

**Technical specifications for
inline router ILR-1800
for quotation no. of**



Schunk inline depanelling system ILR-1800

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1. Basis for quotation

The quotation and technical design are based on the customer's specifications.

2. Modular concept

The new ILR-1800 / ILR-2200 generation of depaneling systems is the successor to the previous ILR-1500 / ILR-2000 machines from Schunk Electronic Solutions GmbH and is based on a modular concept. This includes the entire mechanical and electrical machine structure, production of the electrical circuit diagram using a configurator and all machine software. Using a sales configurator, the machine can be designed specifically to meet the customer's requirements. The modular structure allows the machine to be adapted to new requirements at any time later on during use. This is done by retrofitting the necessary hardware and software. Particular attention has been paid to the great flexibility of the feeder system in terms of machining a wide range of multi panel layouts. The feeder system with linear motor makes the shortest possible multi panel change times possible. Optional inlet modules now also allow multi panels to run into the machine without the gripping function of the feeder grippers previously needed. The multi panel's supporting rails in the milling area allow a multi panel to also be machined in the support area. Various clamping systems in the milling area make sequential clamping and loosening of the multi panel possible in the milling area. An optional trimming waste removal unit on the front and a large number of different trimming waste gripper solutions offer great flexibility in disposing of trimming waste.

The extraction cross-section of the milling head has been increased by 25% to permit even more efficient extraction at the point of machining.

The PCB handling unit has been completely revamped and has reinforced linear axes in all variances so that the PCB gripper can be held accurately in the milling position during the milling process.

One highlight is the new servo gripper with fully automatic gripper jaw changes and linked gripper jaw magazine. Maximum flexibility in gripping the PCBs stems from the ability to combine various jaws.

New functions ensure a safe production process. These include the fully automatic tooling check for all product-specific setup tools, such as grippers, gripper jaws, reversible jaws or trimming waste grippers, using surface scanners in no more than 2 reading cycles.

Rounded off by the use of state-of-the-art technologies, such as absolute measurement systems in all servo axes, the ILR-1800 / 2200 depaneling systems have become modern and highly flexible machines for fully automatic depaneling using milling bits.

3. Scope of delivery for basic machine ILR-1800

- ❑ Sturdy low-vibration welded frame with sheet metal covering and integrated trimming waste box on rollers. Level check performed by counting the faulty bits
- ❑ Protective cover with lift gate on front. Inspection window in lift gate on front. Left and right sides of protective cover for sheet metal inserts without glass panes
- ❑ Electrical cabinet on rear of machine
- ❑ Milling system positioned at bottom with rapid and precise linear motor axes
- ❑ Precision milling spindle
- ❑ Automatic monitoring of milling bit height and ejection
- ❑ Basic feeder system comprising basic frame for manual width adjustment, carriers at front and rear with inlet rails, waste chute, valve units and sensor/actuator boxes for pneumatic actuators
- ❑ IPC controller with Win 7 operating system, path control and DIN-66025 programming for milling program creation. 15.4" touchscreen monitor, keyboard and mouse for operating the machine are fitted (swivel-mounted) on the operator panel. The operator panel is on the front right of the machine
- ❑ Compressed air preparation unit with valve units for controlling pneumatic actuators
- ❑ SMEMA interface on multi panel inlet
- ❑ 2 EMERGENCY STOP buttons (on operator panel and electrical cabinet)
- ❑ Online maintenance instructions
- ❑ Maintenance kit for maintenance work
- ❑ Schunk color scheme
- ❑ ESD cladding
- ❑ Remote servicing
- ❑ Machine capability test
- ❑ Documentation in German/English on data carrier

4. ILR-1800 options

Protective cover

- ❑ Glass insert on left and right sides
- ❑ Protective cover extension on right with output openings at bottom for protruding PCB handling unit (ILR-1800 Plus version) for the output of separated PCBs on external transport systems
- ❑ Soundproofing

Milling head and milling brush support

- ❑ Pneumatic milling brush support with integrated milling bit breakage check
- ❑ Programmable milling brush support with integrated milling bit breakage check
- ❑ Supporting cylinder
- ❑ Milling accessories set (milling brush, intermediate rings, 10 milling bits)

Feeder

- ❑ Single feeder axis with lifting gripper
- ❑ Single feeder axis with swivel gripper
- ❑ Double feeder axis with lifting and swivel gripper as rapid feeder
- ❑ Inlet modules on multi panel inlet for transporting panels in depanelling systems without gripping functions
- ❑ Extension for manual width adjustment
- ❑ Width measurement with display and width monitoring for manual width adjustment
- ❑ Automatic width adjustment
- ❑ Inlet stopper
- ❑ Vertical clamping units on front of multi panel
- ❑ Indexing units on front of multi panel
- ❑ Vertical clamping units on front of multi panel with horizontal lift
- ❑ Rotary clamp 1 on rear of multi panel
- ❑ Rotary clamp 2 on rear of multi panel
- ❑ Rotary clamp extension for free travel upwards
- ❑ Clamping strip with 8 clamping segments on rear of multi panel (being prepared)
- ❑ Trimming waste gripper at rear
- ❑ Trimming waste gripper with cross lift at rear
- ❑ Trimming waste removal unit with linear motor at front
- ❑ Trimming waste gripper at front
- ❑ Trimming waste gripper with cross lift at front
- ❑ Waste chute with opening and sliding plate in conjunction with trimming waste grippers

PCB handling

- ☐ XYZ short cantilevered axis system (operating area within ILR) with one handling head
- ☐ XYZ long cantilevered axis system (protruding on the right, ILR-1800 Plus 1 version) with one handling head
- ☐ XYZ long double cantilevered axis system (protruding on the right, ILR-1800 Plus 2 version) with two handling heads

Controller

- ☐ Operating panel on left
- ☐ Second operator panel
- ☐ SMEMA interface on output side
- ☐ Engmatec interface on output side
- ☐ Safety interface for board handling on inlet side
- ☐ Multicolor signal lamp
- ☐ Werma signal column
- ☐ Horn
- ☐ I/O link activation for servo gripper with changeover for operating pneumatic grippers and servo grippers in turn
- ☐ Phoenix hardware box with firewall and virus protection

