

## PyroViper2<sup>™</sup>-MWIR state-of-the-art Imaging Pyrometers

PyroViper<sup>™</sup> 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”.



PyroViper2<sup>™</sup>-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<sup>™</sup> 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.

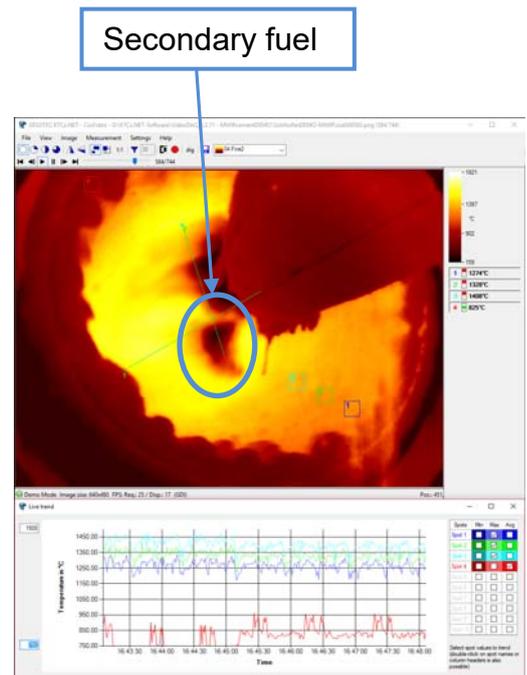
Image, temperature and system status signals are transmitted via fiber optic (up to 2km), coaxial or CAT7 cable to the smart Data-Acquisition-Controller “PDAC-2” that is usually located in the process control room or nearby. This unit includes the software package “VideoDAQ+Ciuvideo”, which processes both video and temperature information of an object in real time.

The PyroViper2<sup>™</sup>-MWIR camera head design features the following **advantages**:

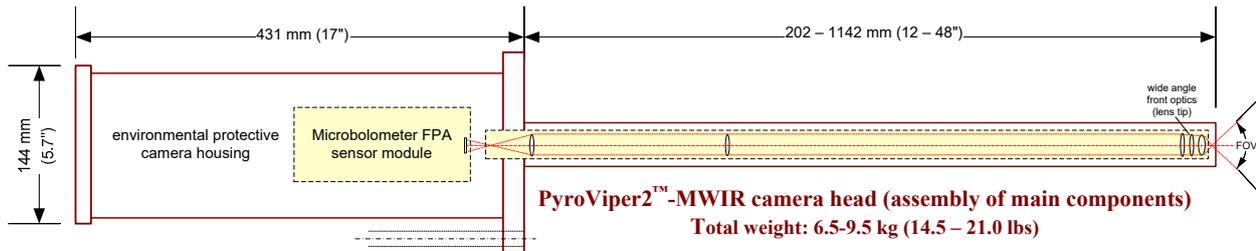
- **Real-time image** through **computer-optimized probe optics**:
  - Excellent **image quality**
  - Online **temperature measurement** everywhere in the captured image
- **Minimum maintenance** cycles and efforts
- **Simple** handling, cleaning and troubleshooting:
  - Housing design protects delicate 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 PyroViper2<sup>™</sup>-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!**



<b>Advantages of PyroViper2<sup>™</sup>-MWIR against conventional CCTV-systems</b>	<b>Industrial process</b>
Quantitative observation & control of heating uniformity, product quality, and combustion. Control of smelt bed size & shape. Improved boiler performance. Reduced pollution. Optimized fuel consumption.	Reheat furnaces & boilers Recovery boilers
Continuous & 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.	Zinc kiln, Cement- & lime- production, Waste burning
Monitoring of the clinker temperature distribution and the clinker flow along the grates. Reliable “Red-River-Detection”. Control of the blower efficiency and clinker bed depth, etc.	Cement clinker coolers
<b>A typical PyroViper2<sup>™</sup>-MWIR system configuration consists of the following basic components</b>	
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.	
Stainless steel furnace optics, i.e. rugged lens assembly with patented “Wide angle, Bright Image Optical System”.	
Furnace wall-box with auto-shutter, automatic-retract assembly, high performance air filtration system with regulator assembly.	
Smart sensor data acquisition controller with industrial Ethernet-LAN connectivity & dual video output for UXGA color monitors.	



### PyroViper2™-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: (available customized ranges from 100°C)	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.

