DAOAI

AI AOI for PCBA
5 Mins AI Programming

Multi–Dimensional AI Detection
Complete Defect Coverage

AI Programming

No CAD files or component libraries required.

Automatic inspection **threshold generation**.

Iterative AI Reduce False Calls

Single golden board for model training.

Feedback loop continuously reduce false call rate.

Ultra–Low Missed Detection Rate

Solves **same–color component** detection challenges.

SOD/LED polarity detection
a historically difficult challenge solved.

Pain Points of Traditional AOI

Manufacturing industries suffer from efficiency losses caused by traditional AOI every day. These problems not only slow down production lines, but also directly affect the competitiveness of enterprises.

Lengthy Changeover Time

Manually drawing inspection boxes/regions and parameter configuration are time-consuming. Switching products takes 3–5 hours and relies on CAD files or component libraries.

Data Silo

Systems operate in isolation with no data interoperability. Management cannot obtain meaningful quality insights.
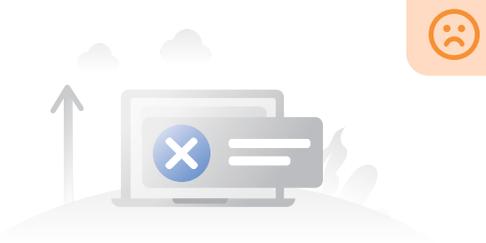
High Dependency on Key Personnel

Heavy reliance on experienced engineers. Personnel are difficult to replace. When employees leave, production lines face immediate shutdown risk.

High Training Costs

Operators require lengthy training. High staff turnover forces continuous investment in retraining resources.

Persistently High False Positive Rate

Excessive false calls consume large amounts of labor for manual re-inspection. Line stoppage costs severely compress profit margins.

Massive Losses from Line Stoppages

Each changeover period stoppage directly results in capacity loss, unsustainable in a highly competitive environment.

Factory Exclusive Visual AI

DaoAI AI AOI for PCBA is not a generic AI. It is a dedicated visual AI trained specifically for your processes.

Full-Stack AI Capability

Single-sample anomaly detection, MARK recognition, component alignment, automatic panel detection, automatic parameter calculation, DIP classification, and OCR — all AI-powered.

Data Never Leaves the Factory

Fully on-premise deployment ensures data security. Core process know-how stays within your facility at all times.

Smarter with Every Use

Continuously learns from operator feedback. The AI model keeps improving, with accuracy increasing over time.

No AOI Programming Engineer Required

Operators manage the entire training workflow independently, lowering the skills threshold and increasing organizational agility.

