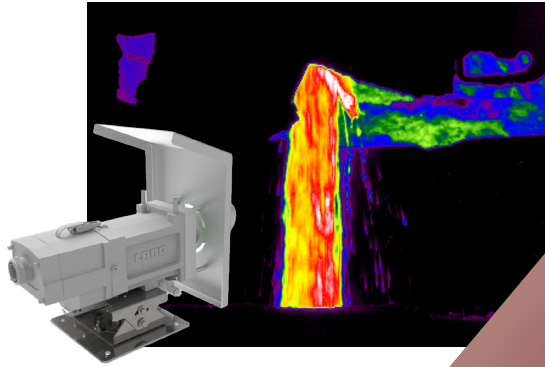# *SDS* V2

ADVANCED THERMAL IMAGING BASED SLAG DETECTION SYSTEM

500 to 1800 °C / 932 to 3272 °F

LAND
AMETEK®

QUALITY CUSTOMER SOLUTIONS

SDS V2

ADVANCED THERMAL IMAGING BASED SLAG DETECTION SYSTEM

RELIABLE SOLUTIONS FOR MORE THAN 75 YEARS.

EXPERTS IN TEMPERATURE MEASUREMENT, AMETEK LAND HAS SUPPORTED THE GLOBAL INDUSTRIAL COMMUNITY FOR MORE THAN 75 YEARS, SUPPLYING INNOVATIVE, RELIABLE PRODUCTS AND SOLUTIONS. WE HAVE A WORLDWIDE REPUTATION AS INNOVATORS AND MANUFACTURERS OF HIGH-QUALITY, PRECISION THERMOMETERS AND THERMAL IMAGERS.

The AMETEK Land Slag Detection System (SDS V2) delivers improved yields, higher-quality steel and reduces costly downstream processing. There are additional benefits in reduced ladle refractory wear.

At the end of the tap the levels of slag and steel rapidly reverse. Quick termination of the tap after the alarm has been triggered is necessary to prevent excessive levels of slag in the ladle. SDS uses a high-resolution thermal imaging camera to detect the transition between steel and slag. The dedicated thermal imaging camera has been specifically designed to survive in the harsh operating conditions and utilizes a particular wavelength to reduce obscuration caused by smoke and fume. Data is presented to the operator in real time enabling them to make informed decisions about the tapping process and the system provides clear alarm notifications.

SUITABLE FOR A VARIETY OF APPLICATIONS

SDS is suitable for operators of secondary steel making vessels (e.g. EAF, BOF) including stainless steel and can also be used in other smelting operations Eg copper and platinum. **By using additional region of interests (ROI) together with a secondary thermal imaging camera integrated into the system, optional features such as stream position or freeboard height can also be integrated providing advanced process monitoring and control.**

GREEN STEEL - DECARBONISATION

Supporting the decarbonisation SDS process in steel production by continuous process control and optimization, energy savings and emission reduction.

THE ROAD TO CO_2 INDUSTRIAL DECARBONIZATION

IMPROVED PRODUCT QUALITY

Using the SDS has been demonstrated to improve operator response time and consistency at the end of each tap. This typically results in a reduction in slag depths of up to 25% compared to traditional methods of stream monitoring.

REDUCED DOWNSTREAM PROCESSING COSTS

The cost of additional downstream processing time and materials can be a significant burden on an operating plant. By controlling slag carry-over this costly downstream processing can be reduced or eliminated, improving plant throughput, product quality and operating margins.

AUTOMATIC OPERATION

As the tap commences, the application dedicated software records a data log and produces a live graph for quality control. A stream tracking mechanism is included to ensure reliable operation in typical installation conditions. When slag appears, and exceeds an operator defined amount, an alarm is automatically triggered. The system is designed to ensure accurate, real-time detection of steel/slag independent of charge weight and without operator intervention.

