What is the true cost of ‘good enough’ manual inspection?

Beyond labor costs, undetected errors in PCB assembly create hidden financial drains that impact your entire operation.

This presentation breaks down the quantifiable risks of relying on manual visual inspection and presents a clear, data-driven path to eliminating them through automation.

SOUTHERN MACHINERY

The Unstable Foundation of Manual Inspection

Manual visual inspection is a constant battle against human limitations, leading to direct and indirect costs that grow over time.

Visual Fatigue & Inconsistency

Visual inspection is prone to fatigue and emotional swings. Inspection standards differ from person to person, leading to inconsistent quality control. Error rates predictably increase throughout a shift, following a clear "visual fatigue curve".

Rising Labor & Training Costs

Labor wages continue to rise. High worker mobility means constantly training newcomers, a recurring cost with no long-term ROI.

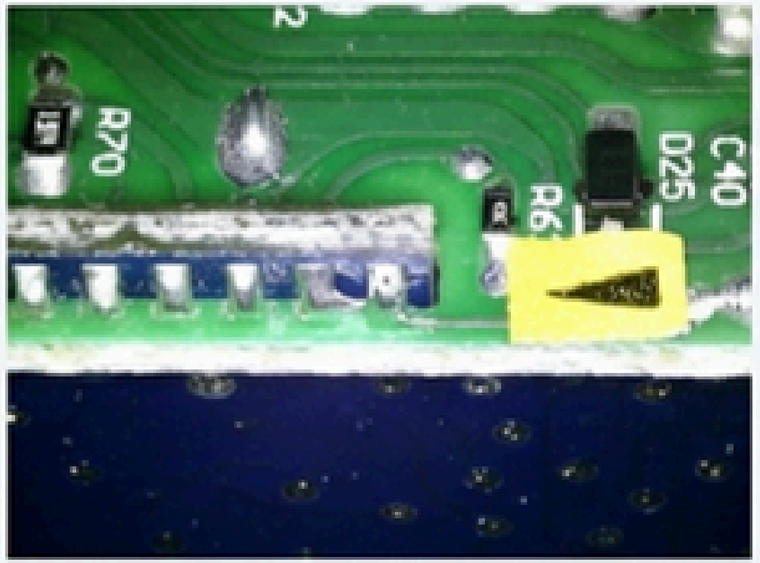
Inability to Scale

Manual inspection cannot keep pace with high-density boards or the miniaturization of components like 0201 and 01005 chips. What the eye can't see, it can't check.

The 'Escape' Catastrophe

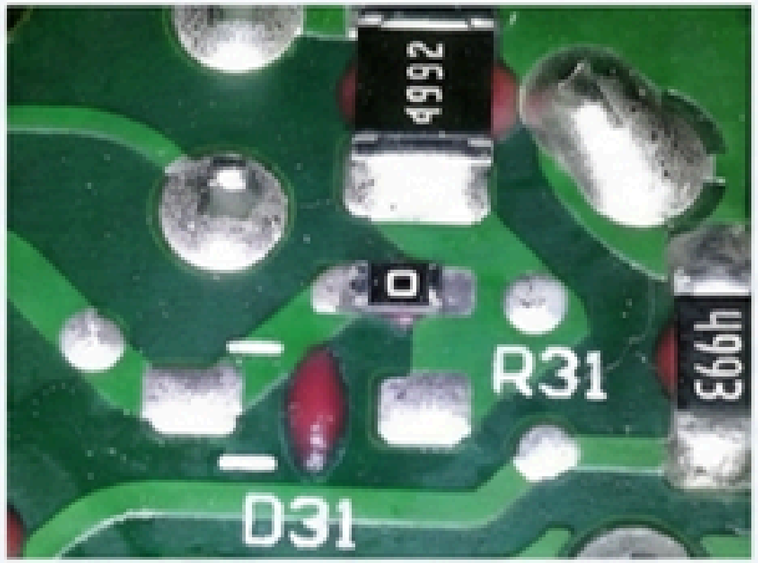
The most expensive error is the one that escapes the factory. A single missed solder bridge or missing component can lead to field failures, product recalls, and damaged client trust.

