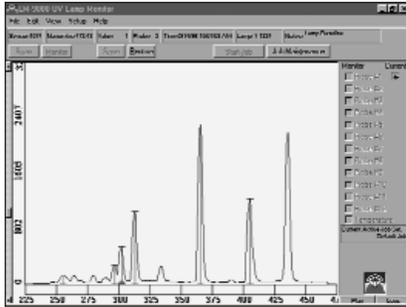


LM-9000™ UV LAMP MONITOR

Continuous, full spectrum monitoring system tracks performance of one to twelve UV curing lamps simultaneously



LM-9000™ Windows® Interface

The **LM-9000™ Continuous Lamp Monitor** is a highly modular, computer-based, full spectrum UV data acquisition and management system providing both real-time display and data storage of UV lamp output characteristics. Through CON-TROL-CURE's exclusive optical probe and fiber optic sub-systems, the LM-9000 allows permanent sensor placement inside the curing zone, reflector housing, or even directly on the lamp.

Why Continuous Lamp Monitoring?

The UV lamp is the most important variable within the entire UV curing process. Lamp performance has been conventionally measured by the use of two distinct methods:

- 1) Indirect mechanical testing (testing product following manufacture); and
- 2) Direct (but limited) radiometric measurement.

Although both methods serve a purpose, the mechanical test occurs too late in the process to prevent poor results, and the radiometric method only takes a snapshot of lamp output when it is used. While both of these methods can yield valuable information, continuous monitoring of lamp performance throughout the curing process is the only method which provides constant, real-time evaluation so costly product failures are avoided, and more consistent end-product is produced.

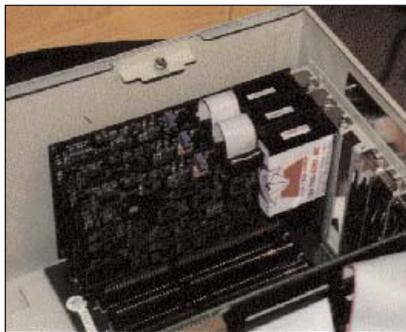
What Is the LM-9000™ Continuous Lamp Monitor?

As a computer hardware- and software-based data acquisition system, the LM-9000™ captures data through the installation of one (or more) of our exclusive high temperature optical probes within the lamp reflector housing. By coupling the sensor to our optical bench (mounted on an internal PC card or in an external housing) via fiber optic cabling, this data is displayed and managed by the LM-9000's custom Windows® lamp monitoring software.

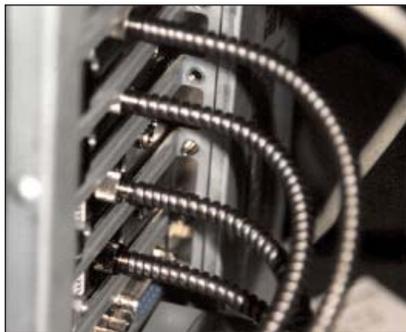
The LM-9000™ Instrument is available in two forms:

- The **internal** LM-9000™ instrument is an PC computer internal card (16 bit ISA Bus) mounted directly inside the computer.
- The **external** LM-9000™ instrument is housed in an impact-resistant case, connected to the PC via standard USB connection.

Both units allow direct connection of the UV-enhanced fiber optic cable to the PC, bringing the full spectrum of ultraviolet light (200-450nm) into the system. The incoming "Light Sample" is broken up into individual wavelengths and reflected onto a CCD array containing 1100 individual sensors. Data from each sensor (each wavelength) is then interpreted by the computer for display, and maintained in an accessible database. Multiple lamp configurations can be created by incorporating additional card (either internal or external) and sensing units into the system.