KEY FEATURES AND BENEFITS ▼

- Steel temperature measurement and monitoring
- Improved production yields
- Lower slag content improves steel quality
- Lower maintenance on BOF / EAF vessel
- Reduced energy costs and emissions
- Automatic stream identification and tracking accurately identifies the stream and reduces background interference
- Secondary imager for stream position and freeboard level monitoring and control

- Clear alarm notification sent to the operator
- Alarms generated by the system directly stop the tap before the slag is carried over
- Fully automatic operation
- Accurate detection independent of charge weight
- Reliable alarm independent of the operator
- Improved connectivity through the use of Open Data Interface
- Powerful IMAGEPro V2-SDS thermal imaging process monitoring and control software, including the full range of functions from a single source.

FIELD OF VIEW

| Distance	4m			5m			7.5m			10m			15m		
	Width	Height	IFOV	Width	Height	IFOV	Width	Height	IFOV	Width	Height	IFOV	Width	Height	IFOV
12° x 9°	0.8 m	0.6 m	1.3 mm	1.1 m	0.8 m	1.6 mm	1.6 m	1.2 m	2.5 mm	2.1 m	1.6 m	3.3 mm	3.2 m	2.4 m	4.9 mm
25° x 19°	1.8 m	1.3 m	2.7 mm	2.2 m	1.7 m	3.4 mm	3.3 m	2.5 m	5.1 mm	4.4 m	3.3 m	6.8 mm	6.7 m	5.0 m	10.2 mm

THE CRITICAL ADVANTAGE ▼

VISIBLE VIEW
Not possible to detect the tapping stream
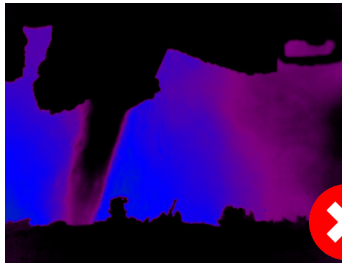
LWIR IMAGER
Not suitable as smoke, particles and hot gasses are present
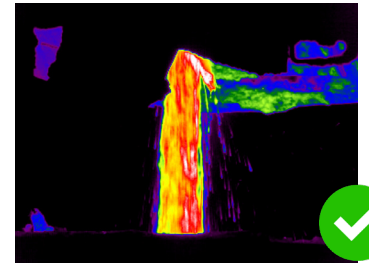
MWIR IMAGER
Best solution, providing the clearest view of the stream

GREEN STEEL PRODUCTION ▼

Slag detection in green steel production is a critical process aimed at identifying and monitoring the presence of slag during its initial stages of production.

Slag is undesirable as it can negatively affect steel quality and lead to costly production issues. Various sensors and monitoring systems are employed to detect and analyze the composition and amount of slag in the steel melt. This information helps steelmakers take timely corrective actions to ensure the production of high-quality steel with minimal waste, contributing to more sustainable and efficient steel manufacturing processes.

