CyberOptics Corporation is a leading global developer and manufacturer of high-precision 3D sensing technology solutions. CyberOptics' sensors are used for inspection and metrology in the SMT and semiconductor capital equipment markets to significantly improve yields and productivity. By leveraging its leading edge technologies, the Company has strategically established itself as a global leader in high precision 3D sensors, allowing CyberOptics to further increase its penetration of key vertical markets.

Headquartered in Minneapolis, Minnesota, CyberOptics conducts worldwide operations through its facilities in North America, Asia and Europe. Through continuous technology advancements, a rich patent portfolio, and our sensor expertise CyberOptics continues to be an industry leader at the forefront of technology.

CyberOptics Award-Winning SMT Inspection Systems
The Global Leader in High-Precision Sensors and Systems for AOI, AOM, SPI and CMM.
Automated Optical Inspection (AOI)
Best-in-Class 3D AOI Technology
Powered by MRS™ Technology

SQ3000™ | Multi-Function
Ultimate in Speed and Accuracy
- Multi-process capability for 3D AOI, SPI and CMM
- Delivering metrology grade accuracy at production speed, powered by MRS Technology
- SQ3000™ X available for Large Board capability
- SQ3000 for 3D AOI only and SQ3000 for 3D SPI only also available

SQ3000™ DD | 3D AOI
Dual Lane - Dual Sensor
- Dual MRS Sensors
- Delivering metrology grade accuracy at production speed, powered by MRS Technology
- Switch from dual to single lane to inspect large boards
- SQ3000™ D Dual Lane option available

Proprietary 3D Multi-Reflection Suppression™ (MRS)
Sensor Technology
The revolutionary MRS technology delivers unmatched accuracy by meticulously identifying and rejecting reflections caused by shiny components and reflective solder joints. Effective suppression of multiple reflections is critical for highly accurate inspection and measurement, making MRS an ideal technology solution for a wide range of applications including those with very high quality requirements.

CyberOptics’s unique sensor architecture with 4 multi-view 3D sensors and a parallel projector, simultaneously captures and transmits multiple images in parallel while proprietary 3D fusing algorithms merge the images together, delivers metrology grade accuracy at production speed.

SQ3000 Multi-Function for 3D AOI, SPI & CMM
SQ3000 with MRS technology has multiple sensor options to meet even the most challenging applications. CyberOptics has advanced the proprietary Multi-Reflection Suppression (MRS) sensor to an even finer resolution. The Ultra-High Resolution MRS sensor enhances the SQ3000 platform, delivering superior inspection performance, ideally suited for the 0201 metric process and microelectronic applications where an even greater degree of accuracy and inspection reliability is critical.

SQ3000 is an all-in-one solution that’s loaded with powerful tools that cover inspection and measurement for AOI, SPI and CMM applications. SQ3000 X offers support of large board capability of up to 720 x 620 mm board sizes.

SQ3000 DD Dual Lane - Dual Sensor
The SQ3000 DD 3D Automated Optical Inspection (AOI) System is an extension of the award-winning SQ3000 3D AOI platform. The dual lane, dual sensor system maximizes flexibility catering to varying PCB widths. This unique design provides the ability to inspect high volume assemblies, the convenience of inspecting different assemblies and board sizes simultaneously on different lanes, or even switching from dual lane to single lane mode to inspect very large boards.

Not only does the SQ3000 DD provide PCB flexibility, it also provides the flexibility to choose two of the same or two different proprietary MRS sensors.

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Automated Optical Inspection (AOI)
High Value - Flexible Inspection 2D AOI Technology

**QX150i™**
- High-Value, Flexible for All Applications
- Strobed Inspection Module (SIM)
- Ideally suited for pre-reflow and selective solder joint inspection

**QX250i™**
- Fast, Flexible, High-Performance
- 2 Strobed Inspection Modules (SIM)
- Shortens production line and delivers ~50% productivity improvement vs. single SIM
- Ideally suited for pre-reflow

**QX600™**
- 2D AOI for FVI
  - Best Performance + Lower Cost of Ownership
- 2 Strobed Inspection Modules (SIM)
  - Automated Final Vision Inspection (FVI) for singulated memory modules

**QX600™**
- Ultra-Fast, Ultra-Versatile
- Strobed Inspection Module (SIM)
- Best-in-Class 01005 and solder joint inspection

2D AOI Sensor Technology - High-speed, On-the-fly Inspection

The SIM (Strobed Inspection Module) is at the core of every CyberOptics’ 2D AOI system. Designed and manufactured exclusively by CyberOptics, the SIM delivers high performance inspection at 200cm²/sec on the QX600.