DaoAI AOI PCBA provides an intuitive and user-friendly interface.
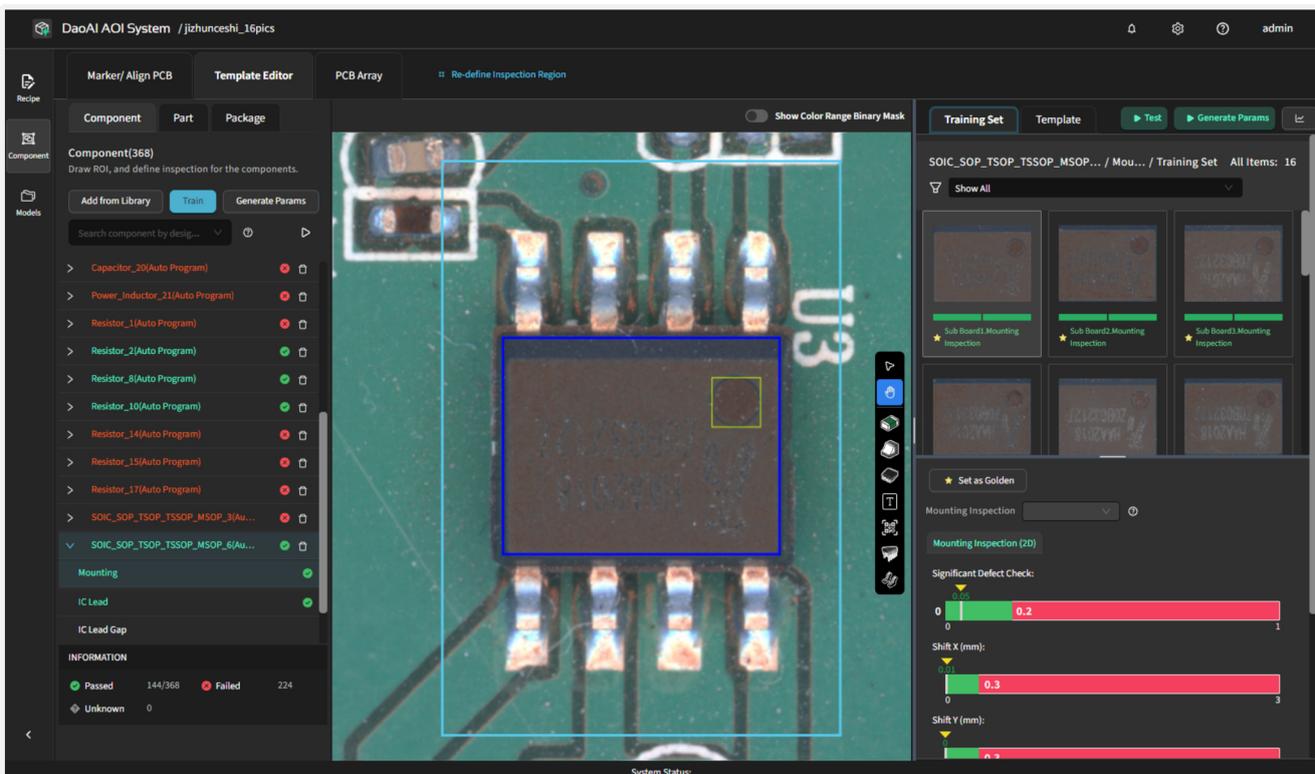
4 Steps to Complete PCBA Programming

🛡 **Key Advantage:** Only a single Golden Board is required to get started — the lowest possible onboarding barrier. Factories of any size can be up and running quickly.

5min

Programming Time
Traditional AOI
requires 3—5 hours

AI Auto–Component Detection & Threshold Generation

No manual region drawing or threshold configuration. AI automatically identifies all components on the PCB, generates inspection regions, and calculates optimized parameters from the Golden Board, significantly reducing programming time.

Intelligent Panel Recognition

Supports automatic panel (array board) recognition — including mirrored panels. One–click alignment and automatic top/bottom side switching, improving programming efficiency.

DAOAI

BUILD A PCBA INSPECTION MODEL WITH AI

Smart Auto-Framing + Auto Parameter Generation
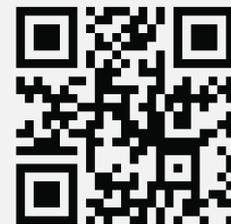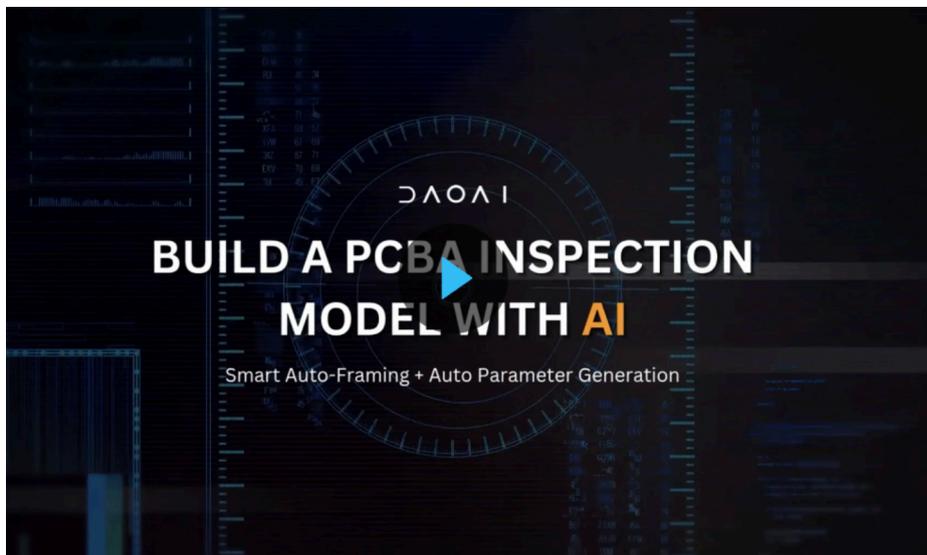
Scan the QR code to watch the video.

