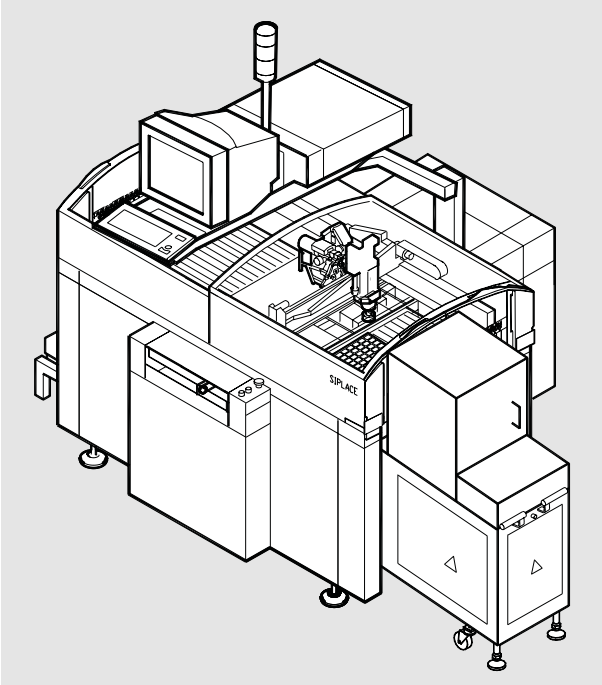
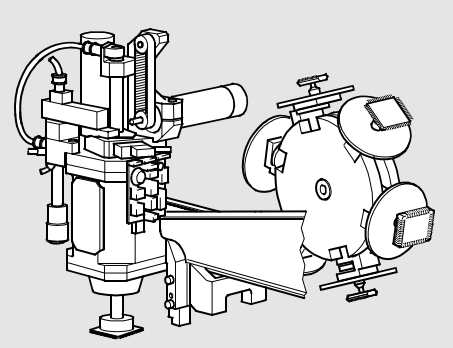
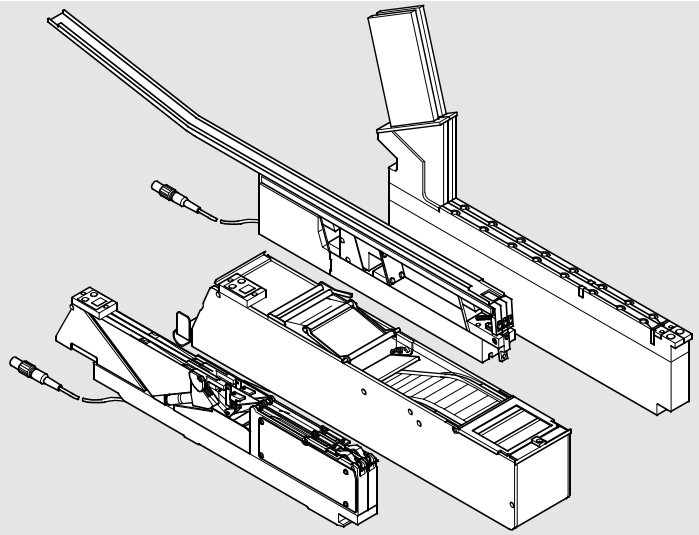
SIEMENS







High Speed Placement of Large ICs, Flip Chips and Bare Dies

# SIPLACE F$^5$ HM

**SIPLACE Specification**

Edition 2
0299-F$^5$-300-e

# High Speed Placement of Large ICs, Flip Chips and Bare Dies SIPLACE F$^5$ HM

Subject to change without notice

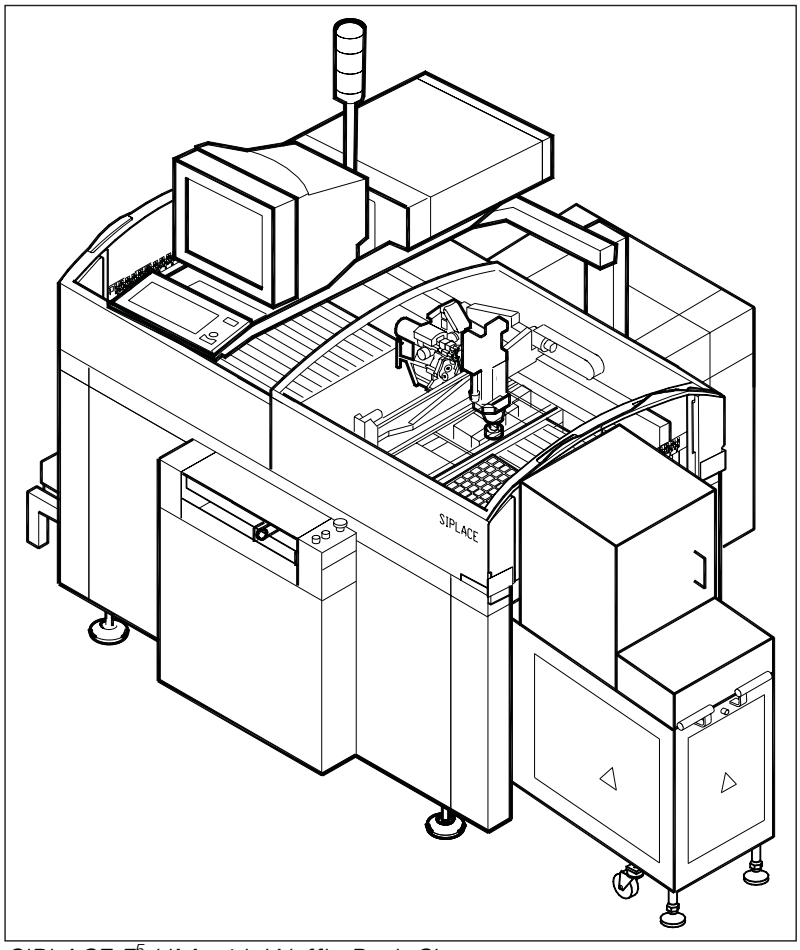
Edition 2

0299-F$^5$-300-e

**Contents** **1**

# High Speed Placement of Large ICs, Flip Chips and Bare Dies
# SIPLACE F$^5$ HM






*SIPLACE F$^5$ HM with Waffle Pack Changer*

# Machine Description

**Technical Data**

| | |
|---|---|
| Process | Pick & Place / Collect & Place |
| Range of components<br>Standard Vision Module<br>DCA Vision Module | <br>0603 to 55 x 55 mm<br>0.5 x 0.25 mm to 55 x 55 mm |
| Benchmark placement rate<br>6-nozzle-revolver head<br>Pick & Place Head | <br>8,000 cph<br>1,800 cph |
| Accuracy at 4 sigma<br>6-nozzle-revolver head<br><br>Pick & Place Head | <br>± 70 µm<br>± 60 µm*<br>± 50 µm<br>± 40 µm** |
| PCB dimensions | 50 x 50 mm to 460 x 460 mm<br>(460 x 508 mm) |
| Feeder capacity | Max. 80 x 8 mm tracks |
| Component table<br><br>Types of Feeder modules | Changeover table, Waffle Pack Changer, manual trays<br>Tapes, stick magazines, Bulk Cases |
| Operating system | Microsoft Windows / RMOS |
| Connection | In-line or standalone |
| Space required | 4 m² / module |

* valid only with DCA-package
** valid only with DCA-package and Flip Chip component vision module for Pick & Place head

**Description**

SIPLACE F$^5$ HM combines the Fine Pitch Pick & Place Head with the 6-nozzle-revolver head (Collect & Place) to unite high precision with high speed.

Equipped with the 6-nozzle-revolver head SIPLACE F$^5$ HM placement system optimally complements, SIPLACE 80 S-20. While the PCB is still being moved, the 6-nozzle-revolver head is already picking up the first components. As soon as the PCB is clamped in the conveyor, its exact position is determined with the PCB vision module. Afterwards the revolver head picks up the remaining components for the entire rotation step and places its 6 components. As soon as it is finished, the Pick & Place Head begins picking up an placing the components assigned to it.

For SIPLACE F$^5$ HM a DCA-package is available, which contains an alternative DCA vision module mounted in the 6-nozzle revolver head instead of the standard vision module. To optimize SIPLACE F$^5$ HM in speed and accuracy for high speed Flip Chip and bare die placement the dynamic of the machine has been changed.

The 6-nozzle-revolver-head greatly increases the speed for products with high percentages of ICs. The ICs are placed on the PCB with the speed of a Collect & Place Head and with the required precision.

The principle of the stationary PCB and the motionless component table has decisive advantages: Components are replenished an the tape is spliced with no idle times during the placement sequence. The vibration-free feeding of components makes it possible to pick up even the smallest components. Travel path and placement sequence can be optimally adjusted. Thanks to the stationary PCB the components retain their exact placement position.

Speed coupled with economic efficiency and set-up reliability is the SIPLACE F$^5$ HM recipe for success. The product range is rounded off by optional additional products such as component changeover tables, tray changers, component and PCB bar code scanners or automatic nozzle changer.

# Line Design

**Technical Data**

| | |
|---|---|
| System | SIPLACE SMT placement lines |
| Modules | SIPLACE HS-50 / SIPLACE 80 S-20 / SIPLACE S-23 HM / SIPLACE G / SIPLACE 80 $F^4$ / SIPLACE $F^5$ HM |
| Peripherals | Loaders/unloaders, screen printers, soldering ovens, etc., available from Siemens |
| Component range | 0.5 x 0.25 mm* to 55 x 55 mm** |
| PCB conveyor<br>PCB dimensions<br><br>Ceramic substrate (dimensions) | Automatic width adjustment<br>50 x 50 mm to 460 x 460 mm (optional 460 x 508 mm)<br><br>2" x 2" to 4" x 7" |
| Placement speed | Depends on module layout |
| Space required | 4 $m^2$ / module |

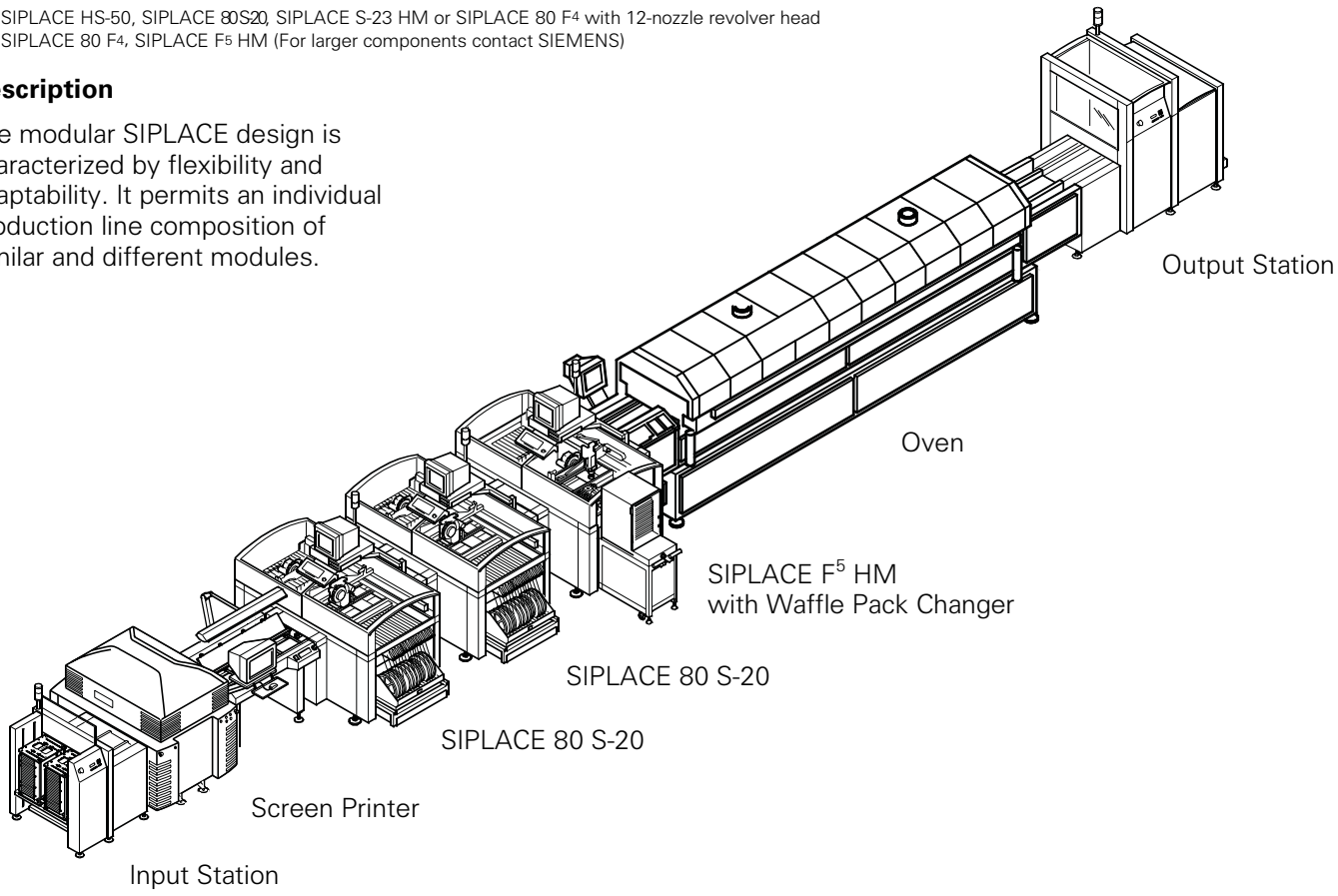
* SIPLACE HS-50, SIPLACE 80 S20, SIPLACE S-23 HM or SIPLACE 80 F4 with 12-nozzle revolver head
** SIPLACE 80 F4, SIPLACE F5 HM (For larger components contact SIEMENS)

**Description**

The modular SIPLACE design is characterized by flexibility and adaptability. It permits an individual production line composition of similar and different modules.

When performance requirements change the individual machines can be recombined quickly an without complications, one of the major reasons being their relatively small size. The SIPLACE family has the right product for any purpose: from high-speed SMD placer SIPLACE S-23 HM to the adhesive application system SIPLACE G.

SIPLACE $F^5$ HM is ideally suited for fixed set-up as well as for family set-up with optimized changeover times. When the required capacity is low, however, it is also suitable as a standalone placement system.

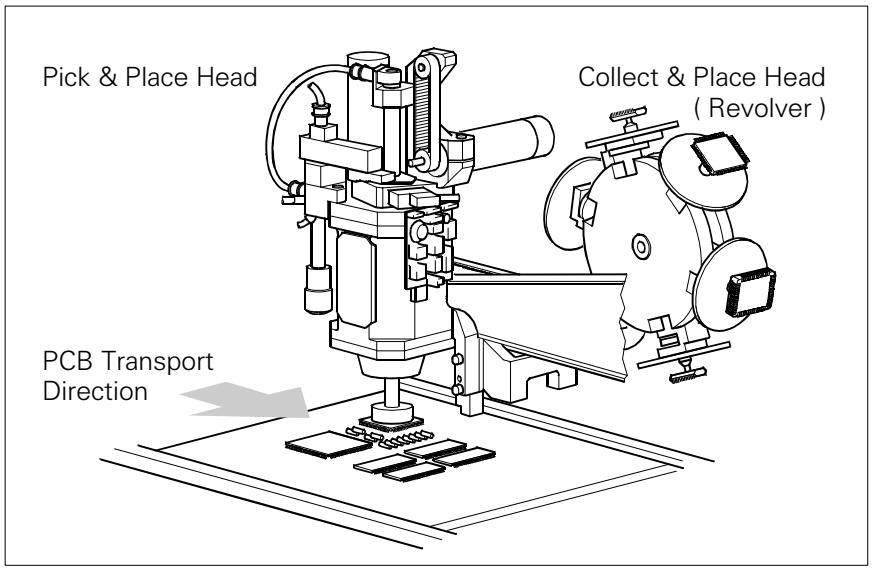



*Example of a SIPLACE Placement Line*

# Placement Heads

**Technical Data**

| | |
|---|---|
| Placement principle | Pick & Place Head<br>Collect & Place (Revolver ) Head |
| Components | Entire SMD range |
| Component table:<br>Pick & Place head<br><br>6-nozzle revolver head | <br>Feeder on changeover table;<br>Waffle Pack Changer or manual trays<br>Feeder on changeover table;<br>Waffle Pack Changer or manual trays |




*Placement Heads SIPLACE F[5] HM*

**Description**

The main X-/Y-gantry features two placement heads, the 6 -nozzle high-speed revolver placement head and the high-precision Pick & Place Head.

With certain overlapping, each placement head is specialized for a specific range of components. Therefore it is possible to optionally distribute the components to be placed between the two heads.

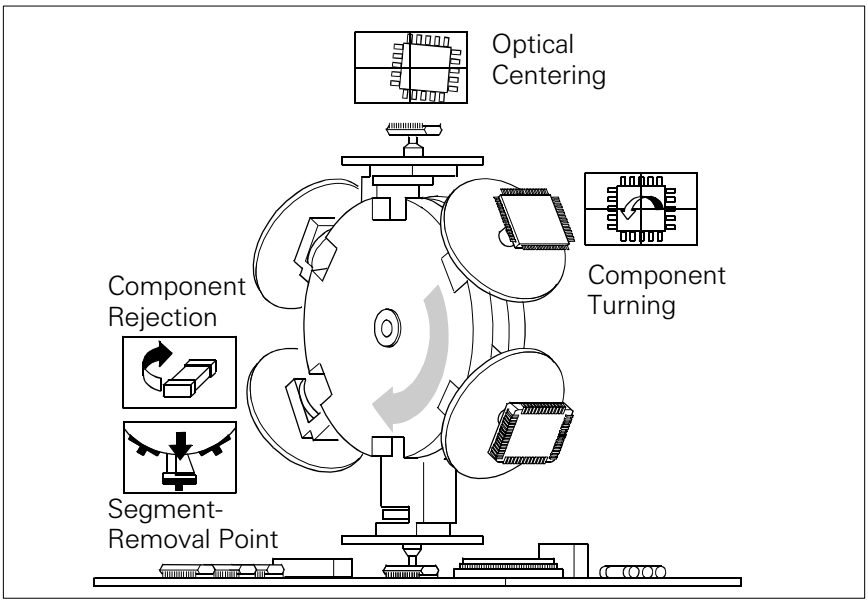
# Placement Heads:
# 6-Nozzle Revolver Head for High-Speed IC Placement

**Technical Data**

| | |
|---|---|
| Max. height*<br>max. weight* | 8.5 mm*<br>5 g* |
| Stroke of Z-axis | max. 16 mm |
| Programmable placement force (Z-axis) | 2.4 to 5.0 N |
| Nozzle types | 18 standard nozzles |
| Benchmark placement rate | 8,000 cph |
| Angular accuracy | ± 0.3° at 4 sigma<br>±0.45° at 6 sigma |
| Placement accuracy<br>Standard vision module | <br>± 70 µm at 4 sigma<br>± 105 µm at 6 sigma |
| DCA vision module | ± 60 µm at 4 sigma**<br>± 90 µm at 6 sigma** |

* A uniformly reliable, speedy and accurate placement is guaranteed over the entire component range up to this limit value. Beyond this, components can be placed if they satisfy specific basic conditions (please contact the factory).