Green steel is crucial to decarbonization efforts because it offers a pathway to significantly reduce carbon emissions in the steel industry, conserve resources, improve energy efficiency, stimulate innovation and economic growth, and meet the growing demand for environmentally sustainable products in a carbon-constrained world.
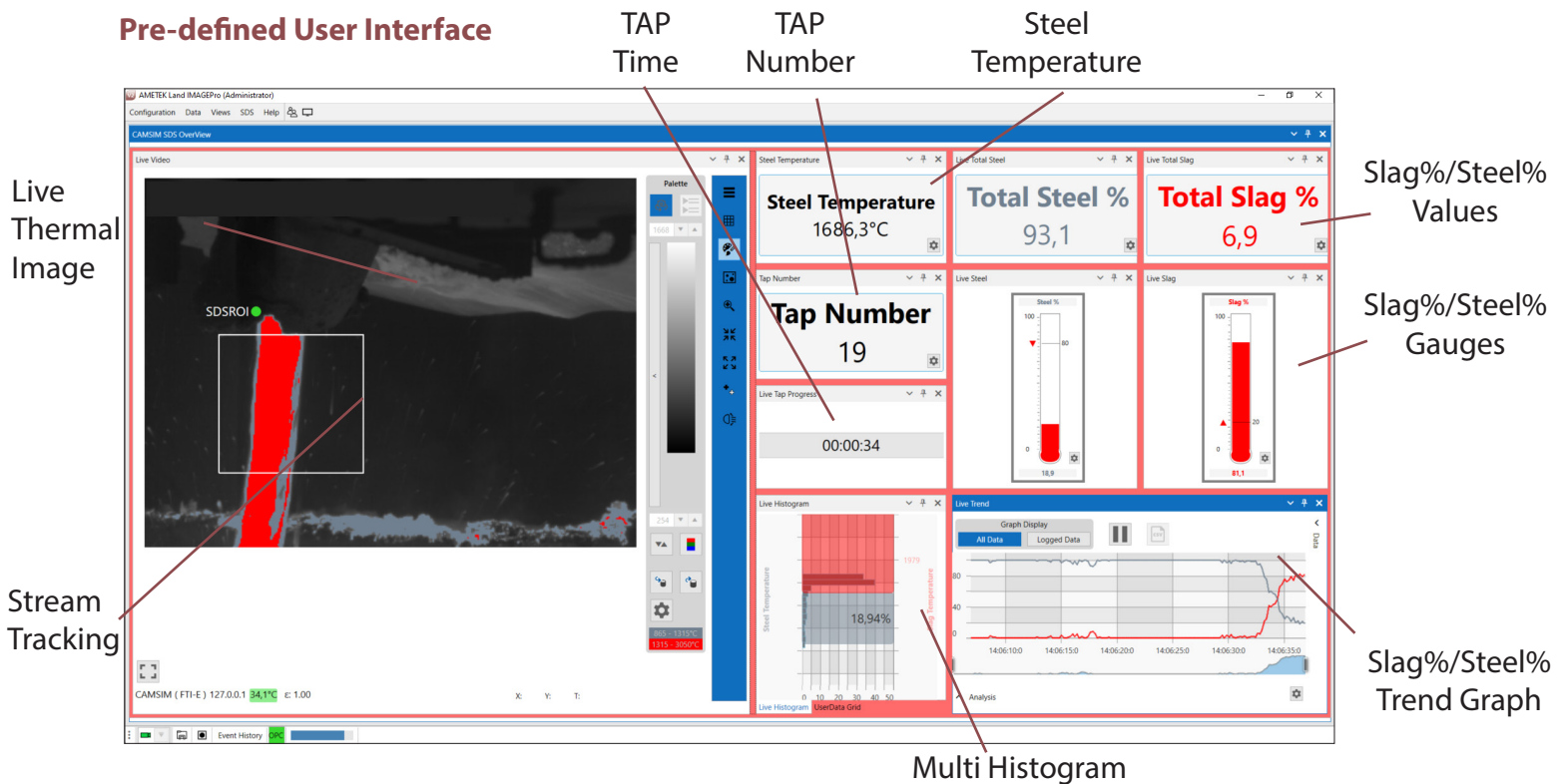
CO_2