Step 1 → **Step 2** → **Step 3** → **Step 4**

Capture the Golden Board

Capture components on the golden good PCB to establish a reference. No CAD files required.

AI Auto–Modeling

AI automatically generates inspection regions, computes parameters, and identifies panel layout.

Review Results

Operator conducts training, evaluation and refines programming.

Feedback & Optimization

Operator launches inspection, reviews false positive components, and provides feedback. AI automatically updates parameters to

Overcoming Difficult Challenges
Multi–Dimensional AI Detection

❯ AI Component Alignment

Component surface contamination can degrade alignment accuracy, causing false positive. DaoAI uses AI algorithms for precise localization of contaminated components.

❯ Same–Color Component Detection

When component body color matches PCB laminate, RGB color-based algorithms fail completely. DaoAI extracts multi–dimensional feature embeddings beyond RGB– reliably detecting components regardless of component color match.

❯ DIP Solder Joint Classification (AI–Based)

DIP accept/reject criteria vary across customers, board types, and etcs. Conventional correlation algorithms can not accommodate this variability. DaoAI trains a local AI classifier to your accept criteria — fast to deploy , high accuracy, no vendor dependency.

❯ Black Inductor & Crystal Oscillator–Character Interference Mitigation

Chip inductors and crystal oscillators are notorious false–positive generators due to dense surface markings resembling defects. DaoAI's multi–feature AI discriminator separates marking signatures from true defect signals — eliminating the root cause of false positives for both component types without rule–writing.

Productivity Features

- Program components by part number and package type; synchronize parameter updates across all instances
- AI–optimized imaging path planning – minimizes cycle time per board
- One–click alignment of panel inspection regions – no manual adjustment required
- Automatic panel recognition: supports irregular, mirrored, and top/bottom combined panels
- Automatic top/bottom side switching for double–sided inspection
- Auto–generated solder bridge (short circuit) detection regions
- Integrated bad–board rejection – automated, zero manual intervention

Traditional AOI VS. DaoAI AI AOI

| Evaluation Criteria	Traditional AOI	Generic AI AOI	DaoAI AI AOI
Training Methodology	Manual rule–based programming	General pre–trained model, not customized	Trained specifically on your golden boards
Programming Time	3-5 hours per board	Depends on AI engineer config	Operator completes in 5 minutes
Data Security	N/A	Risk of IP exposure via cloud	Fully on–premise —data never leaves factory
Optimization	Fixed algorithms, no auto–iteration	Improvements require vendor involvement	Continuously learns from operator feedback
False Call Rate	High false call rate; escape defects present	Limited adaptability to specific processes	Reduced by 80%; accuracy improves over time

Core Business Value

DaoAI AI AOI is a measurable ROI driver — not just a technology refresh. It directly improves throughput, labor efficiency, first–pass yield, and time–to–market.

Changeover Efficiency

Programming time reduced from 3—5 hours to just 5 minutes, dramatically minimizing line stoppage wait time and significantly improving capacity utilization.

Labor Cost Savings

No AI engineer required. Operators are inspection–ready in 30 minutes. Saves approximately USD 15,000—40,000 per person annually (re–inspection labor + line stoppage costs).

Yield Improvement

80% reduction in false calls, fewer unnecessary reworks, increased through–put, and direct improvement in product quality and customer satisfaction.

Rapid Deployment

Only a single Golden Board is needed to start. Minimal onboarding requirements — deployment and production launch possible on the same day.

Impact at a Glance — KPIs

From programming efficiency to quality improvement, DaoAI AI AOI delivers quantifiable and significant enhancements across all key metrics.

