saki
The Future in Focus

3D Solder Paste Inspection Machine (3D SPI)

3Si Series

SAKI's 3D SPI Series is designed
for the Smart Factory Connection

Global Network

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saki Saki Corporation

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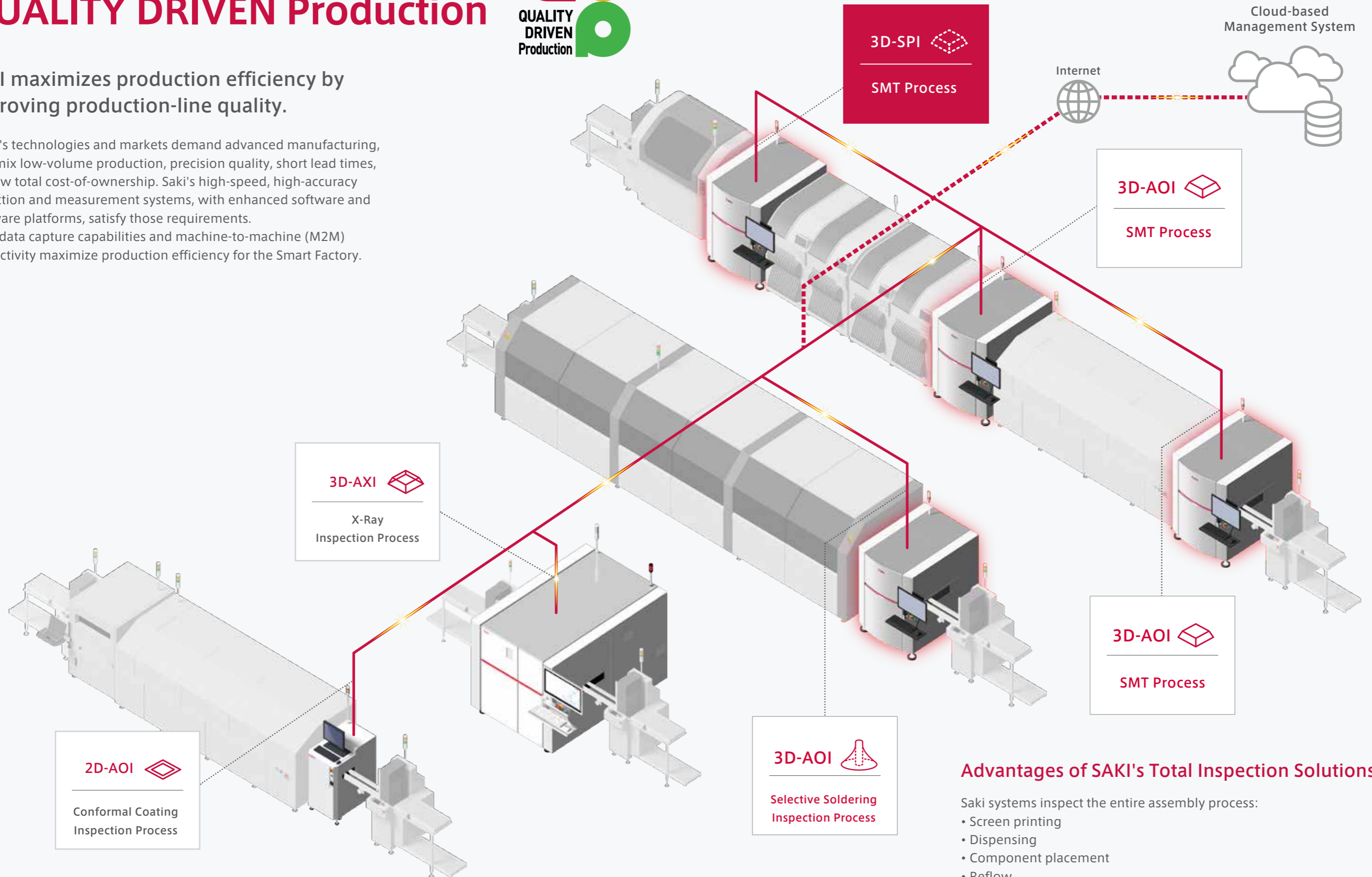TEL: +81-3-6632-7910 FAX: +81-3-6632-7915

Global Network
https://www.sakicorp.com/en/

Saki's Total Smart Factory Inspection Solution

QUALITY DRIVEN Production

QUALITY DRIVEN Production

SAKI maximizes production efficiency by improving production-line quality.