LAND AMETEK
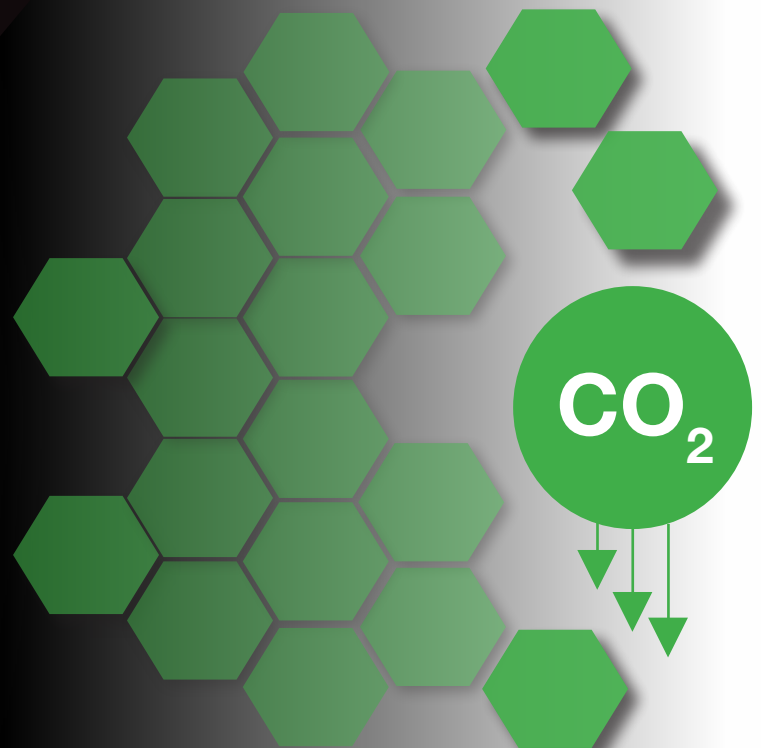
IMAGEPro - SDS V2 APPLICATION SOFTWARE

Pre-defined User Interface

TAP Time   TAP Number   Steel Temperature

Live Thermal Image

Stream Tracking

Slag%/Steel% Values

Slag%/Steel% Gauges

Slag%/Steel% Trend Graph

Multi Histogram

TAP TIME
Monitors and counts the actual and final tapping time.

TAP NUMBER
Current tap number is automatically incremented or based on a in/out tag.

STEEL TEMPERATURE
Monitors the actual steel temperatures, based on emissivity settings.

SLAG%/STEEL% VALUES
Cumulative slag and steel percentages over the whole tapping process.

SLAG%/STEEL% GAUGES
Actual steel and slag %.

SLAG%/STEEL% TREND GRAPH
Time trend graph of the actual steel and slag levels.

MULTI HISTOGRAM
Clearly monitors the ongoing change and levels of steel and slag contents.

STREAM TRACKING
Automatic and intelligent stream tracking by continuously following the actual tapping stream.

LIVE THERMAL IMAGE
Live image of the MWIR-640 SDS thermal imager.

The Second Generation Slag Detection System represents a further development of AMETEK Land's market-leading solution for monitoring and reducing slag carryover in steel facilities.

This system is proven to reduce slag carryover, save money, improve operator safety, and contribute to the reduction of energy consumption and emissions in the process of decarbonizing steel production, based on hundreds of reliably operating field installations.