Optical package

- ☐ Special finish
- ☐ LED machine lamp

ESD package

- ☐ Ionization via blower

Toolkit package

- ❑ Magazine for 10 milling bits with automatic disposal of defective milling bits or milling bits with expired tool life. Fully automatic milling bit changes.
- ❑ Milling bit diameter check with monitoring of milling bit height
- ❑ Milling brush monitoring
- ❑ Milling bit control for different levels
- ❑ Colored ring detection for milling bit rings

Rotation axes for PCB handling unit

- ❑ Continuously rotating freely programmable ERD24 rotation axis for milling applications
- ❑ Continuously rotating freely programmable ERD12 rotation axis for handling tasks

Gripper quick-change heads

- ❑ Manual gripper quick-change head for pneumatic grippers
- ❑ Manual gripper quick-change head for servo grippers and pneumatic grippers
- ❑ Automatic gripper quick-change head for pneumatic and servo grippers

Gripper coding

- ❑ Gripper coding using sensor (max. 5 grippers)
- ❑ Gripper coding using RFID
- ❑ Gripper coding using surface scanner
- ❑ Measurement and test station for gripper fingers

Gripper magazines

The ILR-1800 has two gripper magazine spaces. Each gripper magazine space is designed as a double magazine space and can be configured as follows:

Magazine space on the left

- ❑ Double magazine pneumatic gripper or
- ❑ Single magazine pneumatic gripper + servo gripper with 4-jaw magazines or
- ❑ Single magazine servo gripper + servo gripper with 4-jaw magazines or
- ❑ Servo gripper with 8-jaw magazines

Magazine space in center

- ☐ Double magazine pneumatic gripper or
 - ☐ Single magazine pneumatic gripper + servo gripper with 4-jaw magazines or
 - ☐ Single magazine servo gripper + servo gripper with 4-jaw magazines or
 - ☐ Servo gripper with 8-jaw magazines
- If reversing station is at front, only the following is possible:
- ☐ Single magazine pneumatic gripper or
 - ☐ Single magazine servo gripper

Reversing stations

Reversing stations in the ILR-1800 are only available in the Plus versions (PCB handling unit on right above machine protruding towards part storage on external transport system).

- ☐ Pneumatic reversing station at rear with manual jaw change
- ☐ Pneumatic reversing station at front with manual jaw change
- ☐ Interchangeable reversible jaws
- ☐ Pneumatic reversing station at rear with manual gripper quick-change system
- ☐ Interchangeable gripper
- ☐ Servo electrical reversing station at rear (ERD 12 rotation axis with servo gripper) with jaw quick-change system (being prepared)
- ☐ Quick-change jaws

Pneumatic gripper

- ☐ Pneumatic single gripper for manual gripper changes
- ☐ Pneumatic single gripper for automatic gripper changes
- ☐ Pneumatic multiple gripper for manual gripper changes
- ☐ Pneumatic multiple gripper for automatic gripper changes

Servo gripper

- ☐ I/O link activation for servo gripper with changeover for operating pneumatic grippers and servo grippers in turn
- ☐ 2 x 15 mm servo gripper lift for manual gripper changes
- ☐ 2 x 15 mm servo gripper lift for automatic gripper changes
- ☐ Measurement and test station for gripper fingers
- ☐ Interchangeable jaws for servo gripper

LP position correction vision package

- ❑ LP position correction vision system for handling head
- ❑ LP position correction vision system on milling system at bottom (being prepared)

Automatic separating edge monitoring

- ❑ Upper separating edge check vision system for second handling head (on right)
- ❑ Lower separating edge check vision system for milling system with blast nozzle
- ❑ Calibration tool for demonstrating capability of measuring equipment
- ❑ Intermediate storage station for separating edge check from top with background lighting
- ❑ Product-specific part holders for intermediate storage stations

Dust extraction

- ❑ Ruwac DS 1222-H dust extraction with manual cleaning, including connector accessory
- ❑ Ruwac DS 1222-H dust extraction with automatic cleaning, including connector accessory
- ❑ Standalone manual extraction unit for DS 1222-H with hose holder, installed externally
- ❑ Integrated manual extraction unit for DS 1222-H with pneumatic switch for changing between extraction and manual extraction
- ❑ Ruwac - upstream filter cell system
- ❑ Dust extraction solutions from other manufacturers available on request

CAM package

- ❑ CAM system ILR gen. 2018 for writing sequence program offline, including milling program
- ❑ CAM converter (Gerber data to dxf file)
- ❑ Upgrade to CAM system ILR gen. 2018
- ❑ Network dongle for CAM system

Teach function and automatic calibration (being prepared)

- ❑ Fully automatic setting up of all product-related positions
- ❑ Automatic calibration

Interface package

- ☐ Scanner SR-1000W for PCB handling
- ☐ Hand scanner
- ☐ Surface scanner for fully automatic tooling check
- ☐ Scanner at top, inlet side
- ☐ Scanner at bottom, inlet side

Software connections

- ☐ Customer-specific database connections
- ☐ Standard MDE/BDE production data recording system

Special functions

- ☐ PCB blower module
- ☐ Transponder reading station
- ☐ Empty check for workpiece carrier

Output devices

Standard:

- ☐ Solid webbing belt as OK parts belt
- ☐ Solid webbing belt as not OK belt
- ☐ Box for reject parts
- ☐ PAL-1500 palletizing system, see separate specifications

Project-specific special output devices:

- ☐ Servo electric single or multiple output shuttle
- ☐ Storage for reject parts
- ☐ Intermediate storage station

Tools and accessories

- ☐ Replacement milling spindle
- ☐ Interchangeable milling spindle
- ☐ Electrical cabinet holder for spare spindle with spindle control for optimum spare spindle storage
- ☐ Replacement collet chuck
- ☐ Wear parts packages
- ☐ Replacement and wear parts packages

- ❑ Replacement milling brushes
- ❑ Milling bits

Services

- ❑ Stress loading measurements
- ❑ Setting up customer products
- ❑ Constructive adaptation to customer projects
- ❑ Software adaptation to customer projects
- ❑ Initial and final acceptance
- ❑ Packaging and transport
- ❑ Installation and commissioning at customer's premises
- ❑ Customer training
- ❑ Warranty extensions

5. Function description

Attention: Always differs in the details (e.g. machining of OK/not OK parts yes/no, reject parts belts yes/no). Should always be checked by the Schunk specialist responsible!!!!