Internally mounted PC cards



Fiber Optic Probe connected to PC card

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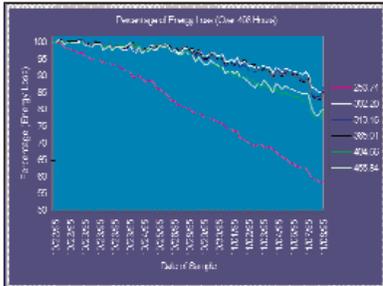
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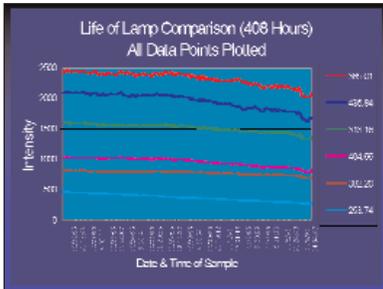


LM-9000™ Lamp Monitor Software

The LM-9000™ Lamp Monitor Software is Windows® compatible. Featuring real-time display of wavelength intensity distribution between 200 and 450 nanometers, selective wavelength monitoring, and a saved baseline display, the LM-9000™ captures all the performance characteristics of your UV lamp output throughout the course of each and every job you produce (not just when the operator pushes a button). The LM-9000™ even saves information, so you can keep process and machine settings, job characteristics and system state information to help duplicate the exact conditions a specific job required at a later date. The "Events" feature allows specific wavelengths to be defined for alerting operators when changes in lamp intensity occur.

LM-9000™ Optical Probes

The basic optical probes are available as small as 1/4" dia. by 3/4" long. They intrude only 3/8" into the curing system, and are easily installed anywhere inside the curing zone, and anywhere around the lamp. Using a proprietary lens system and interface to the connecting fiber optic cabling, basic probes will withstand temperatures up to 400°C, and are available in 4 levels of optical attenuation, each designed to address the very high UV light levels as used in high energy (300+ watt) UV systems.



Optional right angle probes allow for placement under the lamp. The air-operated, shuttered right angle probe uses a controlled stream of air to open the probe while keeping dirt & dust from affecting data collection. Flexible shaft probes and designs which clip directly onto the lamp are also available.

LM-9000™ Fiber Optic Cabling

The connecting fiber optic cabling is designed for industrial applications, and is specially enhanced to transmit all the UV energy in the 200nm to 450nm range without loss of signal. Jacketed and encased within a flexible stainless steel covering, the fiber is designed to function at up to 300°C continuous operation and will not solarize over long term UV exposure. Cables install easily on industrial processing equipment and are protected to prevent damage to the fiber. Available in 2m, 10m, and custom lengths.

Why Do I Need Continuous Lamp Monitoring?

Many factors influence the level of cure within the UV curing process. As we develop more powerful lamps, newer coating formulations, new trends in cooling and IR/UV filtering, as we try to implement higher quality control standards and process controls, we push the envelope of technology in the hopes of higher profits, better throughput, and less wasted time and product. But, if the UV lamp itself is not providing long term, reliable, stable output at the required wavelengths, the entire process is compromised, or even completely inhibited.

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Over the total life span of a given UV lamp, it's output varies and ultimately declines. When a lamp is brand new, it should produce perfectly stable and repeatable results. But, why do product failures continue to occur? When whole or partial jobs fail quality control, it is possible that your lamp, even when new, is the responsible agent. The LM-9000™ can identify such lamp problems before they generate waste in time and money.

With the help of the LM-9000™, we have discovered that an individual lamp loses intensity at various wavelengths at different rates over its operating life. We have also observed two lamps with the same specifications, the same arc length, and used on the same machine, perform with different wavelength intensity distributions. We have even noted some older lamps perform fractionally better than a brand new lamp of the same specification.

Other Concerns In The UV Curing Process

At different power settings, a lamp may not perform in a linear manner at every frequency. When your electric service fluctuates, whether from natural causes, power cutbacks, or when the shop across the street switches on the big machine, your UV curing system may experience specific frequency events that can have profound effects on your production run.

Even differences in cooling air temperature and how it is applied affects lamp output intensity at certain critical wavelengths. As the power supply warms up, its output can fluctuate, causing changes in intensity at different wavelengths. As the lamp itself warms up to operating temperature, output intensity at particular wavelengths can climb to 150% of their operating maximum before stabilizing. This "warm up" period changes from lamp to lamp, and machine to machine as well.

Benefits Obtained From Using The LM-9000™

After installing a new lamp into your curing system, the LM-9000™ will establish the baseline performance characteristics of the lamp. It will then keep track of lamp performance throughout its life span. As lamp hours accrue, it can then show when to replace the lamp with a new one.

When you turn on your curing system, the LM-9000™ will indicate when the system has stabilized and is ready for use. No more production runs wasted because the UV system wasn't ready to properly cure.

