# Delta Smart High-Speed Insertion Machine

Smart High-Speed Insertion Machine

Based on years of experience in electronics manufacturing, Delta has introduced its self-developed Smart High-Speed Insertion Machine DI Series, which mainly applies in odd-form parts insertion, utilizes four industrial cameras to capture synchronized images, and employs AI image recognition technology for precise positioning. The Smart High-Speed Insertion Machine adopts Best Fit algorithm to effectively compensate errors, which achieves a component insertion rate up to 99.5%, enhancing production efficiency and lowering rejection rate. The DI Series offers diverse loading modes for different requirements, realizing non-stop supplementing. Gerber files import and offline programming are also available for fast integration of new models into the production. With high flexibility and stability, the Smart High-Speed Insertion Machine acts as a great partner in the small-volume large-variety production.

High Insertion Quality
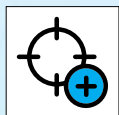
Precise Insertion

Fast Component Insertion

Low Rejection Rate

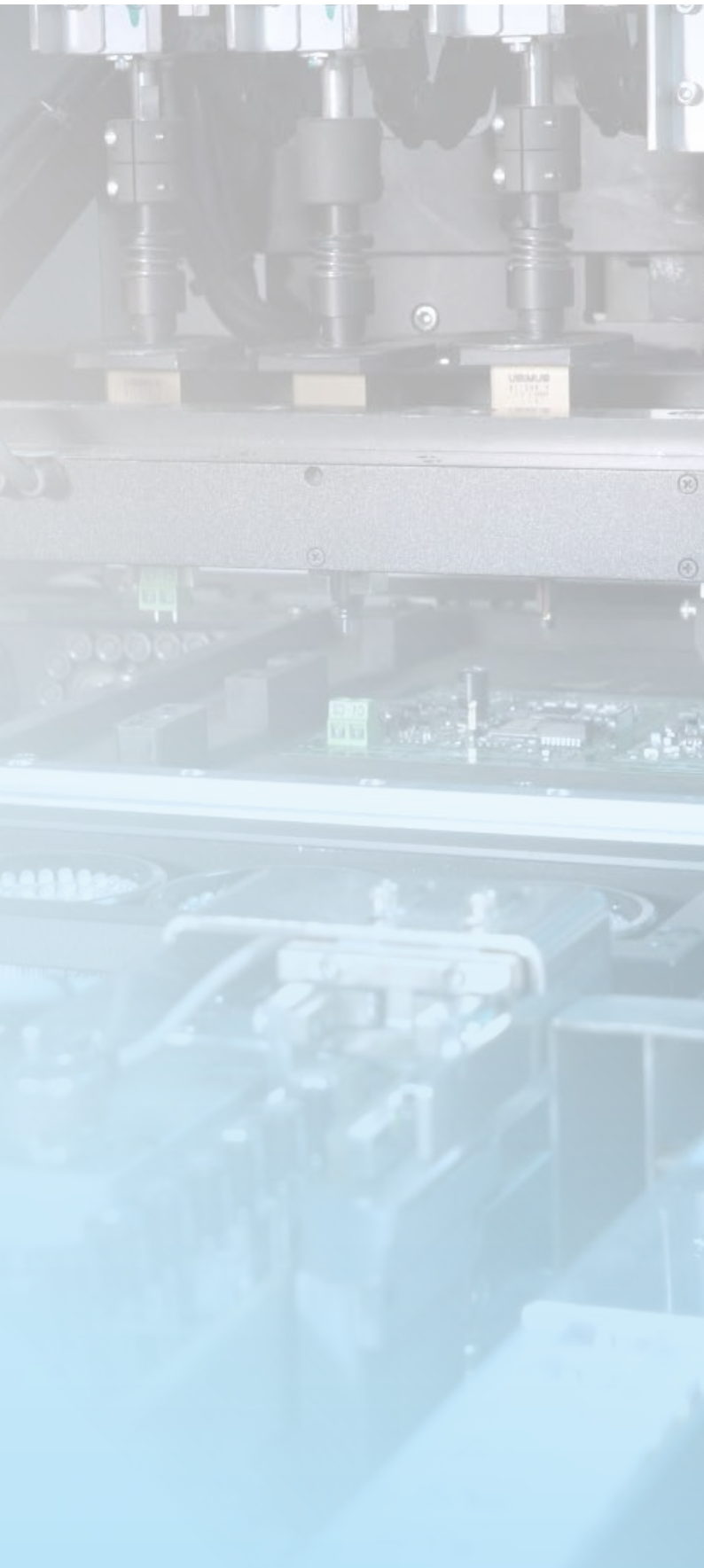**Diverse Feeding Solutions**

Rapid New Product Implementation

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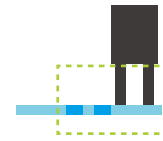
Features