** Valid only with DCA-package




*6-Nozzle Revolver Head for High Speed Placement of large ICs, Flip Chips and Bare Dies*

**Description**

SIPLACE F$^5$ HM combines the high-precision Pick & Place hea with the 6-nozzle revolver head.

With the standard vision module SIPLACE F$^5$ HM places ICs up to a size of 32 mm accurately and rapidly. It is therefore recommende for use when there are large percentages of ICs in the products to be manufactured. It greatly enhances performance in the main application range from PLCC 44 to QFP 208.

Equipped with the alternative DCA vision module the 6-nozzle revolver head handles components from 0.5 mm x 0.25 mm up to 13 mm x 13 mm. This vision module is part of the DCA-package.

Equipped with the DCA-package SIPLACE F$^5$ HM is optimized in speed and accuracy for high speed Flip Chip and bare die placement. Thus the accuracy for the 6-nozzle revolver head with the alternative DCA vision module achieves an accuracy of ± 60 µm at 4 sigma shown on a defined SIPLAC demo board.

The cycle time of the 6-nozzle revolver head - and thus the real achievable performance - depends on the dimensions and the number of leads / bumps of the component.

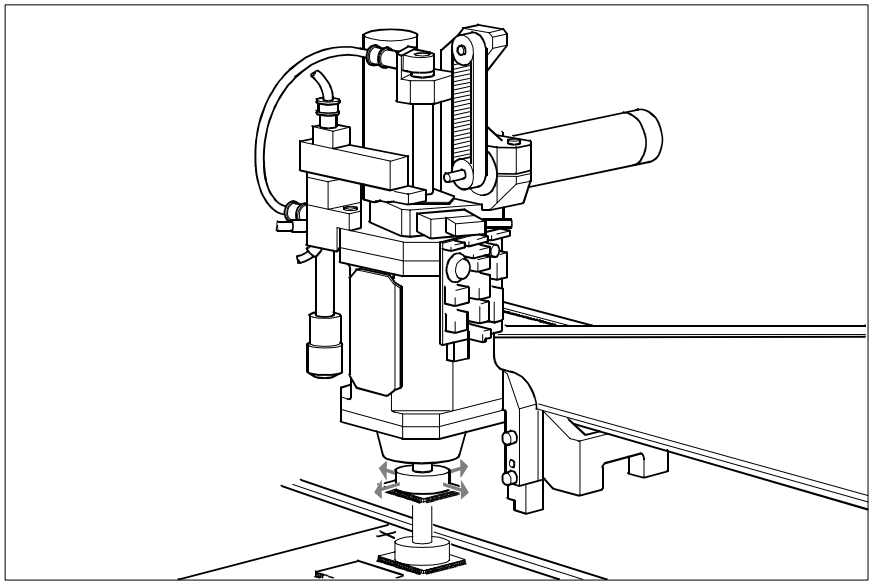
Mechanically and electrically, the 6-nozzle revolver head is structurally very similar to the 12-nozzle revolver head. Nevertheless, the two types of revolver heads cannot be interchanged at will.

# Placement Heads:
# Pick & Place Head for High End / High Accuracy

**Technical Data**

| | |
|---|---|
| Component range | |
| max. height | PCB-height ≤ 13.5 mm (20 mm** Option) – thickness (PCB) – arching (PCB) |
| max. dimensions<br>max. weight | component height ≤ 13.5 mm<br>55 x 55 mm<br>25 g |
| Programmable placement force (Z-axis) | 1 to 10 N |
| Nozzles types | 4 standard nozzles plus<br>Flip Chip nozzle (non-standard nozzle)<br>with nozzle changer (standard) |
| Component centering | Fine Pitch component vision module (standard)<br>Flip Chip component vision module (option) |
| Benchmark placement rate | 1,800 cph |
| X-/Y-placement accuracy | ± 50 µm at 4 sigma ± 75 µm at 6 sigma<br>± 40 µm at 4 sigma* ± 60 µm at 6 sigma* |
| Angular accuracy | ± 0.07° at 4 sigma<br>± 0.105° at 6 sigma |
| Resolution of the D-axis | 0.005° |

* valid only with DCA-package and Flip Chip component vision module for Pick & Place Head
** max. PCB-heiht is depending on the feeder (please contact Siemens service)



*Pick & Place Head*

**Description**

The highly developed Pick & Place Head operates on the Pick & Place principle. It is suitable for picking up particularly sophisticated or large components as well as non-standard models. High-resolution, intelligent vision modules (Fine Pitch and Flip Chip component vision modules) ensure that the components are in satisfactory condition that the placement position is correct.

The sleeve with nozzle is the heart of the Pick & Place Head. The sleeve is mounted such that it is movable in the longitudinal (Z-axis) and rotational direction (D-axis). Each of the two axis are driven by a DC motor; positioning is done by incremental encoder. Thanks to a high-resolution glass incremental panel on the sleeve, the Pick & Place Head has an outstanding high rotational position accuracy. The rotating movement is transmitted directly from D-axis motor to the driving plate on the sleeve via frictional wheel.

- To the standard Fine Pitch component vision module the optional Flip Chip component vision module can be added to allow the Pick & Place Head to place Flip Chips.
- Equipped with the DCA-package SIPLACE $F^5$ HM is optimized in speed and accuracy for high speed Flip Chip and bare die placement. Thus the accuracy for the Pick & Place head in combination with the Flip Chip vision module reaches an accuracy of ± 40 µm at 4 sigma.

# Placement Heads: Nozzle Changer

**Technical Data**

| **6-Nozzle Revolver Head** | |
|---|---|
| Type of nozzle | All version 7xx and 8xx nozzles (non-standard nozzles must be tested individually) |
| Capacity | 5 magazines, each with 6 nozzles, configured at will |
| Nozzle changing times | About 2 s per nozzle |

| **Pick & Place Head** | |
|---|---|
| Type of nozzle | All version 4xx nozzles (non-standard nozzles have to be tested individually) |
| Capacity | 1 to 4 magazines each with 5 nozzles, configured at will |
| Nozzle changing times | About 2 s per nozzle |

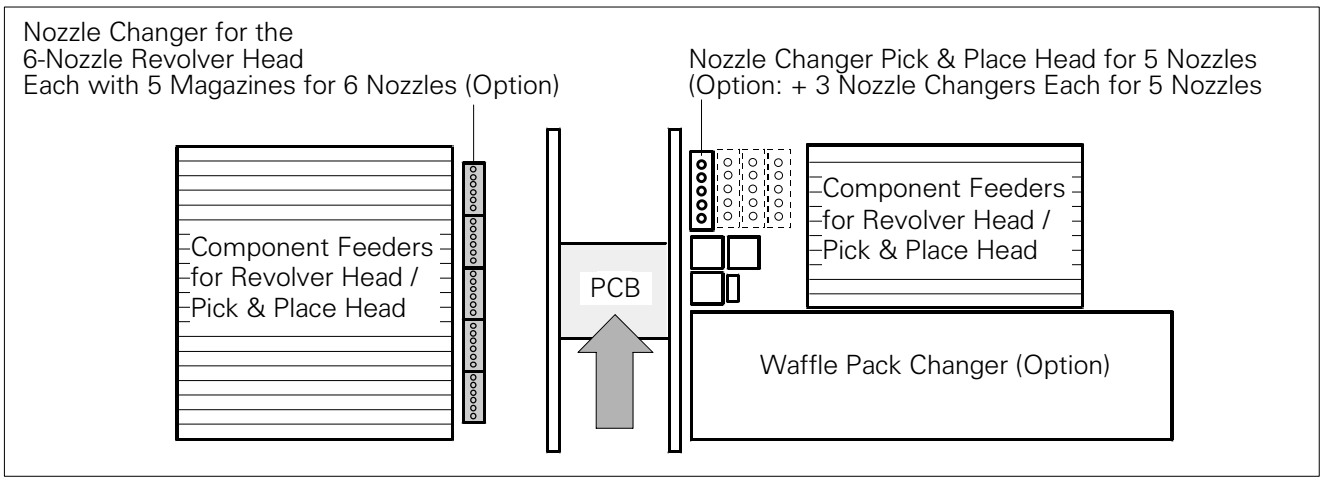
**Description**

***6-Nozzle Revolver Head***

A nozzle changer for the 6-nozzle revolver head can be installed to the left of the PCB conveyor with no loss of feeder locations. It will change the set-up of the placement head quickly and reliably for the specific nozzle configuration valid for a job. Damaged or faulty nozzles can be exchanged via the menu function.

***Pick & Place Head***

SIPLACE F$^5$ HM is equipped with a nozzle changer for the Pick & Place Head. As standard, it is fitted with one magazine. This can simultaneously hold 4 standard nozzles an one non-standard nozzle (e.g., a Flip Chip nozzle). The changer is mounted on the right-hand side of the PCB conveyor with no loss in feeder locations. As an option, 3 additional nozzle magazines can be installed for 5 nozzles each. Nozzles are exchanged automatically during the placement sequence.




*Position of Nozzle Changers*

# Placement Heads:
# Flux Dispenser for Full Flip Chip Capability (Option)

**Technical Data**

| | |
|---|---|
| Programmable amount | 2 µL to 100 µL |
| Smallest application increment | 1 µL |
| Content of syringe | 1 mL |
| Content of flux reservoir | 100 mL |
| Volume to be applied at the mounting location | Varies by Flip Chip size as well as wetting properties of flux and substrate material |
| Flip Chip down holding time after placement | 0 to 5 s |
| Increment down holding time | 0.01 s |
| Minimum waiting time prior to PCB transport | 0 to 40 s |
| Increment waiting time | 1 s |
| Dispensing cycle time | 1.5 s including positioning |
| Rinse cycle | 1 to 10 x contents of syringe |
| Filling level 1 | Warning |
| Filling level 2 | Empty (causes machine stop) |
| Accuracy of dispenser needle positioning | ± 0.05 mm |

**Description**

Full Flip Chip handling capability on the part of the SIPLACE F[5] HM is ensured by a flux dispenser installed directly next to the revolver head. Immediately before the placement head places the Flip Chip, the mounting location on the PCB is wetted with low-viscosity flux by means of a dispensing needle.

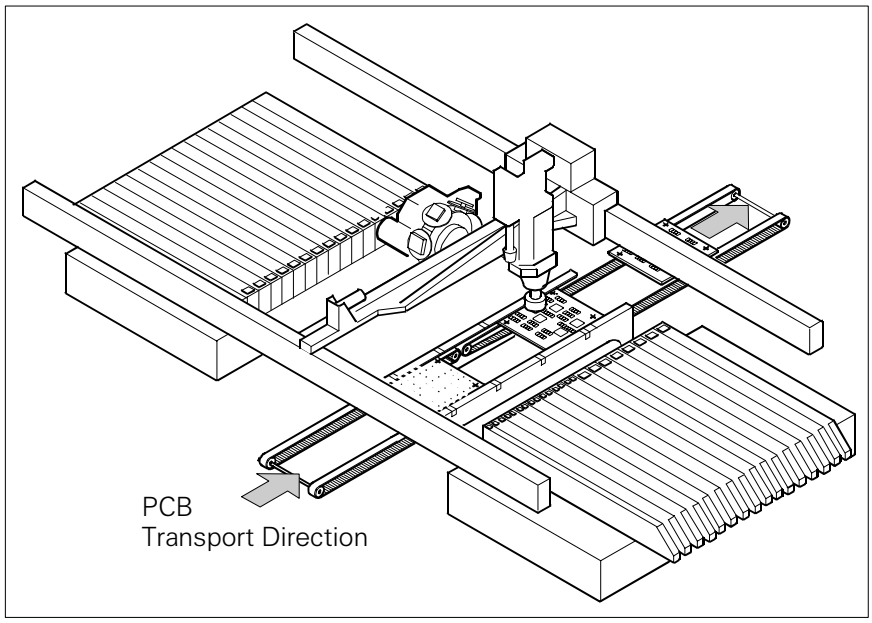
The flux dispenser option essentially comprises one stepping motor with piston, injector and valve to change the operating mode (fill / dispense injector) plus one storage tank. The stepping motor positions the piston over the storage tank to be filled or over the Flip Chip mounting location on the PCB for emptying.

The purpose of a programmable waiting time until PCB transport is to allow the low-viscosity flux sufficient time to dry so that the Fli Chip(s) will not shift position while the PCB is being moved out. A new PCB conveyor control with adjustable acceleration and delay ramps makes programming the waiting time largely superfluous.

# PCB Conveyor:
# Single Conveyor

**Technical Data**

| | |
|---|---|
| PCB dimensions | 50 x 50 mm to 460 x 460 mm<br>(as option, 460 x 508 mm) |
| PCB thickness | 0.5 to 4.5 mm |
| Max. PCB warpage | At top: 4.5 mm - PCB thickness<br>at bottom: 0.5 mm + PCB thickness |
| PCB underside clearance | 25 mm (standard), max. 40 mm (option)<br>software configurable |
| PCB conveyor height | 830 ± 15 mm |
| Fixed conveyor edge | On right (standard); on left (option) |
| Type of interface | Siemens (standard); SMEMA (option) |
| Component-free PCB handling edge | 3 mm |
| PCB changing time | 2.5 s |




*PCB Conveyor*

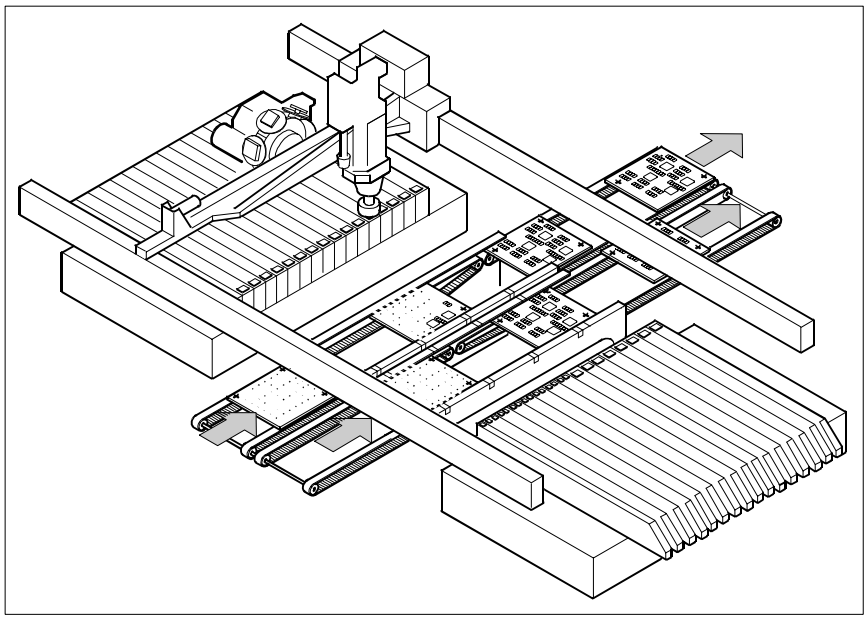
**Description**

On SIPLACE F[5] HM the in-line conveyor system guarantees a quick adjustment to new PCB widths. The change is made either at the station via menu function or from the line computer via the automatic width adjustment unit. Ceramic substrates are also transported and, if necessary, fastened in place via the optional ceramic substrate centering unit. As standard, the SIPLACE placement systems are available with a single conveyor system.

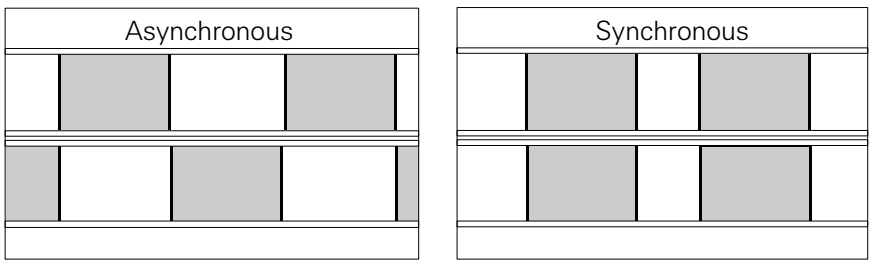
# PCB Conveyor:
# Dual Conveyor

**Technical Data**

| | |
|---|---|
| PCB dimensions | max. 460 x 216 mm; min. 50 x 50 mm |
| Fixed conveyor edge | Right (standard)<br>Left (option) |
| Placement program per conveyor | Synchronous: same or different<br>Asynchronous: same |
| PCB width per conveyor | Synchronous: same or different<br>Asynchronous: same |
| Ink spot recognition | Synchronous: not possible<br>Asynchronous: same |
| Automatic width adjustment | Synchronous: not possible<br>Asynchronous: possible |



*Asynchronous Dual Conveyor*




**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 placer simultaneously (synchronous) or alternately (asynchronous).

In the synchronous type of transport it is possible, for example, to finish the top and bottom of the PCB in a single line without using cluster technology.

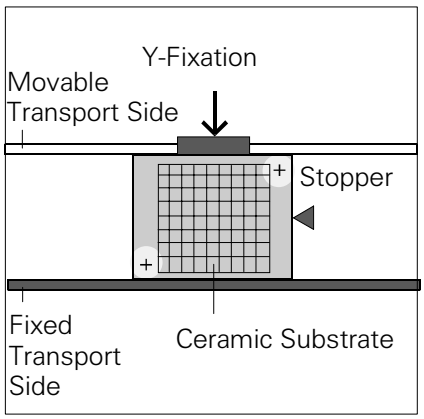
In the asynchronous type of transport a PCB is moved into the placer in "slack time" while another of the same type is being populated. The non-productive time caused by the PCB transport is therefore completely eliminated. The increase in placement speed to be anticipated is between 10 and 30%, depending on the components to be placed on the PCB.

The client can switch between asynchronous and synchronous dual conveyor with little effort. The optional ceramic substrate centering is possible, but the PCB bar code reading process is not.