### PyroViper2™-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”.
Environment: (lens view-port in furnace wall)	Continuous lens operating temperature is up to 1800°C (3272°F) if protected with an additional, open-cycle air cooled wall box shroud made of stainless steel or ceramics. Option: Additional closed-cycle water cooled wall box shroud made of stainless steel.
Lens air purging & cooling:	Instrument-quality air: 34-72Nm <sup>3</sup> /h at 0.1-0.7MPa (20-42scfm at 15-102psi)
Sensor housing air purging & cooling:	Instrument-quality air: 3.4-7.2Nm <sup>3</sup> /h at 0.01-0.07MPa (2.0-4.2scfm at 1.5-10.2psi) Requirement: maximum pressure air temperature 40°C, else vortex cooler recommended
Optional Wall box shroud cooling:	Pre-filtered ambient air: 12-24Nm <sup>3</sup> /h at 0.02-0.1MPa (7-14scfm at 3-15psi). Water cooling option: 5-15 liters per minute at dT≤50°C.

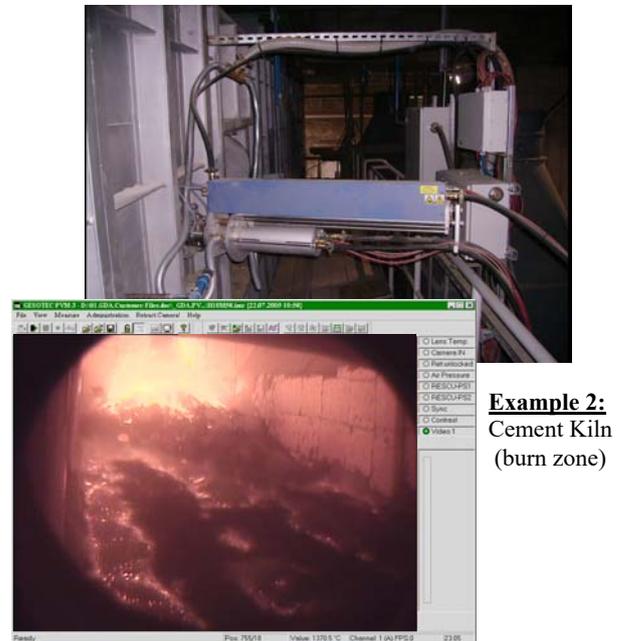
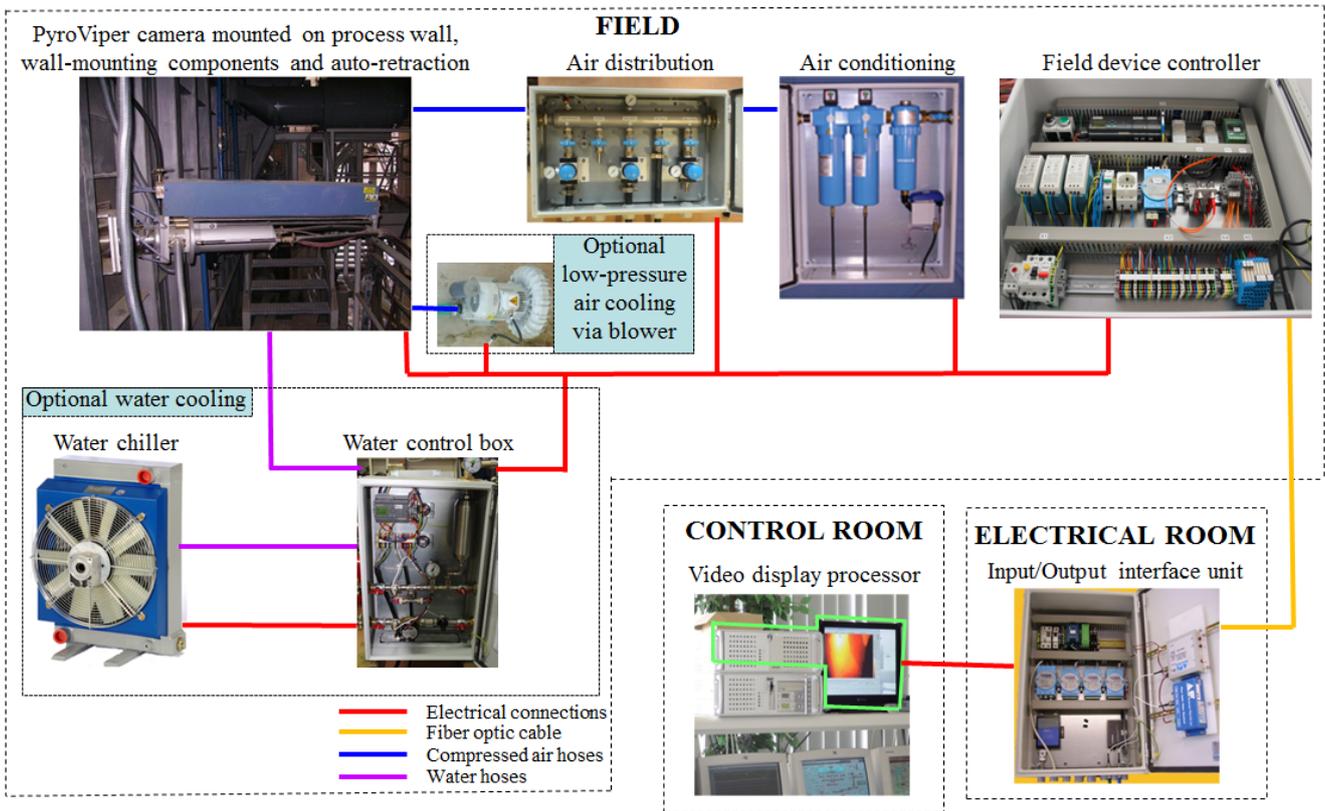
### PyroViper2™-MWIR environmental protective camera housing (sensor module enclosure)

