Closed-loop laser power control system for Cladding and Laser Metal Deposition processes

Continuous monitoring and measurement of the melt pool geometry

ENSURES QUALITY AND REPEATIBILITY

COMPATIBLE WITH MOST OF LASER HEADS AND POWDERS

EASY MECHANICAL INTEGRATION

QUICK CONFIGURATION

System operation

**Continuous melt pool measurement**
- Accurate closed-loop control of the laser power
- Alarm indicator

Configuration S/W friendly user interface
- Easy process setup
- Advanced configuration
- Circular & rectangular ROIs

Process compatibility
- LMD, cladding
- Continuous, single tracks
- Manual (constant power), automatic control & melt pool size monitoring

S/W Indicators
- Melt pool width
- Laser power
- Infrared image
- Laser status

Mechanical integration

- On-axis optical system monitoring melt pool geometry
- Laser head optical path needs IR transmission (>1.1 um)
- Compact system – Embedded IR camera, processor and control
- Integration in the laser head using an existing optical port

System components and dimensions

Infrared camera with processing electronics: 88 x 60 x 92

Connection box: 124.5 x 102 x 28
All dimensions in mm

- Water block with inlet / outlet connectors
- Multi I/O connector
- GigE connector
- C-mount thread
- Lens with locking counterthread
- Multi I/O connector
- Water block with inlet / outlet connectors

NEW INFRARED TECHNOLOGIES

CLAMIR Laser power control system for Cladding and LMD processes www.clamir.com
Operation of CLAMIR with LMD processes

Continuous control of the laser

- Avoids overheating of the part under process and allows a continuous and high quality manufacturing process

Use of CLAMIR

- Reduces rates of defective parts, material reduction cost up to 60% and saves 50% more energy than uncontrolled processes

Laser power is closed-loop controlled in REAL-TIME using the infrared image of the melt pool

- Constant laser power causes overheating and lack of adherence to the base material

Operation of CLAMIR with Cladding processes

Reduces damage to the base material due to excess of laser power application (average reduction of dilution: >40%)

- Allows continuous processing of large cladding lengths
**Specifications**

| **Components** | Infrared camera with real-time processing electronics and waterblock  
Connection box, multi I/O cable (3 m), power supply (24 VDC)  
Software package for system configuration, datalogging and log files analysis  
Infrared emitter for optical calibration |
| **Process compatibility** | LMD process (Laser Metal Deposition)  
Cladding |
| **Optical compatibility** | Transmission of infrared signal (above 1.1 um) from the process area to the optical port is required* |
| **Material compatibility** | Steel powder, Stainless steel powder, Stellite powder, Inconel, others |
| **Laser power control** | Analog signal output for laser power control, 0 VDC - 10 VDC |
| **Dimensions (mm)** | Infrared camera: 88 mm x 60 mm x 92 mm  
Connection box: 124.5 mm x 102 mm x 28 mm |
| **Weight** | 0.5 kg |
| **Power supply** | 24 VDC, 6 W  
Power supply included |
| **Imaging lens** | CaF2, f=50mm with manual focus mechanism  
(other focal lengths available) |
| **Mechanical enclosure (camera)** | IP67 rated mechanical enclosure with embedded heatsink  
Embedded waterblock for air /water cooling |
| **Mechanical interface to laser optics** | C-mount thread with counterthread for tight adjustment |
| **Field of view** | Dependent on the optical system installed in the laser head and diameter of the nozzle |
| **Infrared camera** | VPD PbSe camera, 64x64 pixels (pixel size: 50 microns)  
MWIR response (1 -5 um), frame rate 1000 images per second |
| **Communication interface** | Gigabit Ethernet (RJ-45) |
| **Software** | CLAMIR Acquisition and Configuration SW v.2.0  
NIT Visualization SW v.2.1 |
| **Minimum requirements** | PC with processor i5, RAM memory: 8 GB  
Hard disk available: 1 GB, 0.5.: Windows 10 or later (32/64 bits) |
| **Process control** | Selectable modes: Automatic, Manual |
| **Process configuration** | Selectable process configuration: Tracks, Continuous  
Initial laser power, track length (Tracks mode)  
Laser ON delay & autodetection  
Feedback control parameters |
| **Indicators** | Melt pool width, Laser power, Infrared image, Laser status |
| **Other features** | Laser ON/OFF digital input (optocoupled)  
Monitoring alarm digital output (optocoupled)  
Process data logging, Circular & rectangular Region-Of-Interest (ROI) |

*The performance of the system may be limited if additional optical components are installed in the optical path.*