Individual PCBs are detached from the multi panel in the ILR-1800 depaneling system by means of milling bits using a milling system on the underside. The PCB to be detached is held on the upper side by a gripper of the PCB handling unit.

At the start of production the operator manually selects the program recipe required on the machine. Alternatively, the desired program can also be selected by the superordinate production system. Usually, just one type of product is produced at any one time. The description below is based on this assumption. The necessary machine tooling, such as tooling the right pallets in the empty pallet trolley of a subsequent palletizing system or settings on the high-speed feeder, is also undertaken by the operator at the start of production and/or when changing product. An optional upstream run-in scanner can perform a plausibility check (correct program recipe active) and a database query can be run in the customer's database in order to communicate OK/not OK information about the multi panel to be machined. The multi panel is accurately located in the milling position by a feeder system in the machine. The multi panel is clamped in the milling position in the support area at the front and rear. As an option, pins can be indexed via holes in the panel edge. The optional vision system mounted on the PCB handling unit is used to capture the multi panel's register marks and to correct the position of the PCB handling unit and milling system. The bottom milling system and the upper PCB handling unit then move into position to start the operating routine. The PCB handling unit grasps one PCB in the multi panel and the milling system separates it. The PCB handling unit is equipped with a manual or automatic gripper quick-change system with gripper coding (optional). The system can therefore quickly respond to a change in product with minimal preparations.

The separated PCBs are then placed on the respective output device by the PCB handling unit. Not OK parts in the multi panel are also usually milled out and placed on a reject belt, for example. The reject belt is designed as a cycle belt and its length and width provide sufficient storage capacity. Light barriers monitor filling of the reject belt and the light bar issues operator instructions. The reject belt can be emptied from the outside on the right-hand side of the machine.

Trimming waste is automatically transported into a waste container via a chute. The chute is installed directly behind the high-speed feeder. The waste comes out on the operating side. Monitoring for broken tools prevents PCBs which have not been fully milled out from being lifted up by the PCB handling unit. Once the end of a bit's service life is reached or a bit breaks, it is disposed of via a bit handling device and a new bit is automatically fitted (optional). An integrated toolkit program allows the bit to be used in multiple stages, thereby extending the life of the tool (optional).

The dust produced when milling is extracted using the suction system which is fitted on the milling head. The dust extraction unit (option) is positioned externally behind the machine.

Before changing to a new multi panel type, the machine must be run until empty once production of the previous type is complete.

The process described is merely a typical example. The entire process varies depending on the customer requirements, multi panel layout and machine equipment.

6. Technical data

6.1. Machine dimensions for ILR-1800

| | |
|------------------------------|--|
| □ Length | 1800 mm |
| □ Depth | 2114 mm |
| □ Operating panel projection | 335 mm to the front, 410 mm to the right |
| □ Height | 2145 mm |
| □ Signal column projection | 332 mm upwards |
| □ PCB inlet height | 950 + X |
| □ Weight | approx. 3,200 kg |

6.2. Axis drives/speeds

| | |
|---|------------|
| □ Milling cross axis (X,Y) with direct linear drive and AC servo technology | 2,000 mm/s |
| □ Milling lift axis (Z) with direct linear drive and AC servo technology | 1,000 mm/s |
| □ PCB handling unit (X,Y) with direct linear drive and AC servo technology | 2,000 mm/s |
| □ Gripper axis (Z) with direct linear drive and AC servo technology | 1,000 mm/s |
| □ Feeder axes with direct linear drive and AC servo technology | 1,000 mm/s |

6.3. Levels of accuracy

| | |
|--|--------------------------|
| □ Repetition precision of linear axes in XYZ | ± 0.02 mm |
| □ Milling accuracy | ± 0.15 mm without camera |
| | ± 0.1 mm with camera |

6.4. *Rate of cutting /cycle time*

The average machining time per PCB for product XXX is sec +/- 10% plus communication times on the multi panel inlet for querying good/bad parts (communication times for the customer's database system can only be stated once the software interface has been submitted).

6.5. *Characteristics of spindle and separating tool*

- ❑ Milling bit holder \varnothing 3.175mm
- ❑ Milling bit diameter \varnothing 1.0 – 3.0 mm standard
- ❑ Spindle speed, milling 25,000-60,000 rpm
- ❑ Automatic pneumatic tensioning of milling bit

6.6. *Tool monitoring*

Included in scope of delivery

- ❑ Automatic monitoring of the milling bit service life. Customer can change the milling bit service life. Display of service life remaining.
- ❑ Automatic milling bit breakage check after cutting through the last separating strip of an assembly. If the milling bit is broken, the machine stops. There is an optical fault message
- ❑ Automatic milling bit change when milling bit service life has expired and following troubleshooting and acknowledgment by the operator in the case of a broken milling bit
- ❑ Automatic monitoring of milling bit height after changing milling bit
- ❑ Monitoring for milling bit ejection during changes

Optional:

- ❑ Automatic monitoring of milling bit diameter after changing milling bit. Ascertainable difference in diameter ≥ 0.2 mm with milling bit diameter ≥ 1.2 mm.
- ❑ Automatic milling bit control for different levels. Software module for milling at different heights to utilize the entire length of the milling bit.

- ❑ Colored ring detection for milling bit rings. Different colored milling bit rings are used to distinguish between milling bits of the same diameter with different cutting geometries

6.7. *Disposing of trimming waste*

- ❑ The multi panel frame is disposed of next to the feeder via a chute into a container. The level in the chute is monitored by counting the frames remaining. The trimming waste container on rollers is monitored using light barriers and can be pulled out towards the operator side.

6.8. *Displays*

The machine's operating status is displayed on the monitor by means of full-text messages and as an option via the 3-color signal column with yellow, red and green indicator lights or alternatively via the optional multi-color lamp.

