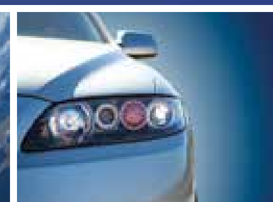
Top performance with or without vacuum

Reflow condensation soldering for multi-faceted areas of application



Condenso series

Condensation Soldering

Reflow soldering by condensation
Multi-faceted processes with the Condenso

The reflow soldering field of industry is wide-ranging, whether it's in aerospace engineering, LED manufacture or power electronics. Electronic components only work in end devices by soldering electronic contacts in a high-quality fashion. But what happens when components on the circuit board are very large or high-mass? Or if vacuum soldering processes should be implemented inline?

In condensation reflow soldering, or vapour-phase soldering, soldering is accomplished using a hot vapour. To put it in simpler terms: Imagine you have just come from the ski slope and walk into a warm chalet with cold ski goggles. The goggles fog up instantly. This is called film condensation. You can only see clearly again once the ski goggles have reached room temperature. Condensation soldering works based on the same principle.

In this case, heat transfer in condensation soldering is up to ten times higher than with convection soldering. This means that even large, high-mass boards can be reliably processed in a stable atmosphere and with innovative vacuum technology with Rehm's Condenso series.

The Condenso series at a glance
Flexible and adjustable

Do you process large and heavy boards for which condensation soldering is out of the question? Or do you want a system that you can reliably carry out vacuum processes with at any time? Then choose a Condenso-Series system that can be customised to your manufacturing environment!

CondensoXC
Space-saving and powerful

- Batch system for low throughput
- Used in laboratory applications, small production lines or prototyping

CondensoXS smart
Great performance with a small footprint

- Inline ready system for medium throughput
- Low space requirements
- Ideal for small-series production

CondensoXM smart
All-rounder for electronics production

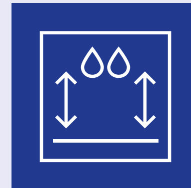
- Inline system for medium throughput
- Autom. side Loeading/unloading with pre-assembled carriers
- Used for small and medium-sized series

Condenso smartline
Ideal for large series

- Inline connection for medium throughput
- Automatical loading, internal carrier return transport
- Used in series production

CondensoX-Line
Reliable in the through-feed process

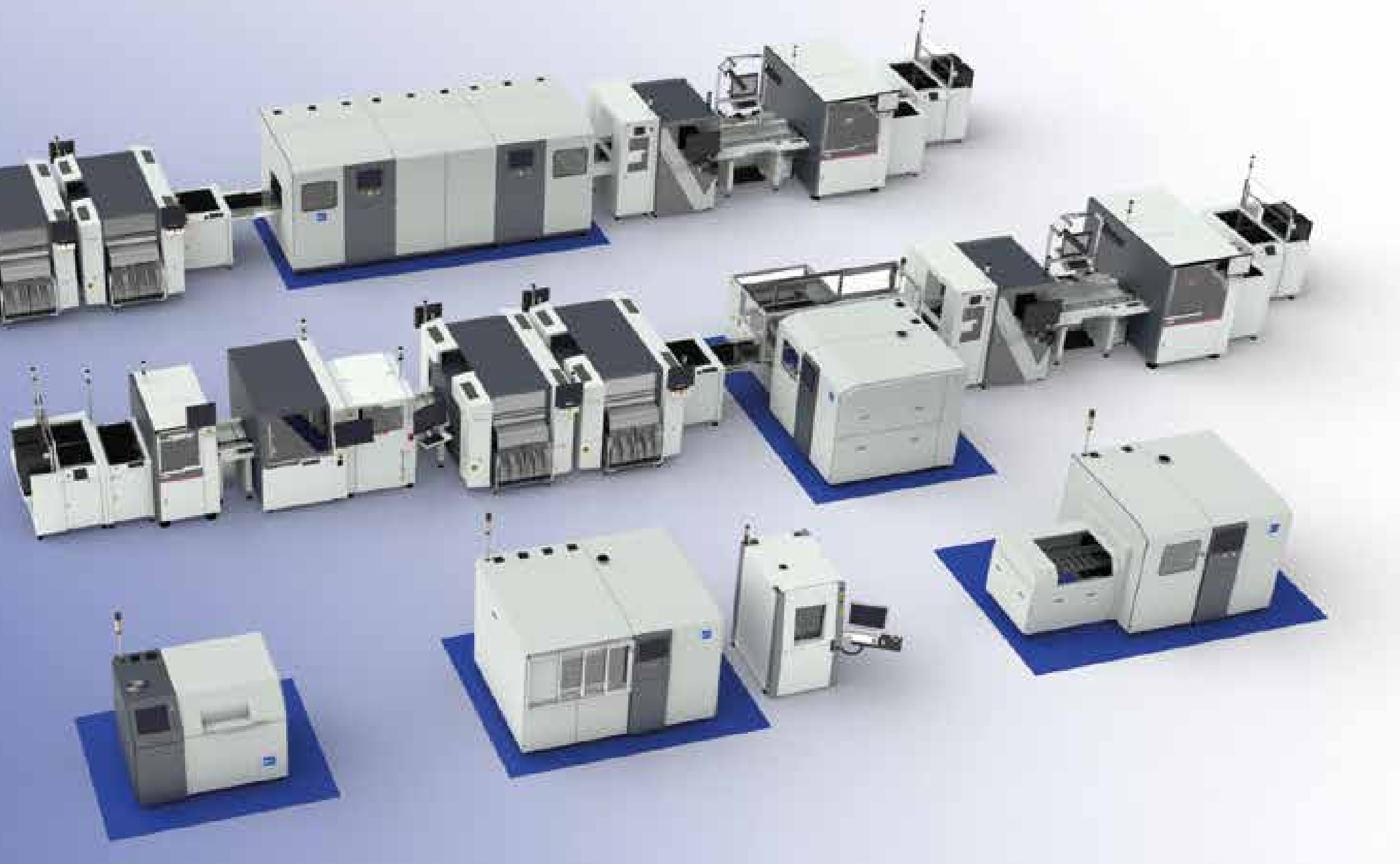
- Inline system for high throughput
- 3-chamber system and built-in vacuum soldering
- Series manufacture and power electronics



