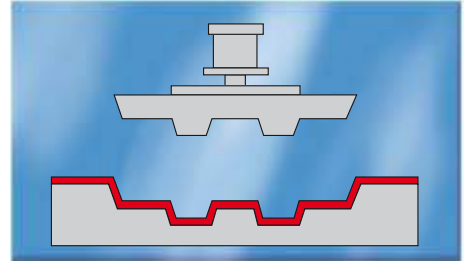
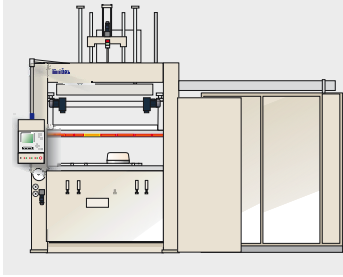


# illig®

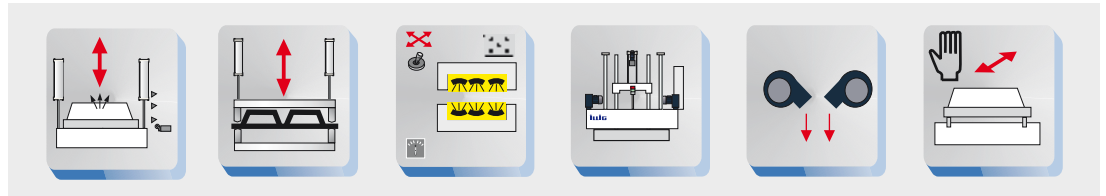


**Sheet processing machine**  
UA 100g, UA 150g, UA 155g  
UA 200g, UA 225g, UA 250g  
UA 300g

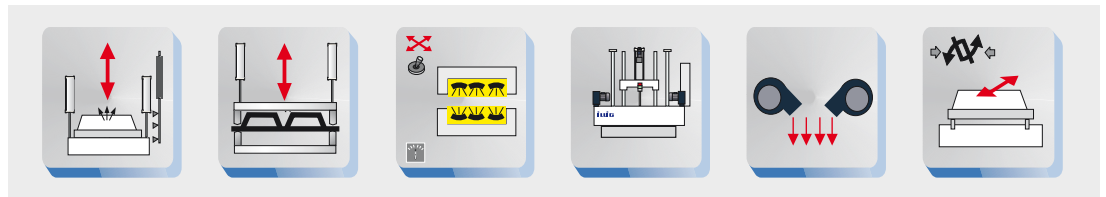
process-controlled machines



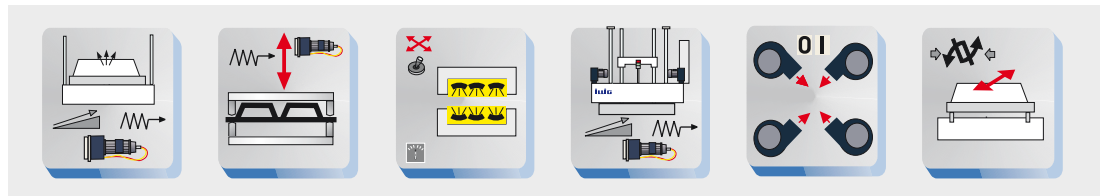
**Single station machine**



**Automated universal machine**



**Process-controlled machine**



## Increase in cycle speeds and improvement of product quality with UA-g process-controlled sheet forming machines

With the process-controlled sheet forming machine UA-g ILLIG introduces a new generation of universal thermoforming machines, which sets new standards as far as speed increase and product quality are concerned. The production of thermoformed parts gets new impulses because the new machine generation of thermoformers fulfills the current requirements of the applicant.

Different forming areas and equipment are available as optional extras, which enable the applicant to use the optimum and most economic machine for his production.

The modular construction of this concept allows for combinations from the basic machine up to the configured process-controlled high-performance machine.

The higher the technical level, the higher the output potential, with an easier and faster tool change, giving the benefit of reduced production costs.

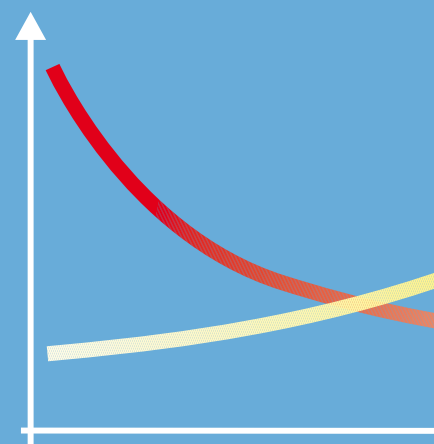
The equipment features can vary depending on customer's requirements and can be supplied in the most different combinations.

With the help of the resulting variety, the different drive concepts and the process control the most efficient technology can be selected, which allows thermoforming "almost without limits".

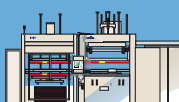
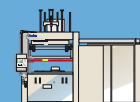
To guarantee a high quality standard of the thermoformed parts it is necessary to make the process-relevant parameters repeatable.

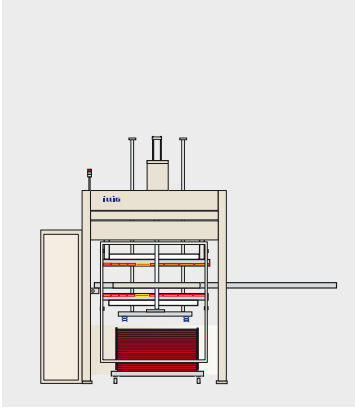
Values of speed, path, temperature and vacuum can be set and stored digitally. By this way the product quality remains consistent and reliable. To realize repeat orders without problems the complete process data is stored and filed.