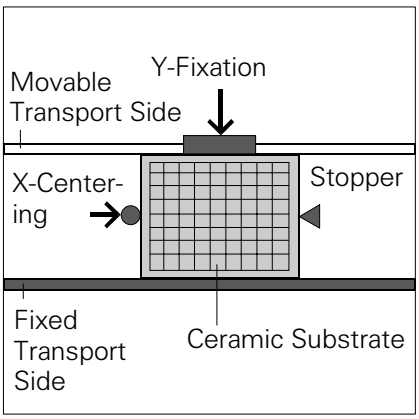
# PCB Conveyor:
# Ceramic Substrate Centering (Option)

**Technical Data**

| | |
|---|---|
| Substrate dimensions | 2" x 2" to 4" x 7" |
| Substrate thickness | 0.5 to 1.5 mm |
| Substrate model | Unscribed (no difficulty)<br>Scribed (after test) |
| Contact in conveyor | 2.5 mm |
| Optical centering: | |
| Field of view of the PCB vision module | 5.7 x 5.7 mm |
| Type of lighting<br>with light-colored pastes<br>with dark pastes and short distance to neighboring structures (>1 mm) | PCB vision module (standard)<br>Oblique lighting (option) |
| Fiducal mark criteria | See PCB vision module position recognition |
| Mechanical centering<br>X-/Y-centering accuracy | ± 0.07 mm at 4 sigma |
| PCB underside clearance | 12 mm |
| Compressed air connection | 5.5 bar |




*Optical Centering via PCB Camera*




*Mechanical Centering*

**Description**

Due to the increasing use of ceramic substrates in Flip Chip technology the demands for precise substrate centering are growing. The optical and mechanical ceramic substrate centering units on SIPLACE 80 S-20, SIPLACE 80 F[4] and SIPLACE F[5] HM placement systems satisfy these demands.

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

In certain cases, mechanical centering is required, e.g., when placement is to continue to the substrate edge, when handling of the edges of the substrate is to be particularly gentle, or when substrates are scribed. In this gentle, bounce-free procedure, the substrate is fixed in place in the Y-direction between a stop rail and a rocking lever pneumatically centered in the X-direction.

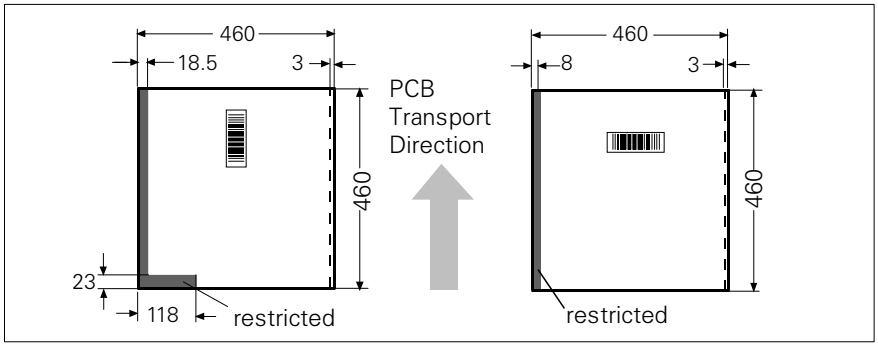
# PCB Conveyor:
# PCB Bar Code for Production-Controlled Manufacturing (Option)

**Technical Data**

| | |
|---|---|
| Max. PCB size<br>Single conveyor | 50 x 50 mm up to 460 x 460 mm<br>(optional 460 x 508 mm)<br>(same width in all jobs of a sequence) |
| Bar-code-free PCB edge | 3 mm left and right parallel to PCB transport direction (the additional restrictions shown in fig. apply for the reading of the bar code from top side) |
| Label dimensions | Stroke width(W): 0.19 <W ≤ 0.3 mm<br>(corresponds to high and medium density)<br>Stroke length: ≥ 4 mm*<br>Length of the reading window: ≤ 90 mm |
| Label alignment an PCB** | Parallel or at right angles to the PCB transport direction, preferably next to fixed conveyor side |
| Recommended label colors (contrast ratio > 70 % to DIN 66236) | Coding: black, dark green or dark blue<br>Background: white, beige, yellow, orange |
| Types of codes | Code 39, Code 128 / EAN 128,<br>Codabar, 2/5 IATA 2/5 industrial,<br>2/5 interleaved, UPC, EAN,<br>Pharma Code,<br>EAN Addendum (more on request) |
| Complete bar code | Max. 25 characters<br>definition of a bar code filter possible |
| Safety of the laser scanner | Laser diode 670 nm (red) / 1 mW<br>Laser protection class 2, degree of protection IP65 |
| Station and line software | From version 401.xxx |
| Read-in / evaluation duration | In slack time (T ≤ 1 s), as parallel to placement of preceding PCB |

* This value is only required when the bar code label on the PCB passes through the scanner at right angles to the transport direction of the machine.

** Depending on the location of the bar code label on the PCB, it is simply to adjust the position of the scanner in the input conveyor belt.




*Restrictions for Bar Code Reading of PCB Sizes 460 x 460 mm*

**Description**

***Single conveyor***

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 placer 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.

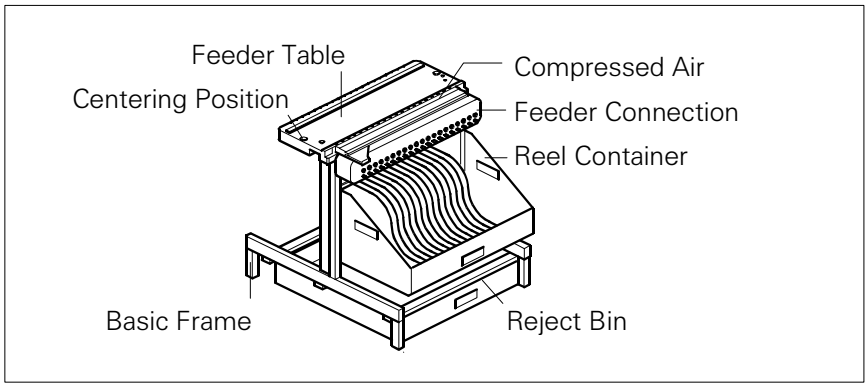
***Dual conveyor***

With a dual conveyor, the sole purpose of the PCB bar code is to relay the bar code via a GEM interface. This is imperative for utilization.

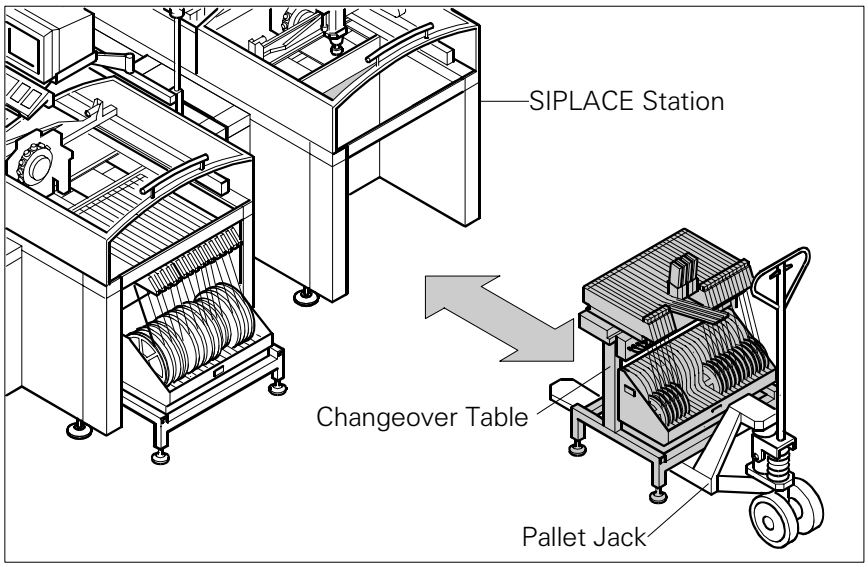
# Component Supply: Changeover Table

**Technical Data**

| | |
|---|---|
| Insert (exchangeable) | In all SIPLACE placement modules |
| Feeder locations | 20 per table = 40 x 8 mm tapes |
| Feeder modules | SIPLACE feeders for tapes, stick magazines, Bulk Cases |
| Accessories | Tape container, waste container, lift cart empty table cutter |




*Construction of a Changeover Table*




*Exchange of a Feeder Changeover Table*

**Description**

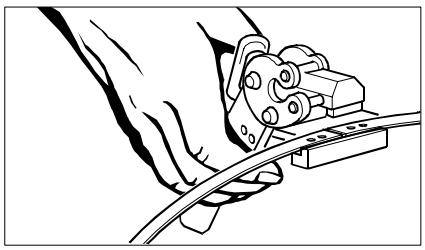
SIPLACE F[5] HM is equipped with two stationary component feeders, one on the left and one on the right of the PCB conveyor. As standard there is a component changeover table on the left. As options, either a tray changer with a narrow component table or another changeover table can be placed on the right. With two component changeover tables the total capacity is, e.g., 2 x 40 tape tracks of 8 mm each.

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

For a changeover, either individual feeders or the entire changeover table can be exchanged without any tools for component tables set up outside the placer.

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 transported with a lift cart in this case. Exchanging the tables takes about 2 minutes per module.



*Splicing Tool*

# Component Supply:
# Tape Feeder

**Technical Data**

| Packaging | Model | Feeder Locations | Transport Distance | Max. Component Height |
|---|---|---|---|---|
| Paper and blister tapes | 2 x 8 mmS* | 1 | 2 or 4 mm | 2.5 |
| | 12/16 mmS | 1 | 4 - 12 mm** | 14 |
| Blister tape | 24/32 mmS | 1.5 | 4 - 32 mm** | 14 |
| | 1 x 44 mmS | 2.5 | 4 - 44 mm** | 14 |
| | 1 x 56 mmS | 2.5 | 4 - 56 mm** | 14 |
| | 1 x 72 mmS | 3 | 4 - 72 mm** | 14 |
| Tape reels | ø 7" to 15" | | | |
| Feeder cycle | S-feeder to 20 mm transport distance < 150 ms | | | |

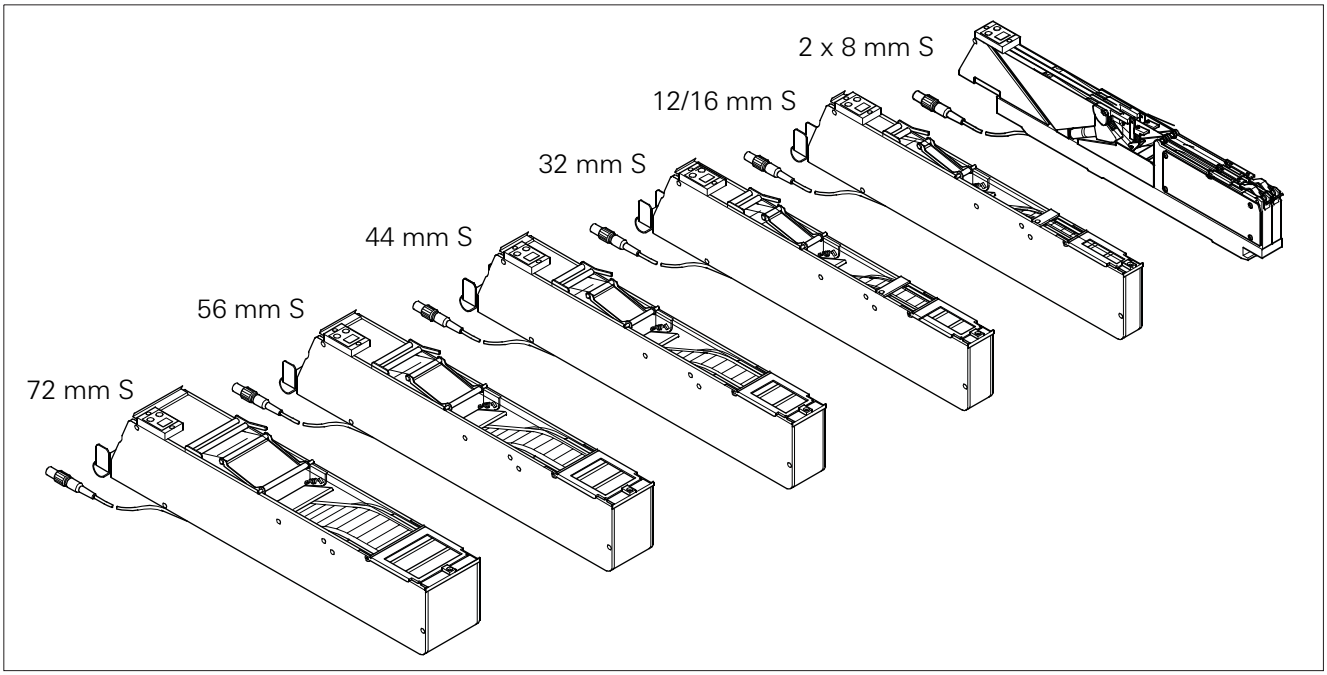
* Fiducial for recognition of position of feeders ** adjustable in increments of 4 mm

**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 s-tinguished 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 suffice - a decisive advantage for investment and logistics. 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.



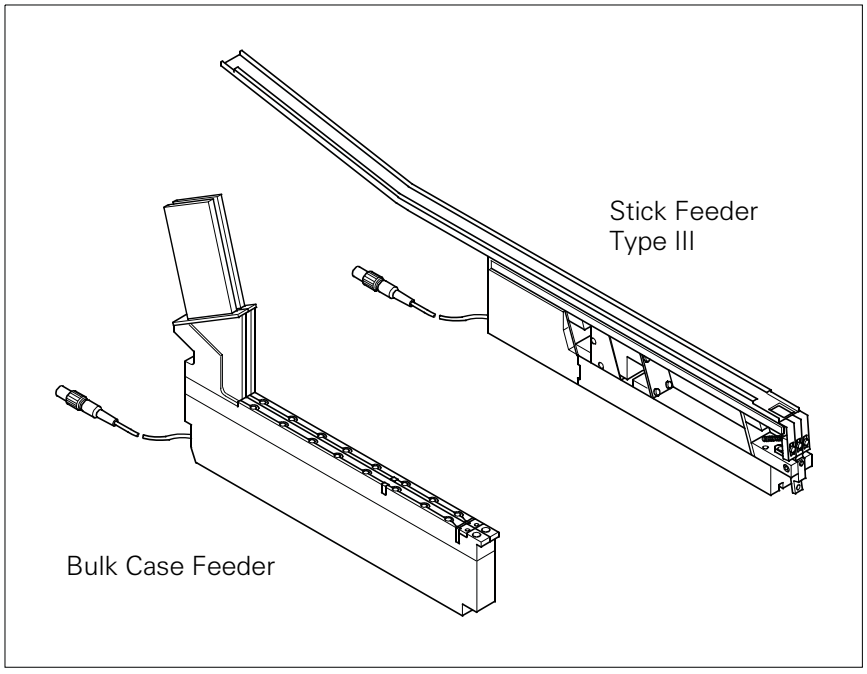

*Tape Feeder Modules S*

# Component Supply:
# Bulk Case Feeders, Stick Magazine Feeders

**Technical Data**

| | |
|---|---|
| Bulk Case feeder*<br>Type of packaging | Bulk Case |
| Feeder rails for | Chip 0402 component height 0.35 mm<br>Chip 0402 component height 0.50 mm<br>Chip 0603 component height 0.45 mm<br>Chip 0603 component height 0.80 mm<br>Chip 0805 component height 0.45 mm<br>Chip 0805 component height 0.60 mm<br>Chip 0805 component height 0.85 mm<br>Chip 0805 component height 1.25 mm<br>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<br>2 x 15 mm<br>1 x > 15 mm<br>1 x 30 mm |
| Feeder location | 1 |

* 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 in bulk. It transports rectangular and round passive components. To replenish the supply, the Bulk Cases are exchanged, simply and without stopping the machine.

Essentially, this feeder module consists of the basic element plus the suitable feeder rail and Bulk Case for the component type and height. The components are separated and transported via compressed air.

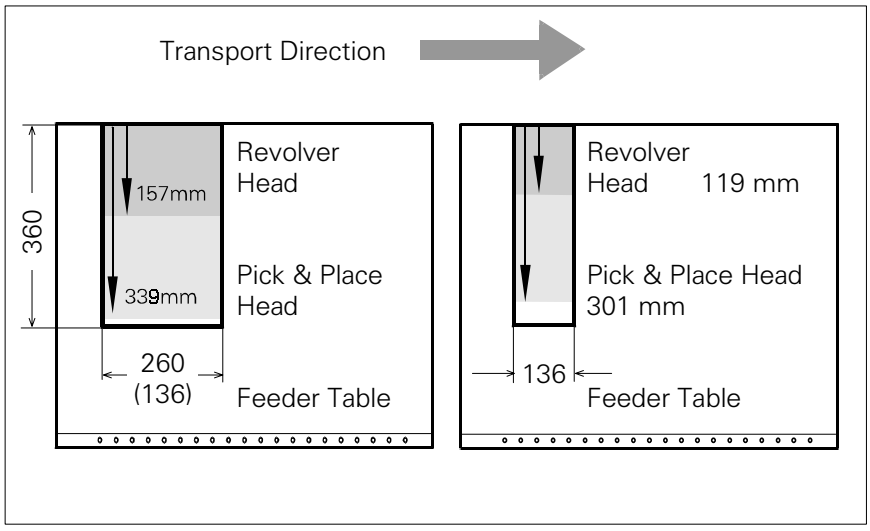
The principle of stationary component tables has been tried and tested specifically with Bulk Cases. Vibrations which developed when other placement methods are used may cause wear, drastically affecting the component quality.

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

# Component Supply:
# Manual Trays

**Technical Data**

| | |
|---|---|
| Sizes | 136 x 360 mm; requires 5 feeder locations<br>260 x 360 mm; requires 9 feeder locations |
| Max. tray height | 12.5 mm including component |
| Parts | Manual tray<br>Carrier tray |
| JEDEC Waffle Packs | Directly in the manual tray<br>136 mm wide |




*Pick & Place Head and Revolver Head Access to Manual Tray*

**Description**

The manual tray change is one possibility for picking up Waffle Packs. A number of "manual trays" are placed on the component tables (right-hand table for Fine Pitch components). The two component changeover tables are retained.

This option is recommended if only a few component types are supplied in the tray.

JEDEC trays can be directly clamped. Therefore there are special access times for the placement heads.