The SIM is designed with enhanced illumination using LED lighting - delivering the best 01005 and solder joint performance ever. With an 80/150 Megapixel sensor and higher resolution (12µm), you get crisp, perfect quality images for more accurate defect review. The capabilities shown below are achieved with CyberOptics’ 2D and 3D AOI systems.

**Memory Module Post-Test Defect Types, Pre-Shipping Inspection**

Inspection Capability includes:
- Components Edge
- Damage PCB Corner
- Goldfinger Discolored / Burnt / Badly Scratched
- Gold tab inspection - Lifted tie bar, burnt, contamination
- Physically Damaged Components

**Components Inspected / Detected**
- Active Pixel Marking
- Missing Pin
- Floating Pin
- Pre-Reflow Inspection
- OK
- NG

**Components Inspected / Detected**
- Intelligent Ranking of Examples
- 01005 component size inspection capability
Intuitive, Easy-to-use Software

The multi-award winning SQ3000 AOI software is a more powerful yet extremely simple software designed with an intuitive interface. Including multi-touch controls, 3D image visualization tools and ultra-fast programming capabilities that brings ease-of-use to a completely new level, which reduces training efforts and minimizes operator interaction - saving time and cost.

Enable Smarter, Faster Inspection

Speed programming and tuning with new capabilities including AutoTeach, AutoTune and AutoDefine for faster set-up and to simplify process.

- New body inspection settings and lead inspection settings; automatically teaches from the height map what parts are loaded based upon CAD data. Lead inspection settings include 3D area measurement.
- New gap inspection settings; blob analysis - looks at height in between leads beyond using an image
- New AutoDefine Feature; automatically detects and adds inspection features including leads and gaps by drawing a box around the package or component
- New AutoFeatureSet and AutoTune; adds body, leads and gaps inspection features to training set data. AutoTune sets nominals for the specific package.

AI² - Superior in Programming & Performance

CyberOptics AI² (Autonomous Image Interpretation) technology is all about keeping it simple - no parameters to adjust or algorithms to tune. And, you do not need to anticipate defects or pre-define variance either - AI² does it all for you. With AI², you have the power to inspect the most comprehensive list of features and identify the widest variety of defect types - including those that you least expect.

Perfect for those high-mix or low volume applications. With its unique ability to ‘ignore’ bad examples in a model, AI² offers precise discrimination even with excessive variance and minimizes effects of outlier examples. The pixel marking feature highlights defective spots, so you can identify genuine defects instantly.

Faster, Highly Accurate Coordinate Measurement (CMM) Suite

CyberCMM™, a comprehensive software suite of coordinate measurement tools provides highly accurate, 100% metrology-grade measurement on all critical points much faster than a traditional CMM, including coplanarity, distance, height and datum X, Y to name a few.

A fast and easy set-up can be performed with the world’s first in-line CMM system for programming complex applications as compared to slow, engineering resource-intensive set-up that typically requires multiple adjustments with traditional coordinate measurement machines (CMMs).

CyberReport™ - Fast, Scaleable SPC Solution

CyberReport offers full-fledged machine-level to factory-level SPC capability with powerful historical analysis and reporting tools delivering complete traceability for process verification and yield improvement. CyberReport is easy to setup and simple to use while providing fast charting with a compact database size.
**Solder Paste Inspection (SPI)**

**Ultimate Precision Accuracy with World-Class Usability**

**SE600™**
- High Precision
  - Dual illumination sensor
  - Inspection speed up to 108 cm²/sec.
  - SE600-X available with Large Board capability

**SE500™ ULTRA**
- High Speed
  - High-speed single illumination sensor
  - All-in-one scan
  - On the fly measurement at 210 cm²/sec.

**SE3000™ 3D SPI**
- A Leap Forward in Solder Paste Inspection
  - MRS Sensor for metrology grade accuracy at production speed
  - Enables unrivaled GR&R
  - SE3000™ X available for Large Board capability

**SE3000™ DD 3D SPI**
- Dual Lane - Dual Sensor
  - Dual MRS sensors delivers metrology grade accuracy at production speed
  - Flexibility to switch from dual to single lane for large boards
  - SE3000™ D Dual Lane option available

**MRS Technology for 3D SPI**

The SE3000 SPI System brings the revolutionary MRS technology to solder paste inspection delivering higher performance in accuracy and precision. Effective suppression of multiple reflections is critical for highly accurate measurements, making MRS an ideal technology solution for a wide range of applications including those with very high quality requirements.

