THE FULL FORCED CONVECTION REFLOW SOLDERING SYSTEM SMT QUATTRO PEAK® SERIES (FROM STO XLPLUS)...

… was developed for the lead-free soldering of electronic component assemblies. The system is designed especially for maximum throughputs and guarantees consistent process parameters at all times. It is, of course, suitable for the processing of ceramic substrates as well as for the curing of adhesives, pottants and other heating processes.
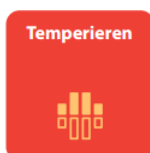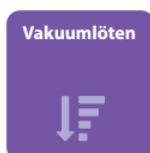
The following requirements were realised in the development of the SMT QUATTRO PEAK®:

- maximum process stability
- maximum machine reliability
- lowest operational costs
- lowest maintenance costs
- ideal accessibility for maintenance and service.

The heating of the component assemblies is achieved via full convection. Whereby the new air guiding system in the SMT QUATTRO PEAK®-Zone effects an extremely efficient heat transfer and allows process gas temperatures that are significantly lower than it is usual on the market.

SMD-Reflowlöten

Vakuumlöten

Beschichten + Aushärten

Temperieren

Heiß- und Kalt-Funktionstest

Individuelle Lösungen

Mechanical Design and technical Equipment

Process chamber

The process area is designed in stainless steel and is divided into the pre-heating zone, the peak zone and the cooling zone. The pre-heating zone consists of single programmable and controllable heating zones.

The peak zone is made up of 4 heating modules, the SMT QUATTRO PEAK®. There are 2 heating modules located above and 2 below the transport system. In the first stage, which has a higher gas temperature, the component assemblies are heated quickly, whereby the smaller components already reach their maximum temperature. A lower gas temperature is set in the second stage. Heating of the larger components continues here, while the smaller components retain their temperature. This results in a significant reduction of the Delta T values.

A multistage cooling zone allows gentle cooling after the peak zone. The further available, cooler stages ensure a low outlet temperature for the component assemblies. The condensate is intercepted selectively and collected in a removable filter located in the collecting tray. The cooling zone can be opened for cleaning purposes and all parts can be removed easily.

Additional condensate filters in the inlet and outlet areas ensure that no uncleaned vapours can enter the exhaust system. The whole heating zone has a powered opening system. The process chamber sealing is air-cooled ensuring a long life time. A potential-free contact for switching on external exhaust air units has the advantage of allowing individual activation of each exhaust system.
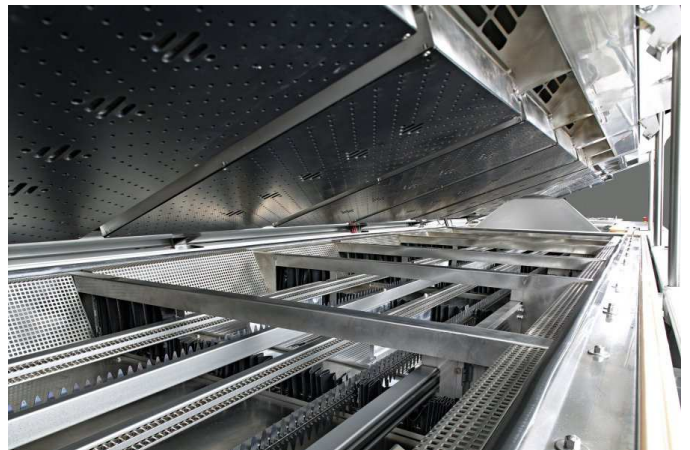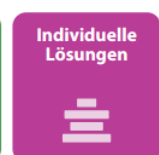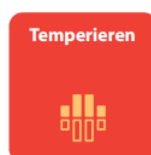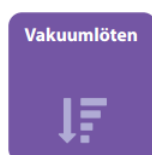
Control
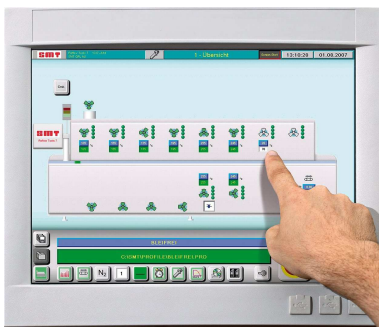
The control regulates and monitors all functions of the system fully automatically. Distinguishing features of the control's user interface are its clarity and most especially its ease of use. All soldering parameters are accessed, modified or saved via the 15-inch flat-touch-screen (EMC-safe). All nominal and actual values are displayed. Different coloured symbols in the software make it easy to use. The password protection with its three user levels that is delivered as a standard allocates the appropriate access rights to each user and so prevents unauthorised modifications in the process flow. (3 USB interfaces)