# Component Supply:
# Surf Tape Feeder for Bare Dies

**Technical Data**

| | |
|---|---|
| Tape size: | Combimodule 8 / 12 / 16 mm |
| Recommended Bare Die size: | 8 mm Surf Tape:<br>1 x 1 mm up to 2.3 x 2.3 mm<br>12 mm Surf Tape:<br>2.3 x 2.3 mm up to 5 x 5 mm<br>16 mm Surf Tape:<br>3.8 x 3.8 mm up to 9.5 x 9.5 mm |
| Component positional requirements: | Size of Bare Die ≤ 2.3 x 2.3 mm:<br>± 100 µm, 6 sigma<br>Size of Bare Die ≥ 2.3 x 2.3 mm:<br>± 200 µm, 6 sigma<br>( in relation to center of pocket ) |
| Min. space between tape pocket web and edge of die: | 0.4 mm (0.015 mil) |
| Tape specification: | IEC 286-3, DIN-IEC-286, EIA 481 und JIS C 0806 |
| Tape reel diameter: | 7" or 15" |
| Feeder space | 1 slot |

**Description**

The Surf Tape feeder is a specific module for the placement of Bare Dies. The feeding technology is different to a standard feeder and requires e.g. a poke-up needle and therefore a special know how.

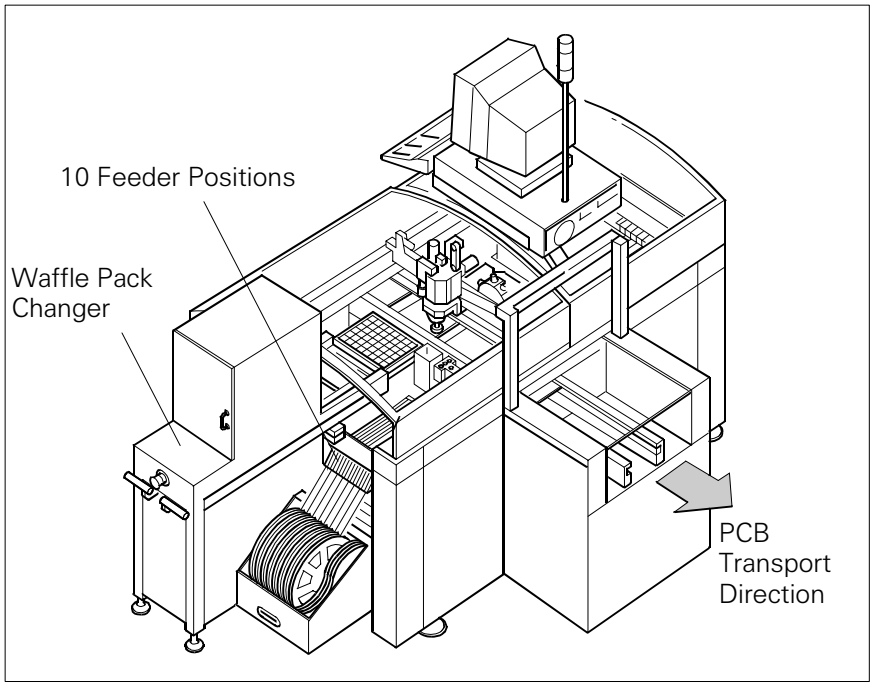
The Surf Tape feeder is offered as a combi module for 8 / 12 / 16 mm Surf Tape material. To switch from one tape size to the other is done very easily by changing only three parts which are included.

The feeding process starts with the transport of the bare die to the pick up position. This position is exactly defined by a sensor. The nozzle moves onto the bare die and the vacuum is activated. A poke-up needle moves up and lifts up the bare die and the nozzle. At the same time the Surf Tape starts to loose contact with the bare die. When there is no contact between the tape and the bare die the nozzle moves upwards and the poke-up needle downwards. The required time for this process depends on different items like storage time of the tape, size of the bare die etc. and is adjustable.

# Component Supply:
# Waffle Pack Changer (Option)

**Technical Data**

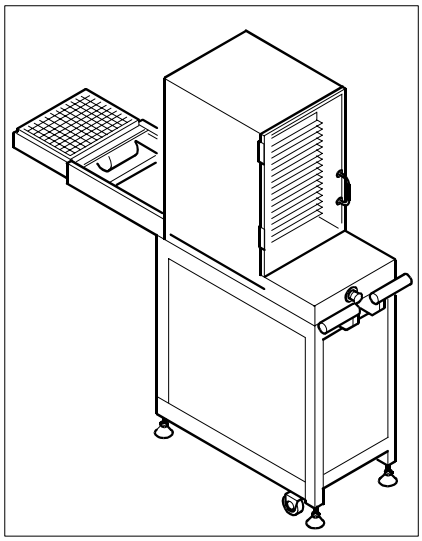
| | |
|---|---|
| Contents of storage | 28 carrier trays for Waffle Packs |
| Max. magazine size | 240 x 340 mm |
| Max. tray size<br>Pick & Place Head<br>6-Nozzle Revolver Head | <br>≤ 240 x 340 mm<br>≤ JEDEC Tray |
| Magazine height | 15 mm including component |
| Max. number of component types | 200 per Waffle Pack Changer |
| Changing time per magazine | < 3 s<br>parallel to other substeps during a placement cycle |




*SIPLACE F[5] HM with Waffle Pack Changer*

**Description**

If a number of Waffle Packs are required during a placement process, it is advisable to utilize the automatic magazine change with the help of the Waffle Pack Changer. The set-up of the Waffle Pack Changer is exactly coordinated with the sequence of placement for a work process optimized in terms of path and time. An elevator automatically brings the correct magazine into the access range of the placement head. The magazine for the first component is changed as soon as a PCB moves into the placement



*Waffle Pack Changer*

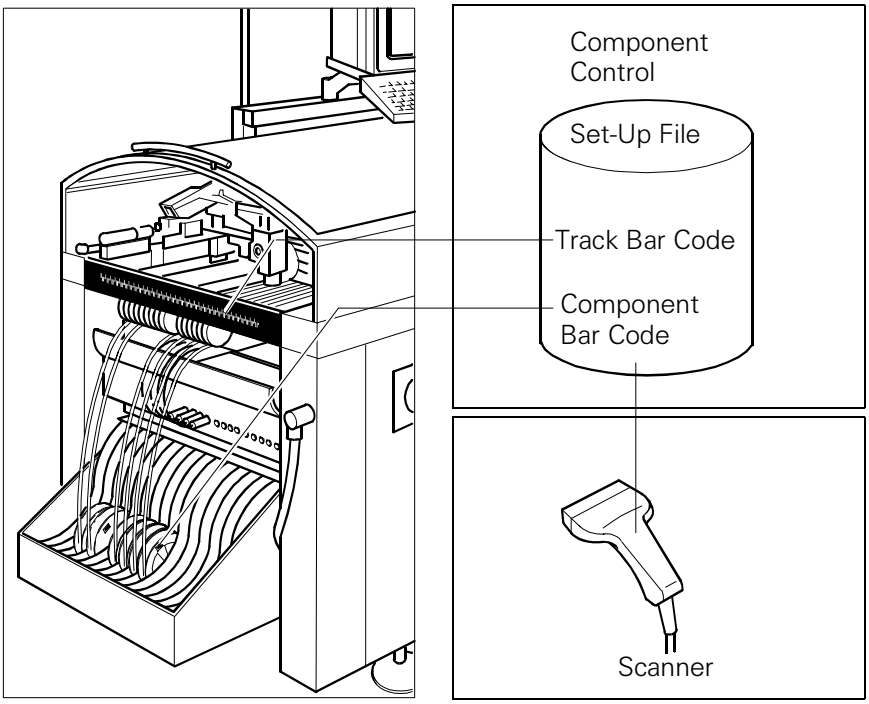
conveyor and valid data for cluster and set-up are available. The remaining magazine changes are made in slack time during placement. The magazines can be replenished without any machine idle time. The placement head puts faulty components back where it picked them up.

A narrow component table with 10 locations for feeder modules is also available on the tray changer (sample capacity: 20 tracks of 8 mm each).

# 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 |
| Max. number of characters | 40 |
| Restrictions | Bar codes beginning with number 1 or 2 or with less than 5 characters |
| Number of bar codes | 6 per component |
| Number of filters to extract relevant data | 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 speedy and reliable check of set-up and refill. To this end the bar codes of the tracks (on the track scale on the component table) 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 can also be entered at the keyboard.

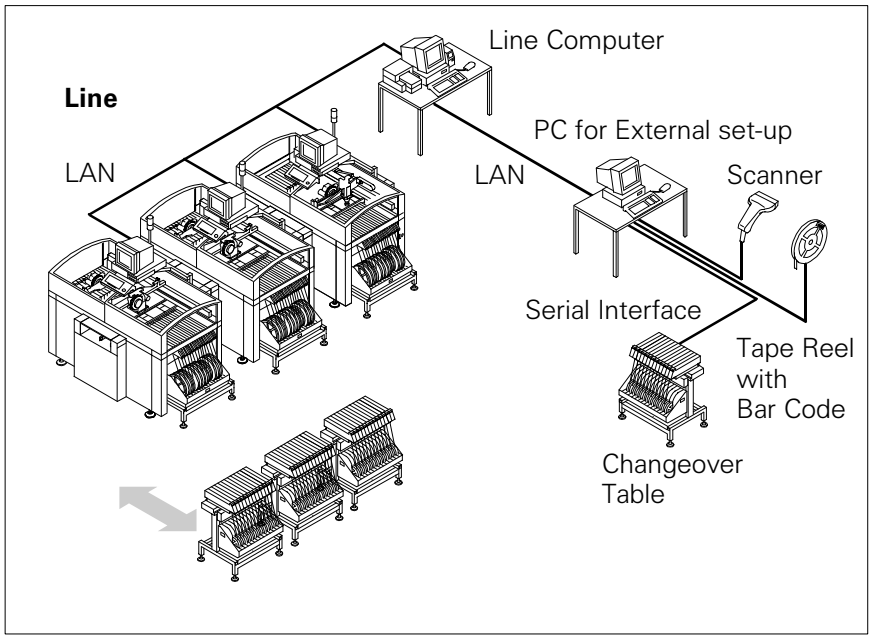
The allocation of the components to their respective track is described in the set-up data. An error message is displayed if the data received from the bar code scanner does not conform with the set-up data.

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**

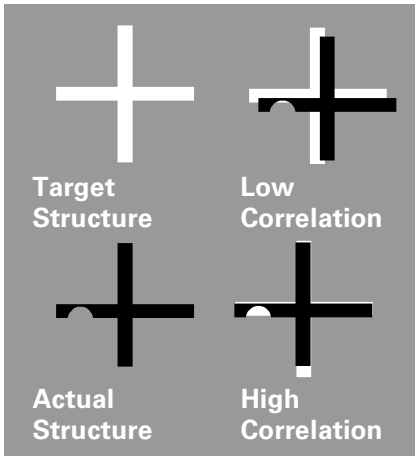
The component changeover tables can be set up and checked at an external SIPLACE set-up station quickly and without machine idle time. The costs for production involving a great variety of components are greatly reduced. During the bar code check outside the machine, 10 minutes of machine standstill 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 $F^5$ 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**

| | |
|---|---|
| Fiducial marks<br>Local fiducial marks<br><br>Library storage | Up to 3 per placement program<br>Up to 2 per component<br>(may be different types)<br>Up to 255 types of fiducial marks |
| Image processing | Correlation principle based on gray values |
| Illumination | Front light |
| Recognition time mark/ink spot | 0.8 s |
| Camera's field of view | 5.7 x 5.7 mm |




*Correlation Principle*

**Description**

With the SIPLACE F[5] HM a number of vision modules with a central vision system to evaluate the recorded image data ensure a high placement accuracy.

At the machine's X-gantry the PCB vision module finds position offsets on the part of the PCB in the conveyor system. This module i also required to measure the machine and/or the feeders on one side of the table. This vision module 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 the gantry with its PCB vision module moves to the programmed mark position. The vision system compares the recorded video image with the sample stored in the PCB description.

With the help of the correlation principle the vision system can determine the correct position even when fiducial marks are incomplete or damaged (actual structures). It does so by making comparisons with programmed nominal structures. The mark configurations are not fixed; they can be taught without restriction.

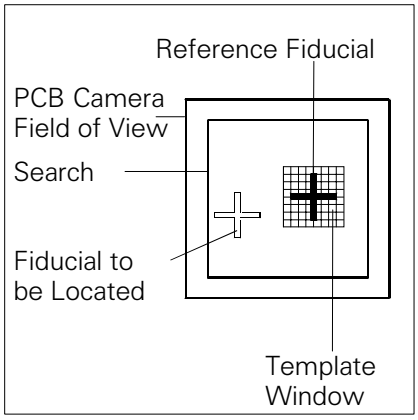
Additional functions of the PCB vision module are recognition of the position of the feeders and ceramic substrate (optional) and recording of the machine data including mapping.

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

# Vision Sensor Technology: PCB Position Recognition

**Fiducial Mark Criteria**

| | | |
|---|---|---|
| Determine 2 fiducials | X-/Y-position, rotation angle, mean distortion | |
| Determine 3 fiducials in addition | Shear, distortion in X- and Y-direction | |
| Fiducial shapes | Freely definable via teaching, e.g., single cross, rectangle, square, circle | |
| Fiducial surface: | | |
| Copper | Without oxidation and solder resist | |
| Tin | Warp ≤ 1/10 of structure width, goo contrast with surroundings | |
| Fiducial dimensions: | | |
| Single cross | Length and width: | 0.9 to 2 mm |
| | Stroke thickness: | 0.3 to 1.0 mm |
| Rectangle/square | Edge length: | 0.5 to 2 mm |
| Circle | Diameter: | 0.5 to 2 mm |
| Fiducial surroundings | No clearance around the fiducial marks necessary if there is no similar fiducial structure within the search area (5.7 x 5.7 mm). | |




**Description**

Various fiducial mark shapes prove to be optimal depending on the condition of the surface.
In the case of bare copper surfaces with little oxidation, the single cross is particularly recommended because maximum recognition reliability is achieved as the result of the high information content. Rectangle, square and circle are less "informative", but save space, are rugged and can be used even if oxidation is advanced.
In the case of tinned structures, circle or square are recommended because the ratio between fiducial dimensions and presoldering thinness is then particularly good.

# Vision Sensor Technology:
# Bad Boards Recognition Using Ink Spots
# Position Recognition of Feeder

**Ink Spot Criteria**

| | |
|---|---|
| Fiducial shapes | Single cross (recommended because susceptibility to disruption lowest)<br>rectangle, square, circle, etc. |
| Masking material | Matt dark (light-absorbing)<br>Not recommended: white or shiny |
| Size or fiducial masking | Circular: ⌀ ≥ 8.1 mm<br>Squared covers: ≥ 5.7 mm |
| Fiducial recognition time (travel > 100 mm) | Fiducial masked: 1.7 s<br>Fiducial not masked: 0.5 s |

**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 not populated. Naturally it is also possible to prevent the population of the subpanel when the ink spot is missing.
With this function it is possible to prevent costs arising due to unnecessary population of faulty subpanels.

***Position Recogniton of Feeder***

The pick-up position of the component 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: Standard Component Vision Module for the 6-Nozzle Revolver Head

**Technical Data**

| | |
|---|---|
| Maximum component size | 32 x 32 mm |
| Component range | 0603 to QFP 208 including BGA, TSOP, QFP, PLCC, SO, SOJ, DRAM |
| Lead pitch | ≥ 0.5 mm |
| Camera's field of view | 39 x 39 mm |
| Illumination | Front light (2 freely programmable planes) |

**Description**

The standard component vision module is integrated directly into the revolver head and images the component in question. While the component is cycling onward into the next station of the revolver head, the recorded image is being evaluated by the central vision system. The component is then corrected by the appropriate angle in this station on the basis of the position offsets determined.

# Vision Sensor Technology:
# DCA-Vision Module for the 6-Nozzle Revolver Head (Option)

**Technical Data**

| | |
|---|---|
| Component spectrum | Flip Chips, Bare Dies, Standard SMDs |
| Component dimensions: | maximum 13 x 13 mm<br>minimum 0.5 x 0.25 mm |
| Min. Bump diameter | 110 µm |
| Min. Bump pitch | 200 µm |
| Field of view | 15.6 mm x 15.6 mm |
| Illumination | Front light<br>(4 freely programmable planes) |

**Description**

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 recognized without problems.

The DCA vision module is integrated into the DCA package which is one of the options available for SIPLACE F[5] HM. This option offers the possibility to process on at one machine both SMDs, Flip Chips and also Bare Dies without problems and therefore to achieve a maximum of flexibility.
Precondition for using this vision module is the central vision system MVS 340 which has improved strongly to enable a faster component recognition time. It is standard in the SIPLACE [5] HM.

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

| Algorithm | Component | Determined on the basis of |
|---|---|---|
| Size Driven | Chip | the component's out line (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 module integrated into the placement head performs 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 (two with the standard vision module and four with the DCA vision module). 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 revolver 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-u 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.

# Vision Sensor Technology:
# Fine Pitch Component Vision Module for the Pick & Place Head

**Technical Data**

| | |
|---|---|
| Max. component size | 32 x 32 mm (single measurement)<br>55 x 55 mm* (multiple measurement) |
| Min. lead pitch | 0.4 mm (standard), 0.25 (option) |
| Component range | PLCC, LCCC, QFP, SO, BGA, Flip Chip components with connections up to 55 x 55 mm (J-leads and gull-wings, balls, bumps) |
| Camera's field of view | 38 x 38 mm |
| Illumination | Front light<br>(3 freely programmable planes) |
| Analysis algorithms | Compare page 27 |

* Larger components available on request

**Description**

The Fine Pitch component vision module operates according to a sophisticated lighting technology and utilizes diverse analysis algorithms. Despite the great diversity of components it boasts a very high recognition reliability with all SMD modules. Like all other vision modules, this one is also connected to the station's central vision system.

The components are illuminated from three lighting planes whose intensity can be adjusted in 256 increments. This enables an optimal illumination of each component. The gray-scale picture recorded is analyzed on the basis of the algorithm best suited for the package form.

ICs, Flip Chips and IC-sockets are centered on the basis over the leads or bumps. In the case of chips, bare chips for subsequent wire bonding and odd-shaped components, centering is based on the outside contour (outline measurement). For these components the optional Flip Chip component vision module can be added, which is capable to center these components by their bumps.

A special inspection mode for the critical IC lead ends (HALE) precisely determines the lateral lead bend as well as pitch error and lead offset. This greatly reduces the risk of short circuits.

Beyond this, the rotational angle deviation and the X-/Y-offset of the component relative to the nozzle center is ascertained and factored in during placement. The X-/Y-offset also results in the correction of the pick-up position.

In order to have the vision module center a component which it does not yet know, it must first be described geometrically in the package form (GF) file. The component test makes it possible to check at the station to determine whether adjustments, in lighting for example, are necessary. These adjustments are automatically assigned as a file to the pertinent package form which represents a component type. Hence they are valid for all of the stations in a line. As the final step, the GF number of the component type is entered in the component file.