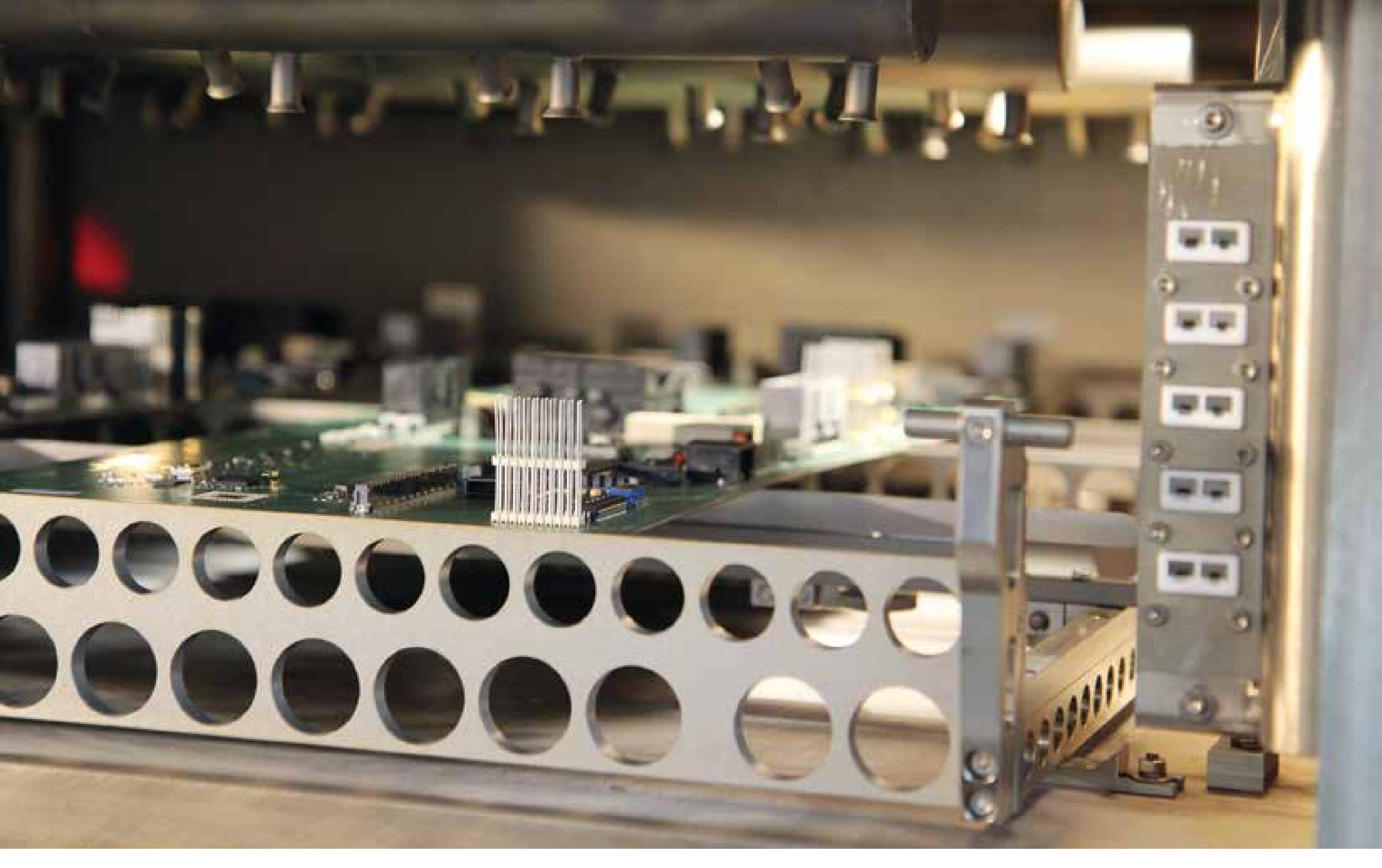
Vapour phase soldering
in every manufacturing environment

The Condenso series system versions can be integrated into a wide range of manufacturing environments. Whether it's a batch operation, inline connection or continuous soldering – Rehm offers the highest degree of process reliability for all areas!

The application options for the Condenso series are as varied as their production. We would be happy to determine the most efficient system for your manufacturing process, taking all relevant processes such as throughput, assembly size, thermal mass and follow-up processes into account.



- Patented injection principle – reproducible reflow profile
- Hermetically sealed process chamber
- Controllable vacuum process – Pre-vacuuming und vacuum feasible after soldering
- No Galden® spreading, active Galden® filtering
- Process monitoring with a wireless WPS system (not with CondensoXC)



Condenso – a patented principle
with clear advantages

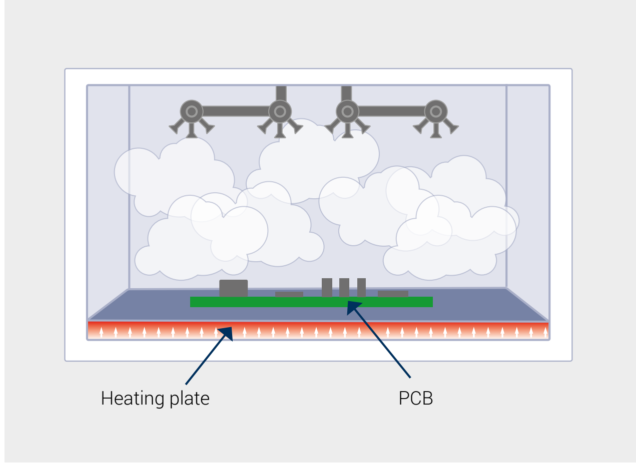
With the Condenso series, a far greater amount of flexibility is available for the condensation soldering process than can be achieved with the conventional method. Using the injection principle and temperature and pressure (vacuum) control ensure more accurate and versatile reflow profiling.

The soldering process takes place in a hermetically sealed process chamber. A film of fluid builds up during condensation soldering using the heat-conducting medium Galden®, which surrounds and vaporises the entire assembly. The steam condenses on the assembly until a soldering temperature of 240°C (e.g. when using HS240) is achieved. Galden® is a perfluorpolyether – fluid polymers that consist of carbon, fluoride and oxygen. Rehm applies a patented injection principle to improve control of the condensation phase. Exactly the right amount of Galden® is incorporated at the right time. Then, during this process, redundant, latent heat is used when changing the state of the medium from vaporous to fluid to evenly and steadily heat the assembly. The max. temperature of the assembly cannot exceed the max. boiling/condensation temperature of the medium to ensure the components don't overheat.