Today's technologies and markets demand advanced manufacturing, high-mix low-volume production, precision quality, short lead times, and low total cost-of-ownership. Saki's high-speed, high-accuracy inspection and measurement systems, with enhanced software and hardware platforms, satisfy those requirements.
Saki's data capture capabilities and machine-to-machine (M2M) connectivity maximize production efficiency for the Smart Factory.

Cloud-based
Management System

Internet

3D-SPI

SMT Process

3D-AOI

SMT Process

3D-AXI

X-Ray
Inspection Process

3D-AOI

SMT Process

2D-AOI

Conformal Coating
Inspection Process

3D-AOI

Selective Soldering
Inspection Process

Advantages of SAKI's Total Inspection Solutions

Saki systems inspect the entire assembly process:
• Screen printing
• Dispensing
• Component placement
• Reflow
• Selective soldering
• Conformal coating

※ SPI: Solder Paste Inspection   AOI: Automated Optical Inspection

QUALITY DRIVEN Production

Quality First

QUALITY DRIVEN Production

SAKI's 3D-SPI systems enable increased production efficiency of the entire line with remarkable speed, as well as increased product and performance quality and takt-time control.

Benefits provided with Saki's 3D-SPI series

Improve production quality

Improve production efficiency

Improve profits

Costs

Productivity

Profits
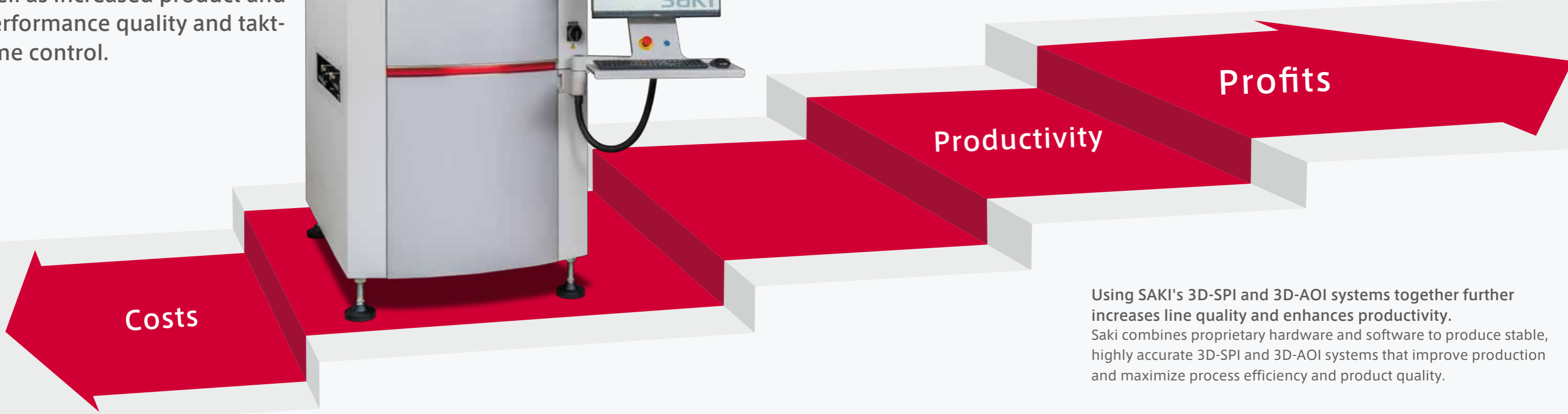
Using SAKI's 3D-SPI and 3D-AOI systems together further increases line quality and enhances productivity.
Saki combines proprietary hardware and software to produce stable, highly accurate 3D-SPI and 3D-AOI systems that improve production and maximize process efficiency and product quality.