product costs/output potential



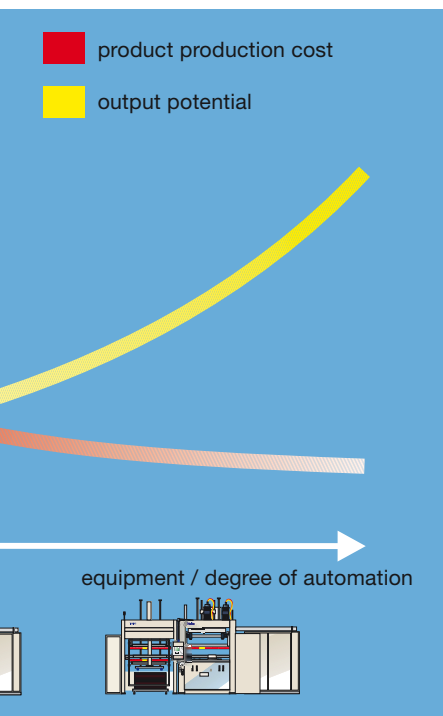
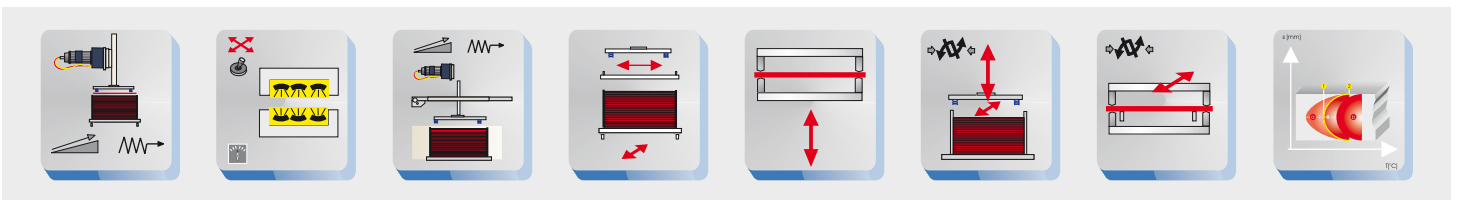
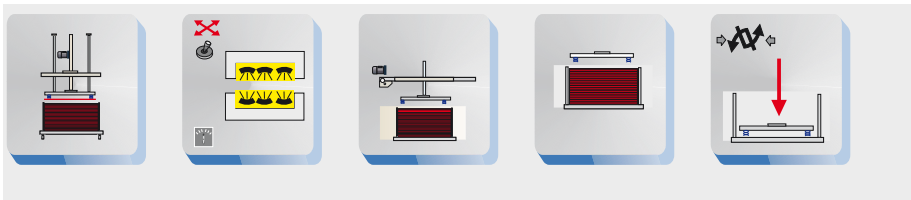
*The higher the technical level, the higher the output potential giving the benefit of reduced production costs.*





**modular machine concept**  
**performance-related**  
**machine configuration**

- sheet processing machine
- sheet loading device
- operation concept
- upper table, continued developments
- schematic tool construction
- quick-change technology
- machine equipment, additional components



**Process optimization for more profitable production**

**Preheating and off-station heating of material**

Increase in production by heating in loading device and reduction of heating time in the forming station.

**Splitting of heating time**

The shortest cycle time is achieved, if both stations work for the same time. Subject to the product, this requirement is met by splitting the heating time between the stations accordingly.

**Automatic basic setting**

All machine setting data and fastest cycle times are established by the program. The data can be taken over by the machine control and stored.

As a rule splitting of heating time is considered and good forming results are produced during the very first cycle – regardless of external influences.

**Repeatability**

Parameters once determined and stored are always available for every order with exact the same and unchanged values.

**Temperature controlled heaters in working and resting position**

ILLIG's heating philosophy featuring temperature control in any heating condition according to the rule: Controlling instead of setting.

**Quality**

Setting data and production data can be printed out and stored as record for quality control of the formed parts.

**Product production costs to a minimum**

Shortest conversion times increase the productive life of the machine by change of format parts as package.

**Profit maximization**

Preheating, off-station heating, optimized cooling and temperature control minimize the product production costs, increase the output potential and reduce the conversion time.

All of the before mentioned elements help to meet the required demands at a corresponding high quality and maximize the profit.





**The UA-g is a universal automatic thermoforming machine suitable for thermoforming from sheet and roll stock. The machine enables highest output potential at maximum customer benefit.**

In order to guarantee long-term success for the processor, the machine has to fulfill a wide range of customer requirements. The necessary pre-conditions are easy machine operability, flexible machine concept as well as high repeatability of all functional elements involved in the process.

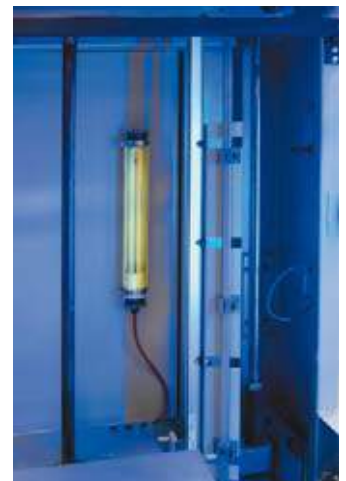
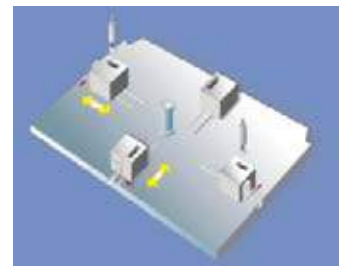
The use of servo-drives counts as new high light in the equipment for all modern sheet processing machines. There are many advantages: The movements of the individual functions can be run at different speed profiles.

An example for its use are: forming table movement, clamping frame drive, material transport and upper table drive.

The precise and especially fast movements have a positive effect on the product quality since for example stretching aids can move exactly and with defined speed almost independently from the ambient conditions. By this way areas of precise forming can be pre-stretched and defined more exactly which results in the use of thinner materials and thus contributes to higher effi-

ciency. Another property of the servo-drives, which should not be underrated, is the low energy consumption compared with pneumatic and hydraulic drives.

Furthermore the servo-drives reproduce production data at very high precision. This results in high availability especially of high-performance machines or machines with frequent format changes. The positions to be actuated can be stored.



*Adjustable mold substructure*

*Position measuring system for digitally adjustable and storable distance switching points*



modular machine concept  
performance-related  
machine configuration

**sheet processing machine**

sheet loading device

operation concept

upper table, continued developments

schematic tool construction

quick-change technology

machine equipment,  
additional components



Sheet forming machine UA 155g  
with sheet loading device BE 155g  
equipped to work from roll stock

An important part plays the mold when plunging into the pre-stretched material during the forming process. The coordination between pneumatic pre-stretching (pre-blowing) and the exact synchronized table movements influence both the even material distribution and the quality of the formed part especially in the corner areas.

The complexity of the process requires different sequences (drive variants) for forming table and pre-stretching plug.

**Lower table-drive variants**

■ **pneumatically**, limit switches, manually adjustable in height or by a distance measuring system for digitally adjustable and storable distance switching points.