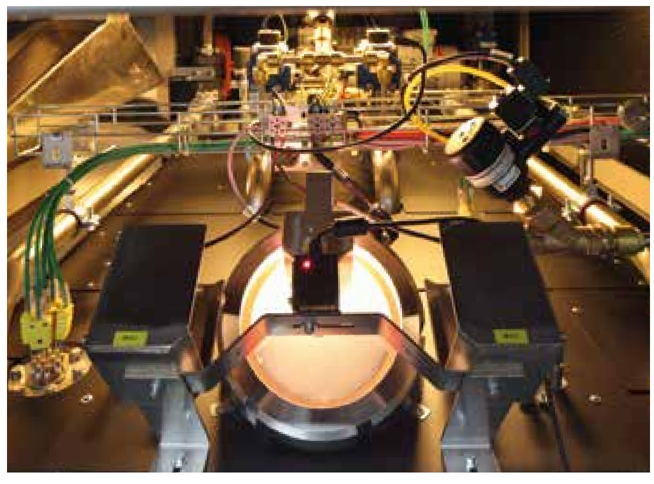
The temperature/reflow profile of the assembly can also be accurately adjusted by precise fluid volume control and intermediate steam extraction. Therefore, reproducible soldering conditions are ensured that increase process stability. A vacuum option is available with all Condenso systems for optimum results that are virtually void-free.

Hermetically sealed Process Chamber
for soldering, vacuum and cooling

With all Condenso series systems, the soldering process takes place in a hermetically sealed process chamber made of aluminium or a mix of stainless steel and aluminium. The process chamber is fitted with high-quality electric panel heaters that ensure optimum process conditions. The assembly is heated up to soldering temperature by injecting and vaporising Galden®. Steam allows for optimum heat transfer to the soldering material. The heating systems' target temperature value remains constant. Therefore, excellent, reproducible soldering results are ensured. The Galden® is fully extracted after the soldering process, and air is blown in via a nozzle system to gently bring the assemblies to lower temperatures before the actual cooling process. The systems can be optionally fitted with a viewing window or camera so that the soldering process can be observed and analysed. Soldering defects can be detected and eliminated in a timely fashion as a result.



Process chamber structure for Condenso


Optional viewing window with camera

Low medium consumption
Resource-conserving and efficient

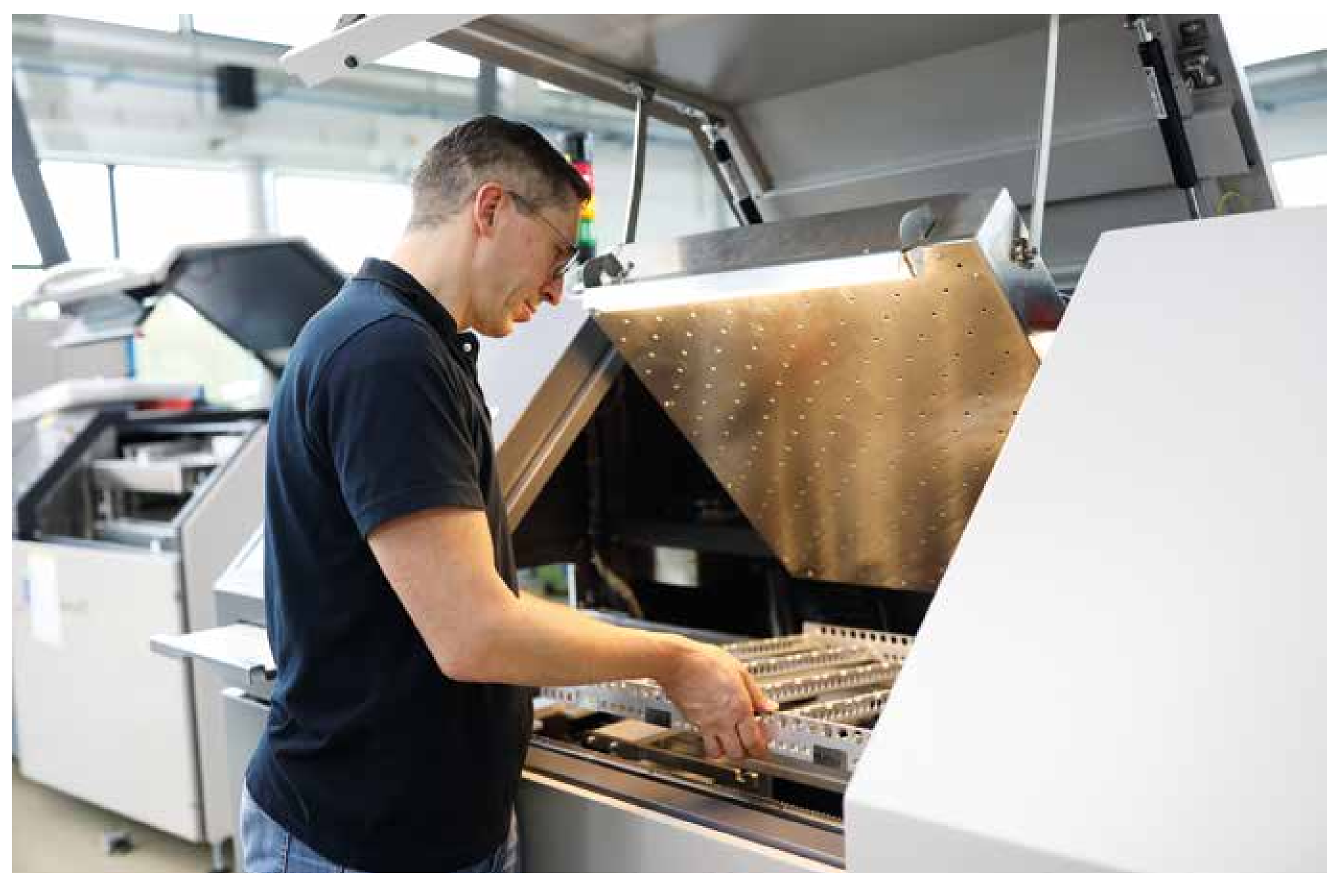
After soldering, the assembly is passed onto the cooling process. Process gas is extracted and cleaned at the same time. Therefore, a large part of the Galden® can be reused – which is a solution that saves a great deal on materials, and is environmentally friendly! A vacuum is created during extraction which also ensures that soldering material is dried quickly.

The extracted Galden® is filtered and cleared of impurities using granules. Approx. 99.9 % of the medium can be recovered as a result. The cleaned fluid is made available in a container for other processes. “Loss of vaporisation” is low during soldering due to hermetically sealing the process chamber. As well as little need for maintenance, you benefit from low medium consumption, and save money as a result.