Key Factor 1	Advanced Hardware Features

Machine Stability and Accuracy
- Same rigid gantry structure as Saki's 3D-AOI
- Self-diagnostic functions
- Rigid gantry structure and dual motor-drive system
- High resolution linear scale for accurate positioning

SPI   AOI

Speed
- Increased conveyor speed
- CoaXPress camera for faster inspection & measurement process

Flexible Configurations for Diverse Requirements
- Simultaneous 2D and 3D inspection of the entire board
- Scalable optical resolutions of 7µm, 12µm, and 18µm
- Flexible gantry for M/L/XL PCBA sizes and dual lanes

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Key Factor 2	Advanced Software Features

Programming
- One common platform supports 3D-SPI, 3D-AOI, and 3D-AXI
- Saki Self-Programming (SSP) Software

SPI   AOI

Speed
- Newly developed high-speed mode increases measurement and inspection speed by about 190%

Measurement and Inspection/SPC Function
- Warpage adjustment
- Coplanarity inspection
- SPC function

Verification
- History Management System for data logging and history
- Golden & Silver Sample Check Function for process verification

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Key Factor 3	Applied Technology

Machine-to-Machine Systems
- Feed-back from SPI to Printer
- Feed-forward from SPI to Pick-and-Place
- Feed-back from AOI to Pick-and-Place

SPI   AOI

Stand-alone Systems
- RMS remotely manages multiple BF2-Monitors with one PC
- MPV lets operators see every inspection result in real time
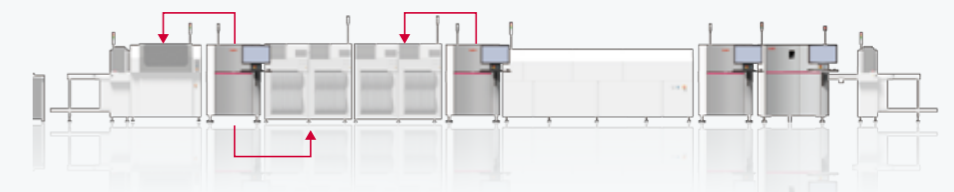
SAKI Technology for M2M Communication

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The Future in Focus

Key Factor 1 — Advanced Hardware Features

Proprietary hardware provides faster measurement and inspection and accurate measurements

- Saki's machines are built with hardware that's made to last.
- A closed-loop, dual servo motor-drive system, high-resolution linear scale, and rigid gantry structure provide unsurpassed accuracy and repeatability for absolute measurements.
- An optimized conveyor system, driven by step motors, enables fast PCBA loading and unloading.
- Both the 3D-AOI and 3D-SPI systems have the same rigid gantry structure that offers high accuracy.

Self-diagnostic System

Saki's predictive and preventive maintenance management system assures stable machine conditions and repeatable, consistent performance. Every key component is monitored along with system conditions, and a detailed diagnostic log is recorded. The optimized preventive maintenance plan reduces maintenance time, machine down-time, manpower, and costs.

QUALITY DRIVEN Production

Time Based Maintenance

Condition Based Maintenance
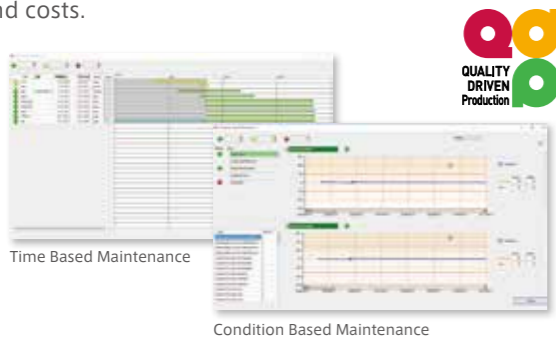
Simultaneous 2D and 3D inspections over the entire board
- 3D-SPI uses both 2D and 3D images for inspection.