3-color signal column indications:

Yellow rotating beacon:

Yellow flashing light: Operator request/shortage of parts

Red rotating beacon:

Red continuous light: System stationary

Red flashing light: Error

Green rotating beacon:

Green continuous light: System in automatic operation, no faults

Green flashing light: System moving to the starting position

6.9. *Operating range and multi panel properties*

- | | |
|--|-----------------------------|
| ❑ Direction of passage | from left to right |
| ❑ Multi panel length (in line direction) | 100 mm – 400 mm |
| ❑ Multi panel width | 80 mm – 300 mm |
| ❑ PCB thickness | 0.5 – 5 mm |
| ❑ Maximum component height | top: 30 mm bottom: 15 mm |
| ❑ Basic multi panel material | CEM, FR4, FR5, IMS(AL), |
| ❑ Max. distortion of printed circuit board | 1% of length and width |
| ❑ Conveyor edge free of components all the way round | min. 3 mm |

Locating holes with pin indexing in milling area:

Ø 3 or 4 mm on panel frame, 1 of which is a longitudinal hole. Measuring from the conveyor edge towards the front fixed clamping element, the center point of the locating hole must have the same distance to all multi panels.

Gripping slots:

Pre-milled gripping slots must not be less than 1.6 mm in width.

6.10. *Output area*

The design of the depanelling system's output area for storing the separated PCBs on the following output system was based on the Schunk PAL-1500 palletizing system. The following downstream output area applies

- ❑ With a PCB handling unit handling head
- ❑ When the rapid feeder is designed with a feeder axis with lifting gripper or double axis. When the rapid feeder is designed with a feeder axis with swivel gripper, the output area is restricted. This should be checked from a structural standpoint.
- ❑ Without reversing stations
- ❑ Structural obstacle contours produced by the project-specific conveyor system are not taken into account (with the exception of PAL-1500). These may restrict the output areas. This should be checked from a structural standpoint.

Taking the above criteria into account results in

- ❑ Storage area for OK parts of 250 x 400 mm. Possible transport heights (bottom edge of PCB) of 900 mm – 1030 mm. Other ranges on request.
- ❑ Storage area for not OK parts of 90 mm x 200 mm. Possible transport heights (bottom edge of PCB) of 900 mm – 1030 mm. Other ranges on request.

Output area for storage to right of depanelling system with cantilevered handling (ILR-1800 Plus version)

- ❑ Storage area for OK parts of 300 x 400 mm. Possible transport heights (bottom edge of PCB) of 900 mm – 1030 mm. Other ranges on request.
- ❑ Storage area for not OK parts of 300 x 200 mm. Possible transport heights (bottom edge of PCB) of 900 mm – 1030 mm. Other ranges on request.

Output area in combination with Schunk PAL-1500 palletizing system

- ❑ If combined with the Schunk PAL-1500 palletizing system, the output area is larger – see specification for PAL-1500 palletizing system.

6.11. Multi panel feed and multi panel positioning

The multi panels are fed to the depanelling system via an upstream optional conveyor belt or an upstream optional demagazine device. The multi panels are transferred via an SMEMA interface. The multi panels can be fed using any transport system with an SMEMA interface.

A feeder system is used to feed in the multi panel, position it in the milling position and dispose of the trimming waste. This can be configured and can therefore be adapted to the respective multi panel layout.

The basic feeder system for the base machine comprises a basic frame for manual width adjustment, carriers with inlet rails for transport support, a waste chute, valve units and sensor/actuator boxes for pneumatic actuators

Depending on application, the feeder system can be equipped as follows:

- ❑ Single feeder axis with linear motor and lifting gripper LDL-US-0100 linear motor axis from Schunk with linear motor drive and absolute measurement system. Indradrive Cs drive controller from Bosch Rexroth. Multi panels are transported by multi panel grippers on the front ends in the 3 mm wide, component-free conveyor edge. Multi panels are changed in 6 sec. Short installation length, no limitation of output area
- ❑ Single feeder axis with linear motor and swivel gripper. LDL-US-0100 linear motor axis from Schunk with linear motor drive and absolute measurement system. Indradrive Cs drive controller from Bosch Rexroth. Multi panels are transported by multi panel grippers on the front ends in the 3 mm wide, component-free conveyor edge. Multi panels are changed in 6 sec. Limitation of output area due to installation length
- ❑ Double feeder axis with linear motor and with lifting and swivel gripper. LDL-US-0100 linear motor axis from Schunk with linear motor drive and absolute measurement system. Indradrive Cs drive controller from Bosch Rexroth. Multi panels are transported by multi panel grippers on the front ends in the 3 mm wide, component-free conveyor edge. Multi panels are changed in 2 sec. Lifting gripper for transporting multi panels from inlet into milling position. Swivel gripper as trimming waste gripper to dispose of trimming waste. Trimming waste gripper can be replaced via single mechanical (bolts/bushes), pneumatic (plug-in couplings) or electrical (screw-in plug) interfaces. Trimming waste gripper can be coded for fully automatic tooling check using surface scanner. Short installation length, no limitation of output area
- ❑ Inlet modules on multi panel inlet. Multi panel inlet into machine via belt drive. Multi panel is positioned without gripping function by sliding against stopper stop above feeder axis with linear motor.

- ❑ Extension for manual width adjustment for rear clamping element via locking brake with switching valve
- ❑ Extension of manual width adjustment with width measurement of set transport width including display on monitor and monitoring of correctly set width before start of production
- ❑ Automatic width adjustment with linear motor
- ❑ Pneumatic inlet stopper
- ❑ Vertical clamping units for clamping on conveyor edge on front of multi panel. The clamping units can be controlled individually meaning that segmented opening and closing is possible. Please note: If multi panels do not have edge trims at the front, individual PCBs cannot be taken up and out vertically.
- ❑ Indexing units for indexing pins on conveyor edge on front of multi panel. Please note: If multi panels do not have edge trims at the front, individual PCBs can be taken up and out vertically.
- ❑ Vertical clamping units with horizontal lift for clamping on conveyor edge on front of multi panel. Please note: If multi panels do not have edge trims at the front, individual PCBs can be taken up and out vertically.
- ❑ Rotary clamping unit 1 for clamping on conveyor edge on rear of multi panel. Please note: If multi panels do not have edge trims at the rear, individual PCBs cannot be taken up and out vertically.
- ❑ Rotary clamping unit 2 for clamping on conveyor edge on rear of multi panel. Please note: If multi panels do not have edge trims at the rear, individual PCBs cannot be taken up and out vertically. If equipped with 2 rotary clamping units, sequential opening at the rear is possible
- ❑ Extension of rotary clamping units 1 and 2 for free travel upwards. The two rotary clamping units can be opened so far that if multi panels do not have edge trims at the rear, individual PCBs can be taken up and out vertically
- ❑ Being prepared: Clamping strip with 8 segments on rear of multi panel. The 8 clamping elements can be controlled individually meaning that segmented opening and closing is possible. Please note: If multi panels do not have edge trims at the rear, individual PCBs cannot be taken up and out vertically.
- ❑ Removal axis with linear motor for edge trims on front of multi panel
- ❑ Interchangeable trimming waste gripper (at front/rear) for disposing of continuous edge trims in lengthwise direction
- ❑ Interchangeable trimming waste gripper with cross lift (at front/rear), arranged crosswise, for disposing of non-continuous edge trims. Edge trims extend into openings of inlet rails (3 openings each at front/rear as standard)
- ❑ Waste chute with opening and pneumatically actuated sliding plate for using trimming waste grippers and if edge trims are sagging downwards