- **No loss of vaporisation in the process chamber**
- **Medium filtering and re-use**
- **Environmentally friendly**

Galden® storage container

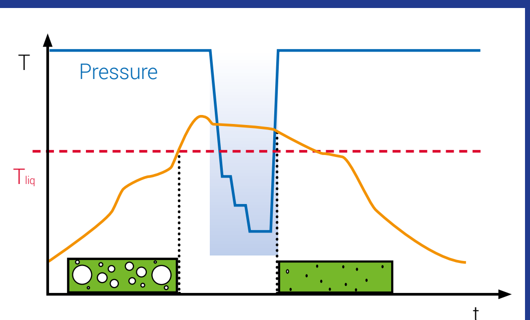
Filter granules



Why vacuum?
Reliable, reproducible soldered joints

Void-free (cavity-free) soldering with unleaded solders is an important requirement for manufacturing power electronics. However, lower void rates can only be achieved with soldering processes where the molten solder is subjected to a vacuum.

The residues that remain in the soldered joint can escape more easily due to the vacuum. The Condenso series can be fitted with a vacuum pump as an option for this reason. You end up with soldered joints with a surface binding proportion of up to 99 %. Vacuum can also be drawn during the melt phase, even before the actual soldering process. This doesn't just allow the Galden® steam to be evenly distributed in the process area, but also enables the solvent and moisture to be de-gassed from the solder paste. In addition, the atmosphere can also be varied in the process chamber throughout the whole dwell time as well the temperature.



Condenso vacuum technology
for void-free results

Condenso vacuum technology is used in a wide range of processes. Oxidation is reduced for drying and adhesive processes, and soldered joint reliability is increased during reflow soldering by reducing voids.

Without Vacuum		With Vacuum
	Surface contacts up to 99 %	
	Improved filling of micro vias and THD-solder joints	
	Minimum of voids (particularly important on power electronics)	
	Improved wetting	

- Pre-vacuum:
  - Prevention of oxidation, drying (solder paste, adhesives)
  - Homogeneous Galden-gas-distribution (3-dimensional soldering)
  - Micro wave plasma (pre-cleaning)
- Vacuum during reflow soldering: Improved wetting
- Vacuum after reflow soldering: Avoiding voids

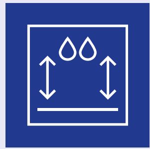
CondensoXC
Optimal results with the smallest footprint

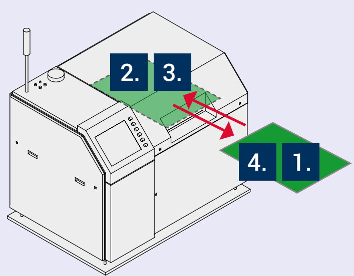
The CondensoXC is a space-saving, powerful system for laboratory applications, small series production and prototyping. Exact profiling by means of the injection principle and the option of soldering under an inert atmosphere provides the optimal soldering results. Void-free soldering can also be carried out easily with the vacuum option, which increases the reliability of assemblies significantly.

With a footprint of just 2.3 m², this system is specially designed for small series and is also ideal for prototype production. As a batch system, it can be used flexibly, irrespective of the production environment.

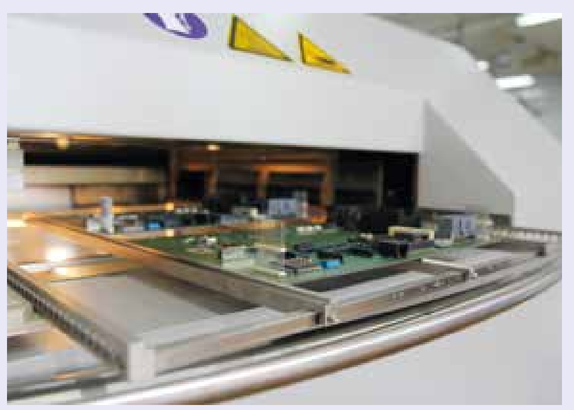
- **Stable process for reliable results**
- **Process chamber for a maximum assembly size of 500 x 540 mm (W x L)**
- **Camera for process observation** (optional)
- **Patentierted injektion prinziple**
- **Vacuum process** (optional)

Loading Concept
The possibilities of CondensoXC





1. Loading
2. Soldering/Vacuum
3. Cooling
4. Unloading



Handling

Front loading with pre-assembled product carriers

The CondensoXC is manually loaded with pre-assembled product carriers from the front on the operator's side. In this way, the assemblies can be easily placed on and removed from the interchangeable product carriers. The product carrier is on a rail system to ensure full access to the working area. Assemblies up to 500 x 540 mm (W x L) can be placed on the product carriers.

Gentle cooling

Gentle cooling processes by convection

After the soldering process, the assembly is cooled by convection to the required temperature. After cooling the bulkhead opens automatically and the product carrier can be completely pulled out on a rail for easy unloading. In addition, a water-cooled cooling zone is optionally available to enhance the cooling capacity.

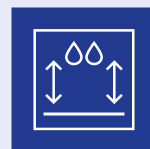
CondensoXS smart
Safe process due to injection

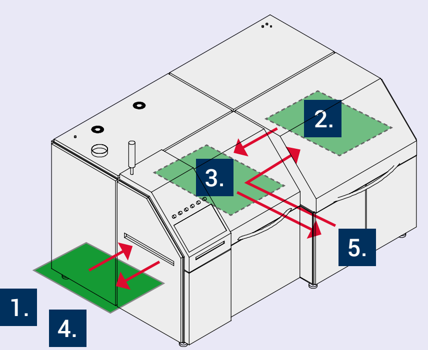
Depending on the choice of basic model, the CondensoXS smart can be loaded and unloaded manually or automatically. With both models, loading is carried out with pre-loaded product carriers that can hold assemblies up to 650 x 650 mm (W x L). In the case of manual loading, the product carriers are inserted from the side and removed in the same way. With the automated model, a handling device can be fitted to the infeed for automatic loading. On the operator's side, there is also the option to position the assemblies on the product carrier or remove them from it when it has already been inserted.

Flexible cooling options, a vacuum and the injection principle also ensure reliable processes with this model in a partially automated production environment with a medium-size production volume.