Optical Unit

- Three camera resolution levels —7 μm, 12 μm, 18 μm— are available to match application requirements.
- Multi-frequency digital projectors (12um & 18um-Two, 7um-Four) provide accurate 3D measurements for high-quality images and quantitatively detect solder printing failures.
- Enhanced 2D and 3D calibration uses multiple calibration height targets for positive and negative heights to guarantee height measurement accuracy.
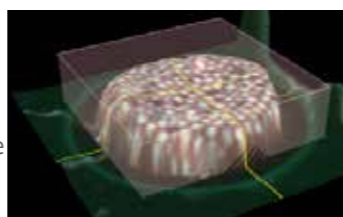
Remarkable Speed

Equipped with newly developed technologies and features

- Both 3D-AOI and 3D-SPI have optimized conveyor systems, driven by step motors, in similar enclosures, enabling fast PCBA loading and unloading.
- The CoaXPress camera enables faster inspection.
- A newly developed high-speed mode and unique imaging system increase measurement and inspection speed by about 190% compared to previous machines.
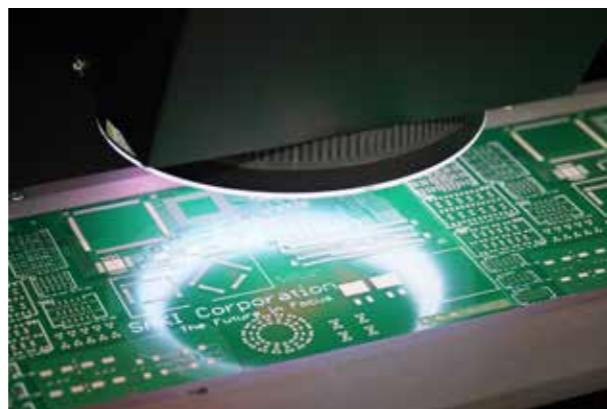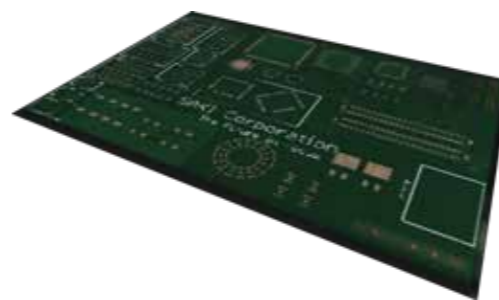

Key Factor 2 — Advanced Software Features

Programming

Reduces set-up time,contributing to increased productivity

- Special BF2 software has a common user-interface for Saki's 3D SPI, AOI, and AXI systems.
- The software saves a complete 3D image of the whole PCBA, so the operator can create inspection data without using the physical board.

Creating programming data faster
- Saki Self-Programming (SSP) Software

Saki's Self-Programming Function was developed on the concepts of Board less, Skill less, and Stress less. Inspection data can be easily created by using various PCB design data in addition to Gerber data and CAD data.

Gerber
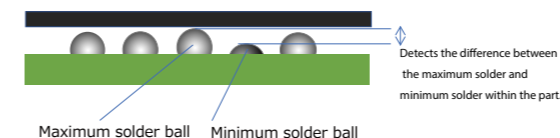Gerber
CAD XY
ECAD Design
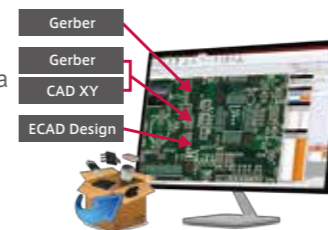
Measurement and Inspection

Saki's unique Warpage Adjustment provides stable inspection for boards with large warpage such as flexible printed circuits.
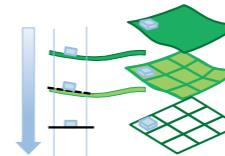
Coplanarity inspection
In addition to inspecting each solder desposit, we inspect the relative variations in the BGA to increase the quality of small and fine-pitch components.

Maximum solder ball   Minimum solder ball

Detects the difference between the maximum solder and minimum solder within the part.

SPC Function

All Charts View

Trend View
Trend View Monitors inspection results during automatic operation and calculates sample values in real time. Through this function, the printed solder paste quality can be maintained and controlled for each board.
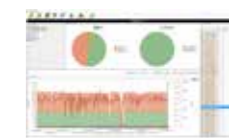
Defect Analysis

Past Board View
This function saves inspection results and measured values for one week. It enables you to search previously inspected boards from the saved data, sort them by placement data, reference, and component type, and primarily check the inspection results, measured values, failure types, and images of failures.

