High-Speed Chip Placer Specifications

Model

CP-642

CP-642E

CNT-CP642-02E

Fuji Machine Manufacturing

Contents

1. Outline

1.1 Outline

The CP-642 / CP-642(E) is a reliable, high-speed automatic component placement machine which places the smallest chips to the larger electronic components on high-density printed circuit boards.

The machine performs placing at a maximum speed of 0.09 sec / shot and can be loaded with up to 140 types of parts. Furthermore, the XY-table speed has been increased on this model.

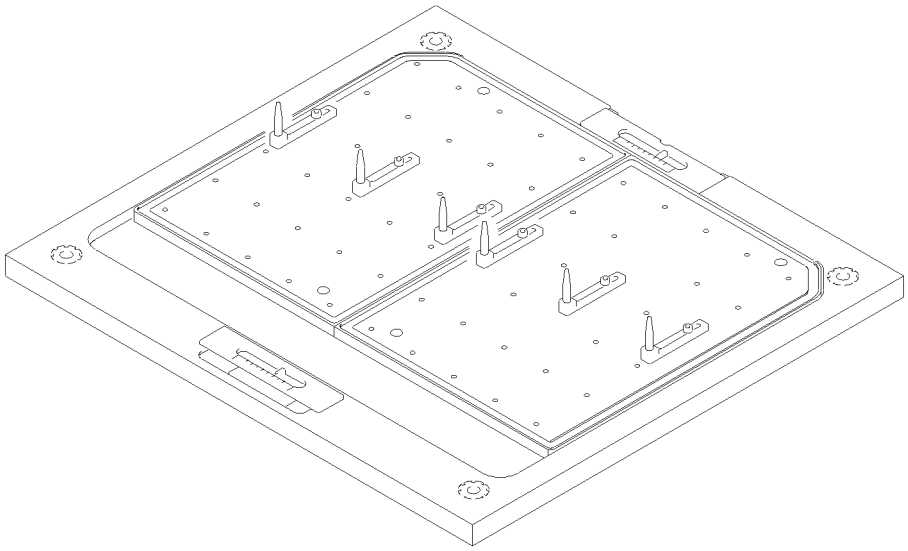
To further reduce noise the machine has been equipped with a rear cover which fully encloses the device tables.

1.2 Features

- The CP-642 / CP-642(E) achieves the world's fastest placing speed, 0.09 sec / shot, in the one-by-one chip shooter category. The CP-642 / CP-642(E) exhibits an improvement of 25 to 30% in throughput compared with the CP IV-3 and an improvement of 10% compared with the CP-6.
- Computerized design analysis has resulted in a rigid machine structure. This rigid structure, along with high-accuracy mechanical parts, endows the CP-642 / CP-642(E) with the highest possible placement accuracy.
- The simple placing head, consisting of six nozzles per head, expands the number of possible nozzle variations and facilitates maintenance.
- A high-speed vision processing system utilizing gray scale technology provides reliable and accurate placement results.
- Press-in type tape feeders reduce the changeover time drastically. Increased rigidity for 13 and 15-inch reel holders minimizes feeder vibration thereby guaranteeing stable tape feed.
- The newly designed rear cover for the D-axis table reduces the noise generated by the D-axis feeders from 82 dB to 76 dB, and so improves the working environment.
- The Windows-based F4G (Fuji 4th Generation software) line management system controls the production line with high efficiency. F4G features user-friendly operation allowing even beginners to utilize it.

Note: The CP-642/CP-642(E) does not include F4G. The F4G software must be purchased separately. See the F4G specifications document for details.

- An expanded backup pin area has eliminated the restrictions on backup positions that existed on the XY-table on previous models. Also, the CP-642 / CP-642(E) easily meets the requirements to load PC boards of 0.5 mm thickness.



- The new loading system employs servo motors to control the PCB lifter rather than the air cylinders used on previous models.
  This system allows the CP-642(E) to shorten the PCB loading and unloading time (reduced from 5 to 4 sec) and control acceleration / deceleration for shock-free placement.

2. Environmental Specifications

2.1 Electrical Power and Air

- Voltage: 3-phase 200 VAC ± 10%
- Frequency: 50 / 60 Hz
- Power consumption: 10 KVA

Notes:

(1) Input voltage: Selectable from 200, 210, 220, 230, 380, 400, 415, 460 and 480 V (by selecting the transformer taps)

(2) An exclusive power source should be used for the machine in order to avoid problems from noise, fluctuations in voltage, and high-frequency distortion.

(3) Compressed air: 0.5 MPa (5 kgf/cm^2)

(4) Air consumption: 50 Nl/min

2.2 Environmental Conditions

- Ambient temperature : 15 to 35° C
- Ambient humidity : 30 to 80 %
- Protection Structure : Class IP22 equivalent

2.3 Machine Weight

Approximately 6000 kg (excluding the D-axis rear cover)

2.4 Machine Monitor

Either Japanese or English.

2.5 Machine Components

- XY-table
- Board conveyor
- Feeder setting tables
- Nozzles
- Placing heads
- Vision processing system

2.6 Machine Color

Body: Beige

Trim: Reddish brown

3. Machine Specifications

3.1 Basic Specifications

• Placing Speed	0.09 sec / chip under the following conditions
	> XY-table travel distance : within 14.8 mm (within 15.3 mm including compensation)
	> D-axis movement : None
	> FQ-axis rotation angle : within 20 degrees
	> PQ-axis rotation angle : 90° or -90°
	> Cam speed : 100%
	> 180° rotation placement : 0.13 sec
• Placing Accuracy	±0.1 mm (3 sigma) in XY-direction
	> Fiducial mark reference
	> Rotational error is translated into an XY-coordinate.
• Placing Reliability	99.99 % (After auto recovery)
• Part Dimensions	1005 to 19 x 20 mm (20 x 20 mm for J-lead parts)
	Part height: maximum 6 mm
• Package Type	8, 12, 16, 24 and 32 mm tape
	Reel diameter: 180 mm, 330 mm and 380 mm
• Maximum Feeder Number	140 feeders (using 8 mm tape feeders)
• Board Loading Time	4.0 sec (XY-table travel time is not included)
• Fiducial Mark Read Time	Approximately 0.5 sec / mark
	> 1.2 mm mark diameter. Time needed to move between the marks and to compensate for mark appearance and displacement is not included.
• Nozzle Indexing Time	1 pitch rotation: 0.09 sec
	2 pitch rotation: 0.15 sec
	3 pitch rotation: 0.18 sec

3.2 Board Transport

(1) Direction of Board Flow

- Left to right – Standard
- Right to left – Optional

(2) Board Transport Height

- $900^{(+15, -5)}$ mm Standard
- $950^{(+15, -5)}$ mm Optional

Vibration isolation pads may increase the board transport height by 12 mm.