High Insertion Quality

Detects the motor current of the insertion head and positioning to identify defects. When deviation or misalignment are detected, the torque protection mechanism is automatically activated, enhancing insertion quality and yield rate
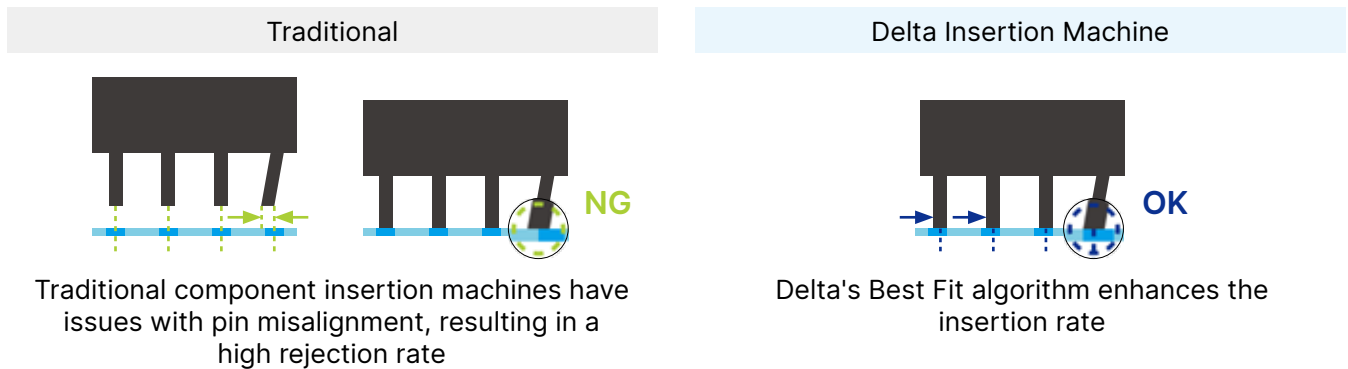
Inserting Deviation
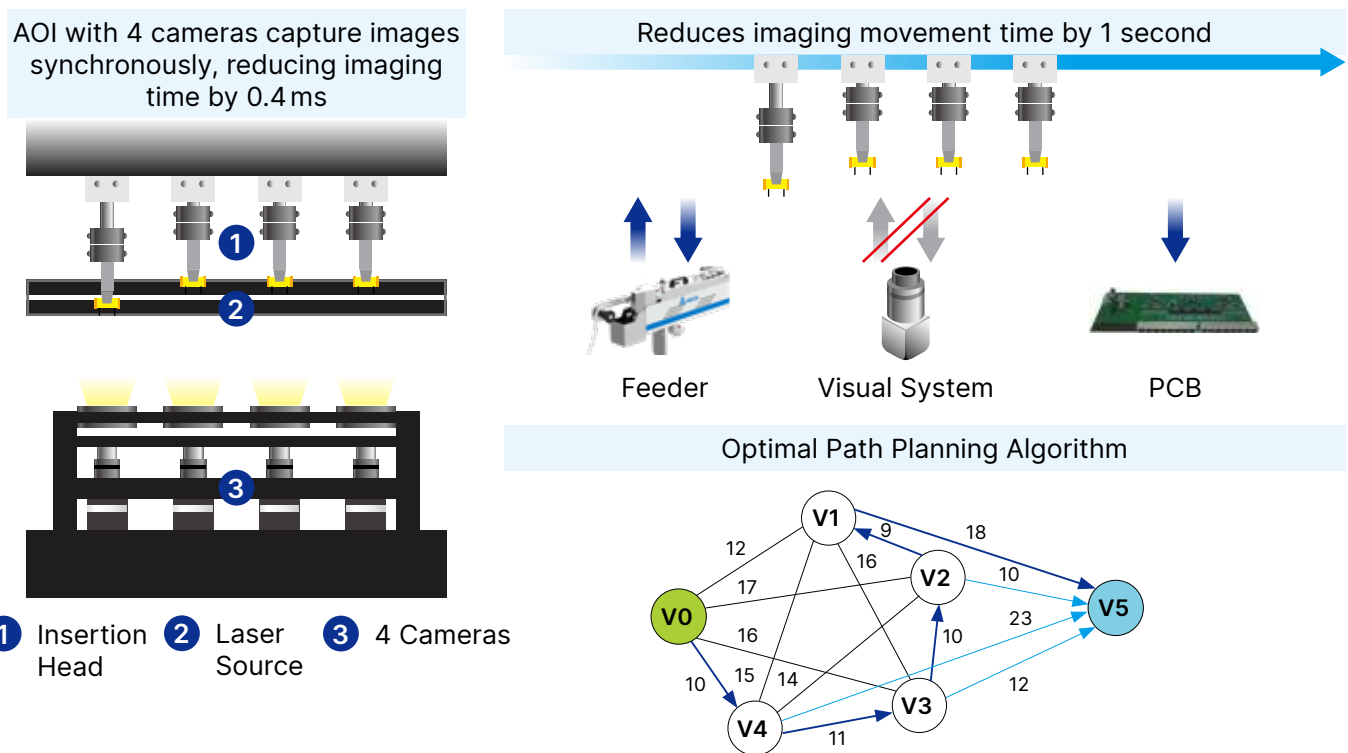
Inserting Misalignment

