

# Metis H311 / H322

Highly Advanced, Full Featured 2-Color High-Speed Pyrometers



High-Speed 2-color pyrometer for non-contact temperature measurement in short wavelength spectral range, primarily for measurements on metals and bright and shiny materials, ceramics and graphite.

- Measurement through polluting sight-glasses, dust or smoke
- Measurements of measuring objects that are smaller than the pyrometer's spot size
- Ideally suited for temperature measurement and control in laser processes.

- Fully digital and very fast with response time < 80  $\mu$ s for more than 25,000 measurements per second
- Temperature ranges between 350°C and 3300°C (662°F and 5972°F)
- Highest accuracy and repeatability
- Dirty window programmable alarm
- Different optics with small spot sizes from 0.8 mm available
- Laser targeting light, color video or through lens sighting
- 10-digit matrix display for temperature and IR sensor parameters
- Configuration via push button device or supplied software
- 2 high resolution 16 bit analog 0/4 to 20 mA outputs
- 3 versatile configurable inputs or outputs
- Serial RS485 high-speed interface
- Optional equipment: PID controller or fieldbus systems, analog input for external setpoint adjustment with PID controller

## Technical Data

Model	H311	H322	
Temperature ranges	600–1100°C 650–1300°C 750–1400°C 900–1800°C	1000–2000°C 1100–2200°C 1300–2500°C 1600–3300°C *) 350–800°C 400–1200°C 500–1300°C 550–1400°C	700–2300°C 1000–2500°C 1300–3000°C **)
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 <sub>90</sub>	< 80 µs, adjustable up to 10 s		
Exposure time	< 40 µs		
Uncertainty (ε = 1, t <sub>90</sub> = 1s, T <sub>A</sub> = 23°C)	0.5% of measured value in °C + 1K		
Repeatability (ε = 1, t <sub>90</sub> = 1s, T <sub>A</sub> = 23°C)	0.2% of measured value in °C + 1K		
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	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 or control output (if equipped with a controller) Outputs can be set individually, inside or outside the measuring range.		
Serial interface	RS485 (max. 921 kBd), resolution 0.1°C or 0.1°F		
Configurable inputs / outputs	12-pin connector model: 3 ports, configurable as digital input or output. 17-pin connector model: 4 digital inputs, 2 digital outputs, 1 analog input ■ Inputs (protected against reverse polarity): laser targeting light on/off, clear peak picker, trigger input for start / stop recording of measured values, load pyrometer configurations, controller start. Analog input (0–20 mA, analog 0–10 V setpoint preset for PID controller (only with 17-pin connector model)). ■ Outputs (12-pin models: max. 50 mA, protected against short circuit; 17-pin models: max. 100 mA): 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.		
Peak picker	Automatic hold mode or manual time settings to clear (reset)		
Display	Only 12-pin connector models: 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	12-pin connector models: via push buttons on the device, serial interface or software <i>SensorTools</i> . 17-pin connector models: only via serial interface / software <i>SensorTools</i> . Settings: 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, selecting analog outputs 0/4–20 mA, Temperature unit °C/°F, language (English / German).		
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)	■ Through lens sighting with adjustable attenuation filter for eye protection from 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 <sub>pp</sub> , 75 Ω, CCIR, NTSC / PAL switchable Resolution: NTSC: 720 x 480 Pixels; PAL: 720 x 576 Pixels; frame rate: NTSC: 60 Hz, PAL: 50 Hz		
Optics	Manual focusable optics (integrated or as fiber optic version)		
Ambient temperature	Operation: 0 to 60°C (32 to 140°F), fiber optic and optics on optics side: -20 to 250°C (-4 to 482°F) Storage: -20 to 85°C (-4 to 185°F) (The camera module is deactivated at a device temperature from 55°C to prevent its overheating)		
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 H311 Specify with temperature range, 12 pin or 17 pin model, sighting method and optics  
Metis H322 Specify with temperature range, 12 pin or 17 pin model, 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.

