CUSTOMER-FOCUSED OPERATIONAL EXCELLENCE

- **Reliability – Low warranty and low out-of-box quality issues.**
- **Fast delivery**
  - Next day shipping on meters, cameras, and some sensors. (adding more sensors soon)
- **Responsive Technical Support**

CALIBRATION AND WARRANTY

- **ISO/IEC 17025 certified calibration**
  - This accreditation assures customers that Coherent produces calibrations to the highest standards.
- **NIST & PTB traceable standards**
  - Gold standards calibrated at NIST semi-annually and PTB annually.
  - Calibrated to meet original product specifications
- **12 months warranty extension after annual calibration**
  - Calibration labs in China, Japan and Germany
  - Typical calibration turnaround time is < 3 weeks from receipt

LASER POWER AND ENERGY MEASUREMENT TECHNOLOGIES

- **Thermopile**
  - Output power of CW lasers
  - Average power of pulsed lasers
  - Provide integrated pulse energy value for single “long” laser pulses
- **Transverse thermoelectric (PowerMax-Pro)**
  - Fast power measurement
  - Provides temporal pulse shape (for >100 µs pulses)
- **Pyroelectric**
  - Pulse energy of pulsed lasers
  - Provide calculated average power of pulsed lasers
- **Semiconductor (Optical)**
  - Very low power
  - Very low pulse energy

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THERMOPILE MEASUREMENT CAPABILITIES

- **Cooling Type & Measurement Ranges**
  - Passive Air-cooled: 100 µW to 150W
  - Active Fan-cooled: up to 300W
  - Water-cooled: up to 6 kW (10kW soon!)

- **Active Area Diameters**
  - Most power sensors have either 19 mm or 50 mm diameter active areas
  - kW sensors are available with 50mm, 100mm, and 200mm diameter active areas

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THERMOPILE MEASUREMENT CAPABILITIES

- **Spectral Range**
  - Broadband coating from 0.19 µm to 11 µm
    - Caution at less than 400 nm. High power UV can degrade over time
  - UV coating from 0.19 µm to 1 µm
    - Best for Excimer lasers; also good for 266nm and 355nm sources

- **Connector Options**
  - USB-Direct
  - RS-232 (typically for OEMs)
  - DB25 (for use with Coherent stand-alone meters)

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PM10K+ -- 10 KW POWER SENSOR

Coherent will launch a new high-power kW sensors, suitable for 10 kW lasers and beyond!

- **Operation: 10 kW continuous / 12 kW intermittent (5 min.)**
- **Performance: <3 second measurement speed (0-99%) using new speed-up algorithm**
- **Active Area:**
  - 65 x 65 mm diameter active area
  - BB+ broadband coating (0.19 to 11 µm spectral range)
  - High laser damage threshold
- **PC Interfaces:**
  - USB (for PC) + DB25 (for legacy and new meters)
  - RS-232

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THERMOPILE MEASUREMENT CAPABILITIES

- **PM versus LM models**
  - PM model are single channel
  - LM model have quad beam position
  - LM Compatibility issues to consider
    - LabMax & LabMax-Pro are easy – works with both
    - FieldMaxII & FieldMate need Smart Sensor Adapter

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FIVE KEY FACTORS FOR LASER POWER MEASUREMENTS

- **Wavelength**
  - Absorption vs. Wavelength
- **Beam Diameter**
  - Too small – Can cause sensor damage
  - Too large – Can yield inaccurate measurement from clipping
- **Power Range**
  - Middle of sensor range for best results
  - Too low can be affected by sensor noise and too high can damage sensor
- **Power Density (W/cm²)** $\left(\frac{Average\ Power}{\pi r^2}\right) \times 100, r\ is\ in\ mm$
- **Measurement Duration**
  - Between process laser verification vs. long-term power stability and closed loop measurement

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PYROELECTRIC MEASUREMENT CAPABILITIES