What the Human Eye Misses, Your Bottom Line Pays For.



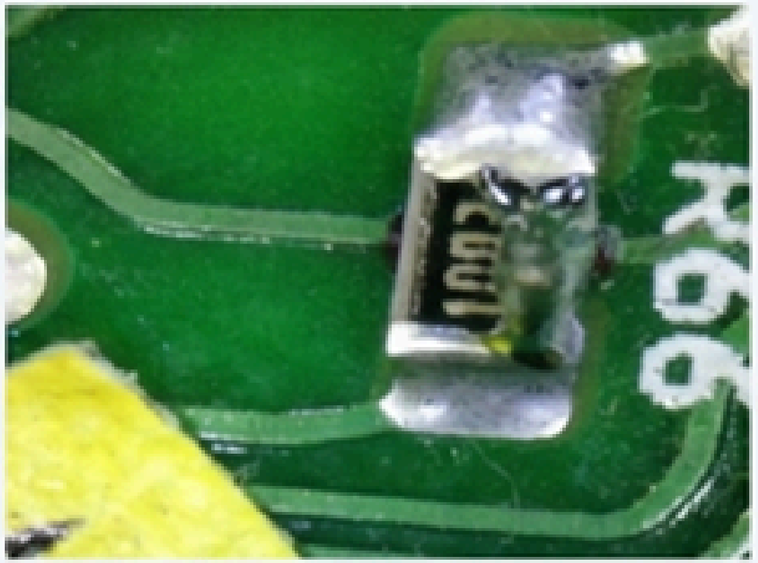
DEFECT: Solder Bridge. A tiny, almost invisible connection causing an immediate short circuit.

Impact: Board failure, potential for costly rework, or a complete scrap.



DEFECT: Missing Solder. A component that looks placed but has no electrical connection.

Impact: Intermittent or total failure, hard to diagnose after final assembly.



DEFECT: Solder Over Body. Easily missed by a fatigued inspector, leading to unpredictable shorts.

Impact: Field failures and warranty claims.

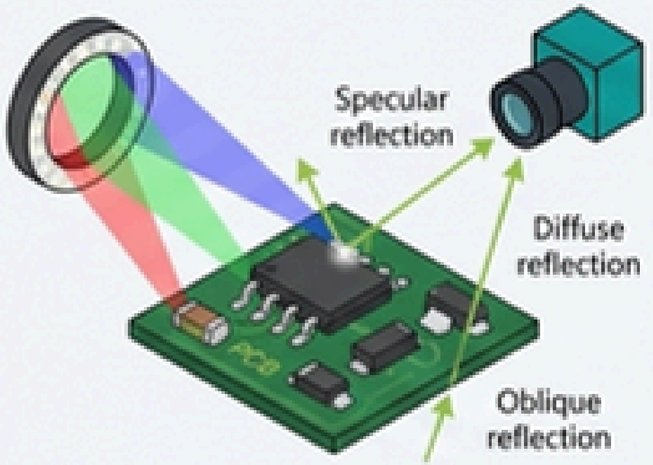
Stop Manual Inspection Errors: Automate PCB Assembly with Southern Machinery AOI

Southern Machinery Automated Optical Inspection (AOI) systems replace guesswork with certainty. Our machines work 24 hours a day, applying standardized, machine-vision precision to every single board, eliminating human error and its associated costs.

> The era of manual visual inspection is gone forever. The intelligent development of AOI technology is bound to become an inevitable development trend.

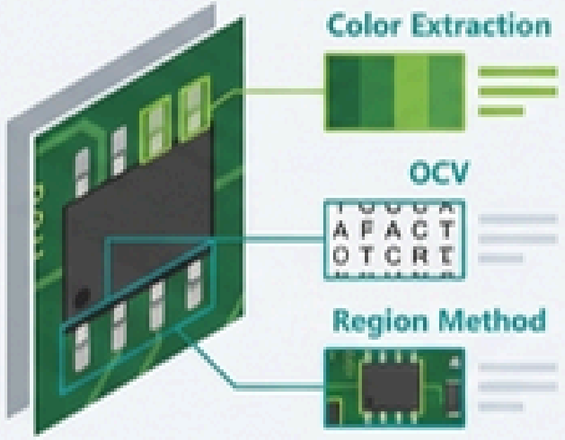
How We See Perfection: Light, Pixels, and Precision Algorithms