Data protection

Data protection is effected via a USB interface or a network connection.

Computer-controlled system monitoring

All functions of the system are monitored and an acoustic and optical warning can be given in the case of errors. All warning signals are freely programmable. (yellow or red signal lamp, with/without an acoustic warning signal)

Computer-independent temperature monitoring

The heating elements are switched off if they exceed a set safety temperature (standard setting 350°C) independently from the control.
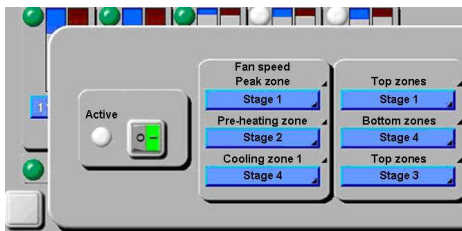
Hardware design

The industrial PC communicates with the actual SPC and the other functional units via a CAN bus. In addition to the CAN bus interface, the industrial computer also has a USB, RS232 and an Ethernet interface. The number of operating hours is displayed in an integrated counter.

Basic package

Fan speed reduction

The speed of the fan has four settings. This means that the air volume can be adjusted to accommodate demanding applications (e.g. the curing of adhesives, flip-chip soldering etc.).

Management data system

Data are collected for the documentation of production processes and saved in XML format for later verification. This meets the requirements for data collection in compliance with DIN/ISO 9000 ff.

Monitoring system for exhaust air

An appropriate error message is displayed on the monitor if there is any breakdown in the exhaust air system.

Optical warning signal – light tower

All errors in the functions of the system are displayed optically.
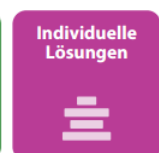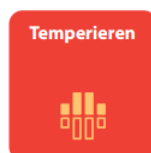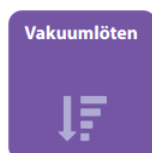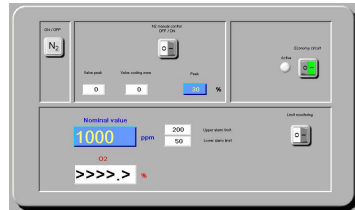
Nitrogen control package

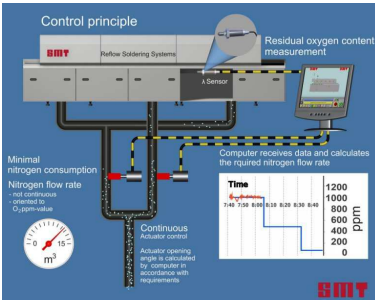### Residual oxygen measuring device with bypass control

The residual oxygen content (ppm value) in the nitrogen atmosphere is measured via the Lambda sensor. The bypass control recognises whether the measured ppm value is over or below the nominal value and closes or rather opens the nitrogen bypass valve respectively. The residual oxygen value is measured within a range of 0 to 210000 ppm with an accuracy ratio of 1 ppm. The data are displayed clearly on the monitor via the control software and saved by the management data system. The Lambda sensor is non-sensitive to process gas and is designed for continuous operation.

The measuring device can even be checked by the customer himself on site.



