PyroViper2™-MWIR state-of-the-art Imaging Pyrometers

PyroViper™ furnace probe camera models “PV2-MWIR” not only provide state-of-the-art infrared imaging for industrial high temperature process scenarios but also integrate “two-dimensional-pyrometry”. They thus deliver great visual details of the process conditions to the operator and at the same time accurately measure the temperature of virtually any object or region of interest within the system’s field of view. The rugged industrial solid-state imaging MWIR sensors have the advantage of no “moving system parts”.

PyroViperTM-MWIR sensor modules are mounted to the “process wall” via an air-cooled wall-box (no additional water cooling required). A heat resistant housing and an automatic retracting device ensure safe operation. All PyroViper™ lens & sensor assemblies are air-purged and cooled by up to two separate air supply lines. The heavy-duty furnace lens is available with standard usable lengths between 202mm and 1142mm (special lengths also available), thus covering most installation conditions.

Both, the image and the temperature information of the process are “observed” via wide angle optics of advanced design and transferred by a special relay lens system to the high-tech, remote controlled sensor module. Image, temperature and system status signals are transmitted via fiber optic (up to 2km), coaxial or CAT7 cable to the smart Data-Acquisition-Controller “PDAC-2” that is usually located in the process control room or nearby. This unit includes the software package “VideoDAQ+Ciuvideo”, which processes both video and temperature information of an object in real time.

The PyroViper2™-MWIR camera head design features the following advantages:

- **Real-time image through computer-optimized probe optics:**
  - Excellent image quality
  - Online temperature measurement everywhere in the captured image
- **Minimum maintenance** cycles and efforts
- **Simple handling, cleaning and troubleshooting:**
  - Housing design protects delicate electronics while open
  - High precision mechanics with clever design for ease of use
  - Fine adjustments to optimize optical and mechanical properties
- **Fully adjustable optical system** with simple mechanical interfaces
  - Optical zoom, focal point position, …
  - Digital zoom, Focus, centering of the optical axis adjustable in operation!
- **Lightweight:** Easy to dismount and transport for repair, inspection or storage
- **Separate air-intake for optics and electronics to minimize maintenance and wear**
- **Exchangeable probe optics**
- Remote control to adjust specific imager settings during operation
- Specifically adapted to applications in MWIR with custom filters
- **Safe operation:** Camera retracts in case of alarm or failure

The flexible PyroViper™-MWIR design includes customizable sensor features: additional sensors (pressure, temperature, humidity, vibration, etc.) can be built into the housing.

**Lifetime technical support via Phone/E-Mail/RemoteDesktop free of charge!**

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### Advantages of PyroViper2™-MWIR against conventional CCTV-systems

<table>
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<th>Industrial process</th>
<th>Advantages of PyroViper2™-MWIR against conventional CCTV-systems</th>
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<tr>
<td>Reheat furnaces &amp; boilers</td>
<td>Quantitative observation &amp; control of heating uniformity, product quality, and combustion. Control of smelt bed size &amp; shape.</td>
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<tr>
<td>Zinc kiln</td>
<td>Continuous &amp; detailed observation of combustion conditions, especially for secondary fuels. Accurate measurement of product and refractory temperature along up to 15 meters of the kiln outlet for control of the process stability to ensure product quality and efficient fuel usage.</td>
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<td>Waste burning</td>
<td>Monitoring of the clinker temperature distribution and the clinker flow along the grates. Reliably “Red-River-Detection”. Control of the blower efficiency and clinker bed depth, etc.</td>
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<td>Cement clinker coolers</td>
<td>A typical PyroViper2™-MWIR system configuration consists of the following basic components</td>
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<td>Industrial camera assembly with an integrated infrared imager for accurate temperature measurement. Air cooled industrial IP66 camera housing with “quick change” furnace probe optics and air supply connectors.</td>
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<td>Stainless steel furnace optics, i.e. rugged lens assembly with patented “Wide angle, Bright Image Optical System”.</td>
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<td>Furnace wall-box with auto-shutter, automatic-retract assembly, high performance air filtration system with regulator assembly.</td>
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<td>Smart sensor data acquisition controller with industrial Ethernet-LAN connectivity &amp; dual video output for UXGA color monitors.</td>
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PyroViper™-MWIR temperature measuring industrial furnace probe camera sensor

**Sensor type:** Analog or digital high performance industrial solid state microbolometer FPA.

**Sensor video signal output:** Analog modules (1V p-p, 75 Ohms): PAL/NTSC, RS-170/CCIR. Digital module options: Ethernet IP-Video, CameraLink, Gigabit Ethernet (“GigE”).

**Sensor “imaging resolution”:** Analog modules: NTSC/PAL signal with up to 640H x 460V “imaging pixels”. Digital module options: 320 x 240 or 640 x 480 effective pixels.

**Sensor frame/field rate:** Analog modules: 25/50Hz (PAL/CCIR), 30/60Hz (NTSC/RS-170). Digital module options: between 5Hz and 100Hz (depending on sensor type & resolution).