6.12. *Milling system*

With the ILR-1800 / ILR-2200 machine types, the PCBs are milled out from below using milling bits. The milling system is designed as an XY cross table with a Z axis fitted above an angle bracket. Linear motor drive and absolute measurement systems make highly dynamic positioning possible with maximum positioning accuracy and process reliability in all axes. The high-precision X-shaped Schunk-specific guidance system with pre-tensioned guide carriages mounted with plain rollers guarantee maximum precision and a long life.

- ❑ LDT-US-0300 X axis from Schunk with linear motor drive and absolute measurement system. Indradrive Cs drive controller from Bosch Rexroth
- ❑ LDT-EL-0600 Y axis from Schunk with linear motor drive and absolute measurement system. Indradrive Cs drive controller from Bosch Rexroth
- ❑ LZN-EL-0300 Z axis from Schunk with linear motor drive and absolute measurement system. Indradrive Cs drive controller from Bosch Rexroth

6.13. *Milling head, milling spindle and milling brush support*

The scope of delivery for the base machine includes

- ❑ Precision 0.5 kW high-frequency spindle with automatic tool changes from Jäger as well as frequency converter

Optional

- ❑ Milling head with pneumatic milling brush support and integrated milling bit breakage check. The milling brush is set down from below onto the underside of the multi panel using pneumatic cylinders and remains in position throughout the milling process to ensure a continuous extraction flow. At the same time, the PCB is supported from below, making pre-milling possible on the upper side without a gripper during the handling movement. The milling bit breakage check is integrated into the milling head and is undertaken directly after the last separating strip is removed.
- ❑ Milling head with programmable milling brush support and integrated milling bit breakage check. The milling brush is set down from below onto the underside of

the multi panel using a linear motor and remains in position throughout the milling process to ensure a continuous extraction flow. At the same time, the PCB is supported from below, making pre-milling possible on the upper side without a gripper during the handling movement. The milling bit breakage check is integrated into the milling head and is undertaken directly after the last separating strip is removed.

Because the milling brush support has a freely programmable linear motor drive, this version is ideally suited to special applications such as

- circumnavigating around tall components on the underside
 - extra support functions
 - avoiding damage to sensitive surfaces or components on the underside (e.g. LED assemblies) by minimal lifting of the milling brush during the separating process
- ❑ Support cylinder for fragile assemblies. If multi panels have unfavorable bond bridges, situations may arise where once particular bond bridges have been cut out, the following PCB assemblage is pulled down due to a lack of lateral bond bridges or is pushed out of its horizontal position. The pneumatic support cylinder mounted on the Z axis is fitted with a precisely guided support pin with centering tip. This support pin can be used to both support these individual PCBs (of this PCB assemblage) and center them using any holes that may be present such that they can again be gripped in the correct position by the upper PCB handling unit and cut out by the milling system.
 - ❑ Largest possible extractable remaining piece 10x10 mm
 - ❑ Possible milling brush lengths of 15 mm and 20 mm

6.14. PCB handling

With the ILR-1800 / ILR-2200 machine types, the individual PCBs are held from above during the cutting process and subsequent handling of the separated PCBs. This PCB handling unit is constructed as an XYZ cantilevered axis system. Linear motor drive and absolute measurement systems make highly dynamic positioning possible with maximum positioning accuracy and process reliability in all axes. The high-precision X-shaped Schunk-specific guidance system with pre-tensioned guide carriages mounted with plain rollers guarantee maximum precision and a long life. In order to be able to hold the PCB gripper precisely in position during the cutting process and thereby to achieve the best possible cutting accuracy, when constructing the PCB handling unit particular attention was paid to the greatest possible guidance rigidity. A linear motor axis developed especially for this purpose as the new X axis forms the basis for it being possible to make the Y and Z axes with reinforced guides, which wasn't possible in the previous ILR-1500/2000 machines. The new version is rounded off by another new development: the ERD 24 rotation axis with double retaining torque.

- ❑ LDW-UL-0800 X axis from Schunk with linear motor drive and absolute measurement system. Indradrive Cs drive controller from Bosch Rexroth
- ❑ LDM-UL-0200 Y axis from Schunk with linear motor drive and absolute measurement system. Indradrive Cs drive controller from Bosch Rexroth
- ❑ LDN-EL-0200 Z axis from Schunk with linear motor drive and absolute measurement system. Indradrive Cs drive controller from Bosch Rexroth
- ❑ Optional: ERD24 C axis from Schunk with torque motor drive and absolute measurement system. Indradrive Cs drive controller from Bosch Rexroth

- ❑ Optional: Second XYZC handling head for parallel processes such as separating edge check on upper side or turning the separated PCB after cutting out/before depositing. The machine can be retrofitted during preparations for delivery – option of retrofitting a second head must be included in scope of order.

6.15. Availability and CE

- ❑ Technical availability > = 98%
- ❑ MCT (machine capability test)
- ❑ CE version in accordance with EC Machinery Directive 2006/42/EC.