Precise Insertion - Insertion Rate > 99.5%

The Best Fit algorithm effectively compensates PCB positioning errors and component pin tolerances for precise insertion

Traditional	Delta Insertion Machine

NG

OK

Traditional component insertion machines have issues with pin misalignment, resulting in a high rejection rate

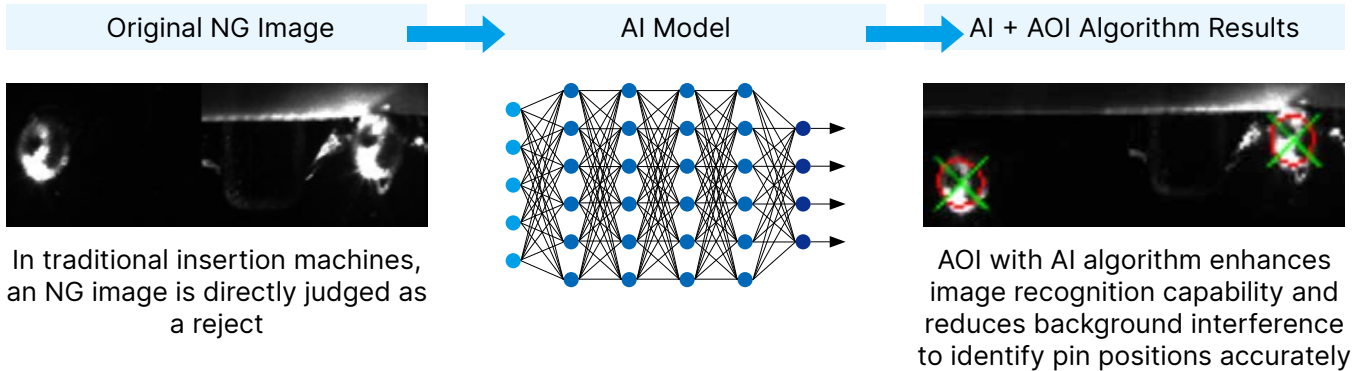Delta's Best Fit algorithm enhances the insertion rate

Fast Component Insertion

Four cameras capture and position synchronously, reducing the time for capturing and movement. Adopts algorithms for optimal path planning, achieving fast component insertion

AOI with 4 cameras capture images synchronously, reducing imaging time by 0.4 ms

Reduces imaging movement time by 1 second

Feeder   Visual System   PCB

① Insertion Head   ② Laser Source   ③ 4 Cameras

Optimal Path Planning Algorithm

Low Rejection Rate - Rejection Rate < 1%

AOI with AI algorithm enhances image recognition capability, minimizes background interference, enhances pin positioning precision, and reduces rejection rate

Original NG Image	AI Model	AI + AOI Algorithm Results

In traditional insertion machines, an NG image is directly judged as a reject

AOI with AI algorithm enhances image recognition capability and reduces background interference to identify pin positions accurately

