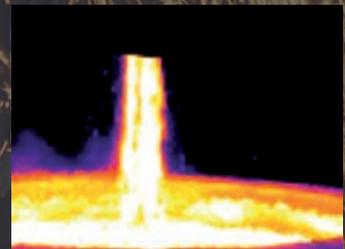
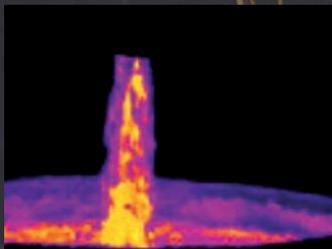
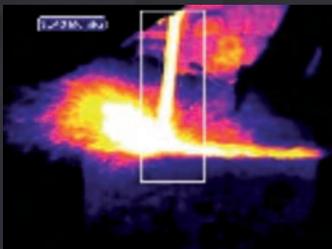


PIEPER



SlagDetection - Slag Carryover Prevention

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commissioning
Industry 4.0
Process M
Systems high temperatu
full HD Cross-

development
ce probes

FOREWORD

ABOUT PIEPER

intelligent vide

Your safety in good hands

50 years of experience, a highly qualified team and a high level of customer satisfaction is what PIEPER GmbH, which has its head office in Schwerte/Germany, stands for. We plan, develop, produce and install complete video, security and image processing systems for industry. Our portfolio also includes support operations and therefore the maintenance, repair and modernization of customized solutions. We are world-renowned for our combustion chamber systems, which monitor processes and furnaces in high-temperature environments at maximum resolution.

Customers value our manufacturer-independent advice, our industry-specific know-how, and our high-quality special solutions for:

- steel industry
- aluminum industry
- glass production
- cement processing
- waste management
- power plants
- petrochemical industry
- passenger and freight transportation

In this regard, our focus lies on combustion chamber video technology for visual process observation in temperature ranges of up to 2,00°C, in video and management systems for mass transportation and airports, as well as in industrial video solutions for production control.

We produce and install systems for digital image processing, communication and data technology, network technology, access control systems, building management solutions, and outdoor area security, plus all the supplementary system components.

Since our company was established in 1968, we have offered our customers futureproof solutions. The fact that we are certified according to DIN ISO 9001 and SCC proves that we offer to quality. We are there for you all over Germany - in Berlin, Cottbus, Düsseldorf and Munich, as well as at our head office in Schwerte. Internationally, we are represented by partnerships and cooperative relationships all over the world.

Hard- and Software

PIEPER has devoted its energies to video technology for half a century. We know the video security and process observation market better than almost any other company. We are therefore on hand to assist you as a reliable partner when it comes to individual recommendations, to which special camera, probe or software is best suited for your system, and to adapting both components and software exactly to your requirements.

We have been working closely with many suppliers for a number of years, including well-known manufacturers such as AG Neovo, aimetis, Automation Technology, AXIS Communication, Barco, BASLER, digivod, IndigoVision, Panasonic and Qognify (formerly SeeTec)

However, we do not supply you with single solutions; what you get from us are complete systems. We help you to select technologies and individually tailor each system to your needs - from planning to commissioning. Our very own R&D department at our head office in Schwerte develops special solutions.



SLAG DETECTION SYSTEM

SYSTEM

Slag Detection System

The Slag Detection System serves as a key solution to improve the steel quality and reduce treatment costs by minimizing the slag carryover during the tapping process.

The system comprises a thermal camera in a protective housing, an application dedicated imaging software for data acquisition, evaluation and system control, a database for the storage of a process-relevant data, a web based user-friendly operator interface and devices for indicating the system status.

How it Works

During the tapping process the camera monitors the pouring stream. Due to the very different radiation properties of liquid metal and slag, the thermal camera can precisely distinguish between these two materials. This allows an accurate calculation of the slag transfer by evaluating the live thermal image in real-time. The acceptable content of slag can be preset in the software. As soon as this threshold is reached an alarm will be triggered to stop the tap. All important data are continuously displayed on the screen in a clearly arranged window. This includes the live thermal image, the slag carryover vs. tap time, the preset alarm threshold for the slag content and the alarm status.

Advanced Data Management

The slag detection system includes a powerful database for automatically storing the thermal images, the measured slag content as a function of the tap time and the process parameters. This allows an extensive subsequent analysis of the tap process. The database may also be connected to the intranet of the plant to enable data exchange with other data processing systems.

