PROCESS SENSORS CORPORATION

Metis H309 / H316 / H318

Highly Advanced, Ultra-Fast, Full Featured 1-Color Pyrometers

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

- **Ideally suited for temperature measurement and control in laser processes.**

APPLICATIONS

- **Laser applications (laser radiation welding, contour welding, simultaneous welding, quasi-simultaneous welding, etc.)**
- **R&D**
- **Turbine Blades**
- **Combustion engines**
- **Medical**
- **Plasma measurements**
- **Airbag testing**
- **Wafer control**
- **Explosion processes**

FEATURES

- **Fully digital and very fast with response time <40 µs for more than 50,000 measurements per second**
- **Temperature ranges between 120°C and 2500°C (248°F and 4532°F)**
- **Highest accuracy and repeatability**
- **Small spot sizes from 0.4 mm**
- **10-digit matrix display for temperature and IR sensor parameters**
- **Configuration via IR sensor push buttons or SensorTools software**
- **2 high resolution 16 bit analog 0/4 to 20mA outputs**
- **3 versatile configurable inputs or outputs**
- **Analog input for external setpoint or emissivity setting**
- **Laser targeting, color video or thru-lens sighting**
- **Serial RS-485 high-speed interface**
- **Optional fieldbus connection: Profinet or Profibus**

Technical Data

Model	H309	H316	H318
Temperature ranges	550 – 1200°C 600 – 1400°C 650 – 1600°C 750 – 1800°C 750 – 2000°C	250 – 800°C 300 – 900°C 350 – 1100°C 400 – 1200°C 500 – 1600°C 600 – 1800°C 700 – 2500°C	120 – 520°C 180 – 800°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
Detector	Silicon	InGaAs	InGaAs
Response time t_{90}	< 40 µs, adjustable up to 10 s		
Exposure time	< 20 µs		
Uncertainty (ε = 1, t_{90} = 1s, T_A = 23°C)	0.5% of reading in °C + 1K		
Repeatability (ε = 1, t_{90} = 1s, T_A = 23°C)	0.2% of reading in °C + 1 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 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	RS-485 (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 for adjustment of emissivity slope, emissivity or setpoint for PID controller. ■ 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.		
Peak picker	Automatic hold mode or manual time settings to clear (reset) or external clear (via input)		
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	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, Temperature unit °F/°C, language (English / German).		
Power requirement	24 V DC (18–30 V DC), max. 12 VA; protected against reverse polarity		
Isolation	Voltage supply, analog outputs and serial interface are galvanically isolated from each other		
Sightings (optional)	■ Thru-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_{PP}, 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 (optional)	Manual focusable optics (integrated or as fiber optic version)		
Ambient temperature	Operation: 0 to 65°C (32 to 149°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 H309	Specify with temperature range, 12 pin or 17 pin model, sighting method and optics
Metis H316	Specify with temperature range, 12 pin or 17 pin model, sighting method and optics
Metis H318	Specify with temperature range, 12 pin or 17 pin model, sighting method and optics

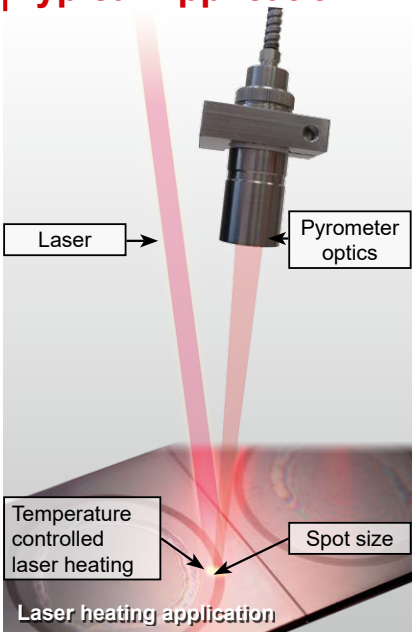
Note: *SensorTools* software is included in scope of delivery,
Connection cables are not included in scope of delivery and have to be ordered separately.

50,000 Measurements per Second

The H3 series stands out where average pyrometers come up short. With an exposure time of only 20 µs the pyrometers measure 50,000 times per second, the response time is 40 µs. 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 into existing instrumentation. The short-wave spectral ranges of the various models are specially designed for accurate temperature measurements of metals and other shiny, reflective materials.

Typical Application



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

Two Model Versions available:
- Standard models with quick adjustable optics
- Optical fiber models for ambient temperatures up to 250°C on the optics

Fast, Accurate Outputs:
- Serial high-speed interface with 921 kBaud
- 2 high resolution 16 bit analog 0/4 to 20 mA outputs

Harsh Environmental Conditions:
- With Sapphire protection window (devices with integrated optics)

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

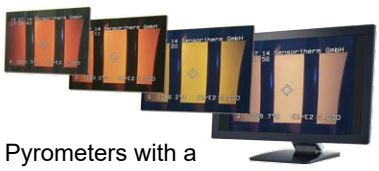
The **view finder** provides upright imagery so that the target under measurement can be viewed visually. A circular reticle shows the measuring spot. Recommended for glowing measurement objects, as a red laser is difficult to detect.

