SPECIFICATION

S

SPECIFICATION SIPLACE S-27 HM

High Speed SMD Placement System

SIEMENS DEMATIC

High Speed SMD Placement System
SIPLACE S-27 HM

Subject to change without notice.

Edition 1
1202-S-27-e

Order No
A10002-P141-T3-X-7600

Machine Description **3**

Line Design **4**

Placement Heads **5**
Head Modularity
Placement Accuracy
Component Range
12-Nozzle Collect & Place Head for High Speed Component Placement
6-Nozzle Collect & Place Head for High-Speed Large Component Placement
Nozzle Changer

PCB Conveyor **10**
Single Conveyor
Dual Conveyor
Ceramic Substrate Centering (Option)
PCB Bar Code for Production-Controlled Manufacturing (Option)

Component Supply **14**
Changeover Table
Tape Feeder
Bulk Case Feeder
Stick Magazine Feeder
Guard for Feeder Locations
Matrix Tray Changer (Option)
Component Bar Code Scanner for Set-Up and Refill Check (Option)
SIPLACE External Set-Up Station (Option)

Vision Sensor Technology **21**
PCB Vision Module
PCB Position Recognition
Bad Board Recognition
Position Recognition of Feeder
Algorithms to determine the X-/Y-Position and the Rotation Angle of Components
Standard Component Vision Modules for 12- and 6-Nozzle Collect & Place Head
DCA-Vision Module for 12- and 6-Nozzle Collect & Place Head (Option)

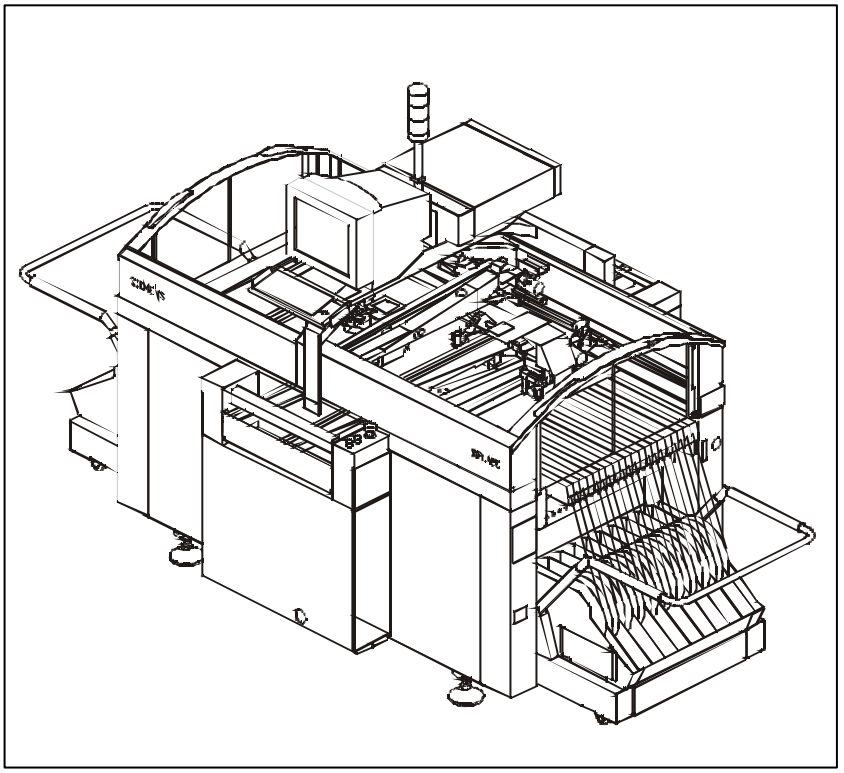
Machine Criteria **26**
Placement Accuracy
Placement Reliability
Mapping (Option)

High Speed SMD Placement System
SIPLACE S-27 HM

SIPLACE Software Architecture **29**
Line Programming System
Station Computer

Technical Data **30**
Signal Interfaces
Connections
Dimensions and Set-Up Conditions
Transporting and Commissioning

Possible Machine Configuration **35**



SIPLACE S-27 HM

Machine Description

Technical Data

Type of placement head	12-Nozzle Collect & Place Head and/or 6-Nozzle Collect & Place Head	
Number of gantries	2	
Benchmark placement rate [a]	12/12 6/12 6/6	26,500 cph 19,500 cph 17,000 cph
Component Range	0.6 x 0.3 mm^2 (0201) to 32 x 32 mm^2	
Max. placement accuracy (at 4 sigma) [a]	90 µm (12-Nozzle C & P Head) 70 µm (6-Nozzle C & P Head)	
PCB dimensions (L x W)		
Single conveyor	50 x 50 mm^2 to 495 x 460 mm^2 / 2" x 2" to 19.5" x 18" (optional up to 610 mm length)	
Dual conveyor	50 x 50 mm^2 to 495 x 216 mm^2 / 2" x 2" to 19.5" x 8.5" (with LBO optional up to 610 mm length)	
Feeding capacity	118 tracks, 8 mm tape	
Component table	Quick changeover table with integrated wheels, reel holder and scrap bin, SIPLACE MTC	
Types of Feeder modules	Tapes, Bulk Cases, Stick Magazines, Surf Tape feeders, application-specific OEM feeders	
Operating system	Microsoft Windows / RMOS	
Power	2 kW	
Compr. air requirements	5.5 - 10 bar, 400 Nl/min, tube ½"	
Vacuum pump (Option)	5.5 - 10 bar, 200 Nl/min, tube ½"	

a) As defined in Scope of Service and Delivery SIPLACE.

Description

The high-speed SMD placement system SIPLACE S-27 HM combines high placement speed with flexibility and accuracy. In contrast to classic chipshooters, a Collect & Place procedure is applied here. SIPLACE S-27 HM placement machines are equipped with two X-/Y-main gantries. Each gantry features a star-shaped Collect & Place placement head with either 12 or 6 nozzles.

The placement heads alternately pick up components from the stationary component feeder and place components on the PCB which is also motionless. This has distinct advantages:

- Component tapes of all sizes can be replenished by splicing a new reel of components to the end of a depleting reel. This eliminates machine stoppage due to component replenishment.
- Stationary, vibration-free feeders ensure a reliable pick-up of even the smallest components (e.g., 0201 and 0402 chips).
- Thanks to the flexible Collect & Place Heads – whose ideal nozzle set-up is automatically specified – the path can be minimized and the sequence of placement optimally adjusted.
- Populating a stationary PCB also prevents components from shifting during placement.

Speed coupled with economic efficiency and set-up reliability is the SIPLACE S-27 HM recipe for success. The first components are already being picked up while the PCB is being moved in. While one Collect & Place Head is placing components, the other one is picking components up.

The product capability is enhanced by optional add-on features such as component bar code scanner, automatic nozzle changer or changeover tables which can be set up outside the machine and exchanged in a matter of minutes.

- Additional changeover tables enables the reduction of job set-up time increasing machine utilisation.
- Dual Conveyor eliminates the non-productive PCB loading times thus increasing machines operating efficiency.
- Automatic nozzle changers for both changeover and storage of nozzles.
- PCB Barcode Reader used for product controlled production changeover.
- Component Bar Code Scanner used for feeder set-up verification.
- To achive the best placement quality we recommend to order an 0201 enhance kit.
- Ceramic Substrat Centering.
- Matrix Tray Changer (MTC) for high speed IC-mounting.

Line Design

Technical Data

System	SIPLACE SMD placement lines
Modules	SIPLACE HS-60 / SIPLACE S-27 HM / SIPLACE F^5 HM / SIPLACE HF
PCB conveyor	Automatic width adjustment
PCB dimensions (L x W)	
Single conveyor	50 x 50 mm^2 to 508 x 460 mm^2 / 2" x 2" to 20" x 18" (optional up to 610 mm length)
Dual conveyor	50 x 50 mm^2 to 460 x 216 mm^2 / 2" x 2" to 18" x 8.5" (optional up to 610 mm length)
Ceramic substrate dimensions (L x W)	50 x 50 mm^2 to 101.6 x 177.8 mm^2 2" x 2" to 4" x 7"
Placement speed	Depends on layout of modules
Space required	4 m² / SIPLACE S & F modules 6.8 m² / SIPLACE HS module 6.0 m^2 SIPLACE HF module

Description

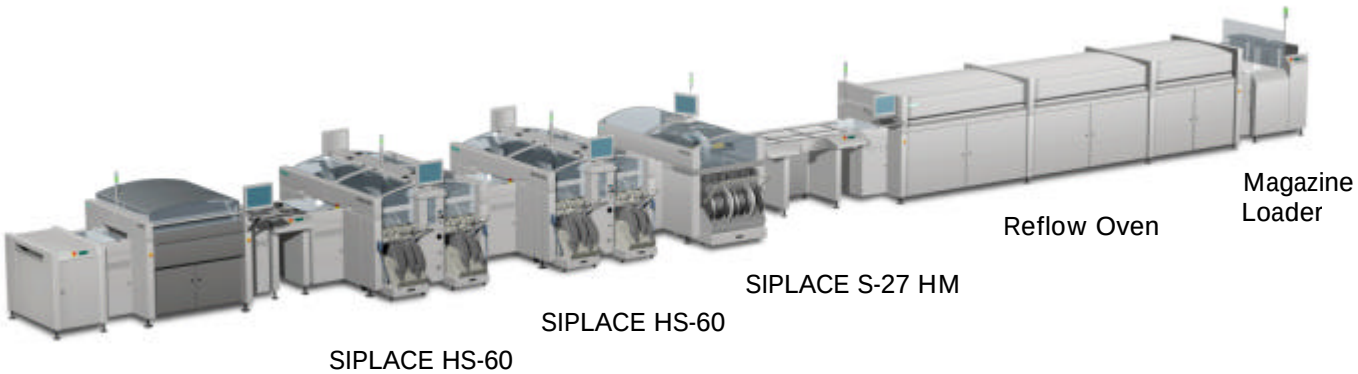
Flexibility and adaptability characterize the modular SIPLACE design. Each production line can be individually composed of similar and different modules.

Because of the small size and robust construction of the SIPLACE modules, they can be recombined quickly and easily to accommodate changes in production requirements.

The SIPLACE family of placement machines offers the right product for each purpose – from the very high-speed placement system SIPLACE HS-60 to the high-speed SMD placement system SIPLACE S-27 HM and the flexible placement systems SIPLACE F^5 HM and SIPLACE HF.

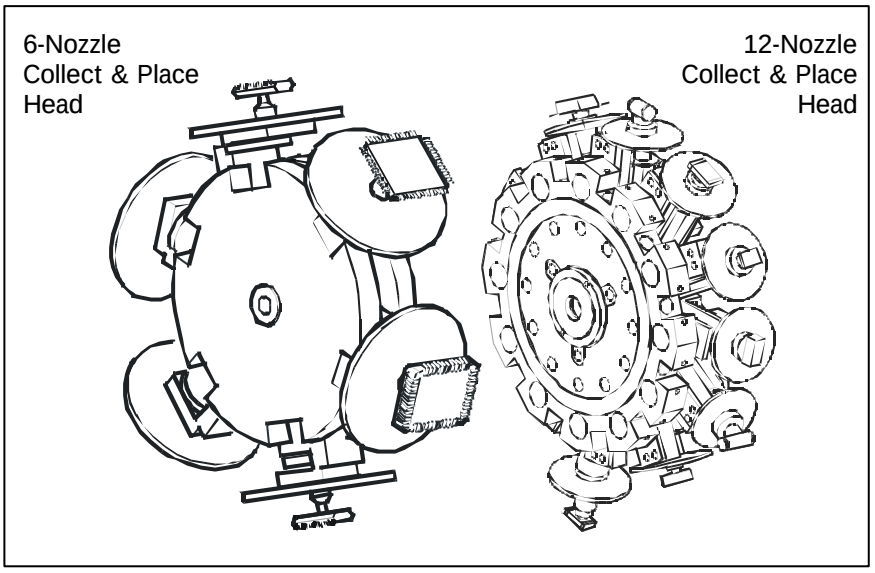
SIPLACE line-level optimization tools generate single set-ups for single products or for several products as well as several set-ups for several products. Also, product programs can be transferred from line to line even when the machine configurations are different.

The SIPLACE SMT platform – always at the cutting edge of technical innovation – guarantees maximum productivity due to its fully modular concept, which allows you to reconfigure your entire factory in a matter of minutes. With SIPLACE, you benefit from a worldwide network of global support and a compatibility across several machine generations, which means a long-term protection of your investment.