(3) Board Transport

- Conveyor belt system
- In-conveyor -> main conveyor (XY-table) -> out-conveyor

(4) Maximum Transport Weight

- 1 kg maximum (2 kg with optional roller guided conveyor)

(5) Conveyor Width Adjustment

- The width of the conveyors can be changed individually or jointly using the adjustment handle and the front rail as a reference.

3.3 PCB Requirements

(1) Board Size

- 356 mm (W) x 457 mm (L) maximum
- 50 mm (W) x 80 mm(L) minimum
- Thickness 0.5 mm – 4.0 mm

Note: Consult Fuji if board backup is required.

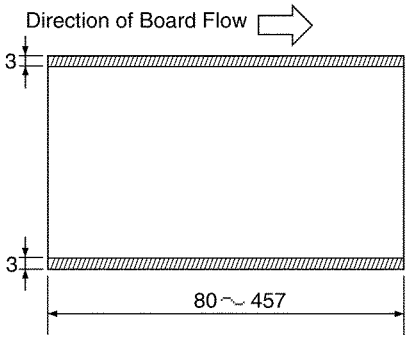
(2) Board Material

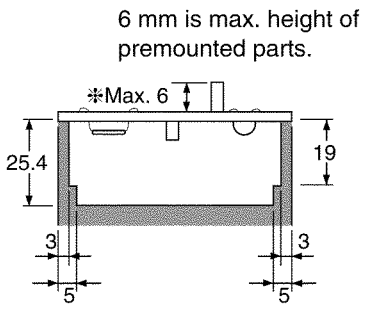
- Glass epoxy, composites, paper phenol, alumina, polyimide, etc.

(3) Board Restrictions

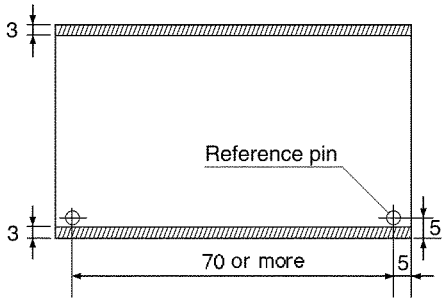
- Warpage: ±1.0 mm maximum
- Height of premounted parts: 6.0 mm maximum
- Height of premounted bottom side parts: 25.4 mm

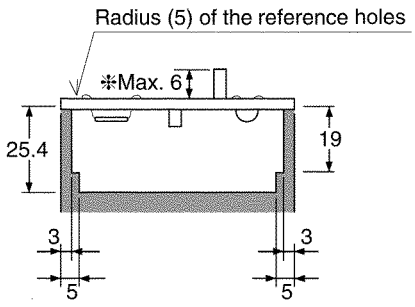
• Fiducial mark reference





• Pin reference





Unit : mm

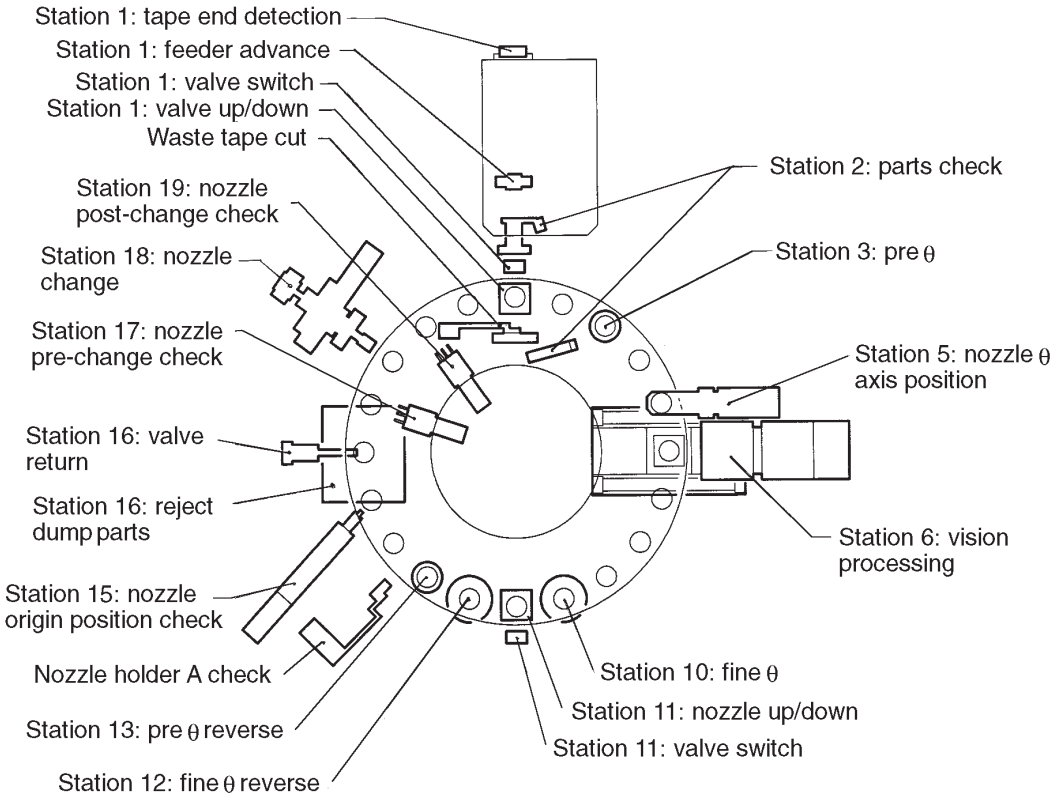
3.4 Warranty

- Warranty period — 2000 hours or 1 year. Fuji will bear no responsibility for damage due to acts of nature (fire, flood, earthquakes, etc) or incorrect operation.