- **Manual or alternatively automatic loading**
- **Flexible cooling inside and outside the process chamber (within optional)**
- **Process chamber for a maximum assembly size of 650 x 650 mm**
- **MES and traceability solutions (optional)**
- **Touch user interface**

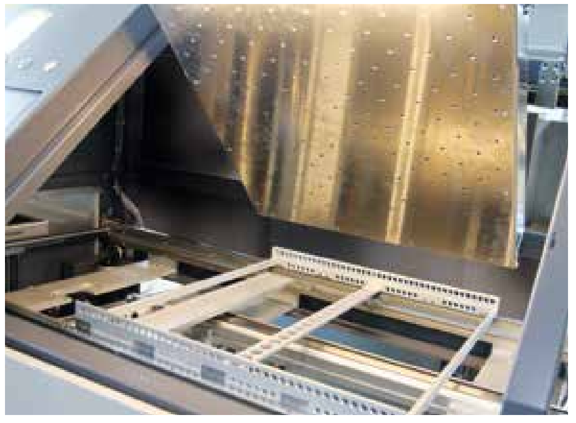
Loading Concept
The possibilities of CondensoXS smart





1. Loading assembled workpiece carier
2. Soldering/Vacuum/Cooling under Liquidus
3. Unloading
4. Unloading workpiece carrier
5. Manual loading / unloading of single PCB's

Cooling



Flexible cooling process achievable

Various cooling processes can be used, depending on requirements. The system is equipped with air cooling in the cooling section as standard. Cooling is also possible inside the process chamber under liquid either with or without nitrogen. For particularly large and heavy boards, water cooling is also recommended for the cooling section. This allows cooling to take place from the underside, too. Flexible cooling gradients can thus be achieved.

Handling

Loading with product carriers can be carried out manually or automatically. The basic product carrier is designed for a max. surface load of 5 kg. Adjustable LP edge supports (max. 5 kg surface load) and an adjustable centre support (max. 5 kg surface load) are available as options.

For particularly heavy assemblies, the surface load can be increased from 5 kg to a maximum of 15 kg as an option.

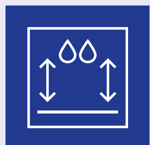
CondensoXM smart
Inline system for automated processes

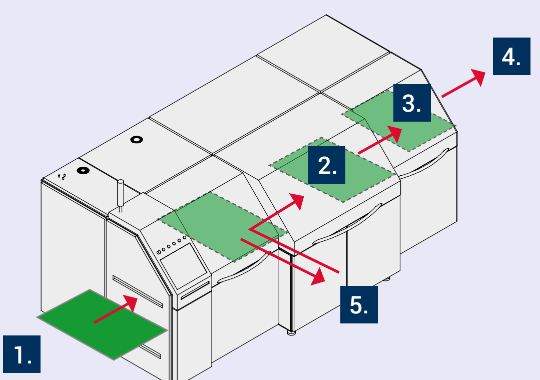
The CondensoXM smart can be integrated into any production environment. You can install the system as an island solution for several production areas and load it manually. Alternatively, upstream handling systems can be used to automate loading. This reduces cycle times and ensures the optimal soldering results even with larger volumes.

Flexible cooling options inside and outside the process chamber – with and without nitrogen – guarantee optimal cooling rates and the correct temperature for downstream production processes such as x-ray inspection or functional testing. Virtually void-free soldering results can also be achieved with the vacuum option.

- During the process a visual inspection is possible
- Manual, alternatively automated loading and unloading of pre-assemled product carriers
- Process chamber for a maximum assembly size of 650 x 650 mm
- Prozess Galden® injection and filtering in a closed loop

Loading Concept
The possibilities of CondensoXM smart





1. Loading assembled workpiece carier
2. Soldering/Vacuum/Cooling under Liquidus
3. Unloading
4. Unloading workpiece carrier
5. Manual loading / unloading of single PCB's

Vacuum pump

The CondensoXM smart can be equipped with an additional vacuum pump. This increases reliability, which is necessary in particular for critical assemblies which make increased demands on the vacuum process. Moreover, two vacuum pumps can be used to reduce the cycle time and thus increase productivity for vacuum applications under 10 mbar in particular.

The option of a second vacuum pump is also available with the CondensoXS smart, CondensoXS smartline and CondensoX Line models.

Software

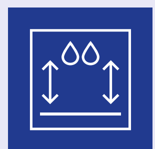
With ViCON Condenso, Rehm offers a clear software package for the Condenso series that is intuitive to use with its touchscreen interface. All messages, commands and parameters are visible at a glance on the main screen with its machine view. Simple profiling with clearly structured process stages is therefore possible – with or without the vacuum option. With numerous other features, such as a favourites bar that can be set up as required, structured grouping of parameters and individual process monitoring and documentation, ViCON offers you optimal support for your manufacturing processes.

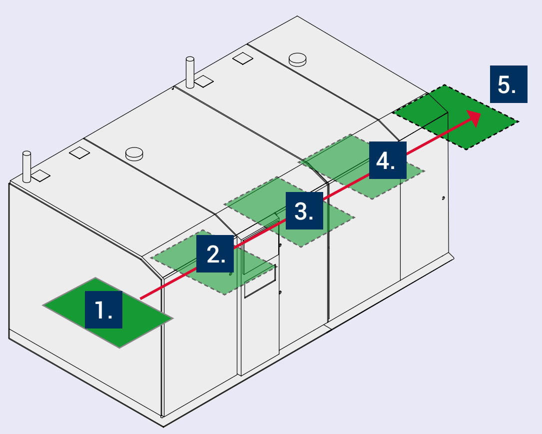
Condenso smartline
Ideal for series production of power electronics

The Condenso smartline is designed for a production environment that requires a fully automated inline connection. Loading is carried out directly from the feed conveyor in front of the system. The soldering process takes place in the process chamber, which can be flooded with nitrogen. If cooling under liquid is required, this can be integrated into the process chamber as an option. After the soldering process, the product carrier is moved into the cooling zone and the assemblies are cooled down to the optimal temperature. The assemblies are then removed automatically onto a downstream conveyor belt. The empty product carrier is moved back to the loading area in the system. With the advantages of the inline condensation soldering process, a high throughput and the integrated product carrier return, the Condenso smartline meets the highest demands of series production in power electronics.