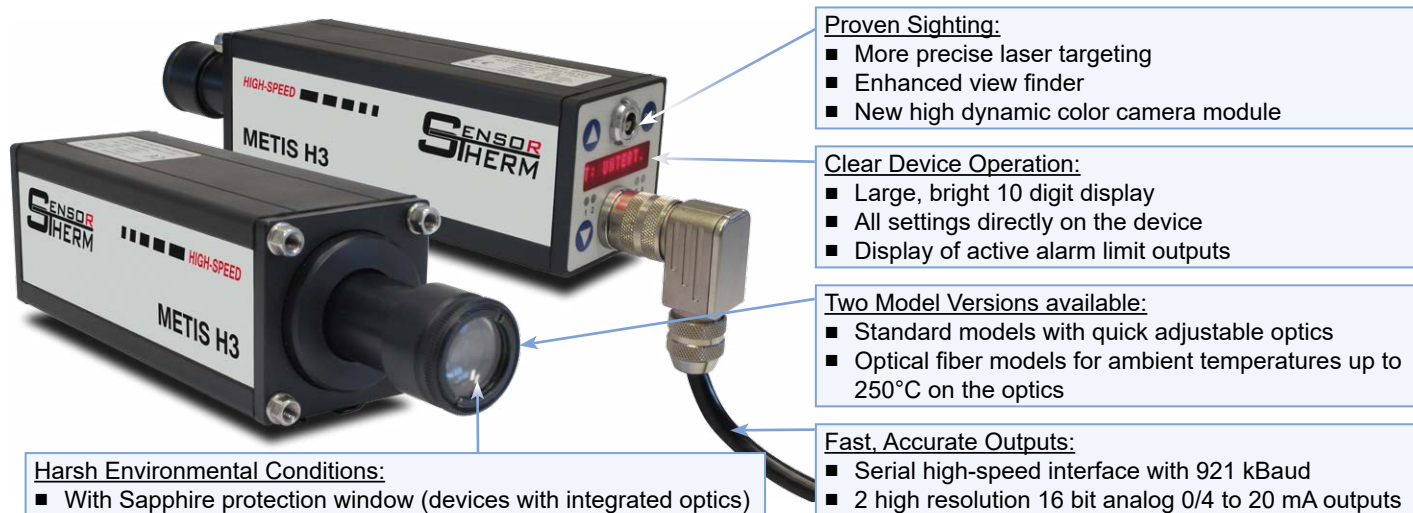
## 25,000 Measurements per Second

The H3 Series stands out everywhere average pyrometers come up short. With an exposure time of only 40  $\mu$ s the pyrometers measure 25,000 times per second. The response time is 80  $\mu$ s. The response time or exposure time is the time it takes until the actual temperature from the measuring object is captured from the pyrometer and converted to an output signal. This makes the H3 Series fast enough to perform a laser power control in near real-time and respond to complex workpiece geometries.

Metis H3 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.

## Features



## Comprehensive Settings

### ■ For Material Properties

- **Emissivity slope:** The emissivity ratio can be adjusted when measuring objects whose emissivity is different at the two wavelengths (e.g. bright, non-oxidized metal surfaces). 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:** When measuring on a cold background, the measurement object can be smaller than the spot size. At this point one 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.
- Simultaneous output of 2-color and 1-color temperature to the 2 analog outputs

### ■ Dirty Window Alarm

A signal strength monitoring function detects the degree of contamination of the pyrometer's optics or viewing window, and identifies 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.

### ■ Equipment Versions

- Pyrometers with integrated **PID controller** measure the temperature and thus control a given temperature level.
- **Fieldbus systems** Profinet or Profibus

## Intelligent Installation Possibilities

### Serial RS485 Interface

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 RS485 long distance connections with high transmission speeds of up to 921 kbd can be realized, the devices can be addressed and can be used in bus configuration.

An interface converter 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 with PID controller (optional) as a control value output.

The outputs allow measuring range limits beyond the pyrometer's temperature range and allows either 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.

### Configurable Inputs / Outputs

12-pin device versions have 3 freely configurable digital inputs / outputs,

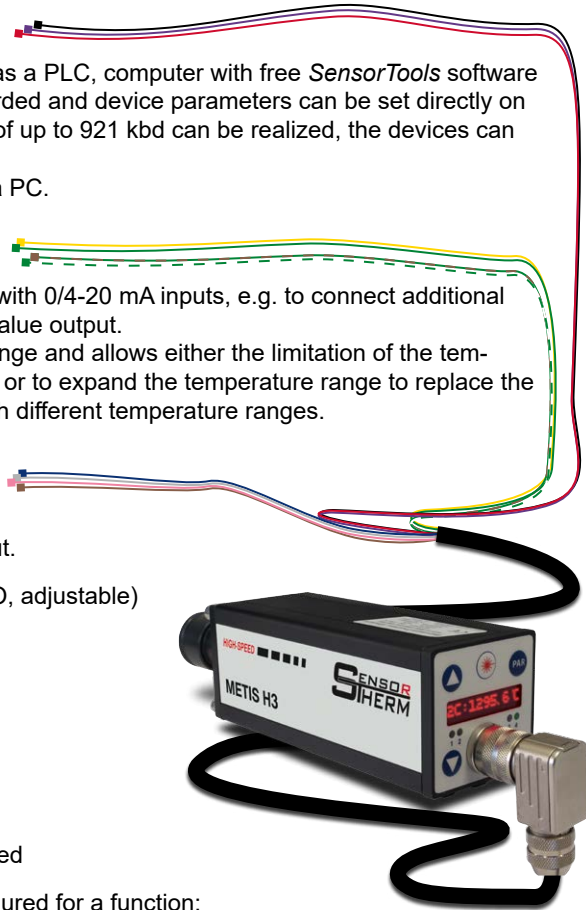
17-pin device versions have 4 digital inputs, 2 digital outputs and one analog input.

