

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

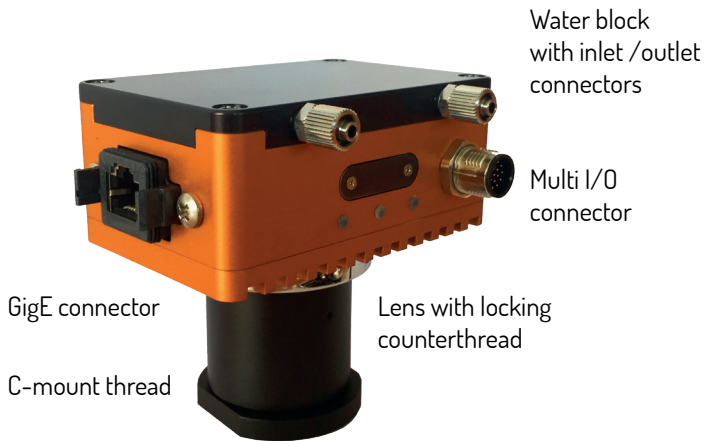
EASY MECHANICAL INTEGRATION

QUICK CONFIGURATION

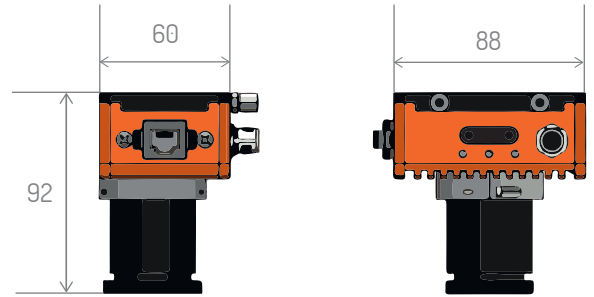


Winner of the Innovation Radar Prize 2018,
category 'Industrial & Enabling Tech',
awarded by the European Commission

System components and dimensions



Infrared camera with processing electronics: 88 x 60 x 92

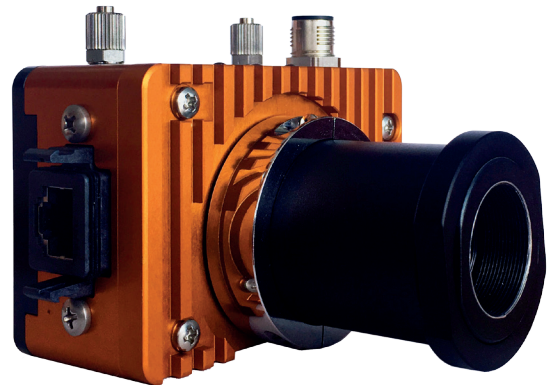


Connection box: 124.5 x 102 x 28

All dimensions in mm

Mechanical integration

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



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

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

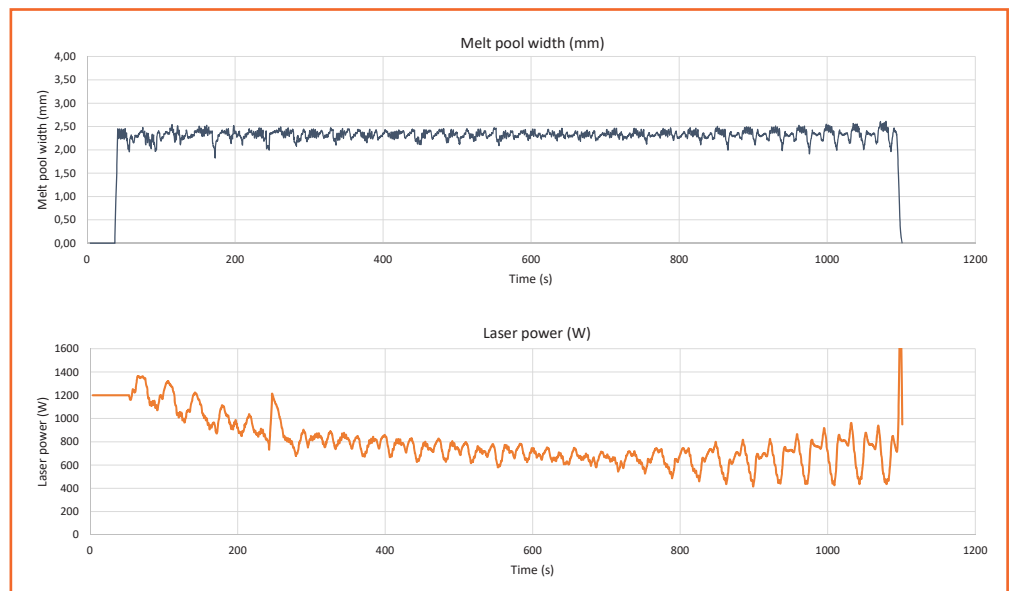
reduces rates of defective parts, material reduction cost up to 60% and saves 50% more energy than uncontrolled processes



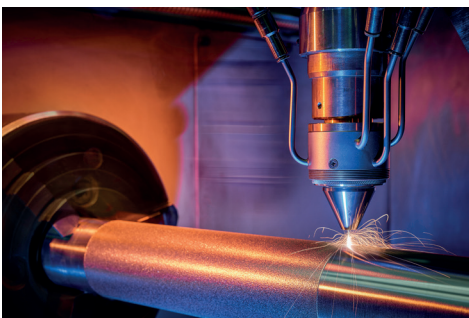
Laser power is closed-loop controlled in REAL-TIME using the infrared image of the melt pool

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

Cuboid structure | CLAMIR laser power control ENABLED



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 μm) 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	Optics configurable according to customer's optical configuration
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 Resolution per pixel	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 μm), frame rate 1000 images per second
Communication interface	Gigabit Ethernet (RJ-45)
Software	CLAMIR Acquisition and Configuration SW v.2.2 CLAMIR DLL v.1.1 NIT Visualization SW v.2.2
Minimum requirements	PC with processor i5, RAM memory: 8 GB Hard disk available: 1 GB, O.S.: 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.