Capture with Advanced Optics



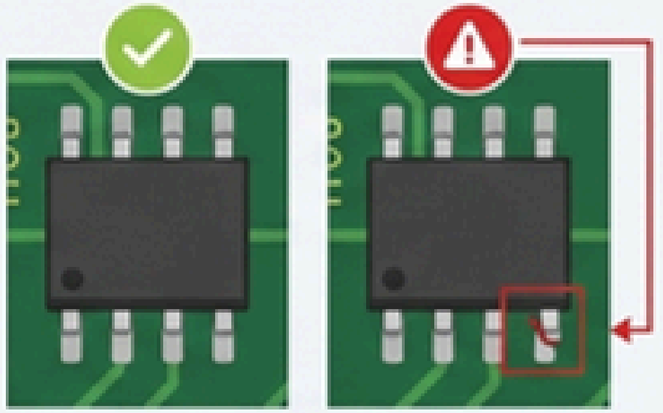
Our system uses a high-resolution, million-pixel industrial camera combined with a configurable RGB LED light source. By controlling specular, diffuse, and oblique reflection, we turn 3D component features into high-contrast 2D images.

Analyze with Intelligent Software



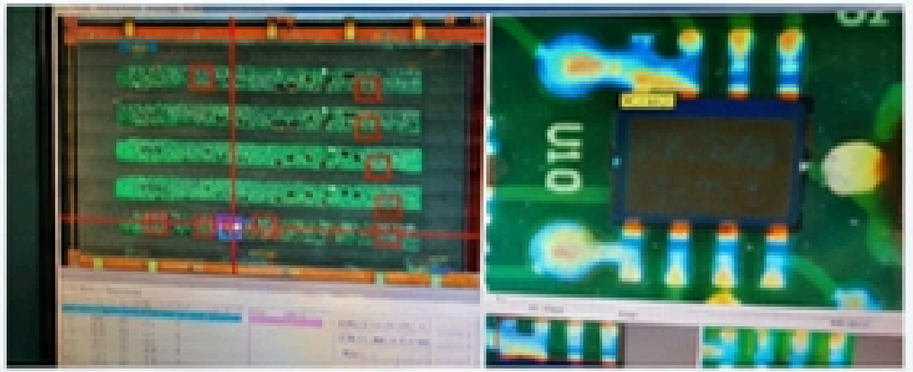
The captured digital image is processed using a suite of powerful algorithms: Color Extraction for solder joints, OCV for silkscreen text, and Region Method for component matching and positioning.

Compare and Decide



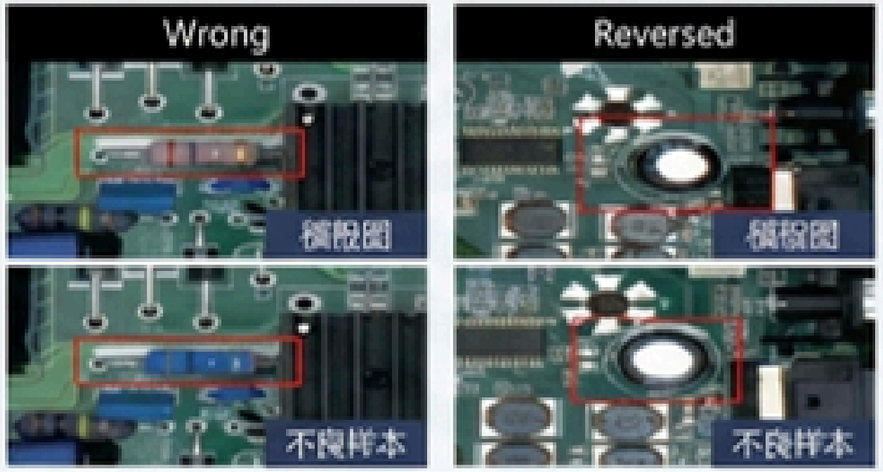
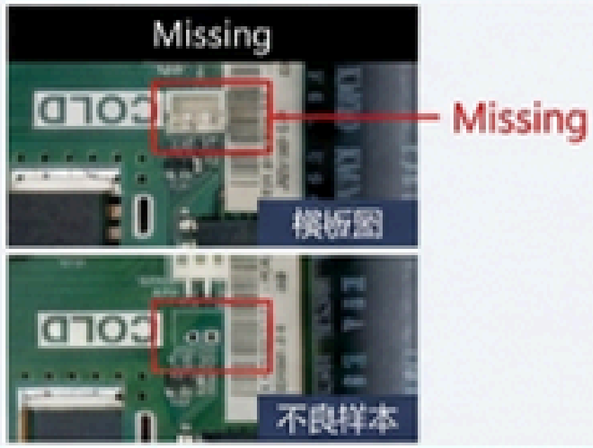
Every captured image is compared against a pre-stored "golden sample" or CAD data. Any deviation exceeding the set threshold is instantly flagged as a defect (NG), complete with its exact location on the board.