- 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
  - Devices with PID controller: Controller active
  - Devices with PID controller: Control within defined setpoint limits
  - Devices with PID controller: Controlling finished successful, hold time finished
- Each **digital input** can be connected to an external contact closure and configured for a function:
  - Laser targeting light on and off
  - Manually delete (reset) of maximum value storage
  - Start / stop recording of measured values via the *SensorTools* software
  - Up to 7 pyrometer configurations (devices with PID controller also control parameters) can be saved and retrieved
  - Devices with PID controller: Start the control process on the device and the recording of the control process in the software
- Using the **analog input** a 0–20 mA current can be fed (0-10 V voltage at 17-pin models) for
  - Analog specification of emissivity slope, emissivity in 1-color mode or setpoint value (devices with PID controller)

### 17-pin Device Design

The 17-pin version omitted the display and the settings keys, all parameters will be changed via PC.

- 4 digital inputs, 2 analog outputs, integrated PID controller, analog input for analog specification of the setpoint value.



## Sighting Method Selection

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

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



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

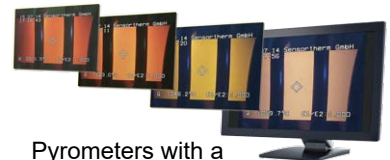
For devices with measuring range above 1800°C, the eyepiece can be darkened for eye protection.



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

Focus

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.



## Device Designs / Optics

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 safe data logging. 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. 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 fill the sensor's spot size with the target.

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.

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.

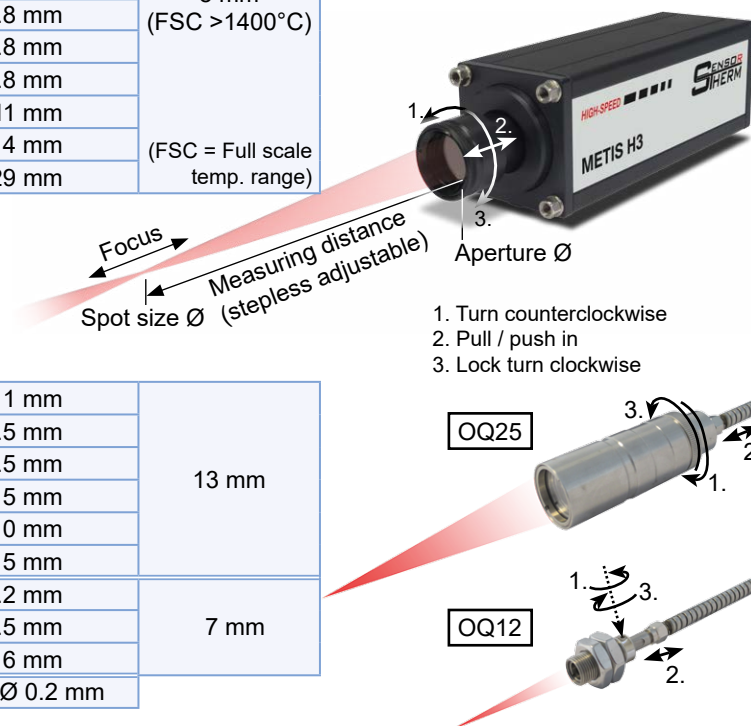
The pyrometer can be used at distances other than its' focal distance, however the spot size is generally larger and therefore the target size must be larger.

### Integrated Optics

Optics (focusable)	Measuring distance a [mm] adjustable	Spot size M [mm]				Aperture Ø D [mm]
		H311 <1200°C	H322 <1200°C	H311 ≥1200°C	H322 ≥1200°C	
H311: OQ11-A1 H322: OQ22-A2	from 340 mm	1.4 mm	0.8 mm			16 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			
H311: OQ11-F1 H322: OQ22-F2	to 3000 mm	14 mm	7.8 mm			8 mm (FSC > 1400°C)
	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			(FSC = Full scale temp. range)
	to 10000 mm	51 mm	29 mm			

### Focusable optics

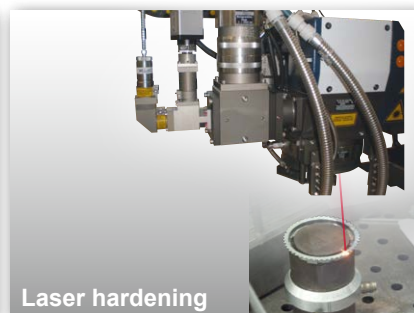
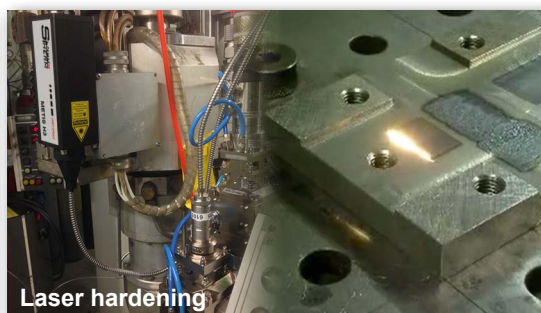
can be continuously adjusted within the minimum and maximum specified measurement distance, providing the smallest possible spot size diameter at that focus distance.