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.

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.
Only available with optics OV09-D1/-D2 (340–3000 mm).

Intelligent Installation Possibilities

Serial RS-485 Interface

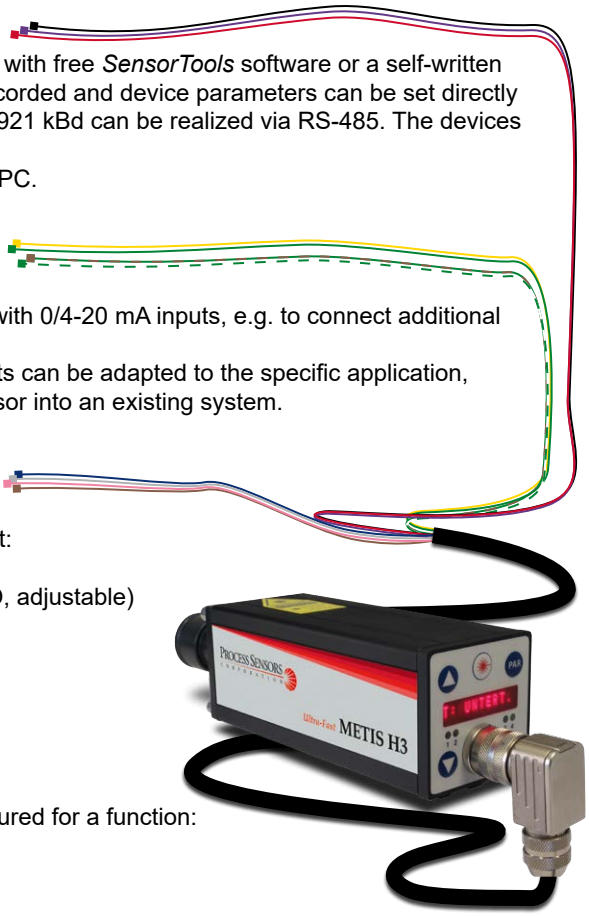
The pyrometer communicates with other digital devices such as a PLC, computer with free *SensorTools* software or a self-written communication software program via serial interface. Measured values can be recorded and device parameters can be set directly on the device. Long distance connections with high transmission speeds of up to 921 kBd can be realized via RS-485. The devices can be addressed and used in a bus configuration.
An interface converter 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 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** a current can be fed (0-10 V voltage at 17-pin models) for
  - Emissivity slope or emissivity in 1-color mode

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 outputs of Profinet or Profibus can be provided.

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.

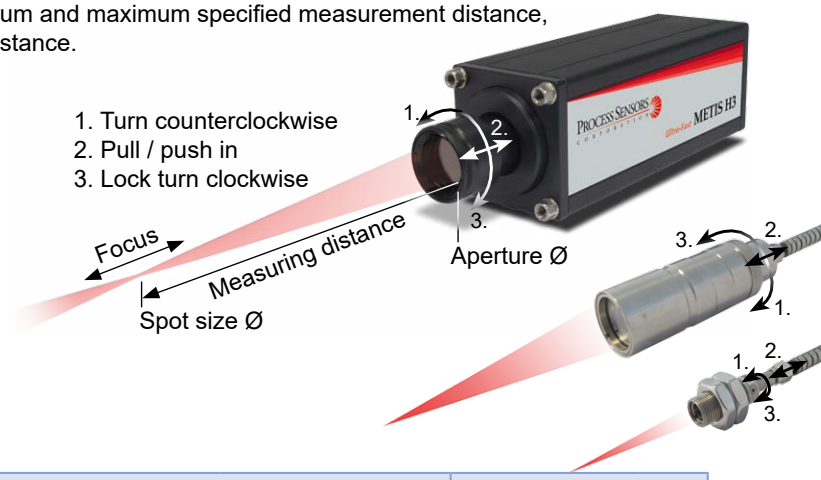
Device Designs / Optics

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

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.