- **Inline system with integrated goods carrier return transport**
- **Fast product change possible**
- **Traceability and MES connection**
- **Inert process atmosphere during the soldering process**
- **No Galden® carryover, active Galden® filtering**

Loading Concept
The possibilities of Condenso smartline





1. Loading
2. Inlet area
3. Soldering/Vacuum
4. Cooling
5. Unloading

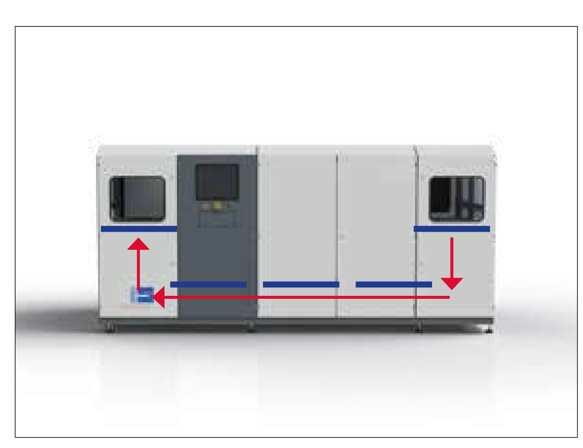
Automatic Loading

The Condenso smartline works with a pusher for loading the product carriers already in the system. The assemblies are pushed from a feed conveyor onto the product carrier. The product carrier can be equipped with a centre support for each track. A maximum of 6 tracks are possible on each product carrier. The max. assembly size is 650 x 650 mm.

Unloading of the product carriers is also carried out with the pusher, which moves them onto the downstream conveyor belt.

Internal carrier return transport

The product carriers in the Condenso smartline are moved internally from the unloading area back to the loading area. As a result, no additional magazine modules or external product carrier systems are required in the area around the system. This saves space and also reduces the amount of contamination of the product carriers thanks to the closed loop system, thereby ensuring that little servicing work is required and downtimes are reduced.



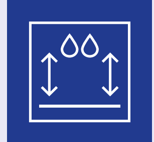
CondensoX-Line
Reliable and repeatable

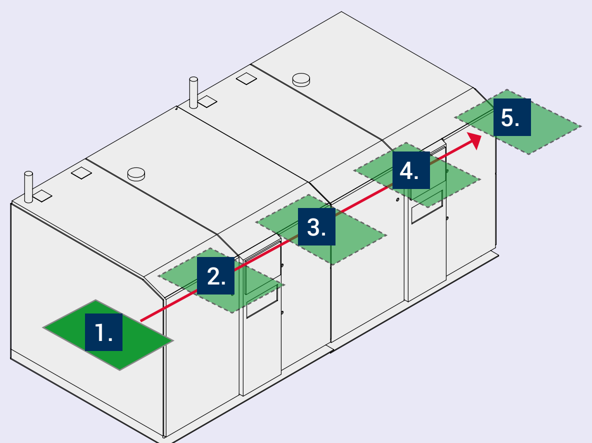
The CondensoX-Line enables vacuum condensation soldering processes to be easily integrated into standard SMD lines. This allows void-free solder joints to be manufactured in a completely inert process environment (<100ppm O2), whether they are standard modules with BGA devices or DCB substrates for power electronics.

By building a 3-chamber system, low cycle times can be achieved for inert soldering processes. The final gas-tight cooling chamber provides for controlled and rapid cooling of the assemblies by means of adjustable convection with less than 100 ppm residual oxygen in the atmosphere. The CondensoX-Line meets the highest demands of mass production in the power electronics.

- **Ideal for the processing of massive assemblies (IGBT, Heatsinks)**
- **Reliable condensation soldering process for SMD manufacturing in a continuous process**
- **Horizontal transport of the modules of the entire process**
- **Inert process atmosphere during the entire soldering process**
- **Cooling section can be used with <100ppm residual oxygen**
- **Void-free soldering with the use of vacuum for best results**

Loading Concept
The possibilities of CondensoX-Line

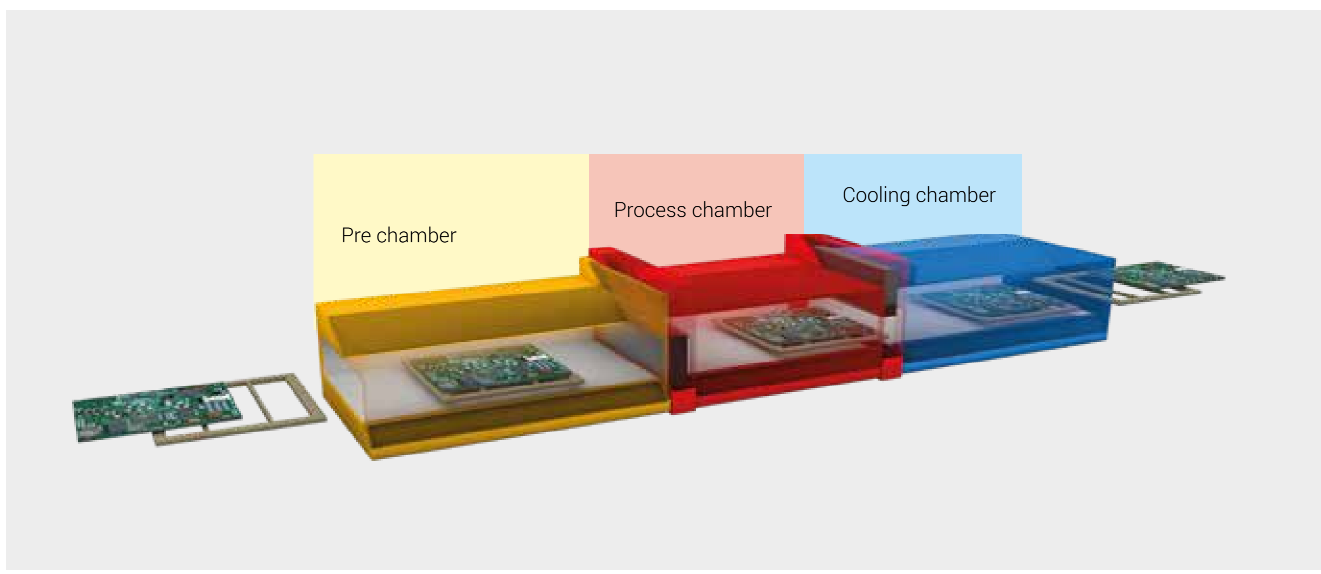




1. Loading
2. Pre-chamber/Pre-inerting
3. Soldering/Vacuum
4. Cooling
5. Unloading

3-chamber system

The CondensoX-Line is set up as a 3-chamber system to achieve low cycle times with inline soldering processes. The first chamber provides a protective nitrogen atmosphere for the products (pre-inerting) before it is transported to the actual soldering process. The second process chamber that is suitable for vacuum can be flooded with nitrogen or forming gases and provides an inert or activating and void-reducing process atmosphere throughout the whole soldering process. In addition, formic acid can be used as an option here for flux-free process control – which is a first in the world of vapour phase soldering systems! Controlled, rapid assembly cooling can be achieved with less than 100 ppm residual oxygen in the atmosphere using controllable convection in the final, gas-tight cooling chamber. In this way, void-reduced soldered joints can be made in a completely inert process environment, irrespective of whether this is with standard assemblies with BGA components or a DCB substrate for power electronics.