Intelligent nitrogen control – incl. Sleeping Mode

The residual oxygen content (ppm value) in the nitrogen atmosphere of the peak zone is measured via the Lambda sensor. The measured ppm value is used by a complex control algorithm for a control-on-demand of several proportional valves. It differs from the bypass control in that the aperture angle of the proportional valve adapts to the measured ppm value. The control deviation between nominal and actual ppm values tends towards zero as the control takes place continuously.

Various process conditions, such as PCB throughputs, differing PCB formats or idle times of the machine, are registered automatically and

immediately incorporated into the control calculations of the proportional valve. The ppm value is saved as part of the soldering profile. Consistent process conditions guarantee consistent results and thus lower the soldering error rates while at the same time reducing nitrogen consumption by 20 – 30% in comparison to conventional controls. It is possible to achieve a reduction in nitrogen costs of more than € 5,000 a year.

Sleeping Mode
If the PCB throughput stops for a certain period (e.g. due to changeover times), the system automatically switches to the Sleeping mode. The fan and heating power is reduced to the required level while the soldering parameters are kept constant. Energy and nitrogen are saved (nitrogen by approx. 10 – 20%).
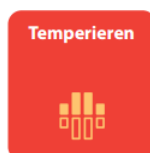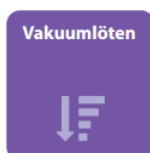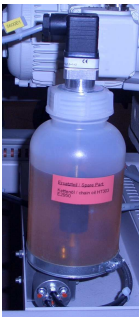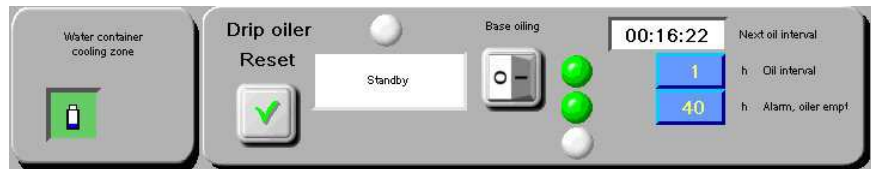
Chain conveyor

The chain conveyor of the SMT Reflow system is designed for inline operation and double-sided printed circuit board assembly. The width and transport speed can be continuously adjusted via software. All mechanical parts of the width adjustment are covered inside the process zone in order to prevent soiling of the adjustment spindles. In order to save energy and nitrogen, the inlet opening is automatically adjusted to the width of the respective PCB. The small deflection radiuses of the conveyor chain ensure that even small component assemblies are transferred safely. Standard movement is from "left to right" ("right to left" on request), the pin length is 3 mm (5 mm on request). The fixed rail of the conveyor is located at the front (at the back on request).

Automatic drip oiler

The automatic drip oiler ensures that the conveyor chains and PCB supports are always oiled. The oiling cycles are set in accordance with the individually adjustable parameters. The oil level in the drip oiler is monitored fully automatically. The software displays a message on the monitor if the level drops to below minimum.
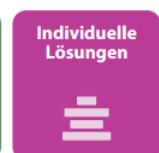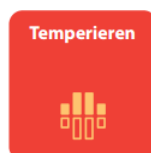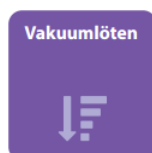

Adjustable PCB support, powered
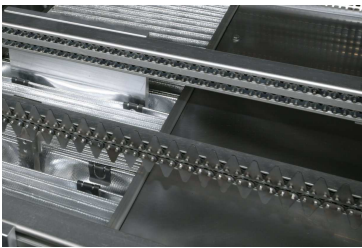
The support prevents larger component assemblies from bending. It can be positioned via the software between the profiles of the chain conveyor individually to fit the width.
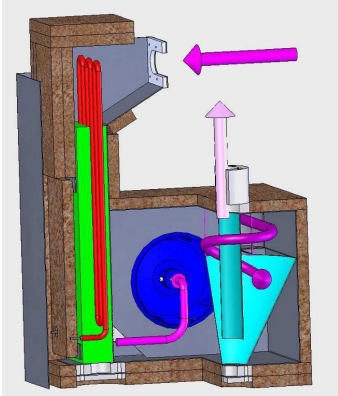
The height can be adjusted on **each** position continuously within a range of 0 to -15 mm.