# Vision Sensor Technology:
# Flip Chip Component Vision Module for the Pick & Place Head (Option)

**Technical Data**

| | |
|---|---|
| Flip Chip size<br>with single measurement<br>with multiple measurement | 1 x 1 mm<br>up to max. 7 x 9 mm<br>max. 20 x 20 mm |
| Dimensions < 3 x 6 mm | Special nozzle,<br>feeding tolerance < 0.2 mm edge length |
| Min. bump diameter | 80 µm |
| Placement cycle | min. 2 s<br>(depending on number of bumps) |
| IC-pitch:<br>Lead pitch<br>Bump pitch | <br>0.25 mm<br>0.14 mm |
| Camera's field of view | 9 x 11.5 mm |
| Illumination | Front light<br>(3 freely programmable planes) |

**Description**

The Flip Chip component vision module extends the capability of processing Fine Pitch and Flip Chip components with extreme fine lead pitches. This add-on module for the Fine Pitch component vision module offers a far higher resolution. The lighting layout is fundamentally changed in the process. At optimal illumination, the imaging of the bumps is as large as possible and the orthogonal s-ruptive structures (e.g., chip printed conductor tracks) are suppressed. In the event of less pronounced disruptive structures, the intensity can be increased by combined lighting. This results in a high recognition reliability even with usually square surfaces of bumped Flip Chips in the conductive adhesive technology.

Special search algorithms are used to recognize the bumps (balls) in surroundings where fault conditions usually prevail.

# Vision Sensor Technology:
# Coplanarity Module for the Pick & Place Head (Option)

**Accuracy of the coplanarity module**
**Uncertainty of checking in case of real components**

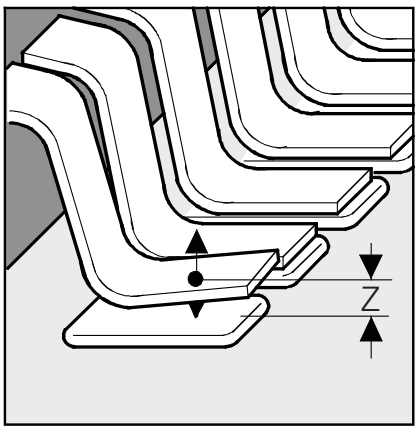
| Dimensions | $U_{99.73}$ [µm]* |
|---|---|
| 32 x 32 mm | 21.5 |
| 55 x 55 mm | 22.7 |

* Checking uncertainty of a single measurement with a confidence interval of 99.73% (corresponds to 3σ)

**Description**

The optional coplanarity check further enhances placement reliability. This check is always conducted right after the deviation of position is ascertained with the Fine Pitch vision module of the Pick & Place head.

The coplanarity module is installed next to the PCB conveyor along with the Fine Pitch vision module of the Pick & Place head.




*Effects of coplanarity (lateral bending of leads) of a populated component*

One of the biggest problems in Fine Pitch technology, the coplanarity of leads, can be largely eliminated by taking one additional step during inspection. The coplanarity module is employed to conduct a contactless, sequential vertical scanning of the IC lead structure on the basis of the laser triangulation principle. The height profile thus obtained for all of the rows of leads is used to calculate placement plane of the IC. The programmed tolerance band based on this placement plane then becomes effective.

If even one lead is outside this placement area, the component is excluded from the placement process. It is gently placed back in the Waffle Pack, entered on the repair list and automatically repaired.

The component picked up by the placement head may be crooked, e.g., because one surface of the package is not parallel to the row of leads. The calculation of the placement eliminates any influence this might have on placement however.

As the result of extensive security measures, the laser can only be operated in the closed machine. It then conforms to **Safety Class 1** (not dangerous for eyes and skin).

Barring manipulation of the protective devices, the laser will not operate outside the machine. Following impermissible tampering, the laser complies with Class B.

On SIPLACE placement systems the component which is picked up is placed on the PCB immediately after the coplanarity check. This procedure ensures that no change can occur after the check as the result of any subsequent mechanical influence. Unlike other designs, with SIPLACE machines it is not necessary to pick up the component again or to transport it in a special pick-up movement.

# Machine Criteria: Placement Accuracy

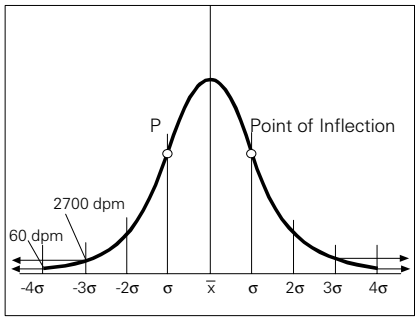
**Technical Data Gantry**

| | |
|---|---|
| Drive | DC servomotors |
| Position measuring system (X/Y) | Linear scales |
| Resolution of X-/Y-axis | 2.5 µm |
| Max. speed of X-axis<br>max. speed of Y-axis | 2 m/s<br>2.5 m/s |

**Placement Accuracy**

| | | | |
|---|---|---|---|
| X-/Y- and D-axis offset in optical component and PCB centering | | | |
| 6-nozzle-revolver head | X-/Y-axis: | ± 70 µm/4σ<br>± 60 µm/4σ* | ± 105 µm/6σ<br>± 90 µm/6σ* |
| | D-axis: | ± 0.3°/4σ | ± 0.45°/6σ |
| Pick & Place Head | X-/Y-axis: | ± 50 µm/4σ<br>± 40 µm/4σ* | ± 75 µm/6σ<br>± 60 µm/6σ* |
| | D-axis: | ± 0.07°/4σ | ± 0.105°/6σ |

* SIPLACE $F^5$ HM with DCA-package and the Flip Chip vision module of specific placement head




*Standard Deviation - dpm*

**Description**

Various factors contribute to the placement accuracy of the SIPLACE $F^5$ 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.

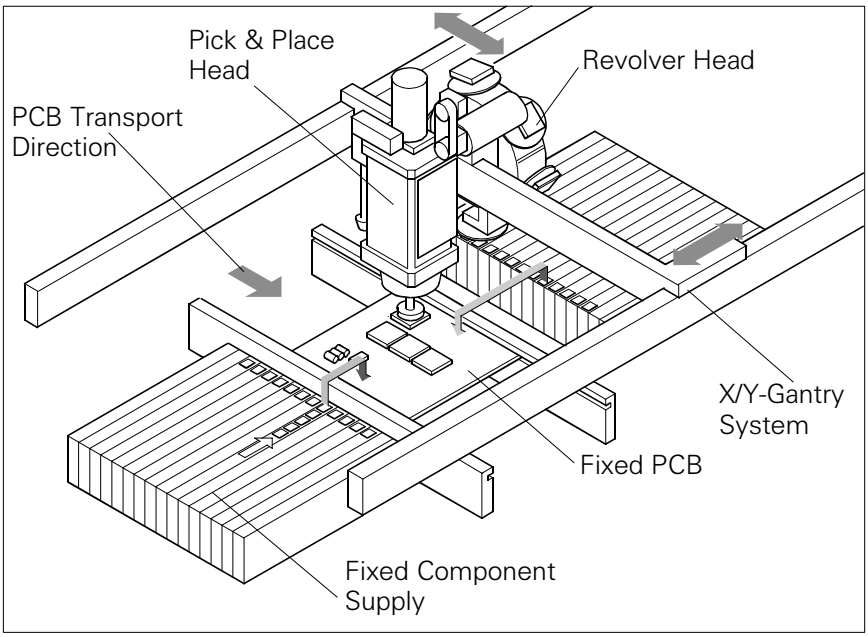
A further guarantee for long-term high placement accuracy is the position recognition of the axes of the gantry and placement head by means of optical scanning by incremental encoders. Revolving star and segments of the revolver head are positioned by means of high-resolution glass incremental panels. 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 12-nozzle-revolver head the placement accuracy is ± 70 µm at a statistical reliability of 4 sigma. In other words, of one million placed components, 60 are outside the specified tolerance (= 60 dpm). 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.

For a real comparison with other manufacturers it is necessary to calculate the pertinent standard deviation. Consequently, ± 50 µm at 4 sigma (60 dpm) is to be assessed higher than ± 50 µm at 3 sigma (2700 dpm), as fewer components are outside the specifie accuracy at 4 sigma.

Upon request, a machine capability test can be conducted during the machine acceptance.

# Machine Criteria:
# Placement Reliability and Placement Speed




*Placement Principle SIPLACE F[5] HM*

**Description**

***Placement Reliability***

Aside from correct positioning, placement reliability also means a gentle handling of the components, so that these can be soldered well later. Rework is minimized or eliminated as a result.

On the SIPLACE [5] HM among others this is ensured through a number of control functions, e.g., the vacuum checks and component vision test during the revolver head sequence.

Unsuitable 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 and thus placement accuracy.

Thanks to the motionless PCB the components remain in the exact position they were placed. The stationary component table protects, for example, the components in Bulk Cases against damage such as may occur due to vibrations which are inevitable with other placement concepts. Optional add-on products ensure further reliability: With the aid of the component bar code scanner, the correct placement program is automatically sent to the station.

***Placement Speed***

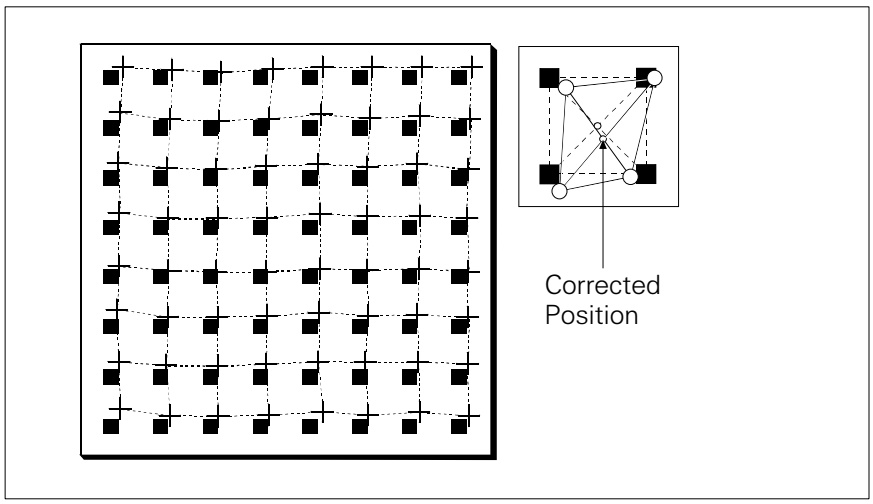
When used alone on the SIPLACE F[5] HM the 6-nozzle revolver head achieves a maximum placement rate of 8,000 cph (**c**omponents **p**er **h**our), the Pick & Place Head at 1,800 cph. These placement rates can be verified on the demonstration PCB at Siemens.

Factors such as PCB size, number of components per board and their layout have a certain effect on the speed in actual practice. The placement speed in practice can be predicted using a calculation program.

# Machine Criteria: Mapping (Option)

**Technical Data**

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




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

**Description**

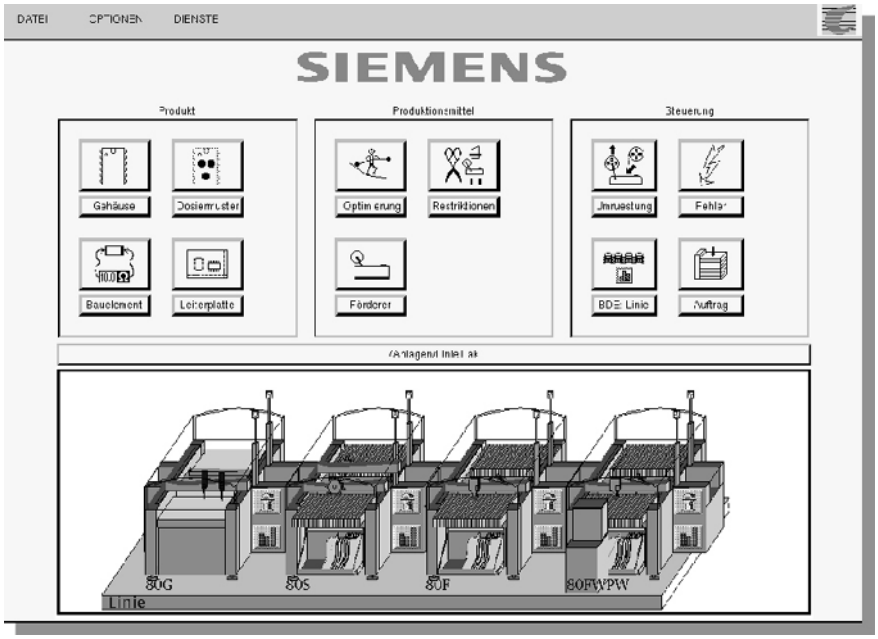
Despite the highly stable machine frame, slight distortions of the gentry axes cannot always be avoided. With the aid of the mapping process the high placement accuracy of the machine is preserved throughout its entire service life.

In this calibration process which can be conducted quickly and easily, the placement head scans a glass mapping plate placed in its working area which bears highly accurate fiducial marks. 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: System Architecture

**Technical Data**

| | |
|---|---|
| Operating system: Line computer | SCO UNIX ® |
| Station computer | Microsoft ® Windows with Touch Screen |
| Machine controller | RMOS ® Realtime Multitasking Operating System |
| Operator Support | On-line information and help system |




*Graphic Operator Environment*

**Description**

The control software is coordinated with the modular architecture of the SIPLACE production line. It is based on a high-level real-time multitasking operating system which is optimally suited for the control of time-critical processes in the placement machine. Window technology and Touch-Screen operator interface facilitate handling with the line and station computers which cooperate closely in dividing the tasks to be performed. The context-sensitive on-line information and help system comments on current events in writing and graphics, for example, and offers short information about button in the toolbar or in menu entries.

The UNIX multitasking operating system of the line computer makes it possible to perform more than one work sequence at a time. While the population of a PCB is in process, for example, it is already possible to determine the optimized layout of the feeders for the next PCB type (set-up optimization). It is also possible to edit in several windows or to look into the MDA/PDA data without affecting the placement speed. When production planning is physically an organizationally separate from the production department, it is advisable to use a second line computer as an off-line programming system.

# SIPLACE Software Architecture: Line Computer / Station Computer

**Functions**

| | |
|---|---|
| Line computer | Programming<br>Optimization<br>Line control<br>Line monitoring<br>Data management |
| Station computer | Machine control<br>Machine monitoring<br>Machine operation |

*Line Computer*

*Station Computer*

**Description**

The UNIX line computer is assigned the following interstation tasks: creation, revision and management of placement programs, job data and component and GF libraries; automatic, optimized generation and administration of machine set-ups (set-up optimization, set-up editors); determination of optimized travel for gantry and nozzle assignments of the revolver heads; control and supply of data to SIPLACE machines in a line; calculation, storage and display of machine and operating data; data backup on built-in magnetic tape drive.

The Windows 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; optional loading control by means of component bar code and optional placement program change by means of PCB bar code.

# SIPLACE Software Architecture: Creation of Placement Programs

| Generation of Placement Program from the CAD Data of the PCB | |
|---|---|
| Data conversion | Configurable postprocessor of the line computer or external postprocessor of the CAD system manufacturer or 3rd party software vendor |
| Data transfer | Standard LAN (Ethernet TCP/IP and FTP or NFS) or disk (MS-DOS; UNIX) |

**Description**

A single placement program on the line computer is sufficient for all of the SIPLACE machines in a production line. It contains the information necessary for placement of a specific type of PCB, from the dimensions of the PCB to the placement positions of the components to the complete component and GF library. The progra can be created manually using editors in the SIPLACE line computer or - easily and time-saving - it can be generated automatically from the CAD data of the PCB. The converted data read in by means of a CAD postprocessor can be transferred into the SIPLACE line computer's data pool via a standard LAN. The placement programs then pass from the HOST computer directly into the master data management of the line computer.

The CAD postprocessor can be variably adjusted insofar as the order of the data and the format are concerned. The data to be converted must meet the following preconditions:

- ASCII data
- Table-oriented: one line per placement position
- Separators can be variably adjusted but must be the same for all fields
- Minimum information content: component name, X-, Y-. angle position.

The central filing of the line computer (master) data enables an automated link to higher-level computer systems. Changes therefore automatically affect all connected, appropriately configured lines. It is possible to switch between local and central data management at any time.

Using a conversion program integrated into the SIPLACE line computer it is possible to adopt placement programs from earlier Siemens SMD placement machines which could be run on an SP-120/HS-180 line or on MS-1xx machines (BP and BM files). The data are converted into the SIPLACE format and stored in the line computer, where they have to be supplemented by additional required information such as PCB dimensions, layouts of subpanels in the cluster and set-ups.

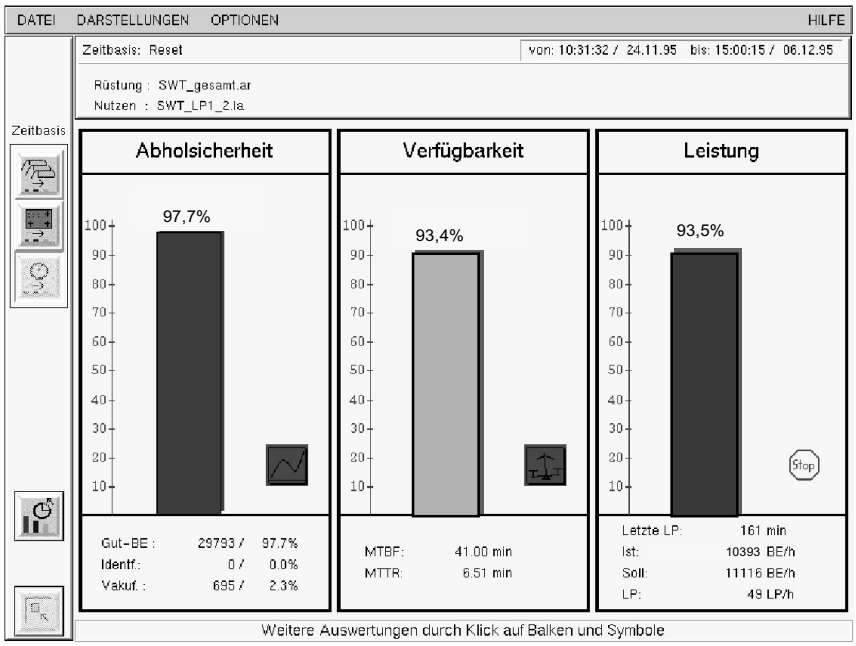
An additional computer with the same hardware and software configuration as the line computer can be employed as an external programming station. Even if it is at a different location than the production equipment, it can manage data for a number of lines an be connected with the line computers in production via LAN.