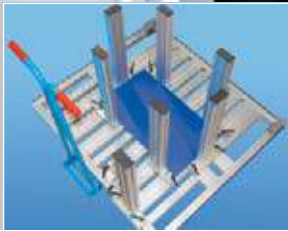
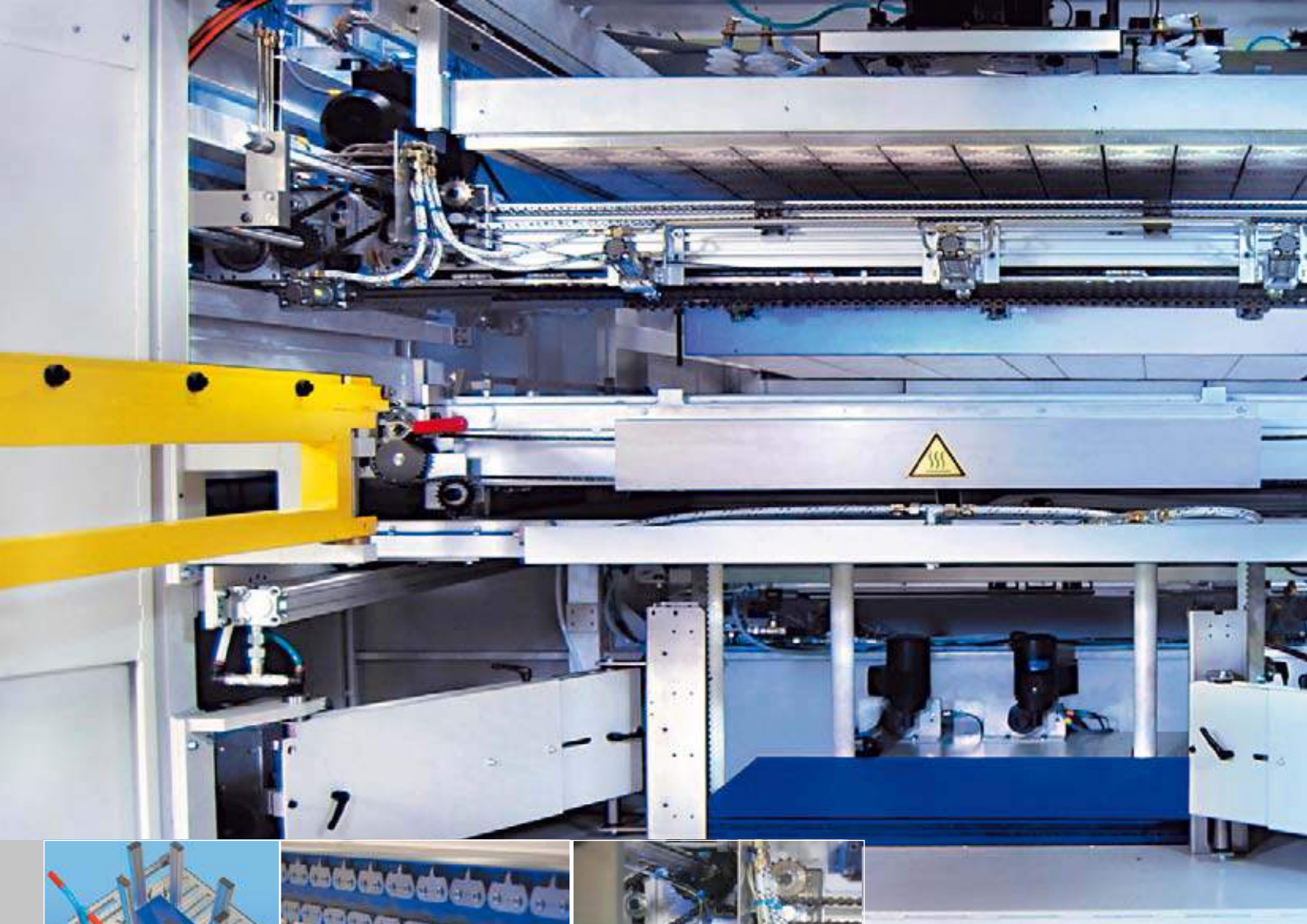
■ **servo-driven**, with digitally adjustable and storable speed profiles for up and down travel of the forming table. Up to three speeds can be stored as profile for each movement.

By this way the movements of forming table and pre-stretching plug can be precisely harmonized. The cycle time is reduced by different speeds.

In order to obtain a more even wall thickness, pneumatically pre-stretching of the heated material is necessary.

This is done by pre-blowing the sheet. For this, controlled air flows into the forming chamber (blow box). A photo-cell controls the resulting bubble. This ensures a constant repeatable product quality by more even distribution of wall thickness. The final geometry of the formed part is achieved by definition by vacuum.

In order to consequently use the possibilities of the machine in practice, the complexity of the process requires specific operator guidance on the screen.



### Automatic sheet loading device

The sheet loading device automates the forming machine. The advantage of an automatic loading device is the better repeatability of the process besides the higher performance, i.e. on account of the automatic, smooth sequence of functions a better quality of the formed part is achieved even for smaller batches. If manual loading is applied, the operator influences the cycle time.

The loading device includes the transport device for the material up to the forming machine. The transport device enables the feed of sheets with strong material sag after heating-up as well as discharge of positively and negatively formed parts even at maximum depth of draw. For this the transport

device can be lifted in inclined position. The adjustment is carried out on the operating panel.

An upper and lower heater can be installed in the loading device. This possibility provides pre-heating or off-station heating of the material and allows for reduction of cycle time. Subject to the behavior of the material and the machine equipment the heating time, which rules the cycle time, can be reduced in the forming station up to 0 seconds.

The equipment featuring the sheet loading device can vary depending on customer's requirements.

#### Centering table:

Working from un-centered sheet stack. A laser pointer is available to assist in aligning the sheet stack. The center-

ing table aligns the sheet in longitudinal and transverse direction so that it can be taken up safely by the transport.

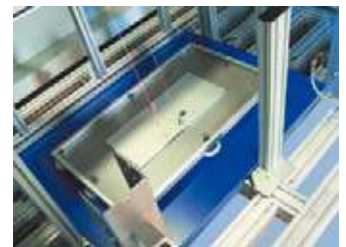
#### Material change options:

1. The sheet magazine can be adjusted manually to the individual sheet size.
2. The format is adjusted automatically and the sheet dimensions can be stored.

Apart from that a sheet carriage is available. It can be loaded outside the loading device and then pushed in. For example another sheet carriage can be prepared for the next order.

### Higher safety for destacking

The servo-driven sheet lift permits different speed profiles for lifting the plate. In addition, a sensor measures the set sheet thickness in the transport and recognizes doubling.



Centering of suction device by laser pointer.



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Higher output potential by application of pre-heating and off-station technology in the sheet loading device