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) or pressure air temperature up to 70°C. Outer furnace wall temperature up to 500°C (932°F) with air cooled wall box shroud.
Environmental protection rating:	IP66 (NEMA 4X).
Wall box mounting interface:	Slide track block or slide track flange.

### PyroViper2™-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.
<b>RE</b> tract- and <b>S</b> ensor <b>C</b> ontrol Unit “ <b>RESC-U2</b> ”: Sensor power supply, automatic retraction control, video & control signal conditioning.
<b>S</b> ignal processor <b>I/O</b> 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).

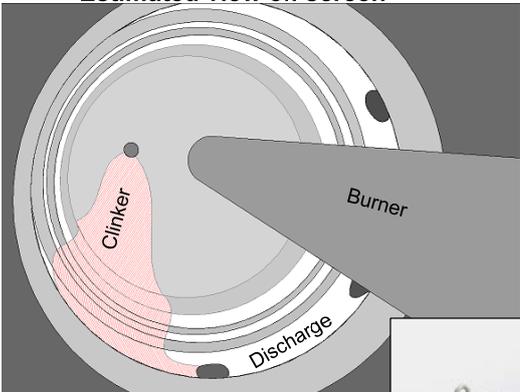
## Schematics of a typical PyroViper Furnace Probe Camera System for Kiln/Cooler Process Monitoring