CyberOptics MRS Sensor architecture, extended from the award-winning SQ3000 AOI platform, has been designed for use in solder paste inspection applications. The unique sensor architecture with multi-view 3D sensors and a parallel projector, simultaneously captures and transmits multiple images in parallel while proprietary 3D fusing algorithms merge the images together, delivering metrology grade accuracy at production speed.

**3D SPI Sensor Technology - Fast, Accurate Performance**

Designed and built by CyberOptics, the sensor is manufactured as an integrated unit with no moving parts – which means no machine-to-machine variation either. Plus, there is no drift over time, no parts to wear and absolutely no recalibration needed. The Dual Illumination Sensor comes standard with the SE600.

For improved repeatability on smallest paste deposits, you can choose from the ULTRA and Dual illumination sensor options on the SE500 ULTRA. Pads as small as 100 microns (4 mils) can be accurately measured with the MicroPad sensor. And, it is easy to swap with the standard sensor too – so you can plug-and-play whenever you need to.
CyberOptics’ software delivers world-class user experience with its intuitive interface that is extremely stable and simple to use, enabling the shortest learning curve. With full multi-touch experience, SPI software offers a range of features that enable smarter and faster inspection:

- Seamless integration of all applications - Teach, Inspection, Defect Review and Real-time SPC
- Unlimited undo-redo and global search options in Teach
- Loads of smart, informative and relevant charts that provide yield summary, FPY information, hotspot display, top 10 pad failures, historical panel and more.
- Easy, hassle-free operation using multi-touch, multi-selection, pinch-zoom and pan-move options.

Closed Loop/ Feed-forward Ready

Reduce rework costs, increase production throughput and improve quality

CyberOptics’ SPI systems fully support feedback and feed forward capability with leading Solder Paste Printer and SMT Mounter vendors. Closed loop feedback gives you the power to do more with SPI results – optimize printing process, establish stencil cleaning cycles and fine-tune printer setup. While feed-forward capability improves the solderability of smaller components by using the printing offset data for compensating parts placement. All this means reduced rework costs, increased production throughput and improved quality.

CyberPrint OPTIMIZER™

Automatically optimizes the print process by proactively analyzing accurate trend data – first-ever in the industry! Pre-defined templates help you get started quickly while customizable rules support perfect customization for specific product needs. With its predictive process improvement capability, you can get better yields and reduce downtime.

CyberReport™ - Fast, Scaleable SPC Solution

CyberReport offers full-fledged machine-level to factory-level SPC capability with powerful historical analysis and reporting tools delivering complete traceability for process verification and yield improvement. CyberReport is easy to setup and simple to use while providing fast charting with a compact database size.
Coordinate Measurement (CMM)
The World’s First In-Line CMM - Ultimate in Speed and Accuracy for SMT, Semiconductor, Microelectronics and Metrology Applications

Faster, Highly Accurate Coordinate Measurement (CMM) Suite
CyberCMM™, a comprehensive software suite of coordinate measurement tools provides highly accurate, 100% metrology-grade measurement on all critical points much faster than a traditional CMM, including coplanarity, distance, height and datum X, Y to name a few.

A fast and easy set-up can be performed with the world’s first in-line CMM system for programming complex applications as compared to slow, engineering resource-intensive set-up that typically requires multiple adjustments with traditional coordinate measurement machines (CMMs).

Fast and highly accurate with repeatable and reproducible coordinate measurements for SMT, semiconductor, microelectronics and metrology applications.

Fastest - Seconds, not Hours
- Significantly speeds attaining coordinate measurements vs. traditional CMMs
- Reduces engineering resource time

Easy-to-use Interface
- Simplifies process with award-winning, intuitive, touch screen experience
- Quick programming for complex applications
- Multi-process capable - AOL, SPI, AOI, CMM

Metrology Grade Accuracy
- Achieve metrology-grade accuracy with MRS-enabled technology
- Repeatable and reproducible measurements for SMT, semiconductor, microelectronics and metrology applications

SQ3000™ 3D CMM
- World’s first in-line CMM system
- Delivering metrology grade accuracy at production speed, powered by MRS Technology

SQ3000 offers unmatched accuracy with the revolutionary MRS technology by meticulously identifying and rejecting reflections caused by shiny components. Effective suppression of multiple reflections is critical for true height measurement making MRS an ideal technology solution for a wide range of applications including those with very high quality requirements.