Construction of the 3-chamber system of the CondensoX-Line

Innovative software
Big data and process management

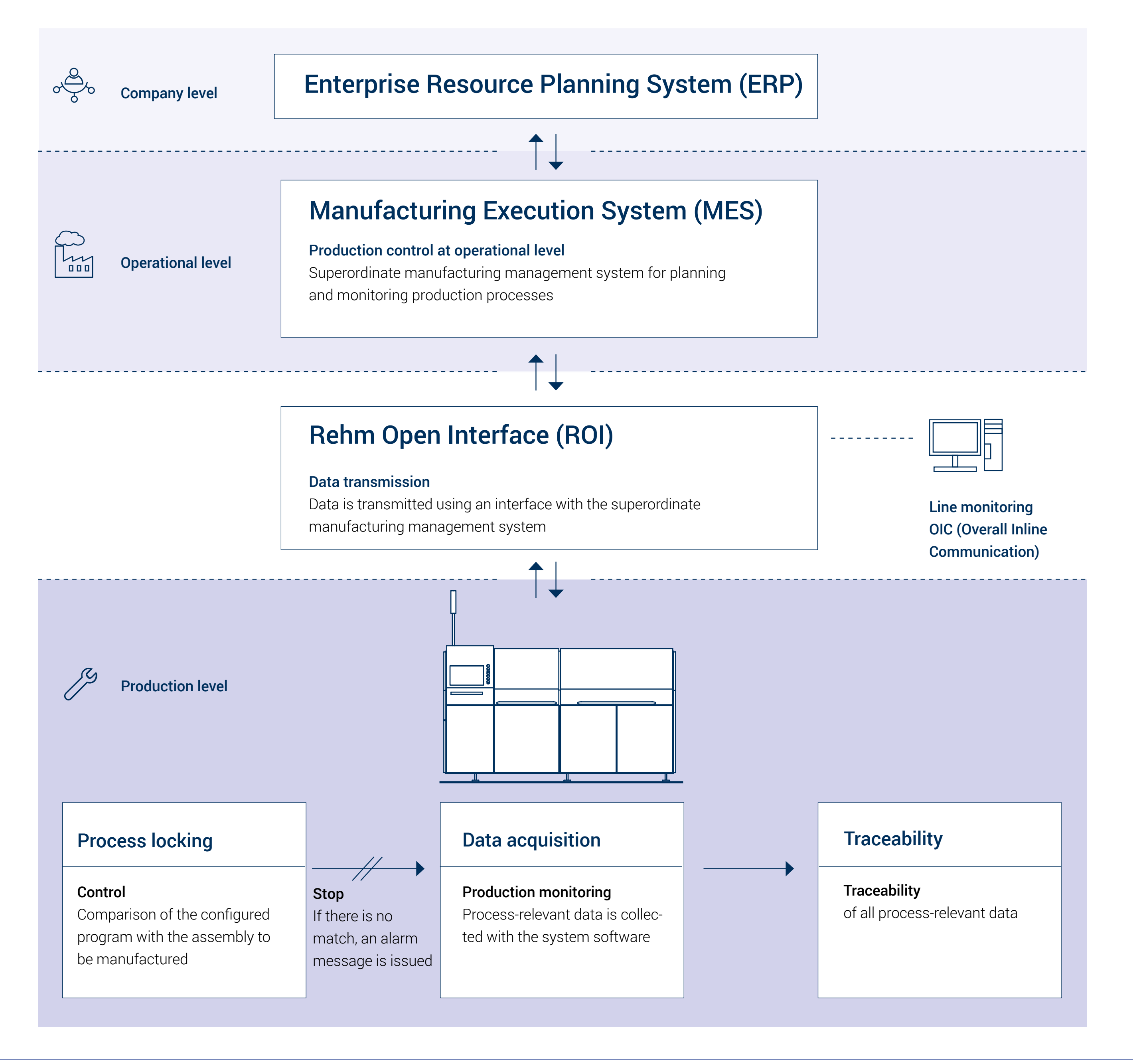
Integrating highly specialised software in modern manufacture will become more and more common in future. Systems and processes are managed, monitored, analysed and optimised. The order, product data, efficiency and status data, specified settings, archived profiles and current values are incorporated into the machine control system product documentation and analysis.

With ViCON Condenso, Rehm offers a clear software package for the Condenso series that is intuitive to use with its touchscreen interface. All messages, commands and parameters are visible at a glance on the main screen with its machine view. Simple profiling with clearly structured process stages is therefore possible – with or without the vacuum option.

With numerous other features, such as a favourites bar that can be set up as required, structured grouping of parameters and individual process monitoring and documentation, ViCON offers you optimal support for your manufacturing processes.

Process documentation, traceability & co.

The variety of MES systems on the market requires individual adjustment of data transfer from the Rehm reflow soldering system to the client's superordinate manufacturing management system (MES). Superordinate to this is the ERP system, which the whole company looks at, and which allows for logistic optimisations across all sites. However, the MES system focuses on a company's individual production lines. Rehm uses an ROI interface (Rehm open interface) to transfer individual data. Machine-specific operational data that is due for the respective system is collected and passed onto the MES system as a bundle. It is possible to ensure the seamless traceability of products, components or batches in this way. A data set is created for every assembly, which documents the relevant process parameter during the run. The assembly can be clearly identified and assigned via a barcode scan on the assembly itself, or by scanning the batch card. Process locking is also available as an option. Here, the scan is compared with the database and the assembly is only transported to the system in the event of approval. Defects can be detected and prevented in this way and therefore lead to process improvements.