Yield Chart

Inspection Data Verification

History Management System
The History Management System records the detailed data modification system in detail (who, what, when, where, why, and how)
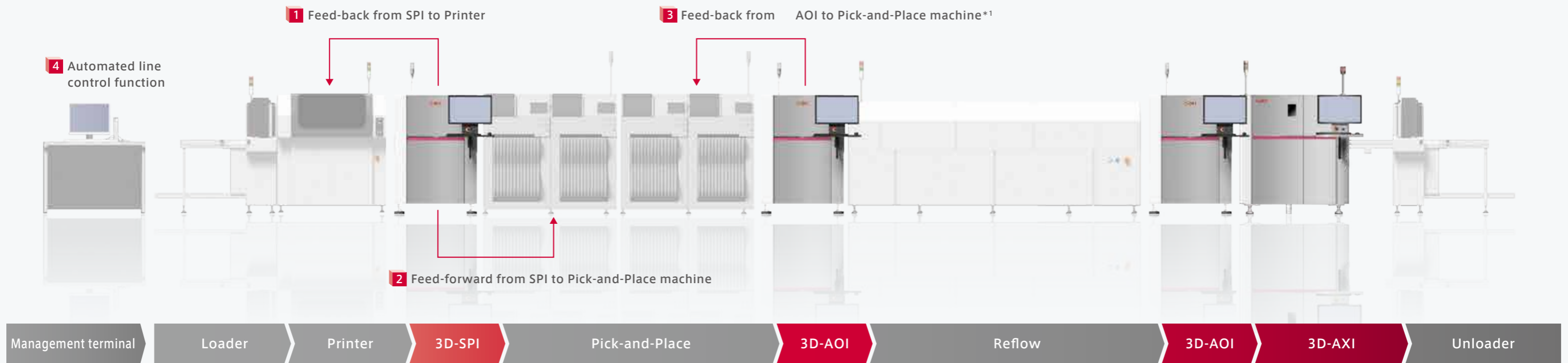
Golden & Silver Sample Check Function
Maintains inspection accuracy by checking machine status and inspection conditions before starting auto operation.

QUALITY DRIVEN Production

Saki's QUALITY DRIVEN Production Solution

1 Feed-back from SPI to Printer

3 Feed-back from AOI to Pick-and-Place machine*¹

4 Automated line control function

2 Feed-forward from SPI to Pick-and-Place machine

| Management terminal	Loader	Printer	3D-SPI	Pick-and-Place	3D-AOI	Reflow	3D-AOI	3D-AXI	Unloader

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Key Factor 3 **Applied Technology**

M2M Solution

1 **Feed-back from SPI to Screen Printer.**

Feeds back misalignment data and prevents print errors by automatically alerting the user when the stencil needs cleaning.

Correction of the print position

Automatic cleaning instructions
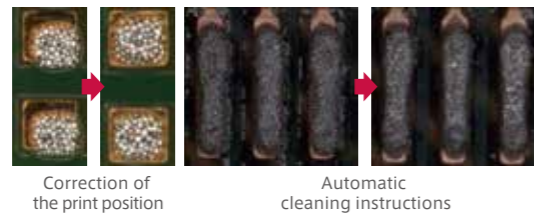
2 **Feed-forward from SPI to Pick-and-Place machine**

Measures the degree the printing position shifts to correct placement positioning. A NG board skip function improves efficiency, quality, and cost.

NG board skip

3 **Feed-back from AOI to Pick-and-Place machine**

Feeds back placement position and location data from AOI to pick-and-place and feeds forward data from SPI to improve quality and efficiency.
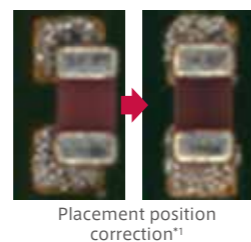
*1 factory installed option

Placement position correction*¹

4 **Automated line control function**

Automates control of the assembly line to reduce rework and waste and increase throughput.