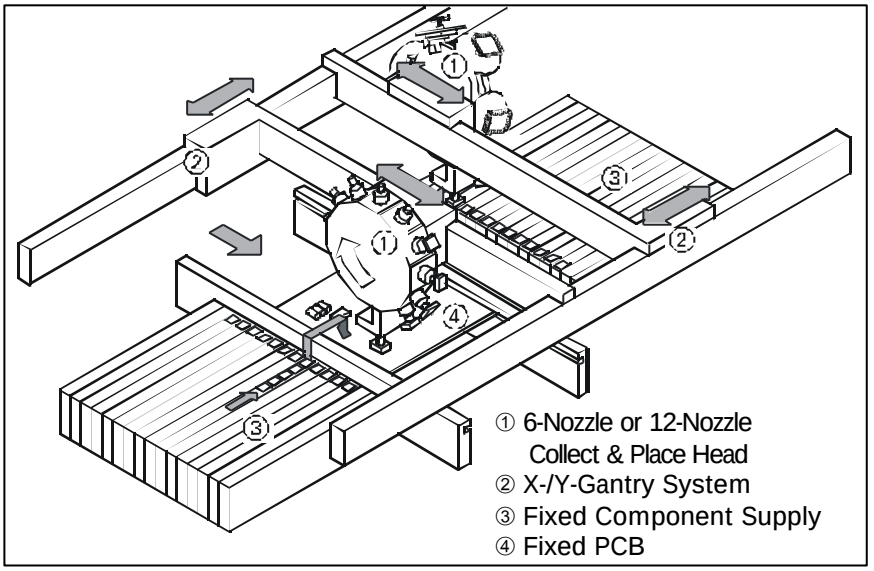


Example of a SIPLACE Placement Line

Placement Heads:
Head Modularity



Placement Heads for SIPLACE S-27 HM



Placement Principle of SIPLACE S-27 HM

Description

Head Modularity allows the customer to specify the machine head configuration according to the component range and output requirements. The 6-Nozzle and the 12-Nozzle Collect & Place Head can be interchanged to accommodate changing manufacturing requirements.

The X/Y-gantry features two placement heads: the 6-Nozzle or the 12-Nozzle high-speed Collect & Place Head.

The possible configuration choices are:

- Two 12-Nozzle Collect & Place Heads.
- Two 6-Nozzle Collect & Place Heads.
- One 6-Nozzle Collect & Place Head and one 12-Nozzle Collect & Place Head.

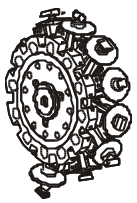
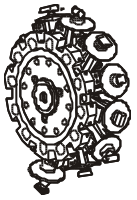
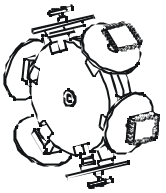
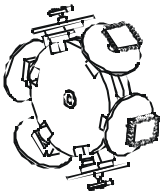
Placement head configuration can also be changed in the field by ordering the respective head reconfiguration kit (head included) and nozzle changer.

Exchanging the Collect & Place Heads requires reconfiguration of the station software and recalibration of the machine by trained personnel. Also – if used – the automatic nozzle changer has to be replaced to match the head used. The reconfiguration will take about 8 hours with a trained service technician.

Changing a placement head and reconfiguring a SIPLACE machine when and where required allows the customer to benefit from the flexibility of different placement heads without having to invest in several SIPLACE machines.

Placement Heads:
Placement Accuracy
Component Range

Placement Accuracy [a]

Placement Accuracy	Placement Head	12-Nozzle Collect & Place Head	12-Nozzle Collect & Place Head with DCA (Option)	6-Nozzle Collect & Place Head	6-Nozzle Collect & Place Head with DCA (Option)
3 Sigma	X/Y Accuracy	± 67.5 µm	± 67.5 µm	± 52.5 µm	± 52.5 µm
	Rot.-Accuracy	± 0.525°	± 0.525°	± 0.225°	± 0.225°
4 Sigma	X/Y Accuracy	± 90.0 µm	± 90.0 µm	± 70.0 µm [b]	± 70.0 µm [b]
	Rot.-Accuracy	± 0.700°	± 0.700°	± 0.400°	± 0.400°
6 Sigma	X/Y Accuracy	± 135.0 µm	± 135.0 µm	± 105.0 µm	± 105.0 µm
	Rot.-Accuracy	± 1.050°	± 1.050°	± 0.450°	± 0.450°

a) As defined in Scope of Service and Delivery SIPLACE.
b) When SIPLACE S-27 HM is equipped with two 6-Nozzle Collect & Place Heads only one can reach 70.0 µm, the second reaches 80.0 µm.

Component Range

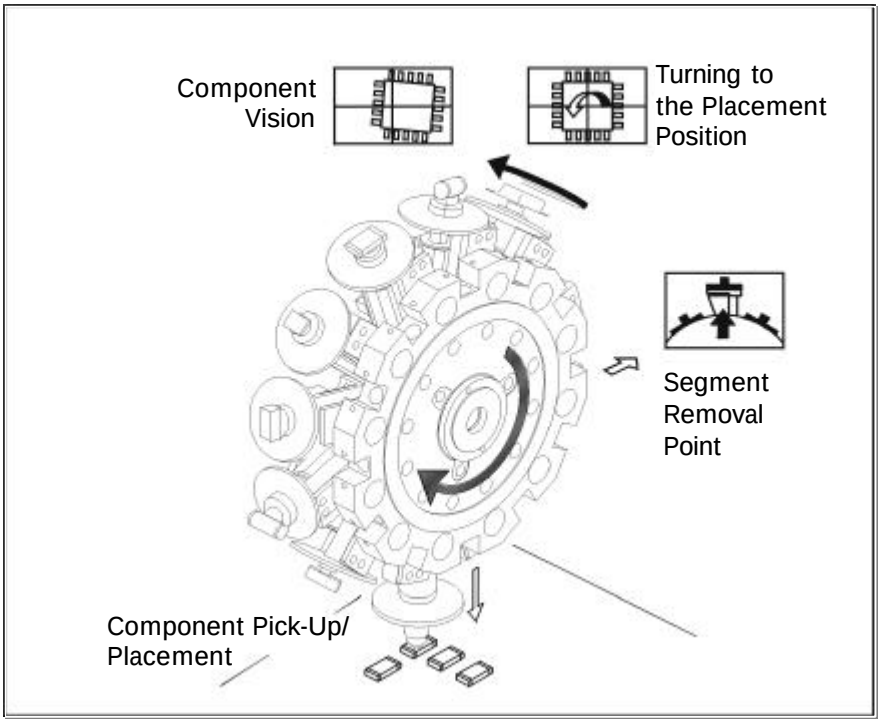
	12-Nozzle Collect & Place Head	12-Nozzle Collect & Place Head with DCA Option)	6-Nozzle Collect & Place Head	6-Nozzle Collect & Place Head with DCA (Option)
Component size	0.6 x 0.3 mm^2 [c] to 18.7 x 18.7 mm^2	0.6 x 0.3 mm^2 [c] to 13 x 13 mm^2	1.6 x 0.8 mm^2 to 32 x 32 mm^2	1.6 x 0.8 mm^2 to 13 x 13 mm^2
Max. component height	6 mm	6 mm	8.5 mm	8.5 mm
Max. component weight	2 gr	2 gr	5 gr	5 gr
Placement force	2.4 - 5.0 N	2.4 - 5.0 N	2.4 - 5.0 N	2.4 - 5.0 N
Performance	See table on page 3	See table on page 3	See table on page 3	See table on page 3
Min. pitch lead / bump [d]	500 / 350 µm	400 / 200 µm	500 / 560 µm	400 / 200 µm
Min. ball / bump diam. [d]	200 µm	110 µm	320 µm	110 µm

c) 0201 (recommended to order the special 0201-kit).
d) Depends also on specification of components (quality, vision...)

Placement Heads:
12-Nozzle Collect & Place Head for High Speed Component Placement

Technical Data

Stroke of Z-axis	max. 16 mm
Programmable placement force	2.4 to 5.0 N



12-Nozzle Collect & Place Head for High Speed Placement

Description

The 12-Nozzle placement head operates on the Collect & Place principle. In contrast to classic chip shooters, the 12 vacuum nozzles of the SIPLACE Collect & Place head rotate around a horizontal axis. This does not only save space:

Due to the small diameter compared to chip shooters, the centrifugal forces are significantly lower. The results are high-speed, reliable placement and the same cycle time for all components.

Components are picked up and placed reliably with the aid of vacuum followed by a gentle air kiss. A number of vacuum tests monitors if the component has been picked up and placed accurately.

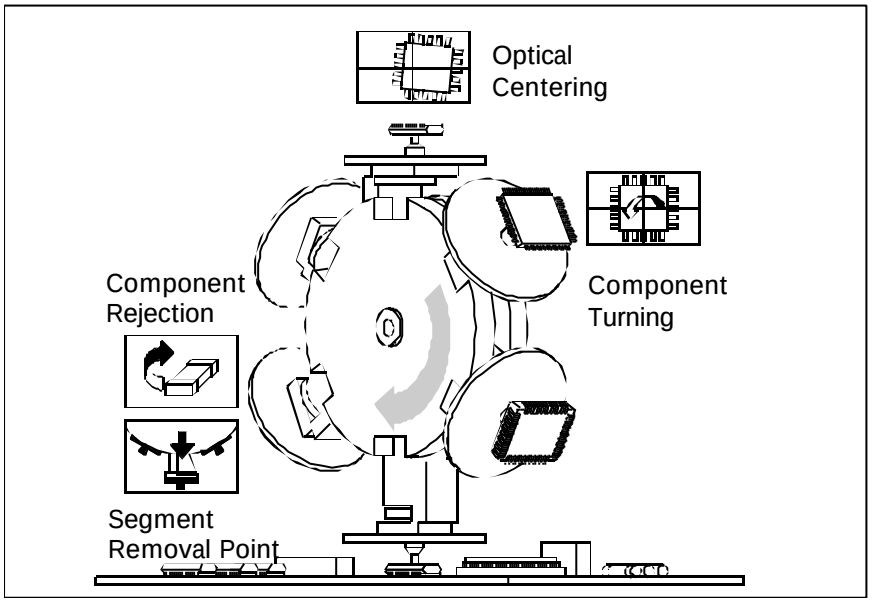
Various control and self-learning functions further enhance the dependability of the system:

- The optical recognition of feeder positions records the exact position of the feeder table.
- A camera on the placement head (component vision module) determines the exact position of each component on the nozzle.
- For every feeder the pick-up offsets are averaged over the last ten pick-ups. This enables the head to dial-in on the precise pick point for each component.
- In addition, the package form is also checked. If the actual geometric dimensions of the component do not correspond to those programmed, the component is rejected.
- Components rejected by the vision system are dumped into a bin, reject feeder or matrix tray. Any rejected component gets automatically placed during a repair run.
- Warpage of the PCB is accommodated by sensor stop activated z-axis placement. The system also keeps the last ten positions of the z-axis at component placement and uses the average of these values to improve the drive down and place speed of the cycle.
- To check very small components, such as 0201, it is helpful to use a component sensor. This infra-red sensor checks the presence of components before pick-up and placement, ensuring reliable handling of even the smallest components.

Placement Heads:
6-Nozzle Collect & Place Head for High-Speed Large Component Placement

Technical Data

Stroke of Z-axis	max. 16 mm
Programmable placement force	2.4 to 5.0 N



6-Nozzle Collect & Place Head for High Speed Placement of large components

Description

The 6-Nozzle placement head operates on the Collect & Place principle.

The cycle time of the 6-Nozzle Collect & Place Head – and thus the real achievable performance – depends on the dimensions and the number of leads / bumps of the component.

Mechanically and electrically, the 6-Nozzle Collect & Place Head is structurally very similar to the 12-Nozzle Collect & Place Head.

Placement Heads:
Nozzle Changer

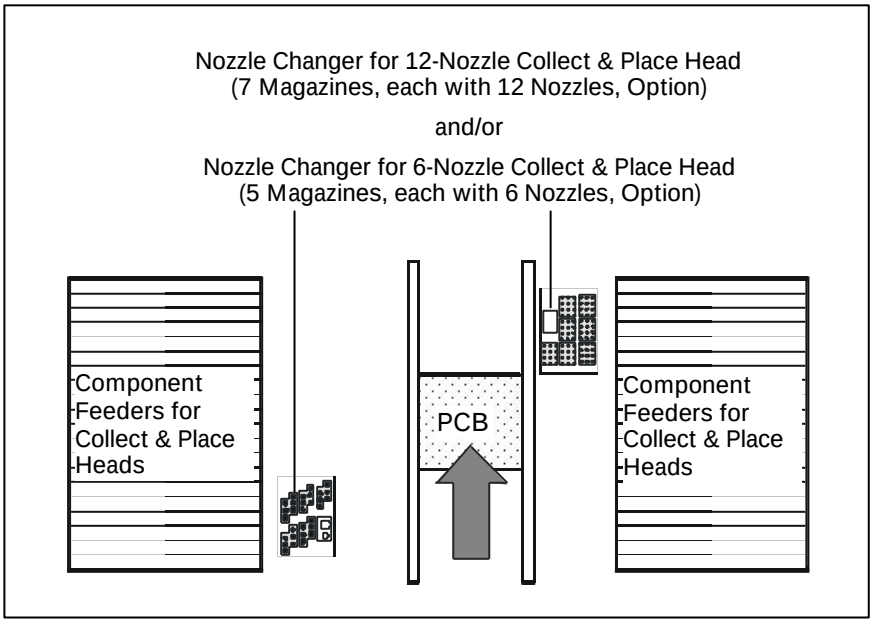
Technical Data

12-Nozzle Collect & Place Head

Type of nozzle	All standard nozzles of nozzle series 7xx/9xx (special nozzles must be tested individually)
Capacity	8 magazines, each with 12 nozzles of one nozzle type
Nozzle changing times	About 2 s per nozzle

6-Nozzle Collect & Place Head

Type of nozzle	All standard nozzles of nozzle series 7xx and 8xx (special nozzles must be tested individually)
Capacity	5 magazines, each with 6 nozzles of one nozzle series
Nozzle changing times	About 2 s per nozzle