### Fiber Optics (outside diameter 25 mm or miniature 12 mm)

H311: OQ25-B1 H322: OQ25-B2	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	7 mm
H311: OQ12-C0	from 120 mm	2.2 mm	1.2 mm	
H322: OQ12-C0	250 mm	5 mm	2.5 mm	
	to 500 mm	12 mm	6 mm	
		Fiber Ø 0.4 mm	Fiber Ø 0.2 mm	

## Typical Applications

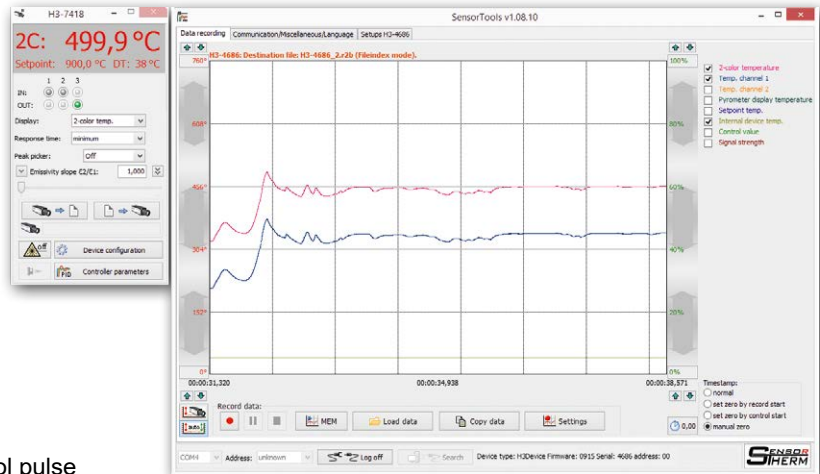


## SensorTools Software

- 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



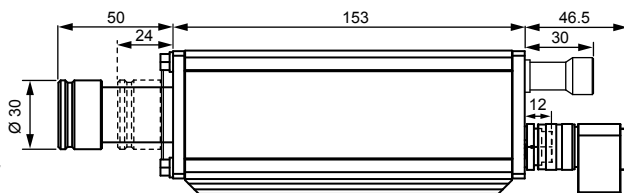
## Recommended Accessories

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 (available in 5 m steps) with 12-pin right angle connector / straight connector
AS51 / AS53	Connection cable (available in 5 m steps) with 17-pin right angle connector / straight connector
AV11 / AV43	Connection cable, interface converter RS485⇄USB with 12-pin right angle connector / straight connector
AS61 / AS63	Connection cable, interface converter RS485⇄USB with 17-pin right angle connector / straight connector
AK50	Connection cable for camera module (Limosa-plug⇄Cinch-plug, available in 5 m steps)
NG12 / 15	Power supply 24 VDC: DIN rail power supply 1.6 A/ desktop power supply 2.5 A
IF0000	LED digital indicator for remote adjustment of IR sensor parameters
Regulus RD / RF	PID program controller as bench top model / for panel mounting



## Dimensions

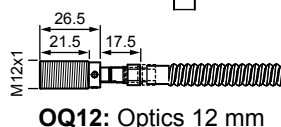
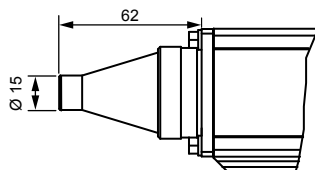
**Manual focusable optics, version with 12-pin connector**



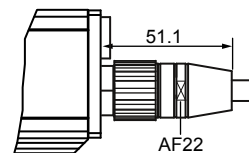
**version with 17-pin connector**



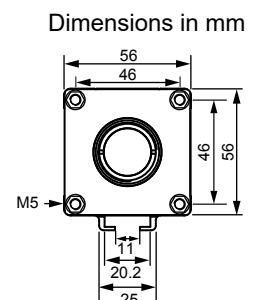
**Fiber optic devices, focusable optics**



**OQ12: Optics 12 mm**



**OQ25: Optics 25 mm**



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

Sensortherm-Datasheet\_Metis\_H311\_H322 (Nov. 14, 2016)

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