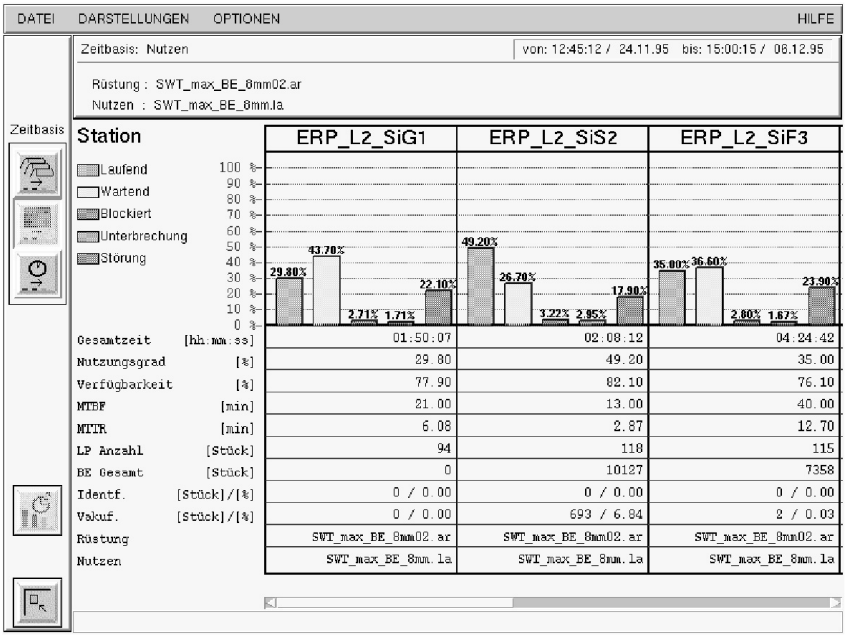
The file format >setupname<.rt, in which set-up data in simple form can be generated, makes it possible to import set-ups which were programmed on your own or third-party systems. It facilitates programming on external systems and the use of higher-level production controls. This file is also stored in table-oriented ASCII format and is therefore very easy to create.

The goal of SIPLACE set-up optimization is to reduce placement times and non-productive machine time. Attention is directed to optimally balancing the entire line in addition to minimizing the placement time of each individual machine. The nozzle allocation of the placement heads is adjusted for the PCB at hand. To minimize travel, the optimal erection location of the feeder and the most favorable order of placement is computed. As long as the component table capacity of a SIPLACE line permits, set-up optimization can be employed to combine a number of products into a single set-up.

An optional add-on is changeover optimization which optimally combines a relatively large number of products in several set-ups. The objectives are to achieve the shortest possible throughput times and optimal balancing of the entire lines but also to factor in changeover/set-up times.

# SIPLACE Software Architecture:
# Machine Data Management System




*Screen Shots of MaDaMas*

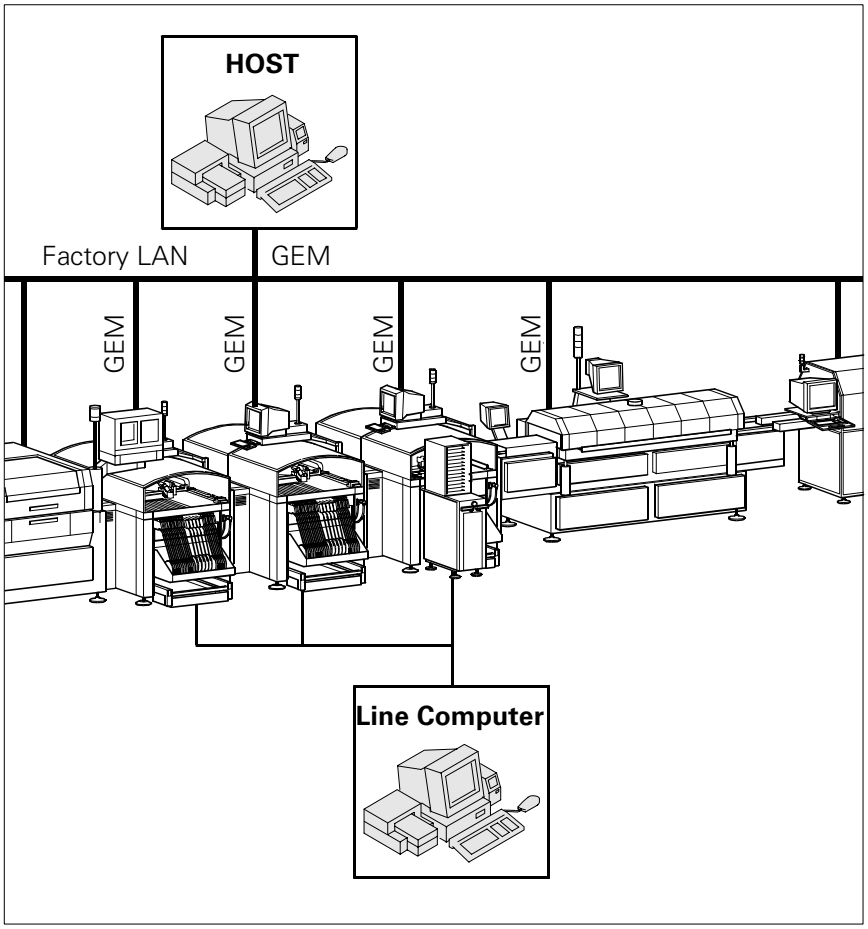
**Description**

The productivity can be further enhanced through exact knowledge of the current system condition and utilization rate. This information is furnished by Production and Machine Data Acquisition systems (PDA/MDA). The SIPLACE system MaDaMaS collects all relevant data about the line and individual stations and presents the data in graphic form. This includes evaluations as to availability, pick-up error rates, placement speed, MTBF and MTTR as well as displaying the track errors complete with component item number of GF number. This speedy, comprehensive view of the operating behavior furnishes starting points for possible improvements.

# SIPLACE Software Architecture: Data Interface SECS II / GEM (Option)

**Functions**

| | |
|---|---|
| Identification | of the equipment |
| Access to | Product data, error messages, machine states, measurement results |
| Protection of | Data, connections (connection set-up, resynchronization) |



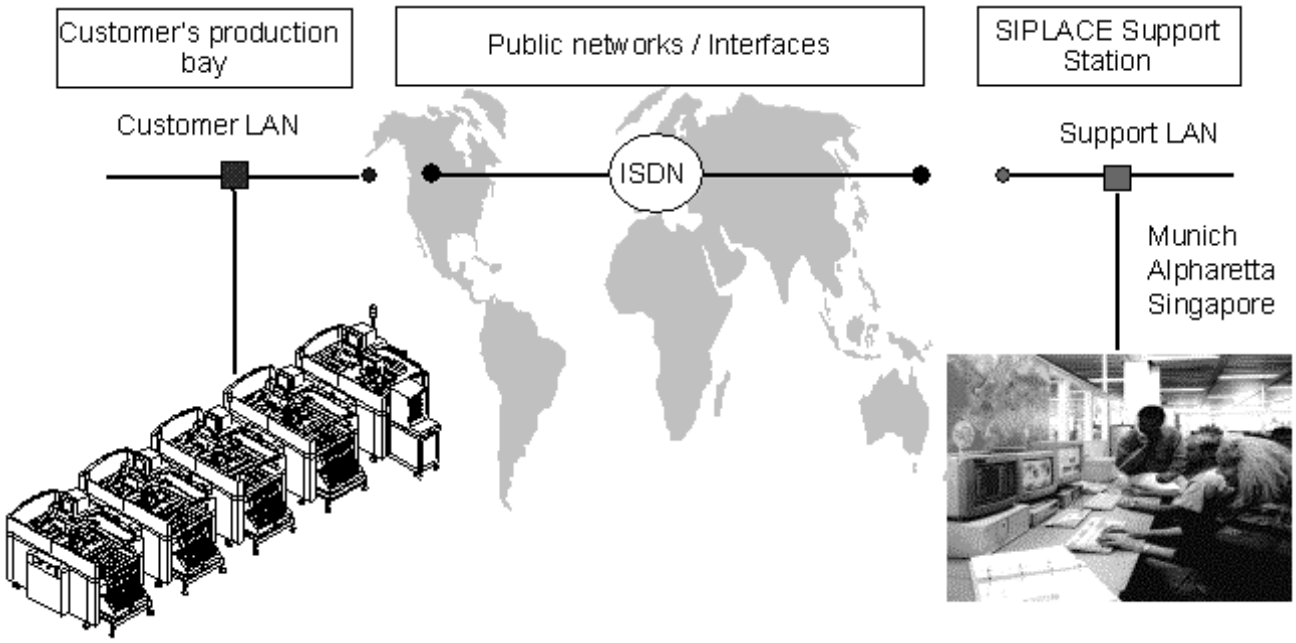

*Configuration of a Production Line with GEM Computer*

**Description**

The function of the Semiconductor Equipment Communication Standard (SECS) II is the uniform definition of communication interfaces to the production equipment obtained from different manufacturers. It has been further developed into GEM Standard (General Equipment Model) which is also suitable for SMT production facilities. To this end, an external user-specific production computer (host) is connected via LAN to a GEM computer integrated into the machine control. The interface is used by host systems created by the user or by application software from a third-party manufacturer.

The SECS II / GEM communication protocol supports central control, process control and their data management of entire production lines at the line computer. It is possible through Statistical Process Control (SPC), for example, to effect preventive maintenance which eliminates or greatly reduces non-productive time.

# SIPLACE Software Architecture: Remote Support (Option)




*SIPLACE Expert Knowledge Immediately and Round the World*

**Description**

***SIPLACE Online***

The product Remote Support enables online access to the line computer, station computer and machine controller of SIPLACE placement systems from the support centers in Munich, Alpharetta and Singapore. The SIPLACE experts in the pertinent support center can employ remote data an the program files of the individual SIPLACE lines in Production to answer all questions about the placement systems, immediately and online.

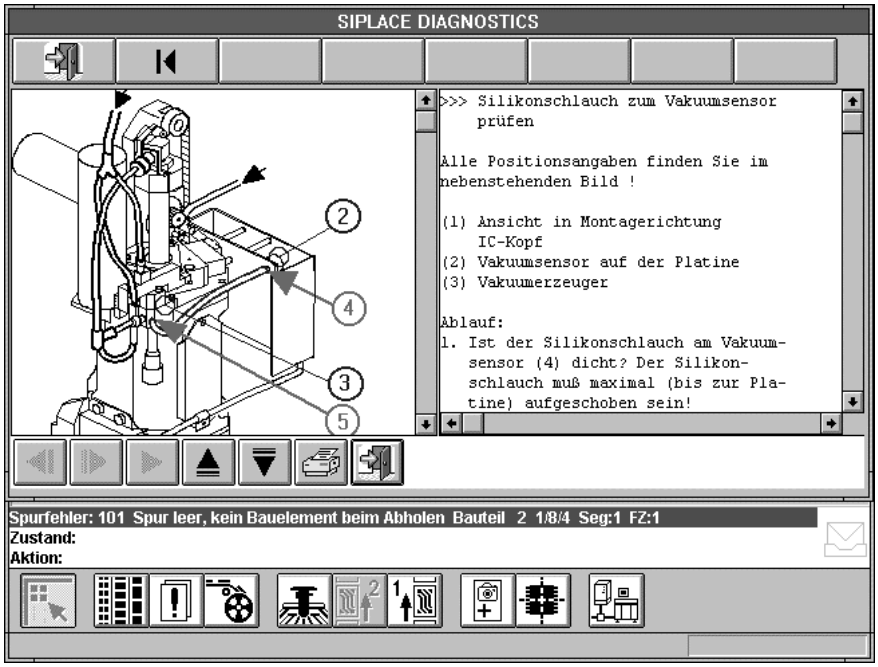
***SIPLACE Remote Support in Actual Practice***

Remote Support is offered on the basis of communication via ISDN (Integrated Services Digital Network). Due to its high data transmission speed (64,000 or 128,000 bits/s) ISDN is an ideal medium for high-speed transfer of large quantities of data, the SIPLACE expert at a "Remote Support Position", which consists of one line computer, one station computer and a communications router, can log himself or herself into the corresponding computers of the SIPLACE line in the customer's plant. Remote Support positions are available in Munich, Atlanta and Singapore. An ISDN router is also installed at the SIPLACE or site LAN of the customer. There need be only one such router per production facility, however, if the lines at the customer's site are interconnected via a site LAN.

Basically, the same functionality is available via Remote Support as is possible at the local computers (line computer, station computer and machine controller).

To comply with the customer's need for security where sensitive production data are involved, many mechanisms (automatic callback, password protection, switch-off mode, etc.) are integrated into the system and can be applied specifically.

# SIPLACE Software Architecture: Diagnostic Tools (Option)




*Analysis and On-Line-Support of SIPLACE Placement Systems*

**Description**

SIPLACE placement machines are high-tech systems whose speed, placement accuracy and flexibility are the result of the interaction of hardware and software. During the placement process all important components in the machines are monitored via software, machine status data are recorded and appropriately displayed to the machine operator. The SIPLACE diagnostic system is available as an option in addition to this standard functionality of SIPLACE. This software tool which can be run on the SIPLACE station computers contains everything required for the more detailed diagnosis of SIPLACE placement systems:

- information about SIPLACE components
- structure and strategy of SIPLACE diagnosis
- and all required notes regarding possible dynamic system control states of SIPLACE.

The SIPLACE diagnostic system thus provides the machine operator with a convenient tool which offers further support during day-to-day work in Production in addition to the SIPLACE system reports.

The diagnosis is performed online at the station computer in dialog mode. The dialog is organized into three main steps:

- analysis of the machine event
- location and derivation of the cause
- resolution of the problem

The queries to locate the cause are made on the basis of a menu, i.e., the operator is privy to all possible answers. At any time during the dialog the machine operator can access additional data such as graphics or texts which furnish him or her directions, hints and aids in answering the questions posed by the diagnostic system.

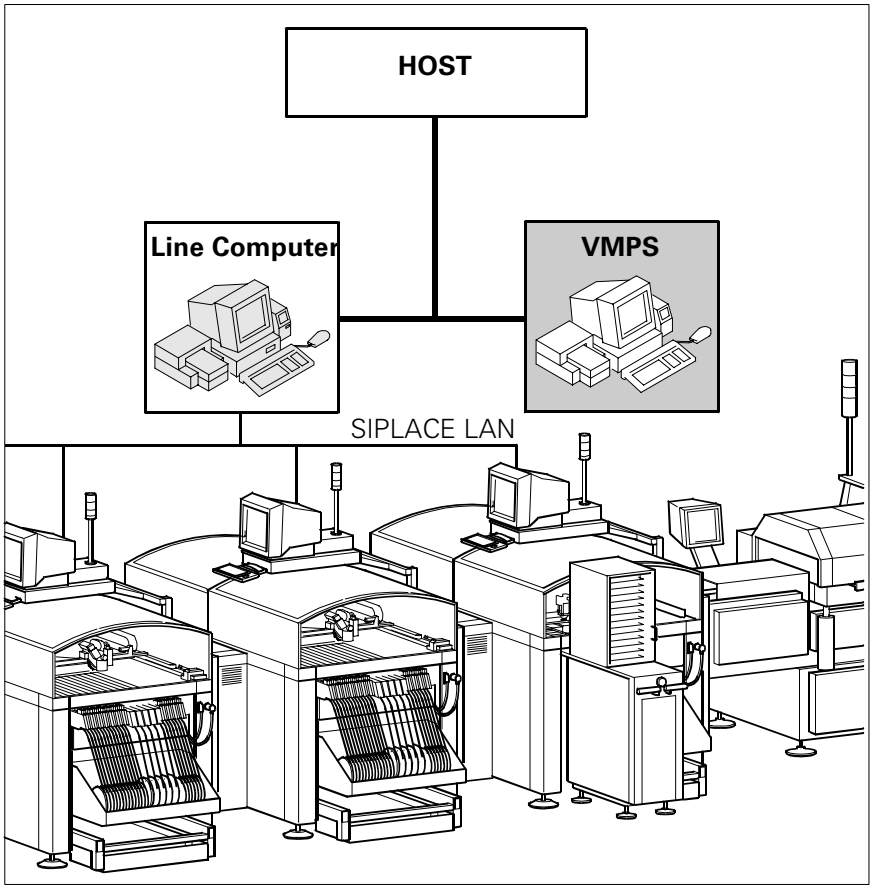
The procedure followed during this dialog is specified by the system. This ensures that the strategy of minimum diagnostic effort implemented in the diagnostic system is followed. "Minimum diagnostic effort" means that causes which can be ascertained easily or eliminated quickly are examined first in order to organize the search for causes efficiently. This strategy is based on the "SIEMENS Information Bank" developed by SIPLACE experts.

The cause discovered is presented in the form of clearly phrased text. The possible solutions for each cause are displayed at the same time as the cause. To facilitate understanding, the solutions are output in the form of graphics with a detailed description of the steps to be taken. All required information is stored in the diagnostic system in the form of texts, scanned images or CAD graphics.

# SIPLACE Software Architecture:
# VMPS - Virtual Machine Programming System (Option)

**Features**

| | |
|---|---|
| Software product for SIPLACE line computer | Interactive ASCII-Data-Processor |
| | Graphical PCB editor |
| | Graphical component editor |
| | Component editor |




*VMPS Configuration*

**Description**

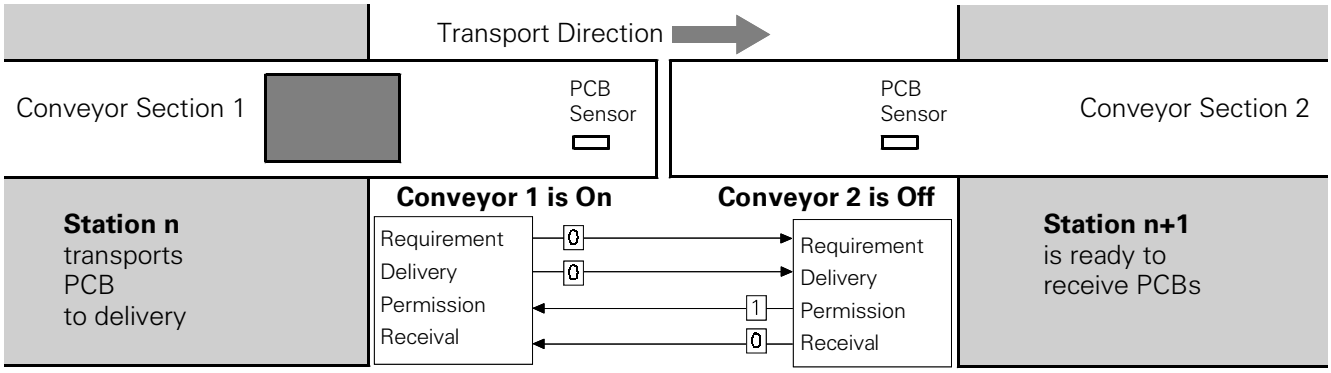
The powerful graphics off-line programming system VMPS with interactive ASCII data postprocessor is employed as an extension to the SIPLACE line computer. It offers short programming times and a drastically reduced processing time when breaking in new products. With the aid of the graphic PCB editor including cluster technology it is possible to print out all or individual components of a PCB true to scale. This corresponds to a virtually complete off-line verification of package forms an placement programs. A component editor supports the set-up and care of a component item number library and the allocation of package form (GF) references.