Evidence of Superiority: Finding Every Solder Defect, Every Time

Defect Type	The Southern Machinery AOI Result
Solder Bridge: Excessive solder creating an unintended electrical path.	
Solder Problem: Insufficient solder or poor wetting.	

Takeaway: Our system detects solder paste issues like presence, offset, less tin, more tin, open circuits, and contamination with machine precision.

Beyond Solder: Complete Component-Level Error Proofing

Defect Type	The Southern Machinery AOI Result
Wrong Part / Reverse: A component that is incorrect or placed backwards.	
Missing Component: A part that was not placed on the board.	

Takeaway: Comprehensive detection of parts defects: missing parts, multiple pieces, offsets, skews, tombstones, sideways, flips, wrong parts, breakage, and reverse polarity

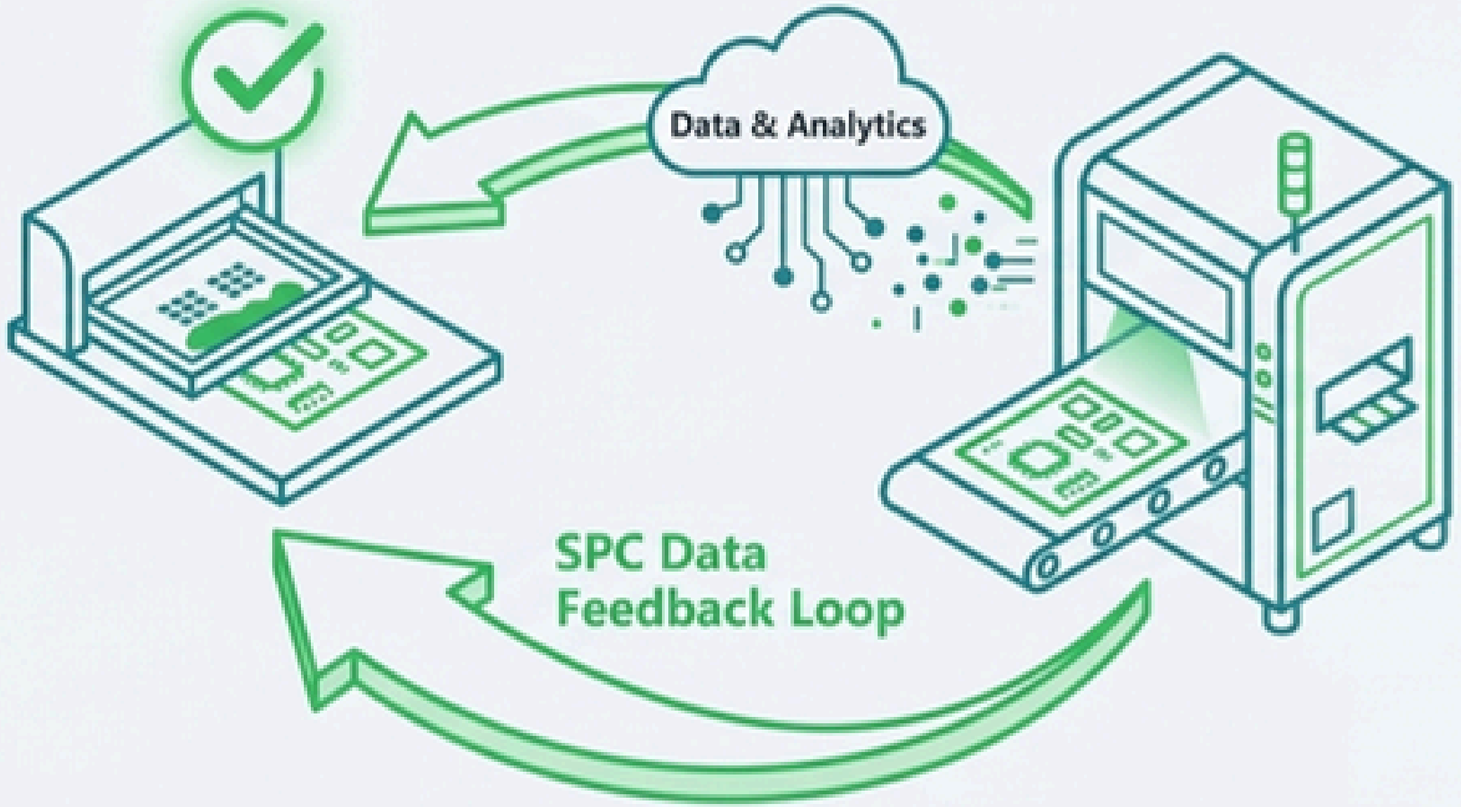
From Defect Detection to Process Optimization