97%
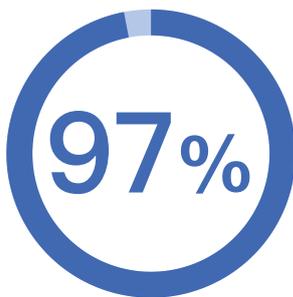
**Reduction in
Programming Time**

Live on the production line immediately; instant go–live, 5–minute changeover.

80%

**Reduction in
False Call Rate**

AI–driven judgment reduces unnecessary manual re–inspection.
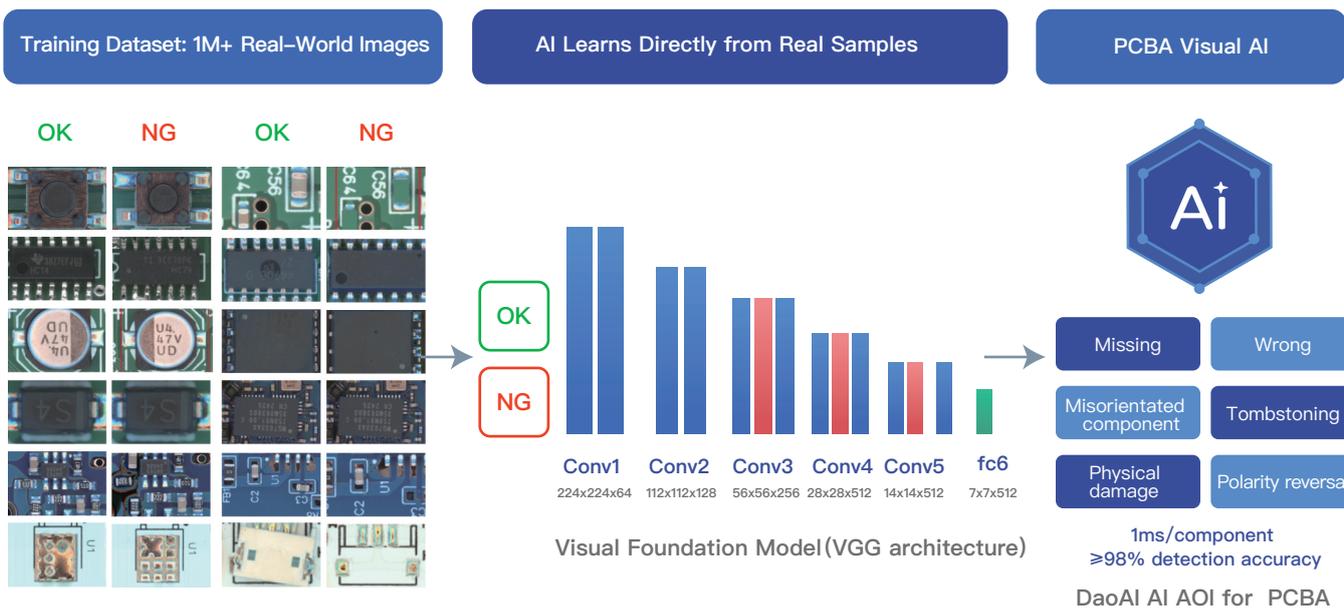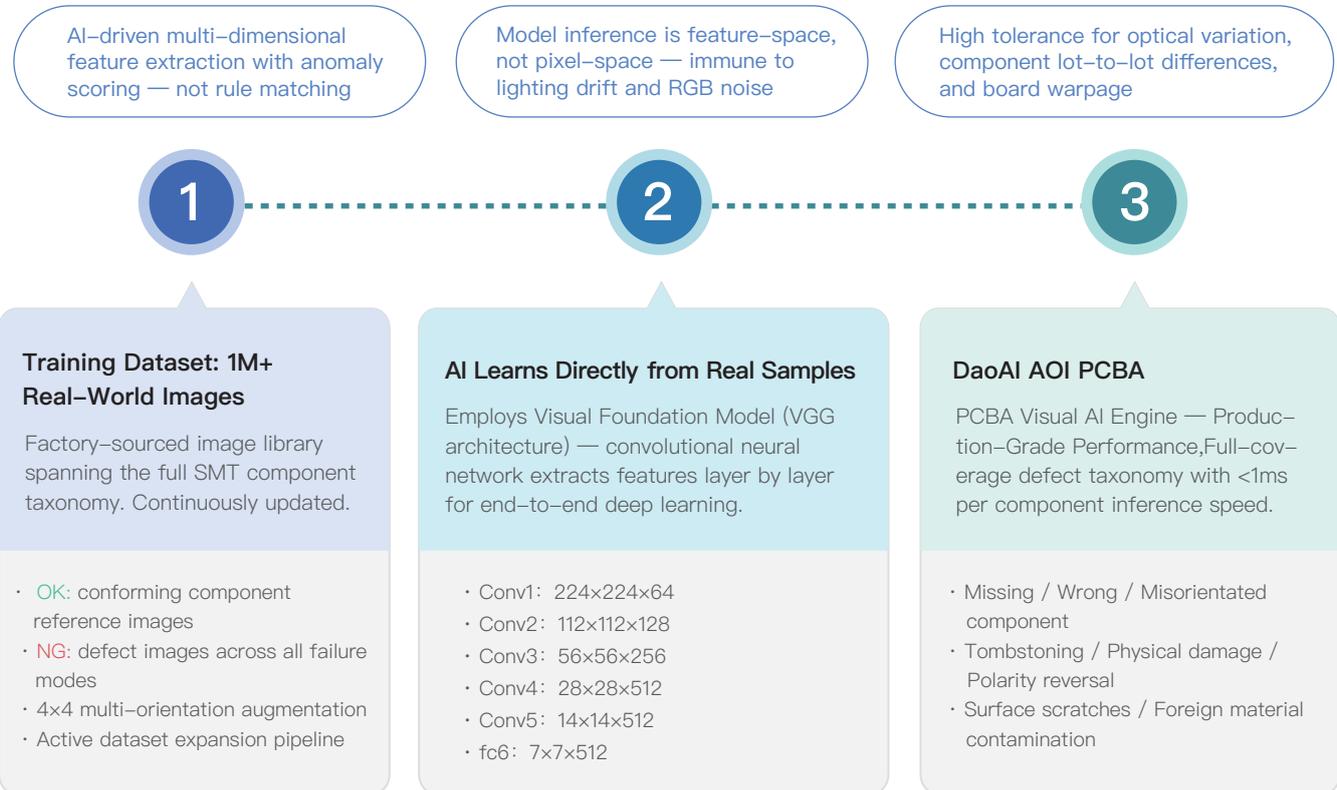
60%
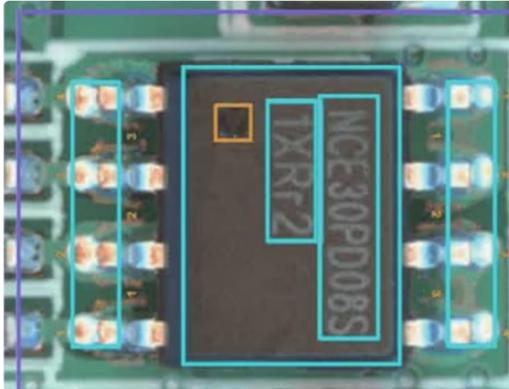
**Reduction in Overall
Operating Costs**

