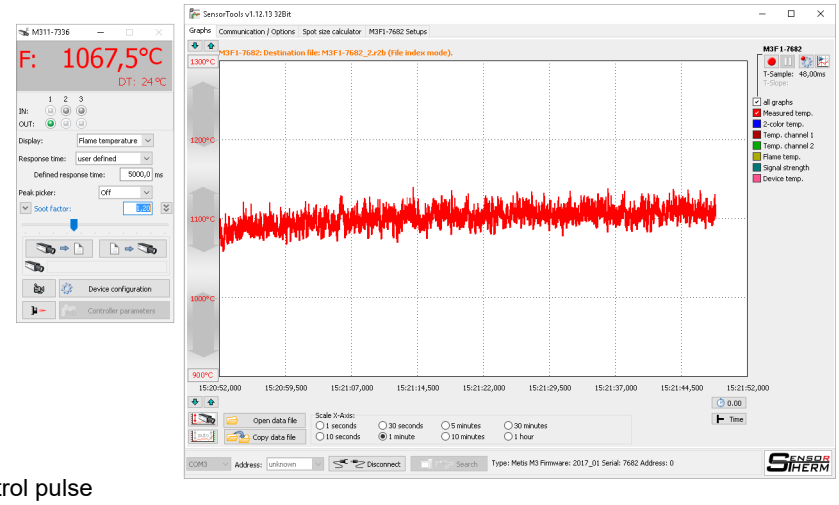
FSC = Full scale temp. range



## *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

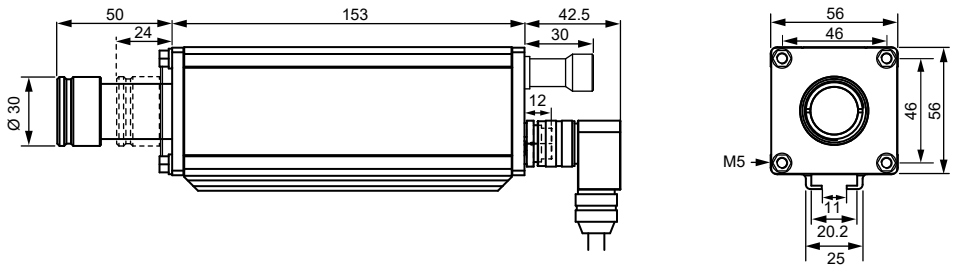
## Recommended Accessories

| | |
|---|---|
| HA20-00 | Ball and socket swivel mount for sensor alignment |
| HA10-00 | Mounting bracket |
| KG10-00 | Aluminum water cooling housing |
| FS10-04 / FS20-04 | Flange system with flange / with swivel mount flange and sapphire protection window |
| KG20-00 | Aluminum cooling plate |
| BL11-00 | 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 RS232⇔USB |
| AV11 / AV43 | Connection cable, 14-wire (available in 5 m lengths), with right angle connector / straight connector and interface converter RS485⇔USB |
| IF00-00 | LED digital indicator for remote adjustment of IR sensor parameters |
| NG12 / 15 | Power supplies 24 V DC: DIN rail power supply 1.6 A / desktop power supply 2.5 A |


## Dimensions

Dimensions in mm

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




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

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