A Southern Machinery AOI is more than a safety net. It's a data-driven process monitoring station that provides actionable insights to improve your entire assembly line.

SPC Statistical Function

Our integrated Statistical Process Control (SPC) records inspection data in the whole process for statistics and analysis. You can view production status and quality analysis of any area.

Imagine the AOI flags "insufficient solder" on the same component for five consecutive boards. The SPC data immediately points to a potential problem upstream at the solder paste printer, allowing you to fix the root cause before you produce an entire batch of faulty boards.



Eliminate Changeover Anxiety: From Hours to Minutes

In a high-mix environment, programming speed is critical. Our system is designed for rapid new product introduction (NPI) and frequent changeovers, minimizing downtime.

CAD Data Import

Directly import coordinate position files (Excel or text format) from your CAD data. The system automatically generates component locations, dramatically simplifying the programming process and improving speed.

Reusable Component Libraries

Create a standard for one component, add it to the library, and use the "Copy Library to same ones" function. The system automatically applies the inspection standard to all identical components across the board.

Offline Programming (OLP)

Use our convenient offline programming software (OLP) to prepare inspection programs without stopping the production line, maximizing machine uptime.

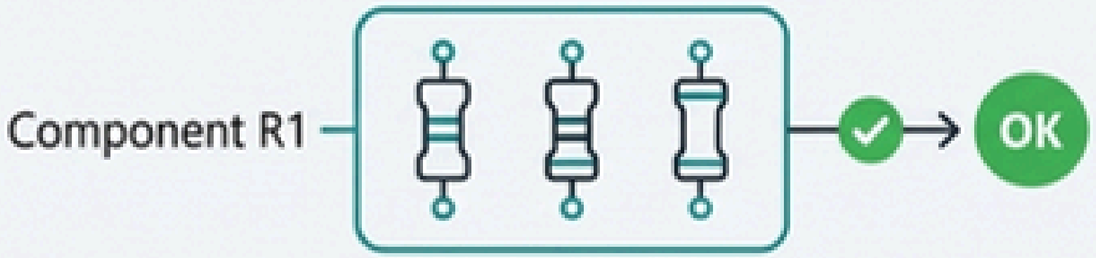
Intelligence That Reduces False Alarms

A stopped line costs money. We've engineered our software to be robust against common production variations, distinguishing true defects from acceptable deviations.

Multi-Template Matching ("Unit Group")

Problem: Slight variations in component appearance (e.g., different batches) can trigger false alarms.