※**1**～**4** Saki partners with the leading PCB equipment manufacturers. Ask us which products we connect with.
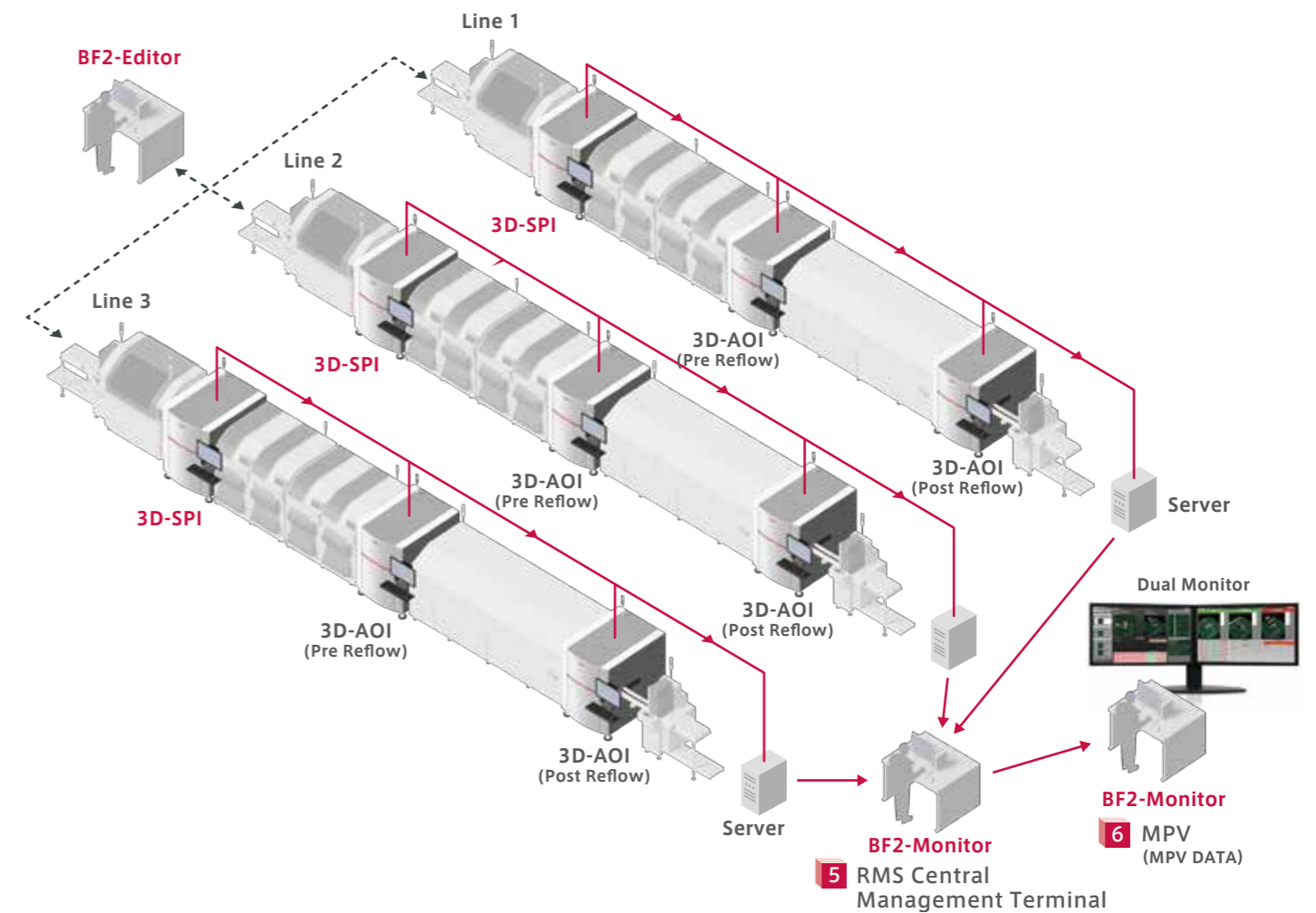
Options

BF2-Editor
Create data and debug the process offline

BF2-Monitor
(Offline verification terminal)

5 **RMS (Remote Management System)**
Remotely control multiple BF2-Monitors with a single PC. Reduces assembly-floor personnel. Moreover, the production status of each device can be confirmed.

6 **MPV (Multi Process View)**
The BF2-Monitor shows the results of all inspection processes (SPI, pre-reflow, and post reflow) on one screen in real time for operator review, simplifying the verification process and making it less subject to error. It is also useful for analyzing the cause of a defective board.