HOW SLAG CARRYOVER IS PREVENTED
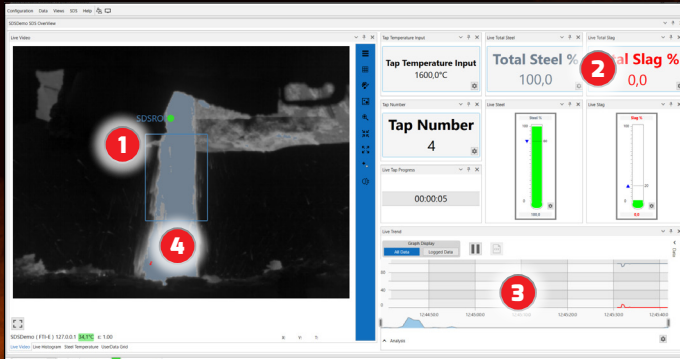
START OF THE TAPPING PROCESS

1. The automatic or input based tap detection starts the slag detection process and tracks the tapping stream during the whole tapping process.
2. Slag and steel percentages are monitored continuously as cumulative and instantaneous values.
3. Graphs and gauges clearly monitor the detected steel/slag levels.
4. The live thermal image continuously provides a process view.
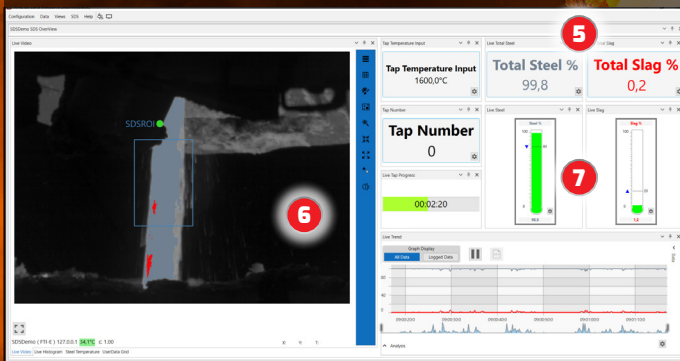
DURING THE TAPPING PROCESS

5. During the whole tapping process the steel and slag levels are accurately measured and monitored, while compared with pre-defined threshold levels.
6. The ongoing tapping process is clearly monitored to the operator.
7. The cumulative level values show the actual tapping process status together with customer defined values, such as tap numbers and further data.
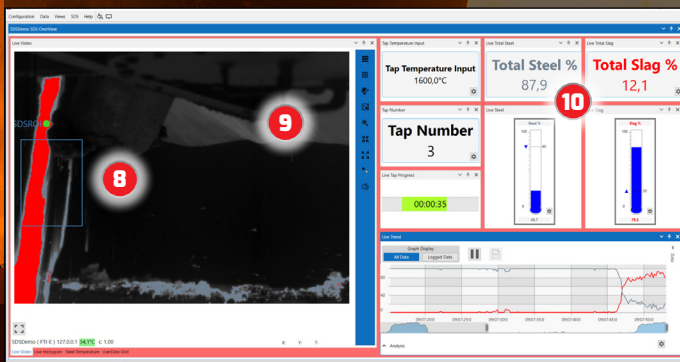
CLEARLY MONITORED ALARM STATUS

8. In case any threshold levels are exceeded, the software surface turns to red and clearly monitors an alarm stage.
9. With the digital and analog I/O interfacing the tapping control system stops the tapping process safely.
10. The alarm status is continuously captured.
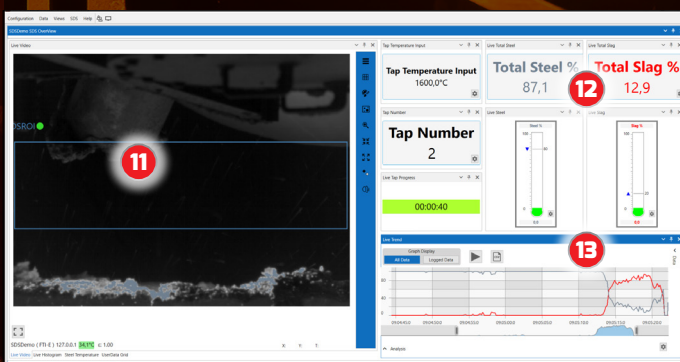
END OF TAPPING PROCESS

11. The system automatically detects the end of the tapping process or uses an external input.
12. With the detected end of a tapping process the tapping time and overall slag and steel levels are monitored and captured.
13. Interfacing options continuously provide these data points to the control system.

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SPECIFICATION & DESIGN

POWERFUL DETECTION SYSTEM PREVENTS SLAG CARRY-OVER

This comprehensive, fully featured system has been developed to provide steel plant engineers and managers with the tools to develop and improve the transfer of steel from one process to another.

SDS offers the steel plant a number of connection methods for on-line control and, more importantly, it automatically records the tap data in three forms for post analysis and future process improvement.

In addition to this, the process imaging workstation comes with software pre-installed and configured to work straight out of the box with minimum set-up required. Once the system hardware is installed in the steel plant, as soon as the system is turned on, the steel plant can immediately begin to reduce slag carryover.