4. Placing Heads

4.1 Placing Heads

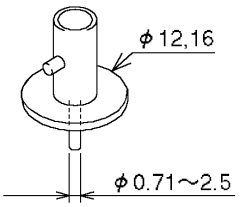
Station	Function
1	Pick-up part from the D-table
2	Part detection (large part only)
3	Pθ: Placement angle pre-rotation in 90 degree angles
4	Idle
5	θ–axis nozzle rotation
6	Vision processing
7	Idle
8	Idle
9	Idle
10	Fθ: Fine placement angle rotation (incl. adjustment)
11	Placement
12	FRθ:Fθ: Fine rotation origin return
13	PRθ:Pθ: Pre-rotation origin return (cam driven)
14	A-head detection
15	Nozzle clutch origin detection
16	NG parts discarded
17	Detection of nozzle type No. 1 - No. 6
18	Nozzle change
19	Nozzle change check (detect type No. 1 - 6)
20	Idle

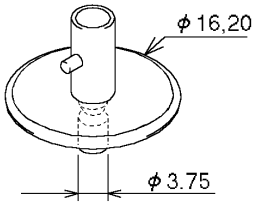


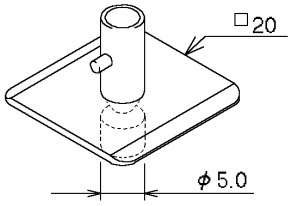
5. Nozzle

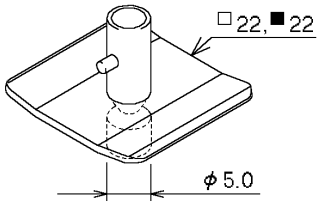
5.1 Nozzle and Nozzle Assembly

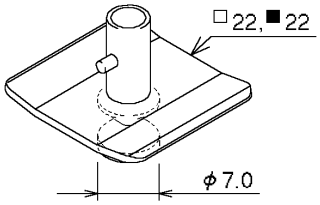
(1) Each placing head carries up to 6 nozzles of different types, selected from a range of 15.











(2) Refer to the following table for nozzle types and applicable parts.

Bkgd	Nozzle diameter	Applicable parts	Nozzle name
ø12	ø0.7	1005, 1608, SSMIN	R12-007
	ø1.0	1608, 2125, SMIN, MIN	R12-010
	ø1.3	2125, 3216, MIN, Tantalum A, Melf	R12, M12-013
	ø1.8	3216, 3225, 4532, Tantalum A/B, PTRR, Trimmer potentiometer	R12-018
ø16	ø2.5	Tantalum B/C/D, PTRR, Melf, SOIC 8, SSOP 16 ~ 20, Filter	R16-025 R20, M20-025
ø16 ø20	ø3.7	Trimmer potentiometer, Aluminum electrolytic capacitor, Tantalum D, SOIC 20~28W, SSOP 16~30, PLCC 18~28, SQFP 48, SOJ 26	R16-037 R20-037
20 mm square	ø5.0	SOIC 20~28W, SSOP 24~30, PLCC 18~32, SQFP 48, SOJ 26, QFP 48	S20-050 S22-050 B22-050
22 mm square			S22-070
22 mm square (black)	ø7.0	SOIC 20~28W, SOJ 26, PLCC 20~52	B22-070

Notes:

(1) The letter in "Nozzle name" denotes the shape of the diffuser (except M&B).
R : Round (back light)
M : Special nozzle for Melf (back light)
S : Square (back light)
B : Square (front light) (B indicates black)

(2) Depending on the shape and weight of the part, a different nozzle may be required.

5.2 Nozzle Arrangement

The standard arrangement of nozzles is either type A or B, as shown below. Other arrangements made up of nozzles A ~ O are possible.

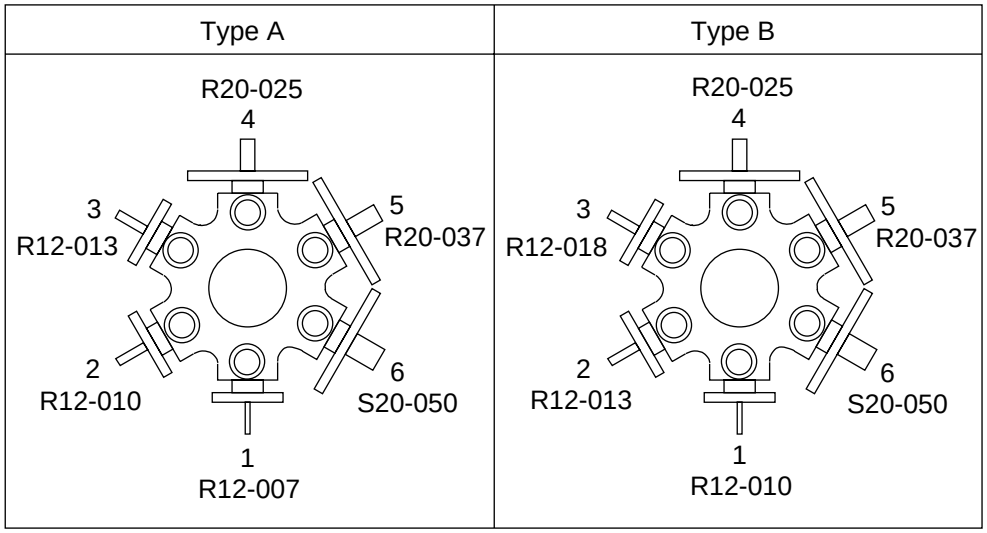
Type A and Type B Nozzle Arrangements

Position on Head	1	2	3	4	5	6
Type A	A	B	C	H	J	K
Type B	B	C	E	H	J	K

The nozzle types listed here are identified in the following table.