Position of Nozzle Changers

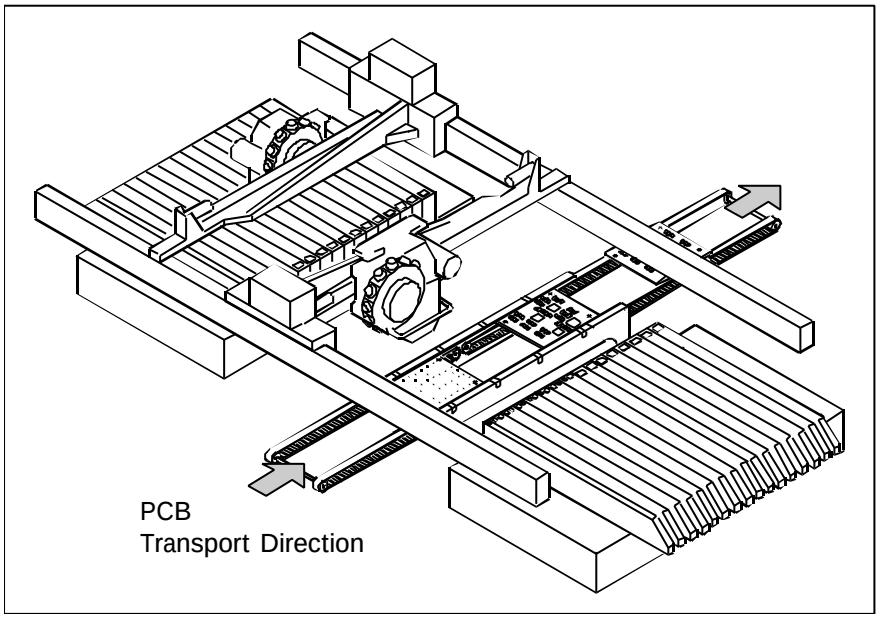
Description

A nozzle changer corresponding to the Collect & Place Head in use can be installed to the left of the PCB conveyor with no loss of feeder capacity. It will change the nozzle set-up of the placement head quickly and reliably for the specific nozzle configuration valid to a job. Damaged or faulty nozzles can be exchanged via the menu function on the station computer.

PCB Conveyor:
Single Conveyor

Technical Data

PCB dimensions	See table on page 3
PCB thickness	0.5 to 4.5 mm
Max. PCB weight	3 kg
Max. PCB warpage	Top: 4.5 mm - PCB thickness Bottom: 0.5 mm + PCB thickness
Free space on PCB bottom side	Standard: 25 mm, Option: max. 40 mm
PCB conveyor height	830 ± 15 mm (Standard) 900 ± 15 mm (Option) 930 ± 15 mm (Option) 950 ± 15 mm (Option) SMEMA
Fixed conveyor edge	Right (standard), left (option)
Type of interface	Siemens (standard); SMEMA (option)
Component-free PCB handling edge	3 mm
PCB loading time	2.5 s



PCB Conveyor

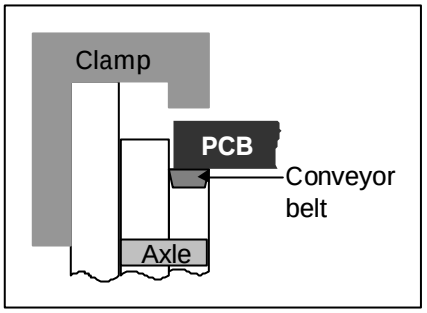
Description

On SIPLACE S-27 HM the in-line conveyor system guarantees a quick adjustment to new PCB widths. The change is made either at the station computer using the menu function or from the line computer via the automatic width adjustment unit.

The PCB is clamped from the bottom to the top side of the conveyor. This offers several advantages:

- Higher real placement rate
- Robust PCB recognition (camera focus point)
- Shorter PCB change time
- Easier change of fixed conveyor edge right/left also in field
- Quicker learning function, as the PCB height does not effect the Z-stroke, resulting in higher placement rates

The conveyor can be ordered with a fixed rail on right or left. As standard the SIPLACE placement systems are available with a single conveyor system.



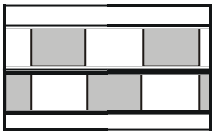
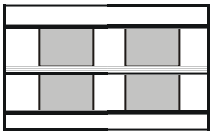
PCB Clamping

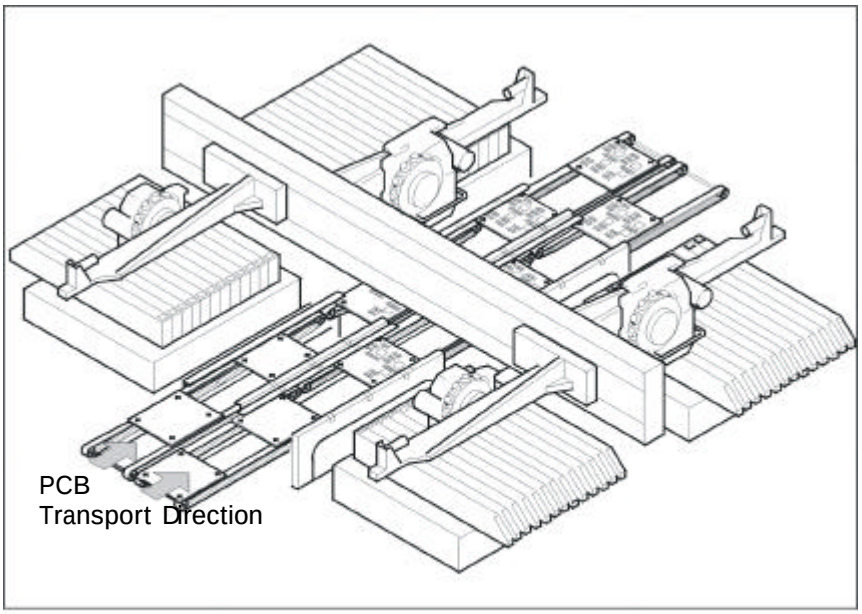
PCB Conveyor:
Dual Conveyor

Technical Data

PCB dimensions	See table on page 3
Fixed conveyor edge	Right (standard), left (option)

Asynchronous and Synchronous Transport on Dual Conveyor

Transport mode	Asynchronous	Synchronous
View		
Placement program per conveyor	same or different	same or different
PCB width per conveyor	same	same or different
Ink spot recognition	possible	not possible
Automatic width adjustment	possible	not possible



Dual Conveyor with Asynchronous Transport

Description

Thanks to reduced non-productive times the dual PCB conveyor can substantially increase the throughput, depending on the program. It makes it possible to transport two PCBs through the machine.

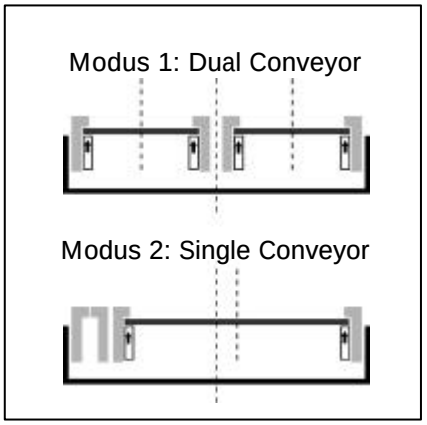
Asynchronous transport

A PCB is moved into the machine in "slack time" while the other PCB is being populated. The non-productive time caused by the PCB transport is completely eliminated. The increase in placement speed reaches 30%, depending on the components placed on the PCB.

Synchronous transport

Two PCBs are populated simultanously. The real placement rate can be increased, especially when boards with only a few components are handled.

The conveyor is already prepared for Flexible Dual Conveyor mode, which allows the handling of PCBs with a maximum width of 380 mm.

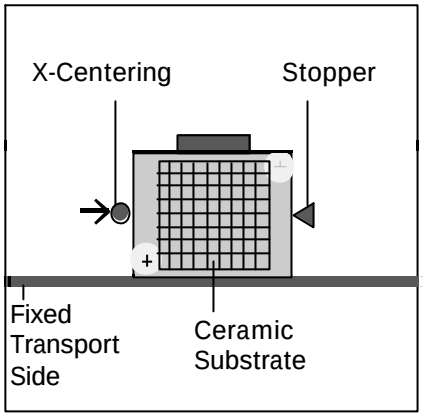


Flexible Dual Conveyor

PCB Conveyor:
Ceramic Substrate Centering (Option)

Technical Data

Substrate dimensions	50 x 50 mm^2 to 101.6 x 177.8 mm^2 / 2" x 2" to 4" x 7"
Substrate thickness	0.5 to 4.5 mm
Substrate model	Unscribed (no difficulty) Scribed (after test)
Contact in conveyor	2.5 mm
Substrate bottom clearance	12 mm
Compressed air connection	5.5 bar



Optical Centering via PCB Camera and Mechanical Fixation

Description

Like the PCB vision module, optical centering of ceramic substrate is conducted with the aid of reference marks (fiducials). Depending on the contrast ratio the machine activates a standard lighting or the oblique lighting.

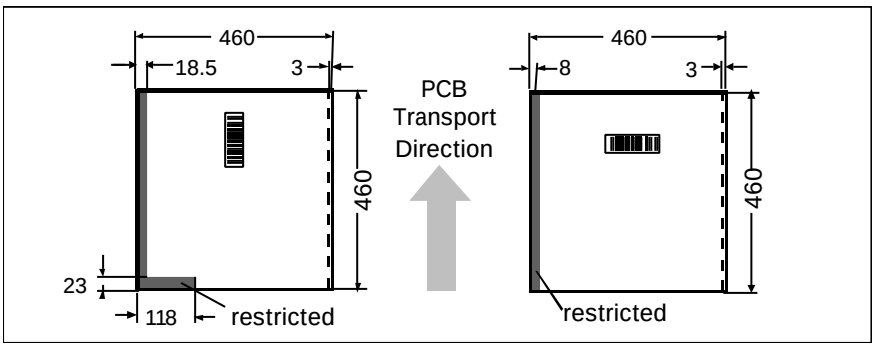
- On ceramic and CM blue light.
- On flexible PCBs using vision module without IF-filter infrared light.

PCB Conveyor:
PCB Bar Code for Production-Controlled Manufacturing (Option)

Technical Data

Bar-code-free PCB edge	3 mm on left and right parallel to PCB transport direction (the additional restrictions shown in figure at the bottom apply for scanning the bar code from above)
Label dimensions	Stroke width: W: 0.19 < W ≤ 0.3 mm (corresponds to high + medium density) Stroke length: ≥ 4 mm [a] Length of scanning window: ≤ 90 mm
Label alignment on PCB [b]	Parallel or at right angles to the PCB transport direction, preferably next to fixed conveyor side
Recommended label colors (contrast ratio > 70% as per DIN 66236)	Color coding: black, dark green or dark blue Background: white, beige, yellow, orange
Code types	Code 39, Code 128 / EAN 128, Codabar, 2/5 IATA 2/5 industrial, 2/5 interleaved, UPC, EAN, Pharma Code, EAN Addendum (more upon request)
Complete bar code	Max. 25 characters Definition of a bar code filter possible
Safety of the laser scanner	Laser diode 670 nm (red) / 1 mW Laser protection class 2, degree of protection IP65
Station and line software	from Version 502.xxx
Scan-in/analysis time	Slack time (T ≤ 1 s), as parallel to the placement of preceding PCB

a) This value can only be met if the bar code label on the PCB moves through the bar code scanner at right angles to the machine's direction of transport.
b) Depending on where the bar code label is located on the PCB, the position of the bar code scanner can be easily adjusted in the input conveyor belt.



Restrictions for Bar Code Reading of PCB Sizes 460 x 460 mm²

Description

The SIPLACE PCB bar code scanner supports the flexible production of SMD products and enhances placement reliability. It recognizes all code types in general use for industrial applications.

The laser scanner reads the bar code label on the top and/or bottom of each PCB moving during transport. On the basis of the bar code information the line computer automatically selects the correct placement program from the previously prepared bar code assignment list and sends it to the station. This procedure is performed in slack time while a PCB already in the machine is being populated. If a number of PCBs with the same bar code are moved in one after the other, the program is only transferred the first time. The following preconditions apply for all products which are to be manufactured with the aid of the PCB bar code:

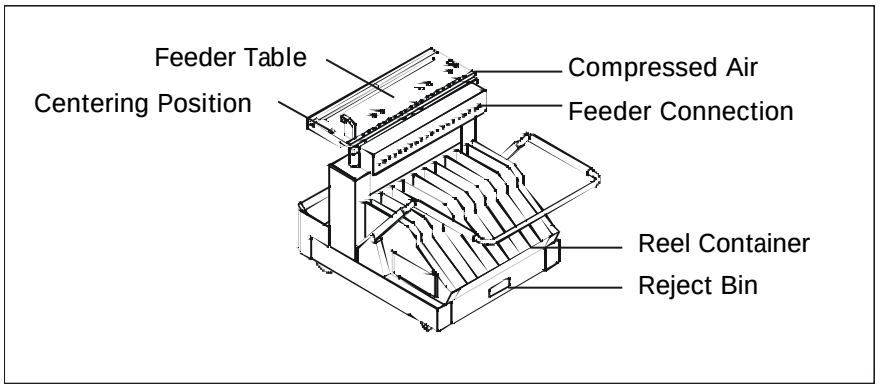
- **identical component set-up at the individual machines in the line**
- **all PCBs of same width.**

The bar code filter can be utilized, if only certain information contained in the bar code is relevant.