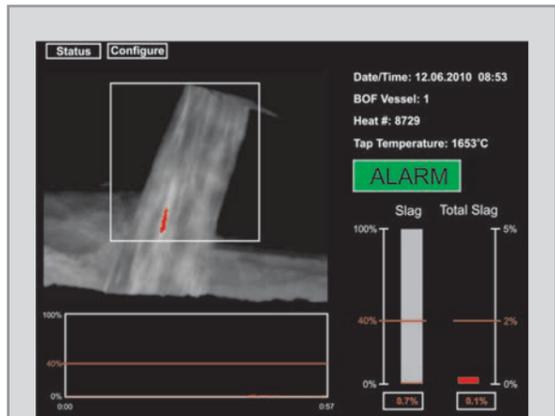
Various interfaces

The system features various interfaces for connecting to your process control, data management and visualization. This comprises ODBC for connecting to a database as well as a data-telegram server for the exchange of process related data via LAN. With its COM/DCOM automation interface the system can be easily connected with a PLC, a process-visualization, or other computers.

Designed for steel plants: Robust and Fail-Safe

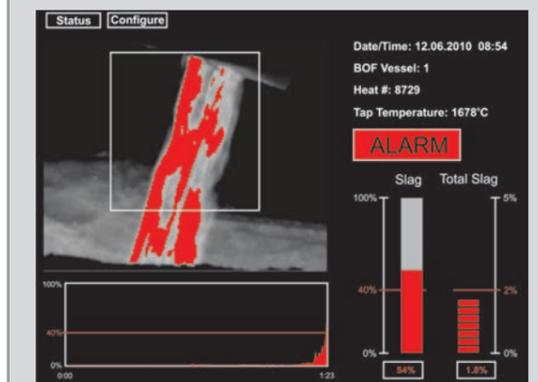
The whole system is designed for reliable 24/7 operation in the harsh environment of a steel plant. Integrated self-diagnostic functions continuously monitor all components. Any possible functional impairment will be immediately detected and indicated. With its intelligent reconfiguration-functions the system is able to eliminate most malfunctions without any user interaction.

To ensure a reliable operation, the thermal camera is protected by a robust enclosure. The housing is cooled by water, while the protective window at the front of the enclosure is held free of contamination by using an air barrier.



Display of Tap Information

Very low slag content in the pouring stream (highlighted in red)



Display of Tap Information

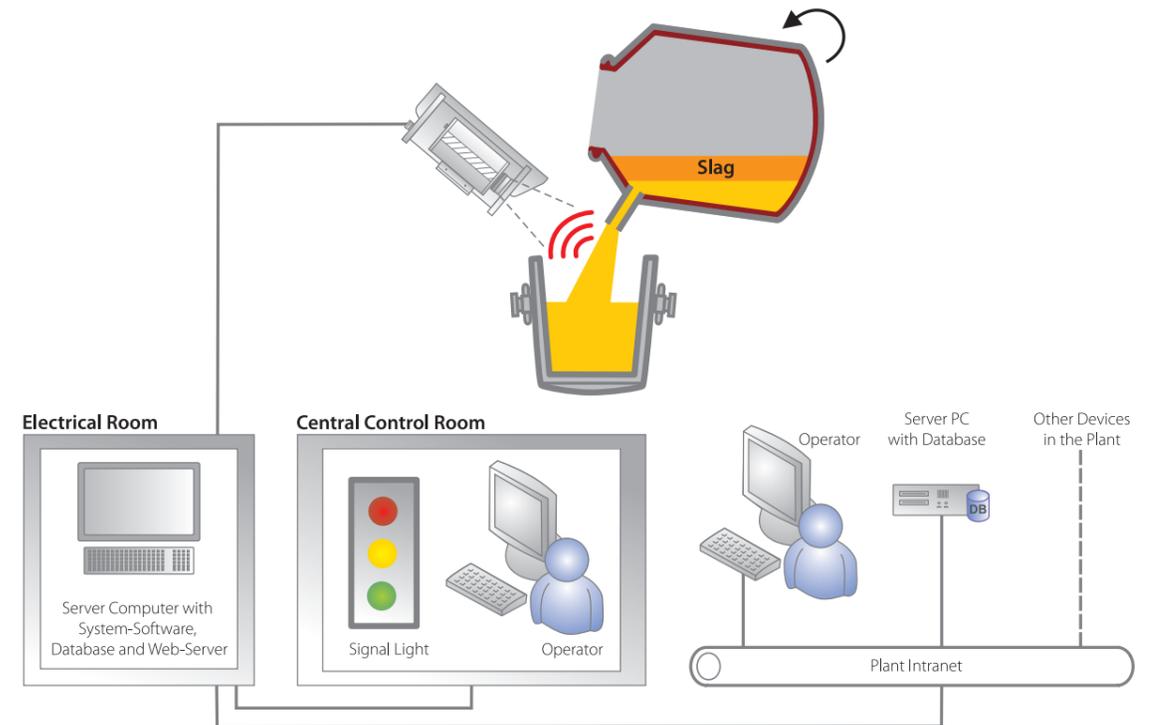
Slag content in the pouring stream exceeds the alarm threshold. Alarm is triggered to stop the tap.