6.16. Noise level

- ❑ Measured at a distance of 1.2m around the machine < =72 db (A)

6.17. System control

- ❑ IPC controller (Beckhoff TwinCat NCI) with DIN-66025 milling programming. 3 network cards as standard (can be extended to 5). 300 GB hard disk
- ❑ Path controller for cutting process and PCB handling
- ❑ Win 7 operating system embedded as standard, 32 bit
- ❑ 15.4" touchscreen monitor
- ❑ Monitor, keyboard and mouse fitted on operator panel for machine operation. The operator panel is on the front right of the machine

6.18. Supply

- ❑ Voltage 400 V / 50 Hz / 63 A
- ❑ Compressed air 0.6mPa (6bar), oil free, filtered and dry
- ❑ Consumption 210 l/min
- ❑ Ambient temperature + 18°C to + 40°C
- ❑ Relative humidity 10% to 80%

RC connection not possible (consultation)

6.19. *Coloring and ESD*

Standard

- ❑ Main surfaces powder-coated in light gray (RAL 7035)
- ❑ Roof cassette, powder-coated Pantone 540 SCHUNK dark blue
- ❑ Corner panels, powder-coated Pantone Process Cyan SCHUNK light blue
- ❑ All surfaces and in particular all parts which come into contact with product are suitable for ESD

Optional

- ❑ Special finish available for an additional charge (Attention: ESD protective finish may not be available)

6.20. *Interfaces*

- ❑ SMEMA interface at inlet included in scope of delivery as standard

Optional interfaces

- ❑ SMEMA interface at outlet
- ❑ Engmatec interface at outlet. Special interface defined with Engmatec on outlet side
- ❑ Safety interface for board handling at inlet. Potential-free contact for monitoring protective cover of upstream board handling equipment to protect against intervention in the depanelling system inlet
- ❑ I/O link activation for servo gripper with changeover for operating pneumatic grippers and servo grippers in turn. I/O link master in principle also suited to activating other I/O link systems
- ❑ Database connections to customer's production systems according to customer's specifications

7. Further optional machine functions

7.1. Ionization

A balance-regulated ionization blower from Keyence undertakes ionization

7.2. Milling brush check

Milling brush wear is monitored by a laser beam light barrier. Parameters for the vertical position of the brush can be set in the control. During milling brush monitoring, the axis system passes through the light barrier at certain intervals (parameters can be set) with the brush and brush wear is established. A warning is issued on the monitor when a certain degree of wear (parameters can be set) is reached.

7.3. Ruwac dust extraction

- ☐ External
- ☐ Ex dust version
- ☐ Filter type H
- ☐ Manual cleaning
- ☐ 35 l dust tray with disposal container
- ☐ Differential pressure nozzle for vacuum monitoring
- ☐ Automatic cleaning as an option
- ☐ Optional simple manual extraction unit installed externally with forked piece, suction hose, hand tube and joint nozzle. Can be placed (wound up) on dust extraction using hose holder
- ☐ Manual extraction with suction hose and joint nozzle integrated as an option. Can be placed (wound up) on lower access door (inside) using hose holder. Hose laid in interior of machine. Pneumatic changeover gate for changing from extraction to manual extraction.

7.4. *Vision system for position correction*

- ❑ Vision system on the top side mounted on the PCB handling system
- ❑ Multi panels position recognition via register marks, fiducial marks, drilled holes or corners
- ❑ Position correction of milling system and PCB gripper

7.5. *OK/not OK part machining via database connection*

- ❑ Transfer of OK/not OK status to depanelling system controller via customer's existing data interface
- ❑ Not OK parts are either milled out or remain in the multi panel frame provided this is technically possible
- ❑ Milled out not OK parts are rejected into the optional waste box directly after being milled out or are placed on the optional reject parts belt

7.6. *Rotation axes for PCB handling unit*

- ❑ Continuously rotating freely programmable ERD 12 rotation axis from Schunk with torque motor drive and absolute measurement system. 2 pneumatic and 4 electric lead-ins for controlling gripper without external cables. Use in ILR for pure handling tasks. Indradrive Cs drive controller from Bosch Rexroth
- ❑ Continuously rotating freely programmable ERD 24 rotation axis from Schunk with torque motor drive and absolute measurement system. 2 pneumatic and 4 electric lead-ins for controlling gripper without external cables. Use in ILR for milling grippers or even pure handling tasks. Indradrive Cs drive controller from Bosch Rexroth

7.7. *Pneumatic gripper*

- ❑ Single or multiple gripper
- ❑ Optional for fully automatic gripper changes
- ❑ Alternating operation with servo gripper possible
- ❑ Maximum gripper jaw width 160 mm
- ❑ Maximum gripper jaw length 45 mm
- ❑ Gripper range 0 – 132 mm depending on corresponding jaw design
- ❑ These values apply to grippers which are fitted fully automatically from the gripper magazine. Other gripper ranges on request

7.8. *Automatic gripper magazine with RFID gripper coding*

- ❑ Gripper magazine with maximum of 4 gripper racks for fully automatic gripper changes
- ❑ Centering of gripper using 2 centering pins
- ❑ Sensor query for gripper presence
- ❑ Each gripper is equipped with a data carrier with RFID identifier
- ❑ At the start of production, the operator should ensure that the gripper needed is in the magazine
- ❑ If the gripper magazine is filled with other grippers, reorganization of the magazine must then be started. The PCB handling unit takes each gripper out of the gripper magazine and moves the data carrier in front of the reading device where the gripper number is read in. The depanelling system's control assigns the grippers to the magazine spaces. For the reorganization, there must not be any multi panels in the depanelling system's feeder because the width adjustment has to be adjusted
- ❑ When changing programs, the PCB handling unit automatically tools the gripper needed
- ❑ If the required gripper is not in the gripper magazine, an error message is issued with an operator prompt
- ❑ For possible equipment variants, see Item 4 Options

7.9. *Servo gripper with fully automatic jaw changes*

- ❑ Maximum gripper force of 200 N. Gripper force per product can be set to between 50 and 200 N
- ❑ Stroke 2 x 15 mm
- ❑ Optional for fully automatic gripper changes
- ❑ Alternating operation with pneumatic gripper possible
- ❑ I/O link control for alternating operation with pneumatic gripper
- ❑ Fully automatic jaw changes
- ❑ Maximum gripper jaw width 57 mm
- ❑ Maximum gripper jaw length 43 mm
- ❑ Gripper range by changing jaws 8 – 124 mm with corresponding jaw design
- ❑ These values apply to gripper jaws which are fitted fully automatically from the gripper jaw magazine. Other gripper ranges on request