BF2-Editor

Line 1
Line 2
Line 3

3D-SPI

3D-AOI
(Pre Reflow)

3D-AOI
(Post Reflow)

3D-SPI

3D-AOI
(Pre Reflow)

3D-AOI
(Post Reflow)

3D-SPI

3D-AOI
(Pre Reflow)

3D-AOI
(Post Reflow)

Server

Server

Dual Monitor

BF2-Monitor

5 RMS Central Management Terminal
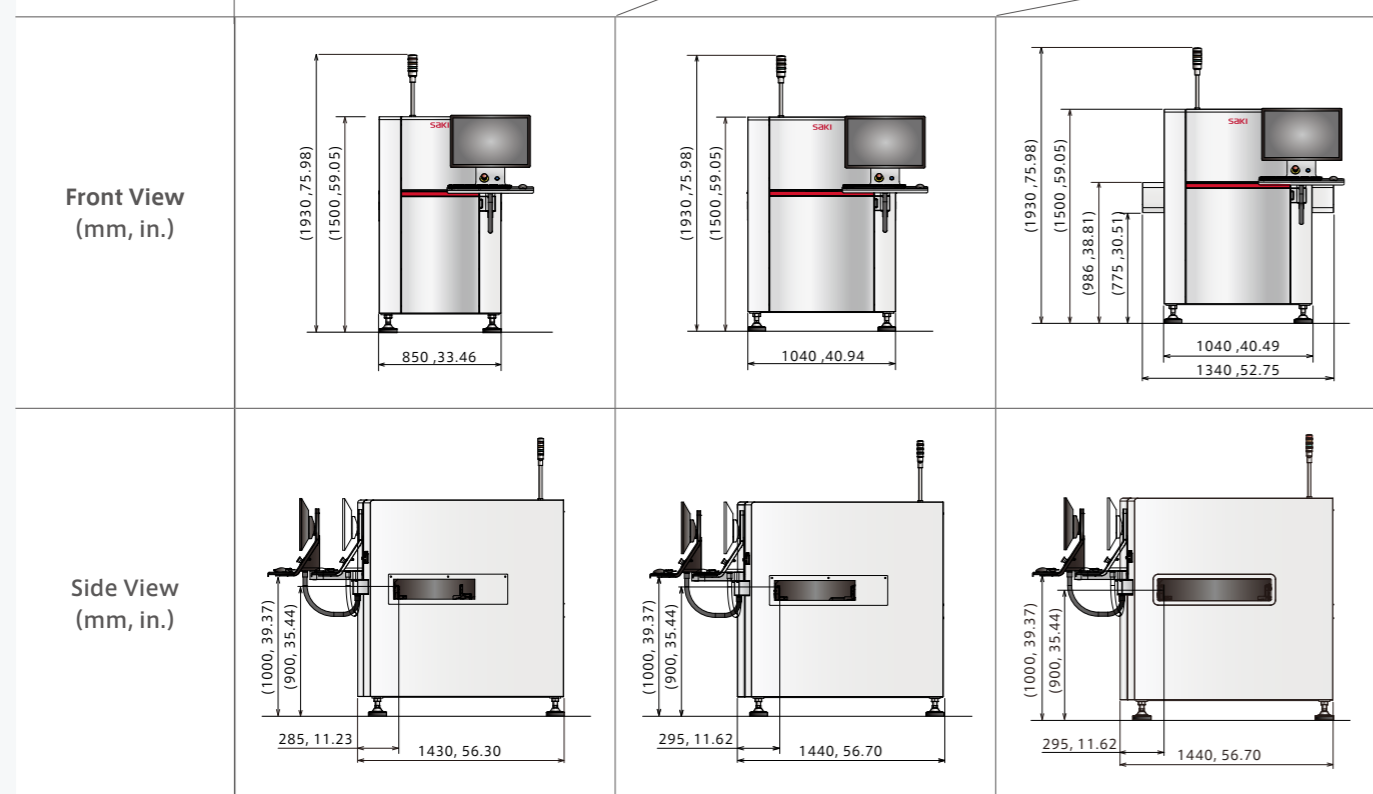
BF2-Monitor
6 MPV
(MPV DATA)

3Si Series Product Specifications

Dual-lane system can inspect 2 different PCBAs simultaneously

Dimensions	M Single lane	M Dual lane	L Single lane	L Dual lane	XL Single lane
Model Name	**3Si-MS2**	**3Si-MD2**	**3Si-LS2**	**3Si-LD2**	**3Si-ZS2**
Size (W)×(D)×(H) (mm, in.)	850 × 1430 × 1500, 33.46 × 56.30 × 59.06		1040 × 1440 × 1500, 40.94 × 56.69 × 59.06		1340×1440×1500, 52.75×56.69×59.06
Weight(kg,lb)	850kg, 1873.93lb		900kg, 1984.16lb		
Electric Power	Single Phase ~ 200-240V+/-10%, 50/60Hz				
Air Requirement	0.5MPa, 5L/min（ANR）				
	_	Single mode	Dual mode	_	Single mode	Dual mode	_

| PCB Size (mm, in.) | 50×60~330×330, 1.97×2.36~ 12.99×12.99 | 50×60~ 330×330, 1.97×2.36~ 12.99×12.99 | 50×60~ 320×330, 1.97×2.36~ 12.60×12.99 | 【7μm camera head】 50×60~330×330, 1.97×2.36~12.99×12.99 — 【12/18μm camera head】 50×60~500×510, 1.97×2.36~19.68×20.07 | 【7μm camera head】 50×60~ 330×330, 1.97×2.36~ 12.99×12.99 — 【12/18μm camera head】 50×60~ 500×510, 1.97×2.36~ 19.68×20.07 | 50×60~ 320×330, 1.97×2.36~ 12.60×12.99 — 50×60~ 320×510, 1.97×2.36~ 12.60×20.07 | 50×60~686×870, 1.97×2.36~27.00×34.25 |