Nozzle Types

A	R12-007	F	R16-025	H	R20-025	L	S22-050
B	R12-010	G	R16-037	I	M20-025	M	B22-050
C	R12-013			J	R20-037	N	S22-070
D	M12-013			K	S20-050	O	B22-070
E	R12-018						



Notes: (1) Only a nozzle with a ø20 reflective disk or smaller can be attached on either side of a nozzle with a 20 mm square reflective plate.

(2) Only a nozzle with ø16 reflective disk or smaller can be attached on either side of a nozzle with a 22 mm square or 22 square (black) reflective plate.

6. Parts Supply System

6.1 Parts Supply Table (D-axis) and Tape Feeders

(1) Types of Components — 140 types (using 70 x 2 tables with 8 mm feeders)

(2) Placeable Components — Components that comply with the packaging, feed pitch and parts height requirements as previously outlined.

(3) Table Drive Method — 2 motor / 2 independent drive mechanisms.

(4) D-table Drive Modes — May be selected from the following

- Device Change Mode
- Changeover Mode
- Joint Mode

(5) Feeder Pitch

		Right side				
		W8	W12	W16	W24	W32
Left side	W8	1P	2P	2P	2P	2P
	W12	2P	2P	2P	2P	3P
	W16	2P	2P	2P	2P	3P
	W24	2P	2P	2P	3P	3P
	W32	2P	3P	3P	3P	3P

Note: The expressions "left side" and "right side" refer to the feeder mounting positions when viewed from the rear of the machine.

(6) Feeder Types (which can be placed at the ends of the device tables)

	W8	W12	W16	W24	W32
D1	√	N / A	N / A	N / A	N / A
D70	√	N / A	N / A	N / A	N / A
D71	√	N / A	N / A	N / A	N / A
D140	√	N / A	N / A	N / A	N / A

(7) Feeder Stands

- A feeder stand is a 3-tier shelf designed to accommodate unused or spare feeders. Shelves can be selected from the following list and attached to the stand.

Feeder Stand	(3 Shelves/ Stand)
Holds 8, 12 mm	(accommodates 34 feeders)
Holds 16 mm	(accommodates 27 feeders)
Holds 24 mm	(accommodates 22 feeders)
Holds 32 mm	(accommodates 19 feeders)

(8) List of CP642 / CP642(E) Compatible Feeders

For 180 mm reel	For 330 mm reel	For 380 mm reel
WD-0802-0.7-180		
WD-0804-1.0-180	WD-0804-1.0-330	
WD-0804-1.3-180	WD-0804-1.3-330	
WD-0804-1.8-180	WD-0804-1.8-330	
WE-0802-0.7-180		
WE-0804-1.0-180	WE-0804-1.0-330	
WE-0804-1.3-180	WE-0804-1.3-330	
WE-0804-1.8-180	WE-0804-1.8-330	
WE-1204-2.5-180	WE-1204-2.5-330	WE-1204-2.5-380
WE-1208-2.5-180	WE-1208-2.5-330	WE-1208-2.5-380
WE-1212-2.5-180	WE-1212-2.5-330	WE-1212-2.5-380
	WE-1604-3.7-330	WE-1604-3.7-380
	WE-1608-3.7-330	WE-1608-3.7-380
	WE-1612-3.7-330	WE-1612-3.7-380
	WE-2404-5.0-330	
	WE-2408-5.0-330	
	WE-2412-5.0-330	
	WE-2416-5.0-330	
	WE-2424-5.0-330	(12 mm Double feeding)
	WE-3212-7.0-330	
	WE-3216-7.0-330	
	WE-3224-7.0-330	(12 mm Double feeding)

Notes: *(1)* *Both 330 and 380 diameter reels can be mounted on reel holders. The feeding capacity is a maximum 10,000 parts at 4 mm/pitch and a maximum 5,000 parts at 8 mm/pitch.*

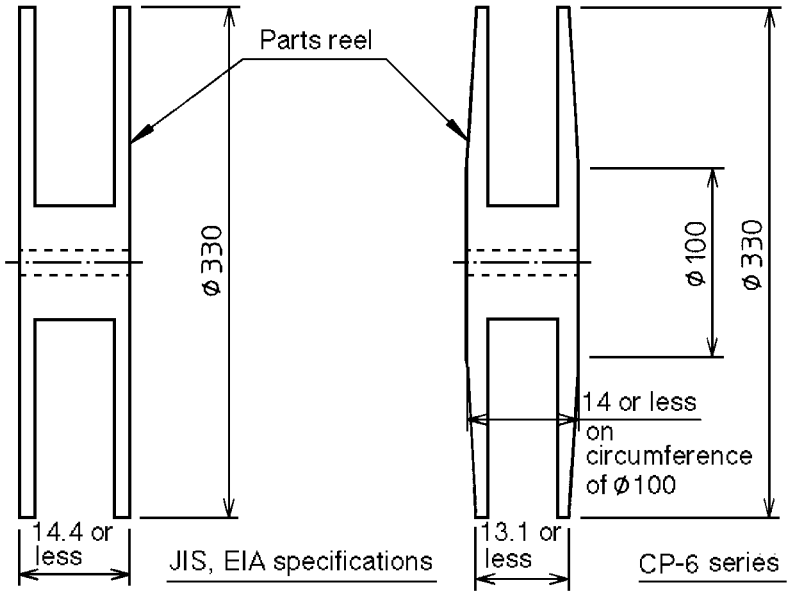
(2) *A part is fed by a single stroke for a pitch of 2, 4, 8, 12 and 16 mm, and by multiple strokes for a pitch up to 24 mm.*
(24 mm is the maximum length of tape which can be cut off.)