Reduces dependency on specialized labor, shortens line stoppage time, and lowers rework losses from escaped defects — delivering significant combined operational savings.

Technical Features

Built on an industry-leading visual foundation model and trained on large-scale real-world SMT production data. Industrial-grade accuracy from day one.

AI-driven multi-dimensional feature extraction with anomaly scoring — not rule matching

Model inference is feature-space, not pixel-space — immune to lighting drift and RGB noise

High tolerance for optical variation, component lot-to-lot differences, and board warpage

1　　　　　**2**　　　　　**3**

Training Dataset: 1M+ Real-World Images

Factory-sourced image library spanning the full SMT component taxonomy. Continuously updated.

- OK: conforming component reference images
- NG: defect images across all failure modes
- 4×4 multi-orientation augmentation
- Active dataset expansion pipeline

AI Learns Directly from Real Samples

Employs Visual Foundation Model (VGG architecture) — convolutional neural network extracts features layer by layer for end-to-end deep learning.

- Conv1：224×224×64
- Conv2：112×112×128
- Conv3：56×56×256
- Conv4：28×28×512
- Conv5：14×14×512
- fc6：7×7×512

DaoAI AOI PCBA

PCBA Visual AI Engine — Production-Grade Performance,Full-coverage defect taxonomy with <1ms per component inference speed.

- Missing / Wrong / Misorientated component
- Tombstoning / Physical damage / Polarity reversal
- Surface scratches / Foreign material contamination

Training Dataset: 1M+ Real-World Images　　**AI Learns Directly from Real Samples**　　**PCBA Visual AI**

OK　NG　OK　NG

OK　NG

Conv1　Conv2　Conv3　Conv4　Conv5　fc6
224x224x64　112x112x128　56x56x256　28x28x512　14x14x512　7x7x512

Visual Foundation Model（VGG architecture）

Missing　Wrong
Misorientated component　Tombstoning
Physical damage　Polarity reversal

1ms/component
≥98% detection accuracy

DaoAI AI AOI for PCBA

Technical Features

✅ One-Frame Multi-Defect Detection

A single inspection region simultaneously detects:

Missing, Wrong, Reversed, Damage, Tombstoning.

Processing Speed:
CPU/GPU parallel processing,
1ms/component | 45 cm²/s throughput

Features and Anomaly Scores
AI Automatic Feature Extraction

Rapid Detection
1ms/component,One-Frame Multi-Defect Detection

Base Model
Real PCBA Samples
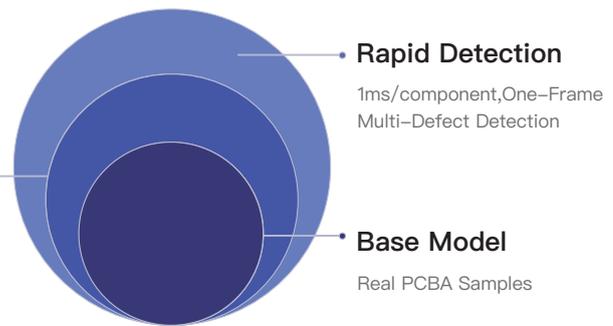
Integration & Extensibility

DaoAI AI AOI is not an isolated inspection system, but an intelligent platform that can be deeply integrated into your existing manufacturing ecosystem, enabling data interoperability and comprehensive quality control.

MES Integration

MES connectivity via open API. Real-time defect data push enables full digital traceability, closed-loop quality control, and compliance-ready audit trails.

SPC Statistical Analysis

Built-in Statistical Process Control module automatically generates quality trend reports, helping management make data-driven decisions.

Remote Access Support

Log in via browser anytime to remotely view inspection status, access reports and exception records — no on-site presence required. Enables flexible multi-site management.

Offline Programming

Supports offline pre-programming — train and prepare new product models without disrupting ongoing production.

🛡 **Open API Architecture:** RESTful API design supports plug-and-play integration with MES platform. Protects existing IT investments and eliminates vendor lock-in.

2D AOI Equipment for PCBA

P1

Offline 2D PCBA AOI

Target Application: : Standard Offline Inspection

Best fit: High–mix / low–volume (HMLV) shops, contract manufacturers, and facilities transitioning from manual visual inspection or legacy AOI. Rapid deployment with zero CAD dependency.

P2

High–Precision Offline 2D PCBA AOI

Target Application: 12MP / 10µm optical system.

Best fit: Advanced packaging (QFN, BGA, CSP), fine–pitch assemblies, medical, aerospace, and defense applications where standard resolution is insufficient.

✓ The DaoAI P–Series AOI equipment covers both offline and inline applications, meeting the needs of manufacturing environments at different scales and precision requirements.