# Technical Data:
# Signal Interfaces

**Signal Interface (20-Pin Ribbon Cable Connector)**

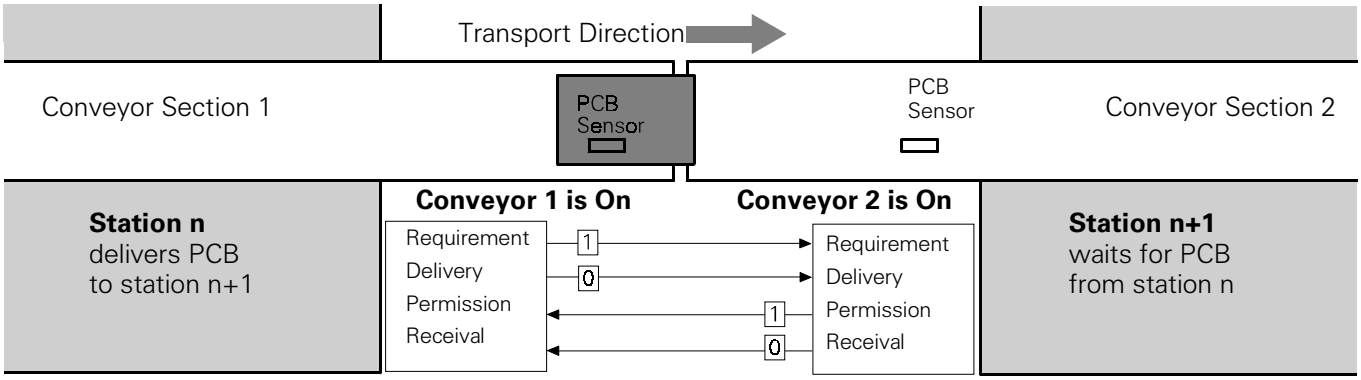
| to upstream station x3 | | to downstream station x4 | |
|---|---|---|---|
| Pin 13 | GND 24 V | Pin 10 | Reserved |
| Pin 14 | Arrived | Pin 9 | Reserved |
| Pin 15 | Permission | Pin 8 | Reserved |
| Pin 19 | Request | Pin 4 | +30 V DC unsaturated |
| Pin 20 | GND 24 V for request / released (contact 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**

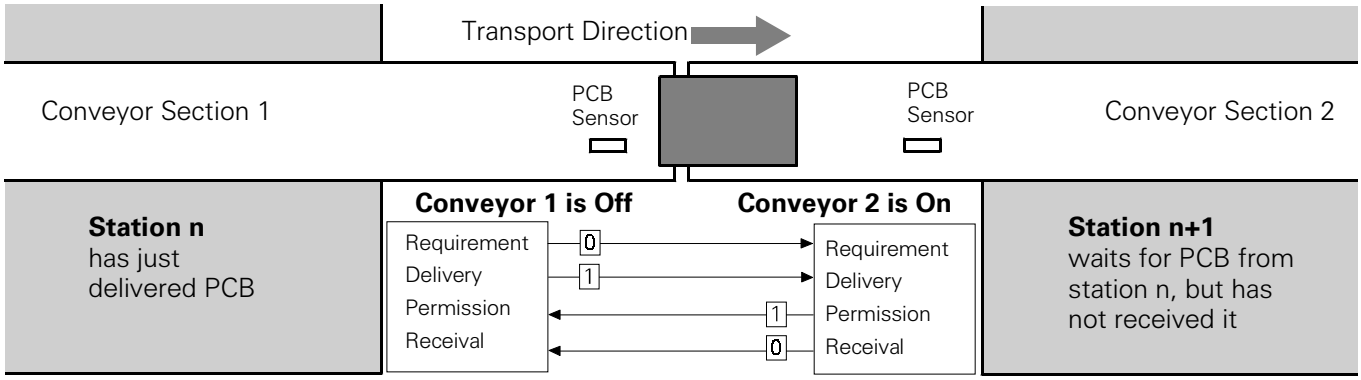


# Technical Data:
# Signal Interfaces

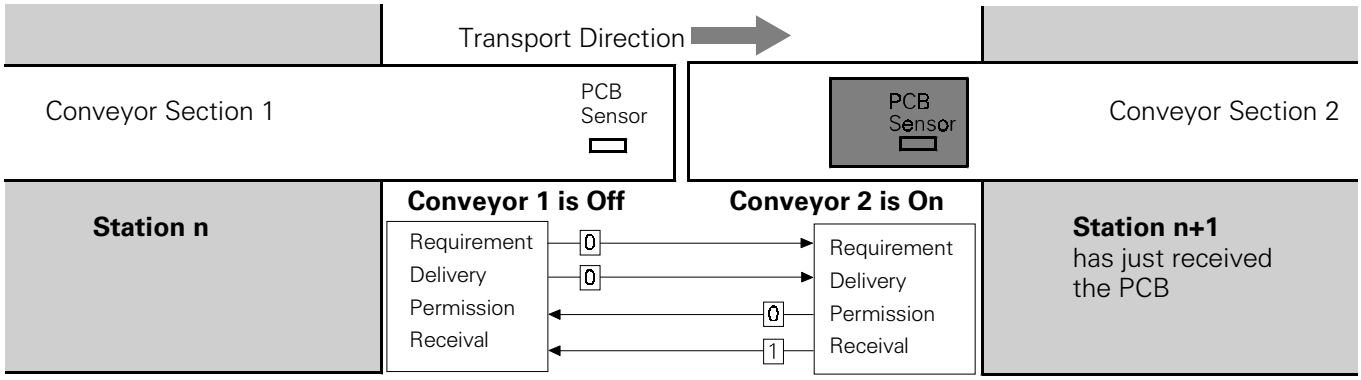
**2. PCB handling has started**




**3. PCB is at delivery**




**4. PCB transport is finished**




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

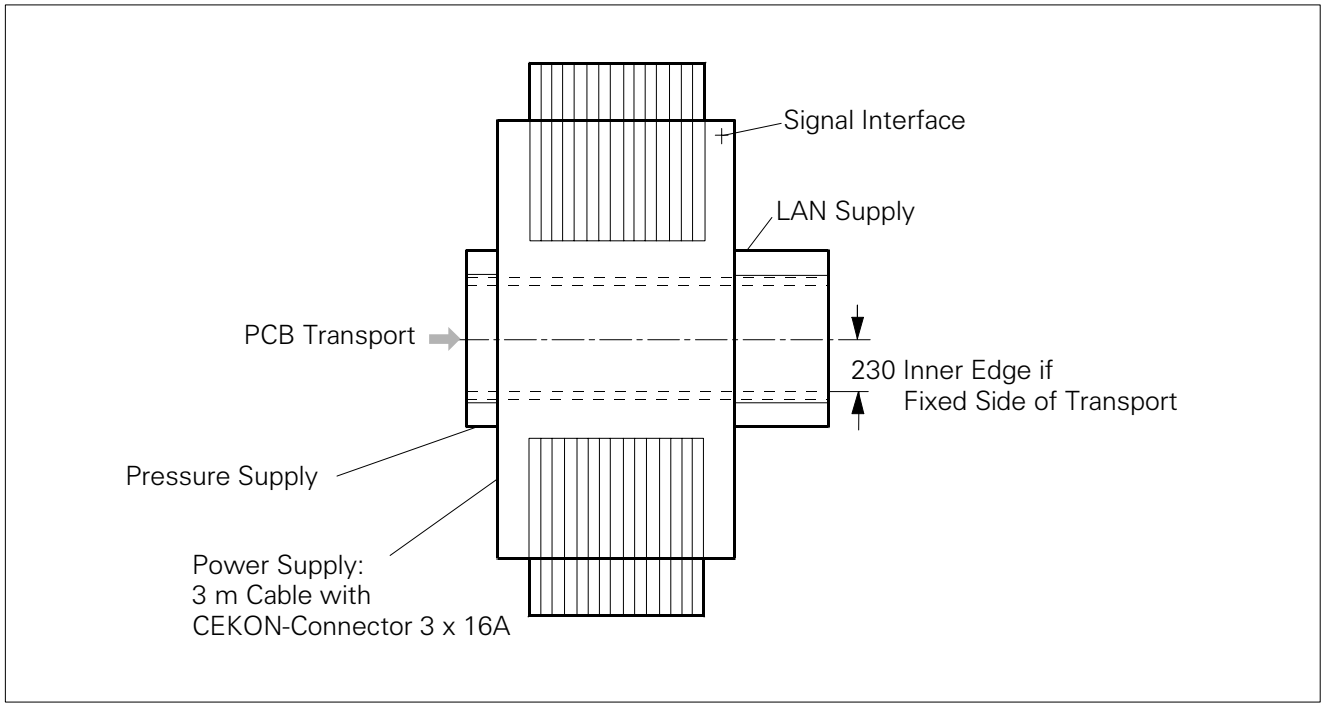
# Technical Data: Connections

**Connections and Required Energy**

| | |
|---|---|
| Connection voltage | 230/400 ~ or 110/230 ~ ± 10%, 50/60 Hz |
| Total connected load | 5 kVA |
| Total power | 5 kW |
| Fuses | 3 x 16 A |
| Voltage failure | max. 20 ms |
| Compressed air connection | min. 5.5 bar, 250 NL/min |

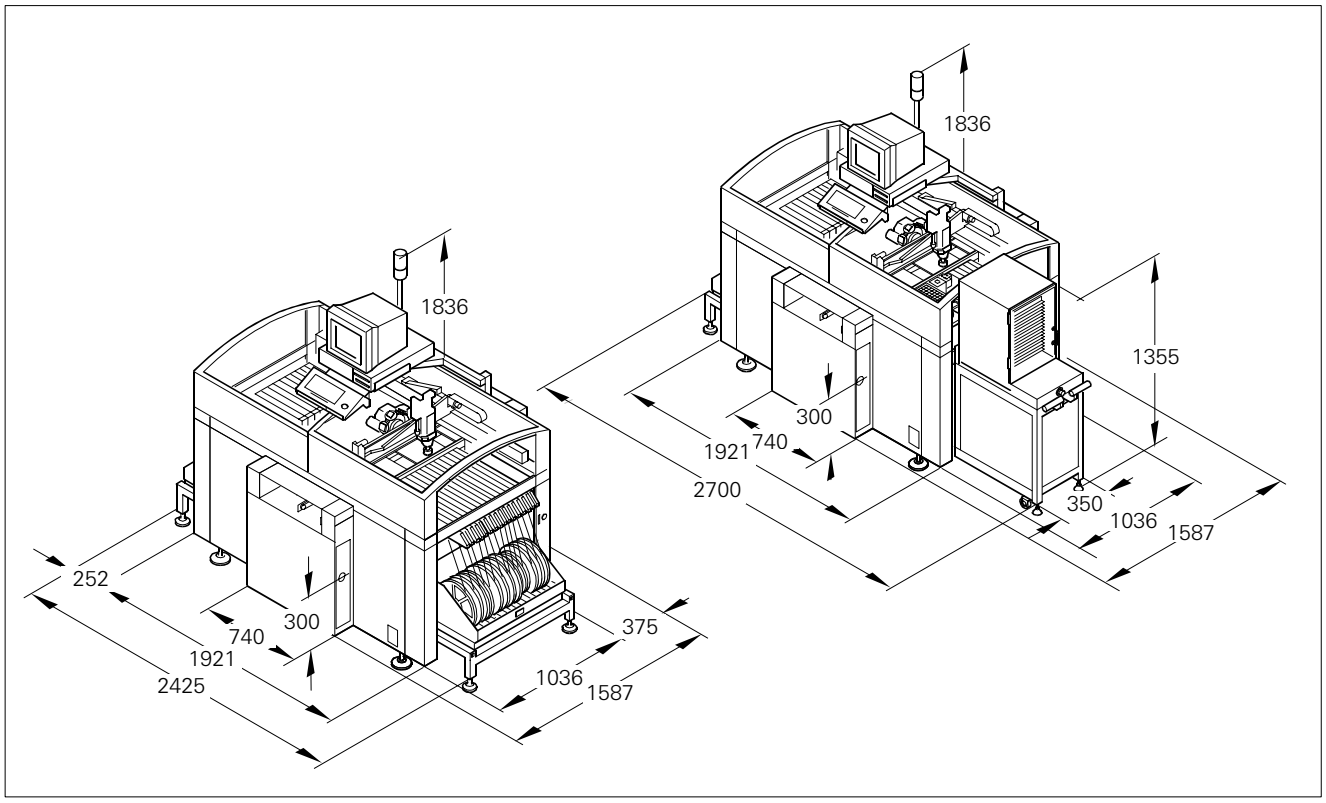
**Compressed Air Specification**

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



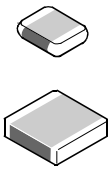
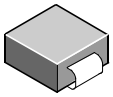
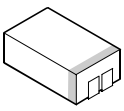
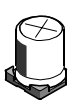
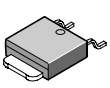
# Technical Data:
# Dimensions and Set-Up Conditions

| **Values** | |
|---|---|
| Length | 1587 mm |
| Width excluding Waffle Pack Changer | 2425 mm |
| Width including Waffle Pack Changer | 2700 mm |
| Height including warning lamp | 1836 mm |
| Weight of basic module | 1500 kg |
| Weight fully equipped excluding Waffle Pack Changer | 2000 kg |
| Weight fully equipped including Waffle Pack Changer | 2320 kg |
| Permissible surface load sub-floor | > 1 metric ton/m² (weight when fully equipped / erection area x safety margin) |
| Permissible environmental influences | Room temperature between 15° and 35° C Humidity: 30-75%, averaging no more than 45%, so that condensation on the machine is always impossible |
| Maximum noise development | 74 $dB_A$ |

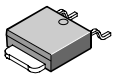
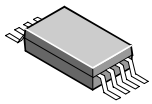
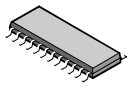
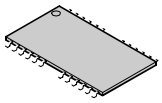
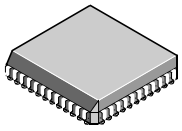



*SIPLACE F⁵ HM*

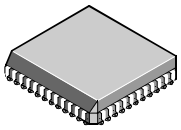
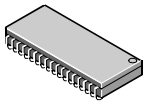
# Component Forms

| Component | Type | GF File | Dimensions | Nozzle Types | |
|---|---|---|---|---|---|
| | | | L x W x H (mm) | 6-Nozzl Revolver Head | Pick & Place Head |
| Rectangular chip capacitors and resistors, PTC and NTC thermistors, metal oxide, varistors  | 0402 | 100 | 1.0 x 0.5 x 0.35 | Type 711 | |
| | 0402 Capacitor | 101 | 1.0 x 0.5 x 0.5 | Type 711 | |
| | 0603 | 102 | 1.6 x 0.8 x 0.5 | Type 714 | |
| | 0805 | 103 | 2.0 x 1.25 x 1 | Type 714 | |
| | 1206 | 105 | 3.2 x 1.6 x 1.8 | Type 714 | |
| | 1210 | 106 | 3.2 x 2.5 x 1.7 | Type 714 | |
| | 1812 | 110 | 4.5 x 3.2 x 1.6 | Type 715 | |
| | 2010 | 111 | 5.0 x 2.5 x 1.6 | Type 715 | |
| | 2220 | 112 | 5.7 x 5.0 x 1.7 | Type 715 | |
| Melf Resistors  | MICROMELF | 200 | 2.0 x ø1.2 | Type 723 | |
| | MINIMELF | 201 | 3.5 x ø1.4 | Type 723 | |
| | MAXIMELF | 202 | 5.9 x ø2.2 | Type 724 | |
| Diodes  | MINIMELF_DIODE SOD80 | 203 | 3.5 x ø1.6 | Type 723 | |
| | MELF_DIODE_small_thick SOD87 | 204 | 3.6 x ø2.0 | Type 723 | |
| | MAXIMELF_DIODE | 205 | 5.0 x ø2.7 | Type 723 | |
| Tantalum chip capacitors   | TANTAL_3.2x1.6_A | 300 | 3.2 x 1.6 x 1.8 | Type 714 | |
| | TANTAL_3.4x2.8_B | 301 | 3.4 x 2.8 x 2.1 | Type 715 | |
| | TANTAL_5.8x3.2_C | 302 | 5.8 x 3.2 x 2.8 | Type 715 | Type 416 |
| | TANTAL_7.3x4.3_D | 303 | 7.3 x 4.3 x 3.0 | Type 717 | Type 416 |
| | TANTAL_8x6.4 | 310 | 8.0 x 6.4 x 3.5 | Type 717 | Type 416 |
| | TANTAL_10.5x8 | 311 | 10.5 x 8.0 x 3.5 | Type 720 | |
| | TANTAL_3.2x2.6_light | 320 | 3.2 x 2.6 x 1.8 | Type 714 | |
| | TANTAL_3.4x2.8_light | 321 | 3.4 x 2.8 x 2.1 | Type 715 | |
| | TANTAL_5.8x3.2_light | 322 | 5.8 x 3.2 x 2.8 | Type 715 | |
| | TANTAL_7.3x4.3_light | 323 | 7.3 x 4.3 x 3.4 | Type 717 | |
| Al-Cup-condensators   | ECV-A_d3_h5.7 | 340 | 3.6 x 3.3 x 5.7 | Type 718 | |
| | ECV-B_d4_h5.7 | 341 | 4.6 x 4.3 x 5.7 | Type 718 | |
| | ECV-C_d5_h5.7 | 342 | 5.9 x 5.3 x 5.7 | Type 719 | |
| | ECV-X | 350 | ø8.0 x 10.6 | | Type 417 |
| | EXV-X | 351 | ø8.0 x 6.5 | Type 721 | Type 417 |
| | EXV-X | 352 | ø10.2 x 10.5 | | Type 417 |
| | ECV-D_d6.3_h5.7 | 343 | 7.0 x 6.6 x 5.7 | 719 / 721 | |
| Transistors  | SOT_23 | 400 | 2.9 x 2.3 x 1.1 | Type 714 | |
| | SOT_89 | 401 | 4.5 x 4.1 x 1.5 | Type 715 | |
| | SOT_143 | 402 | 3.0 x 2.5 x 1.1 | Type 714 | |
| | SOT_223 | 403 | 6.5 x 7.3 x 1.8 | Type 715 | Type 715 |

