2 Tech Drive, Suite 201
Andover MA 01810
www.mksinst.com

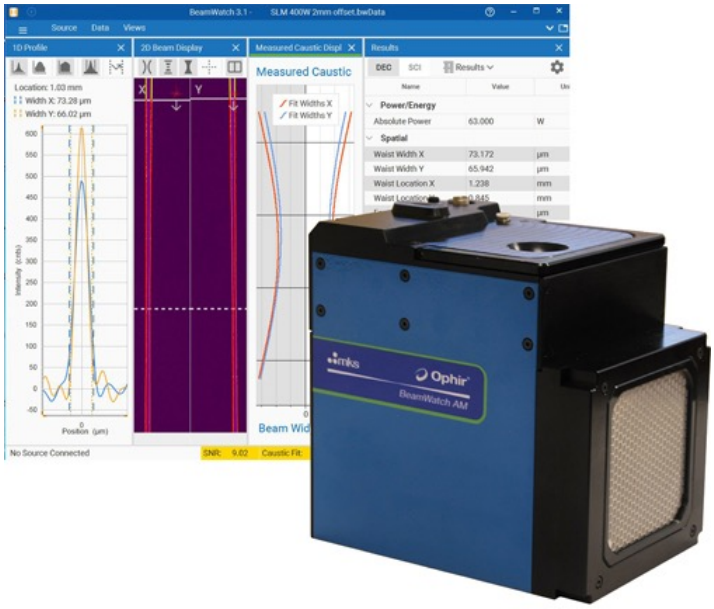
Contact:
Gary Wagner, GM (U.S.)
gary.wagner@us.ophiropt.com

Shari Worthington, PR
sharilee@telesian.com

MKS Announces Ophir® BeamWatch AM, Non-Contact Laser Beam Monitoring System for Additive Manufacturing

Andover, MA – November 20, 2017 – MKS Instruments, Inc. (NASDAQ: MKSI), a global provider of technologies that enable advanced processes and improve productivity, has announced the **Ophir® BeamWatch® AM**, the industry's first non-contact laser beam monitoring system for additive manufacturing. BeamWatch AM is a lightweight, compact system designed for real-time measurement of focal shift during laser startup of powder bed fusion manufacturing processes. It measures key beam size, position, and quality parameters, including focus spot size and beam caustic. These measurements allow users to more easily determine when the beam is aligned and in focus, providing more consistent metallurgy. Measurements can be displayed as tabular, 2D, and 3D views, providing a quick and realistic display of laser characteristics.

"Additive manufacturing processes, such as Selective Laser Sintering (SLS) and Selective Laser Melting (SLM), require symmetrical, uniform, and stable power density distribution of the laser beam," said Gary Wagner, General Manager, Ophir Photonics (U.S.). "This requires a beam spot size and intensity that is maintained within a finite acceptance window when delivered to the material that is to be transformed. Users need to understand where the system laser beam is focusing, if the focus is stable, and, if not, where focus occurs after the system has thermally stabilized in order to avoid structural weakness, captured stress, and voids in



the AM build. BeamWatch AM solves these problems by providing real-time measurement of the beam at the working plane location."

BeamWatch AM is the next generation of the company's laser beam monitoring systems, all of which use Rayleigh scatter to image the beam without contacting the laser. This removes the potential for damage to the laser and speeds the measurement process by up to two minutes. BeamWatch AM can measure laser powers to 1000 watts in-situ at rates up to 14Hz and can handle up to 120,000 joules without cooling. System measurements include laser power, waist width, waist location, focal plane location, spot size at focus, spot size at any point along the 10mm measurement space, ellipticity, Rayleigh length, M^2, K, BPP, divergence, and centroid beam tilt. Results can be charted and exported to .csv files for importing into Excel or other analysis software.

Availability & Pricing
BeamWatch AM is available now. OEM prices available on request.

BeamWatch AM DATA SHEET: http://bit.ly/2hIa5Ez

About MKS Instruments
MKS Instruments, Inc. (NASDAQ: MKSI) is a global provider of instruments, subsystems and process control solutions that measure, control, power, monitor, and analyze critical parameters of advanced manufacturing processes to improve process performance and productivity. Our products are derived from our core competencies in pressure measurement and control, flow measurement and control, gas and vapor delivery, gas composition analysis, residual gas analysis, leak detection, control and information technology, ozone generation and delivery, RF & DC power, reactive gas generation, vacuum technology, photonics, sub-micron positioning, vibration isolation and optics. Our primary served markets include semiconductor capital equipment, general industrial, life sciences and research. Additional information can be found at www.mksinst.com.

About the Ophir Brand
With over 40 years of experience, the Ophir brand comprises a complete line of instrumentation, including power and energy meters and beam profilers. Dedicated to continuous innovation in laser and LED measurement, MKS, through its Ophir brand, holds a number of patents, including the R&D 100 award-winning BeamTrack power/position/size meters; BeamWatch®, the industry's first non-contact, focus spot size and position monitor for lasers in material processing; and Spiricon Ultracal™, the baseline correction algorithm that helped establish the

ISO 11146-3 standard for beam measurement accuracy. The NanoScan family of scanning-slit technology products are capable of measuring beam size and position to sub-micron resolution. The Ophir Optics products include high performance IR thermal lenses and optical elements for the defense, security, and commercial markets, as well as high quality optics for high power CO^2 lasers and 1 micron lasers for cutting, welding, drilling, and 3D printing systems. Ophir is ISO/IEC 17025:2005 accredited for calibration of laser measurement instruments. Their modular, customizable solutions serve manufacturing, medical, military, and research industries throughout the world. For more information, visit http://www.ophiropt.com/.

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Sales Inquiries: sales@us.ophiropt.com

For more information, contact:
Gary Wagner, General Manager
Ophir Business Unit (U.S.)
3050 North 300 West, North Logan, UT 84341
Tel: +1 435-753-3729
E-mail: gary.wagner@us.ophiropt.com
www.ophiropt.com/photonics

Shari Worthington, PR
Telesian Technology
49 Midgley Lane, Worcester, MA 01604
Tel: +1 508-397-6345
E-mail: sharilee@telesian.com