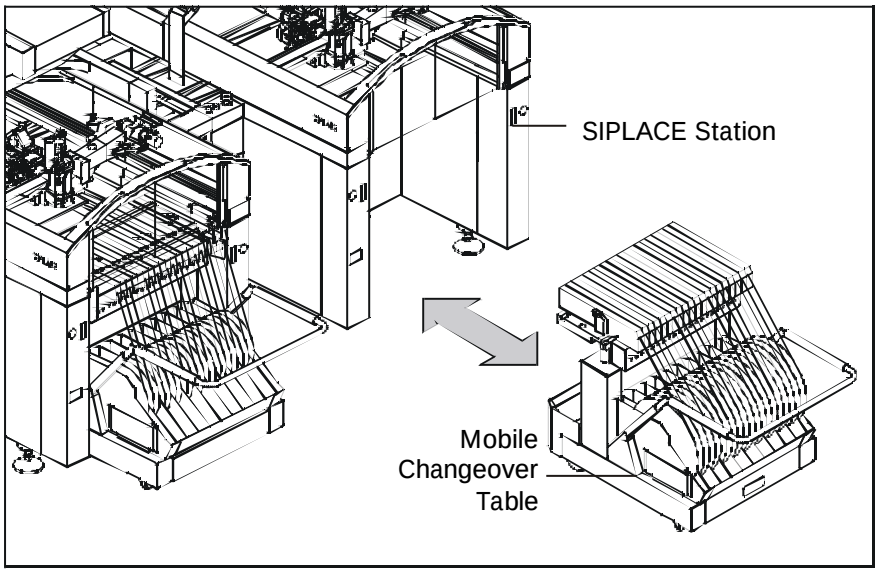
Component Supply: Changeover Table

Technical Data

Insert (exchangeable)	In all SIPLACE placement modules
Feeder locations	59 x 8 mm tracks per table, 118 x 8 mm tracks per machine
Feeder modules	SIPLACE feeders for tapes, stick magazines, Bulk Cases
Accessories	Tape container, waste container, empty tape cutter



Mobile Changeover Table



Exchange of a Feeder Changeover Table

Description

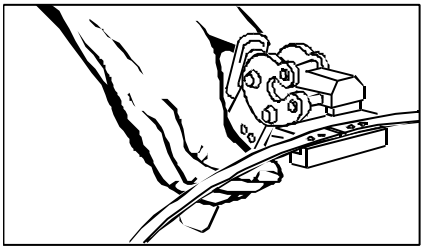
Each side of the machine is equipped with a changeover table. As option, a MTC with a narrow component table can be placed.

The component feeders are stationary during the placement process, therefore it is possible to refill components or splice tapes without stopping the machine.

Either individual feeders or the entire changeover table can be exchanged during changeover.

Use of component bar codes with the aid of an optional component bar code scanner guarantees the correct assignment of the component to the track.

To make full use of the advantages of the component changeover table, the entire set-up including the check can also be conducted outside the machine at the optional SIPLACE set-up station. The changeover tables are equipped with rollers and have an integrated pneumatic lifting device, eliminating the need for a lifting device. Exchanging the tables takes less than 2 minutes per module.



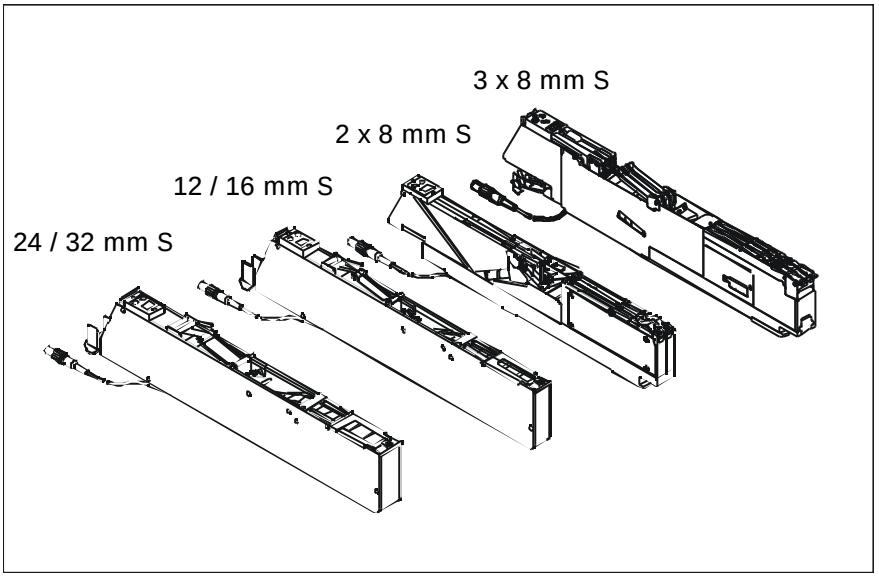
Splicing Tool

Component Supply:
Tape Feeder

Technical Data

Packaging	Model	Feeder locations	Transport distance	Max. Height of component
Paper and blister tapes	2 x 8 mm S [a]	1	2 or 4 mm	2.5 mm
	3 x 8 mm S	1	2 or 4 mm	2.5 mm
	3 x 8 mm S [b]	1	2 mm	0.7 mm
	12/16 mm S	1	4 - 12 mm [c]	14 mm
Blister tape	24/32 mm S	1.5	4 - 32 mm [c]	14 mm
Tape reels	ø 7" to 19" (178 - 475 mm)			
Feeder cycle	S-feeder to 20 mm transport distance < 150 ms			

a) Fiducial for recognition of position of feeders;
b) only for 0201 and 0402;
c) adjustable in increments of 4 mm.



Tape Feeder Modules S

Description

The tape reels of the feeder modules are housed in the tape container of the component changeover table. A cutter automatically chops up empty tape coming out of the tape container.

Feeders used on SIPLACE are distinguished by a short cycle time and a high-precision pick-up position. Even product diversity and small batch sizes can be handled easily since the feeder set-up can be changed quickly.

The increment of the tape cycle is just as variable as the use of tape materials. Thanks to the general purpose tape feeding modules which are equally suitable for paper and blister tapes, a small range of module types will be sufficient. Activated by a signal from the component table, the modules control the entire feeder sequence themselves, including the automatic take-up of the strips.

The S Feeders series feature shorter cycle times and they can handle tapes with 2 mm grids (8 mm S). 8 mm S and 12/16 mm S are equipped with component cover.

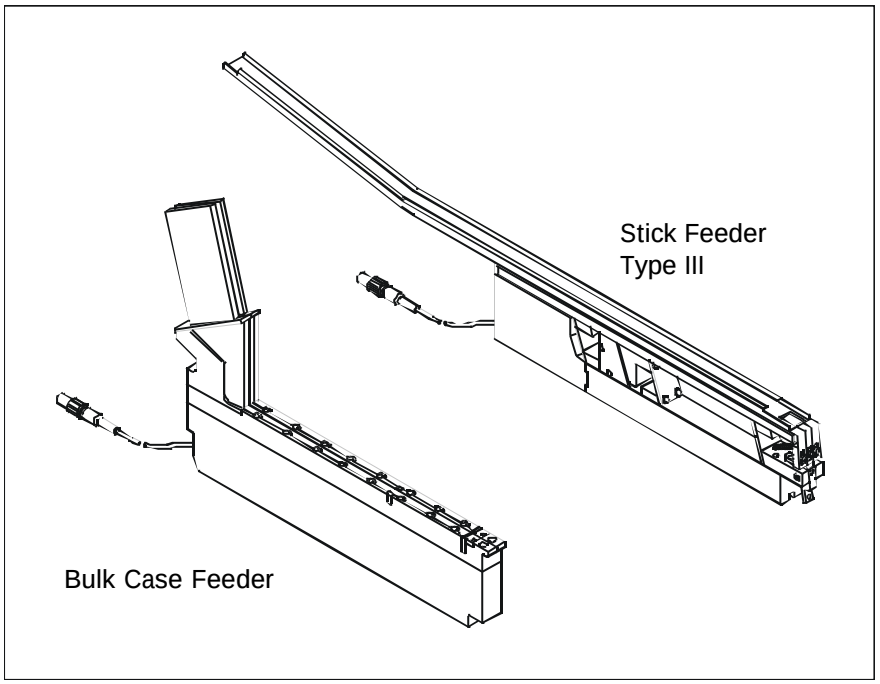
The feeders can be used in other SIPLACE machines as well.

Component Supply:
Bulk Case Feeder
Stick Magazine Feeder

Technical Data

Bulk Case feeder [a] Type of packaging	Bulk Case
Feeder rails for	Chip 0402 component height 0.35 mm Chip 0402 component height 0.50 mm Chip 0603 component height 0.45 mm Chip 0603 component height 0.80 mm Chip 0805 component height 0.45 mm Chip 0805 component height 0.60 mm Chip 0805 component height 0.85 mm Chip 0805 component height 1.25 mm Mini-Melf
Feeder location	1 feeder location for 2 different component types
Stick magazine feeder Type III	With control electronics
Number and width of tracks	3 x 9.5 mm 2 x 15 mm 1 x > 15 mm 1 x 30 mm
Feeder location	1

[a] Fiducial to recognize position of feeder.



Bulk Case Feeder and Stick Feeders

Description

The SIPLACE Bulk Case feeder with 2 tracks is used to handle components packaged in standard bulk containers. It transports rectangular and cylindrical passive components to the pick up area of the machine. To replenish the supply, the Bulk Cases are removed and replaced outside the machine eliminating stoppages for replenishment.

Essentially, this feeder module consists of a base which holds 2 feeder rails. The components are separated and transported through the feeder rail via compressed air.

The principle of stationary component tables has been tried and tested specifically with Bulk Case components. Vibrations, which developed when other placement methods are used may cause wear to the components compromising quality and reliability of the components.

The stationary component table also brings decisive advantages for stick magazines. The general purpose vibratory stick feeder can be refilled during the placement process.

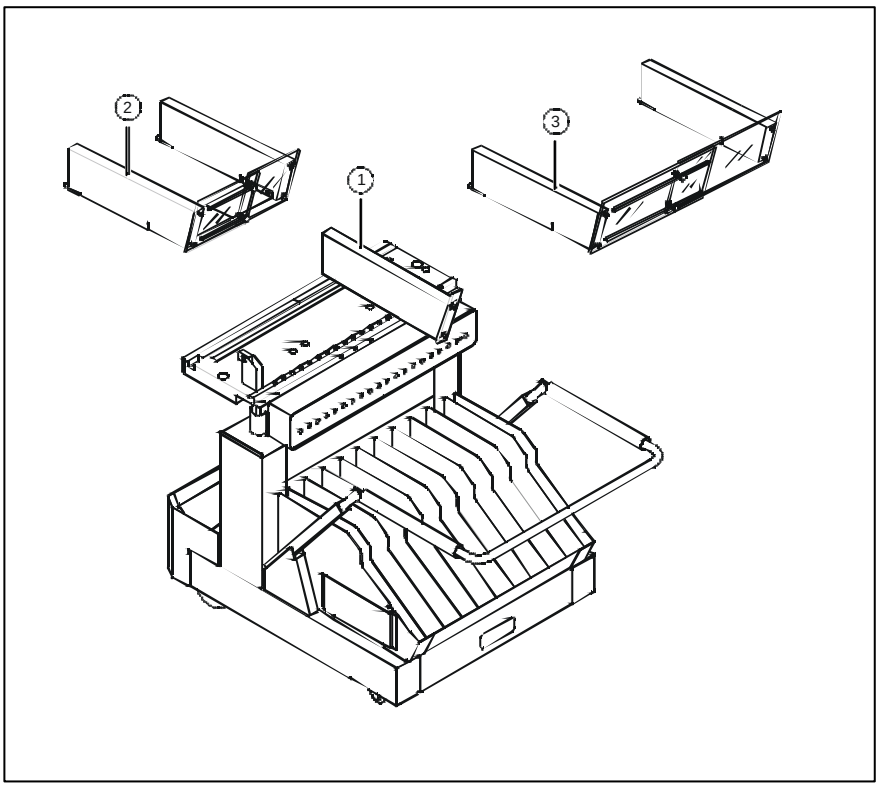
The feeders can be used in other SIPLACE machines as well.

Component Supply:
Guard for Feeder Locations

The following guard-variants can be used:	
1	SIPLACE guard for 1 location
2	SIPLACE guard for 6 - 10 locations
3	SIPLACE guard for 11 - 20 locations

Description

Some local safety requirements dictate that all feeder locations must be equipped with feeders. If the feeder set-up does not fill all feeder locations, guards may be used in place of the modules.