OBSERVE CRITICAL TAP INFORMATION

Pre-installed on the powerful image processing workstation, the display allows users to observe critical tap information such as the live thermal image, steel and slag percentages, time versus percentage graph, alarm level and alarm status.

Secondary information such as tap number, sensor temperature, communications status, tap duration, steel / slag ratio and record status are less prominent so as to not distract the user during the tap. External inputs from the plant can be also be easily monitored and recorded with the SDS data.

VIEW THE TAP INFORMATION THROUGHOUT THE PLANT

Multiple users can remotely view the live tap anywhere on the plant network by using the remote viewer option in IMAGEPro V2-SDS.

At the end of the tap the video, text data and graph are saved by tap number for later analysis and, if needed, be automatically deleted after a user defined number of days.

Data can be transmitted between the plant and the slag detection system via hardware I/O modules or EtherNet (Modbus TCP/IP) or OPC UA, all of which are controlled by the Open Data Interface.

FREEBOARD LEVEL AND STREAM POSITION MONITORING

Using multiple imagers in the system, based on full IMAGEPro functionality and process control options.

STRAIGHTFORWARD FIBRE-OPTIC CONNECTIVITY

Connecting the image processing system to the plant network via multiple interfacing, unsing ethernet interface protocols such as Modbus, TCP/IP or OPC UA, apart from free configureable I/O modules, configured in the Open Data Interface allows live data transfer to and from the slag detection system to improve the steel transfer process.

Data that can be input to the SDS includes tap number, alarm level and five unique variables specified by the steel plant such as charge-number, heat-number, steel grade and tap temperature. When used, these data are recorded in the saved text data file.

Data output from the system can be transmitted at high speed up up to 60 fps - based on the new advanced MWIR-640 SDS thermal imager. This information includes steel slag percentage, alarm status, sensor temperature and communications status.

The SDS Power Supply Unit (PSU) is supplied with the option of fibre-optic or 1 GB copper Ethernet connectivity for easy installation and integration into existing plant systems, based on typical used fiber types
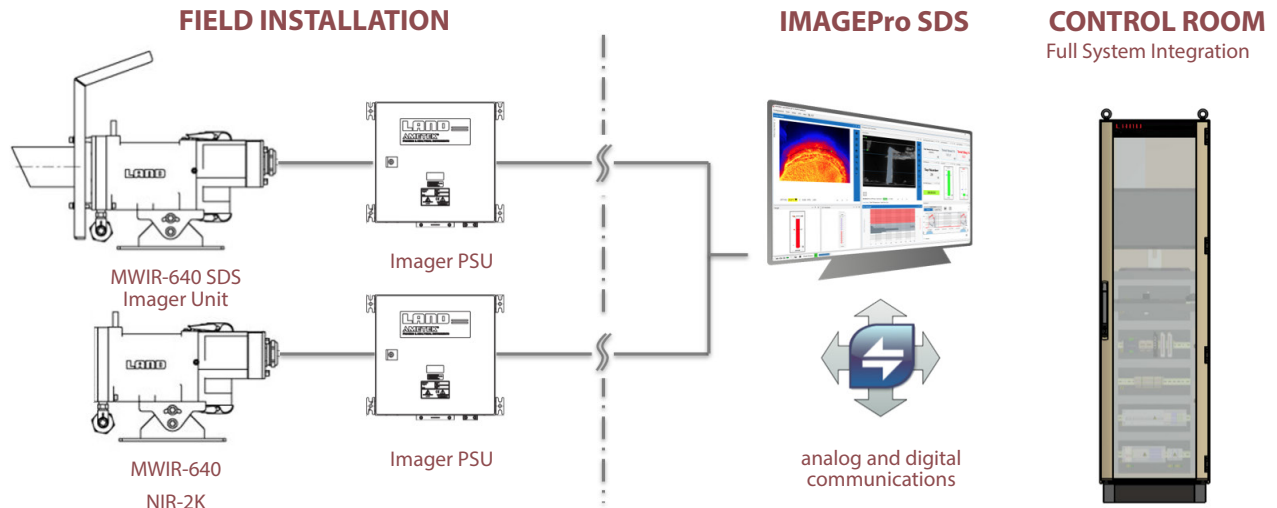
AUTOMATIC STREAM TRACKING