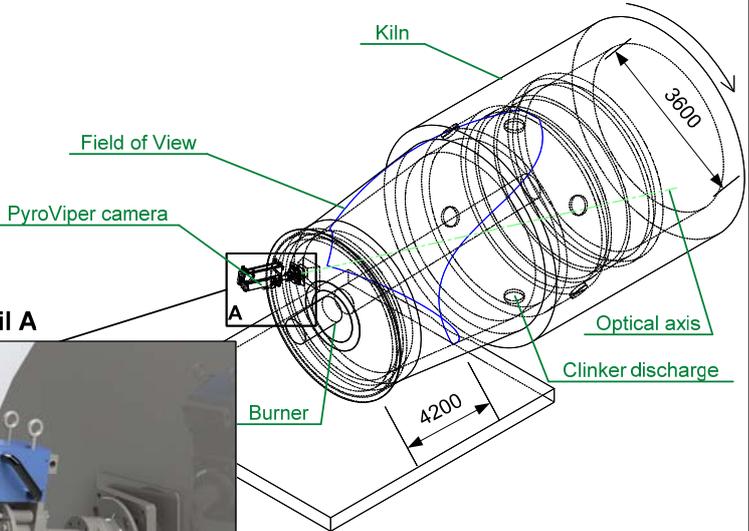


**PyroViper™ application note: cement kiln**

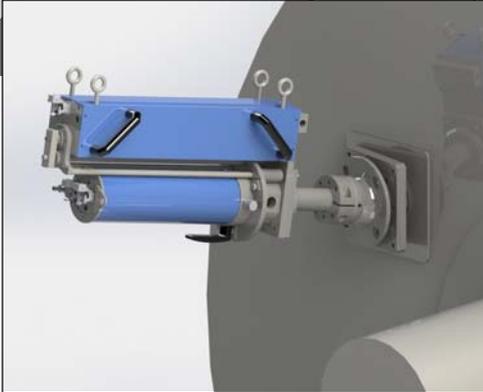
**Project engineering**

**Estimated view on screen**



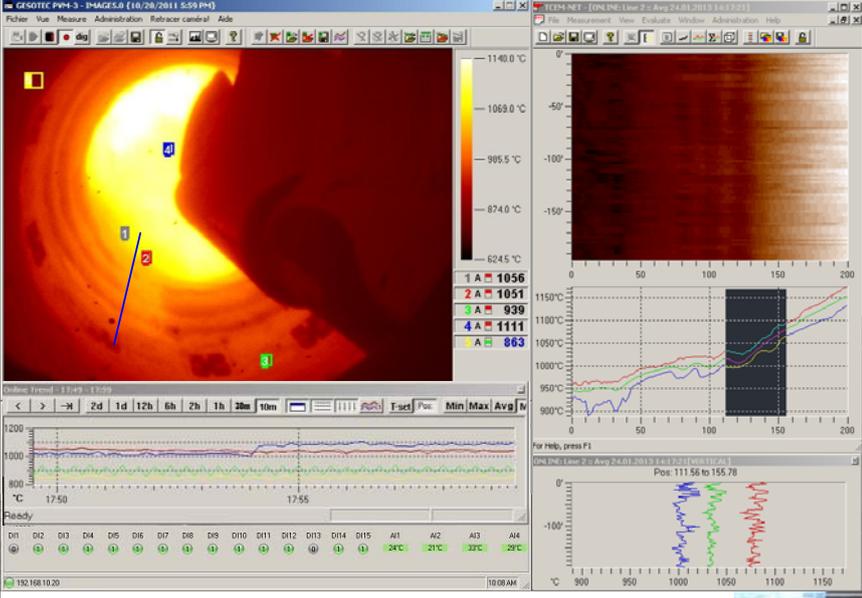


**Detail A**



- 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**



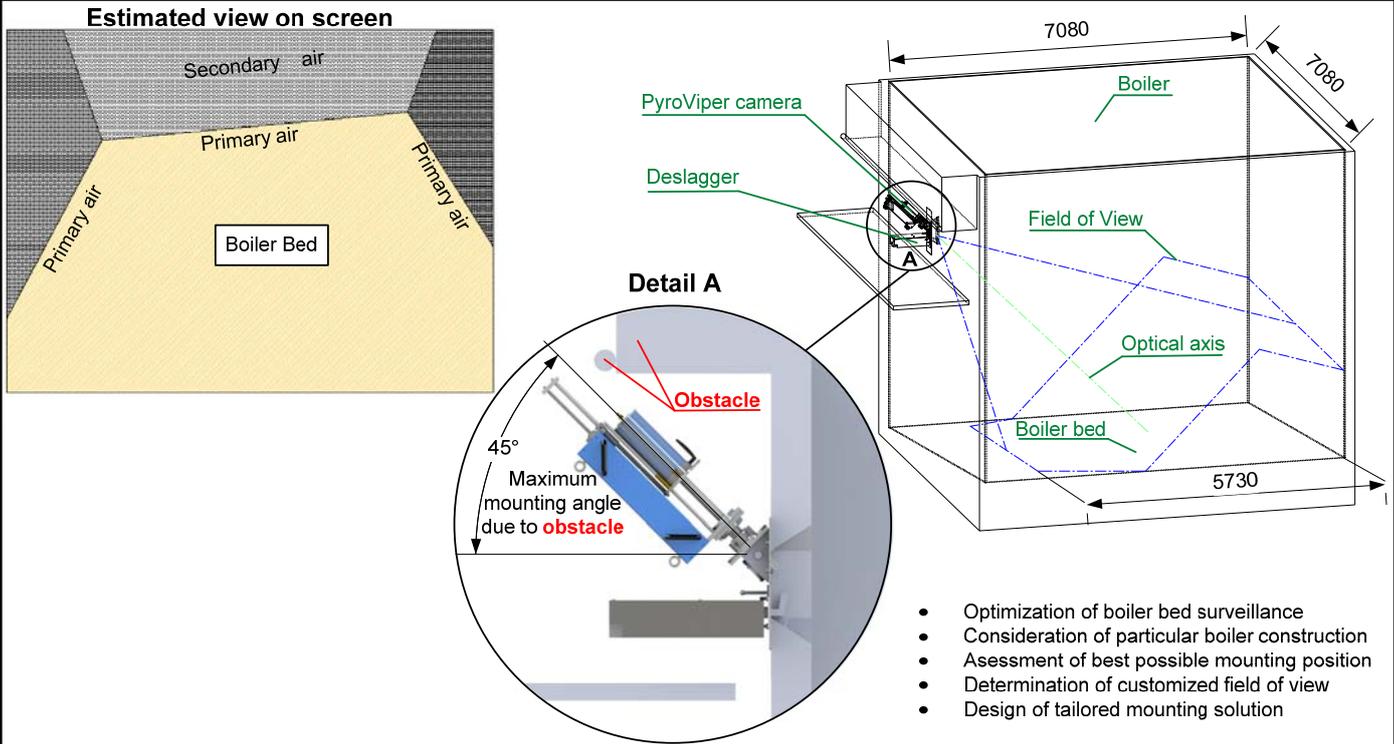
**picture on screen**



**Installation on kiln hood wall**

**PyroViper™-2 application note: Black liquor recovery boiler**

**Project engineering**



**Actual implementation**

**picture on screen**

1	1077
2	1145
3	1084
4	1080
5	1051
6	1017
7	1132
8	998
9	1066
10	1096

**Installation on boiler wall**