Various Guards for Feeder Locations

SAFETY WARNING

Component Supply:
Matrix Tray Changer (Option)

Technical Data

Dimensions (L x W x H)	
of Matrix Tray Changer (MTC)	1,350 mm x 775 mm x 1,499 mm
of cassette	354.1 mm x 154.8 mm x 131 mm
of Waffle Pack Tray Carrier (WPTC)	371 mm x 146 mm x 410.1 mm
of JEDEC tray	320 mm x 135 mm
Stroke vertical (between WPTC 1 and WPTC 40)	502.5 mm
Stroke horizontal (between reference and component position)	approx. 640 mm
Spacing between levels	11 mm
Spacing between cassettes	134.5 mm
Storage capacity	80 WPTCs
Changeover time (over 5 levels)	< 2 s
Weight of MTC	
basic configuration	500 kg incl. cassettes and WPTCs
partially equipped	approx. 532 kg incl. components
fully equipped	600 kg incl. tapes and feeders
Weight of moving mass (equipped)	43.5 kg per tower
Weight of cassette	approx.7.5 kg
Max. floor load fully equipped	
per foot	2.78 kg/cm^2
per castor	4.01 kg/cm^2
Min. component size (L x W)	5 mm x 5 mm
Max. component height	13.5 mm [a]
Max. noise generation	80 dB_A

a) When using components higher than 7.62 mm only every other tray can be used.

Electrical Connection (separate from machine power connection)

Frequency	50 Hz / 60 Hz
Phases	1; 3
Voltage	230/400 V or 110/208 V (USA)
Rated current	2.7 A or 4.2 A (USA)
Fusing	3 x 16 A
Rated current at max. load	2 A

Description

For high-volume production environments requiring a wide range of components, the use of a SIPLACE Matrix Tray Changer is highly recommended. The Matrix Tray Changer is a high-speed, high-capacity component delivery system for SIPLACE S-27 HM.

The SIPLACE S-27 HM can be equipped with up to two Matrix Tray Changers, one on each side. When high-volume production requirements include larger or tray-type components, the SIPLACE MTC is the best solution.

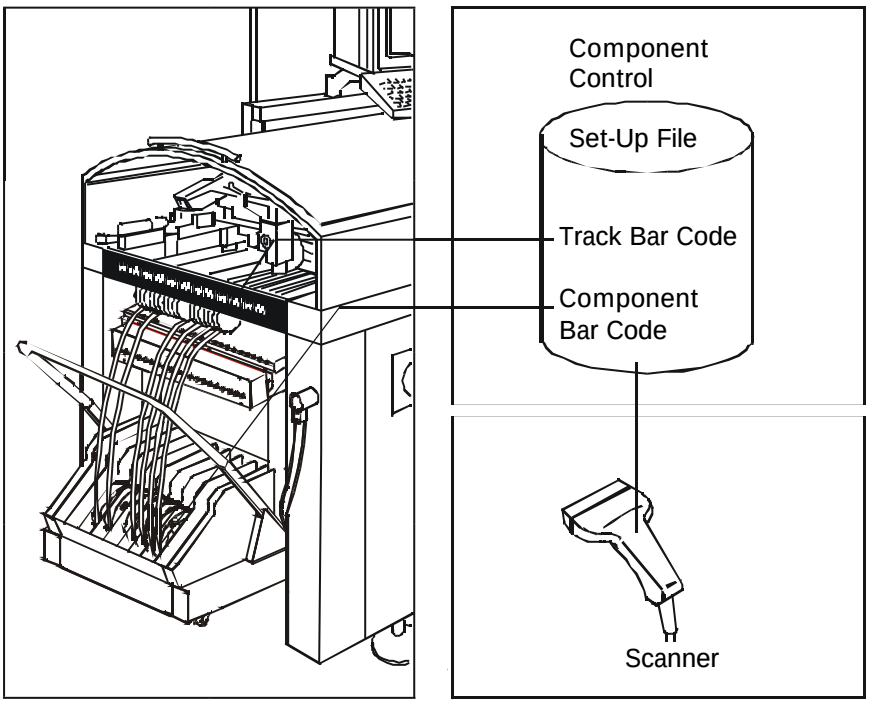
Technology

- Two independent tray carriers, each with a JEDEC tray capacity
- Each tray carrier is equipped with a separate drive system
- Set-up of the MTC is carried out in accordance with the existing SIPLACE optimization routine
- The carrier is moved to the level of the tray to be accessed, then the tray is moved precisely to the access area for pick-up by the placement head
- A separate control unit is connected via interface cable
- Operator information is available via SIPLACE station computer
- Easy handling due to removable waffle pack carriers
- Large storage capacity and multiple component set-up possibilities
- When a waffle pack tray is depleted, an alternate tray can be accessed
- Quick changeover of waffle pack tray magazines containing up to 10 waffle pack trays
- External set-up is possible

Component Supply:
Component Bar Code Scanner for Set-Up and Refill Check (Option)

Technical Data

Connection	Station computer
Data input	Bar code scanner or keyboard
Number of characters	Max. 40
Restrictions	Bar codes beginning with number 1 or 2 and with less than 5 characters
Number of bar codes	Max. 6 per component
Number of filters to extract relevant data	Max. 1 per bar code
Preset code types	Code 39 (standard or full ASCII), Code 2 from 5 interleaved and normal, Code 128, UPC/EAN/JAN codes (more on request)



The scanner checks the corresponding track and the components

Description

The bar code scanner enables a quick and reliable check of component set-up and refill. The bar codes of the tracks and the loaded components assigned to the tracks (bar code labels on tapes, Bulk Cases, etc.) are read in with a hand scanner. An audible and optical signal acknowledges a successful reading operation. If the label is damaged the bar code can be entered at the keyboard.

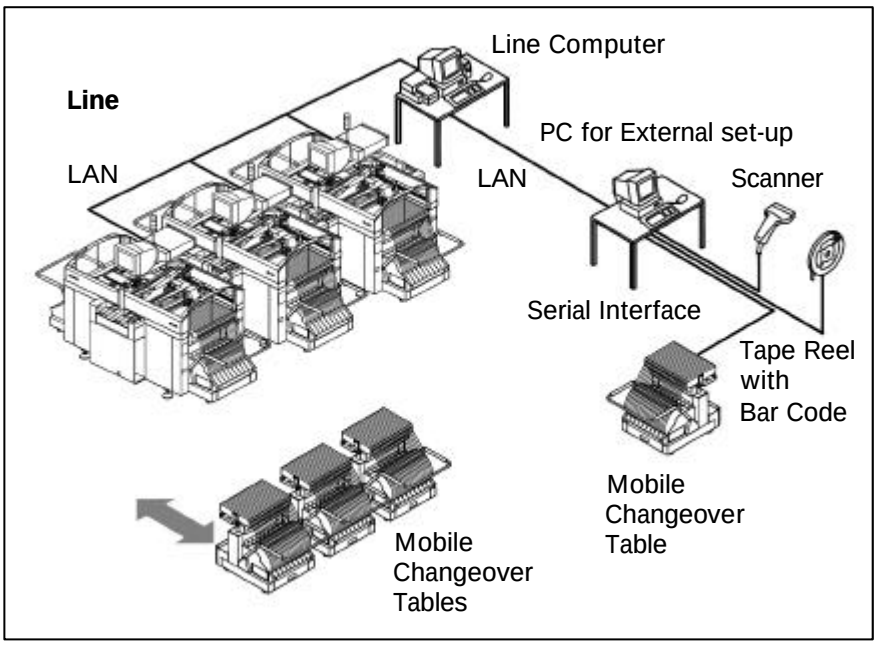
The allocation of the components to their respective track is described in the set-up data. An error message is displayed if the data received from the bar code scanner does not conform to the set-up data.

If the set-up check is switched on, it becomes a mandatory step in the set-up process. If it is switched off the set-up check is optional.

Component Supply:
SIPLACE External Set-Up Station (Option)

Technical Data

Operating system	Windows NT 4.0
Set-up check	Per bar code scanner
Component table change	Time expanded: 2 min / table side



Example for SIPLACE Set-Up Station

Description

The component changeover tables can be set up and checked at an external SIPLACE set-up station quickly and without machine idle time. The costs for production involving a wide variety of components are greatly reduced. During the bar code check outside the machine, 10 minutes of machine standstill are eliminated per set-up change. All current data from up to 4 lines are accessible over a link to the line computer via a Local Area Network (LAN).

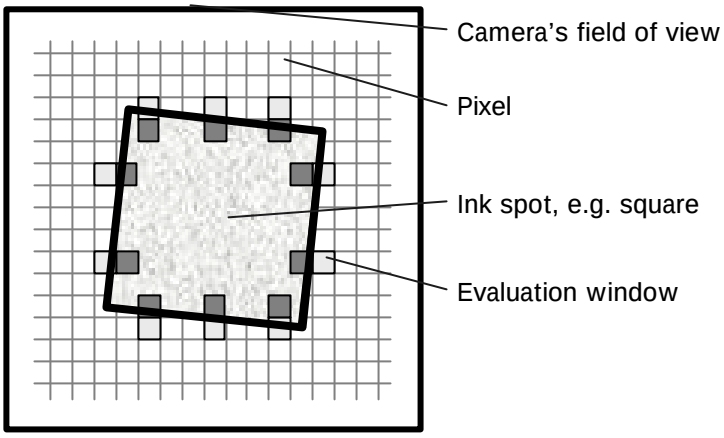
In the case of the SIPLACE S-27 HM a component changeover table is part of the standard equipment. Additional changeover tables are required for optimal use of the set-up station.

Vision Sensor Technology:
PCB Vision Module

Technical Data

Reference marks	up to 3 (subpanels and multiple panels)
Local marks	up to 2 per component (may be of different type)
Library memory	up to 255 types of reference marks
Recognition of bad boards	per subpanel
Image analysis	Correlation principle (geometric alignment) based on gray-scale values
Lighting method	Front lighting
Recognition time fiducial/ bad board marks	0.4 s [a]
Camera's field of view	5.7 x 5.7 mm

a) Software 502.xx required.



Geometrical Alignment

Description

The SIPLACE S-27 HM has a number of vision modules and a central vision system to evaluate the recorded image data ensuring high placement accuracy.

At the machine´s X-gantry the PCB vision module is mounted. It is used to find the PCBs´ positioning-offsets within the conveyor system.

This vision module is also required to measure the machine origin and/or the feeder positions on one side of the table. It consists of a single CCD camera with integrated lighting and optics.

The offsets in the position of the PCBs are determined with the help of at least two but generally three reference fiducial marks on the PCB. When the PCB arrives at the placement area the positioning system with its PCB vision module moves to the programmed mark position.

Using the Geometrical Alignment allows to choose predefined marks from a menu (e.g. cross, circle, square). The size of the mark is programmed at the Station Computer. From this time on form and size of the mark is defined and known.

With this data the PCB vision module is able to search and recognize the mark at the predefined position on the PCB or ceramic substrate without further assistance. For this reason it places several small evaluation windows at the assumed border of the mark. Within these evaluation windows the vision system looks for contrast transitions between bright and dark. After finding such contrasts the actual position of the mark can be assigned by comparision with the predefined – and thus known – form and size.

Evaluation operations calculate possible PCB offsets against given values of X-, Y- and Theta-axis.

Saving the mark by teaching is not necessary any more.

Additional functions of the PCB vision module are recognition of the position of the feeders and ceramic substrate (optional) and recording of the machine data including mapping.

In addition, the bad board recognition unit handles "ink spots" with the aid of the PCB vision module.

Vision Sensor Technology:
PCB Position Recognition

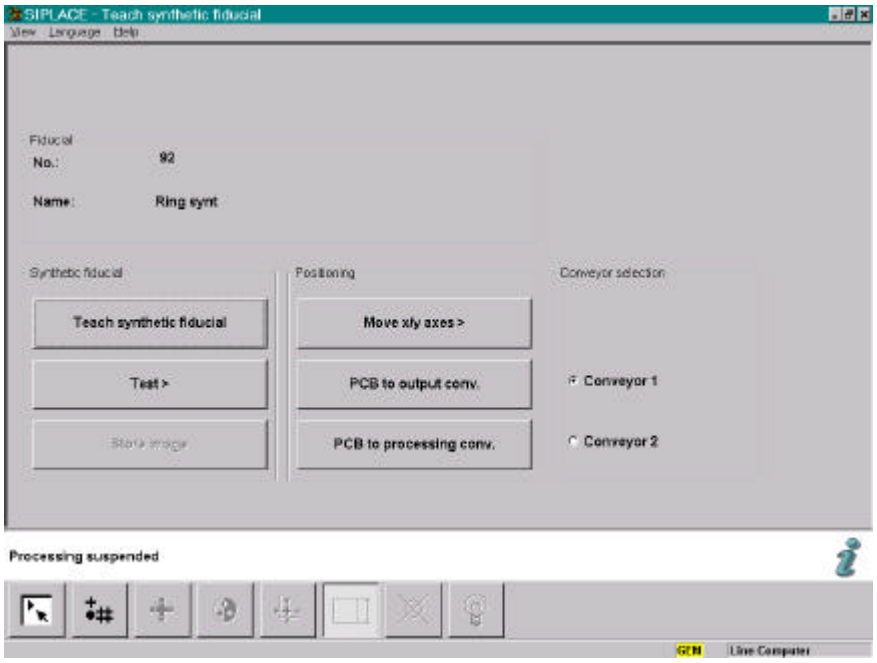
Reference Mark Criteria	
Locate 2 marks Locate 3 marks in addition	X-/Y-position, rotation angle, mean distortion Shear, distortion in X- and Y-direction
Mark shapes	Synthetic marks e.g., circle, cross, square, rectangle, rhombus, circular ring, square ring, octagonal ring (choose from menu)
Mark surface: Copper Tin	 Without oxidation and solder resist Warp ≤ 1/10 of structure width, both with good contrast to environment
Mark dimensions Circle Cross Rectangle/square Rhombus	 Diameter: 0.3 - 3 mm Length and width: 0.3 - 3 mm Line thickness: 0.1 - 1.5 mm Edge length: 0.3 - 3 mm Transversal length: 0.3 - 3 mm
Mark environment	Clearance around reference mark not necessary if there is no similar mark structure in the search area

Description

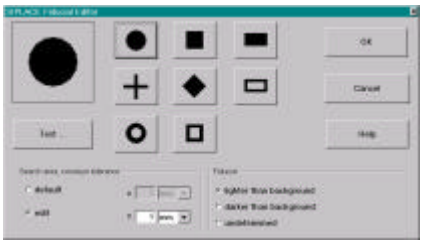
Different reference mark shapes prove to be optimal depending on the condition of the surface.