(3) *380 diameter reel holders are manufactured on demand.*

(4) *The reel's alphanumeric number includes the applicable nozzle size. The size is the maximum nozzle diameter. Nozzles of smaller diameter can be used on the feeder as well.*

(5) *All FCP-6 dedicated feeders are made of aluminum.*

(6) *The dimensions of the W8, 13-inch parts reel are shown below.*
Feeders for the CP6 use a box-type reel holder, providing structural stability which ensures repeated component pick-up accuracy.



Unit : mm

7. Vision System

7.1 Camera Unit (Parts Recognition)

The CP642 / CP-642(E) is equipped with two cameras, each camera being adapted for different uses; a high resolution small F.O.V. camera is used to acquire images of small components such as 1005s and small SOTs, and a large F.O.V. camera is used for SOICs and PLCCs. Also, frontlighting or backlighting can be selected according to the configuration of the parts.

(1) Vision Controller

Attached inside the machine's base control box.

(2) Narrow View Camera

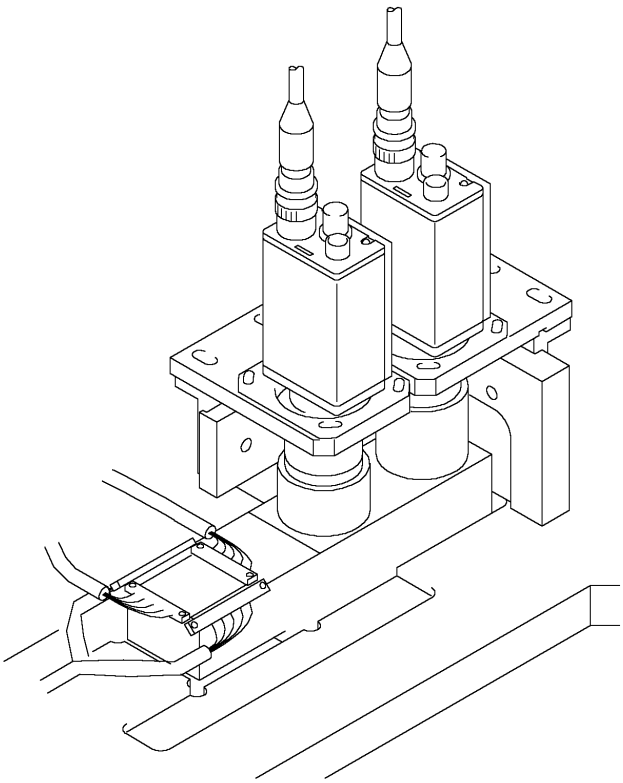
Part camera for backlight use

- 1005, 1608, 2125, 3216, SSMin, SMin, etc.

(3) Wide View Camera

The parts cameras can be switched from backlight to frontlight use. Frontlight use is limited to J-lead parts.

- Backlight compatible parts: 19 x 20 mm maximum
- Frontlight compatible parts: 20 x 20 mm maximum J-lead parts



Notes: *(1) Specify the camera type, narrow or wide view, in part data.*

(2) If a part larger than 3216 in size is inspected using the narrow view camera, the placing speed may be reduced. The narrow view camera is intended for inspecting small components at high resolution.

(3) If a part smaller than 4532 in size is inspected using the wide view camera, the placing accuracy may be adversely affected. The wide view camera is designed for large components from 4532 size parts to SQFP 48 pin devices.

7.2 Fiducial Mark Camera

(1) The camera is installed within the head assembly.

(2) The camera is used to accurately locate the board position by inspecting two or more fiducial marks on the PCB. During operation, corrections are made to the part placement position using this fiducial mark data.

8. Machine Control System

8.1 Machine Control Specifications

(1)	Placement Position Data Entry	• Absolute data
(2)	Acceleration Control (XY-table)	• UHi, Hi, Mid, Low, ULow: 5-level adjustable acceleration and deceleration settings.
(3)	Controllable Axes	• Cam, X, Y, Z, D1, D2, Fθ, FRθ, Nozzle changer: 9 axes
(4)	CPU	• 32 bit
(5)	Maximum Number of Input Sequences	• 5,000 sequences / board
(6)	Maximum Number of Programs in Storage	• 10 (1,500 sequences / program)
(7)	Memory	• Battery backup (lithium battery)
(8)	Data Input	• F4G system *Note: Refer to 9.2.12, "F4G System".*
(9)	Data Unit	• 0.01 mm on X-, Y- and Z-axes. • θ axis units : deg. and min.
(10)	Communication	• RS-232C
(11)	Control Panel	• Numerical keypad and function keys
(12)	Vision Recognition Error Correction	• Board displacement correction • Part displacement correction

8.2 Signal Tower

Machine Status	Blue(steady)	Blue(flashing)	Yellow(steady)	Yellow(flashing)	Red(steady)	Red(flashing)
Automatic Operation	√					
Board Loading	√					
Board Waiting		√				
Command Waiting		√				
Parts Out	√		√			
M/C Stop Due To Parts Out				√		
M/C Stop Due To Error						√
Statistical Warning	√		√			
Operator Call During Changeover				√		
Vision Processing Error					√	
Ready Mode		√				
Changeover In Process		√				
M/C Stop Due To Production Count Up				√		

Notes:

(1) The signal tower lighting condition settings are made in Proper data.

(2) The blue light is replaced by a green light on IEC-compatible machines.

9. Options

9.1 Installation of Optional Parts and Functions

The options listed below are categorized into three groups.

Category A Factory installed (installed by Fuji prior to shipping)

Category B Site installed (installed on-site by Fuji)

Category C User installed (installed by the customer)

•	Reference pin unit	A or B
•	Reference pins	C
•	Backup pins	C
•	Vacuum-type backup pins	A or B
•	Additional nozzles	C
•	Tape feeders	C
•	Handy terminal	C
•	Board-flow direction	A
•	Roller-guided conveyor	A
•	Tri-color signal tower	A
•	HELPS	A
•	F4G	C
•	Others	

9.2 Further Information

9.2.1 Reference Pin Unit

(1) The CP642 / CP-642(E) comes equipped with a fiducial mark camera that reads fiducial marks to ascertain a board's position. Board-holding units for use with reference pins are available as an option.