| PCB Clearance | Top : 40mm, 1.57in. Bottom:60mm, 2.36in. | Top : 40mm, 1.57in. Bottom : 50mm,1.96in. | Top : 40mm, 1.57in. Bottom:60mm, 2.36in. | Top : 40mm, 1.57in. Bottom:50mm, 1.96in. | Top : 40mm, 1.57in. Bottom:60mm, 2.36in. |

Front View (mm, in.)

(1930,75.98) (1500,59.05) 850 ,33.46

(1930,75.98) (1500,59.05) 1040 ,40.94

(1930,75.98) (1500,59.05) (986,38.81) (775,30.51) 1040 ,40.49 1340 ,52.75

Side View (mm, in.)

(1000, 39.37) (900, 35.44) 285, 11.23 1430, 56.30

(1000, 39.37) (900, 35.44) 295, 11.62 1440, 56.70

(1000, 39.37) (900, 35.44) 295, 11.62 1440, 56.70

● 3Si-ZS2 supports the optical unit with resolution of 18μm.

3Si Series Optical Unit Specifications
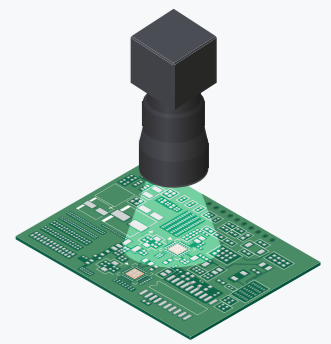
Wide selection of cameras based on various optical resolutions and speeds

Resolution	7μm	12μm	18μm
Height measurement range	**500μm**		
Image capture time	1,063mm²/s 1,64in.²/s	5,500mm²/s 8,52in.²/s	6,400mm²/s 9,92in.²/s
Major characteristics	Meets requirements for production of advanced smart phones, wearable devices, and devices and modules for IoT. Capable of 0201mm (008004in.) pad inspection.	Well balanced system offering both high speed and the inspection of the industry's smallest components.	Saki's new optical sensor increases speed by 190% delivering the industry's highest throughput.

← High-definition   High speed →

Substantially improves inspection speed

Comparison between BF-3Si and 3Si-LS2 using an optical unit with 18μm resolution and PCB size 330x250mm(12.99x9.84in.).

＼ Faster！ ／

25sec ➡ **13**sec

BF-3Si   NEW **3Si-LS2/MS2**