**Technical levels of BE-g Sheet Loading Device:**

**Sheet P**  
Sheet-fed processing

**Roll R**  
Roll-fed processing

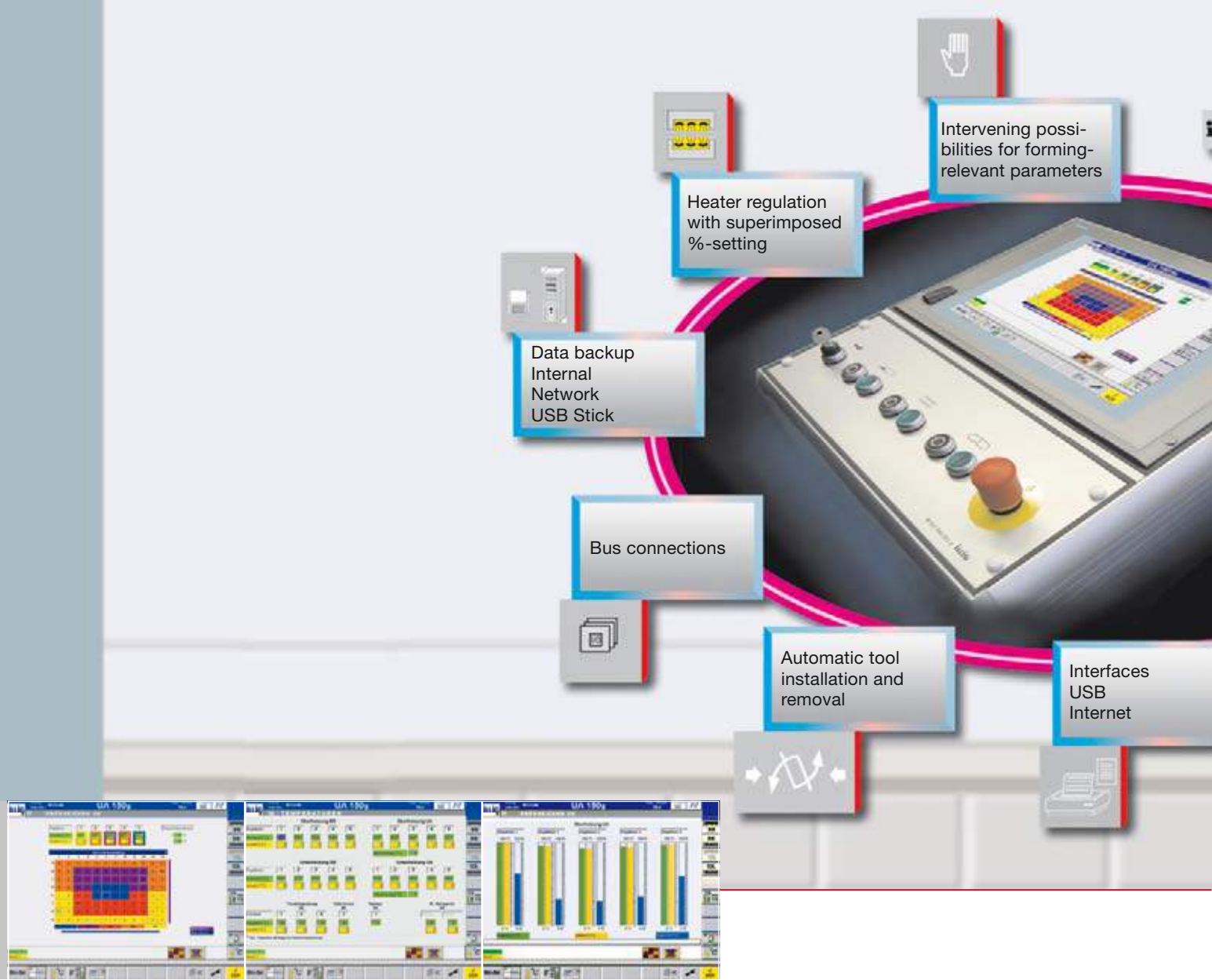
**Sheet – Roll PR**  
Processing from sheet and roll stock. “Working from roll stock“ means processing of roll material or sheet blanks. In the machine the blanks are fully automatically cut from the material roll by a cross cutter (optional extra). In order to obtain maximum number of cycles, the blanks can also be pre-heated or off-station heated. Subject to product and material 180 cycles/h can be realized.



Centering of sheets on centering table



Suction device



## Digitized function sequencing means practicable operation philosophy

### Easy machine operation

The complexity of the thermo-forming process is subject to an optimal control technology where the process parameters can be controlled and optimized. The user surface is an innovation, which enables selective operator guidance through the individual process phases.

This means the operator is given the changeable process parameters, where the number of the adjustable parameters is reduced to a minimum. The results of the setting are displayed on the user surface.

### Advantages of industrial PC (SIEMENS Panel PC)

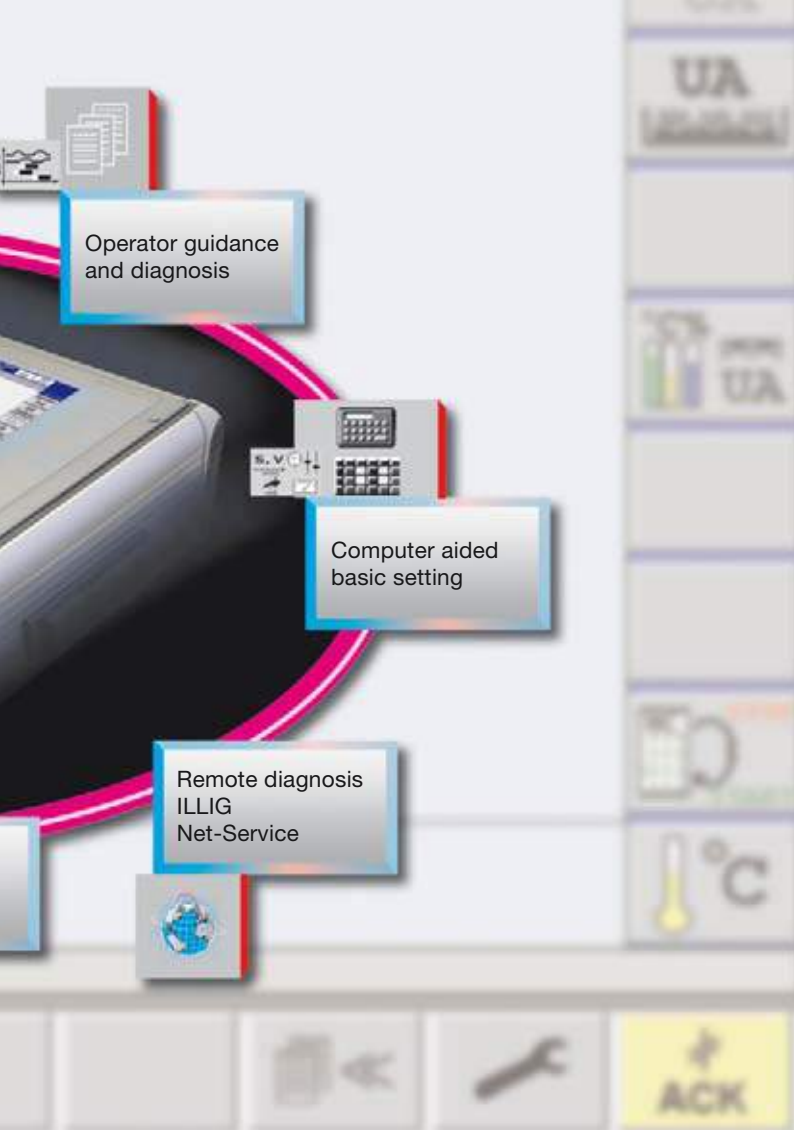
- Newly developed machine control with Soft-PLC based on Windows operation system
- Screen operating panel with high-contrast, brighter Touch-TFT display for simplified operation and better legibility
- Computer-aided basic setting of machine data with expanded optimization of machine sequencing
- The functions pre-blowing, pre-suction, pre-vacuum, forming vacuum, demolding and heating times can be programmed by "teach in". If the operator intervenes

by soft-key buttons, the machine control takes over the time as setpoint value for the next cycle and stores the data in the sequencing program.