7.10. *Automatic gripper jaw magazine with coding*

- ❑ Gripper jaw magazine with maximum of 16 gripper jaw racks for fully automatic gripper jaw changes
- ❑ Centering of gripper jaw using 2 centering pins
- ❑ Magnetic holding-down device for each gripper jaw guarantees safe placement
- ❑ Sensor query for gripper jaw presence
- ❑ Each gripper jaw is equipped with a data carrier with RFID identifier and DMX codes on the top side
- ❑ At the start of production, the operator should ensure that the gripper jaws needed are in the magazine

Coding via RFID:

- ❑ If the gripper jaw magazine is filled with other gripper jaws, reorganization of the gripper jaw magazine must then be started. The PCB handling unit takes each gripper jaw out of the magazine and moves the data carrier in front of the reading device where the gripper jaw number is read in. The depanelling system's control assigns the gripper jaws to the magazine spaces. For the reorganization, there must not be any multi panels in the depanelling system's feeder because the width adjustment has to be adjusted
- ❑ When changing programs, the PCB handling unit automatically tools the gripper jaws needed
- ❑ If the required gripper jaws are not in the magazine, an error message is issued with an operator prompt

- ❑ For possible equipment variants, see Item 4 Options

Coding via surface scanner

- ❑ The optional surface scanner can be used to read the DMX codes on the top of the gripper jaws in all magazine spaces with image acquisition and to assign the gripper jaws to the magazine spaces
- ❑ When changing programs, the PCB handling unit automatically tools the gripper jaws needed
- ❑ If the required gripper jaws are not in the magazine, an error message is issued with an operator prompt
- ❑ For possible equipment variants, see Item 4 Options

7.11. Reversing stations

Reversing stations in the ILR-1800 are only available in the Plus versions (PCB handling unit on right above machine protruding towards part storage on external transport system). Reversing stations are also not possible in conjunction with the PAL-1500 palletizing system.

Standard version

- ❑ Pneumatic swivel unit 0-180°
- ❑ Pneumatic parallel gripper stroke per jaw 6 mm
- ❑ Maximum PCB size 150 x 130 mm
- ❑ Manual jaw change. When changing product, manually replace both gripper jaws. Jaws with mechanical coding. Each jaw is centered using a centering pin + bush and secured with a screw.
- ❑ First reversing station is always at the rear
- ❑ Option of second reversing station at front. Cycle time reduction of approx. 0.3 s when using an additional reversing station.

With complete gripper change

- ❑ Parallel gripper designed with manual quick-change system. When changing product, manually replace the entire gripper

Being prepared: Servo rotary axis with servo gripper and jaw quick-change system

- ❑ ERD12 servo electric, freely programmable rotary axis
- ❑ Servo gripper stroke per jaw 15
- ❑ Manual jaw change using jaw quick-change system

7.12. *Separating edge check on upper side*

With this function, the separated PCBs are placed in a product-specific holder by the handling gripper on an intermediate station. The intermediate station is fitted with background lighting. For reasons associated with the cycle time, the PCB handling unit is fitted with a second handling head. There is a vision system for the separating edge check on this second handling head. The cutting points are approached by the vision system and measured. An OK/not OK assessment is undertaken. The measured PCB is then taken out of the holder and placed in the subsequent station (reversing station, pallet, other output device) by the handling gripper of the second head. Thanks to the second handling head, the separating edge check can often be carried out with a neutral cycle time in parallel to the actual depanelling process.

- ❑ Vision system mounted on upper handling (head on right)
- ❑ Measurement of cutting points of PCB placed in intermediate storage from above
- ❑ Individual bridge measurement or measurement of entire PCB (max. 38 x 38 mm) in transmitted-light procedure
- ❑ Accuracy of measurement +/- 0.1; index of capability of measuring equipment 1.33
- ❑ Measuring programs are based on the dxf file for an individual PCB with customer's specification of tolerances at cutting point
- ❑ Evidence of process capability by measuring calibrated glass plate similar to machine capability analysis
- ❑ Advantage: Cycle time is saved as process runs in parallel

7.13. *Separating edge check on under side (in preparation)*

With this function, the separated PCBs are held by the handling gripper. A vision system with ring light and blower nozzle is installed on the milling system to prevent dust from accumulating and interfering with the separating edge check. The cutting points are approached by the vision system and measured. An OK/not OK assessment is undertaken. The measured PCB is then placed in the subsequent station (reversing station, pallet, other output device) by the handling gripper.

- ❑ Vision system mounted on milling system
- ❑ Measurement of cutting points of the separated PBC held in the gripper from below
- ❑ Individual bridge measurement in transmitted-light procedure
- ❑ Accuracy of measurement/index of capability of measuring equipment pending
- ❑ Measuring programs are based on the dxf file for an individual PCB with customer's specification of tolerances at cutting point
- ❑ Evidence of process capability by measuring calibrated glass plate
- ❑ Advantage: No product-specific PCB holders
- ❑ Disadvantage: Cycle time is extended so suitable for random sample checks

7.14. *Empty check for workpiece carrier*

With this function, before the separated PCB is placed in a holder on the transport system, a sensor mounted on the handling head is used to check whether the holder is free for a new PCB to be inserted in it.

- ❑ Workpiece carrier must be bored free under the PCB support (bore D=11 mm, 46 mm deep)
- ❑ Z position can be set (distance between sensor and top of workpiece carrier approx. 256 mm)
- ❑ Cycle time extended during placement

7.15. Scanner

- ❑ Inlet scanner on multi panel guide for capturing multi panel code. The Schunk standard is SR-1000 W from Keyence. Scanner bracket included in scope of delivery for board handling. Other scanners possible if requested by customer.
- ❑ Hand scanner. The Schunk standard is the CR 2600 code reader from Tritec. Other scanners possible if requested by customer.
- ❑ Other scanners on request

7.16. SR-2000 W scanner for automatic tooling check

- ❑ SR-2000 W stationary scanner from Keyence mounted at top on protective cover roof.
- ❑ Each setup tool (gripper, trimming waste gripper at front and rear, intermediate storage, reversible jaws) has a code (unique assembly no.)
- ❑ All linear axes are moved into the reading position
- ❑ Surface scanner reads (virtually) all tool codes in one reading process
- ❑ Only needed for servo gripper of second reading process for second interchangeable jaw (previously in obstructed vision)
- ❑ Even the codes of special grippers fitted in handling unit (manually inserted, not from magazine) can be read
- ❑ In a max. of 2 reading processes, the entire tool status of all setup tools is known