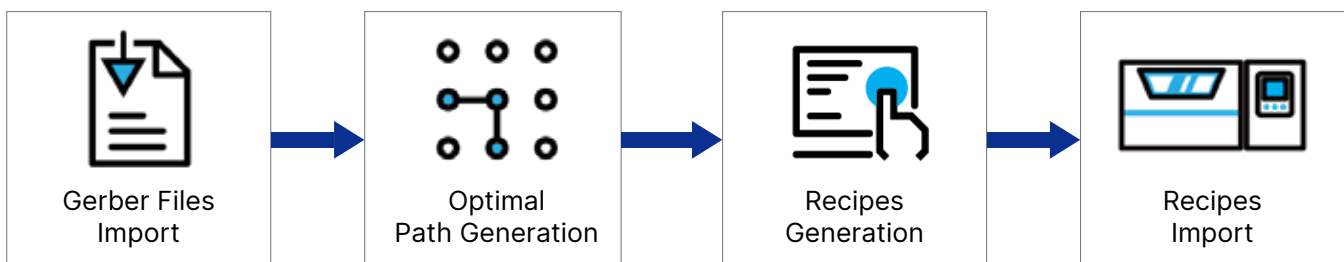| Algorithm	Test Image (pcs)	Positioning Error (pcs)	Rejection Rate
AOI Morphology	1,155	28	2.42%
AOI Pattern Match	1,155	10	0.87%
AI + AOI Deep Learning	1,155	6	0.52%

Reduces the rejection rate by 78.5%

Diverse Feeding Solutions

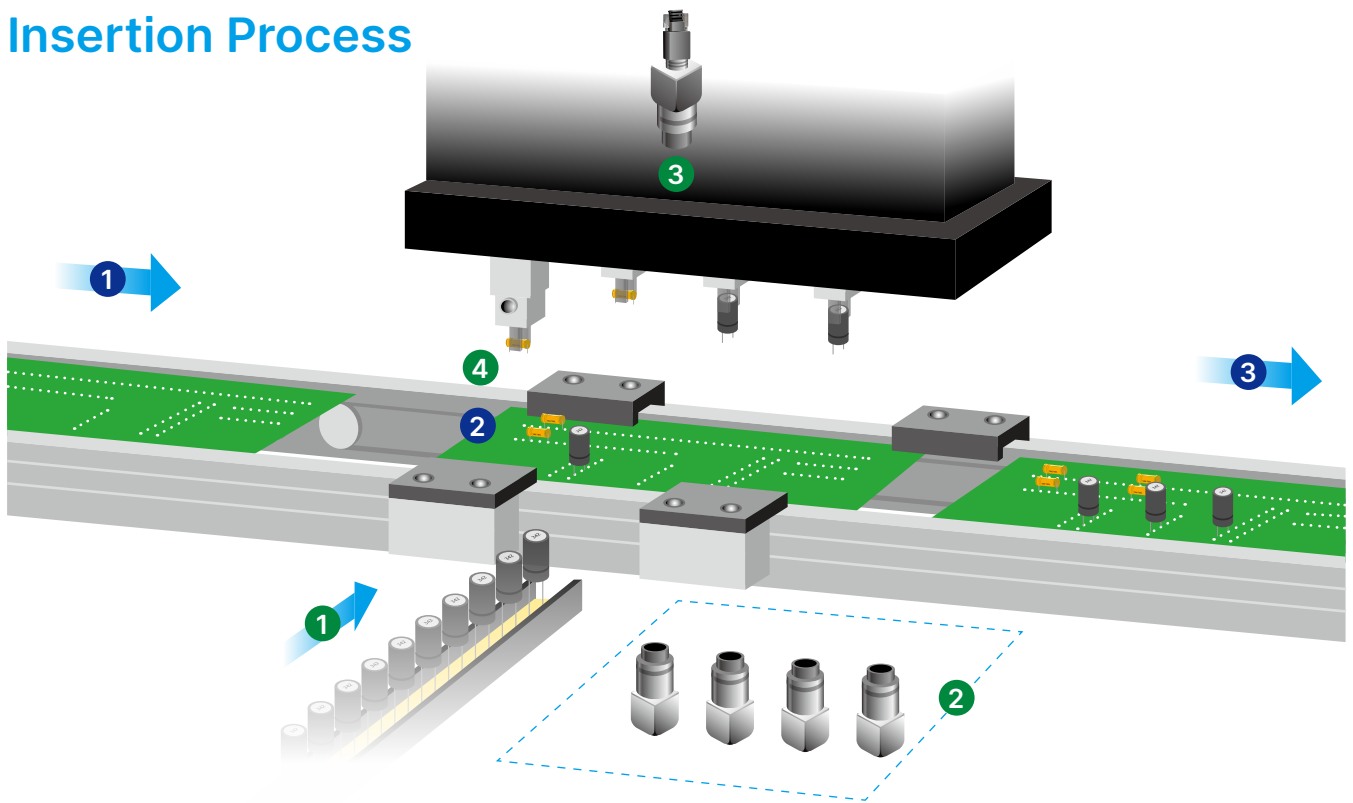Six feeding solutions are available according to different component feeding methods