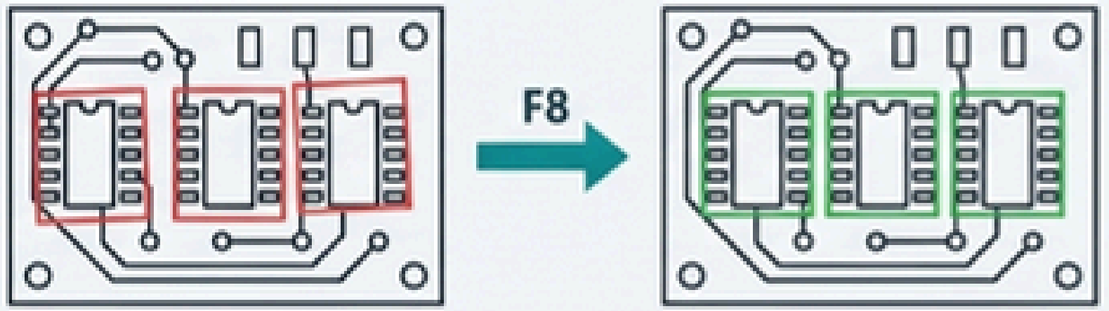
Solution: The 'Add Unit Group' function allows you to add multiple valid inspection templates for a single component. The system will pass the inspection if it matches *any* of the good templates, increasing the pass rate and stability without sacrificing accuracy.



Automatic Position Correction (F8)

Problem: Minor PCB warping or fixture shifts can cause all components to appear offset.

Solution: During debugging, a simple F8 key press automatically aligns the component inspection frames with their actual positions, correcting for global offsets in seconds and preventing mass false calls.



The Business Case: A 6-Month Return on Investment

An investment in Southern Machinery AOI is not a capital expense; it's a direct investment in profitability. Here's a conservative model for payback.

Investment

Investment

Southern Machinery AOI System: **$30,000**

Monthly Savings

Monthly Savings

Labor Replacement (3 QC Inspectors @ $800/mo) = **$2,400 / month**

Rework/Scrap Avoidance (Avg. over 6 months) = **$1,667 / month**

Total Monthly Savings: **$4,067**

Payback Period

Payback Period

$30,000 (Investment) / $4,067 (Monthly Savings)

7.4 Months

This model is conservative. It does not include the long-term value of improved quality, increased throughput, and enhanced customer

The Right Solution for Your Production Line

S-L680 On-line AOI

An on-line model embedded into your production line to automatically complete board feeding, inspection, and discharging. Ideal for high-volume, continuous production.

Seamless Integration: SMEMA communication plug for full line connectivity.

S-H680 Off-line AOI

An off-line model that requires operators to manually load boards. Excellent for high-mix, small-batch production, or inspecting large/awkward boards where flexibility is key.

Maximum Flexibility: Improves OEE in varied production scenarios.

Note: Both models share the same core inspection software and powerful algorithm suite.

Core Technical Specifications

Parameter	Specification
PCB Size	50*50mm (Min) – 400*360mm (Max)
PCB Thickness	0.3 – 5.0mm
Min. Component Size	01005 Chip, 0.3 pitch IC
Camera	5MP Full-color high-speed camera (20MP optional)
Lens Resolution	10um/15um/18um/20um adjustable
XY Drive System	AC servo motor, precision ground ball screw
XY Positioning Accuracy	≤ 8um
Programming Mode	Manual, Auto Search, CAD Data Import
Supported Defect Types	Solder Paste (presence, offset, contamination), Part Defects(missing, skew, wrong part, polarity), Solder Joint Defects (insufficient solder, bridge)

Your Partner in Manufacturing Excellence

We provide more than a machine; we deliver a partnership. Our global support infrastructure is designed to keep your production running at peak efficiency.