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

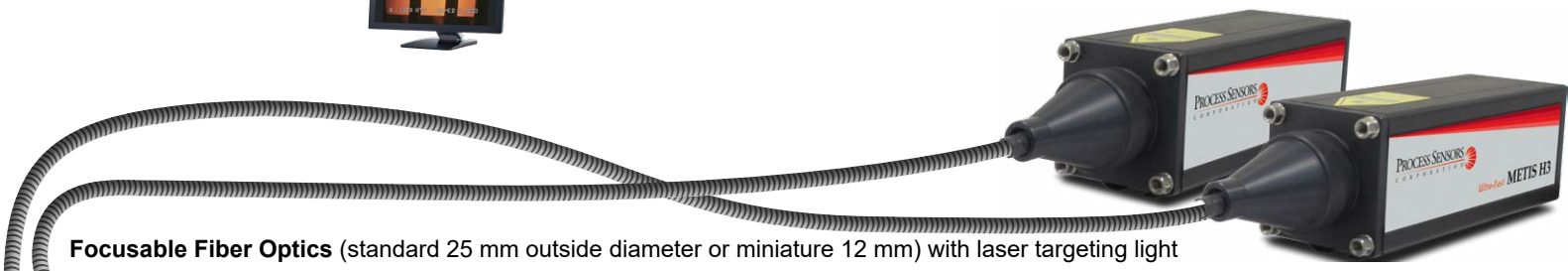


Focusable Optics with laser targeting light or view finder

Optics	Measuring distance a [mm]	Spot size M [mm]		Aperture Ø D [mm]
		H309 all ranges **H316** 400–1200°C 500–1600°C 600–1800°C 700–2500°C **H318** 180–800°C	**H316** 250– 800°C 300– 900°C 350–1100°C **H318** 120– 520°C	
 OM09-**A**0	130 mm	0.4 mm	0.6 mm	16 mm (FSC≤1400°C) 8 mm (FSC>1400°C)
	160 mm	0.5 mm	0.8 mm	
	200 mm	0.65 mm	1.1 mm	
OM09-**B**0	190 mm	0.5 mm	0.8 mm	16 mm (FSC≤1400°C) 8 mm (FSC>1400°C)
	300 mm	0.9 mm	1.4 mm	
	420 mm	1.3 mm	2 mm	
OM09-**C**0	340 mm	0.8 mm	1.3 mm	16 mm (FSC≤1400°C) 8 mm (FSC>1400°C)
	1000 mm	2.9 mm	4.5 mm	
	4000 mm	13 mm	18 mm	

Focusable Optics with color camera module

H309: OV09-**D**1 H316/18: OV09-**D**2	340 mm	0.9 mm	1.8 mm	16 mm (FSC≤1400°C) 8 mm (FSC>1400°C)
	1000 mm	2.8 mm	5.6 mm	
	4000 mm	8.8 mm	17.6 mm	



Focusable Fiber Optics (standard 25 mm outside diameter or miniature 12 mm) with laser targeting light

Standard: OL25 	OL25-**G**0	75 mm	0.45 mm	0.6 mm	13 mm
		130 mm	1 mm	1.3 mm	
		180 mm	1.4 mm	1.8 mm	
	OL25-**H**0	170 mm	1 mm	1.6 mm	13 mm
		2000 mm	15 mm	23 mm	
		4500 mm	34 mm	52 mm	
Miniature: OL12 	OL12-**A**0	100 mm	0.9 mm	1.5 mm	7 mm
		350 mm	3.7 mm	6.2 mm	
		600 mm	6 mm	10.9 mm	
			Fiber Ø 0.2 mm	Fiber Ø 0.4 mm	

FSC = Full scale temperature

Model Selection Table - Metis H309 / H316 / H318

1		2		3		4		5		6		7		8		9		10		11		12
H3xx	-	xxxx	-	xxxx	-	x	-	x	-	x	-	xx	-	x	-	x	-	x	-	x	-	x

1 **Model, Detector, Spectral Range:**
H309 = Silicon, 0.7 – 1.1 µm
H316 = InGaAs, 1.45 – 1.8 µm
H318 = ext. InGaAs, 1.65 – 2.1 µm

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

3 **Full Scale Temperature:**
e.g. 1600 = 1600°C

4 **Sighting Method:**
1 = Laser targeting
2 = Thru-lens view finder
4 = Color camera module

5 **Serial Interface:**
2 = RS485

6 **Optics:**
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 = 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:**
41 = 40 µs, adjustable to 10 s

8 **Version:**
0 = Standard (12 pin connector, display, push buttons, 3 digital inputs / outputs)
4 = Standard + PID controller
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 analog outputs, standard