Radial Tape Feeder	Axial Tape Feeder	Tube Feeder	Tray Feeder	Vibrating Tray Feeder	NXT Feeder

Rapid New Product Implementation

Supports Gerber File offline programming and reduces changeover time

Gerber Files Import	→	Optimal Path Generation	→	Recipes Generation	→	Recipes Import

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Insertion Process

Conveyor Belt

1	2	3
Loads	Conveys the PCB into position and aligns it	Unloads

Insertion Head

1	2	3	4
Moves to the feeder	Grasps the component and positions it above the bottom CCD for position inspection	Moves above the PCB, and the top CCD performs the position inspection	Inserts the component into PCB holes
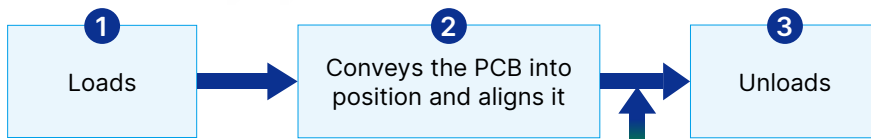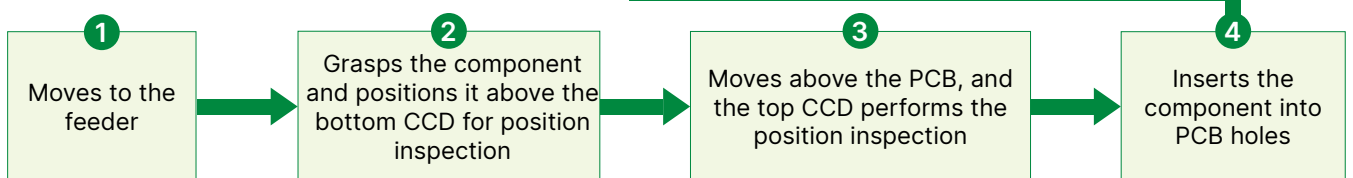
Applications

Consumer electronics, automotive electronics, and power supplies

Consumer Electronics

Automotive Electronics

Power Supplies

DI-F Series Feeder

Modular design and independent control, supports various feeding types | Achieves 90% through-hole component insertion
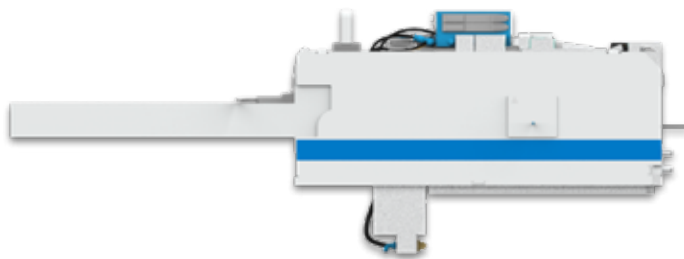
Radial Tape Feeder
DI-FR Series

Feed Speed 0.5 Sec.

Component Pin Cutting Function

Forming Function

Tape Feeding	Electrolytic Capacitor	Multilayer Ceramic Capacitor	Y-Type Capacitor	Thin Film Capacitor	Solid Electrolyte Capacitor	Ceramic Electrolytic Capacitor	Thermistor

Axial Tape Feeder
DI-FA Series

Feed Speed 0.5 Sec.