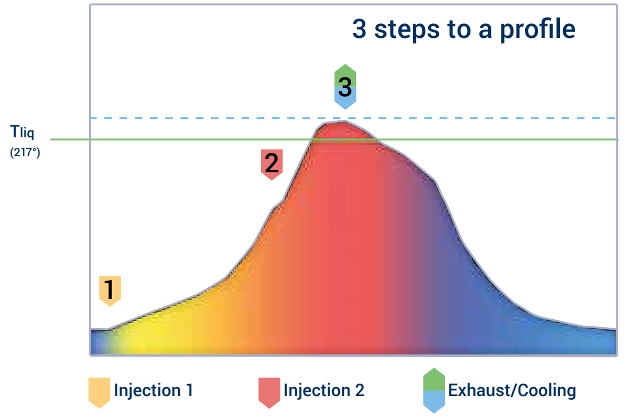


Accurate profiling capability
3 steps to a profile – 5 steps with vacuum

Only 3 steps to a profile

This makes profiling simple! With the Rehm Condenso series, you only need three steps to create an optimum profile for your assembly. What's more, the possibilities are endless for further refining and adjusting your profile, depending on your requirements. However, the following steps are usually enough to reach the optimum temperature profile for your application:

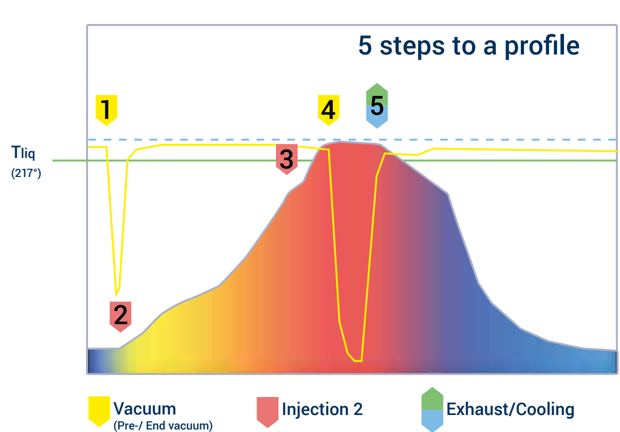
1. **Injection of the Galden® | Pre-heating of the PCB**
2. **Injection of the Galden® | Ideal soldering temperature**
3. **Exhaust of Galden® | Cooling**



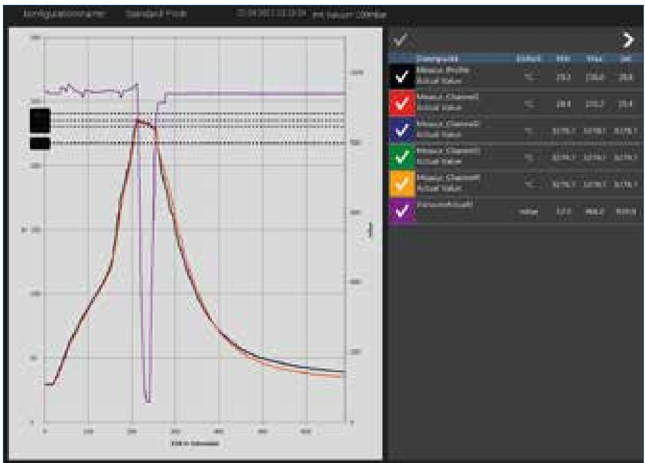
5 steps with vacuum

A pre-vacuum doesn't just allow the Galden® steam to be evenly injected, it also enables solvents and moisture to be de-gassed from the solder paste. After the max. soldering temperature has been reached, the gases that are still present can escape from the solder paste more easily using an end vacuum. Surface binding of up to 99 % occurs as a result.

1. **Pre-vacuum | Uniform distribution of the Galden®**
2. **Injection of the Galden® | Pre-heating of the PCB**
3. **Injection of the Galden® | Ideal soldering temperature**
4. **Vacuum during the melting phase | Void-free solder joint**
5. **Exhaust of the Galden® | Cooling**



Rehm Recorder

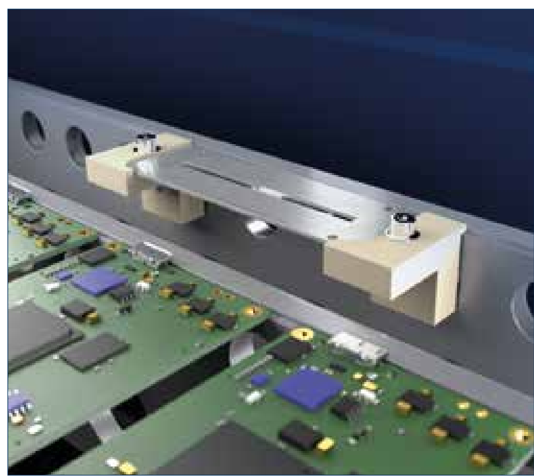


All Condenso systems are fitted with the Rehm recorder. The documentation tool replaces external temperature recorders and records relevant process data such as temperature and pressure. Data collection and traceability are carried out at an unprecedented level – without having to interrupt production. This is how soldering profiles are accurately recorded and can be called up and reproduced every time by series production. The measured values can be shown graphically with the Rehm recorder and can therefore also be documented and compared.

WPS 2.4 – Wireless Profiling System

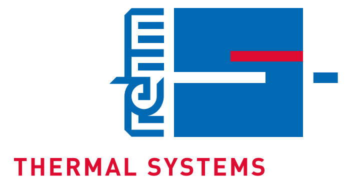
The WPS 2.4 is a brand-new, wireless measuring system which is used to continuously control the temperature profile. It consists of a sensor with antennas, as well as a wireless and evaluation unit. The temperature sensor is directly attached to the workpiece carrier. It works passively and doesn't require an external energy supply. A complete soldering profile can be determined and transferred to the system software in real-time, without any annoying cables or batteries. Software-aided documentation and evaluation functions (Rehm Recorder) allows for a new, complete traceability level.

- **100 % process monitoring**
- **Simple, continuous proof of quality**
- **Stable sensor function without cables or a battery**



Workpiece carrier with temperature sensor in loading position

- **Optimal process control with the ViCON Condenso**
- **Traceability of all process-relevant data**
- **Process monitoring via WPS 2.4 and a Rehm Recorder**
- **Reliable process documentation and maintenance history**
- **Connection to a superordinate Manufacturing Management System (MES)**



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Rehm Worldwide

As a leading manufacturer of innovative thermal system solutions we have customers on every continent. With our own locations in Europe, America and Asia as well as 27 agencies in 24 countries we are able to serve the international markets quickly and to offer outstanding on-site service – worldwide and round the clock!

- Location
- Production facility
- Representation

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