(2) Reference pin units can be used together with fiducial marks.

(3) The reference pin unit does not include reference pins. The reference pins must be ordered using the customer specification form.

9.2.2 Reference Pins

The following reference pins are available. Please specify the quantity and size in your order.

- ø3.0 round or diamond shaped
- ø4.0 round or diamond shaped

9.2.3 Backup Pins

Order backup pins as needed

9.2.4 Vacuum Style Backup Pins

6 pins are used. Use of the vacuum backup pins increases board loading time by one second compared to standard backup pins. However, this may vary depending on the specified table mode.

Loading Speed Mode	Time(sec)
Hi	5.0
Mid	5.5
Low	6.0

9.2.5 Additional Nozzles

Order additional nozzles as needed.

9.2.6 Part Supply Feeders

8, 12, 16, 24 and 32 mm feeders are available. Note requirements in your order.

9.2.7 Handy Terminal

(1) Permits the operator to conveniently enter and view data normally displayed on the control CRT during device checks.

(2) Eliminate errors when replacing reels by allowing device checks via the attached pen-type barcode reader.

9.2.8 Board-flow Direction

(1) Provides support for right to left board flow.

9.2.9 Roller-Guided Conveyor

(1) This unit enhances board transport performance by incorporating rollers under the PCB transport conveyor belt.

(2) The maximum weight allowable is 1 to 2 kg including the transport pallet.

9.2.10 Tri-color Signal Tower

(1) Customer selectable green or blue lights with standard red and yellow lights.

9.2.11 HELPS Specifications

(1) The HELPS system provides an in-line production system that supports automatic changeover. The main features are as follows:

- Automatic changeover of production programs
- Automatic conveyor width adjustment
- Displays confirmation items and manual procedure instructions for automatic changeover operation.

(2) The level of automation varies according to the customer's specification .

- Board type (barcode or pattern-code) trigger.
- Manual (operation SW) trigger

Note: When a barcode or pattern-code is used as a trigger, a separate unit to read data at the previous stage is required. Details are available separately.

9.2.12 F4G System

(1) The F4G system performs data communication with the machine using the following:

- Computer (IBM PC compatible)
- C / C (communication center)
- Program modules (F4GO, F4GP, F4GM, etc. as required)

(2) Refer to the the separate “F4G Specifications” for details.

Note: The PC for the F4G system should be prepared by the customer prior to the installation of the machine.

9.2.13 Other Requirements

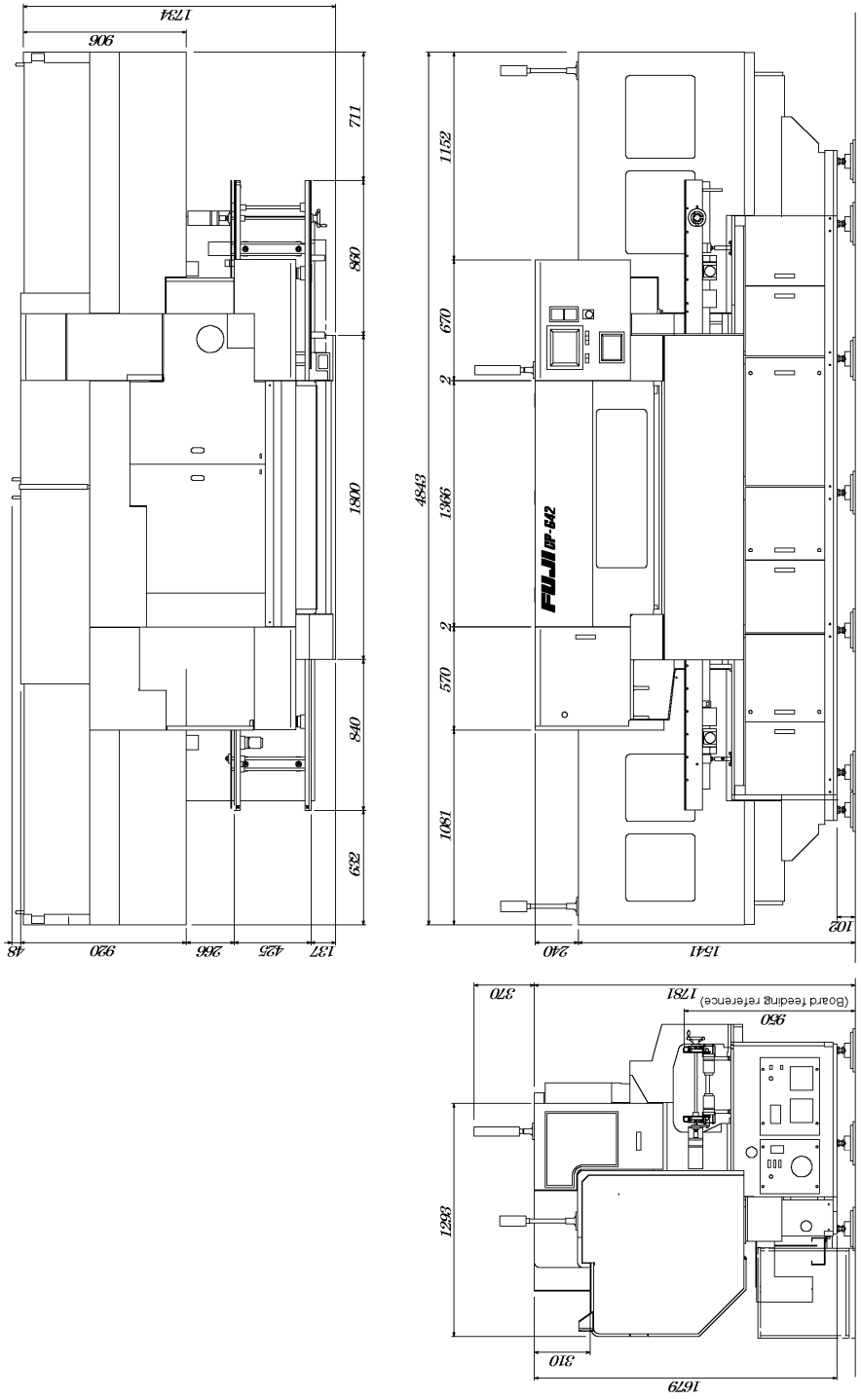
(1) Any requirements not covered in these specifications may be discussed separately.