Particularly advisable for bare copper surfaces with little oxidation is the single cross. Maximum recognition reliability is achieved due to the high information content. Rectangle, square and circle are less “informative” but save space, are rugged, and can even be used when oxidation is at an advanced stage.

Advisable for tinned structures are circle or square because in this case the ratio of the mark dimensions to the presolder thickness is particularly favorable.



Teach Synthetic Fiducial



Fiducial Editor

Vision Sensor Technology:
Bad Board Recognition
Position Recognition of Feeder

Ink Spot Criteria	
Evaluationmethod	
for fiducials	brightness method
for structures	contrast method
Shapes and sizes of fiducials/structures for	
brightness method	square or circular forms edge length/diameter 0.3 - 5 mm
contrast method	rectangular forms edge length 0.3 - 5 mm
Masking material	mat dark (light-absorbing) not recommended: white or shiny
Ink spot recognition time	0.3 s for each method

Description

In the cluster technology each subpanel is assigned an ink spot. If this is present during the measurement via the PCB vision module, the corresponding subpanel is populated. It is also possible to accomplish the population of the subpanel when the ink spot is missing. With this function it is possible to eliminate costs due to unnecessary population of faulty subpanels.

Global Ink Spot

Each bad board evaluation needs time, so naturally the consumed time increases with the number of subpanels per PCB. Using a global ink spot can result in a significant reduction of these secondary times.

The PCB vision module searches at positions taught before for the defined fiducial. In case of recognition there is no following evaluation of subpanels. The system allows the customer to choose also the opposite interpretation.

Position Recognition of Feeder

The pick-up position of the components can be determined precisely with the aid of the position recognition of the feeder. It is activated each time after a change of feeder or component table. The offset in position relative to the stored ideal position is determined on the basis of fiducials on the feeder modules using the PCB vision module. This provides a very high pick-up reliability even for the very first component. This is particularly important with small components.

Vision Sensor Technology: Algorithms to determine the X-/Y-Position and the Rotation Angle of Components

Algorithm	Component	Determined on the basis of
Size Driven	Chip	the component's outline (profile/gradients)
Row Driven	IC	several component leads (correlation method)
Corner Driven	IC	all component leads (correlation method)
Lead Driven	Complex IC	each component connection (**H**igh-**A**ccuracy-**L**ead-**E**xtraction method)
Grid/Ball/Bump	BGA, µBGA, Flip Chip	all defined balls and bumps (gradients/ball or bump centering)

Description

The component vision modules perform a critical contribution to placement accuracy and reliability. It dependably recognizes all package forms (= geometric dimensions of the component) illuminated at various angles from a number of planes. To illuminate each component optimally, the luminosity of the individual planes can be adjusted individually in 256 levels.

Aside from the dimension of the SMD component, the vision system determines the lead number and pitch (lateral IC lead bend) as well as the rotation angle and X-/Y-offset. Components which are not suitable are rejected and automatically corrected in a repair cycle. Rotational and X-/Y-offsets are corrected at the turning station of the Collect & Place Head or via the gantry axes. A relevant X-/Y-pick-up offset is calculated from the positions of a number of components from one track. This is factored in accordance with the self-learning principle during the subsequent pick-up of components.

Prior to placement the required geometrical dimensions of one component type are entered into the package form (GF) editor, creating a synthetic model of the SMD module. This task is simplified by the comprehensive on-line information and Help system. Later the central SIPLACE vision system, to which all other vision modules are connected, analyzes the gray-scale picture of the component vision module. To this end, suitable algorithms are used for the pertinent package type. Due to the combination of algorithms, the vision system also functions reliably under the most difficult conditions, e.g., in the case of different reflection behavior by the leads or disruptive influences from the outside.

The algorithms are used for all component vision modules.

Vision Sensor Technology:
Standard Component Vision Modules for 12- and 6-Nozzle Collect & Place Head
DCA-Vision Module for 12- and 6-Nozzle Collect & Place Head (Option)

Standard Component Vision Module for the 12-Nozzle C & P Head	
Component size	minimum 0.6 x 0.3 mm^2 (0201) / maximum 18.7 x 18.7 mm^2
Component range	See table on page 6
Camera's field of view	24 x 24 mm^2
Illumination	Front light (3 freely programmable planes)
Pixel size	50 µm

Standard Component Vision Module for the 6-Nozzle C & P Head	
Component size	minimum 0.6 x 0.3 mm^2 (0201) / maximum 32 x 32 mm^2
Component range	See table on page 6
Camera's field of view	39 x 39 mm^2
Illumination	Front light (2 freely programmable planes)
Pixel size	80 µm

DCA-Vision Module for 12- and 6-Nozzle C & P Head	
Component size:	minimum 0.6 x 0.3 mm^2 (0201) / maximum 13 x 13 mm^2
Component range	Flip Chips, Bare Dies, Standard SMDs
Camera's field of view	15.6 x 15.6 mm^2
Illumination	Front light (4 freely programmable planes)
Pixel size	27.5 µm

Description

Standard Component Vision Module for 12- and 6-Nozzle Collect & Place Head

The standard component vision module is directly integrated into the Collect & Place Head. While the component is cycling into the next station of the Collect & Place Head, the recorded image is evaluated by the central vision system. The component rotation is then corrected by the appropriate angle based on the position offsets determined with vision inspection.

DCA Vision Module for 12- and 6-Nozzle Collect & Place Head

The DCA vision module was developed specifically for secure, fast and reliable recognition of Flip Chips and Bare Dies. But also standard SMDs can be handled with this vision module including 0201 capacitors and resistors.

The DCA vision module option offers the possibility to process with one machine SMDs, Flip Chips and Bare Dies without problems, thus achieving a maximum of flexibility.

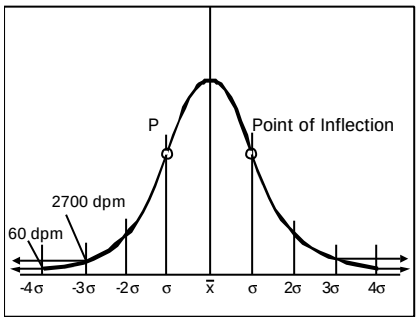
The DCA-Vision Module option replaces the Standard Component Vision Module.

Machine Criteria: Placement Accuracy

Technical Data Gantry

Drive	Brushless AC Temperature Controlled Motor
Position measuring system (X/Y)	Linear scales
Resolution of X-/Y-axis	2.5 µm
Speed of X-axis	max. 2.5 m/s
Speed of Y-axis	max. 2.5 m/s

Placement Accuracy see table on page 6



Standard Deviation - dpm

Description

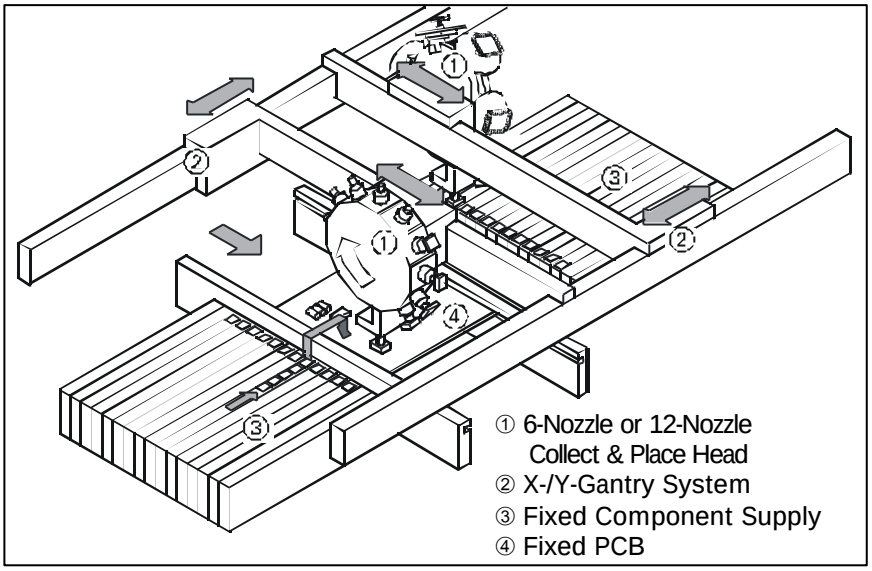
Various factors contribute to the placement accuracy of the SIPLACE S-27 HM machine, e.g., the stationary PCB during the placement process. As no accelerations are acting on the placed components, their position continues unchanged. The PCB moves in and out at a coordinated speed which is automatically reduced just before the nominal position is reached.

A further guarantee for long-term high placement accuracy is the position recognition of the axes of the gantry and placement head by means of optical scanning by incremental encoders. Revolving star and segments of the Collect & Place Head are positioned by means of high-resolution glass incremental panels. The X- and Y-axes are positioned with the help of the metal scales on each gantry axis.

To determine the placement accuracy on SIPLACE machines, highly precision glass components with mounted structures are placed on a dimensionally accurate glass mapping plate. The results are statistically evaluated and presented as a Gaussian standard distribution. In the case of the 6-Nozzle Collect & Place Head at the SIPLACE S-27 HM the placement accuracy is ± 70 µm at a statistical reliability of 4 sigma. If the accuracy value ± 70 µm is divided by the sigma value 4, the result is the standard deviation S of 1 sigma = ± 17.5 µm (as defined in Scope of Service and Delivery SIPLACE).

A machine capability analysis is conducted for each machine acceptance test.

Machine Criteria:
Placement Reliability



Placement Principle of SIPLACE S-27 HM

Description

In addition to correct positioning, placement reliability is important.

On the SIPLACE S-27 HM this is ensured through a number of control functions, such as vacuum checks and component vision testing during the placement sequence.

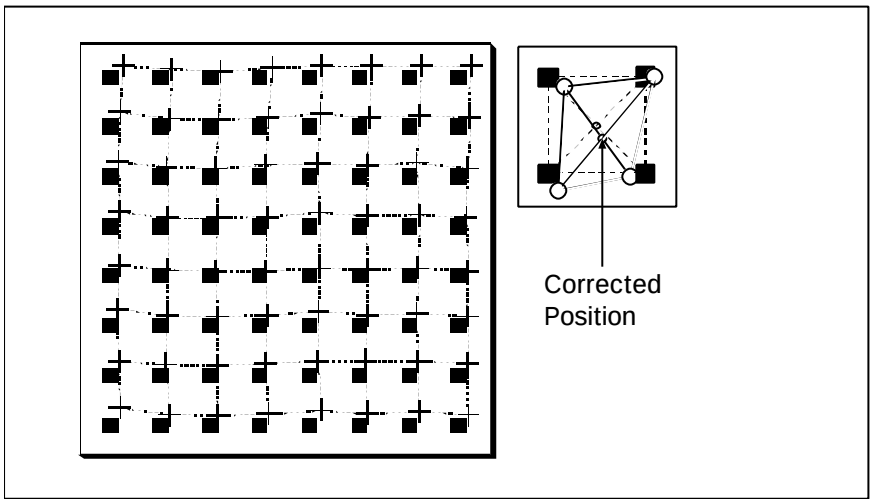
Out of tolerance components are rejected, placed on the repair list and automatically processed during a repair cycle. An offset in the position of the PCB relative to the conveyor system (PCB vision) and an offset of the X-axis, Y-axis or rotation of the component relative to the midpoint of the nozzle (component vision) trigger an immediate correction to ensure placement accuracy.

Since the PCB is fixed, the components remain in the exact position they are placed. The stationary component table ensures a precise pick up. Options, such as the component bar code scanner, can be added to further enhance reliability.

Machine Criteria: Mapping (Option)

Technical Data

Dimensions of the mapping test plate	520 x 460 mm^2 (for single conveyor) 520 x 215 mm^2 (for dual conveyor)
Number of measurement points	13 x 11 (standard resolution) 26 x 21 (high resolution)
Ambient temperature during calibration	+ 20° ± 3°C
Components of the option	Test plate (special glass) Calculation data (disk) Case for secure storage



Nominal Grid of Mapping Plate and Actual Grid with Deviations Due to Gantry

Description

Despite the highly stable machine frame, slight distortions of the gantry axes cannot always be avoided. With the aid of the mapping process the high placement accuracy of the machine is preserved throughout its entire service life.

With this calibrating procedure, which can be conducted quickly and easily, the PCB camera recognizes the fiducials on a mapping calibration plate placed in its operating area. Any distortions are revealed by comparing the nominal grid on the glass plate with the actual grid "drawn" by placement head. These distortions are taken into account during all further positioning of X-/Y-axes and thus compensated for.