7.17. Auto calibration (in preparation, provisional data)

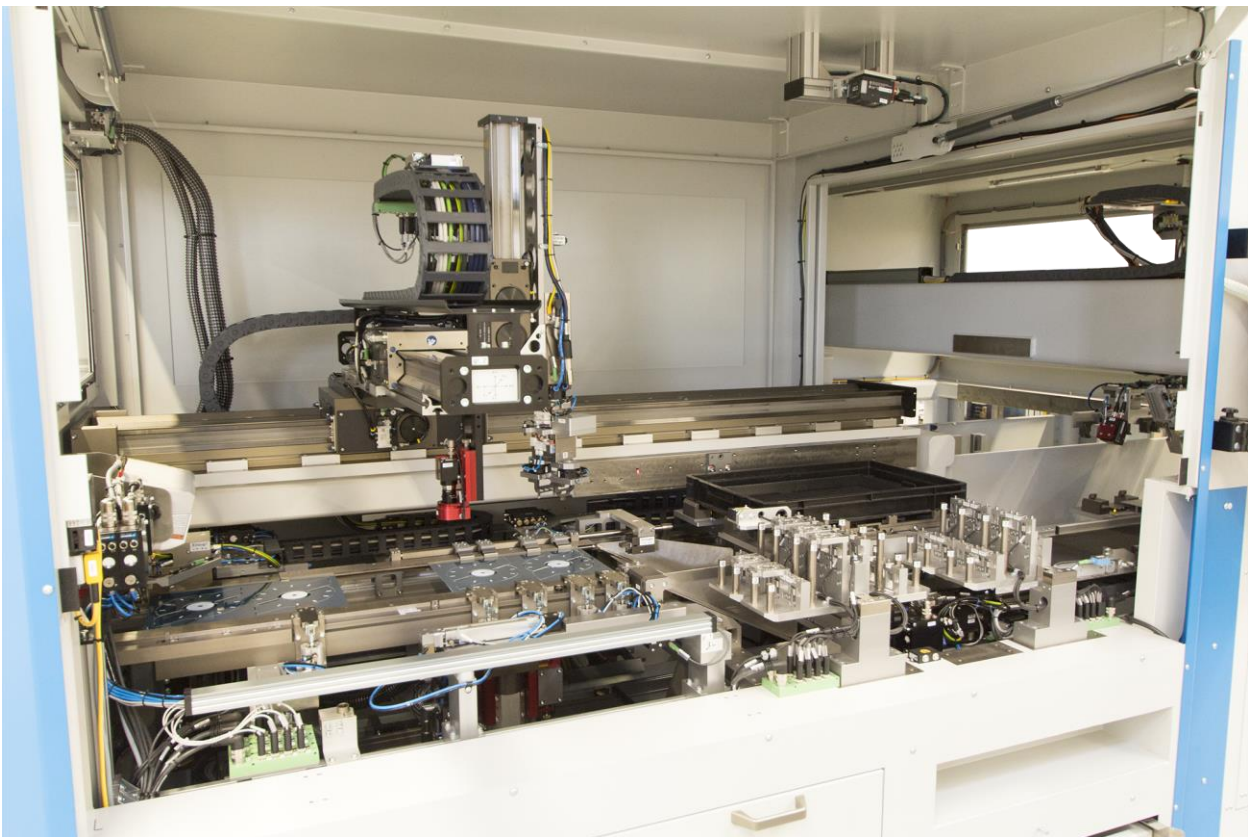
After crash or with incorrect milling

- ❑ PCB handling unit approaches 3 measuring points (camera bolts) with vision system and checks position values
- ❑ Milling system removes camera bolts from milling bit magazine
- ❑ Vision system of PCB handling unit checks at 4 joint positions whether it is in line with the collect chuck center of the milling system (with camera bolts)
- ❑ Step 1: In the event of deviations $> \pm 0.02$ mm, a fault message + operator prompt are issued
- ❑ Vision step 2: Auto correction of PCB handling unit and/or milling system

7.18. *Auto teaching (in preparation, provisional data)*

- ❑ CadCam is used offline to produce the entire **sequence program** for the milling system, high-speed feeder and PCB handling unit (generally valid for all new ILR)
- ❑ All product-related positions (milling points, gripping positions in milling area, all placement positions) are defined in CadCam
- ❑ There is a **compiler program** running on every machine controller, which adapts the sequence program to the relevant machine configuration
- ❑ This aims to transfer all positions to the machine controller without any offset
- ❑ Automatic gripping finger measurement to establish the actual position of the gripping fingers
- ❑ Gripper database for all PCB grippers
- ❑ Option of combining different interchangeable jaws
- ❑ Adopt manually approached positions during manual reteaching
- ❑ Check that gripping fingers are straight before the start of production

7.19. *View into the working space*



8. Optional input and output devices

8.1. Input devices

- ❑ Demagazine device or conveyor belts from Engmatec/MS Motions on request

8.2. Output via solid webbing belt

- ❑ ESD version of solid webbing belt with a width of XXX mm on machine outlet. Right-hand conveyor belt XXX mm above machine. Overall belt length XXX mm. Available as OK or not OK belt as an option
- ❑ Light barrier monitoring for detecting position occupied
- ❑ Designed as conveyor belt with light barrier monitoring for detecting a full belt and a stop to prevent parts falling off the end of the belt
- ❑ Storage in several rows possible
- ❑ Run empty function
- ❑ Safety tunnel as safety guard

8.3. Output via PAL-1500 palletizing system

- ❑ The Schunk PAL-1500 palletizing system can be integrated directly in the ILR-1800/2200 depanelling system, see separate specification

8.4. Output via shuttle systems

- ❑ Single or multiple shuttle systems with linear motor from Schunk on request

8.5. Output via customer-specific transport systems

It goes without saying that the separated PCBs can be output on project- or customer-specific transport systems. Mechanical, electrical and software interfaces should be coordinated. Solutions available on request.