Component Pin Cutting Function

Forming Function

Tape Feeding	Fuse	Resistor	Spark Suppressor

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DI-F Series Feeder

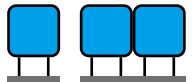**Modular design and independent control, supports various feeding types | Achieves 90% through-hole component insertion**

Tube Feeder
DI-FP Series

Feed Speed	0.5 Sec.
Capacity Height	300 mm
Component Pin Cutting Function	
Feeding Function	

Tube Feeding	4 Pin IC	6 Pin IC	8 Pin IC	Relay	Relay	Transformer	Transformer
	Power Transistor	Inductor	Inductor	Surface Mount Inductor	Button		

Tray Feeder
DI-FT Series

Feed Speed	2.0 Sec.
Tray Layers	21

Tray Feeding	Large Transformer	Radial Capacitor	Heat Sink	Socket

Vibrating Tray Feeder
DI-FV Series

Feed Speed	0.5 Sec.
Component Pin Cutting Function	
Forming Function	
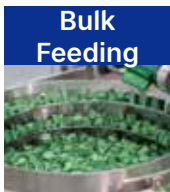
Bulk Feeding	Crystal Oscillator	Inductor	DC Socket	Toggle Switch	Button	Terminal	Terminal

NXT Feeder
DI-FJ Series
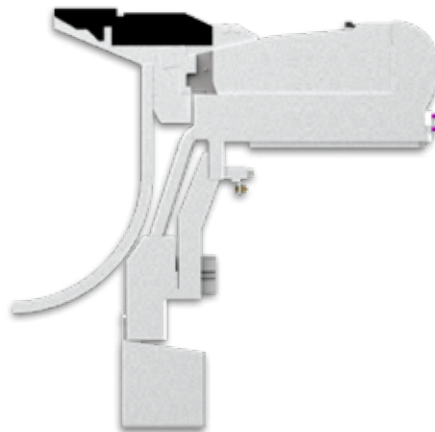
Feed Speed	0.5 Sec.
Refill Interval	30 min.

Reel Tape Feeding	Single-Row Straight Pin	Dual-Row Straight Pin	Single-Row Right-Angle Pin