- All setting data for the data set can be stored at any place (network, USB)
- Active heater element function control
- Graphic display of heater element temperatures
- Heater feed-back control by solid state relay
- Diagnostic aid
- Visual display of forming sequence
- Automatic pre-switch ON of heater panels as well as temperature control of mold and clamping frames

- Printer connection. Printable data and production protocol
- Improved operator guidance during automatic tool installation and removal with possibility to intervene





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Operating panel UA-g machines. Digitized functions enable computer-aided basic setting of the machine data.

### Intelligence based on PC

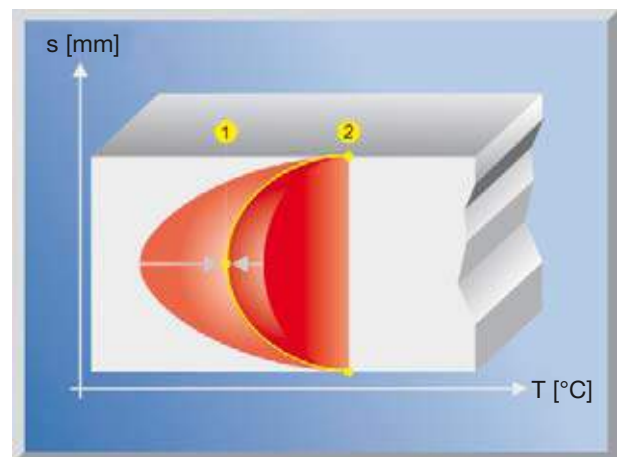
Today high demands are made on production machines with regard to accuracy and repeatability. This is the only way to meet the high quality standards for formed parts. This means that thermoforming machines must have properties, which are already standard on the 3rd generation machines.

The control systems and control strategies developed by ILLIG ensure easy production sequences at high availability and operator comfort.

### Process control

Compensation methods for repeatability of temperature profiles through out the thickness of material.

Advantage of this equipment: Both the surface temperatures as well as the core temperatures of the material are considered, which cannot be measured in the production machine. Since it is not possible to measure the core temperature of the sheet, it is calculated in the background. This way the temperature profile can be kept on constant level all through the cross section of the sheet. Subject to the requirement, temperature of heater elements or heating time are continuously automatically adapted so that all influences like temperature of the stands, ambient temperature and initial temperature of the material are considered automatically.



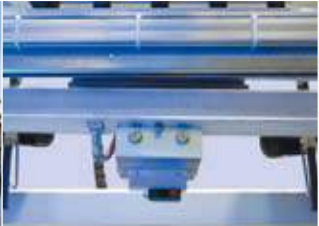
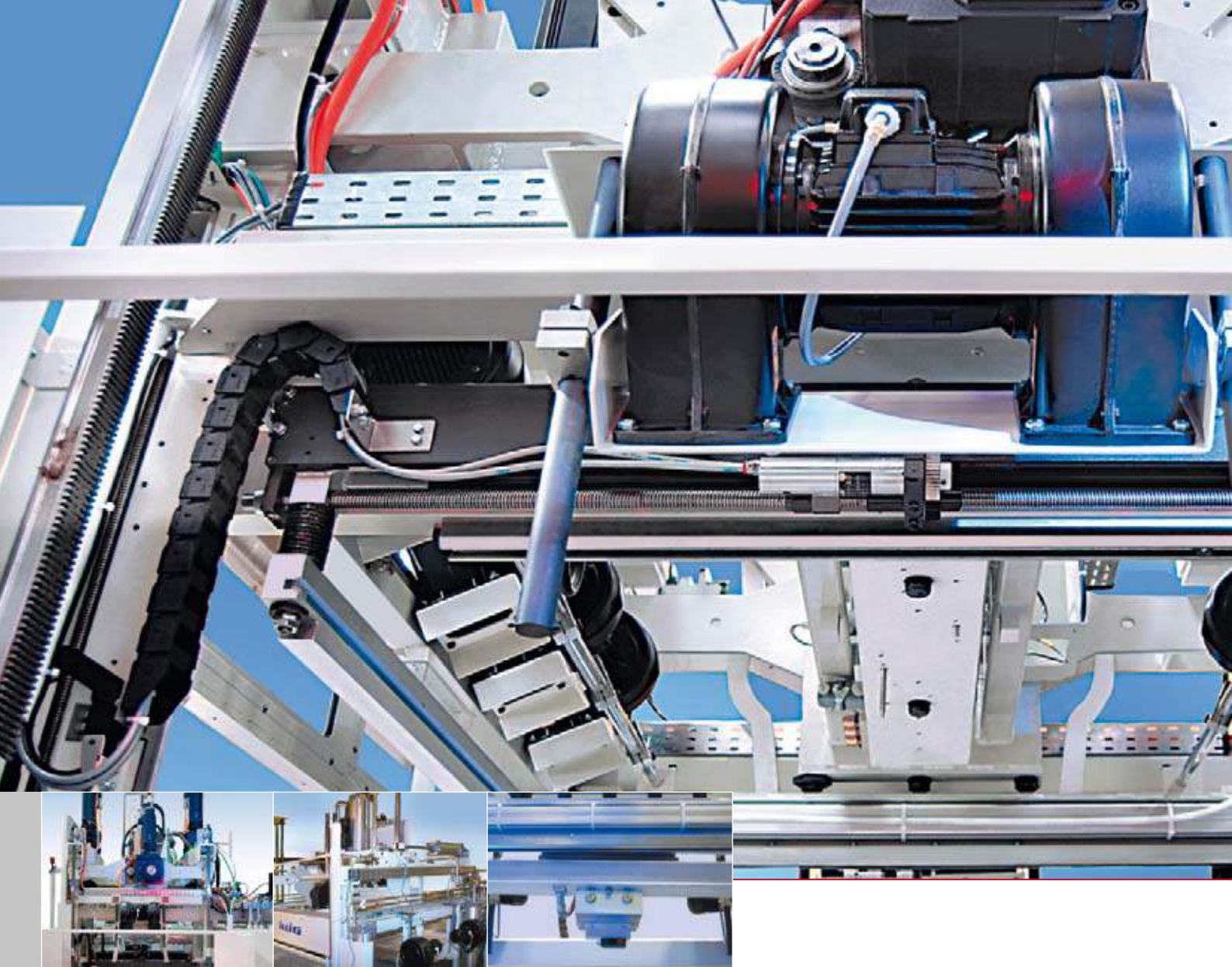
Effect of compensation on heated cross section of sheet

Compensation with infra-red measuring device

① temperature calculated

② temperature controlled / measured

ideal heating up – specifically to material



### Upper table, further developments

In the last few years, developments were made, which considerably improved efficiency of the sheet processing machines even for smaller quantities.

In order to use the advantages of thermoforming to its optimal extent different drive concepts are available for the upper table.