- Special heights on request, e.g. Drop-down of 25mm

ABS – Process gas cleaning system for heating chambers

The soiled process gases are extracted from the pre-heating zones and guided over a hot granulate (silicon matrix). The long-chain molecules, that comprise the soiling in the process gas, are cracked on the microporous surface of the granulate and absorbed by the granulate. The cleaned process gas is traced back into the process zone.

The closed circuit prevents the loss of energy and heat. The expense (time and cycle) needed for cleaning the machine is reduced significantly. The granulate need only be replaced after approx. every 3,000 hours of operation. Experience gained over the last few years shows that the ABS system is the most reliable and the cleanest process gas cleaning system on the market.
You can also take a upgrade to a special "High-Temperature ABS", which occurs in even better results (optional)

## Adjustment of transport width via software

The nominal transport width can be saved together with the soldering profile. If a soldering profile is accessed, the programmed width is automatically set and the actual transport width is displayed on the monitor.

## Adjustment of the PCB support via software
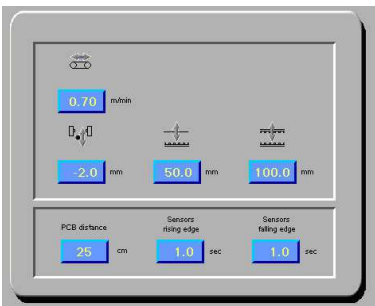
The position of the PCB support can be saved individually in height and width together with the soldering profile. If a soldering profile is accessed, the programmed position of the PCB support is automatically adjusted. This is displayed on the monitor.

PCB pass through control
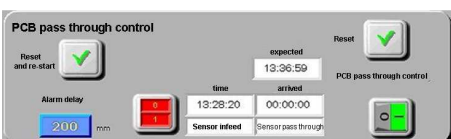
The PCB pass through control is monitored and the position of the PCB in the oven is displayed on the monitor by sensors located in the inlet and outlet of the system. If a component assembly is in the system, the activation of a change in the conveyor width is blocked. An error message is sent if there is a deviation from the

calculated time of discharge, the heating elements are switched off and the Handling interface is blocked. All warning signals are freely programmable. (yellow or red signal lamp, with/without an acoustic warning signal)
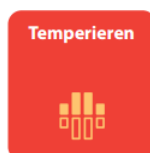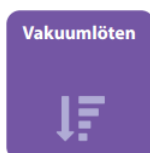
Handling interface
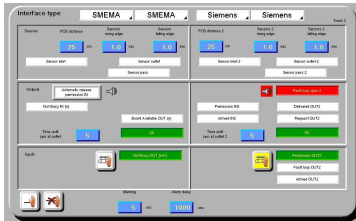
The control communicates with the other line components via the Handling interface. All defined interfaces (e.g. SIEMENS, SMEMA) can be realised. SMEMA is set as a standard.

Options for cooling

Cooling stage (maximum 5 stages possible)

Depending on the process demand the system could be equipped with 1 – 5 cooling stages.

## Package power cooling (requires a minimum 2 cooling stages)
Cooling system with cooling aggregate e or water cooling incl. temp. control of the 1. stage

In addition to the air-cooling system a cooling aggregate is integrated in the last part of the cooling zone. Heat exchange is affected via a specially designed heat exchange plate that is located directly in the underside of the cooling zone. The CFC-free coolant guarantees stable and safe operation of the heat exchanger. A water-cooled heat exchanger can be integrated as an alternative to the cooling system with a cooling aggregate connected to an already existing cooling water circuit supplied by the customer.