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Dimensions

Insertion Machine DI-S20

1,688
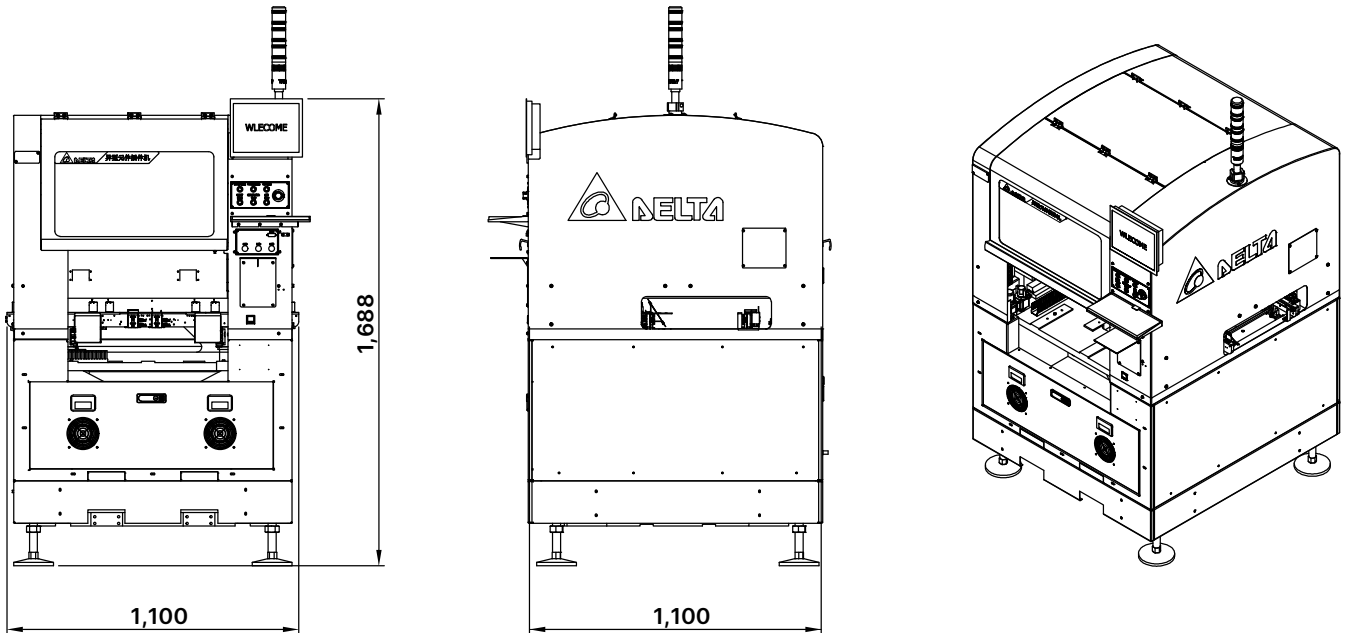
1,100

1,100

Unit: mm

Specifications

Equipment Specifications	
Type	Gantry type
Dimensions (L x W x H, mm)	1,100 x 1,110 x 1,668
Weight	About 1,800 kg
Air Supply Requirements	0.4 ~ 0.6 MPa
Power Supply Requirements	220 V_{AC} / 50 Hz, power 3,000 W
Insertion Speed	0.7 Sec./pcs (Optimal operating conditions, excluding time for PCB conveyance and mark recognition)
Insertion Accuracy	3 σ ± 0.05 mm
Time Between Stop (TBS)	> 2 Hours
Insertion Rate	> 99.5% (PWB hole ≥ Component pin diameter + 0.4 mm)
Rejection Rate	< 1% (Excluding incoming material defects)
Number of Feeding Slots	6
Insertion System	
Number of Insertion Heads	4 heads, independent up and down, independent rotation
Insertion Gripping Method	Gripper / Suction cup
Number of Cameras for Capturing Components	4
Number of Cameras for Capturing PCB Mark	1
Insertion Force Detection	Built-in detection in insertion head
Air Pressure Detection	Air detection
	Real-time positive / negative pressure monitoring of the equipment; digital switch monitoring
Pin Bending Function (Optional)	Pin inward bending / Pin outward bending
Light Source	Laser light, ring light source

Feeder		
Number of Feeding Slots	Radial Tape Feeder	1
	Axial Tape Feeder	1
	Tube Feeder	1
	Tray Feeder	5
	Vibrating Tray Feeder	2
	NXT Feeder	1

Control System	
Operating System	PC; 10" LCD Display
Program Setup Method	Supports Gerber files import and offline programming
Number of Stored Programs	No quantity limitation
Vision Positioning Compensation	Component pin positioning and visual alignment of PCB board
I/O Interface	Front and rear device connection I/O signals, Ø16 4-pin aviation connector x 2
Communication Interface	Ethernet TCP/IP10/100 Mbps
Safety Protection	Access control and smart shutdown

Others	
Product Line Changeover Method	Supports Gerber files import and offline programming
Product Line Changeover Time	15 min. (Excluding manual feeder replacement time)
Defective Product Handling Method	Component identification failure: discards components to the reject bin
	PCB board mark point identification failure: triggers an alarm and automatic ejection
After-Sales Service & Warranty	1-year warranty with 1 operation training session

Conveyor System	
Conveyor Belt Length	1,100 mm (Three-stage chain/Belt conveyor)
Pass Line	750 mm/900 mm ± 30 mm
Direction of Conveyor	Two-way programmable control
Track Width Adjustment Method	Programmed numerical motor adjustment (Adjustment range: 80~400 mm)
Distance Between Track Fixed Edge and Front of the Equipment	460 mm

Product Characteristics		
Applicable Product Range	A. Min. Size	50 mm (W) x 80 mm (D)
	B. Max. Size	360 mm (W) x 400 mm (D) 【Single clamp】 500 mm (W) x 400 mm (D) 【Double clamp】
	C. Pin Bending Range	240 mm (W) x 290 mm (D)
	D. Edge Avoidance	No objects within an 8 mm range of the carrier conveyor edge
	E. Height Avoidance	The height of all components on the carrier must not exceed 40 mm above the surface of the PWB
	F. PWB Positioning	After the PWB is positioned inside the carrier, it should be secured and no movement is allowed in the X, Y, or Z directions
	G. Weight & Dimensional Limitations	Products with wires or products weighing less than 0.5 kg need to undergo conveying performance testing first
PCB Thickness		PCB: 1.2~2.0 mm; Carrier: ≤ 10 mm
Component Size Limitation		ø x H: ø35 x 40 mm; Weight ≤ 50 g
Insertion Direction		0~360°
Max. Weight of PCB And Carrier		5 kg
PCB Restrictions		The PCB plated through-hole diameter should be larger than the component pin diameter by 0.4 mm (with +0.2 mm on each side)

Delta reserves the right to change the specifications without prior notice.

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Smarter. Greener. Together.

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*We reserve the right to change the information in
 this catalogue without prior notice.