If the pneumatically operated machine setting of the moving distances is mainly carried out manually, the servo-driven machine provides higher operation comfort by motor-driven adjustment of most position adjustments. All variants for formed parts can be realized by the variable adjustment possibilities of the moving distances and

speeds in connection with the separately driven upper clamping frame.

A number of additional devices extend the universality of the machine concept. Motor-driven adjustment of stops, synchronizing device for eccentric center of gravity of the parts, loose parts control, corner blowing nozzles etc. extend the application of the upper table.

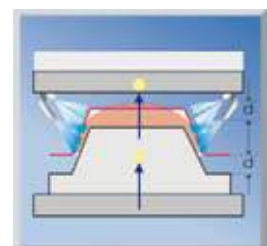
A tracer pin to find the upper table tool and for digital input of motor-driven adjustment of stop for the stroke allows automatic basic setting of the upper table position.

Process optimized production with corresponding increase of output potential becomes useful, if the quality of the formed parts will not be affected, quality of which is achieved on the machine

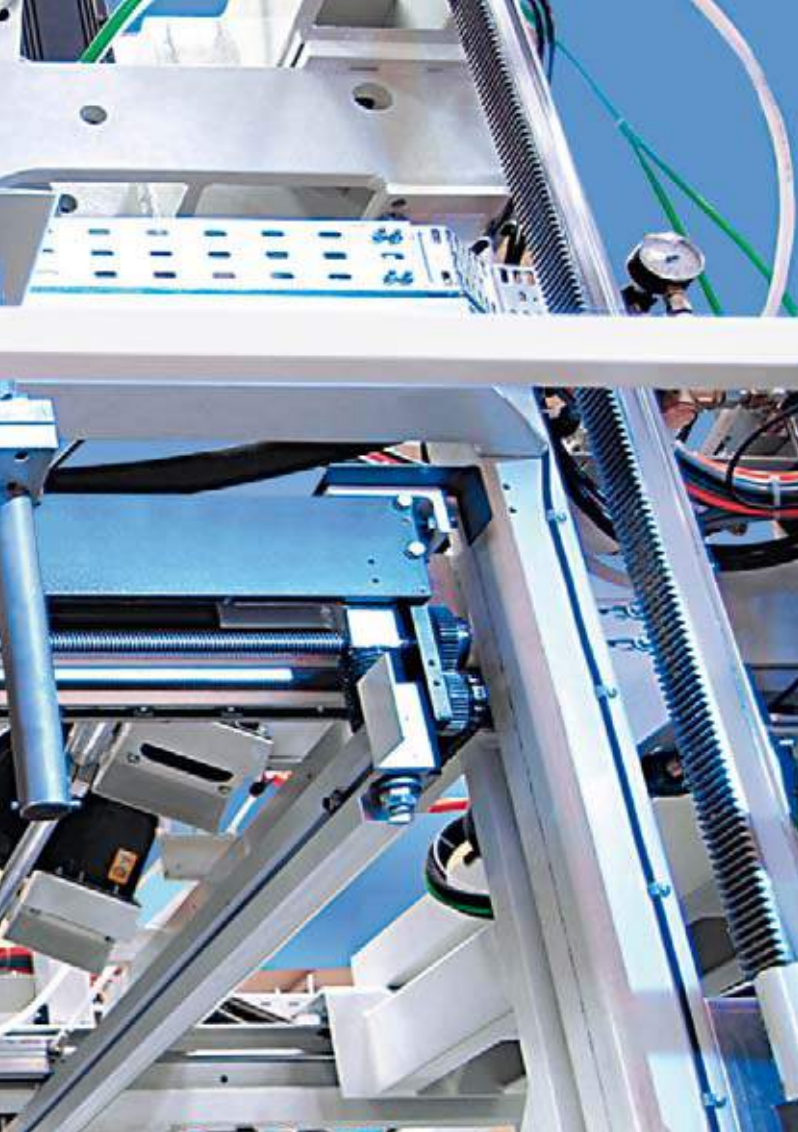
with the help of the already known "computer-aided basic setting". The setting data and process times determined herewith can be optimized to such an extent that the machine sequencing can be adjusted to the formed part to be produced. There will be a performance increase affecting the cycle time without loss of product quality.

By combining all process relevant parameters the definition and distribution of the wall thickness can be influenced repeatedly in the side-wall. Based on many years of experience in thermoforming, the process-controlled machine with servo-drive technology allows increase in speed up to 60 % by uprating the product quality at the same time.

The upper table can be used as demolding aid. Synchronized operation of upper table to lower table (can be selected, both tables in upward travel), makes blowing on the point by corner blowing nozzles possible. Moving speed, working stroke, and tool change position are stored.



Advantage of synchronized operation: During upward travel of table cooling by corner blowing nozzles is possible on same distance level



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*process-controlled machine by servo-drives*

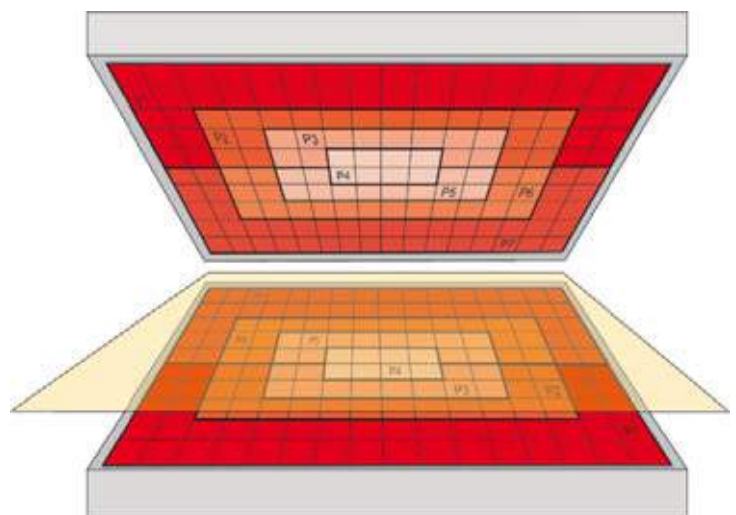
**Optimal production parameters by temperature controlled heaters.**

The smooth and even heating up of the material is the key for a good forming result. The heaters are equipped with high temperature ceramic heater elements (HTS). These elements are hollow, have thermal insulation and a high degree of efficiency.

They have universal heating properties, i.e. preprinted materials, too, can be uniformly heated. The heating times required are not subject to the color of the material. For high efficiency the radiation surface is closed. This ensures good heating results for every clamping frame size up to the edge area. Upper and lower heater provided with Joystick division for heater area is part of the basic equipment.

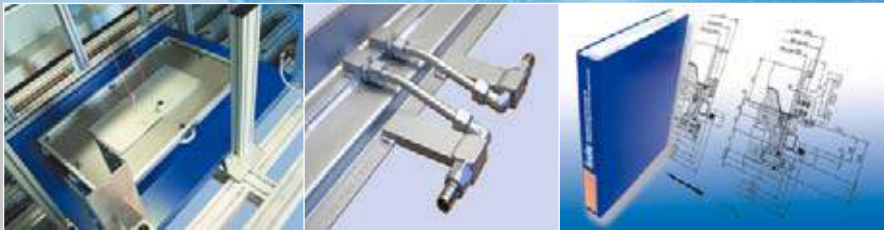
Thereby an optimal heater layout is achieved for the thermoforming process. The temperature control of the heaters is carried out by several pilot heater elements and overlapping performance.