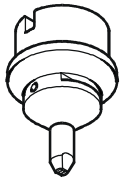
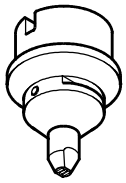
# Component Forms

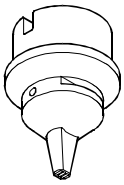
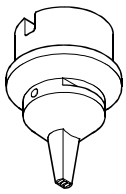
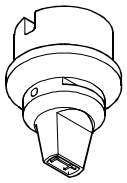
| Component | Type | GF File | Dimensions | Nozzle Types | |
|---|---|---|---|---|---|
| | | | L x W x H (mm) | 6-Nozzl Revolver Head | Pick & Place Head |
| Power transistors  | Drack_TO252 | 404 | 6.5 x 10 x 2.7 | Type 717 | |
| | TO120 similar wing transistor | 405 | 5.1 x 5.1 x 1.6 | Type 714 | |
|  | SOD123 | 410 | 3.7 x 1.55 x 1.4 | Type 714 | |
| | SOT323 | 411 | 2.5 x 1.25 x 1.2 | Type 714 | |
| | DIODE_DO214_AC | 420 | 5.08 x 2.6 x 2.29 | Type 715 | |
| | DIODE_DO214_AA | 421 | 5.4 x 3.6 x 2.16 | Type 715 | |
| | DIODE_DO214_AB | 422 | 8.0 x 6.0 x 1.45 | Type 717 | |
| Semiconductors | SO 6 | 501 | 3.8 x 6.0 x 1.45 | Type 715 | |
| | SO 8 | 502 | 4.9 x 6.0 x 1.55 | Type 715 | |
|  | SO 14 | 504 | 8.65 x 6.0 x 1.55 | 715 / 717 | Type 416 |
| | SO 16 | 505 | 10 x 6.0 x 1.6 | 715 / 717 | Type 416 |
| | SO 14L | 508 | 9.1 x 10.3 x 2.5 | 717 / 720 | Type 416 |
|  | SO 16L | 509 | 10.28 x 10.3 x 2.5 | 717 / 720 | Type 416 |
| | SO 18L | 510 | 11.55 x 10.3 x 2.5 | 717 / 720 | Type 416 |
| | SO 20L | 511 | 12.8 x 10.3 x 2.5 | 717 / 720 | Type 416 |
| | SO 24L | 512 | 15.4 x 10.3 x 2.5 | Type 720 | Type 416 |
| | SO 28L | 513 | 18.0 x 10.3 x 2.45 | Type 720 | Type 416 |
| | SOP48_0.025/b10.3 | 523 | 15.9 x 10.3 x 2.7 | Type 720 | Type 416 |
| | TSSOP20 | 541 | 6.5 x 6.4 x 1.4 | Type 717 | Type 416 |
| | DIL4 | 570 | 4.8 x 9.7 x 4.8 | Type 719 | |
| | DIL6 | 571 | 8.6 x 10.0 x 4.4 | Type 715 | Type 416 |
|  | DIL8 | 572 | 9.3 x 10.0 x 4.4 | Type 717 | Type 416 |
| | SO8_High_OK8 | 582 | 4.9 x 6.0 x 3.2 | Type 715 | |
| | TSOP24_20 | 600 | 16.0 x 6.0 x 1.2 | Type 717 | Type 416 |
| | TSOP I 24/b20 | 601 | 20.0 x 6.0 x 1.2 | Type 717 | Type 416 |
| | TSOP I 32/b20 | 602 | 20.0 x 8.0 x 1.2 | Type 720 | Type 416 |
|  | TSOP I 40/b20 | 603 | 20.0 x 10.0 x 1.2 | Type 720 | 416 / 417 |
| | TSOP I 48/b20 | 604 | 20.0 x 12.0 x 1.2 | Type 720 | 416 / 417 |
| | PLCC 20 | 700 | 9.85 x 9.85 x 4.35 | 720 / 721 | 416 / 417 |
| | PLCC 28 | 701 | 12.35 x 12.4 x 4.35 | 720 / 721 | 416 / 417 |
| | PLCC 44 | 702 | 17.6 x 17.6 x 4.4 | Type 820 | 416/17/18 |
|  | PLCC 52 | 703 | 20.1 x 20.1 x 4.6 | 820 / 821 | 417 / 418 |
| | PLCC 100 | 706 | 35.4 x 35.4 x 4.6 | | Type 418 |
| | PLCC 124 | 707 | 43.0 x 43.0 x 4.6 | | Type 418 |

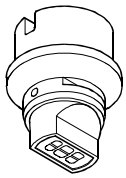
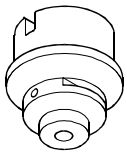
# Component Forms

| Component | Type | GF File | Dimensions | Nozzle Types | |
|---|---|---|---|---|---|
| | | | L x W x H (mm) | 6-Nozzl Revolver Head | Pick & Place Head |
| Semiconductors | PLCC 68 | 704 | | Type 821 | Type 417 |
| | PLCC 24 | 705 | | Type 821 | 416 / 417 |
|  | PLCC18R/11.75*8.15 | 708 | 11.75 x 8.15 x 3.45 | Type 717 | 416 / 417 |
| | PLCC18R/13.45*8.15 | 709 | 13.45 x 8.15 x 3.45 | Type 717 | 416 / 417 |
| | PLCC 22R | 710 | 13.45 x 8.15 x 3.45 | Type 717 | 416 / 417 |
| | PLCC 28R | 711 | 15.05 x 9.95 x 3.45 | Type 720 | 416 / 417 |
| | PLCC 28R | 712 | 13.9 x 13.9 x 3.6 | 717 / 720 | 416 / 417 |
| | SOJ24/b8.6 | 800 | 15.88 x 8.66 x 3.5 | Type 720 | Type 416 |
| | SOJ26/b8.6 | 801 | 17.15 x 8.66 x 3.5 | Type 720 | Type 416 |
|  | SOJ28/b8.66 | 802 | 18.41 x 8.66 x 3.5 | Type 720 | Type 416 |
| | SOJ28/b9.6 | 803 | 18.42 x 9.78 x 3.5 | Type 720 | Type 416 |
| | SOJ28 | 804 | 18.4 x 11.2 x 3.7 | Type 720 | 416 / 417 |
| | SOJ26_20/b8.5 | 810 | 17.15 x 8.51 x 3.5 | Type 720 | Type 416 |
| | SOJ26_20/b9.8 | 811 | 17.51 x 9.78 x 3.5 | Type 720 | Type 416 |
| | QFP 44_1.0 | 900 | 18.6 x 18.6 x 2.6 | Type 720 | Type 416 |
| | QFP 64_1.0 | 903 | 24.7 x 18.7 x 3.2 | Type 720 | |
| | QFP 80 R_0.8 | 913 | 24.7 x 18.7 x 3.2 | Type 720 | |
| | QFP 120_0.8 | 916 | 32.5 x 32.5 x 3.8 | Type 721 | |
| | QFP 128_0.8 | 917 | 32.5 x 32.5 x 3.8 | Type 721 | |
| | QFP 100 R_0.65 | 922 | 24.7 x 18.8 x 3.2 | Type 720 | 416 / 417 |
| | QFP 196 B_0.63 | 936 | 37.6 x 37.6 x 4.3 | Type 721 | |
| | QFP 208_0.5 | 945 | 30.6 x 30.6 x 43.1 | Type 721 | |
| | QFP 240_0.5 | 946 | 34.6 x 34.6 x 4.1 | | |
| | QFP 256_0.4 | 935 | 30.6 x 30.6 x 4.1 | Type 821 | Type 418 |
| | QFP 100_0.3 | 960 | 12.0 x 12.0 x 1.5 | | 416/17/18 |
| | QFP 60 Ru_1.0 | 970 | 25.6 x 19.6 x 2.9 | Type 820 | 417 / 418 |

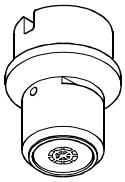
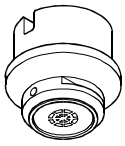
# Nozzle Types:
# Standard Range of Nozzle Types for 6-Nozzle Revolver Head

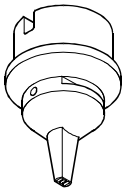
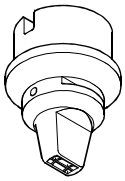
| **Nozzle** | **Type 701** | **Type 704** | **Type 705** |
|---|---|---|---|
| View |  |  |  |
| Material | Ceramics | Ceramics | Ceramics |
| Color ring | yellow | orange | red |
| Suction cross section | 0.20 mm² | 0.58 mm² | 2.88 mm² |
| min. component size | > 1.0 x 0.5 mm | > 1.6 x 0.8 mm | > 3.5 x 1.9 mm |
| Item No. | 00322603-01 | 00322602-01 | 00322600-01 |

| **Nozzle** | **Type 711** | **Type 714** | **Type 715** |
|---|---|---|---|
| View |  |  |  |
| Material | Vectra | Vectra | Vectra |
| Color ring | yellow | orange | red |
| Suction cross section | 0.20 mm² | 0.58 mm² | 2.88 mm² |
| min. component size | > 1.0 x 0.5 mm | > 1.6 x 0.8 mm | > 3.5 x 1.9 mm |
| Item No | 00321854S03 | 00321861S03 | 00321862S03 |

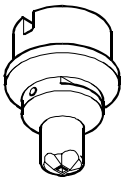
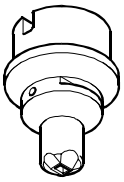
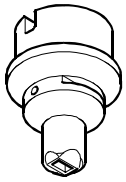
| **Nozzle** | **Type 717** | **Type 718** | **Type 719** |
|---|---|---|---|
| View |  |  |  |
| Material | Vectra/Rubber | Vectra/Rubber | Vectra/Rubber |
| Color ring | black | green | blue |
| Suction cross section | 11.07 mm² | 1.7 mm² | 9.6 mm² |
| min. component size | > 6.0 x 3.0 mm | > ø 3 mm | > ø 5 mm |
| Item No | 00321863S03 | 00321864-03 | 00321867-03 |

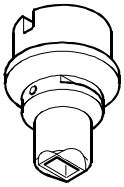
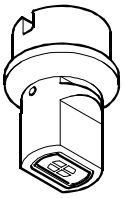
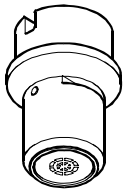
# Nozzle Types:
# Standard Range of Nozzle Types for 6-Nozzle Revolver Head

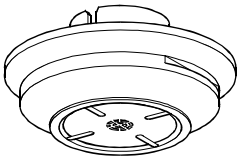
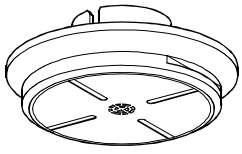
| **Nozzle** | **Type 720** | **Type 721** |
|---|---|---|
| View |  |  |
| Material | Vectra | Vectra |
| Color ring | white | turquoise |
| Suction cross section | 23.75 mm² | 23.75 mm² |
| min. component size | > 6.0 | > 6 mm |
| Component height | < 4.75 mm | > 4.25 mm |
| Item No. | 00325972S02 | 00325970S02 |

| **Nozzle** | **Type 723** | **Type 724** |
|---|---|---|
| View |  |  |
| Material | Vectra | Vectra/Rubber |
| Color ring | brown | light blue |
| Suction cross section | 0.58 mm² | 2.37 mm² |
| min. component size | ø 1.1 mm x 2.2 mm | ø 2.4 x 3.5 mm |
| Item No. | 00324996S03 | 00321866S03 |

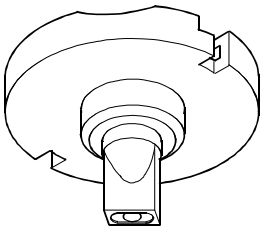
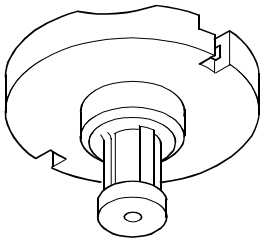
# Nozzle Types:
# Standard Range of Nozzle Types for 6-Nozzle Revolver Head

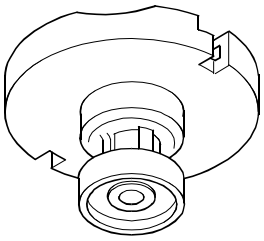
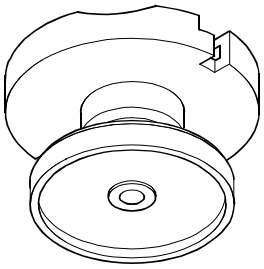
| **Nozzle** | **Type 751** | **Type 752** | **Type 753** |
|---|---|---|---|
| View |  |  |  |
| Material | Vectra/Rubber | Vectra/Rubber | Vectra/Rubber |
| Color ring | yellow | grey | orange |
| Suction cross section | 0.25 mm² | 0.48 mm² | 1.26 mm² |
| min. component size | 1.0 x 1.0 mm | 1.5 x 1.3 mm | 3.0 x 2.5 mm |
| Item No | 00330533-01 | 00330534-01 | 00330535-01 |

| **Nozzle** | **Type 754** | **Type 755** | **Type 756** |
|---|---|---|---|
| View |  |  |  |
| Material | Vectra/Rubber | Vectra/Rubber | Vectra/Rubber |
| Color ring | red | pink | turquoise |
| Suction cross section | 5.50 mm² | 14.77 mm² | 24.6 mm² |
| min. component size | 4.5 x 3.5 mm | 7.0 x 5.0 mm | 8.0 x 8.0 mm |
| Item No. | 00330536-01 | 00330537-01 | 00330538-01 |

| **Nozzle** | **Type 820** | **Type 821** |
|---|---|---|
| View |  |  |
| Material | Vectra/Rubber | Vectra/Rubber |
| Color ring | white | turquoise |
| Suction cross section | 113.09 mm² | 226.98 mm² |
| min. component size | 15 x 15 m | 20 x 20 m |
| Item No | 00326123-01 | 00326124-01 |

# Nozzle Types:
# Standard Range of Nozzle Types for Pick & Place Head

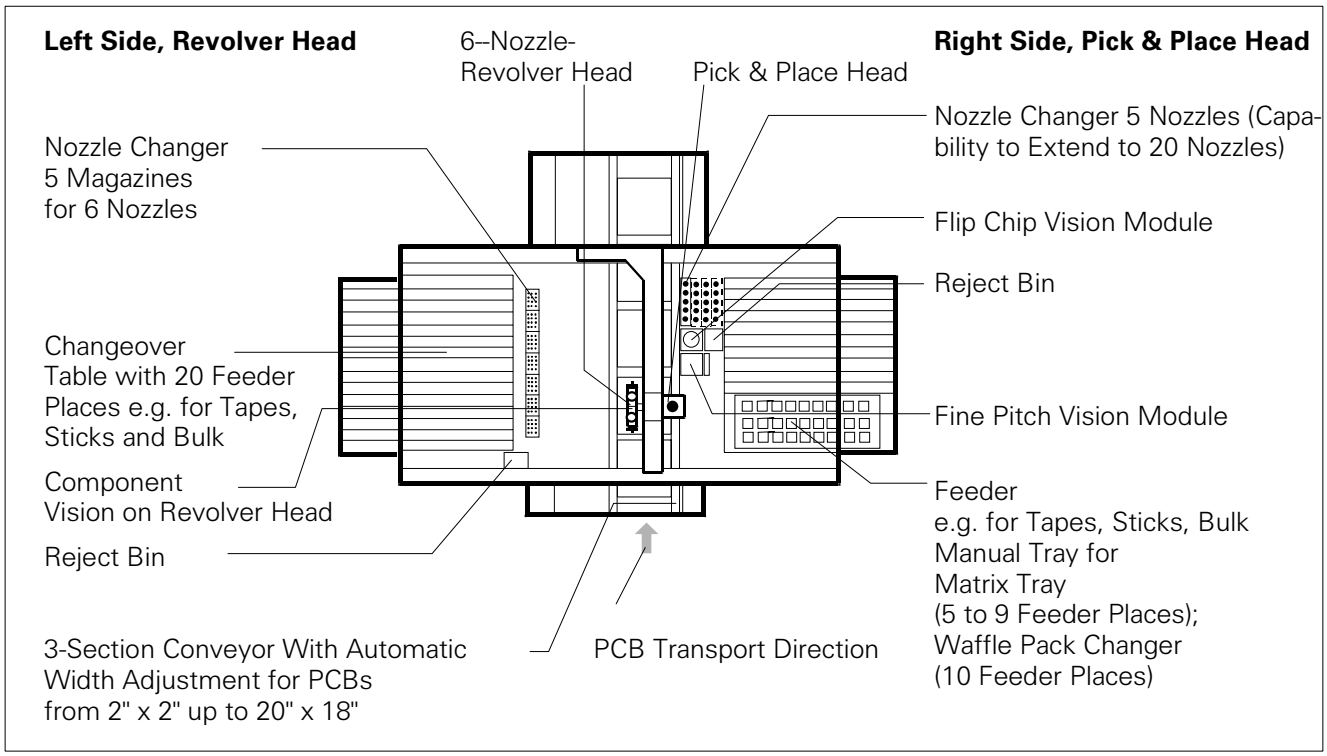
| **Nozzle** | **Type 416** | **Type 417** |
|---|---|---|
| View |  |  |
| Material | Vectra A 700 | Vectra A 700 |
| Outer dimensions | 3 mm x 6 mm | ø 8 mm |
| Inner dimensions | 2 mm x 5 mm slot | ø 6 mm |
| Suction area | 9.1 mm² | 28.3 mm² |
| Item No. | 00322545S01 | 00322543S01 |

| **Nozzle** | **Type 418** | **Type 419** |
|---|---|---|
| View |  |  |
| Material | Vectra A 700 | Vectra A 700 |
| Outer dimensions | ø 12.5 mm | ø 24 mm |
| Inner dimensions | ø 10 mm | ø 21.5 mm |
| Suctions area | 78.5 mm² | 363 mm² |
| Item No. | 00322544S01 | 00322546S01 |

This range of nozzle types is sufficient to handle generally all SMDs.

Should you, however, need special nozzle types please request.

# Possible Machine Configuration



# SMD Placement Systems from Siemens

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Edition 2 0299-F5-300-e