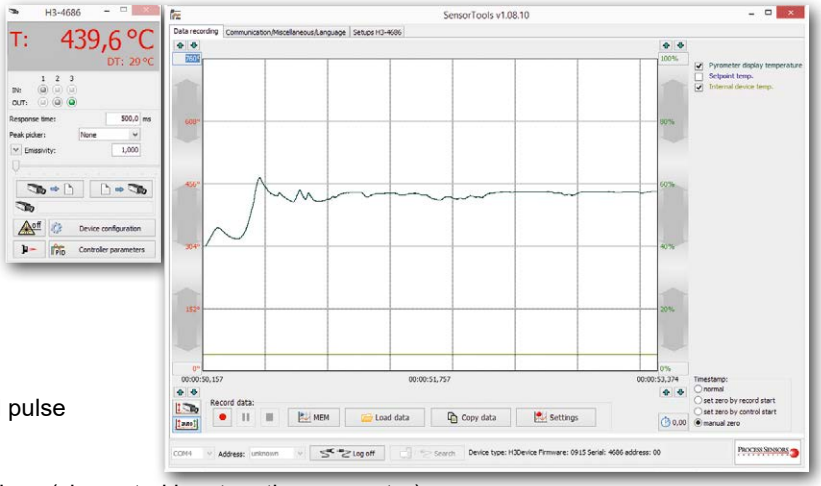
11 **Digital Input / Output:**
3 = 12 pin connector:
3 digital inputs / outputs / 1 analog input 0–20 mA
4 = 17 pin connector (no display):
4 digital inputs + 1 analog input + 2 digital outputs

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

Example: H309-0650-1600-1-2-2-41-0-4-2-3-A
This model refers to: Model H309, temperature range of 650-1600°C, laser targeting, RS485 communication, manual focus optics, 40 µs response time, standard 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 on and off or 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

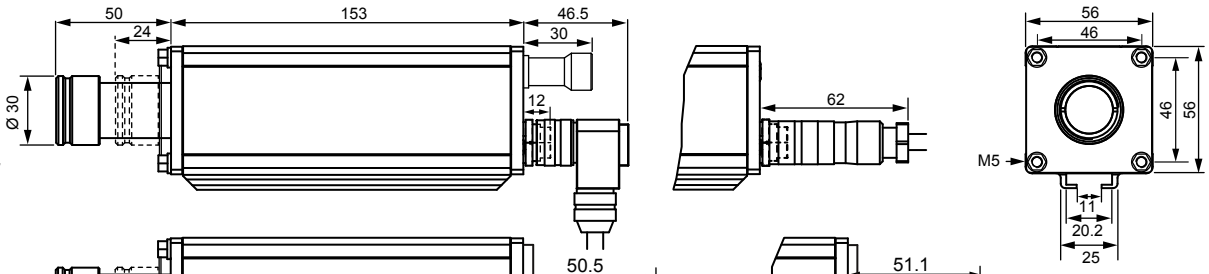
Recommended Accessories

HA20	Ball and socket swivel mount for sensor alignment
HA10	Mounting bracket
HA14 / HA15	Adjustable mounting bracket for fiber optics OL25 / OL12
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 (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 RS-485⇔USB with 12-pin right angle connector / straight connector
AS61 / AS63	Connection cable, interface converter RS-485⇔USB with 17-pin 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

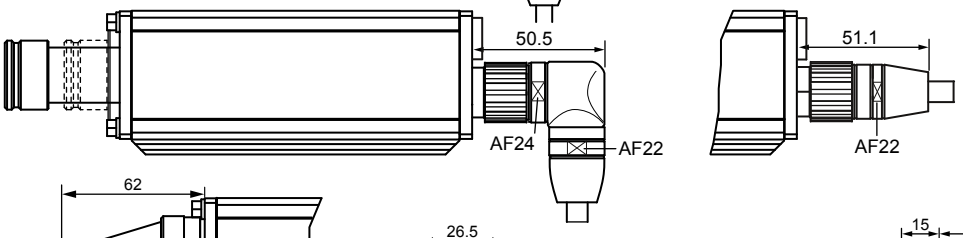
Dimensions

Dimensions in mm

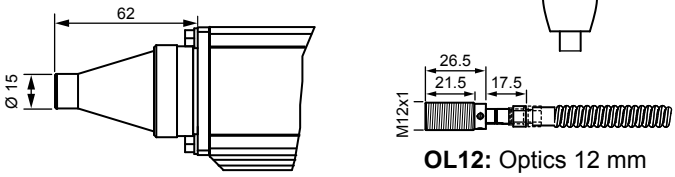
Manual focusable optics, version with 12-pin connector



17-pin connector version



Fiber optic devices, focusable optics



OL12: Optics 12 mm

OL25: Optics 25 mm

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

Datasheet_Metis_H309_H316_H318 (Sept. 22, 2016)

PROCESS SENSORS CORPORATION
IR Temp. Sales Office: 787 Susquehanna Avenue, Franklin Lakes, NJ USA • Tel: 201-485-8773 • Fax: 201-485-8770
Corporate Headquarters: 113 Cedar Street, Milford, MA USA • Tel: 508-473-9901 • Fax: 508-473-0715
www.ProcessSensorsIR.com • irtemp@processsensors.com