With the help of the heater layout set by the basic adjustment program as well as with all sequence times, an almost even temperature distribution is achieved on the heated material, which is sufficient for the most frequent applications. If necessary, the heater layout can be changed very easily. Apart from that the machine can be equipped with IR measuring technology.



*Temperature controlled heaters.*

*Heater layout upper and lower heater*



### Availability and productivity have priority

Reduced change times for tool and format parts, simplified operation and higher availability are further advantages of the sheet processing machine from ILLIG. As a consequence the times such as sheet and tool change as well as maintenance are reduced to a minimum.

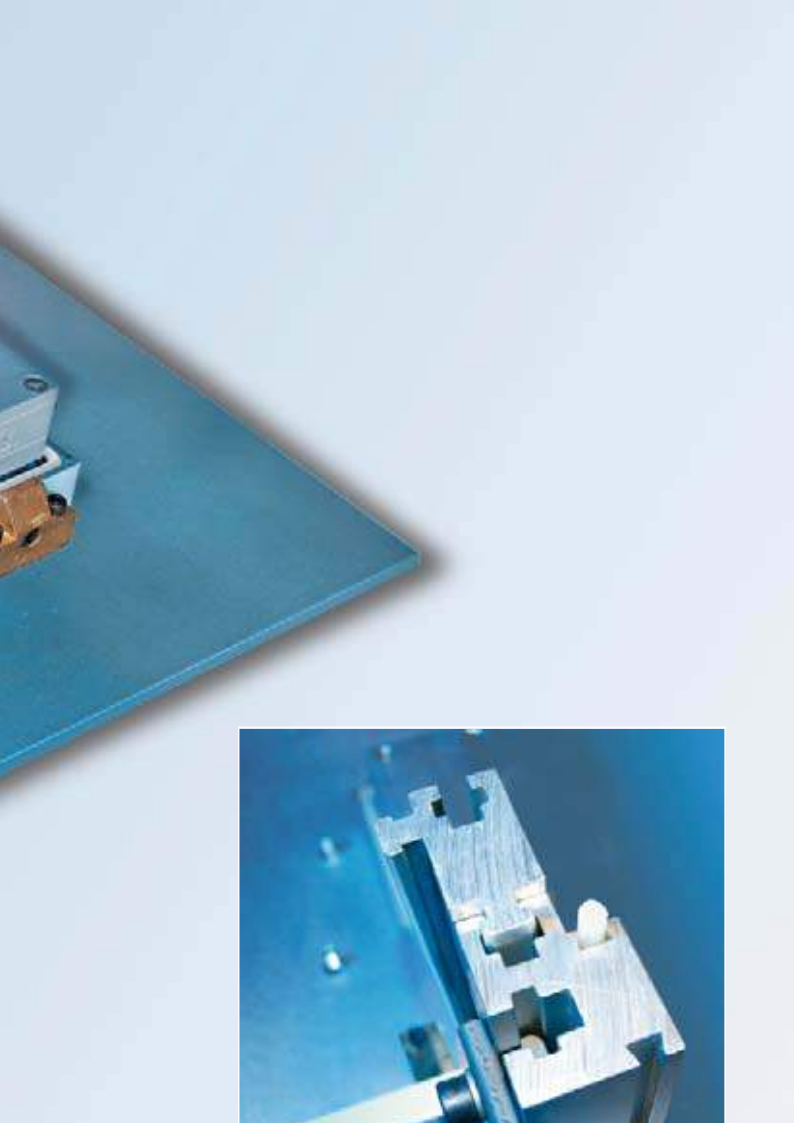
The unique tool and standard parts system for construction of forming tools in connection with the adjustable mold substructure offers special advantages for the production of small series with frequent format change. The mold substructure can be made very easily with the help of the standard profiles P19 and P20.

These profiles form the lower tool together with the support plate of the segment and the actual mold. Such a tool can then be used on all table variants.

ILLIG has developed a manual for construction of molds and tools, which enables the applicant to make simple tools by himself. This saves time and reduces costs for format parts.



*The conversion program supports the operator and enables automatic tool change in all stations.*



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Profiles out of the ILLIG standard parts system

### Reduction of conversion times by automatic procedure

If on the more simple machine the tool change procedure is mainly carried out manually, the automatic quick-change of tool reduces the conversion times for all machine sizes.

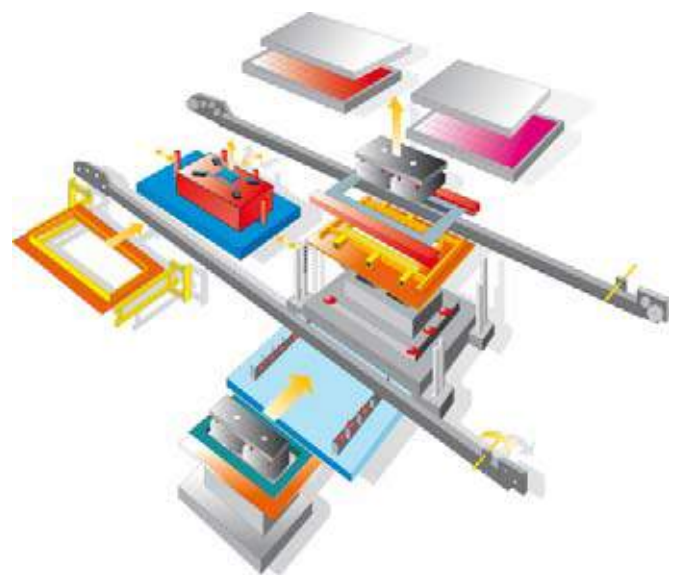
The complete mold package (forming tool, upper and lower clamping frame incl. plug assist) is moved in via the front panel. Pairs of rollers facilitate loading of the tool package into the blow box.

The forming tool centers itself automatically and is clamped by vacuum onto the forming table. This clamping vacuum is controlled automatically. Upon closing the front panel the individual functions run down automatically by the conversion program, e. g. upward travel

of the forming table, locking of upper and lower clamping frame and of plug assist tool.

On machines with automatic sheet loading device the transport adjusts automatically to the new sheet dimensions. The new suction plate is taken up by the sheet lift and clamped. At the same time conversion runs down in all functional devices.