Thermal process control

The infrared camera enables a clear distinction between liquid metal and slag. To ensure a reliable operation, the monitoring station comes with water-cooled protective housing.

SLAG DETECTION SYSTEM SETUP



Configuration of a Typical Slag Monitoring System

- Thermal camera in protective housing for monitoring of the tapping processes
- Server computer with software for real-time processing of thermal images, data management and display of tap data
- Indicating device for alarm status, e.g. signal light

Key Advantages

- Improved steel quality
- Higher production yield
- Reduced treatment costs
- Reduced processing time

Key Features

- Fully automated measurement sequence
- 100% Traceability: Automatic storage of images, measured slag transfer and tap related data
- Advanced data management and tap analysis with database and web-server
- Various interfaces for connecting to your process control, data management and visualization
- Robust and fail-safe design for continuous operation in steel plants



SLAG DETECTION

TECHNICAL DATA

Thermal Cameras

Maintenance-free thermal cameras with uncooled detector. The camera is consistently designed for industrial applications, featuring intelligent processing functions and a Standard-GigE-Interface for data exchange. It is calibrated with an extended measurement range of up to 2000°C for measuring absolute temperatures with high accuracy.

Type	IRSX-I Industrial Infrared Camera
Temp. Measuring Range	+600°C to +2000°C
Field of View	6.2° x 5° other lenses avbl. on request
Frame Rate	50 Hz
Interface	Gigabit Ethernet
Ambient Temperature Range	-40°C to +60°C
Weight	930 g (incl. 6.2° x 5° lens)
Dimensions	55 x 55 x 150 mm (incl. 6.2° x 5° lens)
Protection Class	IP67

Camera Housing

Double-chamber protective housing, manufactured from stainless steel. An air barrier installed at the front side effectively prevents dust formations at the durable Germanium window. All connection cables are guided through one cable gland with a high-temperature-resistant hose at the rear of the housing. Equipped with a wall mount with manually adjustable joint, the housing can be easily installed in any required position.

Type	IRCamSafe AIW 168
Housing Material	Stainless Steel
Coolant	Air or Water
Protective Window	Ø 70 x 3mm
Air Barrier	Adjustable air flow, supply pressure 1-3 bar
Cable Protection	Heat resistant hose, configurable length. Resistant to thermal load: up to +1.640°C
Ambient Temp. Range	0°C to +350°C
Weight	10,5kg
Dimensions	Ø 168 x 505mm
Protection Class	IP67
Mounting Bracket	Heavy duty bracket with joint, made from stainless steel. Load rating 45kg