While running a job, the LM-9000™ can alert operators to energy output events the instant they occur, allowing mid-job correction of press settings or temporary pausing of the job until the problem can be corrected. Setting intensity levels on any monitored wavelength so fluctuations of 25% or 50% of lamp baseline trigger an alarm, you will no longer suffer from inconsistent production runs, wasted product or time.

Enter pertinent data for later retrieval and tracking. Lamp Data, Process Info, Machine/Location, Operator, Job Description and Settings, Coating Data, etc. can all be saved with the actual data to help clear up any discrepancies before they become problems.

If your client requires ISO-9000 level reporting of Job Quality Control, the LM-9000 provides it on demand. Only available hard disk storage limits the number of job baselines or the length of time you can keep information about any particular run.

Does your application require multiple lamp, multiple system monitoring? What about process control interfacing with the LM-9000™ to make production-line control an instantaneous reality? Do you need temperature information? What about color process control, speed data, product counting, thickness or registration monitoring?

With all of these features available, as well as visible light monitoring (in addition to UV), control of other production aspects is possible. We even offer custom hardware and software solutions to fit your needs.

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LM-9000™ SYSTEM FEATURES

- Continuous monitoring of lamp energy
- Full spectral range sensitivity from 200nm through 450nm range
- Selective wavelength monitoring
- Full capabilities at any intensity with no wattage limitations
- Automatic calibration at startup
- Completely modular component design
- Single or multiple lamp configurations available
- Simultaneous multi-lamp monitoring and event storage capabilities
- Choice of view angle to the lamp
- No environmental barriers to probe installation: 400°C maximum temperature
- Probes may be installed anywhere around the lamp, or anywhere within housing
- Small probe profile: 1/4" (6mm) dia., 3/8" intrusion into curing area
- Focal plane positioning using the optional right angle probe
- Long range positioning of central station to monitored lamps
- Up to 20 meters from central station (longer custom ranges are available)
- Selective sampling by hour, minute, day, week or month
- History of lamp performance including:
 1. Full range data storage
 2. Maintains all lamp operation information
 3. Records all lamp operating parameters
 4. Event data storage by job, skid, hour, day, operation, operator, machine
 5. Event recording by critical wavelength/critical energy level
 6. Complete software control: Compatible with Windows®

LM-9000™ DATA COLLECTION FEATURES

- **Lamp Data**
 1. Date & time of lamp installation
 2. Lamp serial number (for tracking)
 3. Number of hours on (in use) and number of lamp starts
 4. Peak irradiance at each wavelength
 5. Baseline performance of new lamp
- **Process Data**
 1. Operating Temperature, Power and Speed Settings
 2. Output Energy Events
 3. User Defined Data Collection
- **Data Storage**
 1. Lamp & Job Baselines
 2. Lamp & Job Description Information
- **Data Reporting Capabilities**
 1. ISO-9000 level reporting
 2. Lamp performance over time
 3. Process data reports on demand
 4. Ink/coating, job, lot & skid
 5. I/O interfacing options for extended process controls and data logging
- **Optional Accessories**
 1. Desktop Computer
 2. Multiple probe options
 3. Probe & fiber optic lengths
 4. Temperature monitoring sensors
 5. Visible spectrum optical bench 200-1000nm
 6. Modular system expansion for additional lamps or probes

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Standard Probe

LM-9000 BASE SYSTEMS

Below are some base systems for the LM-9000™.

However, the LM-9000™ is designed to be a custom system to fit different presses and the unique needs of our customers. So most configurations should be quoted individually.

BASE SINGLE LAMP MONITOR SYSTEM

LM-9000™ Base System (with or without a desktop computer and monitor). Includes one internal ISA LM-9000™ card, 2 meter standard optic cable, and basic probe; this enables an operator to monitor the output of a single UV lamp. Includes complete software package.

PART NUMBER	DESCRIPTION
LM-9000DT	Base LM-9000™ System w/Desktop Computer
LM-9000	Base LM-9000™ System (w/o Desktop Computer)

USB EXTERNAL LAMP MONITOR SYSTEM

LM-9000™ USB External Base System. Includes one external USB LM-9000™ box, 2 meter standard optic cable, and basic probe; this enables an operator to monitor the output of a single UV lamp. Includes complete software package.

PART NUMBER	DESCRIPTION
LM-9000SLL	Base LM-9000™ External USB System

See *LM-9000 Quote Guide* For Custom Configuration Options

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