CyberOptics has advanced the proprietary Multi-Reflection Suppression (MRS) sensor to an even finer resolution. The Ultra-High Resolution MRS sensor enhances the SQ3000 3D CMM platform, delivering superior inspection performance, ideally suited for socket metrology, machined parts inspection, microelectronics and SMT applications where an even greater degree of accuracy and inspection reliability is critical.

CMM Capabilities
SQ3000 3D CMM provides measurement capabilities across a wide variety of applications.
- Line / Distance / XY / Mid Line
- Inter Point / Regression Shifted
- Datum XY / LSF X,Y Offset
- XY Offset / Value / Location / List of XY Value
- Height / Local Height / Regression / Radius
- Coplanarity / Distance to Plane / 2nd Order Fitting
- Difference / Absolute / 2sqrt / VC
- Max / Min / Ave / Sigma / Plus / Minus / Multiply

Socket Metrology
Industrial/ Machined Parts
Solder Ball and Bump
Save Time, Save Expense and Improve Yields with CyberOptics’ Powerful Value-Add Solutions

CyberOptics offers a range of unique value-add software solutions that enable automation, reduce rework costs, minimize scrap and optimize print process.

CyberOptics Software Solutions provides our customers and partners the best added-value possible for inspection and measurement in electronics manufacturing.

As members and participants in the IPC-Connected Factory Initiative and The Hermes Standard, CyberOptics is committed to advancing machine-to-machine communication in SMT assembly and maximize line throughput and traceability in an open protocol.

Enable smarter and faster inspection
- Ultra-fast programming capabilities, auto tuning and enhancements that significantly speed setup, simplify the process, reduce training efforts and minimize operator interaction.
- Speed programming and performance with AI (Autonomous Image Interpretation) technology for set-up in <13 minutes with a data-rich, pre-loaded library and automated scripts that collect and update models all on their own.

Enable smarter and faster inspection
- Reduce training efforts and minimize operator interaction saving time and cost with the powerful yet simple software with intuitive multi-touch interface and 3D visualization tools.
- Optimize printing process, establish stencil cleaning cycles and fine-tune printer set-up.
- Gain the power to do more with SPI results with closed loop feedback.
- Improve the solderability of smaller components by using the printing offset data for compensating parts placement with forward capability.

Enable smarter and faster coordinate measurement (Add-on)
- Extensive suite of CMM tools for precise measurement of critical features
- Significantly speed measurements compared to traditional CMM systems, with high accuracy and repeatability
- Multi-process capable – 3D AOI, 3D AOM, 3D CMM

Automatically optimizes the print process by proactively analyzing current trend data.
- Improve yields and reduce downtime with its predictive process improvement capability.
- Get started quickly with pre-defined templates
- Customize with customizable rules for specific product needs.

A complete Statistical Process Control (SPC), offers full-fledged machine-level to factory-level SPC capability to improves yields
- Attain effective process verification and control with traceability.
- Identify trends and enhance line yields with real-time monitoring tools for historical analysis and reporting.
- Reduce training with easy-to-set-up intuitive interface that facilitates quick learning.
- Achieve fast parsing and charting speed with the robust and scalable software, while enabling an extremely compact database size.
Application Examples
Expanding Capabilities for Multiple Industries

Inspection and Metrology Capabilities

Component Types Inspected
• Standard SMT (chips, J-lead, gull-wing, BGA, etc.), through-hole, odd-form, clips, connectors, header pins, and more

Component Defects
• Missing, polarity, tombstone, billboard, flipped, wrong part, gross body and lead damage, and more

Solder Joint and Other Defects
• Gold finger contamination, excess solder, insufficient solder, bridging, through-hole pins

3D Measurement Inspection
• Lifted Lead, package coplanarity, polarity dimple and chamfer identification

Solder Paste Inspection
• Height, area, volume, registration and bridge detection

Coordinate Measurement Capability
• Line / Distance / X,Y / Mid Line, Inter Point / Regression Shifted, Datum X,Y / LSF X,Y Offset, XY Offset / Value / Location / List of X,Y Values, Height / Local Height / Regression / Radius, Coplanarity / Distance to plane / 2nd Order fitting, Difference / Absolute / 2sqrt / VC, Max / Min / Ave / Sigma / Plus / Minus / Multiple

Automated Optical Inspection

Automotive SMT - Pins

Packaging SMT

Mini/MicroLED Inspection

Through Hole

Memory SMT

Mobile Phone SMT

Medical SMT

Industrial/Machined Parts

Coordinate Measurement - Socket Metrology

BGA/Solder Ball and Bump

Copper Pillar

Micro Bumps

Flip Chip (c4)

Semiconductor Applications

Powered by MRS™ Technology
Case Studies
Proven Inspection and Metrology Solutions that Improve Process and Yield

Rohinni Adopts CyberOptics MRS-Enabled SQ3000 Multi-Function system for Inspection and Metrology of Rohinni’s Micro LED Technology

Rohinni needed an inspection and metrology solution for six critical in-line production process locations including incoming quality inspection of the flexible circuits, solder paste inspection, post and pre reflow AOI, coordinate measurements post placement of the LED die and final test.