Cooling zone control
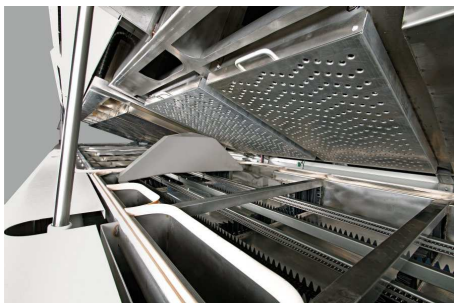
The temperature in the cooling zone is part of the soldering profile and within certain limits can be selected freely. Heating or cooling is then affected respectively. This prevents light component assemblies from cooling down too much. The control can be switched on and off.
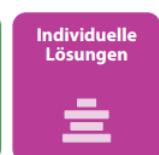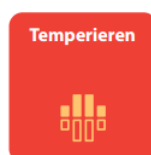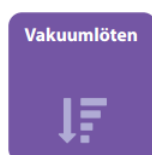
Cooling system with cooling aggregate e

In addition to the air-cooling system a cooling aggregate e is integrated in the last part of the cooling zone. Heat exchange is effected via a specially designed heat exchange plate that is located directly in the underside of the cooling zone. The CFC-free coolant guarantees stable and safe operation of the heat exchanger.

Water-cooled heat exchanger

A water-cooled heat exchanger can be integrated as an alternative to the cooling system with a cooling aggregate e connected to an already existing cooling water circuit supplied by the customer.

Gradient control via frequency converter

The cooling down gradient is controlled via additional frequency converter.

Options for heating

Bottom side heating in the pre-heating zones

In addition to standard peak bottom side heating, the system can also be equipped with heating modules and fans below the transport system (in the pre-heating zones). We recommend using bottom side heating for extremely heavy component assemblies. The additional bottom side heating is equipped with a separate fan speed reduction. The temperatures in each bottom side heating module can be adjusted separately.

Cleaning option

ABS – Process gas cleaning system (maximum 2 possible)

One additional ABS system can be installed in the pre-heating zone to enforce the cleaning effect in the case of PCB materials that give off a lot of vapour deposits and for a further reduction of maintenance expenses.
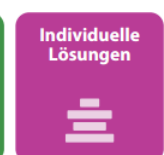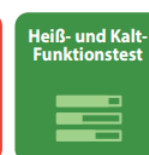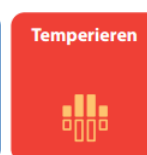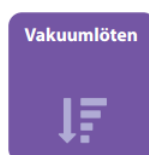
Entrance condensate trap

Avoid from flux contamination in the PCB entrance area and enables easy cleaning thanks to easy accessible filter systems.

Maintenance caused downtime will be decreased significant.

Hardware options

Additional Fan speed reduction

Additional fan speed reductions can be installed for the desired fans in each process zone. The speed of the fan has four settings. This means that the air volume can be adjusted to accommodate demanding applications (e.g. the curing of adhesives, flip-chip soldering etc.).

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Acoustic warning signal - buzzer

An acoustic warning signal is emitted in addition to the optical warning signal on the monitor or via signal lamp.

Uninterrupted Power Supply (UPS)

Emergency power supply for the machine control and the transport motor.

If there is a power cut, this power supply unit ensures that any PCBs still in the process zone are moved out of the soldering system.
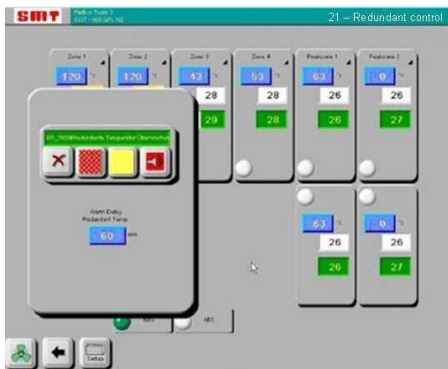
Economy switch
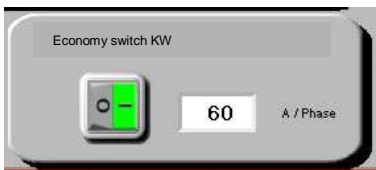
A power limited heating phase can be set via the software. If activated, the individual heating zones are not heated simultaneously, but in groups one after the other. This results in a reduction of the power input.