Pyroelectric – EnergyMax sensors

- **Measurement Ranges**
  - Repetition rates: 1 to 10 kHz
  - Aperture sizes: 10, 25, 50 mm
  - Wavelength: 190 nm to 11 microns
  - Laser Pulse width: picosecond to 5 ms
  - Energy level:100 nJ to 15J
    - ❖ J-10Si-LE & J-10Ge-LE: 750 pJ to 775 nJ range (using photodiodes)
- **EnergyMax Coating technologies**
  - Diffuse metallic – high rep. rate
  - MaxBlack – high damage resistance, broadband
  - MaxUV – highest damage resistance in UV
  - Diffusers – YAG, IR, & UV diffusers available on some models to increase laser damage resistance.
- **Instrumentation Options**
  - USB-Direct
  - RS-232 (typically for OEMs)
  - DB25 (for use with Coherent stand-alone meters)

PYROELECTRIC ENERGY MEASUREMENT

Seven Key Factors for Laser Energy Measurement

- **Wavelength**
  - *Absorption vs. Wavelength*
- **Beam Diameter**
  - *Too small – Can cause sensor damage*
  - *Too large – Can yield inaccurate measurement*
- **Energy Range**
  - *Middle of sensor range for best results*
- **Repetition Rate**
  - *Max repetition rate – 10kHz*
  - *>10kHz – Power sensors only*
- **Pulse Width**
  - *Max pulse width – ~5 ms*
  - *>5 ms – PowerMax-Pro or Thermopile Power sensors only*
- **Energy Density (J/cm²)**
  - $\left(\frac{Energy}{\pi r^2}\right) \times 100, r\ is\ in\ mm$
- **Average Power**
  - *Up to 5W to 20W without heat sink (model dependent)*
  - *Up to 50W with largest heat sink*

OPTICAL SENSOR MEASUREMENT CAPABILITIES

OP-2 Optical Power Sensors

- **Measurement Ranges**
  - Power level: 10 nW to 30 mW
  - Repetition rates: CW Only
  - Aperture sizes: 5 mm to 8 mm
  - Wavelength: 250 nm to 1800 nm (UV, VIS, IR models)
- **Instrumentation Options**
  - DB25 (for use with Coherent stand-alone meters)

USB UV/VIS & USB Wand Sensors

- **Measurement Ranges**
  - Power level: 5 µW to >100 mW
  - Repetition rates: CW and >100 pps lasers
  - Aperture sizes: 8 mm to 10 mm
  - Wavelength (Silicon): 325 to 1064 nm
- **Instrumentation Options**
  - USB

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INSTRUMENTATION - LMC “STAND ALONE” METERS

LabMax-Pro SSIM

- **LabMax-Pro SSIM: Power & Energy meter. Lower cost than other platforms because no display.**
  - Direct PowerMax-Pro high-speed analysis.
  - Compatible with LM sensors.

LabMax Touch

- **LabMax Touch and LabMax Touch Pro: In depth on-board analysis, flexible data logging.**
  - Compatible with all catalog DB25 sensors and supports beam position analysis.
  - Ethernet, USB, and RS-232 interfaces
  - Pro model supports 1 MHz sampling with PowerMax-Pro sensors.

FieldMaxII

- **FieldMaxII-TOP/TO: Stats, USB interface, rechargeable battery.**
  - USB PC interface for use with PC application software
  - TOP Model Measures Power & Energy; TO Model Measures Power only
  - Requires adapter to use LM model thermopiles

FieldMate

- **FieldMate: Basic power meter with digital display and analog tuning needle.**
  - Digital and analog user interface with no PC interface, statics, or data logging.
  - Requires adapter to use LM model thermopiles

LABMAX TOUCH - LASER POWER & ENERGY METERS

New!