Global Service & Expertise

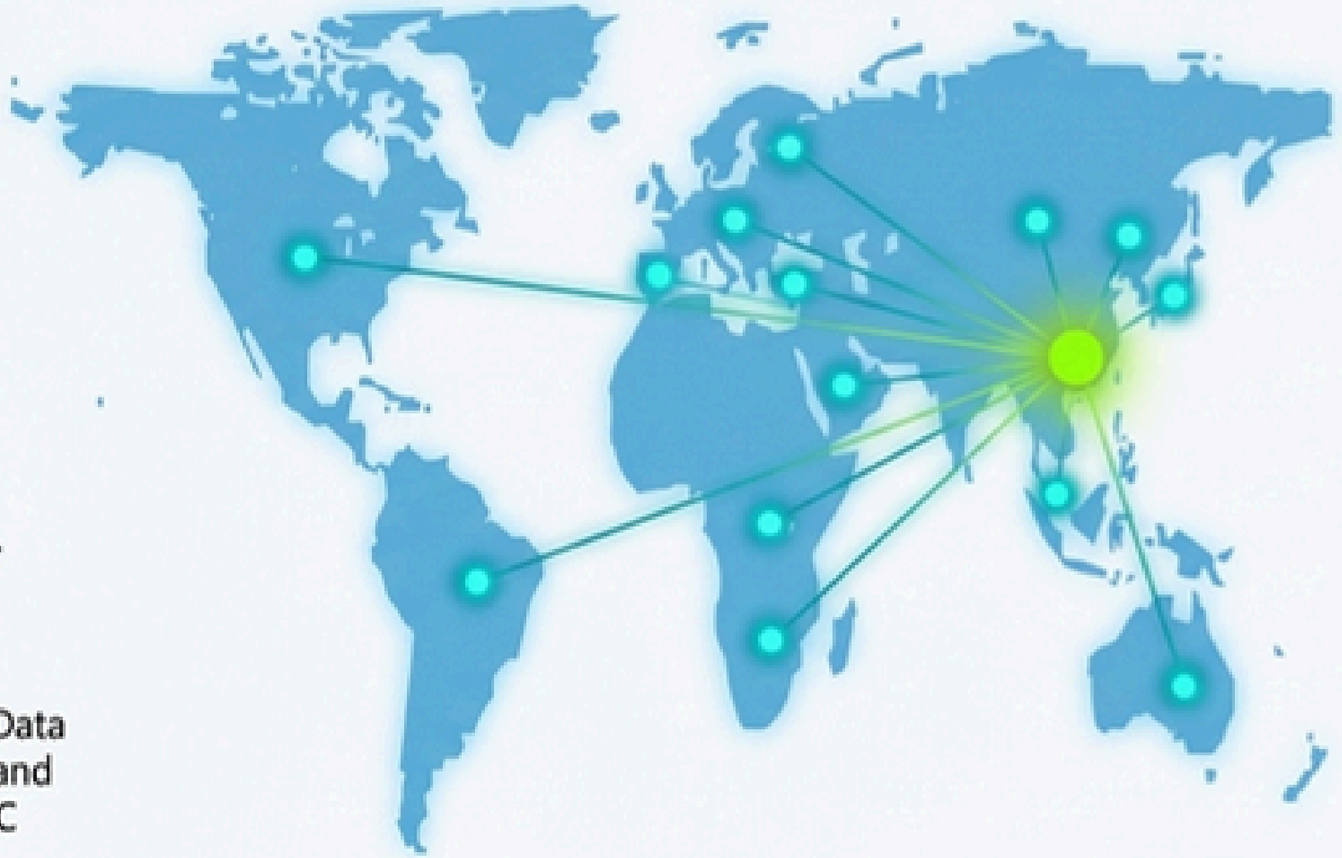
7x24 worldwide support from our Shenzhen-based team with over 10 years of proven expertise in SMT/THT automation.

Remote Diagnostics & Support

Our systems support remote programming, debugging, and management. Our engineers can quickly respond to and resolve issues without an on-site visit, minimizing downtime.

Centralized Management

Configure a 'one-to-many' judgment station. Data from multiple AOI machines can be reviewed and confirmed at a single workstation, reducing QC labor needs by 2-3 people.



See the Proof on Your Own Boards

The best way to understand the power of Southern Machinery AOI is to see it in action on your most challenging products.

Free Sample Inspection & Report

Step 1: Send us one of your assembled PCBs.

Step 2: We will run it through our AOI system and provide you with a comprehensive NG/OK report, detailing every defect our machine finds.

Step 3: See for yourself what you might be missing.

SOUTHERN MACHINERY

info@smthelp.com

www.SMThelp.com