SIPLACE Software Architecture: Line Programming System Station Computer

Functions

Line Programming System for	Data Preparation Optimization Line control Line monitoring Data management
Software	LRL 503.02 (Linux) or SIPLACE Pro 1.4 (Windows 2000)
Station Computer for	Machine control Machine monitoring Machine operation
Software	SW 503.01

Line Programming System

Station Computer

Description

Line Programming System

The Line Programming Systems program, optimize and control complete SIPLACE placement lines. Consequently secondary times are reduced and maximum productivity is guaranteed.

To meet these targets, two software programs can be used: The Linux based LRL (Linux Line Computer), or SIPLACE Pro, which runs on standard PC with Windows 2000.

Station Computer

The station computer in conjunction with the machine controller with its realtime capability performs the following jobs: digital control of the machine gantry systems; control of PCB input and output and of PCB transport; monitoring functions, handling of malfunctions and output of error messages (including Help system); ensuring the optimal quality of the placement process.

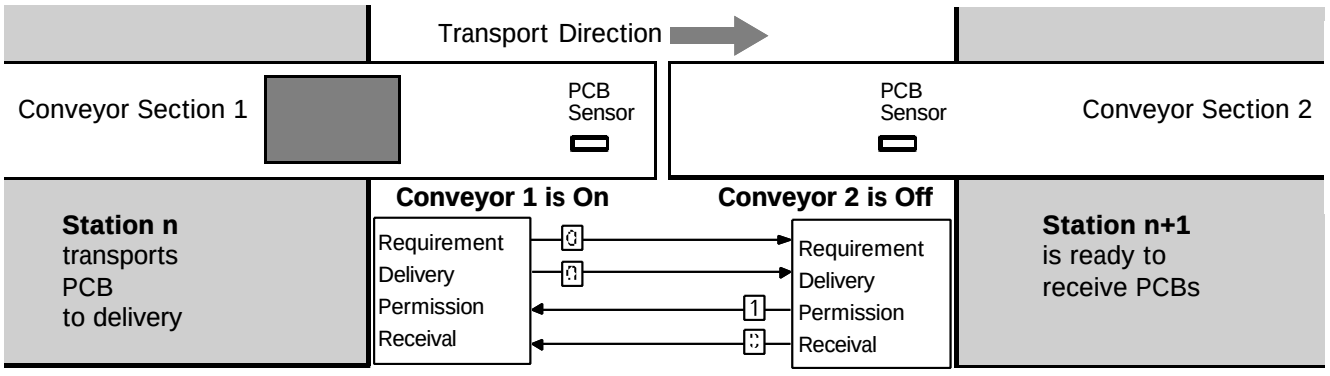
For more details and information on further software options please see SIPLACE Software Specification.

Technical Data:
Signal Interfaces

Signal Interface (20-Pin Ribbon Cable Connector)

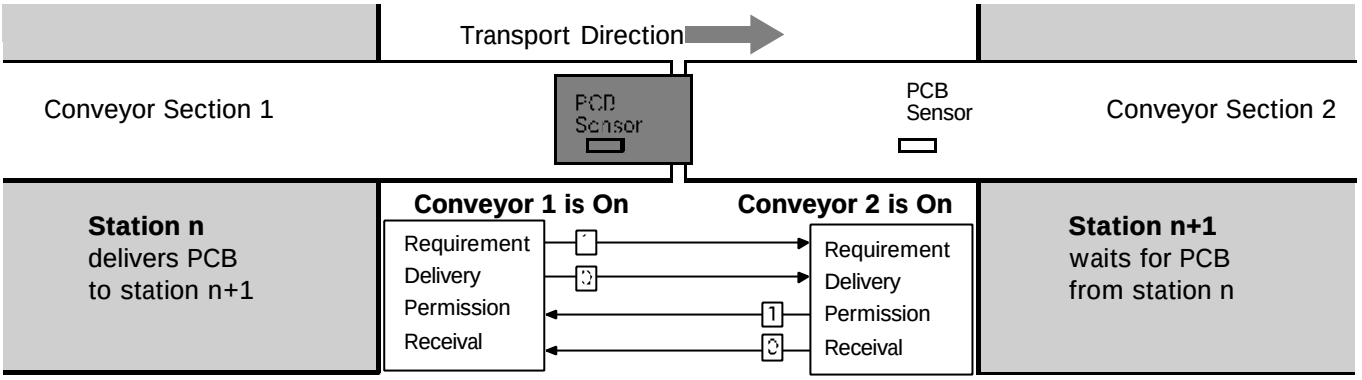
to upstream station x3		to downstream station x4	
Pin 13	GND 24 V	Pin 10	Reserved
Pin 14	Arrived	Pin 9	Reserved
Pin 15	Permission	Pin 8	Reserved
Pin 19	Request	Pin 4	+30 V DC unsaturated
Pin 20	GND 24 V for request / released (contact separation)	Pin 5	GND 24 V
Pin 18	Released	Pin 6	+24 V DC
Pin 12	Trouble signal loop	Pin 11	Trouble signal loop
Pin 11		Pin 12	
Pin 3	+24 V DC	Pin 15	Permission
Pin 2	GND 24 V	Pin 13	GND 24 V for permission / arrived (contact separation)
Pin 1	+30 V DC unsaturated	Pin 14	Arrived
Pin 8	Reserved	Pin 18	Released
Pin 9	Reserved	Pin 19	Released
Pin 10	Reserved	Pin 20	GND 24 V

1. After switching-on the station

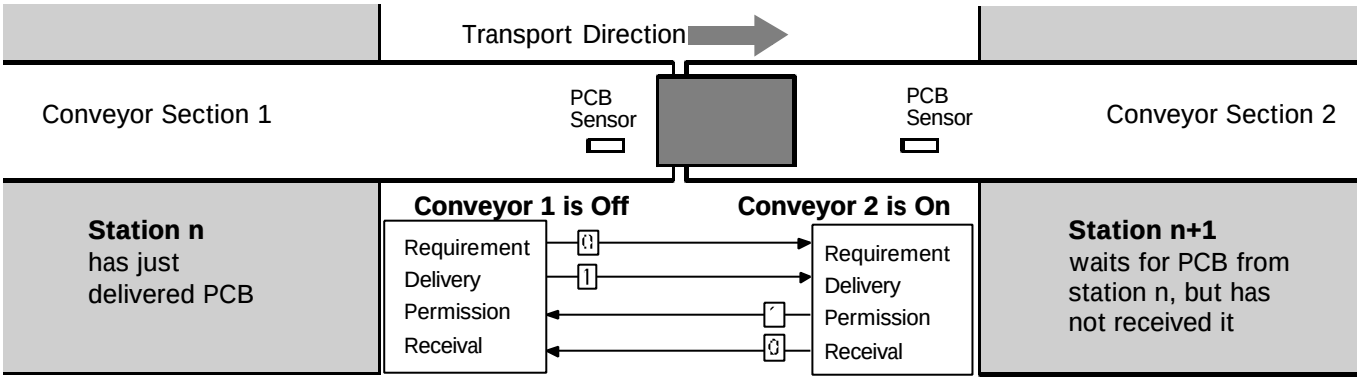


Technical Data:
Signal Interfaces

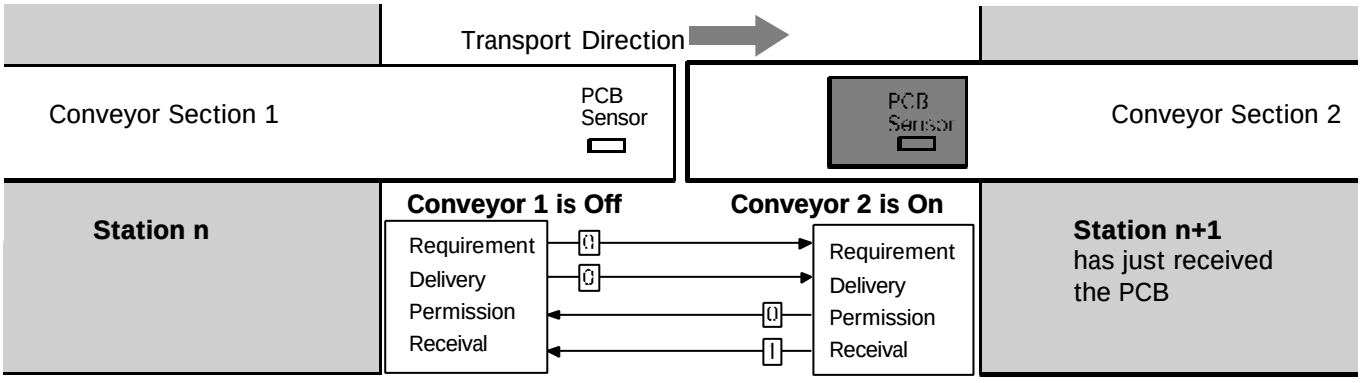
2. PCB handling has started



3. PCB is at delivery



4. PCB transport is finished



A detailed documentation of the PCB transport signal interface is available on request.

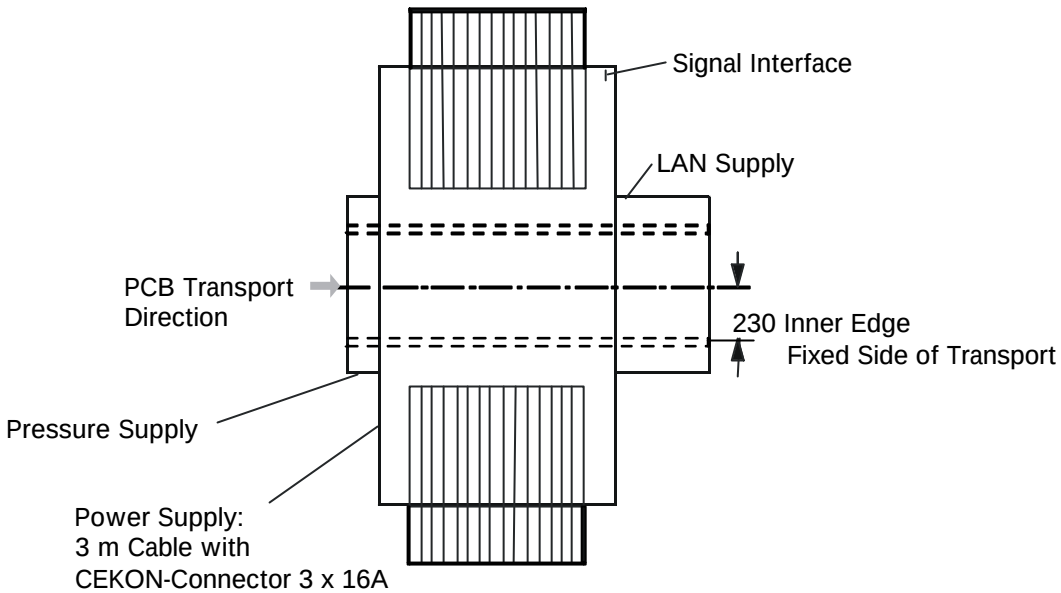
Technical Data:
Connections

Connections and Energy Required

Main voltage requirement	230/400 V~ / 119/208 V~ / 3 x 200 V~ ± 5%, 50/60 Hz
Power	2 kW
Circuit breaker	3 x 16 A
Power outage	max. 20 ms
Compressed air requirements	5.5 - 10 bar, 400 Nl/min, ½" tube
Vacuum pump (Option)	5.5 - 10 bar, 200 Nl/min, ½" tube