Special colour

Colour in accordance with customer request (RAL colours)

Software and Traceability options

Redundant control

There is a second sensor in each heating zone with which the temperature is recorded. A warning signal (buzzer, yellow warning lamp) is given if the deviation from the 1st sensor (the actual control sensor) is > 5K (standard value). As a higher deviation is permissible during the heating stage, this monitoring process is deactivated for an adjustable period after the profile change.

Weekly timer (Auto-Start-Stop function)
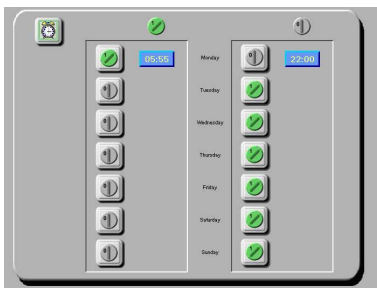
The system can be programmed in such a way that it switches on and off automatically.

Warning:
Pay attention to the safety instructions!
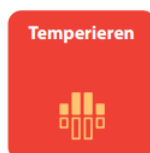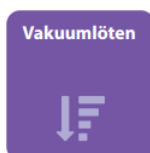
Sleeping Mode

If the PCB throughput stops for a certain period (e.g. due to changeover times), the system automatically switches to the Sleeping mode. The fan and heating power is reduced to the required level while the soldering parameters are kept constant. Energy and nitrogen are saved (nitrogen by approx. 10 – 20%).
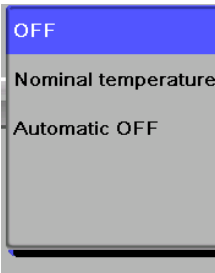
By using the extended sleeping mode there is an additional choice which status of readiness the machine should accomplish after an adjust-able time. There is a choice between "Nominal Temperature" (temperatures are regulated to the set value) and "Automatic OFF" (system is turned off). The reactivation of the system is achieved by:


- Requirement IN (board available) at the handling interface
- Restart of the automatic mode by touching the "Automatic ON" button
- Restart of the automatic mode by an external signal at the infeed to control "Automatic ON"
- During adjustment of nominal temperature via standby button on overview Screen 1

Maintenance software

Depending on operational hours, the operator is notified of any maintenance work that needs to be carried out. Ignoring this message more than once could lead to the system being brought to a standstill (programmable). The work to be carried out is explained in detail by images and text messages.
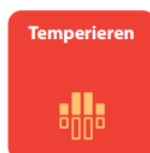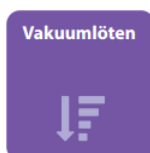

Graphical management data system
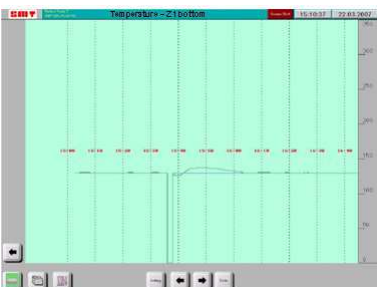
The collected nominal and actual data are collected and displayed graphically on the monitor.

Batch-Report-Software

All process parameters (e.g. zone temperatures, transport speed and residual oxygen values)and their maximum deviations are evaluated clearly and batch-related. All deviations that occur during one batch are recorded. A "batch protocol" can be issued as verification of process stability.

→ *not available at the moment*

Barcode- / Host computer connection

A saved profile of the machine can be linked to the respective product. If the profile is accessed via barcode or host computer, the system will be configured in accordance with the specifications. Production is started up fully automatically when all the specified process parameters have been attained. No action on the part of the operator is necessary for product changeovers in the soldering system.

It is possible with Top- and Bottom Reading at In- and Outfeed. In sum 4 different Barcode-Readers are possible.

Remote Tool

Lasal Remote Manager

With LRM (program on Windows XP platform) the machine could be operated directly from administrators work station via TCP/IP connection (Ethernet) (e.g. set-up of profiles, control of profiles, machine status control). Data exchange is also possible.

MES Server connection

TCP/IP Client/Server Socket connection (e.g. MES)

Via TCP/IP connection (Ethernet) datas are transferred directly from a client (SMT machine) to a host computer.