P3

Inline 2D PCBA AOI

Target Application: Single–lane automated production line

Seamlessly integrates into existing SMT lines with single–lane automated conveyor support, enabling true inline real–time inspection.

P3D

Dual–Track Inline 2D PCBA AOI
Target Application: High–throughput production line

Dual–lane design maximizes production throughput. Purpose–built for high–volume mass production — the preferred choice for high–capacity factories.

The 3D version will be released soon. Please stay tuned.

DaoAI P1/P2

Offline 2D PCBA AOI

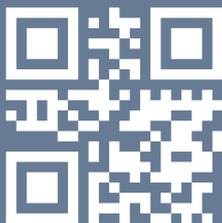| Category / Specification		P1	P2
Vision System	Camera	5MP	12MP
	Resolution	15µm	10µm
	Lighting	Multi–spectral ultra–high–speed RGB6–channel light source	
	Lens	Dual telecentric optical lens	
	Speed	0.238 sec/FOV	
Board & Rail	PCB Size	0.5×50mm – 470×330mm	
	PCB Thickness	0.5mm – 5mm	
	Max PCB Bow	Top: 25mm / Bottom: 110mm	
	In–Process Tol.	±3mm	
	Max Thickness	2.5mm	
Hardware	Repeatability	+/–0.01mm	
	Stage Speed	900mm/s	
	PCB Clamping	Auto–clamp	
	GPU	NVIDIA GeForce RTX 3060	
	Dimensions	860×1040×1318mm (W×D×H)	
Inspection Capability	Component	Missing, Reversed, Offset, Polarity, Wrong, Damage, Bent lead, Foreign objects, Gold finger solder contamination, Adhesive overflow.	
	Solder	Excess/Insufficient solder, Billboarding, Solder bridge, Tombstoning, Cold joint, Lifted lead, Solder ball, Wave solder joint (incl. through–hole)	
Other Features	Programming	AI intelligent programming; CAD coordinate import; auto component library indexing; intelligent panel recognition.	
	HMI	Voice command control	
	Reporting	Auto–generated SPC statistical analysis and data reports	
	Optional	Offline programming, remote real–time debugging, remote viewing.	

DaoAI P3/P3D

Inline 2D PCBA AOI

Category / Specification		P3	P3D
Board & Rail	Conveyor Lanes	Dual Conveyor	Dual Conveyor
	Rail Height	900±25mm	
	PCB Size	50×50mm – 500×325mm (custom larger sizes available)	
	PCB Thickness	0.3mm – 6mm	
	Clearance	Top ≤ 30mm Bottom ≤ 20mm	
	Min Component	0201; IC pitch ≥0.3mm (01005 optional)	
	Board Weight	≤3KG	
Vision System	Camera	20MP high-speed industrial camera (optional)	
	Resolution	10μm (optional)	
	Lighting	High-brightness RGB coaxial ring multi-angle LED	
	Lens	20MP-class telecentric optical lens	
	Depth of Field	8–10mm	
Hardware	PCB Direction	Left-to-Right / Right-to-Left	
	PCB Clamping	Auto open/close dual-edge clamp	
	Computer	Intel Core i7 CPU / 64GB RAM / 512GB SSD / 1TB HDD	
	GPU	NVIDIA GeForce RTX 4060 Ti	
	Dimensions	900×950×1600mm (W×D×H)	
Inspection Capability	Component	Missing, Reversed, Offset, Polarity, Wrong, Damage, Bent lead, Foreign objects, Gold finger solder contamination, Adhesive overflow.	
	Solder	AI intelligent programming; CAD coordinate import; auto component library indexing; intelligent panel recognition	
Other Features	Programming	Excess/Insufficient solder, Billboarding, Solder bridge, Tombstoning, Cold joint, Lifted lead, Solder ball, Wave solder joint (incl. through-hole)	
	Reporting	Auto-generated SPC statistical analysis and data reports	
	Optional	Offline programming, remote debugging, remote viewing, external barcode scanner	

DAOAI

Driving AOI Efficiency and Excellence through AI.

DaoAI Robotics Inc.

Precision Detection. Actionable Insights.

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