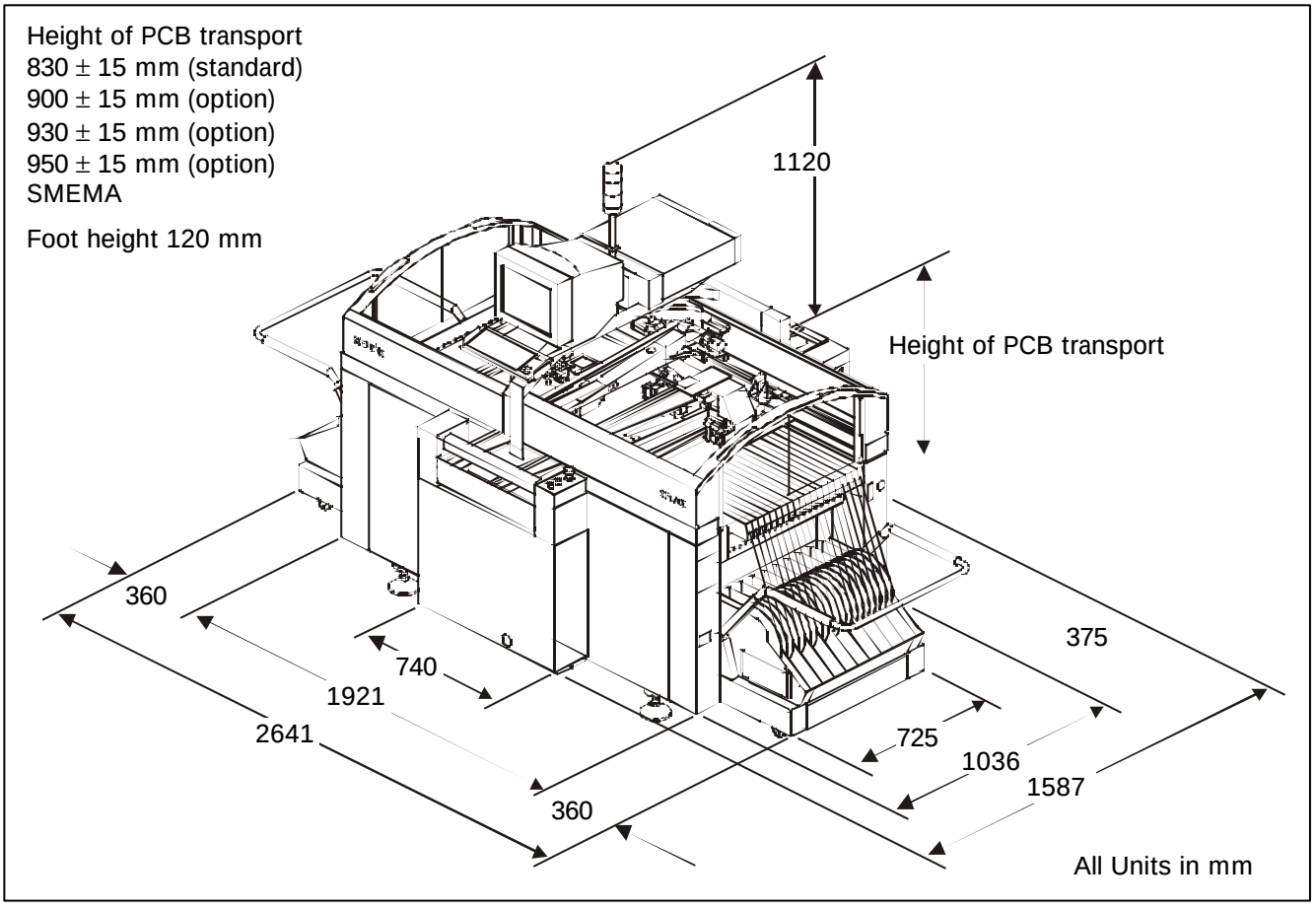
Compressed Air Specification

Particles:	max. particle size by density, based on ISO/DIS 8573-1 Class
Particle size Particle density	0.1 µm 0.1 mg/m³
Dew: Pressure dewpoint Dewpoint	 Class 4 + 3° C
Oil: max. oil content Particle density	 Class 1 0.01 mg/m³



Technical Data:
Dimensions and Set-Up Conditions

Values	
Length	1587 mm
Width of basic module	1921 mm
Width with two changeover tables	2641 mm
Height from transport to warning lamp	1120 mm
Weight of basic module	1500 kg
Weight with two changeover tables	2000 kg
Room temperature	Between 15° and 35°C
Humidity	30-80%, on average not higher than 45%, so that no condensation can ever form on the machine
Maximum noise development	74 dB_A



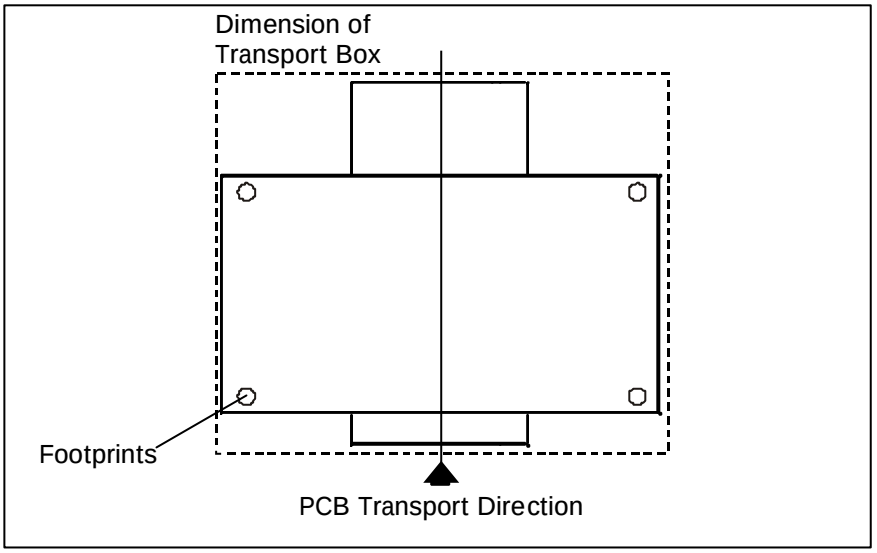
SIPLACE S-27 HM

Technical Data:
Transporting and Commissioning

Transport dimensions	
Length with packing	2150 mm
Width with packing	1850 mm
Height with packing	1600 mm
Center of gravity (X,Y coordinates)	0 mm, 0 mm

Floor load (more details about floor characteristics on request)	
Total weight of equipped machine	2 metric tons
Permissible surface load sub-floor (load per unit area on mounting feet) (based on assumed distribution of machine weight to three machine legs[a])	9 kg/cm^2

a) Worst case scenario; 4 legs per machine installed, area per leg: 104 cm^2.



SIPLACE S-27 HM with Transportbox

Description

Transporting

Use a fork lift with a lifting force of 6 tons to move the SIPLACE S-27 HM placement machine. Forks 2 m long are required for a packed machine, 1.5 m for an unpacked one.

Pick the machine up with the fork lift at the locations especially designed and identified as being for this purpose.

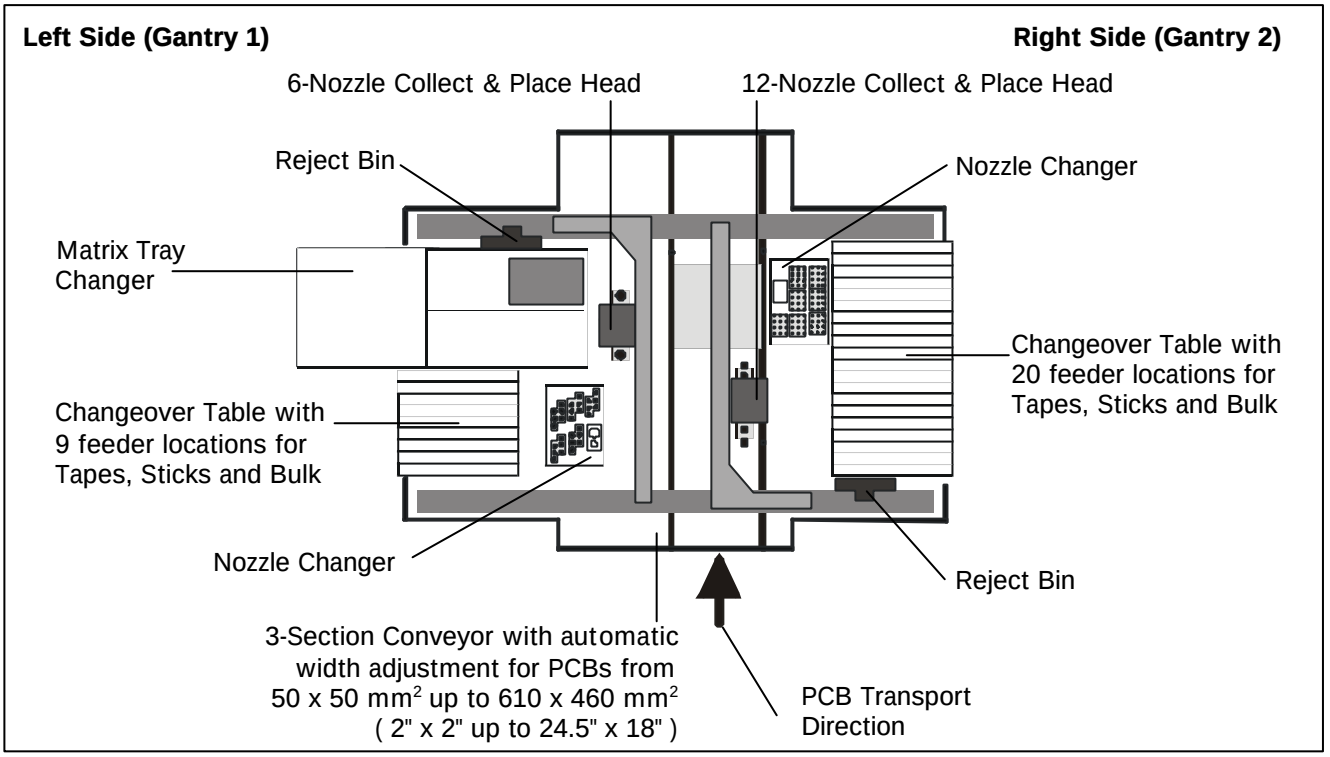
When setting up the SIPLACE S-27 HM, make certain that the surface it is placed on possesses the required load bearing capacity.

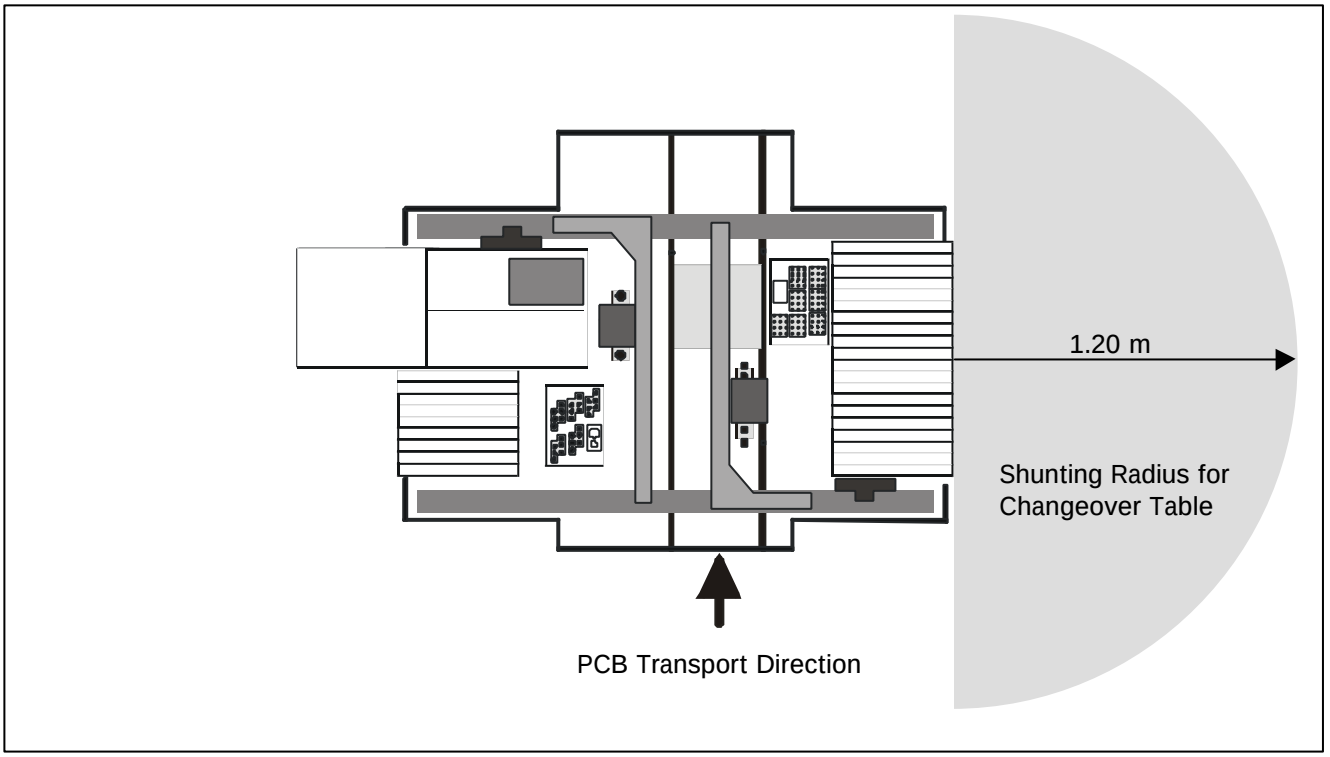
Commissioning

For commissioning, install the following components which were not premounted upon delivery:

- Monitor
- Keyboard
- Warning lamp
- Component changeover tables.

Possible Machine Configuration





SMD Placement Systems from Siemens

Siemens Dematic AG
Electronic Assembly Systems SD EA1
Rupert-Mayer-Straße 44
D-81359 München
Tel. +49 – 89 - 208 00 – 276 00
Fax +49 – 89 - 208 00 – 366 92
e-mail: siplace@mchrm.siemens.de

Siemens Dematic Pte. Ltd.
Electronic Assembly Systems
2, Kallang Sector, 4th Floor
Singapore 349277
Tel. +65 – 67 40 – 74 06
Fax +65 – 67 40 – 74 12
e-mail: sdeasales.sgp@siemens.com

Siemens Dematic
Electronic Assembly Systems Inc.
3140 Northwoods Parkway, Suite 300
Norcross, GA 30071, USA
Tel.: +1 – 770 – 797 - 30 00
Fax: +1 – 770 – 797 - 30 94
e-mail: karen.mcgee@eae.siemens.com

Siemens Dematic
Shanghai, 20F Majesty Building, No. 138
Pu Dong Avenue Shanghai P.R.
China 200120
Tel.: +86 – 21 – 58 87 – 30 30
Fax: +86 – 21 – 58 87 – 61 00

Edition 1 1202-S27-e
Order No A10002-P141-T3-X-7600

Subject to changes without notice.

Siemens Dematic AG
Internet: http://www.siplace.com