Another key feature of the SDS is automatic and intelligent stream tracking. The dedicated slag detection image processing software has the option to track the width and position of the stream regardless of the position of the sensor unit.

When viewing the stream from an acute angle, its position will change during the different phases of the tap - the software accurately tracks any movement that may occur as the pour takes place, only measuring from the area identified as the stream. This reduces any errors caused by background heat sources in the field of view.
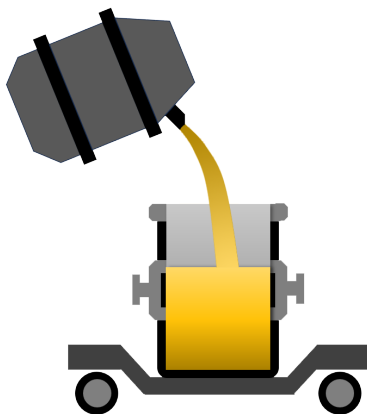
SYSTEM OVERVIEW

FIELD INSTALLATION

MWIR-640 SDS
Imager Unit

Imager PSU

MWIR-640

NIR-2K

Imager PSU

IMAGEPro SDS

analog and digital
communications

CONTROL ROOM
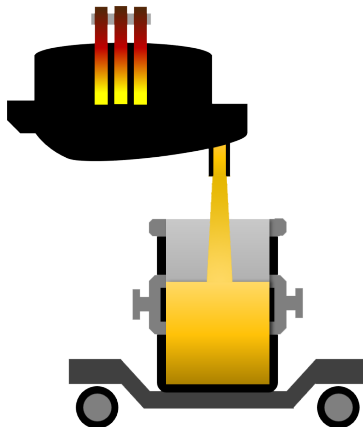Full System Integration

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TYPICAL TAPPING PROCESSES ▼
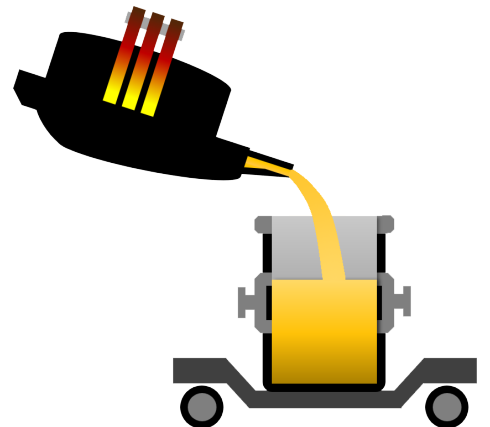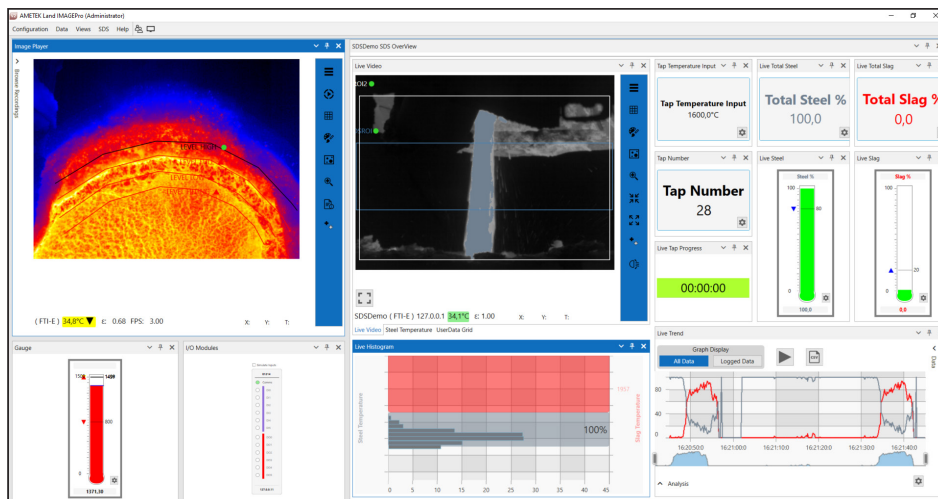
BOF TAPPING