(2) If you have any questions, please contact Fuji or one of our sales representatives.

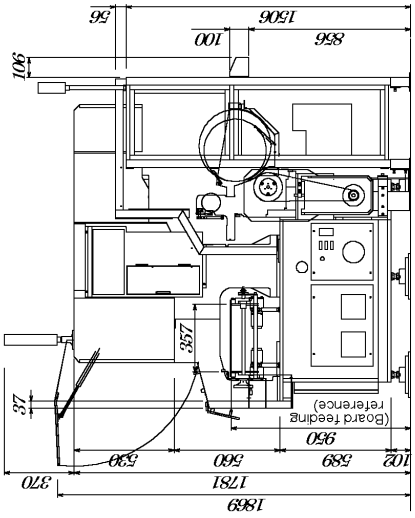
10. Equipment Overview

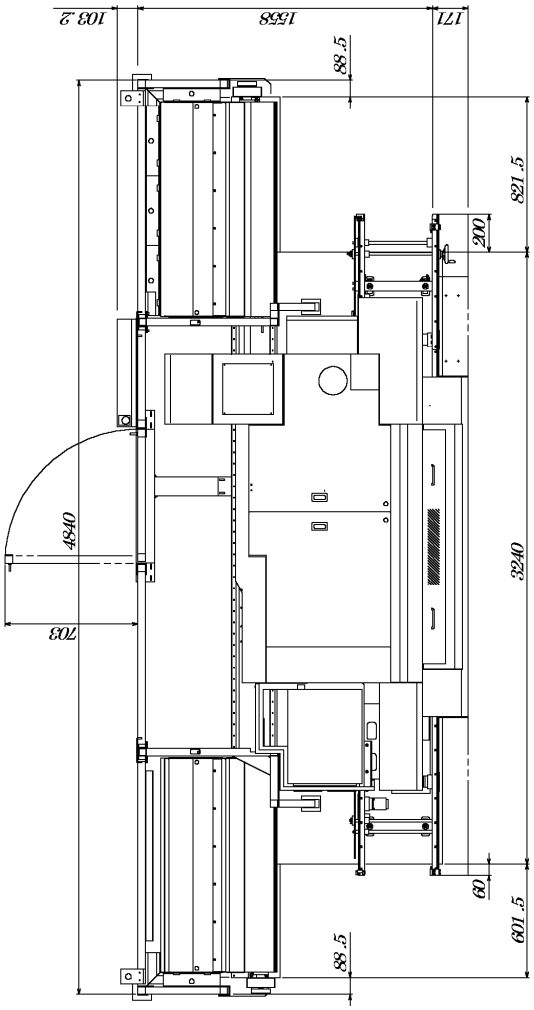
10.1 Exterior Schematic

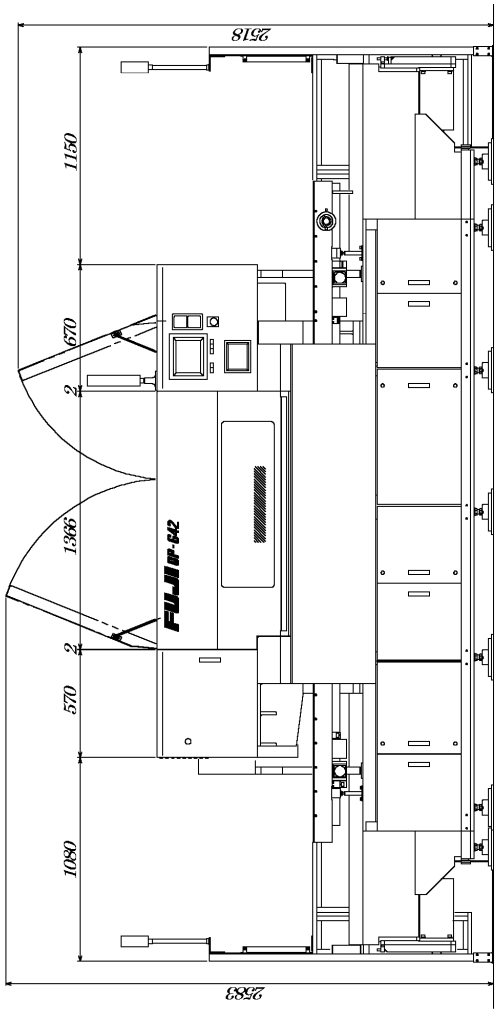
10.1.1 Models with Rear Cover



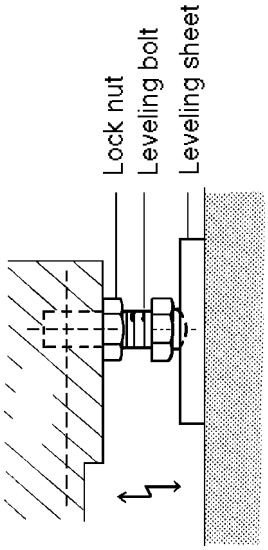