The machine provides the operator with the relevant parameters, which proceeding is displayed on the operating panel. An important advantage of this visualization is the specific display of the required information and auxiliary functions following the principles of the professional industrial design. The operating panel is very simple to understand and



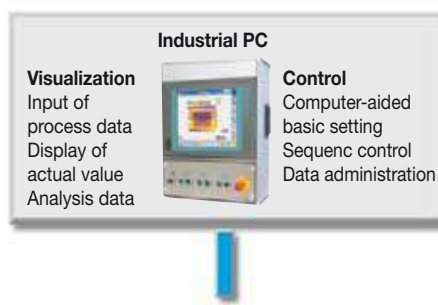
Automatic quick-change of tool

avoids operating errors by its clear and simple menu structure.

Format change without material change is thus reduced to approx. 3 to 6 minutes.



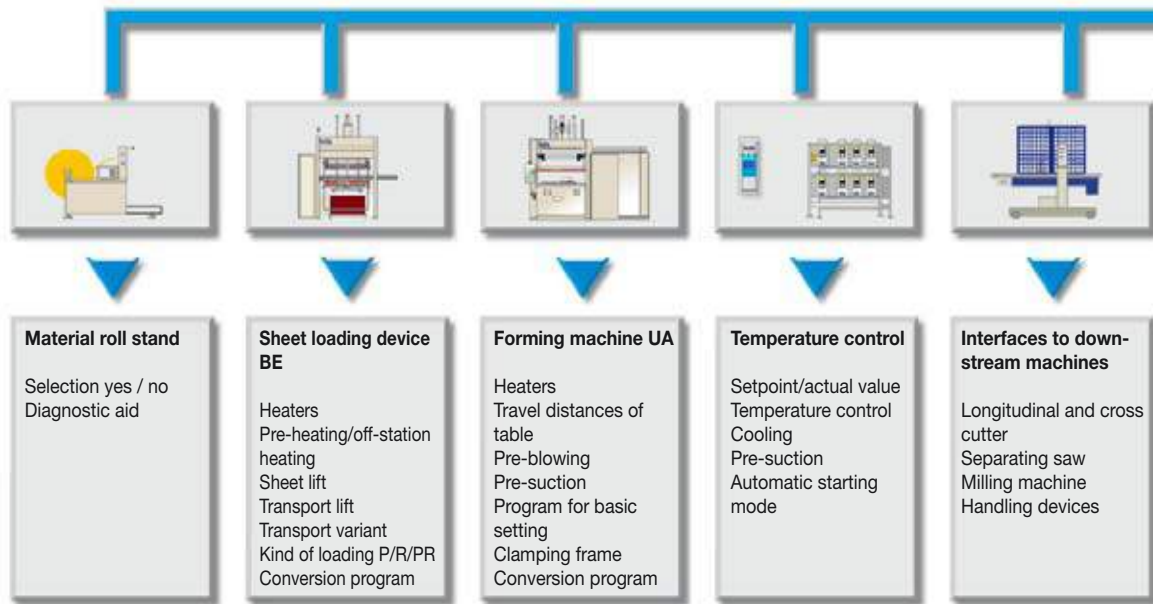
## Control and regulation elements



## process-controlled data exchange

## Machine level

## Function level



## Perfect integration of all systems in the process-controlled machine

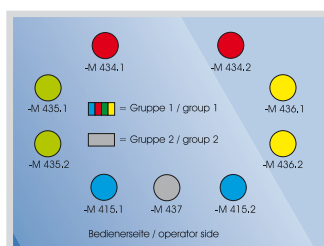
### Cooling systems

On the one hand a large quantity of energy has to be fed for the forming process, which on the other hand has to be dissipated after the forming process by the cooling systems in a useful way and in the shortest possible time. The combination of the individual cooling systems such like tool cooling, air shower in upper frame and cooling fans have the most efficient effect, which then can directly be converted into performance.

On account of cooling fans with reinforced performance and its freely configurable combination high air speeds are achieved where water-spraying nozzles no longer are necessary.

### Temperature control by ITS-System

The ITS-System permits field-proven temperature control of clamping and holding frames as well as of the forming tool. It is also possible to have different temperatures within the forming tool or the upper table tool (e.g. twin-sheet). Depending on material and application temperature modules up to 95 °C



configurable cooling fans

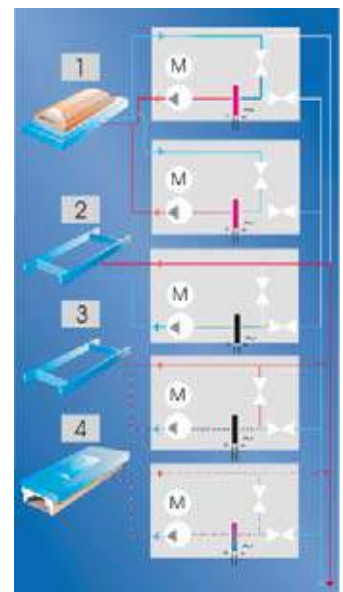
or 140 °C can be used. Interfaces with Profibus connection to the controls enable control via the screen.

### Loose parts controls

For the production of formed parts for example with undercuts ILLIG offers corresponding mechanical and electronic control packages. These additional devices can be attached to both the forming tool, the clamping frame or to the plug assist.

### Photocell for pre-blowing

To be able to achieve more even material distribution specific pre-blowing can be useful. The height of the bubble can either be controlled by blowing time or by a photocell. The photocell can even be adjusted by motor whereby the position is stored.



Temperature control system ITS, example for application

- 1 Forming tool heated by two temperature control circuits switched in parallel
- 2 Holding frame cooled
- 3 Clamping frame temperature controlled
- 4 Upper tool temperature controlled

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### Vacuum device on plug assist

An additional vacuum device is available for negative forming or Twin-sheet thermoforming.

### Cutting in forming station

Formed parts made of foam or thin materials can roughly be cut in the forming machine.

### Heater options

Individual product-dependent heater layouts for highest demands are achieved by multiple position switching and overlapping performance.

Joystick division for upper and lower heater.

Multiple position switching for upper heater and Joystick division for lower heater are possible. In order to form the undercuts or to form the intermediate bridges auxiliary plugs or sectional cooling devices (corner blowing nozzles) can be used. Corresponding devices can be controlled synchronously with the forming process by the plug assist device

On account of this device air is specifically blown onto the warm sheet during the pre-blowing process. Those zones blown at cool down and are therefore stretched less. This means that these zones remain thicker. The air stream used can be regulated and controlled. The advantage of this technology is to avoid marks on the formed part.

To demold indentations or undercuts corresponding loose parts or slides in the forming tool are used. These can be actuated by the formed part itself, subject to sufficient rigidity, or by a control unit depending on time and distance. Corresponding control elements are attached to the machine.

### Competent service

A skilled and competent service team is available.

- Fast reacting service center
- Online service for process optimization and trouble shooting
- Inspection and service for preventive maintenance
- Spare parts service
- Training in our training center or on site at customer's premises

ILLIG Maschinenbau GmbH & Co. KG  
Robert-Bosch-Strasse 10  
74081 Heilbronn/Germany  
Telefon: +49(0)7131/505-0  
Telefax: +49(0)7131/505-303  
e-mail: info@illig.de  
Internet: www.illig.de



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