**Sensor SNR (signal to noise ratio):** Depending on model: 55-63dB (DNR on) and 50-59 dB (DNR off).

**Typical calibrated temperature ranges:**
- R1-Smelt Bed: 800-1200°C (1472-2192°F), R2 - Lime Kiln: 600-1600°C (1112 -2912°F), R3-Cement Kiln: 800-1800°C (1472-3272°F), R4-Clinker Cooler: 150-1400°C (302-2552°F)

**Typical spectral filter:**
- F1 - Smelt Bed, Lime/Cement Kiln: 3.9µm narrow band, F2 - Clinker Cooler: 3.6-4.0µm F3 – Zinc Kiln: 3.9 (also LWIR available at 10.6µm) narrow band, Fx - Custom Optical filters are always optimally adapted to the application (e.g. see through dust/vapor).

**Measurement accuracy, repeatability:** <±1.0% (full scale), <±0.5% (full scale).

**Temperature resolution / NETD:** <2°C (<=3.6°F) / 1.5°C (2.7°F) @ 1000°C (1832°F)

**Typical Spot size 90/50% SRF (FOV=90°/D):**
- Microbolometer FPA with 320x240 pixel: <10/<5mrad
- Microbolometer FPA with 640x480 pixel: <5/<2mrad

**Multiple spot measurement cycle:** <40 ms (continuous measurement) or actual frame rate.

**Power requirements:** 12VDC or 24VDC +/-10% max. 15.0W.

PyroViper™-MWIR high temperature furnace probe lens assembly (standard furnace probe lens models)

**Overall length** 273mm, 451mm, 629mm, 921mm, 1213 mm (12”, 18”, 24”, 36”, 48”).

**Usable length / Shroud diameter:** 202mm, 380mm, 558mm, 850mm, 1142 mm (8”, 15”, 22”, 34”, 45”) / 42.4 mm (1.67”).

**Shroud diameter:** 41.3mm (1.625”) or 60.0mm (2.362”).

**Field of view (FOV):** Typical 72° H x 54°V x 90°D (custom FOVs between 45°D & 110°D are available).

**Angle of view (AOV):** Standard AOV is “straight ahead”. Optional: “right AOV” or “obtuse AOV”.

**Environmental protection rating:** IP66 (NEMA 4X).

**Sensor frame/field rate:** Analog modules: 25/50Hz (PAL/CCIR), 30/60Hz (NTSC/RS-170). Digital module options: between 5Hz and 100Hz (depending on sensor type & resolution).

**Lens air purging & cooling:** Instrument-quality air: 34-72Nm3/h at 0.01-0.07MPa (20-42scfm at 1.5-10.2psi).

**Sensor housing air purging & cooling:** Instrument-quality air: 3.4-7.2Nm3/h at 0.01-0.07MPa (2.0-4.2scfm at 1.5-10.2psi).

**Optional Wall box shroud cooling:** Pre-filtered ambient air: 12-24Nm3/h at 0.02-0.01MPa (7-14scfm at 0.02-0.1MPa).

PyroViper™-MWIR environmental protective camera housing (sensor module enclosure)

**Material:** High temperature synthetic and/or stainless steel/aluminum.

**Environment with standard air cooling:** Furnace surrounding ambient air temperature up to 80°C (176°F). Option: Vortex cooler for ambient air temperature up to 150°C (302°F).

**Environmental protection rating:** IP66 (NEMA 4X).

**Wall box mounting interface:** Slide track block or slide track flange.

PyroViper™-MWIR accessories and options

- Customized optics/optical filters & digital CCD/FPA/microbolometer sensors adapted to the application for optimized image quality.
- High performance air filtration/distribution system, automatic retract assembly, automatic port de-slagger.
- Heavy-duty furnace wall-box with auto-shutter & air-cooled lens protection shroud, water cooled welding socket, ball-head mount, etc.
- **RE** tract and **Sensor** Control Unit “**RESC-U2**”: Sensor power supply, automatic retraction control, video & control signal conditioning.
- Signal processor **I** O unit: Video & control signal conditioning, status & alarm signal I/O, interface to process control systems (PCS).

Isolated video & control signal transmission via fiber-optic cable up to 2km (video transmission via CAT7 <100m / coax cable <30m).
**Example 1:**
Cement Clinker Cooler (hot area)

**Example 2:**
Cement Kiln (burn zone)

Subsystem of KTCx.NET Kiln & Cooler concept: integrated thermal and visual process monitoring.
**PyroViper™ application note: cement kiln**

**Project engineering**

Estimated view on screen

- Optimization of kiln interior surveillance
- Consideration of particular kiln construction
- Assessment of best possible mounting position
- Determination of customized field of view
- Design of tailored mounting solution

**Actual implementation**

Installation on kiln hood wall

picture on screen
PyroViper™-2 application note: Black liquor recovery boiler

Estimated view on screen

- Optimization of boiler bed surveillance
- Consideration of particular boiler construction
- Assessment of best possible mounting position
- Determination of customized field of view
- Design of tailored mounting solution

Actual implementation

Installation on boiler wall

picture on screen