Transferred datas:

- Machine operating datas
- Connected bar code scanning system datas for transfer of serial number inlet/outlet for subsequent enabling of inlet and respectively change of actual profile.
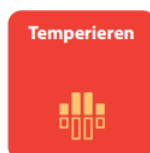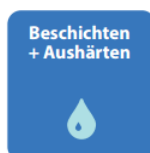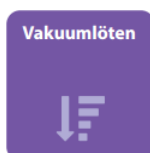- System time alignment between host computer and machine

Configuration of data structure available on request.

Cmk evaluation
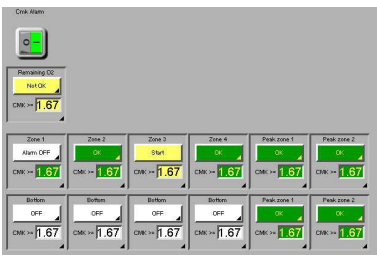
The Cmk value is a machine capability classification number that represents process stability.

The Cmk value is calculated on the basis of the continuous measure-ment of the temperatures, the speed and ppm values and is saved as part of the MDS file. The system is not switched to an operational mode until a process stability with a cmk value >= 1.67 has been achieved. If a cmk value < 1.67 is recorded, the PCB transport is blocked.

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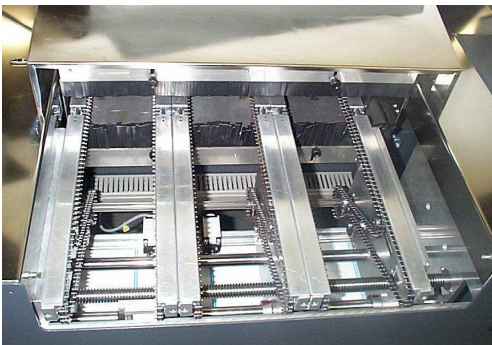www.smt-wertheim.de

Customised modifications
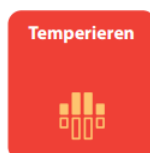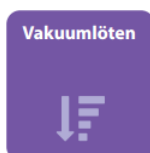
Combi and multiple transport systems

Individually adjusted systems can be provided in addition to the conventional chain or mesh belt transport systems, e.g. several chain conveyors side-by-side with a separate PCB support, chain next to mesh belt or chain above mesh belt. Individual solutions are developed in accordance with your specifications.

Double chain conveyor

Triple chain conveyor

Fourfold chain conveyor

SMD-Reflowlöten

Vakuumlöten

Beschichten + Aushärten

Temperieren

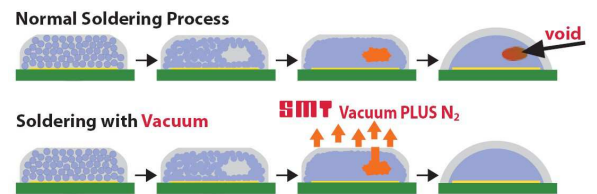Heiß- und Kalt-Funktionstest

Individuelle Lösungen

Vacuum System

Based on our reflow system SMT is offering since 2009 also VAC system to eliminate voids.

Voids are eliminated in a vacuum chamber, which significantly improves the quality of the soldered products. The Vacuum module is integrated in a SMT reflow soldering system.

Advantages of the SMT Vacuum Process:

- Inclusions/voids will be reduced up to 99%
- Cycle time between 60 to 90 seconds
- Vacuum process can be switched on or off → also Standard Reflow process is possible
- Nitrogen and Air soldering possible
- PCB Dimensions: Width 510 mm,
  Length 320 mm (up to 450mm)
- Pass through height: 30 mm (top and bottom)
- Carriers can be utilized for all sizes of boards
- Double-sided PCB possible
- All Vacuum settings are fully computer controlled
- Only one sealing surface in the vacuum chamber
- Small footprint
- Only low increase in nitrogen consumption
- Only 1.5 kW/h in additional energy consumption