10.1.2 Models with Fence

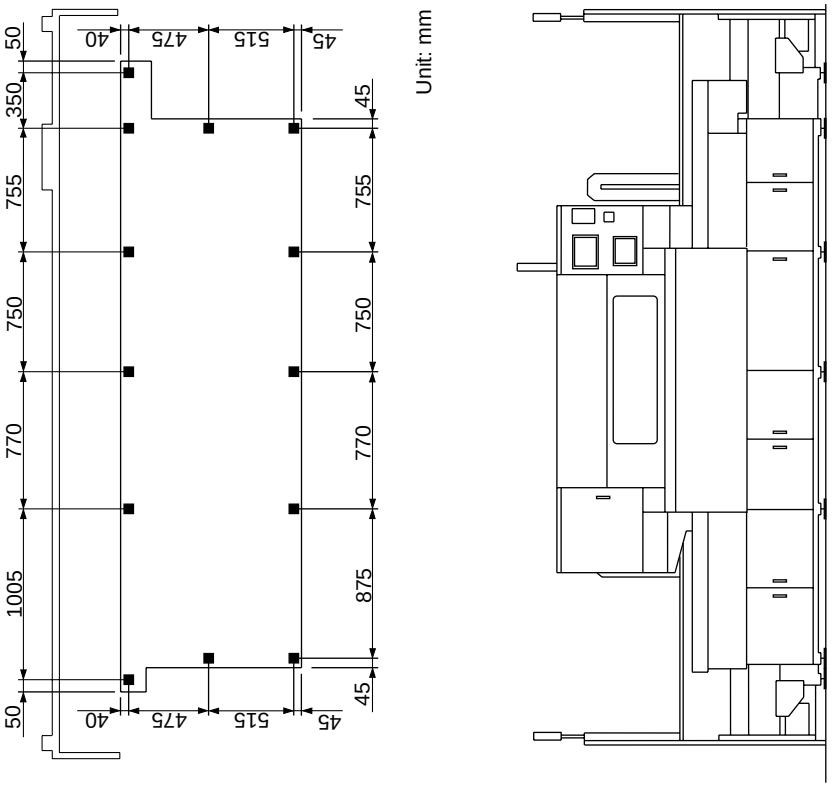




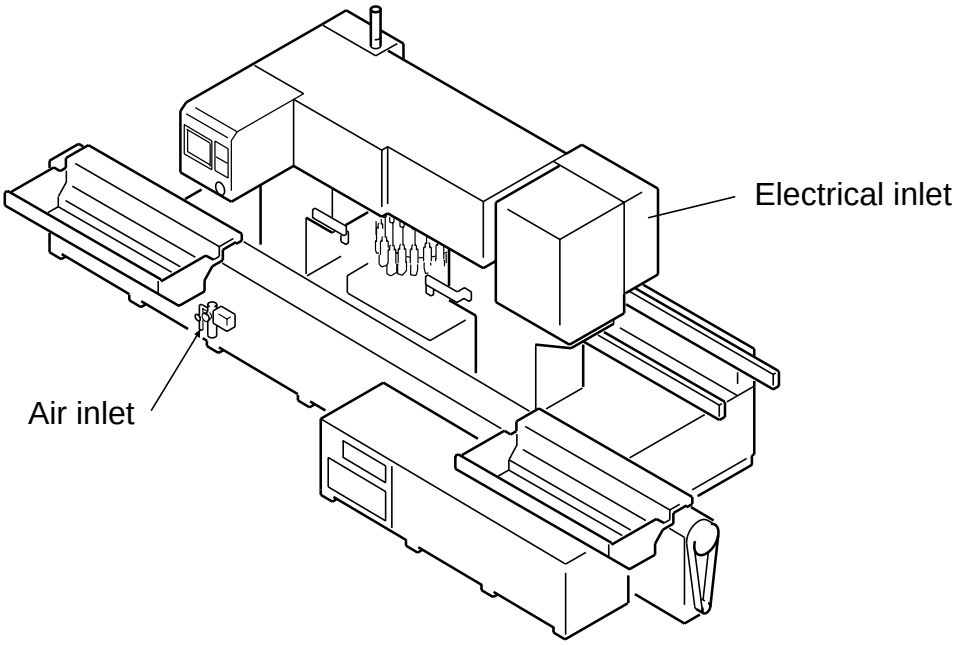


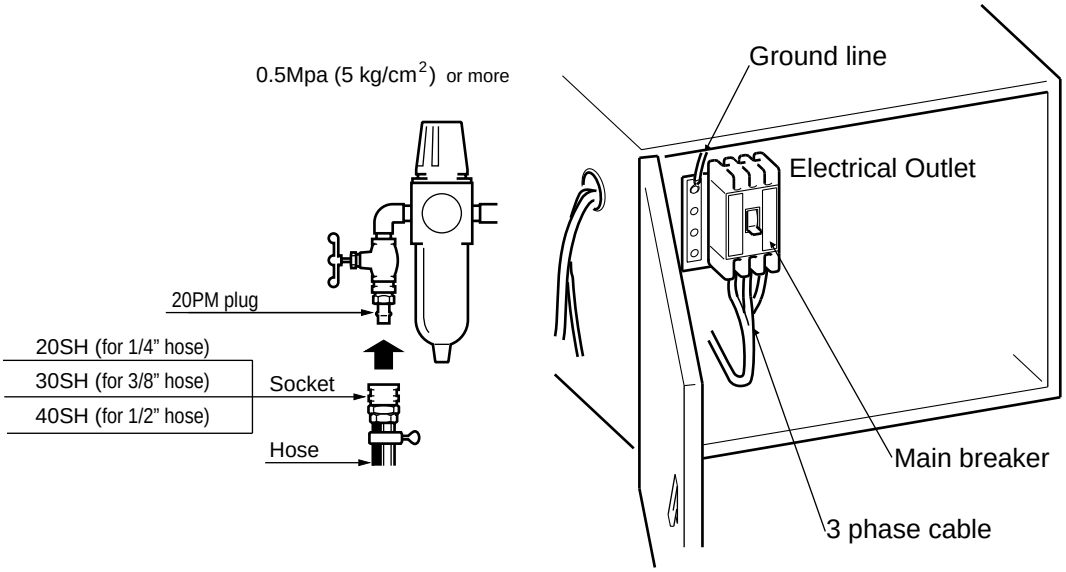
10.2 Leveling Position





10.3 Electrical and Pneumatic Inlets





Note: Fuji does not supply the hose.

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