- **Large 7” Touchscreen Display**
  - Brand New User Interface
  - Input keys for common functions (differentiator)
- **Flexible PC Interface Choices**
  - Ethernet (New!)
  - USB and RS-232
- **HDMI monitor output, mouse control, DIN rail mounting, Alarms/Limits for production applications.**
- **Rugged and Robust industrial design**
  - Rubber bumpers
  - Sturdy metal kickstand
  - Recessed screen and connectors
- **High Speed Sampling**
  - 1 MHz with PowerMax-Pro sensors

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BEAM DIAGNOSTICS PRODUCTS

–Spatial Profile Beam Diagnostics

Qualitative analysis of laser beam to determine intensity profile.

Quantitative measurement of beam diameter.

BeamMaster Knife-Edge Profiler

Knife-Edge Profilers

- Offer for small beams smaller than 200 microns
- Supports CW Lasers only

LaserCam HR II Camera Profiler

Compact USB 2.0 CCD Cameras

- Preferred system for beams >200 microns
- Supports both CW and Pulsed Lasers

Camera Attenuator Accessories

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LASERCAM-HR II – HIGH RESOLUTION BEAM PROFILER

Compact USB 2.0 CCD Cameras

- **Beam Diameters from 0.2mm to 6mm**
- **Supports both CW and Pulsed Lasers**

- 1/2” and 2/3” format active areas
- 4.6 µm and 6.5 µm pixel size
- 12-bit and 14-bit with low noise
- 190 nm to 1100 nm spectral range
- External trigger input
- Variable exposure 1 ms to 500 ms

Cameras Include BeamView software

- TCP/IP and RS232
- Automatic background subtraction
- Multiple camera support
- Flat top beam analysis
- Adjustable trigger delay

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KEY APPLICATIONS OF LASER MEASUREMENT

- **Direct Free Space measurement**
  - Primary Method: This is the most prevalent technique, involving the placement of a sensor directly in the laser beam's path.
  - Usage contexts: Commonly employed in laser manufacturing processes, quality assurance (QA), engineering, and field service.

- **Sampling from a Beam Splitter**
  - Technique: A sensor is positioned behind a beam splitter to sample the laser beam continuously.
  - Purpose: Provides active feedback to the laser controller or for ongoing logging of laser beam performance.
  - Application Areas: Mainly in scientific lasers and R&D setups.

- **Periodic Full Beam Measurement Inside Laser Systems**
  - Integration Method: Frequently, the power or energy sensor is integrated into the laser system or near the laser in a production application.
  - Sensor placement: Typically located near the work surface's edge when embedded inside the system.
  - Operation: The system is configured to direct the beam to the sensor automatically at set intervals, such as daily or during specific operational stages like part filling. The system moves the laser delivery head, or directs the galvo, or swings a robot arm, over to the sensor.

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CUSTOMER PROFILES

- **Laser Source Manufacturers**
  - Focus: Engineering, production/quality assurance, and field service.
  - Requirements: Need for precise measurement in the development and production of laser sources.
- **Laser System Builders/Integrators**
  - Focus: Engineering, OEM embedded measurement and field service.
  - Requirements: Integration of measurement systems within larger laser systems. May require a custom solution to fit in the system and optimized to laser a specific laser condition.
- **Scientific and Academic Institutions, Government Research Labs**
  - Focus: Research
  - Requirements: Utilize laser measurement in experimental setups and for educational purposes.

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MARKETS SERVED

- **Semiconductor & Advanced Packaging**
  - Processes: Lithography, Via drilling, and other semiconductor related processes
- **Microelectronics & Display Technologies**
  - Processes: Annealing and laser lift off for LEDs and OLEDs.
- **Medical Device Manufacturing**
  - Fields: Aesthetic, dental, surgical, and ophthalmic
- **Scientific and Educational Institutions**
  - Activities: Academic research and scientific exploration
- **Life Sciences**
  - Activities: Instrumentation related to life sciences research and testing
- **Military/Aerospace/Government**
- **Industrial Sector**
  - Processes: Material processing including cutting, welding, and other related activities.

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