EAF TAPPING 1

EAF TAPPING 2

MULTI CAMERA OPTION ▼

IMAGEPro V2-SDS is an integrated application within the advanced IMAGEPro thermal imaging software package. With the optional multi-camera license, users can seamlessly integrate additional imagers into the system and software, enabling them to operate independently from the camera and continuous slag detection system.

For instance, you can incorporate extra MWIR-640 and NIR-656/-2K industrial imagers to capture real-time freeboard levels on-site. This comprehensive approach allows for simultaneous recording, visualisation, and control of both processes within a centralized application

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LAND AMETEK®

SDS
SLAG DETECTION SYSTEM

SPECIFICATIONS

MWIR-640-SDS CAMERA UNIT

Measurement Range:	500 to 1800 °C / 932 to 3272 °F
Pixel Resolution:	640 x 480 pixels
Pixel Size / Pitch:	17 µm
Spectral Response:	3.9 µm
Max Frame Rate:	60 fps / 7.5 fps
Optic (HFOV x VFOV):	12° x 9° / 25° x 19°
Focus Range:	Min 0.75 m to infinity (motorised focus) – (12°) Min 0.5 m to infinity (motorised focus) - (25°)
Accuracy:	1% of reading or 2 °C
Noise:	0.5 °C RMS (@500 °C 12°)
Dimensions:	Approx. 450 mm/17.7 " x 373 mm/14.7 " x 215 mm/8.5 " (Full imager enclsoure)
Power Rating:	12 to 24 V DC +/-10% 12 W / IEEE 802.3 at PoE+
Weight:	10 kg / 22.05 lbs.
Environmental Rating:	IP66 / NEMA 4
Compliance:	EMC (EN 61326-1)

SDS CAMERA SUPPLY

Connection:	Local connection interface between camera unit and image processing system
Services:	Water, instrument air, power input, located to the rear of the enclosure

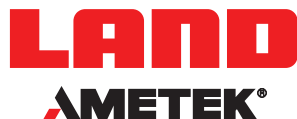### THERMAL IMAGER POWER SUPPLY

Components & Connections:	Power supply, Ethernet communications (switch) Fibre optic data connection (option)
IP Rating:	IP65 / NEMA 4
Size:	380 x 380 x 211 mm / 15 x 15 x 8.3 in.
Weight:	15kg / 33 lbs.

IMAGE PROCESSING UNIT

Slag/Steel Detection:	Alarm activation when a pre-set percentage of either slag or steel/metal detected within defined window
User Display:	Front page information display and location identifier. External data displayed via interface input.
Automatic Functions:	Auto tap detection, stream tracking, steel/slag ratio, thermal video and video file recording, log file of all data including tap number, clear display of steel/slag percentage (bars, numbers and graphs), alarm colours, etc.)
Software:	IMAGEPro V2-SDS - Advanced Image Processing and Application Software
Interfacing:	Open Data Interface, Modbus TCP/IP, Moxa I/O unit

DISCOVER HOW OUR BROAD RANGE OF NON-CONTACT TEMPERATURE MEASUREMENT AND COMBUSTION & EMISSIONS PRODUCTS OFFER A SOLUTION FOR YOUR PROCESS

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