CyberOptics SQ3000 Multi-Function system for Automated Optical Inspection (AOI), Solder Paste Inspection (SPI) and Coordinate Measurements (CMM) was extensively evaluated and adopted to address all six production process locations.

“We are happy to use the SQ3000 in our line solution to inspect various process steps because of its higher speed, higher resolution and higher accuracy with the in-line CMM capability,” said Matthew Gerber, CEO, Rohinni. “The unmatched performance and versatility of the system make it the perfect solution for our challenging application needs and stringent quality requirements.”

Socket Metrology

Our customer was using a Coordinate Measurement Machine (CMM) to handle the intricate measurements required for their socket metrology, semiconductor jigs and mobile phone sensors. A high-volume manufacturer, they needed a stable, robust and accurate metrology solution to inspect a variety of parts. Though highly accurate, the slow speed of their outdated CMM system made it difficult for this company to keep up with customer demand while meeting stringent requirements, taking more than 10 hours to inspect 3,000 contact points. The company’s workaround for the slow measurement speed was a >5% sampling test requiring a great deal of resources to measure and verify the correlation.

The CMM system also required intensive training, routine maintenance and multiple adjustments throughout the inspection period to account for variables. Though there are machines in the market specifically for high-volume manufacturing that have greatly improved the speed of inspection, these machines have a limited field of view (FOV), preventing proper inspection of new, larger socket designs. To meet increasing customer demand and standards, the company needed a way to accelerate inspection without wavering on quality or accuracy.

We worked with our customer to implement the SQ3000 CMM in their backend inspections, accelerating and optimizing production. This system meets and exceeds expectations for full-coordinate measurements. What once took eight hours with the original CMM, now takes less than 13 seconds, including all points and CTFs. The precision gantry provides a larger FOV for a more complete view of the component, allowing our customer to scan a wider range of socket and part sizes.

Daktronics Considers CyberOptics SQ3000 CMM the Best in the Industry for Inspection and Metrology

Daktronics sought a solution to replace a manual microscope method in their metrology lab. Although the microscope system works well for small parts, it is limited in the size of substrate it can handle and it is not very automated.

After a full, extensive evaluation to ensure it would meet Daktronics stringent requirements, the company installed a CyberOptics SQ3000 CMM (Coordinate Measurement Machine) in their lab testing environment for inspection and metrology. Daktronics considers the SQ3000 CMM the best in the industry for their application needs based on the high resolution, high accuracy, comprehensive coordinate measurement software suite, versatility, automation and ease-of-use. It provides the highest quality inspection and metrology data to meet their commitment to the highest quality standard.

Packaging

Our customer experienced increased demand for their PCB boards with 0201 components and needed a way to ramp up and significantly improve their inspection process. Due to the intricacies and variations between elements from a variety of suppliers, manual inspection was not an option. Manual inspection also prohibited effective tracking of defects and anomalies of the intricate 0201 components. Speed and accuracy in high-volume inspection were very important to our customer. Defects, when caught, were discovered at the very end of inspection, forcing significant manufacturing delays. The customer also struggled with a high escape rate. To get to mass market quickly, this customer needed an automated solution that allowed them to catch defects sooner, while reducing operator costs and overhead. Shine was another factor that posed concerns. As parts grew shinier, it became more and more difficult to find a solution that provided reliable, consistent inspection at their goal rate of 20,000 parts in under 20 seconds.

Implementing the SQ3000 allowed for a versatile solution that is easy to use and provides consistent, accurate results at high speeds. The sensor, software and system all work together to completely automate the full-line inspection process, with higher mean time between failures of inspected components — more than 35,000 hours. This solution meets the customer’s production requirement for line cycle time with repeatability of six micrometers in three sigma for X, Y, Z measurement. The 2D scanning provides inspection coverage for text, rotation, position, cracked or damaged components, debris and gap measurements, while the advanced 3D scanning technology provides detailed coplanarity inspection up to eight times faster than competing solutions.

View these Case Studies and others in their entirety at www.CyberOptics.com