Other components

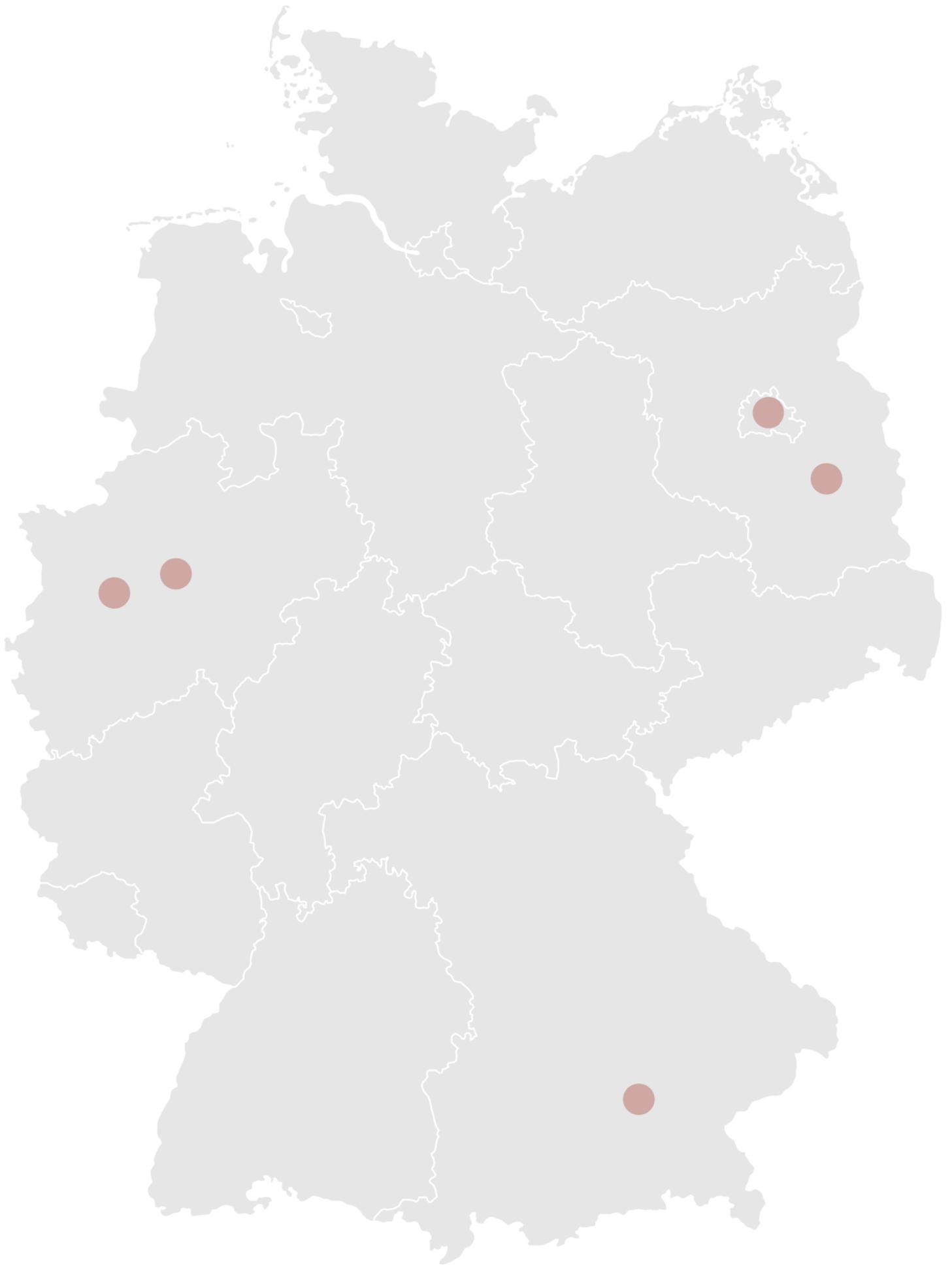
Server Computer	Industry standard server computer, 19" metal case for rack installation. The server computer hosts the infrared monitoring software, the database and the web-server
IRCamSafe Controller	Integrated inside the camera housing. The board gives a significantly reduced installation effort, allowing a direct connection to mains power and Ethernet without any additional connection cabinet. It features various sensors to continuously monitor the ambient conditions in the enclosure, thus ensuring a safe operation of the camera. <ul style="list-style-type: none"> • 4 Port Switch with 2 x LWL-LC 100Base-FX or 2 x RJ45 (10/100) Up-Links • 2 internal sensors for temperature; sensors for pressure and humidity • Supports a ring structure of the network for lower cabling complexity • Switchable camera power and heater via Modbus-TCP/IP (controlled by the monitoring software)

Interfaces

Web-Server	Ethernet Link
ODBC	OPC
Modbus-TCP	SQL data base
Digital I/O, 24V Input/Output, Galvanic-isolated (Fieldbus Module)	

Data Link of Cameras and Computer

Gigabit Ethernet
Up to 90m with Industrial Ethernet Cable
Up to 500m with Multi-Mode Glass Fiber Cable
Up to several km with Single Mode Glass Fiber Cable



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